GARDNER DENVER

13-21-600
Version: 04
May 5, 2011

ENERGY STAR PARTNER

ELECTRA-SAVER II STATIONARY BASE-MOUNTED & TANK MOUNTED COMPRESSOR

MODELS – EBE99Q
15, 20, 25, 30 HP
60HZ

INTERNATIONAL MODELS

EBE99R
20, 25, 30 HP
(15, 19, 22 KW)
50 HZ

OPERATING AND SERVICE MANUAL

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

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

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

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

1. Trained parts specialists to assist you in selecting the correct replacement parts.
2. Factory warranted new and remanufactured rotary screw airends. Most popular model remanufactured airends are maintained in stock at the Remanufacturing Center in Indianapolis, IN., for purchase on an exchange basis with l beral 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 distr butor service technicians are factory trained and skilled in compressor maintenance and repair. They are ready to respond and assist you by providing fast, expert maintenance and repair services.

For the location of your local authorized Gardner Denver Air Compressor distributor, refer to the yellow pages of your phone directory, check the Gardner Denver Web Site at www.gardnerdenver.com or contact:

Gardner Denver
1800 Gardner Expressway
Quincy, IL 62305

Phone: (217) 222-5400

Fax: (217) 224-7814

INSTRUCTIONS FOR ORDERING 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, WILL 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.

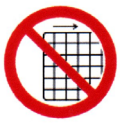
Asphyxiation Hazard – Poisonous Fumes or Toxic Gases in Compressed Air

⚠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:

⚠ DANGER

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

- **Keep fingers and clothing away from rotating fan, drive coupling, etc.**
- **Disconnect the 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.**

⚠ WARNING

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

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

TABLE OF CONTENTS

This book covers the following models:

HP (kW)	PSIG (bar)	Air Cooled	Parts List	Control Manual	Communication Module
15 (11)	100, 125, 150, 175	EBE99Q	13-20-500	13-17-600	13-17-604
20 (15)	100, 125, 150, 175 (6.9), (8.6), (10.3), (12.1)	EBE99Q EBE99R	13-20-500 13-20-501	13-17-600	13-17-604
25 (19)	100, 125, 150, 175 (6.9), (8.6), (10.3), (12.1)	EBE99Q EBE99R	13-20-500 13-20-501	13-17-600	13-17-604
30 (22)	100, 125, 150, 175 (6.9), (8.6), (10.3), (12.1)	EBE99Q EBE99R	13-20-500 13-20-501	13-17-600	13-17-604

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LIST OF ILLUSTRATIONS

SECTION 1
GENERAL INFORMATION

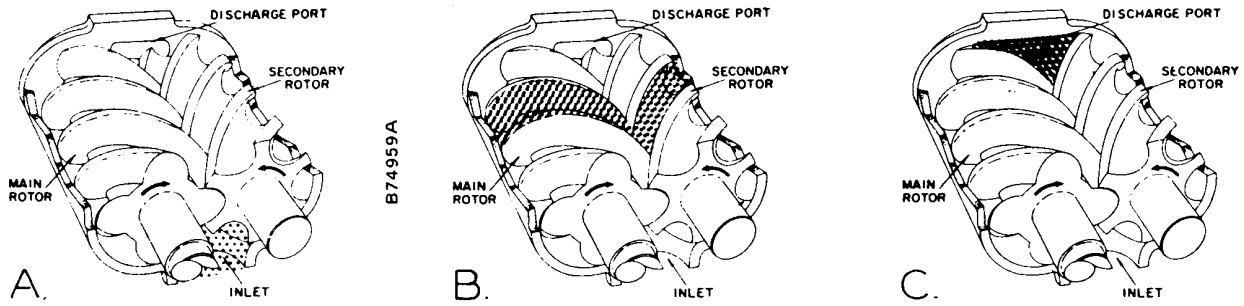


Figure 1-1 – COMPRESSOR CYCLE

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

COMPRESSION PRINCIPLE (Figure 1-1) - Compression is accomplished by the main and secondary rotors synchronously meshing in a one-piece cylinder. The main rotor has four (4) helical lobes 90° apart. The secondary rotor has six (6) matching helical grooves 60° apart to allow meshing with main rotor lobes.

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

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

AIR FLOW IN THE COMPRESSOR SYSTEM (Figure 5-1, page 56) - Air enters the air filter and passes through the inlet unloader valve and on into the compression chamber where oil is injected into the air. After compression, the air/oil mixture passes into the oil reservoir where most of the entrained oil is removed by velocity change and impingement and drops back into the reservoir. The air and remaining oil then passes through the air/oil separator. The air then passes through the minimum pressure/check valve, the aftercooler and the moisture separator and into the plant air lines.

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

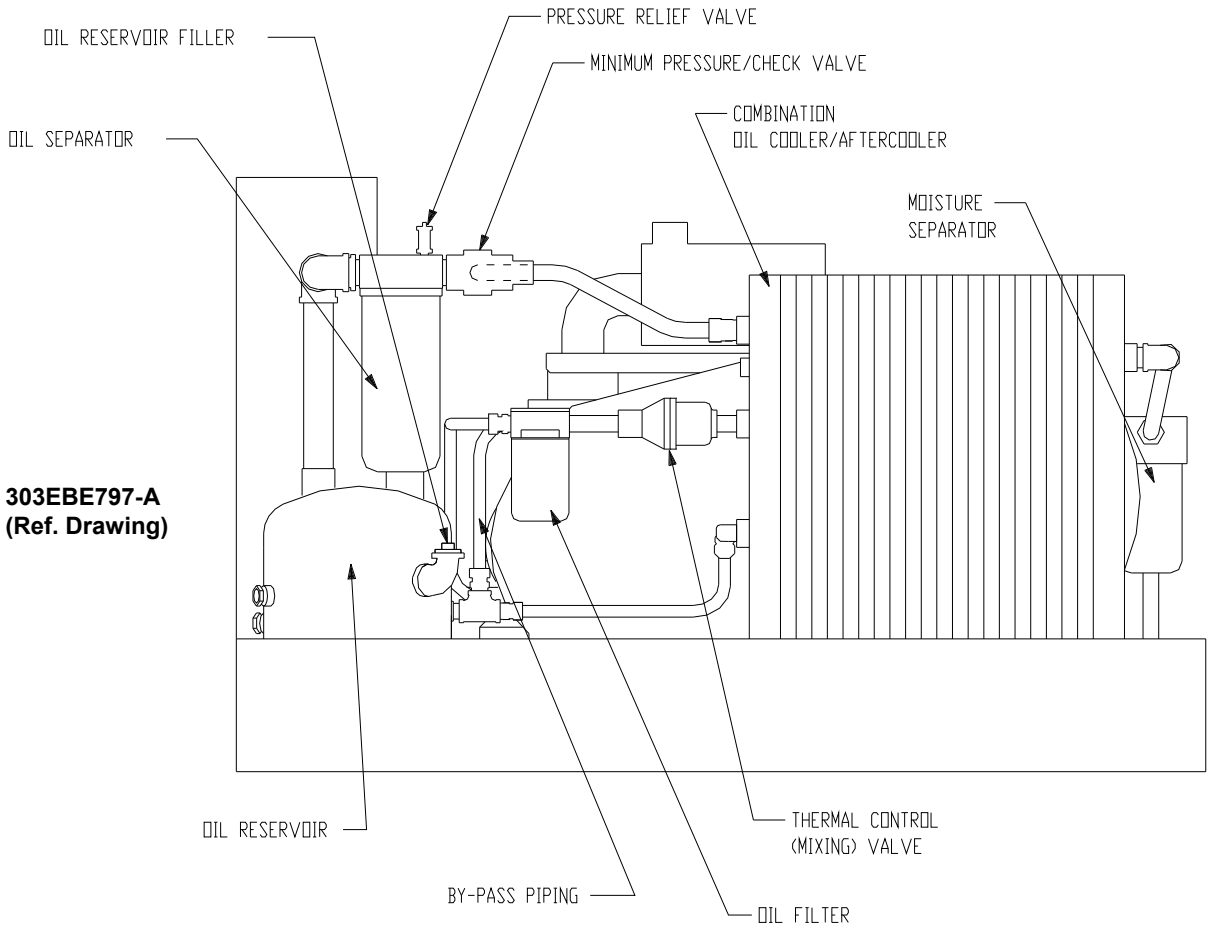


Figure 1-2 – PACKAGE – MINIMUM PRESSURE/CHECK VALVE SEPARATOR & OIL FILTER

303EBE797 - A
(Ref. Drawing)

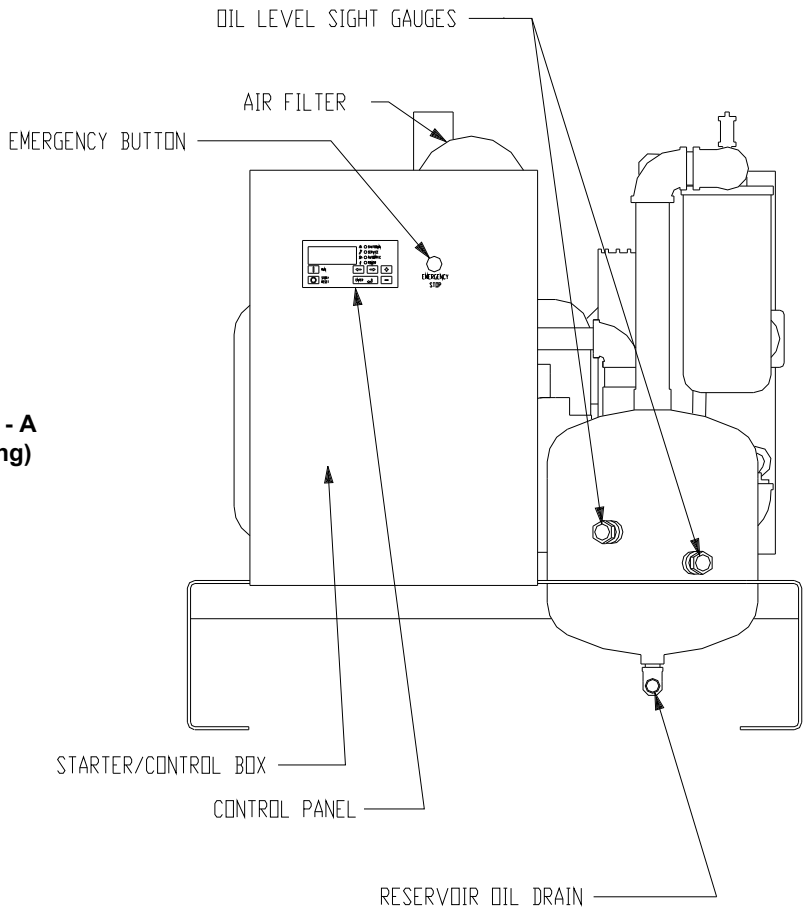


Figure 1-3 – PACKAGE – OIL LEVEL GAUGES, STARTER/CONTROL BOX & AIR FILTER

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 bar.

CAUTION

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

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

⚠ CAUTION

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

Location (Figure 2-1, page 13) - The compressor should be installed where it is protected from rain, snow and freezing temperatures, in a clean, well-lighted, well-ventilated area with ample space all around for maintenance. Select a location that provides a cool, clean, dry source of air. In some cases it may be necessary to install the air filter at some distance from the compressor to obtain proper air supply.

Air-Cooled Unit - A combination oil/aftercooler is supplied as standard equipment on all air-cooled units. The air-cooled unit with the standard enclosure requires sufficient flow for the compressor oil/aftercooling system and electric motor cooling (Figure 2-2, page 13). Air is drawn into the unit at the motor side of the enclosure and is exhausted at the cooler side. Do not block the air flow to and from the unit. Allow three and one half (3-1/2) feet (1.1M) to the nearest obstruction on the starter end and control box end of the unit. Allow two (2) feet (.6M) to the nearest obstruction above and on other sides of unit. For continuous efficiency, oil cooler cores must be periodically cleaned with either vacuum or compressed air. If wet cleaning is required, shield motor and spray on a mild soap solution and flush with clean water.

NOTICE

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

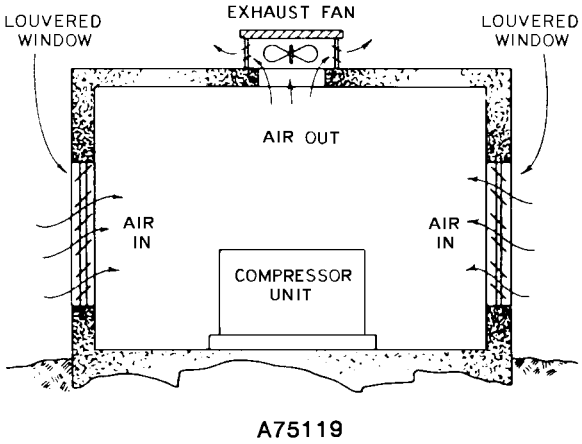


Figure 2-1 – TYPICAL COMPRESSOR ROOM

Minimum Air Flow* for Compressor and Cooling Cubic Feet/Minute (Cubic Meters/Minute)	
	Air Cooled
All Models	3000 cfm (170 M^3/min.)

* 80° F (27° C) Inlet Air

Figure 2-2 – MINIMUM AIR FLOW

FOUNDATION - Rotary screw compressors require no special foundation, but should be mounted on a smooth, solid surface. Whenever possible install the unit near level. Temporary installation may be made at a maximum 10^o angle lengthwise or 10^o sidewise. Mounting bolts are not normally required. However, installation conditions such as piping rigidity, angle of tilt, or danger of shifting from outside vibration or moving vehicles may require the use of mounting bolts and shims to provide uniform support for the base. Belt alignment and tension should be checked after installation. (For information on Belt Alignment and Tension see Section 7, page 70.)

OIL RESERVOIR DRAIN - The oil drain is piped from the bottom of the reservoir to the side of the frame. This drain is approximately 2 inches (50 mm) above the floor level. If this is not sufficient to conveniently drain the oil, some other methods of providing drain are:

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

⚠ CAUTION

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

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 compressor, electric motor, oil cooler and aftercooler are mounted inside the enclosure. Service doors are provided for maintenance access. Be sure to allow enough space around the unit for the doors to be removed.

Any of the enclosure doors may be removed by opening the door and lifting it up slightly to disengage the hinges.

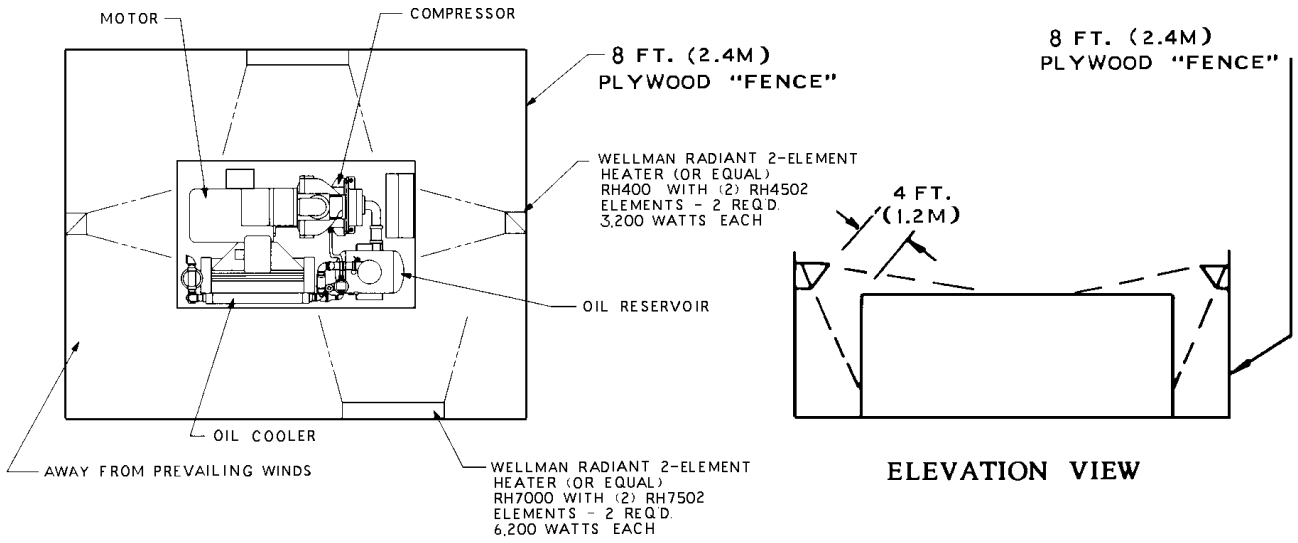
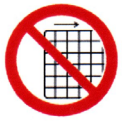


Figure 2-3 – COLD WEATHER INSTALLATION

⚠ DANGER



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

The motor inspection/air filter service panel is held by two latches and lifts away from the enclosure. The air outlet panel is attached by screws to the enclosure and is not readily removable.

INSTALLATION FOR COLD WEATHER OPERATION (Figure 2-3, page 14) - It is recommended that the unit be installed inside a shelter that will be heated to temperatures above freezing (32°F, 0°C). This will eliminate many of the problems associated with operating units in cold climates, such as freezing in control lines and downstream of the cooler.

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

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

⚠WARNING

Failure to remove condensate from an idle cooler in freezing temperatures will cause permanent cooler damage. Drain condensate after system shutdown. It is the owner/operator's responsibility to ensure that condensate has been drained and cooler dried out to prevent cooler damage.

Cold Weather (Down To +10°F, -12°C)

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

2. If an air-cooled aftercooler is to be used, provisions to bypass the aftercooler must be made. Since cold air contains very little moisture, successful operation can be achieved without the aftercooler.

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

4. Use only Gardner Denver AEON 9000SP lubricant.

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

6. Specify NEMA 4 enclosure for electrical devices.

Extreme Cold Weather Operation (Down To -40°F, -40°C)

In addition to the above, the following should be provided:

1. It will be necessary to provide shutters or to block off part of the cooler in some manner since the cooler is greatly oversized for operation in these low temperatures. Since shutters are not provided as a factory option, blocking off a portion of the cooler with plywood should be satisfactory.

2. In extreme environments, run the unit in "Constant Speed" only.

3. Some means of providing heat during shutdown should be provided. There are various methods to accomplish this, but since openings are not provided for sump heaters, the use of radiant heaters is recommended. The heaters should be sized to provide at least a +10°F (-12°C) environment for coolers, motor and sump. Figure 2-3, page 14, this section, shows how these might be located in a typical installation and sizes required.

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

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. When used, an air receiver should be of adequate size, provided with a relief valve of proper setting, a pressure gauge and a means of draining condensate.

MOISTURE SEPARATOR/TRAP - Since the unit is equipped with a built-in aftercooler, a combination moisture separator and trap is furnished with the unit. A means of draining condensate will need to be provided for.

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

INLET LINE - Where an inlet line is used between the air filter and the compressor, it must be thoroughly cleaned on the inside to prevent dirt or scale from entering the compressor. **If welded construction is used, the line must be shot blasted and cleaned to remove welding scale.** In either case, the inlet line must be coated internally by galvanizing or painting with a moisture and oil-proof sealing lacquer. Up to ten (10) feet (3 meters) in length, the inlet line should be the full size of the inlet opening on the compressor. If an extra-long line is necessary, the pipe size should be increased according to Inlet Line Length Chart below.

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

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

Figure 2-4 – INLET LINE LENGTHS

DISCHARGE SERVICE LINE - The discharge service line connection is made at the upper right hand corner of the cooler, viewed from the oil cooler side. A hand operated valve, (air service valve) must be installed between the unit and the customer's air system. When manifolding two or more rotary screw compressor units on the same line, each unit is isolated by the check valve in the unit discharge line. If a rotary screw compressor is manifolded to another compressor, be sure the other compressor has a check valve in the line between the machine and the manifold. If a rotary screw and a reciprocating compressor are manifolded together, an air receiver must be located between the two units.

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.

BLOWDOWN VALVE PIPING - The blowdown valve is fitted with a muffler for operation indoors. If the installation requires, the muffler may be removed and the blowdown valve piped to the outside with a pipe size the same as the blowdown valve outlet connection.

ELECTRICAL WIRING

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

Standard Units - The rotary screw compressor is factory wired for all starter to motor and control connections for the voltage specified on the order. It is necessary only to connect the unit to the correct power supply. The standard unit is supplied with an open drip-proof motor, a UL/NEMA Type 4 starter and control enclosure. See “Location” paragraph, page 12, for distance to nearest obstruction on starter and control box sides of the unit.

The overload settings are to be selected based on motor nameplate full load amperage.

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

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

MOTOR LUBRICATION - Long time satisfactory operation of an electric motor depends in large measure on proper lubrication of the bearings. The following charts show recommended grease qualities and regreasing intervals for ball bearing motors. For additional information refer to the motor manufacturer's instructions. The following procedure should be used in regreasing:

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

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

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

Figure 2-5 – MOTOR GREASE RECOMMENDATIONS (-30°C to 50°C)

Type of Service	Typical Examples	Rating	Relubrication Interval
Standard	One or Two Shift Operation	150 HP (112 kW) & Below	18 Months
Severe	Continuous Operation	150 HP (112 kW) & Below	9 Months
Very severe	Dirty Locations, High Ambient Temperature	150 HP (112 kW) & Below	4 Months

Figure 2-6 – ELECTRIC MOTOR REGREASING INTERVAL

SECTION 3
Starting & Operating Procedures

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

1. **Compressor Oil** - Check oil level in the reservoir. Add oil only if the oil level gauge reads in the red "ADD OIL" range. Do not mix different type oils. Unit is shipped filled with Gardner Denver AEON 4000 Lubricating Coolant which is suitable for the first 4000 hours under normal operating conditions. (AEON 4000 is generally suitable for use up to 4000 hours service life, provided the lubricant is monitored by periodic analysis.)

   REPLACE OIL FILTER EVERY 1000 HOURS

   Initial fill, or filling after a complete draining of the system, may show the oil level above the FULL mark (the bottom of the top sight gauge). After start-up, the oil level will drop and fluctuate as the machine runs. To check for proper oil level, shut off the machine and allow the foam to settle out. If necessary, add oil to bring the level to the FULL mark. See Figure 1-3, page 11.

NOTICE

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

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

During unloaded operation and after shutdown, the system will partially drain back into the oil reservoir and the oil level may read higher than when operating on load. DO NOT DRAIN OIL TO CORRECT; on the next loaded cycle or start, oil will again fill the system and the gauge will indicate the operating level

2. **Air Filter** - Inspect the air filter to be sure it is clean and tightly assembled. Refer to Section 6, page 68 complete servicing instructions. Be sure the inlet line, if used, is tight and clean.

3. **Piping** - Refer to SECTION 2, "Installation", page 12, and make sure piping meets all recommendations.

4. **Electrical** – Check the wiring diagrams furnished with the unit to be sure it is properly wired. See Figures 4-9, through 4-19, pages 34 through 55, for general wiring diagrams and SECTION 2, page 8 for installation instructions.

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

CAUTION

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

6. **Rotation** - Check for correct motor rotation using "JOG MODE." Compressor drive shaft rotation must be clockwise standing facing the compressor sheave. See Control Manual 13-17-600, page 45.

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.

7. **System Pressure** - Set the controls to the desired load pressure. DO NOT EXCEED THE MAXIMUM OPERATING PRESSURE ON THE COMPRESSOR NAMEPLATE. See Control Manual 13-17-600, page 11-12, "Setting the Unload and Load Pressure," for procedure.

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.

8. **Operating Mode** - Refer to Control Manual 13-17-600, for detailed information on the control system.

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

STARTING THE UNIT - Observe the following starting procedures:

Unit Cold:

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

2. Turn on power to the compressor package. To start, press “STOP/RESET”, then press “RUN”.

3. Run for approximately five minutes or until the temperature stabilizes and then open the air service valve.

The unit is equipped with a minimum (65 psig, 4.5 bar) pressure/check valve; no special procedure to maintain the unit reservoir pressure is required.

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

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

2. Turn on power to the compressor package. To start, press “STOP/RESET”, then press “RUN”.

3. Run for approximately one minute and then open the air service valve.

The unit is equipped with a minimum (65 psig, 4.5 bar) pressure/check valve, no special procedure to maintain the unit reservoir pressure is required.

DAILY CHECK - Refer to SECTION 8, “Maintenance Schedule”, page 72 .

STOPPING THE UNIT:

1. To stop compressor operation, press “STOP/RESET”.

2. Wait approximately one minute to allow the compressor to stop.

The oil reservoir will automatically blow down as the motor stops.

Quick Start Guide

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

button to start the compressor, no other settings are required. The Target Pressure comes preset to 100 PSI from the factory. The Unload Pressure is preset to 110 PSI. If a different pressure setting is desired, the following steps can be used as a guide.

Setting the Target Pressure

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

button. The front panel display should read "READY" on line 3.

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

Next, press the Enter 

button to access the Adjustment Menu tree

ADJUSTMENT MENU
OPERATION ADJUSTMENT

(SELECT SUB MENU)

Since the Target Pressure setting is under the Operation Adjustment menu, press Enter 

again to access that sub-menu

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

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

OPERATION ADJUSTMENT
TARGET PRESSURE
100 PSI
(SELECT PARAMETER)

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

OPERATION ADJUSTMENT TARGET PRESSURE 100 PSI (EDIT PARAMETER)

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

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

STORE MODIFIED PARAMETERS? STOP = NO ENTER = YES

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

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)

SECTION 4
CONTROLS & INSTRUMENTATION

GENERAL DESCRIPTION

The Gardner Denver rotary screw compressor is prewired with all controls, motor, and starter for the voltage and horsepower at the time of ordering. It is necessary only to connect the compressor unit to the correct power supply and to the shop air line. A standard compressor unit consists of the compressor, oil reservoir, oil cooling system and filter, motor type as specified, UL/NEMA Type 4 starter / control box, and control components as described below. Inlet valve modulation is standard.

"AIRSMART" OPERATION

Operation of the "AirSmart" is dependent on selection of an operating mode from the controller keypad. Prior to starting, the STOP/RESET key must be pressed to place the controller into its READY state (as indicated on the display). Compressor operation may then be started by pressing the RUN key. While in any operating mode, the display will indicate the mode, and the operating light will be on.

Press the STOP/RESET key at any time to stop the compressor under normal conditions.

AUTOMATIC is the most common selected mode of operation, as it automatically will operate the compressor unit in the most efficient manner for the demand of the air system. Refer to the controller manual for descriptions of other modes.

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

301EBE797-A
(Ref. Drawing)

1. COMPRESSOR
2. OIL COOLER
3. AFTERCOOLER
4. OIL FILTER
5. THERMAL MIXING VALVE
6. AIR FILTER
7. SEPARATOR
8. MINIMUM PRESSURE CHECK VALVE
9. SUBTRACTIVE PILOT
10. RESERVOIR PRESSURE TRANSDUCER
11. CONTROL PRESSURE TRANSDUCER
12. AIR FILTER VACUUM SWITCH
13. INLET VALVE
14. SHUTTLE VALVE
15. BLOWDOWN VALVE
18. ORIFICE
19. CHECK VALVE
20. OIL FILL
21. OIL DRAIN
22. OIL LEVEL GAUGES
23. SEPARATOR OIL RETURN LINE
24. PURGE AIR LINE
25. INLET VALVE CONTROL AIR PRESS LINE
26. FINAL DISCHARGE
27. BLOWDOWN LINE
28. SOLENOID VALVE
29. PURGE AIR VALVE

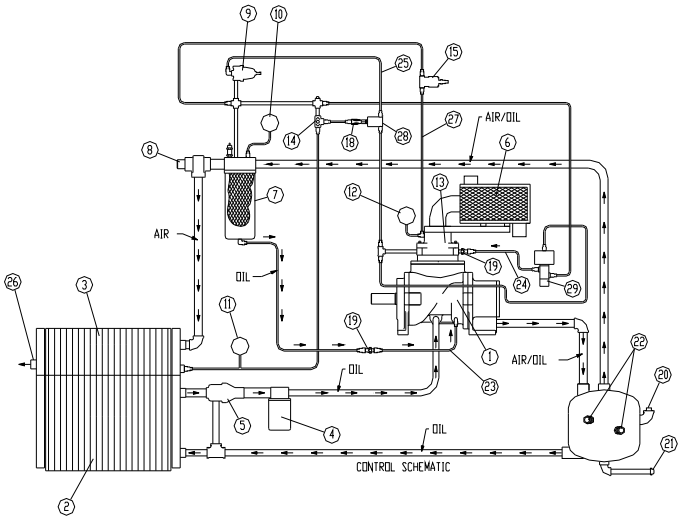


Figure 4-1 – CONTROL SCHEMATIC

CONTROL DEVICES

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

Detailed instructions for the controller are found in the “AirSmart” Controller Operating and Service Manual.

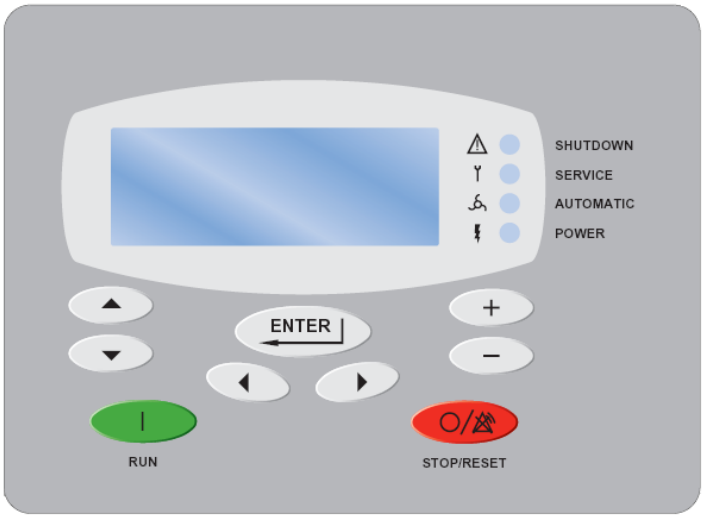


Figure 4-2 – KEY PAD

Relief Valve - A pressure relief valve(s) is (are) installed in the final discharge line and set at the factory for protection against overpressure. Periodic checks should be made to ensure it is operating properly.

The relief valve should be tested for proper operation at least once every year. To test the relief valve, raise the system operating pressure to 75% of the relief valve set pressure and manually open the valve with the hand lever. Hold the valve open for a few seconds and allow it to snap shut.

DANGER

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

CAUTION

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

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.

Oil Level Gauge - This gauge is located on the oil reservoir and indicates the oil level. See “Oil Level Gauge”, Section 5, page 59, for how to read oil level.

Minimum Discharge Pressure/Check Valve (Figure 4-3, page 26) **-** An internal spring-loaded minimum pressure valve is used in the final discharge line to provide a positive pressure on the oil system even when the air service valve is fully open. The valve senses upstream pressure. If demand for air exceeds the compressor capacity, the valve throttles the flow to maintain a minimum pressure on the upstream (oil reservoir) side of the valve. When pressure rises above the minimum pressure (standard setting 60 to 65 PSIG, 4.1 to 4.5 bar), the valve reaches the full open position.

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

The valve does not require maintenance or adjustment. If the valve fails to function, it must be replaced because it is not field adjustable or field repairable.

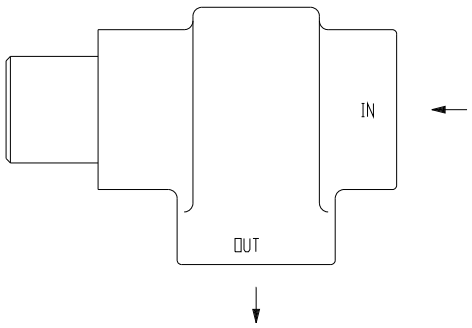


Figure 4-3 – MINIMUM PRESSURE/CHECK VALVE

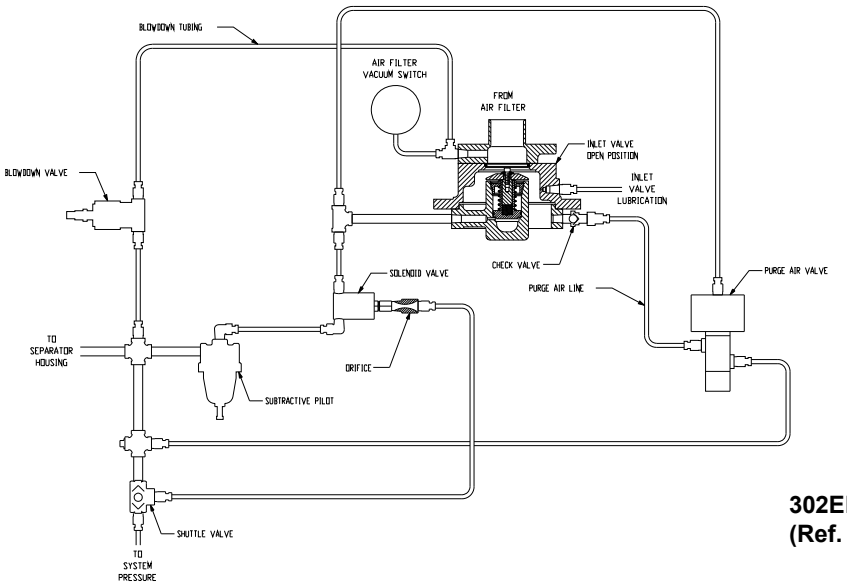


Figure 4-4 – INLET VALVE

Inlet Valve (Figure 4-4, page 27) **-**.The inlet valve is a pilot—actuated valve that restricts the inlet to control capacity and closes to unload the compressor. At shutdown the inlet valve closes to function as a check valve and prevent back flow of air.

As control pressure is increased the valve will begin to close, restricting the inlet and reducing compressor capacity. Approximately 18 psig (1.2 bar) of control pressure is required to close the inlet valve completely. When closed, the inlet valve prevents the flow of air in either direction. With standard modulating control feature: when the control pressure is less than 18 psig (1.2 bar), the inlet valve will modulate to match compressor capacity to system demand.

Blowdown Valve (Figure 4-4, page 27) **-** The blowdown valve is a two-way solenoid valve which is piped into the oil separator outlet ahead of the check valve. When the solenoid is de-energized, the blowdown valve opens and the oil system is blown down. When the solenoid is energized, the blowdown valve closes and allows the oil system to pressurize.

System Pressure Transducer (Figure 4-1, page 24) **-** This transducer is connected after the minimum pressure valve. It converts the pressure in the plant air system into an electrical signal for use by the "AirSmart" controller for modulation and control.

Reservoir Pressure Transducer (Figure 4-1, page 24) **-** This transducer is connected to the coolant system. Its signal is used to prevent loaded starts, monitor oil pressure, and to monitor the condition of the separator.

Air Filter Vacuum Switch (Figure 4-4, page 27) **-** This switch is used to monitor air filter condition and alert the user if the filter requires service or replacement.

Purge Air Valve – The purge valve is a normally closed two-way air actuated valve that admits purge air from the final discharge manifold to the compressor to counteract the oil knock that occurs in oil-flooded rotary screw compressors when they are completely unloaded with pressure in the oil reservoir. This valve is controlled by the same control pressure which controls the inlet valve.

Subtractive Pilot – Used to control the inlet valve for modulation. See page 30 for more detail.

CAUTION

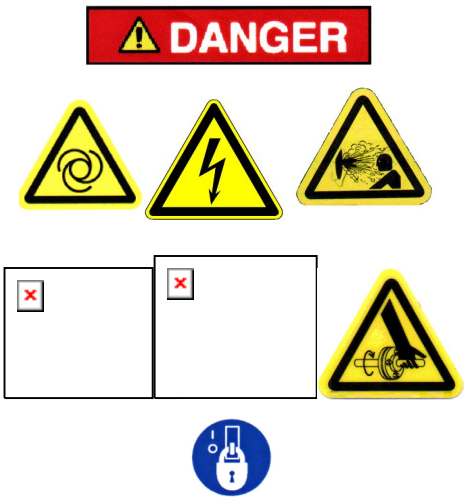
Machine damage will occur if compressor is repeatedly restarted after any one of the shutdown modes stops operation of the unit. Find and correct the malfunction before resuming operation.

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

Reservoir Thermistor - This sensor is located in the reservoir/separator housing and is used to monitor temperature and shut down the compressor if temperature problems occur at the separator.

Emergency Stop Pushbutton - This is a maintained pushbutton, and removes power from the controller outputs regardless of controller status. It is located on the upper section of the control box door, next to the keypad. This should be used for emergency purposes only - use the keypad [STOP/RESET] for normal controlled stopping.

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



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

Control Transformer – For 575 volt AC units, a control transformer is provided to supply 230 volts AC input to the power supply. A secondary fuse is provided on the control transformer. Refer to adjacent labeling for replacement information.

For 230 volt AC units, that can be converted for 460 volt AC operation using conversion Kit 313EFC6005, a control transformer is provided to supply 115-120 volts AC input to the power supply. Two primary and one secondary fuse are provided, mounted on the transformer. Refer to adjacent labeling for fuse replacement information.

Fuse Blocks – For all except 230 volt AC units, two class CC fuse blocks provide line side protection for the power supply and control transformer, as applicable.

Power Supply – This device changes the incoming AC supply voltage, or transformer supply voltage, to 24 volts DC for use by all unit control devices

Terminal Strip - This provides connections for all 24 volt devices not contained within the enclosure.

Main Starter - This starter is used to provide control and overload protection for the main drive motor.

Standard full voltage starters employ a single contactor and overload protection for each motor. Overload settings should be selected and adjusted based on the motor nameplate amps and the instructions located inside the control box door.

Subtractive Pilot (Modulating Feature) - The subtractive pilot is an adjustable, spring-loaded diaphragm valve that controls pressure in relation to the upstream (discharge) pressure

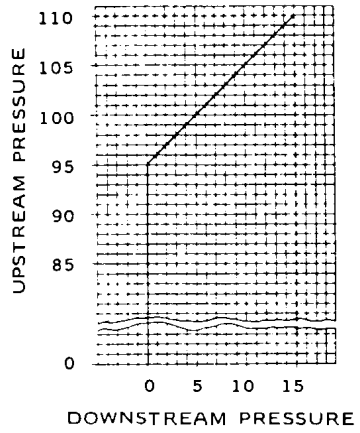


Figure 4-5 – PRESSURE CHART

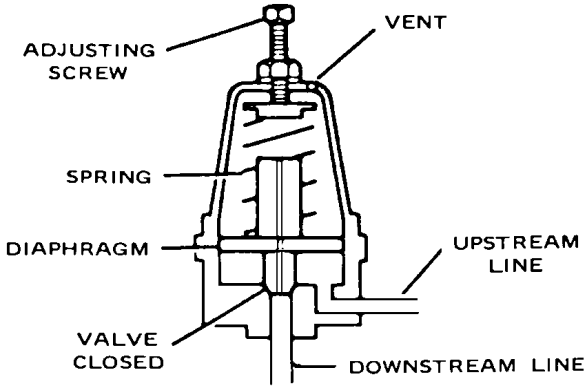


Figure 4-6 – SUBTRACTIVE PILOT (CLOSED)

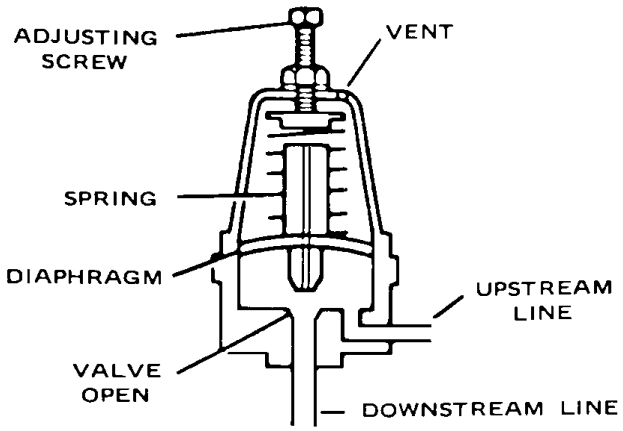


Figure 4-7 – SUBTRACTIVE PILOT (OPENED)

The downstream pressure is maintained equal to the upstream pressure minus a constant which is adjustable. In the example shown in Figure 4-5, page 31, the downstream pressure equals the upstream pressure minus 95 psi (6.6 bar). When the upstream pressure rises to 100 psig (6.9 bar), the downstream pressure rises to 5 psig (.3 bar). This 1 to 1 psi (bar) rise is constant above the set point.

Below the set point, the valve seat is closed and the downstream pressure is vented. In the example of Figure 4-5, page 31, downstream pressure is vented below 95 psig (6.6 bar)

Figure 4-6, shows a schematic cross section of the subtractive pilot with the valve seat closed and downstream line vented.

Figure 4-7, shows the pilot with valve seat open, holding a downstream pressure which is adjustable with the screw. In this position it is normal for the valve to continually bleed air through the small vent hole in the bowl.

Moisture, oil and dirt in the control system lines and components can cause the set point of the subtractive pilot to shift or be erratic. The subtractive pilot can be disassembled and the diaphragm and ports cleaned when necessary.

Operating Air Pressure Adjustment – The "AIRSMART" controller load and unload pressure set points should already be programmed. See Control Manual 13-17-600, page 11 – 12.

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

To adjust the subtractive pilot:

1. With the unit off, loosen the locknut and back out the adjusting screw several turns so the subtractive pilot will fully unload the compressor before the unload pressure set point of the microprocessor controller is reached.

2. Close the air service valve and start the unit in the "RUN" mode. Allow unit to reach the pressure at which the subtractive pilot fully unloads the compressor.

3. Turn-in the adjusting screw until the unload pressure set point is reached and the microprocessor controller allows the unit to blow down.

4. Turn-in the adjusting screw and additional one eighth (1/8) turn and tighten the locknut. As a result, the subtractive pilot will not fully unload the compressor before the microprocessor controller's unload pressure set point is reached.

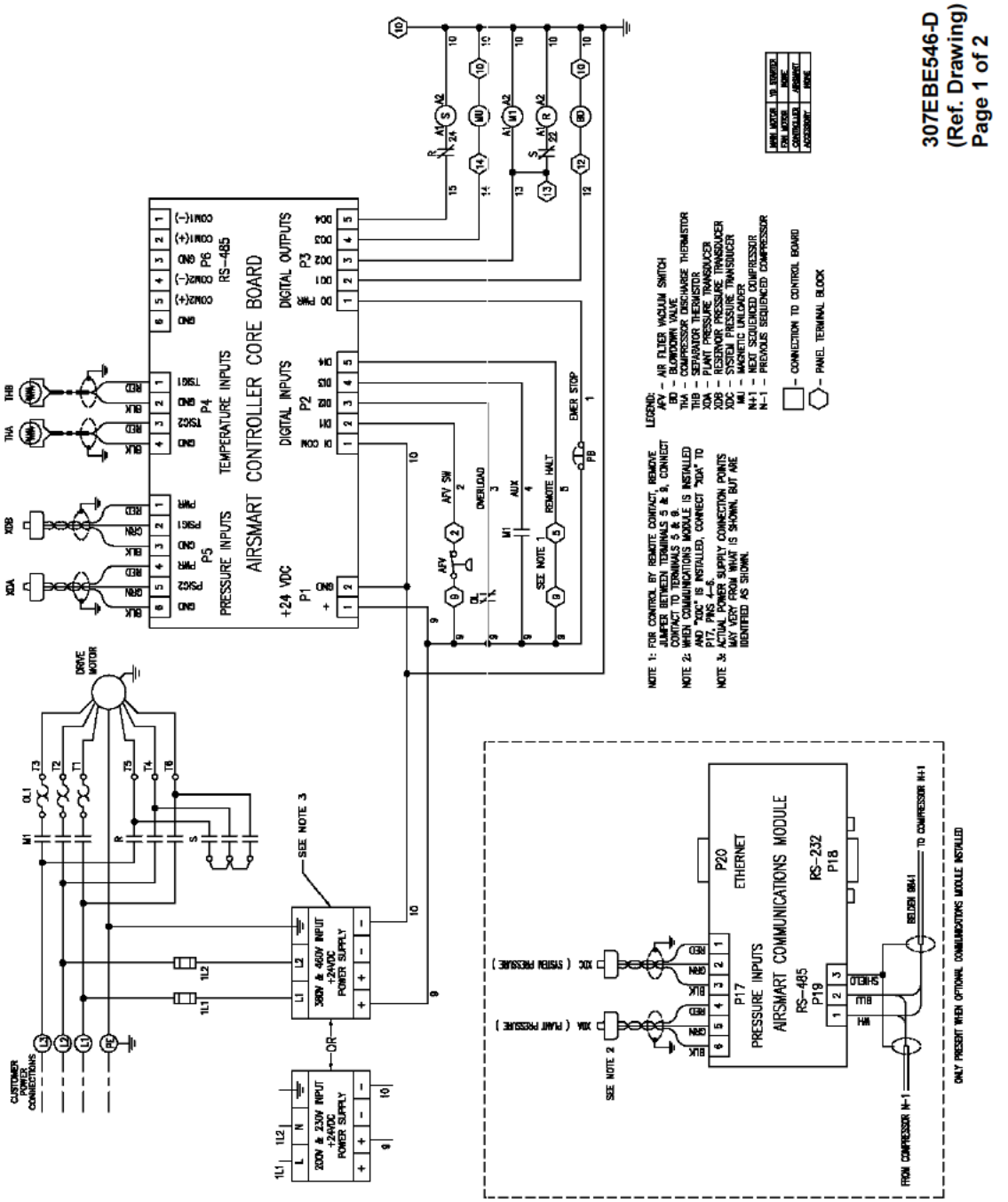
5. Using the air service valve, cycle the unit between load and unload several times to be certain that the unit will reach the microprocessor controller's unload pressure set point and blow down.

NAMEPLATE FULL LOAD OPERATING PRESSURE	CONTROL SYSTEM PRESSURE	
	LOAD	UNLOAD
100 PSIG (6.9 bar) 125 PSIG (8.6 bar) 150 PSIG (10.4 bar) 175 PSIG (12.1 bar)	100 PSIG (6.9 bar) 125 PSIG (8.6 bar) 150 PSIG (10.4 bar) 167 PSIG (11.5 bar)	108 PSIG (7.5 bar) 133 PSIG (9.2 bar) 158 PSIG (10.9 bar) 175 PSIG (12.1 bar)

Figure 4-8 – MAXIMUM SET POINTS FOR AIRSMART CONTROLLER

NOTICE

Load set point cannot be set within 8 psi (.6 bar) of the unload set point. Minimum operating pressure is 60 to 65 psig (4.1 to 4.5 bar)



307EBE546-D
(Ref. Drawing)
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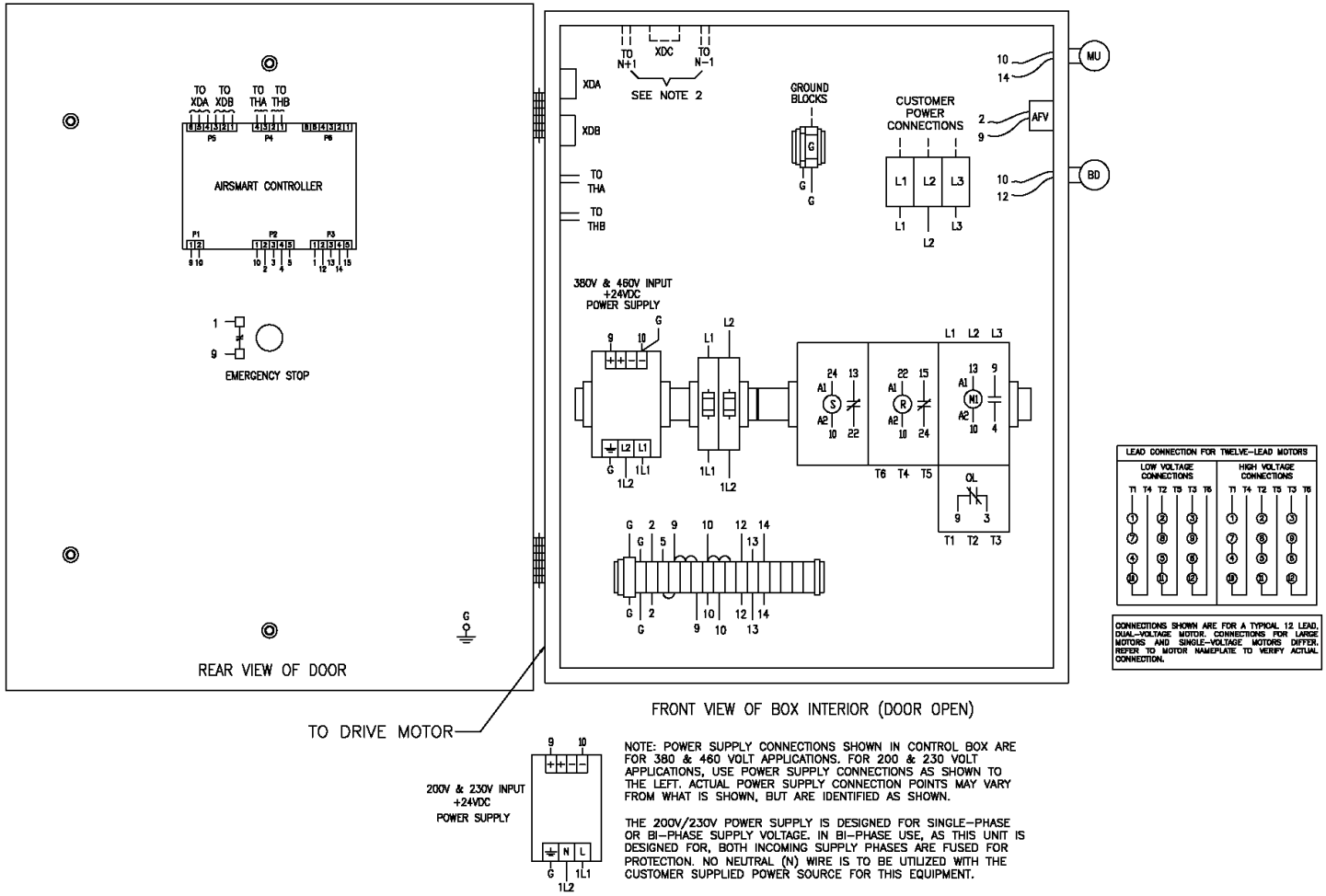
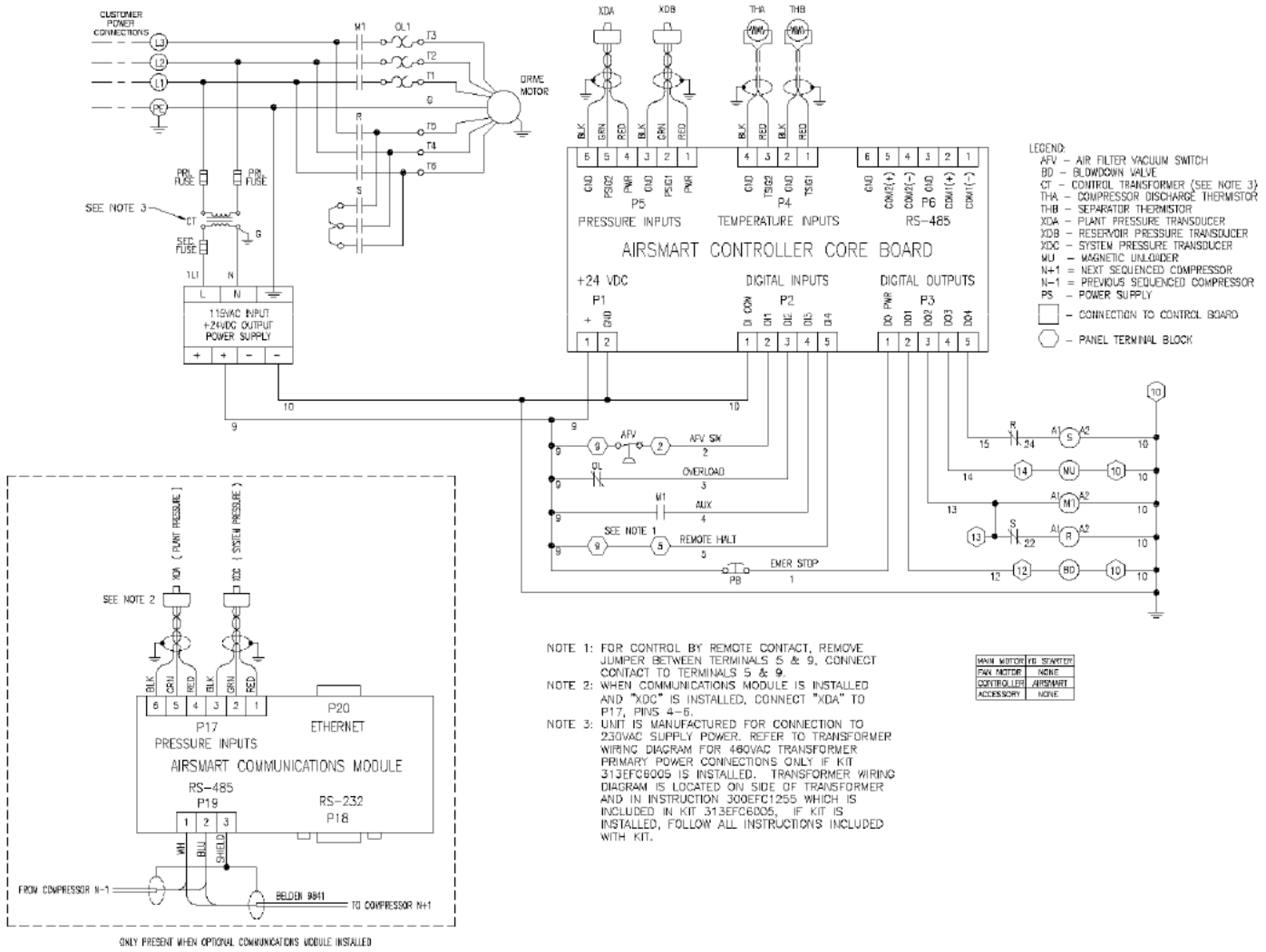
Figure 4-9 – WIRING DIAGRAM – WYE DELTA 15, 20, 25, & 30 HP (200 & 460 VOLT)



CONNECTIONS SHOWN ARE FOR A TYPICAL 12 LEAD, DUAL-VOLTAGE MOTOR. CONNECTIONS FOR LARGE MOTORS AND SINGLE-VOLTAGE MOTORS DIFFER. REFER TO MOTOR NAMEPLATE TO VERIFY ACTUAL CONNECTION.

NOTE: POWER SUPPLY CONNECTIONS SHOWN IN CONTROL BOX ARE FOR 380 & 460 VOLT APPLICATIONS. FOR 200 & 230 VOLT APPLICATIONS, USE POWER SUPPLY CONNECTIONS AS SHOWN TO THE LEFT. ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.

THE 200V/230V POWER SUPPLY IS DESIGNED FOR SINGLE-PHASE OR BI-PHASE SUPPLY VOLTAGE. IN BI-PHASE USE, AS THIS UNIT IS DESIGNED FOR, BOTH INCOMING SUPPLY PHASES ARE FUSED FOR PROTECTION. NO NEUTRAL (N) WIRE IS TO BE UTILIZED WITH THE CUSTOMER SUPPLIED POWER SOURCE FOR THIS EQUIPMENT.



315EBE546-A
(Ref. Drawing)
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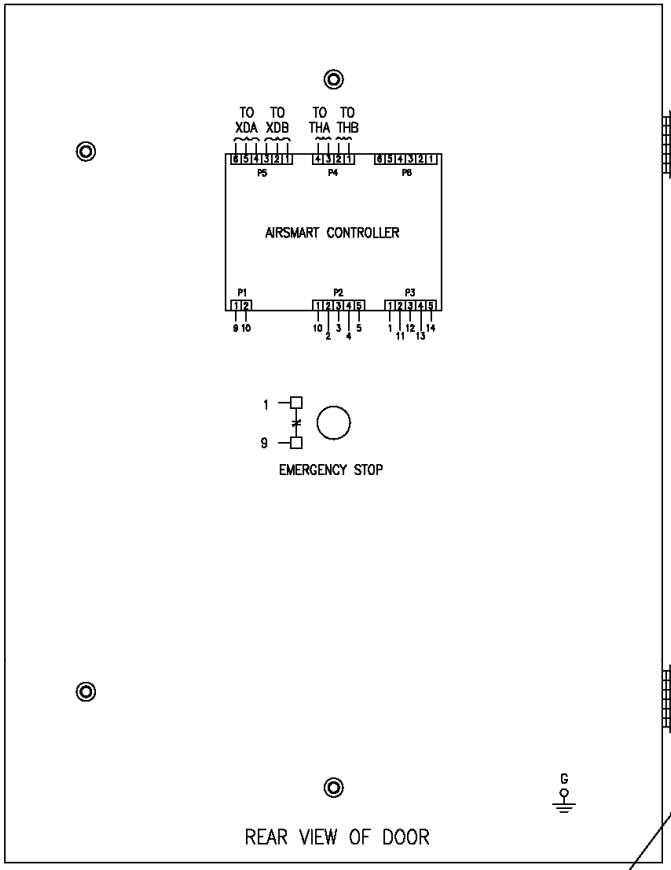
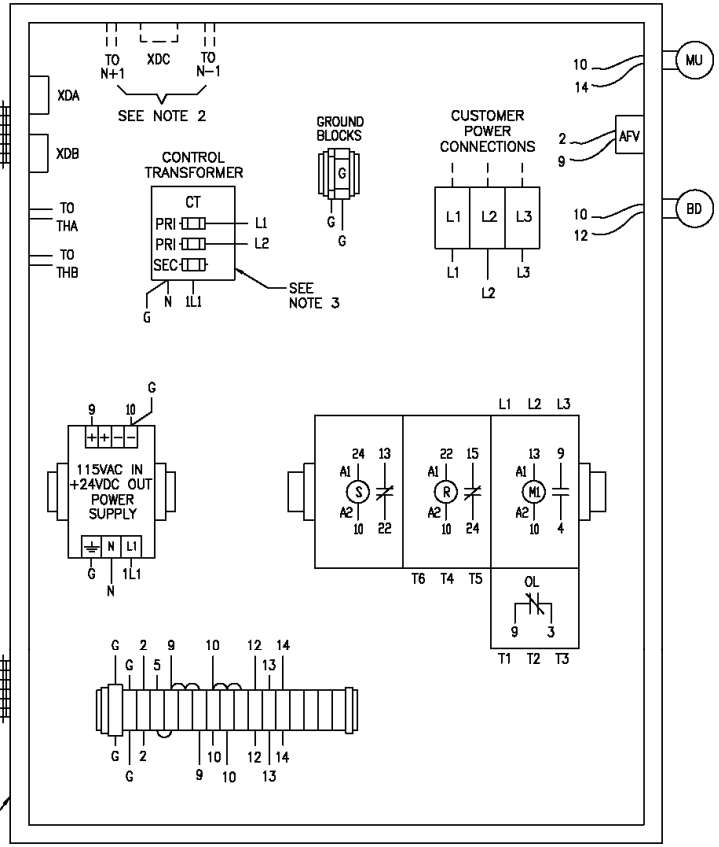
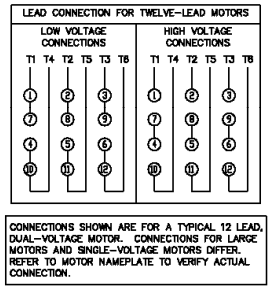
Figure 4-10 – WIRING DIAGRAM – WYE DELTA 15, 20, 25 & 30 HP (230 VOLT)





FRONT VIEW OF BOX INTERIOR (DOOR OPEN)

NOTE: ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.



