Gardner Denver®

13-18-612
Version: 00
Dec 2, 2018

VARIABLE SPEED SINGLE STAGE STATIONARY BASE-MOUNTED COMPRESSOR

AirSmart™ CONTROLLER

VS80-110B

80-110kW

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. A worldwide 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: (800)682-9868

INSTRUCTIONS FOR ORDERING REPAIR PARTS

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

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 – 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 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 – 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 Ear 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

Maintain Compressor Reliability And Performance With Genuine Gardner Denver Compressor Parts And Support Services 1
Instructions For Ordering Repair Parts 1
Warning – Prohibition – Mandatory Label Information 2
Safety Precautions 4
Index 6
List Of Illustrations 7
Section 1, General Information 8
Section 2, Installation 13
Section 3, Starting & Operating Procedures 19
Section 4, Controls & Instrumentation 26
Section 5, Compressor Lubrication - Separation, Filtration And Controls 47
Section 6, Heat Exchangers (Oil, Air), Axial Cooling Fans 56
Section 7, Air Filter 62
Section 8, Shaft Coupling 64
Section 9, Minimum Pressure/Check Valve 68
Section 10, Inlet Control Valve 70
Section 11, Pressure Relief Valve 72
Section 12, Ventilation Fans, Filters (Electrical Enclosure) 74
Section 13, Motor Lubrication 75
Section 14, Maintenance Schedule ..... 76 thru 79
Section 15, Troubleshooting 80

This book covers the following models:

KW	PSIG	Air Cooled and Water Cooled	Parts List	Controller Manual	Comm. Module
80, 110	100 THRU 175	VS80-110B	13-18-509	13-17-600	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

Air Filter, Section 7 62
Air Flow In The Compressor System 8
Air Cooled Units, Location 14
Auxiliary Air Receiver 16

Cold Weather Installation 15
Compression Principle 8
Compressor Lubrication – Separation, Filtration And Controls, Section 5 47
Control Piping 16
Controls & Instrumentation, Section 4 26

Discharge Service Line 16

Electrical Wiring 17
Enclosure 15

Foundation 15

General Information, Section 1 8
Grounding 18

Heat Exchangers (Oil, Air), Axial Cooling Fans, Section 6 56

Inlet Control Valve, Section 10 71
Inlet Line 16
Installation, Section 2 13

Lifting Unit 13
Location
- Air Cooled Units 14
- Water Cooled Units 14

Location 14
Lubrication
- Cooling 8
- Sealing 8

Maintenance Schedule, Section 14 76
Minimum Pressure/Check Valve, Section 9 68
Moisture Separator/Trap (Optional) 16
Motor Lubrication 75

Oil Filter 50
Oil Reservoir Drain 15
Oil System
- Addition Of Oil Between Changes 49
- Compressor 47
- Draining And Cleaning 50
- Moisture 48
- Oil Change Interval 50
- Oil Filter 50
- Oil Mixing Valve 51
- Oil Separation Reservoir/Coalescing Element 53
- Oil Sight Glass 48
- Oil Specifications 47
- Recommended Lubricant 47
- Refilling Oil 50

Piping
- Blow Down Valve 16
- Control 16
- Water 16

Pressure Relief Valve, Section 11 72
Prestart-Up Instructions 19

Quick Start Guide 22

Safety Precautions 4
Service Check List 77
- Every 1000 Hours 76
- Every 8000 Hours 76
- Weekly 76
- Yearly 78

Shaft Coupling, Section 8 64
Starting & Operating Procedures, Section 3 19
Starting The Unit 24
Stopping The Unit 24

Troubleshooting, Section 15 80

Ventilation Filters (Electrical Enclosure), Section 12 74

Warning – Prohibition – Mandatory Label Information 2
Water Cooled Units, Location 14

LIST OF ILLUSTRATIONS

Figure 1-1 – Compressor Cycle 8
Figure 1-2 – Package Illustration (Air Cooled) – External Details 9
Figure 1-3 – Package Illustration (Air cooled) – Internal Details 10
Figure 1-4 – Package Illustration (Water cooled) – External Details 11
Figure 1-5 – Package Illustration (Water cooled) – Internal Details 12

Figure 2-1 – Typical Compressor Room 14
Figure 2-2 – Package Maximum Current Consumption Summary 17
Figure 2-3 - Line Reactor Sizing Recommendations 18

Figure 3-1 – Motor Fan Rotation Check 21

Figure 4-1 – Electrical Enclosure Hardware 27
Figure 4-2 – Piping And Instrumentation Illustration 30
Figure 4-3 – Wiring Diagram – (Air cooled) Single-Stage, VS80/110, 460 VAC 31
Figure 4-4 – Wiring Diagram – (Water cooled) Single-Stage, VS80/110, 460 VAC 35
Figure 4-5 – Wiring Diagram – (Air cooled) Single-Stage VS80/110, 575 VAC 39
Figure 4-6 – Wiring Diagram – (Water cooled) Single-Stage VS80/110, 575 VAC 43

Figure 5-1 – Oil Level Sight Glass 48
Figure 5-2 – Load VS Sight Glass Oil Level Change 49
Figure 5-3 – Thermostatic Mixing Valve Element 52
Figure 5-4 – Pressure Dew Point Of Compressed Air 53
Figure 5-5 – Changing Oil Coalescing Element 54

Figure 6-1 – Air Flow Chart 57
Figure 6 2 – Water cooled Heat Exchanger Coolant Requirements 58
Figure 6-3 – Water Control Valve 59
Figure 6-4 – Water Separator And Drain 60
Figure 6-5 – Detailed Water Separator And Drain 61

Figure 7-1 – Air Filter (Standard) 62

Figure 8-1 – Coupling Components 64
Figure 8-2 – Coupling Element 65
Figure 8-3 – Coupling Removal Tool 67
Figure 8-4 – Location Airend Coupling Hub Installation Tool 67

Figure 9-1 – Minimum Discharge Pressure/Check Valve 69

Figure 10-1 – Inlet Control Valve 70

Figure 11-1 – Pressure Relief Valve 72

SECTION 1
GENERAL INFORMATION

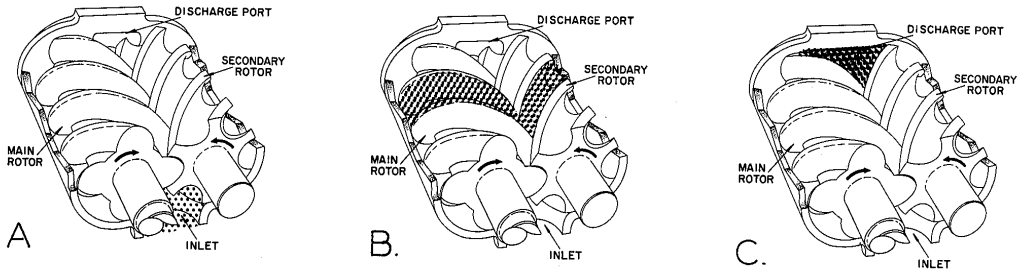


Figure 1-1 – COMPRESSOR CYCLE

COMPRESSOR – 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 arrangement of both roller and ball bearings is designed to withstand reverse 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 six (6) helical grooves, 60° apart, on its matching gate rotor.

The air inlet port is located on top of the compressor cylinder, and the discharge port is located below the compressor cylinder. 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 “fill-compress-discharge” cycle in rapid succession to produce a discharge air flow that is continuous, smooth and shock free.

AIR FLOW IN THE COMPRESSOR SYSTEM (Figure 4-2, page 30) - 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 twin coalescing elements 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, optional moisture separator, and finally to the distribution network.

LUBRICATION, COOLING AND SEALING (Figure 4-2, page 30) - 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.

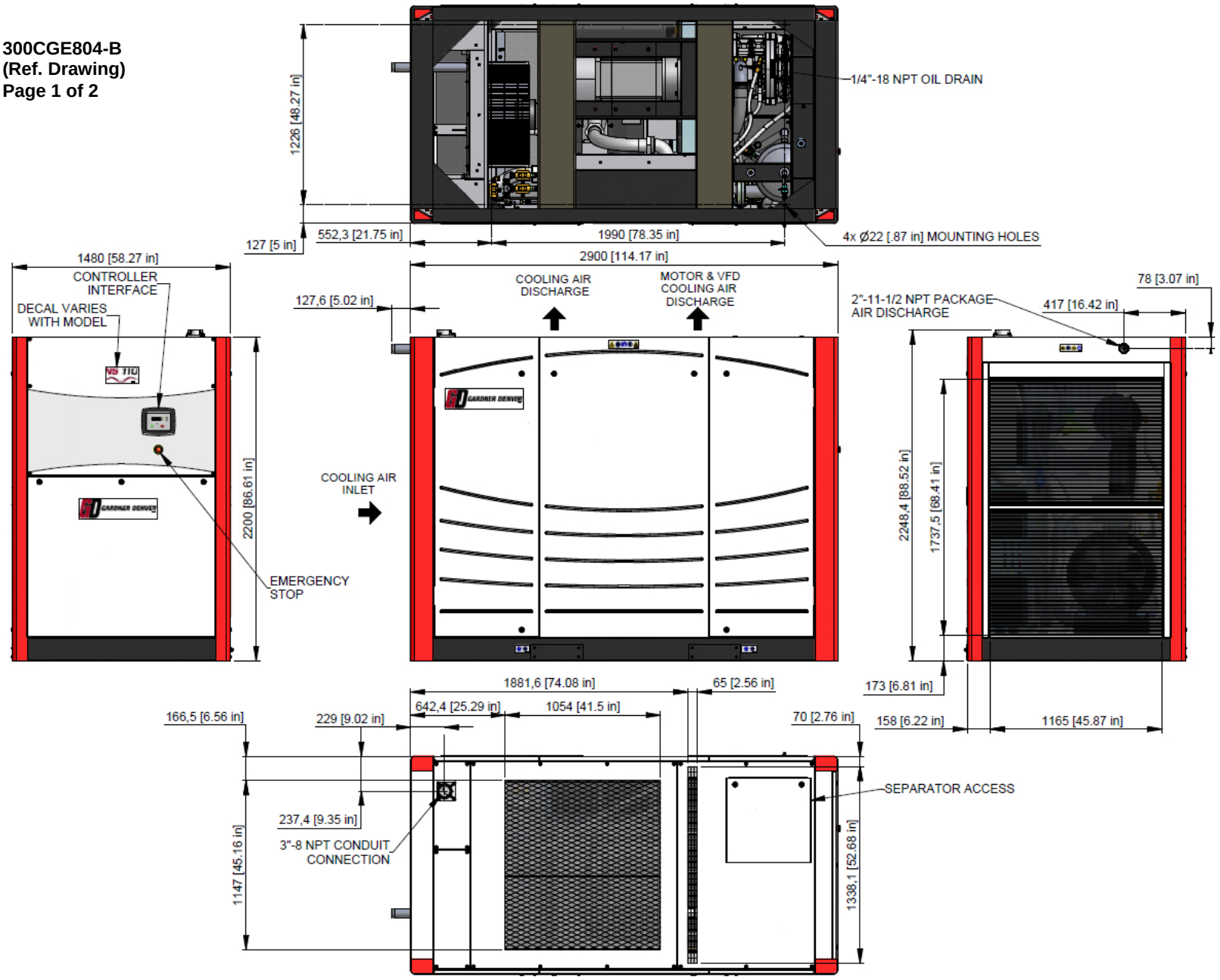


Figure 1-2 – PACKAGE ILLUSTRATION (AIR COOLED) – External Details

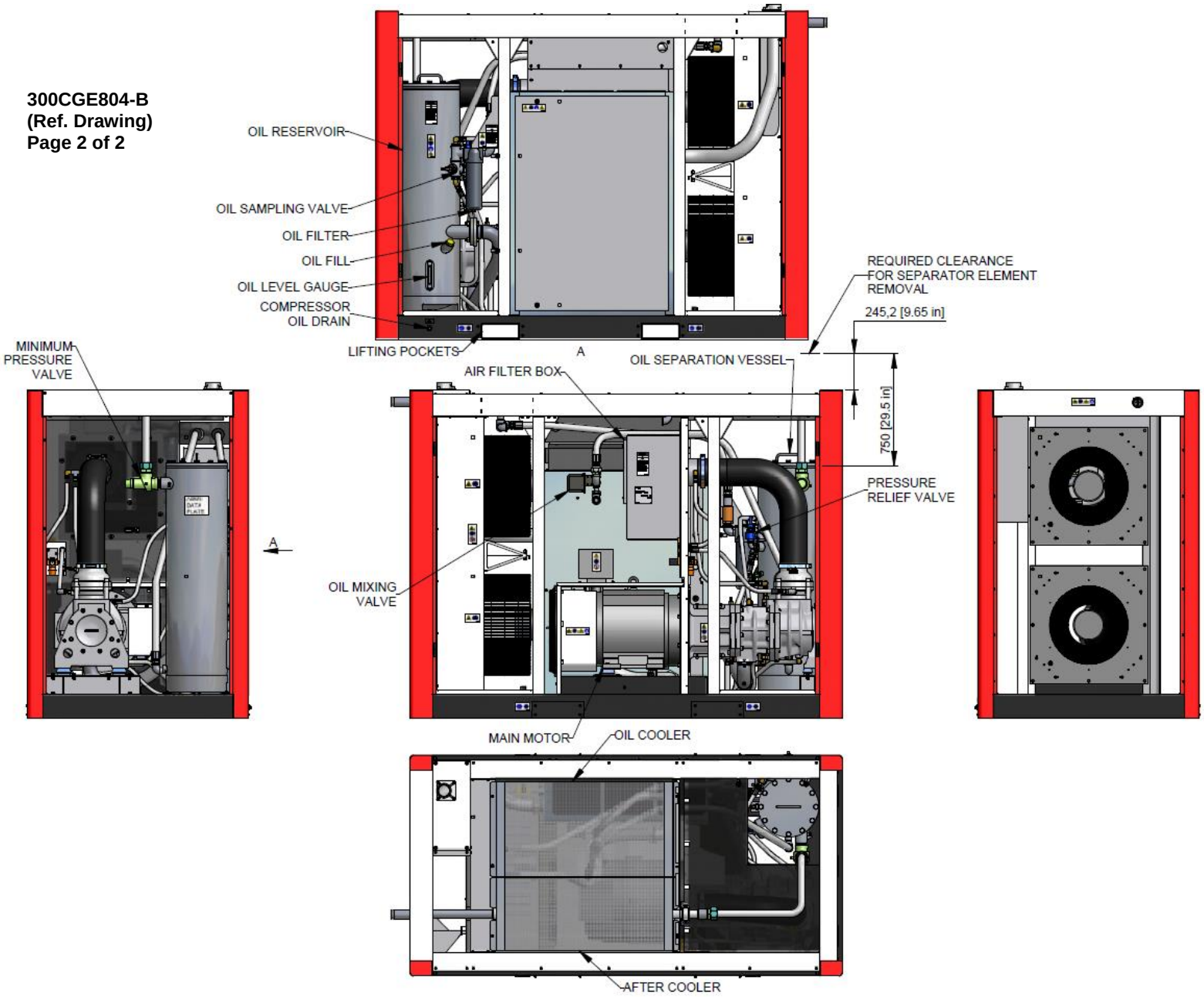


Figure 1-3 – PACKAGE ILLUSTRATION (AIR COOLED) – Internal Details

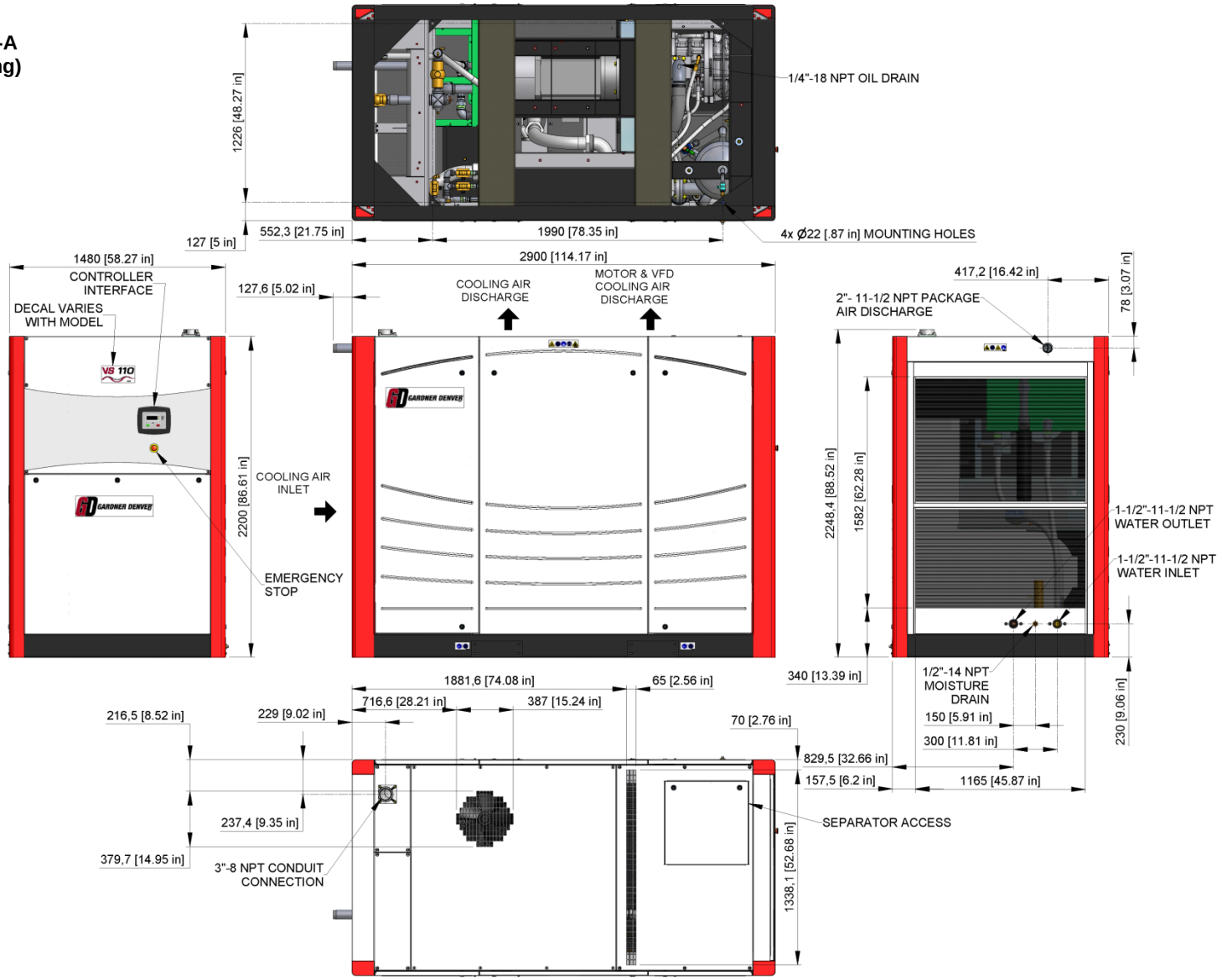


Figure 1-4 – PACKAGE ILLUSTRATION (WATER COOLED) – External Details

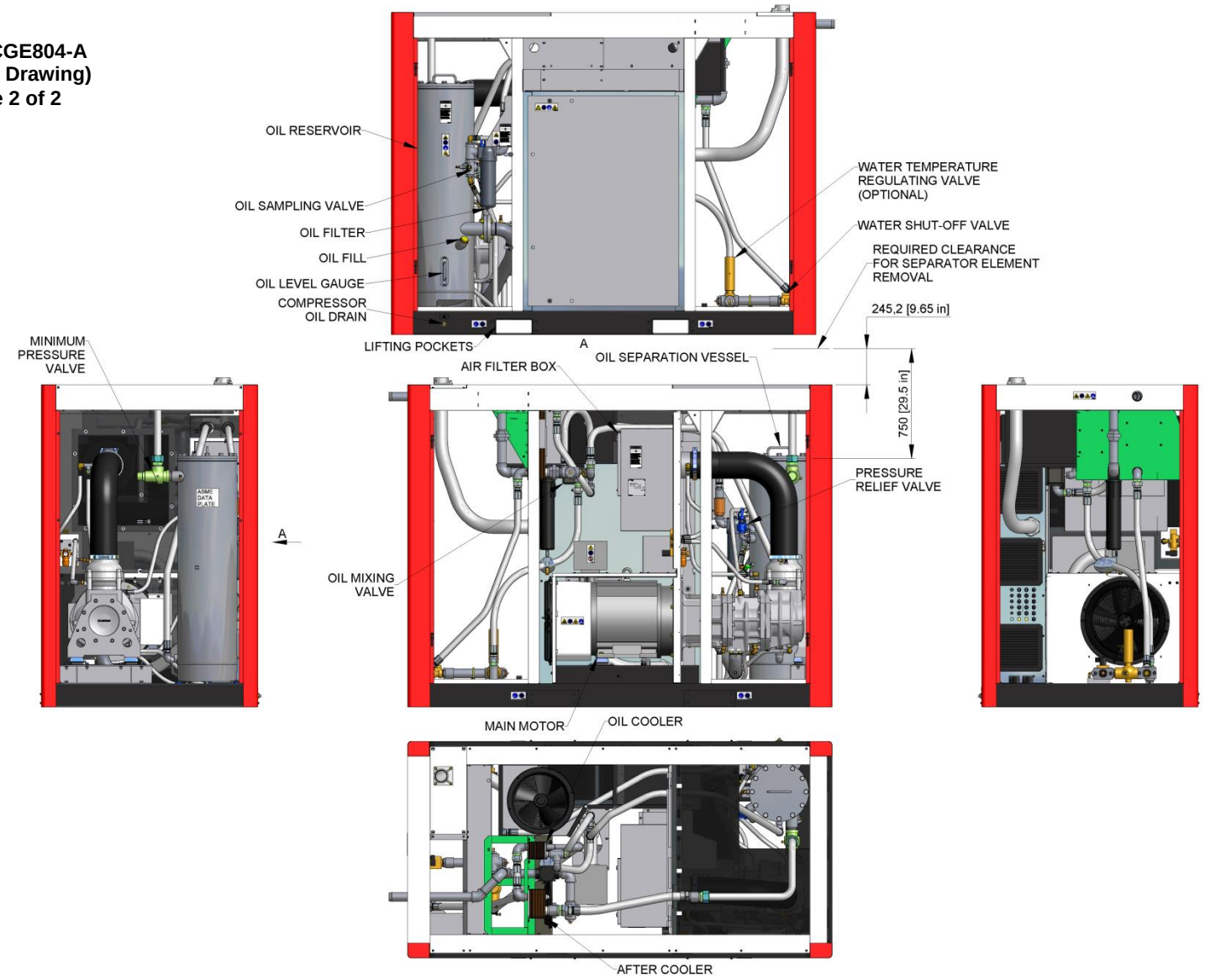


Figure 1-5 – PACKAGE ILLUSTRATION (WATER COOLED) – Internal Details

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.

