13-18-604
Version: 12
May 14, 2014

GARDNER DENVER™

ENERGY STAR PARTNER

VARIABLE SPEED SINGLE STAGE STATIONARY BASE-MOUNTED COMPRESSOR

AirSmart™ CONTROLLER

VS20A

20kW

60HZ

OPERATING AND SERVICE MANUAL

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 ï specifically for Gardner Denver compressor systems. Design and material innovations are the result of years of experience with hundreds of different compressor applications. Reliability in materials and quality assurance is incorporated in our genuine replacement parts.

Your authorized Gardner Denver Compressor distributor offers all the backup youÕll need. An AirSmart™ network of authorized distributors provides the finest product support in the air compressor industry.

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

1. Trained parts specialists to assist you in selecting the correct replacement parts.
2. Factory warranted new and remanufactured rotary screw airends. Most popular model remanufactured airends are maintained in stock at the factory for purchase on an exchange basis with liberal core credit available for the replacement unit.
3. A full line of factory tested AEONÊ 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.

To Contact Gardner Denver or locate your local distributor:

Visit: www.contactgd.com/compressors

Or

Call: (217)222-5400

INSTRUCTIONS FOR ORDERING REPAIR PARTS

When ordering parts, specify Compressor MODEL, Method of Cooling, POWER and SERIAL NUMBER (see nameplate on unit). The Airend Serial Number is also stamped on top of the discharge bearing carrier castings.

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 motor end and look toward the compressor. Right-Hand and Left- Hand are indicated in parenthesis following the part name, i.e. (RH) and (LH), when appropriate.

WARNING – PROHIBITION – MANDATORY LABEL INFORMATION

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.

Boxed text formats are used, within this manual, to alert users of the following conditions:

Safety Labels are used, within this manual and affixed to the appropriate areas of the compressor package, to alert users of the following conditions:

⚠ DANGER

Indicates a hazard with a high level of risk, which if not avoided, <u>WILL</u> result in death or serious injury.

Equipment starts automatically

Health Hazard ï Explosive Release of Pressure

Cutting of Finger or Hand Hazard ï Rotating impeller blade

High Voltage ï Hazard of Shock, Burn, or Death Present until Electrical Power is Removed

Cutting of Finger or Hand Hazard ï Rotating fan blade

Entanglement of Fingers or Hand/Rotating Shaft

⚠WARNING

Indicates a hazard with a medium level of risk which, if not avoided, <u>COULD</u> result in death or serious injury.

Asphyxiation Hazard ï Poisonous Fumes or Toxic Gases in Compressed Air

⚠CAUTION

Indicates a hazard with a low level of risk which, if not avoided, <u>MAY</u> result in a minor or moderate injury.

Burn Hazard ï Hot surface

PROHIBITION/MANDATORY ACTION REQUIREMENTS

Do not Operate Compressor with Guard Removed

Lockout Electrical Equipment in De-Energized State

Do Not Lift Equipment with Hook ï No Lift Point

Loud Noise Hazard ï Wear Ear Protection

Handle Package at Forklift Points Only

Read the Operatorôs Manual Before Proceeding with Task

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:

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

- **Keep fingers and clothing away from rotating fan, drive coupling, etc.**
- **Disconnect the compressor unit from its power source, lockout and tagout before working on the unit – this machine is automatically controlled and may start at any time.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers, the thermostatic mixing valve or break any connections, etc., in the compressor air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Perform all wiring in accordance with the National Electrical Code (NFPA-70) and any applicable local electrical codes. Wiring and electrical service must be performed only by qualified electricians.**
- **Open main disconnect switch, lockout and tagout before working on the control, wait 10 minutes and check for voltage.**

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.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **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.**

TABLE OF CONTENTS

This book covers the following models:

KW	PSIG	Air Cooled	Parts List	Controller Manual	Dryer	Comm. Module
20	100 THRU 175	VS20A	13-18-502	13-17-600	13-18-605	13-17-604

NOTICE

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

INDEX

LIST OF ILLUSTRATIONS

SECTION 1
GENERAL INFORMATION

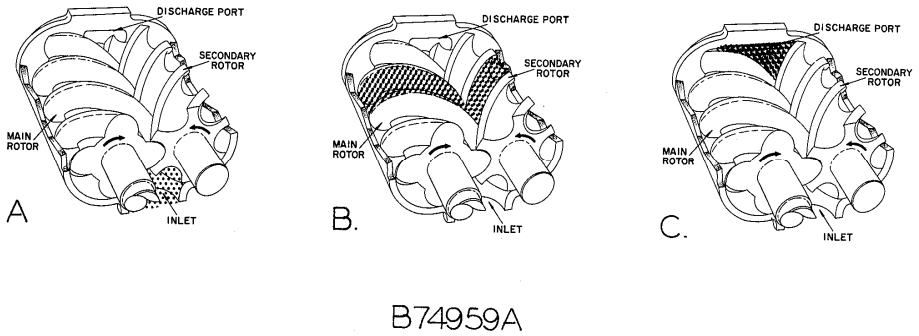


Figure 1-1 – COMPRESSION CYCLE

COMPRESSOR ï Your Gardner Denver Rotary Screw package is fitted with one (1) single stage, positive displacement rotary compressor using meshing helical rotors to effect compression. Each pair of rotors is supported between high capacity anti-friction bearings located outside the compression chamber. Single cylindrical roller bearings are used at each end of the rotors to carry the radial loads. An additional angular contact ball bearing is located at the discharge end of each rotor to carry axial thrust loads. The main rotor sits next to its gate companion, in a side-by-side configuration.

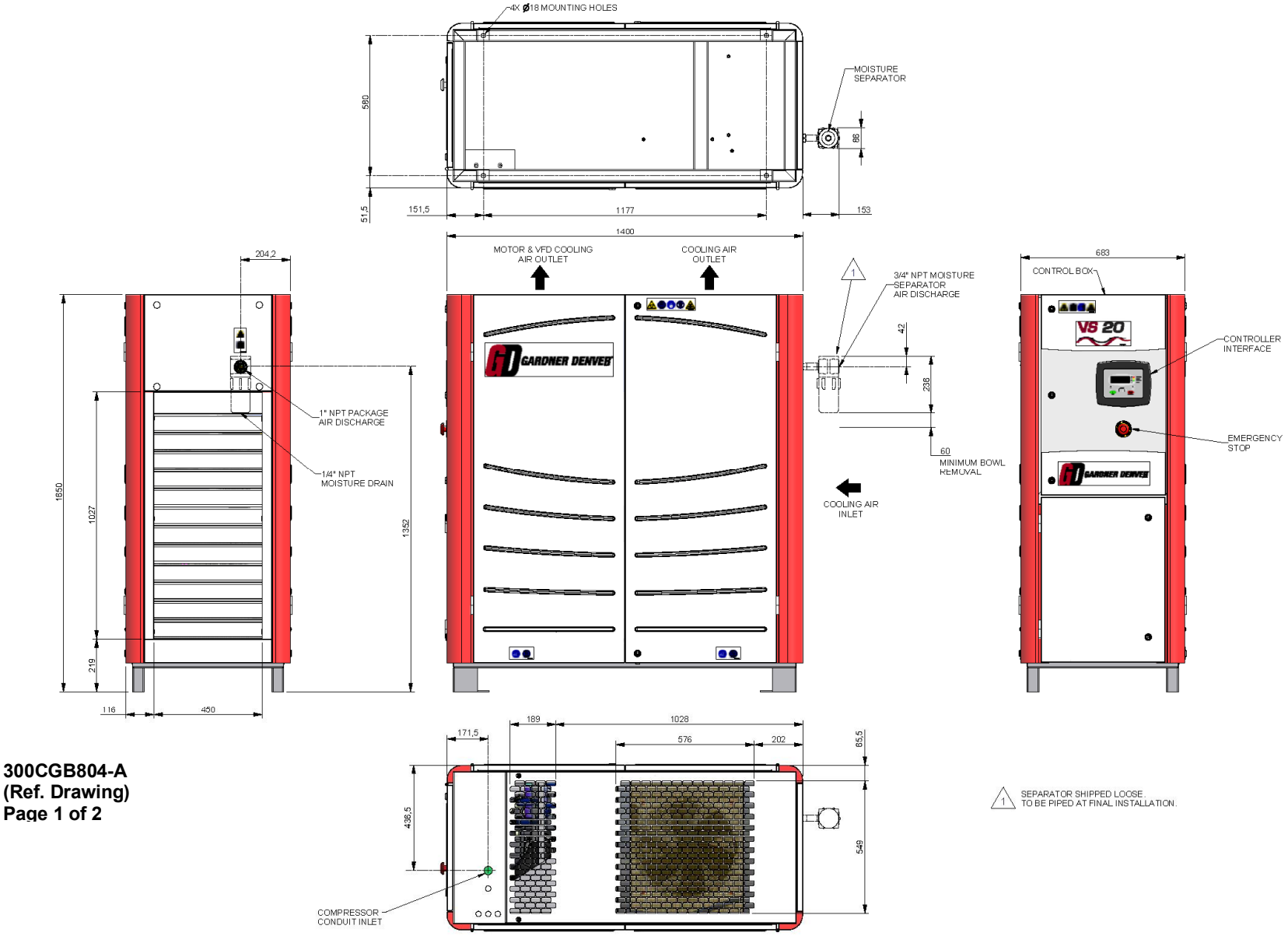
COMPRESSION PRINCIPLE (Figure 1-1) - Compression is accomplished by the main and gate rotors synchronously meshing in a one-piece cylinder. The main rotor has four (4) helical lobes, 90° apart, which mesh with five (5) helical grooves, 72° apart, on its matching gate rotor.

The air inlet port is located on top of the compressor cylinder near the drive shaft end. The discharge port is located near the bottom at the opposite end of the compressor cylinder. *Figure 1-1 is an inverted view to show inlet and discharge ports*. The compression cycle begins as the rotors unmesh at the inlet port and air is drawn into the cavity between the main rotor lobes and gate 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 gate rotor groove, normal volume is reduced and pressure increases.

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

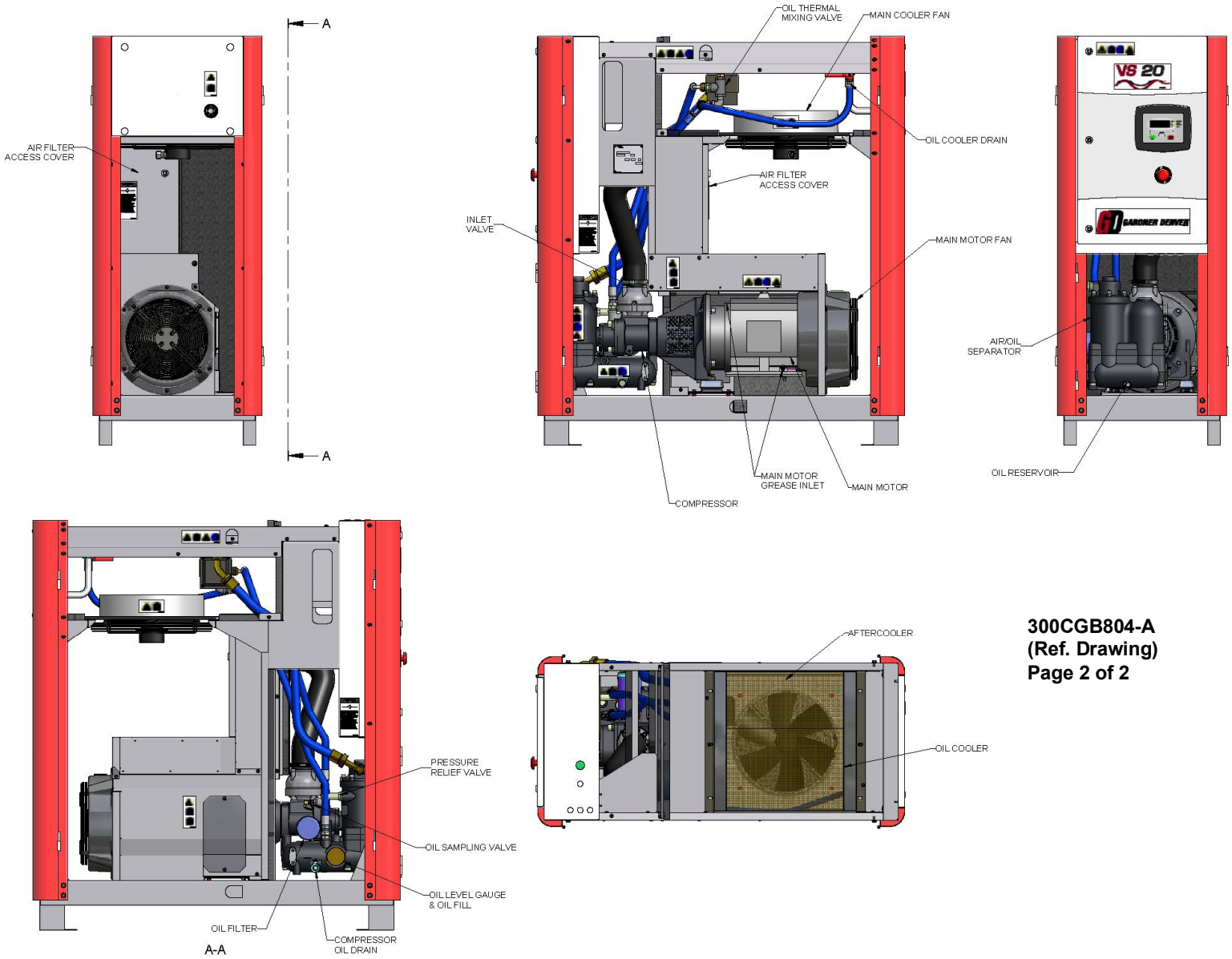
AIR FLOW IN THE COMPRESSOR SYSTEM (Figure 4-2, page 31) - Air enters the air filter and passes through the inlet control (poppet) valve to the compressor inlet flange. After compression, the air/oil mixture enters the oil reservoir where most of the entrained oil is removed by change of direction and impingent. It is further removed by centrifugal action and drained down into the reservoir. The air and remaining aerosols pass into a coalescing element where the oil is captured and drained through a drain line back into a lower pressure region of the compressor. The nearly oil-free air passes through the minimum pressure valve, aftercooler, moisture separator, and finally to the distribution network.

LUBRICATION, COOLING AND SEALING (Figure 4-2, page 31) - Oil is forced by differential pressure from the oil reservoir through the oil cooler, servo-driven oil mixing valve, oil filter, and enters the compressor. A portion of the oil is directed to internal passages within the compressor to lubricate the bearings and shaft oil seals. The balance of the oil is injected into the compressor rotors to remove the heat of compression, seal internal clearances and lubricate the rotors.



300CGB804-A
(Ref. Drawing)
Page 1 of 2

Figure 1-2 – PACKAGE ILLUSTRATION (AIR-COOLED) – External Details



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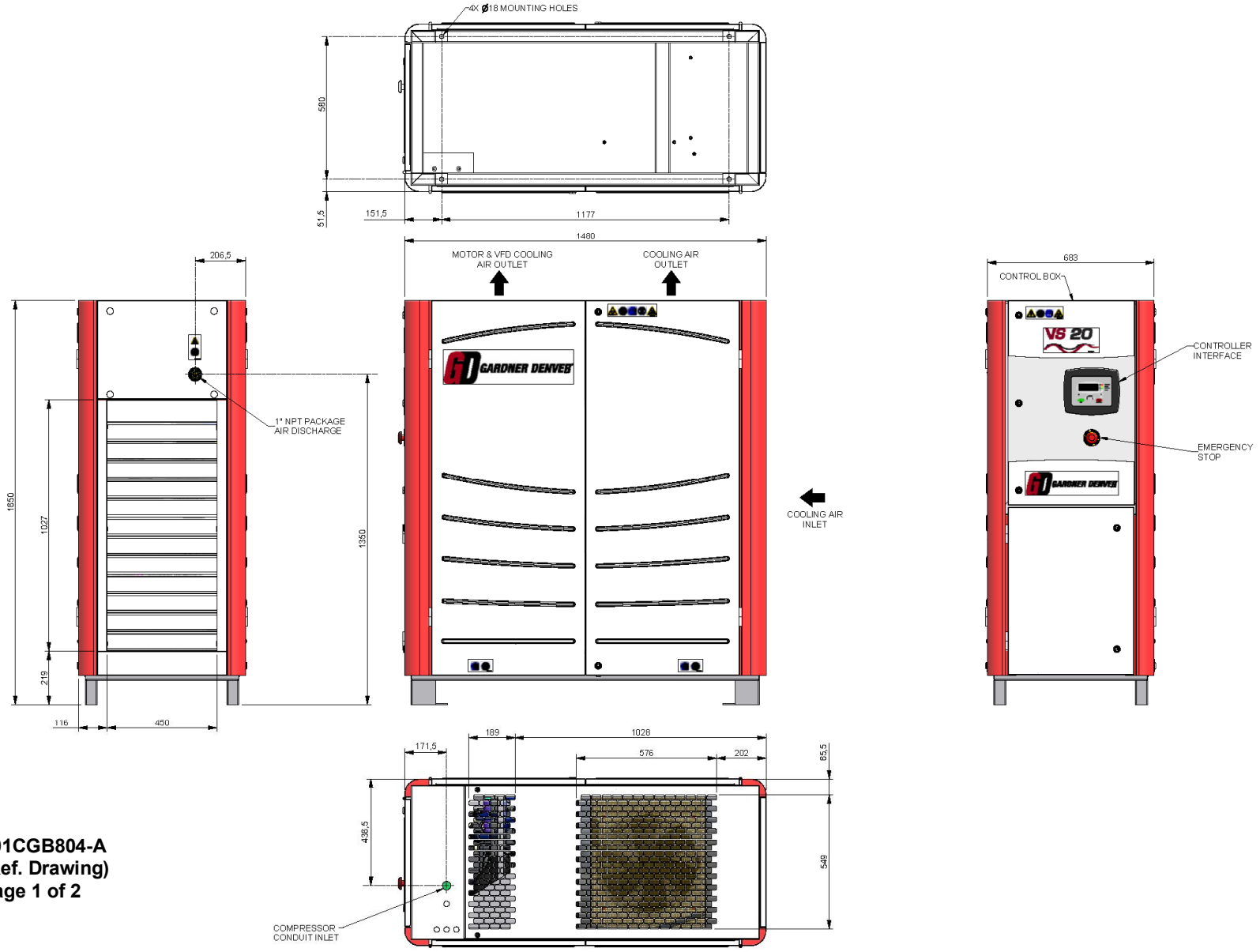
Page 2 of 2

Figure 1-3 – PACKAGE ILLUSTRATION (AIR-COOLED) – Internal Details



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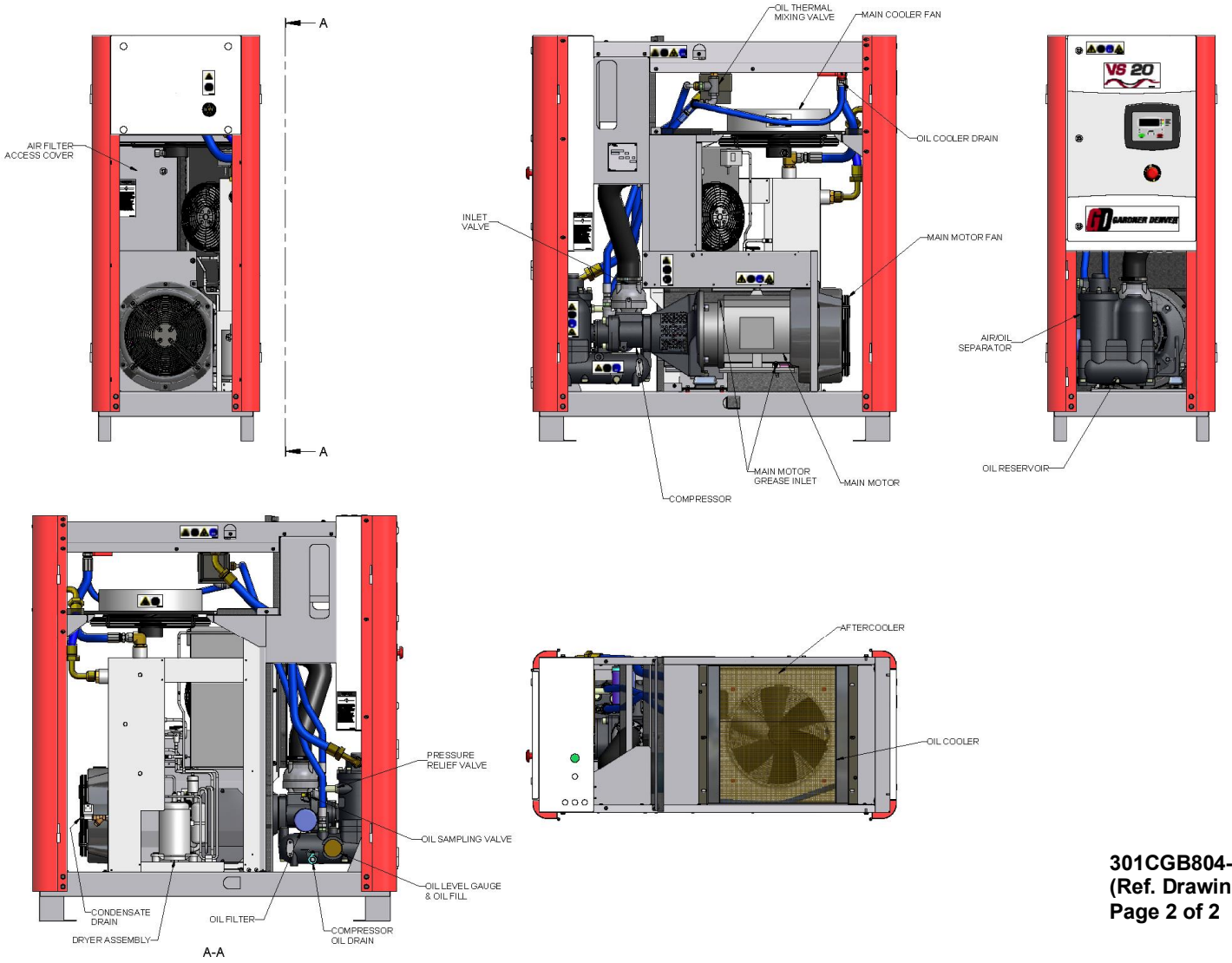
Page 1 of 2

Figure 1-4 – OUTLINE-UNIT/PKG, AIR-COOLED WITH DRYER – External Details



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(Ref. Drawing)
Page 2 of 2

Figure 1-5 – OUTLINE-UNIT/PKG, AIR-COOLED WITH DRYER – Internal Details

SECTION 2
INSTALLATION

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

⚠ CAUTION

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

LIFTING UNIT - Proper lifting and/or transporting methods must be used to prevent damage. Lifting slots are provided in the base for tow motor use. The unit may also be moved into location by rolling on bars.

⚠ CAUTION

Lift compressor package by base only. Do not use other places such as motors, compressors or discharge manifold piping as lifting points.

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

⚠ CAUTION

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

LOCATION - The compressor package shall be installed in a clean, well-lighted, well-ventilated area with ample space all around for maintenance. Select a location that provides a cool, clean, dry source of air. In some cases it may be necessary to install duct works to reach a source of adequate cooling air or to

direct cooling air in and out of the compressor package, to prevent recirculation (e.g., hot cooling air entering the fresh air inlet). The package is designed to operate at ambient temperatures ranging from 40°F to 113°F (at up to 1000 meter elevation). Contact Gardner Denver for package operation at conditions exceeding the stipulated values.

A typical ventilation arrangement is shown in Figure 2-1.

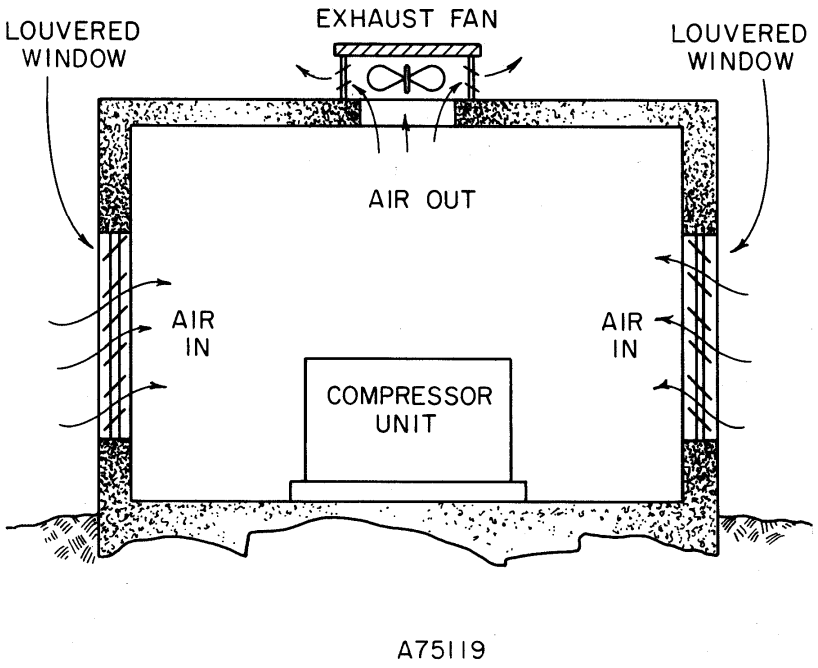


Figure 2-1 – TYPICAL COMPRESSOR ROOM

When selecting the compressor package location, be aware that its noise level may increase above its advertised free-field condition by reflections from nearby objects (e.g., walls, machinery, etc) or by noise from nearby machinery.

Air-Cooled Units - A combination oil/air cooler is supplied as standard equipment on all air-cooled packages. The heat exchangers require sufficient cooling air flow to operate efficiently ï please refer to Section 6, Fig 6-1, page 53 of this manual for detailed instructions on the operation and maintenance of air-cooled heat exchangers, including minimum heat exchanger cooling and enclosure ventilation requirements.

Cooling air for the heat exchangers, main motors, and electronics box is drawn in at the intake grill end of the enclosure and is exhausted through a roof vent. Refer to Package Illustrations on Figure 1-2 thru Figure 1-4, pages 9 thru 12, for hardware details.

Do not block flow of air entering or exiting the enclosure - allow a minimum of 3-1/2 feet (1.1 m) clearance to the nearest obstruction all around and on top.

Air for motor cooling and for the compressor intake is drawn in at the intake grill end of the enclosure and exhausted via a smaller roof vent ï refer to Section 6, page 51 of this manual for enclosure ventilation requirements. Refer to Package Illustrations on Figure 1-2 thru Figure 1-4, pages 9 thru 11.

Do not block flow of air entering or exiting the enclosure - allow minimum of 3-1/2 feet (1.1 m) clearance to the nearest obstruction all around and on top.

FOUNDATION - The Gardner Denver Rotary Screw compressor requires no special foundation, but should be mounted on a smooth, solid surface and as near level as possible. 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 ï Sump drain port, located near the oil filter, is 10ò above the floor level. If this is not sufficient to conveniently drain the oil, other methods are:

1. Elevate the compressor unit on a suitable structure to obtain the desired drain height.

2. Construct an oil sump or trough below the floor level and pump or bail the drained oil.

3. Pump oil from the reservoir filler opening or drain to a container.

ENCLOSURE - The compressors, electric motors and oil/air cooler assembly 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 open completely.

To remove the enclosure doors, open the door and lift it up slightly to disengage the hinges.

⚠ CAUTION

Ducting may be required on air-cooled enclosed machines.

⚠ DANGER

Do not operate the compressors with the fan or coupling guard removed. Exposed fan and couplings may cause personal injury.

INSTALLATION FOR COLD WEATHER OPERATION It is recommended that the unit be installed inside a shelter that will be heated to temperatures above freezing (40° F, 5° C). This will eliminate many of the problems associated with operating units in cold climates where freezing rain, drifting snow, freezing condensate and bitter cold temperatures are encountered.

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

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

AUXILIARY AIR RECEIVER - An auxiliary air receiver is not required if the piping system is large and provides sufficient storage capacity to prevent rapid cycling. An adequate receiver capacity for the VS units is ½ gallon for each cfm delivered by the compressor package.

MOISTURE SEPARATOR/TRAP - Since the unit is equipped with a built-in aftercooler, a combination moisture separator and drain valve are furnished (loose) with the unit. The device must be piped at the outlet of the compressor package during final installation. This device is not used on packages equipped with integrated dryers!

CONTROL PIPING - Control piping is not necessary since the Gardner Denver compressor package is factory wired and piped for the control system specified.

INLET LINE ï The air filter assembly used in the VS compressor package is not suitable for relocation, as its housing assembly is an integral part of the enclosure sheet metal components. See LOCATION comments on this section of the manual for duct work recommendations to bring in ventilation air.

DISCHARGE SERVICE LINE - The discharge service line connection on the air-cooled units is located at the upper right-hand area of the intake grill side of the enclosure. Gardner Denver compressor packages are inherently isolated from the service line by their own minimum pressure/check valves. Installer or end user must ensure that other compressors that are piped into a common pipe manifold with the Gardner Denver compressor package are each provided with an isolation check valve. It is recommended that an additional receiver be installed between the rotary screw and reciprocating compressors sharing a common pipeline. Do not install another check valve in the unitôs discharge line as operational upsets will occur.

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.

BLOW DOWN VALVE PIPING ï The blow down valve is vented between the air filter and inlet valve, thus avoiding the need of any external pipe work.

ELECTRICAL WIRING - The compressor package is (internally) factory wired for use with the voltage specified on the order - it is only necessary to connect power supply and ground wires to the provided wire terminal blocks.

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

Gardner Denver Guidelines for proper wiring, grounding and feed power conditioning - This compressor package is provided with a variable speed drive (VFD) to control compressor motor. The indicated Gardner Denver guidelines for proper wiring, grounding, and feed power conditioning must be followed in order to protect the VFD electronics. Failure to do so will void your warranty.

Electrical Wire Sizing ï A certified electrician familiar with National Electric Codes and applicable local codes shall size the electrical power wires serving the compressor package. Refer to Figure 2-3, for a summary of maximum package current consumption values.

200, 230, 460, and 575 VOLT VS-20 MINIMUM COPPER SUPPLY WIRE RECOMMENDATIONS

				Minimum 75ºC wire	Minimum 90ºC wire	NOTES
Model	Input Voltage	Package Amps (Estimated)	NEC Package Amps at 30ºC	Copper Wire Sized at 40ºC	Copper Wire Sized at 40ºC	
VS-20	200	99.30	122.30	1/0	1	
VS-20	230	98.65	121.65	1/0	1	
VS-20	460	45.85	55.85	6	6	
VS-20	575	35.09	42.44	8	8	

The NEC requires that wire sizes be determined by using the appropriate multiplier for the conductor temperature rating at ambient temperatures other than 30ºC and then selecting the wire that has sufficient ampacity, after correction, to meet the load requirements shown in the "NEC Package Amps @ 30ºC" column above. Wire ampacity is to be corrected, not "Package Amps". Additional correction multipliers apply based on more than three conductors in one conduit. The appropriate installation and use of 75ºC and 90ºC wire is the responsibility of the electrical professional(s) performing the installation and must be per NEC, local and state regulations as allowed. All of the above recommended minimum wire sizes are based on all terminal connections being rated at 75ºC minimum temperature rating and copper wire run lengths of 100 feet or less. Please note that all UL-508A listed control panels are rated for 40ºC ambient conditions.

Figure 2-2 – PACKAGE MAXIMUM CURRENT CONSUMPTION SUMMARY

Electrical Wire Routing ï Routing of the electrical power wires into the electrical hardware enclosure is best done through its roof area.

Line Reactor – A line reactor provides conditioning of the electrical power supply to the compressor package by attenuating noise and fluctuations. It shall be required in your particular application if any of the following conditions exist:

- Transformer KVA is greater than recommended ï see Figure 2-3
- Line has switched Power Factor correction capacitors.
- Existing line reactor not properly sized ï see Figure 2-3.
- Other large loads on the same power feed as the compressor.

GD Model	Volts	VFD HP RATINGS	Max KVA
VS20	200	30	400
VS20	230	50	400
VS20	460	25	300
VS20	575	30	300

Figure 2-3 – LINE REACTOR SIZING RECOMMENDATIONS

GROUNDING – Equipment must be properly grounded in accordance with the National Electrical Code and/or applicable local codes.

⚠ DANGER

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

MOTOR LUBRICATION - Long time satisfactory operation of an electric motor depends in large measure on proper lubrication of the bearings. Refer to Section 13, page 68 of this manual for complete motor lubrication specifications and details.

SECTION 3
STARTING & OPERATING PROCEDURES

NOTICE

Read the Operator's Manual before operating the compressor.

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

1. **Compressor Oil** - Check the oil level in the sump ï with unit stopped, the oil level should reach the top of the measuring rod visible through the site glass. Add oil, with unit stopped and depressurized, when the oil level reaches the bottom of the mark on the measuring rod. Do not mix different type oils. When the unit is shipped, it is filled with Gardner Denver AEONÊ 9000SP lubricating coolant, suitable for the first 8000 hours under normal operating conditions.

NOTICE

Regular maintenance and replacement at required intervals of the oil filter, air filter and air/oil separator is necessary to achieve maximum service and extended drain intervals of AEON 9000SP synthetic lubricating coolant. Use only genuine Gardner Denver filters designed and specified for this compressor.

NOTICE

Whenever the oil is drained from the compressor (e.g., due to oil change or compressor replacement), a minimum amount must be replenished to lubricate and seal rotors during the start-up phase. Temporarily remove the flexible hose between the air filter assembly and the intake poppet valve and add 1/4 gallon of oil through the intake valve opening.

DANGER

Before removing the oil filler plug, always stop the unit and release air pressure, lockout and tagout the power supply to the compressor package. Failure to release pressure or properly disconnect the power may result in personal injury or death.

2. **Air Filter** - Inspect the air filter to be sure it is clean and the assembly is sealed tight. Refer to Section 7, page 55 ñAir Filterò for complete servicing instructions. Be sure the inlet line is clean and sealed tight.

3. **Couplings** - Check setscrews for tightness. See Section 8, page 57.

4. **Piping** - Refer to Section 2, page 13 ñInstallation,òand make sure piping meets all recommendations.

5. **Electrical** - Check the wiring diagrams furnished with the unit to be sure it is properly wired. See Figure 4-3 thru Figure 4-6, pages 32 thru 35 for general wiring diagrams and Section 2, page 13 for installation instructions. Make sure to check the wiring of the optional compressed air dryer, as it is serviced by an independent electrical power feed.

6. **Grounding** - Equipment must be properly grounded according to Gardner Denver Guidelines for proper wiring, grounding and feed power conditioning.

CAUTION

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

NOTICE

Read the Operator's Manual before operating the compressor.

7. **Rotation** - Check for correct rotation of all electric motors:

   - Use controller ñJOG MODEòto bump compressor motor. Proper rotation shall be counter-clockwise when facing the compressor shaft end.

   - Use controller ñJOG MODEòto bump heat exchanger cooling fan. Proper rotation is achieved when cooling air is discharged upward through cooler core.

   - Use controller ñJOG MODEòto bump main motor cooling fan. Proper rotation is achieved when cooling air is discharged over the main motor body.

⚠ CAUTION

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

⚠ CAUTION

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

8. **System Pressure** ï For your convenience, the following excerpt from the Controller Manual 13-17-600 is presented to assist in programming the system pressure:

Quick Start Guide

Operation of the AirSmart controller is easy. Simply select a Target Pressure and then press the Run 

button to start the compressor, no other settings are required. The Target Pressure comes preset from the factory at pressure as ordered. The Unload Pressure is preset to 10 psi higher. If a different pressure setting is desired, the following steps can be used as a guide.

- **Setting the Target Pressure**

  The Target Pressure setting is used to set the operating point of the compressor. To make any adjustments in the operation of the compressor, the machine must be stopped and in the Ready mode. Stop the compressor by pressing the Stop/Reset 

button. The front panel display should read ñREADYò on line 3.

0 PSI	**75°F**
10 HRS	**AUTOMATIC**
READY	
NO SERVICE ADVISORY	

Next, press the Enter  button to access the Adjustment Menu tree

Since the Target Pressure setting is under the Operation Adjustment menu, press Enter  again to access that sub-menu

The Target Pressure is the second item in the Operation Adjustment sub-menu so press the Down  button to navigate to the Target Pressure setting.

To change the Target Pressure, press the Enter  button to edit the value.

A flashing cursor will appear covering the least significant digit in the Target Pressure value, use the Plus  and Minus  buttons to change its value. Use the Right  and Left  buttons to move the cursor to other digits in the Target Pressure value. When the desired Target Pressure value is displayed, press the Enter  button to save the new value. Pressing the Stop/Reset  button will abort the change and restore the previous value.

In order to save the changes made to parameters, press the Stop/Reset button to go back to the heading of the current menu and then press the Stop/Reset button again. If parameter changes have been made, the following screen will appear.

To permanently save the changes that were made, press the Enter  button. If the Stop/Reset button is pressed, the parameter changes will be lost the next time the compressor power is turned off.

- **Setting the Unload and Load Pressure**

  After setting the Target Pressure, set the Unload and Load Pressures values in a similar fashion. The Unload pressure is the third item in the Operation Adjustment sub-menu so press the Down button to navigate to the Unload Pressure setting. The Unload Pressure will control at which pressure the compressor unload and stops.

  OPERATION ADJUSTMENT
  UNLOAD PRESSURE
  110 PSI
  (SELECT PARAMETER)

  The Load pressure is the fourth item in the Operation Adjustment sub-menu so press the Down button to navigate to the Load Pressure setting. The Load Pressure will control at which pressure the compressor will startup again after unloading.

  OPERATION ADJUSTMENT
  LOAD PRESSURE
  100 PSI
  (SELECT PARAMETER)

DANGER

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.

9. **Operating Mode** - Refer to Controller Manual 13-17-600 for more detailed information on the control system.

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

STARTING THE UNIT - Observe the following starting procedures.

Unit Cold - If the unit is located in a cold environment (e.g., ambient temperature below 40°F, 5 °C), the required external heat source must be energized prior to start. Press the red ñSTOP/RESETò button to clear any conditions (e.g., ñLoss of Powerò when electrical system was energized) and start the unit by pushing the green ñSTARTò button. Since the unit is equipped with a minimum pressure valve (60 psig, 4.1 bar), no special procedure to maintain minimum reservoir pressure is required.

Unit Hot - Start-up instructions are the same as that of a cold start.

Compressed Air Dryer (Optional) ï The dryer module is supplied electrical power from a separate (off-package), disconnect provided by the end user ï the disconnect must be engaged prior to dryer operation. Relay contacts, operated by the package AirSmart controller, engage and disengage the dryer from the external power source. The dryer is turned on when the ñSTARTò button is pressed, which also starts the compressor system. The dryer remains powered until the ñSTOPò button is pressed and remains in operation during low air demand periods that temporarily shut down the compressor. Please refer to the dryer manual 13-18-602 for all installation, operation and maintenance instructions.

DAILY CHECK - Refer to Section 14, page 69 ñMaintenance Scheduleò

STOPPING THE UNIT - Press ñSTOP-RESETò button. The oil reservoir will automatically blow down, as the main motor is de-energized. Be sure external heat is turned on if below 40°F (5°C),

Automatic restarting or electrical shock can cause injury or death. Disconnect, lockout and tagout the unit from the power supply and any other circuits before servicing unit.

When the pressure 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 pressure relief valve to prevent injury.

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

DANGER

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

SECTION 4
CONTROLS & INSTRUMENTATION

GENERAL DESCRIPTION - The Gardner Denver rotary screw compressor package is pre-wired with all electrical components suitable for the voltage and horsepower at time of order. It is necessary only to connect the compressor unit to the correct power supply and to the shop air supply network - and to the appropriate water supply if using the water-cooled variant. A standard single stage compressor package consists of unitized module that houses a single rotary screw compressor, oil sump, separation, filtering, and internal injection delivery system, a main drive motor, a VFD, an oil/air cooling system, IP54 electrical enclosure to house VFD on common controller and a sound-attenuating enclosure. The various control devices employed are described as follows:

Controller - The compressor package features the AirSmart controller, which integrates all the control functions under microprocessor control. Controller functions include safety and shutdown, compressor regulation, operator control and advisory/maintenance indicators. The keypad and display provides a logical and easily operated control of the compressor and indication of its condition. The controller is factory adjusted for the compressor package, but allows tuning for specific applications.

NOTICE

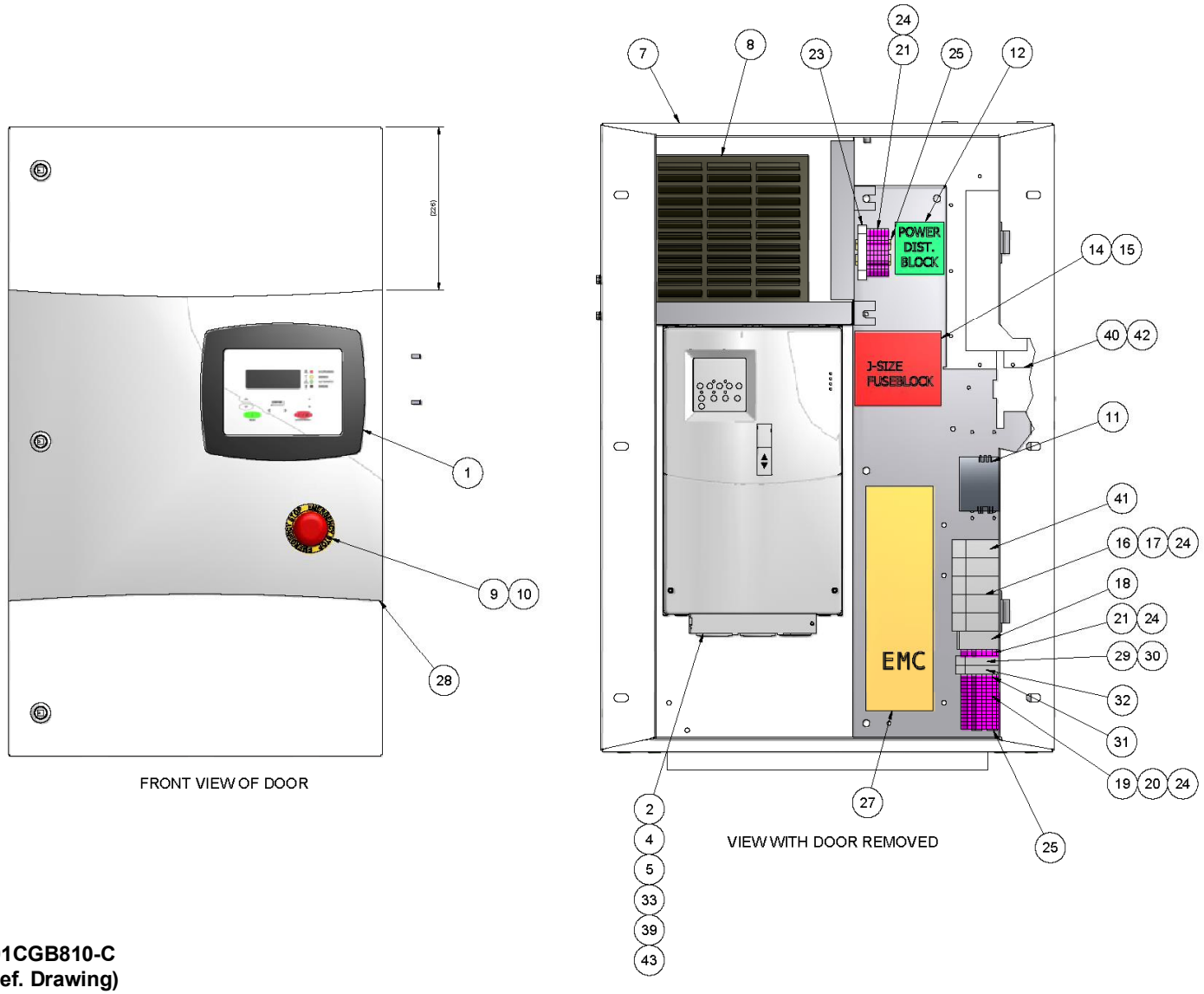
Read the Operator's Manual before operating the compressor. It is critical that the detailed instructions for the controller, found in the controller manual 13-17-600, are read and understood. Once the appropriate parameters have been selected into the controller, compressor operation may commence. For your convenience, a "Quick Start" excerpt from the controller manual is shown on Section 3.8

Press the red ñSTOP/RESETò button to clear any conditions (e.g., ñLoss of Powerò when electrical system was energized) and start the unit by pushing the green ñSTARTò button. Since the unit is equipped with a minimum pressure (60 psig, 4.1 bar) valve, no special procedure to maintain minimum reservoir pressure is required.

Main VFD and Motor ï The compressor is driven by an inverter-duty electric motor, which in turn is energized by a pulse-width modulated, variable frequency drive (commonly referred to as VFD). This combination of components enables the compressor package to match the supply of compressed air (e.g., flow capacity) to meet the customerôs demand in real time and in a step-less fashion. The operational logic which govern the drive and motor-combination is supplied by the AirSmart controller and it is based on the following basic rules:

- The speed of the compressor is modulated (e.g., increased or decreased) until the desired system discharge pressure is achieved.

The drive shares a common IP54 protected enclosure with the AirSmart controller and assorted electrical hardware. Ventilation for the electronics is supplied forced air delivered by the heat exchanger cooling fans and filtered by inlet and outlet filters. The motor is built with a TEFC protected frame and coupled to the compressor via a NEMA-D flange. The drive includes adequate current overload protection for its companion motor.
The drive and motor are designed to operate with 3ph-60Hz-460vac electrical power, which must be installed in accordance with local (site) Electrical Code requirements.



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(Ref. Drawing)

Figure 4-1 – ELECTRICAL ENCLOSURE HARDWARE

*		ASSEMBLED CONTROL BOX WITH EMC FILTER
		ASSEMBLED CONTROL BOX WITHOUT EMC FILTER
	1	AIRSMART CONTROLLER
	2	DRIVE GROUP
	4	SPLITTER CABLE
	5	SCREW TERMINAL PLUG
	7	CONTROL BOX
	8	EXHAUST FILTER
	9	OPERATOR
	10	CONTACT BLOCK
	11	POWER SUPPLY
	12	POWER DISTRIBUTION BLOCK
	13	TERMINAL LUG (not shown)
	14	FUSE HOLDER
	15	FUSE
	16	FUSE BLOCK
	17	FUSE
	18	RELAY
	19	TERMINAL BLOCK
	20	TERMINAL BLOCK
	21	GROUND BLOCK (not shown)
	23	GROUND BLOCK
	24	TERMINAL BLOCK
	25	DIN RAIL
	27	FILTER
	28	DECAL
**	29	FUSE BLOCK
**	30	FUSE
**	31	GROUND BLOCK
**	32	RELAY
**	33	RESISTOR
	34	CORD (not shown)
	35	WIRE (not shown)
	36	WIRE (not shown)
	37	ELECTRICAL FITTING (not shown)
	38	ELECTRICAL FITTING (not shown)

** Added when Package has Dryer

Heat Exchanger Fan/Motor and Starter - The combination axial fan/motor provides cooling air for the heat exchangers and electronics box. The starter provides control for the fan motor only, as the latter includes its own thermally-resettable, internal overload protection. This device is designed to operate with 3 ph-60 Hz-460 vac electrical power ï the necessary electrical wiring has been provided.

Main Motor Ventilation Fan/Motor and Starter ï The combination axial fan/motor cools the main motor by blowing fresh air over its body. The starter provides control for the fan motor only, as the latter includes its own thermally-resettable, internal overload protection. These devices are designed to operate with 3 ph-60 Hz-460 Vac electrical power ï the necessary electrical wiring has been provided.

Control Transformer - This device reduces the incoming power voltage to 110-120 volts for use by various control components (e.g., 24 vdc power supply, electrical enclosure cooling fans, etc.). Two primary fuses and one secondary fuse are provided for overload protection.

Power Supply (24vdc) - This device supplies electrical power to the AirSmart controller and various solenoid valves.

For Letter References A thru U below, see Figure 4-2, page 31.

Inlet (Poppet) Valve (B) ï This device is located at the intake flange of the compressor. When the compressor is running, a 3-way solenoid valve, energized by the AirSmart controller, vents the poppet internals to atmosphere, allowing it to open (normal state). When the compressor is stopped, a sump pressure signal is fed to the poppet internals, forcing it closed and preventing trapped air and oil within the compressor from exiting through the inlet filter. See SECTION 10, page 63 for further details.

Minimum Discharge Pressure/Check Valve (G) – This device maintains a minimum pressure (60psig) within the air/oil reservoir, thus insuring (lubrication/cooling) oil injection flow into the compressors. It also prevents the back flow of compressed air from the customerÕs piping back into the compressor package when the compressor is not running. See SECTION 9, page 61 for further details.

Oil Mixing Valve (L) ï This device prevents the compressor from operating at a pressure and temperature combination that condenses water vapor in the oil system. The servo-driven, 3-way, ball valve mixes cooled and hot oil, prior to delivery to the oil filter and oil injection line, as commanded by an algorithm residing in the package controller. See SECTION 5, page 43 for further details.

Pressure Relief Valve (O) ï This device protects the pressure containing components of the compressor package against high pressure exceeding 188.5 psig. See SECTION 11, page 65 for further details.

Inlet Feed Valve (C) - This (three-way solenoid) device supplies/vents the required pneumatic signal to actuate the inlet poppet valve. When energized, it opens (pressurizes) the inlet poppet valve and when de-energized, it closes (vents) it.

Ball Valve – Oil Drain (N) - This device allows the drainage of the oil charge held in the reservoir during oil change operation.

Blow Down Valve (P) - This (two-way solenoid) device vents compressed air from the air/oil sump. During compressor operation (e.g., compressor is running or has temporarily stopped due to line pressure reaching unload pressure); the blow down valve remains energized (closed) and the air/oil reservoir remains pressurized. When compressor operation is halted (e.g., by use of the red ñSTOPò controller button, by loss of electrical energy, or by a shutdown condition), the valve is de-energized (normally open state) and the air/oil reservoir is blown down.