CONNECTIONS SHOWN ARE FOR A TYPICAL 12 LEAD, DUAL-VOLTAGE MOTOR. CONNECTIONS FOR LARGE MOTORS AND SINGLE-VOLTAGE MOTORS DIFFER. REFER TO MOTOR NAMEPLATE TO VERIFY ACTUAL CONNECTION.

315EBE546-A
(Ref. Drawing)
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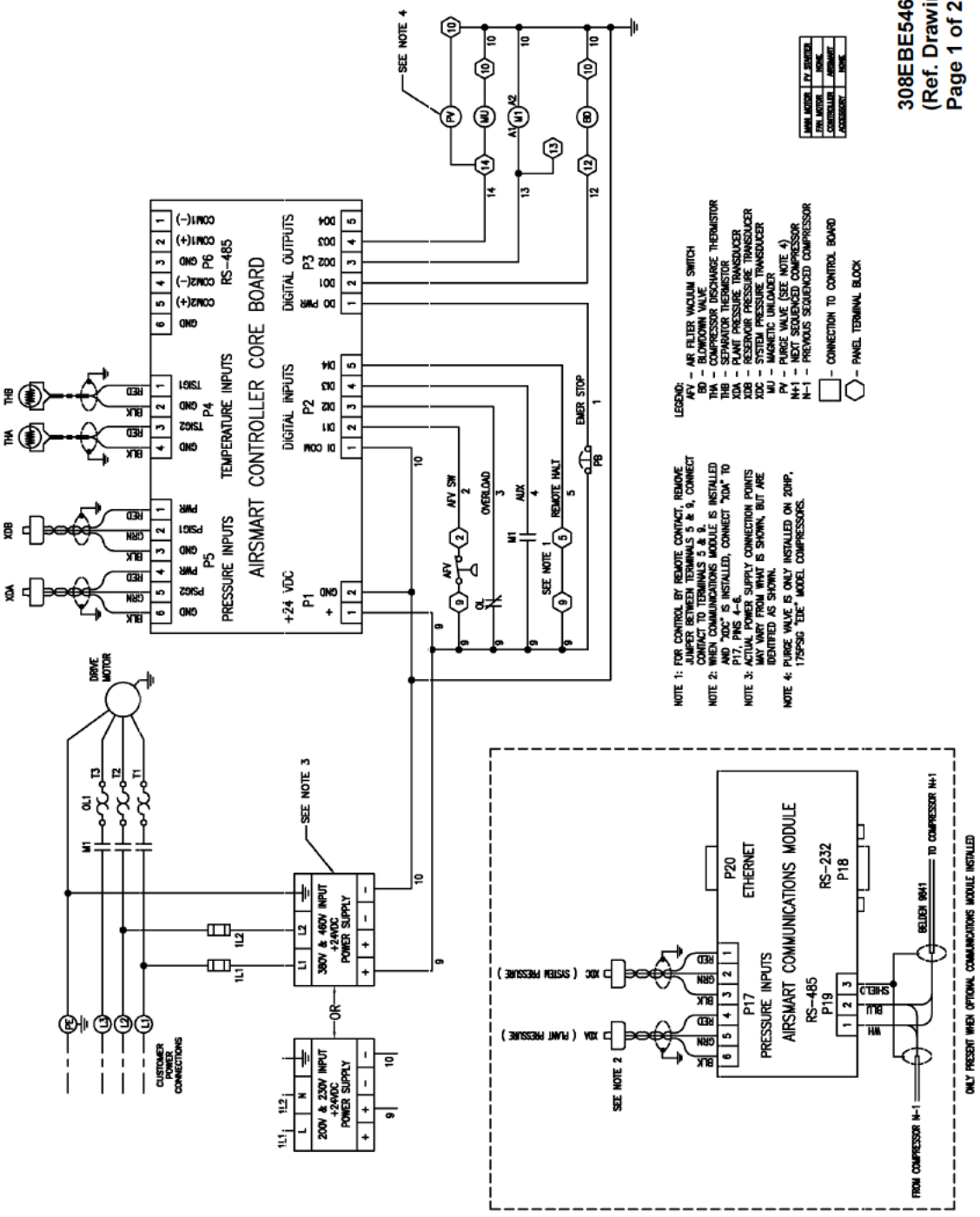

308EBE546-E
(Ref. Drawing)
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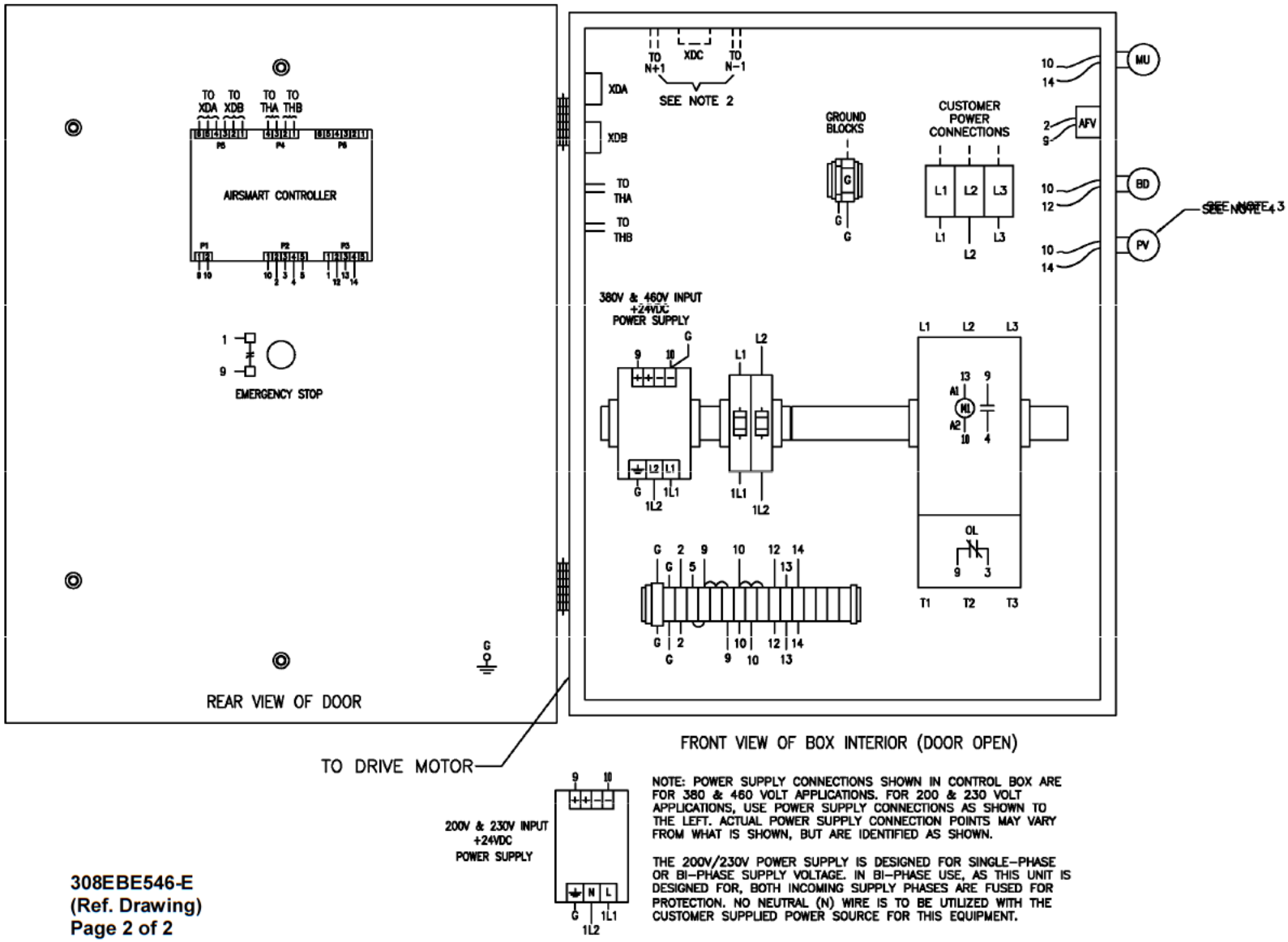
Figure 4-11 – WIRING DIAGRAM – FULL VOLTAGE 15 HP (200 & 460 VOLT) 20, 25 & 30 HP (460 VOLT)



NOTE: POWER SUPPLY CONNECTIONS SHOWN IN CONTROL BOX ARE FOR 380 & 460 VOLT APPLICATIONS. FOR 200 & 230 VOLT APPLICATIONS, USE POWER SUPPLY CONNECTIONS AS SHOWN TO THE LEFT. ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.

THE 200V/230V POWER SUPPLY IS DESIGNED FOR SINGLE-PHASE OR BI-PHASE SUPPLY VOLTAGE. IN BI-PHASE USE, AS THIS UNIT IS DESIGNED FOR, BOTH INCOMING SUPPLY PHASES ARE FUSED FOR PROTECTION. NO NEUTRAL (N) WIRE IS TO BE UTILIZED WITH THE CUSTOMER SUPPLIED POWER SOURCE FOR THIS EQUIPMENT.

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(Ref. Drawing)
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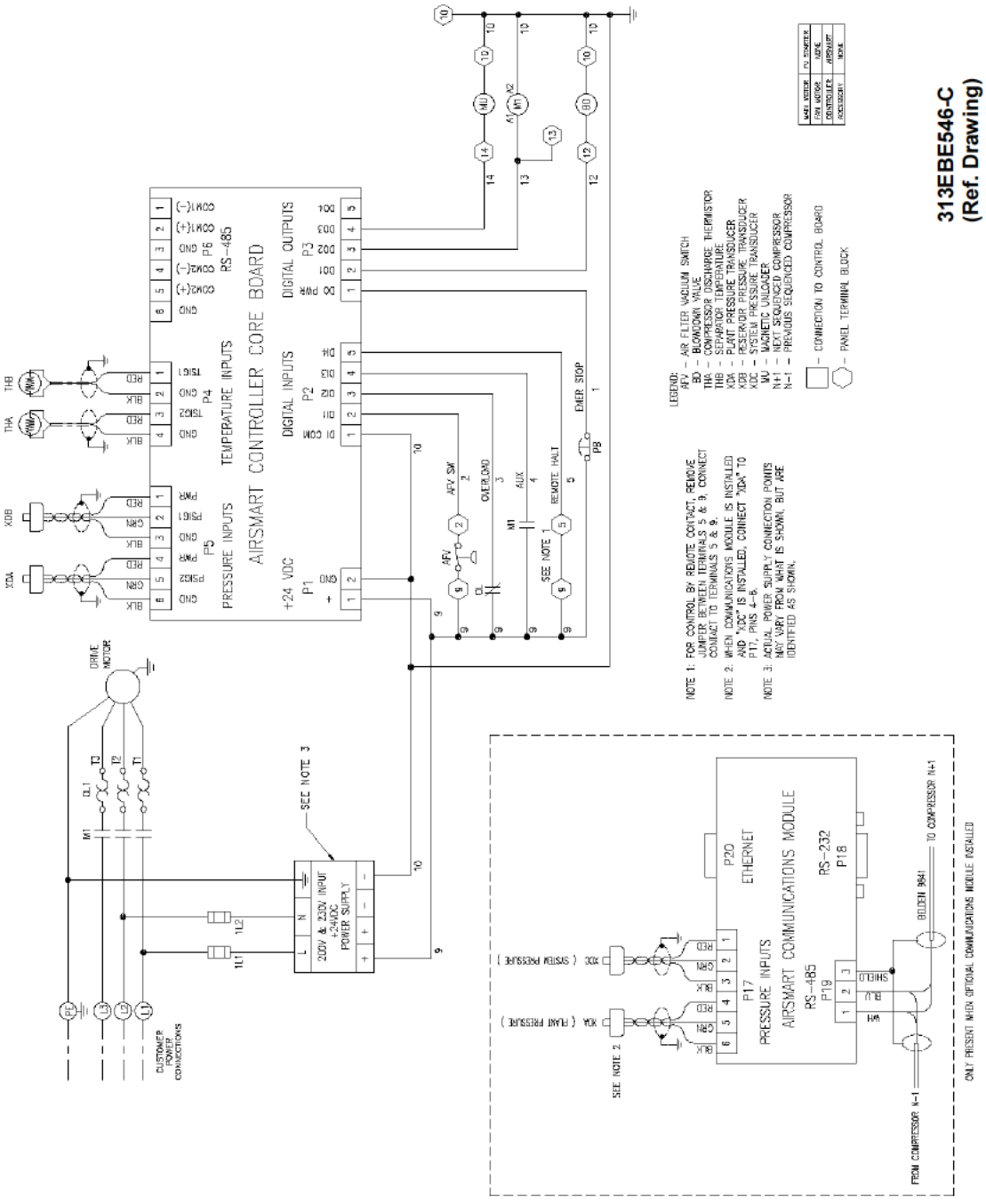

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(Ref. Drawing)
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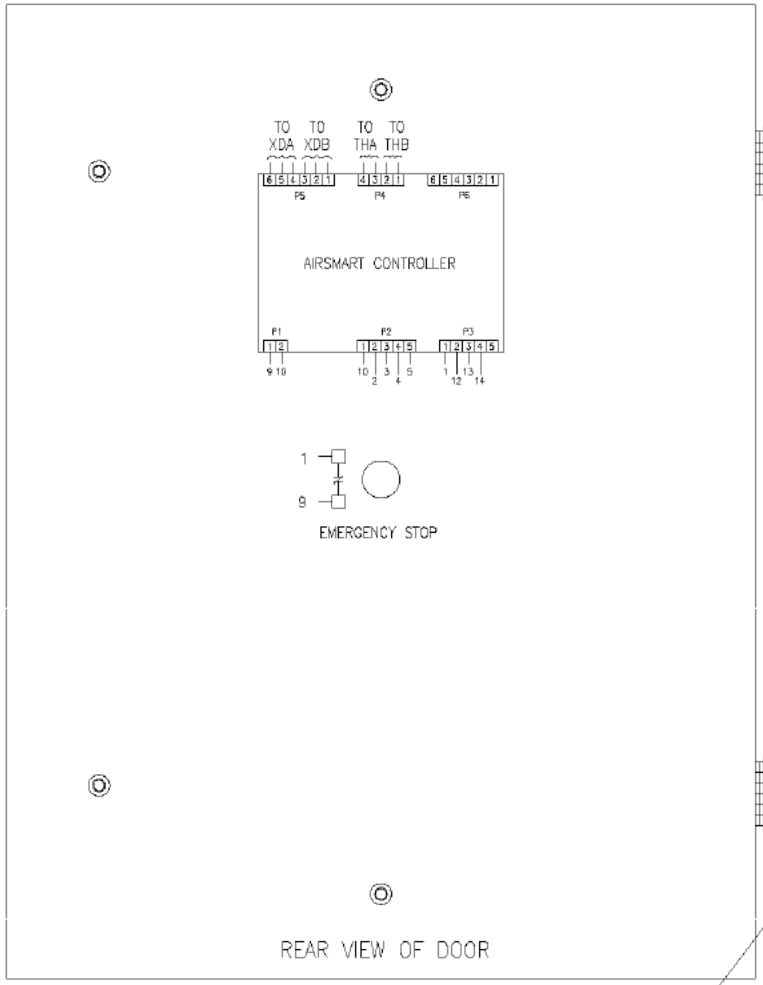
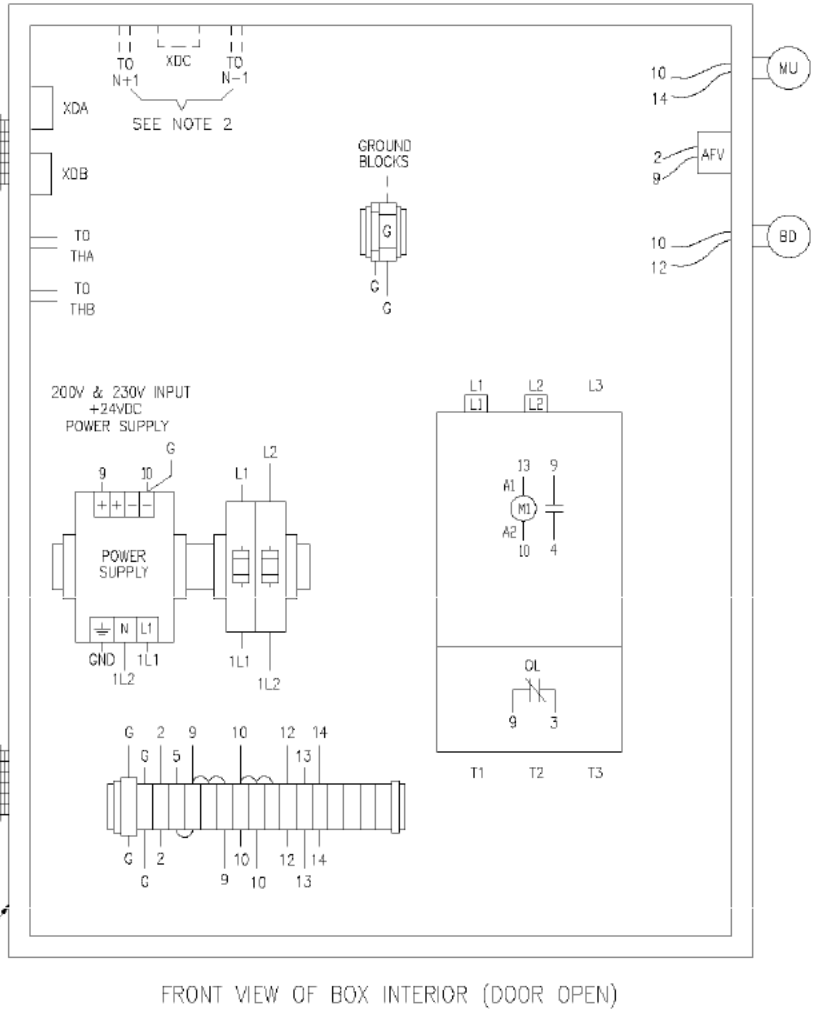
Figure 4-12 – WIRING DIAGRAM – FULL VOLTAGE 20, 25 & 30 HP (200 VOLT)



TO DRIVE MOTOR



FRONT VIEW OF BOX INTERIOR (DOOR OPEN)

NOTES: ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.

THE 200V/230V POWER SUPPLY IS DESIGNED FOR SINGLE-PHASE OR BI-PHASE SUPPLY VOLTAGE. IN BI-PHASE USE, AS THIS UNIT IS DESIGNED FOR, BOTH INCOMING SUPPLY PHASES ARE FUSED FOR PROTECTION. NO NEUTRAL (N) WIRE IS TO BE UTILIZED WITH THE CUSTOMER SUPPLIED POWER SOURCE FOR THIS EQUIPMENT.

313EBE546-C
(Ref. Drawing)
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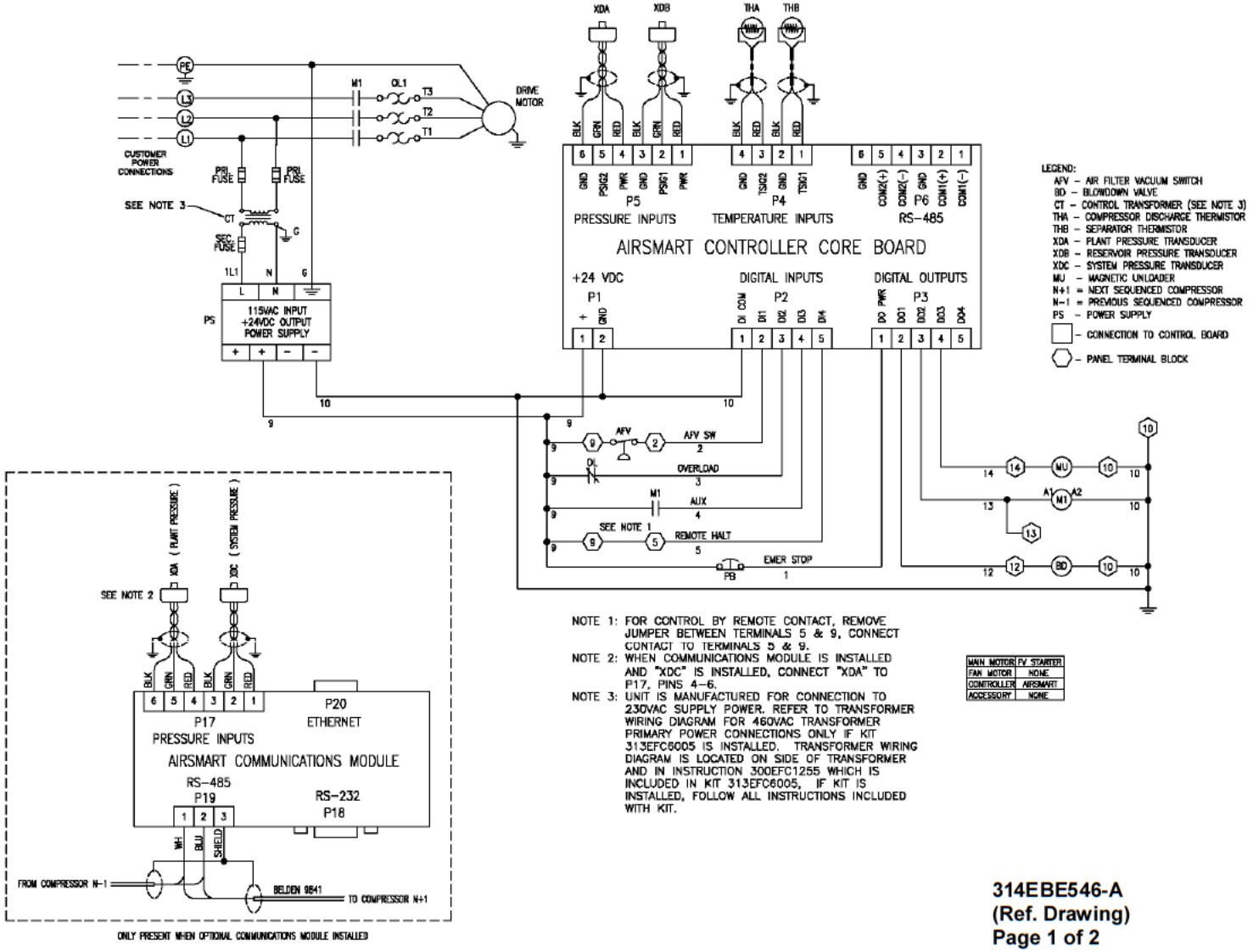
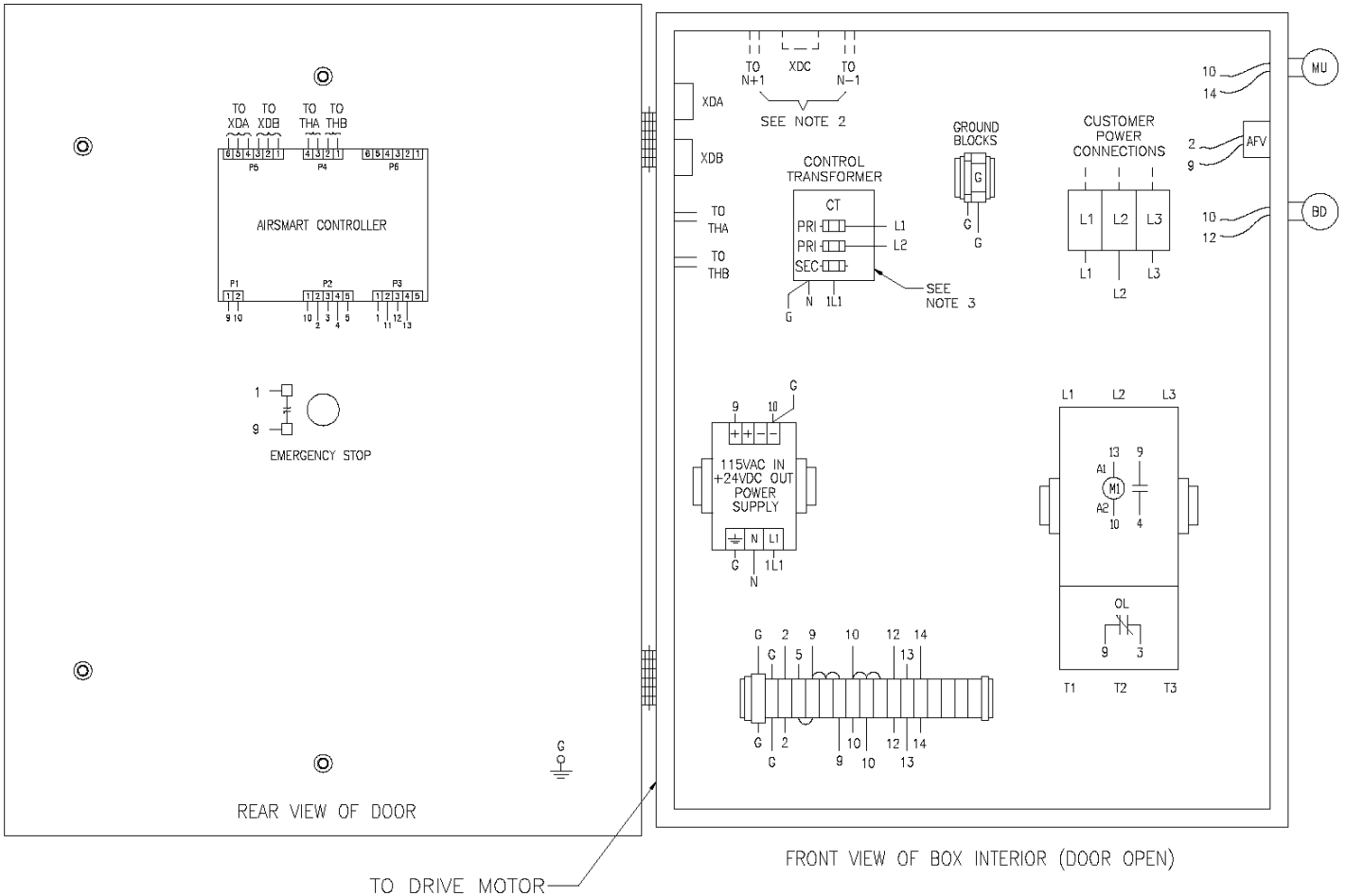


Figure 4-13 – WIRING DIAGRAM – FULL VOLT - 15 & 20 HP (230 VOLT)



NOTE: ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.

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(Ref. Drawing)
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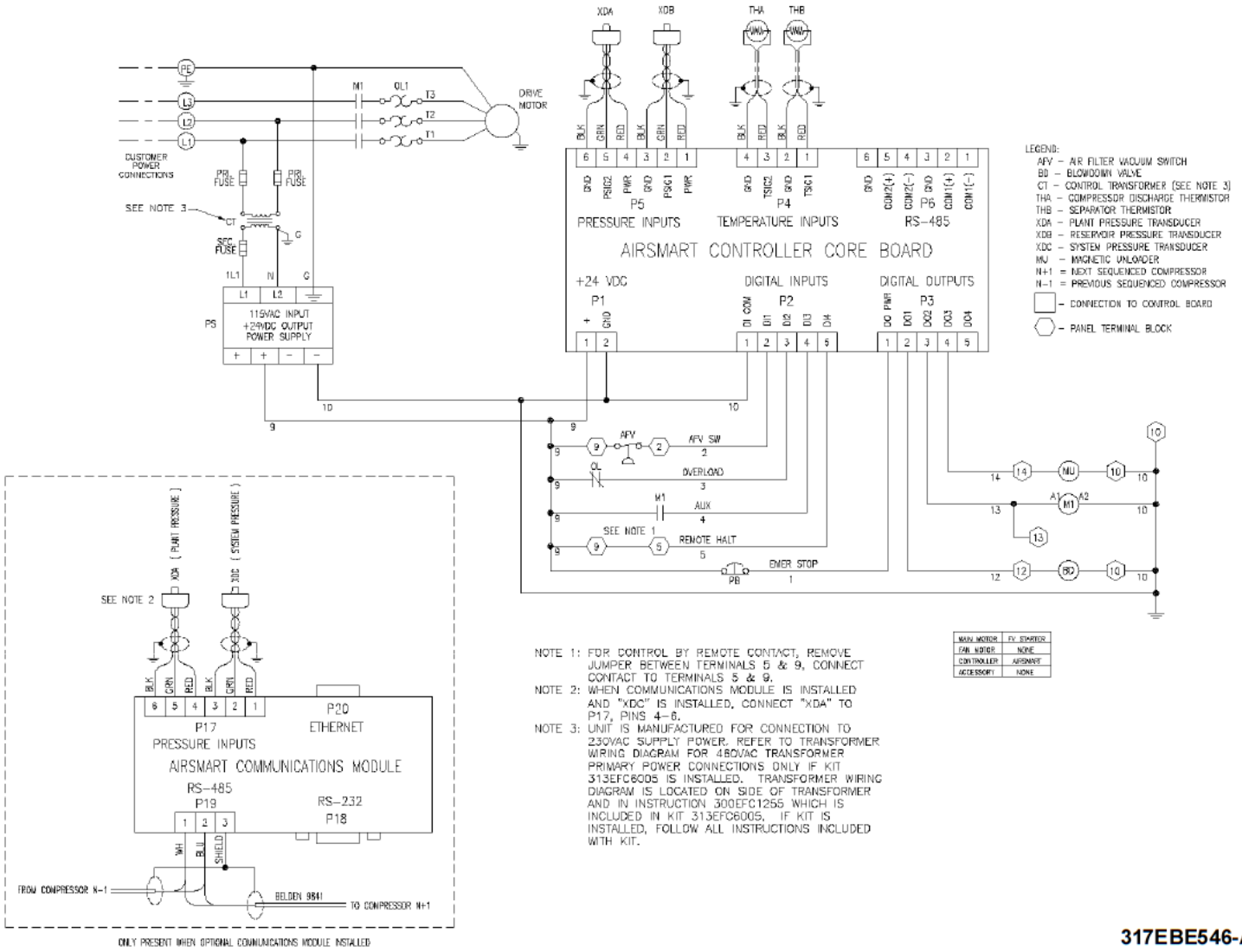

317EBE546-A
(Ref. Drawing)
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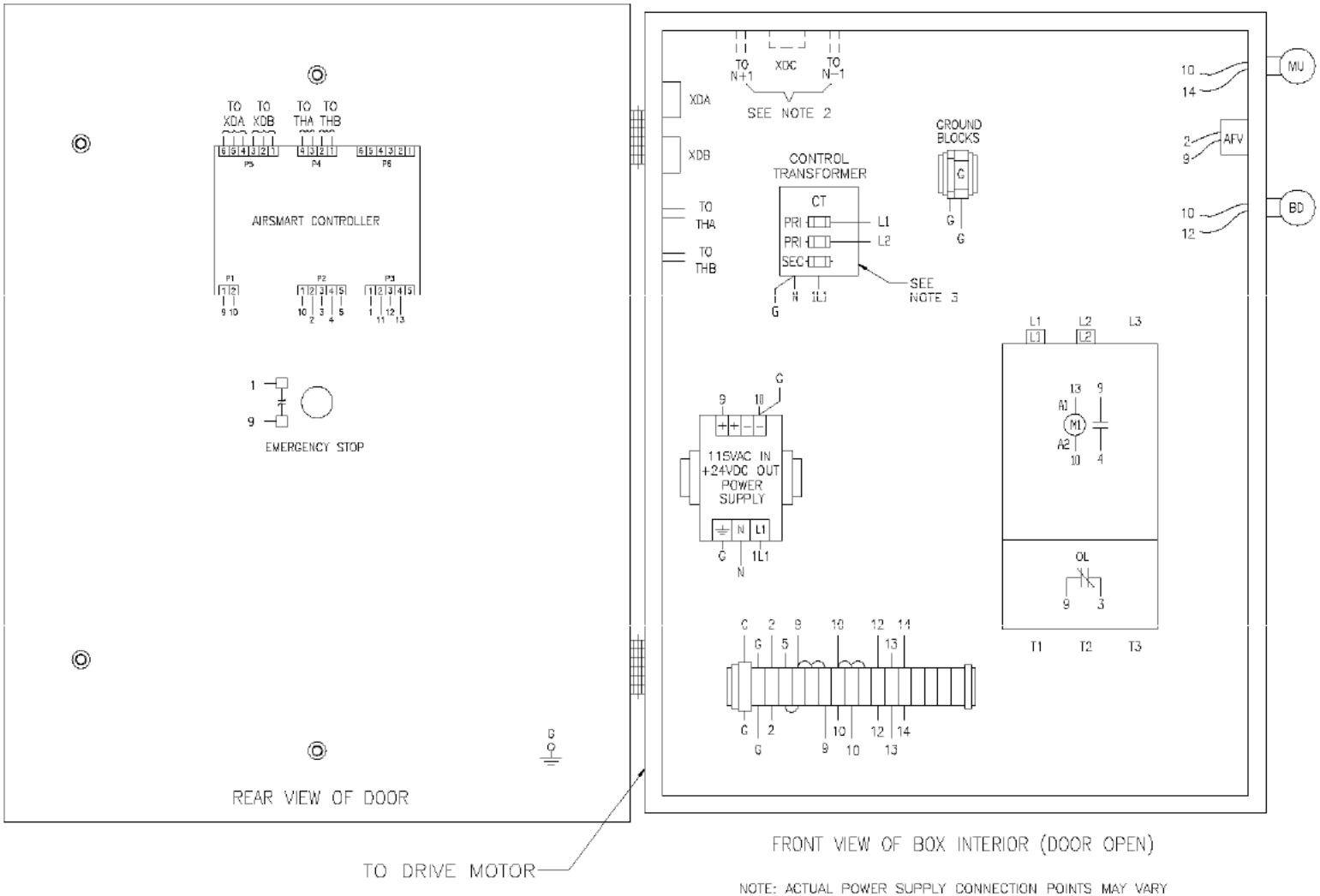
Figure 4-14 – WIRING DIAGRAM – FULL VOLTAGE 25 & 30 HP (230 VOLT)



NOTE: ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.

317EBE546-A
(Ref. Drawing)
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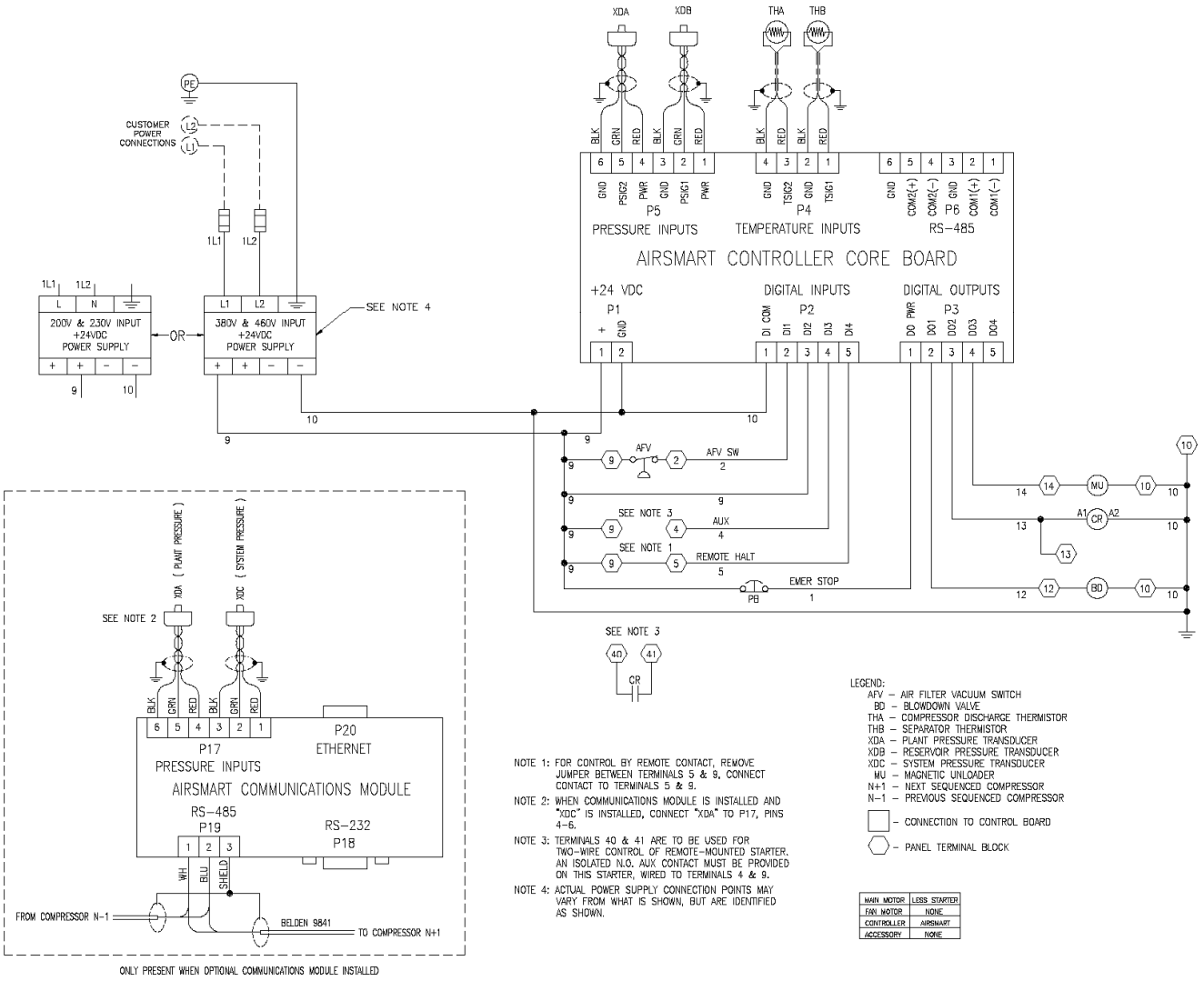

Figure 4-15 – WIRING DIAGRAM – LESS STARTER (200 & 460 VOLT)

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(Ref. Drawing)
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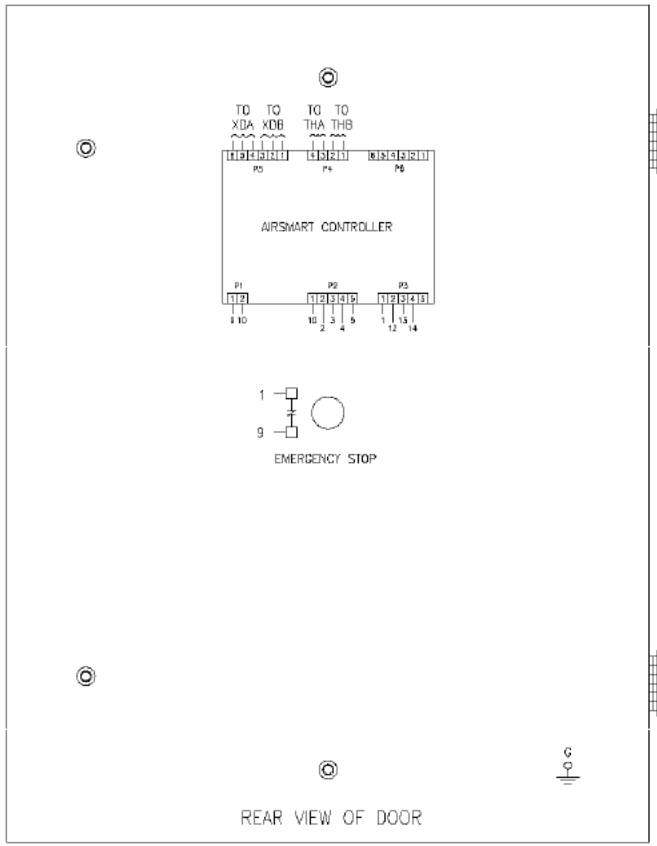
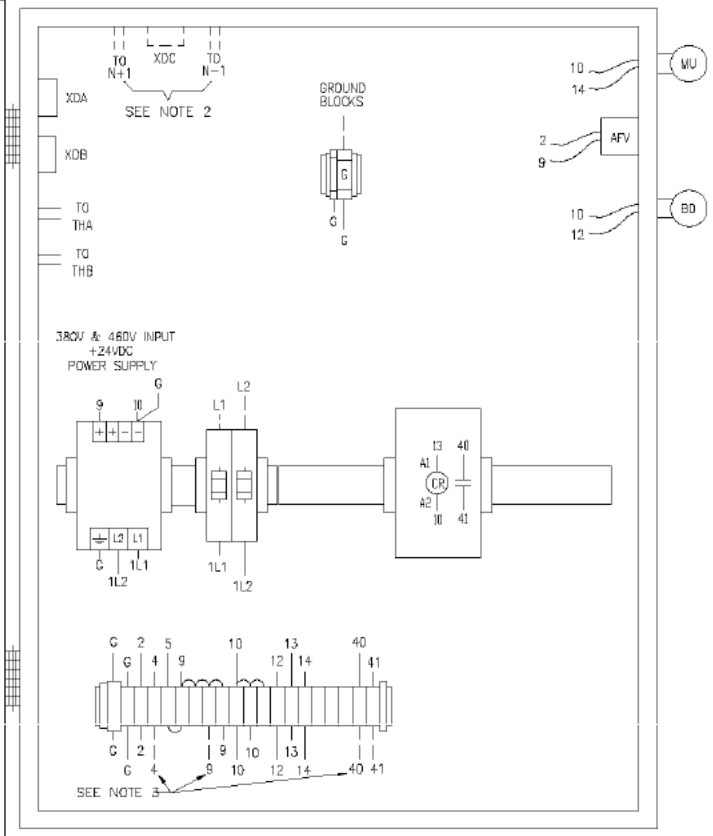
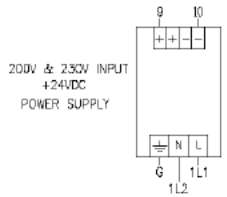


REAR VIEW OF DOOR

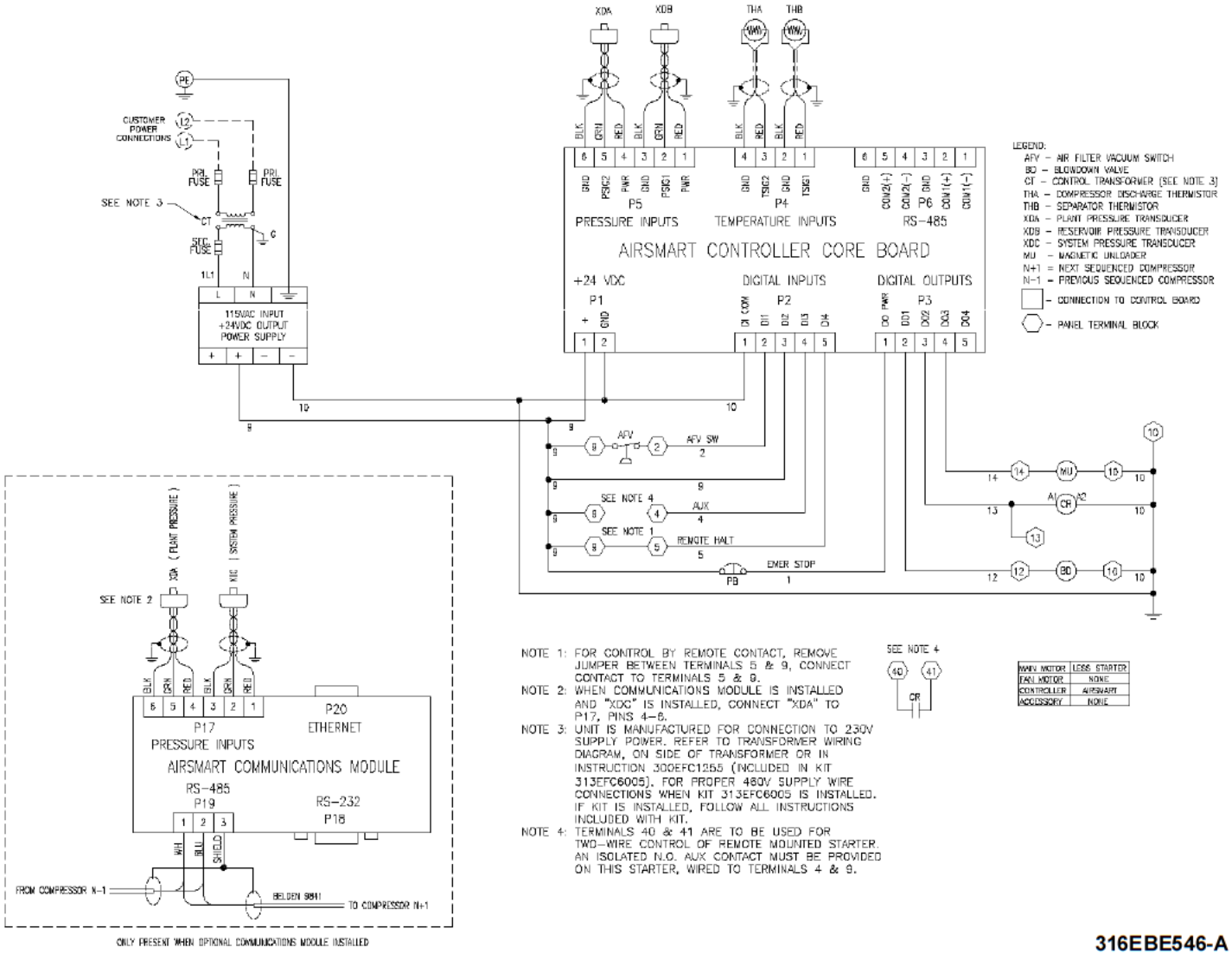


FRONT VIEW OF BOX INTERIOR (DOOR OPEN)



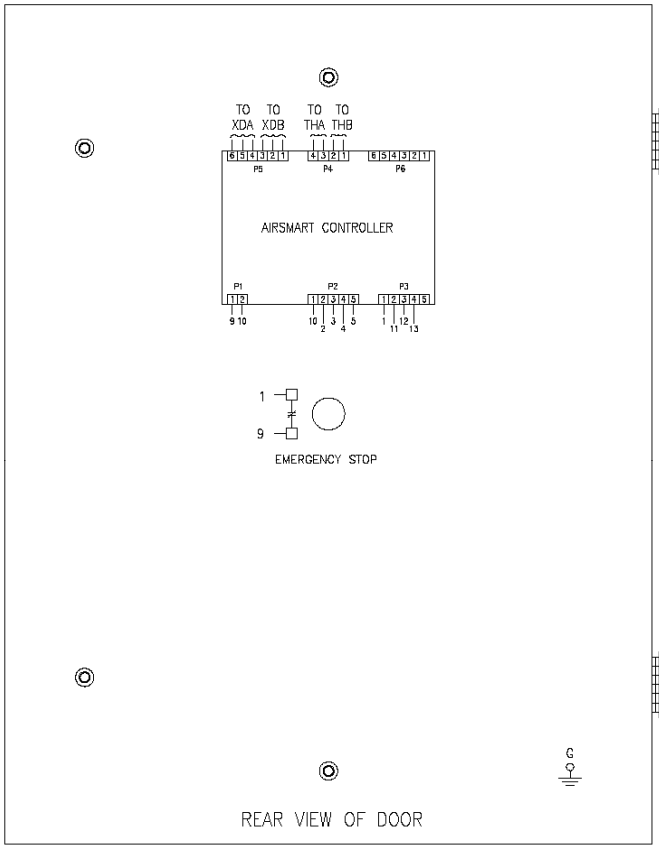
NOTE: POWER SUPPLY CONNECTIONS SHOWN IN CONTROL BOX ARE FOR 380 & 460 VOLT APPLICATIONS. FOR 200 & 230 VOLT APPLICATIONS, USE POWER SUPPLY CONNECTIONS AS SHOWN TO THE LEFT. ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.

THE 200V/230V POWER SUPPLY IS DESIGNED FOR SINGLE-PHASE OR BI-PHASE SUPPLY VOLTAGE. IN BI-PHASE USE, AS THIS UNIT IS DESIGNED FOR, BOTH INCOMING SUPPLY PHASES ARE FUSED FOR PROTECTION. NO NEUTRAL (N) WIRE IS TO BE UTILIZED WITH THE CUSTOMER SUPPLIED POWER SOURCE FOR THIS EQUIPMENT.



316EBE546-A
(Ref. Drawing)
Page 1 of 2

Figure 4-16 – WIRING DIAGRAM – LESS STARTER (230 VOLT)



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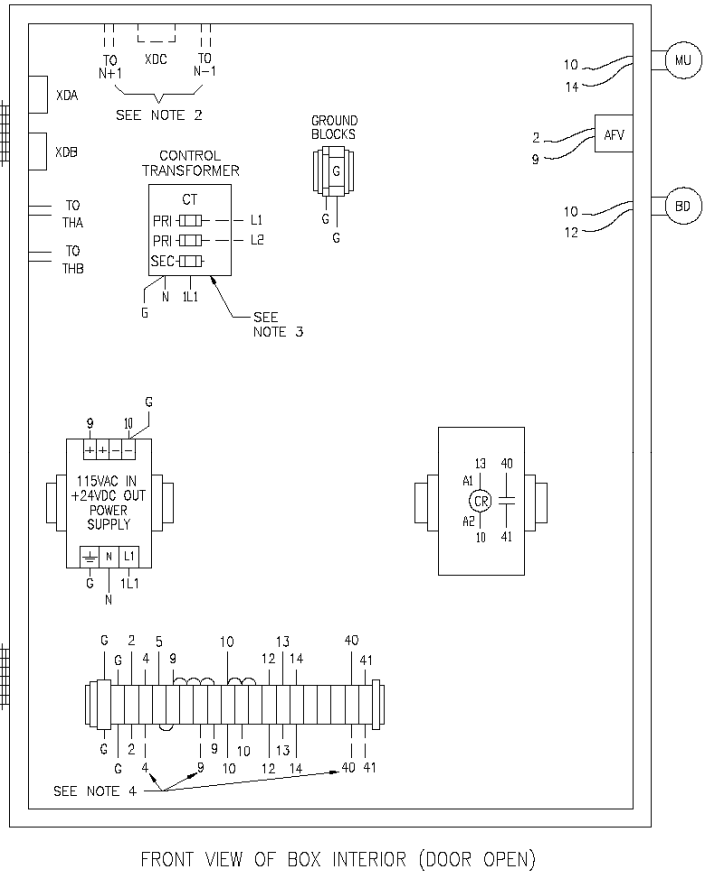
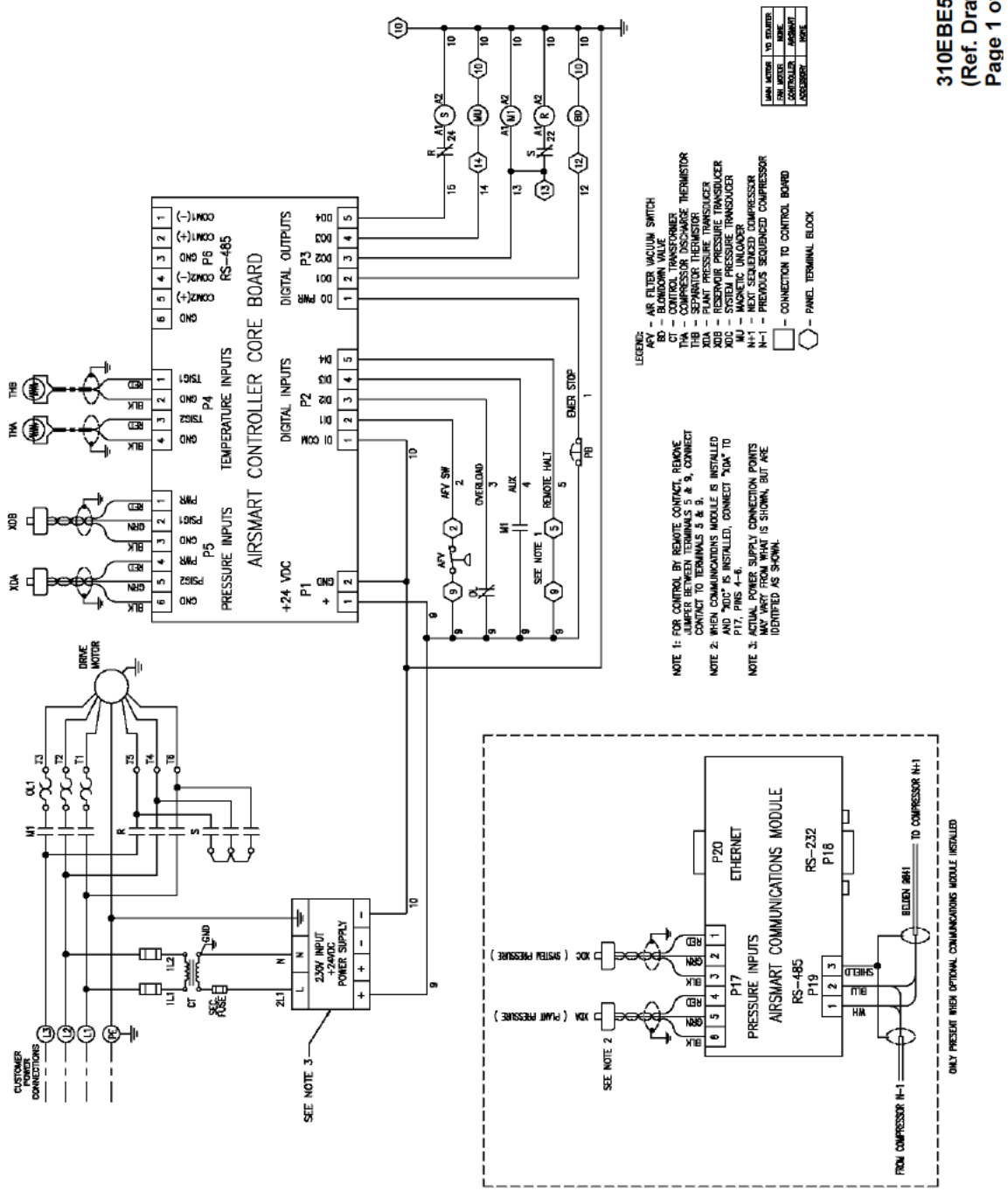


FRONT VIEW OF BOX INTERIOR (DOOR OPEN)

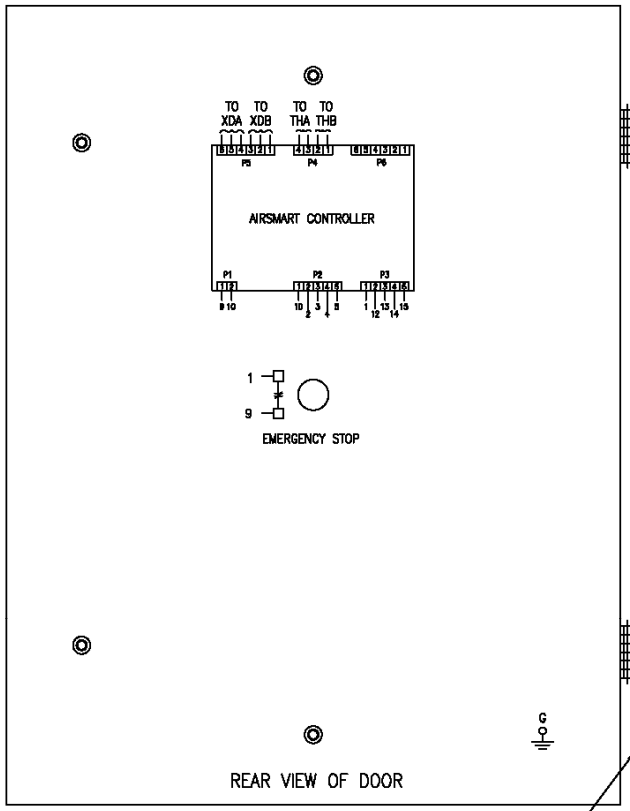
NOTE: ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.

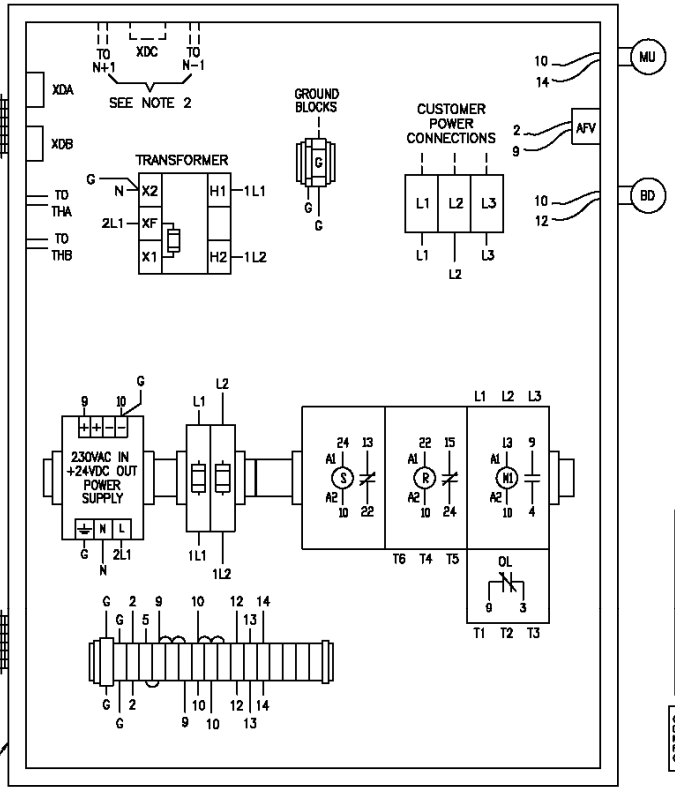
316EBE546-A
(Ref. Drawing)
Page 2 of 2



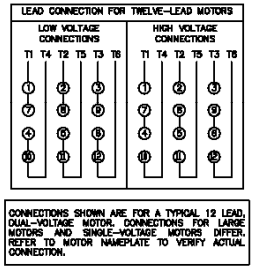
310EBE546-C (Ref. Drawing) Page 1 of 2

Figure 4-17 – WIRING DIAGRAM – WYE DELTA (575 VOLT)





NOTE: ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.