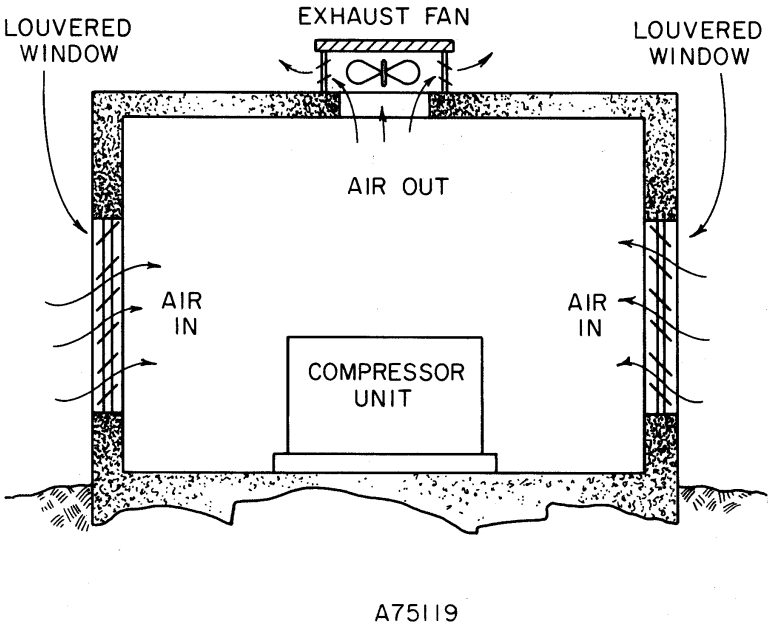


Figure 2-1 – TYPICAL COMPRESSOR ROOM

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 - Separate air and oil coolers are supplied as standard equipment on all air cooled packages. The heat exchangers require sufficient cooling air flow to operate efficiently – please refer to Section 6, Fig 6-1 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, and Figure 1-3, pages 9 and 10 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.

Water Cooled Units – Separate brazed plate-type coolers for air and oil services are supplied on water cooled packages. The heat exchangers require sufficient cooling water flow to operate efficiently – please refer to Section 6 of this manual for detailed instructions on the operation and maintenance of water cooled heat exchangers, including minimum cooling water flow requirements. Refer to Package Illustrations on Figure 1-4 and Figure 1-5, pages 11 and 12, for hardware details.

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 – refer to Section 6 of this manual for enclosure ventilation requirements. Refer to Package Illustrations Figure 1-2 and Figure 1-3, pages 9 and 10, for hardware details.

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 – Sump drain port is located on the lower, right hand corner of the controller-side of the base-frame – see Package Illustrations for further details. 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.

Ducting may be required on air cooled enclosed machines.

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.

OPTIONAL MOISTURE SEPARATOR/TRAP – The unit can be provided with an optional stand-alone combination moisture separator and trap that is field-installed downstream of the aftercooler.

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 – 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 page 13 for 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 both water cooled and 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. The 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 unit's 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 – The blow down valve is vented between the air filter and inlet valve, thus avoiding the need of any external pipe work.

WATER PIPING (Water Cooled Heat Exchanger Models Only) - On machines equipped with water cooled heat exchangers, the water inlet and outlet connections are located on the lower, right-hand area below the intake grill.

It is mandatory that any water cooled unit be installed in a shelter heated to temperatures above freezing (40°F., 5°C).

Please refer to Section 6 of this manual for detailed instructions on the installation, operation and maintenance of the water cooled heat exchangers.

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 – 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 2-2, for a summary of maximum package current consumption values.

460 - 575 VOLT VS-80 and VS-110 MINIMUM COPPER SUPPLY WIRE RECOMMENDATIONS

460 Volt					
APEX VS 80 through VS 110 Minimum Copper Supply Wire Recommendations					
Model	**Minimum Supply Conductor Ampacity**	**Minimum 75°C Copper Wire Sized @ 30°C**	**Minimum 75°C Copper Wire Sized @ 40°C**	**Minimum 75°C Copper Wire Sized @ 45°C**	**Notes**
VS 80	202	4/0	4/0	250	
VS 110	265	300 or 2/0 (2)	350 or 3/0 (2)	400 or 4/0 (2)	[1]
575 Volt					
VS 80	123	1	1/0	1/0	
VS 110	176	3/0	3/0	4/0	

Notes: **Wire sizes are per Table 310.15(B)(16) in the National Electrical Code (NEC)**

[1] 2/0, 3/0, and 4/0 wires sized with derate for two parallel sets of conductors in a single conduit. [2]Wires sized with derate for two parallel sets of conductors in a single conduit.

[3] Wires sized for two parallel sets of conductors in two conduits (one set in each conduit).

The appropriate installation and use of 75ºC 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 – 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 – see Figure 2-3, page 18.
- Line has switched Power Factor correction capacitors.
- Existing line reactor not properly sized – see Figure 2-3, page 18.
- Other large loads on the same power feed as the compressor.

GD Model	Volts	VFD HP RATINGS	Max KVA	3% Line Reactor GD Part Number
VS80	400/480	107	1000	90500142
VS80	575	107	1000	90500141
VS110	400/480	147	1500	90500144
VS110	575	147	1000	90500142

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.

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 75 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 – with unit stopped, the sight gauge should be full or nearly so. Add oil, with unit stopped and depressurized, only if the sight gauge does not show an oil level during steady, warm operation. Do not mix different type oils. When the unit is shipped, it is filled with Gardner Denver AEON™ 9000SP lubricating coolant, suitable for the first 8000 hours under normal operating conditions. See Section 5 for more details on the compressor oil system.

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 1.5 gallons 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 they are clean and the assembly is sealed tight. Refer to Section 7, for complete servicing instructions. Be sure the inlet line is clean and sealed tight.

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

4. **Piping** - Refer to Section 2, “Installation,” and 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 and Figure 4-4, pages 31 and35, for general wiring diagrams and Section 2, for installation instructions.

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 “JOG MODE” to bump compressor motor. Proper rotation shall be counterclockwise when facing the compressor shaft end.

   - Use controller “JOG MODE” to bump heat exchanger cooling fan. Proper rotation shall be clockwise when facing intake side of fan.

   - Use controller “JOG MODE” to bump main motor cooling fan. Proper rotation is achieved when cooling air is discharged over the main motor body or when fan rotation matches that indicated by the arrow decal affixed to the fan hub, as viewed via the serrated cutout on the fan shroud. See Figure 3-1 for details.

- In case the main motor or any of the axial fan/motor combinations are replaced or disconnected from the package wiring system, their rotation must be verified. If the incorrect rotation is noted on any one electric motor, take the following steps to make the necessary correction:

    - Disconnect, lockout and tagout power supply to the compressor package.
    - Locate, within the electrical enclosure, the three (3) wires feeding power to the motor in question.
    - Loosen, reverse, and re-fasten the connections of any two (2) of the wires.
    - Re-energize compressor package and recheck rotation.

⚠ 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.

⚠ CAUTION

The radial fan/motor combinations are integrated, and the incoming electrical power connections do not affect their rotation. If reverse rotation is noted for either radial fan, please notify Gardner Denver for corrective action.

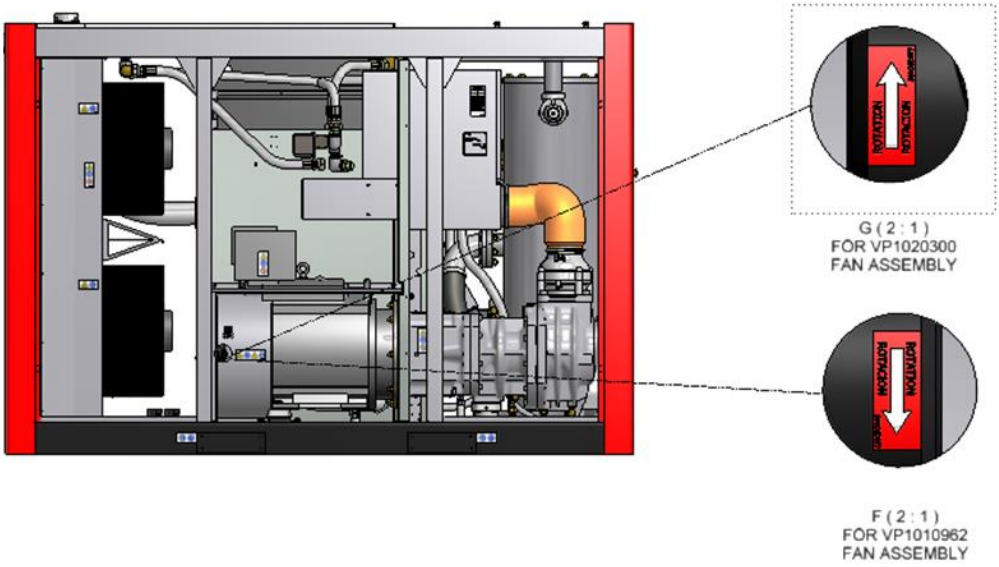


Figure 3- 1 – MOTOR FAN ROTATION CHECK

8. **System Pressure** – For your convenience, the following excerpt from the Controller Manual 13-17-600 is presented to assist in programming the target 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 “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 ENTER button to save the new value. Pressing the Stop/Reset 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 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 fitted with water cooled heat exchangers, fully open water inlet valve(s). 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 "STOP/RESET" button to clear any conditions (e.g., "Loss of Power" when electrical system was energized) and start the unit by pushing the green "START" button. Since the unit is equipped with a minimum pressure valve (80 psig, 5.5 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.

DAILY CHECK - Refer to Section 14; page 76 "Maintenance Schedule".

STOPPING THE UNIT - Press "STOP-RESET" button. The oil reservoir will automatically blow down, as the main motor is de-energized. If the unit is a water cooled heat exchanger type, close any manual water inlet valves after unit has stopped. 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

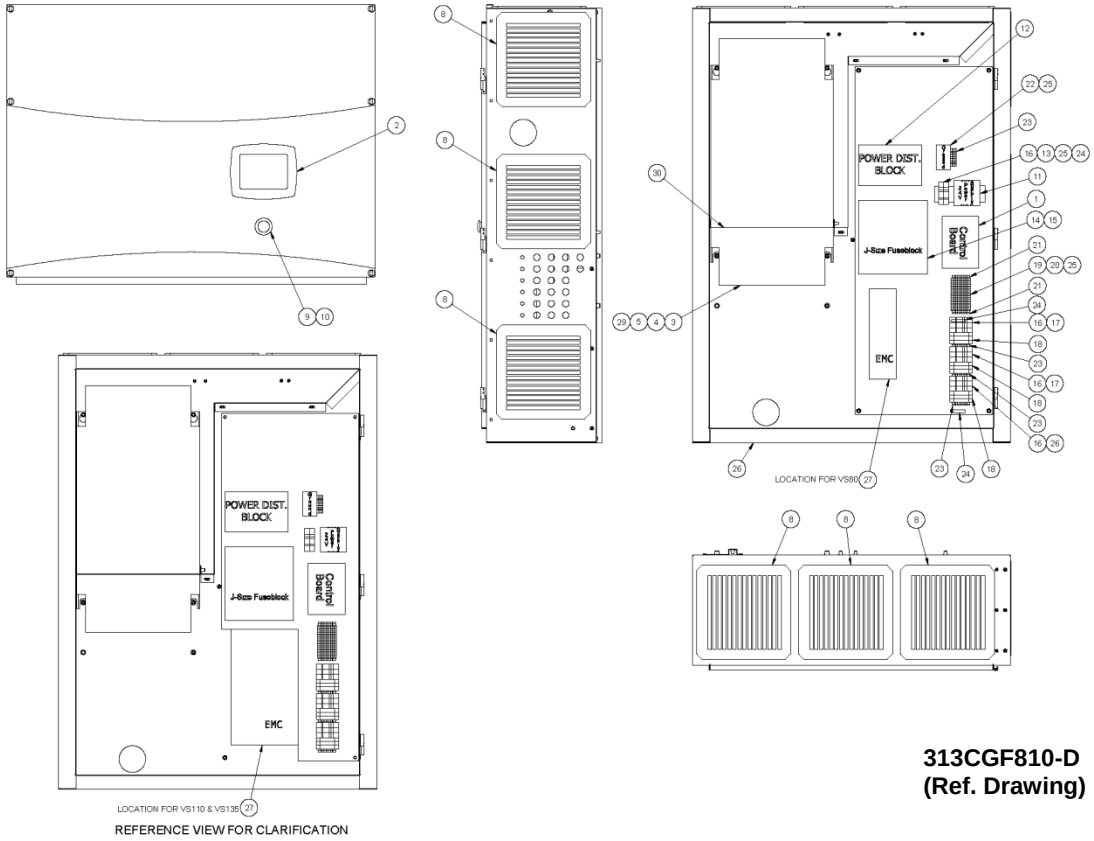
Press the red "STOP/RESET" button to clear any conditions (e.g., "Loss of Power" when electrical system was energized) and start the unit by pushing the green "START" button. Since the unit is equipped with a minimum pressure (80 psig, 5.5 bar) valve, no special procedure to maintain minimum reservoir pressure is required.

Main VFD and Motor – 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 customer's demand in real time and in a step-less fashion. The operational logic which governs 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 TEAO 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.



313CGF810-D
(Ref. Drawing)

Ref. No.	Name of Part
1	AirSmart CONTROL
2	AirSmart MODULE
3	DRIVE GROUP
4	SPLITTER CABLE
5	PLUG KIT
7	CONTROL BOX
8	BLACK GRILLE FILTER
9	OPERATOR
10	CONTACT BLOCK
11	POWER SUPPLY
12	POWER DISTRIBUTION BLOCK
13	FUSE
14	FUSE HOLDER
15	FUSE
16	FUSE BLOCK
17	FUSE
18	RELAY
19	TERMINAL BLOCK
20	TERMINAL BLOCK
21	GROUND BLOCK
22	GROUND BLOCK
23	GROUND BLOCK
24	TERMINAL BLOCK
25	DIN RAIL
26	FUSE
27	FILTER
29	NUT
30	BAFFLE

Figure 4- 1 – ELECTRICAL ENCLOSURE HARDWARE

Heat Exchanger Fan/Motor and Starter - Two (2) radial fan/motor assemblies provide cooling air for the heat exchangers and electronics box. These integrated units enable the AirSmart controller to match the heat exchanger coolant needs in proportion to the package load level (specifically, the speed of the compressor provides the proportioning control signal), thus saving fan power at reduced load operation.

The fans/motor combinations are designed to operate with 3ph-60Hz-460Vac electrical power – the necessary electrical wiring has been provided. For 3ph-60Hz-575Vac electrical power, step-down transformers are included, within the electrical enclosure, to supply the proper voltage to the fan/motor combinations.

Main Motor Ventilation Fan/Motor and Starter – 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 – the necessary electrical wiring has been provided.

Power Supply (24 VDC) - 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 30.

Inlet (Poppet) Valve (B) – This device is located at the intake flange of the compressor. During compressor operation, the underside of the poppet is vented to atmosphere via a 3-way solenoid valve, allowing the poppet to fall (open) and feed fresh air to the compressor inlet. During stopped operation modes (e.g., commanded from keypad or initiated by protective shutdown), the 3-way solenoid valve feeds an air signal to the underside of the poppet, forcing it upward (close) and block off the compressor intake. This prevents trapped air and oil within the compressor from exiting through the inlet filter. See SECTION 10, page 70 for further details.

Minimum Discharge Pressure/Check Valve (G) – This device maintains a minimum pressure (80psig, 5.5 bar) 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 customer's piping back into the compressor package when the compressor is not running. See SECTION 9, page 68 for further details.

The spring-loaded piston does not allow the discharge of compressed air from the air/oil reservoir until the compressor builds up reservoir pressure to 80 psig. Beyond this pressure level, the valve remains fully open.

Oil Mixing Valve (L) – 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 47 for further details.

Pressure Relief Valve (Y) – This device protects the pressure containing components of the compressor package against high pressure exceeding 200 psig. See SECTION 11, page 72 for further details.

Pressure Regulator (BB) – This device supplies the pneumatic signal to actuate the inlet (poppet) valve (B). The regulator is adjusted to achieve an opening pressure of 80psig.

Inlet Feed Valve (C) - This (three-way solenoid) device supplies/vents the required pneumatic signal to actuate the inlet poppet valve. When energized, it vents the air signal from the inlet poppet valve, allowing it to open and when de-energized, it supplies the air signal to the inlet poppet valve, forcing it closed. Note that this pilot operated valve requires 37 to 40 psig pressure, at its intake port, to achieve its normally open position (de-energized).

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., compressors are running or they have 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 “STOP” 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.

Oil Flow Control Valve (U) – This (normally open, two-way solenoid) device reduces the flow of injection oil the compressor. Valve U is normally held open (de-energized) and is closed (energized) to reduce the flow of injection oil to raise the discharge temperature of the compressor during operational conditions such as cold ambient temperature or low package load levels.

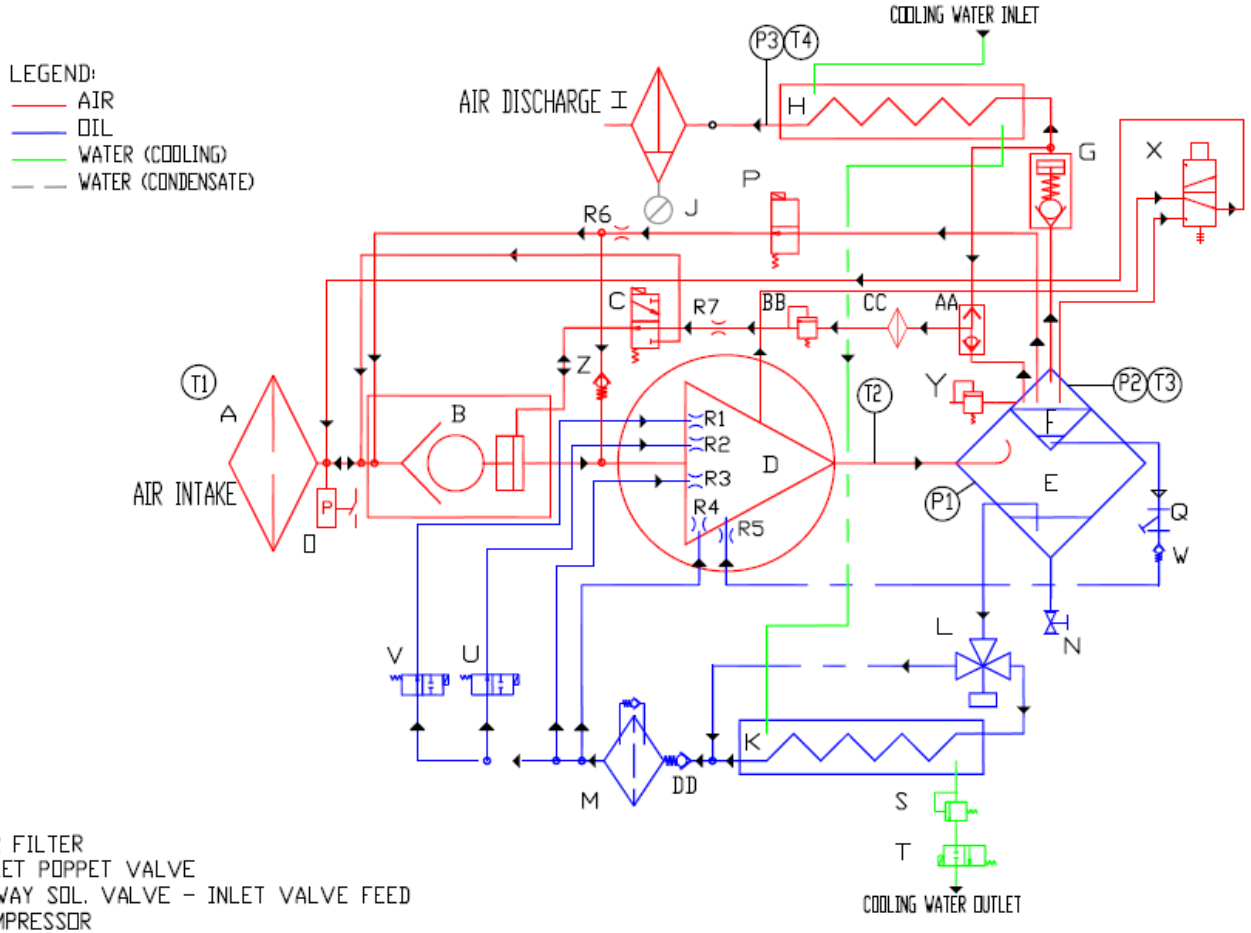
Oil Flow Control Valve (V) – This (normally open, two-way solenoid) device increases the flow of injection oil the compressor. Valve V is normally held closed (energized) and is open (de-energized) to increase the flow of injection oil during the start-up phase of package operation, thus allowing faster build-up of compressed air in the sump.