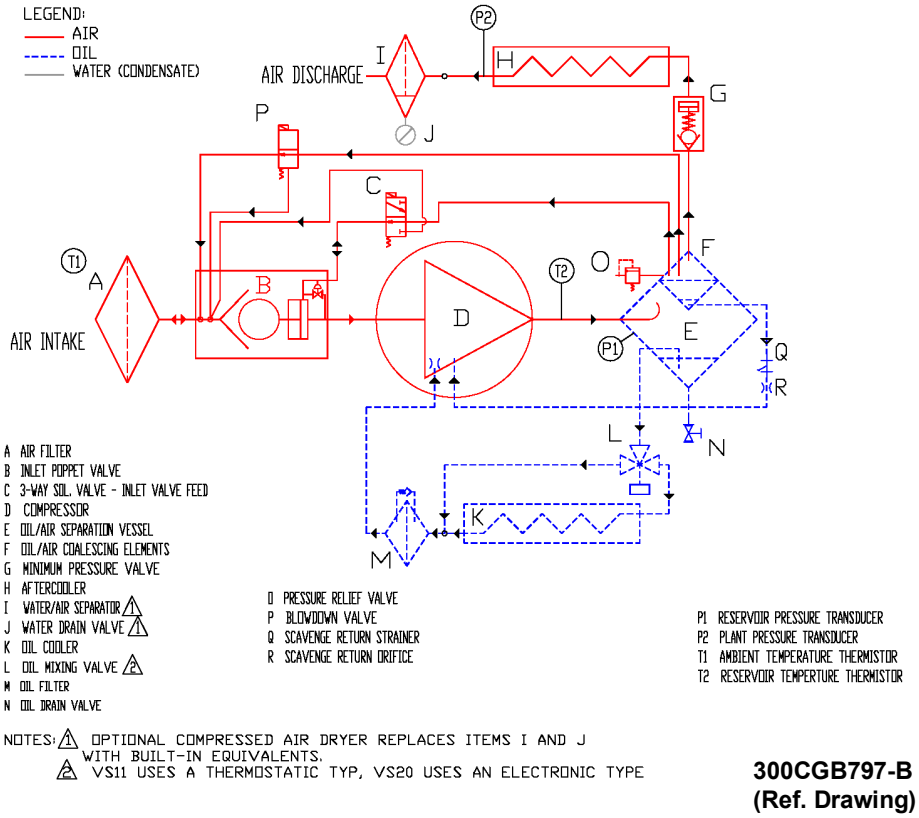
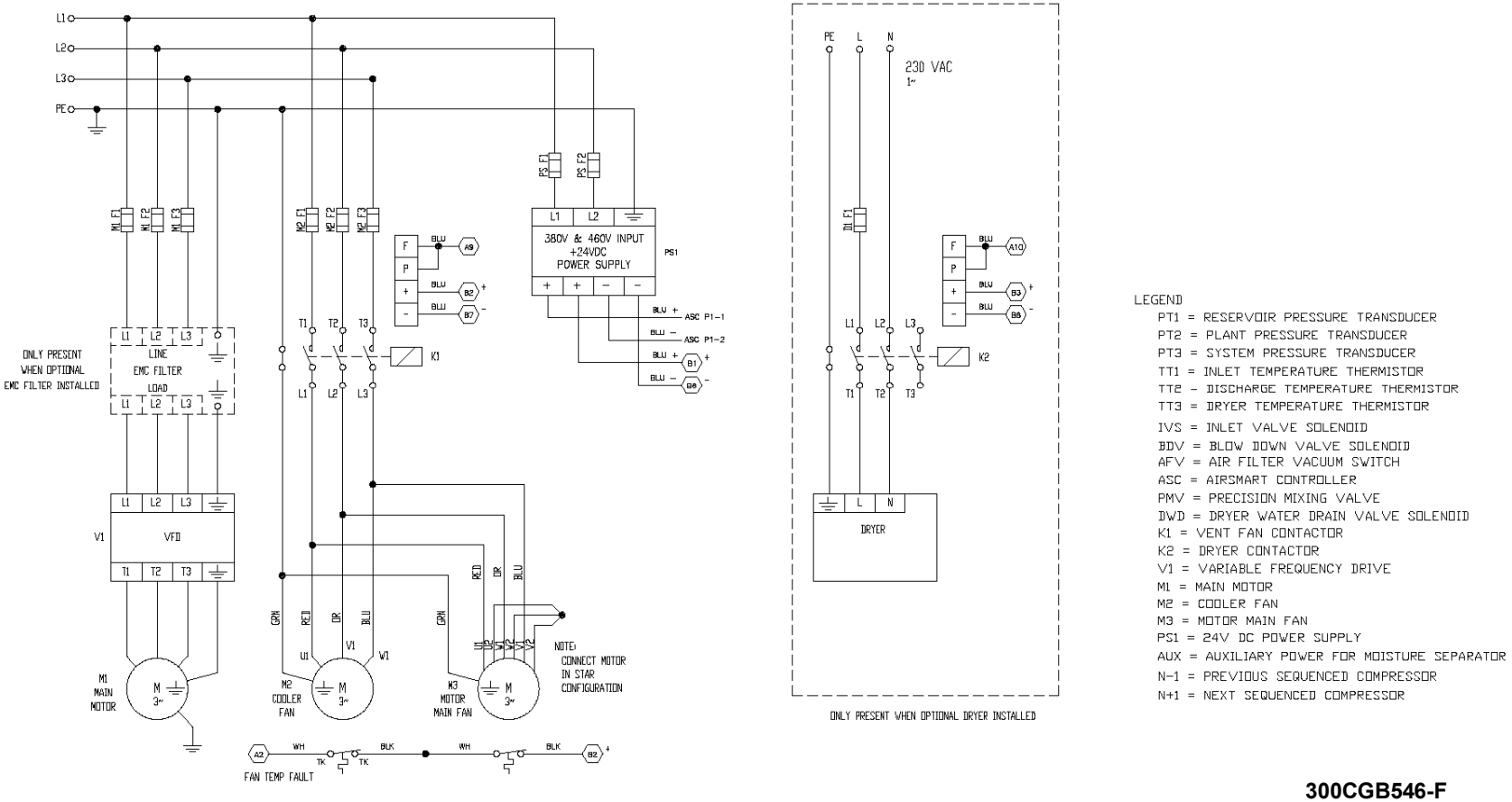


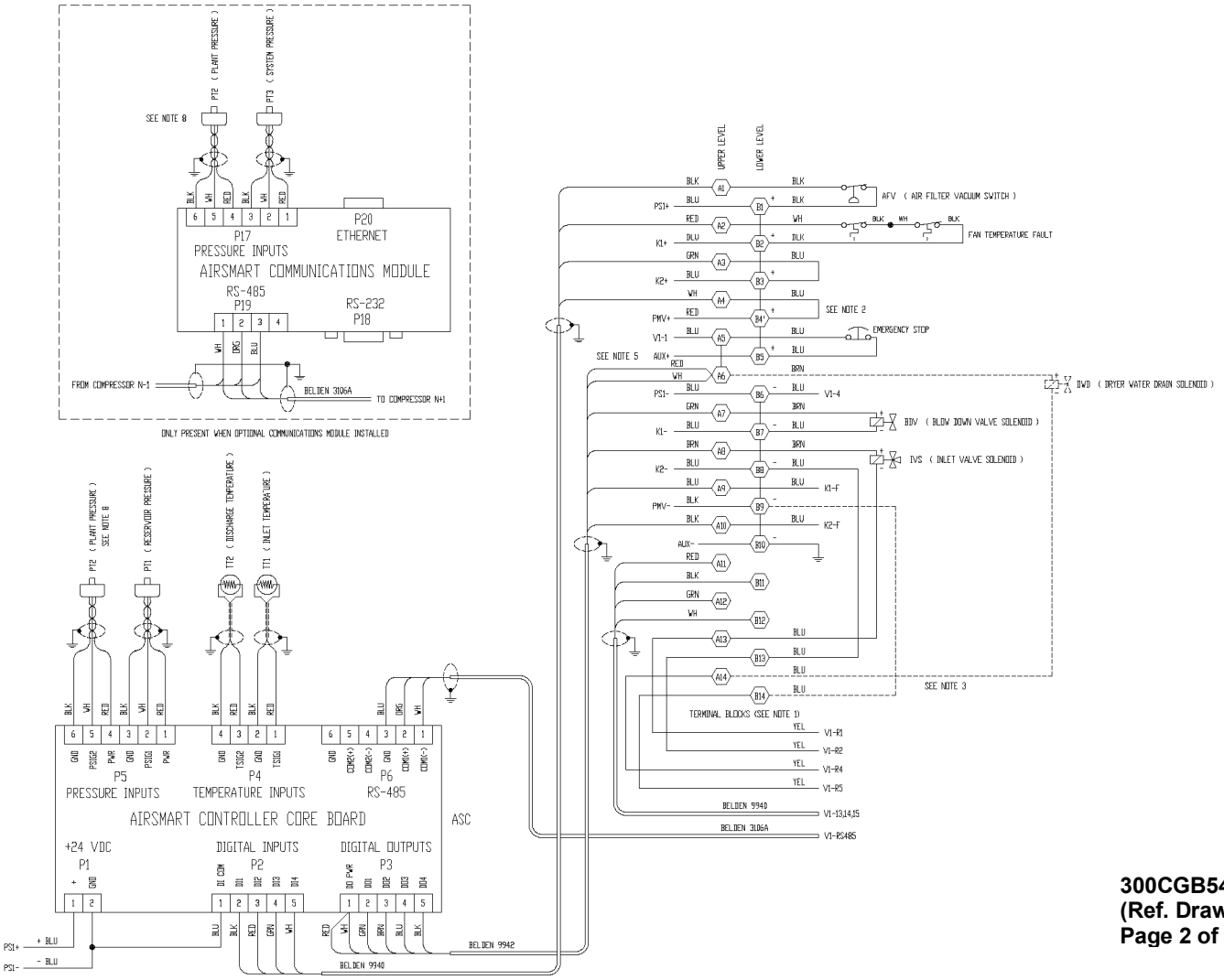
Figure 4-2 – PIPING AND INSTRUMENTATION ILLUSTRATION



LEGEND
- PT1 = RESERVOIR PRESSURE TRANSDUCER
- PT2 = PLANT PRESSURE TRANSDUCER
- PT3 = SYSTEM PRESSURE TRANSDUCER
- TT1 = INLET TEMPERATURE THERMISTOR
- TT2 = DISCHARGE TEMPERATURE THERMISTOR
- TT3 = DRYER TEMPERATURE THERMISTOR
- IVS = INLET VALVE SOLENOID
- BDV = BLOW DOWN VALVE SOLENOID
- AFV = AIR FILTER VACUUM SWITCH
- ASC = AIRSMART CONTROLLER
- PMV = PRECISION MIXING VALVE
- DWD = DRYER WATER DRAIN VALVE SOLENOID
- K1 = VENT FAN CONTACTOR
- K2 = DRYER CONTACTOR
- V1 = VARIABLE FREQUENCY DRIVE
- M1 = MAIN MOTOR
- M2 = COOLER FAN
- M3 = MOTOR MAIN FAN
- PS1 = 24V DC POWER SUPPLY
- AUX = AUXILIARY POWER FOR MOISTURE SEPARATOR
- N-1 = PREVIOUS SEQUENCED COMPRESSOR
- N+1 = NEXT SEQUENCED COMPRESSOR

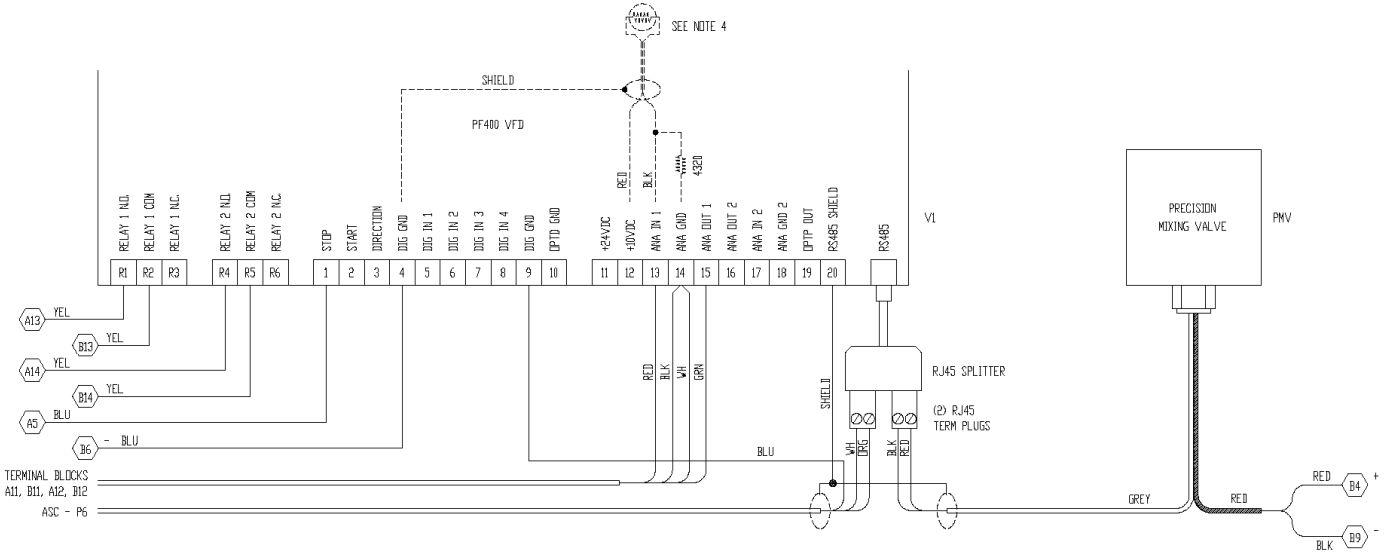
300CGB546-F
(Ref. Drawing)
Page 1 of 4

Figure 4-3 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 460 VOLT



300CGB546-F
(Ref. Drawing)
Page 2 of 4

Figure 4-4 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 460 VOLT

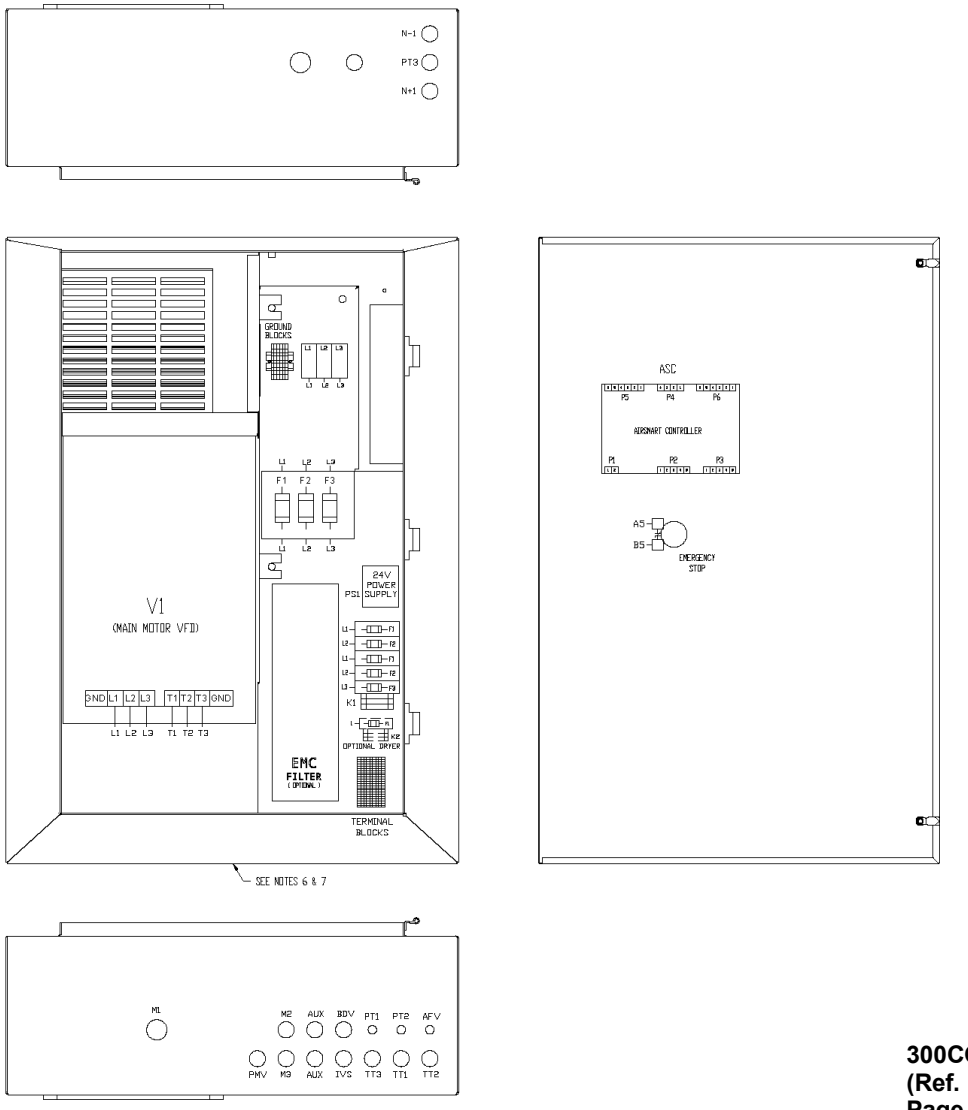


NOTES:

1. SHORTING JUMPERS INSTALLED ON TERMINALS BLOCKS AS FOLLOWS
   +24VDC - B1, B2, B3, B4, B5
   DC GND - B6, B7, B8, B9, B10
   E-STOP QUALIFIED +24VDC - A5, A6
2. FOR CONTROL BY REMOTE CONTACT, REMOVE JUMPER BETWEEN TERMINALS A4 AND B4 AND CONNECT N.C. SWITCH
3. WHEN DRYER IS NOT INSTALLED ADVISORY/SHUTDOWN ALARM CONTACT BETWEEN A14 AND B14 CONTACT RATING: N.O., 3A @ 30VDC, 3A @ 240VAC
4. WHEN DRYER THERMISTER IS INSTALLED CONNECT RED THERMISTOR WIRE TO TERMINAL 12, CONNECT BLACK THERMISTOR WIRE TO TERMINAL 13, CONNECT 4320 OHM, 0.25W, 1% RESISTOR BETWEEN TERMINAL 13 AND TERMINAL 14.
5. AUXILIARY POWER FOR MOISTURE SEPARATOR NOT INSTALLED WHEN DRYER IS USED.
6. BACK PLATE MUST BE BONDED TO CONTROL BOX USING 4 AWG (MIN) BONDING STRAP.
7. DOOR MUST BE BONDED TO CONTROL BOX USING 10 AWG (MIN) BONDING STRAP.
8. WHEN COMMUNICATIONS MODULE IS INSTALLED AND PT3 IS INSTALLED, CONNECT PT2 TO P17, PINS 4-6.

300CGB546-F
(Ref. Drawing)
Page 3 of 4

Figure 4-5 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 460 VOLT



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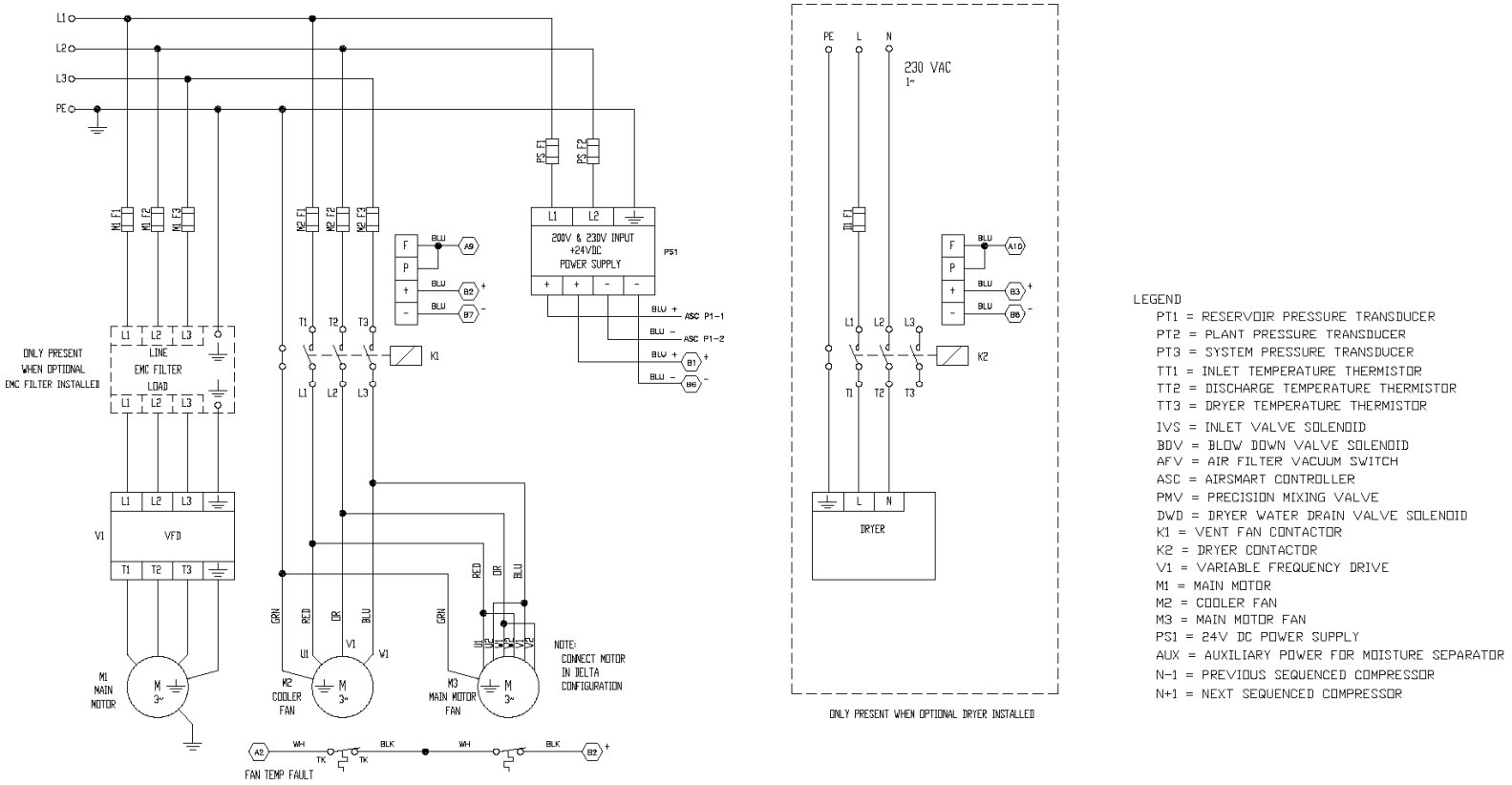
(Ref. Drawing)
Page 4 of 4

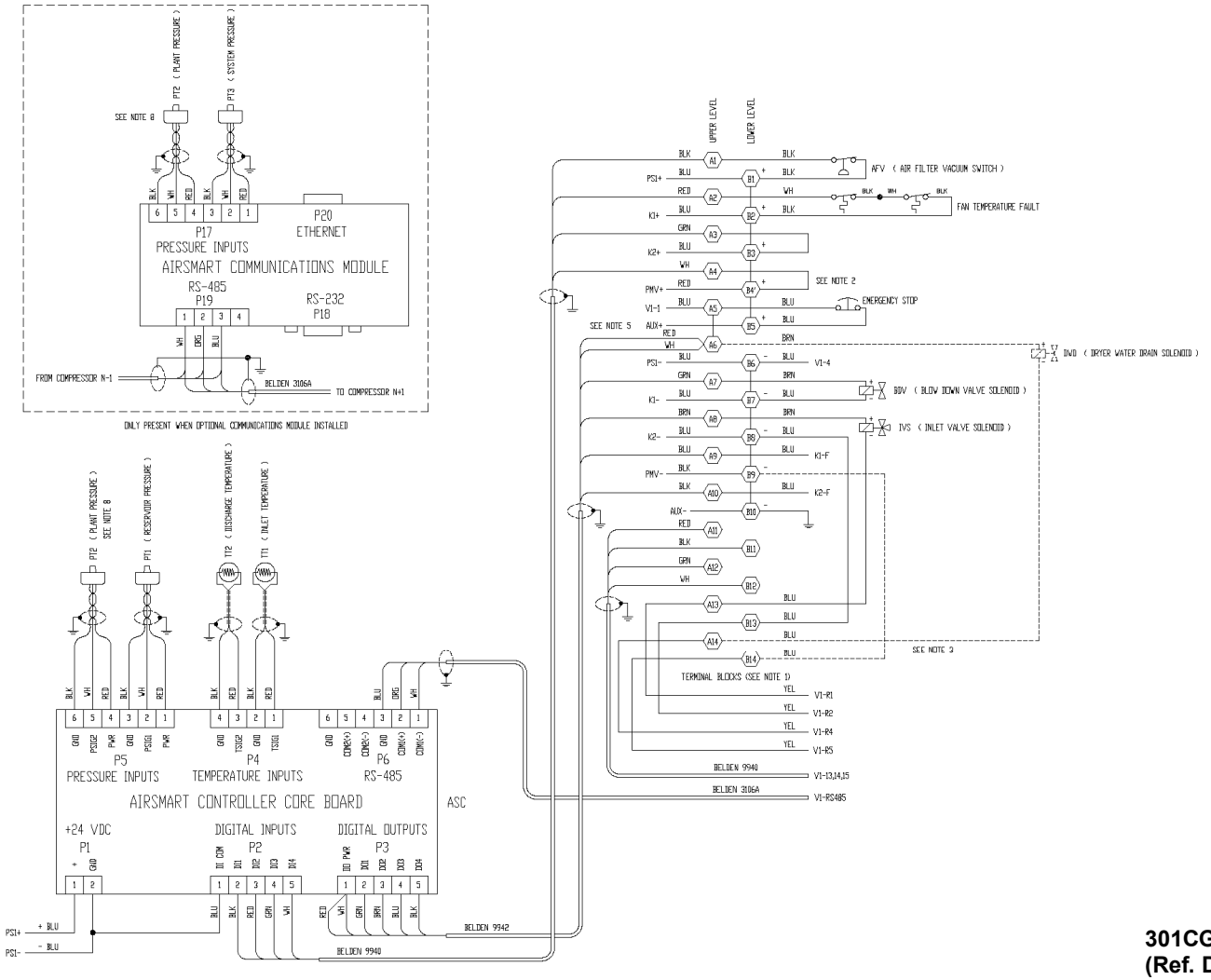
Figure 4-6 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 460 VOLT



LEGEND
- PT1 = RESERVOIR PRESSURE TRANSDUCER
- PT2 = PLANT PRESSURE TRANSDUCER
- PT3 = SYSTEM PRESSURE TRANSDUCER
- TT1 = INLET TEMPERATURE THERMISTOR
- TT2 = DISCHARGE TEMPERATURE THERMISTOR
- TT3 = DRYER TEMPERATURE THERMISTOR
- IVS = INLET VALVE SOLENOID
- BDV = BLOW DOWN VALVE SOLENOID
- AFV = AIR FILTER VACUUM SWITCH
- ASC = AIRSMART CONTROLLER
- PMV = PRECISION MIXING VALVE
- DWD = DRYER WATER DRAIN VALVE SOLENOID
- K1 = VENT FAN CONTACTOR
- K2 = DRYER CONTACTOR
- V1 = VARIABLE FREQUENCY DRIVE
- M1 = MAIN MOTOR
- M2 = COOLER FAN
- M3 = MAIN MOTOR FAN
- PS1 = 24V DC POWER SUPPLY
- AUX = AUXILIARY POWER FOR MOISTURE SEPARATOR
- N-1 = PREVIOUS SEQUENCED COMPRESSOR
- N+1 = NEXT SEQUENCED COMPRESSOR

301CGB546-C
(Ref. Drawing)
Page 1 of 4

Figure 4-7 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 200/230 VOLT



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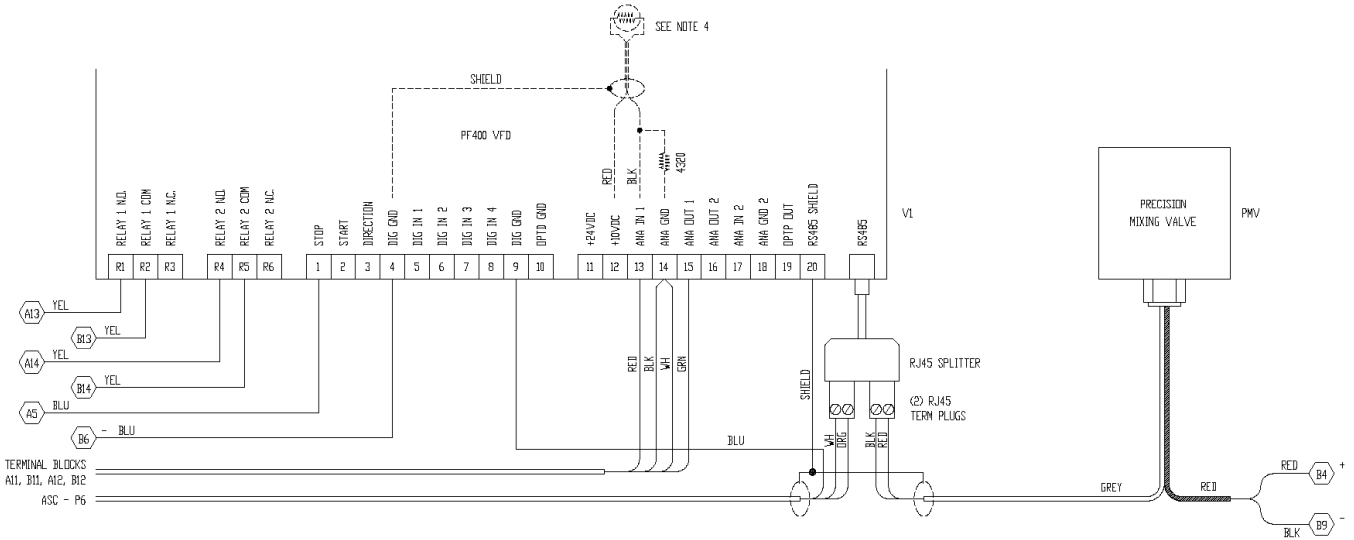
(Ref. Drawing)
Page 2 of 4

Figure 4-8 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 200/230 VOLT

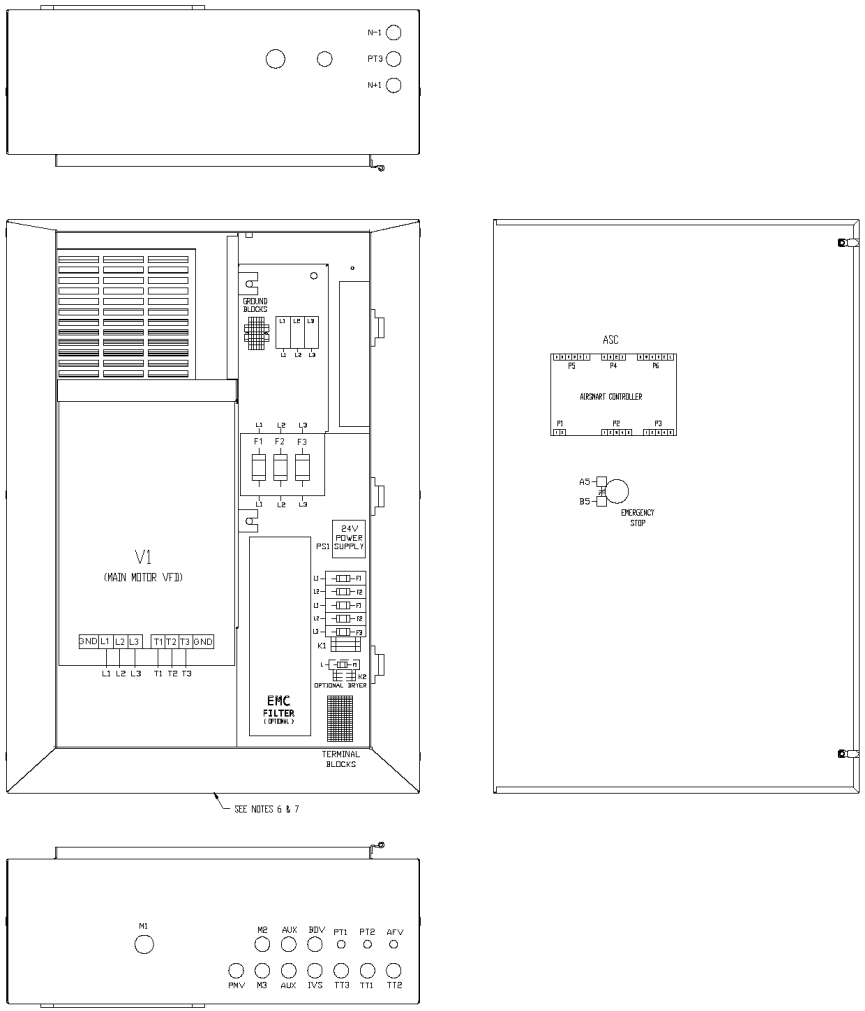


NOTES:

1. SHORTING JUMPERS INSTALLED ON TERMINALS BLOCKS AS FOLLOWS
   +24VDC - B1, B2, B3, B4, B5
   DC GND - B6, B7, B8, B9, B10
   E-STOP QUALIFIED +24VDC - A5, A6
2. FOR CONTROL BY REMOTE CONTACT, REMOVE JUMPER BETWEEN TERMINALS A4 AND B4 AND CONNECT N.C. SWITCH
3. WHEN DRYER IS NOT INSTALLED ADVISORY/SHUTDOWN ALARM CONTACT BETWEEN A14 AND B14 CONTACT RATING: N.O., 3A @ 30VDC, 3A @ 240VAC
4. WHEN DRYER THERMISTER IS INSTALLED CONNECT RED THERMISTOR WIRE TO TERMINAL 12, CONNECT BLACK THERMISTOR WIRE TO TERMINAL 13, CONNECT 4320 OHM, 0.25W, 1% RESISTOR BETWEEN TERMINAL 13 AND TERMINAL 14.
5. AUXILIARY POWER FOR MOISTURE SEPARATOR NOT INSTALLED WHEN DRYER IS USED.
6. BACK PLATE MUST BE BONDED TO CONTROL BOX USING 4 AWG (MIN) BONDING STRAP.
7. DOOR MUST BE BONDED TO CONTROL BOX USING 10 AWG (MIN) BONDING STRAP.
8. WHEN COMMUNICATIONS MODULE IS INSTALLED AND PT3 IS INSTALLED, CONNECT PT2 TO P17, PINS 4-6.

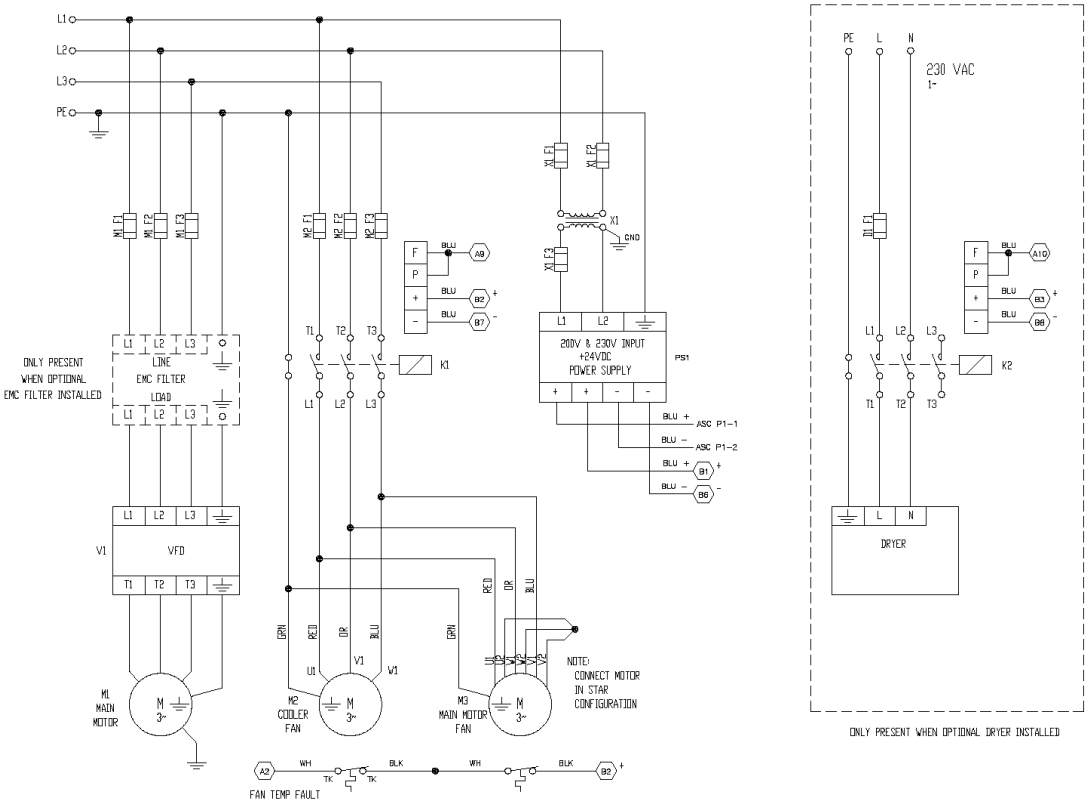
301CGB546-C
(Ref. Drawing)
Page 3 of 4

Figure 4-9 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 200/230 VOLT



301CGB546-C
(Ref. Drawing)
Page 4 of 4

Figure 4-10 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 200/230 VOLT



LEGEND
- PT1 = RESERVOIR PRESSURE TRANSDUCER
- PT2 = PLANT PRESSURE TRANSDUCER
- PT3 = SYSTEM PRESSURE TRANSDUCER
- TT1 = INLET TEMPERATURE THERMISTOR
- TT2 = DISCHARGE TEMPERATURE THERMISTOR
- TT3 = DRYER TEMPERATURE THERMISTOR
- IVS = INLET VALVE SOLENOID
- BDV = BLOW DOWN VALVE SOLENOID
- AFV = AIR FILTER VACUUM SWITCH
- ASC = AIRSMART CONTROLLER
- PMV = PRECISION MIXING VALVE
- DWD = DRYER WATER DRAIN VALVE SOLENOID
- K1 = VENT FAN CONTACTOR
- K2 = DRYER CONTACTOR
- V1 = VARIABLE FREQUENCY DRIVE
- M1 = MAIN MOTOR
- M2 = COOLER FAN
- M3 = MAIN MOTOR FAN
- PS1 = 24V DC POWER SUPPLY
- X1 = CONTROL TRANSFORMER
- AUX = AUXILIARY POWER FOR MOISTURE SEPARATOR
- N-1 = PREVIOUS SEQUENCED COMPRESSOR
- N+1 = NEXT SEQUENCED COMPRESSOR

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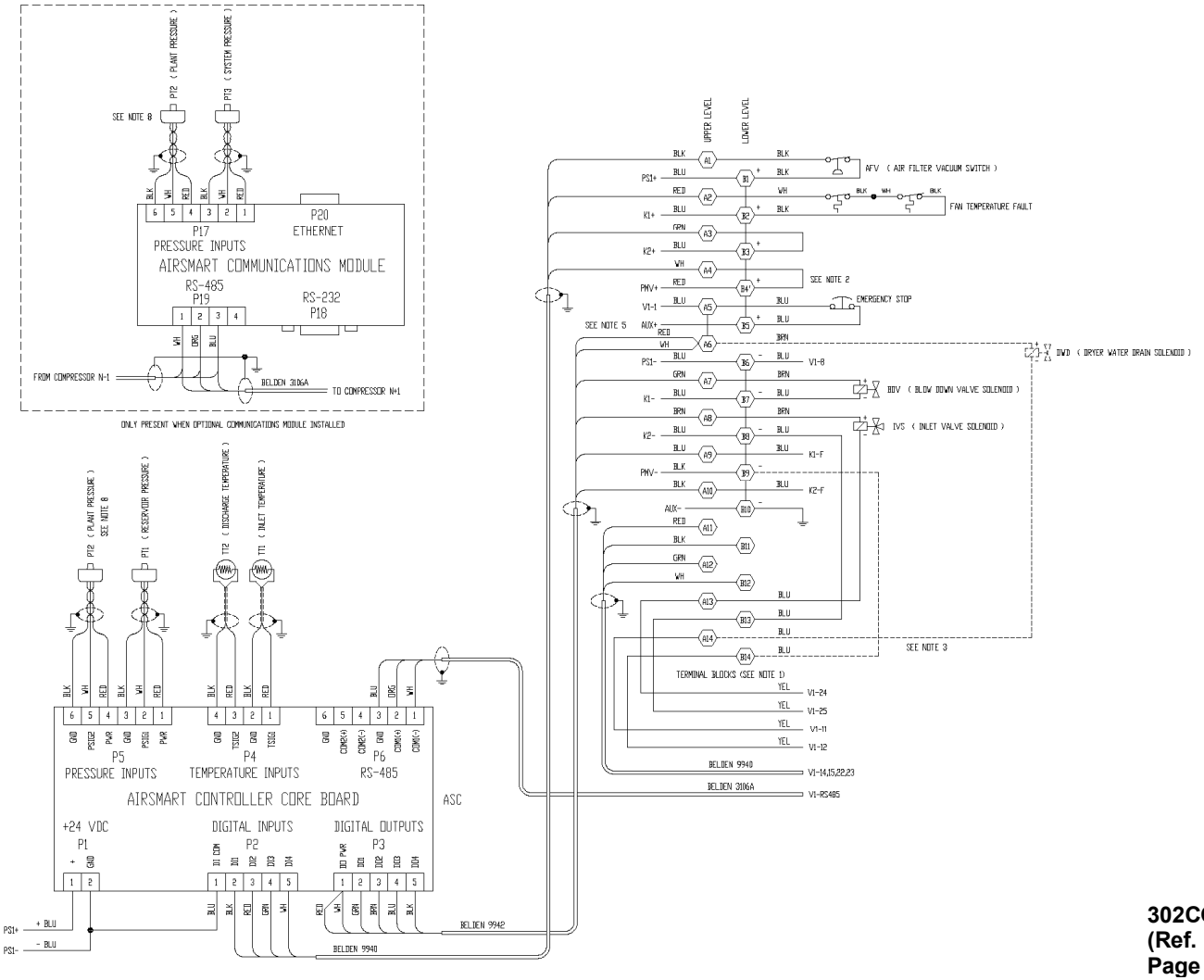
(Ref. Drawing)
Page 1 of 4

Figure 4-11 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 575 VOLT



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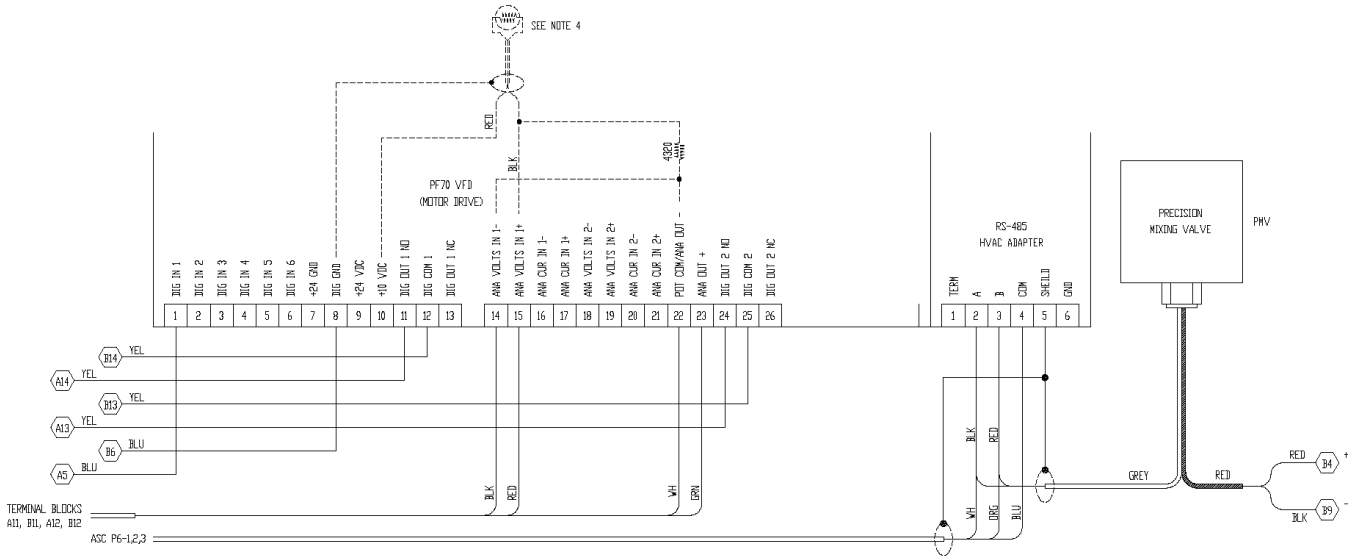
(Ref. Drawing)
Page 2 of 4

Figure 4-12 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 575 VOLT



NOTES:

1. SHORTING JUMPERS INSTALLED ON TERMINALS BLOCKS AS FOLLOWS
   +24VDC - B1, B2, B3, B4, B5
   DC GND - B6, B7, B8, B9, B10
   E-STOP QUALIFIED +24VDC - A5, A6

2. FOR CONTROL BY REMOTE CONTACT, REMOVE JUMPER BETWEEN TERMINALS A4 AND B4 AND CONNECT N.C. SWITCH

3. WHEN DRYER IS NOT INSTALLED ADVISORY/SHUTDOWN ALARM CONTACT BETWEEN A14 AND B14 CONTACT RATING: N.O., 3A @ 30VDC, 3A @ 240VAC

4. WHEN DRYER THERMISTER IS INSTALLED CONNECT RED THERMISTOR WIRE TO TERMINAL 10, CONNECT BLACK THERMISTOR WIRE TO TERMINAL 15, CONNECT 4320 OHM, 0.25W, 1% RESISTOR BETWEEN TERMINAL 14 AND TERMINAL 15, CONNECT WIRE BETWEEN TERMINALS 14 & 22.

5. AUXILIARY POWER FOR MOISTURE SEPARATOR NOT INSTALLED WHEN DRYER IS USED.

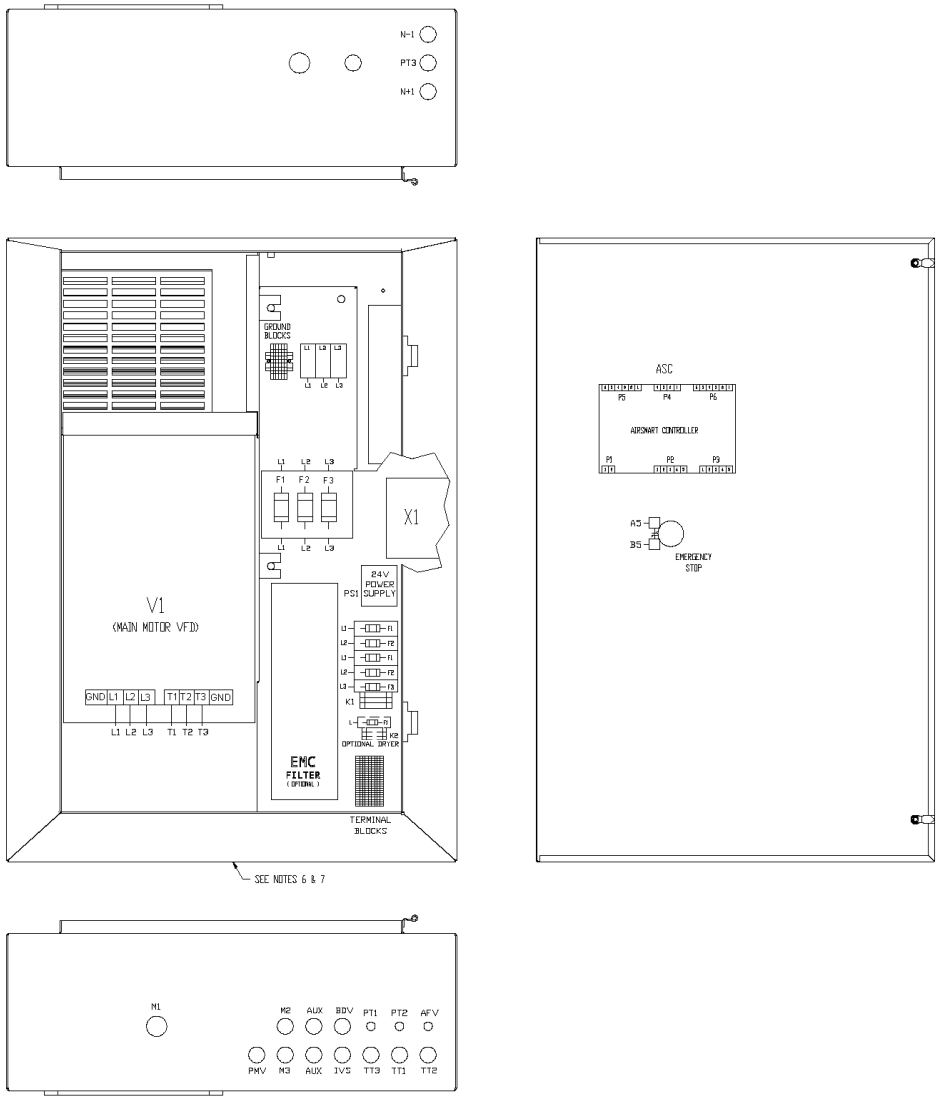
6. BACK PLATE MUST BE BONDED TO CONTROL BOX USING 4 AWG (MIN) BONDING STRAP.

7. DOOR MUST BE BONDED TO CONTROL BOX USING 10 AWG (MIN) BONDING STRAP.

8. WHEN COMMUNICATIONS MODULE IS INSTALLED AND PT3 IS INSTALLED, CONNECT PT2 TO P17, PINS 4-6.

302CGB546-C
(Ref. Drawing)
Page 3 of 4

Figure 4-13 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 575 VOLT



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(Ref. Drawing)
Page 4 of 4

Figure 4-14 – WIRING DIAGRAM – (AIR-COOLED) Single-Stage VS Control, 575 VOLT

SECTION 5
COMPRESSOR LUBRICATION – SEPARATION, FILTRATION AND CONTROLS

⚠ DANGER

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

⚠ CAUTION

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

COMPRESSOR OIL SYSTEM ï Lubricating oil is employed to absorb the heat of compression, lubricate moving parts and seal internal clearances between the rotor and air cylinder. Pressure differential between the air/oil reservoir and various injection points is used to flow oil through the package.

Oil exits the air/oil sump and is then routed to the heat exchanger and the thermal mixing valve, where cold (oil cooler branch) and hot (bypass branch) are mixed to a temperature that will avoid water vapor condensation within the oil system. Tempered oil is sent to the oil filter for cleaning, then onto injection. The injected oil absorbs heat from compression while progressing through the compression chamber and is then discharged back into the oil separation chamber as a mixture of liquids and aerosols (oil) and gas (air).

Centrifugal action within the air/oil reservoir separates the bulk of the oil from the air, where it is collected and readied for the next cooling cycle. The compressed air and aerosols continue through a coalescing filter, where all but 4 ppm of oil is removed from the compressed air and discharged to the aftercooler.

RECOMMENDED LUBRICANT ï The Gardner Denver compressor is factory-filled with AEON 9000SP lubricant. This lubricant is formulated to the highest quality standards and is factory-authorized, tested and approved for use in our rotary screw compressors. AEON 9000SP lubricant is available through your authorized Gardner Denver compressor distributor.

OIL SPECIFICATIONS - The factory fill compressor lubricant is Gardner Denver AEON 9000SP lubricating coolant for all-year-round operation. This is a polyalphaolefin (PAO) synthetic lubricant specially formulated for rotary screw compressor service.

It is highly recommended that the lubricating oil be analyzed frequently in order to identify its quality and remaining operational life. A sampling valve, located on the tubing between the oil filter and the injection manifold, is provided for this purpose.

⚠ CAUTION

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

⚠ CAUTION

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

AEON 9000SP Synthetic Lubricating Coolant is not compatible with Nitrile (Buna N) or acrylic paints. AEON 9000SP is compatible with most air system downstream components.

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

MOISTURE IN THE OIL SYSTEM - The oil mixing valve provided with your compressor package has been designed to avoid water vapor condensation during all modes of operation (e.g., load level, ambient temperature or relative humidity and discharge pressure). See ñOil Mixing Valveò notes within this section for further details on this device.

This feature does not eliminate the need to analyze the lubricating oil frequently. If an analysis reveals the presence of water in the oil, it may indicate that the oil mixing valve is malfunctioning. Contact your authorized Gardner Denver factory distributor for assistance.

OIL SIGHT GLASS - This device indicates oil level within the air/oil reservoir. Check oil level only with the compressor running. Normal oil level is area between ñminòand ñmaxòmarks. Add oil only when oil level has reached the ñminòmark. Drain oil only when the oil level has exceeded the ñmaxòmark.

ADDITION OF OIL BETWEEN CHANGES ï Oil losses (typically 4 ppm) from the oil separation system may require replenishment between scheduled changes. If (during operation only) the sight glass shows no oil or less than 25% of full height, add oil per following steps: (See Figure 5-1, page 47).

1. Be sure the unit is completely off and oil sump is depressurized.

2. Disconnect lockout and tagout the power supply to the compressor package.

3. Close (when provided) valve isolating compressor package from air system.

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

5. Remove the oil filler plug (1) and add (or drain by removing plug (3) if correcting high level) sufficient oil to adjust its level to nearly the top of the measuring rod.

6. Install the oil filler plug, open isolation valve (when provided), restore power, then run unit to check for leaks.

Note that repeated addition of oil between oil changes may indicate excessive oil carry-over and should be investigated.

⚠ CAUTION

Excessive oil carry-over can damage equipment. Never fill oil reservoir above the "max" level mark.

⚠ CAUTION

Use only CLEAN containers and funnels to avoid contamination of oil. Provide for clean storage of oils. Changing the oil will be of little benefit if done in a careless manner

OIL CHANGE INTERVAL ï The AEON 9000SP Synthetic Lubricating Coolant shall be changed every 8000 hours of operation or as prescribed by the results of an oil analysis, whichever comes first. Note that severe operating conditions (e.g., very dusty, high humidity, etc.), may require more frequent oil changes.

Gardner Denver offers a free oil analysis program with our AEON 9000SP lubricant. The first sample from a new unit should be sent in between 40-100 hours of operation.

DRAINING AND CLEANING OIL SYSTEM - Always drain the complete system. Draining when the oil is hot will help to prevent varnish deposits and carry away impurities. To drain the system, use the following method: (See Figure 5-1, page 47.

1. Be sure the unit is completely off and oil sump is depressurized.
2. Disconnect lockout and tagout the power supply to the compressor package.
3. Close (if provided by user) valve isolating compressor package from air system.
4. Wipe away all dirt around the oil fill plug (1) and remove it..
5. Remove drain (3) plug to evacuate oil.
6. Replace drain plug (3), add oil up to the max level on the oil sight gauge, and replace fill plug (1).
7. Restore power and run unit to check for leaks.
8. After 1-2 minutes of operation, stop the unit, allow the oil to settle, and check that a proper oil level has been achieved. If additional oil is required, repeat steps 1,2,3,4, and 6, 7 to correct oil level.

9. If the drained oil and/or the oil filter element are contaminated with dirt, flush the entire system, reservoir, oil cooler, mixing valve and lines. Inspect the oil separator element for dirt accumulation; replace if necessary. If a varnish deposit exists, contact the factory for recommendations for removal of the deposit and prevention of varnish.

Ref. No.	Name
1	Oil Fill
2	Pressure Relief Valve
3	Oil Drain

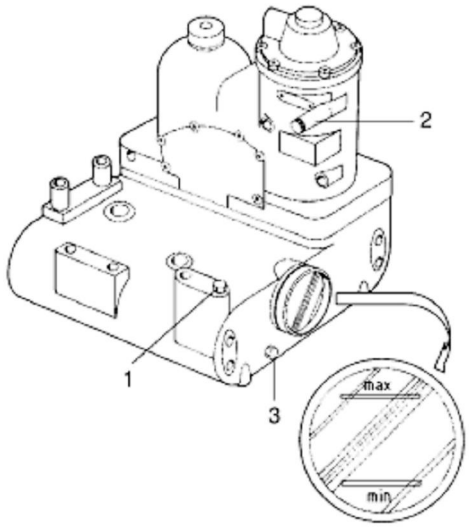


Figure 5-1 – CHECKING OIL LEVEL

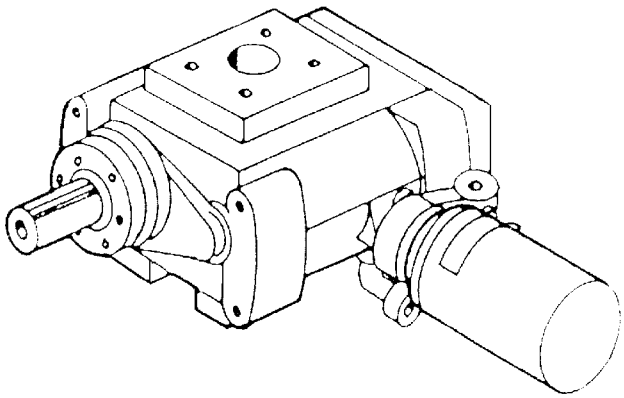


Figure 5-2 – CHANGING OIL FILTER

REFILLING OIL SYSTEM - The steps to refill the drained oil system are the same as those already presented for the addition of oil between changes ï see page 45, for full details. The only exception is that to fill all the empty lines and components (e.g., oil cooler, compressors, and oil filter) a much larger volume of oil will be required.

The VS20 package requires nearly 2 gallons of AEON 9000SP Synthetic Lubricating Coolant to fill all the lines and components and achieve normal oil level.

COMPRESSOR OIL FILTER - The oil filter is a vital part in maintaining a trouble-free compressor, since it removes dirt and abrasives from the circulated oil. It should be replaced every 1000 hours of operation, sooner if necessary due to dirty environment and when the oil is changed.

A flow bypass valve, mounted inside the filter cartridge, provides uninterrupted oil flow when the filter element is contaminated and its backpressure exceeds 29-36 psid (at typical operating conditions of 140°F and 100 psi). However, since this condition introduces unfiltered, potentially contaminated oil into the compressor, it is best avoided by following the recommended filter replacement intervals.

⚠CAUTION

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

The filter media is contained within an easily replaced, spin-on cartridge. Use the following procedure to replace the filter. Do not disturb the piping:

1. Be sure the unit is completely off and that the oil sump is depressurized.
2. Disconnect lockout and tagout the power supply to the compressor package.
3. Close (when provided) valve isolating compressor package from air system.
4. Unscrew (counter-clockwise) the cartridge with adequate tool (e.g., strap wrench) and remove.
5. Clean (wipe) and lubricate sealing surface on filter housing with grease.
6. Lubricate o-ring seal on new element with grease.
7. Screw-new element onto filter head firmly ï approximately 3/4 turns after cartridge and head make contact.
8. Open isolation valve (when provided), restore power, then run unit to check for leaks. Re-set oil filter service interval in AirSmart controller.

OIL MIXING VALVE (Electronic) ï This device mixes cold (from oil cooler) and hot (bypassed) oil in order to achieve a compressor discharge temperature above the saturation level of the water vapor contained in the compressed air ï thus avoiding water collection in the oil system.

Figure 5-3 – THERMOSTATIC MIXING VALVE ELEMENT

Normal Package Operation - The AirSmart controller includes an algorithm that determines, in real time, and on the basis of the intake temperature and the programmed target discharge pressure, the minimum discharge temperature the compressor must attain in order to keep water vapor from condensing in the oil system. Signals from the controller command the 3-way ball valve servo to rotate and mix hot and cold oil streams until the desired compressor discharge temperature is achieved. Refer to Figure 5-4 for the dew point trends of the compressed air at four typical pressure levels.

At startup, the mixing valve is on full bypass mode. As system heat load increases with ambient temperature or load, the mixing valve sends more oil flow to the cooler to maintain adequate compressor discharge temperature.

While the mixing valve is in its modulating range (between extremes of valve position), a compressor discharge temperature deviation exceeding +/- 10°F from the calculated value will trigger an alarm display to caution that a system malfunction is taking place. Note that the alarm is not triggered once the valve has reached either end-of-travel position, as oil mixing no longer controls the compressor discharge temperature.

Low Air Demand and Package Operation ï During periods of very low air demand, such as when the package is operated in short cycles, the oil system may not reach a high enough temperature to keep water vapor from condensing, in spite of the oil mixing valve bypassing all flow around the heat exchanger.

Under these conditions, it is recommended that the package operation be prolonged after each unload condition is achieved - this can be easily accomplished by adjusting the ñAuto Timerò option in the AirSmart controller. Refer to the AirSmart controller userôs manual 13-17-600 for detailed programming instructions of this parameter and adjust the ñAuto Timerò parameter to a value of at least 5 minutes.

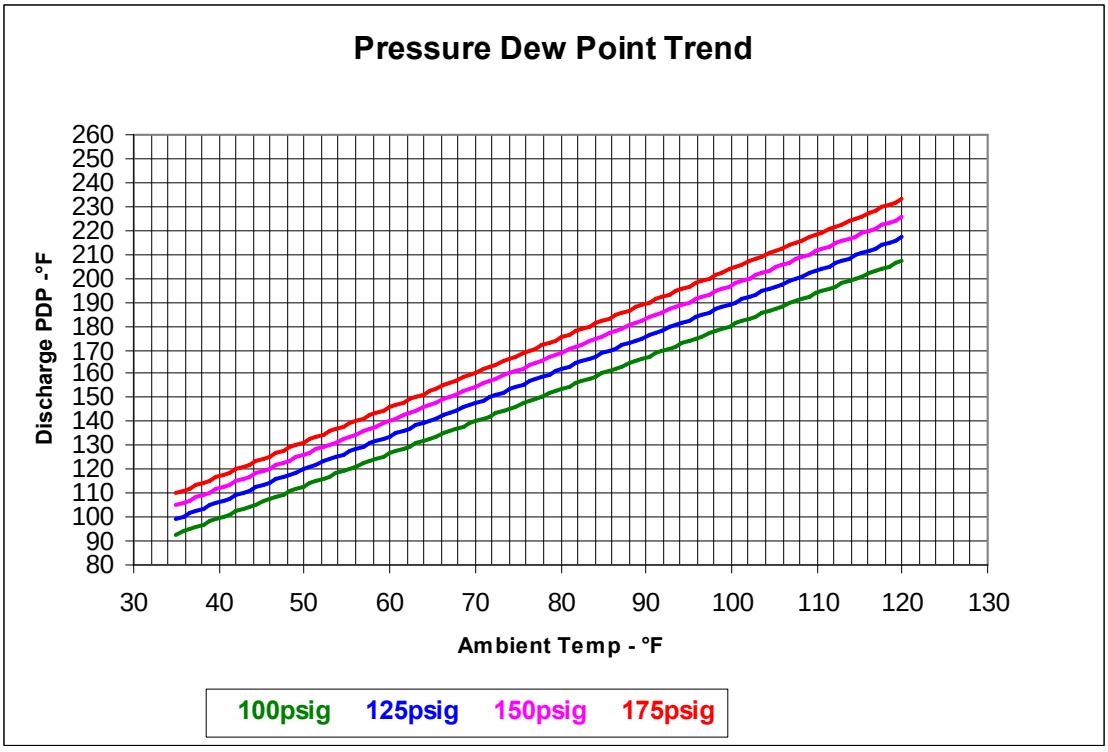


Figure 5-4 – PRESSURE DEW POINT OF COMPRESSED AIR

OIL SEPARATION RESERVOIR / COALESCING ELEMENT - This device serves multiple functions in the compressor package:

- **Air/oil centrifugal separation** - The bulk of the liquid oil is separated, by change of direction, impingement and additional centrifugal effects, away from the compressed air and aerosol streams, and is then gravity-collected at the bottom of the sump.

- **Oil degassing and holding** - The sump has sufficient holding capacity to degas the oil mass before it is drained off on its way to cooling, filtering and re-injection. It also serves as a storage volume for the oil mass migrating from higher elevations (e.g., oil cooler, compressor casings, and piping).

- **Air/oil final separation** - The aerosols and compressed air streams are led to the upper portion of the sump, where the coalescing element resides. The fine droplets of oil (aerosol) are trapped in the element media, coalesced, then gravity-drained, through a low-point connection and associated tubing (oil return line) into a lower pressure region of the compressor.

Separation performance - The package oil separation system has been designed to yield 2 ppm total oil carryover at the discharge of the air/oil reservoir ï the oil content level at the discharge of the package will be lower and will depend on the amount of moisture rejected by the aftercooler.

This high level of performance will be affected by the following typical offset conditions:

- Contaminated (e.g., dirt, varnish, moisture) or damaged (e.g., ruptured) coalescing element.
- Contaminated (e.g., dirt, varnish, moisture) or inadequate oil in use.
- High oil level in air/oil reservoir.
- Blockage of oil return line strainer or orifice.
- Abnormally frequent or fast depressurization cycles - leading to oil foaming.

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

Oil Coalescing Element Monitoring - The AirSmart controller keeps track of the pressure differential across the coalescing element. A pressure differential of 8 psi will trigger a service advisory to change the element and a pressure differential of 15 psi will initiate a system shutdown.

⚠CAUTION

Using an oil separator element at excessive pressure differential can cause damage to equipment. Replace the separator when the "Change Separator" advisory appears.

NOTICE

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

Ref. No.	Description
1	Minimum Pressure/Check Valve
2	Air/Oil Separator Element
3	Oil Scavenge Line Orifices
4	Oil Scavenge Line Strainer
5	O-Ring
6	Minimum Pressure/Check Valve Adjusting Nut

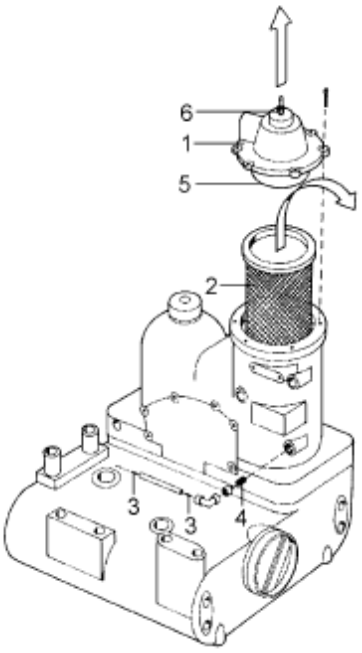


Figure 5-5 – CHANGING OIL COALESCING ELEMENT

Oil Coalescing Element Service – Use the following procedures to replace or inspect the element:

1. Be sure the unit is completely off and that oil sump is depressurized.

2. Disconnect, lockout and tagout power supply to the compressor package.

3. Remove cap screws and body of MPV/sump cover (1).

4. Lift the air/oil coalescing element from sump.

5. Inspect and/or replace the element if necessary - shine a light inside the element to reveal areas of heavy dirt, varnish deposits or breaks (ruptures) in its media. Also inspect (sealing) o-ring in element for damage. Before installing new or old element, apply (heavy) grease to sealing o-ring ï to avoid damage during installation.