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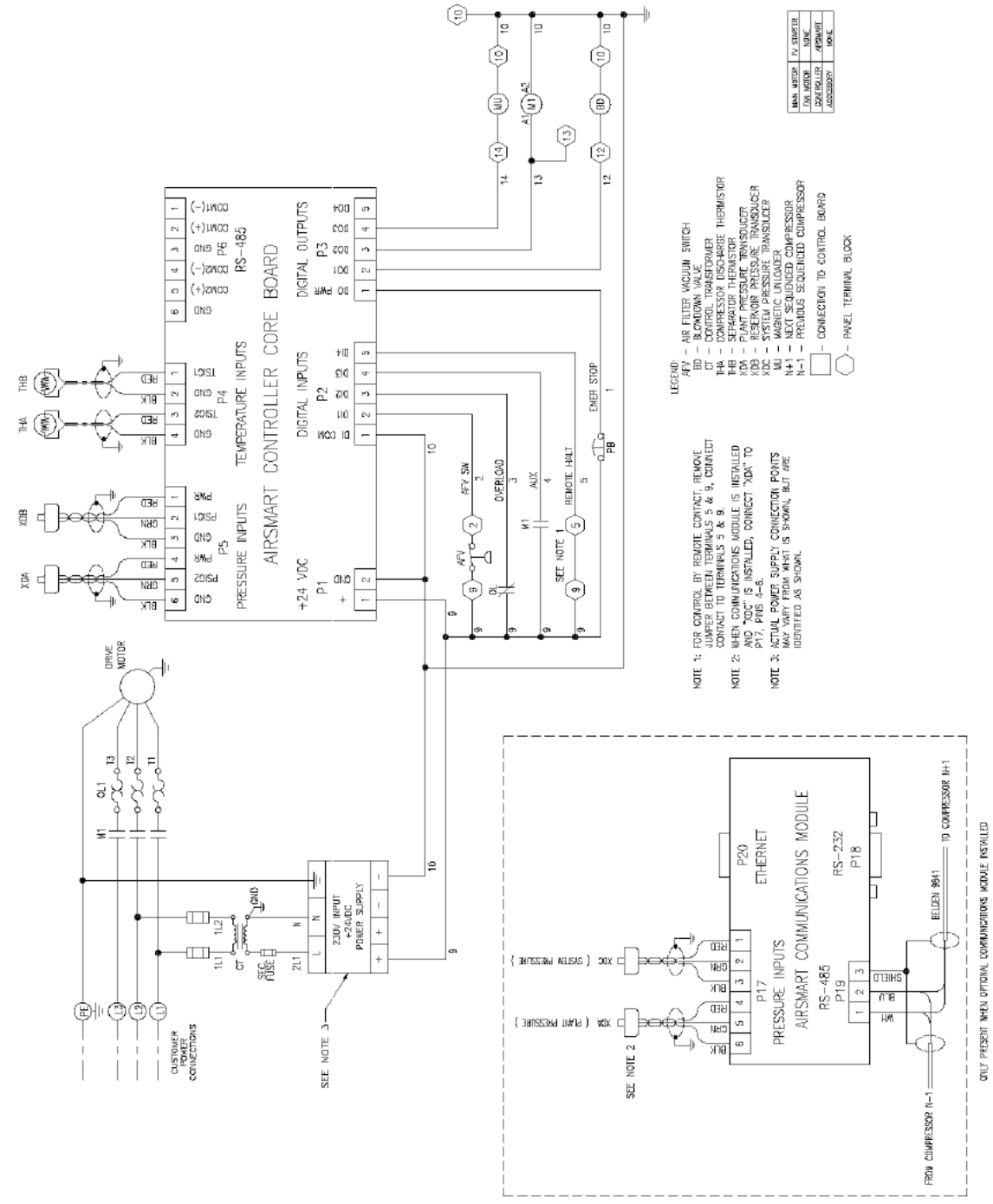
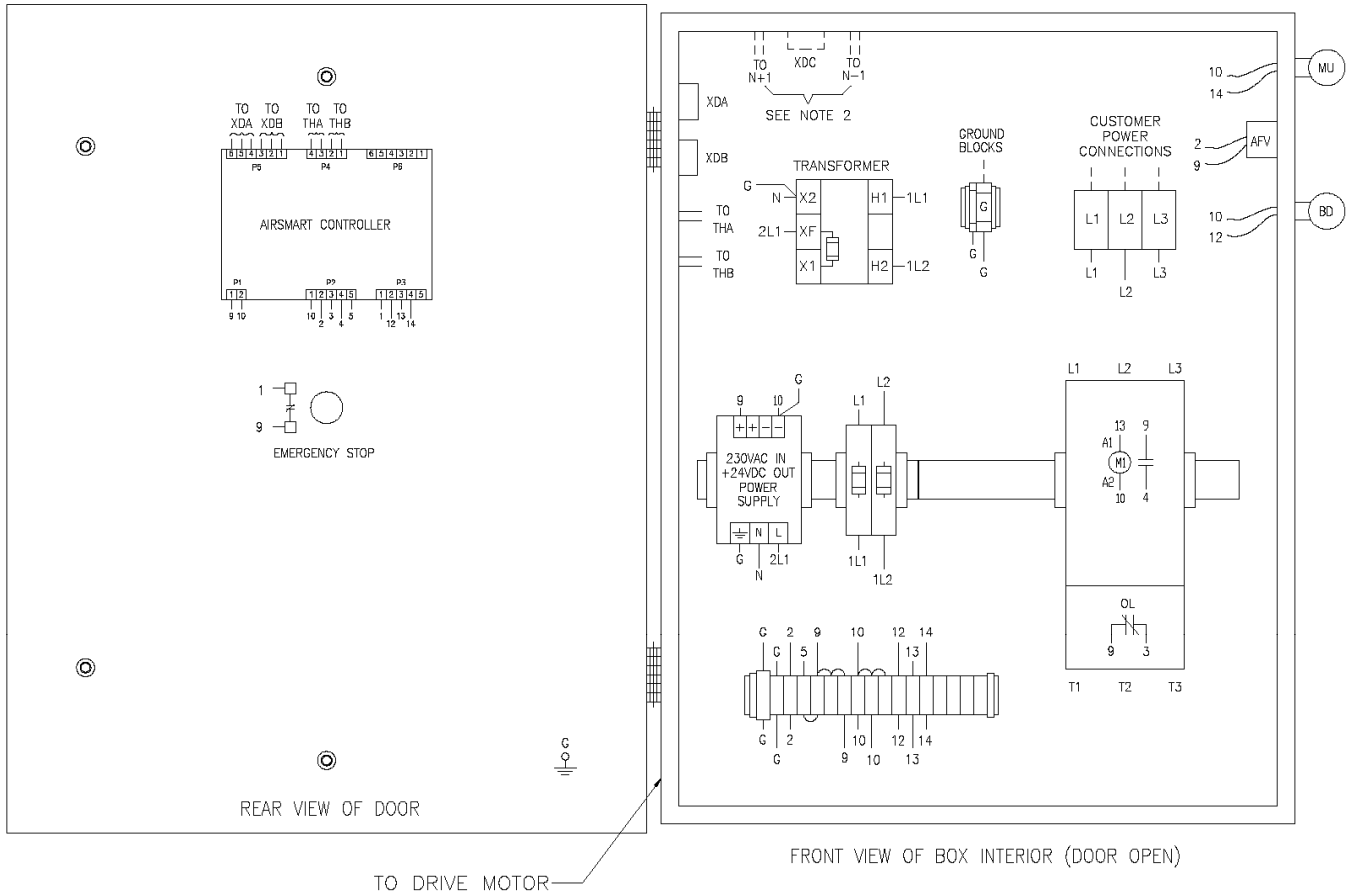
(Ref. Drawing)
Page 2 of 2

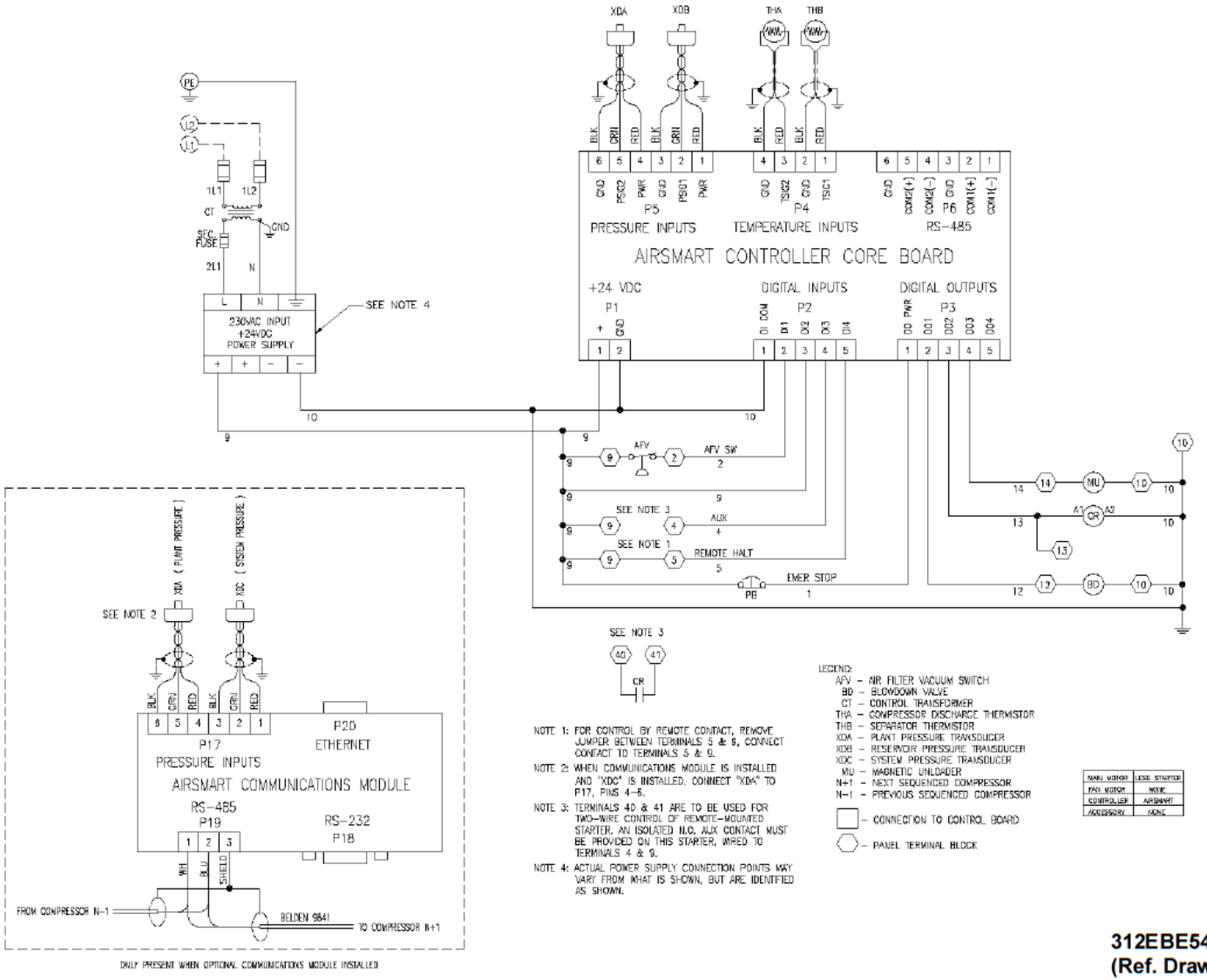


311EBE546-C (Ref. Drawing) Page 1 of 2

Figure 4-18 – WIRING DIAGRAM – FULL VOLT (575 VOLT)



NOTE: ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.



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(Ref. Drawing)
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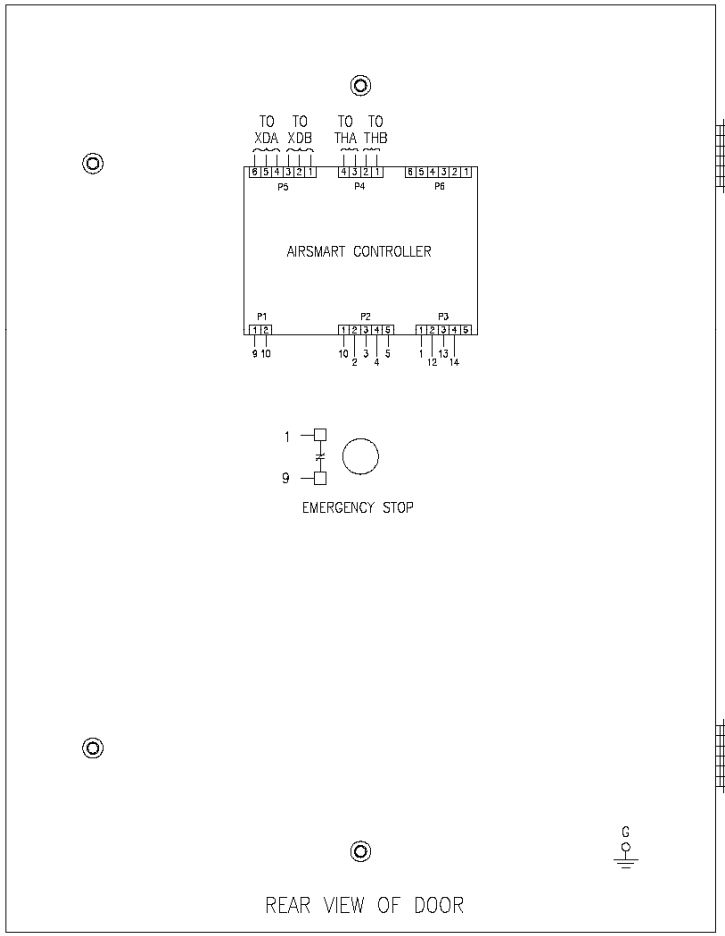
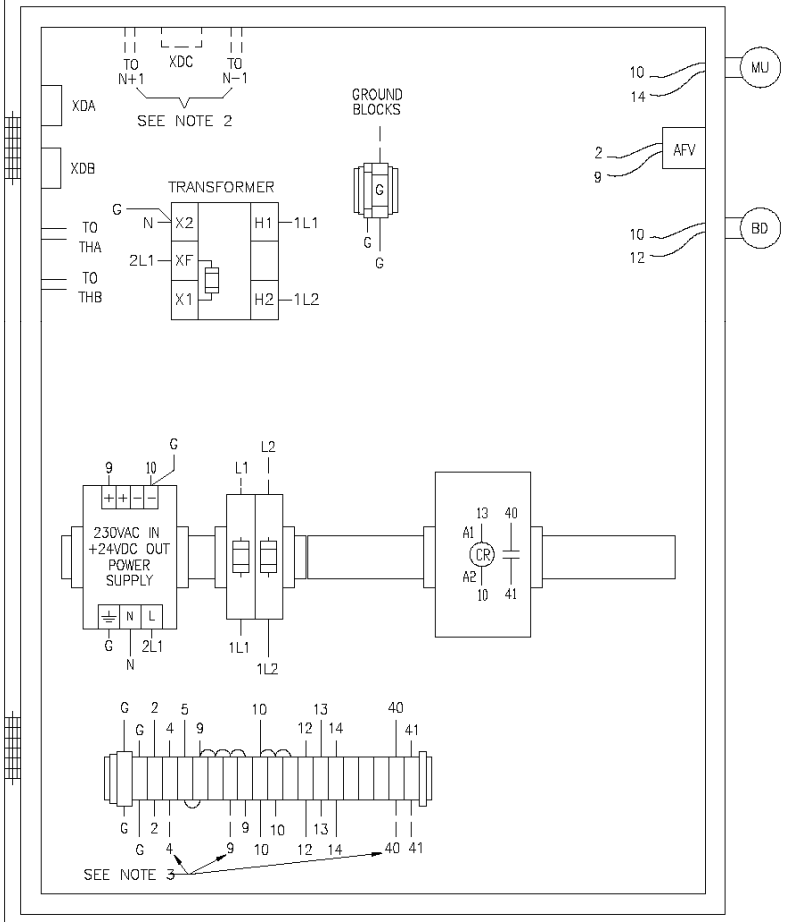
Figure 4-19 – WIRING DIAGRAM – LESS STARTER (575 VOLT)



REAR VIEW OF DOOR



FRONT VIEW OF BOX INTERIOR (DOOR OPEN)

NOTE: ACTUAL POWER SUPPLY CONNECTION POINTS MAY VARY FROM WHAT IS SHOWN, BUT ARE IDENTIFIED AS SHOWN.

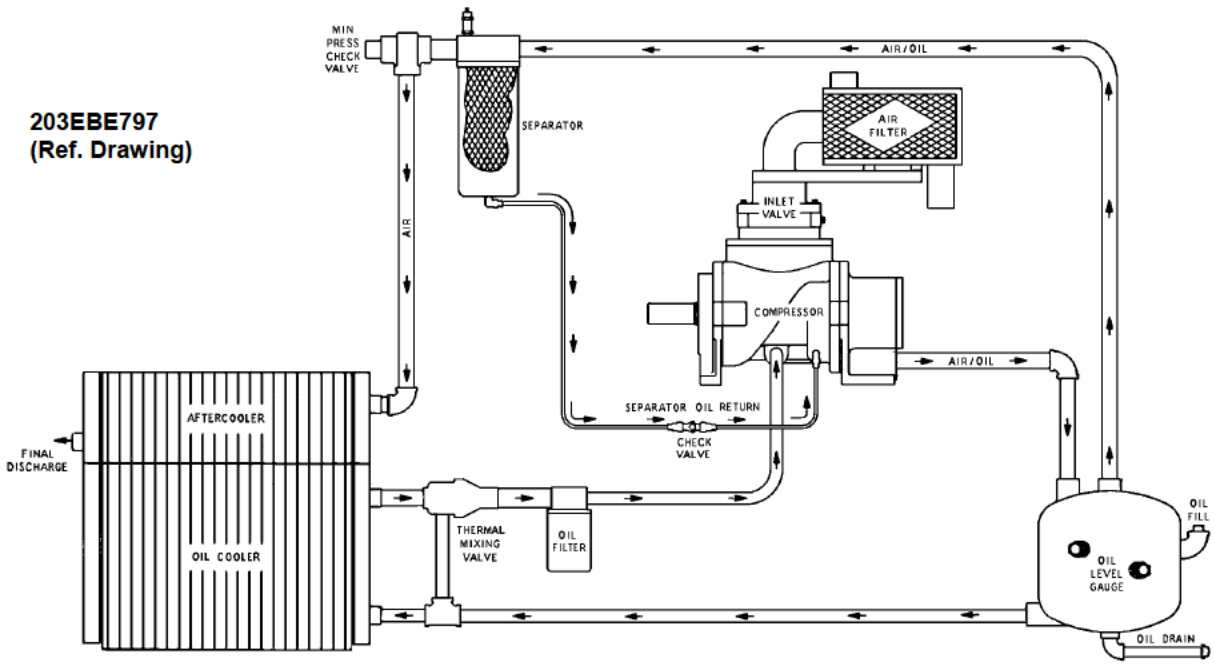


Figure 5-1 – FLOW DIAGRAM – AIR/OIL SYSTEM

COMPRESSOR OIL SYSTEM (Figure 5-1) cools the compressor, lubricates moving parts and seals internal clearances in the compression chamber.

The oil inlet line is connected at the bottom of the oil reservoir. Air pressure in the oil reservoir forces oil through the oil cooler, thermostatic mixing valve, oil filter and into the compressor main oil gallery.

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

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

OIL SPECIFICATIONS - The recommended compressor lubricant is Gardner Denver AEON 4000 Lubricating Coolant which can be used for year-round operation except as noted in the "High Temperature Operation" paragraph below, or low temperature, see "Installation for Cold Weather," page 15. AEON 4000 Lubricating Coolant is a superior petroleum base lubricant formulated and containing additives for use in Gardner Denver compressors.

⚠ CAUTION

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

HIGH TEMPERATURE OPERATION - If the discharge temperature is sustained between 200°F to 210°F (93° C to 99° C) for a period of more than four (4) hours due to continuing high ambient air temperature, use Gardner Denver AEON 9000SP Lubricating Coolant which is a superior synthetic lubricant. Short periods of up to four (4) hours of sustained discharge temperatures up to 210° F (99° C) do not require a change from the recommended year-round lubricant AEON 4000.

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

1. Thoroughly drain system:
   - Drain oil from air end and cooler while hot.
   - Break low point connections and drain oil from pipe runs.
   - Dump oil from the filter and reinstall used filter.
2. Fill the system with a 50 percent charge of the new lubricant:
   - Start the machine and stay there to observe.
   - Allow the machine to run about five minutes at temperature, or until temperature stabilizes, then shut down.
3. Thoroughly drain the machine.
4. Change to new filter and separator.
5. Fill the system with a full charge of the new lubricant.
6. Machine should then be run normally, however, total run time after the initial change-out should be 50 percent of normal anticipated service life of the new lubricant.
   - Drain all lubricant from the system, change the filter and separator, and replace with a full charge of the new lubricant.
7. Subsequent lubricant change-outs should be at normal intervals. (See “Oil Change Interval”, Figure 5-5, page 61.)

⚠ CAUTION

Improper equipment maintenance with use of synthetic lubricants will damage equipment. Oil filter and oil separator change intervals remain the same as for AEON 4000 – See “Maintenance Schedule”, page 72.

DANGER

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

CAUTION

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

CAUTION

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

CAUTION

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

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

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

COLD AMBIENT OPERATION - See “Installation for Cold Weather Operation”, page 15 and Figure 2-3, page 14.

Reservoir Capacity to “FULL” Level.....	2.5 U.S. Gallons (9.5 Liters)
System Capacity: Reservoir Plus Oil Cooler and Piping	3.5 U.S. Gallons (13.25 Liters)
“ADD” Range to “FULL” Level.....	3.0 U.S. Quarts (2.75 Liters)

Figure 5-2 – APPROXIMATE OIL SYSTEM CAPACITIES

ADDITION OF OIL BETWEEN CHANGES must be made when the oil level is below the center of the lower sight gauge as read while the unit is completely off and blown down, and the foam has settled out.

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

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

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

4. Remove the oil filler plug and add oil as required to return the oil level to the bottom of the upper sight gauge.

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

DO NOT OVERFILL (you should not see oil in the upper sight gauge after running fully loaded and then shutting down the machine and allowing the foam to settle out). The quantity required to raise the oil level from "ADD" to "FULL" is shown in Figure 5-2, page 58. Repeated addition of oil between oil changes may indicate excessive oil carry-over and should be investigated.

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

CAUTION

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

CAUTION

Excessive oil carry-over can damage equipment. Never fill oil reservoir above the "FULL" marker.

OIL LEVEL SIGHT GAUGES (Figure 1-3, page 11) indicate the amount of oil in the oil reservoir. Read oil level when unit is shut off and the foam has settled out. In operation the oil level will fluctuate as the compressor loads and unloads. If oil can be seen in the lower sight gauge, the oil level is adequate.

MOISTURE IN THE OIL SYSTEM – In environments with normal operating temperatures and pressures and low relative humidity, the thermal mixing valve controls the oil temperature and prevents moisture accumulation in the oil. Unusual cooling of the oil reservoir, light duty cycles, high humidity, gross compressor over-sizing or malfunctions of the thermal mixing valve may result in moisture accumulation which is detrimental to compressor lubrication and may cause

excessive oil carryover in the lubricant or compressor failure. Please note that the airend discharge temperature must be maintained a minimum of 10° F above the pressure dew point temperature in Figure 5-3, page 60. Failure to maintain the discharge temperature will cause moisture formation and compressor damage. The compressor must be observed to ensure that it is operating properly. The best method for detecting moisture is a disciplined lubricant sampling analysis program every 2,000 hours of operation. If moisture is observed in the oil reservoir, drain the moisture and correct the operating conditions to reduce moisture. See “Thermal Control (Thermostatic Mixing) Valve, page 65, “Water Shutoff Valve”, page 53 and “Compressor Oil System Check”, page 66, for additional system considerations. If moisture accumulation is observed in the lubricant, the best option is a higher temperature mixing valve, AEON 9000TH lubricating fluid and setting the high discharge temperature shutdown to 240° F (new controller software may be required), to prevent water from forming in the oil. Please contact Technical Services in MDC for part numbers, availability and controller software version verification (S/N required).

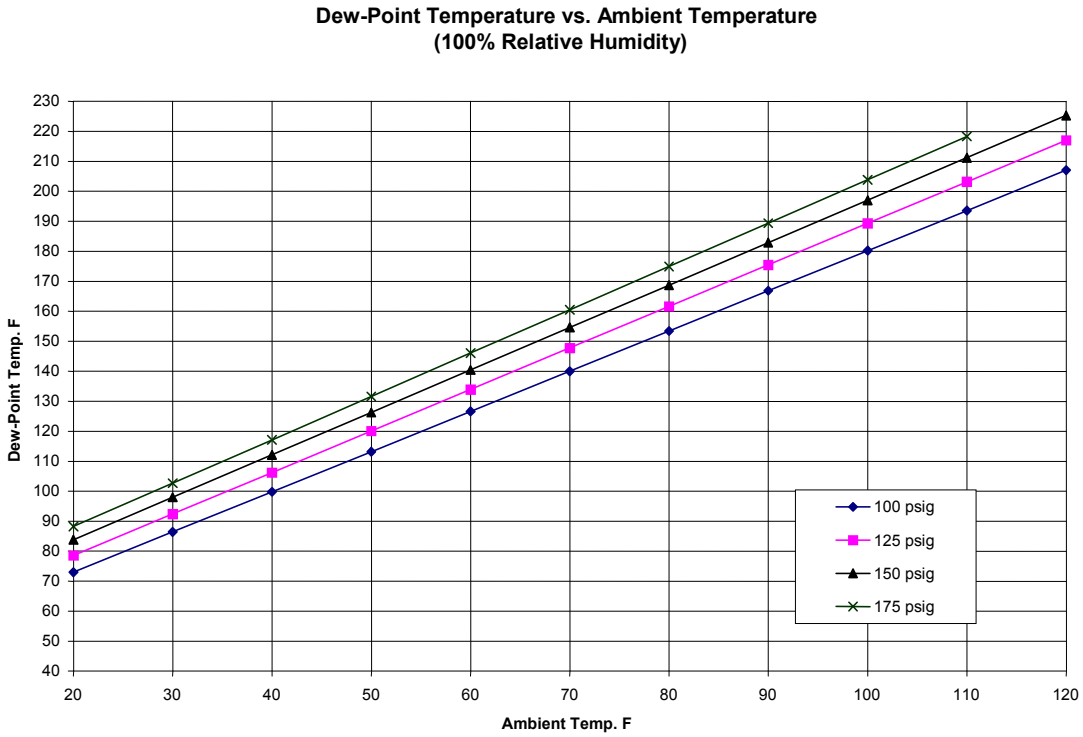


Figure 5-3 – DEW POINT CHART °F

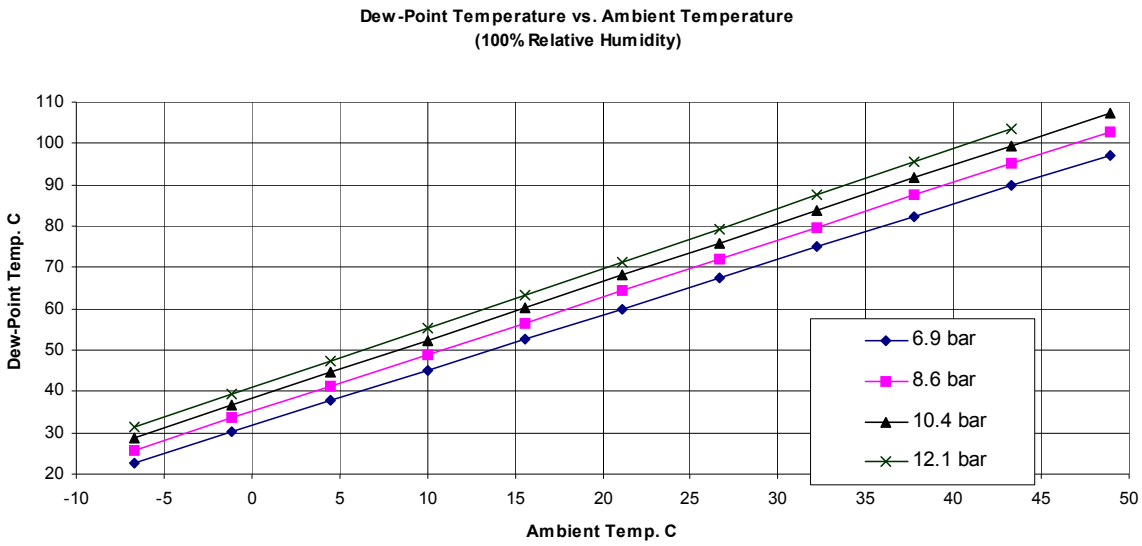


Figure 5-4 – DEW POINT CHART °C

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

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

When operating conditions are severe (very dusty, high humidity, etc.), it will be necessary to change the oil more frequently. Operating conditions and the appearance of the drained oil must be surveyed and the oil change intervals planned accordingly by the user. Gardner Denver offers a free oil analysis program with the AEON lubricants, and we recommend a sample be sent in at 100 hours on a new unit.

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

Figure 5-5 – OIL CHANGE INTERVAL

DRAINING AND CLEANING OIL SYSTEM

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

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

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

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

1. If the unit is not elevated high enough to use the oil reservoir drain line to drain oil, a small hand, electric or air operated pump should be used to drain reservoir through the oil filler opening or from the drain valve.

2. If the unit is elevated so that the oil reservoir drain can be used, empty the oil reservoir through the drain valve to a suitable container or sump.

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

FILLING OIL RESERVOIR

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

CAUTION

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

1. Be sure the unit is completely off and that no air pressure is in the oil reservoir.
2. Disconnect, tag and lockout the power supply to the starter.
3. Wipe away all dirt around the oil filler plug.
4. Remove the oil filler plug and add oil as required to return the oil level to the bottom of the upper sight gauge.
5. Install the oil filler plug and operate the unit for about a minute allowing oil to fill all areas of the system. Check for leaks.
6. Shut down unit, allowing the oil to settle, and be certain all pressure is relieved.
7. Add oil, if necessary, to bring level to "FULL."

On unloaded operation and after shutdown, some oil will drain back into the oil reservoir and the oil level will read over "FULL". DO NOT DRAIN OIL TO CORRECT. On the next start, oil will again fill the system and the gauge will indicate operating at the proper level. DO NOT OVERFILL (you should not see oil in the upper sight gauge when running fully loaded) as oil carryover will result. The quantity of oil required to raise the oil level from "ADD" to "FULL" is shown in Figure 5-2, page 58, this section. Repeated addition of oil between oil changes may indicate excessive oil carryover and should be investigated.

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

CAUTION

Excessive oil carry-over can damage equipment. Never fill oil reservoir above the "FULL" marker.

COMPRESSOR OIL FILTER (Figure 1-2, page 10) - This replaceable element filter is a vital part in maintaining a trouble-free compressor, since it removes dirt and abrasives from the circulated oil. The filter is equipped with a relief valve that opens in the event the element becomes dirty enough to block the flow of oil.

CAUTION

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

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

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

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

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

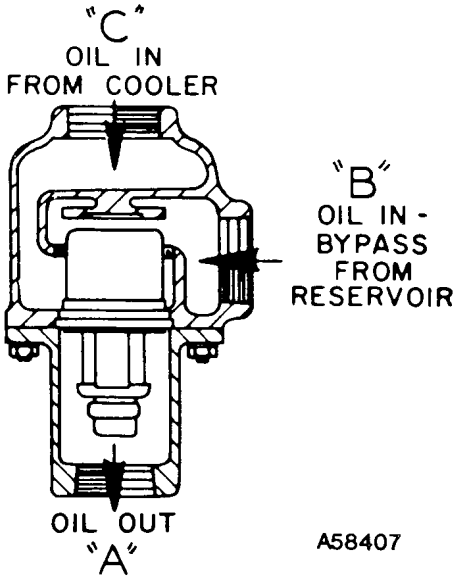


Figure 5-6 – THERMOSTATIC MIXING VALVE

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

THERMAL CONTROL (THERMOSTATIC MIXING) VALVE (Figure 5-6) is installed in the system as shown in Figure 5-1, page 56. This valve is used to control the temperature of the oil. On start-up with unit cold, the element is open to bypass, allowing oil to pass directly from the reservoir to compressor during warm-up. As oil warms, the element gradually closes to the bypass allowing more of the oil from the cooler to mix with oil from the bypass.

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

To check the element, heat in oil - it should be fully extended at 170° F (77° C). If the unit shuts down due to high air discharge temperature, the cause may be that the element is stuck open to the bypass, in which case bypass lines (Figure 5-1, page 56) will be hot to touch and lines out of mixing valve much cooler. When flushing the oil system, remove the mixing valve and clean all parts thoroughly.

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

COMPRESSOR OIL SEPARATOR - The compressor oil separator located above the oil reservoir features a renewable spin-on type separator element and provides the final removal of oil from the air flow.

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

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

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

Pressure Differential Gauging - The “CHANGE SEPARATOR” message will flash when the pressure differential across the oil separator reaches approximately 8 psi (.6 bar). Replace the oil separator element at this time. If ignored, the unit will shut down and the display will indicate shutdown and the change separator text advisory will display when the pressure differential reaches 15 psi (1 bar).

To measure the pressure differential, see Controller Manual 13-17-600, page 4, “Separator Pressure Differential”. Simply subtract the downstream reading from the upstream reading.

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

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

1. Be certain the unit is off and all system pressure is relieved.
2. Disconnect, tag and lockout the power supply to the starter.
3. At the bottom of the separator, disconnect the oil return (scavenge) tube and remove the tube elbow.
4. Remove the spin-on element.
5. Clean the gasket seating surface of the head.
6. Inspect and/or replace the separator as necessary. Before reassembly, coat the separator element gasket with the same lubricant used in the unit.
7. Screw on until gasket makes contact. Hand tighten 1/3 to 1/2 turn extra.
8. Reinstall the tube elbow and oil return line.
9. Run the unit and check for leaks.

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

Air and Oil Discharge Temperature - 170°F to 200°F (77°C to 93°C) - Read at the gauge on the instrument panel or check with a thermometer at the discharge housing.

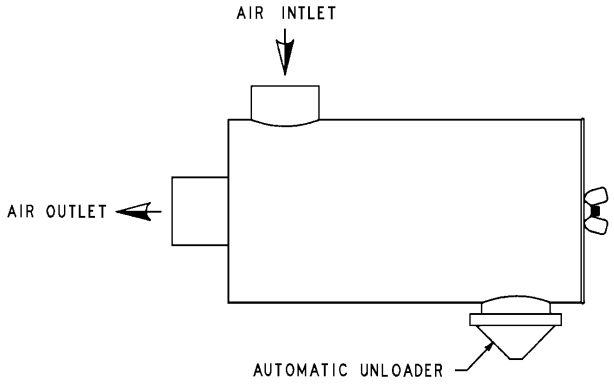
Compressor Oil Inlet Temperature - 165°F to 175°F (74°C to 79°C) - Install a tee at the oil filter outlet and check with a thermometer.

Oil Inlet Pressure - Check at the fitting in the line near the compressor oil inlet. With air receiver pressure at 100 psi (6.9 bar), oil inlet pressure should be 65-75 psig (4.5 to 5.2 bar).

Oil Cooler Oil Pressure Differential (Air-Cooled Radiator) - Check differential across the oil system by measuring oil inlet pressure as described above.

Oil Cooler Temperature Differential (Air-Cooled Radiator) - The oil temperature differential depends on the temperature of the air at the oil cooler fan and cleanliness of the core faces. As ambient temperatures and core restrictions increase, the oil cooler outlet temperature will increase. The oil inlet temperature is approximately the same as the air discharge temperature - see the gauge on the instrument panel. The outlet oil temperature may be checked by installing a tee at the oil filter outlet.

SECTION 6
AIR FILTER



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(Ref. Drawing)

Figure 6-1 – HEAVY DUTY AIR FILTER

GENERAL - The air filter must receive proper maintenance if maximum service is to be obtained from the unit. Establishing adequate and timely filter service is MOST IMPORTANT. A wide range of operating hours is possible. With wide variation of dust conditions encountered, only experience can determine the proper time interval for servicing filters.

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

Filter Element - Service the air filter element when the "CHANGE AIR FILTER" LED is illuminated. Clean every 50 to 150 operating hours depending on dust conditions.

NOTICE

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

To service:

1. Remove the wing nut and pull out the filter element.

2. Visually inspect the element. If cleaning is not necessary, reinstall the filter element. If the element requires cleaning, go through steps 3, 4 and 5.

3. Wash the element by soaking about 15 minutes in warm water with a mild non-sudsing detergent. Rinse the element thoroughly with clean water; a hose may be used if the water pressure does not exceed 40 psig (2.8 bar).

4. Inspect the element for ruptures or cracks in the pleated media; replace the element if any are found. Inspect the gasket on the bottom (outlet end) of the element; replace the entire element if the gasket is damaged, a spare element will keep downtime to a minimum.

5. Allow the element to air dry COMPLETELY. Do not expose the element to heat over 150° F (66° C). Install the element in the filter body and fasten securely with the wing nut.

⚠ 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.

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

1. Visual inspection indicates a rupture, crack or pin hole in the pleated media. Inspection should be done by placing a bright light inside the element.

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

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

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

NOTICE

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

SECTION 7
BELT DRIVE

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

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

⚠ CAUTION

Excessive belt tension can damage the equipment. Tension the belts as shown in Figure 7-1, page 71.

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

Next, use the adjusting screws in the motor base to loosen belt tension. Remove the belts, and replace with new belts. Check for correct belt tension and re-attach the wire guard.

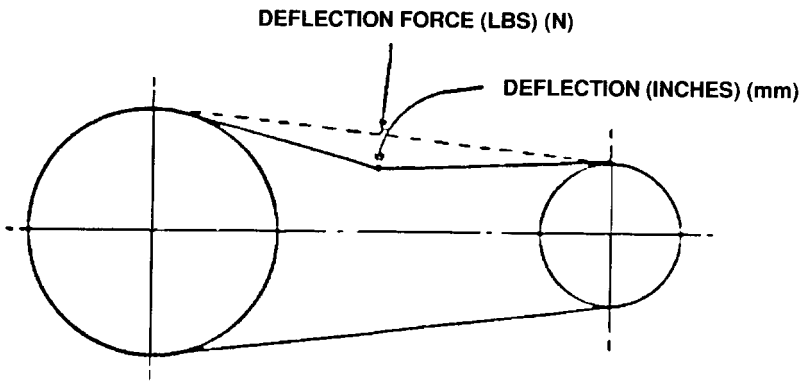
⚠ CAUTION

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

CHECKING BELT TENSION - Using a spring scale, apply a perpendicular force to each belt at the midpoint of the span and measure the deflection. Correct deflection force and deflection are shown in Figure 7-1, page 71. To tighten belts, merely increase the center distance.

NOTICE

When a new set of belts is installed on a drive, the initial deflection force should be 1/3 greater than shown in Figure 7-1, page 71. Recheck tension frequently during the first 24 hours of operation.



Motor H.P. (kW)	No. of Belts	Deflection Force Pounds (Newtons) (per belt)	Deflection in Inches (mm)
15 (11 kW)	4	6 to 8.5 (1.3 to 1.9)	5/16 (8)
20 (15 kW)	4	6 to 7 (1.3 to 1.5)	5/16 (8)
25 (19 kW)	4	6 to 8.5 (1.3 to 1.9)	5/16 (8)
30 (22 kW)	4	6 to 7 (1.3 to 1.5)	5/16 (8)

Figure 7-1 – BELT TENSION 3VX BELTS

SECTION 8
MAINTENANCE SCHEDULE

SERVICE CHECK LIST –

Air Filter - Operating conditions determine frequency of service. The “CHANGE AIR FILTER” display will flash to signal that the air filter requires servicing or changing. See “Air Filter”, Section 6, page 68

Oil Separator - Operating conditions determine frequency of service. The “CHANGE SEPARATOR” display will flash to signal that oil separator element requires changing. See “Compressor Oil Separator” in Section 5 for further details.

Motor Lubrication - Refer to SECTION 2, page 12 and Maintenance Schedule Chart below.

Every 8 Hours Operation

1. Check the reservoir oil level - add oil if required. See Section 5, page 56. If oil consumption is high, refer to “Excessive Oil Consumption”, page 75.

2. Observe if the unit loads and unloads properly.

3. Check discharge pressure and temperature.

4. Check control panel display for advisory text messages.

Every 125 Hours Operation

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

Every 1000 Hours Operation

Change the oil filter element.

Every 4000 Hours Operation

Change the compressor lubricant. UNDER ADVERSE CONDITIONS, CHANGE MORE FREQUENTLY (refer to “Oil Change Interval”, page 61). Flush system if required.

Every Year

Check the relief valve for proper operation. See SECTION 4, page 25.

Change air/oil separator.

MAINTENANCE SCHEDULE (See detail notes above)						
Maintenance Action	**If Text Advisory is Displayed**	**Every 8 Hours**	**Every 125 Hours**	**Every 1000 Hours**	**Every 4000 * Hours**	**Every Year**
Change Air Filter	•					
Change Oil Separator	•					•
Check Reservoir Oil Level		•				
Check for Proper Load/Unload		•				
Check Discharge Pressure/Temp		•				
Check Dirt Accumulation on Cooler			•			
Change Oil Filter Element				•		
Change Compressor Lubricant (AEON 4000)	•				•	
Check Relief Valve						•

SECTION 9
TROUBLESHOOTING

SYSTEM	POSSIBLE CAUSE	REMEDY
Compressor fails to start	1. Wrong lead connections	1. Change leads
	2. Blown fuses in control box	2. Replace fuse
	3. Motor starter overload relay tripped	3. Reset and investigate cause of overload
	4. Pressure in reservoir	4. Inspect blowdown valve
	5. Read error message on control panel. See Control Manual 13-17-600	5. Replace switch
Compressor starts but stops after a short time	1. High discharge temperature	1. See “High Temperature Operation”, page 57.
	2. High discharge temperature switch malfunction	2. Replace switch
	3. Blown fuse in starter/control box	3. Replace fuse (investigate if fuses continue to blow)
	4. Motor starter overload relay tripped	4. Reset and investigate cause of overload
Compressor does not unload (or load)	1. Improperly adjusted control	1. Refer to Controller Manual 13-17-600
	2. Air leak in control lines	2. Determine source of leak and correct
	3. Restricted control line	3. Clean control lines
	4. Subtractive pilot or blowdown valve malfunction	4. Repair, clean or replace valve
Compressor cycles from load to unload excessively	1. Insufficient receiver capacity	1. Increase receiver size
	2. Restriction in control tubing	2. Inspect and clean control tubing
	3. Subtractive pilot setting too high	3. Adjust the valve. See SECTION 4, page 30
Compressor is low on delivery and pressure	1. Restricted air filter	1. Clean or replace filter
	2. Sticking inlet valve	2. Inspect and clean inlet valve
	3. Subtractive pilot or unload pressure adjusted too low	3. Adjust the valve or unload pressure. See page 30.
	4. Minimum pressure valve stuck closed	4. Replace valve

SYSTEM	POSSIBLE CAUSE	REMEDY
High discharge air temperature	1. Thermostatic mixing valve stuck open	1. Repair or replace valve
	2. Dirty or clogged cooler face	2. Clean cooler
	3. Insufficient cooling air flow	3. Provide unrestricted supply of cooling air
	4. Clogged oil filter or cooler (interior)	4. Replace filter or clean cooler
	5. Low compressor oil	5. Add oil to proper level
Excessive oil consumption	1. Oil carryover through lines	1. See “Oil Carryover”, below
	2. Oil leaks at all fittings and gaskets	2. Tighten or replace fittings or gasket
Oil Carryover	1. Overfilling the reservoir	1. Drain excess oil from system
	2. Clogged, broken or loose oil return lines	2. Tighten or replace faulty lines
	3. Ruptured oil separator element	3. Replace element
	4. Loose assembly	4. Tighten all fittings and gaskets
	5. Foam caused by use of incorrect oil	5. Use Gardner Denver AEON 4000 or 9000SP Lubricating Coolant
	6. Inoperative minimum pressure valve	6. Replace valve
	7. Operation at elevated discharge temperatures	7. Reduce temperature. See “High Temperature Operation”, page 57.
	8. Scavenge line check valve failure	8. Replace check valve
	9. Water condensate in oil	9. Check oil reservoir temperature, and if low, change thermal mixing valve element to higher temperature.

SYSTEM	POSSIBLE CAUSE	REMEDY
"CHANGE SEPARATOR" Text Advisory	1. Separator differential is greater than 15 psid (1 bar) or change interval hours have been exceeded.	1. Change Separator
	2. Bad Transducer	2. Verify readings with mechanical gauges. If defective, replace with Transducer listed in Parts List 13-21-500.
	3. Misadjusted minimum pressure valve	3. Set minimum pressure valve at 65 psig (4.5 bar)
	4. Sticky minimum pressure valve	4. Disassemble and clean
	5. Defective minimum pressure valve. [Won't set at 65 psig (4.5 bar)]	5. Rebuild or replace
	6. Electrical noise creating false readings	6. Make sure transducer wires are kept to a minimum length and are twisted
	7. Ruptured oil separator element	7. Replace element
	8. Loose assembly	8. Tighten all fittings and gaskets
	9. Foam caused by use of incorrect oil	9. Use Gardner Denver AEON 4000 or 9000SP Lubricating Coolant
	10. Inoperative minimum pressure valve	10. Clean out or replace valve
	11. Operation at elevated discharge temperatures	11. Reduce temperature. See "High Temperature Operation", page 57.
	12. Scavenge line check valve failure	12. Replace check valve
	13. Water condensate in oil	13. Check oil reservoir temperature, and if low, change thermal mixing valve element to higher temperature.

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

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

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

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

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

5. Any reconditioned or prior owned product.

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

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

AIRENDS
Airends, consisting of all parts within and including the cylinder and gear housing, are warranted for 24 months from date of initial use or 27 months from date of shipment to the purchaser, whichever occurs first. Inlet valves and airends contain wearing items that must be serviced according to the operator's manual. A material or workmanship defect in these items is warrantable. Normal wear and servicing of these items is not covered under the warranty.

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

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

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

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

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

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

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

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

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

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

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

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

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

Gardner Denver

ENERGY STAR PARTNER

 Litho in U.S.A

For additional information contact your local representative or

Gardner Denver, Inc.
1800 Gardner Expressway, Quincy, Illinois 62305

Telephone: (800) 682-9868
FAX: (217) 224-7814

Visit our Web Site: www.gardnerdenver.com

GARDNER DENVER

ENERGY STAR PARTNER

13-21-500
Version: 07
December 19, 2010

ELECTRA-SAVER II
BASE-MOUNTED AND TANK MOUNTED COMPRESSOR

AIRSMART™ CONTROLS

MODELS

EBE99Q
15, 20, 25, 30 HP

60 HZ

PARTS LIST

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

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

Your authorized Gardner Denver Compressor distributor offers all the backup you'll need. 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 Remanufacturing Center in Indianapolis, IN., for purchase on an exchange basis with liberal core credit available for the replacement unit.
3. A full line of factory tested AEON™ compressor lubricants specifically formulated for use in Gardner Denver compressors.
4. Repair and maintenance kits designed with the necessary parts to simplify servicing your compressor.

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

For the location of your local authorized Gardner Denver Air Compressor distributor, refer to the yellow pages of your phone directory, check the Gardner Denver Web Site at www.gardnerdenver.com or contact:

Factory:
Gardner Denver
1800 Gardner Expressway
Quincy, IL 62305

Phone: (217) 222-5400

Fax: (217) 224-7814

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.

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

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

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

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

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

REMANUFACTURED AIRENDS

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

Immediately Available

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

Skilled Craftsmen

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

Precision Remanufacturing

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

Extensive Testing

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

Warranty

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

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

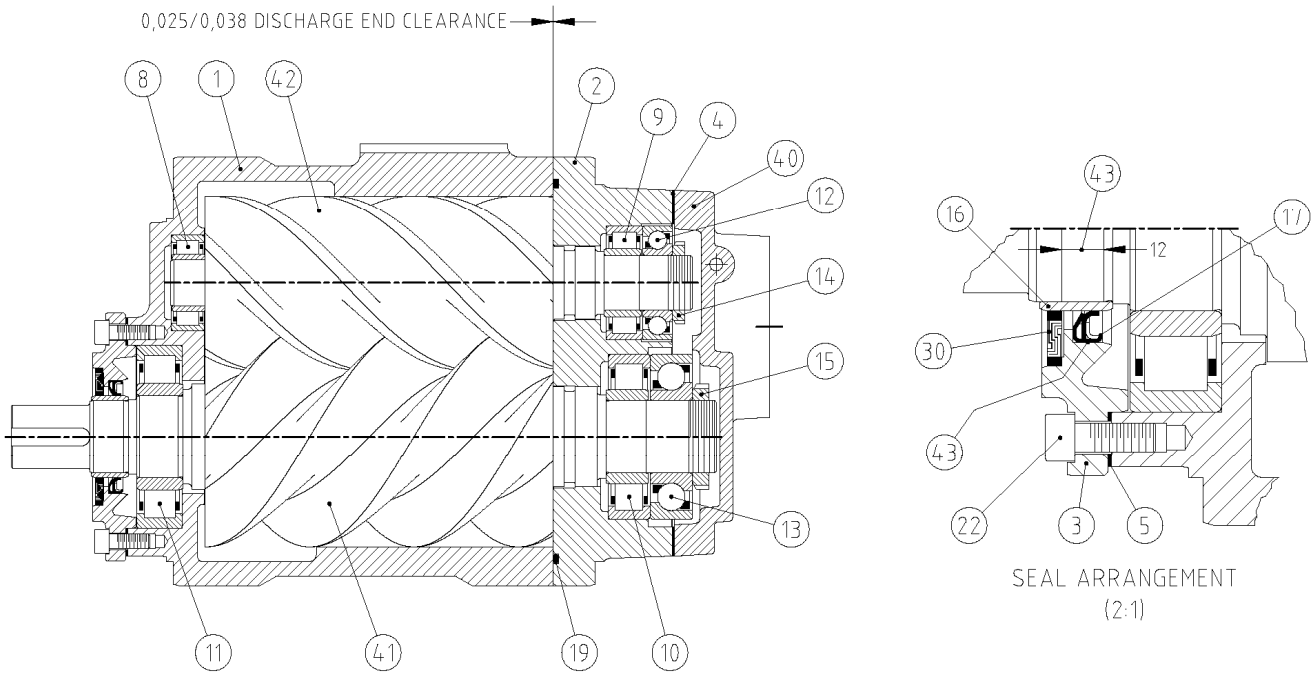
Call Gardner Denver for information on the airend exchange program and the name of your authorized distributor.

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

TABLE OF CONTENTS

For Operating and Service Manual, see	
SERVICE MANUAL	**13-21-600**
CONTROL MANUAL	**13-17-600**
COMM. MODULE	**13-17-604**

AIREND CROSS SECTION
(ENDURO 12+)



332EFD810-A
(Ref. Drawing)
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ASSEMBLIES WITH TWO SHAFT SEALS

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

AIREND CROSS SECTION (ENDURO 12+)

Ref. No.		Name of Part	Qty.	B/M: 50553346; CC1018803 CC1018804 Part No.
	1	CYLINDER (ENDURO 12)	1	**********
	2	BEARING DISCHARGE HOUSING (ENDURO 12)	1	**********
	3	SEAL HOUSING	1	**********
**	4	GASKET	1	22318708
***	5	GASKET	1	30805908
*	8	ROLLER BEARING	1	12BA207
*	9	ROLLER BEARING	1	12BA226
*	10	ROLLER BEARING	1	12BA227
*	11	ROLLER BEARING	1	12BA228
*	12	ROLLER BEARING	1	12BA229
*	13	ROLLER BEARING	1	12BA230
*	14	NUT	1	87252589
*	15	NUT	1	86912899
***	16	WEAR SLEEVE	1	89533499
***	17	SEAL	1	89532919
**	19	O-RING	1	87090019
	22	SCREW	6	**********
***	30	DUST SEAL	1	89599799
	40	DISCHARGE FLANGE	1	**********
	41	ROTOR MALE (E12+)	1	**********
	42	ROTOR-FEMALE (E12+)	1	**********
	43	LOCTITE SEALANT	1	25BC848

For Replacement Airend, order Part Number 300EBE1095.

* For Periodic Overhaul Kit, order Part Number 307EFD6013. See page 72.

** For Gasket Kit, order Part Number 306CGC6013. See page 72

*** For Seal Repair Kit, order Part Number 301EFD6029. See page 72.

AIREND BOLTS AND PLUGS
(ENDURO 12+)

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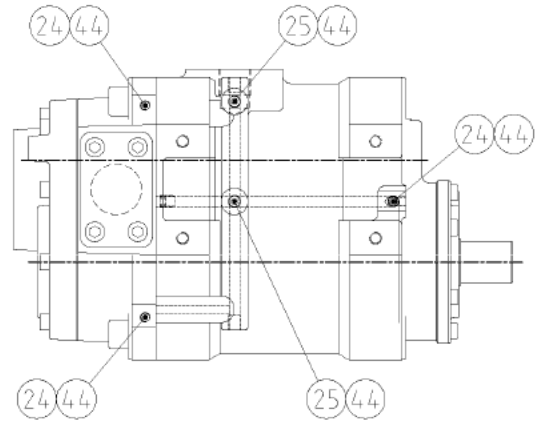
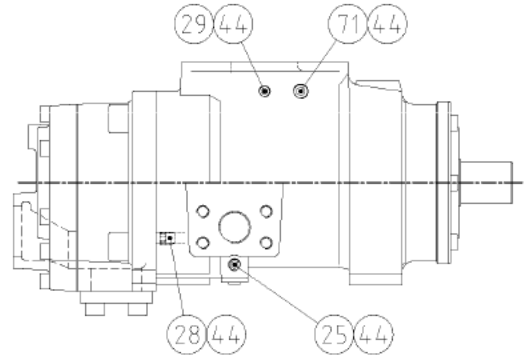
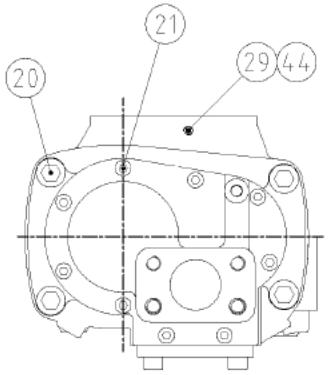
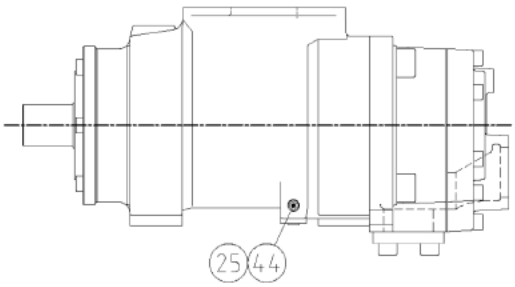
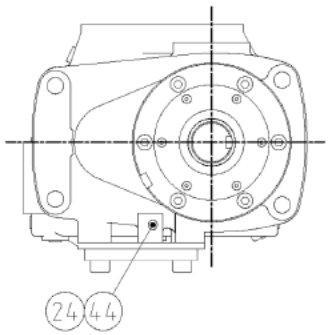
(Ref. Drawing)
Page 2 of 2

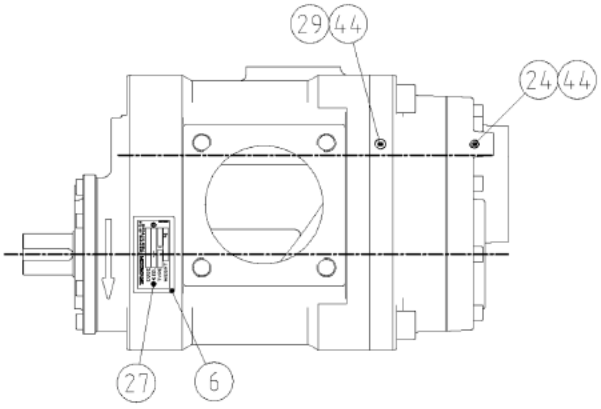


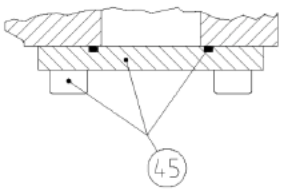












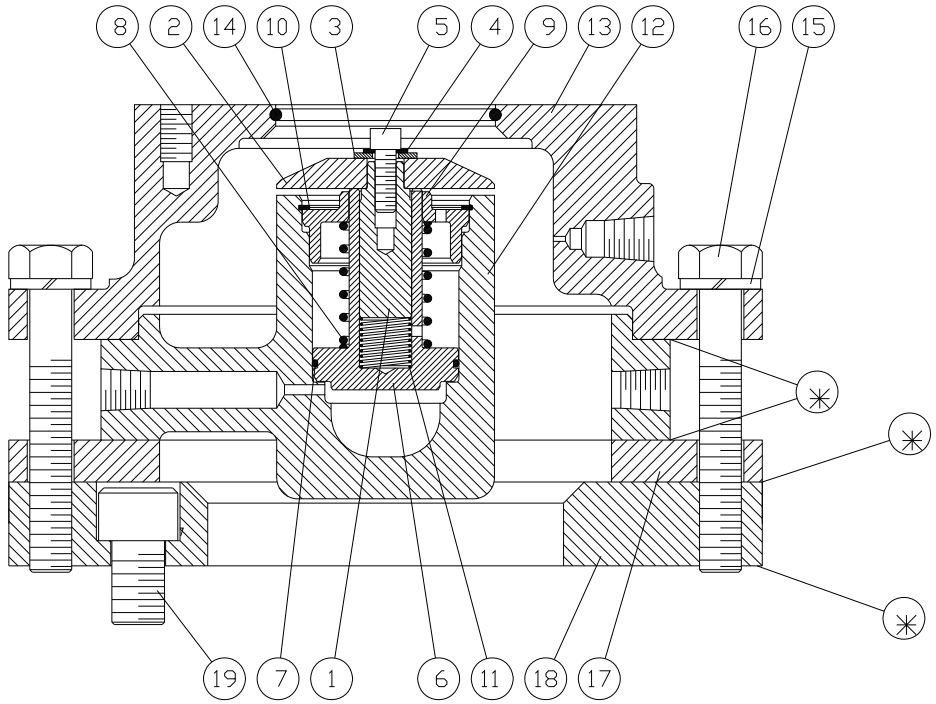
BOTTOM DISCHARGE FLANGE COVER
(2:1)

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

AIREND BOLTS AND PLUGS
(ENDURO 12+)

Ref. No.	Name of Part	Qty.	B/M: 50553346 CC1018803 CC1018804 Part No.
20	SCREW	4	665SMCA16045Z
21	SCREW	9	665SMCA08035Z
24	PLUG	5	64AA47
25	PLUG	4	64AA48
28	SCREW	1	76F158
29	PLUG 1/8”	3	80704779
44	LOCTITE SEALANT	1	25BC888
45	FLANGE KIT	1	30937478
71	PLUG	1	64AA50

INLET VALVE



313EBE810-A
(Ref. Drawing)

✳GASKET ELIMINATOR REQUIRED

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

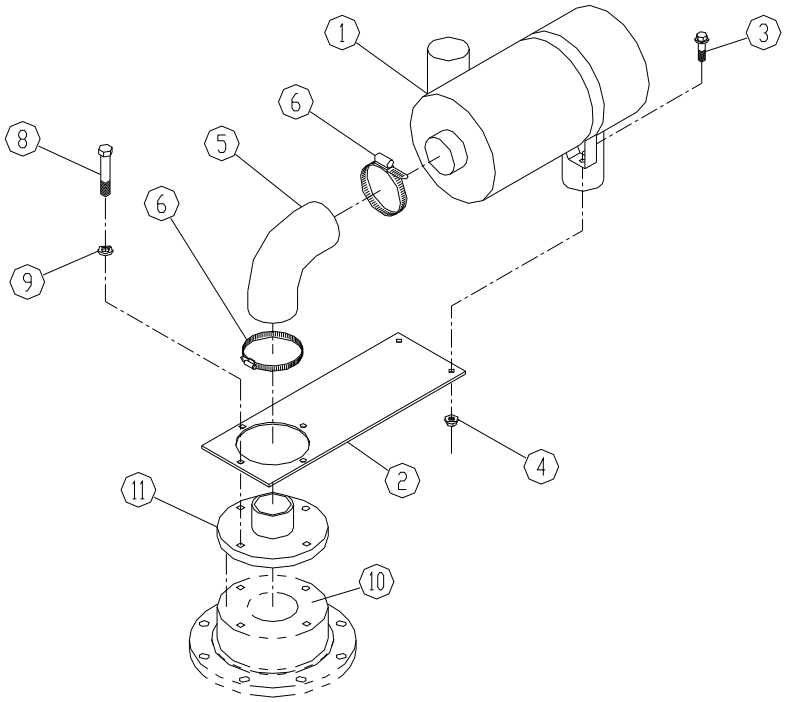
INLET VALVE

B/M: 300EBE4030

	Ref. No.	Name of Part	Qty.	Part No.
	1	GUIDE-VALVE	1	201SSE483
	2	VALVE-INLET	1	202SSE044
	3	WASHER-PLAIN	1	95A1
	4	LOCKWASHER	1	95H56
	5	SCREW	1	655EC03N
	6	PISTON-INLET VALVE	1	202SSE043
+	7	O-RING	1	25BC440
+	8	SPRING	1	78H22
	9	RETAINER	1	200SSE205
+	10	RING-RETAINING	1	74D87
+	11	SPRING	1	78W59
	12	HOUSING-INLET	1	205SSE041
	13	SEAT	1	204SSE256
+	14	O-RING	1	25AM15
	15	LOCKWASHER	8	95B5
	16	SCREW	8	655EE140
	17	PLATE-RETAINER	1	300EBE168
	18	ADAPTOR	1	300EBE170
	19	SCREW (METRIC)	4	665SMCA160250
	+	GASKET ELIMINATOR	1	25BC222

+ Parts included in Periodic Maintenance Kit Part Number 302EBE6013. Refer to page 71.