Check Valve – Auxiliary Purge (Z) – This device supplies air to the compressor inlet during operation which requires the inlet valve to remain closed (e.g., unloaded running).

Air Filter Vacuum Switch (O) - This device monitors the vacuum pressure at the discharge side of the inlet air filter. When air filter vacuum reaches 30” of water column, it triggers an air filter service notification via the AirSmart controller.

Shuttle Valve (AA) – This device allows fast operation of the Inlet Feed Valve (C) even when the sump is depressurized.

Shaft Seal Drain Valve (X) – This device allows the collection of oil bypassing the compressor shaft seal, as well as its return into the compressor inlet. It is a 3-way solenoid valve which in its normally closed state (de-energized), it allows the collection of shaft bypassed oil in a nylon tube connected to its exhaust port. In its open state (energized), the valve drains the collection tube with a short blast of compressed (air tapped from the dry-side of the oil sump) and routed to the compressor inlet. The valve is powered by the AirSmart controller, via its built-in “Drain Close/Open Intervals” logic usually dedicated to actuate the condensate drain valve on the optional dryer modules. One (2) sec [open] interval and one (30) minute [close] intervals are typically adequate to collect and drain shaft bypass oil - See AirSmart controller manual 13-17-600 for further instructions.



300CGE797-A
(Ref. Drawing)

ORIFICE SIZE DETAIL
R1 - INTERNAL TO AIREND
R2 - INTERNAL TO AIREND
R3 - INTERNAL TO AIREND
R4 - INTERNAL TO AIREND
R5 - ø.031
R6 - ø.156
R7 - ø.100

A AIR FILTER
B INLET POPPET VALVE
C 3-WAY SOL. VALVE - INLET VALVE FEED
D COMPRESSOR
E OIL/AIR SEPARATION VESSEL
F OIL/AIR COALESCING ELEMENTS
G MINIMUM PRESSURE VALVE
H AFTERCOOLER
I WATER/AIR SEPARATOR (OPTIONAL)
J WATER DRAIN VALVE (OPTIONAL)
K OIL COOLER
L OIL MIXING VALVE (ELECTRONIC)
M OIL FILTER
N OIL DRAIN VALVE
O VACUUM SWITCH
P BLOWDOWN VALVE
Q SCAVENGE RETURN STRAINER

R ORIFICE - SEE TABLE FOR SIZES
S THERMOSTATIC FLOW REGULATOR
T FLOW STOP SOLENOID VALVE
U OIL FLOW DECREASE SOLENOID VALVE
V OIL FLOW INCREASE SOLENOID VALVE
W SCAVENGE RETURN CHECK VALVE
X SHAFT SEAL DRAIN VALVE
Y PRESSURE RELIEF VALVE
Z PURGE CHECK VALVE
AA SHUTTLE VALVE
BB PRESSURE REGULATOR
CC INLINE FILTER
DD OIL FLOW CHECK VALVE

P1 RESERVOIR PRESSURE TRANSDUCER - WET SIDE
P2 RESERVOIR PRESSURE TRANSDUCER - DRY SIDE
P3 SYSTEM PRESSURE TRANSDUCER
T1 INLET TEMPERATURE TRANSDUCER
T2 DISCHARGE TEMPERATURE TRANSDUCER
T3 DRY-SIDE TEMPERATURE TRANSDUCER
T4 SYSTEM TEMPERATURE TRANSDUCER

Figure 4- 2 – PIPING AND INSTRUMENTATION ILLUSTRATION

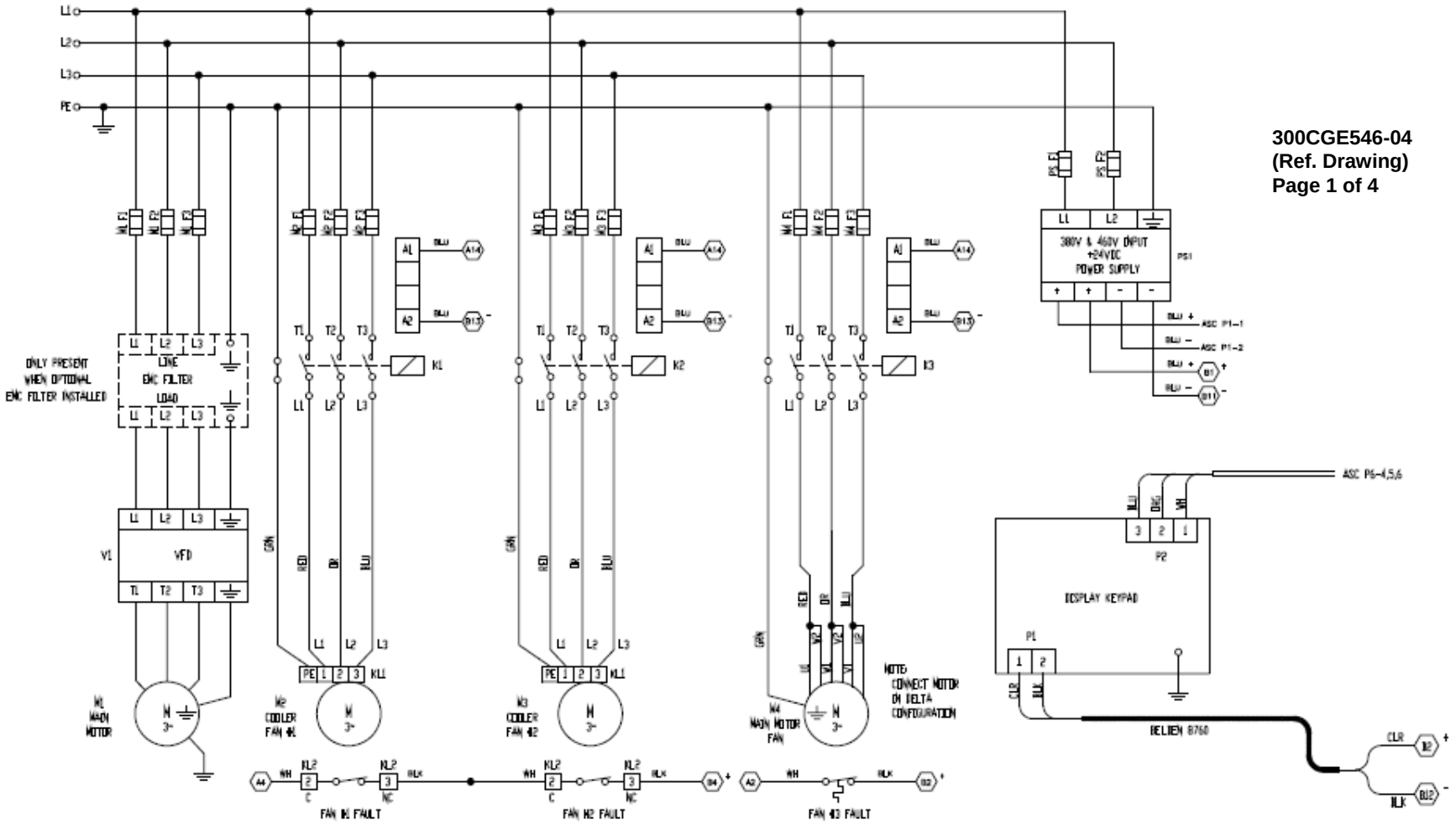
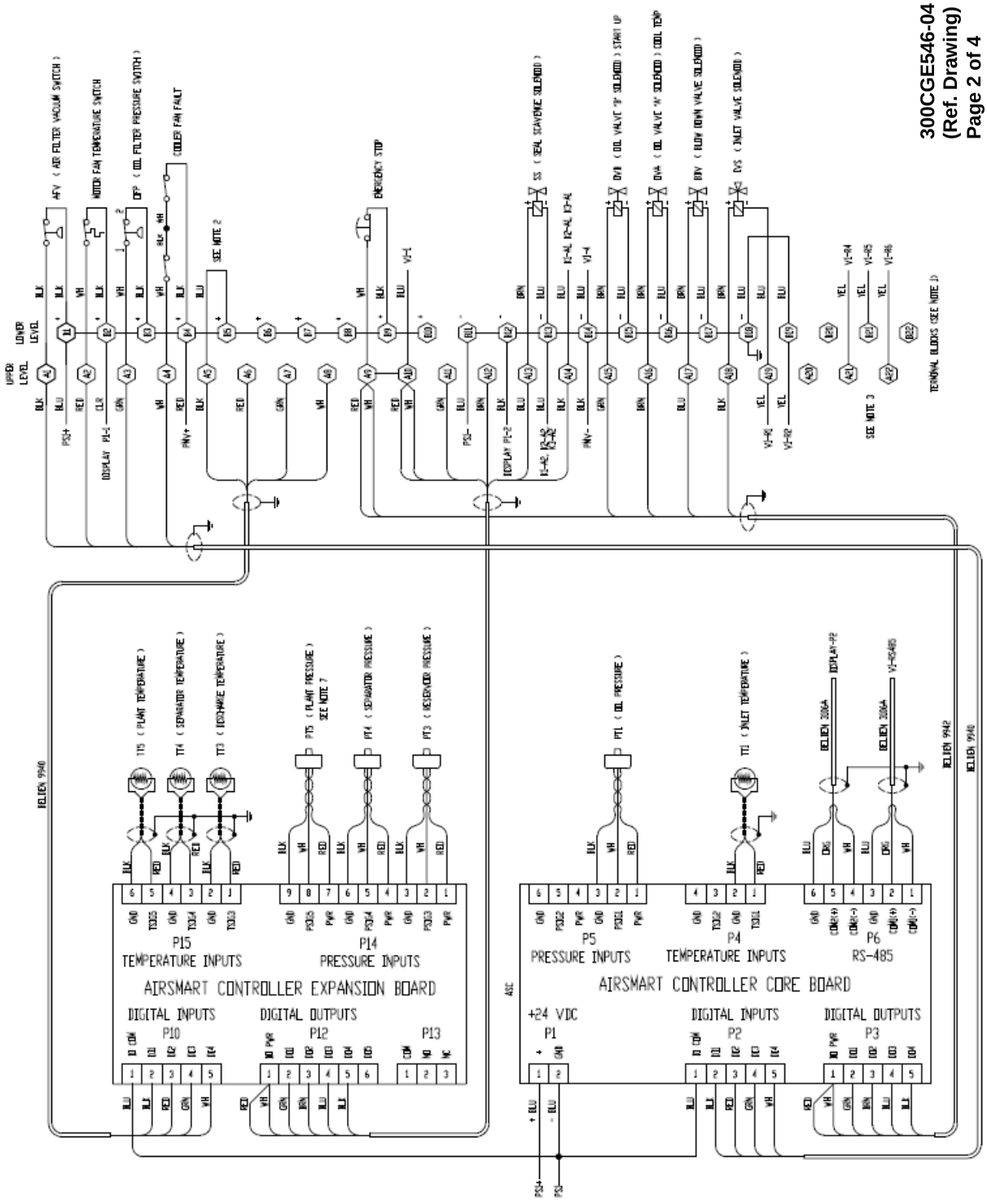
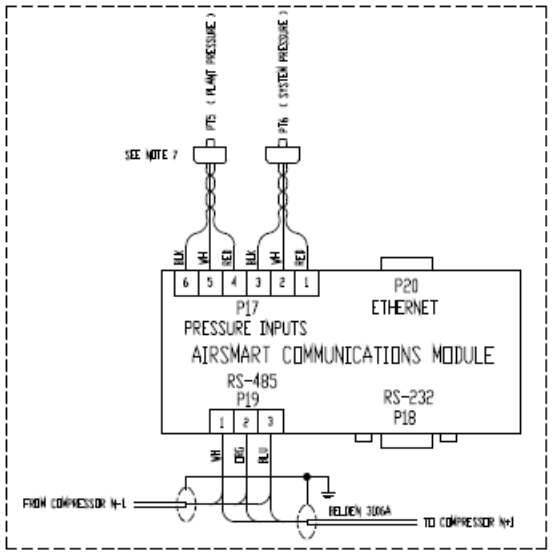
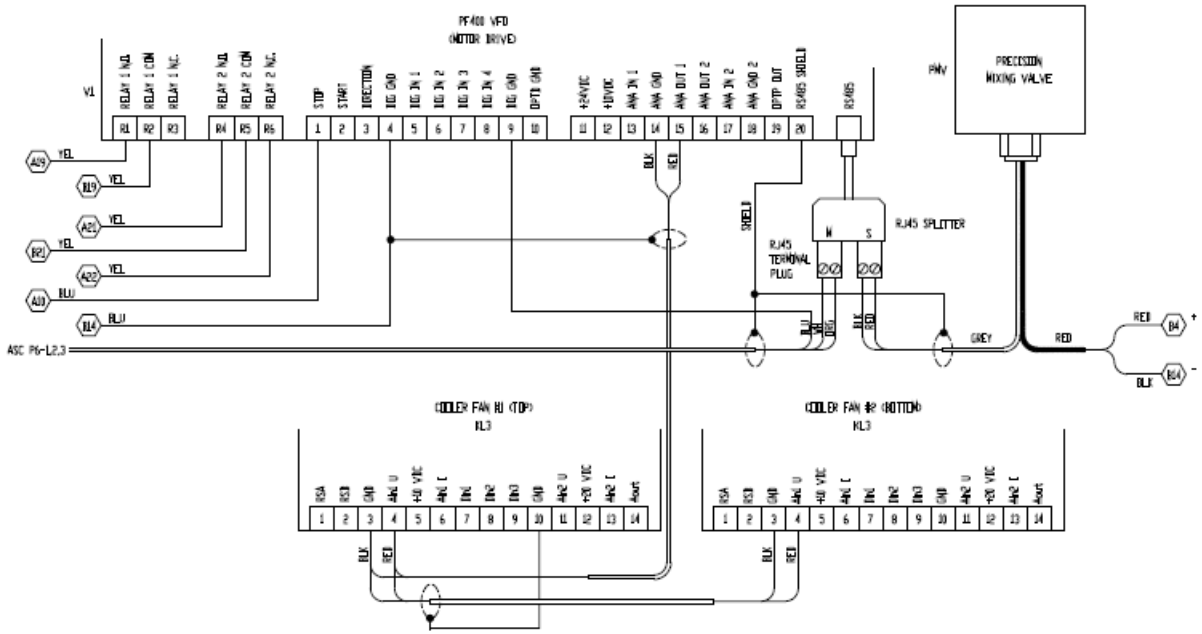


Figure 4- 3 – WIRING DIAGRAM – (AIR COOLED) Single-Stage, VS80/110, 460vac


AFV (AIR FILTER VACUUM SWITCH)
MOTOR FAN TEMPERATURE SWITCH
OFP (OIL FILTER PRESSURE SWITCH)
COOLER FAN FAULT
SEE NOTE 2
EMERGENCY STOP
SS (SERVICE SOLENOID)
DV1 (OIL VALVE "B" SOLENOID) START UP
DV4 (OIL VALVE "A" SOLENOID) COOL TEMP
DBV (BLOW DOWN VALVE SOLENOID)
DVS (INLET VALVE SOLENOID)
TERMINAL BLOCKS (SEE NOTE 1)
SEE NOTE 3
HELIXEN 9940
HELIXEN 9942
TT5 (PLANT TEMPERATURE)
TT4 (SEPARATOR TEMPERATURE)
TT3 (DISCHARGE TEMPERATURE)
PT5 (PLANT PRESSURE) SEE NOTE 7
PT4 (SEPARATOR PRESSURE)
PT3 (RESERVOIR PRESSURE)
PT1 (OIL PRESSURE)
TT1 (INLET TEMPERATURE)
HELIXEN 2004
DISPLAY-P2
V1-RS485
P15
TEMPERATURE INPUTS
P14
PRESSURE INPUTS
AIRSMART CONTROLLER EXPANSION BOARD
DIGITAL INPUTS
P10
DIGITAL OUTPUTS
P12
P13
P5
PRESSURE INPUTS
P4
TEMPERATURE INPUTS
P6
RS-485
AIRSMART CONTROLLER CORE BOARD
+24 VDC
P1
DIGITAL INPUTS
P2
DIGITAL OUTPUTS
P3



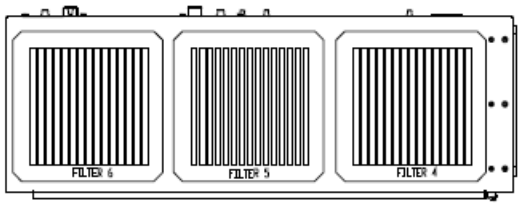
ONLY PRESENT WHEN OPTIONAL COMMUNICATIONS MODULE INSTALLED



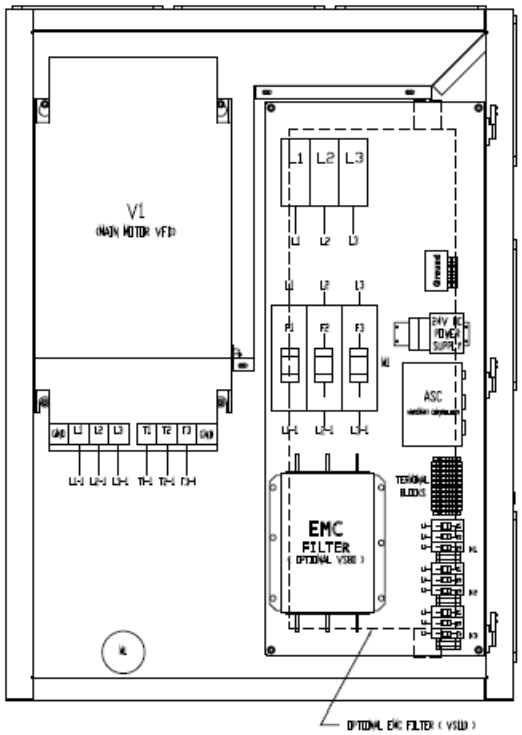
LEGEND

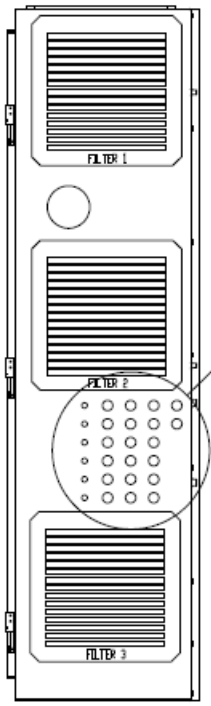
- PT1 = OIL PRESSURE TRANSDUCER
- PT3 = RESERVOIR PRESSURE TRANSDUCER
- PT4 = SEPARATOR PRESSURE TRANSDUCER
- PT5 = PLANT PRESSURE TRANSDUCER
- PT6 = SYSTEM PRESSURE TRANSDUCER
- TT1 = INLET TEMPERATURE THERMISTOR
- TT3 = DISCHARGE TEMPERATURE THERMISTOR
- TT4 = SEPARATOR TEMPERATURE THERMISTOR
- TT5 = PLANT TEMPERATURE THERMISTOR
- IVS = INLET VALVE SOLENOID
- BDV = BLOW DOWN VALVE SOLENOID
- PMV = PRECISION MIXING VALVE
- AFV = AIR FILTER VACUUM SWITCH
- ASC = AIRSMART CONTROLLER
- K1 = COOLER FAN CONTACTOR #1
- K2 = COOLER FAN CONTACTOR #2
- K3 = MOTOR FAN CONTACTOR
- OVA = OIL FLOW SOLENOID VALVE A
- OVB = OIL FLOW SOLENOID VALVE B
- OFP = OIL FILTER PRESSURE SWITCH
- SS = SEAL SCAVENGE SOLENOID VALVE
- V1 = VARIABLE FREQUENCY DRIVE
- M1 = MAIN MOTOR
- M2 = COOLER FAN #1
- M3 = COOLER FAN #2
- M4 = MAIN MOTOR FAN
- PS1 = 24V DC POWER SUPPLY
- N+1 = NEXT SEQUENCED COMPRESSOR
- N-1 = PREVIOUS SEQUENCED COMPRESSOR

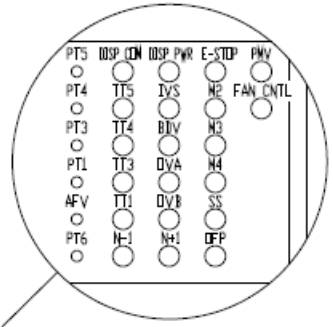
300CGE546-04
(Ref. Drawing)
Page 3 of 4



EMERGENCY STOP AND DISPLAY KEYPAD MOUNTED INTO ENCLOSURE PANEL







NOTES:

1. SHORTING JUMPERS INSTALLED ON TERMINALS BLOCKS AS FOLLOWS
   +24VDC - B1, B2, B3, B4, B5, B6, B7, B8, B9, B10
   DC GND - B11, B12, B13, B14, B15, B16, B17, B18
   E-STOP QUALIFIED +24VDC - A9, A10
2. FOR CONTROL BY REMOTE CONTACT, REMOVE JUMPER BETWEEN TERMINALS A5 AND B5 AND CONNECT N.C. SWITCH
3. ADVISORY/SHUTDOWN ALARM CONTACT BETWEEN A21 AND B21 (N.O.), A22 AND B21 (N.C.). - CONTACT RATING N.O., 3A @ 30VDC, 3A @ 240VAC
4. THE MAIN BACK PLATE MUST BE BONDED TO CONTROL BOX USING 4 AWG (MIN) BONDING STRAP.
5. THE CONTROLLER BACK PLATE MUST BE BONDED TO MAIN BACK PLATE USING 4 AWG (MIN) BONDING STRAP.
6. THE CONTROL BOX DOORS MUST BE BONDED TO CONTROL BOX USING 10 AWG (MIN) BONDING STRAP.
7. WHEN COMMUNICATIONS MODULE IS INSTALLED AND PT6 IS INSTALLED, CONNECT PT5 TO P17, PINS 4-6.