6. Inspect oil scavenge orifice (3) and strainer (4) for fouling. Replace if necessary.

7. Wipe the MPV/sump cover seal o-ring (5) clean and inspect for damage. Replace if necessary.

8. Lower element into sump and press element down into holder. Do not use excessive force as element damage may occur.

9. Carefully place MPV/sump cover and o-ring seal on sump flange. Check that centering pin (on MPV/sump cover) has engaged element cavity and that MPV/sump cover lays flat against sump flange. Install and tighten cap screws.

10. After compressor is started and pressurized, inspect MPV/sump cover joint for leaks. Reset oil coalescing element service interval in AirSmart controller.

SECTION 6
HEAT EXCHANGERS (OIL, AIR), AXIAL COOLING FANS

⚠ CAUTION

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

⚠ DANGER

Do not attempt inspection or cleaning of air-cooled heat exchangers until cooling fan has stopped rotating. Disconnect, lockout and tagout package from power supply.

⚠ DANGER

Automatic restarting or electrical shock can cause injury or death. Disconnect, lockout and tagout package from the power supply.

OIL/AIR HEAT EXCHANGERS – The heat of compression absorbed by the oil injected into the compressors (for cooling and lubrication) is ultimately rejected in a convenient medium such as air (for air-cooled cores) or water (for water-cooled cores). Proper operation of these heat exchangers is essential for the following processes:

- The compressors require a stable, cool (140°F typical at 80°F ambient air) supply of injection oil in order to operate at optimal efficiency. Under these conditions, the oil core allows 13.2 gpm oil flow with 9.0 psid pressure loss.
- The lubricating and cooling oil must be kept at a normal operating temperature below 225°F in order to preserve its longevity.
- The compressed air supply must be delivered into the distribution system at a temperature not exceeding 15°F above the ambient level in order to protect other devices (e.g., filters, dryers, tools, etc) against damage. At 100 psi of discharge pressure, the air core allows the flow of 120 cfm with 0.7 psid pressure loss.

AIR-COOLED HEAT EXCHANGERS ï Air-cooled cores (radiator-type) are provided as standard feature. An axial fan, located below the heat exchangers, pumps the required amount of cooling air and expels it through an opening on the enclosure roof. The fan is driven by a close-coupled, IP54-protected, electric motor. A full-voltage starter energizes the fan motor.

Refer to Figure 6-1 for estimates of ventilation requirements. Please note that the air-cooled package requires the combined total of the heat exchanger plus the enclosure ventilation flow rates (which include motor ventilation and compressor intake). Furthermore, when package location makes it necessary to duct fresh cooling air in/out, these ducts must be sized with a maximum (total) pressure loss of .1 inch water gauge to avoid impacting the heat exchanger cooling air system. An external ventilation fan may be required to properly evacuate hot air from the compressor room.

Minimum Cooling Air Flow Requirements		
CFM		
KW	Air-Cooled Heat Exchangers	Enclosure Ventilation
20	2100	771

Figure 6-1 – AIR FLOW CHART

All the required hardware, mechanical and electrical connections have been made at the Gardner Denver factory, thus the only regular maintenance required is to keep the exterior core fins free from dirt and other airborne debris per the following procedure:

⚠ CAUTION

Air-cooled heat exchanger cores are fabricated from aluminum. Do not use caustic liquids to cleanse core or permanent damage will take place.

1. Be sure the unit is completely off and that oil reservoir is depressurized.
2. Disconnect, lockout and tagout power supply to the compressor package.
3. Open and/or remove enclosure door panels adjacent to cooler assembly.
4. Locate cooler housing side covers (See Figure 6-2) and remove by unscrewing fasteners.
5. Inspect core area. If blocked with debris, use a moderate (e.g., 100psi) source of compressed air and/or water while directing nozzle (pointed through core to inside) to dislodge debris and clean. Vacuum (applied from inside) can also be employed to clean the heat exchanger cores.
6. Inspect core area. If blocked with debris, use a moderate (e.g., 100psi) source of compressed air and/or water while directing nozzle (pointed through core to inside) to dislodge debris and clean. Vacuum (applied from inside) can also be employed to clean the heat exchanger cores.
7. Inspect core area. If blocked with debris, use a moderate (e.g., 100psi) source of compressed air and/or water while directing nozzle (pointed through core to inside) to dislodge debris and clean. Vacuum (applied from inside) can also be employed to clean the heat exchanger cores.
8. Inspect core area. If blocked with debris, use a moderate (e.g., 100psi) source of compressed air and/or water while directing nozzle (pointed through core to inside) to dislodge debris and clean. Vacuum (applied from inside) can also be employed to clean the heat exchanger cores.
9. Inspect core area. If blocked with debris, use a moderate (e.g., 100psi) source of compressed air and/or water while directing nozzle (pointed through core to inside) to dislodge debris and clean. Vacuum (applied from inside) can also be employed to clean the heat exchanger cores.
10. Remove all loose debris and water from cooler box after cleaning process is complete.
11. Re-attach cooler housing side covers with provided fasteners and re-install enclosure door panels.

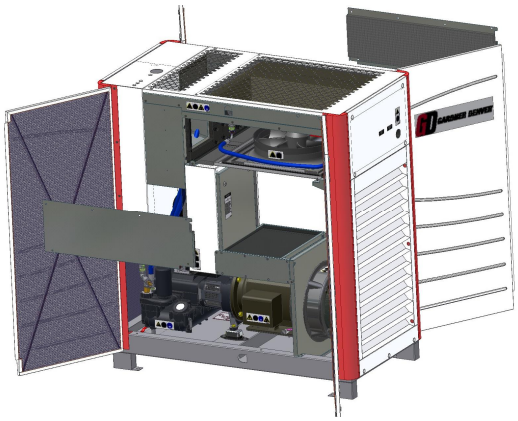


Figure 6-2 – COOLER HOUSING SIDE COVERS

Automatic restarting or electrical shock can cause injury or death. Disconnect, lockout and tagout package from the power supply.

AXIAL COOLING FANS

1. Follow the Lock-Out Tag-Out procedures to de-energize the package. Allow adequate time for the VFD capacitors to fully discharge before beginning maintenance.
2. Exercise caution around compressor parts after stopping the package for service. Fans and coolers will be hot after stopping the compressor.
3. Remove access panels and guards as needed to gain access to the fan blades.
4. Cover motors, mixing valves, fan motors and other electrical components to prevent damage from the cleaning process.
5. Use a mild detergent or degreaser to soften and dissolve accumulated grime.
6. Using a soft cloth or sponge, remove the surface grime from both sides of the blade surface.
7. Wipe up and remove all traces of cleaning residue and cleaning materials.
8. Reinstall all access panels and guards that were removed to access the fans.
9. Follow the Lock-Out Tag-Out procedures to re-energize the package.
10. Jog fans to verify there is no interference with the guard or cowling ring before the package is placed back in service.

All axial cooling fans should be inspected and cleaned at the same interval as the heat exchangers are. Ambient conditions will determine the actual maintenance interval at each installation.

WATER SEPARATOR AND DRAIN ï These devices separate and drain the water (condensed by the air cooler) mixed with the compressed air delivered by the compressor package. Note that this device is not used when the optional compressed air dryer is supplied, as the latterõs water separator is employed for this process.

Figure 6-3 – WATER SEPARATOR AND DRAIN

The separator (4) removes the liquid water from the compressed air stream by inertial effects and collected in a lower bowl (3). The collected water is evacuated by a float-type drain valve (1). The device prevents the loss of compressed air by only allowing the discharge of liquid water during its opening phase. An isolation ball valve (5) is provided between the separator bowl (3) and the drain valve body (1). This allows the safe and quick removal of the drain valve for servicing, in case the drain valve malfunctions.

In case the drain valve is fouled with dirt, cleanse the collection bowl also:

1. Be sure the unit is completely off and oil sump is depressurized.
2. Disconnect, lockout and tagout power supply to the compressor package.
3. Close (when provided) valve isolating compressor package from air system.
4. Unscrew drain valve (1) from isolation valve (5).
5. Unscrew collection bowl (3) from separator housing (4).
6. Inspect and cleans collection bowl and sealing o-ring.
7. Reinstall in reverse order

SECTION 7
AIR FILTER

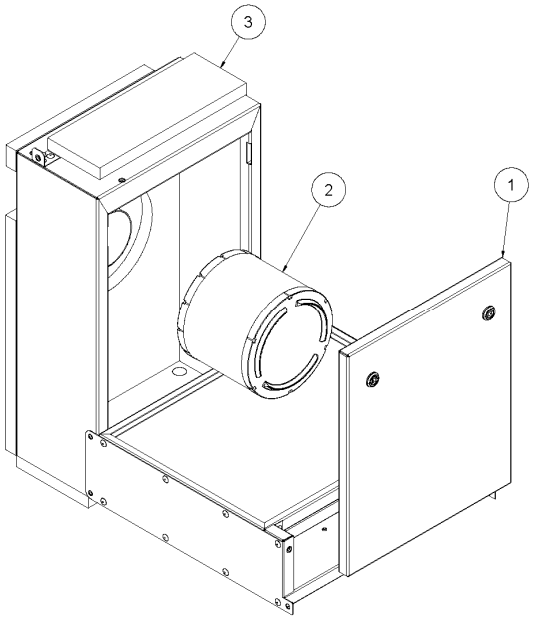


Figure 7-1 – AIR FILTER (STANDARD)

AIR FILTER - This device cleans the air stream entering the compressor inlet and is furnished as standard equipment with the compressor package. Its single high efficiency, synthetic media element is housed in a metal housing integrated in the enclosure structure.

Efficient compressor package operation depends on the unrestricted, clean supply of fresh air delivered by the air filter. In turn, the longevity of the filter element depends on the cleanliness of the local environment.

NOTICE

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

⚠ CAUTION

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 air filter element. Never use elements that are damaged, ruptured or wet. Keep spare elements on hand to reduce downtime. Store elements in a protected area free from damage, dirt and moisture. Handle all parts with care.

Filter Element Inspection and Replacement:

1. Remove air cleaner cover (1) and remove filter element.

2. Visually inspect housing inner tube against which the element makes a seal. Wipe dirt from outer surface if necessary. Also visually inspect the matching o-ring seal that is bonded to the element for defects and dirt, then wipe clean if necessary.

3. Visually inspect media. If flaws (e.g., tears of media, damage to sealing o-ring, etc.) are evident or if the pressure loss has triggered the vacuum switch (activation level is 30 inches water gauge) provided with the package instrumentation, replace the element. Cleansing the element with air or water is not recommended, as media damage is very probable.

4. Replace element and cover and fasten cover to filter housing.

SECTION 8
SHAFT COUPLING

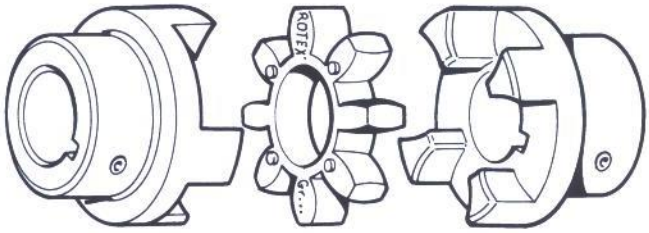


Figure 8-1 – COUPLING COMPONENTS

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

SHAFT COUPLING ï Main motors drive their companion compressors by means of curved jaw-type couplings. Each coupling hub is fixed to the shaft with a setscrew and key combinations. The power is transmitted through a meshing, single, dry, vibrations damping element ï see Figure 8-1, for details of the main components.

The close-coupled arrangement of motor and compressor, through a machined cast housing, provides automatic alignment of shafts and coupling. The coupling assembly requires no lubrication.

Coupling Element (Rotex size 28) Inspection and Replacement:

1. Disconnect, lockout and tagout power supply to the compressor package.
2. Remove fasteners securing coupling guard to access opening on compressor-motor housing and remove guard.
3. Depending on the bore-to-shaft fits (e.g., clearance or interference) on either of the coupling hubs, proceeds as directed. For hub-to-shaft clearance fit hubs:
   - Loosen setscrews fastening hubs to shafts and slide hubs away from each other to allow removal of coupling element. Note that if the hubs do not slide on the shafts after this step, they should be considered interference fitted, thus proceed directly to Step 4, for further removal instructions.
   - Inspect coupling element for signs of wear and tear such as indentations, cracks, deformation, extrusions, etc. Replace, if necessary.

- After engaging each hub on the matching recesses of the coupling element, check that the gap between the hub flats (see dimension ñEò on Figure 8-2) is within 0.79/.85 in (20.0/21.5 mm). A smaller gap will produce abnormal wear of the element by friction and excessive thermal expansion ï the latter could cause compressor damage by axially displacing the input shaft. Make sure that keys are in proper alignment with key-ways on hubs.

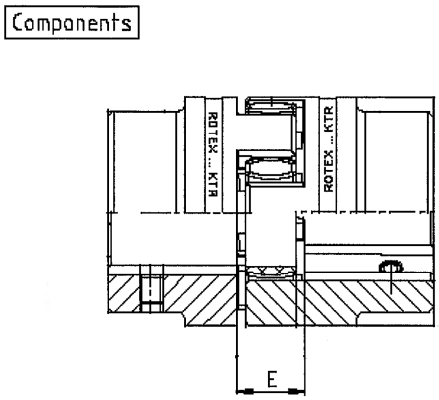


Figure 8-2 – COUPLING ELEMENT

4. For hub-to-shaft interference fit hubs, main drive motor removal is necessary:

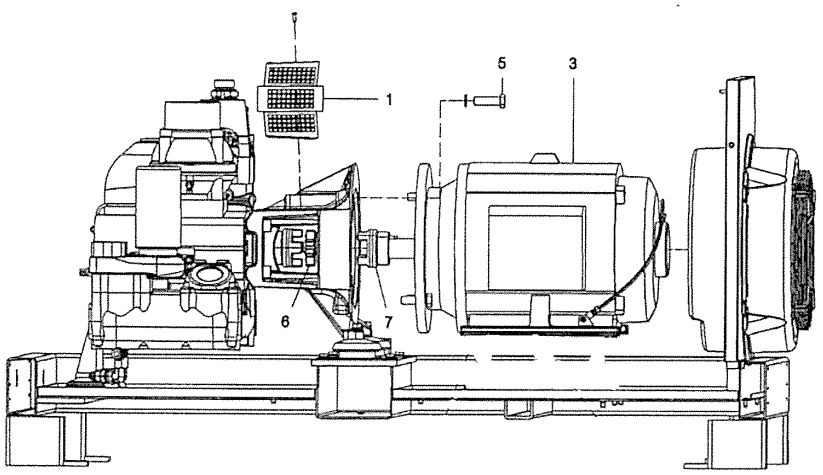


Figure 8-3 – MOTOR REMOVAL HARDWARE

- Remove inlet filter duct above motor body (3).
- Remove service hatch and metal panel on opposite side of motor body (3).
- Remove coupling guard (1)
- Unfasten bolts securing (cooling fan) support to base frame and move support away from main motor (3).

- Insert a suitable lifting (e.g., 2òx 4òwood member) between the motor underside and the base frame.
- Remove motor bolts (5) and move motor away from the adaptor flange.
- Remove the coupling element and inspect it for signs of wear and tear such as indentations, cracks, deformation, extrusions, etc. Replace, if necessary.
- Re-assemble main motor and cooling fan components in reverse.
- After engaging each hub on the matching recesses of the coupling element, check that the gap between the hub flats (see dimension ñEò on Figure 8-2) is within 0.79/.85 in (20.0/21.5 mm). A smaller gap will produce abnormal wear of the element by friction and excessive thermal expansion ï the latter could cause compressor damage by axially displacing the input shaft. Make sure that keys are in proper alignment with key-ways on hubs.
- Apply a thread-locking compound to the hub setscrews (M6 size) and tighten to 3.5 lb-ft (4.8 N-m) of torque. Reinstall coupling guard with provided fasteners.

Interference-fitted Coupling Hub Installation and Removal ï In the event that a coupling hub has to be removed, please note that these are designed to fit on compressor and motor shafts with a transitional interference fit. Coupling hubs and their companion shafts which have bore diameters which fall in the interference range of the design fit must be installed or removed with the aid of a pulling tool and/or heat dilation. The recommended steps are based on the assumption that the main motor has been pulled away from the compressor and that the motor adaptor housing is still attached to the compressor.

Coupling Hub Installation:

- Have coupling installation tool part number CC1021458 available ï contact Gardner Denver for sourcing details.
- Mount coupling hub onto tool via provided magnets.
- Make sure that the keyway on the coupling hub and its companion shaft are properly de-burred, cleaned and that the key fits easily into either.
- Thoroughly cleanse the surface of the companion shaft and cover it with a film of anti-seize lubricant part number 25BC850 ï contact Garner Denver for sourcing details.
- Expose hub and tool assembly to the heat source until the hub reaches a temperature of 200° F. Note that an oven is a preferred method to heat up the hardware.
- With the help of insulating gloves, remove the hub and tool assembly from the heat source and quickly bring it to the companion shaft. Engage the coupling hub bore onto the companion shaft and slide it until the latter contacts the stop. Refer to Figure 8-2 and Figure 8-3 for details of typical tool aligning the coupling hub onto the compressor and motor shafts, respectively. Note that hub-to-shaft alignment distances are different.
- Once the hub has cooled down sufficiently to grip the companion shaft, remove the installation tool.
- Apply a thread-locking compound to the hub setscrews (M6 size) and tighten to 3.5 lb-ft (4.8 N-m) of torque. Reinstall coupling guard with provided fasteners.

Coupling Hub Removal:

- Have removal tool part number 90500152 available ï contact Gardner Denver for sourcing details. Before removing an interference-fitted hub, note and record the position of the hub with respect to the end of the companion shaft. This is particularly critical if an installation tool is not available.
- Assemble the removal tool unto the hub as shown in Figure 8-4. Make sure that the shaft protector piece is captured between the puller screw and the end of the shaft
- Apply torque to the puller screw with a suitable torque wrench in order to pull hub away from the shaft. If the torque applied to the puller exceeds 75ft-lb (8.4N-m), it indicates that a heavy interference fit between the hub and the shaft exists and heat dilation must be used to expand the hub and loosen its grip on the shaft surface. Secure a suitable heating source and apply heat the hub body while slowly rotating the shaft by means of the removal tool handle. Once the hub body has expanded enough, the present tension of the removal tool will pull the hub away from the shaft.

⚠ DANGER

Heated surfaces of coupling hubs and installation or removal tools may cause severe burns. Make sure to use suitable heat protective gloves and clothes.

NOTICE

If heat was applied to the [compressor] coupling hub during its removal, there is the possibility that the compressor shaft seal was damaged and it must be replaced. Contact Gardner Denver for further instructions.

Figure 8-4 – COUPLING REMOVAL TOOL – VS40 MODEL SHOWN

SECTION 9
MINIMUM PRESSURE/CHECK VALVE

MINIMUM PRESSURE/CHECK VALVE - This device maintains minimum pressure within the air/oil reservoir, thus insuring (cooling/lubricating) oil injection flow into the compressors. It also serves as a check valve to prevent back flow of compressed air flow from the customerûs piping or pipe network back into the compressor package when the compressor is not active. The spring-loaded piston does not allow the discharge of compressed air from the air/oil reservoir until the compressor builds up reservoir pressure exceeding 60 psig. Beyond this pressure level, the valve remains fully open.

The valve does not require maintenance or adjustment. If the valve fails to function, check the valve stem O-ring for sealing, valve orifices for restriction, or valve and valve seat for burrs and dirt. Repair kits are available from your local authorized Gardner Denver distributor.

Before servicing the minimum pressure valve, always stop the unit, release air pressure, lockout and tagout the power supply to the compressor package. Failure to release pressure or properly disconnect the power may result in personal injury or death.

NOTICE

Working spring within valve body is under tension. Failure to relieve spring tension gradually may cause serious injury upon cap removal.

Minimum Pressure/Check Valve (MPV) Inspection:

1. Be sure the unit is completely off and that the oil sump is depressurized ï including pipe works between MVP and (external) isolation valve.
2. Disconnect, lockout and tagout power supply to the compressor package.
3. Tighten nut (12) on the MPV frame (5) ï this compresses the internal components prior to removal.
4. Unscrew bolts fastening MPV frame (5) to the sump housing and remove MPV assembly.
5. Remove snap ring (8) restraining internal components to the cover.
6. Remove internal component assembly (1-4, 6-11, 15) away from MPV frame (5) and inspect or replace components

7. Re-assemble internal assembly (1-4, 6-11, 15) into MPV frame (5) in reverse order.

8. Clean o-ring sealing surfaces between sump and bottom of MPV frame (5). Inspect, clean and or replace o-ring prior to re-installation.

9. Re-install MPV unto sump with provided bolts.

10. Adjust nut (13) so that there is a small (.05ò to .08ð) between itself and the frame (5) surface.

11. Check for leaks after unit is back in operation.

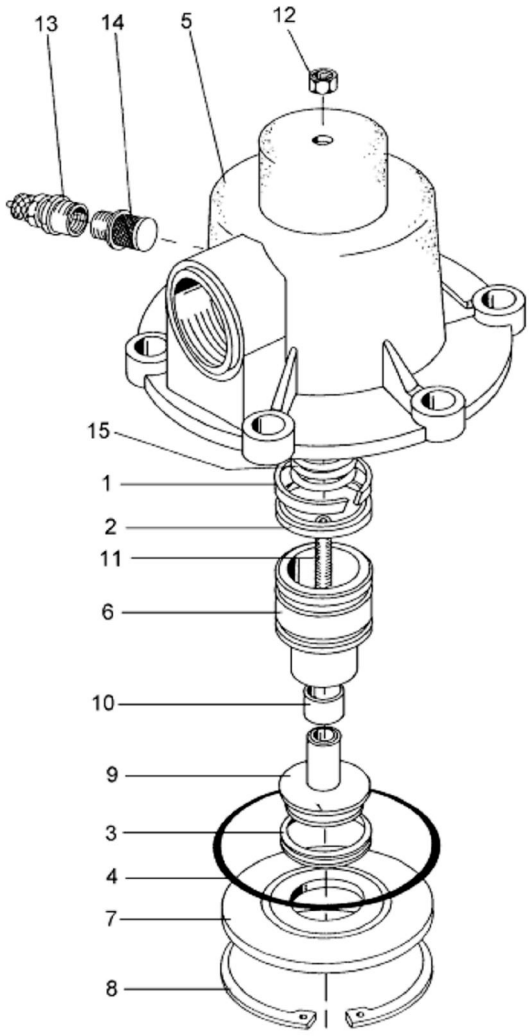
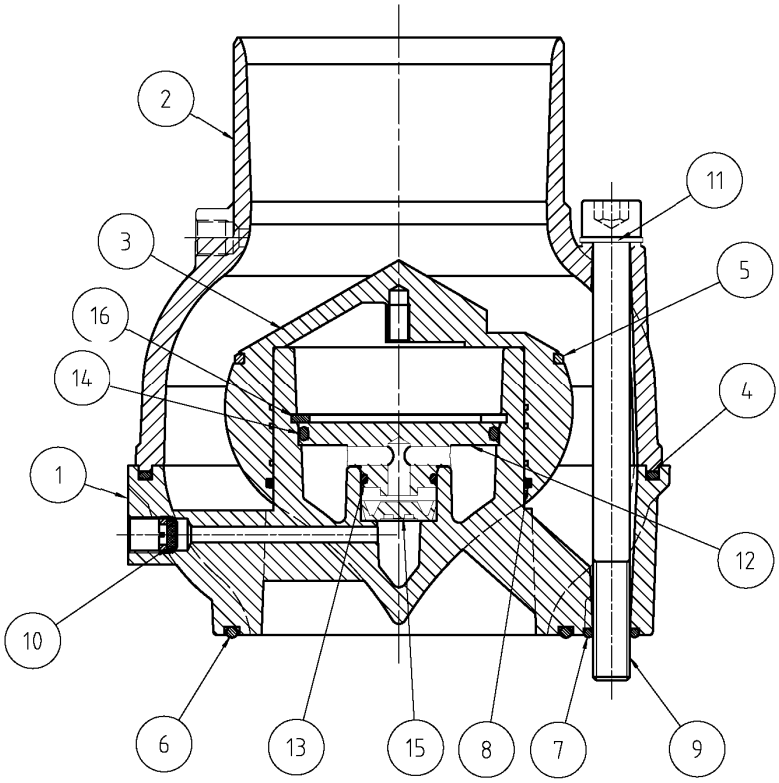


Figure 9-1 – MINIMUM DISCHARGE PRESSURE/CHECK VALVE

SECTION 10
INLET CONTROL VALVE

INLET CONTROL VALVE ï This device is located at the intake flange of the compressor, and allows the compressor to remain pressurized and ready for quick response to air demand when the latter is not running.

During compressor operation, the underside of the poppet is vented to atmosphere via a 3-way solenoid valve, allowing it to fall (open) and feed fresh air to the compressor inlet. An internal self-actuated blow-off valve helps venting quickly the air signal trapped below the poppet. During stopped operation modes (e.g., commanded from the key pad or initiated by protective shutdowns), the 3-way solenoid valve feeds sump air to the underside of the poppet, forcing it upward (closed) and blocking-off the compressor intake. The internal blow-off valve is also forced closed by the sump air signal.



89863529
(Ref. Drawing)

Figure 10-1 – INLET CONTROL VALVE

Inlet Control Valve (Body) Inspection - The valve does not require maintenance or lubrication. If air/oil leaks develop across the valve disc during pressurized conditions (e.g., machine stopped), valve seals should be inspected for wear and tear signs:

1. Be sure the unit is completely off and oil sump is depressurized.
2. Disconnect, lockout and tagout power supply to the compressor package.
3. Close (when provided) valve isolating compressor package from air system.
4. Identify (by position) each tube connected to the valve body and remove.

5. Remove four bolts (9) securing valve body to compressor body and remove valve.

6. Inspect poppet seal (o-ring) (5) for wear and tear. Replace, if necessary.

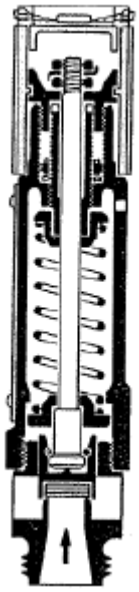
7. In case of noted malfunction (e.g., valve will not open/close properly with good air signal), proceed to dismantle internal blow-off valve.

    - Carefully lift and remove poppet (3).
    - Remove lock ring (16).
    - Pull cover (12) and seal (14).
    - Inspect seals (13 & 15) for wear and tear. Replace if necessary.
    - Re-assemble blow-off valve in reverse order.

8. Reassemble inlet control valve in reverse order.

SECTION 11
PRESSURE RELIEF VALVE

Pressure Relief Valve - This device protects the pressure-containing components of the compressor package against pressures exceeding 188.5 psig. It is installed on the dry-side of the oil sump.



⚠ DANGER

Before inspecting the pressure relief valve, release air pressure, lockout and tagout the power supply to the compressor package. Failure to release pressure or properly disconnect the power may result in personal injury or death.

⚠ CAUTION

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

DANGER

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

Pressure Relief Valve Check During Operation - The pressure relief valve has no user-serviceable or repairable components. However, it should be tested for proper operation at least once every year. To test the pressure relief valve:

- Raise the system operating pressure to its normal level
- Turn the top cap on valve 1-2 turns counter-clockwise to open valve and let it vent for a few seconds.
- Close the valve by firmly turning top cap clockwise. Make sure that cap is firmly tightened to avoid damage by vibrations.

SECTION 12
VENTILATION FILTERS (ELECTRICAL ENCLOSURE)

Ventilation Filters - The electronics housed in the standard IP54 enclosure box are ventilated by a combination of an intake air filter and pressurized air provided by the heat exchanger cooling fans.

Filter Inspection - In order to ensure the electronics operate at peak efficiency and free from troublesome temperature-related stoppages, it is imperative that the filter elements be kept clean:

1. Be sure the unit is completely off and oil reservoir is depressurized.
2. Disconnect, lockout and tagout power supply to the compressor package.
3. To service intake-side filter, open access door (oil filter side) and remove access door located on cooler housing cover ï Refer to Fig 6-2, page 54 for details.
4. To service discharge-side filter, open access door (dryer side) and reach behind electrical box.
5. Remove filter elements from each bracket by prying open the retaining grill area.
6. Inspect the elements. If dirty, gently clean with soapy water and allow to dry completely before re-installation. If damage is evident, replace.
7. Replace elements into frame and replace snap grills.
8. Replace access panel in reverse order.
9. Close access doors.

SECTION 13
MOTOR LUBRICATION

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

Motor Lubrication - Long time satisfactory operation of an electric motor depends in large measure on proper lubrication of the bearings. The following charts show recommended grease qualities and re-greasing intervals for ball bearing motors. For additional information refer to the motor manufacturerôs instructions. The following procedure should be used in re-greasing:

1. Disconnect, lockout and tagout power supply to the compressor package.

2. Locate the automatic grease relief fittings (one at each motor bottom end) and make sure that their spring loaded covers are operational.

3. Locate the grease fittings provided at each end of the motor top end ï be aware the one or both may be relocated away from the motor for easier access. Wipe each grease fitting clean and add grease with a hand - operated gun until excess grease starts draining from the companion grease relief fitting. Make sure that the grease volume does not exceed the motor manufacturerôs recommendation by a factor of approximately 2x.

4. Wipe off only excess grease expelled by the automatic grease relief fittings.

5. Re-start the unit.

Main Motor Grease Specifications:

MANUFACTURER	TRADE NAME	GD Part No.
KLUBER	KLUBER QUIET BQH 72-72	28H312 (1Kg can) 28H311 (400 Gram Cartridge) 28H313 (25 Kg pail)

ELECTRIC MOTOR REGREASING INTERVAL

Type of Service	Typical	Rating	Lubrication Interval
Standard	Continuous Operation	20 kW	8000 hrs
Severe	Humid, dirty, high ambient sites	20 kW	4000 hrs

SECTION 14
MAINTENANCE SCHEDULE

SERVICE CHECK LIST

Daily Checks:

- **Air Filter (Compressor)** - Replace when controller displays ñCHANGE AIR FILTERòmessage. Refer to Section 7 for air filter details.
- **Oil Separator Element** - Replace when controller displays ñCHANGE OIL SEPARATOR ELEMENTò Refer to Section 5, page 43 for oil separator element details.
- **Air/Oil Reservoir Oil Level** - Check the reservoir oil level during compressor operation only - add oil if required. Refer to Section 5, page 43 for full details. DO NOT MIX LUBRICANTS.
- **Start/Modulation/Stop Operation** ï Verify that compressors maintain steady compressed air pressure.
- **AirSmart Operational Parameters** ï Maintaining a periodic log of package critical parameters (e.g., pressures, temperatures, speeds, load levels, etc) helps identify when abnormal operation occurs.
- **AirSmart Controller Messages and Alarms** ï Acknowledge the presence of an abnormal condition and take action to correct it.

Weekly Checks:

- **Heat Exchangers (Air-Cooled)** - Check for dirt accumulation on (air-cooled) air/oil heat exchanger finned surfaces. Refer to Section 6 for detailed instructions to clean heat exchanger surfaces.
- **Axial cooling fans** ï Check for grime and dirt build-up on fan blade surfaces. Refer to Section 6 for detailed instructions to clean axial cooling fan blade surfaces
- **Air Filter (Electrical Box)** ï Check filter elements for dirt accumulation. Refer to Section 12 for detailed instruction to clean filter elements.

Every 1000 Hours or as often as operating conditions require it:

- **Oil Filter** - Replace.
- **Oil** - Sample and analyze.

Every 8000 Hours (or as Prescribed by Oil Analysis Results):

1. **Compressor Lubricant –** Replace.

Yearly Checks:

- **Heat Exchangers (Air and Water-Cooled)** ï Check cooling performance of air and oil cores ï see Section 6 of this manual for details on typical performance expectations as well as recommended cleaning procedures.

- **Pressure Relief Valve –** Check operation of device ï see Section 11 for test procedure.

- **Motor Lubrication –** Inspect motors for abnormal noise and vibration. Grease-lubricate per guidelines included in Section 13 of this manual.

- **Compressor/Motor Shaft Couplings –** Check coupling element for signs of wear and tear ï see Section 8 for detailed instruction on coupling inspection procedures.

SECTION 15
TROUBLESHOOTING

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

SYMPTOM		POSSIBLE CAUSE		REMEDY
Compressor fails to start	1.	Main disconnect open	1.	Check and reset.
	2.	Blown fuses in control box	2.	Check voltage and fuses. Replace fuses.
	3.	Shutdown event sensed by controller not re-set	3.	Investigate cause of fault and press ñSTOP/RESETò button to reset.
	4.	Read error message on control panel	4.	Take appropriate action. See Manual 13-17-600.
	5.	Remote Contact is open	5.	Replace switch or jumper.
	6.	Variable Frequency Drive fault active	6.	Investigate and correct cause of fault and press ñSTOP/RESETò button to reset.
	7.	System pressure exceeds set pressure	7.	Wait until system pressure falls below set pressure.
Compressor starts but stops after a short time	1.	High discharge temperature	1.	See ñHigh Discharge Air Temperature,ò this section.
	2.	Low oil injection pressure	2.	Check oil filter dP.
	3.	Blown fuse in control box	3.	Replace fuse (investigate if fuses continue to blow).
	4.	Variable Frequency Drive overload sensor tripped	4.	Reset and investigate cause of overload.

SYMPTOM		POSSIBLE CAUSE		REMEDY
Compressor does not unload (or load)	1.	Improperly adjusted controller	1.	Refer to Manual 13-17-600 and adjust control.
	2.	Feed 3-way solenoid valve malfunction	3.	Repair, clean or replace valve.
	3.	Inlet valve stuck	4.	Inspect and replace valve.
	4.	Blow down valve malfunction	5.	Repair, clean or replace valve.
Compressor cycles from load to unload excessively	1.	Insufficient receiver capacity	1.	Increase receiver size
	2.	Restriction in service piping	2.	Inspect and clean service piping.
	3.	Restriction in control tubing	3.	Inspect and clean control tubing.
Compressor starts too slowly	1.	Acceleration time in VFD set too long	1.	Contact your Gardner Denver distributor.
	2.	Minimum Pressure/Check Valve is leaking	2.	Repair or replace.
Compressor is low on delivery and pressure	1,	Improperly adjusted control	1.	Refer to Manual 13-17-600 and adjust control.
	2.	Restricted air filter	2.	Clean or replace filter element.
	3.	Inlet valve not fully open	3.	Inspect, adjust or replace feed solenoid valve and/or pressure regulator.
	4.	Minimum pressure valve stuck closed	4.	Inspect, service or replace valve.
	5.	Blowdown valve leaking	5.	Inspect or replace solenoid valve. Ensure local ambient temperature has not exceeded 113°F. limit.
	6.	Air demand exceeds supply	6.	Make sure air demand matches compressor specifications for flow and pressure.

SYMPTOM		POSSIBLE CAUSE		REMEDY
Excessive oil consumption	1.	Oil separation malfunction	1.	See ñOil Carryoverò in this section.
	2.	Oil leaks at fittings and gaskets	2.	Detect and correct oil leaks.
	3.	Shaft seal leaking	3.	Inspect or replace shaft seal.
High discharge air, oil Temperature (air, water cooled cores)	1.	Oil mixing valve stuck on bypass mode	1.	Check 24Vdc power feed to servo. Check ModBus connection to servo. Check servo-to-valve coupling. Check rotation of ball valve.
	2.	Clogged oil filter	2.	Inspect and replace filter.
	3.	Clogged cooler (interior)	3.	Inspect and clear cooler.
	4.	Clogged oil lines	4.	Inspect and clear oil lines.
	5.	Low oil level	5.	Add oil to proper level.
High discharge air, oil Temperature (air cooled cores)	1.	Dirty or clogged cooler outer surfaces.	1.	Inspect and clean cooler outer surfaces.
	2.	Insufficient cooling air flow	2.	Verify (ductwork) back pressure does not exceed .1ò water gauge.
VFD Shutdown on Overheat	1.	Ambient temperature exceeds 45°C	1.	Check location ventilation and improve if necessary.
	2.	VFD air filters dirty	2.	Inspect, clean or replace elements.

SYMPTOM		POSSIBLE CAUSE		REMEDY
Excessive oil at intake filter area	1.	Intake valve seals leaking.	1.	Check location ventilation and improve if necessary. Inspect, repair or replace valve.
	2.	Slow intake valve poppet action	2.	Inspect poppet and guide surfaces. Replace if necessary.
	3.	Feed 3-way solenoid valve malfunction	3.	Repair, clean or replace valve.
Oil carryover	1.	Overfilling oil separation vessel	1.	Drain excess oil from system.
	2.	Clogged oil return line orifice	2.	Inspect and service.
	3.	Clogged oil return line strainer	3.	Inspect and service.
	4.	Clogged, broken, or loose oil return line fittings	4.	Inspect and tighten or replace.
	5.	Ruptured oil separator element.	5.	Replace element.
	6.	Loose assembly	6.	Tighten all fittings and gaskets.
	7.	Foam caused by use of incorrect oil	7.	Use Gardner Denver AEON 9000SP oil only.
	8.	Minimum pressure valve malfunction ï discharge pressure below 80 psig	8.	Repair or replace. Inspect, adjust or replace regulator.

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, free of defects in material and workmanship. No warranty is made with respect to:

1. Any product which has been repaired or altered in such a way, in the Company's judgment, as to affect the product adversely.
2. Any product which has, in the Company's judgment been subject to negligence, accident, improper storage, or improper installation or application.
3. Any product which has not been operated or maintained in accordance with the recommendations of the Company.
4. Components or accessories manufactured, warranted and/or serviced by others.
5. Any reconditioned or prior owned product.

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, any part, which in its judgment proved not to be as warranted within the applicable Warranty Period as follows. Regular lubricant sampling and use of genuine GD OEM parts is strongly recommended.

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. Shaft seals are a routine maintenance item and carry a 12 month warranty. Inlet valves and airends contain wearing items that must be serviced according to the operator's manual. A material or workmanship defect in these items is warrantable. Normal wear and servicing of these items is not covered under the warranty.

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 AirSmart™ controller, variable frequency drive, drive motor(s), reservoir, mixing valve, drive coupling, coupling insert, cooling fan(s) and cooling fan motor(s) are warranted for 24 months from date of initial use or 27 months from date of shipment to the first purchaser, whichever occurs first, as provided in, and subject to the terms of the original component manufacturer's warranty. The oil cooler and aftercooler are warranted for 36 months from date of initial use or 39 months from date of shipment to the first purchaser, whichever occurs first, as provided in, and subject to the terms of the original, component manufacturer's warranty.

OTHER COMPONENTS
All other components not specified above are warranted for 12 months from date of initial use or 15 months from date of shipment to first purchaser, whichever occurs first.

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

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

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

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

DISCLAIMER
THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES AND HEREBY EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION, EXPRESSED, IMPLIED OR STATUTORY WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE.

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

NO STATEMENT, REPRESENTATION, AGREEMENT, OR UNDERSTANDING, ORAL OR WRITTEN, MADE BY ANY AGENT, DISTRIBUTOR, REPRESENTATIVE, OR EMPLOYEE OF THE COMPANY WHICH IS NOT CONTAINED IN THIS WARRANTY WILL BE BINDING UPON THE COMPANY UNLESS MADE IN WRITING AND EXECUTED BY AN OFFICER OF THE COMPANY.

THIS WARRANTY SHALL NOT BE EFFECTIVE AS TO ANY CLAIM WHICH IS NOT PRESENTED WITHIN 30 DAYS AFTER THE DATE UPON WHICH THE PRODUCT IS CLAIMED NOT TO HAVE BEEN AS WARRANTED. ANY ACTION FOR BREACH OF THIS WARRANTY MUST BE COMMENCED WITHIN ONE YEAR AFTER THE DATE UPON WHICH THE CAUSE OF ACTION OCCURRED.

ANY ADJUSTMENT MADE PURSUANT TO THIS WARRANTY SHALL NOT BE CONSTRUED AS AN ADMISSION BY THE COMPANY THAT ANY PRODUCT WAS NOT AS WARRANTED.

Gardner Denver®

For additional information, contact your local representative or visit:
www.contactgd.com/compressors

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ENERGY STAR PARTNER

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2008 ANAB DNV

MEMBER OF CAGI Compressed Air & Gas Institute

KNOW PRESSURE COMPRESSED AIR CHALLENGE

Please recycle after use.

13-18-502
Version: 17
February 25, 2014

VARIABLE SPEED SINGLE STAGE BASE-MOUNTED COMPRESSOR

AIRSMART™ - CONTROLLER

MODELS

VS20A

20 kW

60 HZ

PARTS LIST

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

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

Your authorized Gardner Denver Compressor distributor offers all the backup you'll need. An AirSmart™ network of authorized distributors provides the finest product support in the air compressor industry.

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

1. Trained parts specialists to assist you in selecting the correct replacement parts.
2. Factory warranted new and remanufactured rotary screw airends. Most popular model remanufactured airends are maintained in stock at the factory, 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.

To Contact Gardner Denver or locate your local distributor:

Visit: www.contactgd.com/compressors

Or

Call: (217)222-5400

INSTRUCTIONS FOR ORDERING REPAIR PARTS

When ordering parts, specify Compressor MODEL, Method of Cooling, POWER and SERIAL NUMBER (see nameplate on unit). The Airend Serial Number is also stamped on top of the discharge bearing carrier castings.

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 motor end and look toward the compressor. Right-Hand and Left- Hand are indicated in parenthesis following the part name, i.e. (RH) and (LH), when appropriate.

TOTAL PRODUCT SUPPORT – GARDNER DENVER'S CONTINUING COMMITMENT TO YOUR AIR COMPRESSOR PERFORMANCE

Commitment to total product support continues long after the purchase of your quality Gardner Denver rotary screw compressor.

Gardner Denver original parts incorporate years of experience and improvements in design, materials and quality assurance. Maintaining your compressor investment with Gardner Denver parts will insure protection for the air compressor unit and long, dependable service life.

Your authorized Gardner Denver compressor distributor maintains a complete stock of all common maintenance parts, factory approved AEON lubricants, and Gardner Denver factory warranted exchange airends. In addition, authorized distributor technicians are factory trained, and can provide complete diagnostic, compressor maintenance and repair services.

This manual is designed to assist you in maintaining high performance and receiving many years of dependable service you expect from your Gardner Denver compressor.

REMANUFACTURED AIRENDS

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

Immediately Available

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

Skilled Craftsmen

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

Precision Remanufacturing

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

Extensive Testing

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

Warranty

Gardner Denver backs up every remanufactured airend with a new warranty…27 months from purchase, 24 months from service.

Gardner Denver remanufactured airends deliver quality without question…year in and year out.

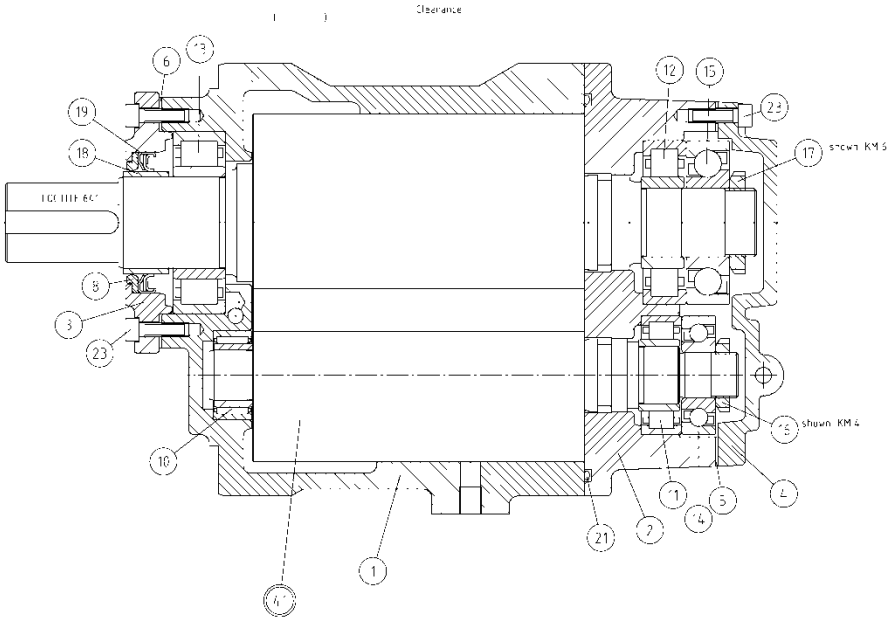
Call Gardner Denver for information on the airend exchange program and the name of your authorized distributor.

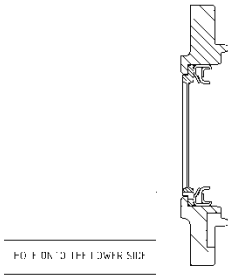
Phone Number: (217) 222-5400 or
Fax: (217) 224-7814

TABLE OF CONTENTS

For Operating and Service Instructions, see:	
SERVICE MANUAL:	**13-18-604**
AIRSMART CONTROLLER MANUAL:	**13-17-600**
DRYER:	**13-18-605**
COMMUNICATION MODULE:	**13-17-604**

AIREND CROSS SECTION
(ENDURO 6)





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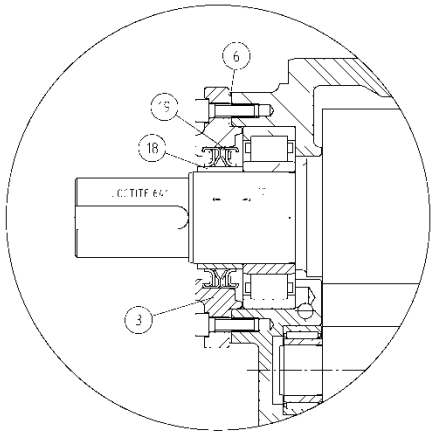
NOTE
IN THE FIRST TIME ASSEMBLY FILL THE SPACE BETWEEN THE SHAFT SEALS WITH BEARING GREASE EXAMPLE Shell Alvania Grease G2.



ASSEMBLIES WITH TWO SHAFT SEALS

Order by Part Number and Description. Reference Numbers are for your convenience only

AIREND CROSS SECTION
(ENDURO 6)

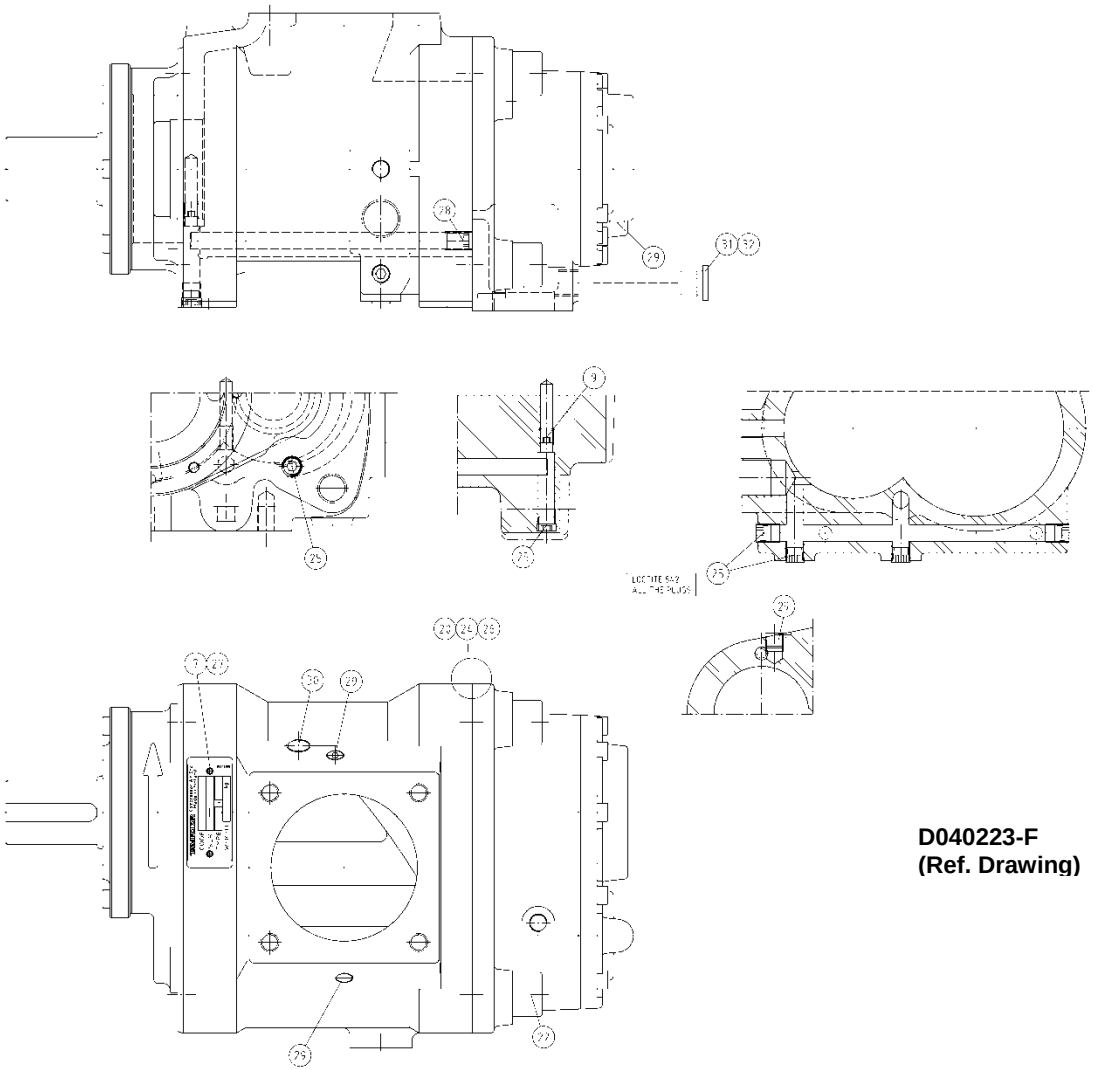
Ref. No.	Name of Part	Qty.	B/M: 50563802; CC1018002; CC1018004 Part No.
1	AIR CYLINDER	1	----------
2	DISCHARGE BEARING HOUSING	1	----------
3	SEAL HOUSING	1	----------
4	BEARING COVER	1	----------
+ 5	SEAL	1	SEFC30809788
+ * 6	GASKET	1	SEFC30809658
+ * 8	DUST SEAL	1	89599799
+ 10	ROLLER BEARING	1	12BA210
+ 11	ROLLER BEARING	1	12BA207
+ 12	ROLLER BEARING	1	12BA208
+ 13	ROLLER BEARING	1	12BA209
+ 14	BALL BEARING	1	89846509
+ 15	ROLLER BEARING	1	12BA212
+ 16	LOCKNUT	1	89846629
+ 17	LOCKNUT	1	87252589
+ *18	WEAR SLEEVE	1	89535389
+ *19	OIL SEAL	1	89532919
41	ROTOR (Pair E6)	1	

* Parts included in Drive Shaft Seal Kit Part Number 301CGB6029. Refer to page 37.

\+ Parts included in Airend Overhaul Kit Part Number 303CGB6013. Refer to Page 38.

Note: Replacing Drive Shaft Seal requires Tool Kit Part Number 301CGB6031. Refer to page 38.

AIREND BOLTS AND PLUGS
(ENDURO 6)



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(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

AIREND BOLTS AND PLUGS
(ENDURO 6)

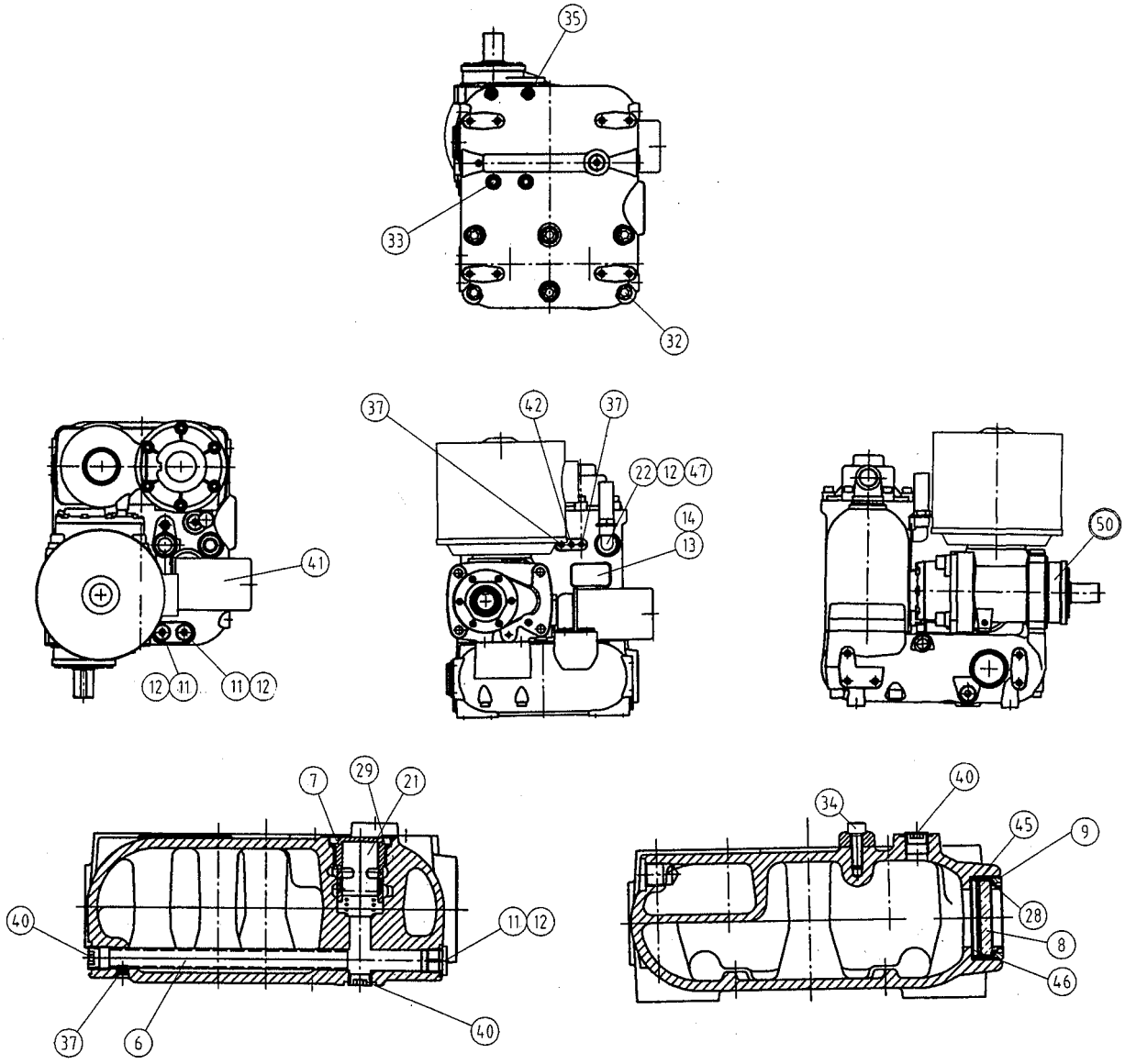
Ref. No.	Name of Part	Qty.	B/M: 50563802; CC1018002; CC1018004 Part No.
9	ORIFICE	1	30809938
* 20	O-RING	2	87908849
22	SCREW	4	665SMCA16040Z
24	PLUG	2	64AA47
25	PLUG	6	64AA48
26	PIN	2	62M178
29	PLUG	4	64AA55
30	PLUG	1	64AA50
31	PLUG	1	64AA32
32	GASKET	1	25BC584

AIREND REPAIR KITS

Model	KW	PSI	Replacement Airend Kit	Bearing Kit *	Inlet Valve Repair Kit	Drive Shaft Seal Kit	Package Tool Kit	Coupling Tool Kit
VS20A	20	100-175	301CGB6013	303CGB6013	VP1011323	301CGB6029	301CGB6031	300CGB6031

* Part included in Airend Overhaul Kit Part Number 303CGB6013. Refer to page 38.