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

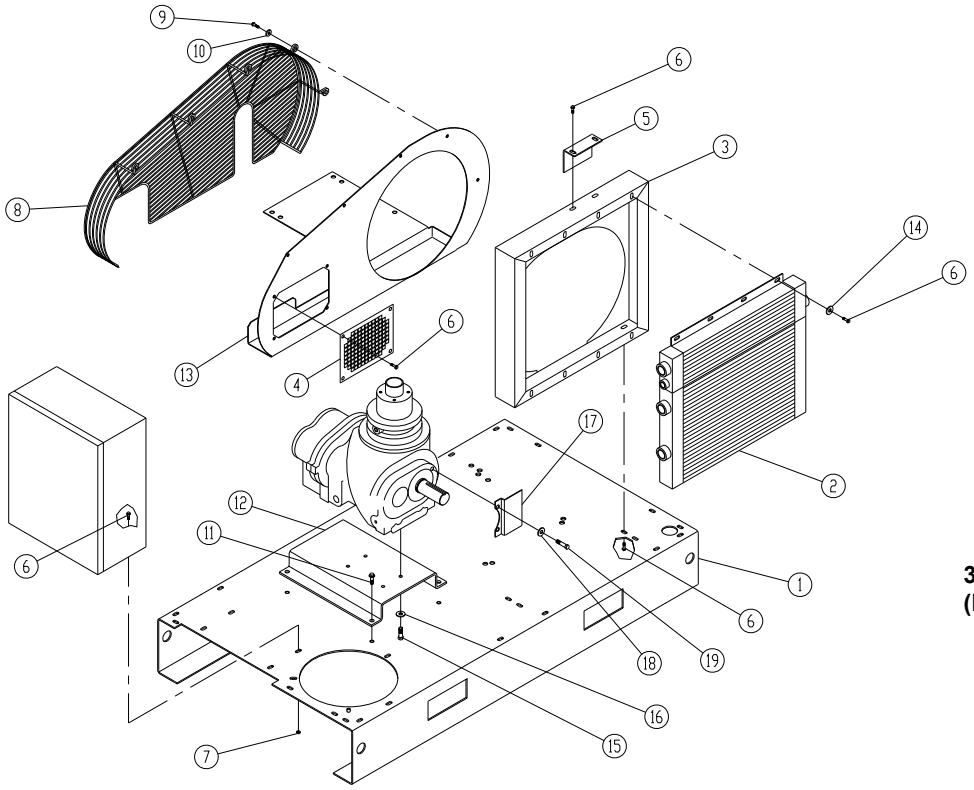


315EBE810-B
(Ref. Drawing)

SEVERE DUTY AIR FILTER AND MOUNTING (STANDARD)

Ref. No.	Name of Part	Qty.	B/M: 300EBE4054; 301EBE4054 Part No.
1	FILTER-AIR	1	5L350
2	BRACKET-FILTER	1	300EBE389
3	SCREW	2	75LM97
4	NUT	2	50AW4
5	HOSE	1	29Z468
6	CLAMP	2	2009395
8	SCREW	4	655ED080
9	LOCKWASHER	4	95B3
10	GASKET-ELIMINATOR	1	25BC222
11	FILTER	1	201EBE070
	ELEMENT (REPAIR) (AIR FILTER)	1	2118314

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

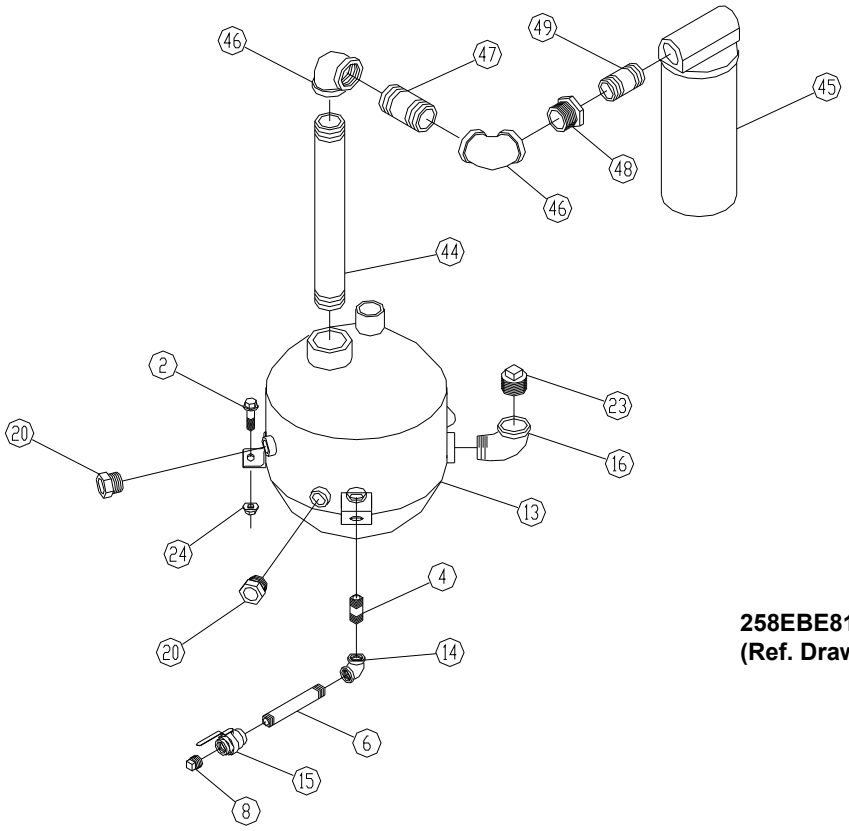


312EBE810-B
(Ref. Drawing)

BASE AND OIL COOLER MOUNTING

Ref. No.	Name of Part	Qty.	B/M: 300EBE4003 200EBE4013 15/20 HP Part No.	B/M: 300EBE4003 201EBE4013 25/30 HP Part No.
1	BASE	1	203EBE285	203EBE285
2	COOLER-OIL	1	202EBE201	202EBE201
3	BAFFLE	1	200EBE840	200EBE840
4	PLATE-INSPECTION	1	200EBE052	200EBE052
5	BRACKET	1	200EBE142	200EBE142
6	SCREW	22	75LM51	75LM51
7	NUT	4	50AW5	50AW5
8	GUARD-FAN	1	300EBE393	300EBE393
9	SCREW	5	75LM150	75LM150
10	RETAINER	5	2014731	2014731
11	SCREW	4	75LM135	75LM135
12	SUPPORT	1	300EBE165	300EBE165
13	ORIFICE	1	206EBE814	207EBE814
14	WASHER-PLAIN	8	95A3	95A3
15	SCREW (METRIC)	4	665HMCA100200	665HMCA100200
16	WASHER-PLAIN	4	95A3	95A3
17	GUARD-DRIVE	1	300EBE477	300EBE477
18	LOCKWASHER	2	95B7	95B7
19	SCREW (METRIC)	2	655SMCA160250	655SMCA160250

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



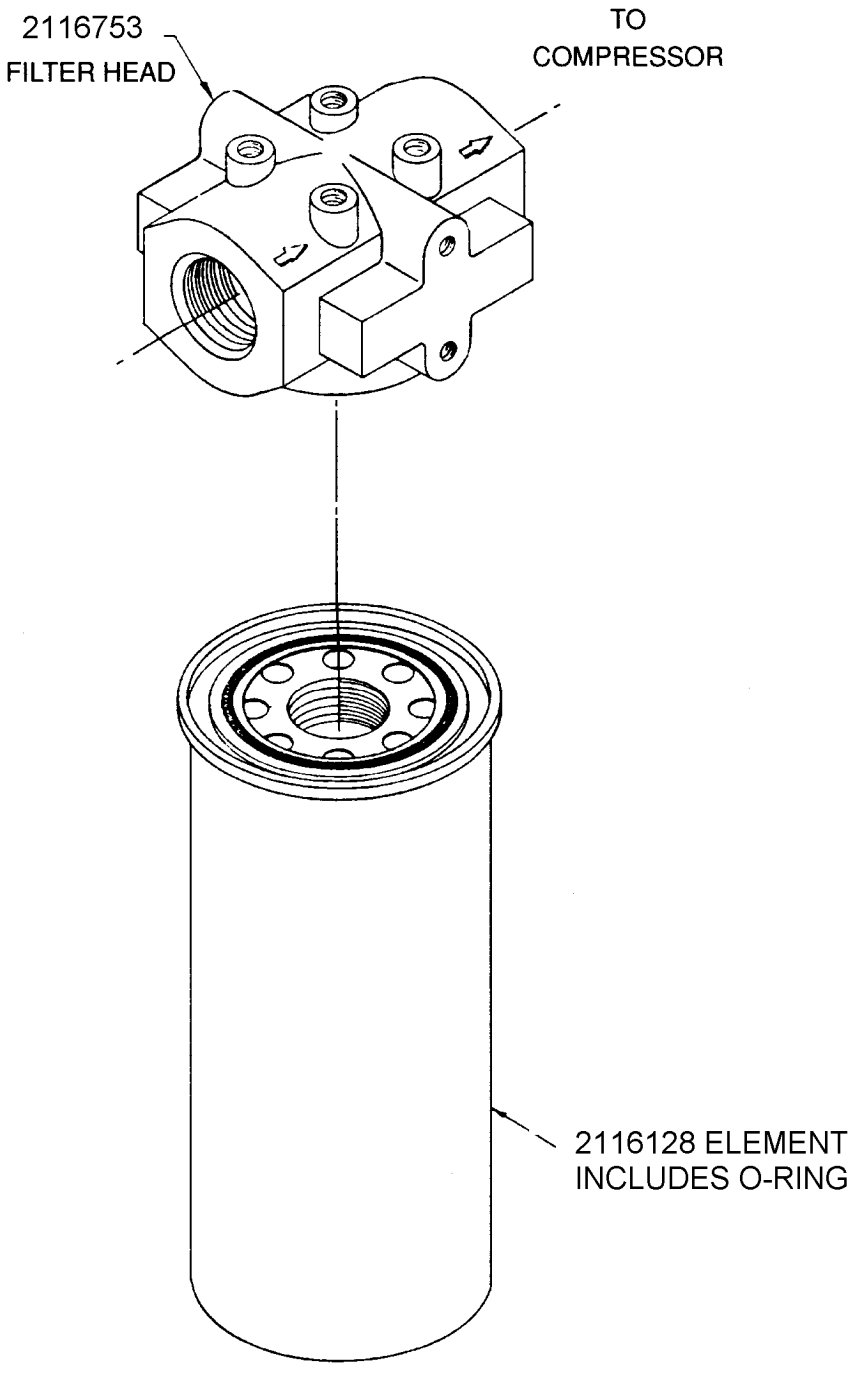
258EBE810-B
(Ref. Drawing)

OIL RESERVOIR

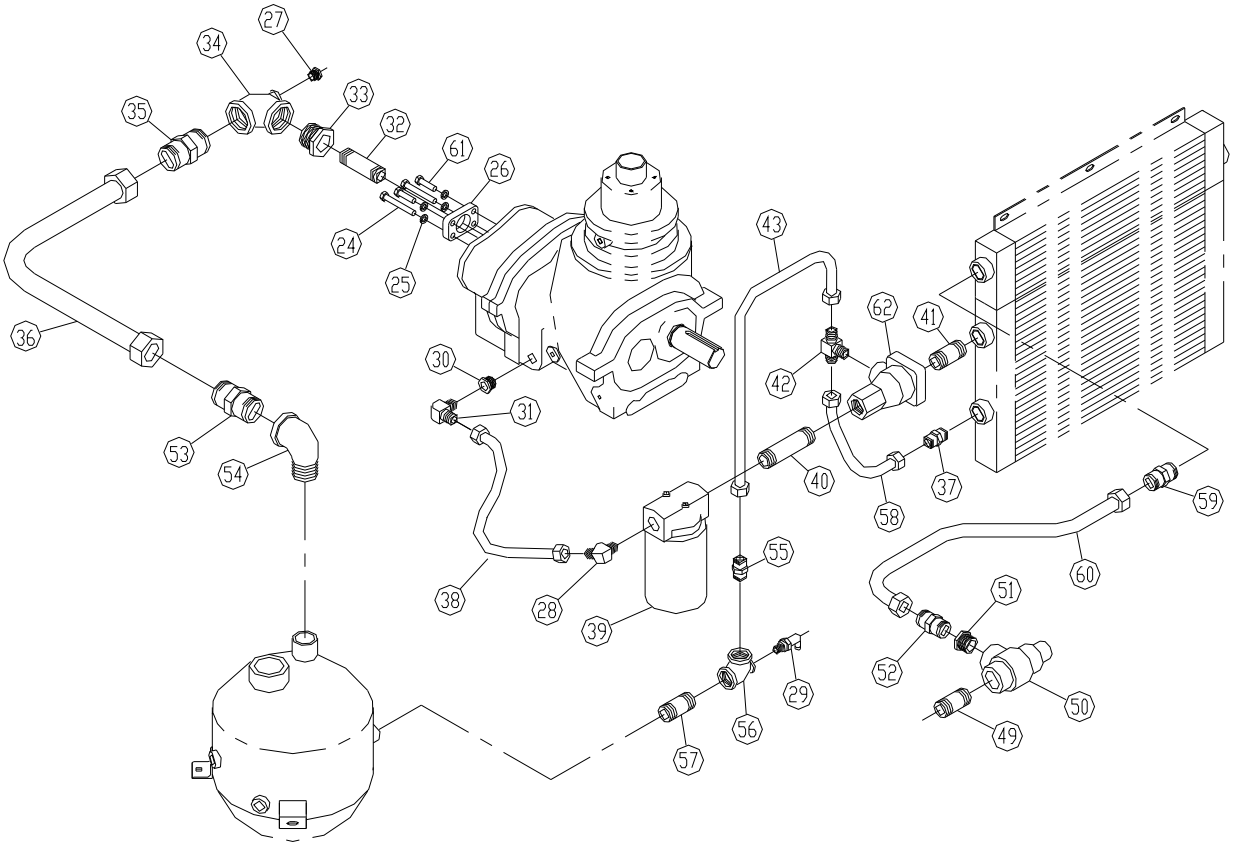
B/M: 200EBE4018; 300EBE4018 & 304EBE4002

Ref. No.		Name of Part	Qty.	Part No.
	2	SCREW	3	75LM51
	4	NIPPLE	1	63F1G
	6	NIPPLE	1	63F6G
	8	PLUG	1	64AA7
	13	OIL RESERVOIR	1	203EBE037
	14	ELBOW	1	64C4G
	15	BALL VALVE	1	90AR360
	16	ELBOW	1	64D7G
	17	PLUG	1	64A26
	20	GAUGE	2	40P11
	23	PLUG	1	64A26
	24	NUT	3	50AW5
	44	NIPPLE	1	63K34G
*	45	OIL SEPARATOR	1	300EBE035
	46	ELBOW	2	64C8G
	47	NIPPLE	1	63K3G
	48	PIPE BUSHING	1	64E98
	49	NIPPLE	1	63J15G

* For replacement Element and O-ring, order Part No. 2116717.
For replacement Head, order Part No. 2116716.


2116753
FILTER HEAD
TO
COMPRESSOR
2116128 ELEMENT
INCLUDES O-RING

OIL LINE FITTINGS



316EBE810-E
(Ref. Drawing)

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

OIL LINE FITTINGS

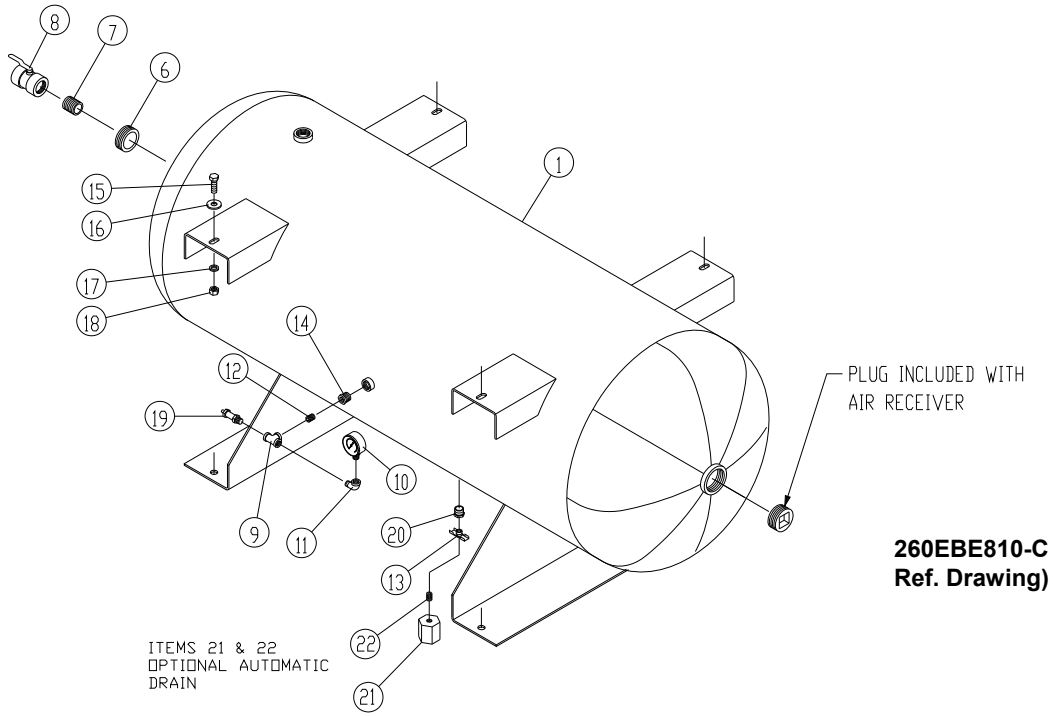
B/M: 301EBE4019; 301 & 302EBE4030; 304EBE4002; 300EBE4018

Ref. No.		Name of Part	Qty.	Part No.
	24	SCREW	2	665HMCA120900
	25	LOCKWASHER	4	95B5
	26	FLANGE	1	300EBE073
	27	PIPE BUSHING	1	64E43
	28	ADAPTOR	1	29Z226
	29	OIL SAMPLING VALVE	1	86H345
	30	BUSHING	1	86H156
	31	ADAPTOR	1	29Z241
	32	NIPPLE	1	63K24G
	33	PIPE BUSHING	1	64EB304
	34	TEE	1	64P106G
	35	CONNECTOR	1	86H142
	36	TUBE WITH FITTING	1	304EBE863
	37	TUBE CONNECTOR	1	86H137
	38	HOSE	1	306EFB127
**	39	OIL FILTER	1	26C27
	40	NIPPLE	1	63G2G
	41	NIPPLE	1	63G33G
	42	TEE	1	86N286
	43	TUBE WITH FITTING	1	200EBE863
	49	NIPPLE	1	63J15G
	50	MINIMUM PRESSURE VALVE	1	200EDE527
	51	PIPE BUSHING	1	64E97
	52	TUBE CONNECTOR	1	86H138
	53	TUBE CONNECTOR	1	86H142
	54	ELBOW	1	64U6G
	55	TUBE CONNECTOR	1	86H137
	56	TEE	1	64P14G
	57	NIPPLE	1	63G1G
	58	TUBE WITH FITTING	1	202EBE863
	59	TUBE CONNECTOR	1	86H138
	60	TUBE WITH FITTING	1	206EBE863
	61	SCREW	2	665HMCA120350
*	62	THERMO VALVE		
		170°	1	90AR1093
		180°	1	90AR1100

* See page 20 for repair part numbers.

** See page 13 for repair part numbers.

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



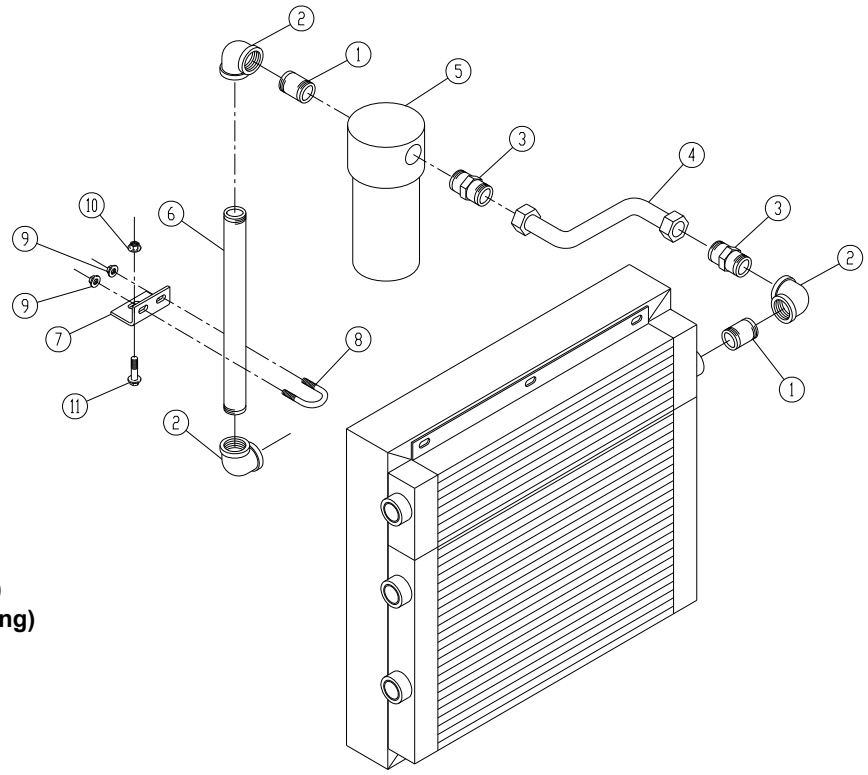
260EBE810-C
Ref. Drawing)

AIR RECEIVER GROUP

B/M: 202EBE4023
203EBE4023, 204EBE4023
207EBE4023

Ref. No.	Name of Part	Qty.	Part No.
1	RECEIVER-AIR		
	120 GALLON	1	200EJB645
	200 GALLON	1	201EJB645
6	BUSHING-PIPE	1	64E11
7	NIPPLE	1	63H1G
8	VALVE-BALL	1	90AR362
9	TEE	1	64G3G
10	GAUGE-AIR PRESSURE	1	27A114
11	ELBOW	1	64D2G
12	NIPPLE	1	63D1G
13	COCK (Not required with Automatic Drain)	1	90C12
14	BUSHING-PIPE	1	64E2G
15	SCREW	4	655EE060
16	WASHER	8	95A5
17	LOCKWASHER	4	95B5
18	NUT	4	50B5
19	VALVE-PRESSURE RELIEF	1	90AR657
20	BUSHING-PIPE	1	64E2G
21	AUTOMATIC DRAIN VALVE (Optional)	1	90AR319
22	PIPE-NIPPLE (Optional)	1	63F21G

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

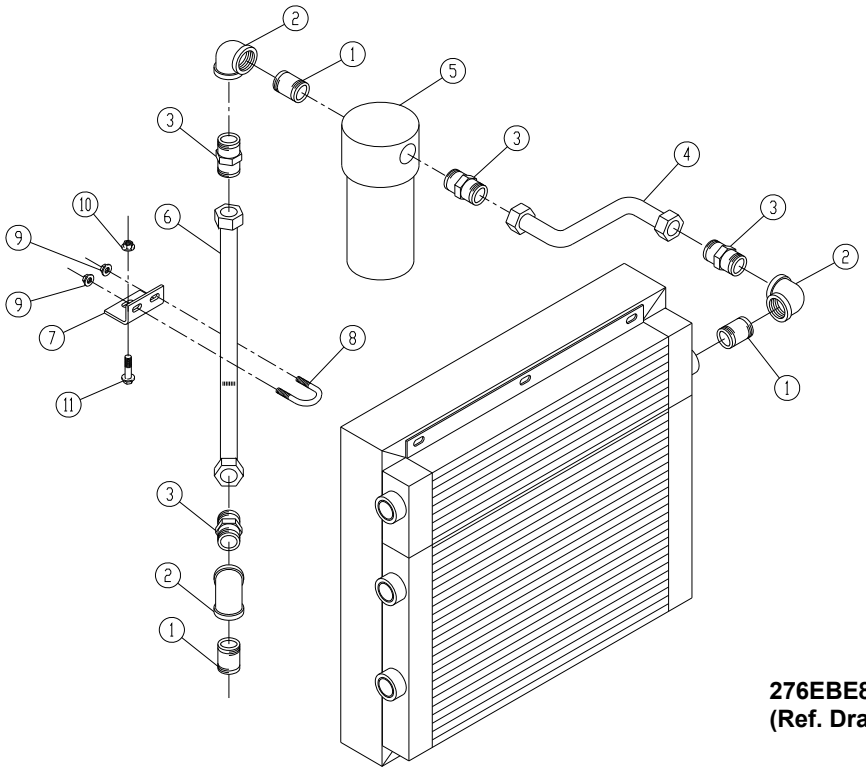


277EBE810
(Ref. Drawing)

DISCHARGE PIPING – BASE MOUNTED UNITS (WITH SEPARATOR)

Ref. No.	Name of Part	Qty.	B/M: 211EBE4019; 303EBE4019 Part No.
1	NIPPLE	2	63H1G
2	ELBOW	3	64C6G
3	CONNECTOR-TUBE	2	86H138
4	TUBE WITH FITTINGS	1	203EBE863
5	TRAP	1	83C78
6	NIPPLE	1	63N16X134G
7	BRACKET	1	204EJB142
8	U-BOLT	1	143738
9	NUT	2	50AW4
10	NUT	1	50AW5
11	SCREW	1	75LM51

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

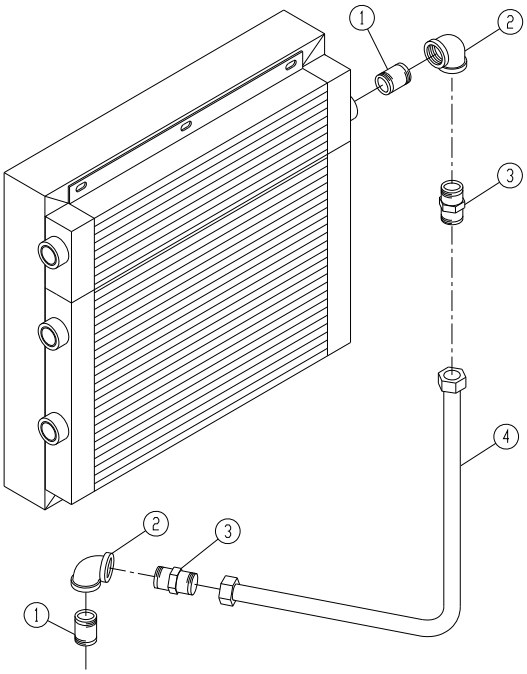


276EBE810
(Ref. Drawing)

DISCHARGE PIPING – TANK MOUNTED UNITS (WITH SEPARATOR)

Ref. No.	Name of Part	Qty.	B/M: 210EBE4019; 302EBE4019 Part No.
1	NIPPLE	3	63H1G
2	ELBOW	3	64C6G
3	CONNECTOR-TUBE	4	86H138
4	TUBE WITH FITTINGS	1	203EBE863
5	TRAP	1	83C78
6	TUBE WITH FITTINGS	1	204EBE863
7	BRACKET	1	202EJB142
8	U-BOLT	1	15U59
9	NUT	2	50AW3
10	NUT	1	50AW5
11	SCREW	1	75LM51

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



278EBE810
(Ref. Drawing)

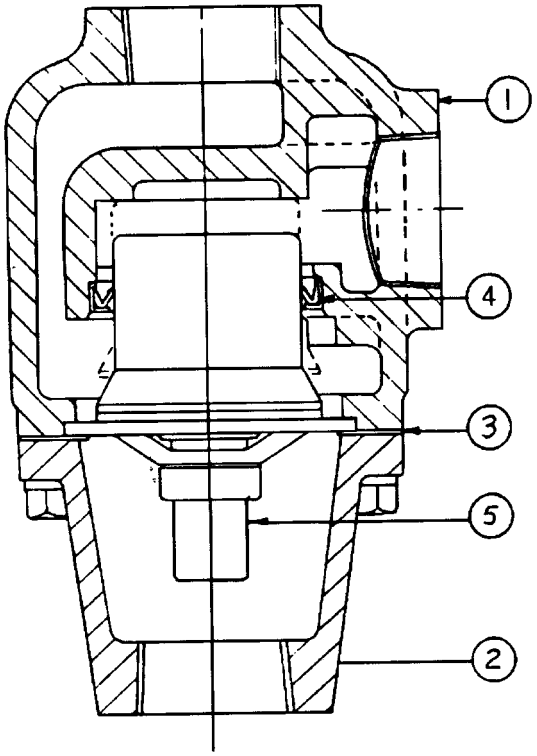
DISCHARGE PIPING – TANK MOUNTED UNITS (WITHOUT SEPARATOR – TRAP)

B/M: 212EBE4019

Ref. No.	Name of Part	Qty.	Part No.
1	NIPPLE	2	63H1G
2	ELBOW	2	64C6G
3	CONNECTOR-TUBE	2	86H138
4	TUBE WITH FITTINGS	1	205EBE863

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

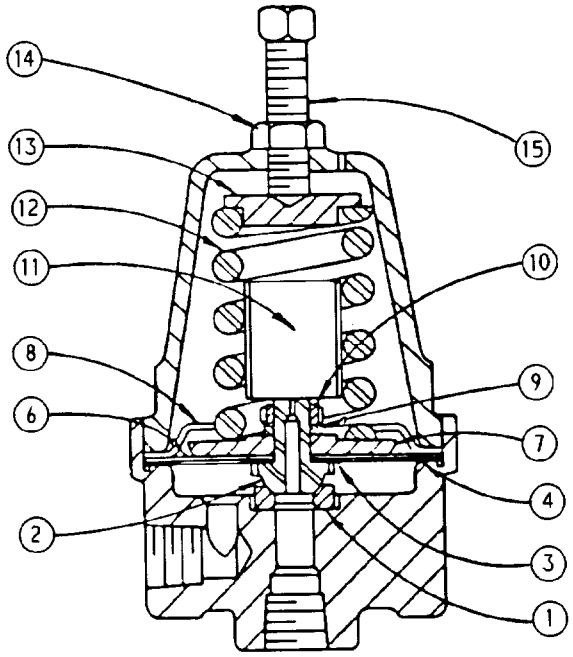
THERMAL VALVE
(Thermostatic Mixing)



90AR1093 ASSEMBLY VALVE – THERMAL (ALUMINUM HOUSING)

Ref. No.	Name of Part	Qty.	Part No.
1	VALVE BODY (3/4”)	1	2117072
2	VALVE COVER (3/4”)	1	2117073
	VALVE KIT (Includes Items 3, 4 & 5)		
	150° THERMOSTAT (Optional)	1	2115542
	160° THERMOSTAT (Optional)	1	2115543
	170° THERMOSTAT (Standard)	1	2117074
	180° THERMOSTAT (Optional)	1	2117075
3	O-RING (Included in Valve Kit)	1	
4	LIP SEAL (Included in Valve Kit)	1	
5	ELEMENT (Included in Valve Kit)	1	

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

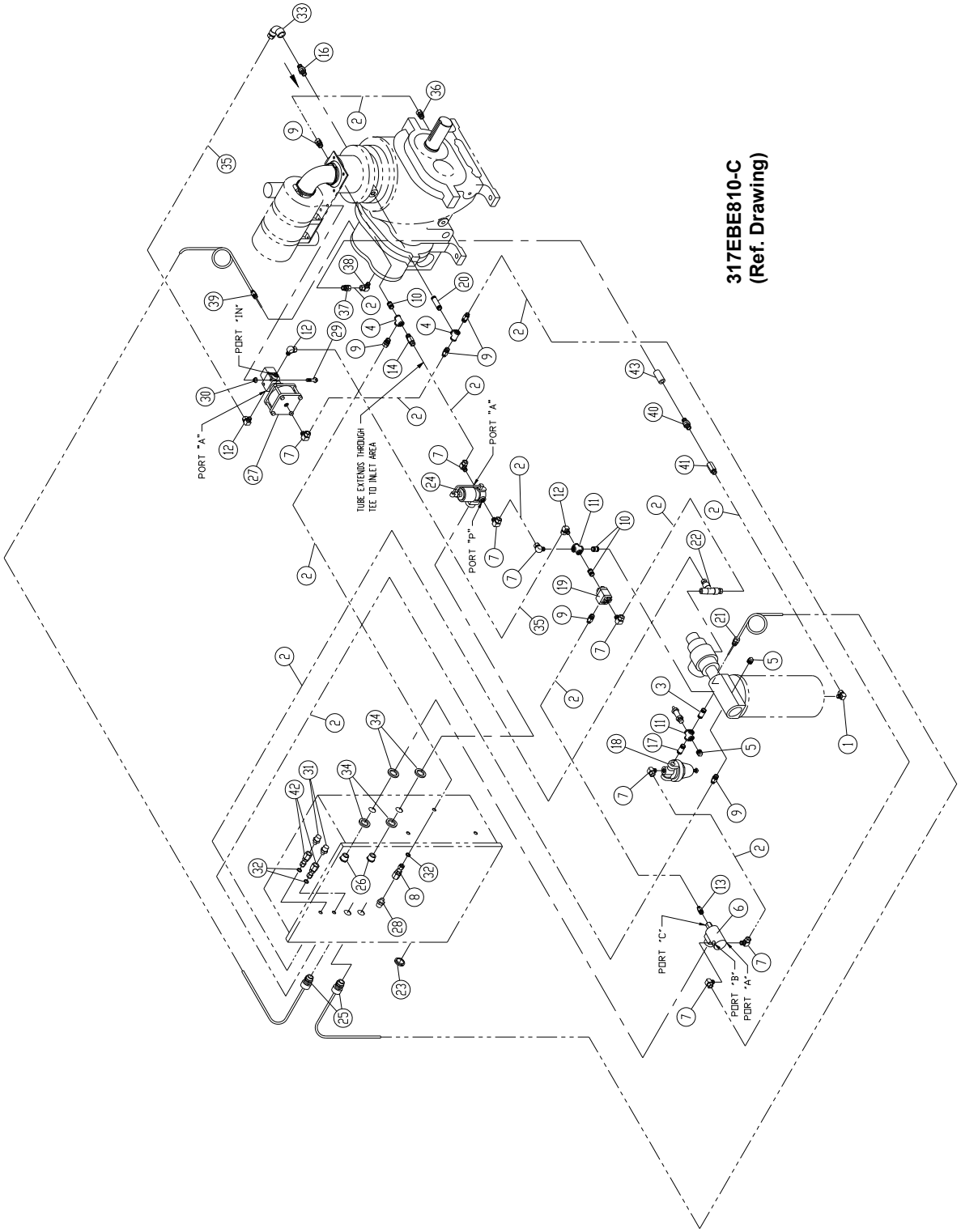


SUBTRACTIVE PILOT VALVE

Ref. No.	Name of Part	Qty.	Part No.
	VALVE-SUBTRACTIVE PILOT (Includes Items 1 thru 15		2009398
1	RING-SEAT	1	2008021
2	DISC-SEAT	1	2010080
3	GASKET	1	2008019
4	GASKET	1	2008017
6	DIAPHRAGM SET (Set of 5)	1	2008018
7	PLATE-PRESSURE	1	2008015
8	STOP-DIAPHRAGM	1	2008016
9	LOCKWASHER	1	95B1
10	NUT	1	2008888
11	DAMPER	1	2008711
12	SPRING	1	2008014
13	BUTTON-SPRING	1	2008891
14	LOCKNUT	1	50Y2
15	SCREW	1	2008952

NOTE: It is necessary to replace some parts in groups to insure satisfactory repair. When replacing diaphragm, also replace both diaphragm and seat gaskets. When replacing seat disc or seat ring, replace the mating seat ring or disc and the seat disc gasket.

CONTROL GROUP



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

CONTROL GROUP

B/M: 303 & 304EBE4002; 301EBE4054

Ref. No.		Name of Part	Qty.	Part No.
	1	ELBOW	1	86E219
	2	TUBE (IN FEET)	25	85K3
	3	NIPPLE	1	63D3G
	4	TEE	2	64G3G
	5	PLUG	2	64AC2
+	6	SOLENOID VALVE	1	91B248
	7	ELBOW	8	86E220
	8	TUBE CONNECTOR	1	86N287
	9	TUBE FITTING	6	86E210
	10	NIPPLE	3	63D1G
	11	CROSS	2	64K1G
	12	TUBE FITTING	3	86E222
	13	TUBE FITTING	1	86E210
	14	CONNECTOR	1	86N242
++	16	CHECK VALVE	1	90AR261
	17	NIPPLE	1	63D3G
*** ++	18	VALVE-SUB/PILOT	1	2009398
++	19	CONTROL VALVE	1	90AR1034
	20	NIPPLE	1	63D6G
+	21	ELECTRICAL PROBE	1	21D264
	22	TUBE FITTING	1	86E236
	23	SEAL	1	24A415
+ *	24	SOLENOID VALVE	1	91B250
	25	ELECTRICAL FITTING	2	24CA2865
	26	NIPPLE	2	24CA4641
++ **	27	CONTROL VALVE	1	90AR1082
+	28	SWITCH	1	88H195
	29	SCREW	2	75LM48
	30	NUT	2	50AW3
+	31	TRANSDUCER	2	88H365
	32	O-RING	3	165011
	33	TUBE FITTING	1	86E231
	34	O-RING	4	24A383
	35	TUBE (IN FEET)	5	85K5
	36	TUBE CONNECTOR	1	86H159
	37	ORIFICE	1	86N339
	38	ELBOW-TUBE	1	86H160
+	39	THERMISTOR PROBE	1	21D264
	40	FILTER	1	90AR1170
	41	TUBE FITTING	1	86E218
	42	TUBE CONNECTOR	2	86N316
	43	COUPLING	1	64BK2G

* For Repair Kit, (Includes Springs, Seals, Piston Assembly, Plunger Assembly, Nut and O-Ring), order Part Number 2116077 or for Coil order Part Number 2116078.

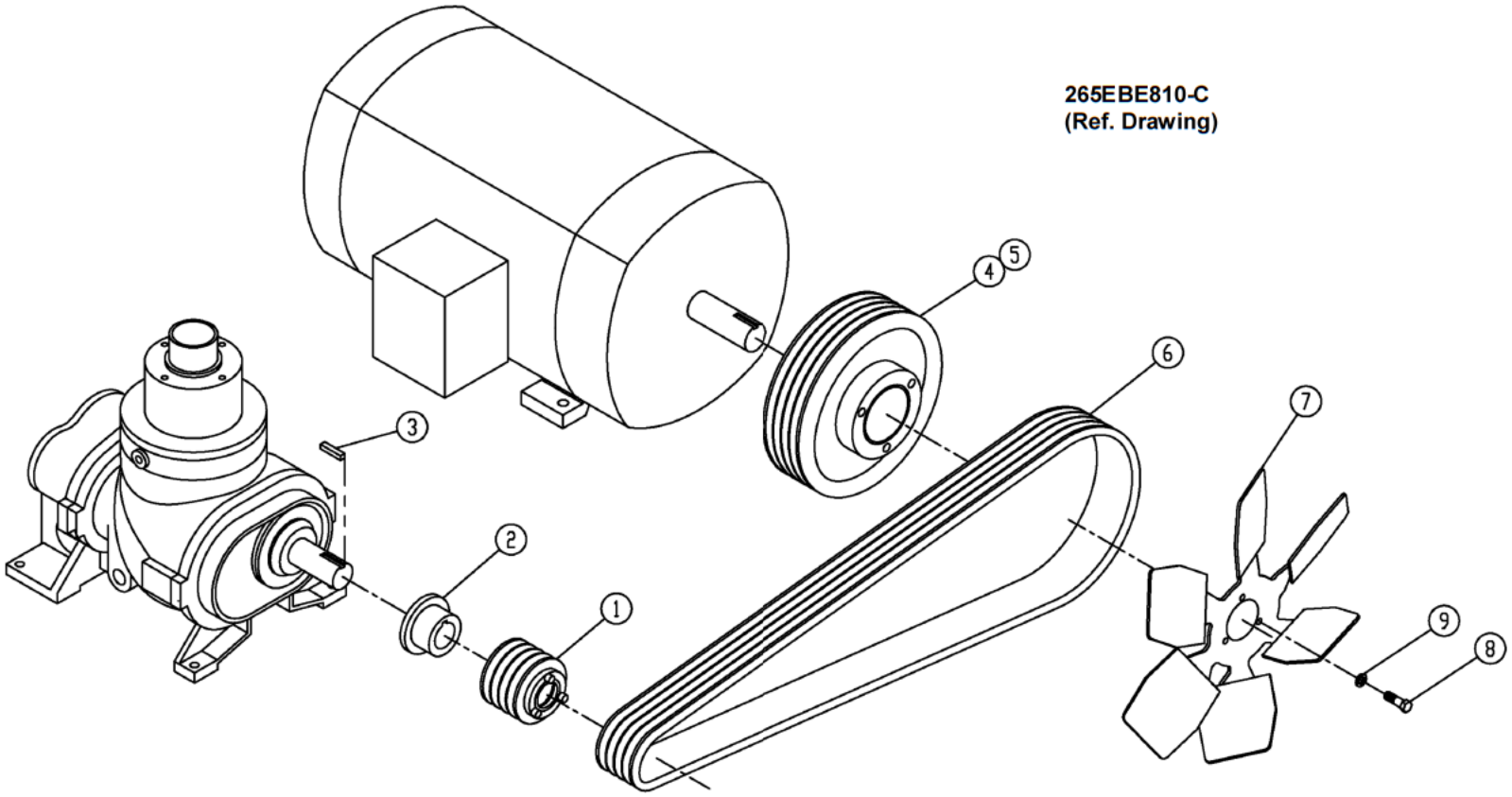
** For repair of U-Cup (Piston Seal), order Part Number 2117904; For O-Ring (Top Plate), order Part Number 2117905.

*** For Repair parts, see page 21.

\+ Parts included in Electrical Control Kit Part Number 307EBE6013. Refer to page 71

++ Parts included in Pneumatic Control Kit Part Number 300EBE6013. Refer to page 71.

DRIVE GROUPS – 15, 20, 25 & 30 HP



DETAIL NO. 10 NOT SHOWN

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

DRIVE GROUPS – 15 HP

Ref. No.	Name of Part	Qty.	100 PSIG 300EBE4004 Part No.	125 PSIG 301EBE4004 Part No.	150 PSIG 302EBE4004 Part No.	175 PSIG 303EBE4004 Part No.
1	SHEAVE	1	73N43V45	73N43V50	73N43V56	300EBE099
2	BUSHING-HUB	1	22K35D	22K35D	22K35D	22K35F
3	KEY	1	35L74	35L74	35L74	35L74
4	SHEAVE	1	202EBE099	202EBE099	202EBE099	202EBE099
5	SCREW	2	76F65	76F65	76F65	76F65
6	SET-BELT 4 PC	1	13AG5604	13AG5604	13AG5604	13AG5604
7	FAN	1	203EBE701	203EBE701	203EBE701	203EBE701
8	SCREW	3	655ED030	655ED030	655ED030	655ED030
9	LOCKWASHER	3	95B3	95B3	95B3	95B3
* 10	VALVE-PRESSURE/RELIEF	1	90AR662	90AR663	90AR657	90AR657

DRIVE GROUPS – 20 HP

Ref. No.	Name of Part	Qty.	100 PSIG 304EBE4004 Part No.	125 PSIG 305EBE4004 Part No.	150 PSIG 306EBE4004 Part No.	175 PSIG 307EBE4004 Part No.
1	SHEAVE	1	73N43V50	73N43V56	301EBE099	303EBE099
2	BUSHING-HUB	1	22K35D	22K35D	22K35F	22K35F
3	KEY	1	35L74	35L74	35L74	35L74
4	SHEAVE	1	205EBE099	205EBE099	205EBE099	205EBE099
5	SCREW	2	76F65	76F65	76F65	76F65
6	BELT-SET 4 PC.	1	13AG6004	13AG6004	13AG6304	13AG6304
7	FAN	1	203EBE701	203EBE701	203EBE701	203EBE701
8	SCREW	3	655ED030	655ED030	655ED030	655ED030
9	LOCKWASHER	3	95B3	95B3	95B3	95B3
* 10	VALVE-PRESSURE/RELIEF	1	90AR662	90AR663	90AR657	90AR657

* Not shown on drawing.

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

DRIVE GROUPS – 25 HP

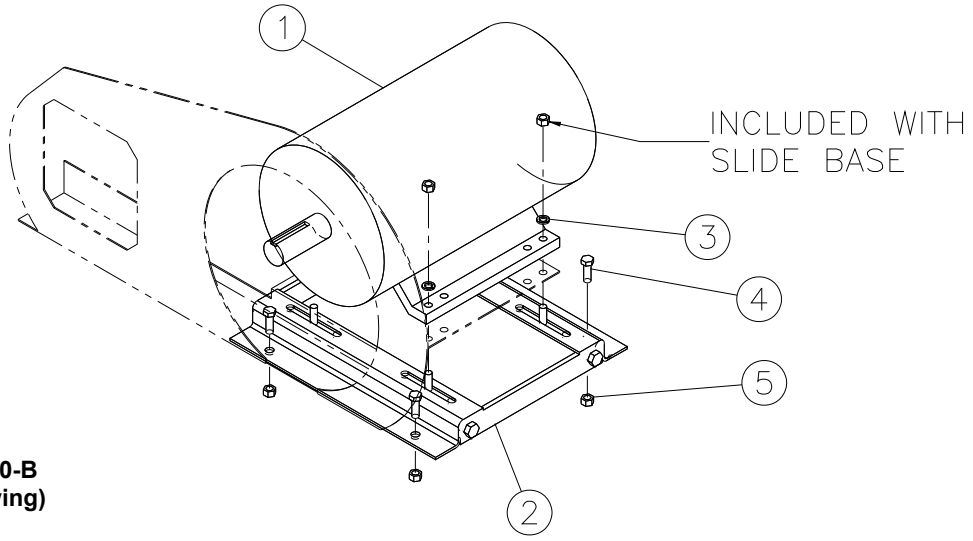
Ref. No.	Name of Part	Qty.	100 PSIG 308EBE4004 Part No.	125 PSIG 309EBE4004 Part No.	150 PSIG 310EBE4004 Part No.	175 PSIG 311EBE4004 Part No.
1	SHEAVE	1	73N43V53	300EBE099	301EBE099	302EBE099
2	BUSHING-HUB	1	22K35D	22K35F	22K35F	22K35F
3	KEY	1	35L74	35L74	35L74	35L74
4	SHEAVE	1	204EBE099	204EBE099	204EBE099	204EBE099
5	SCREW	2	76F65	76F65	76F65	76F65
6	SET-BELT 4 PC	1	13AG6304	13AG6304	13AG6304	13AG6704
7	FAN	1	202EBE701	202EBE701	202EBE701	202EBE701
8	SCREW	3	655ED030	655ED030	655ED030	655ED030
9	LOCKWASHER	3	95B3	95B3	95B3	95B3
+ 10	VALVE-PRESSURE/RELIEF	1	*	90AR663	90AR657	90AR657

DRIVE GROUPS – 30 HP

Ref. No.	Name of Part	Qty.	100 PSIG 312EBE4004 Part No.	125 PSIG 313EBE4004 Part No.	150 PSIG 314EBE4004 Part No.	175 PSIG 315EBE4004 Part No.
1	SHEAVE	1	73N43V50	73N43V56	300EBE099	301EBE099
2	BUSHING-HUB	1	22K35D	22K35D	22K35F	22K35F
3	KEY	1	35L74	35L74	35L74	35L74
4	SHEAVE	1	203EJB099	203EJB099	203EJB099	203EJB099
5	SCREW	2	76F65	76F65	76F65	76F65
6	BELT-SET 4 PC.	1	13AG6704	13AG6704	13AG6704	13AG6704
7	FAN	1	202EBE701	202EBE701	202EBE701	202EBE701
8	SCREW	3	655ED030	655ED030	655ED030	655ED030
9	LOCKWASHER	3	95B3	95B3	95B3	95B3
+ 10	VALVE-PRESSURE/RELIEF	1	*	90AR663	90AR657	90AR657

+ Not shown on drawing.

* (2) 90AR662 Relief Valves required.