300CGE546-04
(Ref. Drawing)
Page 4 of 4

301CGE546-B
(Ref. Drawing)
Page 1 of 4

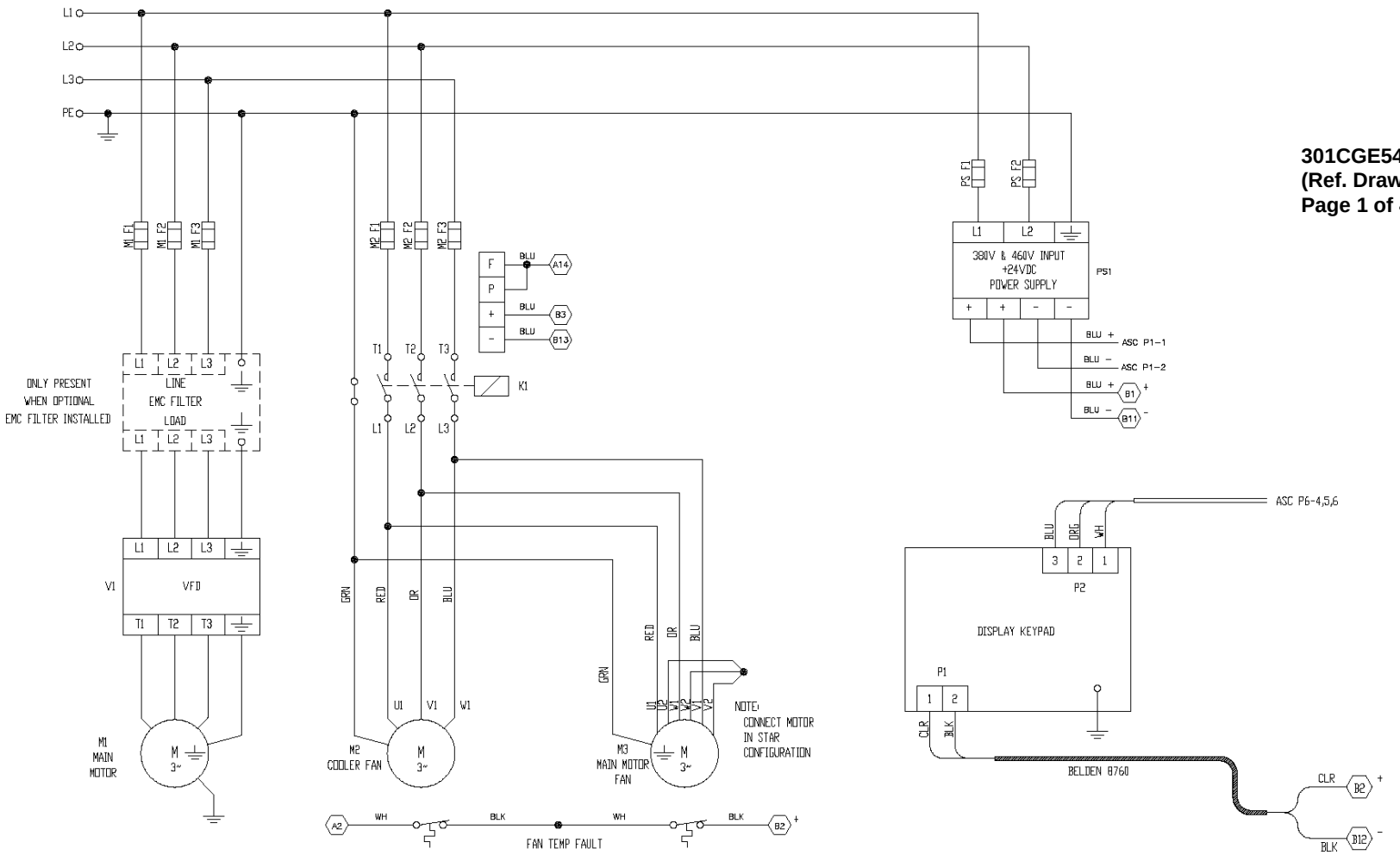
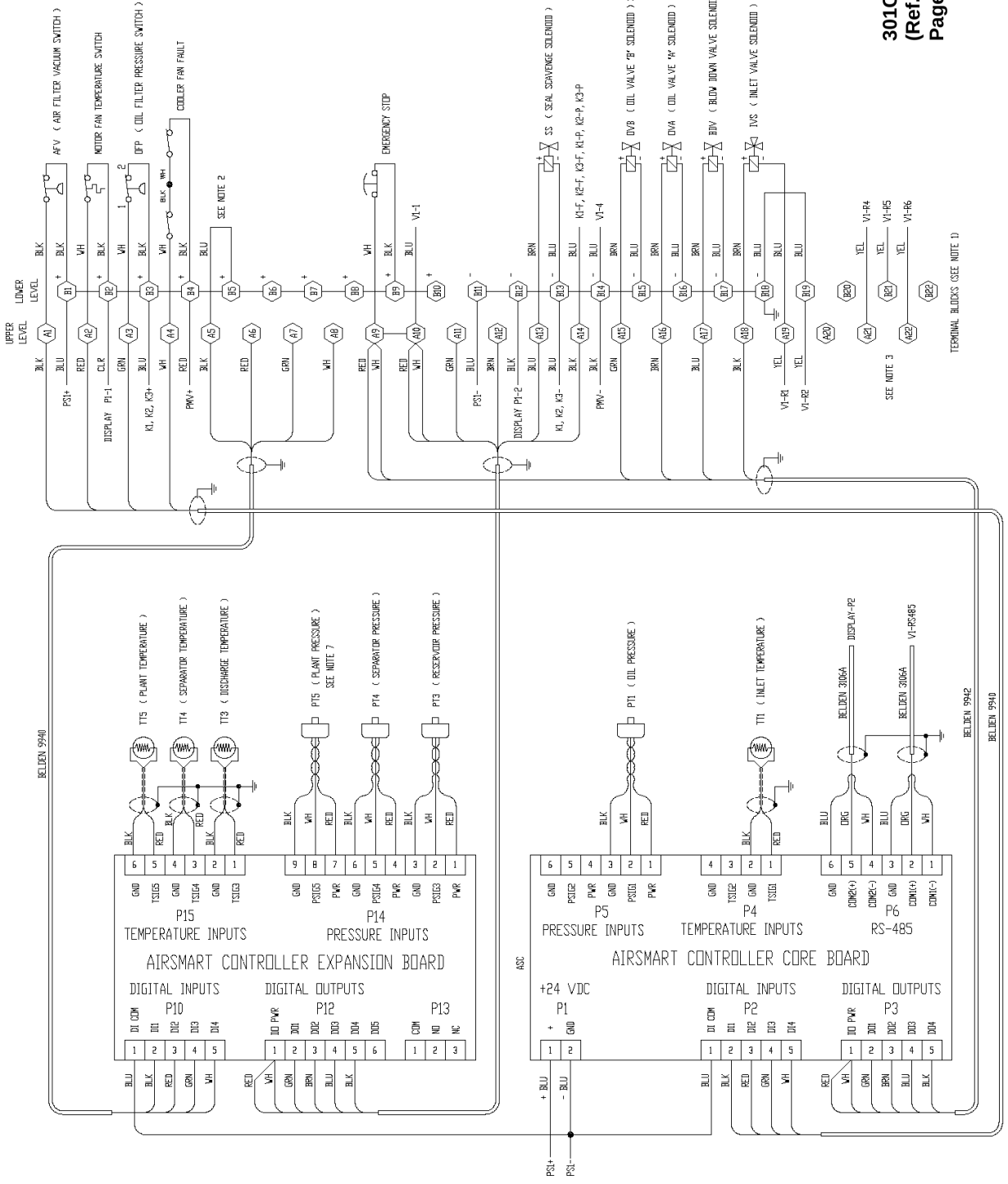
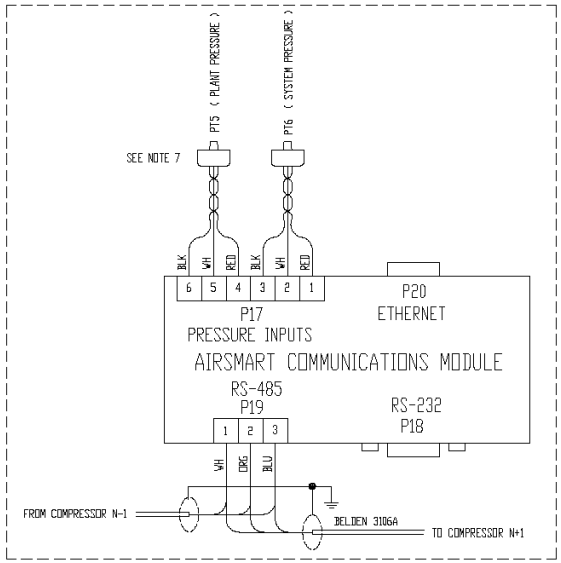


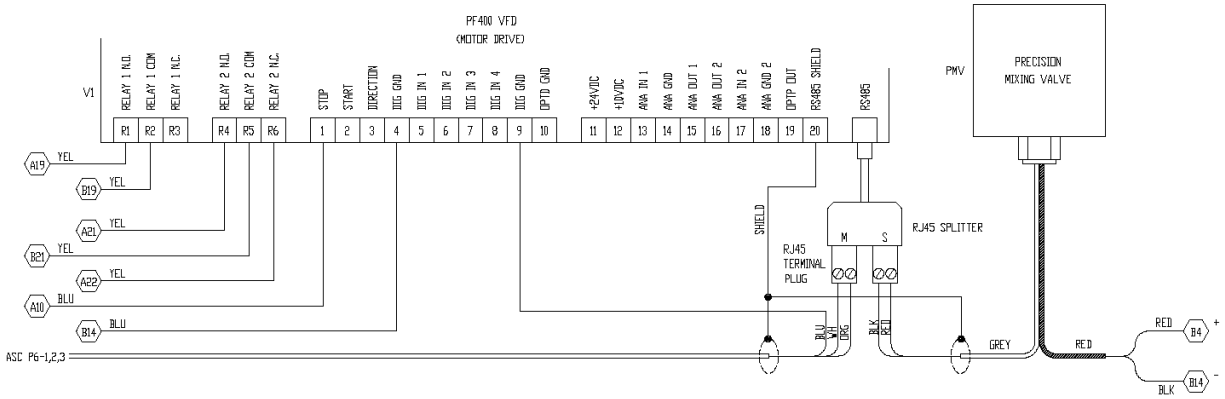
Figure 4- 4 – WIRING DIAGRAM – (WATER COOLED) Single-Stage, VS80/110, 460Vac


301CGE546-B
(Ref. Drawing)
Page 2 of 4
AIRSMART CONTROLLER EXPANSION BOARD
AIRSMART CONTROLLER CORE BOARD
P15 TEMPERATURE INPUTS
P14 PRESSURE INPUTS
P5 PRESSURE INPUTS
P4 TEMPERATURE INPUTS
P6 RS-485
DIGITAL INPUTS
DIGITAL OUTPUTS
+24 VDC
AFV (AIR FILTER VACUUM SWITCH)
MOTOR FAN TEMPERATURE SWITCH
DFP (OIL FILTER PRESSURE SWITCH)
COOLER FAN FAULT
EMERGENCY STOP
SS (SEAL SCAVENGE SOLENOID)
DVB (OIL VALVE "B" SOLENOID) START UP
DVA (OIL VALVE "A" SOLENOID) COOL TEMP
BDV (BLOW DOWN VALVE SOLENOID)
IVS (INLET VALVE SOLENOID)
TT5 (PLANT TEMPERATURE)
TT4 (SEPARATOR TEMPERATURE)
TT3 (DISCHARGE TEMPERATURE)
PT5 (PLANT PRESSURE)
SEE NOTE 7
PT4 (SEPARATOR PRESSURE)
PT3 (RESERVOIR PRESSURE)
PT1 (OIL PRESSURE)
TT1 (INLET TEMPERATURE)
BELDEN 3106A
DISPLAY-P2
V1-RS485
BELDEN 9940
BELDEN 9942
SEE NOTE 2
SEE NOTE 3
TERMINAL BLOCKS (SEE NOTE 1)

301CGE546-B
(Ref. Drawing)
Page 3 of 4

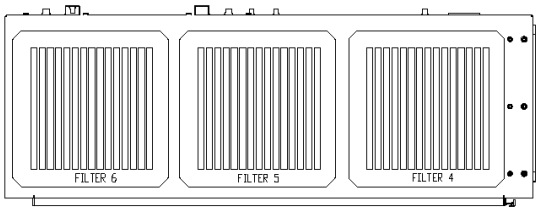


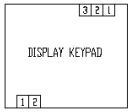
ONLY PRESENT WHEN OPTIONAL COMMUNICATIONS MODULE INSTALLED

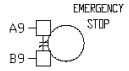


LEGEND

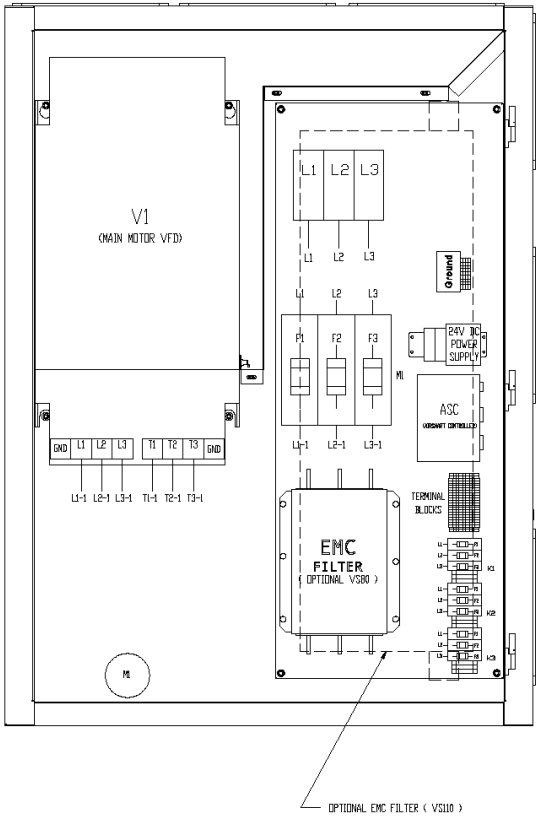
PT1 = OIL PRESSURE TRANSDUCER
PT3 = RESERVOIR PRESSURE TRANSDUCER
PT4 = SEPARATOR PRESSURE TRANSDUCER
PT5 = PLANT PRESSURE TRANSDUCER
PT6 = SYSTEM PRESSURE TRANSDUCER
TT1 = INLET TEMPERATURE THERMISTOR
TT3 = DISCHARGE TEMPERATURE THERMISTOR
TT4 = SEPARATOR TEMPERATURE THERMISTOR
TT5 = PLANT TEMPERATURE THERMISTOR
IVS = INLET VALVE SOLENOID
BDV = BLOW DOWN VALVE SOLENOID
PMV = PRECISION MIXING VALVE
AFV = AIR FILTER VACUUM SWITCH
ASC = AIRSMART CONTROLLER
K1 = COOLER FAN CONTACTOR
OVA = OIL FLOW SOLENOID VALVE A
OVB = OIL FLOW SOLENOID VALVE B
OFP = OIL FILTER PRESSURE SWITCH
SS = SEAL SCAVENGE SOLENOID VALVE
WSV = WATER STOP VALVE SOLENOID
V1 = VARIABLE FREQUENCY DRIVE
M1 = MAIN MOTOR
M2 = COOLER FAN
M3 = MAIN MOTOR FAN
PS1 = 24V DC POWER SUPPLY
N+1 = NEXT SEQUENCED COMPRESSOR
N-1 = PREVIOUS SEQUENCED COMPRESSOR

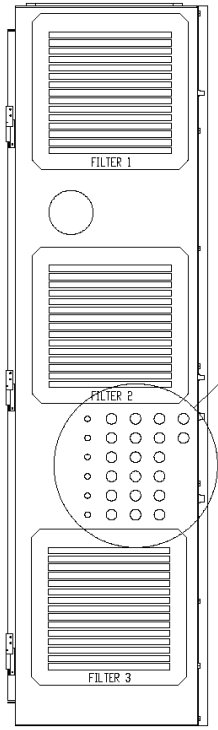


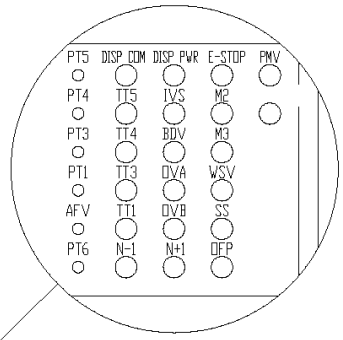




EMERGENCY STOP AND DISPLAY KEYPAD
MOUNTED INTO ENCLOSURE PANEL







NOTES:

1. SHORTING JUMPERS INSTALLED ON TERMINALS BLOCKS AS FOLLOWS
   +24VDC - B1, B2, B3, B4, B5, B6, B7, B8, B9, B10
   DC GND - B11, B12, B13, B14, B15, B16, B17, B18
   E-STOP QUALIFIED +24VDC - A9, A10
2. FOR CONTROL BY REMOTE CONTACT, REMOVE JUMPER BETWEEN TERMINALS A5 AND B5 AND CONNECT N.C. SWITCH
3. ADVISORY/SHUTDOWN ALARM CONTACT BETWEEN A21 AND B21 (N.O.), A22 AND B21 (N.C.). - CONTACT RATING: N.O., 3A @ 30VDC, 3A @ 240VAC
4. THE MAIN BACK PLATE MUST BE BONDED TO CONTROL BOX USING 4 AWG (MIN) BONDING STRAP.
5. THE CONTROLLER BACK PLATE MUST BE BONDED TO MAIN BACK PLATE USING 4 AWG (MIN) BONDING STRAP.
6. THE CONTROL BOX DOORS MUST BE BONDED TO CONTROL BOX USING 10 AWG (MIN) BONDING STRAP.
7. WHEN COMMUNICATIONS MODULE IS INSTALLED AND PT6 IS INSTALLED, CONNECT PT5 TO P17, PINS 4-6.