MAIN ASSEMBLY – T6



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(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

MAIN ASSEMBLY – T6

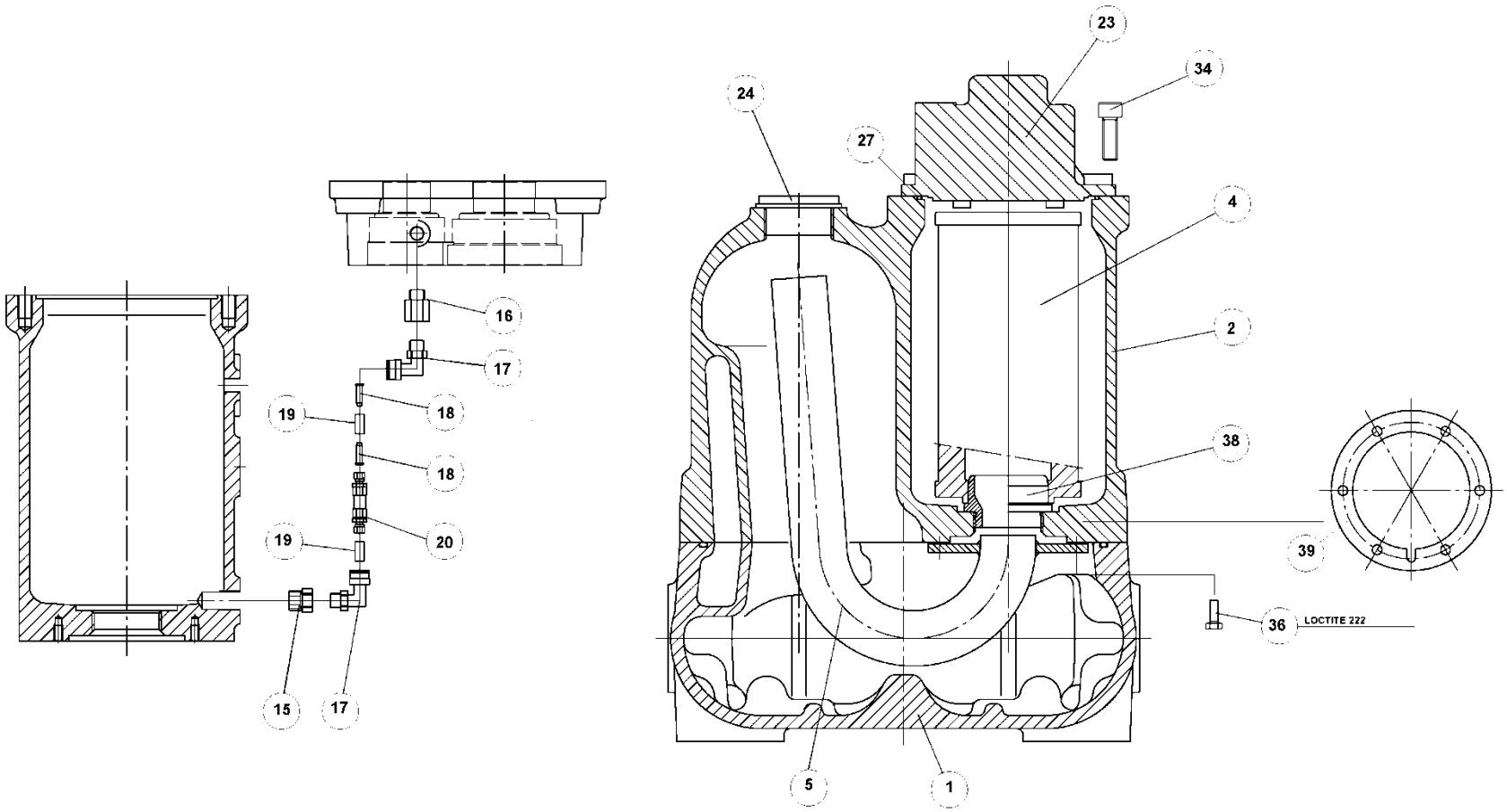
Ref. No.	Name of Part	Qty.	B/M: 03981122; 303EFC1095 Part No.
6	TUBE	1	37641008
7	HOUSING	1	37622208
9	OIL SITE GLASS	1	CC1025419
11	PLUG	4	03381178
* 12	GASKET	5	80034799
21	PLUG ASSEMBLY		
	ADAPTOR	1	CC1018662
	SPRING	1	78A127
* 22	PRESSURE RELIEF VALVE	1	89728559
28	O-RING	1	89573939
29	O-RING	1	85646299
32	SCREW	6	665SMCA16140Z
33	SCREW	2	665SMCA12130Z
34	SCREW	7	665SMCA10030Z
35	SCREW	2	665SMCA10120Z
37	PLUG	8	80704779
40	PLUG	3	03381178
40	GASKET	3	80034799
** 41	OIL FILTER	1	89675429
45	RETAINING RING	1	42227570
46	GASKET	1	20000581
47	ELBOW	1	64EB1021
*** 50	AIREND (See pages 4-7)	1	50563802

* Parts included in Pneumatic Control Kit Part Number 302CGB6013. Refer to page 38.

** Parts included in Routine Maintenance Kit Part Number 300CGB6013. Refer to page 37.

*** Part included in Airend Repair Kit Part Number 301CGB6013. Refer to page 38.

OIL SEPARATOR – T6



D039811-K
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

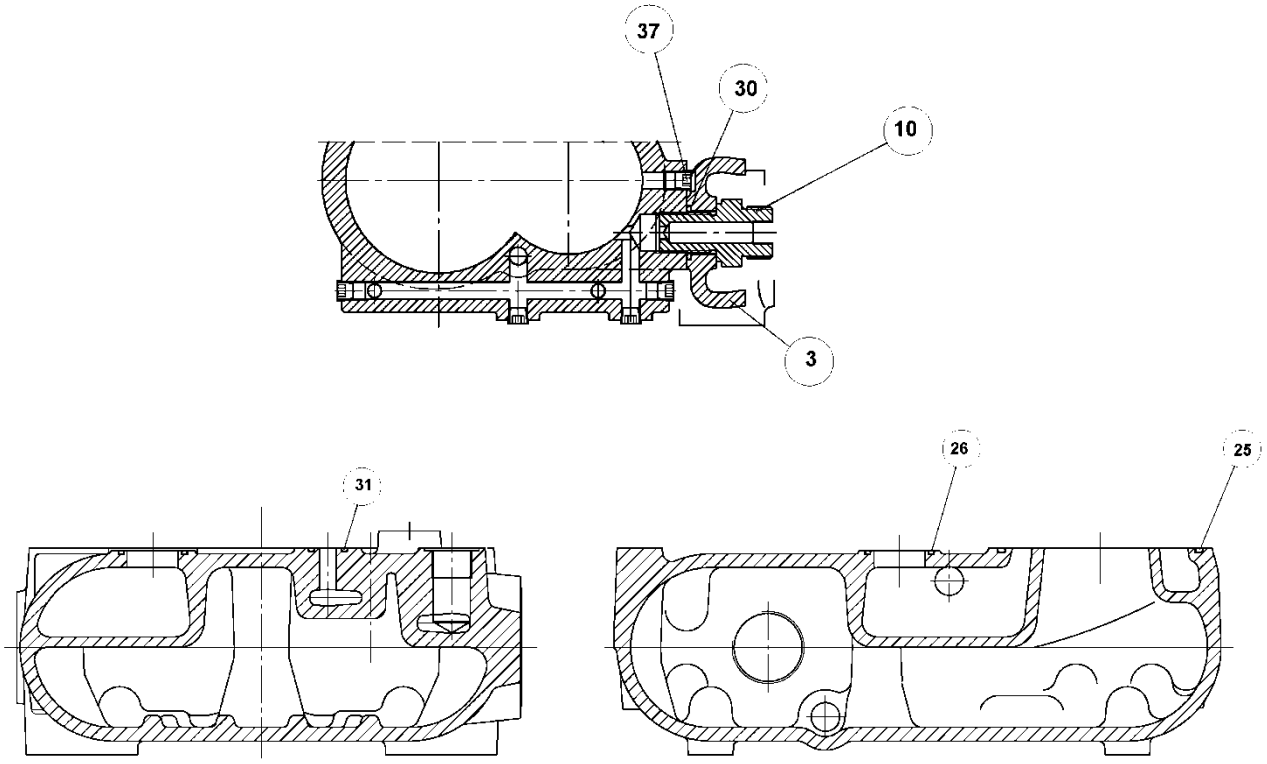
OIL SEPARATOR – T6

B/M: 03981122

Ref. No.	Name of Part	Qty.	Part No.	Ref. No.	Name of Part	Qty.	Part No.
1	OIL SUMP	1	04028328	** 20	CHECK VALVE	1	CC1040088
2	SEPARATOR HOUSING	1	04028458	23	MIN/PRESS CHECK VLV (See pages 14-17)	1	03603078
* 4	OIL SEPARATOR ELEMENT	1	03498328	24	PLUG	1	85328079
5	GUN	1	37622338	* 27	O-RING	1	85387979
15	NIPPLE	1	81344929	34	SCREW	7	665SMCA10030Z
**16	OIL SCREEN FILTER	1	85588619	36	SCREW	6	665HMCA06016Z
17	ELBOW	2	81744279	38	ADAPTOR	1	30934298
18	ORIFICE	1	30895408	39	GASKET	1	30809658
19	PLASTIC TUBE	1	85200299				

* Parts included in Oil Separator Kit Part Number 301EFC6013. Refer to page 37.

** Parts included in Pneumatic Control Kit Part Number 302CGB6013. Refer to page 38.



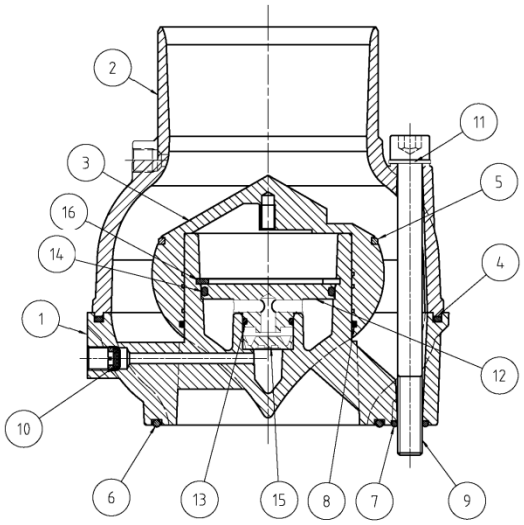
D039811-K
(Ref. Drawing)

OIL FILTER – T6

Ref. No.	Name of Part	Qty.	B/M: 03981122 Part No.
3	OIL MANIFOLD	1	03981258
10	NIPPLE	1	30932308
25	O-RING	1	89594619
*+ 26	O-RING	1	89594599
*+ 30	O-RING	1	89594469
*+ 31	O-RING	1	89534789
37	PLUG	8	64AA55

* Parts included in Airend Overhaul Kit Part Number 303CGB6013. Refer to page 38.
\+ Parts included in Airend Repair Kit Part Number 301CGB6013. Refer to page 38.

Order by Part Number and Description. Reference Numbers are for your convenience only.



INLET VALVE

	Ref. No.	Name of Part	Qty.	B/M: 89863529 Part No.
	1	LOWER PART OF INLET VALVE	1	VP1011309
	2	UPPER PART OF INLET VALVE	1	VP1011310
*	3	POPPET	1	VP1011311
+ *	4	O-RING	1	VP1011312
+ *	5	GASKET	1	VP1011313
**+ *	6	O-RING	1	VP1011314
**+ *	7	O-RING	4	VP1011315
+ *	8	O-RING	1	VP1011316
	9	SCREW	4	VP1011317
	10	STRAINER	1	89837209
+ *	11	WASHER	4	VP1011318
	12	VALVE COVER	1	VP1011319
+ *	13	O-RING	1	VP1011320
+ *	14	O-RING	1	VP1008710
+ *	15	GASKET	1	VP1008709
+ *	16	LOCK RING	1	VP1011321

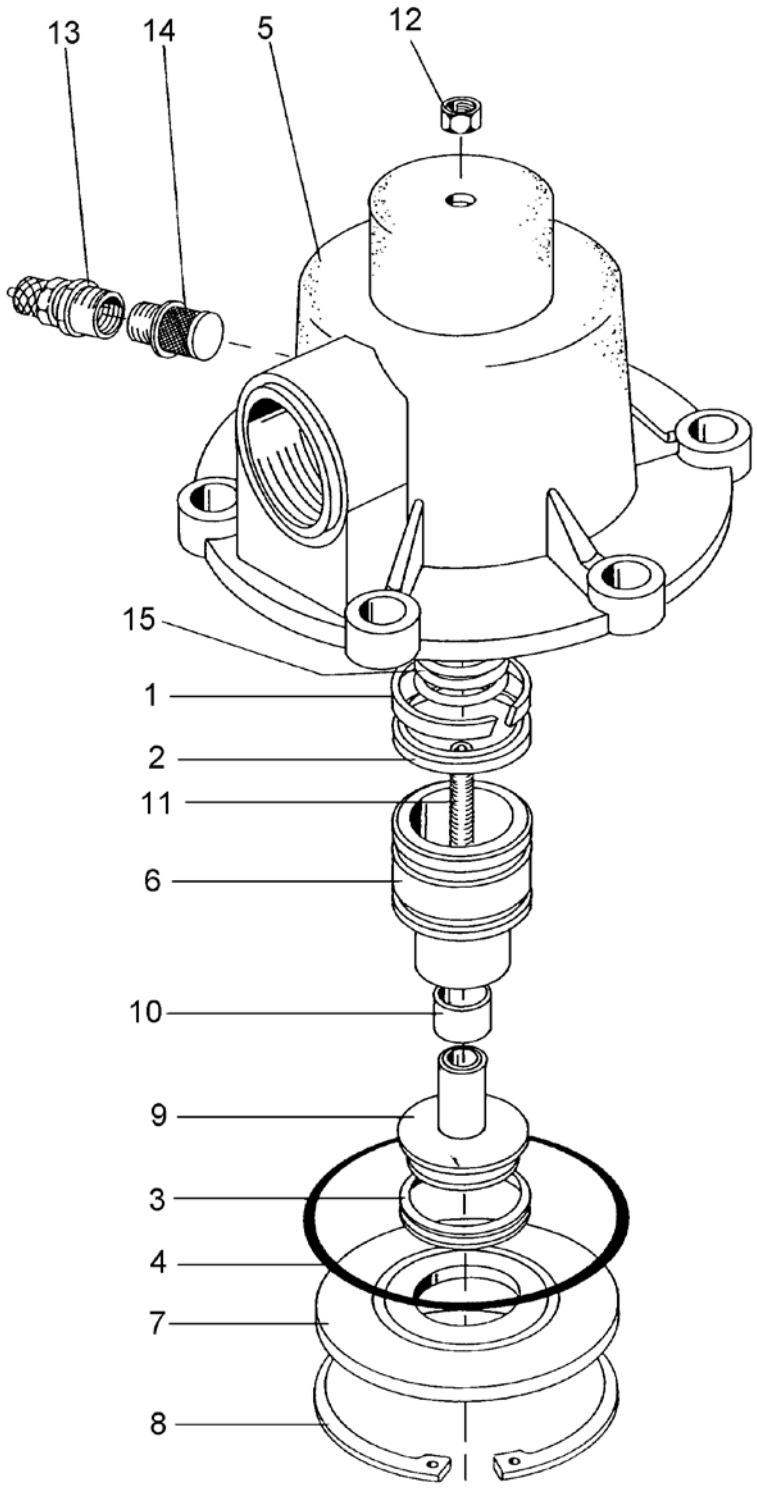
* Parts included in Inlet Valve Repair Kit Part Number VP1011323. Refer to page 37.

** Parts included in Airend Repair Kit Part Number 301CGB6013. Refer to page 38.

\+ Parts included in Inlet Valve Seal Kit Part Number VP1011322. Refer to page 37.

Note: Individual parts in Inlet Valve Kits are not available for purchase.

MINIMUM PRESSURE/CHECK VALVE



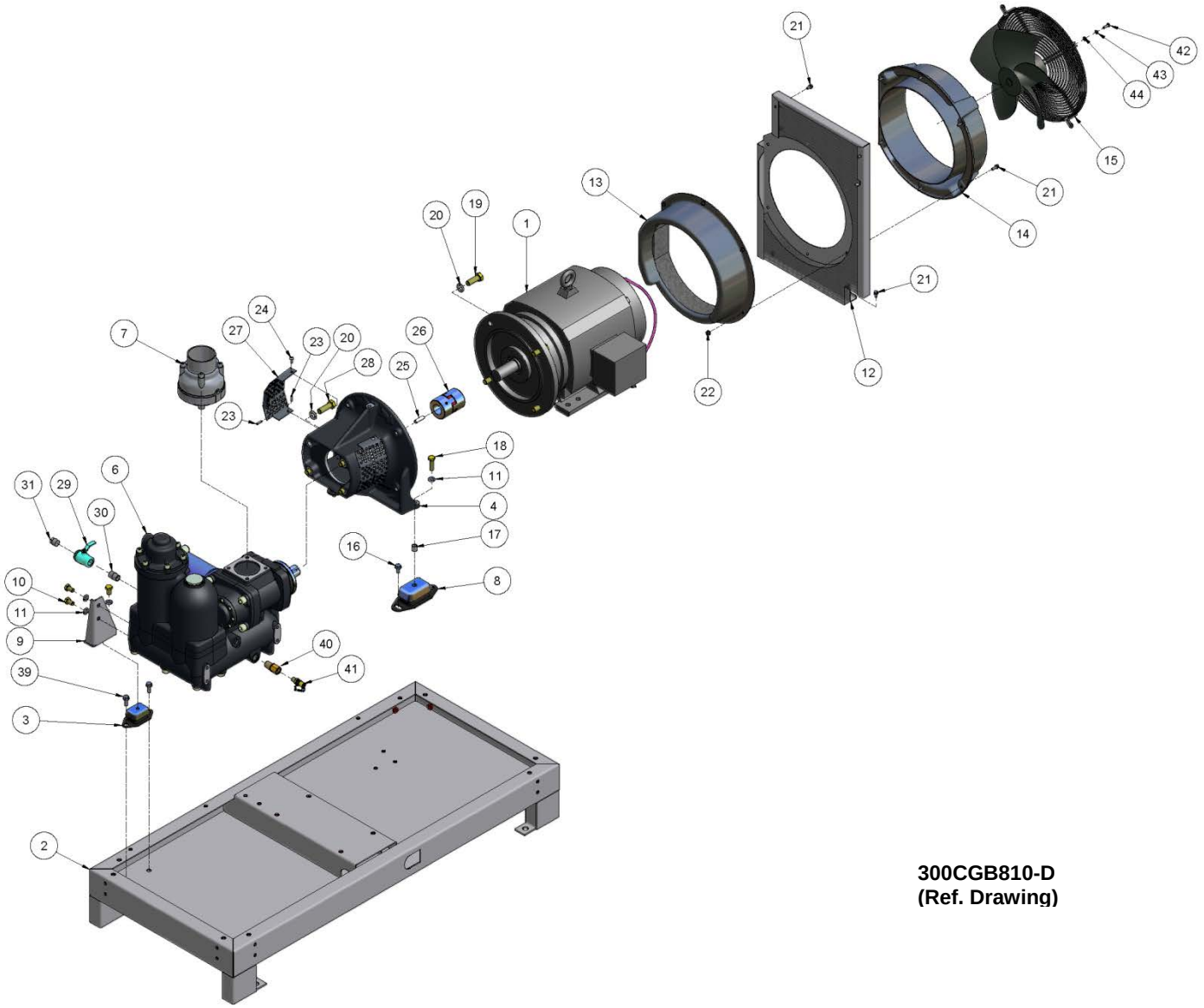
Order by Part Number and Description. Reference Numbers are for your convenience only.

MINIMUM PRESSURE/CHECK VALVE

Ref. No.	Name of Part	Part No.
	MINIMUM PRESSURE/CHECK VALVE ASSEMBLY	03603078
	MINIMUM PRESSURE/CHECK VALVE SEAL KIT (Includes Reference Numbers 1-4)	03389270
*	MINIMUM PRESSURE/CHECK VALVE ASSEMBLY KIT (Includes Reference Numbers 1-4, 10, 15)	89555599
1	RING	
2	PISTON GASKET	
3	GASKET	
4	O-RING	
5	FRAME	
6	PISTON	
7	PLATE	
8	LOCK RING	
9	PLATE	
10	BEARING	
11	SCREW	
12	NUT	
13	CONNECTOR	
14	FILTER	
15	SPRING	

* Parts included in Min/Press Maintenance Kit Part Number 303EFC6013. Refer to page 37.

BASE, AIREND AND MOTOR ASSEMBLY



300CGB810-D
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

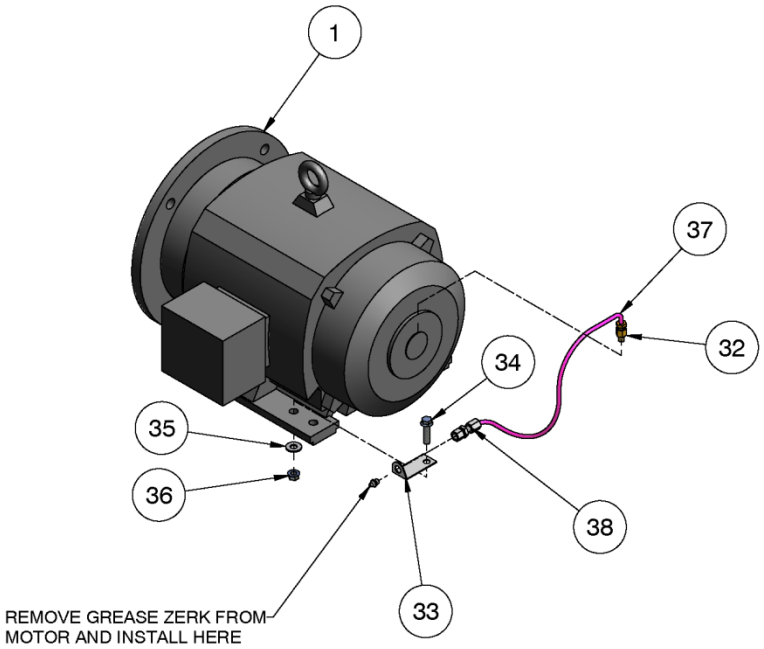
BASE, AIREND AND MOTOR ASSEMBLY

B/M: 300CGB4001; 301 thru 304CGB4015

Ref. No.	Name of Part	Qty.	Part No.		Ref. No.	Name of Part	Qty.	Part No.
1	MOTOR				17	INSERT	2	34A71
	200V & 230V	1	VP1029684		18	SCREW	2	665HMCA12040Z
	460V	1	90500005		19	SCREW	4	665HMCA16045Z
	575V	1	VP1029686		20	WASHER	8	671HLHR16Z
2	BASE	1	20500149		21	SCREW	10	75LM48
3	VIBRATION ISOLATOR	1	49C119		22	NUT	6	50AW3
4	COUPLING HOUSING	1	20000782		23	PIN	4	89872829
6	TEMPEST 6+ AIREND (See pages 4-12)	1	303EFC1095		24	SCREW	2	75G70
7	INLET VALVE (See page 13)	1	89863529		25	KEY	1	35L74
8	VIBRATION ISOLATOR	2	49C120	*	26	COUPLING ASSEMBLY	1	CC1012522
9	FOOT	1	CC1012594			COUPLING HUB, AIREND SIDE	1	VP1011453
10	SCREW	3	665HMCA12020Z			COUPLING HUB, MOTOR SIDE	1	VP1011454
11	LOCKWASHER	5	671HLHR12Z			COUPLING SPIDER	1	VP1011455
12	PANEL	1	CC1012593		27	COVER	2	CC1012595
13	PLASTIC AIR GUIDE	1	20001116		28	SCREW	4	665SMCA16055Z
14	PLASTIC FAN FRAME				29	BALL VALVE	1	90AR241
	200V	1	CC1030046		30	NIPPLE	1	86H154
	230V	1	CC1028548		31	PLUG	1	64AA7G
	460V	1	20001095		39	SCREW	6	75K48
	575V	1	CC1030046		40	BUSHING ADAPTOR	1	86H155
15	FAN MOTOR				41	OIL SAMPLING VALVE	1	86N345
	200V	1	VP1030433		42	SCREW	4	665HMCA06020Z
	230V	1	VP1083906		43	LOCKWASHER	4	671HLHR06Z
	460V	1	VP1012345		44	WASHER	4	670FPHN06Z
	575V	1	VP1024771					
16	SCREW	4	75LM51					

* For removal & installation of Coupling Hubs to Shafts Kit 300CGB6031 is required. Refer to page 38

Order by Part Number and Description. Reference Numbers are for your convenience only.

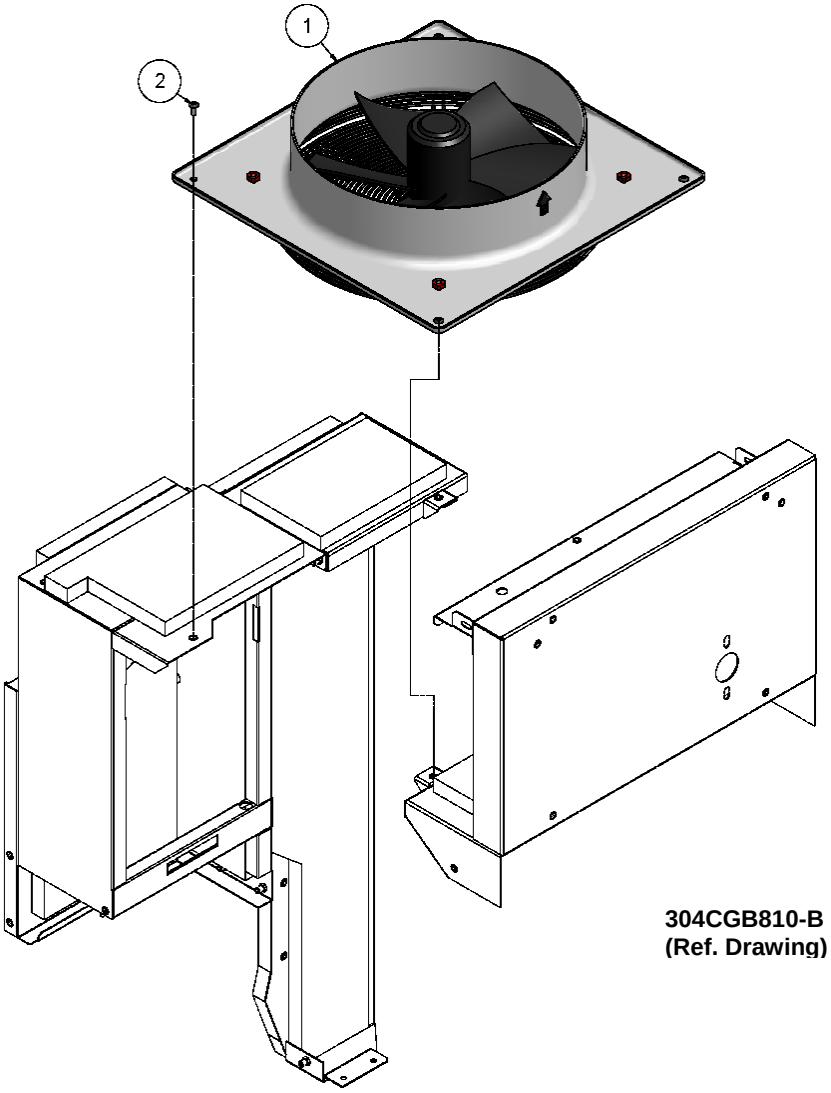


300CGB810-D
(Ref. Drawing)

MOTOR LUBRICATION

Ref. No.	Name of Part	Qty.	B/M: 300CGB4001 Part No.
32	TUBE FITTING	1	86E162
33	BRACKET	1	CC1010920
34	SCREW	1	75LM78
35	WASHER	1	95A3
36	NUT	1	50AW5
37	TUBE (IN FEET)	1	85G3
38	TUBE CONNECTOR	1	86N287

Order by Part Number and Description. Reference Numbers are for your convenience only.



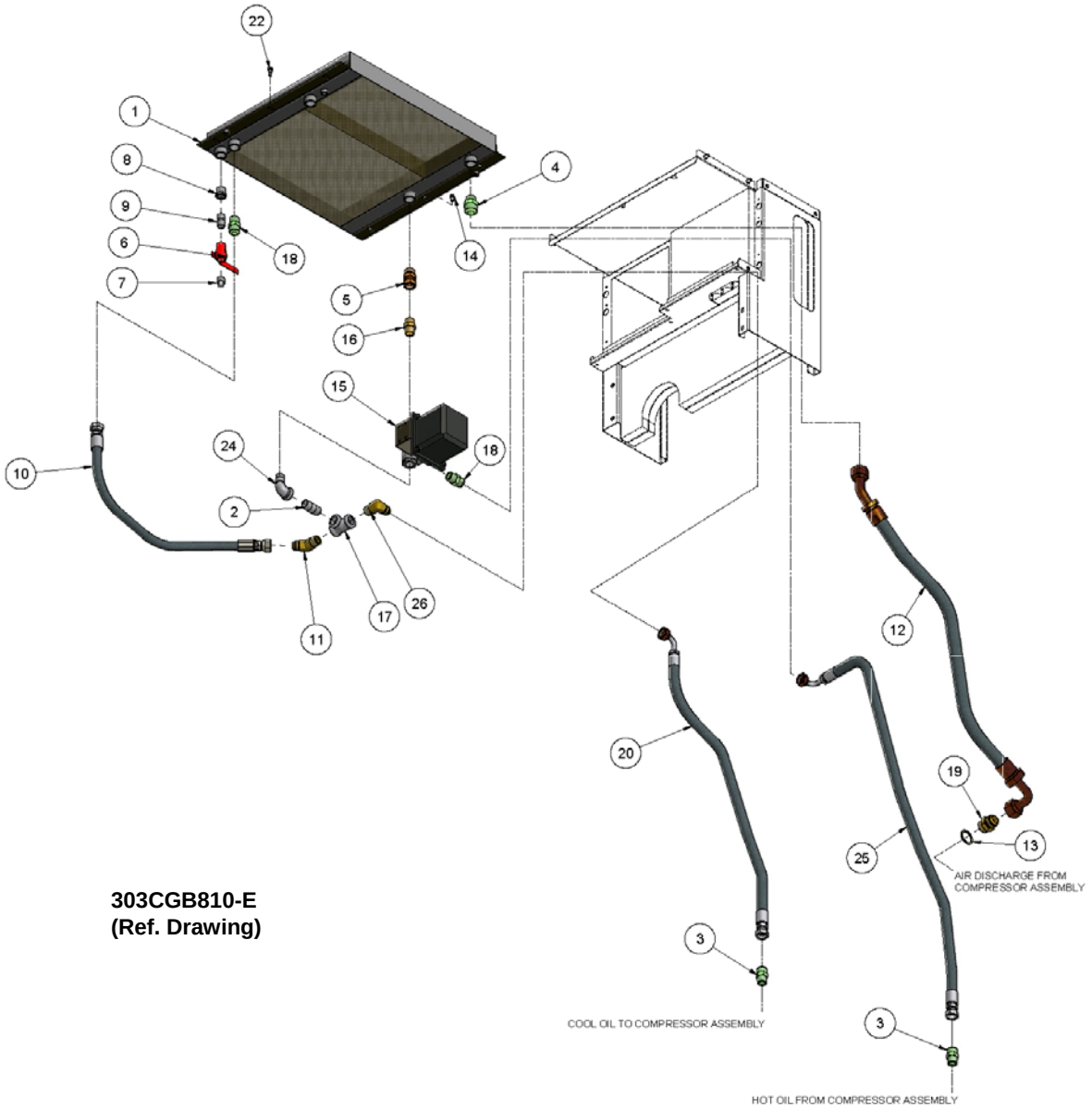
304CGB810-B
(Ref. Drawing)

COOLING FAN

B/M: 300 thru 303CGB4058

Ref. No.	Name of Part	Qty.	Part No.
1	VENT FAN		
	200V	1	VP1030434
	230V	1	VP1021199
	460V	1	301ETK701
	575V	1	VP1021200
2	SCREW	4	75LM47

COOLER ASSEMBLY



303CGB810-E
(Ref. Drawing)

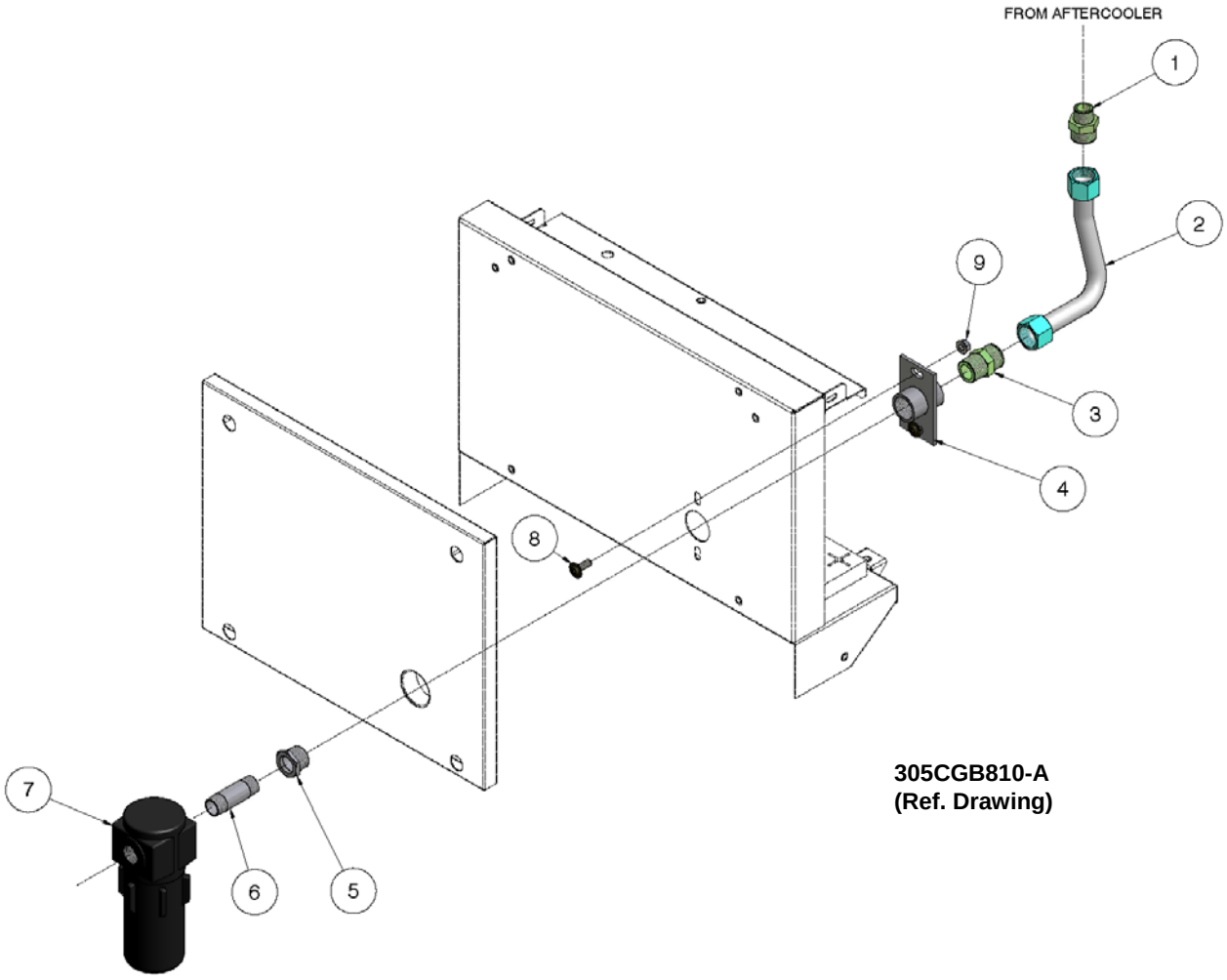
Order by Part Number and Description. Reference Numbers are for your convenience only.

COOLER ASSEMBLY

B/M: 300CGB4003; 301CGB4003

Ref. No.	Name of Part	Qty.	Part No.	Ref. No.	Name of Part	Qty.	Part No.
1	OIL/AIR RADIATOR COOLER			12	HOSE	1	VP1054928
	STANDARD	1	VP1011505	13	GASKET	1	25BC876
	SEA COAST	1	VP1013152	14	SCREW	1	75LM47
2	NIPPLE	1	63G2G	15	MIXING VALVE	1	91B238
3	TUBE CONNECTOR	2	86H149	16	NIPPLE	1	5000883
4	TUBE CONNECTOR	1	86H183	17	TEE	1	64G7G
5	ADAPTOR	1	29Q16	18	TUBE CONNECTOR	2	86H137
6	BALL VALVE	1	90AR360	19	TUBE CONNECTOR	1	86H192
7	PLUG	1	64AA7G	20	HOSE	1	VP1059744
8	PIPE BUSHING	1	64E95G	22	SCREW	1	75LM223
9	NIPPLE	1	63F1G	24	ELBOW	1	64D6G
10	HOSE	1	VP1059743	25	HOSE	1	VP1055380
11	ADAPTOR	1	29Z226	26	ADAPTOR	1	29Z241

Order by Part Number and Description. Reference Numbers are for your convenience only.

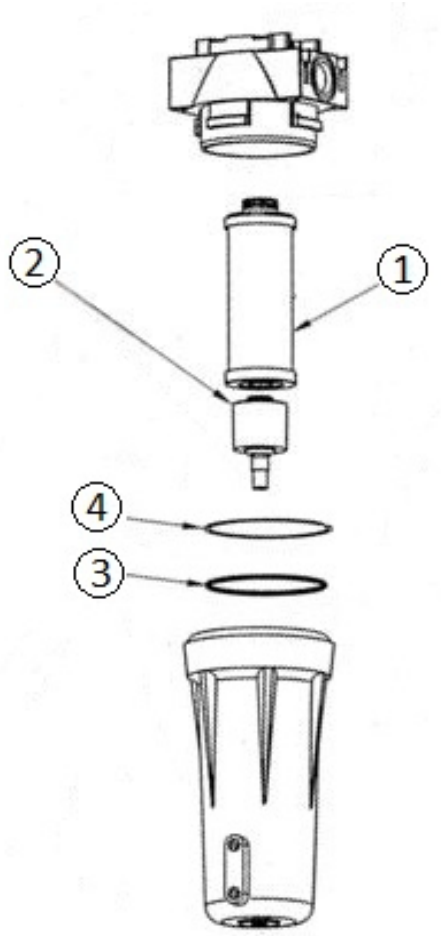


305CGB810-A
(Ref. Drawing)

AIR-COOLED AIR DISCHARGE ASSEMBLY

B/M: 301CGB4023

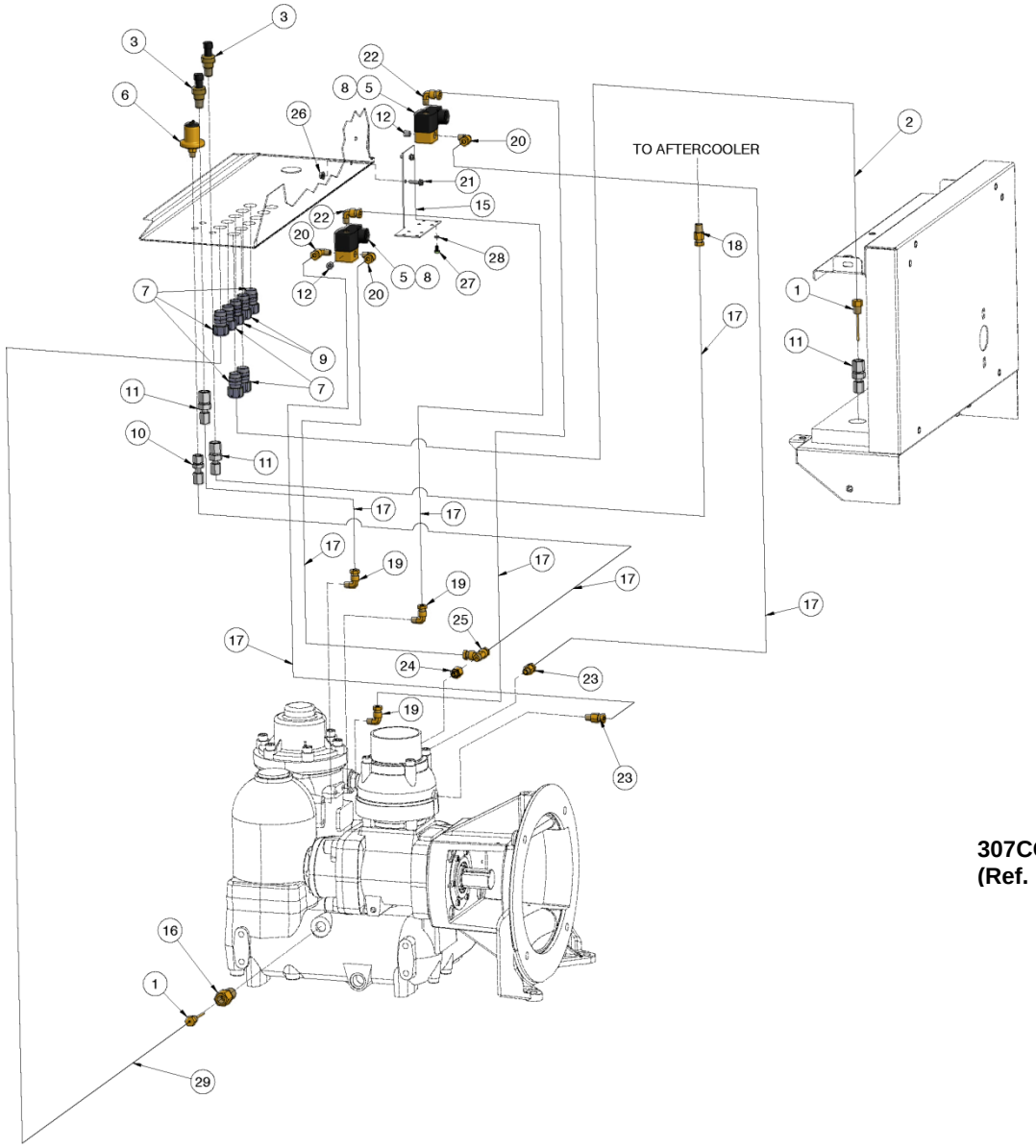
Ref. No.	Name of Part	Qty.	Part No.
1	TUBE CONNECTOR	1	86H183
2	TUBE WITH FITTING	1	CC1013147
3	TUBE CONNECTOR	1	86H138
4	MANIFOLD	1	200ECM072
6	NIPPLE	1	63H7G
7	WATER SEPARATOR (See Page 23)	1	FIL20A17AZYTW
8	SCREW	2	75LM51
9	NUT	2	50AW5



MOISTURE SEPARATOR
(FIL20A17AZYTW)

Ref. No.	Name of Part	Qty.	Part No.
1	FILTER ELEMENT	1	FIL20AE
2	AUTO-DRAIN KIT	1	G3152270
3	O-RING	1	G9320-552-16
4	WAVE SPRING.....	1	G5340-743-1

CONTROL GROUP



307CGB810-F
(Ref. Drawing)

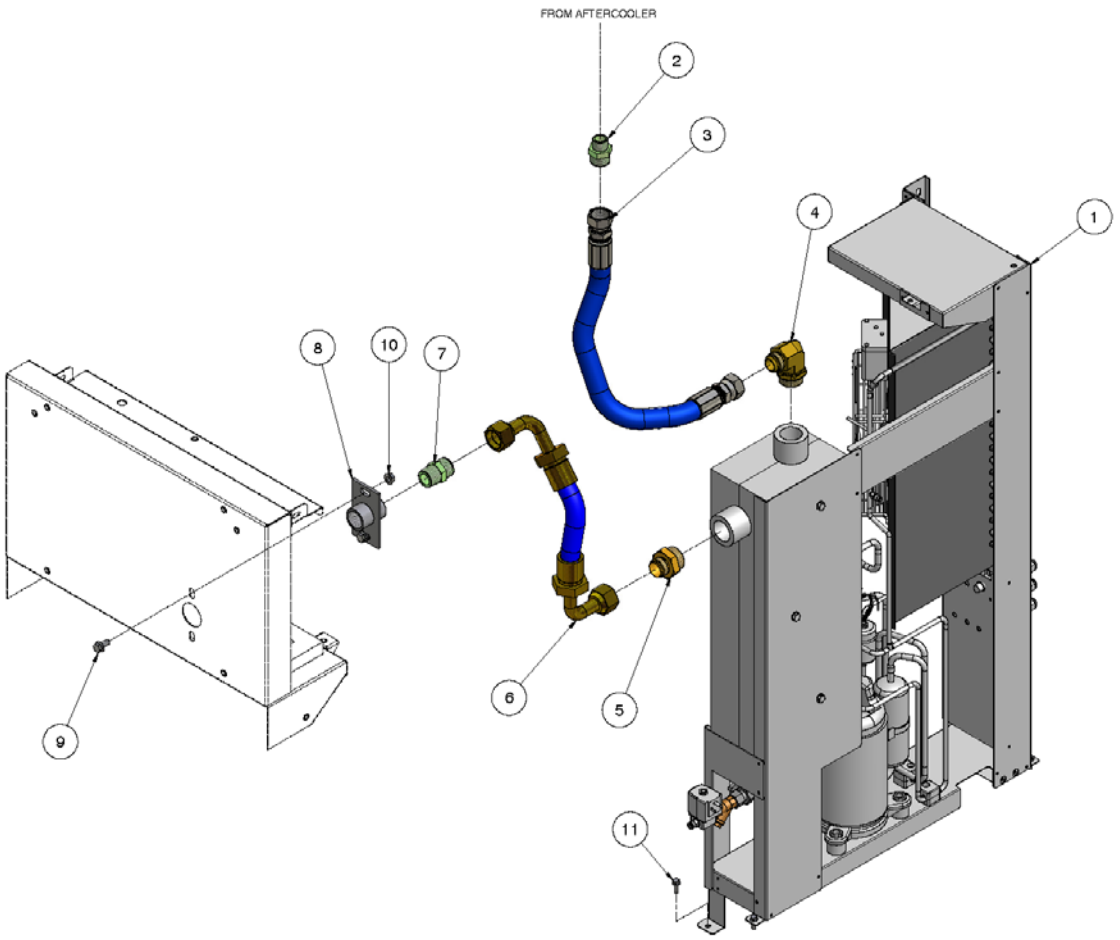
Order by Part Number and Description. Reference Numbers are for your convenience only.

CONTROL GROUP

Ref. No.	Name of Part	Qty.	Part No.	Ref. No.	Name of Part	Qty.	B/M: 301 & 302CGB4002 Part No.
* 1	THERMISTOR PROBE	2	VP1018671	16	ADAPTOR	1	86H155
* 2	CORD	1	VP1018672	17	TUBE (IN FEET)	20	85G3
* 3	PRESSURE TRANSDUCER	2	VP1011577	18	TUBE FITTING	1	86E210
* 5	SOLENOID VALVE	2	91B235	19	TUBE FITTING	3	86H163
* 6	VACUUM SWITCH	1	88H195	20	TUBE FITTING	3	86E219
7	ELECTRICAL FITTING	5	24CA2865	21	SCREW	2	75LM269
8	CORD	2	VP1010781	22	TUBE FITTING	2	86E229
9	ELECTRICAL FITTING	2	24CA610	23	TUBE FITTING	2	86H162
10	TUBE CONNECTOR	1	86N287	24	ADAPTOR	1	86H174
11	CONNECTOR	3	86N316	25	TUBE FITTING	1	86E235
12	PLUG	2	64AC1	26	NUT	2	50AW2
13	WIRE (IN FEET) (not shown)	6	97J77	27	SCREW	8	75G71
14	TERMINAL LUG (not shown)	4	24CA518	28	LOCKWASHER	8	95B13
15	SOLENOID BRACKET	1	CC1018490	* 29	CORD	1	VP1018675

* Parts included in Electrical Control Kit Part Number 304CGB6013. Refer to page 39.

DRYER ASSEMBLY



306CGB810-A
(Ref. Drawing)

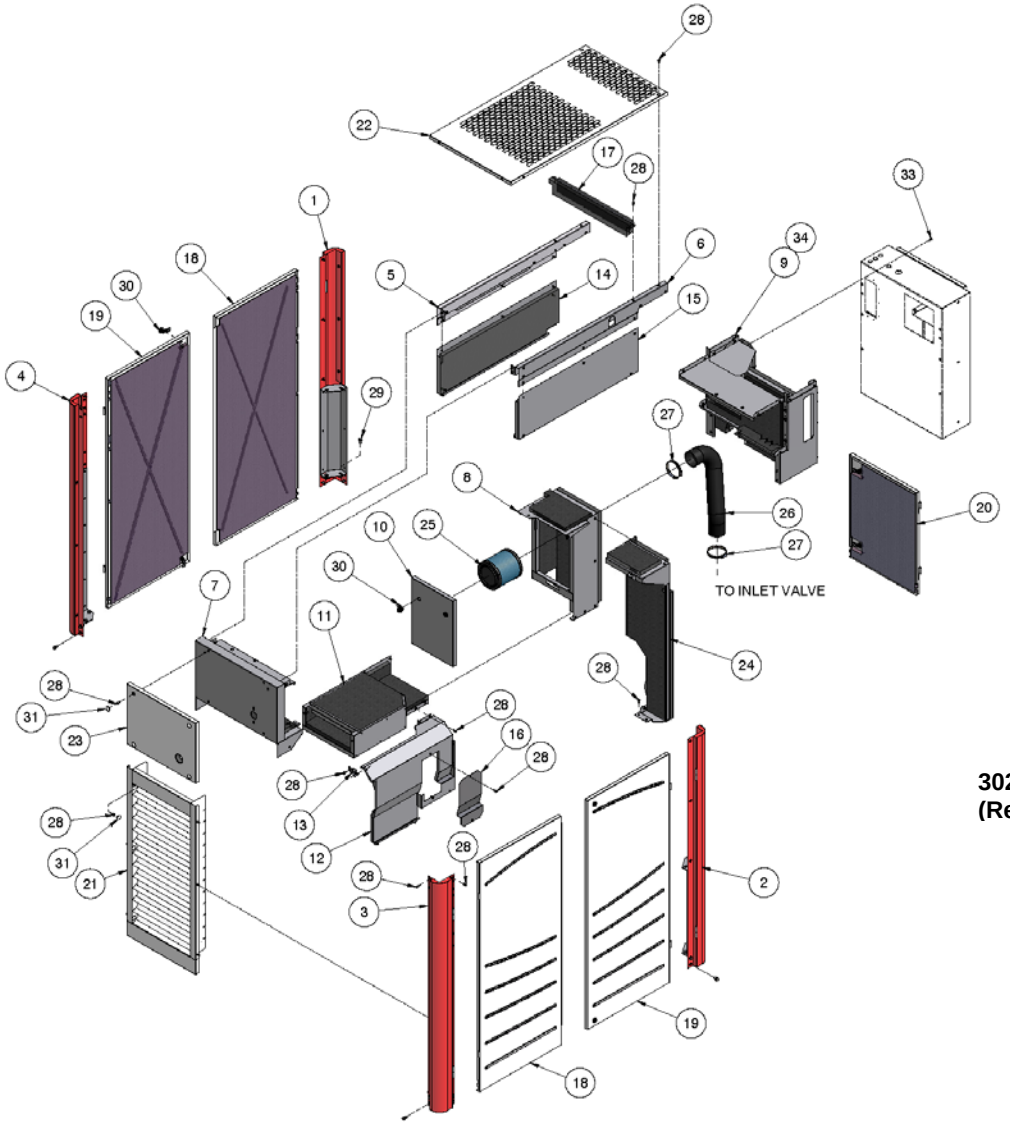
Order by Part Number and Description. Reference Numbers are for your convenience only.

DRYER ASSEMBLY

B/M: 302CGB4023

Ref. No.	Name of Part	Qty.	Part No.
1	AIR DRYER	1	VP1026478
2	TUBE CONNECTOR	1	86H183
3	HOSE	1	VP1013190
4	ADAPTOR	1	5010030
5	ADAPTOR	1	188850
6	HOSE	1	VP1013191
7	TUBE CONNECTOR	1	86H138
8	MANIFOLD	1	200ECM072
9	SCREW	2	75LM51
10	NUT	2	50AW5
11	SCREW	3	75LM48
12	CORD (not shown)	1	VP1010780

ENCLOSURE



302CGB810-B
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers are for your convenience only.

ENCLOSURE

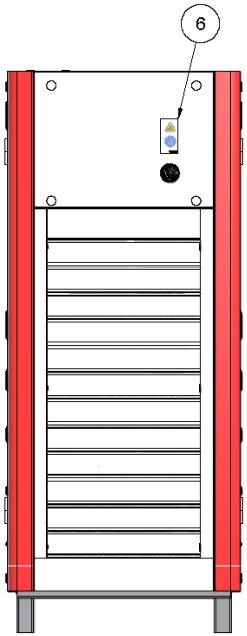
B/M: 300 thru 303CGB4017; 300CGB4013

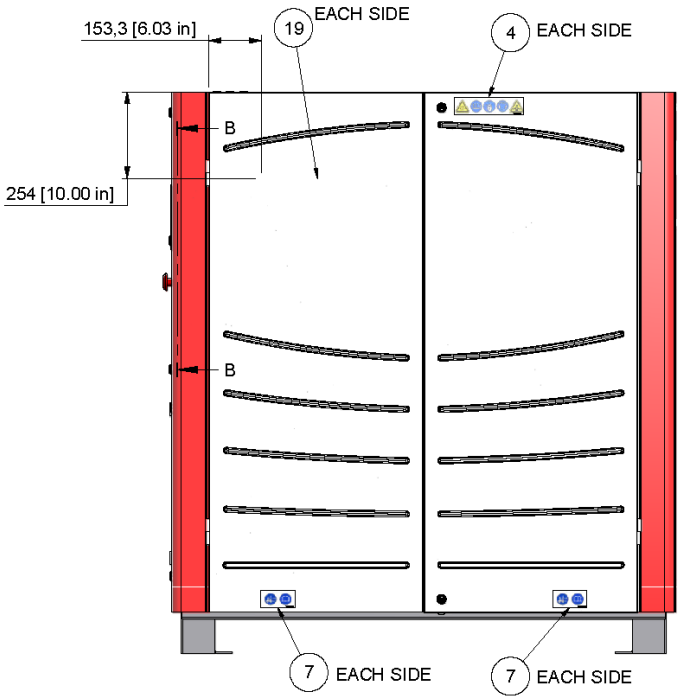
Ref. No.	Name of Part	Qty.	Part No.	Ref. No.	Name of Part	Qty.	Part No.
1	POST	1	20500150	18	LEFT DOOR	2	CC1012586
2	POST	1	20500151	19	RIGHT DOOR	2	CC1012587
3	POST	1	20500152	20	CONTROL BOX DOOR	1	CC1012588
4	POST	1	20500153	21	GRILLE	1	CC1022209
5	FRAME	1	20500154	22	PANEL	1	CC1012590
6	FRAME	1	20500155	23	COVER	1	CC1012589
7	FRAME	1	CC1012584	24	WALL VENT (LESS DRYER ONLY)	1	CC1012591
8	INLET HOUSING	1	CC1012578	* 25	AIR FILTER	1	VP1008517
9	SUPPORT	1	20500156	26	INLET HOSE	1	VP1036688
10	COVER	1	CC1012580	27	CLAMP	2	29B36
11	BAFFLE	1	CC1012581	28	SCREW	102	75LM47
12	PANEL	1	CC1012583	29	SCREW	24	75LM51
13	BRACKET	1	CC1012585	30	LATCH	8	89865139
14	PANEL	1	CC1012576	31	PLUG	10	24CA5943
15	PANEL	1	CC1012577	32	KEY (not shown)	2	VP1049035
16	DOOR	1	CC1012582	33	SCREW	7	75LM215
17	PANEL	1	CC1013053	**34	EXHAUST FILTER	1	89821069

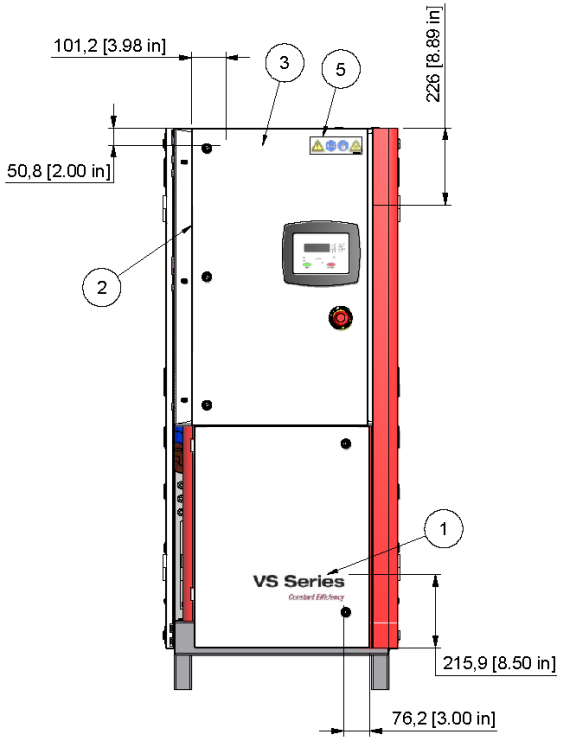
* Included in Routine Maintenance Kit Part Number 300CGB6013. Refer to page 37.

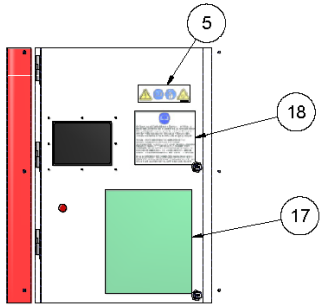
** For Replacement Filter Element, order Part Number 24CA5937.

DECAL LAYOUT - EXTERNAL









VIEW B-B
(INSIDE CONTROL BOX DOOR)

308CGB810-D
(Ref. Drawing)
Page 1 of 2

Order by Part Number and Description. Reference Numbers are for your convenience only.

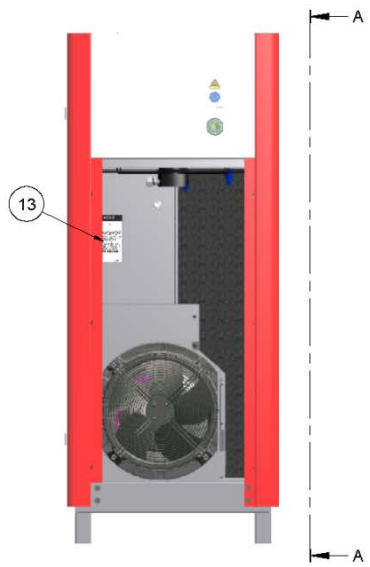
DECAL LAYOUT - EXTERNAL

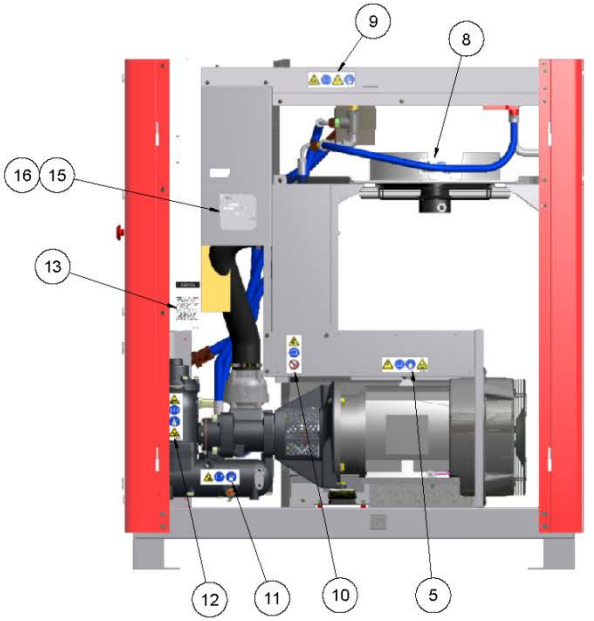
B/M: 301 thru 304 CGB4011

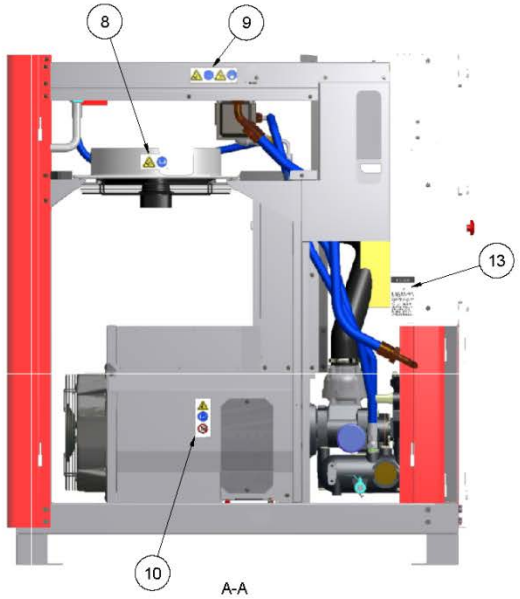
Ref. No.	Name of Part	Qty.	Part No.
1	DECAL VS SERIES (LARGE)	1	VP1044841
2	DECAL, GRAY CONTROL BOX	1	CC1013043
3	DECAL, GD	1	VP1039380
* 4	DECAL, ISO WARNING, Sides Above Doors	2	VP1009372
* 5	DECAL, ISO WARNING, Control Box	3	VP1009371
* 6	DECAL, ISO WARNING, Package Discharge Air	1	VP1009623
* 7	DECAL, ISO WARNING, Fork Pocket	4	VP1009373
17	POCKET	1	VP1009797
18	DECAL, MANUAL		
	ENGLISH	1	VP1009795
	FRENCH	1	VP1012949
	SPANISH	1	VP1012948
19	DECAL, GARDNER DENVER PRODUCT LOGO	2	VP1042952

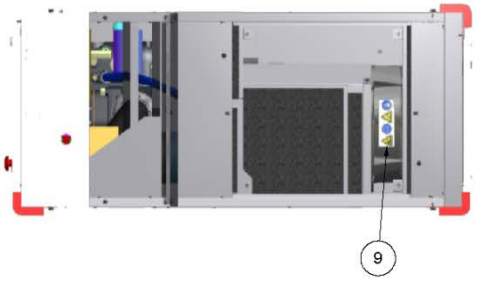
* For Replacement Decals, order Part Number CC1010403 Decal Group Sheet.