310EBE810-B
(Ref. Drawing)

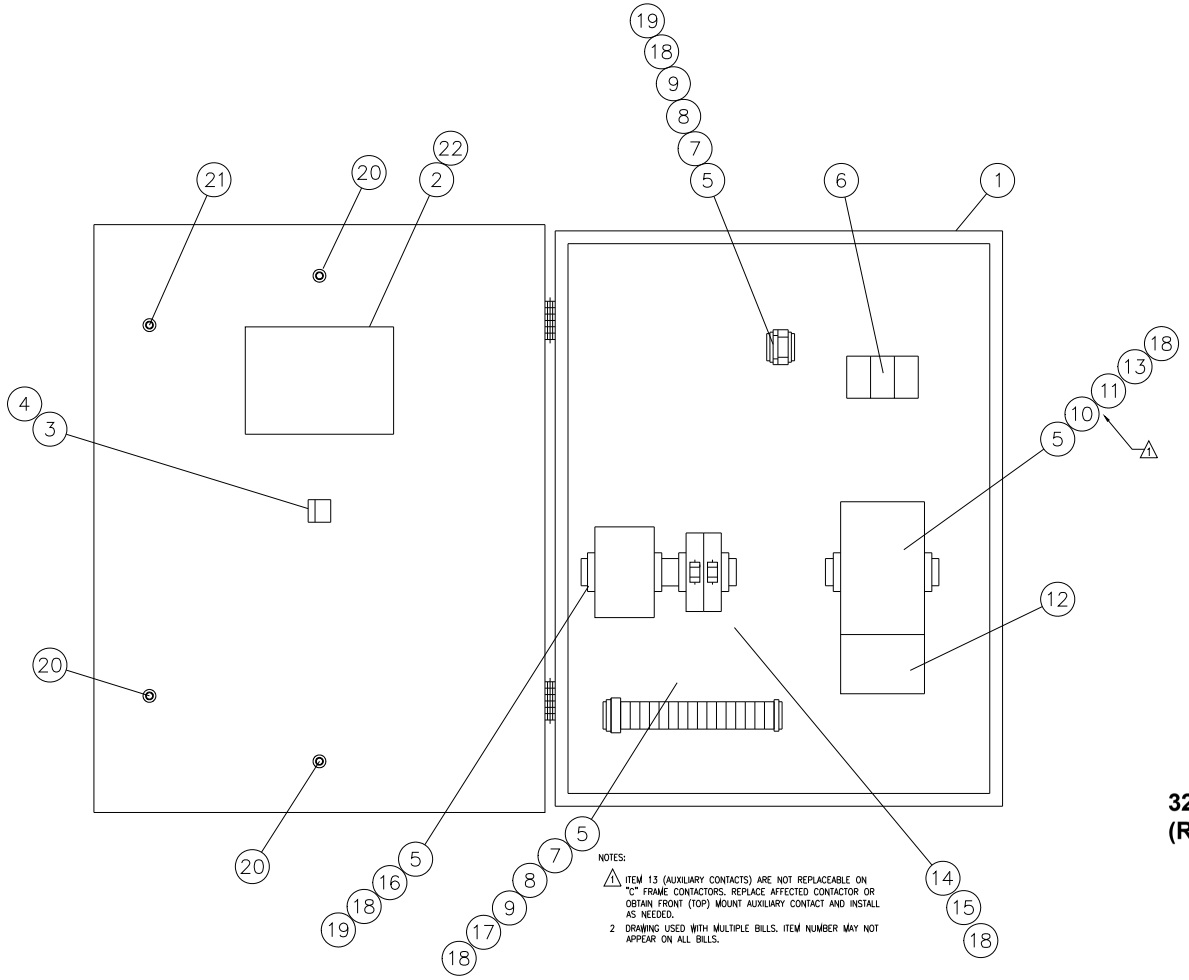
MAIN MOTOR GROUP

Ref. No.	Name of Part	Qty.	Part No.
1	MOTOR.....	1	*
2	BASE	1	*
3	LOCKWASHER	4	95B5
4	SCREW.....	4	75LM135
5	NUT.....	4	50AW35

* Selective -- See pages 69 and 70

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

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 15 HP (200 VOLT)



328EFC810-B
(Ref. Drawing)

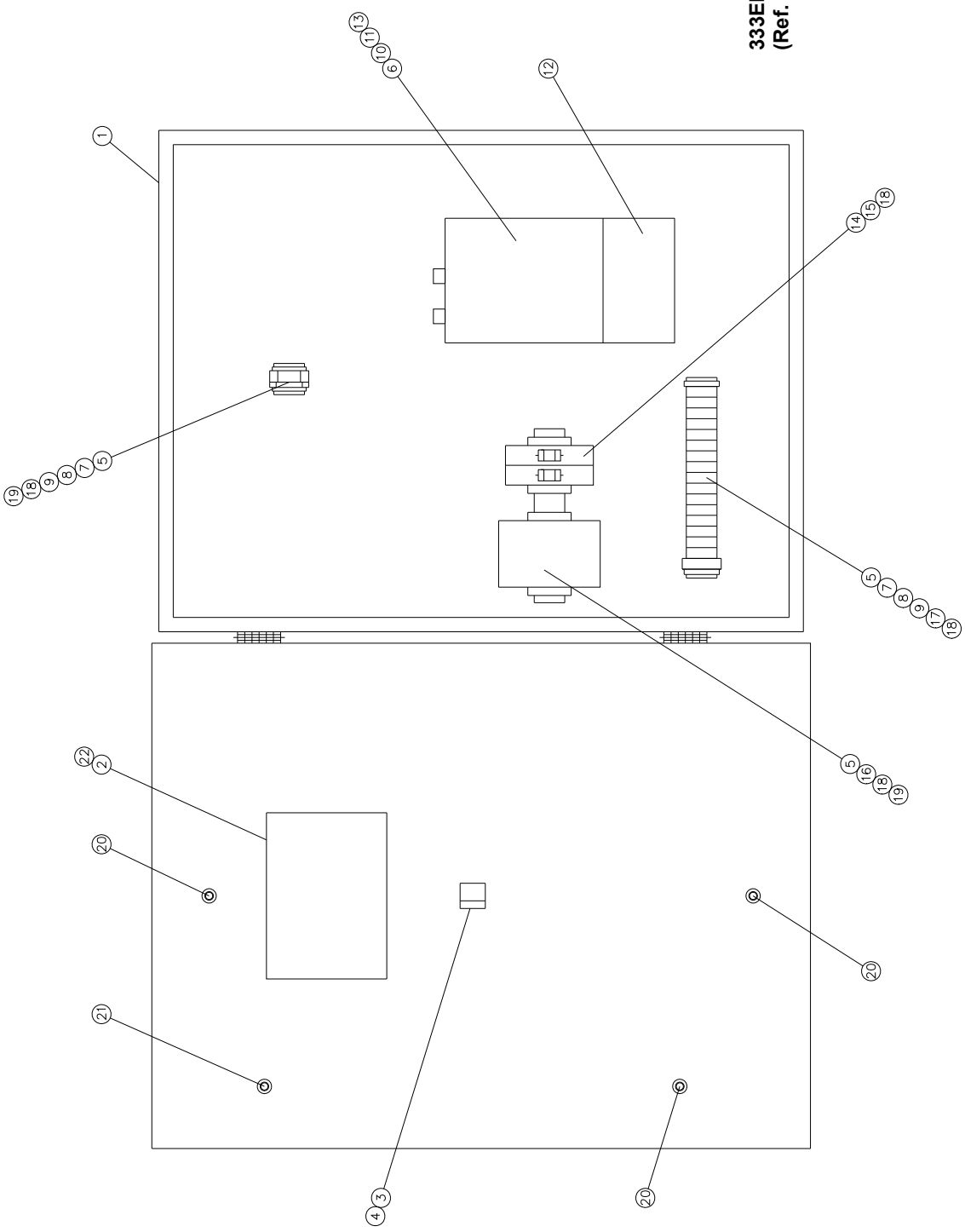
Order by Part Number and Description. Reference Numbers are for your convenience only

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 15 HP (200 VOLT)

		QTY.	200V
	NEMA 4 CONTROL BOX		366EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179
2	CONTROLLER	1	89864799
3	OPERATOR	1	24CA2907
4	CONTACT BLOCK	1	24CA2908
5	DIN RAIL	1	24CA5991
6	POWER DISTRIBUTION BLOCK	1	24CA5983
7	GROUND BLOCK	2	24CA5989
8	GROUND BLOCK	2	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993
10	STARTER	1	24CA6059
11	COIL	1	2118575
12	RELAY	1	24CA6029
13	CONTACT	1	24CA6042
14	FUSE BLOCK	2	24CA5910
15	FUSE	2	24CA4320
16	POWER SUPPLY	1	24CA6051
17	TERMINAL BLOCK	15	24CA5992
18	TERMINAL BLOCK	8	24CA5987
19	TERMINAL END STOP	2	24CA6052
20	LATCH	3	31D80
21	LATCH	1	31D79
22	GASKET	1	VP1033867

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 20, 25 & 30 HP (200 VOLT)

333EFC810-B
(Ref. Drawing)

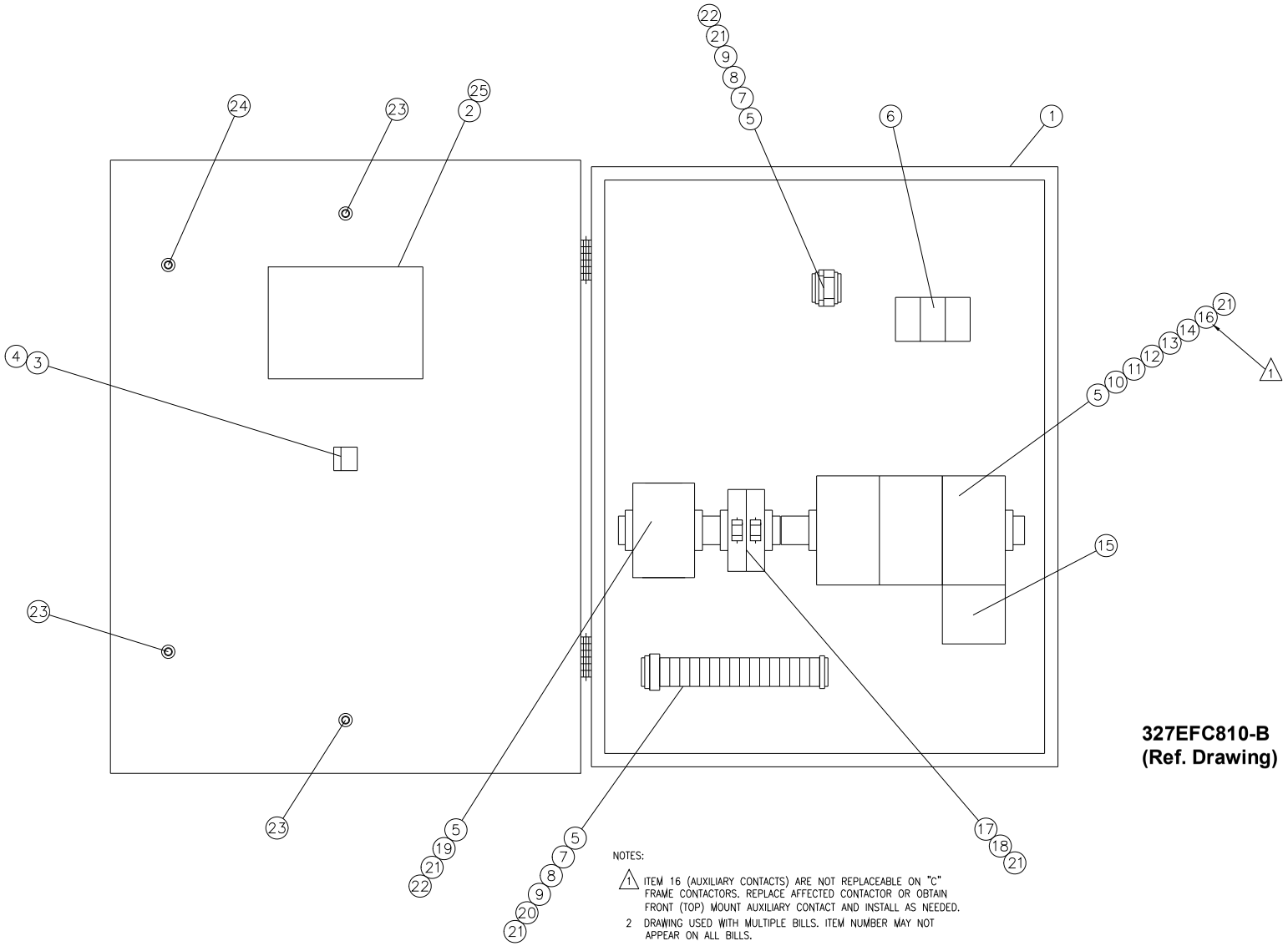


Order by Part Number and Description. Reference Numbers are for your convenience only

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 20, 25 & 30 HP (200 VOLT)

		QTY.	20 HP 200V	25 HP 200V	30 HP 200V
	NEMA 4 CONTROL BOX		367EFC466	368EFC466	369EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179	304EFC179
2	AIRSMART CONTROLLER	1	89864799	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991	24CA5991
6	CONTROL WIRE EXTENSION TERMINAL	2	24CA6060	24CA6060	24CA6060
7	GROUND BLOCK	2	24CA5989	24CA5989	24CA6071
8	GROUND BLOCK	2	24CA5986	24CA5986	24CA5986
9	TERMINAL BLOCK	2	24CA5993	24CA5993	24CA5993
10	STARTER	1	24CA6056	24CA6006	24CA6011
11	COIL	1	2118576	2118576	2118577
12	OVERLOAD RELAY	1	24CA6034	24CA6034	24CA6039
13	CONTACT	1	24CA6042	24CA6042	24CA6042
14	FUSE BLOCK	2	24CA5910	24CA5910	24CA5910
15	FUSE	2	24CA4320	24CA4320	24CA4320
16	POWER SUPPLY	1	24CA6051	24CA6051	24CA6051
17	TERMINAL BLOCK	15	24CA5992	24CA5992	24CA5992
18	TERMINAL BLOCK	6	24CA5987	24CA5987	24CA5987
19	TERMINAL END STOP	2	24CA6052	24CA6052	24CA6052
20	LATCH	3	31D80	31D80	31D80
21	LATCH	1	31D79	31D79	31D79
22	GASKET	1	VP1033867	VP1033867	VP1033867

CONTROLLER ASSEMBLY – WYE DELTA STARTER – 15, 20 & 25 HP (200 VOLT)



327EFC810-B
(Ref. Drawing)

NOTES:

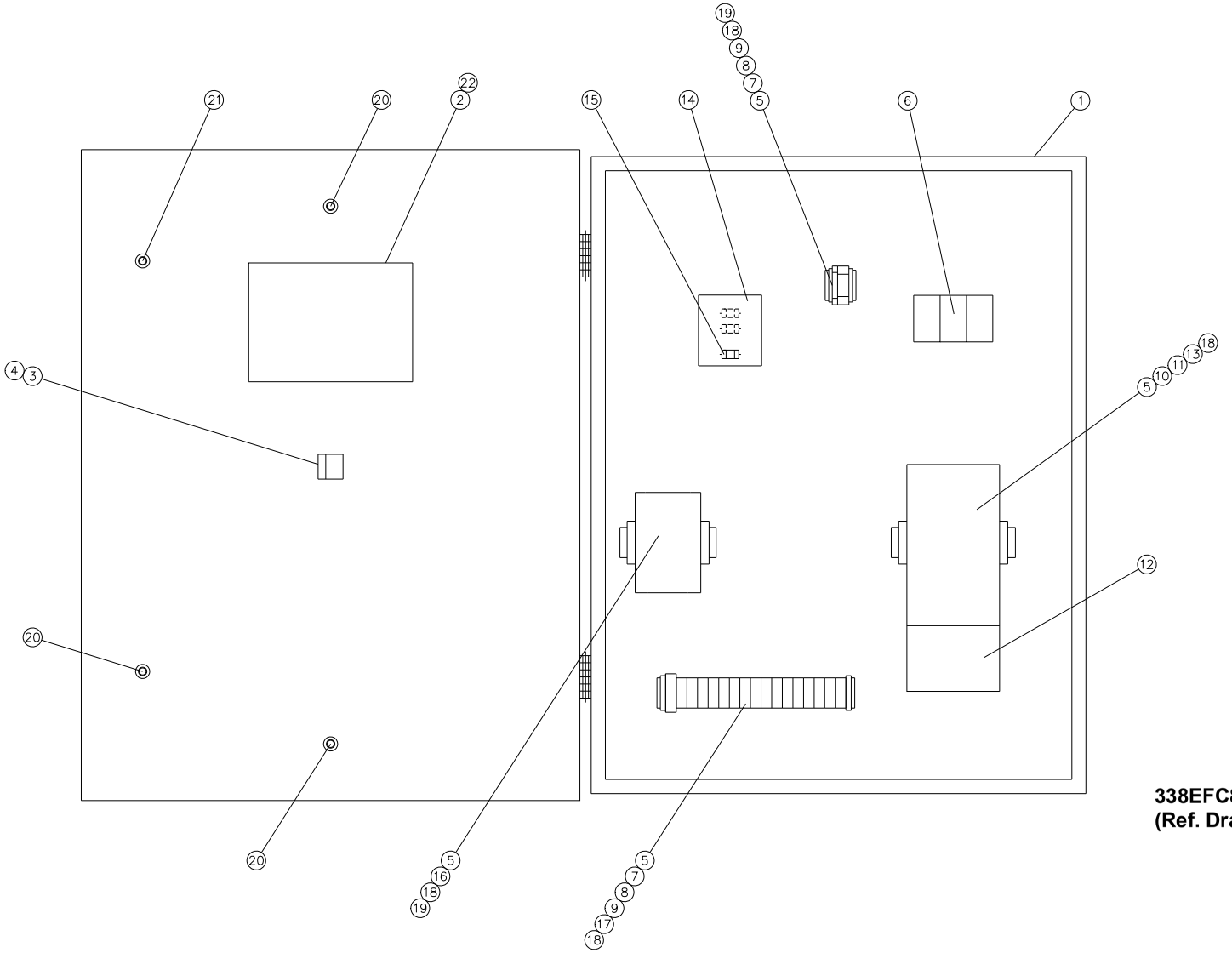
1. ITEM 16 (AUXILIARY CONTACTS) ARE NOT REPLACEABLE ON "C" FRAME CONTACTORS. REPLACE AFFECTED CONTACTOR OR OBTAIN FRONT (TOP) MOUNT AUXILIARY CONTACT AND INSTALL AS NEEDED.
2. DRAWING USED WITH MULTIPLE BILLS. ITEM NUMBER MAY NOT APPEAR ON ALL BILLS.

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

CONTROLLER ASSEMBLY – WYE DELTA STARTER – 15, 20 & 25 HP (200 VOLT)

		QTY.	15 HP	20 HP	25 HP
	NEMA 4 CONTROL BOX		382EFC466	383EFC466	384EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179	304EFC179
2	AIRSMART CONTROLLER	1	89864799	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991	24CA5991
6	POWER DISTRIBUTION BLOCK	1	24CA5983	24CA5932	24CA5932
7	GROUND BLOCK	2	24CA5989	24CA5989	24CA5989
8	GROUND BLOCK	2	24CA5986	24CA5986	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993	24CA5993	24CA5993
10	CONTACTOR	1	24CA6014	24CA6015	24CA6016
11	CONTACTOR	2	24CA6014	24CA6015	24CA6016
12	COIL	3	2118575	2118575	2118575
13	MECHANICAL INTERLOCK	1	24CA6045	24CA6045	24CA6045
14	ELECTRICAL LINK KIT	1	24CA6048	24CA6048	24CA6048
15	OVERLOAD RELAY	1	24CA6028	24CA6029	24CA6029
16	AUXILIARY CONTACT	3	24CA6043	24CA6043	24CA6043
17	FUSE BLOCK	2	24CA5910	24CA5910	24CA5910
18	FUSE	2	24CA4320	24CA4320	24CA4320
19	POWER SUPPLY	1	24CA6051	24CA6051	24CA6051
20	TERMINAL BLOCK	15	24CA5992	24CA5992	24CA5992
21	TERMINAL BLOCK	8	24CA5987	24CA5987	24CA5987
22	TERMINAL END STOP	2	24CA6052	24CA6052	24CA6052
23	LATCH	3	31D80	31D80	31D80
24	LATCH	1	31D79	31D79	31D79
25	GASKET	1	VP1033867	VP1033867	VP1033867

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 15 & 20 HP (230 VOLT)



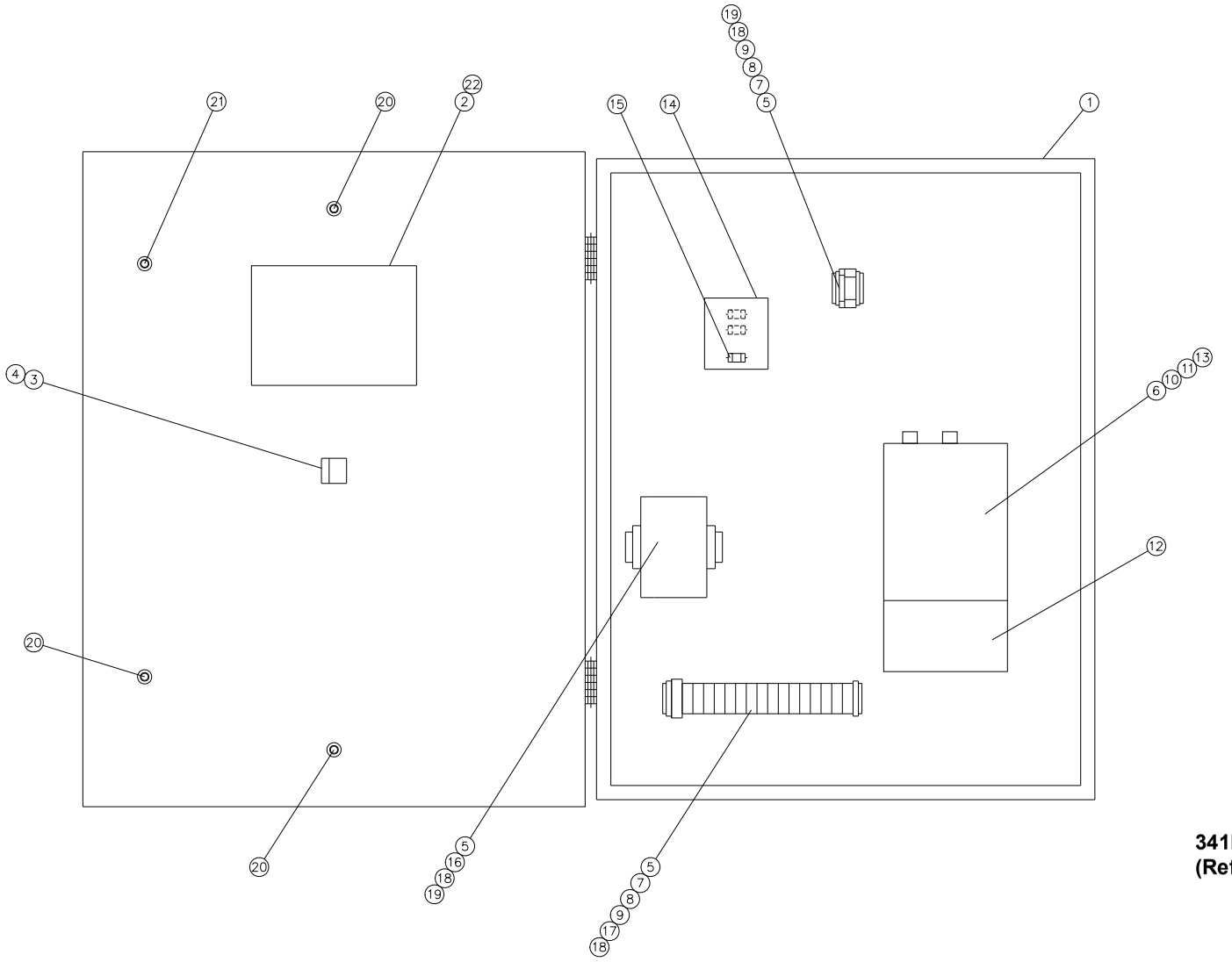
338EFC810-A
(Ref. Drawing)

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

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 15 & 20 HP (230 VOLT)

Ref. No.	Name of Part	Qty.	15 HP	20 HP
	NEMA 4 CONTROL BOX		406EFC466	407EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179
2	AIRSMART CONTROLLER	1	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991
6	POWER DISTRIBUTION BLOCK	1	24CA5983	24CA5983
7	GROUND BLOCK	2	24CA5989	24CA5989
8	GROUND BLOCK	2	24CA5986	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993	24CA5993
10	STARTER	1	24CA6103	24CA6104
11	COIL	1	2118575	2118575
12	RELAY	1	24CA6108	24CA6108
13	CONTACT	1	24CA6042	24CA6042
14	TRANSFORMER	1	24CA5181	24CA5181
15	FUSE	1	24CA3725	24CA3725
16	POWER SUPPLY	1	24CA6051	24CA6051
17	TERMINAL BLOCK	15	24CA5992	24CA5992
18	TERMINAL BLOCK	6	24CA5987	24CA5987
19	TERMINAL END STOP	2	24CA6052	24CA6052
20	LATCH	3	31D80	31D80
21	LATCH	1	31D79	31D79
22	GASKET	1	VP1033867	VP1033867

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 25 & 30 HP (230 VOLT)



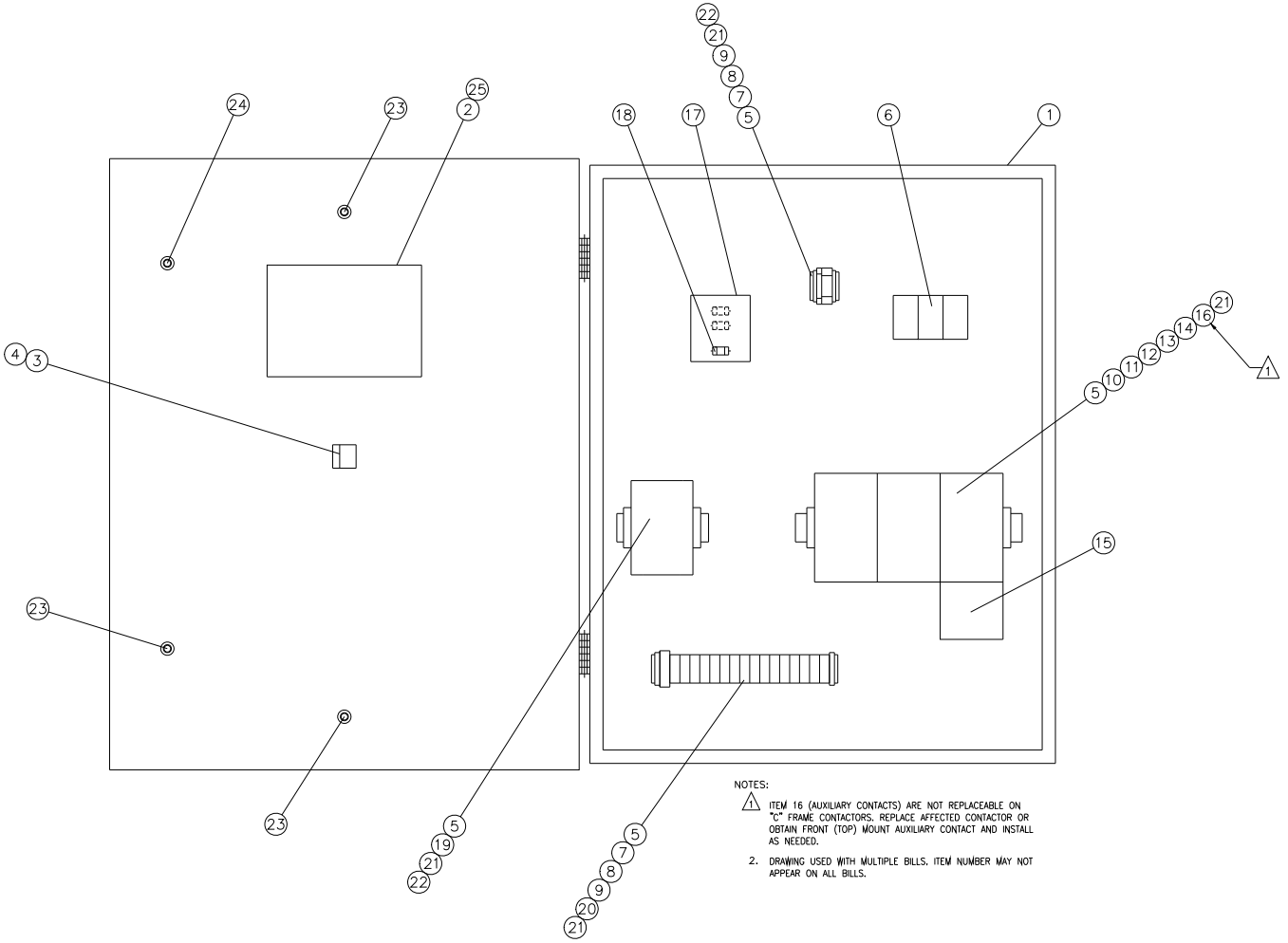
341EFC810-A
(Ref. Drawing)

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

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 25 & 30 HP (230 VOLT)

Ref. No.	Name of Part	Qty.	25 HP	30 HP
	NEMA 4 CONTROL BOX		408EFC466	409EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179
2	AIRSMART CONTROLLER	1	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991
6	CONTROL WIRE EXTENSION TERMINAL	1	24CA6060	24CA6060
7	GROUND BLOCK	2	24CA5989	24CA5989
8	GROUND BLOCK	2	24CA5986	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993	24CA5993
10	STARTER	1	24CA6105	24CA6106
11	COIL	1	2118576	2118576
12	RELAY	1	24CA6109	24CA6109
13	CONTACT	1	24CA6042	24CA6042
14	TRANSFORMER	1	24CA5181	24CA5181
15	FUSE	1	24CA3725	24CA3725
16	POWER SUPPLY	1	24CA6051	24CA6051
17	TERMINAL BLOCK	15	24CA5992	24CA5992
18	TERMINAL BLOCK	4	24CA5987	24CA5987
19	TERMINAL END STOP	2	24CA6052	24CA6052
20	LATCH	3	31D80	31D80
21	LATCH	1	31D79	31D79
22	GASKET	1	VP1033867	VP1033867

CONTROLLER ASSEMBLY – WYE DELTA VOLTAGE STARTER – 15, 20, 25 &30 HP (230 VOLT)



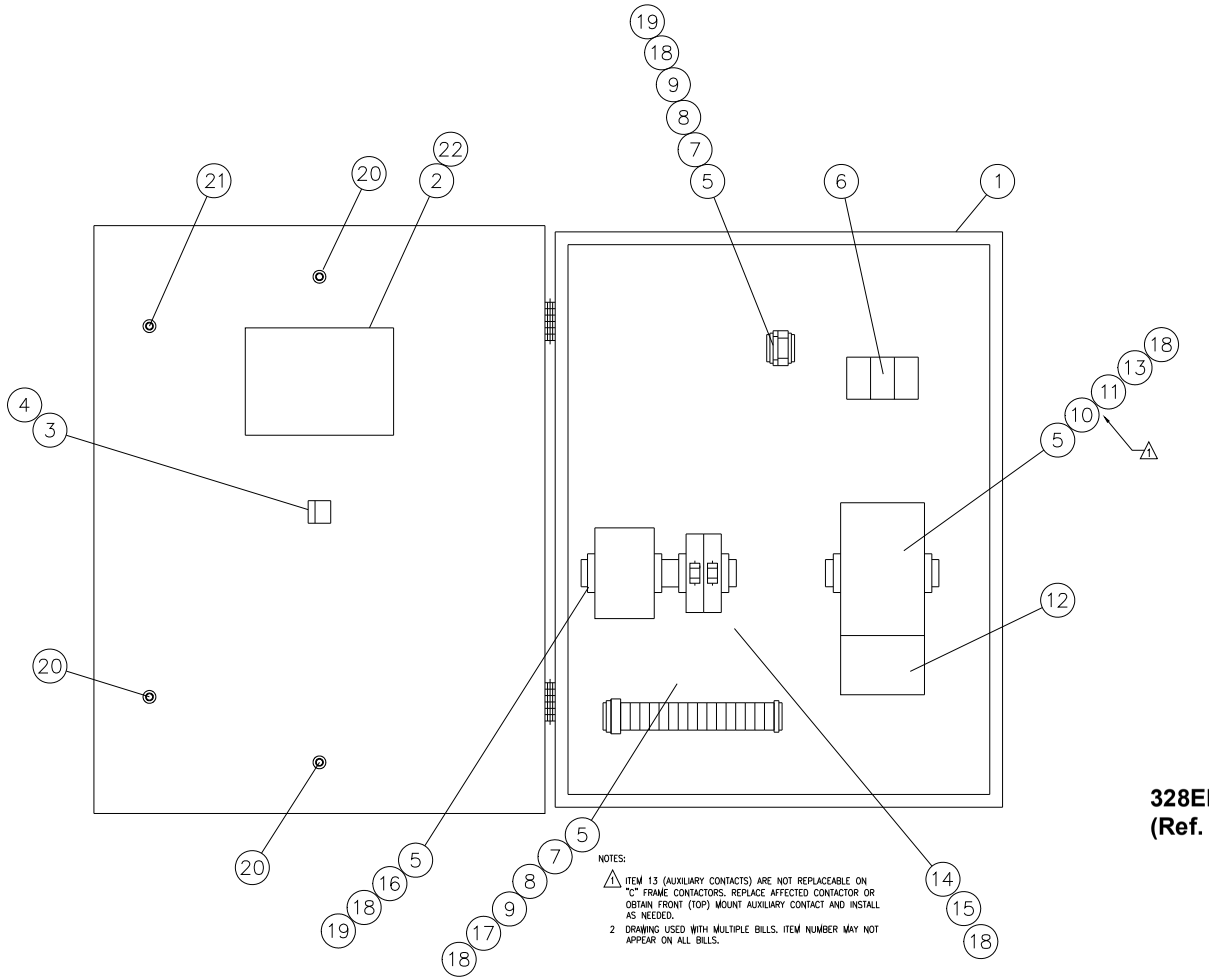
339EFC810-A
(Ref. Drawing)

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

CONTROLLER ASSEMBLY – WYE DELTA VOLTAGE STARTER – 15, 20, 25 &30 HP (230 VOLT)

		QTY.	15 HP	20 HP	25 HP	30 HP
	NEMA 4 CONTROL BOX		410EFC466	411EFC466	412EFC466	413EFC466
1	BOX-CONTROL,ENCL(AirSmart) NEMA 4	1	304EFC179	304EFC179	304EFC179	304EFC179
2	CONTROL BOX ENCLOSURE	1	89864799	89864799	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991	24CA5991	24CA5991
6	POWER DISTRIBUTION BLOCK	1	24CA5983	24CA5983	24CA5932	24CA5932
7	GROUND BLOCK	2	24CA5989	24CA5989	24CA5989	24CA5989
8	GROUND BLOCK	2	24CA5986	24CA5986	24CA5986	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993	24CA5993	24CA5993	24CA5993
10	CONTACTOR	1	24CA6013	24CA6014	24CA6015	24CA6016
11	CONTACTOR	2	24CA6021	24CA6014	24CA6015	24CA6016
12	COIL	3	2118574	2118575	2118575	2118575
13	CONTACTORS	1	24CA6044	24CA6045	24CA6045	24CA6045
14	CONTACTORS	1	24CA6047	24CA6048	24CA6048	24CA6048
15	RELAY-OVERLOAD	1	24CA6107	24CA6108	24CA6108	24CA6108
16	CONTACT	3	----------	24CA6043	24CA6043	24CA6043
17	TRANSFORMER	1	24CA5181	24CA5181	24CA5181	24CA5181
18	FUSE	1	24CA3725	24CA3725	24CA3725	24CA3725
19	POWER SUPPLY	1	24CA6051	24CA6051	24CA6051	24CA6051
20	TERMINAL BLOCK	15	24CA5992	24CA5992	24CA5992	24CA5992
21	TERMINAL BLOCK, END STOP	6	24CA5987	24CA5987	24CA5987	24CA5987
22	TERMINAL END STOP	2	24CA6052	24CA6052	24CA6052	24CA6052
23	LATCH	3	31D80	31D80	31D80	31D80
24	LATCH	1	31D79	31D79	31D79	31D79
25	GASKET	1	VP1033867	VP1033867	VP1033867	VP1033867

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 15, 20, 25 & 30 HP (460 VOLT)



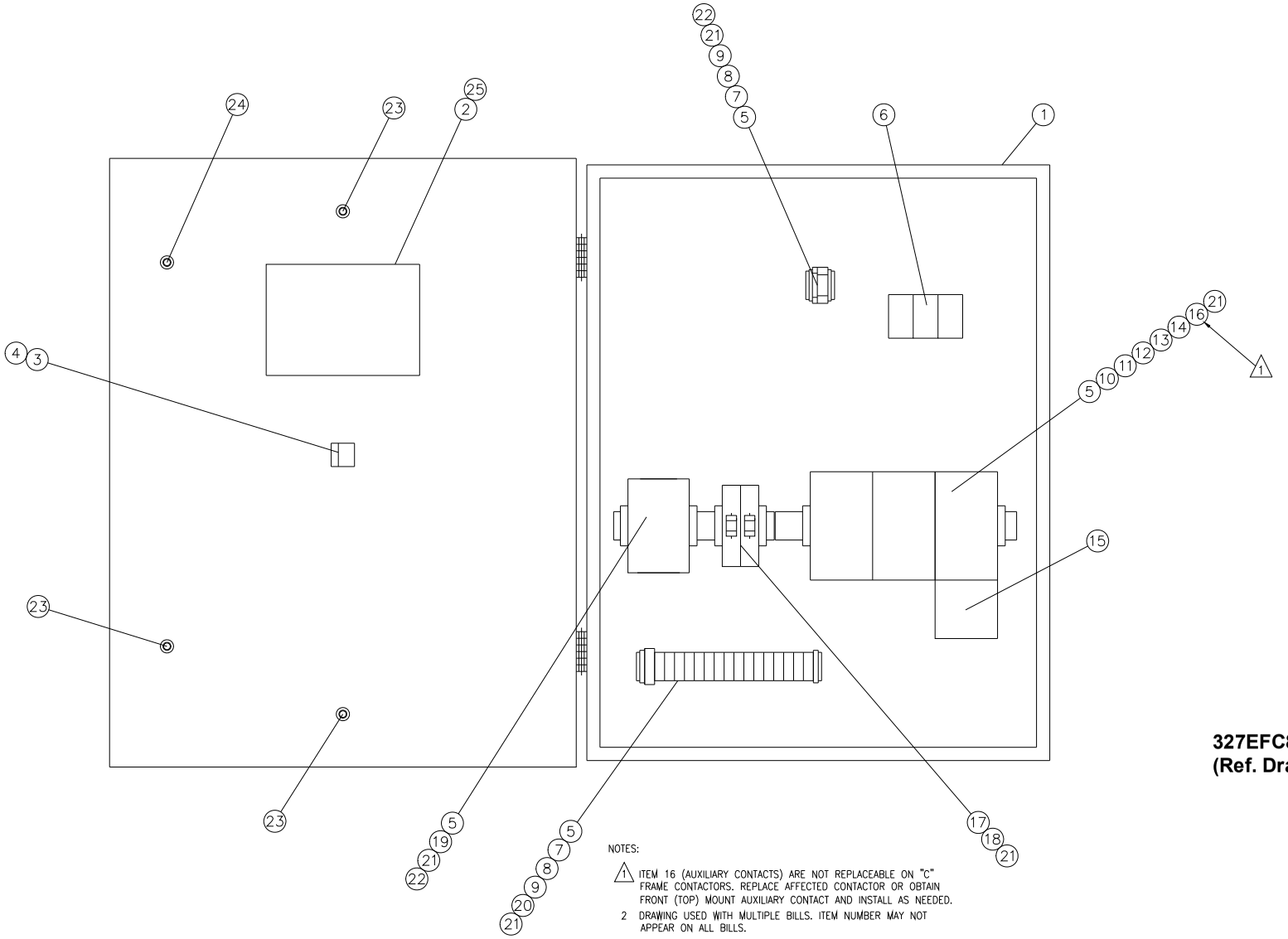
328EFC810-B
(Ref. Drawing)

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

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 15, 20, 25 & 30 HP (460 VOLT)

		QTY.	15 HP	20 HP	25 HP	30 HP
	NEMA 4 CONTROL BOX		374EFC466	375EFC466	376EFC466	377EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179	304EFC179	304EFC179
2	AIRSMART CONTROLLER	1	89864799	89864799	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991	24CA5991	24CA5991
6	POWER DISTRIBUTION BLOCK	1	24CA5983	24CA5983	24CA5983	24CA5983
7	GROUND BLOCK	2	24CA5989	24CA5989	24CA5989	24CA5989
8	GROUND BLOCK	2	24CA5986	24CA5986	24CA5986	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993	24CA5993	24CA5993	24CA5993
10	STARTER	1	24CA5995	24CA5996	24CA6000	24CA6001
11	COIL	1	2118574	2118574	2118575	2118575
12	OVERLOAD RELAY	1	24CA6024	24CA5971	24CA6028	24CA6029
13	CONTACT	1	----------	----------	24CA6042	24CA6042
14	FUSE	2	24CA5910	24CA5910	24CA5910	24CA5910
15	FUSE	2	24CA4088	24CA4088	24CA4088	24CA4088
16	POWER SUPPLY	1	24CA6050	24CA6050	24CA6050	24CA6050
17	TERMINAL BLOCK	15	24CA5992	24CA5992	24CA5992	24CA5992
18	TERMINAL BLOCK END STOP	8	24CA5987	24CA5987	24CA5987	24CA5987
19	TERMINAL END STOP	2	24CA6052	24CA6052	24CA6052	24CA6052
20	LATCH	3	31D80	31D80	31D80	31D80
21	LATCH	1	31D79	31D79	31D79	31D79
22	GASKET	1	VP1033867	VP1033867	VP1033867	VP1033867

CONTROLLER ASSEMBLY – WYE DELTA VOLTAGE STARTER – 15, 20, 25 & 30 HP (460 VOLT)



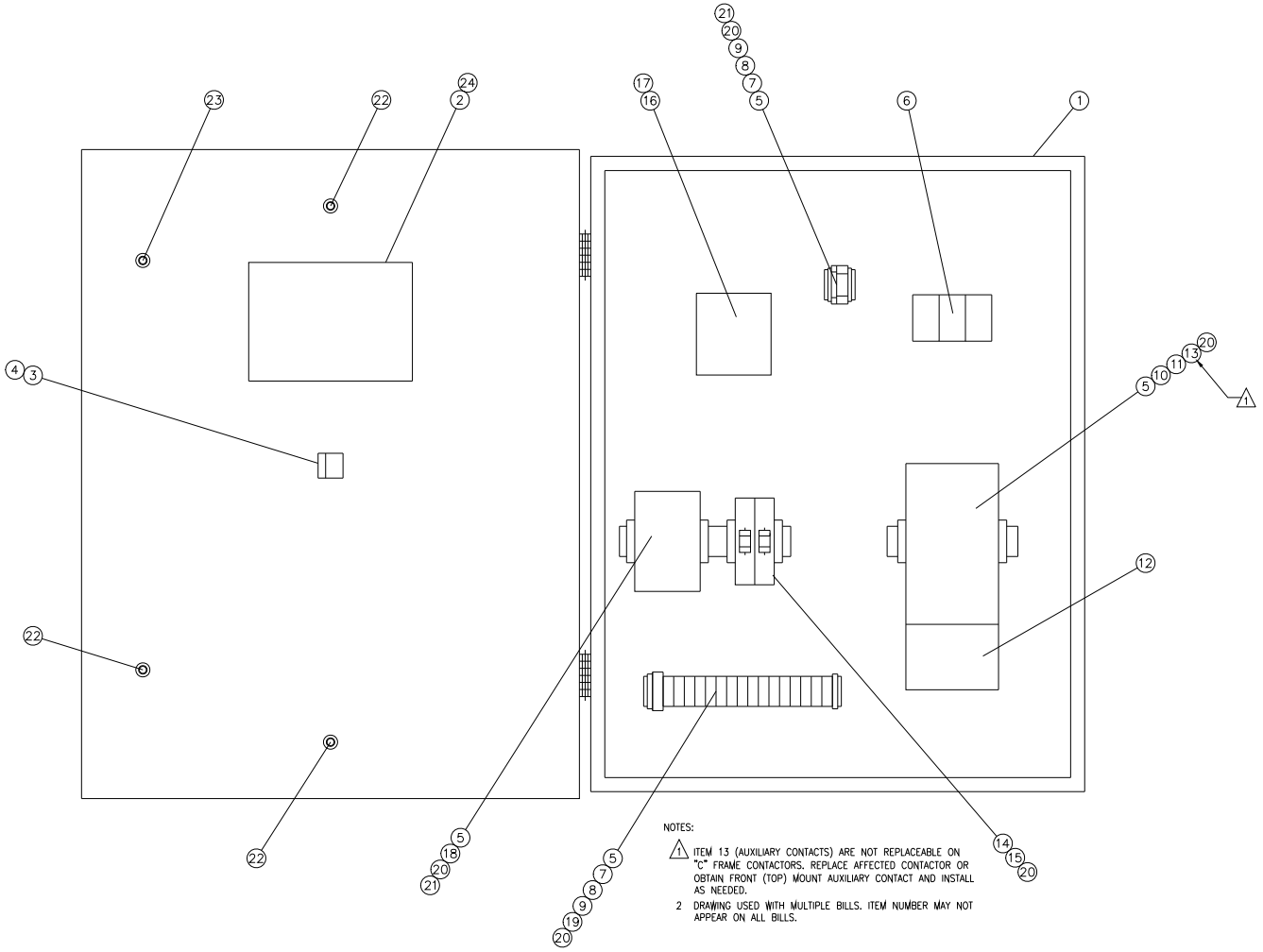
327EFC810-B
(Ref. Drawing)

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

CONTROLLER ASSEMBLY – WYE DELTA VOLTAGE STARTER – 15, 20, 25 & 30 HP (460 VOLT)

		QTY.	15 HP	20 HP	25 HP	30 HP
	NEMA 4 CONTROL BOX		393EFC466	394EFC466	395EFC466	396EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179	304EFC179	304EFC179
2	AIRSMART CONTROLLER	1	89864799	89864799	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991	24CA5991	24CA5991
6	POWER DISTRIBUTION BLOCK	1	24CA5983	24CA5983	24CA5983	24CA5983
7	GROUND BLOCK	2	24CA5989	24CA5989	24CA5989	24CA5989
8	GROUND BLOCK	2	24CA5986	24CA5986	24CA5986	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993	24CA5993	24CA5993	24CA5993
10	CONTACTOR	1	24CA6012	24CA6012	24CA5969	24CA6013
11	CONTACTOR	2	24CA6020	24CA6020	24CA5970	24CA6021
12	COIL	3	2118574	2118574	2118574	2118574
13	CONTACTORS	1	24CA6044	24CA6044	24CA6044	24CA6044
14	CONTACTORS	1	24CA6047	24CA6047	24CA6047	24CA6047
15	OVERLOAD RELAY	1	24CA6023	24CA6024	24CA6024	24CA5971
17	FUSE BLOCK	2	24CA5910	24CA5910	24CA5910	24CA5910
18	FUSE	2	24CA4088	24CA4088	24CA4088	24CA4088
19	POWER SUPPLY	1	24CA6050	24CA6050	24CA6050	24CA6050
20	TERMINAL BLOCK	15	24CA5992	24CA5992	24CA5992	24CA5992
21	TERMINAL BLOCK	8	24CA5987	24CA5987	24CA5987	24CA5987
22	TERMINAL END STOP	2	24CA6052	24CA6052	24CA6052	24CA6052
23	LATCH	3	31D80	31D80	31D80	31D80
24	LATCH	1	31D79	31D79	31D79	31D79
25	GASKET	1	VP1033867	VP1033867	VP1033867	VP1033867

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 575 VOLT



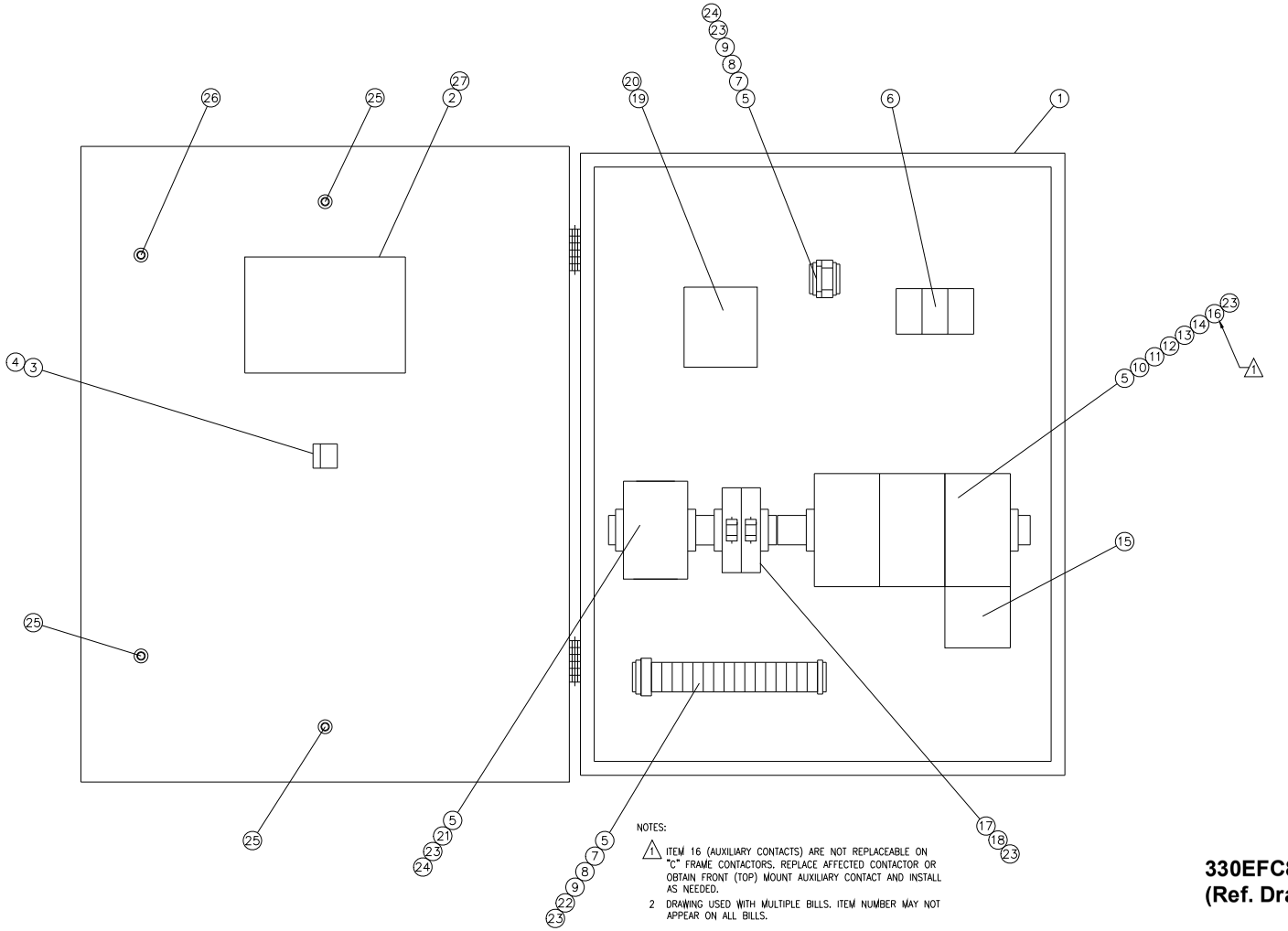
331EFC810-B
(Ref. Drawing)

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

CONTROLLER ASSEMBLY – FULL VOLTAGE STARTER – 575 VOLT

		QTY.	15 HP	20 HP	25 HP	30 HP
	NEMA 4 CONTROL BOX		378EFC466	379EFC466	380EFC466	381EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179	304EFC179	304EFC179
2	CONTROLLER	1	89864799	89864799	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991	24CA5991	24CA5991
6	POWER DISTRIBUTION BLOCK	1	24CA5983	24CA5983	24CA5983	24CA5983
7	GROUND BLOCK	2	24CA5989	24CA5989	24CA5989	24CA5989
8	GROUND BLOCK	2	24CA5986	24CA5986	24CA5986	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993	24CA5993	24CA5993	24CA5993
10	STARTER	1	24CA5995	24CA5996	24CA6000	24CA6000
11	COIL	1	2118574	2118574	2118575	2118575
12	RELAY	1	24CA6024	24CA5971	24CA6028	24CA6028
13	CONTACT	1	---------	---------	24CA6042	24CA6042
14	FUSE BLOCK	2	24CA5910	24CA5910	24CA5910	24CA5910
15	FUSE	2	24CA3720	24CA3720	24CA3720	24CA3720
16	TRANSFORMER	1	VP1024577	VP1024577	VP1024577	VP1024577
17	FUSE	1	24CA2779	24CA2779	24CA2779	24CA2779
18	POWER SUPPLY	1	24CA6051	24CA6051	24CA6051	24CA6051
19	TERMINAL BLOCK	15	24CA5992	24CA5992	24CA5992	24CA5992
20	TERMINAL BLOCK	8	24CA5987	24CA5987	24CA5987	24CA5987
21	TERMINAL END STOP	2	24CA6052	24CA6052	24CA6052	24CA6052
22	LATCH	3	31D80	31D80	31D80	31D80
23	LATCH	1	31D79	31D79	31D79	31D79
24	GASKET	1	VP1033867	VP1033867	VP1033867	VP1033867

CONTROLLER ASSEMBLY – WYE DELTA STARTER – 575 VOLT



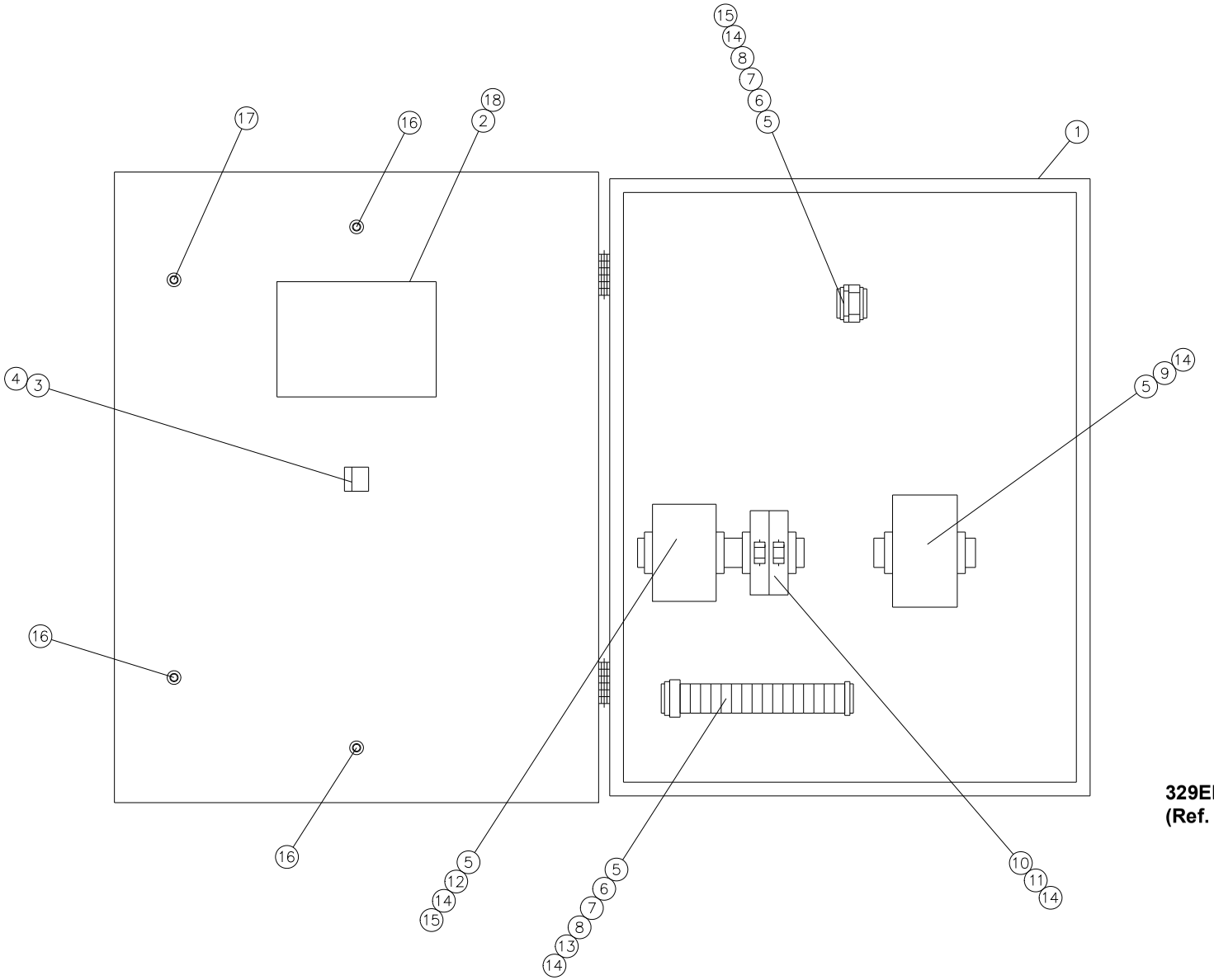
330EFC810-B
(Ref. Drawing)

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

CONTROLLER ASSEMBLY – WYE DELTA STARTER – 575 VOLT

		QTY.	15 HP	20 HP	25 HP	30 HP
	NEMA 4 CONTROL BOX		397EFC466	398EFC466	399EFC466	400EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179	304EFC179	304EFC179
2	AIRSMART CONTROLLER	1	89864799	89864799	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991	24CA5991	24CA5991
6	POWER DISTRIBUTION BLOCK	1	24CA5983	24CA5983	24CA5983	24CA5983
7	GROUND BLOCK	2	24CA5989	24CA5989	24CA5989	24CA5989
8	GROUND BLOCK	2	24CA5986	24CA5986	24CA5986	24CA5986
9	TERMINAL BLOCK END PLATE	2	24CA5993	24CA5993	24CA5993	24CA5993
10	CONTACTOR	1	24CA6012	24CA6012	24CA5969	24CA5969
11	CONTACTOR	2	24CA6020	24CA6020	24CA5970	24CA5970
12	COIL	3	2118574	2118574	2118574	2118574
13	MECHANICAL INTERLOCK	1	24CA6044	24CA6044	24CA6044	24CA6044
14	ELECTRICAL LINK KIT	1	24CA6047	24CA6047	24CA6047	24CA6047
15	OVERLOAD RELAY	1	24CA6023	24CA6023	24CA6024	24CA6024
17	FUSE BLOCK	2	24CA5910	24CA5910	24CA5910	24CA5910
18	FUSE	2	24CA3719	24CA3719	24CA3719	24CA3719
19	TRANSFORMER	1	VP1024577	VP1024577	VP1024577	VP1024577
20	FUSE	1	24CA2779	24CA2779	24CA2779	24CA2779
21	POWER SUPPLY	1	24CA6051	24CA6051	24CA6051	24CA6051
22	TERMINAL BLOCK	15	24CA5992	24CA5992	24CA5992	24CA5992
23	TERMINAL BLOCK	8	24CA5987	24CA5987	24CA5987	24CA5987
24	TERMINAL END STOP	2	24CA6052	24CA6052	24CA6052	24CA6052
25	LATCH	3	31D80	31D80	31D80	31D80
26	LATCH	1	31D79	31D79	31D79	31D79
27	GASKET	1	VP1033867	VP1033867	VP1033867	VP1033867

CONTROLLER ASSEMBLY – LESS STARTER
20, 25 & 30 HP
(200V, & 460V)



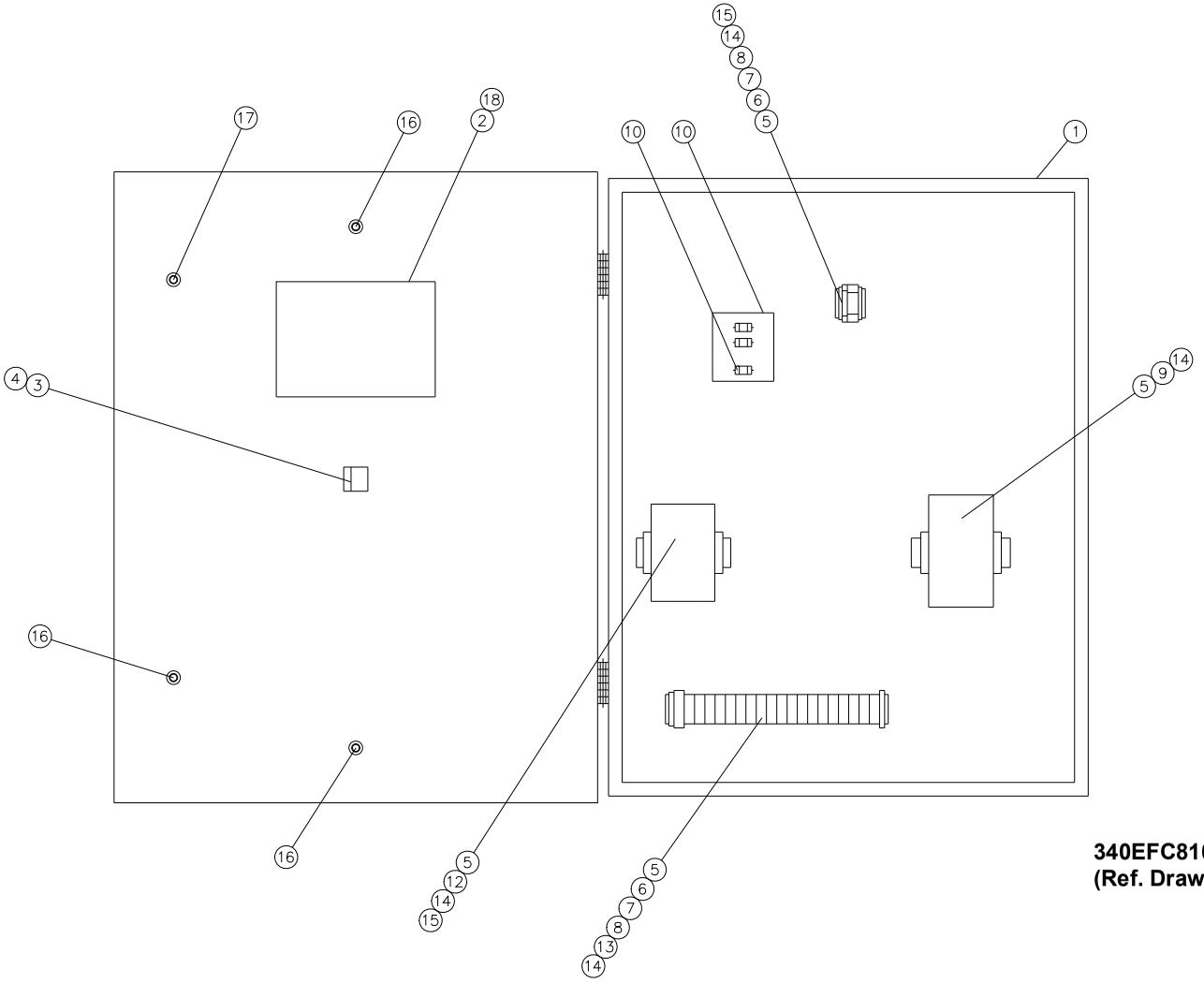
329EFC810-B
(Ref. Drawing)

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

CONTROLLER ASSEMBLY – LESS STARTER
20, 25 & 30 HP
(200V, & 460V)

		QTY.	200V	460V
	NEMA 4 CONTROL BOX		401EFC466	404EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179	304EFC179
2	AIRSMART CONTROLLER	1	89864799	89864799
3	OPERATOR	1	24CA2907	24CA2907
4	CONTACT BLOCK	1	24CA2908	24CA2908
5	DIN RAIL	1	24CA5991	24CA5991
6	GROUND BLOCK	2	24CA5989	24CA5989
7	GROUND BLOCK	2	24CA5986	24CA5986
8	TERMINAL BLOCK	2	24CA5993	24CA5993
9	RELAY	1	24CA5979	24CA5979
10	FUSE BLOCK	2	24CA5910	24CA5910
11	FUSE	2	24CA4320	24CA4088
12	POWER SUPPLY	1	24CA6051	24CA6050
13	TERMINAL BLOCK	18	24CA5992	24CA5992
14	TERMINAL BLOCK	8	24CA5987	24CA5987
15	TERMINAL END STOP	2	24CA6052	24CA6052
16	LATCH	3	31D80	31D80
17	LATCH	1	31D79	31D79
18	GASKET	1	VP1033867	VP1033867

CONTROLLER ASSEMBLY – LESS STARTER
20, 25 & 30 HP
(230V)