301CGE546-B
(Ref. Drawing)
Page 4 of 4

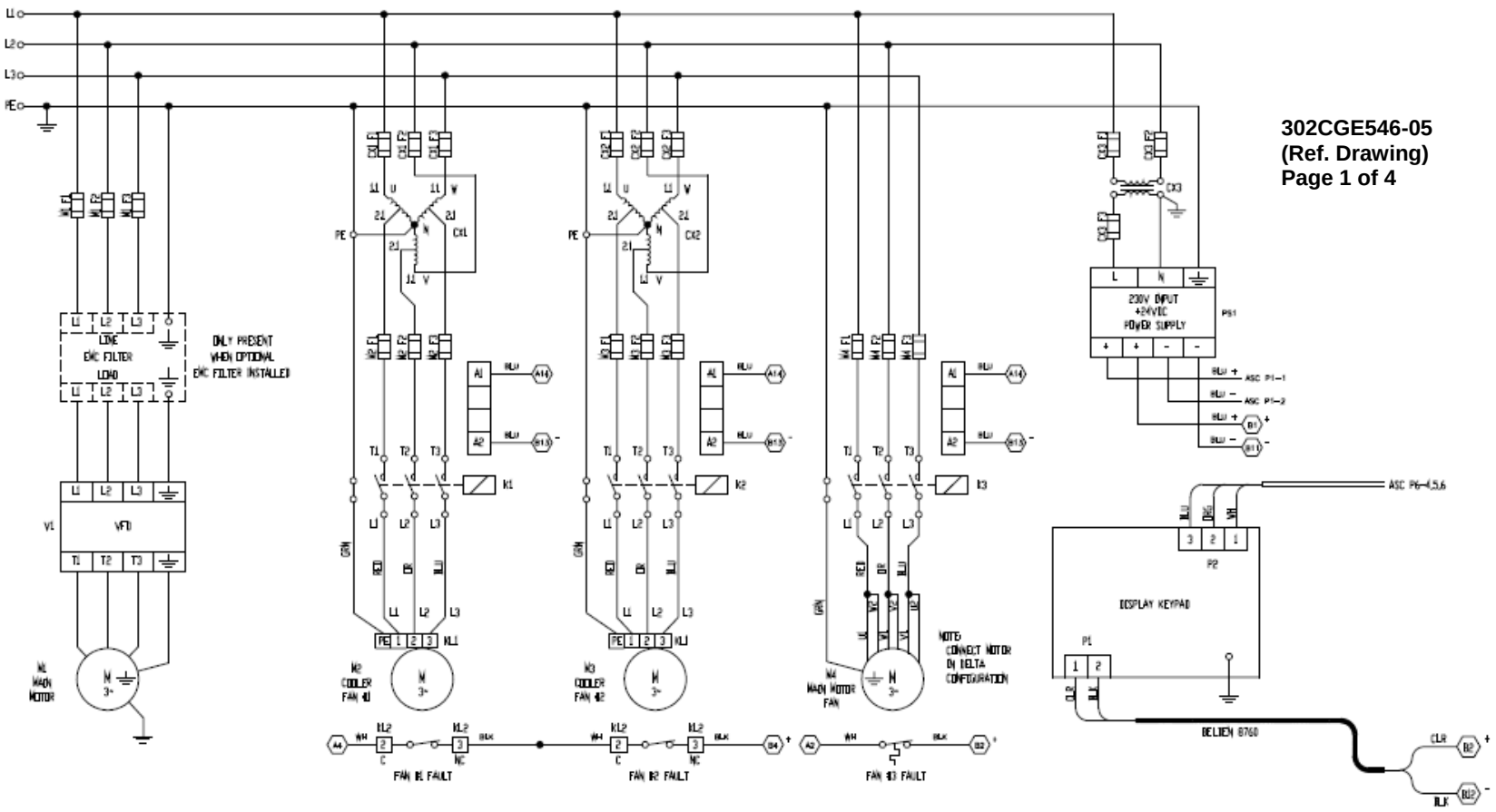
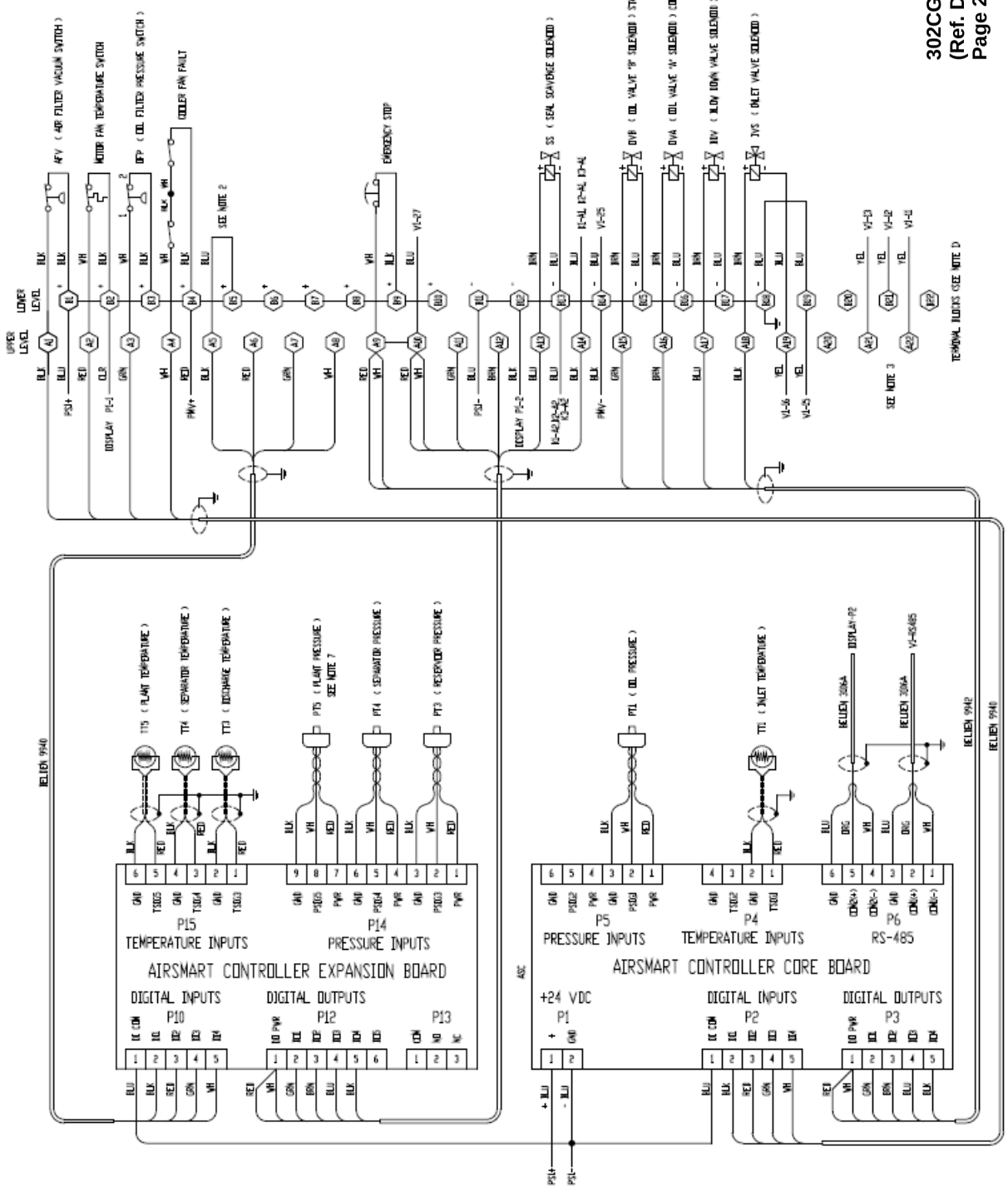
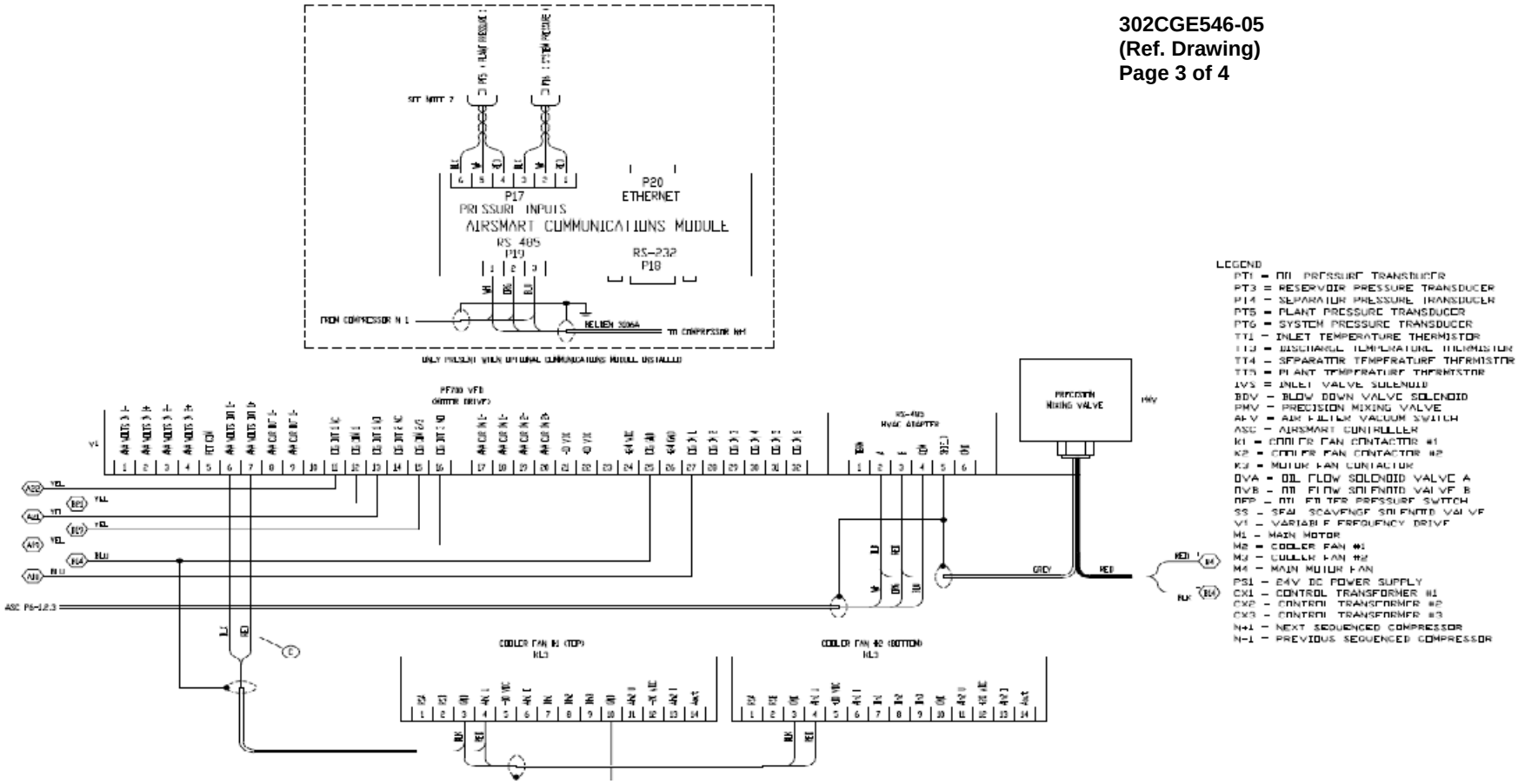
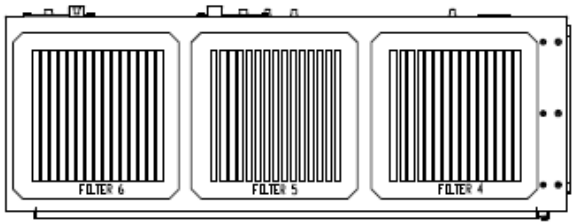
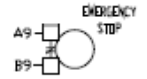


Figure 4- 5 – WIRING DIAGRAM – (AIR COOLED) Single-Stage VS80/110, 575Vac

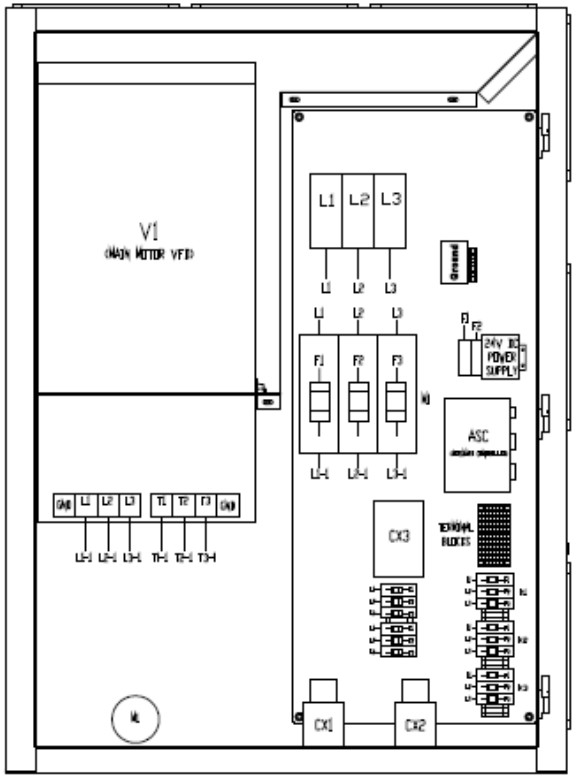

AFV (AIR FILTER VACUUM SWITCH)
MOTOR FAN TEMPERATURE SWITCH
DFP (OIL FILTER PRESSURE SWITCH)
COOLER FAN FAULT
SEE NOTE 2
EMERGENCY STOP
SS (SEAL SCAVENGE SOLENOID)
DVB (OIL VALVE "B" SOLENOID) START UP
DVA (OIL VALVE "A" SOLENOID) COOL DOWN
BDV (BLOW DOWN VALVE SOLENOID)
IVS (INLET VALVE SOLENOID)
TERMINAL BLOCKS (SEE NOTE 1)
SEE NOTE 3
T15 (PLANT TEMPERATURE)
T14 (SEPARATOR TEMPERATURE)
T13 (DISCHARGE TEMPERATURE)
P15
TEMPERATURE INPUTS
P13 (RECEIVER PRESSURE)
P14 (SEPARATOR PRESSURE)
P15 (PLANT PRESSURE)
SEE NOTE 7
P14
PRESSURE INPUTS
AIRSMART CONTROLLER EXPANSION BOARD
DIGITAL INPUTS
P10
DIGITAL OUTPUTS
P12
P13
P1 (OIL PRESSURE)
T11 (INLET TEMPERATURE)
P5
PRESSURE INPUTS
P4
TEMPERATURE INPUTS
P6
RS-485
AIRSMART CONTROLLER CORE BOARD
+24 VDC
P1
DIGITAL INPUTS
P2
DIGITAL OUTPUTS
P3
DISPLAY-P2
VI-HS485
BELDEN 3106A
BELDEN 9940
BELDEN 9842
BELDEN 9841

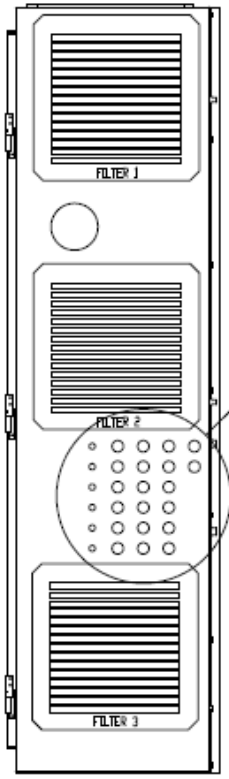

P17
PRESSURE INPUTS
AIRSMART COMMUNICATIONS MODULE
RS 485
P19
RS-232
P18
P20
ETHERNET
ONLY PRESENT WITH OPTIONAL COMMUNICATIONS MODULE INSTALLED
PF700 VFD
(MOTOR DRIVE)
PRECISION
MIXING VALVE
COOLER FAN #1 (TOP)
COOLER FAN #2 (BOTTOM)
LEGEND
PT1 = OIL PRESSURE TRANSDUCER
PT3 = RESERVOIR PRESSURE TRANSDUCER
PT4 = SEPARATOR PRESSURE TRANSDUCER
PT5 = PLANT PRESSURE TRANSDUCER
PT6 = SYSTEM PRESSURE TRANSDUCER
TT1 = INLET TEMPERATURE THERMISTOR
TT3 = DISCHARGE ELEMENT(S) TEMPERATURE THERMISTOR
TT4 = SEPARATOR TEMPERATURE THERMISTOR
TT5 = PLANT TEMPERATURE THERMISTOR
IVS = INLET VALVE SOLENOID
BDV = BLOW DOWN VALVE SOLENOID
PMV = PRECISION MIXING VALVE
AFV = AIR FILTER VACUUM SWITCH
ASC = AIRSMART CONTROLLER
K1 = COOLER FAN CONTACTOR #1
K2 = COOLER FAN CONTACTOR #2
K3 = MOTOR FAN CONTACTOR
OVA = OIL FLOW SOLENOID VALVE A
OVB = OIL FLOW SOLENOID VALVE B
OFP = OIL FILTER PRESSURE SWITCH
SS = SEAL SCAVENGE SOLENOID VALVE
V1 = VARIABLE FREQUENCY DRIVE
M1 = MAIN MOTOR
M2 = COOLER FAN #1
M3 = COOLER FAN #2
M4 = MAIN MOTOR FAN
PS1 = 24V DC POWER SUPPLY
CX1 = CONTROL TRANSFORMER #1
CX2 = CONTROL TRANSFORMER #2
CX3 = CONTROL TRANSFORMER #3
N+1 = NEXT SEQUENCED COMPRESSOR
N-1 = PREVIOUS SEQUENCED COMPRESSOR

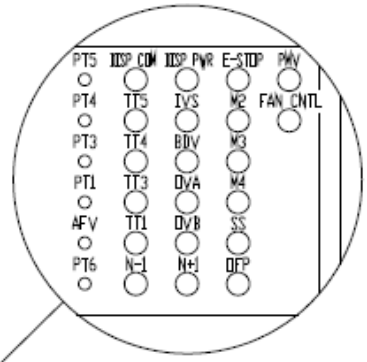




EMERGENCY STOP AND DISPLAY (KEYPAD) MOUNTED ONTO ENCLOSURE PANEL







NOTES:

1. SHORTING JUMPERS INSTALLED ON TERMINALS BLOCKS AS FOLLOWS
   +24VDC - B1, B2, B3, B4, B5, B6, B7, B8, B9, B10
   DC GND - B11, B12, B13, B14, B15, B16, B17, B18
   E-STOP QUALIFIED +24VDC - A9, A10
2. FOR CONTROL BY REMOTE CONTACT, REMOVE JUMPER BETWEEN TERMINALS A5 AND B5 AND CONNECT N.C. SWITCH
3. ADVISORY/SHUTDOWN ALARM CONTACT BETWEEN A21 AND B21 (N.O.), A22 AND B21 (N.C.). - CONTACT RATING: N.O., 3A @ 30VDC, 3A @ 240VAC
4. THE MAIN BACK PLATE MUST BE BONDED TO CONTROL BOX USING 4 AWG (MIN) BONDING STRAP.
5. THE CONTROLLER BACK PLATE MUST BE BONDED TO MAIN BACK PLATE USING 4 AWG (MIN) BONDING STRAP.
6. THE CONTROL BOX DOORS MUST BE BONDED TO CONTROL BOX USING 10 AWG (MIN) BONDING STRAP.
7. WHEN COMMUNICATIONS MODULE IS INSTALLED AND PT6 IS INSTALLED, CONNECT PT5 TO P17, PINS 4-6.