DECAL LAYOUT - INTERNAL









Order by Part Number and Description. Reference Numbers are for your convenience only.

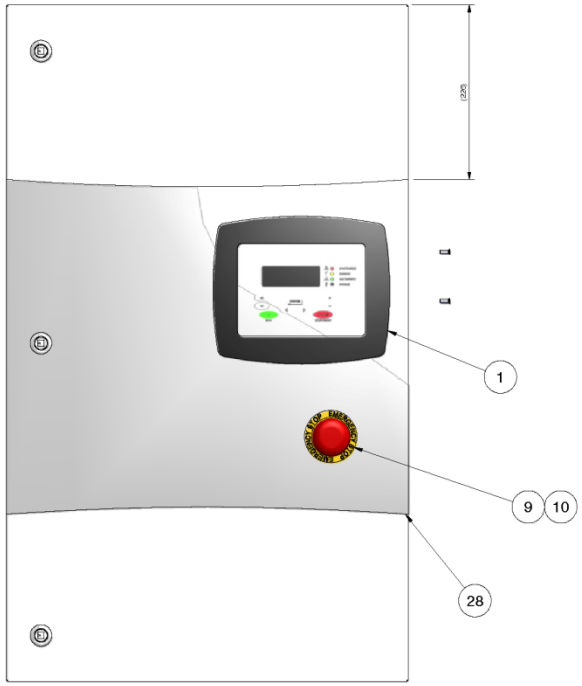
DECAL LAYOUT - INTERNAL

B/M: 301CGB4011

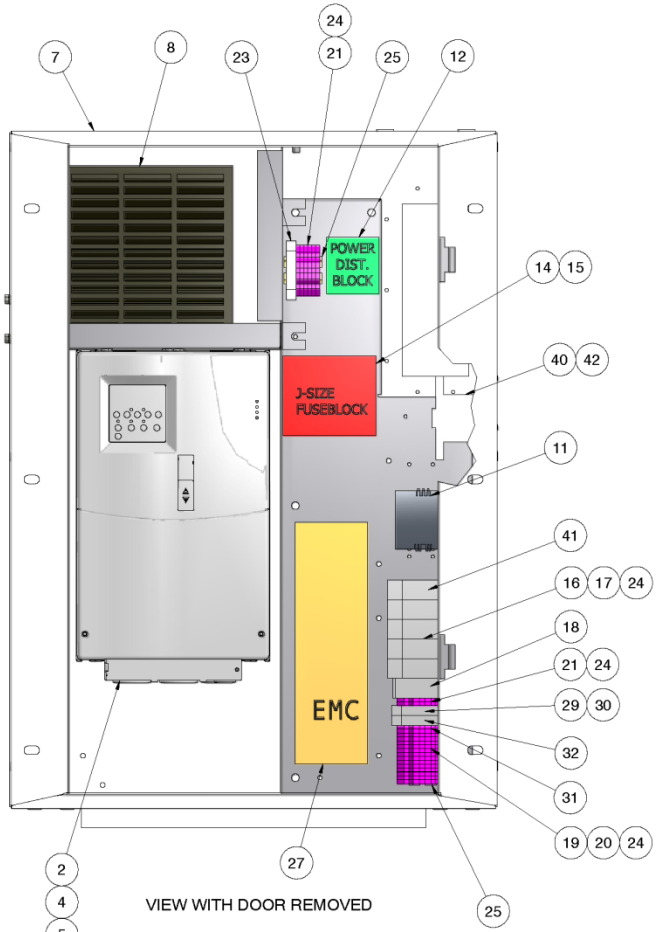
Ref. No.	Name of Part	Qty.	Part No.
* 5	DECAL, ISO WARNING-Control Box	3	VP1009371
* 8	DECAL, ISO WARNING-Rotating Fans.....	2	VP1009640
* 9	DECAL, ISO WARNING-Fan/Cooler Housing	3	VP1009582
* 10	DECAL, ISO WARNING-Coupling Housing.....	2	VP1009375
* 11	DECAL, ISO WARNING-Tempest casting.....	1	VP1009583
* 12	DECAL, ISO WARNING-Separator Tank	1	VP1009376
* 13	DECAL-NOTICE (USE GENUINE GD PARTS)	3	CC1009474

* For Replacement Decals, order Part Number CC1010403 Decal Group Sheet.

CONTROL BOX LAYOUT



FRONT VIEW OF DOOR



VIEW WITH DOOR REMOVED

301CGB810-C
(Ref. Drawing)

NOTE:
1. DRAWING IS USED WITH MULTIPLE BILLS ITEMS MAY NOT APPEAR ON SOME BILLS
2. DETAILS 29, 30, 31, 32 & 33 ADDED WHEN PACKAGE HAS DRYER
3. DETAILS 34, 35, 36, 37 & 38 NOT SHOWN

Order by Part Number and Description. Reference Numbers are for your convenience only.

CONTROL BOX LAYOUT

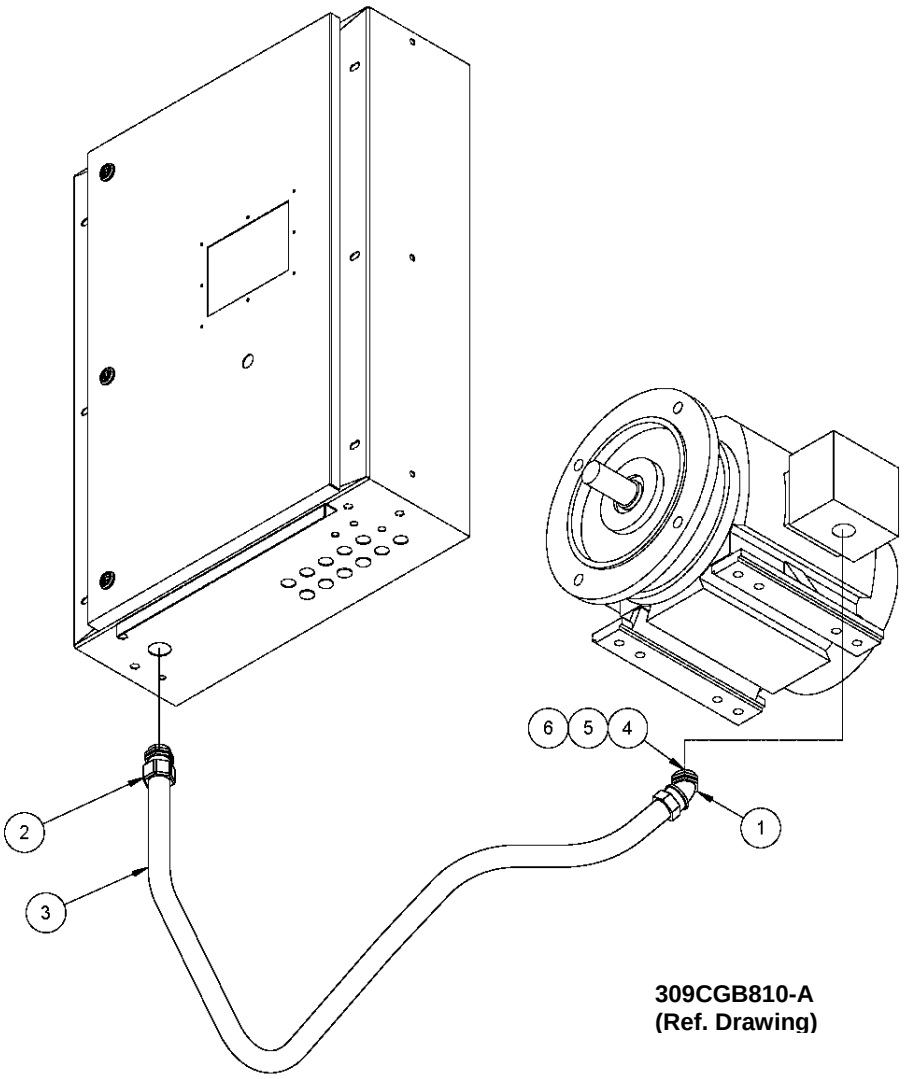
Ref. No.	Name of Part	Qty	200/230 VOLT	460V	575V
*	ASSEMBLED CONTROL BOX WITHOUT EMC FILTER		304CGB1189	301CGB1189	306CGB1189
	AIRSMART CONTROLLER WITH EMC FILTER		305CGB1189	303CGB1189	307CGB1189
1	AIRSMART CONTROLLER	1	89864799	89864799	89864799
2	DRIVE GROUP	1	VP1038573A	90500026D	VP1038204A
4	SPLITTER CABLE.	1	24CA5899	24CA5899	----------
5	SCREW TERMINAL PLUG KIT	1	24CA5933	24CA5933	----------
7	CONTROL BOX	1	CC1011535	CC1011535	CC1011535
** 8	BLACK GRILLE FILTER	1	24CA5914	89821069	24CA5914
9	OPERATOR-	1	24CA2907	24CA2907	24CA2907
10	CONTACT BLOCK	1	24CA2908	24CA2908	24CA2908
11	POWER SUPPLY	1	24CA6051	24CA6050	24CA6051
12	POWER DISTRIBUTION BLOCK	1	24CA5948	24CA5947	24CA5947
14	FUSE HOLDER	1	24CA5919	24CA5946	24CA5946
15	FUSE	3	24CA5917	24CA5945	24CA5944
16	FUSE BLOCK	5	24CA5910	24CA5910	24CA5910
17	FUSE	3	24CA4092	24CA4091	24CA4090
18	RELAY	1	24CA5931	24CA5931	24CA5931
19	TERMINAL BLOCK	14	24CA5984	24CA5984	24CA5984
20	TERMINAL BLOCK	1	24CA5985	24CA5985	24CA5985
21	GROUND BLOCK	2	24CA5986	24CA5986	24CA5986
23	GROUND BLOCK	3	24CA5989	24CA5989	24CA5989
24	TERMINAL BLOCK	4	24CA5987	24CA5987	24CA5987
25	DIN RAIL	1	24CA5991	24CA5991	24CA5991
* 27	EMC FILTER	1	89864669	89871669	VP1039576
28	DECAL	1	CC1013043	CC1013043	CC1013043
39	NUT	4	50AW4	50AW4	50AW4
40	TRANSFORMER	1	----------	----------	VP1024577
41	FUSE	2	24CA5982	24CA5981	24CA3719
42	FUSE	1	----------	----------	24CA2779
43	COMMUNICATION MODULE (not shown)	1	----------	----------	90500154

* Only used with EMC Filter Control Box.

** For Replacement Filter Element, order Part Number 24CA5937.

Note: When Package has Optional Integrated Dryer, use Electrical Part Number 302CGB4007.

Note: For AirSmart Communication Module Kit, see Part Number 300ETK6028. Refer to page 39.



309CGB810-A
(Ref. Drawing)

BASE AND AIREND ASSEMBLY

Ref. No.	Name of Part	Qty.	B/M: 303CGB4007 200/230 VOLT Part No.	B/M: 301CGB4007 460/575 VOLT Part No.
1	CONDUIT FITTING	1	2009329	2009324
2	CONDUIT FITTING	1	2009328	2009323
3	CONDUIT (IN FEET)	8	2009805	2009314
4	WIRE (IN FEET)	40	2009708	2009406
5	WIRE (IN FEET)	10	97J39	97J39
6	TERMINAL LUB.....	3	2009531	24A306

REPAIR KITS

Your Gardner Denver rotary screw compressor is designed and manufactured for many years of reliable operation. All components are engineered to exacting specifications, which will function together as a system to provide maximum efficiency. To insure the continuing integrity of compressor operation, use only original quality genuine Gardner Denver replacement parts and accessories.

Name of Part	Qty.	Part No.
ROUTINE MAINTENANCE KIT		**300CGB6013**
ELEMENT, AIR FILTER	2	VP1008517
ELEMENT, OIL FILTER	3	89675429
OIL SEPARATOR KIT		**301EFC6013**
OIL COALESCING ELEMENT	1	03498328
O-RING	1	85387979
LUBRICANT	1	2116755
INLET VALVE SEAL KIT (SOLD AS KIT ONLY)		**VP1011322**
O-RING	1	VP1011312
GASKET	1	VP1011313
O-RING	1	VP1011314
O-RING	1	VP1011315
O-RING	1	VP1011316
WASHER	1	VP1011318
O-RING	1	VP1011320
O-RING	1	VP1008710
GASKET	1	VP1008709
LOCK RING	1	VP1011321
INLET VALVE REPAIR KIT (SOLD AS KIT ONLY)		**VP1011323**
POPPET	1	VP1011311
O-RING	1	VP1011312
GASKET	1	VP1011313
O-RING	1	VP1011314
O-RING	1	VP1011315
O-RING	1	VP1011316
WASHER	1	VP1011318
O-RING	1	VP1011320
O-RING	1	VP1008710
GASKET	1	VP1008709
LOCK RING	1	VP1011321
PERIODIC MAINTENANCE KIT (Minimum Pressure/Check Valve)		**303EFC6013**
MINIMUM PRESSURE VALVE SEAL KIT	1	89555599
O-RING	1	85387979
DRIVE SHAFT SEAL KIT		**301CGB6029**
GASKET	1	30809658
ANTI-SEIZE COMPOUND	1	25BC850
GASKET ELIMINATOR	1	25BC632
COUPLING INSTALLATION SHEET	1	MP167
WEAR SLEEVE	1	89535389
OIL SEAL	1	89532919
DUST SEAL	1	89599799

Name of Part	Qty.	Part No.
PACKAGE TOOL KIT		**301CGB6031**
SHAFT SEAL TOOL (Drift)	1	03416008
ASSEMBLY TOOL	1	37917818
SHAFT SEAL TOOL	1	03424708
WEAR SLEEVE PULLER	1	89587189
SIGHT GLASS TOOL	1	89747909
THERMOSTAT TOOL	1	30975188
COUPLING INSTALLATION TOOL	1	CC1021458
PULLER	1	90500152
COUPLING INSTALLATION SHEET	1	MP167
COUPLING TOOL KIT		**300CGB6031**
TOOL	1	CC1021458
PULLER	1	90500152
COUPLING INSTALLATION SHEET	1	MP167
BARE AIREND REPAIR KIT		**301CGB6013**
AIREND, ENDURO 6	1	50563802
O-RING	1	89594599
O-RING	1	89594469
O-RING	1	89534789
INLET VALVE	1	VP1011322
PERIODIC OVERHAUL KIT, AIREND		**303CGB6013**
SEAL	1	30809788
GASKET	1	30809658
ROLLER BEARING	1	12BA210
ROLLER BEARING	1	12BA207
ROLLER BEARING	1	12BA208
ROLLER BEARING	1	12BA209
BALL BEARING	1	89846509
ROLLER BEARING	1	12BA212
LOCKNUT	1	89846629
LOCKNUT	1	87252589
WEAR SLEEVE	1	89535389
OIL SEAL	1	89532919
O-RING	1	87908849
O-RING	1	87454239
O-RING	1	89594599
O-RING	1	89594469
O-RING	1	89534789
DUST SEAL	1	89599799
PNEUMATIC CONTROL KIT		**302CGB6013**
PRESSURE RELIEF VALVE	1	90AR1204
CHECK VALVE	1	CC1040088
OIL SCREEN FILTER	1	85588619
GASKET	1	80034799

ELECTRICAL CONTROL KIT		**304CGB6013**
PRESSURE TRANSDUCER	2	VP1011577
THERMISTOR PROBE	2	VP1018671
CORD (30 FT)	1	VP1018672
SOLENOID VALVE	2	91B235
VACUUM SWITCH	1	88H195
CORD (8 FT)	1	VP1018675
DRYER CONVERSION KIT (VS20)		**300CGB6005**
AIR DRYER	1	VP1026478
HOSE	1	VP1013190
ADAPTOR	1	5010030
ADAPTOR	1	86H220
HOSE	1	VP1013191
SCREW	3	75LM48
CORD	1	VP1010780
ELECTRICAL GROUP	1	302CGB4007
AIRSMART COMMUNICATION MODULE KIT		**300ETK6028**
ELECTRICAL FITTING	2	24CA615
PIPE COUPLING	1	64EB368
TRANSDUCER	1	VP1011577
PLUG	1	64AC2
AIRSMART CONTROL	1	301ETK1173
CONNECTOR	1	VP1023309
COVER	1	VP1023310
CABLE (IN FEET)	100	97J93
LUBRICANT (AEON 9000SP) - STANDARD		
5 GALLON PAIL	1	28H109
55 GALLON DRUM	1	28H110
LUBRICANT (AEON 9000TH)		
5 GALLION PAIL	1	28H286
55 GALLON DRUM	1	28H270
LUBRICANT (AEON 6000FG)		
5 GALLON PAIL	1	28H99
55 GALLON DRUM	1	28H100
TOUCH-UP PAINT		
5 GALLON PAIL (White)	1	28H76
1 GALLON CAN (White)	1	28H84
1 QUART CAN (White)	1	28H83
5 GALLON PAIL (Red)	1	28H325
1 GALLON CAN (Red)	1	28H324
1 QUART CAN (Red)	1	28H323

Gardner Denver®

For additional information, contact your local representative or visit:
www.contactgd.com/compressors

 Printed in U.S.A.

ENERGY STAR PARTNER

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2008 ANAB DNV

MEMBER OF CAGI Compressed Air & Gas Institute

KNOW PRESSURE COMPRESSED AIR CHALLENGE

Please recycle after use.

GARDNER DENVER

13-17-600
Version: 03
October 2, 2009

AIRSMART™ CONTROLLER

USER'S MANUAL

(Compressor Application)

WARNING – PROHIBITION – MANDATORY LABEL INFORMATION

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.

Boxed text formats are used, within this manual, to alert users of the following conditions:

Safety Labels are used, within this manual and affixed to the appropriate areas of the compressor package, to alert users of the following conditions:

⚠ DANGER

Indicates a hazard with a high level of risk, which if not avoided, <u>WILL</u> result in death or serious injury.

Equipment Starts Automatically

Health Hazard – Explosive Release of Pressure

Cutting of Finger or Hand Hazard – Rotating Impeller Blade

High Voltage – Hazard of Shock, Burn or Death Present Until Electrical Power is Removed

Cutting of Finger or Hand Hazard – Rotating Fan Blade

Entanglement of Fingers or Hand – Rotating Shaft

⚠WARNING

Indicates a hazard with a medium level of risk, which if not avoided, <u>COULD</u> result in death or serious injury.

Asphyxiation Hazard – Poisonous Fumes or Toxic Gas in Compressed Air

⚠CAUTION

Indicates a hazard with a low level of risk, which if not avoided, <u>MAY</u> result in a minor or moderate injury.

Burn Hazard – Hot Surface

PROHIBITION - MANDATORY ACTION REQUIREMENTS

Do Not Operate Compressor with Guard Removed

Lockout Electrical Equipment in De-Energized State

Do Not Lift Equipment with Hook – No Lift Point

Loud Noise Hazard – Wear Hearing Protection

Handle Package at Forklift Points Only

Read the Operator's Manual Before Proceeding with Task

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:

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

- **Keep fingers and clothing away from rotating fan, drive coupling, etc.**
- **Disconnect the compressor unit from its power source, lockout and tagout before working on the unit – this machine is automatically controlled and may start at any time.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers, the thermostatic mixing valve or break any connections, etc., in the compressor air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Perform all wiring in accordance with the National Electrical Code (NFPA-70) and any applicable local electrical codes. Wiring and electrical service must be performed only by qualified electricians.**
- **Open main disconnect switch, lockout and tagout before working on the control, wait 10 minutes and check for voltage.**

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.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **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.**

Table of Contents

1 General Information

The AirSmart™ Controller was designed specifically for use in the Gardner Denver Global Line of variable speed, rotary screw air compressors. The AirSmart™ Controller is also capable of controlling fixed speed air compressors which use traditional motor starters. The microprocessor-based unit can control up to three Variable Frequency motor Drives (VFDs) while monitoring all necessary temperature and pressure points within the compressor in order to safely operate the machine and satisfy user air demand. The Control Panel displays a comprehensive overview of the compressor status and allows easy access to operational parameters such as pressure set points, alarm set points and language selection.

1.1 AirSmart Controller Features

- ✓ Microprocessor controlled
- ✓ Low voltage 24 VDC operation
- ✓ Supports up to thee VFDs via Modbus link
- ✓ Compressor air regulation via PID control
- ✓ Can control variable speed or fixed speed compressors.
- ✓ Intelligent limiting for operation in extreme environmental conditions
- ✓ Feature rich error handling for safe machine operation
- ✓ Expandable to meet the I/O needs of large compressor packages
- ✓ Up to five pressure transducer inputs
- ✓ Up to five temperature transducer inputs
- ✓ Up to three discrete inputs for user control
- ✓ Up to two discrete outputs for user status
- ✓ Sequence capability for control of up to eight compressors (w/ opt. Communications Module)
- ✓ RS-232 Serial communications for local monitoring (w/ opt. Communication Module)
- ✓ Ethernet communications for remote monitoring (w/ opt. Communications Module)

1.2 Control Panel Features

- ✓ 4 x 20 Character LCD display with LED back lighting is easy to read in all lighting conditions.
- ✓ 9 Buttons for easy compressor control and menu navigation
- ✓ 4 status LEDs for “at-a-glance” compressor status
- ✓ Password protection of setup parameter menus
- ✓ Multiple language support

2 Controller Operation

2.1 Compressor Front Panel

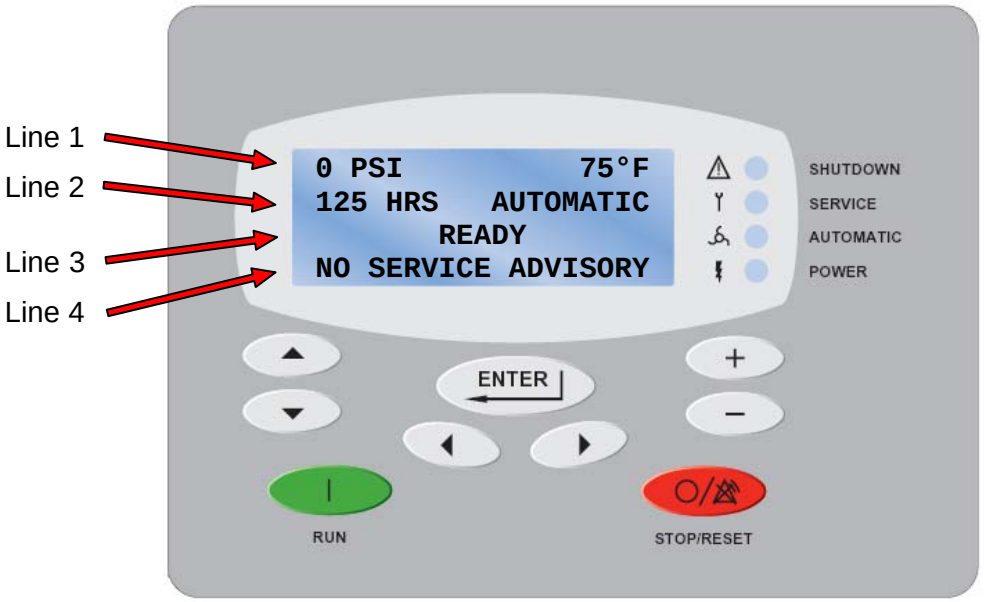
1. AirSmart Controller Control Panel

The Control Panel is mounted on the front panel of the compressor and is used to operate the compressor and observe system status using its four-line LCD display, four status LED indicators and nine buttons.

2. Emergency Stop Button

The Emergency Stop button, when pressed, will immediately shut down the compressor. To reset the compressor after an Emergency Stop, pull the Emergency Stop button out and then press the STOP/RESET button on the Control/Display Panel to clear the Emergency Stop fault.

2.2 Control Panel Four-Line Display



1. **Line 1**

   The first line of the display is used to show the package pressure and temperature while the compressor is operating. When editing parameters in the Adjustment Menus, the first line is used to show the menu heading.

2. **Line 2**

   The second line of the display is used to show the total operating hours and operating mode while the compressor is running. The second line is also used to show Shutdown fault information. When editing parameters in the Adjustment Menus, the second line is used to show the parameter heading.

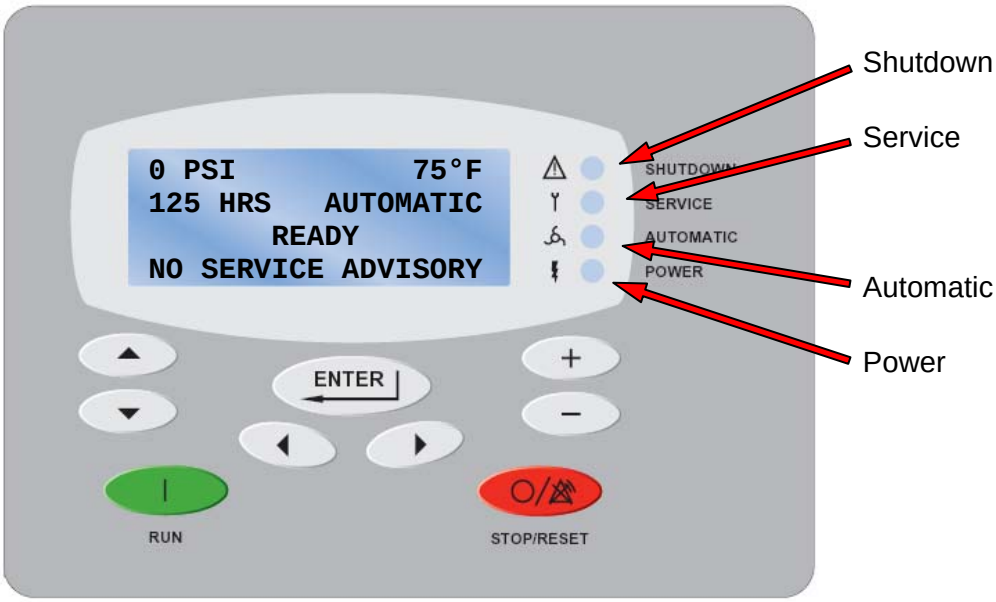
3. **Line 3**

   The third line of the display is used to show the state of the compressor while it is operating. The third line is also used to show additional Shutdown fault information. When editing parameters in the Adjustment Menus, the third line is used to show the parameter value.

4. **Line 4**

   The fourth line of the display is used to show Service Advisory fault information and the Operational Menus. When editing parameters under the Adjustment Menus, the fourth line is used to show the editing mode.

2.3 Control Panel Indicator Functions



1. **Shutdown LED Indicator (red)**

   The Shutdown LED indicates a shutdown fault in the compressor. The type of shutdown fault will be shown in the four-line display. When the Shutdown LED is flashing, the shutdown fault condition is active. When the Shutdown LED is on steady, the shutdown fault condition no longer exists, but the fault has not been acknowledged. To acknowledge a shutdown fault and reset the compressor, press the STOP/RESET button on the Control Panel.

   Pressing the STOP/RESET button will not clear an active shutdown fault. The shutdown fault condition must be removed before it can be reset.

2. **Service LED Indicator (yellow)**

   The Service LED indicates a service advisory fault in the compressor. The type of service advisory fault will be shown in the four-line display. When the Service LED is on steady, the advisory fault condition is active, but the fault has not been acknowledged. To acknowledge an advisory fault, press the ENTER button on the Control Panel.

   If the service advisory fault condition has not been cleared before it is acknowledged, the advisory fault indication will occur again in a short period of time.

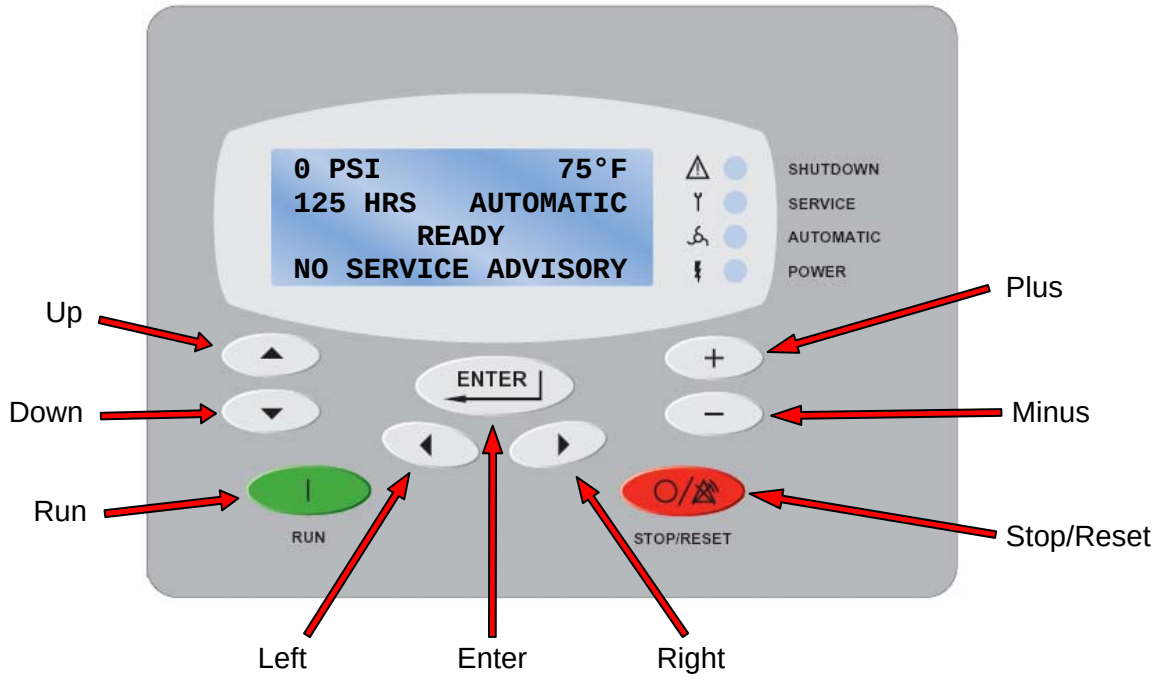
3. **Automatic LED Indicator (green)**

   The Automatic LED indicates that the compressor capable of starting automatically.

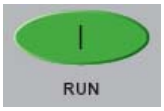
4. **Power LED Indicator (white)**

   The Power LED indicates that power has been applied to the compressor.

2.4 Control Panel Button Functions



1. **RUN Button**



The RUN button is used to start the compressor.

2. **STOP/RESET Button**

The STOP/RESET button is used to stop and blowdown the compressor. The STOP/RESET button is also used to acknowledge and reset shutdown faults or exit from the Adjustment Menu tree.

3. **ENTER Button**

The ENTER button is used to acknowledge a service advisory fault. The ENTER button is also used to enter the Adjustment Menu tree, select a parameter for editing or save an edited parameter.

4. **Left Arrow Button**

The Left Arrow button is used to navigate horizontally to the next Operational or Adjustment menu.

5. **Right Arrow Button**

The Right Arrow button is used to navigate horizontally to the next Operational or Adjustment menu.

6. **Up Arrow Button**

The Up Arrow button is used to navigate vertically to the next item inside a menu**.**

7. **Down Arrow Button**

The Down Arrow button is used to navigate vertically to the next item inside a menu.

8. **Plus Button**

The Plus button is used increment the value of a selected parameter while in the edit mode.

9. **Minus Button**

The Minus button is used decrement the value of a selected parameter while in the edit mode.

3 Quick Start Guide

Operation of the AirSmart controller is easy. Simply select a Target Pressure and then press the Run  button to start the compressor, no other settings are required. The Target Pressure comes preset to 100 PSI from the factory. The Unload Pressure is preset to 110 PSI. If a different pressure setting is desired, the following steps can be used as a guide.

3.1 Setting the Target Pressure

The Target Pressure setting is used to set the operating point of the compressor. To make any adjustments in the operation of the compressor, the machine must be stopped and in the Ready mode. Stop the compressor by pressing the Stop/Reset  button. The front panel display should read “READY” on line 3.

```
0 PSI              75°F
10 HRS       AUTOMATIC
         READY
 NO SERVICE ADVISORY
```

Next, press the Enter  button to access the Adjustment Menu tree

```
   ADJUSTMENT MENU
OPERATION ADJUSTMENT

  (SELECT SUB MENU)
```

Since the Target Pressure setting is under the Operation Adjustment menu, press Enter  again to access that sub-menu

```
OPERATION ADJUSTMENT
  LANGUAGE-LANGUAGE
    ENGLISH (US)
 (SELECT PARAMETER)
```

The Target Pressure is the second item in the Operation Adjustment sub-menu so press the Down  button to navigate to the Target Pressure setting.

```
OPERATION ADJUSTMENT
  TARGET PRESSURE
       100 PSI
 (SELECT PARAMETER)
```

To change the Target Pressure, press the Enter button to edit the value.

```
OPERATION ADJUSTMENT
  TARGET PRESSURE
      100 PSI
  (EDIT PARAMETER)
```

A flashing cursor will appear covering the least significant digit in the Target Pressure value, use the Plus and Minus buttons to change its value. Use the Right and Left buttons to move the cursor to other digits in the Target Pressure value. When the desired Target Pressure value is displayed, press the Enter button to save the new value. Pressing the Stop/Reset button will abort the change and restore the previous value.

In order to save the changes made to parameters, press the Stop/Reset button to go back to the heading of the current menu and then press the Stop/Reset button again. If parameter changes have been made, the following screen will appear.

```
  STORE MODIFIED
   PARAMETERS?
    STOP = NO
   ENTER = YES
```

To permanently save the changes that were made, press the Enter button. If the Stop/Reset button is pressed, the parameter changes will be lost the next time the compressor power is turned off.

3.2 Setting the Load and Unload Pressure

After setting the Target Pressure, set the Unload and Load Pressures values in a similar fashion. The Unload pressure is the third item in the Operation Adjustment sub-menu so press the Down button to navigate to the Unload Pressure setting. The Unload Pressure will control at which pressure the compressor unload and stops.

```
OPERATION ADJUSTMENT
  UNLOAD PRESSURE
      110 PSI
  (SELECT PARAMETER)
```

The Load pressure is the fourth item in the Operation Adjustment sub-menu so press the Down button to navigate to the Load Pressure setting. The Load Pressure will control at which pressure the compressor will startup again after unloading.

```
OPERATION ADJUSTMENT
  LOAD PRESSURE
      100 PSI
  (SELECT PARAMETER)
```

4 Air Compressor Control

The AirSmart Controller has been successfully implemented in a wide variety of compressor types within the Gardner Denver product line from large variable speed, multi-stage, rotary screw compressors to small fixed speed models. Each type of machine requires a certain amount of complexity for control and the AirSmart Controller can employ everything from PID control loops with specialized I/O down to simple binary (on/off) control. The following paragraphs present a brief description of how the AirSmart Controller regulates pressure depending on machine type

4.1 Variable Speed Compressors

A variable speed compressor employs a Variable Frequency Drive (VFD) to regulate the airflow by speeding up or slowing down the main motor which is directly connected to the airend. The Gardner Denver VS and VST line of compressors are variable speed machines. The TARGET PRESSURE setting is used to generate a difference value (error value) when compared to the package discharge or PLANT PRESSURE signal. The TARGET PRESSURE setting is compared to the air storage receiver or SYSTEM PRESSURE signal on units with the optional communications module that are run in Sequence mode of operation. The error value is fed into a PID (Proportional, Integral and Derivative) algorithm in the AirSmart Controller which produces an appropriate command for the VFD to change the speed of the main motor thereby increasing or decreasing the pressure so that the PLANT PRESSURE value will match the TARGET PRESSURE value. In a two-stage, variable speed compressor, a second PID algorithm is used to match the power output from the second stage VFD to that of the first stage VFD. PID control algorithms require tuning in order to function correctly without losing control of the machine. The PID algorithms in the AirSmart Controller were carefully tuned for each compressor model during the product development process and do not require any further adjustment by the end user.

During normal operation, as the demand for air increases, the speed of the compressor will also increase to meet the demand. When the speed of the compressor reaches the set maximum value for the given the TARGET PRESSURE setting, it will not increase any further. As the demand for air decreases, the speed of the compressor will decrease down to the set minimum value for the given TARGET PRESSURE setting. If the demand for air continues to decrease, the PLANT PRESSURE value will increase until it reaches the UNLOAD PRESSURE value programmed into the AirSmart Controller at which time the compressor will unload and the main motor will stop. The compressor will start again when PLANT PRESSURE falls below the LOAD PRESSURE setting. The minimum and maximum motor speeds are fixed in the controller for each compressor model to ensure that the motor and VFD current limits are not exceeded at any given TARGET PRESSURE setting.

4.2 Variable Flow Compressors

A variable flow compressor can be defined as a machine which uses a fixed speed motor (with a traditional full voltage or wye-delta starter) but can regulate the air flow by using mechanical devices such as a turn valve to change the size of the compression chamber in the airend or a variable inlet valve to restrict the intake of air. The Gardner Denver Electra-Saver line of compressors are an example of variable flow machines. In the case of a compressor with an inlet valve and a turn valve, two separate PID algorithms are used which control each device based on the package discharge pressure, that is, PLANT PRESSURE is compared to TARGET PRESSUE. So that the two independent algorithms do not attempt to cancel or fight each other, each is used in succession while the compressor is operating in different flow regions. The TARGET PRESSURE setting is compared to the air storage receiver or SYSTEM PRESSURE signal on units with the optional communications module that are run in Sequence mode of operation. In a typical Gardner Denver machine, the turn valve is used to control the flow between 100% and typically 40% of full capacity while the inlet valve

is used to control the flow at even lower capacity levels. The AirSmart Controller can also be programmed to use only the inlet valve for flow control over the full capacity range of the machine.

At full capacity, the inlet valve is fully open and the turn valve is in the fully closed state. As the air demand decreases, the AirSmart Controller will open the turn valve to decrease the capacity of the airend to match the demand and keep the PLANT PRESSURE value at the TARGET PRESSURE setting. When the turn valve is fully open and as the demand continues to decrease, the AirSmart Controller will begin to close the inlet valve to further decrease the air flow after PLANT PRESSURE has risen to TARGET PRESSURE + 3 PSI. The 3 PSI offset helps keep the two PID controllers from interfering with each other. Decreasing the demand for air from this point will cause either the inlet valve to fully close or the pressure to rise to the UNLOAD PRESSURE setting both of which will cause the compressor to unload. If the demand increases the inlet valve will open followed by the closing of the turn valve to meet the new demand. If the demand does not increase, the compressor package will eventually stop. The compressor will start again when the PLANT PRESSURE value falls below the LOAD PRESSURE setting.

4.3 Fixed Speed Compressors

A fixed speed compressor is the simplest type of machine in the Gardner Denver product line and uses a fixed speed motor along with a binary inlet valve (open or closed) for flow control. The Integra compressor series offered by Gardner Denver are representative of this type of machine. In a simple fixed speed compressor, the TARGET PRESSURE setting in the AirSmart Controller is ignored due to the fact that there is no way to partially restrict the air flow. The controller loads (starts) and unloads (stops) the compressor based only on the LOAD PRESSURE and UNLOAD PRESSURE settings. The LOAD PRESSURE and UNLOAD PRESSURE settings are compared to the air storage receiver or SYSTEM PRESSURE signal on units with the optional communications module that are run in Sequence mode of operation.

5 AirSmart Controller Menus

The AirSmart Controller has two sets of menus that serve as a window into the operation of the compressor. The first set is the Operational Menus, which allow the user to observe the current status of various parts of the compressor like the motor(s) or the air-oil separator. The second set of menus are the Adjustment Menus, which allow the user to change the operating parameters of the compressor such as the plant pressure set point and the high temperature alarm limit. The default values for the adjustable parameters are determined by the Controller Model Table stored in the controller's memory.

5.1 Operational Menus

The Operational Menus are available at all times - while the compressor is running, stopped or even while in a fault condition. To enter the Operational Menu trees press the Right  or Left  buttons to access one of eight different menus. Once the desired menu heading is shown in the fourth line of the display, use the Up  and Down  buttons to access the individual items in the selected menu, which are also shown in the fourth line of the display. If the Up or Down buttons are not pressed within five seconds of pressing the Right or Left buttons, the fourth line of the display will return to its previous state.

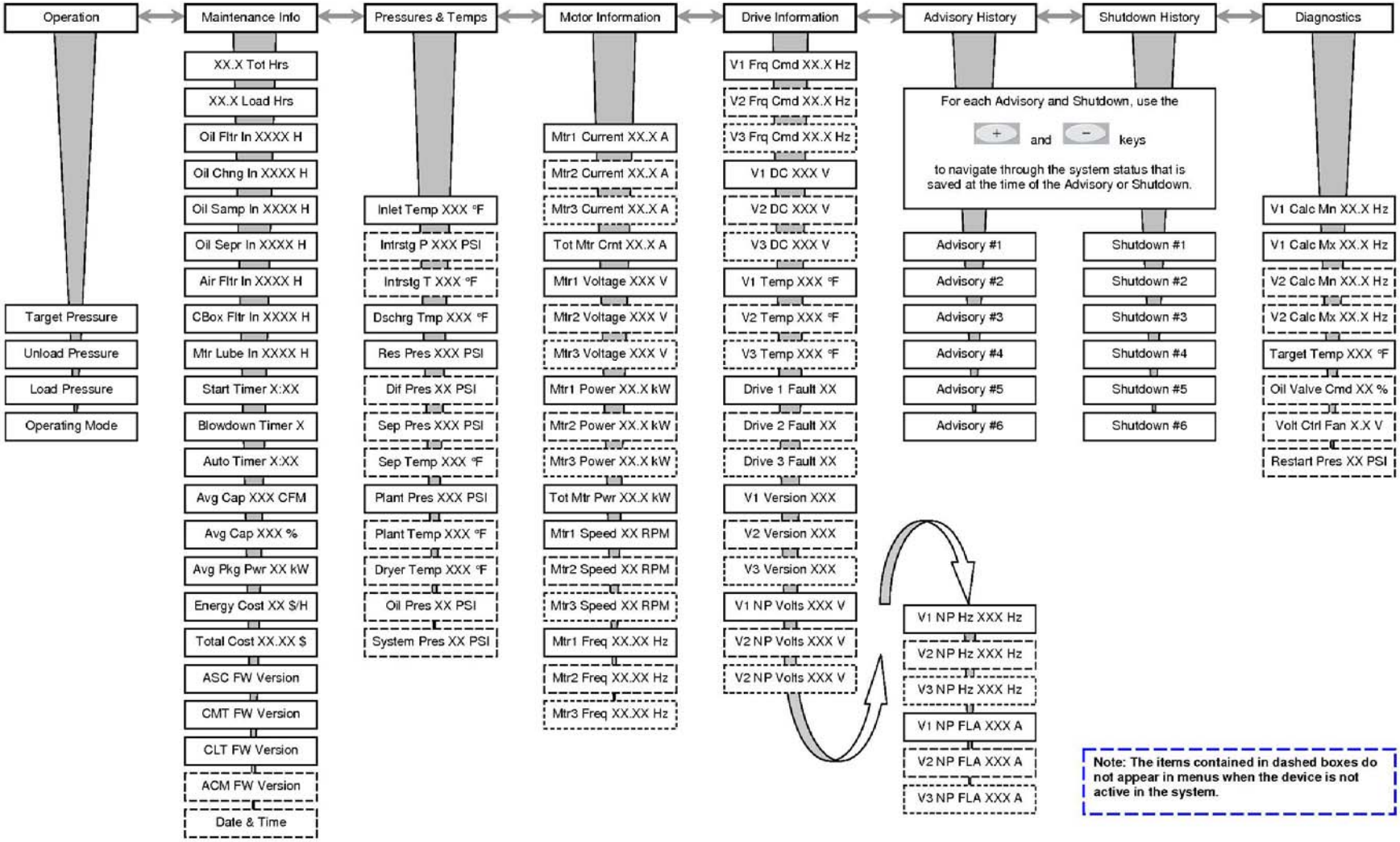
It is not necessary to navigate back to the top of a particular menu in order to enter another menu. Simply press the Right  or Left  buttons to go back to the heading of the current menu and then use the Right or Left buttons again to find the desired menu heading as described above.

- *Note: Advisory fault information is also shown in the fourth line of the display. If an advisory is active and the fault condition has not been cleared, the Operational Menu text will be periodically replaced by the advisory text*.

AirSmart Controller Operational Menus (Compressor Application)

Use the ◄ ► keys to navigate through the horizontal main menus. These keys are also used to exit the vertical menu items.

Use the ▲ ▼ keys to navigate through the vertical menu items.



4.1.1 Operation Menu

The Operation Menu gives the user the ability to change the pressure set points and the operating mode while the compressor is running or stopped. While in the Operation menu, small incremental changes can be made to the parameter values using the Plus + and Minus − buttons. When changing parameters, the "**=**" character will change to "**->**" to show that the value has been changed. Pressing the Enter ENTER button will apply the change.

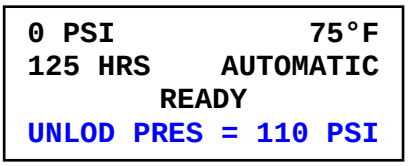
1. Target Pressure

The first item in the Operation menu is the Target Pressure. This value is the pressure set point of the compressor. When the Target Pressure is changed, the Unload Pressure and the Load Pressure values are also changed by the same amount as the Target Pressure. If this action is not desired, the Unload and Load Pressure values may be changed individually. The Target Pressure can also be changed inside the Operation Adjustment menu.

Min Value: Min Target Pressure in Unit Setup Adjustment menu
Max Value: 181 PSI (12.5 bar)
Default Value: 100 PSI (7 bar)

2. Unload Pressure

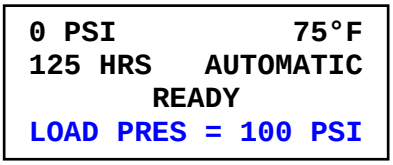
The next item in the Operation menu is the Unload Pressure. This pressure value is where the compressor will unload and begin the unload/stop sequence. The Unload Pressure value cannot be set any lower than [Target Pressure + 5 PSI].



Min Value: Target Pressure + 5 PSI (0.3 bar)
Max Value: 185 PSI (12.8 bar)
Default Value: 110 PSI (7.5 bar)

3. Load Pressure

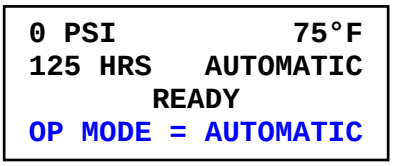
The next item in the Operation menu is the Load Pressure. This pressure value is where the compressor will load again after an unload/stop sequence. The Load Pressure value cannot be set any higher than Target Pressure.



Min Value: 30 PSI (2 bar)
Max Value: Target Pressure
Default Value: 100 PSI (7 bar)

4. Operating Mode

The next item in the Operation menu is the Operating Mode. The controller can be set to one of four operational modes; Automatic, Sequence, Low Demand and Constant.



AUTOMATIC: (Default mode) the compressor uses its internal modulation algorithms and the motor(s) will stop after it goes through the timed unload/blowdown sequence using the Blowdown and Auto Timers.

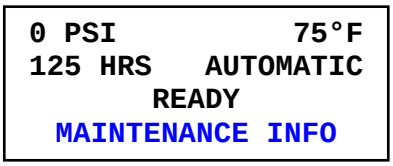
SEQUENCE: The compressor is part of a sequenced group of machines. Refer to Gardner Denver document 13-17-604 for further details about sequencing with the AirSmart Controller.

LOW DEMAND: The compressor uses its internal modulation algorithms but motor(s) will NOT stop after it goes through the timed unload/blowdown sequence. The Blowdown Timer is used, however, the Auto Timer is ignored in Low Demand mode.

CONSTANT: The compressor uses its internal modulation algorithms but motor(s) will NOT stop and the compressor will NOT blowdown after it unloads. The Blowdown and Auto Timers are both ignored in Constant mode.

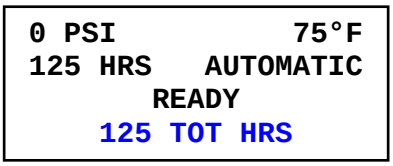
4.1.2 Maintenance Info Menu

The Maintenance Menu gives the user access to the current status of all the maintenance counters and system timers.



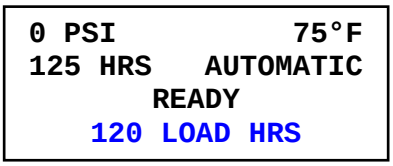
1. Total Hours

The first item in the Maintenance Info menu is the total number of hours the compressor has been in operation. This information is also available in the second line of the display during normal compressor operation.



2. Loaded Hours

The next item in the Maintenance Info menu is the number of hours the compressor has been loaded.

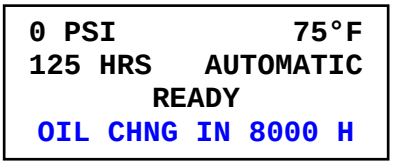


3. Time To Next Oil Filter Change

The next item in the Maintenance Info menu is the number of hours before the next oil filter change is needed. The Oil Filter Change Interval Timer can be reset under the Maintenance Adjust menu. The Oil Filter Change Interval Time can be changed under the Unit Setup Adjust menu

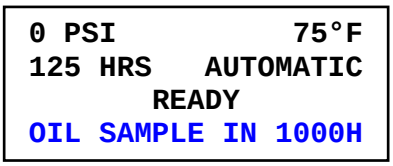
4. Time To Next Oil Change

The next item in the Maintenance Info menu is the number of hours before the next oil change is needed. The Oil Change Interval Timer can be reset under the Maintenance Adjust menu. The Oil Change Interval Time can be changed under the Unit Setup Adjust menu.



5. Time To Next Oil Sample

The next item in the Maintenance Info menu is the number of hours before the next oil sample should be taken. The Oil Sample Interval Timer can be reset under the Maintenance Adjust menu. The Oil Sample Interval Time can be changed under the Unit Setup Adjust menu.



6. Time To Next Separator Element Change

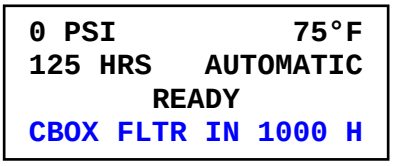
The next item in the Maintenance Info menu is the number of hours before the next separator element change is needed. The Separator Element Change Interval Timer can be reset under the Maintenance Adjust menu. The Separator Element Change Interval Time can be changed under the Unit Setup Adjust menu.

7. Time To Next Air Filter Change

The next item in the Maintenance Info menu is the number of hours before the next air filter change is needed. The Air Filter Change Interval Timer can be reset under the Maintenance Adjust menu. The Air Filter Change Interval Time can be changed under the Unit Setup Adjust menu.

8. Time To Control Box Filter Change

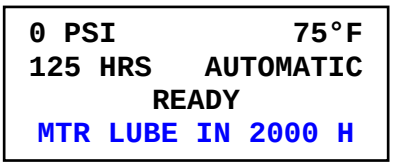
The next item in the Maintenance Info menu is the number of hours before the next control box filter change is needed. The Control Box Filter Change Interval Timer can be reset under the Maintenance Adjust menu. The Control Box Filter Change Interval Time can be changed under the Unit Setup Adjust menu.



- **Note: This parameter is not available in all compressor packages.**

9. Time To Next Motor Lubrication

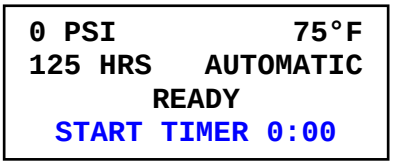
The next item in the Maintenance Info menu is the number of hours before motor lubrication is needed. The Motor Lubrication Interval Timer can be reset under the Maintenance Adjust menu. The Motor Lubrication Interval Time can be changed under the Unit Setup Adjust menu.



- **Note: This parameter is not available in all compressor packages.**

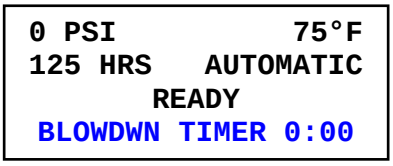
10. Start Timer

The next item in the Maintenance Info menu is the current value of the Start Timer. The Start Timer is used to control the amount of time the compressor will run at before moving on to the modulation phase after the RUN button has been pressed. The Start Timer Interval is set under the Operation Adjust menu in the Adjustment menu tree.



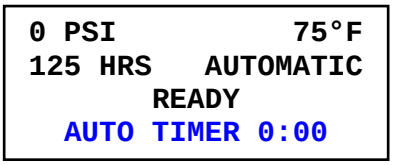
11. Blowdown Timer

The next item in the Maintenance Info menu is the current value of the Blowdown Timer. The Blowdown Timer is used to control the amount of time the compressor will run unloaded before starting the blowdown process. The Blowdown Timer Interval is set under the Operation Adjust menu in the Adjustment menu tree.



12. Auto Timer

The next item in the Maintenance Info menu is the current value of the Auto Timer. The Auto Timer is used to control the amount of time the compressor will run during the blowdown process. The Auto Timer interval is set under the Operation Adjust menu in the Adjustment Menu tree.



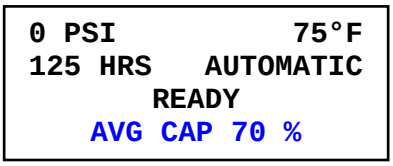
13. Average Capacity

The next item in the Maintenance Info menu shows the Average Capacity of the compressor based on a moving window average function which samples the compressor speed every five minutes and calculates the capacity using the last twelve samples (1 hour of data).

- **Note: This parameter is only available in variable speed compressor packages.**

14. Average Percent Capacity

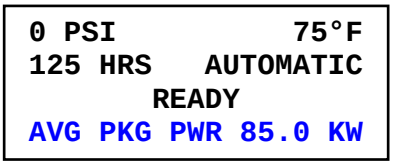
The next item in the Maintenance Info menu shows the Average Percent of Full Capacity of the compressor based on a moving window average function which samples the compressor speed every five minutes and calculates the average percent capacity using the last twelve samples (1 hour of data).



- **Note: This parameter is only available in variable speed compressor packages.**

15. Average Package Power

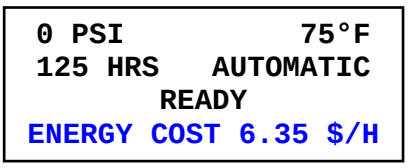
The next item in the Maintenance Info menu shows the Average Package Power of the compressor based on a moving window average function which samples the drive power output every five minutes and calculates the average power using the last twelve samples (1 hour of data).



- **Note: This parameter is only available in variable speed compressor packages.**

16. Current Energy Cost

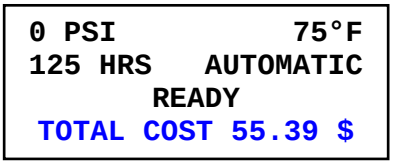
The next item in the Maintenance Info menu shows the cost of operating the compressor at the current power level. This number is based on the current package power output and the Energy Cost value that is entered under the Configuration Adjust menu.



- **Note: This parameter is only available in variable speed compressor packages.**

17. Cumulative Energy Cost

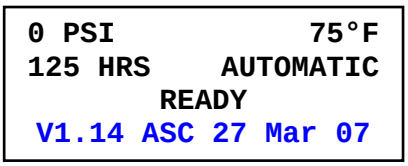
The next item in the Maintenance Info menu is the Cumulative Energy Cost of operating the compressor. This value is based on Average Package Power and the Energy Cost value under the Configuration Adjust menu. The user may reset the cumulative energy cost value under the Maintenance Adjust menu.

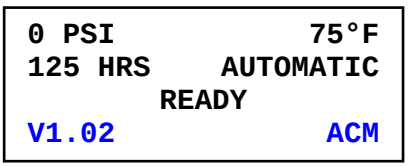


- **Note: This parameter is only available in variable speed compressor packages.**

18. Firmware Version

The next four items in the Maintenance Info Menu show the current versions of the AirSmart Controller Firmware, the Controller Model Table, the Controller Language Table and the Communications Module firmware (if installed) that are loaded into the AirSmart Controller.

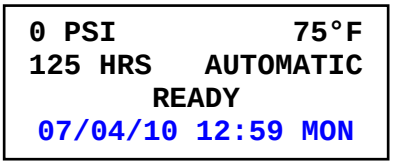




- **Note: This parameter is only available when Communications Module is installed.**

19. Time and Date

The last item in the Maintenance Info Menu is the current time and date kept by the battery backed, real time clock on the Communications Module. The time and date can be changed under the Time Adjust menu. This menu item is not displayed if the optional Communications Module is not installed.



- **Note: This parameter is only available when Communications Module is installed.**

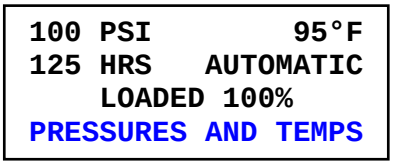
The date & time format reads as follows:

YY/MM/DD HH:MM DOW

Where:
YY = Year
MM = Month
DD = Date
HH = Hour (using 24 hour clock)
MM = Minute
DOW = Day of week

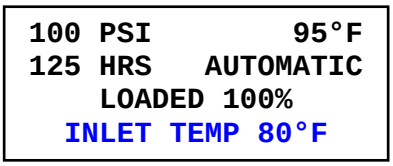
4.1.3 Pressures and Temps Menu

The Pressures and Temps menu gives the user access to the current status of all pressure and temperature values in the compressor package as well as the status of any optional sensors installed in the compressor package.