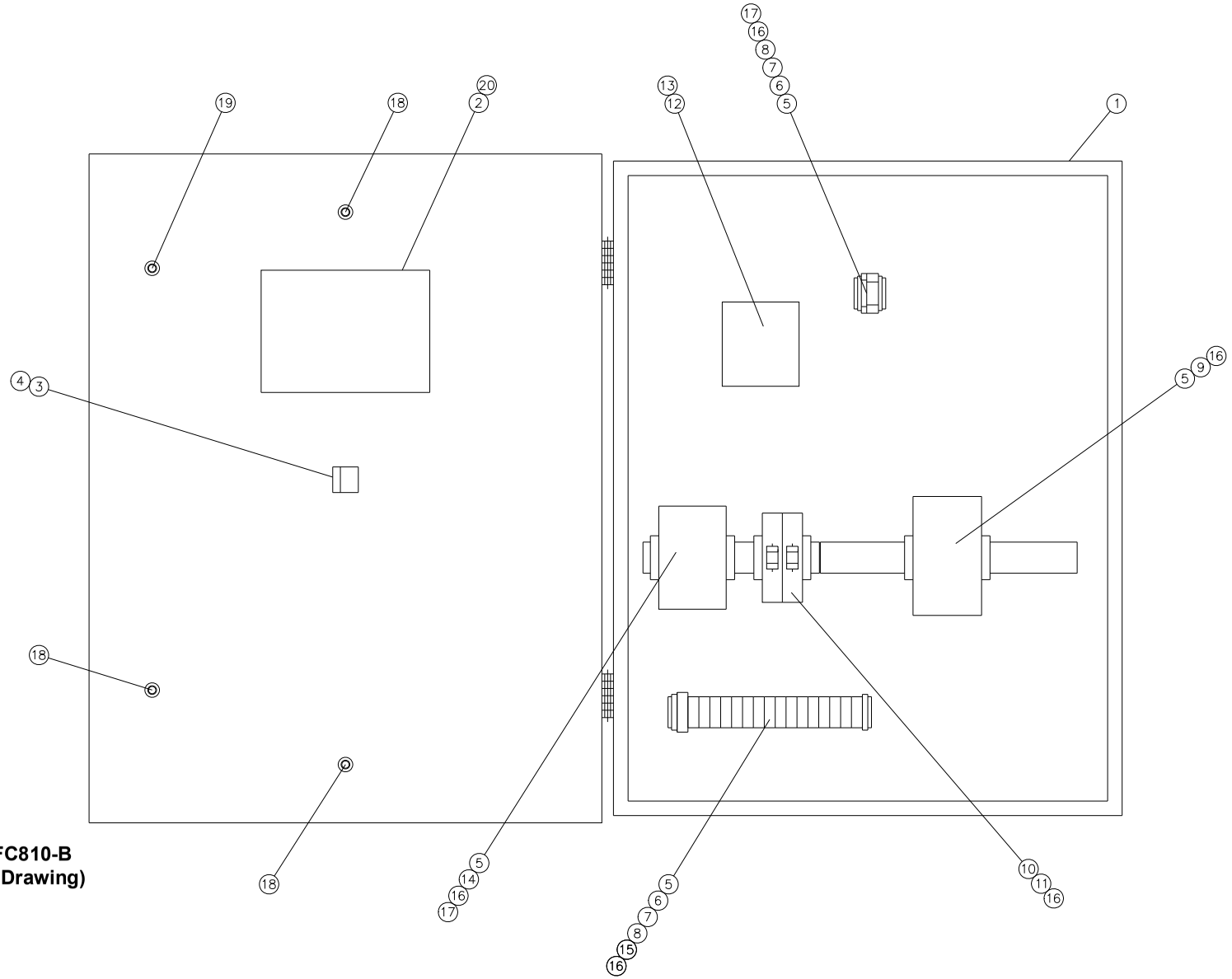


340EFC810-A
(Ref. Drawing)

CONTROLLER ASSEMBLY – LESS STARTER
20, 25 & 30 HP
(230V)

		QTY.	200V
	NEMA 4 CONTROL BOX		414EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179
2	AIRSMART CONTROLLER	1	89864799
3	OPERATOR	1	24CA2907
4	CONTACT BLOCK	1	24CA2908
5	DIN RAIL	1	24CA5991
6	GROUND BLOCK	2	24CA5989
7	GROUND BLOCK	2	24CA5986
8	TERMINAL BLOCK	2	24CA5993
9	RELAY	1	24CA5979
10	TRANSFORMER	1	24CA5181
11	FUSE	1	24CA3725
12	POWER SUPPLY	1	24CA6051
13	TERMINAL BLOCK	18	24CA5992
14	TERMINAL BLOCK	8	24CA5987
15	TERMINAL END STOP	2	24CA6052
16	LATCH	3	31D80
17	LATCH	1	31D79
18	GASKET	1	VP1033867

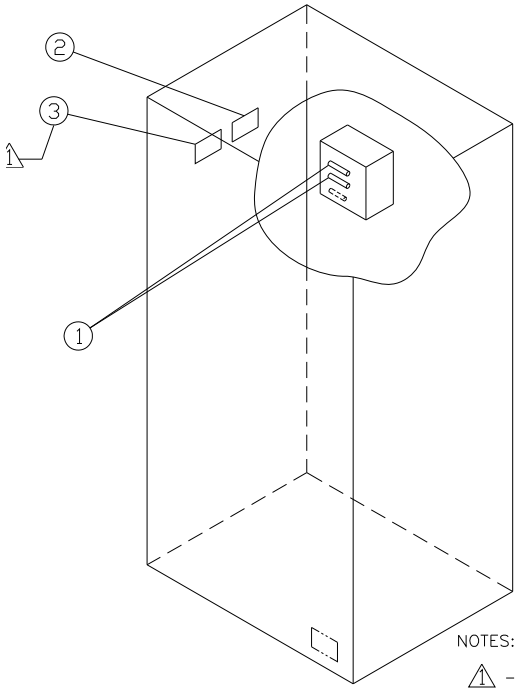
CONTROLLER ASSEMBLY – LESS STARTER – 575 VOLT



332EFC810-B
(Ref. Drawing)

CONTROLLER ASSEMBLY – LESS STARTER – 575 VOLT

		QTY.	575V
	NEMA 4 CONTROL BOX		405EFC466
1	CONTROL BOX ENCLOSURE	1	304EFC179
2	AIRSMART CONTROLLER	1	89864799
3	OPERATOR	1	24CA2907
4	CONTACT BLOCK	1	24CA2908
5	DIN RAIL	1	24CA5991
6	GROUND BLOCK	2	24CA5989
7	GROUND BLOCK	2	24CA5986
8	TERMINAL BLOCK	2	24CA5993
9	RELAY	1	24CA5979
10	FUSE BLOCK	2	24CA5910
11	FUSE	2	24CA4088
12	TRANSFORMER	1	VP1024577
13	FUSE	1	24CA2779
14	POWER SUPPLY	1	24CA6050
15	TERMINAL BLOCK	18	24CA5992
16	TERMINAL BLOCK	8	24CA5987
17	TERMINAL END STOP	2	24CA6052
18	LATCH	3	31D80
19	LATCH	1	31D79
20	GASKET	1	VP1033867



342EFC810-A
(Ref. Drawing)

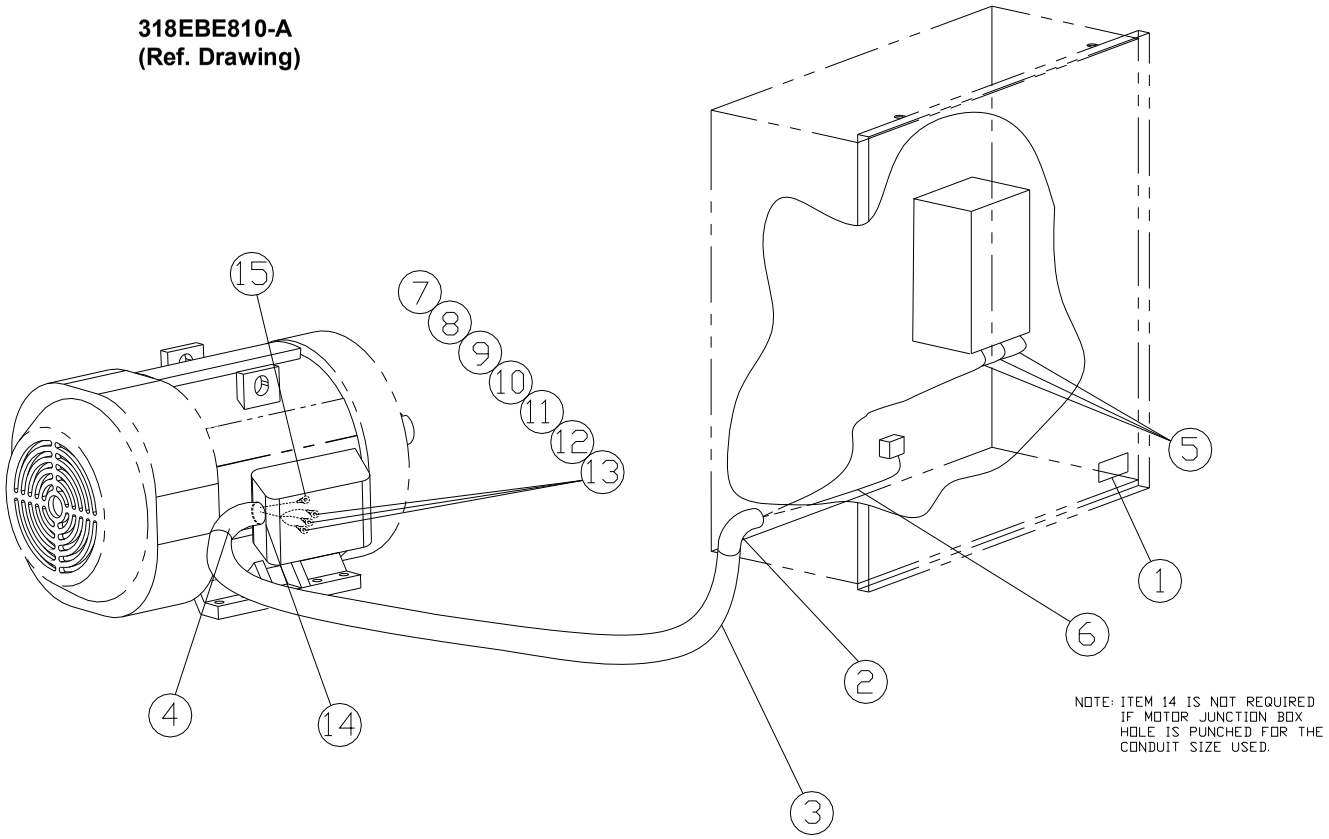
FUSE AND DECAL GROUP (230V)

B/M: 350EFC4007

		QTY.	230 VOLT
1	FUSE.....	2	24CA2785
2	DECAL	1	264AUX077
3	DECAL	1	297AUX077
4	VOLTAGE MARKER.....	1	69F51

MOTOR WIRING – FULL VOLTAGE
(See Pages 53, 54, 55 & 56 for B/M's)

318EBE810-A
(Ref. Drawing)



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

MOTOR WIRING – FULL VOLTAGE – 200 VOLT
(See Page 52 for Drawing)

Ref. No.	Name of Part	QTY.	B/M: 340EBE4007 15 HP	B/M: 341EBE4007 20 & 25 HP	B/M: 342EBE4007 30 HP
1	VOLTAGE MARKER	1	69F50	69F50	69F50
2	FITTING	1	2009325	2009330	2009335
3	CONDUIT	1	2009314	2009805	2009315
4	FITTING	1	2009324	2009329	2009334
5	WIRE (IN FEET)	15	2009408	2009708	2009410
6	WIRE (IN FEET)	5	97J65	97J65	97J76
7	TERMINAL LUG	3	24A498	2009531	24CA202
8	SCREW	3	655EC03B	655EC03B	655EC03B
9	NUT	3	50X16	50X16	50X16
10	WASHER	3	95H16	95H16	95H16
11	TERMINAL LUG	12	24CA1980	24CA1980	24CA1980
12	TAPE	1	24CA882	24CA882	24CA882
13	TAPE	1	24CA883	24CA883	24CA883
14	WASHER	2	2009872	2009871	----------
15	TERMINAL LUG	1	24A307	24A307	24CA1444

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

MOTOR WIRING – FULL VOLTAGE – 230 VOLT
(See Page 52 for Drawing)

Ref. No.	Name of Part	QTY.	B/M: 3337EBE4007 15 HP	B/M: 338EBE4007 20 HP	B/M: 339EBE4007 25 &30 HP
1	VOLTAGE MARKER	1	69F51	69F51	69F51
2	FITTING	1	24A386	2009325	2009330
3	CONDUIT	3	24A443	2009314	2009805
4	FITTING	1	24A385	2009324	2009329
5	WIRE (IN FEET)	15	2009406	2009408	2009708
6	WIRE (IN FEET)	5	97J65	97J65	97J65
7	TERMINAL LUG	3	24A306	24A498	2009531
8	SCREW	3	655EC03B	655EC03B	655EC03B
9	NUT	3	50X16	50X16	50X16
10	WASHER	3	95H16	95H16	95H16
11	TERMINAL LUG	12	24CA1980	24CA1980	24CA1980
12	TAPE	1	24CA882	24CA882	24CA882
13	TAPE	1	24CA883	24CA883	24CA883
14	WASHER	2	24CA78	2009872	2009871
15	TERMINAL LUG	1	24A307	24A307	24A307

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

MOTOR WIRING – FULL VOLTAGE – 460 VOLT
(See Page 52 for Drawing)

Ref. No.	Name of Part	QTY.	B/M: 334EBE4007 15 HP	B/M: 335EBE4007 20 & 25 HP	B/M: 336EBE4007 30 HP
1	VOLTAGE MARKER	1	69F52	69F52	69F52
2	FITTING	1	24A386	24A386	24A386
3	CONDUIT	3	24A443	24A443	24A443
4	FITTING	1	24A385	24A385	24A385
5	WIRE (IN FEET)	15	2009800	2009801	2009406
6	WIRE (IN FEET)	5	2009989	97J39	97J39
7	TERMINAL LUG	3	24CA1980	24A165	24A307
8	SCREW	6	655EC03B	655EC03B	655EC03B
9	NUT	6	50X16	50X16	50X16
10	WASHER	6	95H16	95H16	95H16
11	TERMINAL LUG	12	24CA1980	24CA1980	24CA1980
12	TAPE	1	24CA882	24CA882	24CA882
13	TAPE	1	24CA883	24CA883	24CA883
14	WASHER	2	24CA78	24CA78	24CA78
15	TERMINAL LUG	1	24A298	2009946	2009946

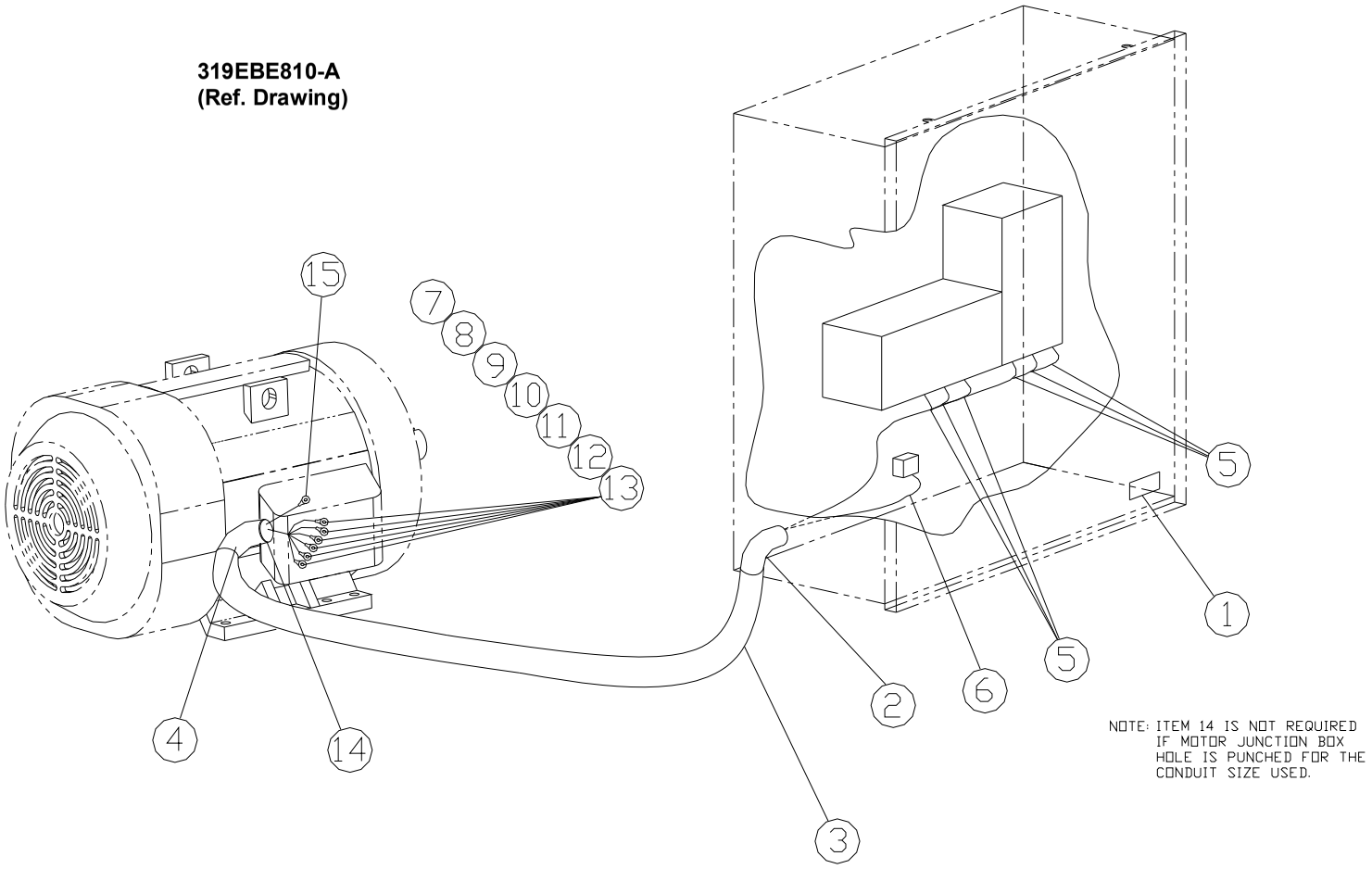
Order by Part Number and Description. Reference Numbers are for your convenience only

MOTOR WIRING – FULL VOLTAGE – 575 VOLT
(See Page 52 for Drawing)

Ref. No.	Name of Part	QTY.	B/M: 331EBE4007 15 HP	B/M: 332EBE4007 20 & 25 HP	B/M: 333EBE4007 30 HP
1	VOLTAGE MARKER	1	69F60	69F60	69F60
2	FITTING	1	24A386	24A386	24A386
3	CONDUIT	3	24A443	24A443	24A443
4	FITTING	1	24A385	24A385	24A385
5	WIRE (IN FEET)	15	2009800	2009801	2009801
6	WIRE (IN FEET)	5	2009989	2009989	97J39
7	TERMINAL LUG	3	24CA1980	24A165	24A165
8	SCREW	3	655EC03B	655EC03B	655EC03B
9	NUT	3	50X16	50X16	50X16
10	WASHER	3	95H16	95H16	95H16
11	TERMINAL LUG	12	24CA1980	24CA1980	24CA1980
12	TAPE	1	24CA882	24CA882	24CA882
13	TAPE	1	24CA883	24CA883	24CA883
14	WASHER	2	24CA78	24CA78	24CA78
15	TERMINAL LUG	1	24A298	24A298	2009946

MOTOR WIRING – WYE DELTA
(See Pages 58, 59, 60 & 61 for B/M's)

319EBE810-A
(Ref. Drawing)



NOTE: ITEM 14 IS NOT REQUIRED IF MOTOR JUNCTION BOX HOLE IS PUNCHED FOR THE CONDUIT SIZE USED.

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

MOTOR WIRING – WYE DELTA – 200 VOLT
(See Page 57 for Drawing)

Ref. No.	Name of Part	QTY.	B/M: 351EBE4007 15 HP	B/M: 352EBE4007 20 & 25 HP	B/M: 353EBE4007 30 HP
1	VOLTAGE MARKER	1	69F50	69F50	69F50
2	FITTING	1	2009325	2009330	2009330
3	CONDUIT	3	2009314	2009805	2009805
4	FITTING	1	2009324	2009329	2009329
5	WIRE (IN FEET)	30	2009801	2009406	2009408
6	WIRE (IN FEET)	5	97J39	97J65	97J76
7	TERMINAL LUG	6	24A165	24A306	24A498
8	SCREW	6	655EC03B	655EC03B	655EC03B
9	NUT	6	50X16	50X16	50X16
10	WASHER	6	95H16	95H16	95H16
11	TERMINAL LUG	12	24CA1980	24CA1980	24CA1980
12	TAPE	1	24CA882	24CA882	24CA882
13	TAPE	1	24CA883	24CA883	24CA883
14	WASHER	2	2009872	2009871	2009871
15	TERMINAL LUG	1	2009946	24A307	24CA1444

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

MOTOR WIRING – WYE DELTA – 230 VOLT
(See Page 57 for Drawing)

Ref. No.	Name of Part	QTY.	B/M: 348EBE4007 15 & 20 HP	B/M: 349EBE4007 25 HP	B/M: 350EBE4007 30 HP
1	VOLTAGE MARKER	1	69F51	69F51	69F51
2	FITTING	1	2009325	2009330	2009330
3	CONDUIT	3	2009314	2009805	2009805
4	FITTING	1	2009324	2009329	2009329
5	WIRE (IN FEET)	30	2009801	2009406	2009408
6	WIRE (IN FEET)	5	97J39	97J65	97J65
7	TERMINAL LUG	6	24A165	24A306	24A498
8	SCREW	6	655EC03B	655EC03B	655EC03B
9	NUT	6	50X16	50X16	50X16
10	WASHER	6	95H16	95H16	95H16
11	TERMINAL LUG	12	24CA1980	24CA1980	24CA1980
12	TAPE	1	24CA882	24CA882	24CA882
13	TAPE	1	24CA883	24CA883	24CA883
14	WASHER	2	2009872	2009871	2009871
15	TERMINAL LUG	1	2009946	24A307	24a307

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

MOTOR WIRING – WYE DELTA – 460 VOLT
(See Page 57 for Drawing)

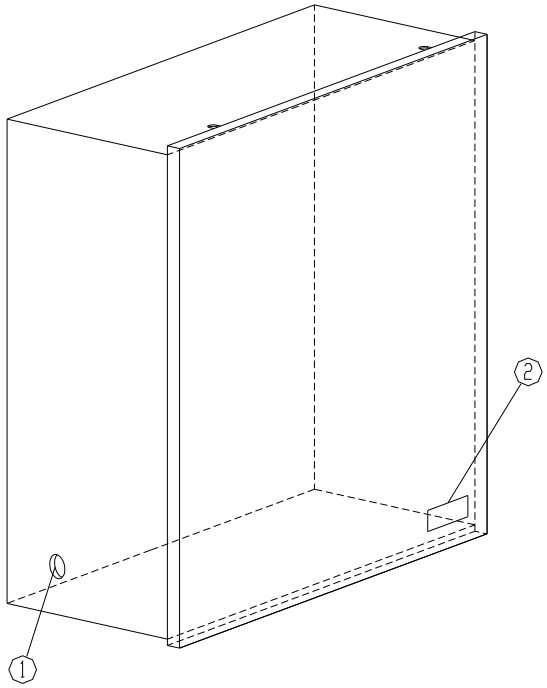
Ref. No.	Name of Part	QTY.	B/M: 346EBE4007 15 & 20 HP	B/M: 347EBE4007 25 & 30 HP
1	VOLTAGE MARKER	1	69F52	69F52
2	FITTING	1	24a386	2009325
3	CONDUIT	3	24a443	2009314
4	FITTING	1	24A385	2009324
5	WIRE (IN FEET)	30	2009800	2009801
6	WIRE (IN FEET)	5	2009989	97J39
7	TERMINAL LUG	6	24CA1980	24A165
8	SCREW	9	655EC03B	655EC03B
9	NUT	9	50X16	50X16
10	WASHER	9	95H16	95H16
11	TERMINAL LUG	12	24CA1980	24CA1980
12	TAPE	1	24CA882	24CA882
13	TAPE	1	24CA883	24CA883
14	WASHER	2	24CA78	2009872
15	TERMINAL LUG	1	24A298	2009946

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

MOTOR WIRING – WYE DELTA – 575 VOLT
(See Page 57 for Drawing)

Ref. No.	Name of Part	QTY.	B/M: 343EBE4007 15 HP	B/M: 344EBE4007 20 & 25 HP	B/M: 345EBE4007 30 HP
1	VOLTAGE MARKER	1	69F60	69F60	69F60
2	FITTING	1	24A386	24A386	2009325
3	CONDUIT	3	24A443	24A443	2009314
4	FITTING	1	24A385	24A385	2009324
5	WIRE (IN FEET)	30	2009319	2009800	2009801
6	WIRE (IN FEET)	5	2009989	2009989	97J39
7	TERMINAL LUG	6	24CA1980	24CA1980	24A165
8	SCREW	6	655EC03B	655EC03B	655EC03B
9	NUT	6	50X16	50X16	50X16
10	WASHER	6	95H16	95H16	95H16
11	TERMINAL LUG	12	24CA1980	24CA1980	24CA1980
12	TAPE	1	24CA882	24CA882	24CA882
13	TAPE	1	24CA883	24CA883	24CA883
14	WASHER	2	24CA78	24CA78	2009872
15	TERMINAL LUG	1	24CA1980	24A298	2009946

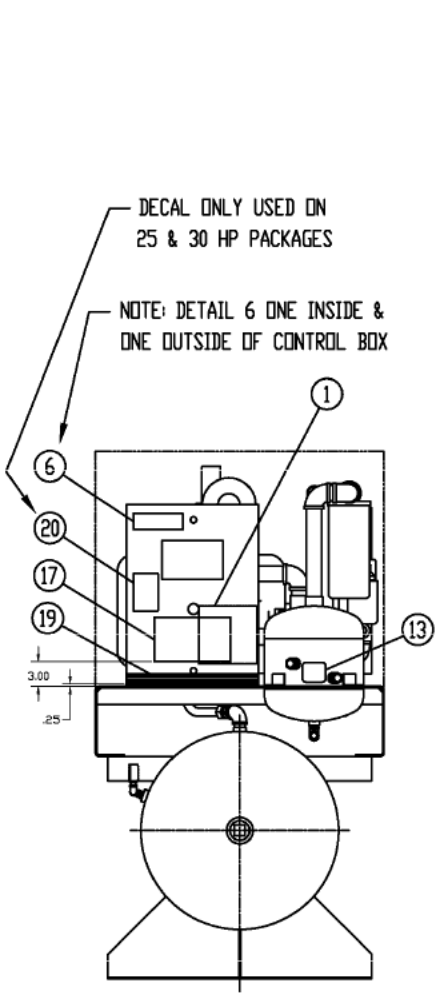
Order by Part Number and Description. Reference Numbers are for your convenience only



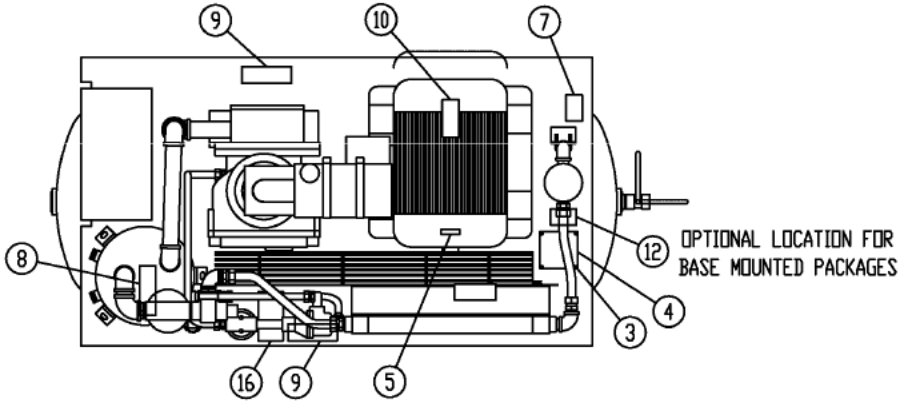
320EBE810-A
(Ref. Drawing)

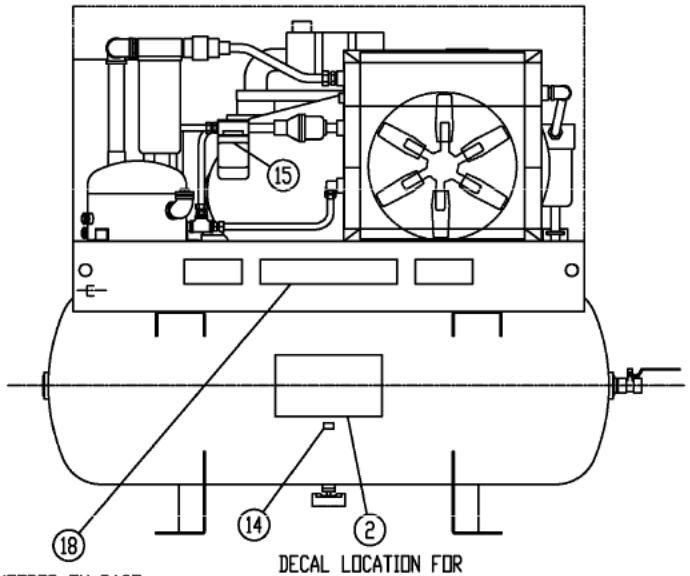
MOTOR WIRING – LESS STARTER

Ref. No.	Name of Part	Qty.	B/M: 357EFC4007 200 Volt Part No.	B/M: 356EFC4007 230 Volt Part No.	B/M: 355EFC4007 460 Volt Part No.	B/M: 354EFC4007 575 Volt Part No.
1	PLUG SEAL	1	24A415	24A415	24A415	24A415
2	VOLTAGE MARKER.....	1	69F50	69F51	69F52	69F60



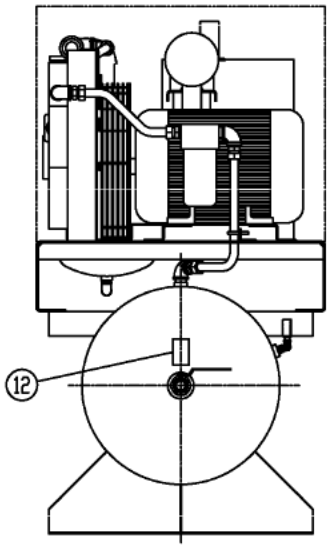
321EBE810-B
(Ref. Drawing)





CENTERED ON BASE
BOTH SIDES

DECAL LOCATION FOR
TANK MOUNTED PACKAGES ONLY
(CENTERED ON TANK BOTH SIDES)



NOTE: DETAIL 11 ONE DECAL FRONT &
BACK PANELS ENCLOSED PACKAGES ONLY.

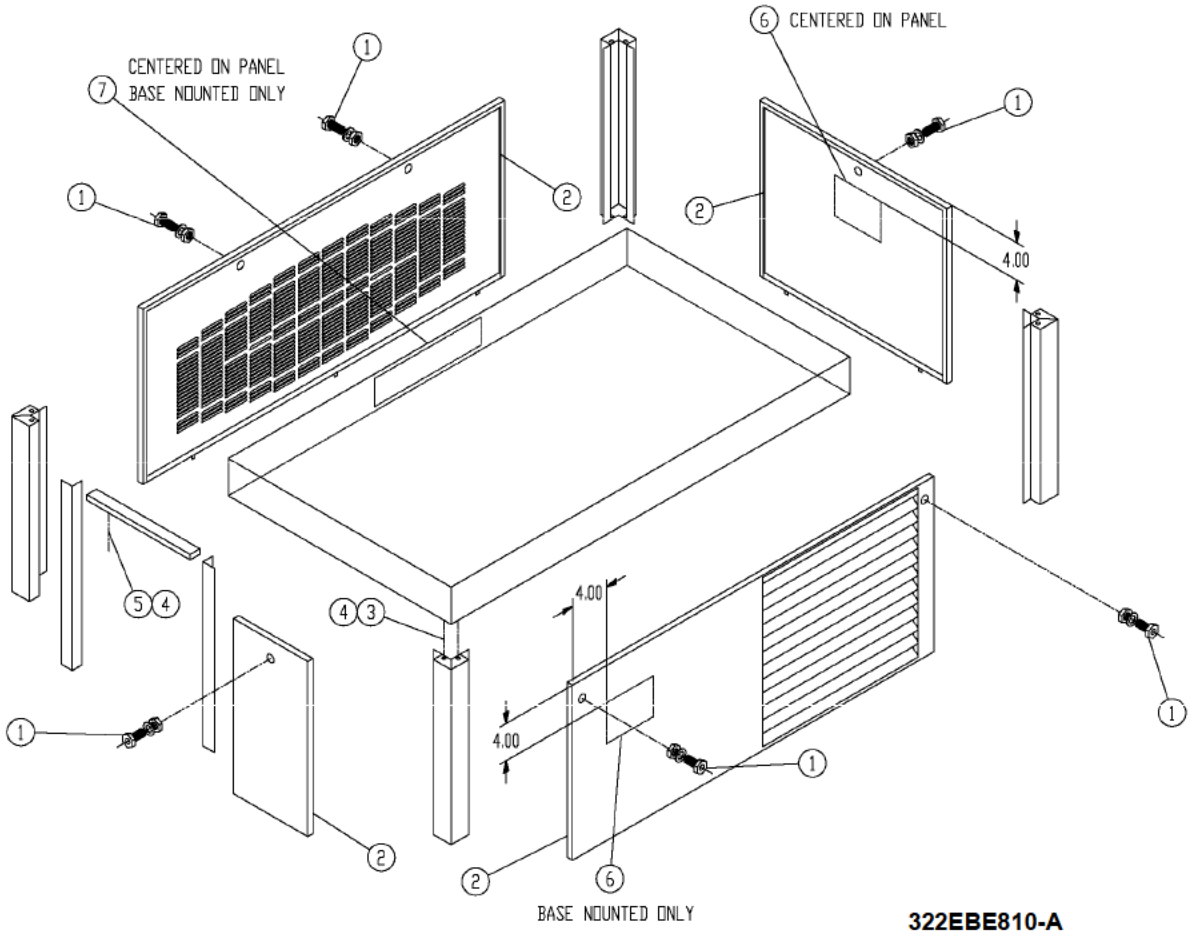
IDENTIFICATION AND INSTRUCTION GROUP

B/M: 301EBE4011
Thru 305EBE4011

Ref. No.	Name of Part	Qty.	Part No.
1	DECAL, CD MANUALS		
	ENGLISH	1	VP1009795
	FRENCH	1	VP1012949
	MEXICAN SPANISH	1	VP1012948
* 2	DECAL, GARDNER DENVER PRODUCT LOGO	2	VP1051554
* 5	DECAL, ROTATION ARROW	1	304EFC077
* 6	DECAL, ISO WARNING –CONTROL BOX	2	VP1009371
* 7	DECAL, ISO WARNING – OIL FILTER	2	VP1009379
* 8	DECAL, ISO WARNING – SEPARATOR TANK	1	VP1009376
* 9	DECAL, ISO WARNING – FAN/COOLER HOUSING	2	VP1009582
* 10	DECAL, ISO WARNING – MOTOR	1	VP1009374
11	DECAL, ISO WARNING (SIDES ABOVE DOORS)	2	VP1009372
* 12	DECAL, ISO WARNING – PACKAGE DISCHARGE AIR	1	VP1009623
* 13	DECAL OIL LEVEL	1	200EJB077
14	DECAL (DRAIN MOISTURE DAILY)	1	205ESO077
15	DECAL OIL FILL ELEMENT	1	205EBE077
* 16	DECAL, NOTICE (USE GENUINE GD PARTS)	2	CC1009474
17	DECAL, GD LOGO (SMALL)	1	VP1051555
18	DECAL, ELECTRA SAVER II (LARGE)	2	VP1051551
19	DECAL, STRIPE (SMALL)	1	VP1051553
20	DECAL, CAGI PERFORMANCE	1	CC1031484

* For Replacement Decals Order Part Number CC1010403 Decal Group Sheet.

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



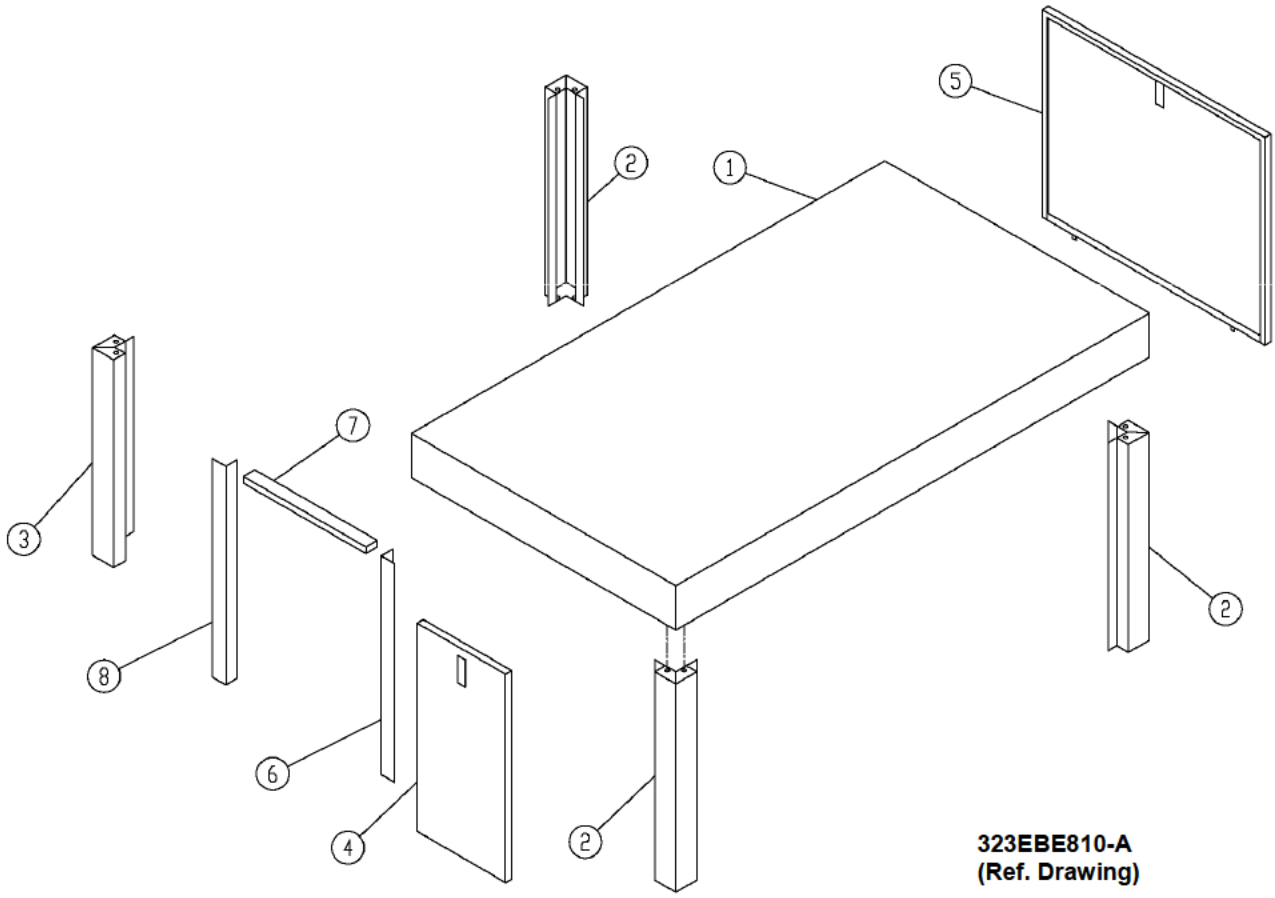
322EBE810-A
(Ref. Drawing)

ENCLOSURE – HARDWARE & DECALS

B/M: 305 & 306EBE4017

Ref. No.	Name of Part	Qty.	Part No.
1	LATCH	6	31D68
2	SEAL (IN FEET)	28	32E12
3	SCREW	20	75LM150
4	NUT	22	50AW5
5	SCREW	2	75LM78
6	DECAL GD	2	VP1039380
7	DECAL (GARDNER DENVER)	1	VP1044830
8	KEY (not shown)	2	VP1049035

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



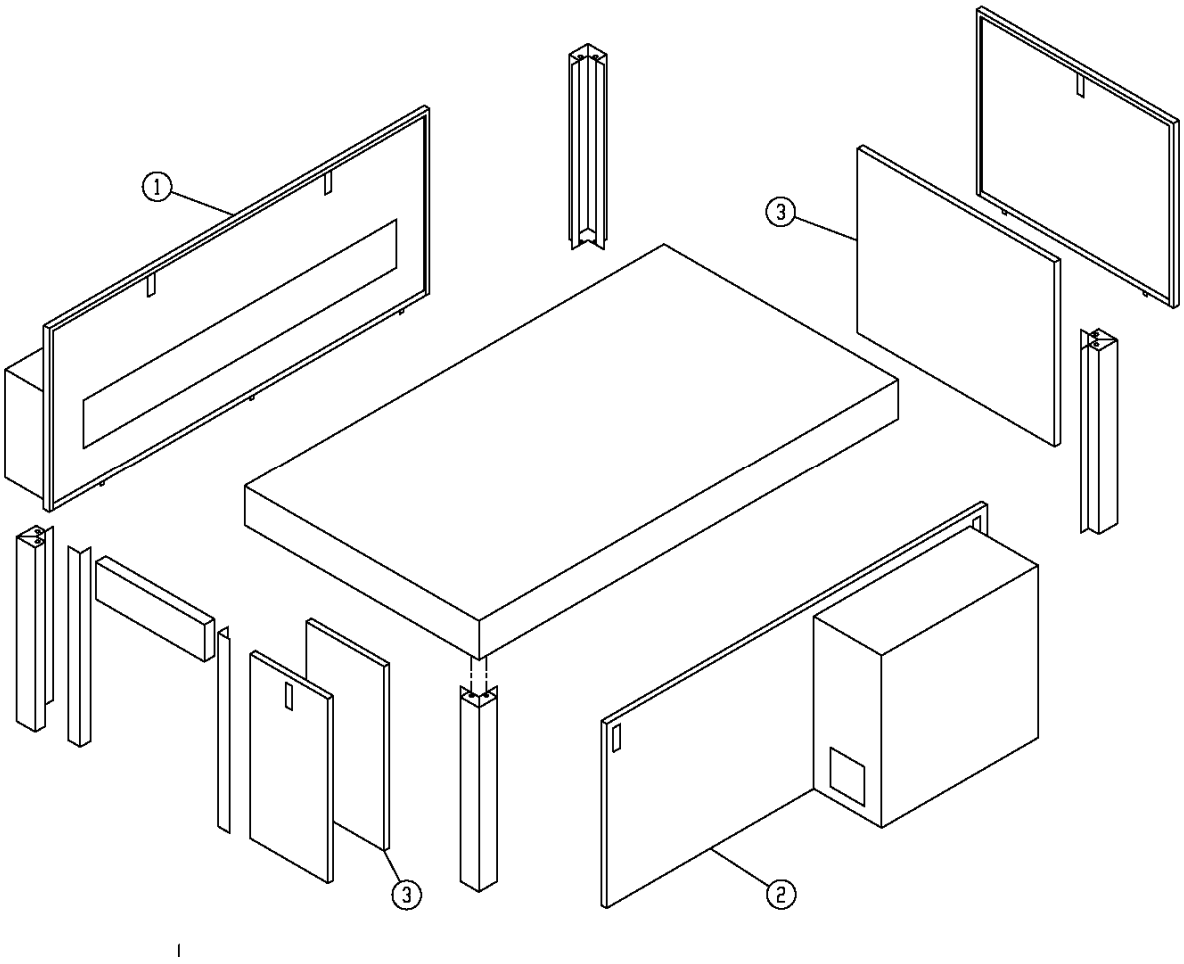
323EBE810-A
(Ref. Drawing)

ENCLOSURE – BASIC PARTS

B/M: 304EBE4017

Ref. No.	Name of Part	Qty.	Part No.
1	HOOD	1	200EBE053
2	POST	3	CC1045543
3	POST	1	CC1045544
4	PANEL	1	CC1016658
5	PANEL	1	CC1016656
6	BRACKET RH SIDE OF CONTROL BOX	1	301EBE142
7	BRACKET (FORMED) TOP OF CONTROL BOX	1	300EBE142
8	BRACKET LH SIDE OF CONTROL BOX	1	302EBE142

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



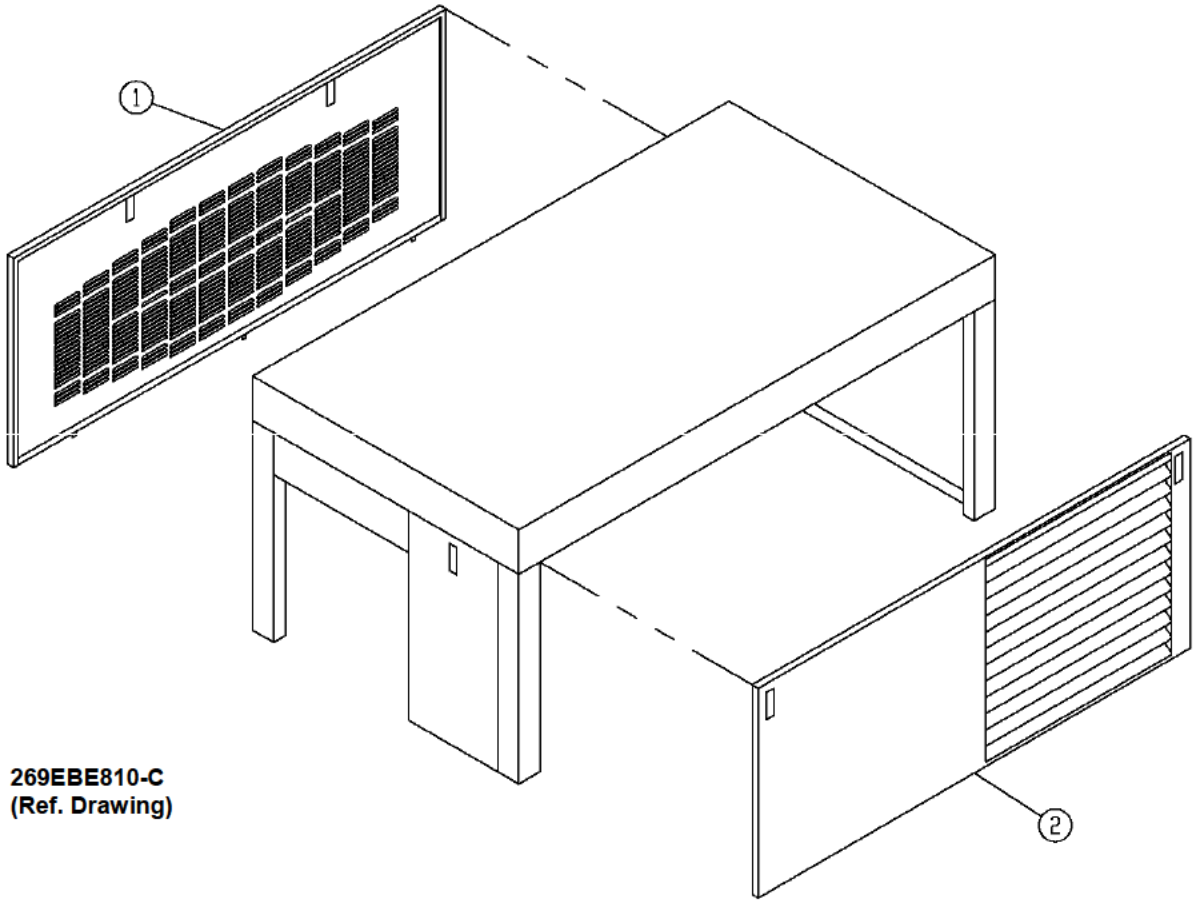
268EBE810-C
(Ref. Drawing)

QUIET ENCLOSURE – ODP MOTOR ONLY

B/M: 211EBE4017

Ref. No.	Name of Part	Qty.	Part No.
1	PANEL	1	CC1016661
2	PANEL	1	CC1016662
3	INSULATION	1	200EJB470

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



269EBE810-C
(Ref. Drawing)

ENCLOSURE – PANELS

Ref. No.	Name of Part	Qty.	B/M: 209EBE4017 ODP Motors Part No.	B/M: 210EBE4017 TEFC Motors Part No.
1	PANEL.....	1	CC1016657	CC1016659
2	PANEL.....	1	CC1016660	CC1016660

MAIN MOTOR (EISA - EFFICIENCY, ODP/TEFC) (FULL VOLTAGE)

Name of Part	15 HP Part No.	20 HP Part No.	25 HP Part No.	30 HP Part No.
EISA EFFICIENCY - OPEN DRIP PROOF				
MOTOR, 200V	24CA6289	24CA6301	24CA6313	24CA6325
MOTOR, 230V	24CA6290	24CA6302	24CA6314	24CA6326
MOTOR, 460V	24CA6290	24CA6302	24CA6314	24CA6326
MOTOR, 575V	24CA6291	24CA6303	24CA6315	24CA6327
EISA EFFICIENCY - TOTALLY ENCLOSED FAN COOLED				
MOTOR, 200V	24CA26924	24CA6304	24CA6316	24CA6328
MOTOR, 230V	24CA6293	24CA6305	24CA6317	24CA6329
MOTOR, 460V	24CA6293	24CA6305	24CA6317	24CA6329
MOTOR, 575V	24CA6294	24CA6306	24CA6318	24CA6330

MOTOR BASES

HP	Motor Frame	Part No.
15	254	24AZ21
20	256	24AZ22
25	284	24AZ23
30	286	24AZ24

MAIN MOTOR (EISA - EFFICIENCY, ODP/TEFC) (WYE DELTA)

Name of Part	15 HP Part No.	20 HP Part No.	25 HP Part No.	30 HP Part No.
EISA EFFICIENCY - OPEN DRIP PROOF				
MOTOR, 200V	24CA6295	24CA6307	24CA6319	24CA6331
MOTOR, 230V	24CA6296	24CA6308	24CA6320	24CA6332
MOTOR, 460V	24CA6296	24CA6308	24CA6320	24CA6332
MOTOR, 575V	24CA6297	24CA6309	24CA6321	24CA6333
EISA EFFICIENCY - TOTALLY ENCLOSED FAN COOLED				
MOTOR, 200V	24CA6298	24CA6310	24CA6322	24CA6334
MOTOR, 230V	24CA6299	24CA6311	24CA6323	24CA6335
MOTOR, 460V	24CA6299	24CA6311	24CA6323	24CA6335
MOTOR, 575V	24CA6300	24CA6312	24CA6328	24CA6336

REPAIR KITS

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

Name of Part	Qty.	Part No.
ROUTINE MAINTENANCE KIT		304EBE6013
ELEMENT, AIR FILTER	2	2118314
ELEMENT, OIL FILTER	3	2116128
PERIODIC MAINTENANCE KIT (Inlet Valve)		302EBE6013
O-RING	1	25BC440
SPRING	1	78H22
SPRING	1	78W59
O-RING	1	25AM15
RING-RETAINING	1	74D87
GASKET (ELIMINATOR)	1	25BC222
OIL SEPARATOR ELEMENT	1	2116717
FIELD ENCLOSURE KIT (ODP Motor)(Field Conversion Kit) (Std)	1	300EBE6005
FIELD ENCLOSURE KIT (TEFC Motor)(Field Conversion Kit) (Std)	1	301EBE6005
QUIET ENCLOSURE KIT (ODP Motor) (Field Conversion Kit) (Quiet)	1	302EBE6005
ELECTRICAL CONTROL KIT		307EBE6013
PRESSURE TRANSDUCER	2	88H365
ELECTRICAL PROBE	2	21D264
VALVE-SOLDNOID	1	91B250
VALVE SOLENOID	1	91B248
VACUUM SWITCH	1	88H195
PNEUMATIC CONTROL KIT		300EBE6013
VALVE-SUBTRACTIVE PILOT	1	2009398
VALVE-CONTROL	1	90AR1034
VALVE-CHECK	3	90AR261
CONTROL VALVE	1	90AR1082

Name of Part	Qty.	Part No.
TOUCH-UP PAINT		
5-GALLON (WHITE)	1	28H76
1-GALLON (WHITE)	1	28H84
1-QUART CAN (WHITE)	1	28H83
DRIVE SHAFT SEAL KIT		301EFD6029
SHAFT SEAL	1	89532919
GASKET	1	30805908
WEAR SLEEVE	1	89533499
GASKET ELIMINATOR	1	25BC632
DUST SEAL	1	89599799
DRIVE SHAFT SEAL TOOL KIT		305EBE6013
SHAFT SEAL TOOL (Drift)	1	03416008
ASSEMBLY TOOL	1	37917818
SHAFT SEAL TOOL	1	03424708
WEAR SLEEVE PULLER	1	89587189
PERIODIC OVERHAUL KIT		307EFD6013
SHAFT SEAL KIT	1	30834028
OVERHAUL KIT	1	50308830
O-RING	1	89558369
GASKET KIT		306CGC6013
GASKET	1	22318708
O-RING	2	87908849
O-RING	1	87090019
PIN	2	81531869
LUBRICANT (AEON 9000SP) – STANDARD		
5-GALLON PAIL	1	28H109
55-GALLON DRUM	1	28H103
LUBRICANT (AEON 9000TH)		
5-GALLON PAIL	1	28H286
55-GALLON DRUM	1	28H270
LUBRICANT (AEON 6000FG)		
5-GALLON PAIL	1	28H99
55-GALLON DRUM	1	28H100

Name of Part	Qty.	Part No.
LUBRICANT (AEON 6000FG-68)		
5-GALLON PAIL	1	28H314
55-GALLON DRUM	1	28H315
LUBRICANT (AEON BIO)		
5-GALLON PAIL	1	28H102
55-GALLON DRUM	1	28H103

Gardner Denver

ENERGY STAR PARTNER

Specification subject to change without notice.

 Litho in U.S.A

For additional information contact your local representative or

Gardner Denver, Inc.
1800 Gardner Expressway, Quincy, Illinois 62305

Telephone: (800) 682-9868
FAX: (217) 224-7814

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GARDNER DENVER

Experience Proven Results™

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

AIRSMART™ CONTROLLER

USER'S MANUAL

(Compressor Application)

WARNING – PROHIBITION – MANDATORY LABEL INFORMATION

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

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

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

⚠ DANGER

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

Equipment Starts Automatically

Health Hazard – Explosive Release of Pressure

Cutting of Finger or Hand Hazard – Rotating Impeller Blade

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

Cutting of Finger or Hand Hazard – Rotating Fan Blade

Entanglement of Fingers or Hand – Rotating Shaft

⚠WARNING

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

Asphyxiation Hazard – Poisonous Fumes or Toxic Gas in Compressed Air

⚠CAUTION

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

Burn Hazard – Hot Surface

PROHIBITION - MANDATORY ACTION REQUIREMENTS

Do Not Operate Compressor with Guard Removed

Lockout Electrical Equipment in De-Energized State

Do Not Lift Equipment with Hook – No Lift Point

Loud Noise Hazard – Wear Hearing Protection

Handle Package at Forklift Points Only

Read the Operator's Manual Before Proceeding with Task

SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious. Some general safety precautions are given below:

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

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

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

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

Table of Contents

1 General Information

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

1.1 AirSmart Controller Features

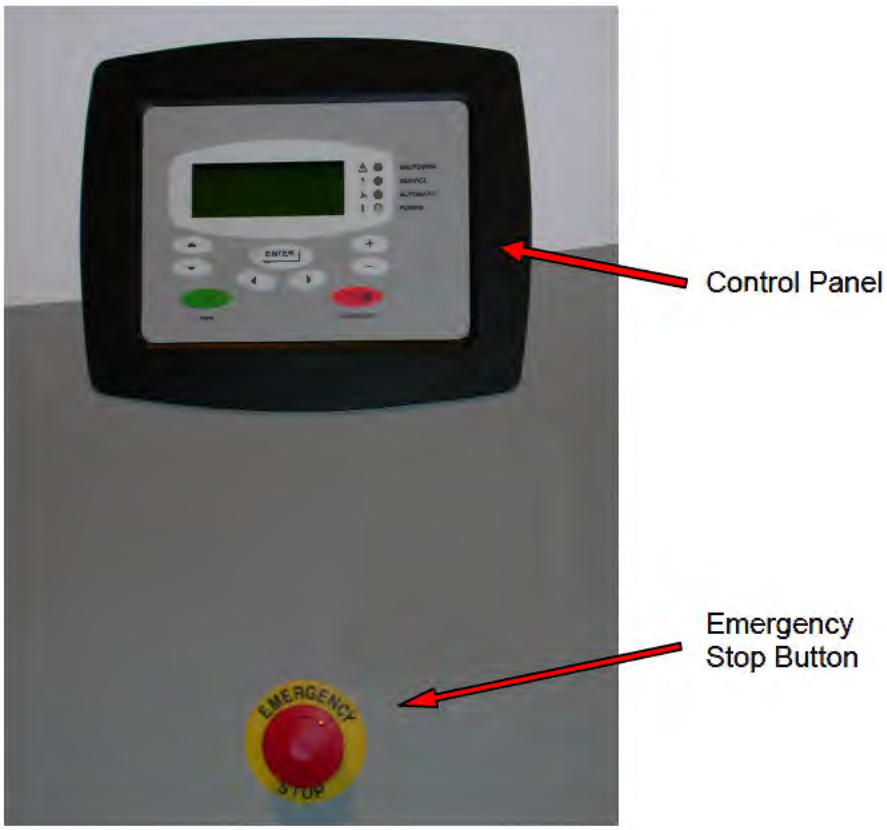
- ✓ Microprocessor controlled
- ✓ Low voltage 24 VDC operation
- ✓ Supports up to thee VFDs via Modbus link
- ✓ Compressor air regulation via PID control
- ✓ Can control variable speed or fixed speed compressors.
- ✓ Intelligent limiting for operation in extreme environmental conditions
- ✓ Feature rich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

1.2 Control Panel Features

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

2 Controller Operation

2.1 Compressor Front Panel



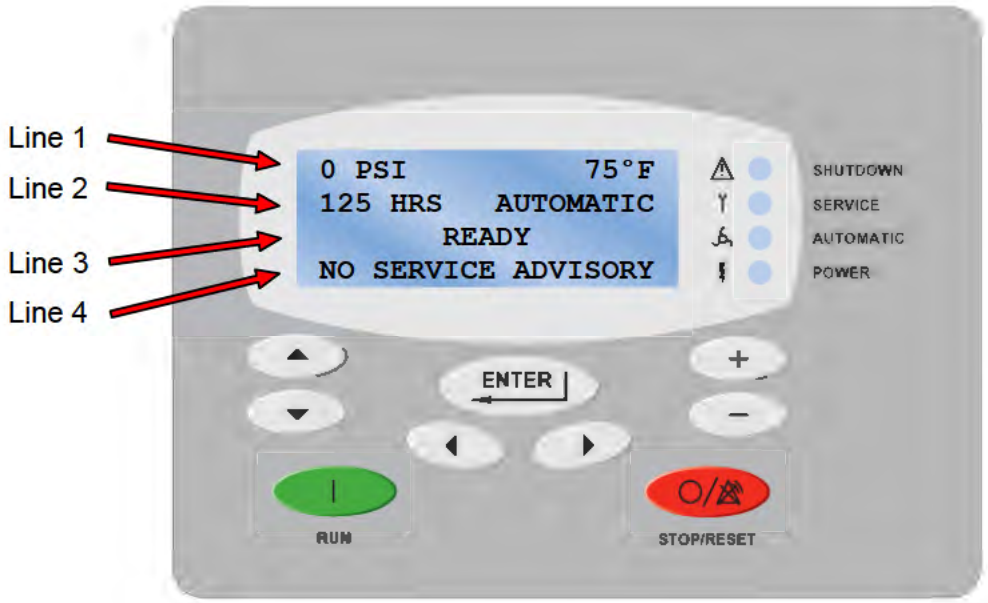
1. **AirSmart Controller Control Panel**

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

2. **Emergency Stop Button**

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

2.2 Control Panel Four-Line Display



1. **Line 1**

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

2. **Line 2**

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

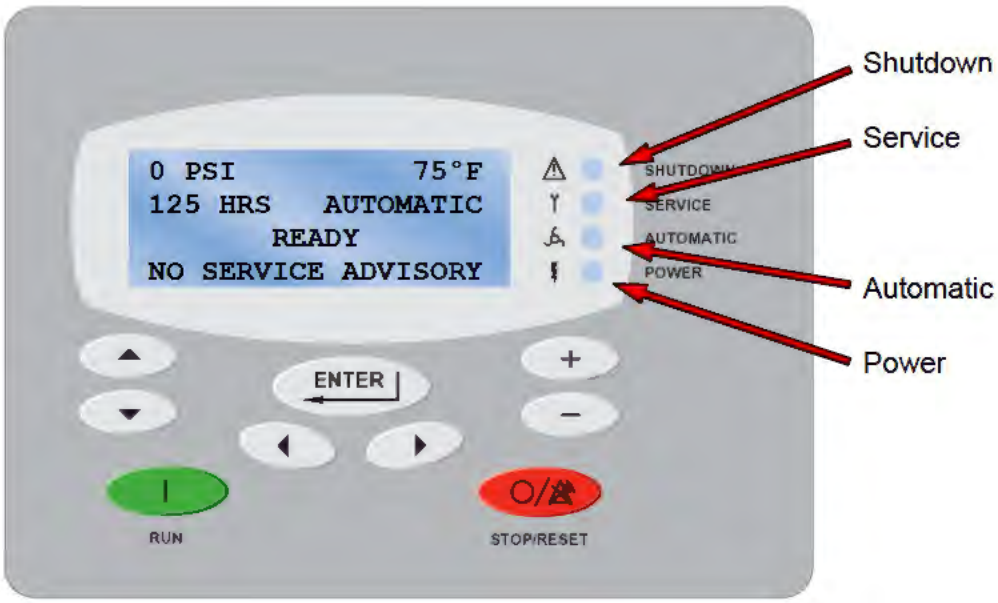
3. **Line 3**

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

4. **Line 4**

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

2.3 Control Panel Indicator Functions



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

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

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

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

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

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

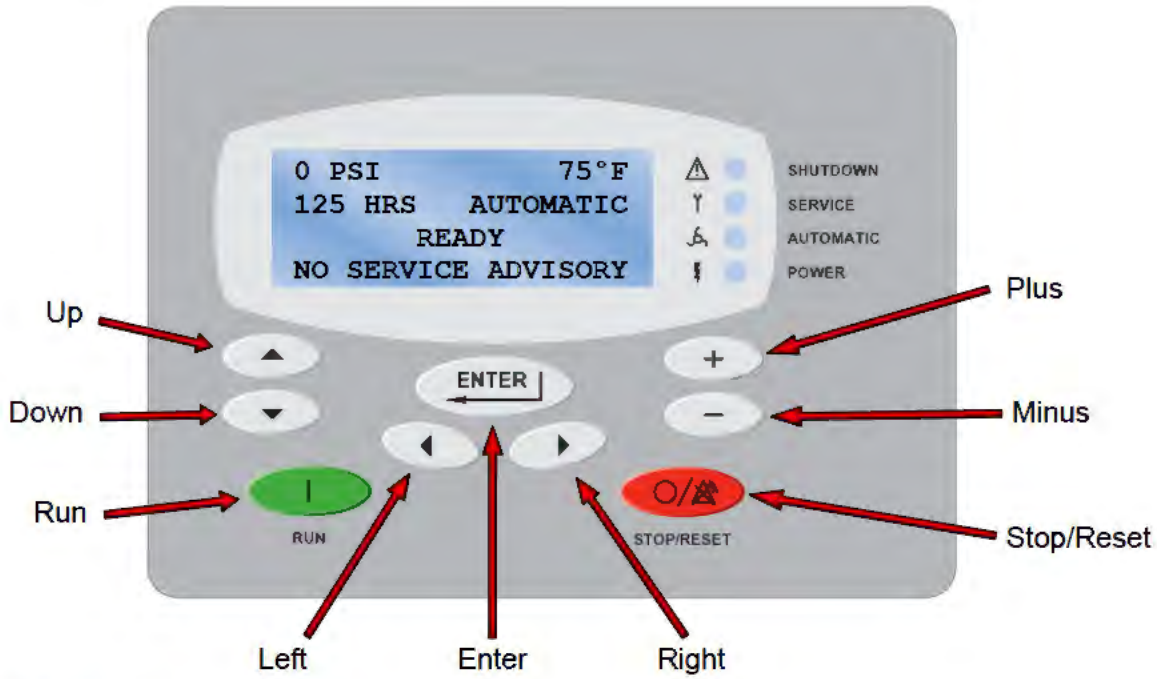
3. **Automatic LED Indicator (green)**

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

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

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

2.4 Control Panel Button Functions



1. **RUN Button**

The RUN button is used to start the compressor.