302CGE546-05
(Ref. Drawing)
Page 4 of 4

303CGE546-B
(Ref. Drawing)
Page 1 of 4

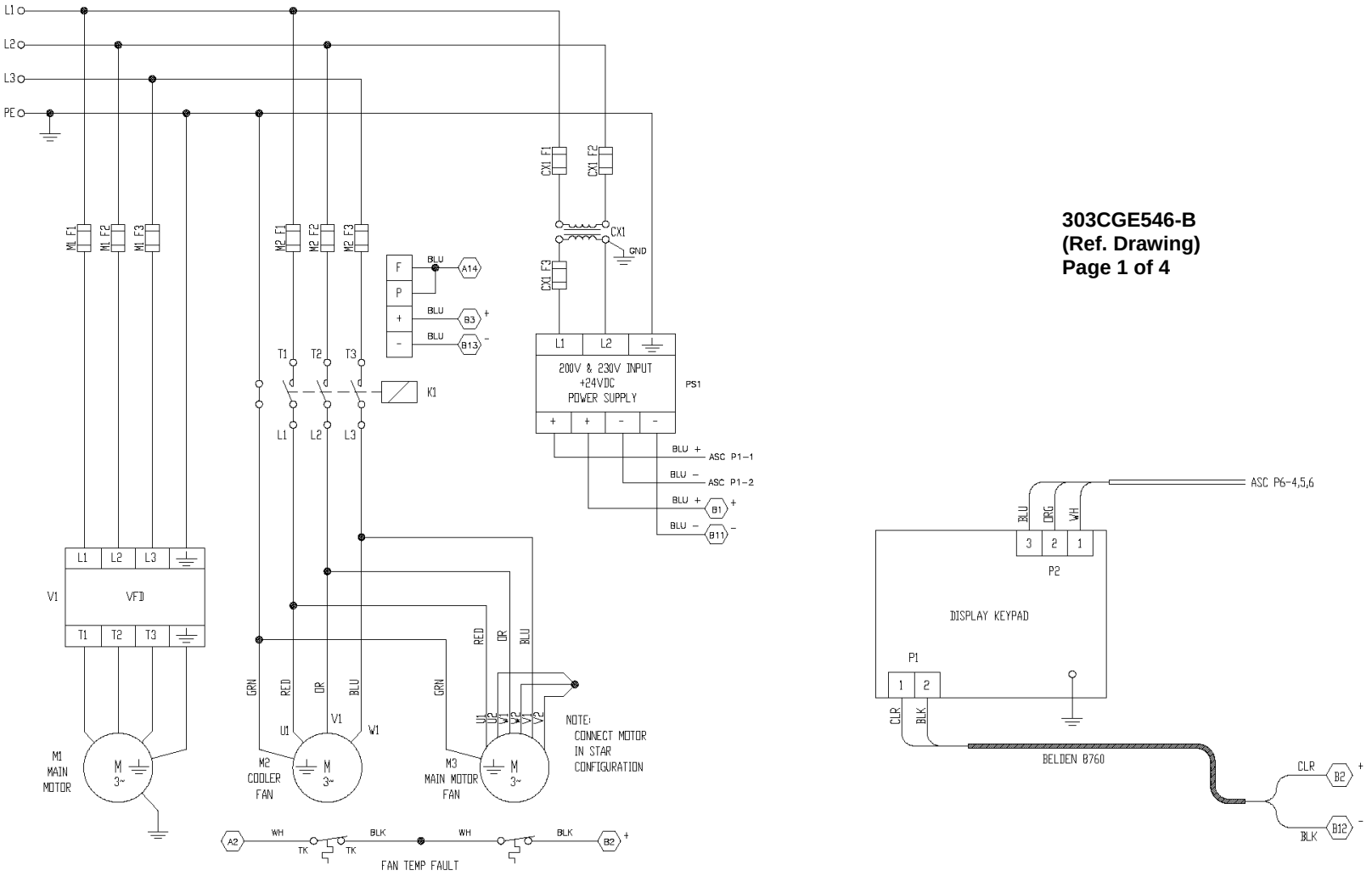
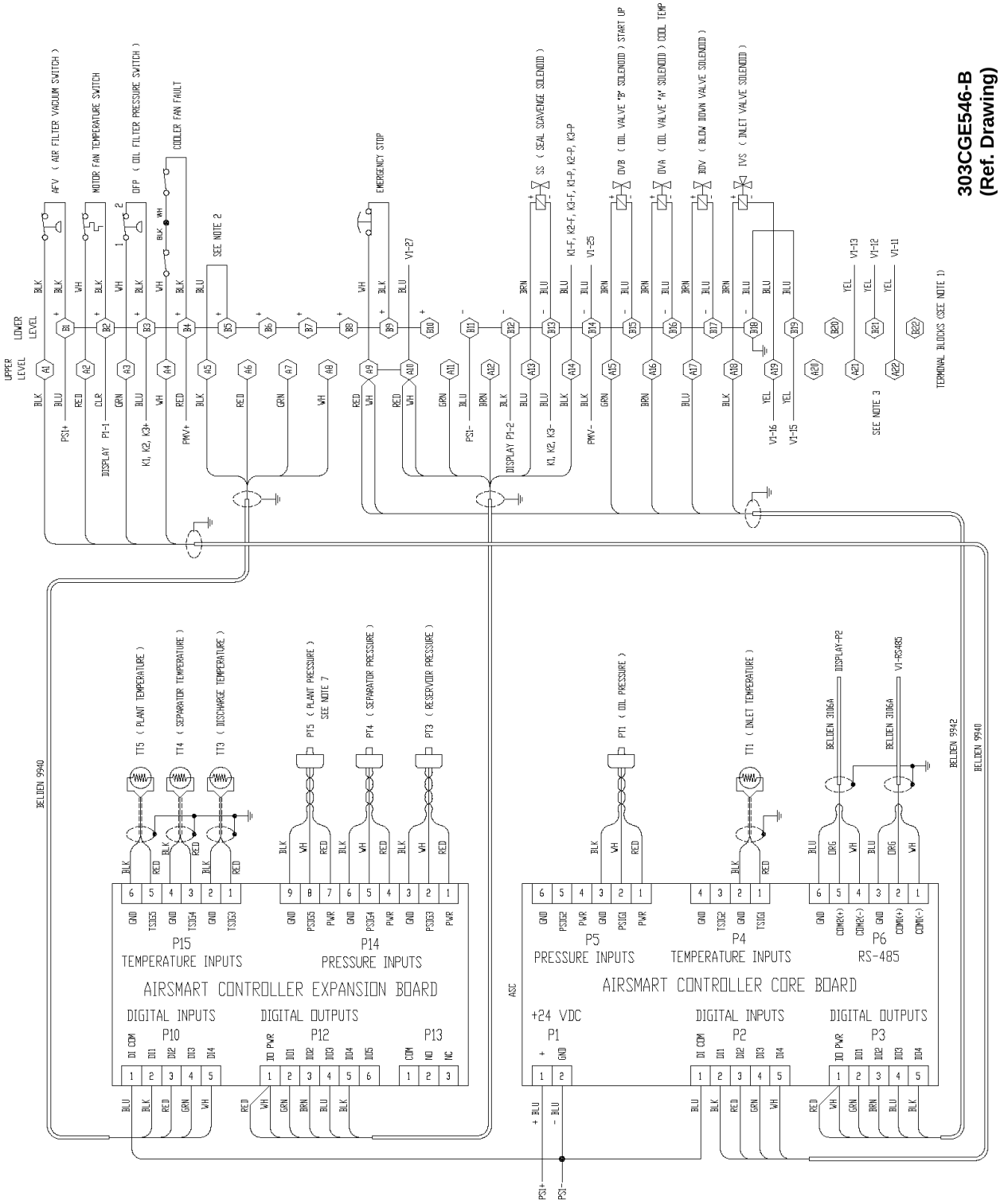
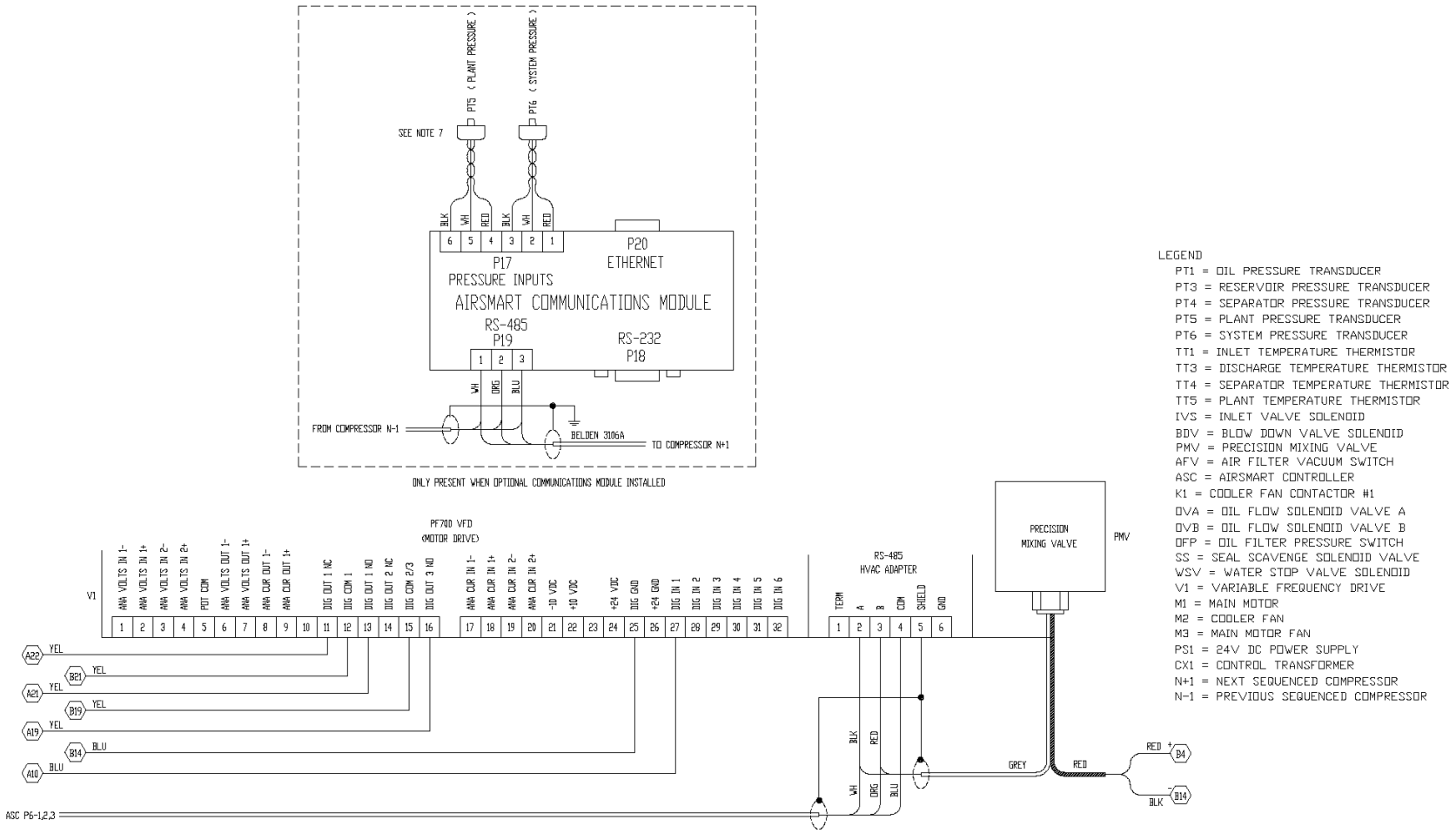


Figure 4- 6 – WIRING DIAGRAM – (WATER COOLED) Single-Stage VS80/110, 575Vac

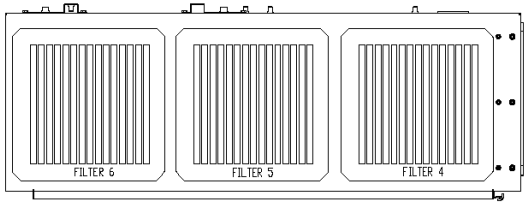

303CGE546-B
(Ref. Drawing)
Page 2 of 4
AIRSMART CONTROLLER EXPANSION BOARD
AIRSMART CONTROLLER CORE BOARD
P15
TEMPERATURE INPUTS
P14
PRESSURE INPUTS
P5
PRESSURE INPUTS
P4
TEMPERATURE INPUTS
P6
RS-485
P10
P12
P13
P1
P2
P3
DIGITAL INPUTS
DIGITAL OUTPUTS
+24 VDC
TERMINAL BLOCKS (SEE NOTE 1)
SEE NOTE 3
SEE NOTE 7
BELDEN 9940
BELDEN 9942
AFV (AIR FILTER VACUUM SWITCH)
MOTOR FAN TEMPERATURE SWITCH
OFP (OIL FILTER PRESSURE SWITCH)
COOLER FAN FAULT
EMERGENCY STOP
SS (SEAL SCAVENGE SOLENOID)
DVB (OIL VALVE "B" SOLENOID) START UP
DVA (OIL VALVE "A" SOLENOID) COOL TEMP
BDV (BLOW DOWN VALVE SOLENOID)
IVS (INLET VALVE SOLENOID)
TT5 (PLANT TEMPERATURE)
TT4 (SEPARATOR TEMPERATURE)
TT3 (DISCHARGE TEMPERATURE)
PT5 (PLANT PRESSURE)
PT4 (SEPARATOR PRESSURE)
PT3 (RESERVOIR PRESSURE)
PT1 (OIL PRESSURE)
TT1 (INLET TEMPERATURE)
BELDEN 3106A
DISPLAY-P2
V1-RS485



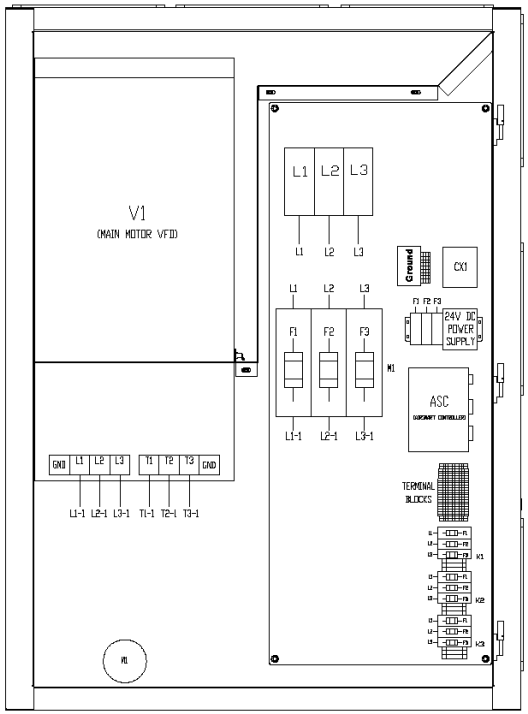
LEGEND

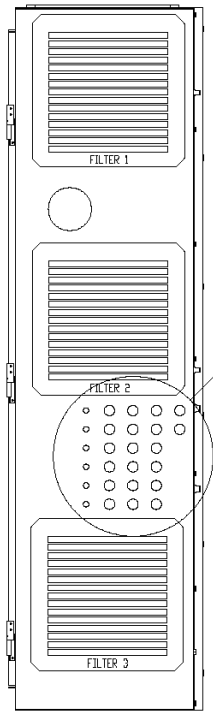
- PT1 = OIL PRESSURE TRANSDUCER
- PT3 = RESERVOIR PRESSURE TRANSDUCER
- PT4 = SEPARATOR PRESSURE TRANSDUCER
- PT5 = PLANT PRESSURE TRANSDUCER
- PT6 = SYSTEM PRESSURE TRANSDUCER
- TT1 = INLET TEMPERATURE THERMISTOR
- TT3 = DISCHARGE TEMPERATURE THERMISTOR
- TT4 = SEPARATOR TEMPERATURE THERMISTOR
- TT5 = PLANT TEMPERATURE THERMISTOR
- IVS = INLET VALVE SOLENOID
- BDV = BLOW DOWN VALVE SOLENOID
- PMV = PRECISION MIXING VALVE
- AFV = AIR FILTER VACUUM SWITCH
- ASC = AIRSMART CONTROLLER
- K1 = COOLER FAN CONTACTOR #1
- OVA = OIL FLOW SOLENOID VALVE A
- OVB = OIL FLOW SOLENOID VALVE B
- OFP = OIL FILTER PRESSURE SWITCH
- SS = SEAL SCAVENGE SOLENOID VALVE
- WSV = WATER STOP VALVE SOLENOID
- V1 = VARIABLE FREQUENCY DRIVE
- M1 = MAIN MOTOR
- M2 = COOLER FAN
- M3 = MAIN MOTOR FAN
- PS1 = 24V DC POWER SUPPLY
- CX1 = CONTROL TRANSFORMER
- N+1 = NEXT SEQUENCED COMPRESSOR
- N-1 = PREVIOUS SEQUENCED COMPRESSOR

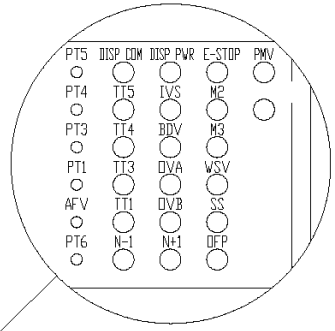
303CGE546-B
(Ref. Drawing)
Page 3 of 4



EMERGENCY STOP AND DISPLAY KEYPAD MOUNTED INTO ENCLOSURE PANEL







NOTES:

1. SHORTING JUMPERS INSTALLED ON TERMINALS BLOCKS AS FOLLOWS
   +24VDC - B1, B2, B3, B4, B5, B6, B7, B8, B9, B10
   DC GND - B11, B12, B13, B14, B15, B16, B17, B18
   E-STOP QUALIFIED +24VDC - A9, A10
2. FOR CONTROL BY REMOTE CONTACT, REMOVE JUMPER BETWEEN TERMINALS A5 AND B5 AND CONNECT N.C. SWITCH
3. ADVISORY/SHUTDOWN ALARM CONTACT BETWEEN A21 AND B21 (N.O.), A22 AND B21 (N.C.). - CONTACT RATING: N.O., 3A @ 30VDC, 3A @ 240VAC
4. THE MAIN BACK PLATE MUST BE BONDED TO CONTROL BOX USING 4 AWG (MIN) BONDING STRAP.
5. THE CONTROLLER BACK PLATE MUST BE BONDED TO MAIN BACK PLATE USING 4 AWG (MIN) BONDING STRAP.
6. THE CONTROL BOX DOORS MUST BE BONDED TO CONTROL BOX USING 10 AWG (MIN) BONDING STRAP.
7. WHEN COMMUNICATIONS MODULE IS INSTALLED AND PT6 IS INSTALLED, CONNECT PT5 TO P17, PINS 4-6.

303CGE546-B
(Ref. Drawing)
Page 4 of 4

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 – 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 2 ppm of oil concentration is removed from the compressed air and discharged to the aftercooler.

RECOMMENDED LUBRICANT – 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 heat exchanger 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.

Safety Data Sheets (SDS) are available for all AEON lubricants at.

www.gardnerdenverproducts.com/downloads.aspx

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 “Oil Mixing Valve” 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. Figure 5-1 for details.

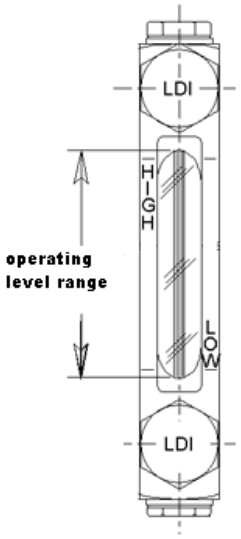


Figure 5- 1 – OIL LEVEL SIGHT GLASS

To ensure best performance from the oil separation system, adhere to the following guidelines:

- Before starting the unit, make sure that oil level is visible in the sight gauge. An oil level of at least ½ the sight gauge height will ensure there is enough oil to safely operate the compressor.
- During unit operation, and after a steady compressor discharge temperature is reached, check the oil level:
  - Add oil only when the level is below the LOW mark on sight glass. This will make the refill intervals less frequent. Note that each inch of oil level represents 0.9 gal. of oil.
  - Drain oil only when the level is above the HIGH mark on sight glass. Be aware that a stopped unit, when filled to its maximum oil capacity (approximately 16 gallons), may show a full sight glass – this is normal and does not require oil drainage.
  - The oil level in the sight glass will fluctuate as the compressor load changes, as a function of the air/oil volume ratio within the compressor pipe works. Refer to **Error! Reference ource not found.** for typical operational oil levels attained at various compressor load levels and with a full charge of oil:

Controller Display Load Level - %	Oil Sight Glass level with full oil charge - inches	Oil Sight Glass lowest acceptable level - in
100	4.0	2.0
80	3.5	1.5
60	3.0	1.0
40	2.5	.5
20	2.0	.0

Figure 5- 2 – LOAD VS SIGHT GLASS OIL LEVEL CHANGE

ADDITION OF OIL BETWEEN CHANGES – Oil losses (typically 2 ppm concentration) from the oil separation system may require replenishment between scheduled changes. If (during operation only) the site glass shows no oil or less than 25% of full height, add oil per following steps: (Figure 1-3, page 10 and Figure 1-5, page 12).

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 and add sufficient oil. A charge of 4.0 gallons will raise the operating oil level from the LOW to the HIGH mark on the sight glass when the unit is running at 100% load. At lesser loads, the sight glass oil level reached will be lower in proportion to the running load level listed on Fig 5-2.

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 top of the sight glass.

⚠ 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 – 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 1-3 and Figure 1-5, pages 10 and 12).

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. Remove fill plug and drain valve to evacuate oil.
5. Close drain valve, add oil up to top of the sight glass, and replace fill plug.
6. 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.

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 – see page 49, 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 VS80/110 package requires nearly 16 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. (See Figure 1-3, page 10) and Figure 1-5, page 12) for the location of the oil filter within the package.

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 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 – 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.

THERMOSTATIC OIL MIXING VALVE (FIGURE 5-3) (Electronic) – 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 – thus avoiding water collection in the oil system.

Figure 5- 3 – THERMOSTATIC OIL MIXING VALVE

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 – 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 “Auto Timer” option in the AirSmart controller. Refer to the AirSmart controller user’s manual 13-17-600 for detailed programming instructions of this parameter and adjust the “Auto Timer” parameter to a value of at least 5 minutes.