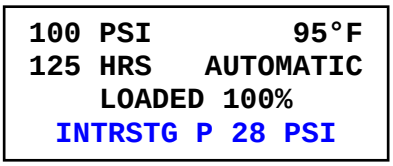
1. Inlet Temperature

The first item in the Pressures and Temps menu is the Inlet Temperature, which reflects the current ambient temperature outside the compressor package.



2. Interstage Pressure

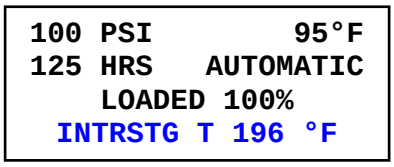
The next item in the Pressures and Temps menu is the Interstage Pressure, which reflects the current air pressure inside the interstage pipe of a two-stage compressor package.



- **Note: This parameter is only available in two-stage compressor packages.**

3. Interstage Temperature

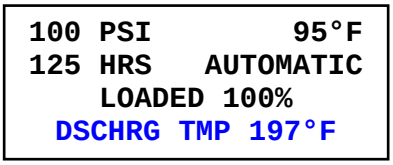
The next item in the Pressures and Temps menu is the Interstage Temperature, which reflects the current temperature inside the interstage pipe of a two-stage compressor package.



- **Note: This parameter is only available in two-stage compressor packages.**

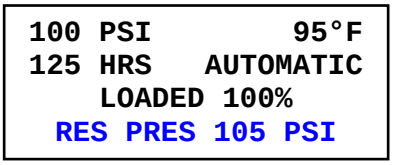
4. Discharge Temperature

The next item in the Pressures and Temps menu is the Discharge Temperature, which reflects the current temperature at the discharge of the airend but before the air-oil separator. The Discharge Temperature value is seen in the first line of the display if there is no Plant Temperature sensor in the system.



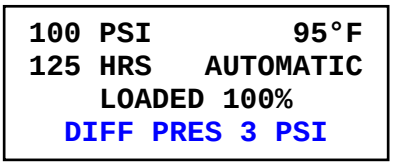
5. Reservoir Pressure

The next item in the Pressures and Temps menu is the Reservoir Pressure, which reflects the current air pressure at the "wet side" of the air-oil separator.



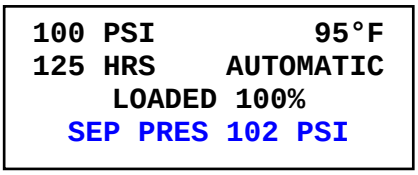
6. Differential Pressure

The next item in the Pressures and Temps menu is the Differential Pressure, which reflects the current air pressure differential across the air-oil separator. Differential Pressure is calculated as [Reservoir Pressure – Separator Pressure] when the compressor package contains s Separator Pressure transducer. Differential Pressure is calculated as [Reservoir Pressure – (Plant Pressure + Aftercooler Offset)] in systems that do not have a Separator Pressure transducer. The Aftercooler Offset is a fixed value that represents the pressure drop across the aftercooler.



7. Separator Pressure

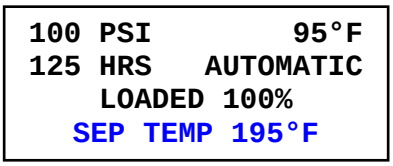
The next item in the Pressures and Temps menu is the Separator Pressure, which reflects the current air pressure at the "dry side" of the air-oil separator.



- **Note: This parameter is not available in all compressor packages.**

8. Separator Temperature

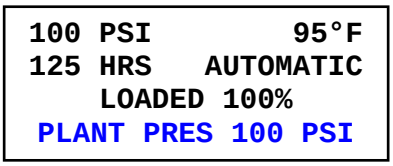
The next item in the Pressures and Temps menu is the Separator Temperature, which reflects the current temperature at the “dry side” of the air-oil separator.



- **Note: This parameter is not available in all compressor packages.**

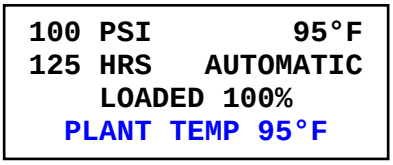
9. Plant Pressure

The next item in the Pressures and Temps menu is the Plant Pressure, which reflects the current air pressure at the package discharge port. The Plant Pressure value is also always seen in the first line of the display. The Plant Pressure value is used to control compressor modulation.



10. Plant Temperature

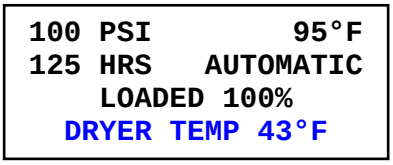
The next item in the Pressures and Temps menu is the Plant Temperature, which reflects the current temperature at the compressor package discharge port. The Plant Temperature value is also always seen in the first line of the display. The Discharge Temperature value is seen in the first line of the display if there is no Plant Temperature sensor in the system.



- **Note: This parameter is not available in all compressor packages.**

11. Dryer Temperature

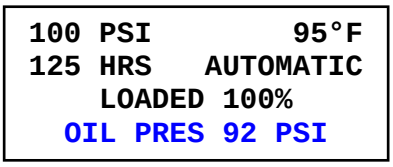
The next item in the Pressures and Temps menu is the Dryer Temperature, which reflects the current refrigerant temperature of the integrated dyer if present in the system.



- **Note: This parameter is not available in all compressor packages.**

12. Oil Pressure

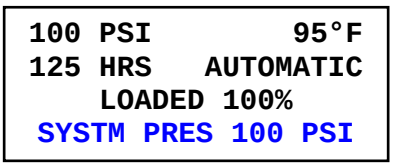
The next item in the Pressures and Temps menu is the Oil Pressure, which reflects the current oil pressure at the oil manifold, which is the main distribution point for the oil injection system.



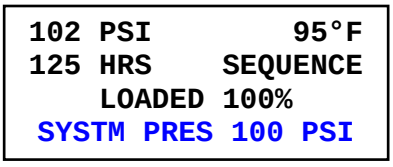
- **Note: This parameter is not available in all compressor packages.**

13. System Pressure

The next item in the Pressures and Temps menu is the System Pressure, which reflects the current pressure at the system manifold. This parameter is only available when the Communications Module is installed and the compressor is set up for sequencing. The System Pressure value is used to control compressor modulation in the Sequence mode. While in the sequence mode, the System Pressure is shown in the fourth line of the display.

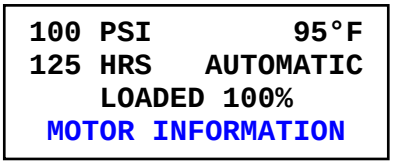


- **Note: This parameter is not available in all compressor packages.**



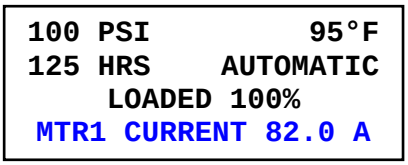
4.1.4 Motor Information Menu

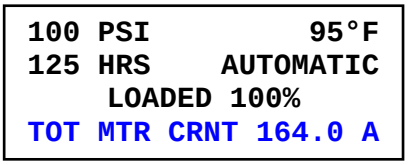
The Motor Information menu gives the user access to the current status of all the Variable Frequency Drive (VFD) controlled motors (up to three) that are installed in the compressor. The Motor Information menu is not visible if no VFDs are installed with the exception of Motor Current which is visible if the current sensor option is installed in a fixed speed compressor.



1. Motor Current

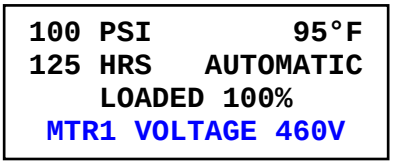
The first item(s) in the Motor Information menu is the Motor Current consumption value of each individual motor in the system followed by the total current consumption of all the motors. In the first display below, “MTR1” is followed by “MTR2” and “MTR3” depending on which motor is being observed.





2. Motor Voltage

The next item(s) in the Motor Information menu is the AC Voltage level being delivered by the VFD to each individual motor in the system. In the display below, “MTR1” is followed by “MRT2” and “MTR3” depending on which motor is being observed.



3. Motor Power

The next item(s) in the Motor Information menu is the Motor Power consumption value of each individual motor in the system followed by the total power consumption of all the motors. In the first display below, “MTR1” is followed by “MTR2” and “MTR3” depending on which motor is being observed.

```
100 PSI        95°F
125 HRS   AUTOMATIC
    LOADED 100%
 MTR1 POWER 42.0 KW
```

```
100 PSI        95°F
125 HRS   AUTOMATIC
       READY
TOT MTR PWR 84.0 KW
```

4. Motor Speed

The next item(s) in the Motor Information menu is the Motor Speed value of each individual motor in the system. In the display below, “MTR1” is followed by “MTR2” and “MTR3” depending on which motor is being observed.

```
100 PSI        95°F
125 HRS   AUTOMATIC
    LOADED 100%
MTR1 SPEED 5151 RPM
```

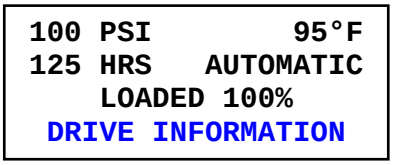
5. Motor Frequency

The next item(s) in the Motor Information menu is the Motor operating Frequency value of each individual motor in the system. In the display below, “MTR1” is followed by “MTR2” and “MTR3” depending on which motor is being observed.

```
100 PSI        95°F
125 HRS   AUTOMATIC
    LOADED 100%
 MTR1 FREQ 171.7 HZ
```

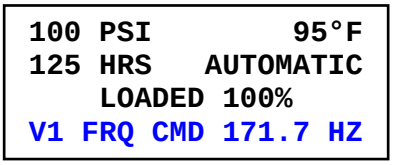
4.1.5 Drive Information Menu

The Drive Information menu gives the user access to the current status of all the Variable Frequency motor Drives (up to three) that are installed in the compressor. The Drive Information menu is not visible if no VFDs are installed.



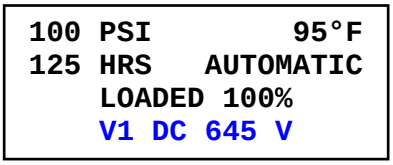
1. Commanded Motor Frequency

The first item(s) in the Drive Information menu is the Commanded Motor Frequency value of each individual drive in the system. This value indicates the speed at which each VFD has been commanded to run by the AirSmart controller. In the display below, "V1" is followed by "V2" and "V3" depending on which drive is being observed.



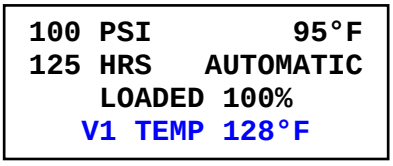
2. Drive DC Bus Voltage

The next item(s) in the Drive Information menu is the DC Bus Voltage value of each individual drive in the system. In the display below, "V1" is followed by "V2" and "V3" depending on which drive is being observed.



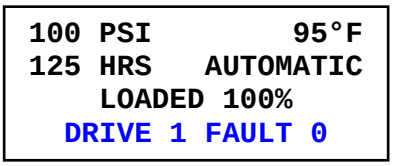
3. Drive Temperature

The next item(s) in the Drive Information menu is the VFD Heat Sink Temperature value of each individual drive in the system. In the display below, "V1" is followed by "V2" and "V3" depending on which drive is being observed.



4. Drive Fault

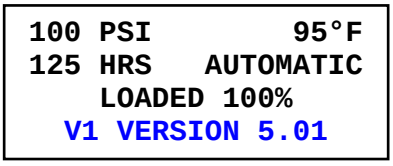
The next item(s) in the Drive Information menu is the fault value of each individual drive in the system. In the display below, “DRIVE1” is followed by “DRIVE2” and “DRIVE3” depending on which drive is being observed.



Note: Consult the appropriate VFD user’s manual for a listing of fault values and their meaning depending on which drive(s) have been installed in the compressor.

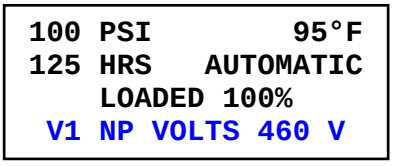
5. Firmware Version

The next item(s) in the Drive Information menu is the Firmware Version of each individual drive in the system. In the display below, “V1” is followed by “V2” and “V3” depending on which drive is being observed.



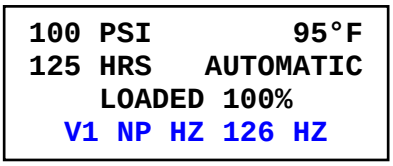
6. Motor Nameplate Volts

The next item(s) in the Drive Information menu is the Motor Nameplate Volts value of each individual motor in the system. In the display below, “V1” is followed by “V2” and “V3” depending on which drive is being observed.



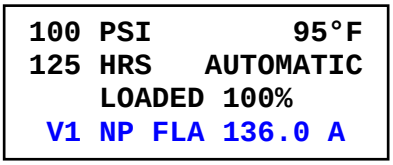
7. Motor Nameplate Frequency

The next item(s) in the Drive Information menu is the Motor Nameplate Frequency value of each individual motor in the system. In the display below, “V1” is followed by “V2” and “V3” depending on which drive is being observed.



8. Motor Nameplate Full Load Amps

The next item(s) in the Drive Information menu is the Motor Nameplate Full Load Amps (FLA) value of each individual motor in the system. In the display below, “V1” is followed by “V2” and “V3” depending on which drive is being observed.



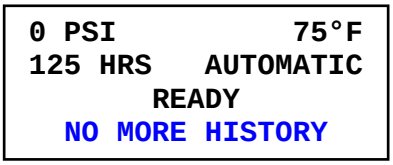
4.1.6 Advisory History Menu

The Advisory History menu gives the user immediate access to the system status during the last six advisory faults in the compressor.

1. Advisory #1 through #6

By using the Up and Down buttons, each of the advisories (up to six) is shown in the fourth line of the display.

If less than six advisories are stored in the controller, the display will indicate the end of the list as shown below.



2. System Status

When the desired advisory is shown in the fourth line of the display, use the Plus and Minus buttons to access the system status that was stored at the time of the advisory. The status values will also be shown in the fourth line of the display.

3. System Status List

The following is the list of the status items that are stored at the time of an Advisory or Shutdown fault.

- Advisory/Shutdown count since last EEPROM reset
- Total machine hours
- Date and time*
- Inlet temperature
- Interstage pressure*
- Interstage temperature*
- Discharge temperature
- Reservoir pressure
- Separator pressure*
- Separator temperature*
- Plant pressure
- Plant temperature*
- Most recent Drive 1 fault value*
- Motor 1 frequency*
- Motor 1 speed*
- Motor 1 current*
- Drive 1 temperature*
- Drive 1 DC bus voltage*
- Most recent Drive 2 fault value*
- Motor 2 frequency*
- Motor 2 speed*
- Motor 2 current*
- Drive 2 temperature*
- Drive 2 DC bus voltage*

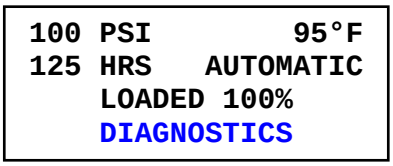
Note: * Appears only if parameter is available in compressor package

4.1.7 Shutdown History Menu

The Shutdown History menu gives the user immediate access to the system status during the last six shutdown faults in the compressor. Navigating through the system status information in the Shutdown History menu is identical to navigating through the Advisory History menu.

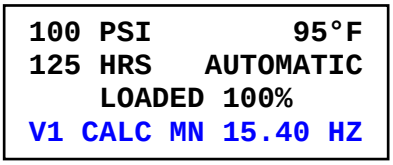
4.1.8 Diagnostics Menu

The Diagnostics menu gives the user access the current value of a number of calculated parameters that are used in controlling the compressor.



1. Drive Calculated Frequency Limits

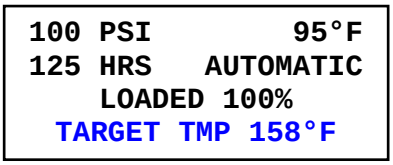
The first two or four items in the Diagnostics menu are the Calculated VFD Frequency Limits for each main motor drive in the system. These values indicate the minimum and maximum speed at which each VFD can be commanded to run by the AirSmart Controller. In the display below, "V1 CALC MN" is followed by "V1 CALC MX", "V2 CALC MN" and "V2 CALC MX" depending on which drive is being observed and is present in the system.



- **Note: These parameters are only available in variable speed compressor packages.**

2. Target Temperature

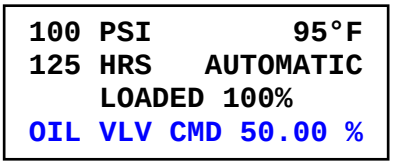
The next item in the Diagnostics menu is the Target Discharge Temperature that is being calculated by the oil flow algorithm. The discharge temperature of the compressor is automatically kept greater than the displayed value to avoid water condensation inside the compressor.



- **Note: This parameter is not available in all compressor packages.**

3. Oil Valve Command

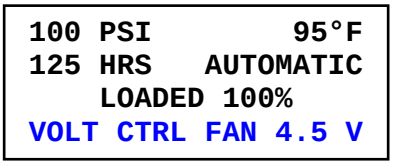
The next item in the Diagnostics menu shows the current position of the Precision Oil Mixing Valve. A value of 50% indicates that equal amounts of oil are flowing through the oil cooler and the oil cooler bypass line. A value is less than 50% indicates that more oil is being routed to the oil cooler while a value greater than 50% indicates that more oil is bypassing the oil cooler.



- **Note: This parameter is not available in all compressor packages.**

4. Fan Control Voltage

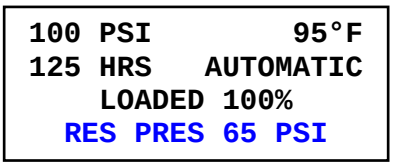
The next item in the Diagnostics menu shows the current value of the Fan Control Voltage for machines with voltage controlled variable speed cooler fans. The voltage value will increase with increasing compressor output power.



- **Note: This parameter is not available in all compressor packages.**

5. Restart Pressure

The next item in the Diagnostics menu shows the current value of the Restart Pressure setting which reflects the maximum pressure allowed in the oil reservoir before the compressor can start or restart.



- **Note: This parameter is not available in all compressor packages.**

5.2 Adjustment Menus

The Adjustment Menus are only available when the compressor is stopped. To enter the Adjustment Menu tree, press the Enter button and then press the Right or Left buttons to access one of four different menus. Once the desired menu heading is shown in the second line of the display, press the Enter button again to access that menu. Use the Up and Down buttons to access the individual items in the selected menu, which are also shown in the second line of the display.

It is not necessary to navigate back to the top of a particular menu in order to enter another menu. Simply press the Stop/Reset button to go back to the heading of the current menu and then use the Right or Left buttons again to find the desired menu heading as described above.

To completely exit from the Adjustment menus, press the Stop/Reset button again. If parameter changes have been made, the following screen will appear.

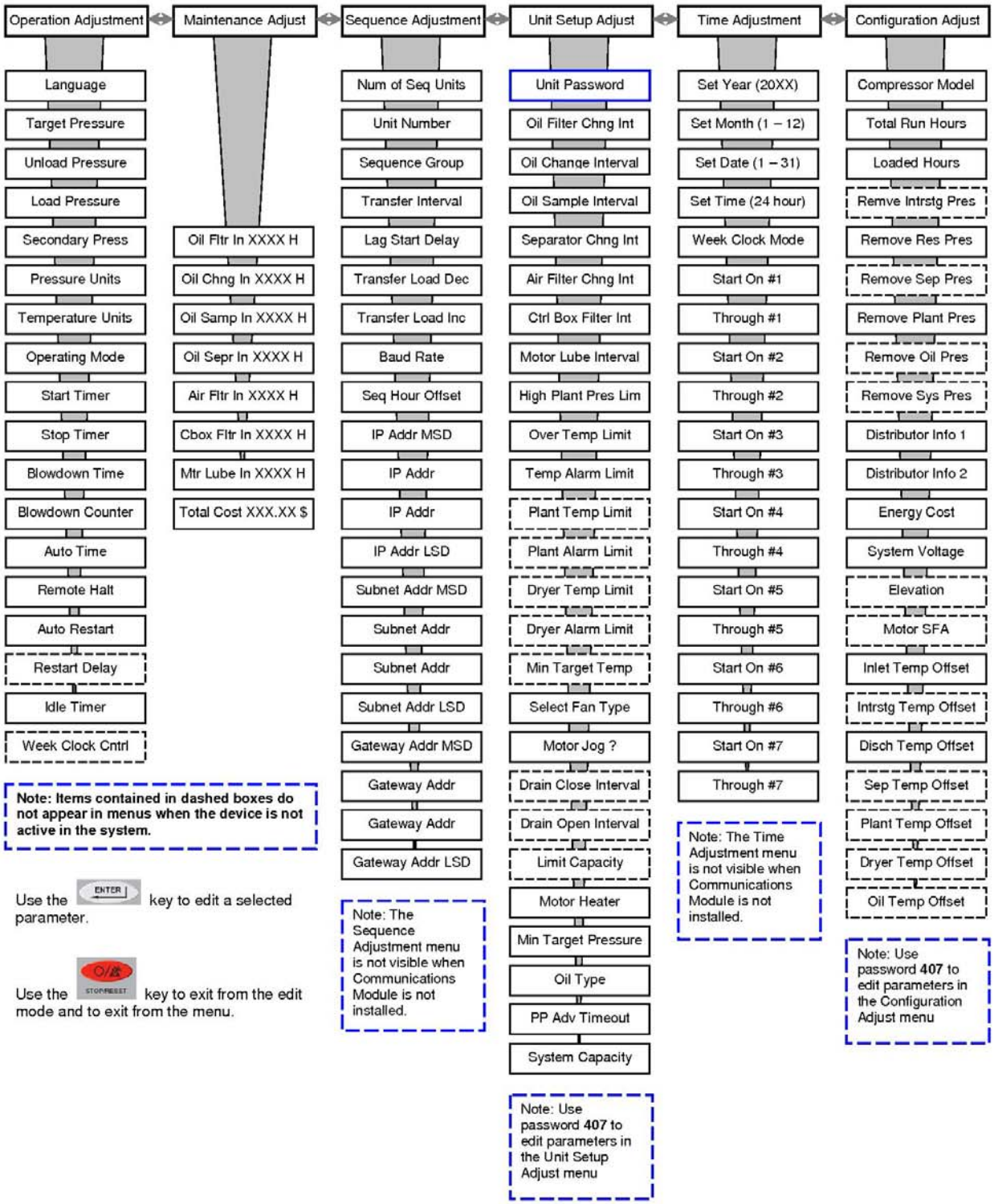
```
STORE MODIFIED
PARAMETERS?
 STOP = NO
ENTER = YES
```

To permanently save the changes that were made, press the Enter button. If the Stop/Reset button is pressed, the parameter changes that have been made are still valid but will be lost the next time the compressor is disconnected from main power.

AirSmart Controller Adjustment Menus (Compressor Application)

Use the ENTER key to enter the Adjustment menus (compressor must be stopped). Use the ◄ ► keys to navigate through the horizontal main menus.

Use the ENTER key again to select the horizontal menu item. Use the ▲ ▼ keys to navigate through the vertical menu items.



Note: Items contained in dashed boxes do not appear in menus when the device is not active in the system.

Use the ENTER key to edit a selected parameter.

Use the O/R STOP/RESET key to exit from the edit mode and to exit from the menu.

Note: The Sequence Adjustment menu is not visible when Communications Module is not installed.

Note: Use password **407** to edit parameters in the Unit Setup Adjust menu

Note: The Time Adjustment menu is not visible when Communications Module is not installed.

Note: Use password **407** to edit parameters in the Configuration Adjust menu

4.2.1 Operation Adjustment Menu

The Operation Adjustment menu provides access to the parameters that control the basic operation of the compressor

```
ADJUSTMENT MENU
OPERATION ADJUSTMENT

(SELECT SUB MENU)
```

1. Language

The first item in the Operation Adjustment menu is language selection. The language selection can also be entered directly by holding down the Stop/Reset button for five seconds when the compressor is stopped. The AirSmart controller can have up to eight different language translations available at one time in the Controller Language Table, which is stored in the controller's memory.

```
OPERATION ADJUSTMENT
LANGUAGE-LANGUAGE
ENGLISH (US)
(SELECT PARAMETER)
```

2. Target Pressure

The next item in the Operation Adjustment menu is the Target Pressure. This value is the pressure set point of the compressor. The Target Pressure parameter is ignored in fixed speed compressors.

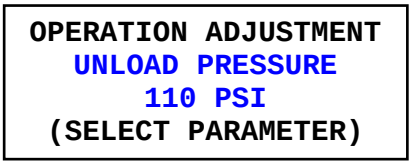
```
OPERATION ADJUSTMENT
TARGET PRESSURE
100 PSI
(SELECT PARAMETER)
```

Min Value: Min Target Pressure in Unit Setup Adjust menu
Max Value: 181 PSI (12.5 bar)
Default Value: 100 PSI (7 bar)

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

3. Unload Pressure

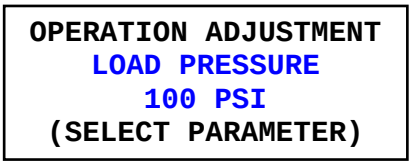
The next item in the Operation Adjustment menu is the Unload Pressure. This pressure value is where the compressor will unload and begin the unload/stop sequence. The Unload Pressure value cannot be set any lower than [Target Pressure + 5 PSI]. If the Target Pressure setting is changed, the Unload Pressure setting will be automatically changed by the same amount as the Target Pressure setting.



Min Value: Target Pressure + 5 PSI (0.3 bar)
Max Value: 185 PSI (12.8 bar)
Default Value: 110 PSI (7.5 bar)

4. Load Pressure

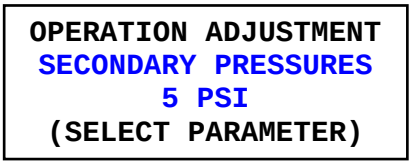
The next item in the Operation Adjustment menu is the Load Pressure. This pressure value is where the compressor will load again after an unload/stop sequence. The Load Pressure value cannot be set any higher than Target Pressure. If the Target Pressure setting is changed, the Load Pressure setting will be automatically changed by the same amount as the Target Pressure setting.



Min Value: 30 PSI (2 bar)
Max Value: Target Pressure
Default Value: 100 PSI (7 bar)

5. Secondary Pressures

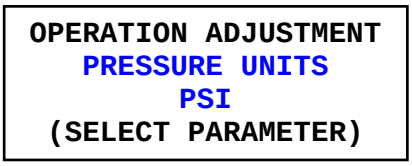
The next item in the Operation Adjustment menu is the Secondary Pressures. This parameter is used to add a positive or negative offset to the Target, Load and Unload Pressure set points when a digital input programmed to the Secondary Pressures function becomes active. The Target, Load and Unload set points are still subject to system limits when the Secondary Pressures feature is used. Secondary Pressures can also be triggered using the timer function of the optional Communications Module when installed.



Min Value: -60 PSI (-4 bar)
Max Value: 30 PSI (2 Bar)
Default Value: 0 PSI

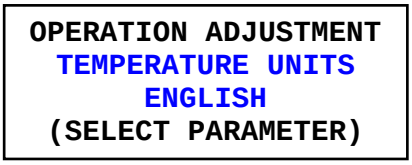
6. Pressure Units

The next item in the Operation Adjustment menu is the Pressure Units, which will determine how all pressure values will be displayed on the control panel. Pressure can be displayed in pounds per square inch (PSI), Bar (BAR), kilopascals (KPA) or kilograms per square centimeter (KGC).



7. Temperature Units

The next item in the Operation Adjustment menu is the Temperature Units, which will determine how all temperature values will be displayed on the control panel. Temperature can be displayed in English/Fahrenheit (°F) or Metric/Celsius (°C).



8. Operating Mode

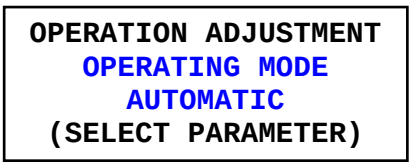
The next item in the Operation Adjustment menu is the operating mode. The controller can be set to one of four operational modes.

AUTOMATIC: (Default mode) the compressor uses its internal modulation algorithms and the motor(s) will stop after it goes through the timed unload/blowdown sequence using the Blowdown and Auto Timers.

SEQUENCE: The compressor is part of a sequenced group of machines. Refer to Gardner Denver document 13-17-604 for further details about sequencing with the AirSmart Controller.

LOW DEMAND: The compressor uses its internal modulation algorithms but motor(s) will NOT stop after it goes through the timed unload/blowdown sequence. The Blowdown Timer is used, however, the Auto Timer is ignored in Low Demand mode.

CONSTANT: The compressor uses its internal modulation algorithms but motor(s) will NOT stop and the compressor will NOT blowdown after it unloads. The Blowdown and Auto Timers are both ignored in Constant mode.



9. Start Timer

The next item in the Operation Adjustment menu is the Start Timer. The Start Timer is used to extend how long the compressor will run in the "Pause" state before it is allowed to start modulating.

```
OPERATION ADJUSTMENT
     START TIMER
      0 SECONDS
  (SELECT PARAMETER)
```

Min Value: 0 seconds
Max Value: 600 seconds
Default Value: 0 seconds (variable speed units), 5 seconds (fixed speed units)

10. Stop Timer

The next item in the Operation Adjustment menu is the Stop Timer. When the Stop/Reset button is pressed or a remote stop is activated, the compressor will blow down and the motor(s) will continue to run until this timer expires.

```
OPERATION ADJUSTMENT
     STOP TIMER
      5 SECONDS
  (SELECT PARAMETER)
```

Min Value: 0 seconds
Max Value: 120 seconds
Default Value: 5 seconds

11. Blowdown Timer

The next item in the Operation Adjustment menu is the Blowdown Timer. The Blowdown Timer is used to control the amount of time the compressor will run unloaded before starting the timed blowdown process. The Blowdown Timer is reset to the programmed value when the compressor is in the Modulation state.

Note: The Blowdown Timer is used primarily in fixed speed compressor operations.

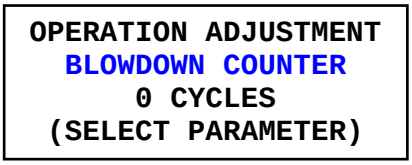
```
OPERATION ADJUSTMENT
    BLOWDOWN TIME
      1 SECONDS
  (SELECT PARAMETER)
```

Min Value: 1 second
Max Value: 1200 seconds
Default Value: 1 second (variable speed units), 600 seconds (fixed speed units)

12. Blowdown Counter

The next item in the Operation Adjust menu is the Blowdown Counter, which is used to control the number of complete unload/blowdown cycles the compressor will execute. When the Blowdown Counter reaches zero, the compressor will skip the Unload State and go directly to the Blowdown State. The Blowdown Counter is reset to the programmed value if the compressor returns to the Modulation State from either the Unload or Blowdown State.

Note: The Blowdown Counter is used primarily in fixed speed compressor operations.

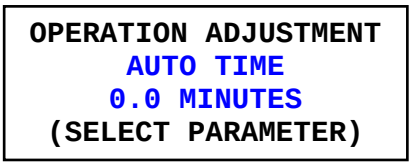


Min Value: 0 cycles
Max Value: 10 cycles
Default Value: 0 cycles (variable speed units), 5 cycles (fixed speed units)

13. Auto Timer

The next item in the Operation Adjustment menu is the Auto Timer. The Auto Timer is used to control the amount of time the compressor will run during the blowdown process. When the Auto Timer expires, the compressor will stop provided the Operation Mode is set to Automatic. The Auto Timer is reset to the programmed value when the compressor is in the Modulation state.

Note: The Auto Timer is used primarily in fixed speed compressor operations.



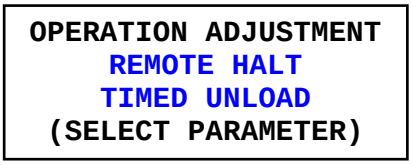
Min Value: 0.0 minutes
Max Value: 20.0 minutes
Default Value: 0.0 minutes (variable speed units), 10.0 minutes (fixed speed units)

14. Remote Halt

The next item in the Operation Adjustment menu is the Remote Halt function, which controls how the compressor will stop if a Remote Halt signal is detected on one of the controller's digital inputs. Refer to the appropriate compressor electrical wiring diagram for connection of an external Remote Halt signal.

Timed Unload: The compressor will stop after the Blowdown and Auto Timers have expired.

Immediate: The compressor will unload and stop immediately just as if the Blowdown and Auto Timers were set to zero.



15. Auto Restart

The next item in the Operation Adjustment menu is the Auto Restart function. If Auto Restart is turned on, the compressor will resume operation in the mode it was in prior to the power interruption when power is restored.

OPERATION ADJUSTMENT
AUTO RESTART
ON
(SELECT PARAMETER)

Default Value: OFF

Automatic restarting of the compressor can cause injury or death

16. Restart Delay

The next item in the Operation Adjustment menu is the Restart Delay Timer, which controls how long the compressor will wait to start after power has been restored.

OPERATION ADJUSTMENT
RESTART DELAY
10 SECONDS
(SELECT PARAMETER)

- **Note: This parameter is only visible if Auto Restart is ON.**

Min Value: 5 seconds
Max Value: 300 seconds
Default Value: 10 seconds

17. Idle Timer

The next item in the Operation Adjustment menu is the Idle Timer, which is used to control the blow down of the ail/oil reservoir during long periods of compressor inactivity. If the Idle Timer is set to zero, this feature is disabled.

```
OPERATION ADJUSTMENT
     IDLE TIMER
    90.0 MINUTES
 (SELECT PARAMETER)
```

Min Value: 0.0 minutes (feature is disabled when set to 0)
Max Value: 120.0 minutes
Default Value: 90.0 minutes (variable speed units), 0.1 minutes (fixed speed units)

18. Week Clock Control

The last item in the Operation Adjustment menu is the Week Clock Control function. When the Week Clock Control is turned on, the compressor can be started and stopped using the seven programmable timers under the Time Adjust menu. This menu item is not displayed if the optional Communications Module is not installed. Consult Gardner Denver document 13-17-604 for more information about timed start/stop or secondary pressures operation.

```
OPERATION ADJUSTMENT
 WEEK CLOCK CONTROL
         ON
 (SELECT PARAMETER)
```

- **Note: This parameter is only available when Communications Module is installed.**

Default Value: OFF

Automatic starting of the compressor can cause injury or death

4.2.2 Maintenance Adjust Menu

The Maintenance Adjust menu provides a means for resetting the maintenance timers after servicing the compressor.

```
ADJUSTMENT MENU
MAINTENANCE ADJUST

(SELECT SUB MENU)
```

1. Maintenance Timers

The six timers under the Maintenance Adjust menu are:

Oil Filter Change Timer
Oil Change Timer
Oil Sample Timer
Oil Separator Element Change Timer
Air Filter Change Timer
Control Box Filter Change Timer (only on variable speed units)
Motor Lubrication Timer (only on variable speed units)

After service has been performed, navigate to the appropriate timer and press the Enter 

button to select timer reset. The default timer intervals can be set in the Unit Setup Adjust menu.

```
MAINTENANCE ADJUST
   OIL CHNG IN
    230 HRS
(SELECT PARAMETER)
```

Pressing the Enter 

button again will reset the timer to the default value. The Stop/Reset 

button will abort the timer reset.

```
MAINTENANCE ADJUST
   OIL CHNG IN
    8000 HRS
(ACCEPT OR REJECT)
```

2. Total Cost

The next item in the Maintenance Adjust menu after the maintenance timers is the total operating cost reset screen. The value is reset to 0 by pressing the Enter 

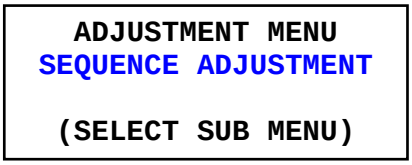
button twice.

```
MAINTENANCE ADJUST
   TOTAL COST
    55.383 $
(SELECT PARAMETER)
```

- **Note: This parameter is not visible in packages without a Variable Frequency Drive (VFD) installed.**

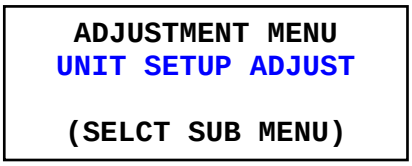
4.2.3 Sequence Adjustment Menu

The Sequence Adjustment menu provides access to the parameters that control the sequencing operation of the compressor. This menu is only visible if the optional AirSmart Communications Module, Gardner Denver P/N 301ETK1173, is installed. Refer to Gardner Denver document 13-17-604 for operation of the compressor in Sequence Mode.



4.2.4 Unit Setup Adjust Menu

The Unit Setup Adjust menu provides access to the parameters that control advanced operation of the compressor. The parameters in the Unit Setup adjust menu can only be changed if the correct value has been entered into the Unit Password menu item.

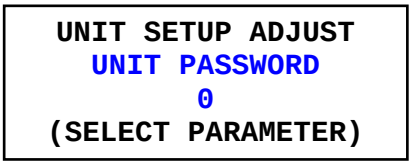


1. Unit Password

The first item in the Unit Setup Adjust menu is the Unit Password. The correct value entered here will allow the items in Unit Setup Adjust menu, the Configuration Adjust menu and the I/O Adjust menu to be changed.

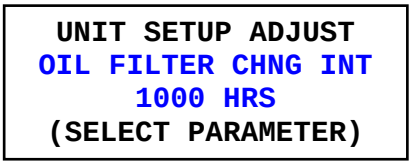
The Following passwords unlock the listed menus for visibility and editing:

407: Unit Setup Adjust menu
407: Configuration Adjust menu
8412: Programmable I/O Adjust menu



2. Oil Filter Change Interval

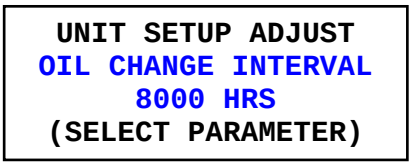
The next item in the Unit Setup Adjust menu is the Oil Filter Change Interval. This value sets the default oil filter change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



Min Value: 100 hours
Max Value: 4000 hours
Default Value: 1000 hours

3. Oil Change Interval

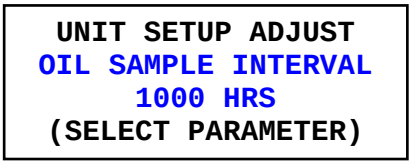
The next item in the Unit Setup Adjust menu is the Oil Change Interval. This value sets the default oil change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



Min Value: 1000 hours
Max Value: 12000 hours
Default Value: 8000 hours

4. Oil Sample Interval

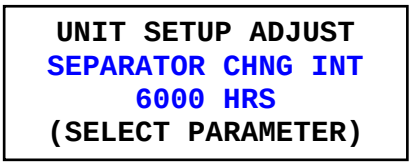
The next item in the Unit Setup Adjust menu is the Oil Sample Interval. This value sets the default oil sample countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



Min Value: 100 hours
Max Value: 4000 hours
Default Value: 1000 hours

5. Separator Element Change Interval

The next item in the Unit Setup Adjust menu is the Separator Element Change Interval. This value sets the default separator change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



Min Value: 1000 hours
Max Value: 9000 hours
Default Value: 6000 hours

6. Air Filter Change Interval

The next item in the Unit Setup Adjust menu is the Air Filter Change Interval. This value sets the default air filter change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.

Min Value: 100 hours
Max Value: 4000 hours
Default Value: 3000 hours

7. Control Box Filter Change Interval

The next item in the Unit Setup Adjust menu is the Control Box Filter Change Interval. This value sets the default control box filter change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.

Min Value: 100 hours
Max Value: 4000 hours
Default Value: 1000 hours (variable speed units), 0 (fixed speed units)

8. Motor Lubrication Interval

The next item in the Unit Setup Adjust menu is the Motor Lubrication Interval. This value sets the default motor lubrication countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.

```
UNIT SETUP ADJUST
MOTOR LUBE INTERVAL
     8000 HRS
(SELECT PARAMETER)
```

Min Value: 500 hours
Max Value: 10000 hours
Default Value: 8000 hours (variable speed units), 0 (fixed speed units)

9. High Plant Pressure Limit

The next item in the Unit Setup Adjust menu is the High Plant Pressure Limit. This value sets the maximum internal pressure limit where the compressor will shut down.

```
UNIT SETUP ADJUST
HIGH PLANT PRES LIM
     190 PSI
(SELECT PARAMETER)
```

Min Value: 70 PSI (4.8 bar)
Max Value: 200 PSI (13.8 bar)
Default Value: 190 PSI (13 bar)

Operation of the compressor with improper High Plant Pressure Limit setting can cause personal injury or damage to equipment. Do not adjust the High Plant Pressure Limit above the level of the pressure relief valve or 200 PSI (13.8 bar).

10. Over Temperature Shutdown Limit

The next item in the Unit Setup Adjust menu is the Over Temperature Shutdown Limit. This value sets the maximum internal temperature limit where the compressor will shut down

```
UNIT SETUP ADJUST
OVER TEMP LIMIT
     240°F
(SELECT PARAMETER)
```

Min Value: 175°F (79°C)
Max Value: 240°F (115°C)
Default Value: 240°F (115°C) for variable speed units, 225°F (107°C) for fixed speed units

Operation of the unit at excessive high temperatures can cause personal injury or damage to equipment. Do no adjust the Over Temperature Shutdown Limit above 240°F (115°C).

11. Temperature Alarm Limit

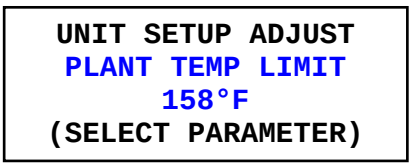
The next item in the Unit Setup Adjust menu is the Temperature Alarm Limit. This value sets the internal temperature limit at which the compressor will give and advisory alarm.

```
UNIT SETUP ADJUST
TEMP ALARM LIMIT
     225°F
(SELECT PARAMETER)
```

Min Value: 175°F (79°C)
Max Value: 240°F (115°C)
Default Value: 225°F (107°C) for variable speed units, 210°F (99°C) for fixed speed units

12. Plant Temperature Shutdown Limit

The next item in the Unit Setup Adjust menu is the Plant Temperature Shutdown Limit. This value sets the maximum package discharge temperature limit where the compressor will shut down. This menu item is not visible if there is no plant temperature sensor installed in the system.

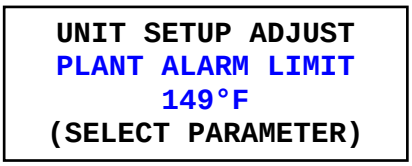


- **Note: This parameter is not visible in all compressor packages.**

Min Value: 122°F (50°C)
Max Value: 176°F (80°C)
Default Value: 158°F (70°C)

13. Plant Temperature Alarm Limit

The next item in the Unit Setup Adjust menu is the Plant Temperature Alarm Limit. This value sets the package discharge temperature limit at which the compressor will give and advisory alarm. This menu item is not visible if there is no plant temperature sensor installed in the system.

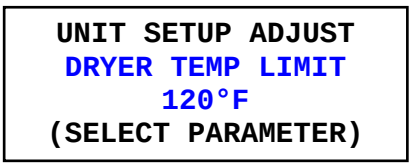


- **Note: This parameter is not visible in all compressor packages.**

Min Value: 104°F (40°C)
Max Value: 176°F (80°C)
Default Value: 149°F (65°C)

14. Dryer Temperature Shutdown Limit

The next item in the Unit Setup Adjust menu is the Dryer Temperature Shutdown Limit. This value sets the maximum dryer temperature limit where the compressor will shut down. This menu item is not visible if there is no integrated dryer installed in the system.



- **Note: This parameter is not visible in packages without an integrated dryer.**

Min Value: 50°F (10°C)
Max Value: 250°F (121°C)
Default Value: 120°F (49°C)

15. Dryer Temperature Alarm Limit

The next item in the Unit Setup Adjust menu is the Dryer Temperature Alarm Limit. This value sets the dryer temperature limit at which the compressor will give and advisory alarm. This menu item is not visible if there is no integrated dryer installed in the system.

```
UNIT SETUP ADJUST
DRYER ALARM LIMIT
     100°F
(SELECT PARAMETER)
```

- **Note: This parameter is not visible in packages without an integrated dryer.**

Min Value: 50°F (10°C)
Max Value: 250°F (121°C)
Default Value: 100°F (38°C)

16. Minimum Target Temperature

The next item in the Unit Setup Adjust menu is the Minimum Target Temperature. This value sets the lower temperature limit of the oil temperature control system on compressor packages with a Precision Mixing Valve installed.

```
UNIT SETUP ADJUST
MIN TARGET TEMP
     158°F
(SELECT PARAMETER)
```

- **Note: This parameter is not visible in packages without a Precision Oil Mixing valve.**

Min Value: 158°F (70°C)
Max Value: 203°F (95°C)
Default Value: 158°F (70°C)

17. Select Fan Type

The next item in the Unit Setup Adjust menu is the Fan Type Selection, which alerts the controller as to which type of fan is being used with the air/oil cooler. Five different fan types are available.

SINGLE SPEED FAN: Air/oil cooler fan uses standard fixed speed motor.
TWO SPEED FAN: Air/oil cooler fan uses a dual winding motor.
VARIABLE SPEED FAN: Air/oil cooler uses a VFD to control fan speed based on the discharge temperature of the compressor.
WATER COOLED: Used if compressor is a water-cooled package.
VS FAN (V1 PWR): Air/oil cooler uses a VFD to control fan speed based on the output power from the main motor VFD.

```
UNIT SETUP ADJUST
SELECT FAN TYPE
SINGLE SPEED FAN
(SELECT PARAMTER)
```

18. Motor Jog

The next item in the Unit Setup Adjust menu is the Motor Jog function, which will cause all of the motors in the compressor package to run for the programmed amount of time as soon as the Enter 

button is pressed. The Motor Jog function is used to check the rotation of the motor(s) after the main power has been connected during installation of the compress package or the power cables between the motor and the VFD are reconnected.

```
UNIT SETUP ADJUST
MOTOR JOG ?
0.0 SECONDS
(SELECT PARAMETER)
```

Min Value: 0.1 seconds
Max Value: 2.0 seconds (variable speed units), 0.5 seconds (fixed speed units)

Do not operate the compressor with the fan or coupling guard removed. Exposed fan and coupling may cause personal injury.

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

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

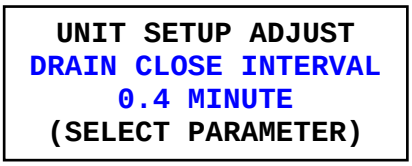
19. Drain Close/Open Intervals

The next two items in the Unit Setup Adjust menu are the Water Drain Close/Open Intervals, which are used to control a solenoid operated drain valve in a water separator unit, integrated dryer unit or oil scavenge system. The Drain Close Interval is variable and dependent upon the speed of the main motor using the following formula: Actual Drain Close Time = Drain Close Interval / (% of Full Speed / 100). For fixed speed compressors, % of full speed will always be 100%. See example calculation below.

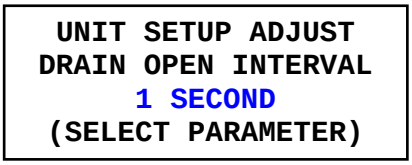
Note: Setting the Drain Open Interval to zero seconds will disable the water drain function.

Example Drain Close Interval Calculation:

Speed of main motor: 80%
Drain Close Interval setting: 0.4 minutes (24 seconds)
Actual Drain Close Time = 24 / (80 / 100) = 30 seconds



Min Value: 0.1 minute
Max Value: 30.0 minutes
Default Value: 0.4 min. (units with integrated dryer), 15.0 min. (units with oil scavenge)

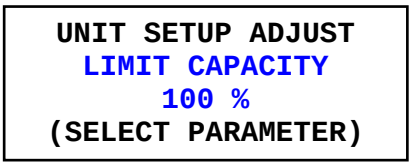


- **Note: These parameters are not visible in packages without a drain valve solenoid installed.**

Min Value: 0 seconds
Max Value: 10 seconds
Default Value: 1 second

20. Limit Capacity

The next item in the Unit Setup Adjust menu is the Capacity Limit value, which controls the maximum speed of a variable speed compressor.



- **Note: This parameter is not visible in packages without a Variable Frequency Drive (VFD) installed.**

Min Value: 50%
Max Value: 100%
Default Value: 100%

21. Motor Heater

The next item in the Unit Setup Adjust menu is the Motor Heater function. The Motor Heater provides a DC signal to warm the motor windings of the main motor(s) for starting in cold environments.

```
UNIT SETUP ADJUST
MOTOR HEATER
OFF
(SELECT PARAMETER)
```

- **Note: This parameter is not visible in packages without a Variable Frequency Drive (VFD) installed.**

Default Value: OFF

22. Minimum Target Pressure

The next item in the Unit Setup Adjust menu is the Minimum Target Pressure setting, which sets the lower limit for the Target Pressure parameter in the Operation Adjustment menu. This parameter should be set equal to or greater than the compressor's minimum pressure valve setting.

```
UNIT SETUP ADJUST
MIN TARGET PRESSURE
80 SI
(SELECT PARAMETER)
```

Min Value: 40 PSI (3 bar)
Max Value: 150 PSI (10 bar)
Default Value: Compressor model dependent

23. Oil Type

The next item in the Unit Setup Adjust menu selects the Oil Type. The Oil Type setting determines how fast the Oil Change Timer will count down as the compressor discharge temperature rises as shown in the table below. The Oil Type selections are as follows.

```
UNIT SETUP ADJUST
OIL TYPE
HIGH TEMP
(SELECT PARAMETER)
```

Default Value: Compressor model dependent

STANDARD: Oil Change Timer counts down normally at high temperature. Use with AEON 9000SP or similar lubricant.

HIGH TEMP: Oil Change Timer counts down more slowly at high temperature. Use with AEON 9000TH or similar lubricant.

FOOD GRADE: Oil Change Timer counts down at same rate as Standard Oil. Use with AEON 6000FG or similar lubricant.

Oil Aging Clock Multiplier	Standard/Food Grade Oil Temperature Break Points	High Temp Oil Temperature Break Points
X 1	< 180°F (82°C)	< 210°F (99°C)
X 1.3	180°F - 189°F (82°C - 87°C)	210°F - 219°F (99°C - 104°C)
X 2	190°F - 198°F (88°C - 92°C)	220°F - 228°F (104°C - 109°C)
X 4	199°F - 216°F (93°C - 102°C)	> 229°F (109°C)
X 8	217°F - 234°F (103°C - 112°C)	
X 16	> 234°F (112°C)	

24. Plant Pressure Advisory Timeout

The next item in the Unit Setup Adjust menu is the Plant Pressure Advisory Timeout setting, which controls the length of time the Plant Pressure value may remain under the Target Pressure setting before generating an advisory fault.

Note: Setting this parameter to zero will disable the Plant Pressure Advisory.

```
UNIT SETUP ADJUST
PP ADV TIMEOUT
3.0 MINUTES
(SELECT PARAMETER)
```

Min Value: 0.0 minutes
Max Value: 30.0 minutes
Default Value: 3.0 minutes

25. System Capacity

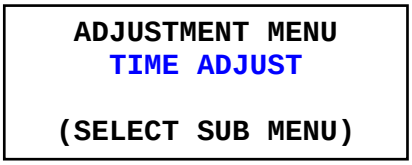
The last item in the Unit Setup Adjust menu is the System Capacity setting. This parameter is used by the lead machine in a sequencing group to determine running speeds and other sequencing related operations. Refer to Gardner Denver document 13-17-604 for operation of the compressor in Sequence Mode.

```
UNIT SETUP ADJUST
SYSTEM CAPACITY
436 CFM
(SELECT PARAMETER)
```

Min Value: 0 CFM
Max Value: 5000 CFM
Default Value: Compressor package dependant.

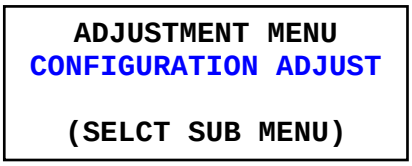
4.2.5 Time Adjustment Menu

The Time Adjustment menu provides access to the parameters that control the real time clock operation of the compressor. This menu is only visible if the optional AirSmart Communications Module, Gardner Denver P/N 301ETK1173, is installed. Refer to Gardner Denver document 13-17-604 for operation of the compressor real time clock functions.



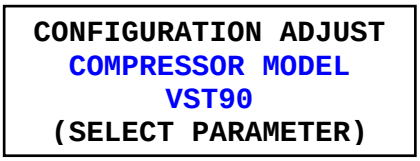
4.2.6 Configuration Adjust Menu

The Configuration Adjust menu also provides access to the parameters that control advanced operation of the compressor. The parameters in the Configuration Adjust menu are not visible unless the correct value has been entered into the Unit Password menu item in the Unit Setup Adjust menu.



1. Compressor Model

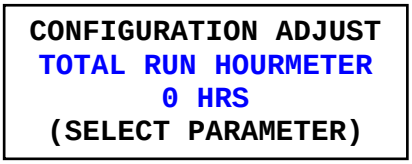
The first item in the Configuration Adjust menu is the Compressor Model selection. Up to 25 different compressor models are available from the Controller Model Table that is stored in the controller's memory. Selecting a compressor model from the Model Table will configure the controller for the chosen machine and reset all of the adjustable parameters to their factory default value.



Selection of a Model Type different from the installed unit could cause personal injury or damage to equipment.

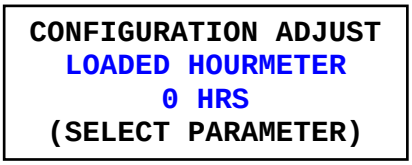
2. Total Run Hour Meter

The next item in the Configuration Adjust menu is the Total Run Hour Meter, which records the number of hours that the compressor main motor has been running. The value of this hour meter is shown in line 2 of the normal display and in the Maintenance Info menu. This parameter can not be changed and will not appear in the menu tree unless the current value is zero. On a replacement controller, this value must be preset with the value from the replaced controller before the unit is started.



3. Loaded Hour Meter

The next item in the Configuration Adjust menu is the Loaded Hour Meter, which records the number of hours that the compressor has been loaded. The value of this hour meter is shown in the Maintenance Info menu. This parameter can not be changed and will not appear in the menu tree unless the current value is zero. On a replacement controller, this value must be preset with the value from the replaced controller before the unit is started.



4. Pressure Transducer Zero Set

The next items in the Configuration Adjust menu are used for setting the zero point of the pressure transducers in the compressor. The following is a list of possible pressure transducers. Not all compressor models will have all six transducers.

1. Interstage pressure transducer
2. Reservoir pressure transducer
3. Oil separator pressure transducer
4. Plant pressure (package discharge) transducer
5. Oil pressure transducer
6. System pressure transducer

After all pressure has been removed from the system and the line to the transducer has been removed, navigate to the appropriate transducer and press the Enter 

button to select the zero pressure point. With zero pressure, the display should read 0.50 Volts +/- 0.05 Volts.

```
CONFIGURATION ADJUST
  REMOVE RES PRES
     0.51 VOLT
(SELECT PARAMETER)
```

Pressing the Enter 

button again will accept the displayed voltage as the zero pressure value. The Stop/Reset 

button will abort the set point process.

```
CONFIGURATION ADJUST
  REMOVE RES PRES
     0.51 VOLT
(ACCEPT OR REJECT)
```

5. Distributor Information #1

The next item in the Configuration Adjust menu after the Pressure Transducer Zero Set is the first Distributor Information screen. This parameter is used to set up a contact name, which appears in the display when a service item such as an air filter or oil change is needed.

```
CONFIGURATION ADJUST
 DISTRIBUTOR INFO 1
   GARDNER DENVER
 (SELECT PARAMETER)
```

6. Distributor Information #2

The next item in the Configuration Adjust is the second Distributor Information screen. This parameter is used to set up a contact number, which appears in the display when a service item such as an air filter or oil change is needed.

```
CONFIGURATION ADJUST
 DISTRIBUTOR INFO 2
   (217) 222-5400
 (SELECT PARAMETER)
```

7. Energy Cost

The next item in the Configuration Adjust is the Energy Cost value. This parameter should be set equal to the cost of each kWH that appears in the power bill and is used to calculate the Energy Cost and Total Cost values under the Maintenance Info menu.

```
CONFIGURATION ADJUST
     ENERGY COST
     0.060 $/KWH
 (SELECT PARAMETER)
```

- **Note: This parameter is not visible in packages without a Variable Frequency Drive (VFD) installed.**

Min Value: 0.001
Max Value: 65.000

8. System Voltage

The next item in the Configuration Adjust is the System Voltage, which should be set to line voltage value connected to the compressor. This parameter controls the maximum speed limits used in variable speed compressor applications. Failure to set this parameter to the correct value may limit the maximum running speed of the unit.

```
CONFIGURATION ADJUST
   SYSTEM VOLTAGE
       460 V
(SELECT PARAMETER)
```

- **Note: This parameter is not visible in packages without a Variable Frequency Drive (VFD) installed.**

Min Value: 115 Volts
Max Value: 1000 Volts
Default Value: 460 Volts

9. Elevation

The next item in the Configuration Adjust is the elevation setting. This parameter should be set equal to the elevation above sea level at the compressor site. This parameter is used to de-rate the compressor drive system at higher elevations where heat dissipation is less effective. There is no de-rating performed at elevations below 3300 feet (1000 m).

```
CONFIGURATION ADJUST
     ELEVATION
       0 FEET
(SELECT PARAMETER)
```

- **Note: This parameter is not visible in packages without a Variable Frequency Drive (VFD) installed.**

Min Value: 0 feet (0 meters)
Max Value: 30,000 feet (9144 meters)
Default Value: 0 feet (0 meters)

10. Motor SFA

The next item in the Configuration Adjust is the Motor SFA value. This parameter should be set equal to the motor nameplate service factor amps (SFA, if given) or the motor nameplate full load amps (FLA) times the motor service factor (SF). It may be set lower if desired. If current monitoring is not installed, set this parameter to zero to disable current monitoring.

Note: The Motor SFA is used primarily in fixed speed compressor operations.

```
CONFIGURATION ADJUST
     MOTOR SFA
     74.7 AMPS
(SELECT PARAMETER)
```

- **Note: This parameter is not visible in packages without a current transducer installed.**

Min Value: 0.0 Amps
Max Value: 1500.0 Amps
Default Value: Compressor package dependant.