2. **STOP/RESET Button**

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

3. **ENTER Button**

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

4. **Left Arrow Button**

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

5. **Right Arrow Button**

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

6. **Up Arrow Button**

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

7. **Down Arrow Button**

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

8. **Plus Button**

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

9. **Minus Button**

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

3 Quick Start Guide

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

button to start the compressor, no other settings are required. The Target Pressure comes preset to 100 PSI from the factory. The Unload Pressure is preset to 110 PSI. If a different pressure setting is desired, the following steps can be used as a guide.

3.1 Setting the Target Pressure

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

button. The front panel display should read “READY” on line 3.

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

Next, press the Enter 

button to access the Adjustment Menu tree

```
   ADJUSTMENT MENU
OPERATION ADJUSTMENT

  (SELECT SUB MENU)
```

Since the Target Pressure setting is under the Operation Adjustment menu, press Enter 

again to access that sub-menu

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

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

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

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

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

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

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

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

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

3.2 Setting the Load and Unload Pressure

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

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

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

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

4 Air Compressor Control

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

4.1 Variable Speed Compressors

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

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

4.2 Variable Flow Compressors

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

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

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

4.3 Fixed Speed Compressors

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

5 AirSmart Controller Menus

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

5.1 Operational Menus

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

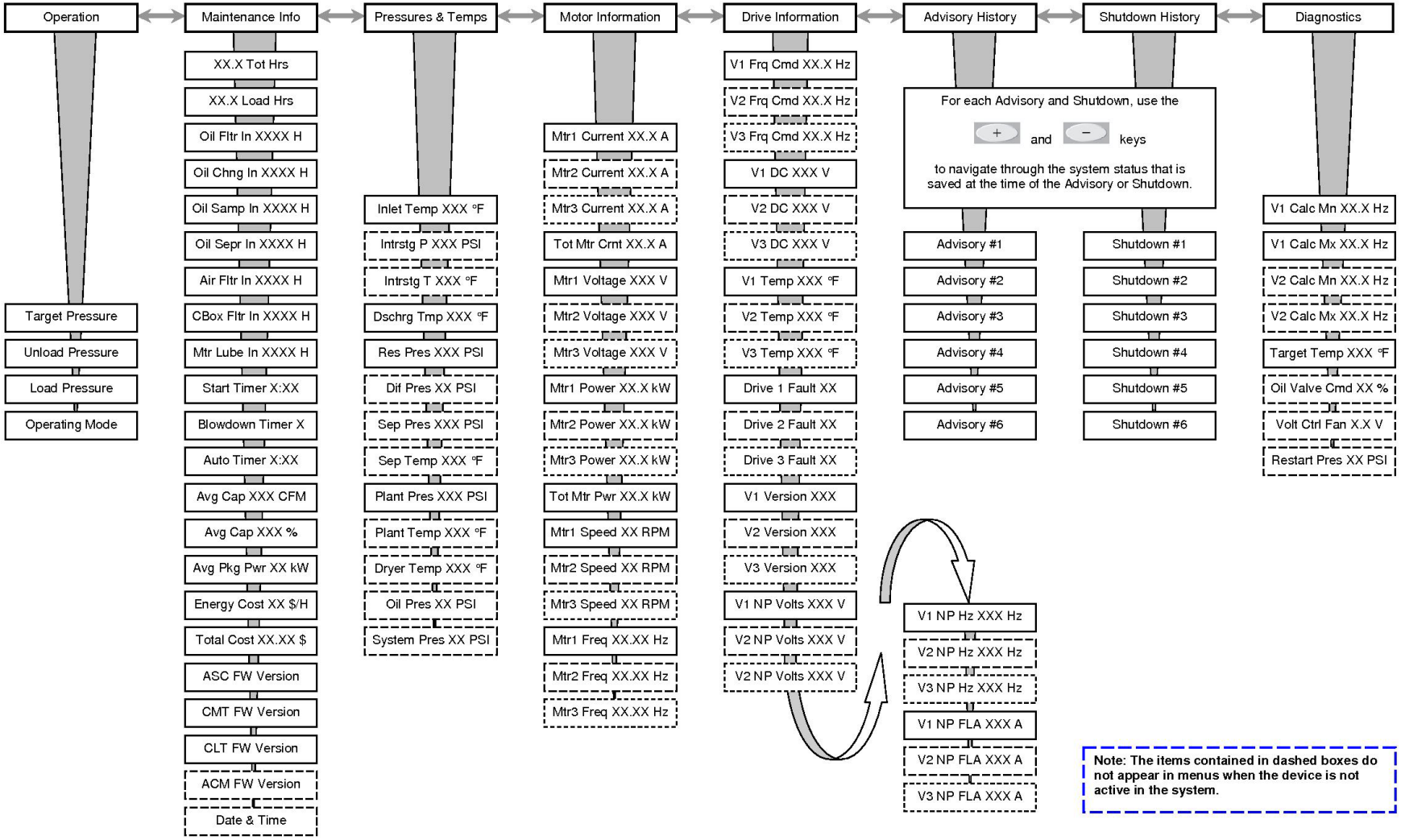
It is not necessary to navigate back to the top of a particular menu in order to enter another menu. Simply press the Right or Left buttons to go back to the heading of the current menu and then use the Right or Left buttons again to find the desired menu heading as described above.

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

AirSmart Controller Operational Menus (Compressor Application)

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

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



4.1.1 Operation Menu

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

```
0 PSI          75°F
125 HRS   AUTOMATIC
       READY
     OPERATION
```

1. Target Pressure

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

```
0 PSI          75°F
125 HRS   AUTOMATIC
       READY
 TARGT PRES=100PSI
```

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

2. Unload Pressure

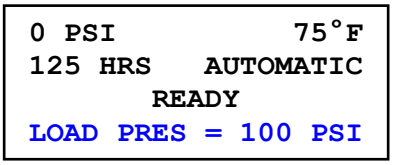
The next item in the Operation menu is the Unload Pressure. This pressure value is where the compressor will unload and begin the unload/stop sequence. The Unload Pressure value cannot be set any lower than [Target Pressure + 5 PSI].

```
0 PSI          75°F
125 HRS   AUTOMATIC
       READY
UNLOD PRES = 110 PSI
```

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

3. Load Pressure

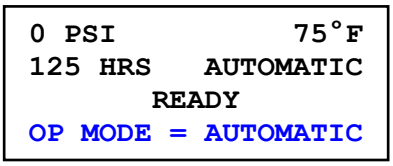
The next item in the Operation menu is the Load Pressure. This pressure value is where the compressor will load again after an unload/stop sequence. The Load Pressure value cannot be set any higher than Target Pressure.



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

4. Operating Mode

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



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

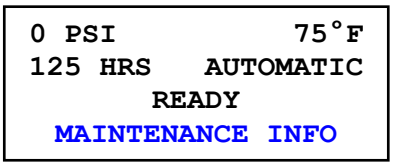
SEQUENCE: The compressor is part of a sequenced group of machines. Refer to Gardner Denver document 13-17-604 for further details about sequencing with the AirSmart Controller.

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

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

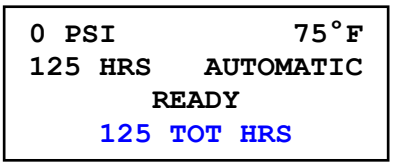
4.1.2 Maintenance Info Menu

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



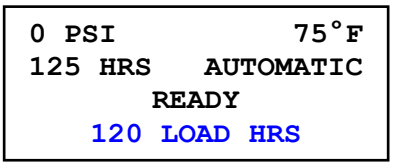
1. Total Hours

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



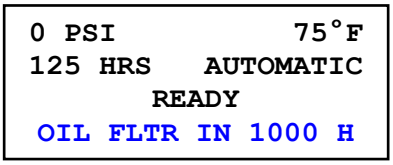
2. Loaded Hours

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



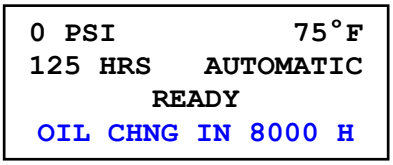
3. Time To Next Oil Filter Change

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



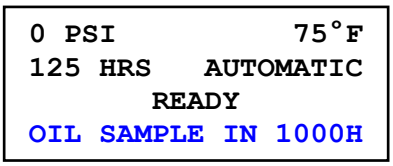
4. Time To Next Oil Change

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



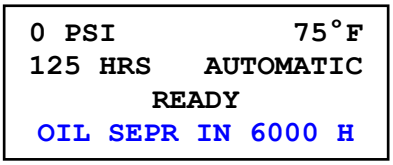
5. Time To Next Oil Sample

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



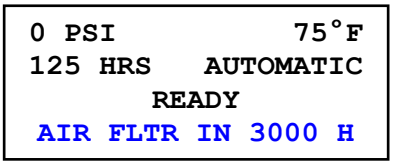
6. Time To Next Separator Element Change

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



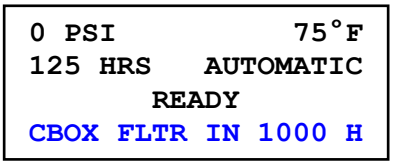
7. Time To Next Air Filter Change

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



8. Time To Control Box Filter Change

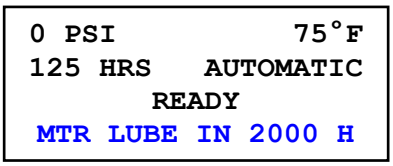
The next item in the Maintenance Info menu is the number of hours before the next control box filter change is needed. The Control Box Filter Change Interval Timer can be reset under the Maintenance Adjust menu. The Control Box Filter Change Interval Time can be changed under the Unit Setup Adjust menu.



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

9. Time To Next Motor Lubrication

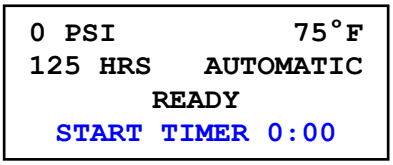
The next item in the Maintenance Info menu is the number of hours before motor lubrication is needed. The Motor Lubrication Interval Timer can be reset under the Maintenance Adjust menu. The Motor Lubrication Interval Time can be changed under the Unit Setup Adjust menu.



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

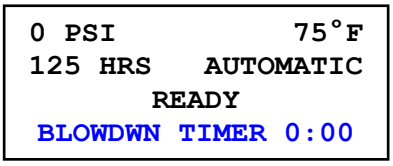
10. Start Timer

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



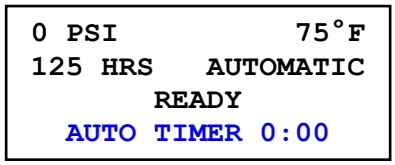
11. Blowdown Timer

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



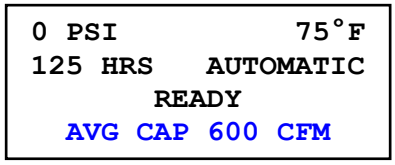
12. Auto Timer

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



13. Average Capacity

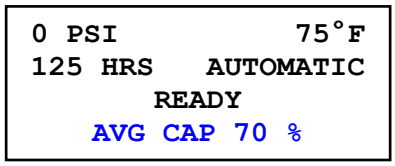
The next item in the Maintenance Info menu shows the Average Capacity of the compressor based on a moving window average function which samples the compressor speed every five minutes and calculates the capacity using the last twelve samples (1 hour of data).



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

14. Average Percent Capacity

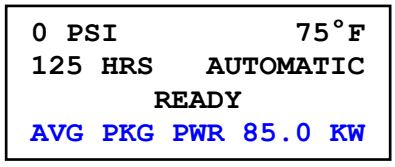
The next item in the Maintenance Info menu shows the Average Percent of Full Capacity of the compressor based on a moving window average function which samples the compressor speed every five minutes and calculates the average percent capacity using the last twelve samples (1 hour of data).



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

15. Average Package Power

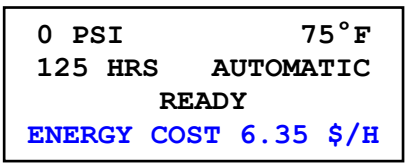
The next item in the Maintenance Info menu shows the Average Package Power of the compressor based on a moving window average function which samples the drive power output every five minutes and calculates the average power using the last twelve samples (1 hour of data).



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

16. Current Energy Cost

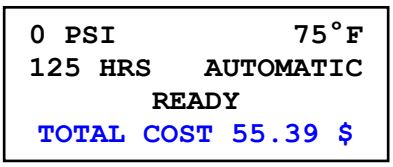
The next item in the Maintenance Info menu shows the cost of operating the compressor at the current power level. This number is based on the current package power output and the Energy Cost value that is entered under the Configuration Adjust menu.



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

17. Cumulative Energy Cost

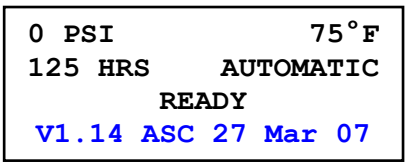
The next item in the Maintenance Info menu is the Cumulative Energy Cost of operating the compressor. This value is based on Average Package Power and the Energy Cost value under the Configuration Adjust menu. The user may reset the cumulative energy cost value under the Maintenance Adjust menu.

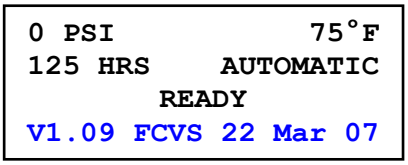


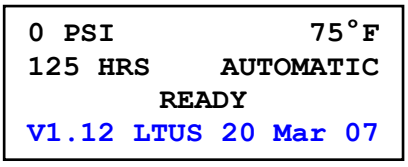
- **Note: This parameter is only available in variable speed compressor packages.**

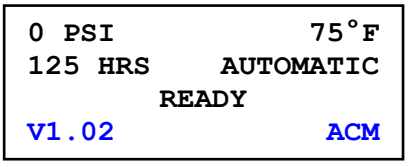
18. Firmware Version

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





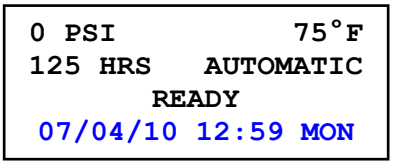




- **Note: This parameter is only available when Communications Module is installed.**

19. Time and Date

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



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

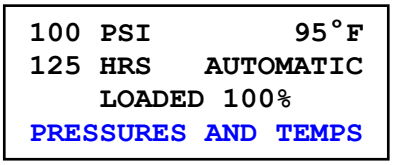
The date & time format reads as follows:

YY/MM/DD HH:MM DOW

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

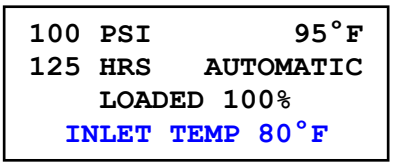
4.1.3 Pressures and Temps Menu

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



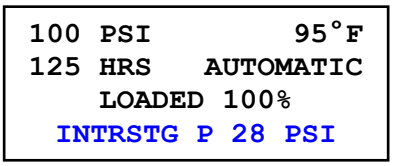
1. Inlet Temperature

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



2. Interstage Pressure

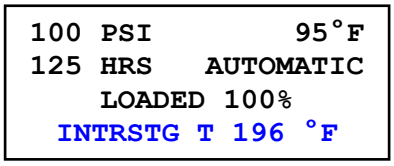
The next item in the Pressures and Temps menu is the Interstage Pressure, which reflects the current air pressure inside the interstage pipe of a two-stage compressor package.



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

3. Interstage Temperature

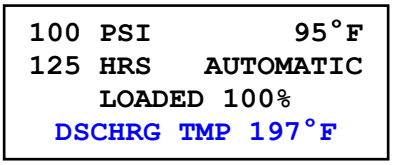
The next item in the Pressures and Temps menu is the Interstage Temperature, which reflects the current temperature inside the interstage pipe of a two-stage compressor package.



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

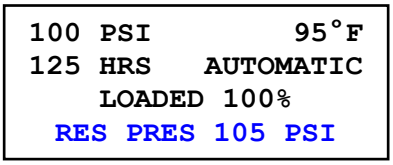
4. Discharge Temperature

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



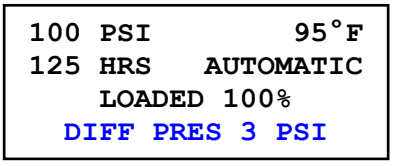
5. Reservoir Pressure

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



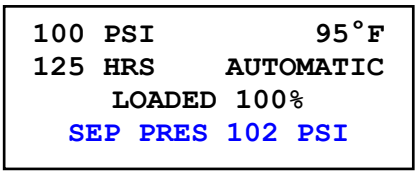
6. Differential Pressure

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



7. Separator Pressure

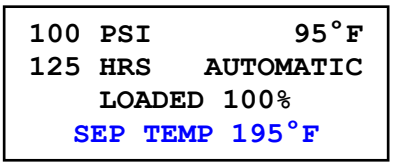
The next item in the Pressures and Temps menu is the Separator Pressure, which reflects the current air pressure at the “dry side” of the air-oil separator.



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

8. Separator Temperature

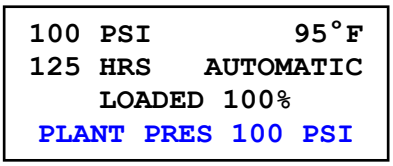
The next item in the Pressures and Temps menu is the Separator Temperature, which reflects the current temperature at the “dry side” of the air-oil separator.



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

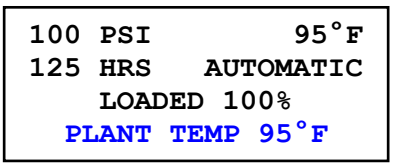
9. Plant Pressure

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



10. Plant Temperature

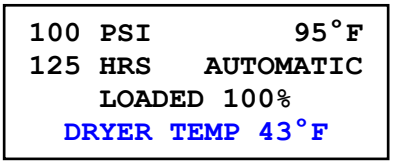
The next item in the Pressures and Temps menu is the Plant Temperature, which reflects the current temperature at the compressor package discharge port. The Plant Temperature value is also always seen in the first line of the display. The Discharge Temperature value is seen in the first line of the display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



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

11. Dryer Temperature

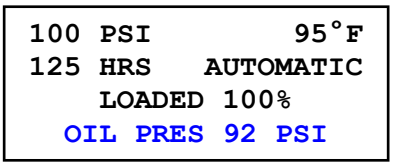
The next item in the Pressures and Temps menu is the Dryer Temperature, which reflects the current refrigerant temperature of the integrated dyer if present in the system.



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

12. Oil Pressure

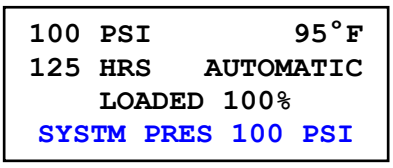
The next item in the Pressures and Temps menu is the Oil Pressure, which reflects the current oil pressure at the oil manifold, which is the main distribution point for the oil injection system.



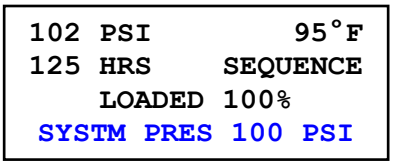
- **Note: This parameter is not available in all compressor packages.**

13. System Pressure

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

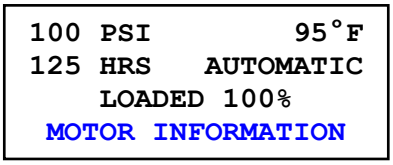


- **Note: This parameter is not available in all compressor packages.**



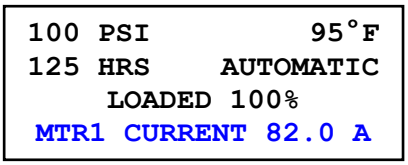
4.1.4 Motor Information Menu

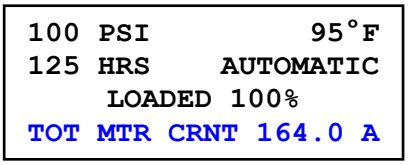
The Motor Information menu gives the user access to the current status of all the Variable Frequency Drive (VFD) controlled motors (up to three) that are installed in the compressor. The Motor Information menu is not visible if no VFDs are installed with the exception of Motor Current which is visible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



1. Motor Current

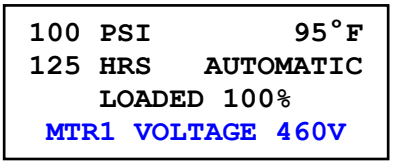
The first item(s) in the Motor Information menu is the Motor Current consumption value of each individual motor in the system followed by the total current consumption of all the motors. In the first display below, “MTR1” is followed by “MTR2” and “MTR3” depending on which motor is being observed.





2. Motor Voltage

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



3. Motor Power

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

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

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

4. Motor Speed

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

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

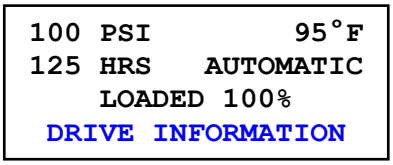
5. Motor Frequency

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

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

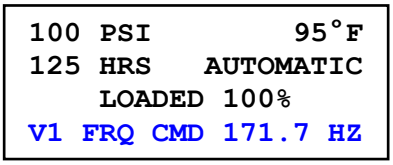
4.1.5 Drive Information Menu

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



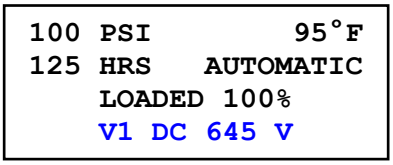
1. Commanded Motor Frequency

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



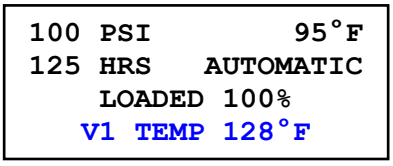
2. Drive DC Bus Voltage

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



3. Drive Temperature

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



4. **Drive Fault**

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

```
100 PSI         95°F
125 HRS    AUTOMATIC
     LOADED 100%
  DRIVE 1 FAULT 0
```

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

5. **Firmware Version**

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

```
100 PSI         95°F
125 HRS    AUTOMATIC
     LOADED 100%
  V1 VERSION 5.01
```

6. **Motor Nameplate Volts**

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

```
100 PSI         95°F
125 HRS    AUTOMATIC
     LOADED 100%
 V1 NP VOLTS 460 V
```

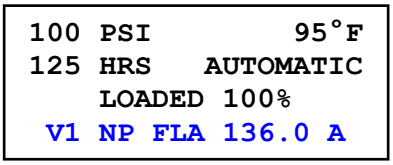
7. **Motor Nameplate Frequency**

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

```
100 PSI         95°F
125 HRS    AUTOMATIC
     LOADED 100%
  V1 NP HZ 126 HZ
```

8. Motor Nameplate Full Load Amps

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



4.1.6 Advisory History Menu

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

```
0 PSI          75°F
125 HRS   AUTOMATIC
       READY
  ADVISORY HISTORY
```

1. **Advisory #1 through #6**

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

```
0 PSI          75°F
125 HRS   AUTOMATIC
       READY
1 = HIGH DISCH TEMP
```

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

```
0 PSI          75°F
125 HRS   AUTOMATIC
       READY
  NO MORE HISTORY
```

2. **System Status**

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

```
0 PSI          75°F
125 HRS   AUTOMATIC
       READY
   ADVISORY # 3
```

3. System Status List

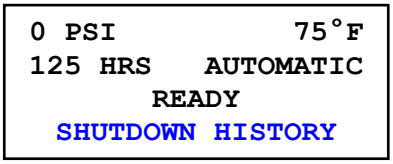
The following is the list of the status items that are stored at the time of an Advisory or Shutdown fault.

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

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

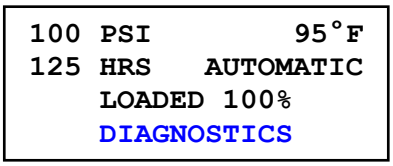
4.1.7 Shutdown History Menu

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



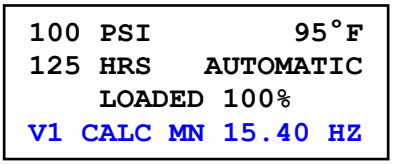
4.1.8 Diagnostics Menu

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



1. Drive Calculated Frequency Limits

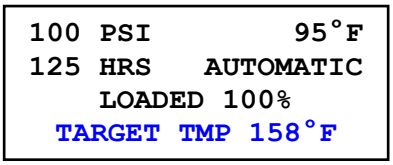
The first two or four items in the Diagnostics menu are the Calculated VFD Frequency Limits for each main motor drive in the system. These values indicate the minimum and maximum speed at which each VFD can be commanded to run by the AirSmart Controller. In the display below, "V1 CALC MN" is followed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



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

2. Target Temperature

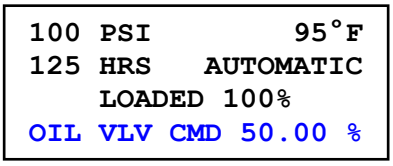
The next item in the Diagnostics menu is the Target Discharge Temperature that is being calculated by the oil flow algorithm. The discharge temperature of the compressor is automatically kept greater than the displayed value to avoid water condensation inside the compressor.



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

3. Oil Valve Command

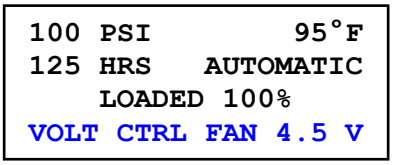
The next item in the Diagnostics menu shows the current position of the Precision Oil Mixing Valve. A value of 50% indicates that equal amounts of oil are flowing through the oil cooler and the oil cooler bypass line. A value is less than 50% indicates that more oil is being routed to the oil cooler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



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

4. Fan Control Voltage

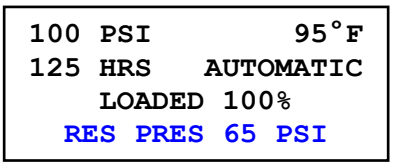
The next item in the Diagnostics menu shows the current value of the Fan Control Voltage for machines with voltage controlled variable speed cooler fans. The voltage value will increase with increasing compressor output power.



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

5. Restart Pressure

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



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

5.2 Adjustment Menus

The Adjustment Menus are only available when the compressor is stopped. To enter the Adjustment Menu tree, press the Enter 

button and then press the Right  or Left  buttons to access one of four different menus. Once the desired menu heading is shown in the second line of the display, press the Enter 

button again to access that menu. Use the Up  and Down  buttons to access the individual items in the selected menu, which are also shown in the second line of the display.

It is not necessary to navigate back to the top of a particular menu in order to enter another menu. Simply press the Stop/Reset 

button to go back to the heading of the current menu and then use the Right  or Left  buttons again to find the desired menu heading as described above.

To completely exit from the Adjustment menus, press the Stop/Reset 

button again. If parameter changes have been made, the following screen will appear.

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

To permanently save the changes that were made, press the Enter 

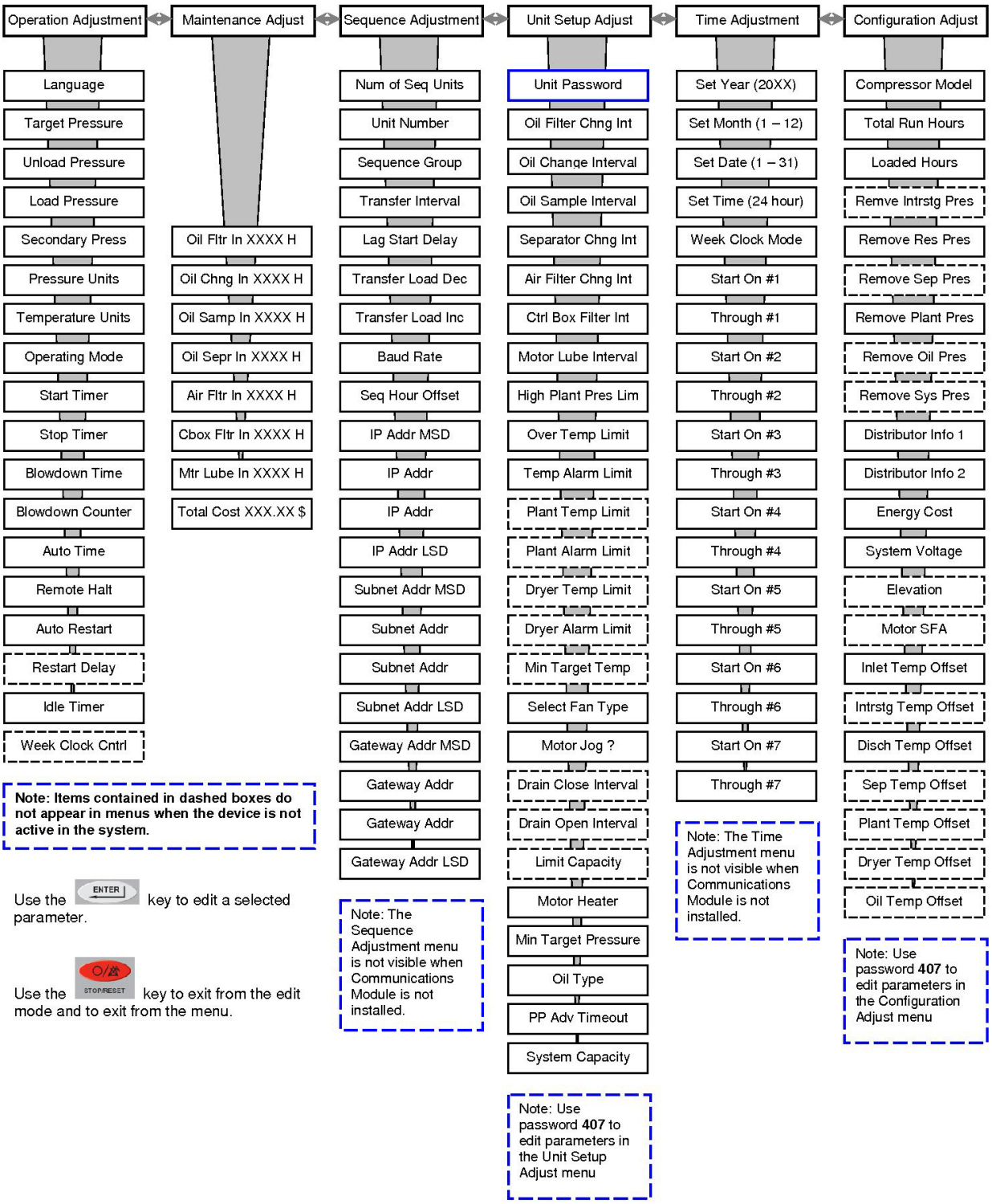
button. If the Stop/Reset 

button is pressed, the parameter changes that have been made are still valid but will be lost the next time the compressor is disconnected from main power.

AirSmart Controller Adjustment Menus (Compressor Application)

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

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



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

Use the ENTER key to edit a selected parameter.

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

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

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

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

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

4.2.1 Operation Adjustment Menu

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

```
ADJUSTMENT MENU
OPERATION ADJUSTMENT

(SELECT SUB MENU)
```

1. Language

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

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

2. Target Pressure

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

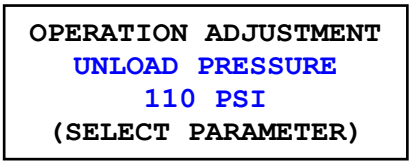
```
OPERATION ADJUSTMENT
  TARGET PRESSURE
      100 PSI
(SELECT PARAMETER)
```

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

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

3. Unload Pressure

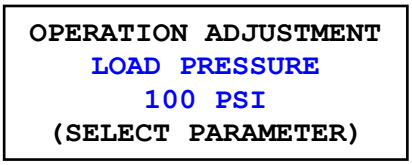
The next item in the Operation Adjustment menu is the Unload Pressure. This pressure value is where the compressor will unload and begin the unload/stop sequence. The Unload Pressure value cannot be set any lower than [Target Pressure + 5 PSI]. If the Target Pressure setting is changed, the Unload Pressure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



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

4. Load Pressure

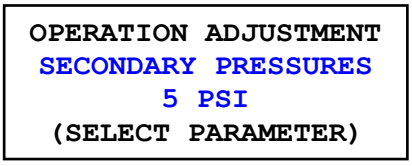
The next item in the Operation Adjustment menu is the Load Pressure. This pressure value is where the compressor will load again after an unload/stop sequence. The Load Pressure value cannot be set any higher than Target Pressure. If the Target Pressure setting is changed, the Load Pressure setting will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



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

5. Secondary Pressures

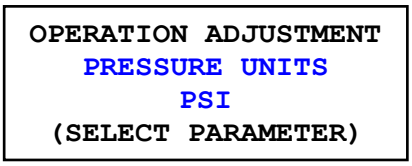
The next item in the Operation Adjustment menu is the Secondary Pressures. This parameter is used to add a positive or negative offset to the Target, Load and Unload Pressure set points when a digital input programmed to the Secondary Pressures function becomes active. The Target, Load and Unload set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



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

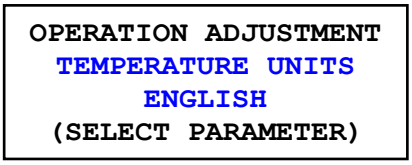
6. Pressure Units

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



7. Temperature Units

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



8. Operating Mode

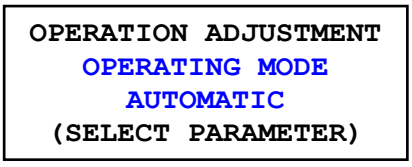
The next item in the Operation Adjustment menu is the operating mode. The controller can be set to one of four operational modes.

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

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

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

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



9. Start Timer

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

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

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

10. Stop Timer

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

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

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

11. Blowdown Timer

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

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

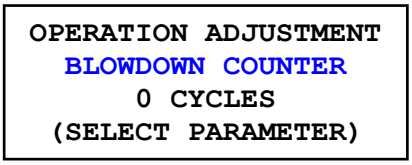
```
OPERATION ADJUSTMENT
    BLOWDOWN TIME
      1 SECONDS
  (SELECT PARAMETER)
```

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

12. Blowdown Counter

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

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

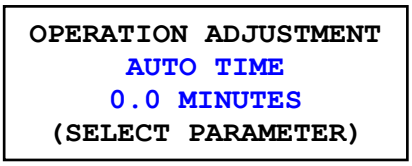


Min Value: 0 cycles
Max Value: 10 cycles
Default Value: 0 cycles (variable speed units), 5 cycles (fixed speed units)

13. Auto Timer

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

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



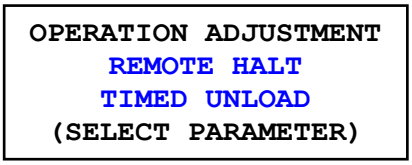
Min Value: 0.0 minutes
Max Value: 20.0 minutes
Default Value: 0.0 minutes (variable speed units), 10.0 minutes (fixed speed units)

14. Remote Halt

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

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

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



15. Auto Restart

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

```
OPERATION ADJUSTMENT
    AUTO RESTART
         ON
 (SELECT PARAMETER)
```

Default Value: OFF

Automatic restarting of the compressor can cause injury or death

16. Restart Delay

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

```
OPERATION ADJUSTMENT
    RESTART DELAY
      10 SECONDS
 (SELECT PARAMETER)
```

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

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

17. Idle Timer

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

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

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

18. Week Clock Control

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

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

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

Default Value: OFF

Automatic starting of the compressor can cause injury or death

4.2.2 Maintenance Adjust Menu

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

```
ADJUSTMENT MENU
MAINTENANCE ADJUST

(SELECT SUB MENU)
```

1. Maintenance Timers

The six timers under the Maintenance Adjust menu are:

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

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

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

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

Pressing the Enter 

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

button will abort the timer reset.

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

2. Total Cost

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

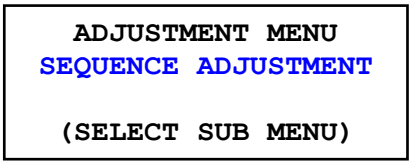
button twice.

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

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

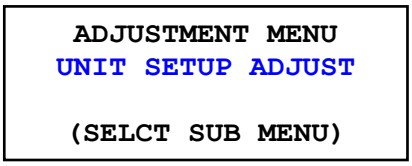
4.2.3 Sequence Adjustment Menu

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



4.2.4 Unit Setup Adjust Menu

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

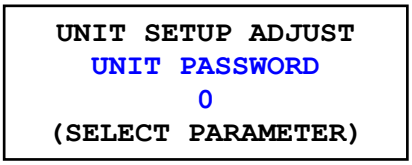


1. Unit Password

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

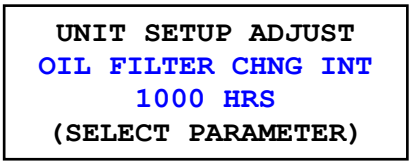
The Following passwords unlock the listed menus for visibility and editing:

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



2. Oil Filter Change Interval

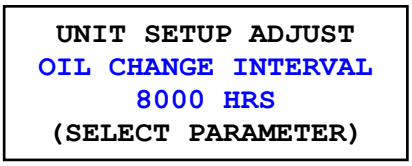
The next item in the Unit Setup Adjust menu is the Oil Filter Change Interval. This value sets the default oil filter change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



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

3. Oil Change Interval

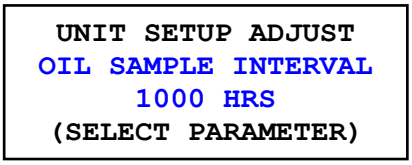
The next item in the Unit Setup Adjust menu is the Oil Change Interval. This value sets the default oil change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



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

4. Oil Sample Interval

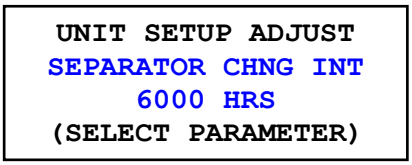
The next item in the Unit Setup Adjust menu is the Oil Sample Interval. This value sets the default oil sample countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



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

5. Separator Element Change Interval

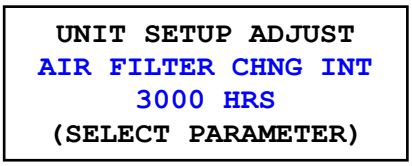
The next item in the Unit Setup Adjust menu is the Separator Element Change Interval. This value sets the default separator change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



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

6. Air Filter Change Interval

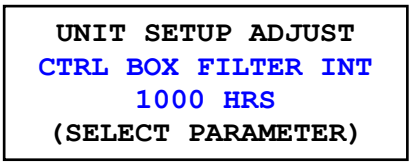
The next item in the Unit Setup Adjust menu is the Air Filter Change Interval. This value sets the default air filter change countdown timer value that gets set under the Maintenance Adjust menu. Setting this parameter to zero will disable the timer and its associated alarms.



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

7. Control Box Filter Change Interval

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



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

8. Motor Lubrication Interval

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

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

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

9. High Plant Pressure Limit

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

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

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

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

10. Over Temperature Shutdown Limit

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

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

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

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

11. Temperature Alarm Limit

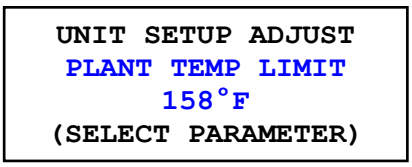
The next item in the Unit Setup Adjust menu is the Temperature Alarm Limit. This value sets the internal temperature limit at which the compressor will give and advisory alarm.

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

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

12. Plant Temperature Shutdown Limit

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

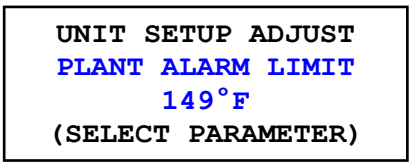


- **Note: This parameter is not visible in all compressor packages.**

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

13. Plant Temperature Alarm Limit

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

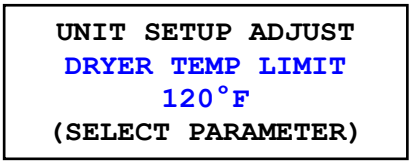


- **Note: This parameter is not visible in all compressor packages.**

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

14. Dryer Temperature Shutdown Limit

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



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

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

15. Dryer Temperature Alarm Limit

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

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

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

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

16. Minimum Target Temperature

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

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

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

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

17. Select Fan Type

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

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

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

18. Motor Jog

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

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

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

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

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

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

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

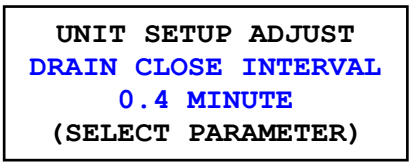
19. Drain Close/Open Intervals

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

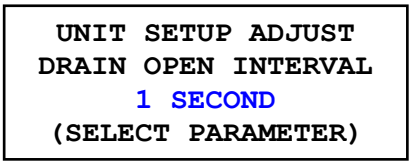
Note: Setting the Drain Open Interval to zero seconds will disable the water drain function.

Example Drain Close Interval Calculation:

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



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

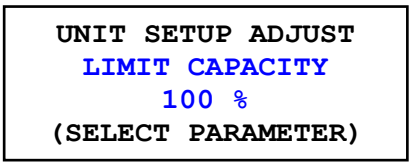


- **Note: These parameters are not visible in packages without a drain valve solenoid installed.**

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

20. Limit Capacity

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



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

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

21. Motor Heater

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

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

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

Default Value: OFF

22. Minimum Target Pressure

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

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

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

23. Oil Type

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

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

Default Value: Compressor model dependent

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

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

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

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

24. Plant Pressure Advisory Timeout

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

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

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

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

25. System Capacity

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

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

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

4.2.5 Time Adjustment Menu

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

```
ADJUSTMENT MENU
  TIME ADJUST

(SELECT SUB MENU)
```

4.2.6 Configuration Adjust Menu

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

```
ADJUSTMENT MENU
CONFIGURATION ADJUST

(SELCT SUB MENU)
```

1. Compressor Model

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

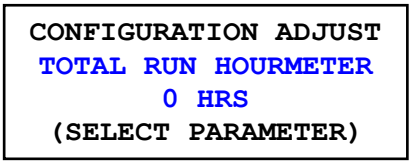
```
CONFIGURATION ADJUST
  COMPRESSOR MODEL
        VST90
 (SELECT PARAMETER)
```

⚠WARNING

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

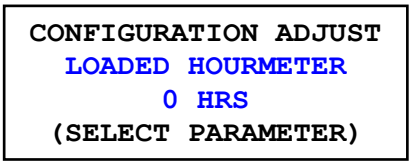
2. Total Run Hour Meter

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



3. Loaded Hour Meter

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



4. Pressure Transducer Zero Set

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

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

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

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

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

Pressing the Enter 

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

button will abort the set point process.

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

5. Distributor Information #1

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

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

6. Distributor Information #2

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

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

7. Energy Cost

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

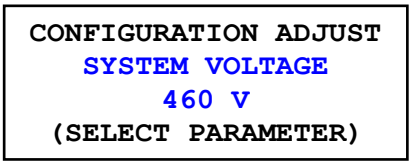
```
CONFIGURATION ADJUST
     ENERGY COST
     0.060 $/KWH
 (SELECT PARAMETER)
```

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

Min Value: 0.001
Max Value: 65.000

8. System Voltage

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

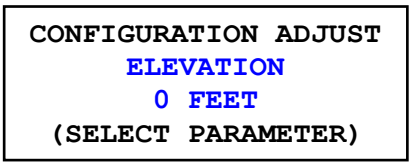


- **Note: This parameter is not visible in packages without a Variable Frequency Drive (VFD) installed.**

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

9. Elevation

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



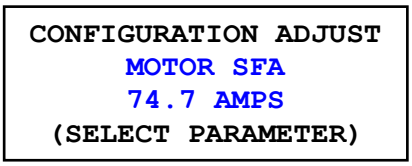
- **Note: This parameter is not visible in packages without a Variable Frequency Drive (VFD) installed.**

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

10. Motor SFA

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

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



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

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

11. Temperature Transducer Offsets

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

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

Navigate to the appropriate temperature transducer offset and press the Enter 

button to select and edit the temperature offset value.

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

Min Value: -9 °
Max Value: 9 °

6 Error Management

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

6.1 VS Limiters

When the AirSmart Controller is installed in a variable speed compressor, there are five limiting functions which will reduce the maximum speed of the compressor by up to ten percent in order to prevent a nuisance shutdown during extreme environmental conditions.

1. Current Limiter

The first limiter function is the Current Limiter which becomes active if the main motor current becomes greater than the Motor NP Current for more than 30 seconds. When the Current Limiter is active, the display will read as shown below. The Current Limiter may become active when the compressor is running at peak capacity, filling an empty system or the air demand exceeds the compressor capacity. If running at less than maximum capacity, the Current Limiter can indicate a problem with the airend or main motor which is drawing excess current.

```
100 PSI        85°F
125 HRS   AUTOMATIC
  AMPS LIM SET nn%
NO SERVICE ADVISORY
```

2. VFD Heatsink Temperature Limiter

The second limiter function is the VFD Heatsink Temperature Limiter which becomes active if the VFD heatsink temperature becomes greater than the prescribed value for that compressor model. When the VFD Heatsink Temperature Limiter is active, the display will read as shown below. The VFD Heatsink Temperature Limiter may become active when the compressor is running at peak capacity while the ambient temperature is elevated.

```
100 PSI        85°F
125 HRS   AUTOMATIC
DRV TMP LIM SET nn%
NO SERVICE ADVISORY
```

3. Ambient Temperature Limiter

The third limiter function is the Ambient Temperature Limiter which becomes active if the ambient temperature becomes greater than 113 °F (45. °C) When the Ambient Temperature Limiter is active, the display will read as shown below.

```
100 PSI         85°F
125 HRS   AUTOMATIC
  AMB LIM SET nn%
NO SERVICE ADVISORY
```

4. Voltage Limiter

The fourth limiter function is the Voltage Limiter which becomes active if the incoming line voltage drops lower than the line System Voltage setting under the Configuration Adjust menu. When the Voltage Limiter is active, the display will read as shown below.

```
100 PSI         85°F
125 HRS   AUTOMATIC
    VOLT LIM nn%
NO SERVICE ADVISORY
```

5. Manual Limiter

The fifth limiter function is the Manual Limiter which becomes active if the Limit Capacity parameter under the Unit Setup Adjust menu is set lower than 100%. When the Manual Limiter is active, the display will read as shown below.

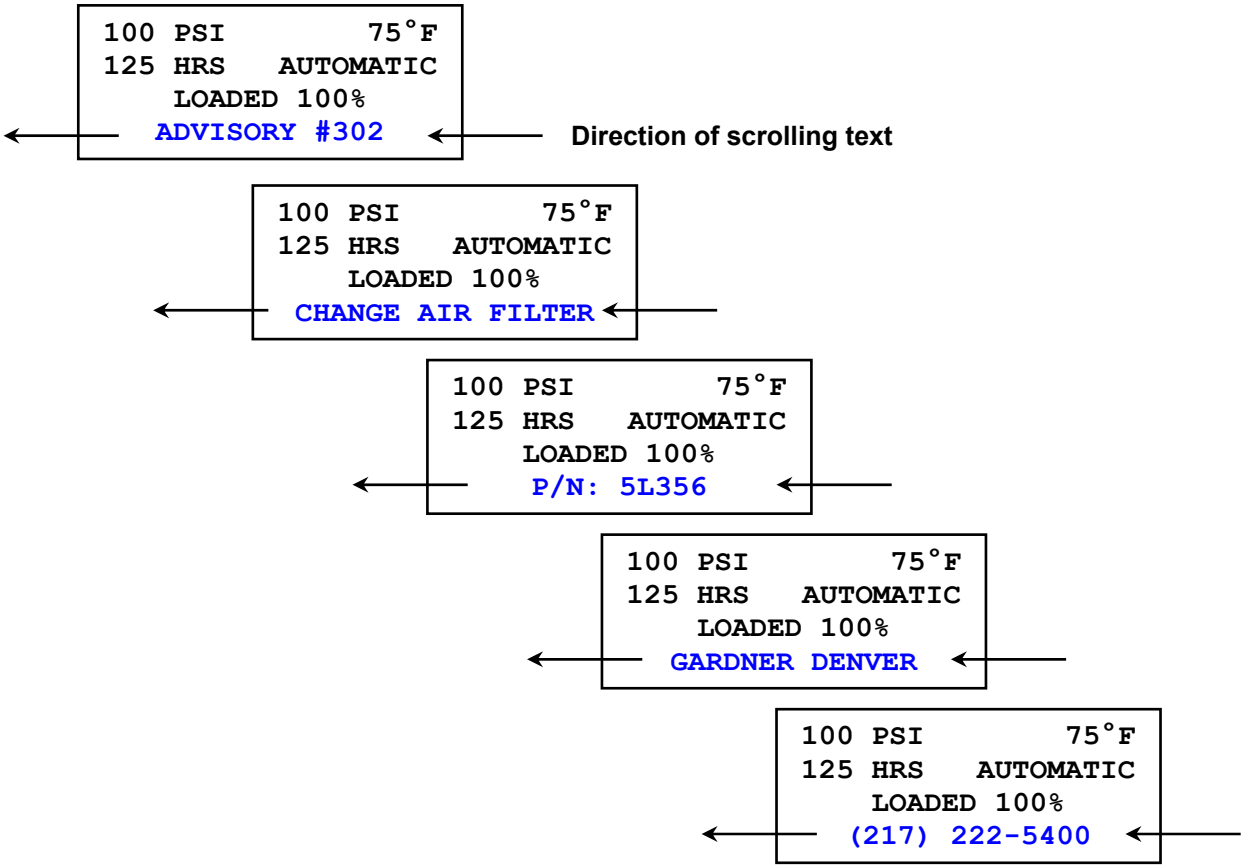
```
100 PSI         85°F
125 HRS   AUTOMATIC
    CAP LIM nn%
NO SERVICE ADVISORY
```

6.2 Advisory Faults

The advisory faults in the AirSmart Controller are designed to alert the user of needed service or that or that certain parameters may be approaching their shutdown level. Advisory faults can be reset while the compressor is running or stopped by pressing the Enter 

button. If the error condition still exists after resetting the advisory fault, the advisory fault will occur again. The status of the compressor at the time of the last six advisories is stored in non-volatile memory, which can be accessed through the Advisory History menu.

Advisory fault information is shown in the fourth line of the control panel display in a scrolling fashion. The advisory number is shown first followed by a short description of the fault. If the advisory indicates that service is necessary, the scrolling information will also include the Gardner Denver part number of the service item and contact information to obtain the service item.



The following table is a list of advisory faults that can occur in the AirSmart Controller:

Advisory	Advisory Text	Description	Action
#301	CHANGE SEPARATOR	Differential pressure > 8 PSIG	Change separator element
#302	CHANGE AIR FILTER	Vacuum switch after inlet air filter has tripped	Change air filter
#303	CHANGE AIR FILTER	Maintenance timer for air filter change has expired	Change air filter and reset timer
#304	CHANGE OIL FILTER	Maintenance timer for oil filter change has expired	Change oil filter and reset timer
#305	CHANGE OIL	Maintenance timer for oil change has expired	Change oil and reset timer
#306	LOW AMB TEMP A	Package discharge (Plant) temperature < 40°F (4°C)	Locate compressor to area where ambient temperature > 32°F (0°C)
#307	LOW AMB TEMP B	Separator temperature < 40°F (4°C)	Locate compressor to area where ambient temperature > 32°F (0°C)
#308	HIGH SEP TEMP	Temperature in separator > 225°F (107°C)	Check oil cooler system functionality or reduce package power
#309	HIGH PLANT TEMP	Temperature at package discharge > 149°F (65°C)	Check air cooler functionality or reduce package power
#310	HIGH INLET TEMP	Temperature at package inlet > 113°F (45°C). On some models, this may trigger at 104°F (40°C)	Wait for ambient temperature to cool
#315	CHANGE SEPARATOR	Maintenance timer for separator element change has expired	Change separator element and reset timer
#316	HIGH DISCH TEMP	Temperature at airend discharge > 225°F (107°C)	Check oil cooler system functionality or reduce package power
#317	HIGH INTERSTG TEMP	Temperature in interstage pipe > 225°F (two-stage package only) (107°C)	Check oil cooler system functionality or reduce package power
#318	OPTIONAL ALARM	Digital input programmed for Optional Alarm has tripped	Check device connected to input

Advisory	Advisory Text	Description	Action
#320	CHANGE OIL FILTER	Pressure switch in oil filter assembly has tripped	Change oil filter
#321	LOW VOLTAGE	Digital input programmed for Low Voltage has tripped	Check line voltage
#322	MOTOR OVERTEMP	Digital input programmed for Motor Over Temperature has tripped	Check main motor(s) temperature or reduce package power
#323	WATER PRESSURE	Digital input programmed for Water Pressure has tripped	Check water pressure
#324	HIGH VIBRATION	Digital input programmed for High Vibration has tripped	Check for source of vibration
#325	LOW DISCH TEMP	Temperature at airend discharge < 185°F (85°C) (two-stage package only)	Check oil cooler system functionality
#326	HIGH DRYER TEMP	Temperature at dryer > 100°F (38°C)	Integrated dryer may have shut down, check dryer functionality
#327	CHANGE MOTOR LUBE	Motor lubrication interval timer has expired	Lubricate motor(s) and reset timer
#328	PLANT PRESSURE	Compressor is unable to maintain target pressure setting	Reduce demand on compressor
#329	LOW OIL PRESSURE	Oil pressure has dropped below (Interstage Pressure + 5 PSI) in two-stage compressor	Change oil filter or check for oil system leaks or plugs
#330	V1 MAX SINK TEMP	Main motor drive heat sink temperature > 175°F (79°C)	Check if control box air has become clogged or ambient temperature too high
#331	V2 MAX SINK TEMP	Second stage motor drive heat sink temperature > 175°F (79°C)	Check if control box air has become clogged or ambient temperature too high
#332	CHNG CTRL BOX FILTER	Control box filter change interval timer has expired	Change or clean control box air filter element
#333	DRYER ALARM	Integrated dryer has shut down	Check dryer functionality
#334	TAKE OIL SAMPLE	The maintenance timer for taking an oil sample has expired	Take an oil sample and reset the timer

6.3 Shutdown Faults

The shutdown faults in the AirSmart Controller are designed to protect the compressor from component failure or extreme environmental conditions. Shutdown faults can be reset after the compressor has stopped by pressing the Stop/Reset 

button. If the error condition still exists as indicated by a blinking Shutdown LED on the control panel, the shutdown fault can not be reset. The status of the compressor at the time of the last six shutdowns is stored in non-volatile memory, which can be accessed through the Shutdown History menu.