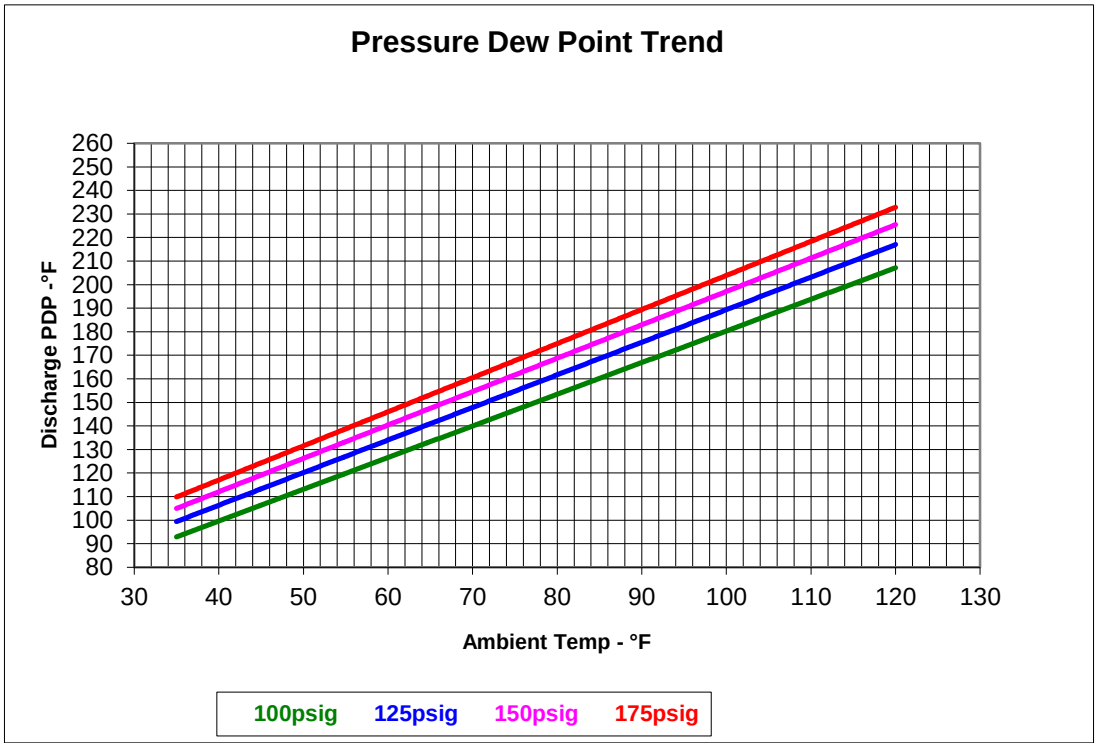


Figure 5- 4 – PRESSURE DEW POINT OF COMPRESSED AIR

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 – 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.

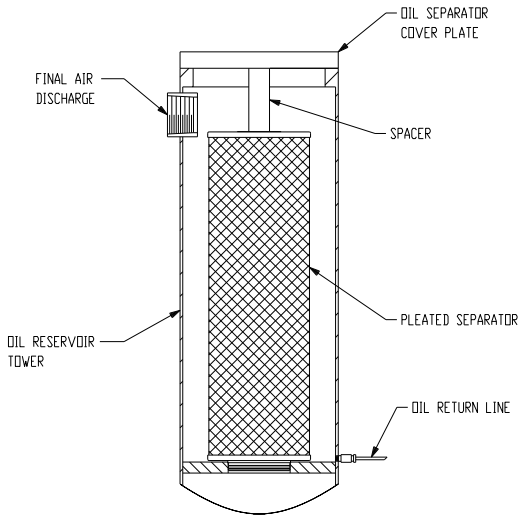


Figure 5- 5 – CHANGING OIL COALESCING ELEMENT

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 bolts holding the oil sump cover and lift the cover away.

4. Lift the element from the sump.

5. Inspect and/or replace the elements 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. Oil may be wiped off by the holder and the o-ring could be damaged.

6. Inspect oil scavenge orifice and strainer for fouling. Replace if necessary.

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

8. Carefully place sump cover and o-ring seal on sump flange. Check that the adjustable space (e.g., pipe segment threaded under cover) makes contact with the top of the elements. The contact (e.g.,1/32" interference typical) should be firm enough to provide a grounding path between the elements and the vessel without crush-damaging the former's structure.

9. After compressor is started and pressurized, inspect sump cover joint for leaks.

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

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.

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 29 gpm oil flow with 9.0 psid pressure loss (VS110 @ 100 psig discharge pressure).

- 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 689 cfm with 2.0 psid pressure loss (VS110 package).

AIR COOLED HEAT EXCHANGERS – Air cooled cores (radiator-type) are provided as standard feature. Two (2) radial fans, located behind the fresh air inlet grille, pump the required amount of cooling air and expel it through an opening on the enclosure roof. Each fan is driven by a close-coupled, IP54-protected, electric motor which also includes an integrated electronic controller for variable speed modulation and fan overload protection.

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 Fans
80	14299	3895
110	15183	3895

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 – See Fig 1-3, Page 10, for details.
4. Prior to do any cleaning of the heat exchanger cores, cover the main motor roof vents, air filter intake vent (opening faces upwards), and Smart mixing valve assembly with suitable water-proof material (e.g., plastic sheet). This will avoid depositing debris and/or water on these areas.
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 downward through core) to dislodge debris and clean. Vacuum (applied from outside) can also be employed to clean the heat exchanger cores.
6. Remove all loose debris and water from cooler box after cleaning process is complete. Also remove temporary covers on main motor roof vents, air filter intake, and Smart valve assembly.
7. Re-install enclosure door panels.

⚠ CAUTION

The ventilation system for the air cooled package relies on positive back pressure to cool the heat exchanger. Make sure that the enclosure panels that surround the heat exchanger area are closed during compressor operation, or the compressor discharge temperature will reach shutdown levels quickly.

⚠ DANGER

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

AXIAL COOLING FANS

1. Follow 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 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 COOLED HEAT EXCHANGERS – Optional water cooled cores (brazed-plate type) are available. Both cores are of a counter-current and cross-flow design. The cooling water is fed to the cores in a series arrangement – it passes through the air core first and proceeds through the oil core before exiting the package. Please refer to Figure 6-3 for estimates of requirements.

AIR & OIL COOLER (Series Water Piping)							
		Water flow requirements at various inlet water temperatures (gpm)				Maximum Water Flow (gpm) *	Approximate (total) water pressure drop @ 80° F water flow (psi)
KW	Model	60° F	70° F	80° F	90° F		
80	VS80A	23.2	26.6	31.4	38.8	48	25
110	VS110A	30.3	34.8	41.0	48.0	48	15

* Flows exceeding "Maximum Water Flow" will cause severe erosion and will void unit warranty.

Figure 6- 2 – WATER COOLED HEAT EXCHANGER COOLANT REQUIREMENTS

The water supply shall be capable of delivering the flow/temperature combinations shown in Figure 6-2, page 58, at a minimum pressure of 40 psig (2.8 bar) - the water flow rates shown are approximate and a guide to sizing of piping, cooling tower and other water system equipment.

The maximum allowable supply water pressure is 150 psig (10.3 bar) and the maximum allowed (package) outlet water temperature is 110°F (43°C). If a water supply with a temperature lower than 60°F (16°C) is used, heat transfer areas of the coolers may be fouled due to low water flow velocities, resulting in poor cooler performance and shortened operational life.

All the required hardware, mechanical and electrical connections have been made at the Gardner Denver factory. Regular maintenance is required to keep the interior core areas free from dirt and other fowling agents. In order to protect package components that are in contact with the cooling water from attack by corrosive or fouling agents, we recommend that the cooling water meet the following quality standards:

Total Dissolved Solids (TDS)	<500 ppm
Iron	<2 ppm
Total Hardness	<60 ppm
Silica	<25 ppm
Oil and Grease	<5 ppm
Sulfate	<50 ppm
Chloride	<50 ppm
Nitrate	<2 ppm
Corrosivity	Langelier Index between 0 to1

It is strongly recommended that a reputable, local firm be contracted to evaluate the quality of water available and recommend corrective and/or preventive steps to meet our requirements.

WATER FLOW REGULATING VALVE (Optional Hardware). This device is used to adjust the flow of cooling water in proportion to its temperature. It's a normally closed (two-way) valve which opens once the thermostatic bulb senses a predetermined water temperature level and then continues to modulate water flow to maintain water temperature – within a 2°F to 5°F span. The package piping provides a permanent bypass line (1/4" tube) around the flow regulating valve to ensure a small amount of water flows around the sensing bulb when the valve is in the closed position – it does not provide a complete shutoff of water flow.

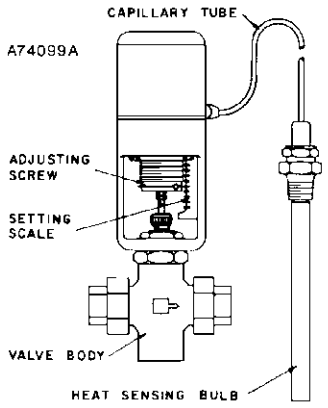


Figure 6- 3 – WATER CONTROL VALVE

Adjustments – The regulator valve shall be adjusted so that it closes when the cooling water entering and exiting the package are at the same temperature – a condition that is present after the compressors have stopped and the heat exchangers have cooled down. Note that the bypass line allows a small amount of water flow when the valve closes. Adjustment to the regulator valve can be made as follows:

- To decrease water flow (e.g., increase exiting cooling water temperature) turn the adjusting screw from left to right, increasing spring tension. (The groove at the lower edge of the adjusting screw is an index line for use with the index scale 0 to 8 in obtaining a desired setting).

- To increase water flow (e.g., decrease exiting cooling water temperature) turn the adjusting screw from right to left, decreasing spring tension. (The groove at the lower edge of the adjusting screw is an index line for use with the index scale 0 to 8 in obtaining a desired setting).

Care must be used when handling the capillary tube; a kink or break in the tubing or connections will make the valve inoperative. Never attempt to change capillary length. Excess capillary tube should be carefully coiled and placed so that damage will not occur with normal maintenance or traffic past the unit.

If a leak develops through the packing, tighten the packing gland nut firmly with a wrench to reseat the packing around the valve stem, back off the nut until loose and finally retighten the nut finger tight. Tightening the packing nut too tight may cause erratic operation. An occasional drop of oil on the valve stem at the packing nut will prolong packing life.

If the valve malfunctions, check for a bend or binding in the capillary tube, paint or corrosion on valve stem, foreign material in valve, erosion or thermal system (capillary) failure.

WATER FLOW SHUTOFF VALVE - This device completely shuts off the flow of cooling water when the compressors are not operating. Its normally closed state prevents the waste of cooling water even in the case of power failure. It is a common companion to the water flow regulating valve.

The water flow regulating valve and the water shutoff valve are factory-installed options. If the presence of foreign material or scale formation in the cooling water is likely, the use of a strainer in the inlet water line is recommended.

OPTIONAL WATER SEPARATOR AND DRAIN – These devices separate and drain the water (condensed by the air cooler) mixed with the compressed air delivered by the compressor package. The optional water separator assembly is shipped loose and must be field-installed by the end user:

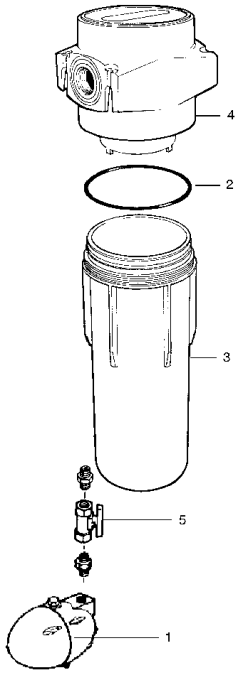


Figure 6- 4 – WATER SEPARATOR AND DRAIN

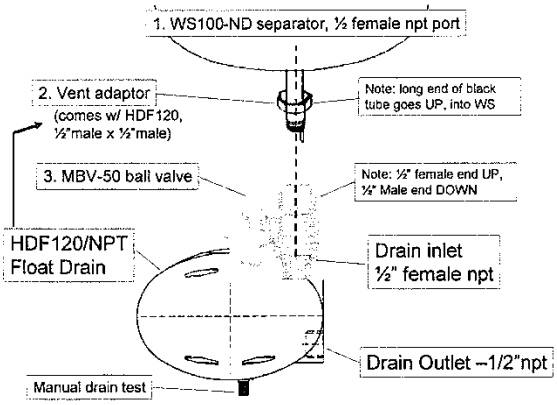


Figure 6- 5 – DETAILED WATER SEPARATOR AND DRAIN

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.

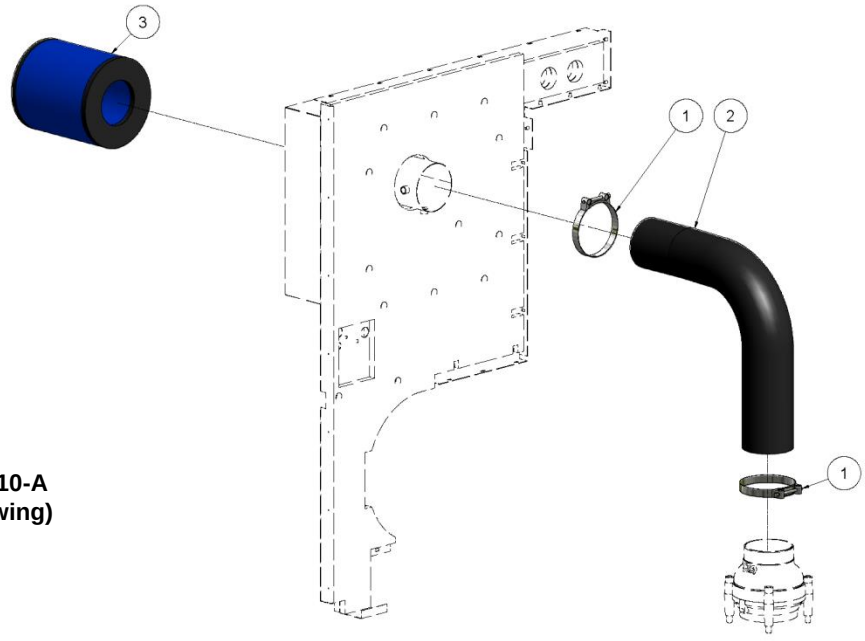
In case the drain valve is fouled with dirt, cleanse the collection bowl also:

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 clean collection bowl and sealing o-ring.
7. Reinstall in reverse order. If the vent adaptor has been removed from the bowl, note its location and orientation in relation to the bowl (5) – see detail Figure 6-5. The long end of the black tube attached to the vent adaptor must protrude upward into the bowl (5) during installation. This is necessary to promote adequate gas venting during liquid drainage.

⚠ CAUTION

Make sure that the isolation valve between the water separator and the drain valve is open prior to compressor operation. Failure to do so will prevent the drainage of separated water and will flood air lines beyond the package discharge with water.

.



303CGE810-A
(Ref. Drawing)

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 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

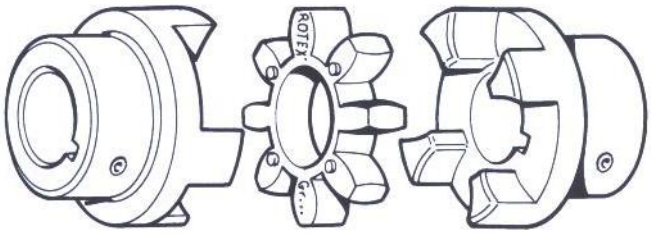


Figure 8- 1 – COUPLING COMPONENTS

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 – 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 – see Figure 8-1, for details of the main components.

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

Coupling Element (Rotex size 65) 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 “E” on Figure 8-2) is within 1.38/1.50 in (35/38 mm).

- A smaller gap will produce abnormal wear of the element by friction and excessive thermal expansion – 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 set screws (M10 size) and tighten to 12.6 lb-ft (17 N-m) of torque. Reinstall coupling guard with provided fasteners.

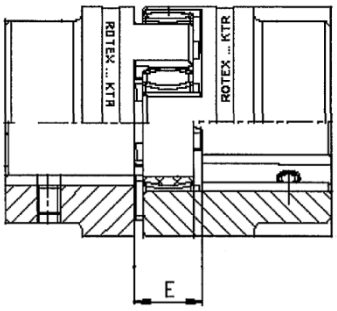


Figure 8- 2 – COUPLING ELEMENT

4. For hub-to-shaft interference fit hubs, main drive motor removal is necessary:
   - Remove coupling guard by removing fasteners
   - Remove coupling ventilation shroud by removing fasteners
   - Drain oil entrained in discharge manifold by placing appropriate collection pan underneath elbow segment and removing the 1/4" npt plug threaded tangent to said elbow. Proceed then to drop the flanged of the discharge manifold by removing the bolts from compressor flange.
   - Remove the following various lines connecting the package to the compressor. Make sure to identify each line and matching [compressor-side connection] for proper reassembly – you may also refer to the Parts List 13-18-505 for more details:
   - Oil Injection hoses (one (1) base flow, two (2) solenoid valve flow)
   - Bearing oil lubrication tube
   - Drain nylon tube
   - Inlet poppet valve pneumatic signal hose
   - Air filter discharge hose
   - Engage jack screws [built into base frame] until they make solid contact with the [front side] motor mounting pads.
   - Remove vertical support wall by removing fasteners and slide side-ways through door opening.
   - Remove four bolts securing (main motor) rear support to base frame.
   - Engage jack screw [built into base frame] until it makes solid contact with the compressor/motor adaptor housing.
   - Remove eight (8) bolts/nut/washer combos securing motor to adaptor housing.
   - Lift/Pull away compressor and main motor adaptor from motor until coupling hubs separate and allow removal of spider.
   - Inspect coupling element for signs of wear and tear such as indentations, cracks, deformation, extrusions, etc. It is highly recommended that the coupling element be replaced at this time.
   - Re-assemble main motor and related components in reverse order.
   - After engaging each hub on the matching recesses of the coupling element, check that the gap between the hub flats (see dimension "E" on Figure 8-2) is within 1.38/1.50 in (35/38 mm). A smaller gap will produce abnormal wear of the element by friction and excessive thermal expansion – 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 (M10 size) and tighten to 12.6 lb-ft (17 N-m) of torque. Reinstall coupling guard and coupling ventilation shroud with provided fasteners.

Interference-fitted Coupling Hub Installation and Removal – 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 CC1026209 available – contact Gardner Denver for sourcing details.
- Assemble tool kit components onto coupling hub as shown on Figure 8-4.
- 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 – contact Gardner 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.
- Once the hub has cooled down sufficiently to the grip the companion shaft, remove the installation tool.
- Apply a thread-locking compound to the hub setscrews (M10 size) and tighten to 12.6 lb-ft (17 N-m) of torque. Reinstall coupling guard with provided fasteners.

Coupling Hub Removal:

- Have removal tool part number 90500151 available – contact GD 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 onto the hub as shown in **Error! Reference source not found.**. Make ure 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 130ft-lb (176 N-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.

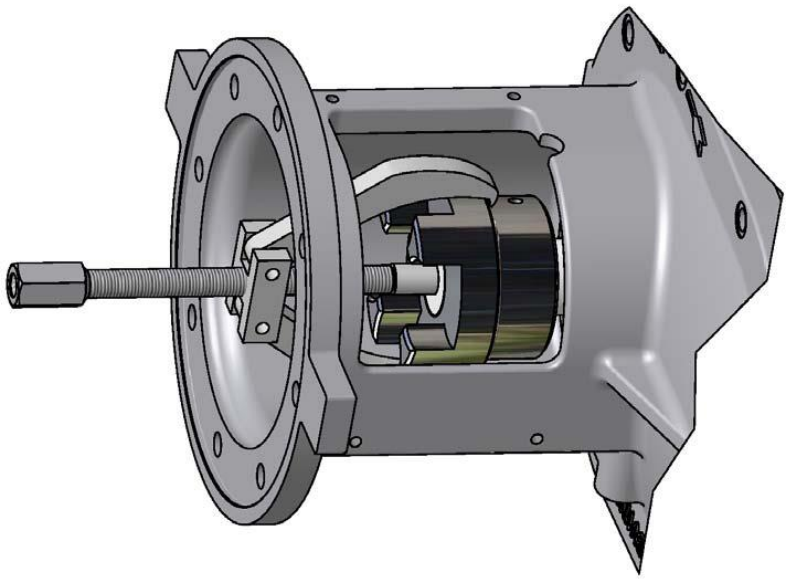
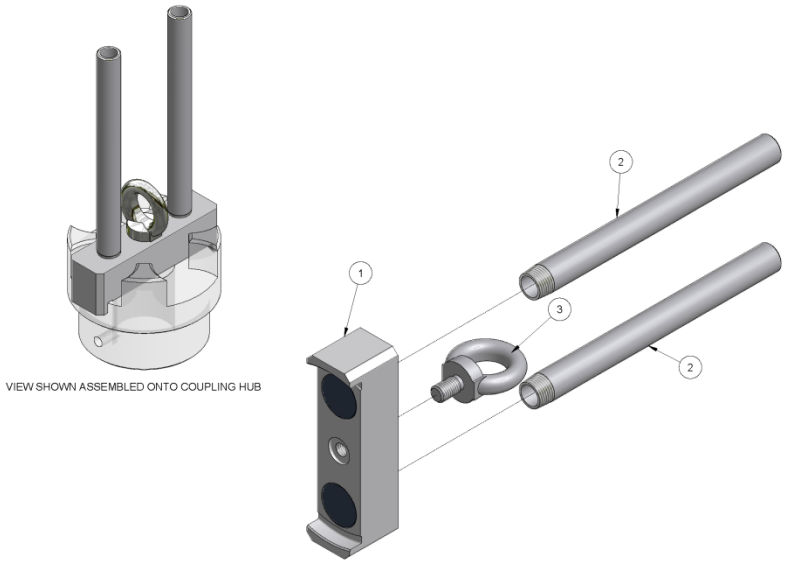


Figure 8- 3 – COUPLING REMOVAL TOOL



CC1026209-A
Ref. Drawing

Figure 8- 4 – LOCATION AIREND COUPLING HUB INSTALLATION TOOL

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 customer's piping or pipe network back into the compressor package when the compressor is not active.