11. Temperature Transducer Offsets

The next items in the Configuration Adjust menu are used for adding a fixed offset value to the temperature transducers in the compressor. The following is a list of possible temperature transducers. Not all compressor models will have all seven transducers.

1. Inlet temperature transducer
2. Interstage temperature transducer
3. Discharge temperature transducer
4. Separator temperature transducer
5. Plant temperature transducer
6. Dryer temperature transducer
7. Oil temperature transducer

Navigate to the appropriate temperature transducer offset and press the Enter 

button to select and edit the temperature offset value.

```
CONFIGURATION ADJUST
  INLET TEMP OFFSET
        0 °F
 (SELECT PARAMETER)
```

Min Value: -9 °
Max Value: 9 °

6 Error Management

The AirSmart Controller, developed by Gardner Denver, represents the most current development in air compressor control systems. The AirSmart Controller has the ability to control up to three variable speed motor drives, read more than ten analog inputs (with expansion board) and control a host of digital I/O in order to achieve system objectives. To that end, there are numerous tests that are performed every second by the AirSmart Controller in order to determine the state of the compressor system. Many of those tests are designed to check if certain parameters have been exceeded so that action can be taken to protect the machine.

6.1 VS Limiters

When the AirSmart Controller is installed in a variable speed compressor, there are five limiting functions which will reduce the maximum speed of the compressor by up to ten percent in order to prevent a nuisance shutdown during extreme environmental conditions.

1. Current Limiter

The first limiter function is the Current Limiter which becomes active if the main motor current becomes greater than the Motor NP Current for more than 30 seconds. When the Current Limiter is active, the display will read as shown below. The Current Limiter may become active when the compressor is running at peak capacity, filling an empty system or the air demand exceeds the compressor capacity. If running at less than maximum capacity, the Current Limiter can indicate a problem with the airend or main motor which is drawing excess current.

```
100 PSI        85°F
125 HRS   AUTOMATIC
  AMPS LIM SET nn%
NO SERVICE ADVISORY
```

2. VFD Heatsink Temperature Limiter

The second limiter function is the VFD Heatsink Temperature Limiter which becomes active if the VFD heatsink temperature becomes greater than the prescribed value for that compressor model. When the VFD Heatsink Temperature Limiter is active, the display will read as shown below. The VFD Heatsink Temperature Limiter may become active when the compressor is running at peak capacity while the ambient temperature is elevated.

```
100 PSI        85°F
125 HRS   AUTOMATIC
DRV TMP LIM SET nn%
NO SERVICE ADVISORY
```

3. Ambient Temperature Limiter

The third limiter function is the Ambient Temperature Limiter which becomes active if the ambient temperature becomes greater than 113 °F (45. °C) When the Ambient Temperature Limiter is active, the display will read as shown below.

```
100 PSI        85°F
125 HRS   AUTOMATIC
  AMB LIM SET nn%
NO SERVICE ADVISORY
```

4. Voltage Limiter

The fourth limiter function is the Voltage Limiter which becomes active if the incoming line voltage drops lower than the line System Voltage setting under the Configuration Adjust menu. When the Voltage Limiter is active, the display will read as shown below.

```
100 PSI        85°F
125 HRS   AUTOMATIC
    VOLT LIM nn%
NO SERVICE ADVISORY
```

5. Manual Limiter

The fifth limiter function is the Manual Limiter which becomes active if the Limit Capacity parameter under the Unit Setup Adjust menu is set lower than 100%. When the Manual Limiter is active, the display will read as shown below.

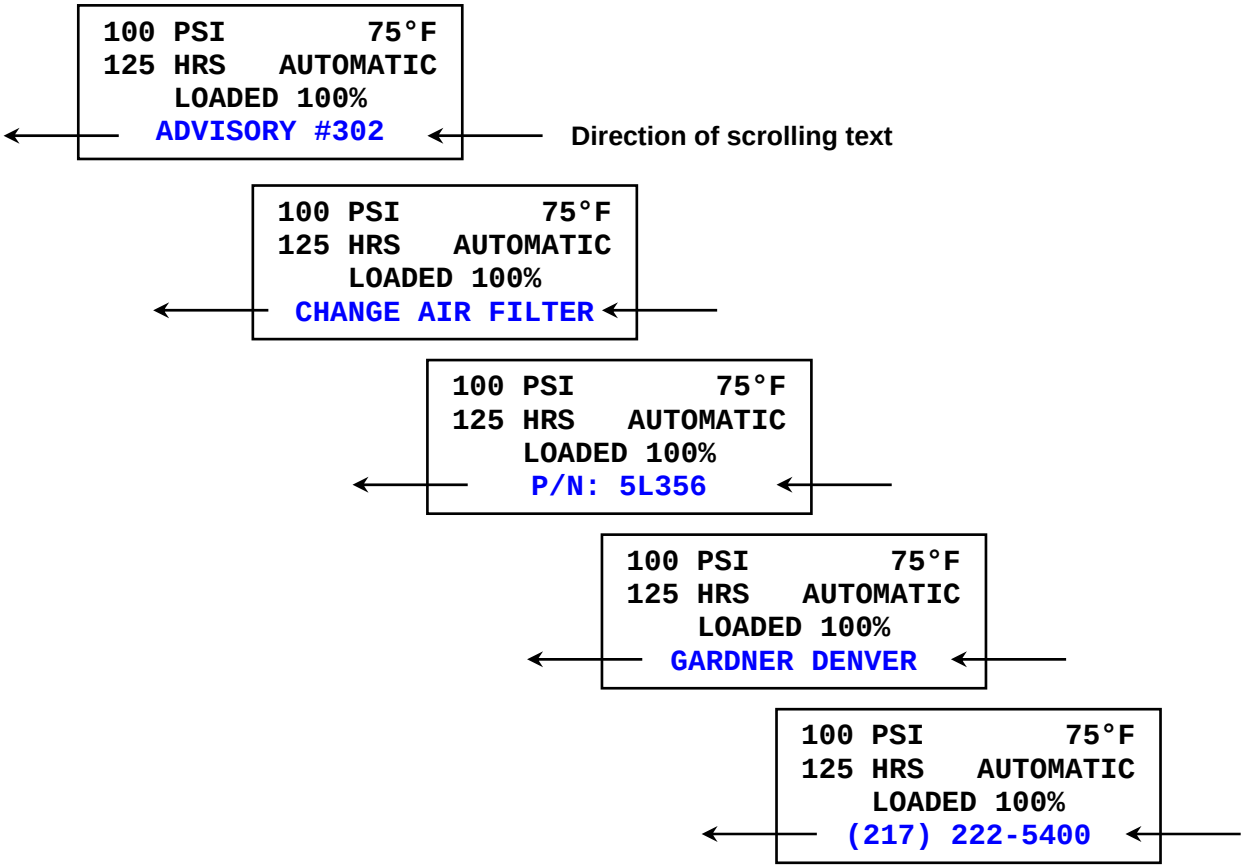
```
100 PSI        85°F
125 HRS   AUTOMATIC
    CAP LIM nn%
NO SERVICE ADVISORY
```

6.2 Advisory Faults

The advisory faults in the AirSmart Controller are designed to alert the user of needed service or that or that certain parameters may be approaching their shutdown level. Advisory faults can be reset while the compressor is running or stopped by pressing the Enter 

button. If the error condition still exists after resetting the advisory fault, the advisory fault will occur again. The status of the compressor at the time of the last six advisories is stored in non-volatile memory, which can be accessed through the Advisory History menu.

Advisory fault information is shown in the fourth line of the control panel display in a scrolling fashion. The advisory number is shown first followed by a short description of the fault. If the advisory indicates that service is necessary, the scrolling information will also include the Gardner Denver part number of the service item and contact information to obtain the service item.



The following table is a list of advisory faults that can occur in the AirSmart Controller:

Advisory	Advisory Text	Description	Action
#301	CHANGE SEPARATOR	Differential pressure > 8 PSIG	Change separator element
#302	CHANGE AIR FILTER	Vacuum switch after inlet air filter has tripped	Change air filter
#303	CHANGE AIR FILTER	Maintenance timer for air filter change has expired	Change air filter and reset timer
#304	CHANGE OIL FILTER	Maintenance timer for oil filter change has expired	Change oil filter and reset timer
#305	CHANGE OIL	Maintenance timer for oil change has expired	Change oil and reset timer
#306	LOW AMB TEMP A	Package discharge (Plant) temperature < 40°F (4°C)	Locate compressor to area where ambient temperature > 32°F (0°C)
#307	LOW AMB TEMP B	Separator temperature < 40°F (4°C)	Locate compressor to area where ambient temperature > 32°F (0°C)
#308	HIGH SEP TEMP	Temperature in separator > 225°F (107°C)	Check oil cooler system functionality or reduce package power
#309	HIGH PLANT TEMP	Temperature at package discharge > 149°F (65°C)	Check air cooler functionality or reduce package power
#310	HIGH INLET TEMP	Temperature at package inlet > 113°F (45°C). On some models, this may trigger at 104°F (40°C)	Wait for ambient temperature to cool
#315	CHANGE SEPARATOR	Maintenance timer for separator element change has expired	Change separator element and reset timer
#316	HIGH DISCH TEMP	Temperature at airend discharge > 225°F (107°C)	Check oil cooler system functionality or reduce package power
#317	HIGH INTERSTG TEMP	Temperature in interstage pipe > 225°F (two-stage package only) (107°C)	Check oil cooler system functionality or reduce package power
#318	OPTIONAL ALARM	Digital input programmed for Optional Alarm has tripped	Check device connected to input

Advisory	Advisory Text	Description	Action
#320	CHANGE OIL FILTER	Pressure switch in oil filter assembly has tripped	Change oil filter
#321	LOW VOLTAGE	Digital input programmed for Low Voltage has tripped	Check line voltage
#322	MOTOR OVERTEMP	Digital input programmed for Motor Over Temperature has tripped	Check main motor(s) temperature or reduce package power
#323	WATER PRESSURE	Digital input programmed for Water Pressure has tripped	Check water pressure
#324	HIGH VIBRATION	Digital input programmed for High Vibration has tripped	Check for source of vibration
#325	LOW DISCH TEMP	Temperature at airend discharge < 185°F (85°C) (two-stage package only)	Check oil cooler system functionality
#326	HIGH DRYER TEMP	Temperature at dryer > 100°F (38°C)	Integrated dryer may have shut down, check dryer functionality
#327	CHANGE MOTOR LUBE	Motor lubrication interval timer has expired	Lubricate motor(s) and reset timer
#328	PLANT PRESSURE	Compressor is unable to maintain target pressure setting	Reduce demand on compressor
#329	LOW OIL PRESSURE	Oil pressure has dropped below (Interstage Pressure + 5 PSI) in two-stage compressor	Change oil filter or check for oil system leaks or plugs
#330	V1 MAX SINK TEMP	Main motor drive heat sink temperature > 175°F (79°C)	Check if control box air has become clogged or ambient temperature too high
#331	V2 MAX SINK TEMP	Second stage motor drive heat sink temperature > 175°F (79°C)	Check if control box air has become clogged or ambient temperature too high
#332	CHNG CTRL BOX FILTER	Control box filter change interval timer has expired	Change or clean control box air filter element
#333	DRYER ALARM	Integrated dryer has shut down	Check dryer functionality
#334	TAKE OIL SAMPLE	The maintenance timer for taking an oil sample has expired	Take an oil sample and reset the timer

6.3 Shutdown Faults

The shutdown faults in the AirSmart Controller are designed to protect the compressor from component failure or extreme environmental conditions. Shutdown faults can be reset after the compressor has stopped by pressing the Stop/Reset  button. If the error condition still exists as indicated by a blinking Shutdown LED on the control panel, the shutdown fault can not be reset. The status of the compressor at the time of the last six shutdowns is stored in non-volatile memory, which can be accessed through the Shutdown History menu.

Shutdown fault information is shown in the second and third lines of the control panel display. The shutdown number is shown in the second line followed by a short description of the fault in the third line.

```
0 PSI          75°F
   SHUTDOWN # 128
  HIGH DISCH TEMP
NO SERVICE ADVISORY
```

The following table is a list of shutdown faults that can occur in the AirSmart Controller:

Shutdown	Shutdown Text	Description	Action
#101	FAN FAULT	Cooler or vent fan over temp fault	Check fan motor and associated fuses and wiring
#102	DRIVE 1 FAULT	Main motor VFD has shut down	Check main motor VFD operation
#103	DRIVE 2 FAULT	Main motor VFD #2 has shut down (two-stage package only)	Check main motor VFD #2 operation
#104	DRIVE 3 FAULT	Cooler fan motor VFD has shut down (when equipped)	Check cooler fan motor VFD operation
#105	EMERGENCY STOP	Compressor stopped using Emergency Stop button	Pull out Emergency Stop button to its normal position
#106	OPEN XDUCER XD5	Connection to pressure transducer PT5 is open	Check wiring between pressure transducer PT5 and controller
#107	HIGH PLANT PRES	Pressure at package discharge > 190 PSIG (13 bar)	Check for sources of high system pressure
#108	SHORTED XDUCER XD5	Connection to pressure transducer PT5 is shorted	Check wiring between pressure transducer PT5 and controller
#109	OPEN XDUCER XD4	Connection to pressure transducer PT4 is open	Check wiring between pressure transducer PT4 and controller
#110	HIGH SEP PRES	Pressure in separator tank > 190 PSIG (13 bar)	Check for sources of high system pressure
#111	SHORTED XDUCER XD4	Connection to pressure transducer PT4 is shorted	Check wiring between pressure transducer PT4 and controller
#112	OPEN XDUCER XD3	Connection to pressure transducer PT3 is open	Check wiring between pressure transducer PT3 and controller
#113	HIGH RESVR PRES	Pressure at airend discharge > 190 PSIG (13 bar)	Check for sources of high system pressure
#114	SHORTED XDUCER XD3	Connection to pressure transducer PT3 is shorted	Check wiring between pressure transducer PT3 and controller
#115	OPEN XDUCER XD2	Connection to pressure transducer PT2 is open	Check wiring between pressure transducer PT2 and controller

Shutdown	Shutdown Text	Description	Action
#116	HIGH INT PRES	Pressure in interstage pipe > 190 PSIG (13 bar)	Check for sources of high system pressure
#117	SHORTED XDUCER XD2	Connection to pressure transducer PT2 is shorted	Check wiring between pressure transducer PT2 and controller
#118	OPEN XDUCER XD1	Connection to pressure transducer PT1 is open	Check wiring between pressure transducer PT1 and controller
#120	SHORTED XDUCER XD1	Connection to pressure transducer PT1 is shorted	Check wiring between pressure transducer PT1 and controller
#121	OPEN THERM T5	Connection to thermistor TT5 is open	Check wiring between thermistor TT5 and controller
#122	HIGH PKG DISCH TMP	Temperature at package discharge > 158°F (70°C)	Check air cooler functionality or reduce package power
#123	SHORTED THERM T5	Connection to thermistor TT5 is shorted	Check wiring between thermistor TT5 and controller
#124	OPEN THERM T4	Connection to thermistor TT4 is open	Check wiring between thermistor TT4 and controller
#125	HIGH SEP TEMP	Temperature in separator > 240°F (116°C)	Check oil cooler system functionality or reduce package power
#126	SHORTED THERM T4	Connection to thermistor TT4 is shorted	Check wiring between thermistor TT4 and controller
#127	OPEN THERM T3	Connection to thermistor TT3 is open	Check wiring between thermistor TT3 and controller
#128	HIGH DISCH TEMP	Temperature at airend discharge > 240°F (116°C)	Check oil cooler system functionality or reduce package power
#129	SHORTED THERM T3	Connection to thermistor TT3 is shorted	Check wiring between thermistor TT3 and controller
#130	OPEN THERM T2	Connection to thermistor TT2 is open	Check wiring between thermistor TT2 and controller
#131	HIGH INTERSTG TMP	Temperature in interstage pipe > 240°F (116°C) (two-stage package only)	Check oil cooler system functionality or reduce package power

Shutdown	Shutdown Text	Description	Action
#132	SHORTED THERM T2	Connection to thermistor TT2 is shorted	Check wiring between thermistor TT2 and controller
#133	OPEN THERM T1	Connection to thermistor TT1 is open	Check wiring between thermistor TT1 and controller
#134	HIGH INLET TEMP	Temperature at package inlet > 113°F (45°C)	Ambient temperature too high for safe compressor operation
#135	SHORTED THERM T1	Connection to thermistor TT1 is shorted	Check wiring between thermistor TT1 and controller
#136	HIGH SEPRATR RATE	Rapid temperature rise in air/oil separator tank detected	Check separator element or oil cooler system functionality
#137	HIGH DISCH RATE	Rapid temperature rise at airend discharge detected	Check airend oil injection or oil cooler system functionality
#138	FAN STARTER	Fan Aux input does not match Cooler Start digital output	Check fan contactor operation
#139	DRIVE 1 STARTER	Main motor VFD start failure	Check main motor VFD operation
#140	DRIVE 2 STARTER	Main motor VFD #2 start failure (two-stage package only)	Check main motor VFD #2 operation
#141	DRIVE 3 STARTER	Cooler fan motor VDF start failure	Check cooler fan motor VFD operation
#142	POWER FAILURE	Loss of power to compressor package	Check line voltage
#143	XB1 COMM ERROR	Controller internal communications failure	Replace controller
#144	DRIVE 1 COMM ERROR	Communications failure between controller and main motor VFD #1	Check wiring or communications parameters in main motor VFD
#145	DRIVE 2 COMM ERROR	Communications failure between controller and main motor VFD #2 (two-stage package only)	Check wiring or communications parameters in main motor VFD #2
#146	DRIVE 3 COMM ERROR	Communications failure between controller and cooler fan motor VFD (when equipped)	Check wiring or communications parameters in cooler fan motor VFD

Shutdown	Shutdown Text	Description	Action
#147	OPTIONAL SHUTDOWN	Digital input programmed for Optional Shutdown has tripped	Check device connected to input
#148	LOW VOLTAGE	Digital input programmed for Low Voltage has tripped	Check voltage relay
#149	PHASE SEQUENCE	Digital input programmed for Phase Sequence has tripped	Check phase relay
#150	MOTOR OVERTEMP	Digital input programmed for Motor Over Temperature has tripped	Check main motor(s), motor overload relay or reduce package power
#151	WATER PRESSURE	Digital input programmed for Water Pressure has tripped	Check water pressure
#152	HIGH VIBRATION	Digital input programmed for High Vibration has tripped	Check for source of vibration
#153	ZERO XDUCER XD5	Pressure transducer PT5 not properly zeroed or vacuum present in system	Zero pressure transducer PT5 or remove vacuum
#154	ZERO XDUCER XD4	Pressure transducer PT4 not properly zeroed or vacuum present in system	Zero pressure transducer PT4 or remove vacuum
#155	ZERO XDUCER XD3	Pressure transducer PT3 not properly zeroed or vacuum present in system	Zero pressure transducer PT3 or remove vacuum
#156	ZERO XDUCER XD2	Pressure transducer PT2 not properly zeroed or vacuum present in system	Zero pressure transducer PT2 or remove vacuum
#157	ZERO XDUCER XD1	Pressure transducer PT1 not properly zeroed or vacuum present in system	Zero pressure transducer PT1 or remove vacuum
#160	CONTROLLER ERROR	Controller internal failure	Replace controller
#161	EEPROM RESTORED	Main parameter set in non-volatile memory restored with backup set	No action required

Shutdown	Shutdown Text	Description	Action
#164	INVALID MODEL	Valid compressor model not selected during factory setup or controller replacement	Select valid compressor model Configuration Adjust menu
#165	DC POWER LOW	24 VDC input to controller < 18.5 VDC +/- 1.5 VDC	Check 24 VDC power supply
#166	HIGH DRYER TEMP	Temperature at dryer > 120°F (49°C)	Integrated dryer may have shut down. Check dryer functionality
#167	OPEN THERM T6	Connection to thermistor TT6 is open	Check wiring between thermistor TT6 and controller
#168	SHORTED THERM T6	Connection to thermistor TT6 is shorted	Check wiring between thermistor TT6 and controller
#169	CM TABLE INVALID	Model Table in memory has been corrupted	Load new Model Table values
#170	ACTUATOR COMM ERROR	Communications failure between controller and precision mixing valve	Check wiring or mixing valve operation
#171	LOW OIL PRESSURE	Oil pressure has dropped below (Interstage Pressure + 2.5 PSI) in two-stage compressor	Change oil filter or check for oil system leaks or plugs.
#172	SEQUENCER COMM ERR	Communications failure between controller and communications module	Remove and reconnect or replace communications module
#173	OPEN XDUCER XD6	Connection to pressure transducer PT6 is shorted	Check wiring between pressure transducer PT6 and communications module
#174	SHORTED XDUCER XD6	Connection to pressure transducer PT6 is open	Check wiring between pressure transducer PT6 and communications module
#175	ZERO XDUCER XD6	Pressure transducer PT6 not properly zeroed or vacuum present in system	Zero pressure transducer PT6 or remove vacuum

Shutdown	Shutdown Text	Description	Action
#176	OPEN XDUCER XD7	Connection to pressure transducer PT7 is shorted	Check wiring between pressure transducer PT7 and communications module
#177	SHORTED XDUCER XD7	Connection to pressure transducer PT7 is open	Check wiring between pressure transducer PT7 and communications module
#178	ZERO XDUCER XD7	Pressure transducer PT7 not properly zeroed or vacuum present in system	Zero pressure transducer PT7 or remove vacuum
#179	MAIN STARTER	Motor Aux digital input does not match Main Contactor digital output	Check main motor contactor operation
#201	LOW SUMP PRES	Pressure in reservoir < 15 PSIG (1 bar) after one minute of compressor operation	Check inlet valve or minimum pressure valve operation
#202	CHANGE SEPARATOR	Differential pressure over separator element > 15 PSIG (1 bar)	Change separator element

6.4 Transducer Locations

Gardner Denver compressors are equipped with a number of temperature and pressure transducers to monitor status and control the machine. The following table is a list of the various locations where these transducers are typically used depending on the AirSmart Controller installed in the unit.

Transducer Reference	AirSmart Controller P/N: 89864799	AirSmart Controller with Expansion Board P/N: 300ETK1173	AirSmart Controller Communications Module P/N: 301ETK1173
TT1	Inlet Temperature	Inlet Temperature	
TT2	Airend Discharge Temperature	Interstage Temperature (two-stage only)	
TT3		Airend Discharge Temperature	
TT4		Separator Temperature (dry side)	
TT5		Package Discharge (Plant) Temperature	
TT6	Dryer Temperature (connected to VFD analog input)		
PT1	Reservoir Pressure	Oil Pressure	
PT2	Package Discharge (Plant) Pressure	Interstage Pressure (two-stage only)	
PT3		Reservoir Pressure (wet side)	
PT4		Separator Pressure (dry side)	
PT5		Package Discharge (Plant) Pressure	
PT6			System Pressure (sequencing)
PT7			Package Discharge (Plant) Pressure

7 Auxiliary Inputs and Outputs

As mentioned earlier in this manual, the AirSmart Controller has the ability to control up to three variable speed motor drives, read more than ten analog inputs and a control a host of digital I/O in order to achieve system objectives. The digital and analog I/O connect to the AirSmart Controller through a highly flexible mapping system which enables each input and output to perform a wide variety of functions. The following sections describe how to choose and configure the AirSmart's I/O for the correct task.

Changing of inputs and outputs which have already been configured at the factory can cause personal injury or damage to equipment.

7.1 Operating Device Addresses

There are four defined function sets, one each for digital inputs, digital outputs, analog inputs and analog outputs. Each function in each set has an address, which directs the corresponding function to the desired input or output. The functions and addresses are located in "PROG I/O ADJUST" menu, which becomes visible when **8412** is entered as the password parameter under the "UNIT SETUP ADJUST" menu.

The controller can map input and output functions to unique input and output ports. System inputs and outputs are addressed numerically. Each operating device in the system has a unique number as shown in the following table.

Operating Device	Unit Number
AirSmart Controller Core Board	1
AirSmart Controller Expansion Board	2
Drive 1	3
Drive 2	4
Drive 3	5
Modbus Registers	6
AirSmart Communications Module	7

A unit's base address is formed by multiplying the unit number by sixteen (16). A corresponding unit port address is formed by adding the device's port number to the unit base address. For example, the address for the AirSmart Controller's Expansion Board digital input #2 would be 2 × 16 + 2 = 34. Same addressing principal applies with all inputs and outputs, digital or analog.

7.2 Digital Input/Output Functions

The following tables are a list of the various digital input and output functions that are avaialble in the AirSmart Controller. A digital input or output fuction is active only when a valid address is assigned to that function. Any function is disabled when the address is set to zero.

Note: Functions listed in **BOLD** print may be pre-programmed at the factory. **DO NOT** change the address of these I/O functions or the compressor will not function correctly.

Digital Input Function	Description
Fan Fault	Input used to signal a fan motor over temperature fault.
Fan Auxiliary	Used to signal the failure of the fan motor starter.
Remote Halt	Used to remote start/stop compressor.
Remote Halt Enable	Used to enable/disable Remote Halt input.
Advisory Alarm	Used to trigger a generic advisory alarm.
Shutdown Fault	Used to trigger a generic shutdown fault.
Air Filter	Used to signal a dirty air filter.
Oil Filter	Used to signal a dirty oil filter.
Low Voltage Relay Alarm	Used to signal low line voltage detected by external device.
Low Voltage Relay Shutdown	
Phase Sequence	Used to signal incorrect connection of three phase power input detected by external device.
Motor Overtemp Alarm	Used to signal motor over temperature or motor overload relay trip.
Motor Overtemp Shutdown	
Water Pressure Alarm	Used to signal high water pressure in water cooled systems.
Water Pressure Shutdown	
High Vibration Alarm	Used to signal high vibration detected by external device.
High Vibration Shutdown	
Clock Override	Used to disable clock controlled functions.
Reset Alarm	Used to control remote rest of alarms.
Heavy Consumer Start	Used to control staggered starting of multiple compressors.
Heavy Consumer Load	Used to control staggered loading of multiple compressors.
Remote Load	Used to remotely load the compressor
Remote Load Enable	Used to enable/disable Remote Load input.
Dryer Alarm	Used to signal a dryer alarm
Secondary Pressures	Used to switch control to secondary pressure offset.
Motor Auxiliary	Used to signal the failure of the main motor starter.
Unload	Used to remotely unload the compressor.

Digital Output Function	Description
Advisory Alarm	Used to indicate an active advisory alarm.
Shutdown Fault	Used to indicate an active shutdown alarm.
Inlet Valve	Used to control the inlet valve of the compressor.
Blowdown Valve	Used to control the blowdown valve of the compressor.
Oil Flow A	Used to control the airend coolant oil injection in some compressor models.
Oil Flow B	Used to control the airend coolant oil injection in some compressor models.
Oil Flow C	Used to control the airend coolant oil injection in some compressor models.
Cooler Start	Used to control the cooler fan or water source in some compressor models.
Auto Operation	Used to indicate a compressor is operating in the Automatic Mode.
Run	Used to indicate the compressor's main motor is running.
Delayed Break Run	Used to indicate the compressor's main motor is running but stays active for ten minutes after the motor stops.
Standby	Used to indicate the compressor is waiting to run.
Dryer Start	Used to control an integrated dryer in some compressor models.
Heater Start	Used to control integrated heater in some compressor models.
Water Drain	Used to control a timed water drain or oil scavenge system in some compressor models.
Heavy Consumer	Used to control staggered starting of multiple compressors.
Maintenance Alarm	Used to indicate an active advisory alarm.
Any Alarm	Used to indicate an active advisory or shutdown alarm.
Good To Go	Used to indicate compressor is started or running.
Main Contactor	Used to control the main motor starter in fixed speed compressor models.
Start Contactor	Used to control the start contactor in a Wye-Delta motor starter in fixed speed compressor models.
IVO - Inlet Valve Open	Used to modulate the inlet valve in some compressor models.
IVC - Inlet Valve Close	Used to modulate the inlet valve in some compressor models.
TVO - Turn Valve Open	Used to modulate the turn valve in some compressor models.
TVC - Turn Valve Close	Used to modulate the turn valve in some compressor models.

Digital I/O functions can be programmed to be either active high or active low by using the Plus + and Minus − keys to change the polarity of the input. A positive address value corresponds to an active high function and a negative address value likewise corresponds to an active low function.

7.3 Analog Input/Output Functions

The following tables are a list of the various analog input and output functions that are availble in the AirSmart Controller. An analog input or output fuction is active only when a valid address is assigned to that function. Any function is disabled when the address is set to zero.

Note: Functions listed in **BOLD** print may be pre-programmed at the factory. **DO NOT** change the address of these I/O functions or the compressor will not fuction correctly.

Analog Input Function	Description
Inlet Temperature	Used to indicate the compressor air inlet temperature.
Interstage Temperature	Used to indicate the interstage temperature in two-stage compressor models.
Discharge Temperature	Used to indicate the airend discharge temperature.
Separator Temperature	Used to indicate the dry side separator temperature.
Plant Temperature	Used to indicate the package discharge temperature.
Dryer Temperature	Used to indicate the internal temperature of an integrated dryer in some compressor models.
Oil Temperature	Used to indicate the oil temperature in some compressor models.
Inlet Pressure	Used to indicate the compressor inlet pressure.
Interstage Pressure	Used to indicate the interstage pressure in two-stage compressor models.
Reservoir Pressure	Used to indicate the wet side reservoir pressure.
Separator Pressure	Used to indicate the dry side reservoir pressure.
Plant Pressure	Used to indicate the package discharge pressure. Also used as control pressure reference to AirSmart Controller.
Oil Pressure	Used to indicate the oil pressure in some compressor models.
System Pressure	Used to indicate the control pressure in a sequenced group of compressors.
Current Sensor	Used to indicate the main motor current in some fixed speed compressor models.

Analog Output Function	Description
Oil Valve Command	Used to control the precision mixing valve in some compressor models.
Plant Pressure	Used to indicate the current plant pressure value.
Discharge Temperature	Used to indicate the current discharge temperature value.
Voltage Controlled Fan	Used to control the variable speed cooler fan in some compressor models.

7.4 Example “RUN” Digital Output Signal

The following example shows how to provide a "RUN" output signal on single-stage, variable speed VS20 through VS70 compressor. This procedure can also be used on other machines; however the I/O addresses will need to be changed. Provided the VS machine does not have an integrated dryer, there are two outputs that can be programmed to serve as a “RUN” signal. There is a 24 VDC output on terminal block A10 (ground reference on B6 thru B10) and there is also a N.O relay contact between terminal blocks A14 and B14. Either one of these contact points can be programmed to be active when the compressor is running.

1. Press the Enter ENTER key on the display to access the Adjustment menu tree.
2. Use Right ▶ or Left ◀ keys to navigate to the Unit Setup Adjust menu.
3. Press the Enter ENTER key to enter the Unit Setup Adjust menu.
4. The Unit Password parameter will be the first item in the Unit Setup Adjust menu. Press the Enter ENTER key to change the Password to **8412**.
5. Use the Plus + and Minus − keys the change the value of each digit.
6. Use the Right ▶ or Left ◀ keys to select individual password digits.
7. Press the Enter ENTER key to confirm the password value.
8. Press the Stop/Reset O/⊗ STOP/RESET key to return to the Adjustment menu tree.
9. Press the Right ▶ key twice to navigate to the Prog I/O Adjust menu.
10. Press the Enter ENTER key to access the Prog I/O Adjust menu.
11. To use terminals A14/B14 (N.O. relay contact) for the "RUN" signal, skip to step #19 below.
12. To use terminal A10 for the "RUN" signal, continue with step #13.
13. Press the Down ▼ key to navigate to the "RUN" Digital Output address. The controller display should read as below.

```
PROG I/O ADJUST
RUN
0 DIGTIAL OUT
(SELECT PARAMETER)
```

14. Press the Enter  key to edit the I/O address for the "RUN" signal. Use address **20** for terminal A10.

15. Use the Plus  and Minus  keys the change the value of each digit.

16. Use the Right  or Left  keys to select individual address digits.

17. Press the Enter  key to confirm the address value. The controller display should read as below.

```
PROG I/O ADJUST
      RUN
20 DIGTIAL OUT
(SELECT PARAMETER)
```

18. Skip now to step #28.

19. To use terminals A14/B14 (N.O. relay contact) for the "RUN" signal, continue with step #20 below.

20. Press the Down  key to navigate to the "ANY ALARM" Digital Output address. The controller display should read as below.

```
PROG I/O ADJUST
    ANY ALARM
50 DIGTIAL OUT
(SELECT PARAMETER)
```

21. We must first set this address to **0** in order to disable this function so that the relay output can be re-used for the "RUN" signal.

22. Press the Enter  key to edit the I/O address for the "ANY ALARM" signal.

23. Use the Plus  and Minus  keys the change the value of each digit.

24. Use the Right  or Left  keys to select individual address digits.

25. Press the Enter  key to confirm the address value. The controller display should read as below.

```
PROG I/O ADJUST
    ANY ALARM
0 DIGTIAL OUT
(SELECT PARAMETER)
```

26. Press the Up  key to navigate to the "RUN" Digital Output address.

27. Skip back to step #14 except that you need to use address **50** for the relay output instead of address 20 as stated in step #14.

28. Press the Stop/Reset  key twice. The controller display will read as below.


```
STORE MODIFIED
 PARAMETERS?
  STOP = NO
 ENTER = YES
```

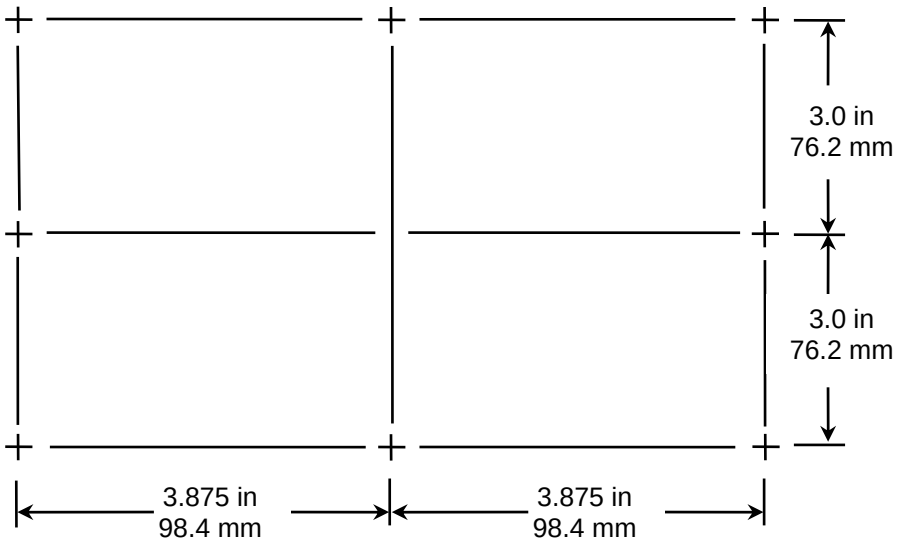
29. Press the Enter  key to permanently save to changed parameters in the controller's memory.

8 Technical Data

8.1 All-In-One AirSmart Controller

Outside dimensions for the All-In-One AirSmart Controller and Display Unit:
9.0 in x 7.5 in x 1.8 in
228.6 mm x 190.5 mm x 45.7 mm

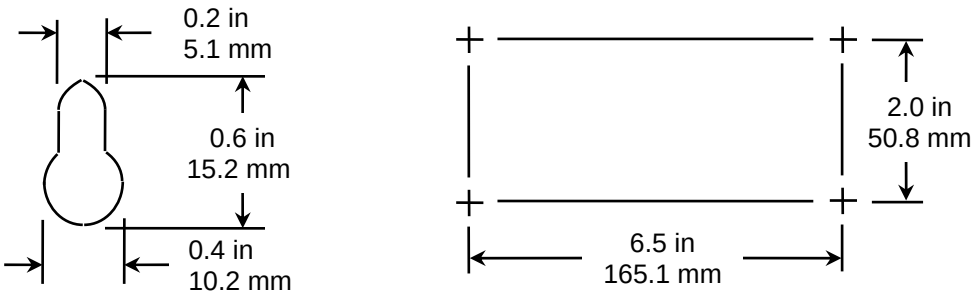
Mounting arrangement for the All-In-One AirSmart Controller and Display Unit:



8.2 Full-Sized AirSmart Controller

Outside dimensions for Full-Sized AirSmart Controller with connectors installed:
7.0 in x 5.1 in x 2.4 in
177.8 mm x 129.5 mm x 61.0 mm

Mounting arrangement for Full-Sized AirSmart Controller:



8.3 Agency Certifications

The AirSmart Controller is UL Recognized in the United States and Canada under File No.E150840

8.4 Environmental Ratings

Operating temperature range: -40°F to 185°F (-40°C to 85°C)
Storage temperature range: -67°F to 300°F (-55°C to 150°C)
Humidity: 0 to 95% non-condensing

8.5 Electrical Ratings

DC power input (P1 on Core board): 24 VDC +/- 10% @ 150 mA.

Digital Inputs (P2 on Core board):
Four 0 to 24 VDC inputs - Low = 0 to 4 VDC / High = 20 - 24 VDC.

Digital Inputs (P10 on Expansion board):
Four 0 to 24 VDC inputs - Low = 0 to 4 VDC / High = 20 to 24 VDC.

Digital Outputs (P3 on Core board):
Four 24 VDC outputs @ 2.6 A continuous.

Digital Outputs (P12 on Expansion board):
Five 24 VDC outputs @ 800 mA continuous.

Form-C relay output (P13 on Expansion board):
One relay contact - Rating: 125 mA @ 250 VAC, 2.0 A @ 30 VDC.

Analog Inputs (P4, P5 on Core Board): Four 0 – 5 VDC inputs.
Two configured for use with 2-wire, 3 kOhm, NTC, 150°C thermistors.
Two configured for use with 250 PSI, 0.5 – 4.5 VDC ratiometric output transducers.

Analog Inputs (P14, P15 on Expansion Board): Six 0 – 5 VDC inputs.
Three configured for use with 2-wire, 3 kOhm, NTC, 150°C thermistors.
Three configured for use with 250 PSI, 0.5 – 4.5 VDC ratiometric output transducers.

Gardner Denver®

For additional information, contact your local representative or visit:
www.contactgd.com/compressors

 Printed in U.S.A.

ENERGY STAR PARTNER

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2008 ANAB DNV

MEMBER OF CAGI Compressed Air & Gas Institute

LEAN PRESSURE COMPRESSED AIR CHALLENGE

Please recycle after use.

13-18-605
Version: 07
September 16, 2008

GARDNER DENVER

ENERGY STAR PARTNER

REFRIGERATED AIR DRYER FOR

COMPRESSOR MODELS

VS11A, VS20A
VS25A, VS30A, VS40A
VS45A, VS50A, VS70A

60HZ

OPERATING AND SERVICE MANUAL

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

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

Your authorized Gardner Denver Compressor distributor offers all the backup you'll need. An AirSmart™ network of authorized distributors provides the finest product support in the air compressor industry.

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

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

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

For the location of your local authorized Gardner Denver Air Compressor distributor, refer to the yellow pages of your phone directory, check the Gardner Denver Web Site at www.gardnerdenver.com or contact:

Gardner Denver
1800 Gardner Expressway
Quincy, IL 62305

Phone: (217) 222-5400

Fax: (217) 224-7814

INSTRUCTIONS FOR ORDERING (DRYER) REPAIR PARTS

When ordering parts for the refrigerated dryer, supply information listed in its identification plate (affixed to the dryer support frame), as well as the compressor package serial number (affixed to the package base frame).

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

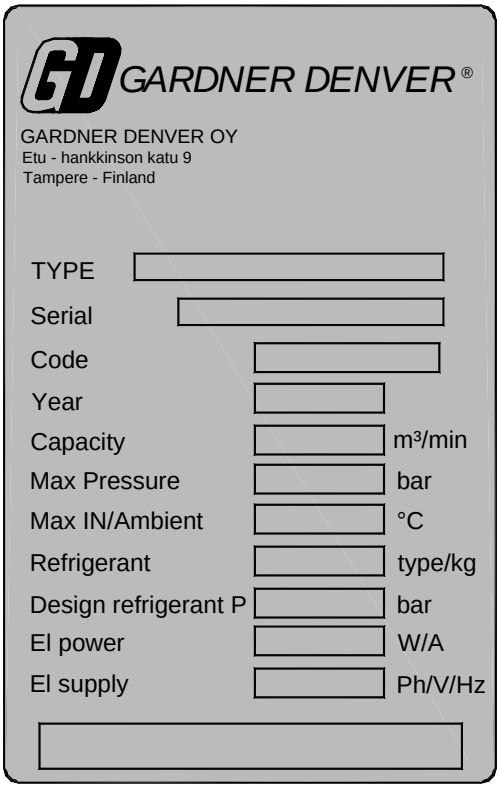
Where NOT specified, quantity of parts required per compressor or unit is one (1); where more than one is required per unit, quantity is indicated in parenthesis. SPECIFY EXACTLY THE NUMBER OF PARTS REQUIRED.

DO NOT ORDER BY SETS OR GROUPS.

TABLE OF CONTENTS

INDEX

LIST OF ILLUSTRATIONS



REFRIGERATED DRYER IDENTIFICATION PLATE

SECTION 1
GENERAL INFORMATION

Gardner Denver Refrigerated Air Dryers 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 of the refrigerated air dryer. Careful adherence to these instructions will result in economical operation and minimum downtime.

For the operation, maintenance and adjustment of the Gardner Denver Rotary Screw compressor package, refer to Table below:

MODEL	VS11	VS20	VS25-40	VS45-70
PARTS LIST	13-18-503	13-18-502	13-18-501	13-18-500
SERVICE MANUAL	13-18-606	13-18-604	13-18-603	13-18-601
CONTROLLER MANUAL	13-17-600	13-17-600	13-18-600	13-18-600

WARNING – PROHIBITION – MANDATORY LABEL INFORMATION

Safety Labels are used, within this manual and affixed to the appropriate areas of the refrigerated dryer module, to alert users of the following conditions:


Read the Operator's Manual Before Proceeding with Task


Indicates a hazard with a high level of risk, which if not avoided, WILL result in death or serious injury


High Voltage – Hazard of Shock, Burn, or Death Present until Electrical Power is Removed


Health Hazard – Explosive Release of Pressure


Burn Hazard – Hot Surface


Asphyxiation Hazard – Poisonous Fumes or Toxic Gases in Compressed Air.


Electrical Shock Hazard – Do NOT extinguish fire with water


Danger hazard – Do NOT operate dryer with guard removed

Maintenance task to be performed by qualified personnel only.

Compressed air inlet connection port.

Compressed air outlet connection port.

Condensate drain connection port.

Operational task to be performed by qualified personnel only

NOTE : Information not involving safety precautions:

The design of this unit has been done with the following environmental concerns:

- Use of CFC free refrigerants
- Use of CFC free insulation parts
- Reduced energy consumption
- Reduced acoustical emission
- Use of recyclable packaging materials

The user is encouraged to follow the ecology-impacting suggestions highlighted with this symbol

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 rotating fan, drive coupling, etc.**
- **Disconnect the refrigerated dryer unit from its power source, lockout and tagout before working on the unit – this machine is automatically controlled and may start at any time.**
- **Electrical shock can and may be fatal.**
- **Perform all wiring in accordance with the National Electrical Code (NFPA-70) and any applicable local electrical codes. Wiring and electrical service must be performed only by qualified personnel only.**
- **The unit employs an environmentally friendly refrigerant (HFC R404A) and must be serviced by qualified personnel only. Refrigerant R404A, in bulk concentrations, may be hazardous to humans. In case of refrigerant leaks noted, evacuate the area and ventilate.**
- **The sole purpose of the dryer is the separation of water and aerosol particles present in the compressed air stream. Do NOT use the compressed air exiting the drier for breathing purposes, or food processing services**

⚠ 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.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **Do not exceed the rated maximum pressure, temperature, voltage, or frequency values shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**
- **Do not operate the dryer module in unventilated areas, in the presence of explosive or flammable substances.**

MODEL		VS11		
Gardner Denver Part Number:		VP1020462		
Flow rate at 95ºF, 100 psig	cfm (m³/min)	No load	65.3 (1.85)	61.1 (1.73)
Dew point	°F (°C)	n.a.	38.8 (3.8)	61 (16)
Ambient temperature	°F (°C)	77(25)	77 (25)	113 (45)
Min/Max. ambient temperature	°F (°C)	34 / 113 (1 / 45)		
Inlet air temperature	°F (°C)		95 (35)	131 (55)
Min/Max inlet air temperature	°F (°C)	34/131 (1/55)		
Inlet air pressure	psig (barg)	100 (7)		
Max. inlet air pressure	psig (barg)	203 (14)		
Max. pressure drop - Δp	psi (bar)	2.6 (0.18)		
Air connections		G 1” BSP		
Type of refrigerant		R134a – HFC		
Refrigerant quantity	lb (kg)	.73 (.33)		
Cooling air flow	cfm (m³/min)	177 (5)		
Standard power supply	(Ph/V/Hz)	1/230-240/60		
Typical electrical energy use	(W) (A)	279 1.99	374 2.06	596 3.08
Weight	lb (kg)	57 (26)		

Figure 1-1 – VS11 DRYER MODULE - SPECIFICATIONS

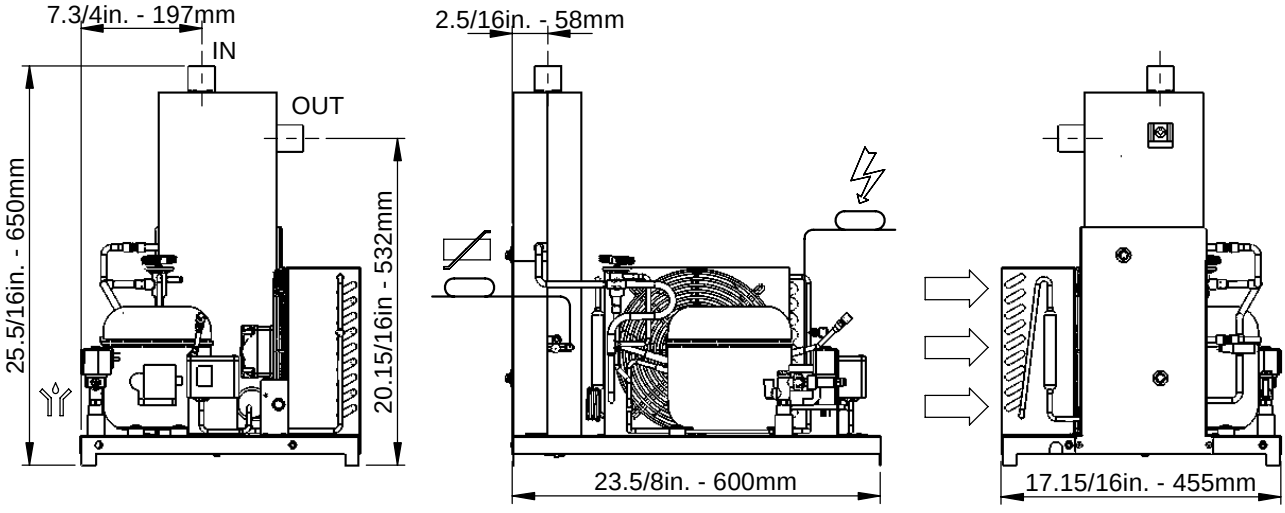


Figure 1-2 – VS11 DRYER MODULE – OVERALL DETAILS

MODEL		VS20		
Gardner Denver Part Number:		300CGB463		
Flow rate at 95ºF, 100 psig	cfm (m³/min)	No load	120 (3.41)	111 (3.13)
Dew point	°F (°C)	35.6 (2.0)	41.9 (5.5)	68 (20)
Ambient temperature	°F (°C)	77(25)	77 (25)	113 (45)
Min/Max. ambient temperature	°F (°C)	34 / 113 (1 / 45)		
Inlet air temperature	°F (°C)		95 (35)	131 (55)
Min/Max inlet air temperature	°F (°C)	34/131 (1/55)		
Inlet air pressure	psig (barg)	100 (7)		
Max. inlet air pressure	psig (barg)	203 (14)		
Max. pressure drop - Δp	psi (bar)	2.6 (0.18)		
Air connections		G 1-1/4" BSP		
Type of refrigerant		R404A – HFC		
Refrigerant quantity	lb (kg)	2.16 (.98)		
Cooling air flow	cfm (m³/m)	353 (10)		
Standard power supply	(Ph/V/Hz)	1/230-240/60		
Typical electrical energy use	(W) (A)	740/1040 3.5/4.6	911 4.2	1210 5.5
Weight	lb (kg)	99 (45)		

Figure 1-3 – VS20 DRYER MODULE – SPECIFICATIONS

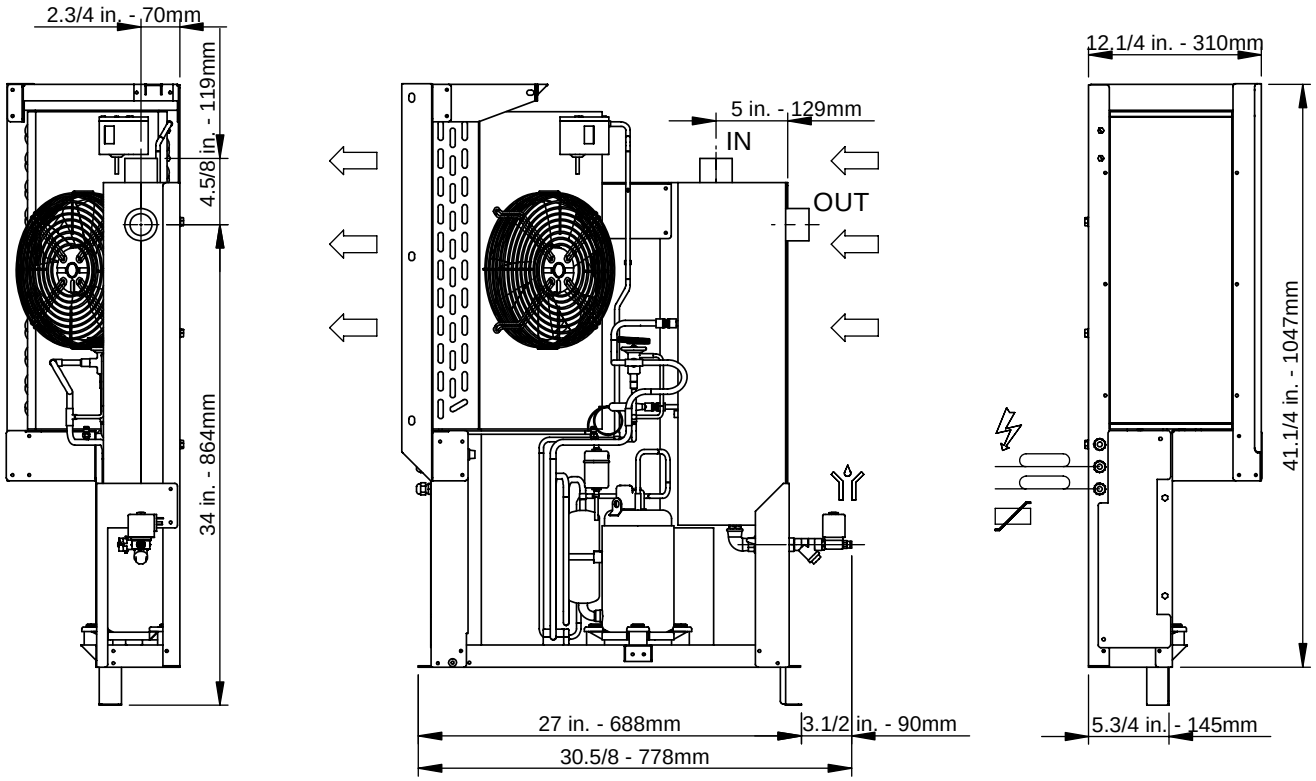


Figure 1-4 – VS20 DRYER MODULE – OVERALL DETAILS

MODEL		VS25, VS30 & VS40		
Gardner Denver Part Number:		300CGC463		
Flow rate at 95ºF, 100 psig	cfm (m³/min)	No load	240 (6.8)	239 (6.3)
Dew point	°F (°C)	37 (2.7)	42 (5.5)	85 (29.5)
Ambient temperature	°F (°C)	77(25)	77 (25)	113 (45)
Min/Max. ambient temperature	°F (°C)	34 / 113 (1 / 45)		
Inlet air temperature	°F (°C)		95 (35)	131 (55)
Min/Max inlet air temperature	°F (°C)	34/131 (1/55)		
Inlet air pressure	psig (barg)	100 (7)		
Max. inlet air pressure	psig (barg)	203 (14)		
Max. pressure drop - Δp	psi (bar)	3.6 (0.246)		
Air connections		G 1-1/2" BSP		
Type of refrigerant		R404A – HFC		
Refrigerant quantity	lb (kg)	2.6 (1.17)		
Cooling air flow	cfm (m³/m)	447 (12.7)		
Standard power supply	(Ph/V/Hz)	1/230-240/60		
Typical electrical energy use	(W) (A)	1280 6.5	1280 5.9	1870 8.4
Weight	lb (kg)	137 (62)		

Figure 1-5 – VS25, VS30 & VS40 DRYER MODULE - SPECIFICATIONS

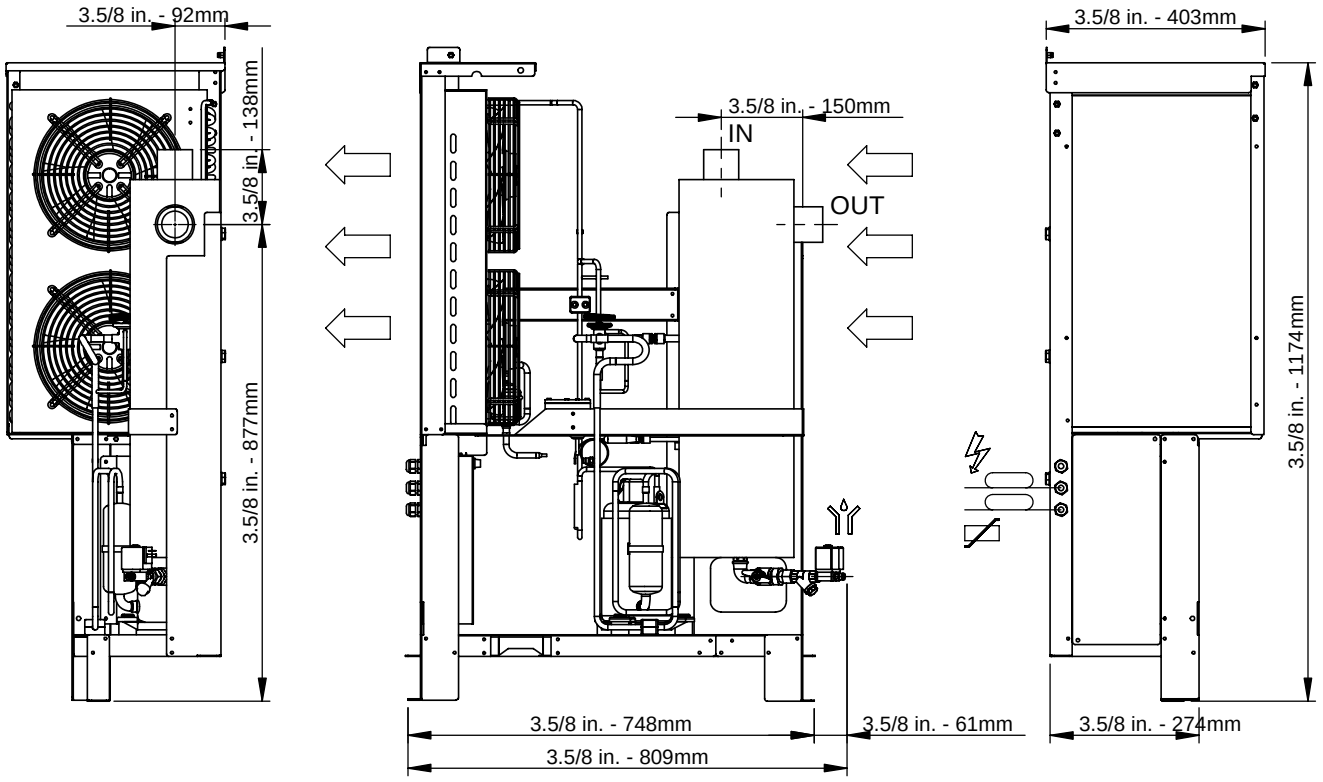


Figure 1-6 – VS25, VS30 & VS40 DRYER MODULE – OVERALL DETAILS

MODEL		VS45, VS50 & VS70		
Gardner Denver Part Number:		300CGD463		
Flow rate at 95ºF, 100 psig	cfm (m³/min)	No load	425 (12.0)	424 (12.0)
Dew point	°F (°C)	37 (2.7)	41.2 (5.1)	88.9 (31.6)
Ambient temperature	°F (°C)	77(25)	77 (25)	113 (45)
Min/Max. ambient temperature	°F (°C)	34 / 113 (1 / 45)		
Inlet air temperature	°F (°C)		95 (35)	131 (55)
Min/Max inlet air temperature	°F (°C)	34/131 (1/55)		
Inlet air pressure	psig (barg)	100 (7)		
Max. inlet air pressure	psig (barg)	203 (14)		
Max. pressure drop - Δp	psi (bar)	1.6 (0.110)		
Air connections		G 2-1/2" BSP		
Type of refrigerant		R404A – HFC		
Refrigerant quantity	lb (kg)	4.74 (2.15)		
Cooling air flow	cfm (m³/m)	2590 (73.3)		
Standard power supply	(Ph/V/Hz)	1/230-240/60		
Typical electrical energy use	(W) (A)	1480/2300 6.7/9.7	1920 8.6	2840 13.1
Weight	lb (kg)	342 (155)		

Figure 1-7 – VS45, VS50 & VS70 DRYER MODULE - SPECIFICATIONS

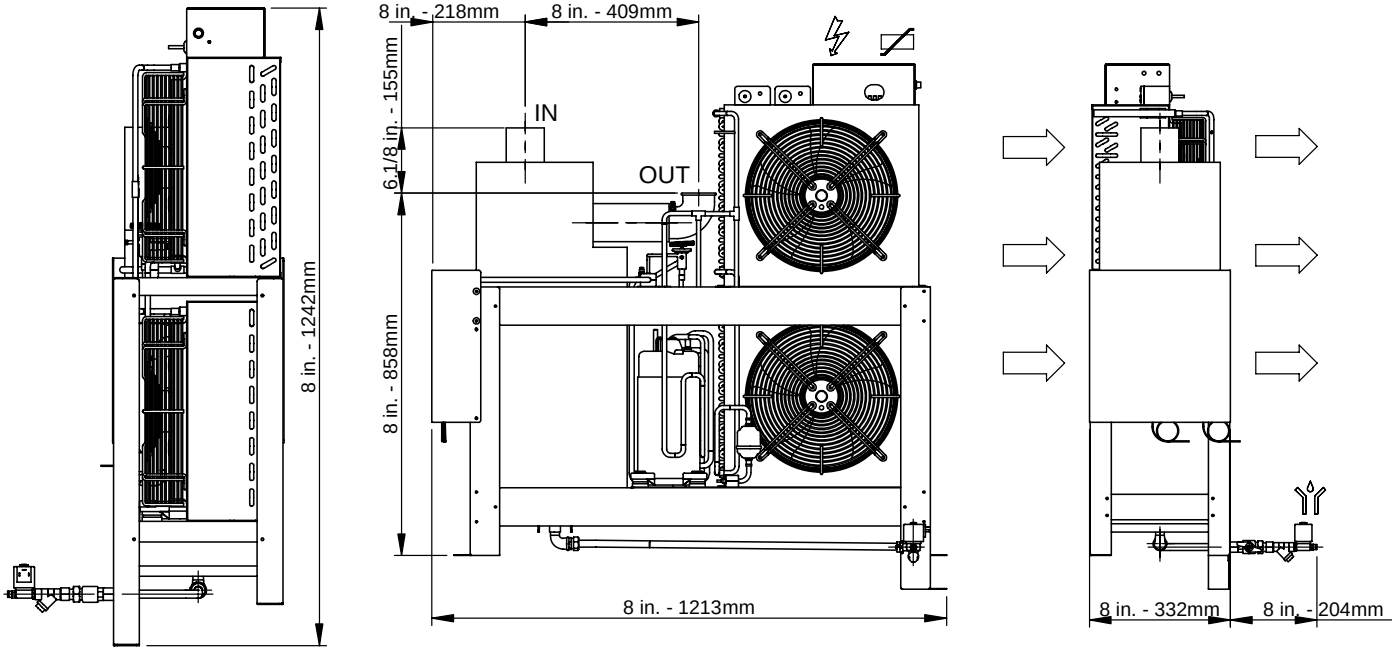


Figure 1-8 – VS45, VS50 & VS70 DRYER MODULE – OVERALL DETAILS

SECTION 2

INSTALLATION

2.1 TRANSPORT

During installation, servicing, or removal of the refrigerated dryer module, make sure to comply with the following guidelines:

- The dryer module is heavy; thus, use handling tools (e.g., forklift) of adequate lifting capacity.
- Keep dryer module in a vertical position. Damage may occur at other attitudes.
- Handle with care. Heavy blows could cause irreparable damage.
- Keep a new, vendor supplied dryer module in its original shipping protection until ready to install it in the compressor package. Do not store the dryer module outdoors, exposed to the weather.