The valve does not require maintenance or (internal) adjustment. Refer to Part List 13-18-505 for spare parts.

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 – including pipe works between MPV and (external) isolation valve.

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

3. Carefully and gradually unscrew the valve cap from the body – this will also release tension from the working spring within the valve. After cap removal, all internal parts can be retrieved – note their relative positions during disassembly to help the re-assembly process. See Figure 9-1, page 69.

4. Re-assemble in reverse order

.

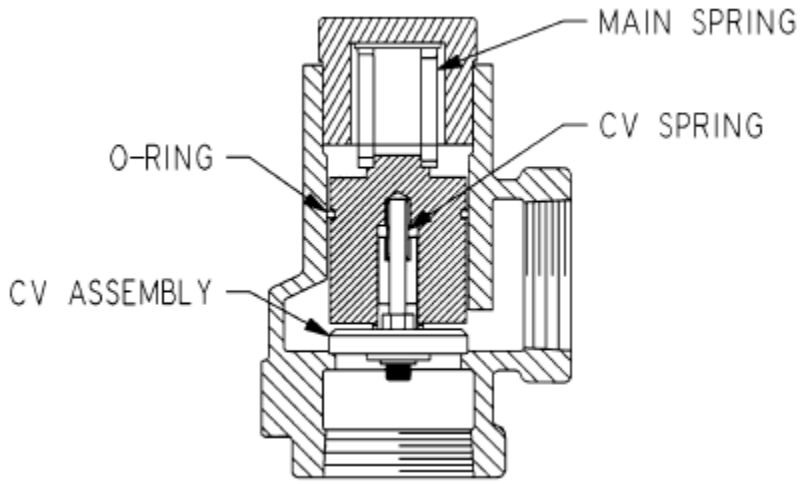


Figure 9- 1 – MINIMUM DISCHARGE PRESSURE/CHECK VALVE

SECTION 10
INLET CONTROL VALVE

INLET CONTROL VALVE – This device is located at the intake flange of the compressor. During compressor stoppage, planned or accidental (e.g., power failure), it blocks off the compressor intake and allows it to remain pressurized and ready for quick re-start. A spring-loaded check feature is provided as added insurance against air or oil backflow.

During compressor operation, the underside of the poppet is vented to atmosphere via a 3-way solenoid valve, allowing the poppet to fall (open) and feed fresh air to the compressor inlet – the spring loaded check feature is pushed open by a very small pressure differential resulting from the incoming air stream. During stopped operation modes (e.g., commanded from keypad or initiated by protective shutdown), the 3-way solenoid valve feeds an air signal to the underside of the poppet, forcing it upward (closed), compressing the spring loaded check feature and blocking-off the compressor intake.

Refer to Part List 13-18-505 for spare parts.

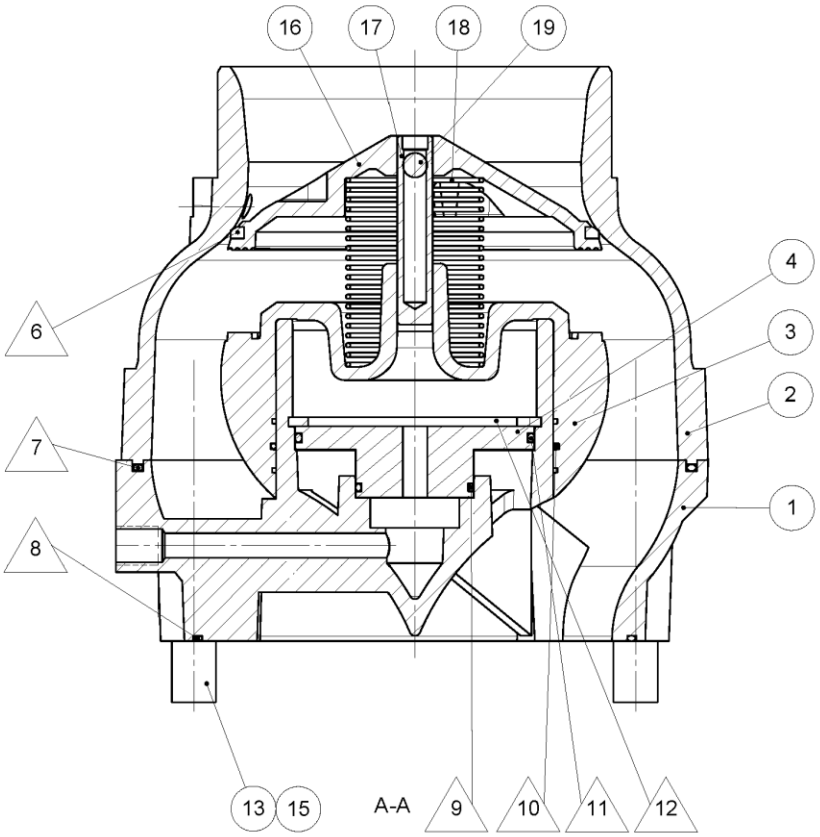


Figure 10- 1 – INLET CONTROL VALVE

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

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

3. Identify (by position) each tube connected to the valve body and remove.

4. Remove four bolts (Item 13) securing valve body to compressor body and remove valve.

5. Inspect poppet seals (o-ring) (Item 6, 10) for wear and tear. Replace, if necessary.

6. Remove lock ring (Item 12) and pull out cover (Item 4).

7. Inspect seals (Items 9, 11) for wear and tear. Replace if necessary.

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 200 psig. It is installed on the dry-side of the oil separator.

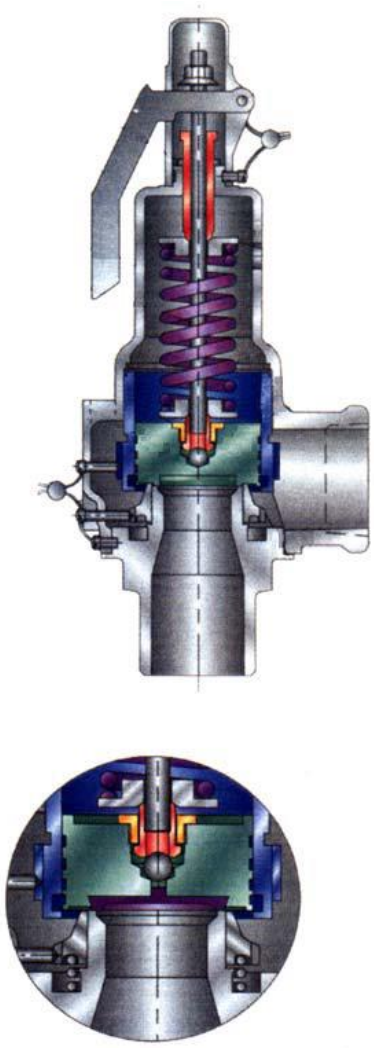


Figure 11- 1 – PRESSURE RELIEF VALVE

⚠ 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.
- Manually open the valve by lifting the hand lever.
- Hold the valve open for a few seconds and allow it to snap shut.

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 on the right-hand side of the electrical enclosure – Refer to Figure 4-1, page 27 for details.

4. To service discharge-side filter, open access door to the electrical enclosure – Refer to Fig 4-1, Page 27 for details.

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. 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 manufacturer's 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 – 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.

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 BQ 72-72	28H311 (400 Gram Cartridge) 28H312 (1Kg can) 28H313 (25 Kg pail)

ELECTRIC MOTOR REGREASING INTERVAL

Type of Service	Typical	Rating	Lubrication Interval
ALL	Continuous Operation Humid, dirty, high ambient sites	80-110 kW	3000 hrs

SECTION 14
MAINTENANCE SCHEDULE

SERVICE CHECK LIST

Air Filter) – Operating conditions determine frequency of service. See “Air Filter”, Section 7.

Package Inlet Filters – Operating conditions determine frequency of service. See “Air Filter”, Section 7.

Motor Lubrication – See “Installation”, Section 2.

Every 8 Hours Operation

1. Check air/oil reservoir oil level, add oil if required. See Section 5 for information. If oil consumption is high, refer to Section 15, Excessive Oil Consumption. DO NOT MIX LUBRICANTS.
2. Check operation of the machine, proper loading and unloading.
3. Check discharge pressure and temperature.
4. Check control panel for advisory text messages.

Every 125 Hours Operation

1. Check for dirt accumulation on oil/aftercooler core faces and the cooling fan. If cleaning is required, clean the exterior fin surfaces of the cores by blowing compressed air carrying a nonflammable safety solvent, which will not damage aluminum, in a direction opposite that of the cooling air flow. The cleaning operation will keep the exterior cooling surfaces clean and ensure effective heat dissipation.

Every 1000 Hours Operation Or 3 Months

1. Replace the oil filter element, as indicated by the AirSmart Controller, every 1000 hours or every 3 months, whichever occurs first. See “Oil Filter”, Section 5.
2. Clean or replace the control box filter (if applicable), as indicated by the Air Smart Controller, ever 1000 hours or every 3 months, whichever occurs first.

Every 2000 Hours Operation Or 6 Months

1. Replace air filter element, operating conditions determine the frequency of service. The air filter will need to be changed, as indicated by the Controller, every 2000 hours or every 6 months, whichever occurs first. See "Air Filter", Section 7.
2. Collect oil sample and send to the GD oil lab.
3. Replace package enclosure filter pad (if applicable.)

Every 3000 Hours Operation Or 9 Months

1. Inspect the motor bearings, re-grease if necessary, see Section 2.

SERVICE CHECK LIST :

Every 4000 Hours Operation or 12 Months

1. Replace Air/Oil Separator, operating conditions determine the frequency of service. The air/oil separator will need to be changed as indicated by the Controller, every 4000 hours or every year, whichever occurs first. See "Compressor Oil Separator" in Section 5 for further details.
2. Inspect the scavenge line, replace the check valve, clean the scavenge line if necessary.
3. Inspect the inlet valve, service if necessary, see parts list for repair kit part number.
4. Visually check for leakage on the shaft seal, replace as required. See the parts lists for the kit part number and for the tool kit part number. The tool kit is required to change the oil seal. If the oil seal is a lip seal, the wear sleeve must always be replaced.
5. Inspect the drive belts (if applicable), replace if necessary. See section 7.
6. Replace lubricant every 8000 hours** . UNDER ADVERSE CONDITIONS, CHANGE MORE FREQUENTLY. (refer to "Oil Change Interval", in Section 5). Flush system if required.
7. Check pressure relief valve, see Section 11

** - Check Section 5 for specific lubricant basic life, based on actual lubricant in the package.

Every 8000 Hours Operation or 24 Months

1. Inspect solenoid valves / vacuum switch operation, replace if necessary.
2. Inspect blow-down valve operation, replace if necessary.
3. Inspect thermistor probes operation, replace if necessary.
4. Inspect pressure transducer, replace if necessary.
5. Inspect minimum pressure/check valve operation, repair if necessary. See Section 9 "Minimum Discharge Pressure/Check Valve".
6. Inspect thermal mixing valve operation, replace element if necessary. See Section 5 "Thermal Mixing Valve" and "Draining and Cleaning Oil System Check".
7. Inspect, replace if necessary the drive coupling spider (coupling element). See Section 7 for detailed instructions on replacing the drive coupling spider.
8. Inspect hoses, replace if necessary.
9. Inspect, observe operation of the turn valve, repair if necessary. See Section 4 '"Turn Valve" and "Turn Valve Actuator"(if applicable).

Maintenance Schedule	As indicated by Controller	Every 8 hours of operation	Every 125 hours of operation	Per oil analysis results	3 months/1000hours	6 months/2000 hours	9 months/3000 hours	12 months/4000hours	15 months/5000hours	18 months/6000hours	21 months/7000hours	24 months/8000hours	27 months/9000hours	30 months/10000hours	33 months/11000hours	36 months/12000hours	39 months/13000hours	42 months/14000 hours	45 months/15000 hours	48 months/16000hours	51 months/17000hours	54 months/18000hours	57 months/19000hours	60 months/20000hours
Check air/oil reservoir oil level		x																						
Check operation of the machine, is it loading and unloading properly		x																						
Check discharge pressure and temperature		x																						
Check control panel for advisory text messages		x																						
Inspect, Clean if necessary Cooler / Fan			x																					
Replace oil filter element	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace Control Box Filter (if applicable)					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace package enclosure filter pad (if applicable)						x		x		x		x		x		x		x		x		x		x
Replace air filter element	x					x		x		x		x		x		x		x		x		x		x
Oil Sample						x		x		x		x		x		x		x		x		x		x
Replace Air/Oil Separator	x							x				x				x				x				x
Inspect, clean if necessary scavenge line, replace check valve								x				x				x				x				x
Inspect, service if necessary Inlet Valve								x				x				x				x				x
Visually check for leakage Shaft Seal								x				x				x				x				x
Inspect, re-grease if necessary Motor Bearings							x			x			x			x			x			x		
Inspect, Replace if necessary Drive Belts (if applicable)								x				x				x				x				x
Replace Lubricant	x			x				x				x				x				x				x
Check pressure relief valve								x				x				x				x				x
Inspect, replace if necessary Solenoid Valves / Vacuum Switch												x								x				
Inspect, replace if necessary Blow-down Valve												x								x				
Inspect, replace if necessary Thermistor Probes												x								x				
Inspect, replace if necessary Pressure Transducer												x								x				
Inspect, replace if necessary Min. Pressure/Check Valve												x								x				
Inspect, replace if necessary Thermal Mixing Valve												x								x				
Inspect, replace if necessary the drive Coupling Spider												x								x				
Inspect, replace if necessary Hoses												x								x				
Inspect, repair if necessary Turn valve												x								x				

Maintenance Schedule	As indicated by Controller	Every 8 hours of operation	Every 125 hours of operation	Per oil analysis results	63 months/21000hours	66 months/22000hours	69 months/23000hours	72 months/24000hours	75 months/25000hours	78 months/26000 hours	81 months/27000 hours	84 months/28000hours	87 months/29000hours	90 months/30000hours	93 months/31000hours	96 months/32000hours	99 months/33000hours	102 months/34000hours	105 months/35000hours	108 months/36000hours	111 months/37000hours	114 months/38000 hours	117 months/39000 hours	120 months/42000hours
Check air/oil reservoir oil level		x																						
Check operation of the machine, is it loading and unloading properly		x																						
Check discharge pressure and temperature		x																						
Check control panel for advisory text messages		x																						
Inspect, Clean if necessary Cooler / Fan			x																					
Replace oil filter element					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Control Box Filter (if applicable)					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Replace cool air inlet filter pad (if applicable)						x		x		x		x		x		x		x		x		x		x
Replace air filter element						x		x		x		x		x		x		x		x		x		x
Oil Sample						x		x		x		x		x		x		x		x		x		x
Replace Air/Oil Separator								x				x				x				x				x
Inspect, clean if necessary scavenge line, replace check valve								x				x				x				x				x
Inspect, service if necessary Inlet Valve								x				x				x				x				x
Visually check for leakage Shaft Seal								x				x				x				x				x
Inspect, re-grease if necessary Motor Bearings					x			x			x			x			x			x			x	
Inspect, Replace if necessary Drive Belts (if applicable)								x				x				x				x				x
Replace Lubricant	x			x				x				x				x				x				x
Check pressure relief valve								x				x				x				x				x
Inspect, replace if necessary Solenoid Valves / Vacuum Switch								x								x								x
Inspect, replace if necessary Blow-down Valve								x								x								x
Inspect, replace if necessary Thermistor Probes								x								x								x
Inspect, replace if necessary Pressure Transducer								x								x								x
Inspect, replace if necessary Min. Pressure/Check Valve								x								x								x
Inspect, replace if necessary Thermal Mixing Valve								x								x								x
Inspect, replace if necessary the drive Coupling Spider								x								x								x
Inspect, replace if necessary Hoses								x								x								x
Inspect, repair if necessary Turn valve								x								x								x

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 “STOP/RESET” 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 “STOP/RESET” button to reset.
	7.	System pressure exceeds set pressure	7.	Wait until system pressure falls below set pressure.
	8.	Compressor lock-up	8.	Confirm compressor shaft is not free to turn. Contact GD for further instructions.
Compressor starts but stops after a short time	1.	High discharge temperature	1.	See “High Discharge Air Temperature,” 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
	5.	Compressor lock-up	5.	Confirm compressor shaft is not free to turn. Contact GD for further instructions.
Compressor does not unload (or load)	1.	Improperly adjusted controller	1.	Refer to Manual 13-17-600 and adjust control.
	2.	Feed pressure regulator not adjusted	2.	Inspect, adjust and replace pressure regulator.
	3.	Feed 3-way solenoid valve malfunction	3.	Repair, clean or replace valve.
	4.	Inlet valve stuck	4.	Inspect and replace valve.
	5.	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 “Oil Carryover” 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 .1” water gauge.
High discharge air, oil Temperature (water cooled cores)	1.	Optional water temp regulating or shut-off valve malfunction	1.	Refer to Section 6, Page 56 “Heat Exchangers” for details.
	2.	Insufficient cooling water flow	2	See Section 6, Page 56 for details on adequate cooling water flow rates.
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 – discharge pressure below 80 psig	8.	Repair or replace. Inspect, adjust or replace regulator.
Low Discharge Temperature	1.	Oil mixing valve stuck on full cooler flow mode	1.	Check 24 Vdc power feed to servo. Check ModBus connection to servo. Check servo-to-valve coupling. Check rotation of ball valve.
	2.	Short load/unload cycles do not allow oil to reach normal operating temperature	2.	Adjust “Auto Timer” in AirSmart controller to at least 5 min value. This action forces package to operate at min speed for set time before stopping.

Standard Warranty

Oil-Lubricated Rotary Screw / Rotary Vane Compressor Packages

APEX, APEX VS, Electra Screw, Integra, Electra Saver II, Electra Saver, L, LRS, VS, VST, V, HV, HV RS, and HR Series

STANDARD WARRANTY

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. **This Standard Warranty statement applies to compressors shipped after April 1st, 2015.**

STANDARD 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 maintenance in accordance with the service manual is required. Use of genuine Gardner Denver OEM parts and lubricants are highly recommended. If a component failure is deemed a result of using non-genuine Gardner Denver parts and lubricants, warranty will not be allowed.**

COMPONENT	STANDARD WARRANTY COVERAGE	DETAILS
Package	**12 months** from startup or **15 months** from date of shipment to first purchaser, whichever occurs first	All components within the package, excluding normal wear items
Airend	**24 months** from startup or **27 months** from date of shipment to first purchaser, whichever occurs first	Normal wearing items, such as shaft seals and inlet valve components, along with the servicing of these items is not covered under the warranty unless deemed as material or workmanship defects. 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
Electric Motors	**12 months** from startup or **15 months** from date of shipment to first purchaser, whichever occurs first	Includes both drive motor and cooling fan motor. For nonstandard motors, the original manufacturer's warranty will take precedence.
Major Package Components	**24 months** from startup or **27 months** from date of shipment to first purchaser, whichever occurs first	Includes package controller, variable frequency drive if applicable, air/oil reservoir, air/oil cooler, and precision mixing valve (VS Series)
Labor	**Package / Electric Motors: 12 months** from startup or **15 months** from date of shipment to first purchaser, whichever occurs first **Airend / Major Package Components: 24 months** from startup or **27 months** from date of shipment to first purchaser, whichever occurs first	Service will be provided by Company representative or authorized service personnel, for repair or replacement of any product or part which in the Company's sole judgment is proved not to be as warranted. Labor shall be limited to the amount specified in the Company's labor rate schedule. All costs of transportation of product, parts, and repaired or replacement parts claimed not to be as warranted to and 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.

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**

STANDARD WARRANTY 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. WARRANTY IS NOT TRANSFERRABLE

NOTES

NOTES

Gardner Denver®

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

 Printed in U.S.A.

Member

Please recycle after use.