The packaging materials are recyclable. Each single material must be properly disposed in a manner complying with the rules in force in your country.

2.2 MECHANICAL CONNECTION TO THE COMPRESSOR PACKAGE

If your compressor package is fitted with the factory-installed refrigerated dryer option, the necessary pipe and tube connections have already been made, and the only task to complete is as follows:

- Connect the dryer's drain outlet with a suitable 1/4'" fitting and sufficient plastic tubing to route the drained water into a suitable floor drain location - the drain tube may be easily routed outside the enclosure confines via the lower fresh air intake grill vanes. Once this is done, you may proceed to Section 2.3 to hook up the dryer to the electrical system.

If the refrigerated dryer module is to be field-fitted to an existing compressor package, the following tasks must be accomplished to achieve the integration of hardware:

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

- Identify the compressor package power rating and cooling type from the package identification nameplate. Verify that the dryer module to be installed matches the package power rating and cooling type.
- Inspect general appearance of dryer module for signs of component damage as received – contact Gardner Denver in case of damage.
- Verify that the required dryer module components are at hand – refer to the appropriate Dryer Assembly bill of materials and supporting drawing within Parts List, see Table on Page 3, to identify and cross-check the new hardware prior to installation. Use the Dryer information in the Parts Lists pages as reference during the installation of the dryer module.

- Be sure that the unit is completely off and that the oil sump is depressurised.
- Disconnect, lockout and tagout the power supply to the compressor package.
- Close (when provided) valve isolating compressor package from air system.
- Locate the appropriate Air Discharge Assembly bill of materials and supporting drawing within Parts List 13-18-500, 13-18-501, 13-18-502 or 13-18-503, remove the tube fittings between the aftercooler and the package outlet connection.
- Replace the removed components with those included with the dryer module.
- Connect the dryer's drain outlet with a suitable 1/4'" fitting and sufficient plastic tubing to route the drained water into a suitable floor drain location. The drain tube may be easily routed outside the enclosure confines via the lower fresh air intake grill vanes.
- Locate the drain solenoid valve (Item 21 on Figures 7-2, 7-3, 7-4 or 7-5 of this manual) supplied with the dryer module, and connect its wires and the additional jumper cable to the terminal block within the electrical enclosure. Refer to the appropriate wiring diagrams (listed below) to identify the required locations in the terminal block for the solenoid valve wires and the associated jumper cable – remember to use wire ties to adequately affix the cable to nearby components.

  - 300CGA546, included in VS11 Service Manual 13-18-606
  - 300CGB546 and 301CGB546, included in VS20 Service Manual 13-18-604.
  - 300CGC546 and 301CGC546, included in VS25, VS30 &VS40 Service Manual 13-18-603
  - 300CGD546 and 301CGD546, included in VS45, VS50 & VS70 Service Manual 13-18-601

- Locate the dew point [temp] sensor (Item 8 on Figures 7-2, 7-3, 7-4 or 7-5 of this manual) supplied with the dryer module, and connect its wires to the terminal block within the electrical enclosure. Refer to the appropriate wiring diagram to identify the required locations in the terminal block for the sensor wires – remember to use wire ties to adequately affix the cable to nearby components.
- Locate the electrical hardware box (Item 63 on Figure 7-2, 7-3, or 7-4 and Item 1 on Figure 7-1 of this manual) supplied with the dryer module, and inter-connect its terminal block, via the cable provided with the dryer kit, to the K2 contactor within the electrical enclosure. Refer to the appropriate wiring diagram to identify the location of the K2 contactor – remember to use wire ties to adequately affix the cable to nearby components.

⚠WARNING

The dryer drain discharges water condensate under pressure - same pressure of the air entering the dryer.

Make sure to direct the drain line termination to avoid direct condensate discharge (or indirect splashing) toward nearby personnel.

Drained water condensate may contain impurities such as oil particles. Dispose of the condensate in compliance with the local regulations.

2.3 ELECTRICAL CONNECTION TO THE POWER SOURCE

Once the necessary mechanical connections have been completed, proceed to connect the dryer module to the electrical power supply.

Electrical Power Supply - The dryer module requires an electrical power feed separate from that of the compressor package - typically 1ph-60Hz-230vac, but verify by reading dryer nameplate. A certified electrician, familiar with National Codes and applicable local codes, shall:

- Select and install a suitable fused or circuit breaker disconnect, with overload protection, to control the electrical power supply to the dryer. Note that this device shall be located outside the confines of the compressor package.

- Select and install the electrical power wires serving the dryer module as well as the required disconnect device. Routing of the electrical power wires into the compressor package electrical enclosure is best done through the roof area.

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

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

SECTION 3

Starting and Operating Procedures

⚠WARNING

Read the Operator's Manual Before Proceeding with Task

Maintenance task to be performed by qualified personnel only.

3.1 PRESTART-UP INSTRUCTIONS - Each new dryer, as received from the factory, has been tested and packaged for shipping only. **DO NOT** attempt to operate the unit until checked and serviced as follows:

- **Connections** – Refer to Section 2, "Installation", and make sure that mechanical and electrical connections meet all requirements.
- **Grounding** – Equipment must be properly grounded according to Gardner Denver Guidelines for proper wiring and grounding.
- **Overall Integrity** – Inspect dryer module for signs of component damage. If damages are evident, contact Gardner Denver for instructions.
- **Program Drain Valve Cycle** – Refer to Section 4, "Drain Valve", for full programming details.

3.2 OPERATION – It is recommended that both the compressor and the dryer be running in order to verify correct dryer operation:

Starting the dryer module

- Activate electrical disconnect device to energize dryer module.
- Start compressor package operation – refer to compressor package operating and service manual for details.
- Allow dryer inlet and outlet temperatures to stabilize – it may take several minutes for this to take place.
- Verify electrical power consumption of dryer matches nameplate data.
- Verify the operation of the condensate drain circuit. The "ON" and "OFF" drain intervals are controlled by the compressor package controller - refer to Section 4, "Drain Valve", for full programming details.
- Check the piping for air leakage.
- Daily checks – Refer to Section 6 "Controls and Maintenance".

Stopping the dryer module

* Dryer operation may be stopped as follows:

- Stop compressor package operation – refer to compressor package operating and service manual for details.
- Deactivate electrical disconnect device.

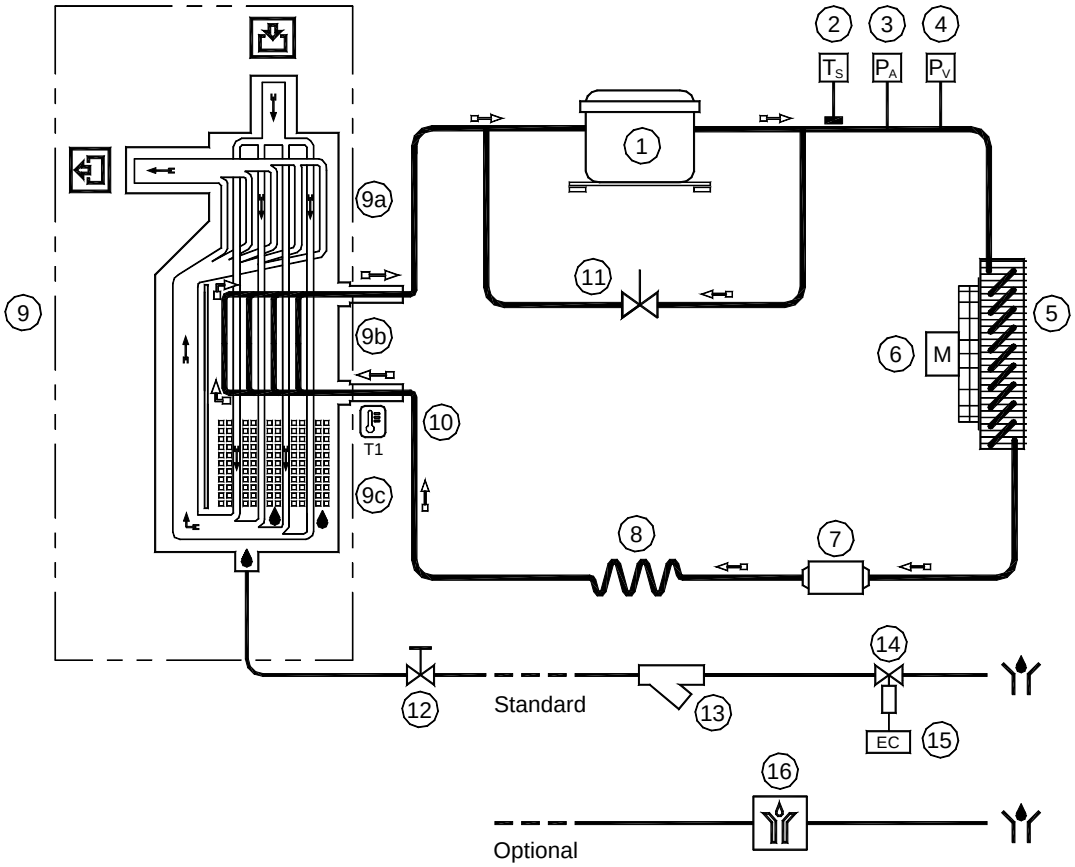
Note that dryer operation is automatically stopped (via contactor within control box) whenever a shutdown condition has been detected by the compressor package controller.

Do not start/stop the dryer more than 5 times in an hour.
After stopping the dryer wait at least 5 minutes before re-starting it again.

SECTION 4

CONTROLS AND INSTRUMENTATION

GENERAL DESCRIPTION – The Gardner Denver air dryer module includes all the necessary hardware for operation within the compressor package. The various devices used are described as follows - refer to Figure 4-1 for hardware details and their relative location:



1. Refrigeration compressor
2. Ts Safety thermo-switch
3. P_A Refrigerant pressure switch - high pressure (VS70 only)
4. P_V Fan control pressure switch
5. Condenser
6. Condenser fan
7. Dehydration filter
8. Capillary tube
9. Alu-Dry Module
   - a – Air-to-air heat exchanger
   - b – Air-to-refrigerant heat exchanger
   - c – Condensate Separator
10. DP DewPoint temperature sensor
11. Hot gas by-pass valve
12. Condensate drain service valve
13. Condensate drain strainer
14. Condensate drain solenoid valve
15. EC – Electronic Controller
16. Electronic level drain (optional)

Compressed Air flow direction

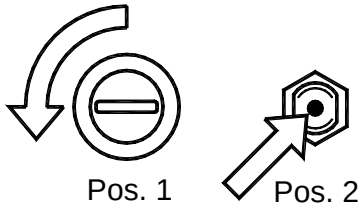
Refrigerant fluid flow direction

Figure 4-1 – PIPING AND INSTRUMENTATION ILLUSTRATION

Refrigerant compressor (1) – The device compresses refrigerant gas from a low pressure and temperature state to a higher pressure and temperature state. It is driven by an integral electric motor, which is cooled by suction-side refrigerant gas. Both compressor and motor are encased in a permanently sealed shell, supported by vibration-dampening mounts, and provided with external connections for the refrigerant flow and the electrical power feed.

The electric motor is protected against refrigeration compressor overloads by an internal, thermal-type device. Once the motor temperature has decreased to a safe level, the overload device resets itself. The electric motor is energized by a disconnect device located outside the compressor package.

Safety thermo-switch (2) – The device interrupts refrigerant compressor operation in case abnormally high (above 212ºF (100ºC)) discharge temperatures of the refrigerant gas are sensed. It is located on the tube feeding refrigerant to the condenser.



The safety thermo-switch must be manually reset.
After the gas temperature has dropped below the trigger point, unscrew the cover (see pos.1) and press the reset button (see pos.2).

Refrigerant pressure switch (3) – The device (used on VS45, VS50 & VS70 models only) interrupts refrigerant compressor operation in case abnormally high (above 442psig (30.5bar)) discharge pressure of the refrigerant gas is sensed. It is located on the tube feeding refrigerant to the condenser, and it includes a manual reset button on the body of the sensor itself.

Fan control pressure switch (4) – The device cycles the condenser electric fan(s) on/off in order to maintain optimal condensed refrigerant temperature, and thus dryer dew point.

- For dryers that use 404a refrigerant (VS20 through VS70), the fan(s) are turned on at a pressure of 290 psig/115º F [20 barg/46º C] and turned off at a pressure of 232 psig/99º F [8 barg/37º C]. Switch resolution is ± 14.5 psig [+/- 1 barg].

- For dryers that use 134a refrigerant (VS11 only), the fan is turned on at a pressure of 159.5 psig/117 º F [11 barg/47º C] and turned off at a pressure of 116 psig/97º F [8 barg/36º C]. Switch resolution is ± 14.5 psig [+/- 1 barg].

Condenser Assembly (5, 6) – The device receives the hot, high-pressure refrigerant discharged by the compressor and cools and condenses it into a liquid. Its copper tubes and external aluminium fins reject the refrigerant heat to an air stream provided by an electric axial fan.

The fan/motor combination (more than one fan/motor unit may be used) is cycled on/off via temperature switch. The fan motor is also energized by the disconnect device outside the compressor package.

De-hydration filter (7) – The device traps impurities and moisture carried by the liquid refrigerant.

Capillary tube (8) – The device provides controlled expansion (e.g., throttling) of the warm, high pressure liquid refrigerant into a cold, low pressure gaseous state, thus providing the necessary heat transfer sink to cool the compressed air within the evaporator. The combination of inside diameter and length of its copper body determine the pressure-reducing behaviour to the flow of refrigerant, and requires no maintenance or adjustment.

Alu-Dry Module (9) – The device combines the functions of two (2) heat exchangers and a water separation chamber:

- **Air-air heat exchanger (9a)** – Warm and humid air entering the dryer exchanges heat with cool, dry air exiting the evaporator (device 9b) in this device. The process results in the reduction of heat load to the refrigeration plant by as much as 50% and the heating (several degrees above the dew point) of the compressed air stream delivered by the dryer.

- **Air-refrigerant exchanger (9b)** – Cooler mixture of compressed air and condensed water exchange heat with the cold refrigerant stream in this device. The process results in the reduction of humidity of the air steam to its saturation (e.g., dew point) level, and the heating of the refrigerant stream, thus ensuring that it returns to the refrigerant compressor in a gaseous state.

- **Condensate separator (9c) –** The water condensed in the preceding stage is separated from the air stream by inertial effects. The dry air is delivered to the air cooler (device 9a) and the collected water is ready for evacuation by the action of an externally operated solenoid drain valve (see item13).

Dew Point temperature sensor (10) – This device measures the temperature of the cold refrigerant gas entering the evaporator, and approximately indicates the pressure dew point of the compressed air exiting the evaporator - it is housed in a thermowell affixed to the tube work. The AirSmart controller displays the device's temperature signal (See "Dryer Temperature" in the controller manual 13-17-600) and also uses it to halt dryer operation when abnormally high levels are sensed – an alarm is displayed at 113º F (45ºC) and the dryer is shutdown at 175º F (79º C).

Hot Gas Bypass Valve (11) – This device artificially heats up the cold gas entering the refrigeration compressor during low load operating conditions (e.g., low compressed air flow, low ambient or compressed air temperature, etc.) by using hot gas from the discharge side. The valve has been adjusted at the factory to provide proper performance. Only personnel trained and certified to handle refrigerant-based equipment shall be allowed to make the necessary adjustments, if they are required.

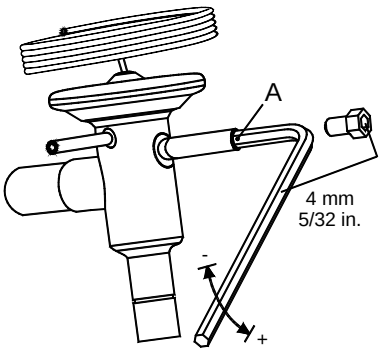
⚠WARNING

The use of any ¼" Schrader service valve to monitor refrigerant pressure may accidentally vent a portion of the refrigerant charge to the atmosphere, thus affecting the operation of the refrigeration plant, as well as releasing a potentially harmful gas into the environment. This task must be performed by qualified personnel only.

ADJUSTMENT

With the dryer module is in operation, but no compressed air flow present, rotate the adjusting screw (position A on the drawing) until the following hot gas setting value is reached:

Refrigerant:	R404a	R134a
Temperature:	34/32 º F (1/0 º C)	34/32 º F (1/0 º C)
Pressure:	77/76 psi (5.3/5.2 bar)	30/29 psi (2.1/2.0 bar)



Condensate drain isolation valve and strainer (12, 13) – An isolation valve (12) is provided to enable the servicing of drain line components without interruption of the dryer operation. An in-line strainer (13) is also provided to protect the drain solenoid valve from blockage by particles present in the condensed water stream collected by the dryer.

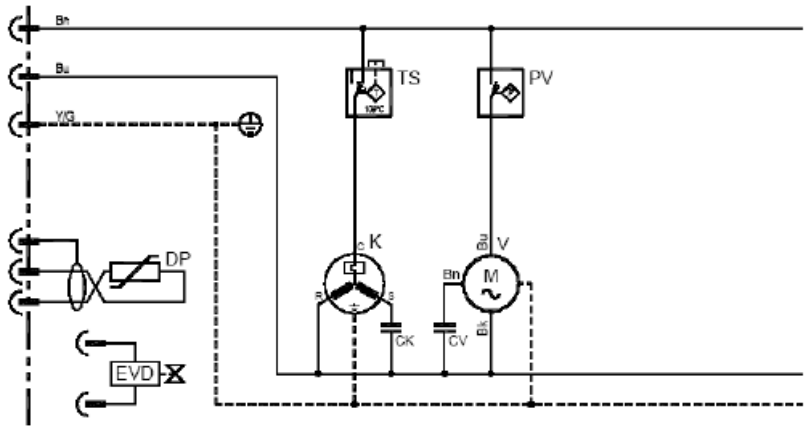
NOTE: The isolation valve (12) must be open for proper condensate drainage. Inspect this drain valve at start up to insure that it is open.

Condensate drain solenoid valve (14) – The device, standard [drain] equipment with the dryer module, evacuates the condensed water collected in the water separator chamber (see item 9c). It is a two-way, normally closed, 24vdc solenoid valve, cycled on and off by a program residing in the AirSmart controller included with the compressor package.

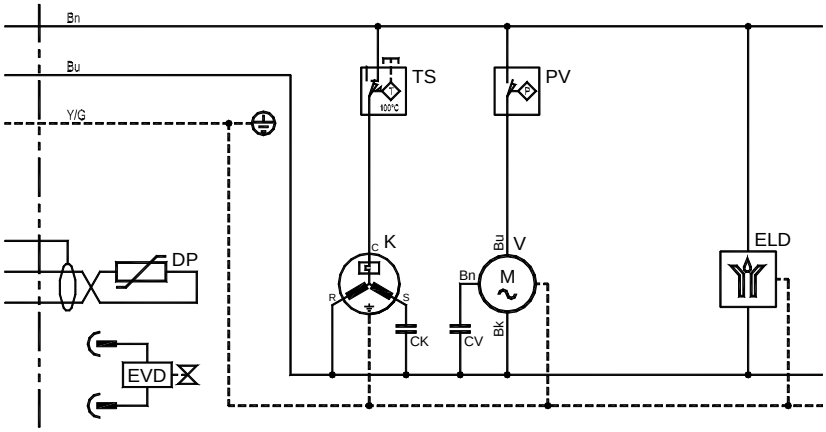
- **Programming drain "close/open" intervals –** Refer to the AirSmart controller manual number 13-17-600, for full instruction in programming the action of the drain valve. A summary of the required steps are presented below:
  - Navigate to the "Unit Setup Adjust" menu and access the "Drain Close Interval" menu. This parameter controls the time the drain valve remains closed after each open cycle. It is adjustable between 1 to 180 seconds. Default value is 20 sec.
  - Next, access the "Drain Open Interval menu. This parameter controls the time the drain valve remains open after each closed cycle. It is adjustable between 0 to 10 seconds. Default value is 1 second, but it may not be adequate for condition of service. Note that using the 0 value disables completely the drain function (no cycling takes place).

- **Additional notes on the drain valves**
  - The AirSmart controller adjusts the drain close interval in proportion to the speed of the compressor. As the compressor flow decreases, the drain close interval is increased to allow the collection of a condensed water volume equivalent to that of the full flow system – this minimizes the venting of compressed air.
  - The correct drain close/open value combination to use is that which, for the prevailing humidity volume rejected by the dryer, will evacuate all of the water collected - e.g., a solid column of water is visible in the drain line and only a little air/water mixture is visible at the very end of the open cycle. A typical 20 sec closed interval is a good starting point, but the open interval value must be identified through testing.
  - An optional level-sensing drain valve is also available. Contact Gardner Denver for information.

Model VS11



Model VS20



Model VS25, VS30 & VS40

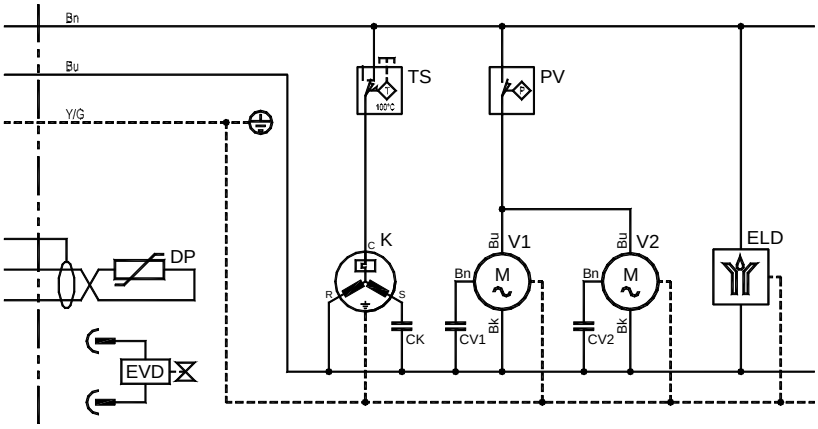
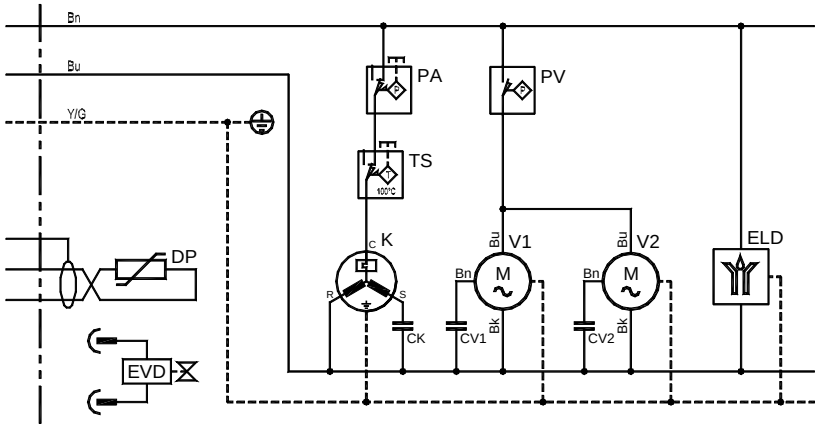


Figure 4-2 – WIRING DIAGRAMS, VS11, VS20, VS25, VS30 & VS40

Model VS45, VS50 & VS70



Legend :

K : Refrigeration compressor
CK : Compressor capacitor
V : Condenser fan (VS20 only)
CV : Fan capacitor (VS20 only)
PV : Fan control pressure switch
PA : Refrigerant pressure switch (high pressure - VS70 only)
TS : Safety thermo-switch

V1 : Condenser fan 1 (VS 40-70 only)
CV1 : Fan 1 capacitor (VS 40-70 only)
V2 : Condenser fan 2 (VS 40-70 only)
CV2 : Fan 2 capacitor (VS 40-70 only)
EVD : Drain solenoid valve – 24VDC
ELD : Electronic level drain - Optional
DP : Dew Point temperature sensor

BN=Brown BU=Blue BK=Black YG=Yellow/Green

Figure 4-3 – WIRING DIAGRAMS, VS45, VS50 & VS70

SECTION 5

MAINTENANCE SCHEDULE

SERVICE CHECK LIST

Daily Checks:

- Check for proper operation of the condensate drain system. In case of poor condensed water drainage, inspect the in-line strainer (13) and drain solenoid valve (14) for signs of fouling or blockage.

Monthly Checks (or every 200 hrs):

- Check for dirt accumulation on condensor finned surfaces. In case of poor dryer performance or obvious fouling of the condensor surfaces, direct a low pressure (30psig max) stream of compressed air toward the condensor finned surfaces in order to remove the fouling. **DO NOT** use caustic substances on the aluminum surfaces of the condensor or irreparable damage may occurr.

Yearly Checks (or every 1000 hrs):

- Check dew point performance of dryer.
- Check tightness of all electrical connections.
- Check drain hose plastic lines for signs of cracking. Replace if necessary.

SECTION 6

TROUBLESHOOTING

DANGER

Compressed air under pressure will cause severe personal injury or death. Shutdown compressor and dryer, relieve system of all compressed air pressure, disconnect, lockout and tagout power supply to the compressor package and dryer before removing valves, caps, plugs, fitting, bolts, and filters.

Pressurized refrigerant fluid, if accidentally vented to atmosphere, may cause freezing burns and serious damage to exposed skin and eyes. Maintenance of the refrigeration system must be carried out by qualified personnel only.

PROBLEM	POSSIBLE CAUSE	REMEDY
Dryer fails to start	1. Main disconnect open. 2. Blown fuses. 3. System thermo-switch (TS) has been activated. 4. AirSmart controller shut dryer down due to high dew point sensor temperature 5. Refrigerant pressure switch (PA) has been activated [VS45, VS50 & VS70 models only]	1. Close or reset. 2. Inspect and/or replace fuses. 3. Wait for thermo-switch to reset. 4. Investigate condition and correct. 5. Investigate condition and manually reset switch.
Refrigeration compressor fails to start and electrical power feed is active	1. Compressor thermal overload has been activated. 2. Incorrect wiring. 3. Compressor failure. 4. Refrigerant pressure switch (PA) has been activated [VS45, VS50 & VS70 models only]	1. Wait 30 min to allow reset of thermal overload. 2. Check wiring. 3. Replace compressor. 4. Investigate condition and manually reset switch

PROBLEM	POSSIBLE CAUSE	REMEDY
Condenser fan fails to start and electrical power feed is active	1. Pressure switch (PV) is faulty. 2. Incorrect wiring. 3. System thermo-switch (TS) has been activated. 4. Fan motor failure.	1. Check and replace pressure switch. 2. Check wiring. 3. Wait for thermo-switch to reset. 4. Replace fan motor.
Dew point is too high	1. Dryer is not operating. 2. Dew point sensor (T1/DP) is not detecting refrigerant temp. 3. Service conditions (ambient temp, intake air temp, intake air pressure or intake air flow) have been exceeded. 4. Condenser unit is dirty. 5. Condensed water is pooling is the evaporator. 6. Hot gas bypass valve is out of adjustment. 7. Insufficient refrigerant charge in dryer system.	1. See “Dryer”, “Compressor”, or “Condenser Fan” fails to start, this section. 2. Check that dew point sensor is fully inserted in thermowell and that thermowell is full of heat conducting grease. 3. Verify that dew point corresponds to service conditions - see Dryer Module Specs. Do not exceed Min/Max levels. 4. Cleanse external fin area of condenser. 5. Check drain valve operation – see “Drain valve”, this section. 6. Have qualified personnel check/adjust hot gas bypass valve operation. 7. Have qualified personnel check refrigerant charge.
Dew point is too low	1. Condenser fan remains on at all times. 2. Hot gas bypass valve is out of adjustment.	1. Have qualified personnel check/replace pressure switch (PV). 2. Have qualified personnel check/adjust hot gas bypass valve operation.

PROBLEM	POSSIBLE CAUSE	REMEDY
High pressure drop across dryer inlet/outlet connections	1. Condensed water is pooling in the evaporator. 2. Dew point is too low and the evaporator is blocked with frozen water condensate.	1. Check drain valve operation – see “Drain valve”, this section. 2. Have qualified personnel check/adjust hot gas bypass valve operation.
Drain valve [condensate removal] malfunction	1. Incorrect wiring. 2. Selection of Off/On cycles are inadequate to drain water condensate from evaporator. 3. Drain valve is stuck closed. 4. Valve solenoid failed. 5. Strainer on drain line is clogged. 6. Dew point is too low and the water condensate is frozen. 7. Isolation valve closed.	1. Check wiring. 2. Re-program Off/On cycles to fully drain condensed water. 3. Check drain valve for blockage and clear. 4. Inspect/replace valve solenoid. 5. Inspect/clear strainer basket. 6. Allow water condensate to thaw and refer to “Dew point is too low”, this section. 7. Open isolation valve.
Drain valve (excessive or continuous drain) malfunction	1. Drain valve is stuck open. 2. Selection of Off/On cycles allow valve to remain open too long.	1. Check drain valve for fouling and cleanse. 2. Re-program Off/On cycles to fully drain condensed water with only a couple of seconds of air/water drain at the end of the cycle.
Water present at dryer discharge connection	1. Dryer is not operating. 2. Dew point is too high. 3. Improper water condensate drainage.	1. See “Dryer”, “Compressor”, or “Condenser Fan” fails to start, this section. 2. See “Dew point is too high”, this section. 3. See “Drain valve” malfunction, this section.

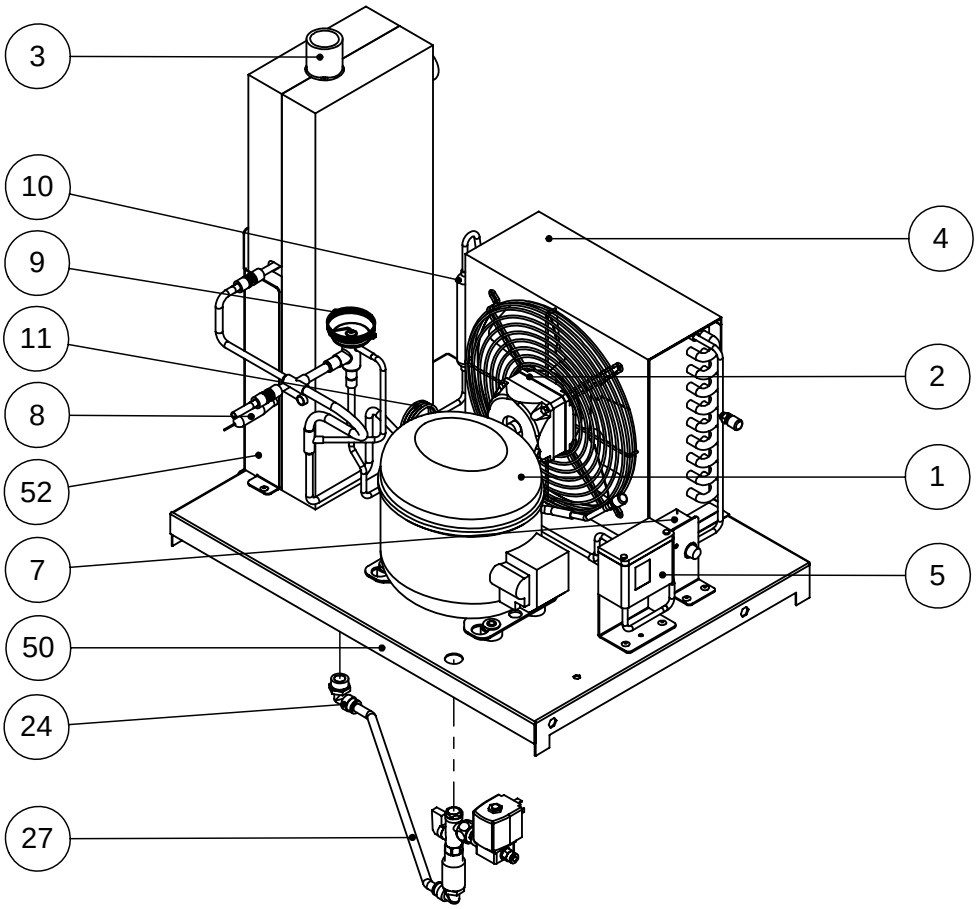
PROBLEM	POSSIBLE CAUSE	REMEDY
System thermo switch (TS) has been activated	1. Service conditions (ambient temp, intake air temp, intake air pressure or intake air flow) have been exceeded.	1. Verify that dew point corresponds to service conditions - see Dryer Module Specs. Do not exceed Min/Max levels.
	2. Condenser unit is dirty.	2. Cleanse external fin area of condenser.
	3. Condenser fan is not working.	3. See “Condenser fan failure”, this section.
	4. Insufficient refrigerant charge in dryer system.	4. Have qualified personnel check refrigerant charge.
	5. Thermo switch is faulty.	5. Have qualified personnel check/replace thermo switch.

DRYER HARDWARE DISPOSAL

The basic composition of main dryer components are listed in Figure Figure 7-1, to facilitate their proper disposal in accordance with prevailing local environmental regulations

PART	Material
Refrigerant fluid	R404A – HFC, Oil R134a – HFC (VS11)
Canopy and Supports	Carbon steel
Refrigeration Compressor	Steel, Copper, Aluminum, Oil
Alu-Dry Module	Aluminum
Condenser Unit	Aluminum, Copper, Carbon steel
Pipe	Copper
Fan	Aluminum, Copper, Steel
Valve	Brass, Steel
Timed Drain	Brass, Steel, PVC
Insulation Material	Synthetic gum without CFC, Polystyrene, Polyurethane
Electric cable	Copper, PVC
Electric Parts	PVC, Copper, Brass

Figure 7-1 – DRYER HARDWARE DISPOSAL



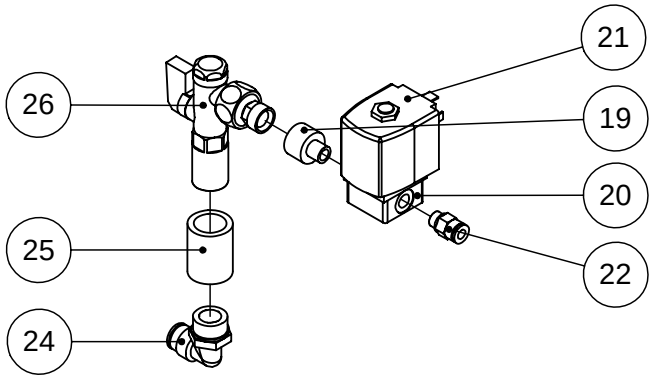


Figure 7-2 – EXPLODED VIEW VS11 DRYER MODULE

Order by Part Number and Description. Reference Numbers are for your convenience only.

AIR DRYER – VS11

B/M: VP1026477

Ref. No.	Name of Part	Qty.	Part No.
1	COMPRESSOR	1	2118622
2	FAN	1	2118626
3	ALU DRY MODULE	1	2118629
4	CONDENSER	1	2118633
5	PRESSURE SWITCH, Pv	1	2118728
7	THERMO-SWITCH, Ts	1	2118639
8	DEW POINT SENSOR	1	2118640
9	HOT GAS BY-PASS VALVE	1	2118729
10	DEHYDRATION FILTER	1	2118642
11	CAPILLARY TUBE	1	2118711
19	DRAIN REDUCER	1	2118656
20	SOLENOID VALVE DRAIN	1	2118659
21	COIL, DRAIN	1	2118661
22	CONNECTOR, DRAIN	1	2118662
24	ELBOW CONNECTOR, DRAIN	2	2118663
25	CONNECTOR, DRAIN	1	2118664
26	STRAINER/VALVE, DRAIN	1	2118665
27	PIPE, DRAIN	1	2118666
50	PLATE	1	2118667
52	POST	1	2118674

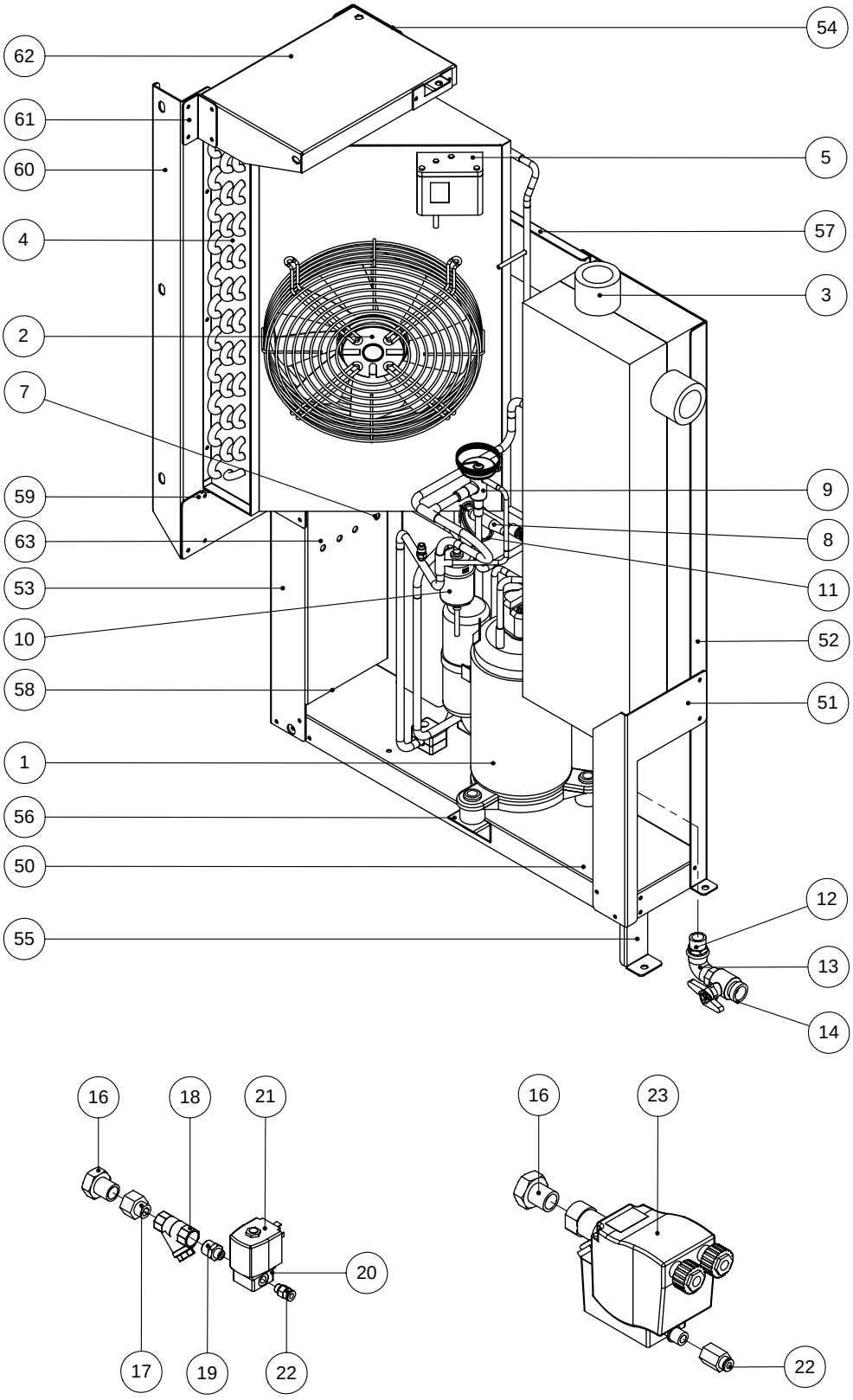


Figure 7-3 – EXPLODED VIEW VS20 DRYER MODULE

Order by Part Number and Description. Reference Numbers are for your convenience only.

AIR DRYER – VS20

B/M: 300CGB463

Ref. No.	Name of Part	Qty.	Part No.
1	COMPRESSOR VS20	1	2118623
2	FAN	1	2118627
3	ALU DRY MODULE	1	2118630
4	CONDENSER UNIT	1	2118634
5	PRESSURE SWITCH, Pv	1	2118728
7	THERMO-SWITCH, Ts	1	2118639
8	DEW POINT SENSOR	1	2118640
9	HOT GAS BY-PASS VALVE	1	2118641
10	DEHYDRATION FILTER	1	2118710
11	CAPILLARY TUBE	1	2118644
12	NIPPLE	1	2118647
13	ELBOW	1	2118648
14	SERVICE VALVE	1	2118649
16	DRAIN FITTING	1	2118651
17	REDUCER, DRAIN	1	2118654
18	STRAINER, DRAIN	1	2118655
19	REDUCER, DRAIN	1	2118657
20	SOLENOID VALVE, DRAIN	1	2118659
21	COIL, SOLENOID VALVE, DRAIN	1	2118661
22	CONNECTOR, DRAIN	1	2118662
22	CONNECTOR, DRAIN	1	2118652
23	ELECTRONIC LEVEL DRAIN	1	2118653
50	BASE PLATE	1	2118668
51	FRONT LEFT POST	1	2118671
52	FRONT RIGHT POST	1	2118675
53	BACK LEFT POST	1	2118678
54	BACK RIGHT POST	1	2118681
55	FRONT BASE SUPPORT	1	2118684
56	LEFT SUPPORT BASE	1	2118687
57	RIGHT BASE SUPPORT	1	2118690
58	BACK BASE SUPPORT	1	2118693
59	BACK CONDENSER SUPPORT	1	2118696
60	SIDE CONDENSER POST	1	2118699
61	SIDE CONDENSER SUPPORT	1	2118701
62	UPPER CONDENSER SUPPORT	1	2118702
63	ELECTRIC BOX	1	2118704
63	ELECTRIC BOX COVER	1	2118725

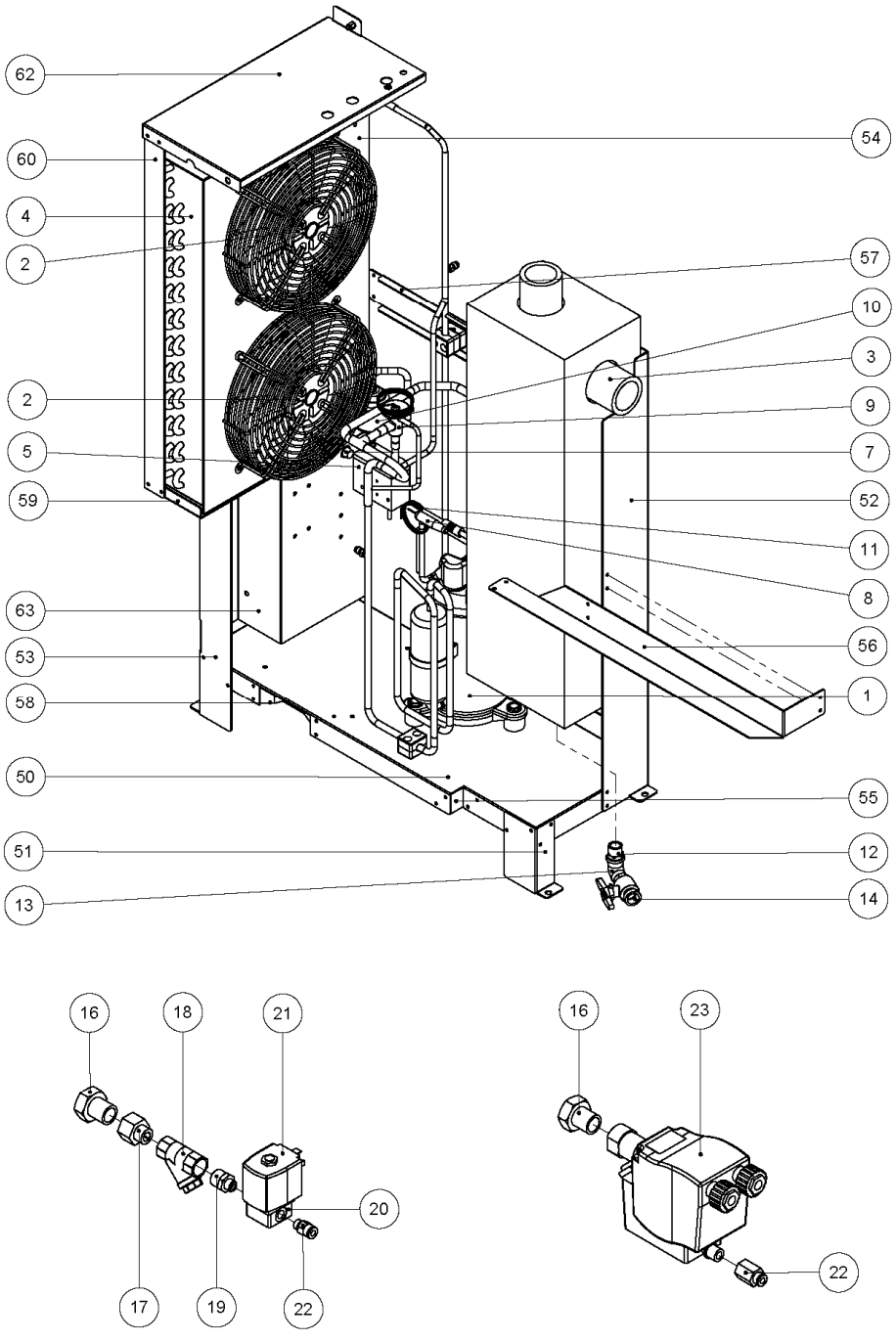


Figure 7-4 – EXPLODED VIEW VS25, VS30 & VS40 DRYER MODULE

Order by Part Number and Description. Reference Numbers are for your convenience only.

AIR DRYER – VS25 – VS30 – VS40

B/M: 300CGC463

Ref. No.	Name of Part	Qty.	Part No.
1	COMPRESSOR	1	2118624
2	FAN	1	2118627
3	ALU DRY MODULE	1	2118631
4	CONDENSER UNIT	1	2118635
5	PRESSURE SWITCH, Pv	1	2118728
7	THERMO-SWITCH, Ts	1	2118639
8	DEW POINT SENSOR	1	2118640
9	HOT GAS BY-PASS VALVE	1	2118641
10	DEHYDRATION FILTER	1	2118643
11	CAPILLARY TUBE	1	2118645
12	NIPPLE	1	2118647
13	ELBOW	1	2118648
14	SERVICE VALVE	1	2118649
16	DRAIN FITTING	1	2118651
17	REDUCER, DRAIN	1	2118654
18	STRAINER, DRAIN	1	2118655
19	REDUCER, DRAIN	1	2118657
20	SOLENOID VALVE, DRAIN	1	2118659
21	COIL, DRAIN	1	2118661
22	PIPE CONNECTOR, DRAIN	1	2118662
22	PIPE CONNECTOR DRAIN	1	2118652
23	ELECTRONIC LEVEL DRAIN	1	2118653
50	BASE PLATE	1	2118669
51	FRONT LEFT POST	1	2118672
52	FRONT RIGHT POST	1	2118676
53	BACK LEFT POST	1	2118679
54	BACK RIGHT POST	1	2118682
55	FRONT BASE SUPPORT	1	2118685
56	LEFT SUPPORT BASE	1	2118688
57	RIGHT BASE SUPPORT	1	2118691
58	BACK BASE SUPPORT	1	2118694
59	BACK CONDENSER SUPPORT	1	2118697
60	SIDE CONDENSER POST	1	2118700
62	UPPER CONDENSER SUPPORT	1	2118703
63	ELECTRIC BOX	1	2118705
63	ELECTRIC BOX COVER	1	2118726

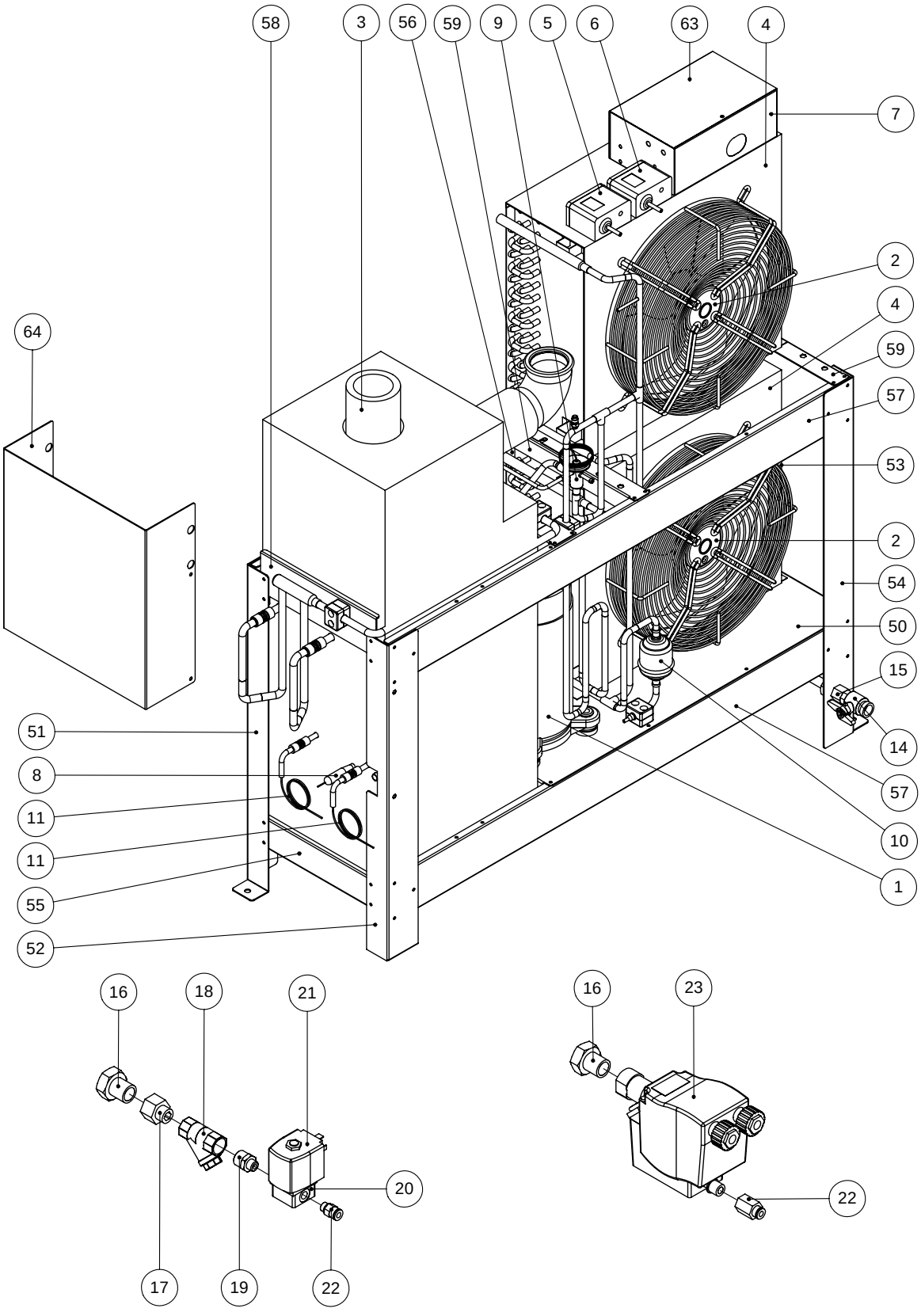


Figure 7-5 – EXPLODED VIEW VS45, VS50 & VS70 DRYER MODULE

Order by Part Number and Description. Reference Numbers are for your convenience only.

AIR DRYER – VS45 – V50 – V70

B/M: 300CGD463

Ref. No.	Name of Part	Qty.	Part No.
1	COMPRESSOR	1	2118625
2	FAN	2	2118628
3	ALU DRY MODULE	1	2118632
4	CONDENSER UNIT	2	2118636
5	PRESSURE SWITCH, Pv	1	2118728
6	PRESSURE SWITCH, Pa	1	2118638
7	THERMO-SWITCH, Ts	1	2118639
8	DEW POINT SENSOR	1	2118640
9	HOT GAS BY-PASS VALVE	1	2118641
10	DEHYDRATION FILTER	1	2118643
11	CAPILLARY TUBE	2	2118646
14	SERVICE VALVE	1	2118649
16	DRAIN FITTING	1	2118651
17	REDUCER, DRAIN	1	2118654
18	STRAINER, DRAIN	1	2118655
19	REDUCER, DRAIN	1	2118657
20	SOLENOID VALVE, DRAIN	1	2118659
21	COIL, DRAIN	1	2118661
22	PIPE CONNECTOR, DRAIN	1	2118662
22	PIPE CONNECTOR DRAIN	1	2118652
23	ELECTRONIC LEVEL DRAIN	1	2118653
50	BASE PLATE	1	2118670
51	FRONT LEFT POST	1	2118673
52	FRONT RIGHT POST	1	2118677
53	BACK LEFT POST	1	2118680
54	BACK RIGHT POST	1	2118683
55	FRONT BASE SUPPORT	1	2118686
56	LEFT BASE SUPPORT	1	2118689
57	BACK BASE SUPPORT	1	2118692
58	RIGHT BASE SUPPORT	1	2118695
59	BACK CONDENSER SUPPORT	2	2118698
63	ELECTRIC BOX	1	2118706
63	ELECTRIC BOX COVER	1	2118727
64	PIPE PROTECTION	1	2118707

WARRANTY
VS AND VST SERIES
LUBRICATED ROTARY SCREW COMPRESSORS

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, free of defects in 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. 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, any part, which in its judgment proved not to be as warranted within the applicable Warranty Period as follows. Regular lubricant sampling and use of genuine GD OEM parts is strongly recommended.

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. Shaft seals are a routine maintenance item and carry a 12 month warranty.

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 AirSmart™ controller, variable frequency drive, drive motor(s), reservoir, mixing valve, drive coupling, coupling insert, cooling fan(s) and cooling fan motor(s) are warranted for 24 months from date of initial use or 27 months from date of shipment to the first purchaser, whichever occurs first, as provided in, and subject to the terms of the original component manufacturer's warranty. The oil cooler and aftercooler are warranted for 36 months from date of initial use or 39 months from date of shipment to the first purchaser, whichever occurs first, as provided in, and subject to the terms of the original, component manufacturer's warranty.

OTHER COMPONENTS
All other components not specified above are warranted for 12 months from date of initial use or 15 months from date of shipment to first purchaser, whichever occurs first.

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

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

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

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

DISCLAIMER
THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES AND HEREBY EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION, EXPRESSED, IMPLIED OR STATUTORY WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE.

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

NO STATEMENT, REPRESENTATION, AGREEMENT, OR UNDERSTANDING, ORAL OR WRITTEN, MADE BY ANY AGENT, DISTRIBUTOR, REPRESENTATIVE, OR EMPLOYEE OF THE COMPANY WHICH IS NOT CONTAINED IN THIS WARRANTY WILL BE BINDING UPON THE COMPANY UNLESS MADE IN WRITING AND EXECUTED BY AN OFFICER OF THE COMPANY.

THIS WARRANTY SHALL NOT BE EFFECTIVE AS TO ANY CLAIM WHICH IS NOT PRESENTED WITHIN 30 DAYS AFTER THE DATE UPON WHICH THE PRODUCT IS CLAIMED NOT TO HAVE BEEN AS WARRANTED. ANY ACTION FOR BREACH OF THIS WARRANTY MUST BE COMMENCED WITHIN ONE YEAR AFTER THE DATE UPON WHICH THE CAUSE OF ACTION OCCURRED.

ANY ADJUSTMENT MADE PURSUANT TO THIS WARRANTY SHALL NOT BE CONSTRUED AS AN ADMISSION BY THE COMPANY THAT ANY PRODUCT WAS NOT AS WARRANTED.

Gardner Denver

For additional information contact your local representative or

Gardner Denver Compressor Division,
1800 Gardner Expressway, Quincy, Illinois 62305

Telephone: (800) 682-9868
FAX: (217) 224-7814

Visit our Web Site: www.gardnerdenver.com

Sales and Service in all major cities.

Specifications subject to change without notice.

Litho in U.S.A.