Shutdown fault information is shown in the second and third lines of the control panel display. The shutdown number is shown in the second line followed by a short description of the fault in the third line.

```
0 PSI          75°F
   SHUTDOWN # 128
  HIGH DISCH TEMP
NO SERVICE ADVISORY
```

The following table is a list of shutdown faults that can occur in the AirSmart Controller:

Shutdown	Shutdown Text	Description	Action
#101	FAN FAULT	Cooler or vent fan over temp fault	Check fan motor and associated fuses and wiring
#102	DRIVE 1 FAULT	Main motor VFD has shut down	Check main motor VFD operation
#103	DRIVE 2 FAULT	Main motor VFD #2 has shut down (two-stage package only)	Check main motor VFD #2 operation
#104	DRIVE 3 FAULT	Cooler fan motor VFD has shut down (when equipped)	Check cooler fan motor VFD operation
#105	EMERGENCY STOP	Compressor stopped using Emergency Stop button	Pull out Emergency Stop button to its normal position
#106	OPEN XDUCER XD5	Connection to pressure transducer PT5 is open	Check wiring between pressure transducer PT5 and controller
#107	HIGH PLANT PRES	Pressure at package discharge > 190 PSIG (13 bar)	Check for sources of high system pressure
#108	SHORTED XDUCER XD5	Connection to pressure transducer PT5 is shorted	Check wiring between pressure transducer PT5 and controller
#109	OPEN XDUCER XD4	Connection to pressure transducer PT4 is open	Check wiring between pressure transducer PT4 and controller
#110	HIGH SEP PRES	Pressure in separator tank > 190 PSIG (13 bar)	Check for sources of high system pressure
#111	SHORTED XDUCER XD4	Connection to pressure transducer PT4 is shorted	Check wiring between pressure transducer PT4 and controller
#112	OPEN XDUCER XD3	Connection to pressure transducer PT3 is open	Check wiring between pressure transducer PT3 and controller
#113	HIGH RESVR PRES	Pressure at airend discharge > 190 PSIG (13 bar)	Check for sources of high system pressure
#114	SHORTED XDUCER XD3	Connection to pressure transducer PT3 is shorted	Check wiring between pressure transducer PT3 and controller
#115	OPEN XDUCER XD2	Connection to pressure transducer PT2 is open	Check wiring between pressure transducer PT2 and controller

Shutdown	Shutdown Text	Description	Action
#116	HIGH INT PRES	Pressure in interstage pipe > 190 PSIG (13 bar)	Check for sources of high system pressure
#117	SHORTED XDUCER XD2	Connection to pressure transducer PT2 is shorted	Check wiring between pressure transducer PT2 and controller
#118	OPEN XDUCER XD1	Connection to pressure transducer PT1 is open	Check wiring between pressure transducer PT1 and controller
#120	SHORTED XDUCER XD1	Connection to pressure transducer PT1 is shorted	Check wiring between pressure transducer PT1 and controller
#121	OPEN THERM T5	Connection to thermistor TT5 is open	Check wiring between thermistor TT5 and controller
#122	HIGH PKG DISCH TMP	Temperature at package discharge > 158°F (70°C)	Check air cooler functionality or reduce package power
#123	SHORTED THERM T5	Connection to thermistor TT5 is shorted	Check wiring between thermistor TT5 and controller
#124	OPEN THERM T4	Connection to thermistor TT4 is open	Check wiring between thermistor TT4 and controller
#125	HIGH SEP TEMP	Temperature in separator > 240°F (116°C)	Check oil cooler system functionality or reduce package power
#126	SHORTED THERM T4	Connection to thermistor TT4 is shorted	Check wiring between thermistor TT4 and controller
#127	OPEN THERM T3	Connection to thermistor TT3 is open	Check wiring between thermistor TT3 and controller
#128	HIGH DISCH TEMP	Temperature at airend discharge > 240°F (116°C)	Check oil cooler system functionality or reduce package power
#129	SHORTED THERM T3	Connection to thermistor TT3 is shorted	Check wiring between thermistor TT3 and controller
#130	OPEN THERM T2	Connection to thermistor TT2 is open	Check wiring between thermistor TT2 and controller
#131	HIGH INTERSTG TMP	Temperature in interstage pipe > 240°F (116°C) (two-stage package only)	Check oil cooler system functionality or reduce package power

Shutdown	Shutdown Text	Description	Action
#132	SHORTED THERM T2	Connection to thermistor TT2 is shorted	Check wiring between thermistor TT2 and controller
#133	OPEN THERM T1	Connection to thermistor TT1 is open	Check wiring between thermistor TT1 and controller
#134	HIGH INLET TEMP	Temperature at package inlet > 113°F (45°C)	Ambient temperature too high for safe compressor operation
#135	SHORTED THERM T1	Connection to thermistor TT1 is shorted	Check wiring between thermistor TT1 and controller
#136	HIGH SEPRATR RATE	Rapid temperature rise in air/oil separator tank detected	Check separator element or oil cooler system functionality
#137	HIGH DISCH RATE	Rapid temperature rise at airend discharge detected	Check airend oil injection or oil cooler system functionality
#138	FAN STARTER	Fan Aux input does not match Cooler Start digital output	Check fan contactor operation
#139	DRIVE 1 STARTER	Main motor VFD start failure	Check main motor VFD operation
#140	DRIVE 2 STARTER	Main motor VFD #2 start failure (two-stage package only)	Check main motor VFD #2 operation
#141	DRIVE 3 STARTER	Cooler fan motor VDF start failure	Check cooler fan motor VFD operation
#142	POWER FAILURE	Loss of power to compressor package	Check line voltage
#143	XB1 COMM ERROR	Controller internal communications failure	Replace controller
#144	DRIVE 1 COMM ERROR	Communications failure between controller and main motor VFD #1	Check wiring or communications parameters in main motor VFD
#145	DRIVE 2 COMM ERROR	Communications failure between controller and main motor VFD #2 (two-stage package only)	Check wiring or communications parameters in main motor VFD #2
#146	DRIVE 3 COMM ERROR	Communications failure between controller and cooler fan motor VFD (when equipped)	Check wiring or communications parameters in cooler fan motor VFD

Shutdown	Shutdown Text	Description	Action
#147	OPTIONAL SHUTDOWN	Digital input programmed for Optional Shutdown has tripped	Check device connected to input
#148	LOW VOLTAGE	Digital input programmed for Low Voltage has tripped	Check voltage relay
#149	PHASE SEQUENCE	Digital input programmed for Phase Sequence has tripped	Check phase relay
#150	MOTOR OVERTEMP	Digital input programmed for Motor Over Temperature has tripped	Check main motor(s), motor overload relay or reduce package power
#151	WATER PRESSURE	Digital input programmed for Water Pressure has tripped	Check water pressure
#152	HIGH VIBRATION	Digital input programmed for High Vibration has tripped	Check for source of vibration
#153	ZERO XDUCER XD5	Pressure transducer PT5 not properly zeroed or vacuum present in system	Zero pressure transducer PT5 or remove vacuum
#154	ZERO XDUCER XD4	Pressure transducer PT4 not properly zeroed or vacuum present in system	Zero pressure transducer PT4 or remove vacuum
#155	ZERO XDUCER XD3	Pressure transducer PT3 not properly zeroed or vacuum present in system	Zero pressure transducer PT3 or remove vacuum
#156	ZERO XDUCER XD2	Pressure transducer PT2 not properly zeroed or vacuum present in system	Zero pressure transducer PT2 or remove vacuum
#157	ZERO XDUCER XD1	Pressure transducer PT1 not properly zeroed or vacuum present in system	Zero pressure transducer PT1 or remove vacuum
#160	CONTROLLER ERROR	Controller internal failure	Replace controller
#161	EEPROM RESTORED	Main parameter set in non-volatile memory restored with backup set	No action required

Shutdown	Shutdown Text	Description	Action
#164	INVALID MODEL	Valid compressor model not selected during factory setup or controller replacement	Select valid compressor model Configuration Adjust menu
#165	DC POWER LOW	24 VDC input to controller < 18.5 VDC +/- 1.5 VDC	Check 24 VDC power supply
#166	HIGH DRYER TEMP	Temperature at dryer > 120°F (49°C)	Integrated dryer may have shut down. Check dryer functionality
#167	OPEN THERM T6	Connection to thermistor TT6 is open	Check wiring between thermistor TT6 and controller
#168	SHORTED THERM T6	Connection to thermistor TT6 is shorted	Check wiring between thermistor TT6 and controller
#169	CM TABLE INVALID	Model Table in memory has been corrupted	Load new Model Table values
#170	ACTUATOR COMM ERROR	Communications failure between controller and precision mixing valve	Check wiring or mixing valve operation
#171	LOW OIL PRESSURE	Oil pressure has dropped below (Interstage Pressure + 2.5 PSI) in two-stage compressor	Change oil filter or check for oil system leaks or plugs.
#172	SEQUENCER COMM ERR	Communications failure between controller and communications module	Remove and reconnect or replace communications module
#173	OPEN XDUCER XD6	Connection to pressure transducer PT6 is shorted	Check wiring between pressure transducer PT6 and communications module
#174	SHORTED XDUCER XD6	Connection to pressure transducer PT6 is open	Check wiring between pressure transducer PT6 and communications module
#175	ZERO XDUCER XD6	Pressure transducer PT6 not properly zeroed or vacuum present in system	Zero pressure transducer PT6 or remove vacuum

Shutdown	Shutdown Text	Description	Action
#176	OPEN XDUCER XD7	Connection to pressure transducer PT7 is shorted	Check wiring between pressure transducer PT7 and communications module
#177	SHORTED XDUCER XD7	Connection to pressure transducer PT7 is open	Check wiring between pressure transducer PT7 and communications module
#178	ZERO XDUCER XD7	Pressure transducer PT7 not properly zeroed or vacuum present in system	Zero pressure transducer PT7 or remove vacuum
#179	MAIN STARTER	Motor Aux digital input does not match Main Contactor digital output	Check main motor contactor operation
#201	LOW SUMP PRES	Pressure in reservoir < 15 PSIG (1 bar) after one minute of compressor operation	Check inlet valve or minimum pressure valve operation
#202	CHANGE SEPARATOR	Differential pressure over separator element > 15 PSIG (1 bar)	Change separator element

6.4 Transducer Locations

Gardner Denver compressors are equipped with a number of temperature and pressure transducers to monitor status and control the machine. The following table is a list of the various locations where these transducers are typically used depending on the AirSmart Controller installed in the unit.

Transducer Reference	AirSmart Controller P/N: 89864799	AirSmart Controller with Expansion Board P/N: 300ETK1173	AirSmart Controller Communications Module P/N: 301ETK1173
TT1	Inlet Temperature	Inlet Temperature	
TT2	Airend Discharge Temperature	Interstage Temperature (two-stage only)	
TT3		Airend Discharge Temperature	
TT4		Separator Temperature (dry side)	
TT5		Package Discharge (Plant) Temperature	
TT6	Dryer Temperature (connected to VFD analog input)		
PT1	Reservoir Pressure	Oil Pressure	
PT2	Package Discharge (Plant) Pressure	Interstage Pressure (two-stage only)	
PT3		Reservoir Pressure (wet side)	
PT4		Separator Pressure (dry side)	
PT5		Package Discharge (Plant) Pressure	
PT6			System Pressure (sequencing)
PT7			Package Discharge (Plant) Pressure

7 Auxiliary Inputs and Outputs

As mentioned earlier in this manual, the AirSmart Controller has the ability to control up to three variable speed motor drives, read more than ten analog inputs and a control a host of digital I/O in order to achieve system objectives. The digital and analog I/O connect to the AirSmart Controller through a highly flexible mapping system which enables each input and output to perform a wide variety of functions. The following sections describe how to choose and configure the AirSmart's I/O for the correct task.

Changing of inputs and outputs which have already been configured at the factory can cause personal injury or damage to equipment.

7.1 Operating Device Addresses

There are four defined function sets, one each for digital inputs, digital outputs, analog inputs and analog outputs. Each function in each set has an address, which directs the corresponding function to the desired input or output. The functions and addresses are located in "PROG I/O ADJUST" menu, which becomes visible when **8412** is entered as the password parameter under the "UNIT SETUP ADJUST" menu.

The controller can map input and output functions to unique input and output ports. System inputs and outputs are addressed numerically. Each operating device in the system has a unique number as shown in the following table.

Operating Device	Unit Number
AirSmart Controller Core Board	1
AirSmart Controller Expansion Board	2
Drive 1	3
Drive 2	4
Drive 3	5
Modbus Registers	6
AirSmart Communications Module	7

A unit's base address is formed by multiplying the unit number by sixteen (16). A corresponding unit port address is formed by adding the device's port number to the unit base address. For example, the address for the AirSmart Controller's Expansion Board digital input #2 would be 2 × 16 + 2 = 34. Same addressing principal applies with all inputs and outputs, digital or analog.

7.2 Digital Input/Output Functions

The following tables are a list of the various digital input and output functions that are avaialble in the AirSmart Controller. A digital input or output fuction is active only when a valid address is assigned to that function. Any function is disabled when the address is set to zero.

Note: Functions listed in **BOLD** print may be pre-programmed at the factory. **DO NOT** change the address of these I/O functions or the compressor will not function correctly.

Digital Input Function	Description
Fan Fault	Input used to signal a fan motor over temperature fault.
Fan Auxiliary	Used to signal the failure of the fan motor starter.
Remote Halt	Used to remote start/stop compressor.
Remote Halt Enable	Used to enable/disable Remote Halt input.
Advisory Alarm	Used to trigger a generic advisory alarm.
Shutdown Fault	Used to trigger a generic shutdown fault.
Air Filter	Used to signal a dirty air filter.
Oil Filter	Used to signal a dirty oil filter.
Low Voltage Relay Alarm	Used to signal low line voltage detected by external device.
Low Voltage Relay Shutdown	
Phase Sequence	Used to signal incorrect connection of three phase power input detected by external device.
Motor Overtemp Alarm	Used to signal motor over temperature or motor overload relay trip.
Motor Overtemp Shutdown	
Water Pressure Alarm	Used to signal high water pressure in water cooled systems.
Water Pressure Shutdown	
High Vibration Alarm	Used to signal high vibration detected by external device.
High Vibration Shutdown	
Clock Override	Used to disable clock controlled functions.
Reset Alarm	Used to control remote rest of alarms.
Heavy Consumer Start	Used to control staggered starting of multiple compressors.
Heavy Consumer Load	Used to control staggered loading of multiple compressors.
Remote Load	Used to remotely load the compressor
Remote Load Enable	Used to enable/disable Remote Load input.
Dryer Alarm	Used to signal a dryer alarm
Secondary Pressures	Used to switch control to secondary pressure offset.
Motor Auxiliary	Used to signal the failure of the main motor starter.
Unload	Used to remotely unload the compressor.

Digital Output Function	Description
Advisory Alarm	Used to indicate an active advisory alarm.
Shutdown Fault	Used to indicate an active shutdown alarm.
Inlet Valve	Used to control the inlet valve of the compressor.
Blowdown Valve	Used to control the blowdown valve of the compressor.
Oil Flow A	Used to control the airend coolant oil injection in some compressor models.
Oil Flow B	Used to control the airend coolant oil injection in some compressor models.
Oil Flow C	Used to control the airend coolant oil injection in some compressor models.
Cooler Start	Used to control the cooler fan or water source in some compressor models.
Auto Operation	Used to indicate a compressor is operating in the Automatic Mode.
Run	Used to indicate the compressor's main motor is running.
Delayed Break Run	Used to indicate the compressor's main motor is running but stays active for ten minutes after the motor stops.
Standby	Used to indicate the compressor is waiting to run.
Dryer Start	Used to control an integrated dryer in some compressor models.
Heater Start	Used to control integrated heater in some compressor models.
Water Drain	Used to control a timed water drain or oil scavenge system in some compressor models.
Heavy Consumer	Used to control staggered starting of multiple compressors.
Maintenance Alarm	Used to indicate an active advisory alarm.
Any Alarm	Used to indicate an active advisory or shutdown alarm.
Good To Go	Used to indicate compressor is started or running.
Main Contactor	Used to control the main motor starter in fixed speed compressor models.
Start Contactor	Used to control the start contactor in a Wye-Delta motor starter in fixed speed compressor models.
IVO - Inlet Valve Open	Used to modulate the inlet valve in some compressor models.
IVC - Inlet Valve Close	Used to modulate the inlet valve in some compressor models.
TVO - Turn Valve Open	Used to modulate the turn valve in some compressor models.
TVC - Turn Valve Close	Used to modulate the turn valve in some compressor models.

Digital I/O functions can be programmed to be either active high or active low by using the Plus + and Minus − keys to change the polarity of the input. A positive address value corresponds to an active high function and a negative address value likewise corresponds to an active low function.

7.3 Analog Input/Output Functions

The following tables are a list of the various analog input and output functions that are availble in the AirSmart Controller. An analog input or output fuction is active only when a valid address is assigned to that function. Any function is disabled when the address is set to zero.

Note: Functions listed in **BOLD** print may be pre-programmed at the factory. **DO NOT** change the address of these I/O functions or the compressor will not fuction correctly.

Analog Input Function	Description
Inlet Temperature	Used to indicate the compressor air inlet temperature.
Interstage Temperature	Used to indicate the interstage temperature in two-stage compressor models.
Discharge Temperature	Used to indicate the airend discharge temperature.
Separator Temperature	Used to indicate the dry side separator temperature.
Plant Temperature	Used to indicate the package discharge temperature.
Dryer Temperature	Used to indicate the internal temperature of an integrated dryer in some compressor models.
Oil Temperature	Used to indicate the oil temperature in some compressor models.
Inlet Pressure	Used to indicate the compressor inlet pressure.
Interstage Pressure	Used to indicate the interstage pressure in two-stage compressor models.
Reservoir Pressure	Used to indicate the wet side reservoir pressure.
Separator Pressure	Used to indicate the dry side reservoir pressure.
Plant Pressure	Used to indicate the package discharge pressure. Also used as control pressure reference to AirSmart Controller.
Oil Pressure	Used to indicate the oil pressure in some compressor models.
System Pressure	Used to indicate the control pressure in a sequenced group of compressors.
Current Sensor	Used to indicate the main motor current in some fixed speed compressor models.

Analog Output Function	Description
Oil Valve Command	Used to control the precision mixing valve in some compressor models.
Plant Pressure	Used to indicate the current plant pressure value.
Discharge Temperature	Used to indicate the current discharge temperature value.
Voltage Controlled Fan	Used to control the variable speed cooler fan in some compressor models.

7.4 Example “RUN” Digital Output Signal

The following example shows how to provide a "RUN" output signal on single-stage, variable speed VS20 through VS70 compressor. This procedure can also be used on other machines; however the I/O addresses will need to be changed. Provided the VS machine does not have an integrated dryer, there are two outputs that can be programmed to serve as a “RUN” signal. There is a 24 VDC output on terminal block A10 (ground reference on B6 thru B10) and there is also a N.O relay contact between terminal blocks A14 and B14. Either one of these contact points can be programmed to be active when the compressor is running.

1. Press the Enter ENTER key on the display to access the Adjustment menu tree.
2. Use Right ▶ or Left ◀ keys to navigate to the Unit Setup Adjust menu.
3. Press the Enter ENTER key to enter the Unit Setup Adjust menu.
4. The Unit Password parameter will be the first item in the Unit Setup Adjust menu. Press the Enter ENTER key to change the Password to **8412**.
5. Use the Plus + and Minus − keys the change the value of each digit.
6. Use the Right ▶ or Left ◀ keys to select individual password digits.
7. Press the Enter ENTER key to confirm the password value.
8. Press the Stop/Reset STOP/RESET key to return to the Adjustment menu tree.
9. Press the Right ▶ key twice to navigate to the Prog I/O Adjust menu.
10. Press the Enter ENTER key to access the Prog I/O Adjust menu.
11. To use terminals A14/B14 (N.O. relay contact) for the "RUN" signal, skip to step #19 below.
12. To use terminal A10 for the "RUN" signal, continue with step #13.
13. Press the Down ▼ key to navigate to the "RUN" Digital Output address. The controller display should read as below.

```
PROG I/O ADJUST
RUN
0 DIGTIAL OUT
(SELECT PARAMETER)
```

14. Press the Enter key to edit the I/O address for the "RUN" signal. Use address **20** for terminal A10.

15. Use the Plus and Minus keys the change the value of each digit.

16. Use the Right or Left keys to select individual address digits.

17. Press the Enter key to confirm the address value. The controller display should read as below.

```
PROG I/O ADJUST
      RUN
20 DIGTIAL OUT
(SELECT PARAMETER)
```

18. Skip now to step #28.

19. To use terminals A14/B14 (N.O. relay contact) for the "RUN" signal, continue with step #20 below.

20. Press the Down key to navigate to the "ANY ALARM" Digital Output address. The controller display should read as below.

```
PROG I/O ADJUST
   ANY ALARM
50 DIGTIAL OUT
(SELECT PARAMETER)
```

21. We must first set this address to **0** in order to disable this function so that the relay output can be re-used for the "RUN" signal.

22. Press the Enter key to edit the I/O address for the "ANY ALARM" signal.

23. Use the Plus and Minus keys the change the value of each digit.

24. Use the Right or Left keys to select individual address digits.

25. Press the Enter key to confirm the address value. The controller display should read as below.

```
PROG I/O ADJUST
   ANY ALARM
 0 DIGTIAL OUT
(SELECT PARAMETER)
```

26. Press the Up key to navigate to the "RUN" Digital Output address.

27. Skip back to step #14 except that you need to use address **50** for the relay output instead of address 20 as stated in step #14.

28. Press the Stop/Reset 

key twice. The controller display will read as below.

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

29. Press the Enter 

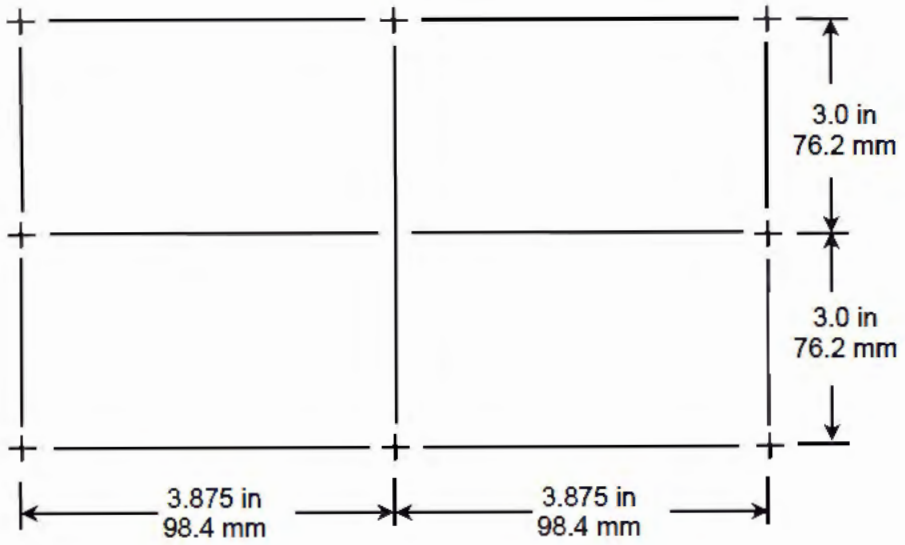
key to permanently save to changed parameters in the controller's memory.

8 Technical Data

8.1 All-In-One AirSmart Controller

Outside dimensions for the All-In-One AirSmart Controller and Display Unit:
9.0 in x 7.5 in x 1.8 in
228.6 mm x 190.5 mm x 45.7 mm

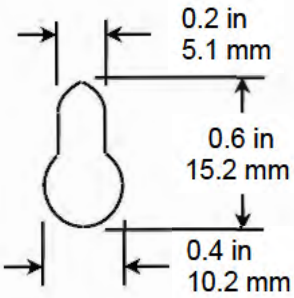
Mounting arrangement for the All-In-One AirSmart Controller and Display Unit:

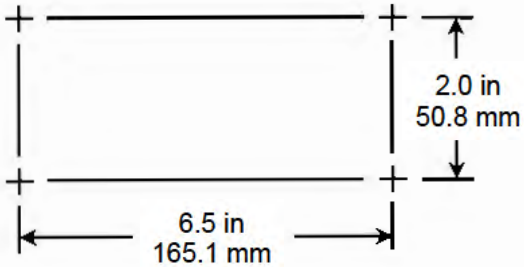


8.2 Full-Sized AirSmart Controller

Outside dimensions for Full-Sized AirSmart Controller with connectors installed:
7.0 in x 5.1 in x 2.4 in
177.8 mm x 129.5 mm x 61.0 mm

Mounting arrangement for Full-Sized AirSmart Controller:





8.3 Agency Certifications

The AirSmart Controller is UL Recognized in the United States and Canada under File No.E150840

8.4 Environmental Ratings

Operating temperature range: -40°F to 185°F (-40°C to 85°C)
Storage temperature range: -67°F to 300°F (-55°C to 150°C)
Humidity: 0 to 95% non-condensing

8.5 Electrical Ratings

DC power input (P1 on Core board): 24 VDC +/- 10% @ 150 mA.

Digital Inputs (P2 on Core board):
Four 0 to 24 VDC inputs - Low = 0 to 4 VDC / High = 20 - 24 VDC.

Digital Inputs (P10 on Expansion board):
Four 0 to 24 VDC inputs - Low = 0 to 4 VDC / High = 20 to 24 VDC.

Digital Outputs (P3 on Core board):
Four 24 VDC outputs @ 2.6 A continuous.

Digital Outputs (P12 on Expansion board):
Five 24 VDC outputs @ 800 mA continuous.

Form-C relay output (P13 on Expansion board):
One relay contact - Rating: 125 mA @ 250 VAC, 2.0 A @ 30 VDC.

Analog Inputs (P4, P5 on Core Board): Four 0 – 5 VDC inputs.
Two configured for use with 2-wire, 3 kOhm, NTC, 150°C thermistors.
Two configured for use with 250 PSI, 0.5 – 4.5 VDC ratiometric output transducers.

Analog Inputs (P14, P15 on Expansion Board): Six 0 – 5 VDC inputs.
Three configured for use with 2-wire, 3 kOhm, NTC, 150°C thermistors.
Three configured for use with 250 PSI, 0.5 – 4.5 VDC ratiometric output transducers.

Gardner Denver

Specifications subject to change without notice.

 Litho in U.S.A.

For additional information contact your local representative or

Gardner Denver Compressor Division,
1800 Gardner Expressway, Quincy, Illinois 62305

Telephone: (800) 682-9868
FAX: (217) 224-7814

Visit our Web Site: www.gardnerdenver.com

Sales and Service in all major cities.

GARDNER DENVER

13-17-604
Version: 02
October 2, 2009

AIRSMART™ CONTROLLER COMM MODULE

USER'S MANUAL

WARNING – PROHIBITION – MANDATORY LABEL INFORMATION

Gardner Denver positive displacement blowers 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 blower package, to alert users of the following conditions:

⚠ DANGER

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

Asphyxiation Hazard – Poisonous Fumes or Toxic Gas in Compressed Air

⚠CAUTION

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

Burn Hazard – Hot Surface

PROHIBITION - MANDATORY ACTION REQUIREMENTS

Do Not Operate Blower with Guard Removed

Lockout Electrical Equipment in De-Energized State

Do Not Lift Equipment with Hook – No Lift Point

Loud Noise Hazard – Wear Hearing Protection

Handle Package at Forklift Points Only

Read the Operator's Manual Before Proceeding with Task

SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious. Some general safety precautions are given below:

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

- **Keep fingers and clothing away from rotating fan, belt drive, etc.**
- **Disconnect the blower unit from its power source, lockout and tag out 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 blower 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 tag out 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 blower are required.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **An Excess Flow Valve should be on all compressed air supply hoses exceeding 1/2 inch inside diameter (OSHA Regulation, Section 1926.302).**
- **Do not exceed the rated maximum pressure values shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

Table of Contents

1 General Information

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

The AirSmart Communications Module is an extension of the AirSmart Controller, which provides a means of sequencing multiple compressors or blowers together so that they may act as one machine. The AirSmart Communications Module also provides the ability to monitor machine operation from a remote location through serial and Ethernet connections. Finally, the AirSmart Communications Module can start and stop a machine up to seven different times using a programmable week clock.

1.1 AirSmart Communications Module Features

- ✓ Easy Installation.
- ✓ Battery-backed real time clock.
- ✓ Week clock timer with seven programmable start/stop times.
- ✓ Sequencing control for up to eight compressors or blowers.
- ✓ Two additional pressure transducer inputs for system pressure.
- ✓ Remote monitoring through RS-232 serial port on 9-pin D-Sub connector.
- ✓ Remote monitoring through IEEE 802.3 100 megabit Ethernet port on RJ-45 connector.

2 Communications Module Installation

The AirSmart Communication Module is simple to install. Follow the steps below to attach the Communications Module to the AirSmart Controller.

1. Step 1 – Remove all power from the compressor or blower package. Make sure the electrical disconnect is OFF AND LOCKED OUT in accordance with the lockout/tagout procedure. After power has been removed, open the control box to gain access to the AirSmart Controller.

Failure to observe lockout/tagout procedures can cause injury or death!

Step 2 – Remove the rubber plug on the enclosure of the AirSmart Controller to expose the expansion connector as seen in Figure 1 and Figure 2.

Figure 1 - Remove Rubber Cover – Value Controller

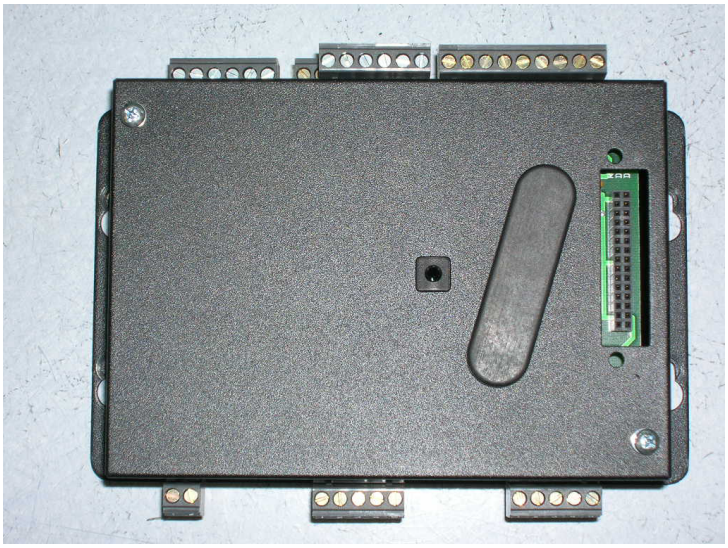


Figure 2 – Remove Rubber Cover – Full Controller

Note – The AirSmart Controllers shown in the photos are not installed in a machine. It is **NOT** necessary to remove the AirSmart Controller from the machine to install the Communications Module.

Step 3 – Inset the connector protruding from the backside of the Communications Module into the expansion connector on the AirSmart controller, as seen in Figure 3, and press into place. **Do not** force the connectors together; the two pieces should fit together easily.

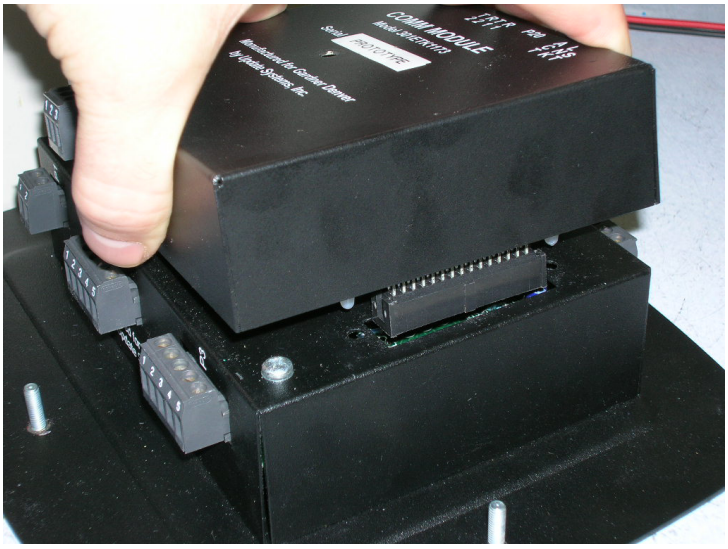


Figure 3 - Insert Comm Module Connector

Step 4 – Secure the Communications Module in place by tightening the captive screw with a #2 Phillips screwdriver as seen in Figure 4 below.

Figure 4 - Tighten Captive Screw

Step 5 – Be sure to read all sections below for proper configuration of the AirSmart Communications Module.

3 AirSmart Controller Menus

3.1 Operational Menus

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

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

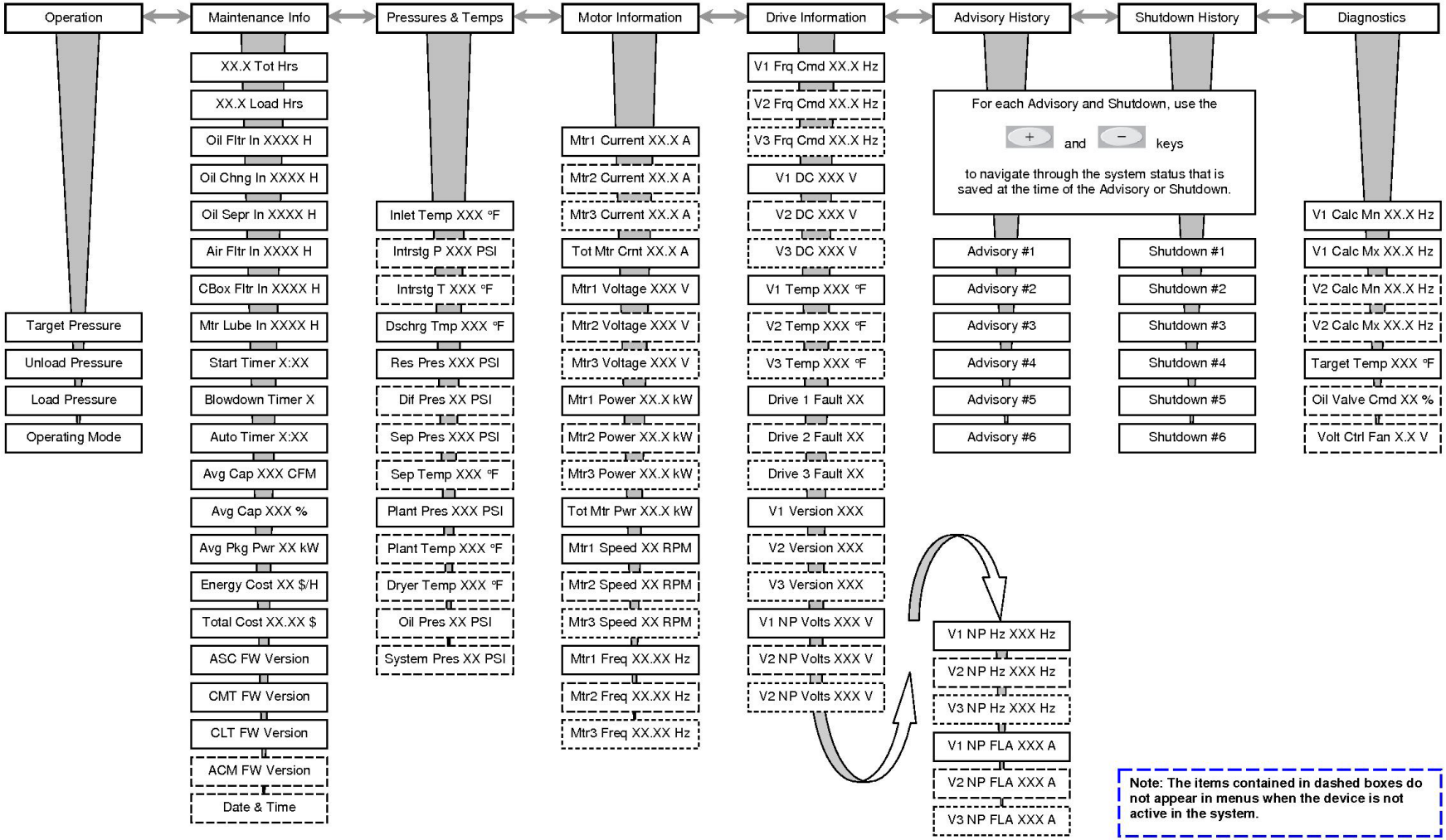
- *Note: Advisory fault information is also shown in the fourth line of the display. If an advisory is active and the fault condition has not been cleared, the Operational Menu text will be periodically replaced by the advisory text*.

- *Note: Only the information associated with the Communications Module is shown below. For a full listing of other menu items, refer to the AirSmart Controller User's Manual, Gardner Denver document 13-17-600 for the compressor application or IQ-7-200 for the blower application.*

AirSmart Controller Operational Menus (Compressor Application)

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

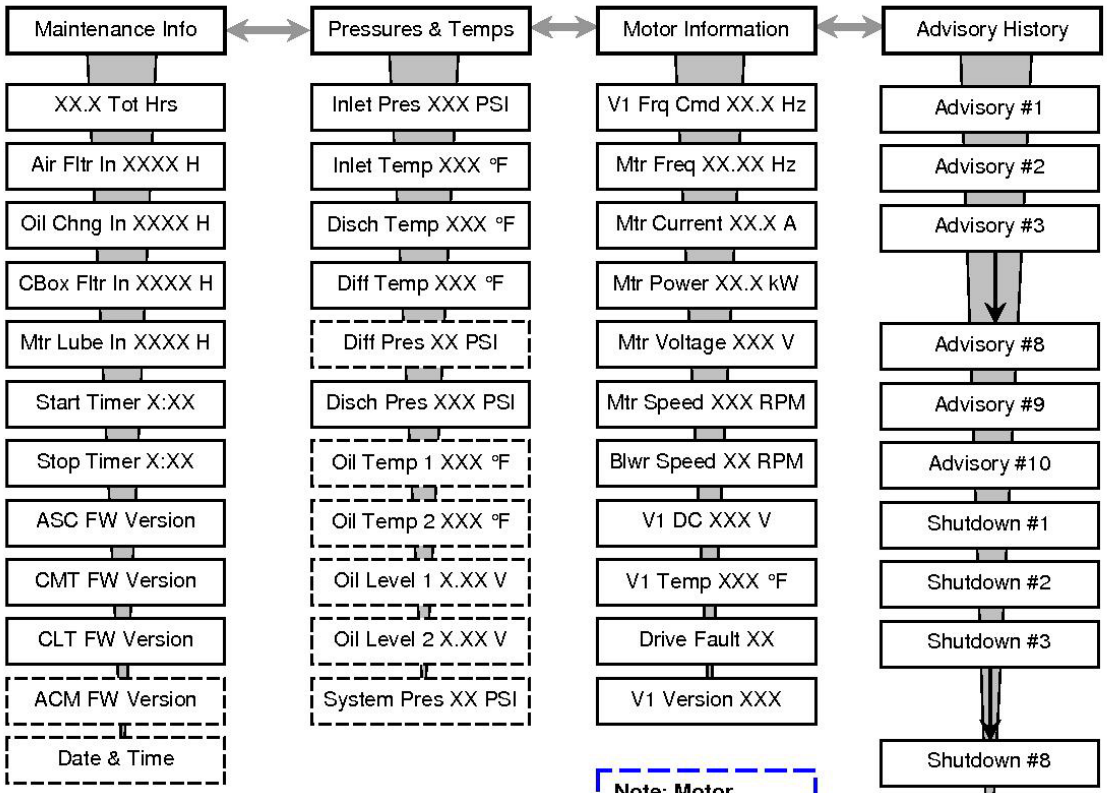
Use the ▲ ▼ keys to navigate through the vertical menu items.



AirSmart Controller Operational Menus (Blower Application)

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

Use the keys to navigate through the vertical menu items.



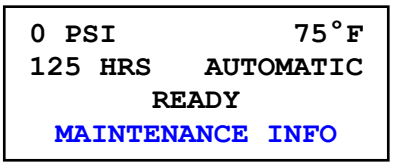
Note: The items contained in dashed boxes do not appear in menus when the device is not installed in the package.

Note: Motor Information menu not visible when VFD not installed in package.

For each Advisory and Shutdown, use the + and − keys to navigate through the system status that is saved at the time of the Advisory or Shutdown.

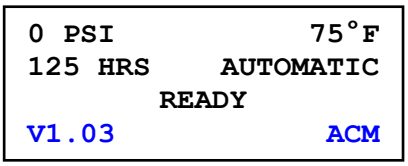
3.1.1 Maintenance Info Menu

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



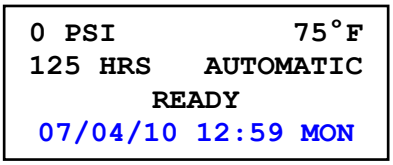
1. ACM Firmware Version

When the AirSmart Communications Module (ACM) is installed, the version number of the firmware loaded in the module is displayed as the next to last item in the Maintenance Info menu.



2. Time and Date

The last item in the Maintenance Info Menu is the current time and date kept by the battery backed, real time clock on the Communications Module. The time and date can be changed under the Time Adjust menu.



The date & time format reads as follows:

YY/MM/DD HH:MM DOW

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

3.2 Adjustment Menus

The Adjustment Menus are only available when the compressor or blower is stopped. To enter the Adjustment Menu tree, press the Enter 

button and then press the Right  or Left  buttons to access up to six different menus. Once the desired menu heading is shown in the second line of the display, press the Enter 

button again to access that menu. Use the Up  and Down  buttons to access the individual items in the selected menu, which are also shown in the second line of the display.

It is not necessary to navigate back to the top of a particular menu in order to enter another menu. Simply press the Stop/Reset 

button to go back to the heading of the current menu and then use the Right  or Left  buttons again to find the desired menu heading as described above.

To completely exit from the Adjustment menus, press the Stop/Reset 

button again. If parameter changes have been made, the following screen will appear.

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

To permanently save the changes that were made, press the Enter 

button. If the Stop/Reset 

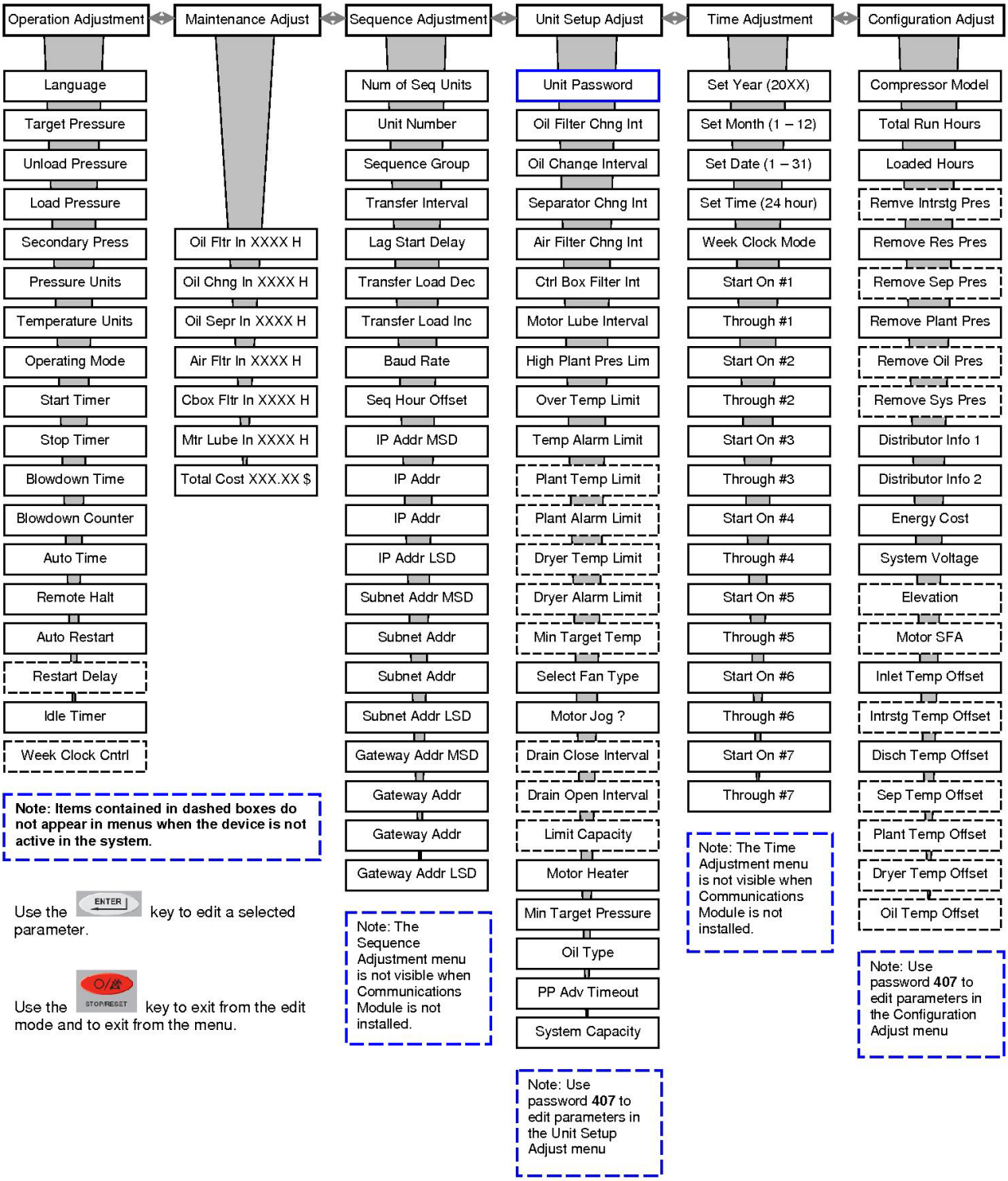
button is pressed, the parameter changes that have been made are still valid but will be lost the next time the compressor is disconnected from main power.

- *Note: Only the information associated with the Communications Module is shown below. For a full listing of other menu items, refer to the AirSmart Controller User's Manual, Gardner Denver document 13-17-600 for the compressor application or IQ-7-200 for the blower application.*

AirSmart Controller Adjustment Menus (Compressor Application)

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

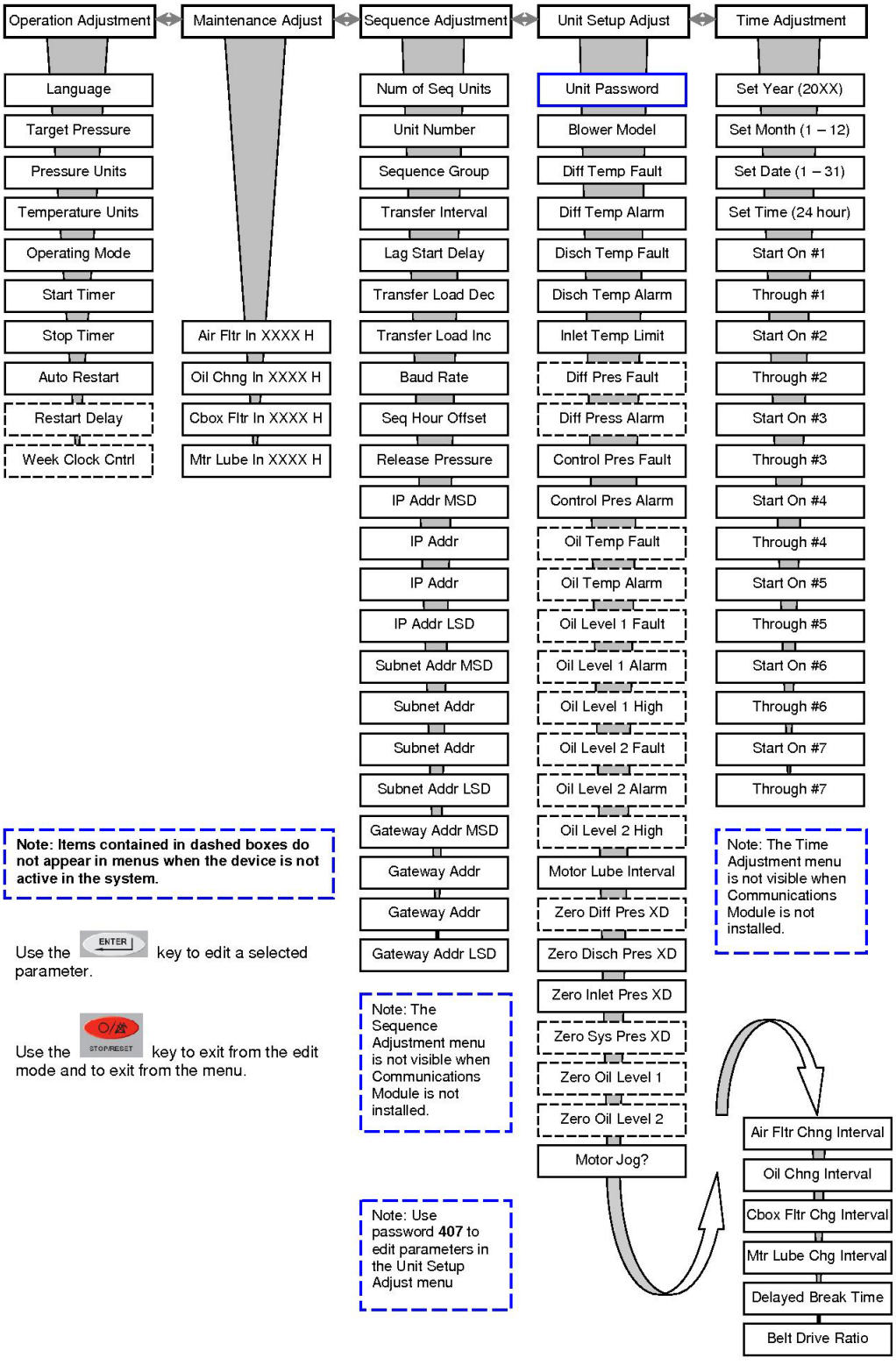
Use the ENTER key again to select the horizontal menu item. Use the ▲ ▼ keys to navigate through the vertical menu items.



AirSmart Controller Adjustment Menus (Blower Application)

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

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



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

Use the ENTER key to edit a selected parameter.

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

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

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

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

3.2.1 Operation Adjustment Menu

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

```
ADJUSTMENT MENU
OPERATION ADJUSTMENT

(SELECT SUB MENU)
```

1. Operating Mode

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

AUTOMATIC: (Default mode) the compressor or blower uses its internal modulation algorithms to control the operation of the machine. Refer to the appropriate AirSmart Users manual for machine operation in Automatic mode (Gardner Denver document 13-17-600 for the compressor application or IQ-7-200 for the blower application).

SEQUENCE: The compressor or blower operates similar to Automatic mode but is part of a sequenced group of machines.

LOW DEMAND: (compressor application only – refer to Gardner Denver document 13-17-600).

CONSTANT: (compressor application only – refer to Gardner Denver document 13-17-600).

```
OPERATION ADJUSTMENT
   OPERATING MODE
     AUTOMATIC
 (SELECT PARAMETER)
```

2. Week Clock Control

The last item in the Operation Adjustment menu is the Week Clock Control function. When the Week Clock Control is turned on, the compressor or blower can be started and stopped using the seven programmable timers under the Time Adjust menu.

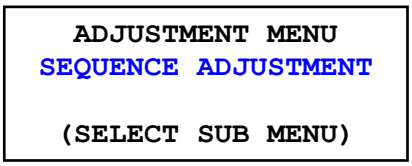
```
OPERATION ADJUSTMENT
WEEK CLOCK CONTROL
        ON
(SELECT PARAMETER)
```

Default Value: OFF

Automatic starting of the compressor or blower can cause injury or death

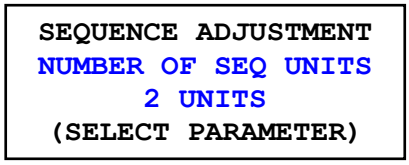
3.2.2 Sequence Adjustment Menu

The Sequence Adjustment menu provides access to the parameters that control the sequencing operation of the compressor or blower. This menu is only visible if the AirSmart Communications Module is installed.



1. Number of Sequence Units

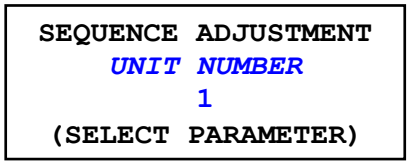
The first item in the Sequence Adjust menu is the Number of Sequence Units, which specifies the number of compressors or blower connected in a sequence group. For stand-alone operation, this parameter is set to 1. When set to 1, all other sequence related items in the menu are not visible.



Min Value: 1
Max Value: 8
Default Value: 1

2. Unit Number

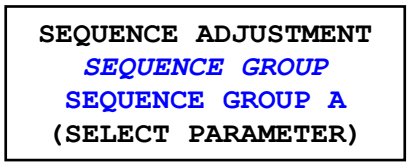
The next item in the Sequence Adjust menu is the Unit Number. A unique number must identify each of the possible eight units in a sequence group. The primary Lead, which is always the largest capacity compressor or blower in the group, must be programmed as Unit Number 1.



Min Value: 1
Max Value: 8
Default Value: 1

3. Sequence Group

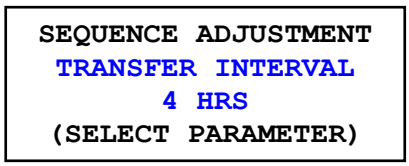
The next item in the Sequence Adjust menu is the Sequence Group, which simply identifies a group of up to eight machines for remote monitoring purposes. All compressors or blowers within a group must be set to the same group.



Min Value: SEQUENCE GROUP A
Max Value: SEQUENCE GROUP H
Default Value: SEQUENCE GROUP A

4. Transfer Interval

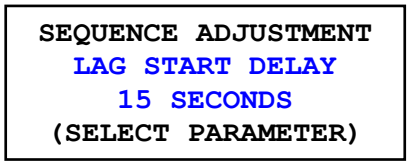
The next item in the Sequence Adjust menu is the Transfer Interval. This parameter controls how often the group Lead is transferred to a dormant compressor or blower during periods of low demand. This parameter is referenced to the Total Hour meter value as seen in the second line of the display or the Maintenance Info menu. A value of zero will disable this feature.



Min Value: 0 Hours
Max Value: 5000 Hours
Default Value: 4 Hours

5. Lag Start Delay

The next item in the Sequence Adjust menu is the Lag Start Delay timer value. This parameter controls the delay between The Transfer Load Increment trigger (see below) and the starting of the next available compressor or blower during periods of increasing demand. The Lag Start Delay time is reset and begins to count down whenever a dormant machine is brought on line. If the Lag Start Delay timer expires before the next available unit comes on line, there will be no delay during startup.



Min Value: 1 Second
Max Value: 60 Seconds
Default Value: 15 Seconds

6. Transfer Load Decrement

The next item in the Sequence Adjust menu is the Transfer Load Decrement value, which controls the load level the group must reach before dropping a compressor or blower from the sequence group during periods of decreasing demand.

```
SEQUENCE ADJUSTMENT
TRANSFER LOAD DEC
      35 %
(SELECT PARAMETER)
```

Note: Do not adjust this parameter unless it is absolutely necessary! The factory default value will provide the most efficient operation of the sequence group.

Min Value: 20%
Max Value: 100%
Default Value: 35% (variable speed compressor), 40% (variable speed blower), 100% (fixed speed compressor or blower)

7. Transfer Load Increment

The next item in the Sequence Adjust menu is the Transfer Load Increment value, which controls the load level the group must reach before adding a compressor or blower to the sequence group during periods of increasing demand.

```
SEQUENCE ADJUSTMENT
TRANSFER LOAD INC
      80 %
(SELECT PARAMETER)
```

Note: Do not adjust this parameter unless it is absolutely necessary! The factory default value will provide the most efficient operation of the sequence group.

Min Value: 70%
Max Value: 100%
Default Value: 80% (variable speed compressor or blower), 100% (fixed speed compressor or blower)

8. Baud Rate

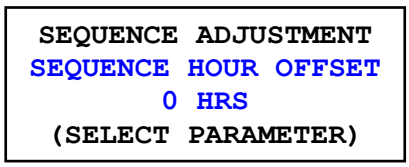
The next item in the Sequence Adjust controls the Baud Rate of the RS-232 port (9-pin D-Sub connector) used for remote monitoring.

```
SEQUENCE ADJUSTMENT
     BAUD RATE
       9600
(SELECT PARAMETER)
```

Baud Rate Values: 1200, 2400, 4800, 9600, 19200
Default Value: 9600

9. Sequence Hour Offset

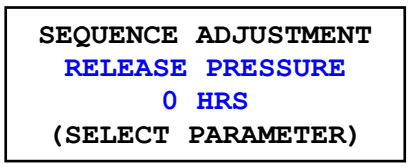
The next item in the Sequence Adjust menu is the Sequence Hour Offset. This parameter value is added to the Total Hour meter and allows two machines with large differences in Total Hour meter values to transfer the sequence lead using the Transfer Interval Timer.



Min Value: 0 Hours
Max Value: 87600 Hours
Default Value: 0 Hours

10. Release Pressure (Used in blower application only)

The next item in the Sequence Adjust menu is the Release Pressure value, which controls when a blower will be released from the sequence group during periods of decreasing demand. This parameter is used in an equivalent fashion as the Unload Pressure value in the compressor application.

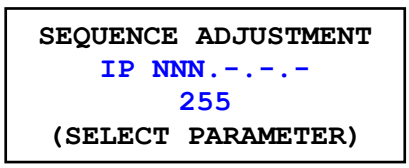


Min Value: 0 PSI
Max Value: Blower package dependant
Default Value: Blower package dependant

11. IP Address

The next four items in the Sequence Adjust menu make up the four octets (eight bit segments) of the IP (Internet Protocol) Address used by the Ethernet port for remote monitoring. The Communications Module does not support Dynamic Host Configuration Protocol (DHCP) so it is necessary for each unit to be programmed with a unique IP address.

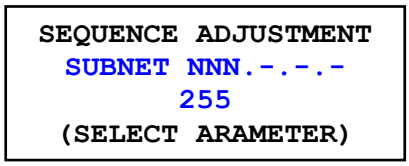
The LSB (Least Significant Byte) of the IP address also doubles as the Modbus RTU packet address when using the RS-232 port for remote monitoring.



Min Value: 0.0.0.0
Max Value: 255.255.255.255

12. Sub-Network Mask

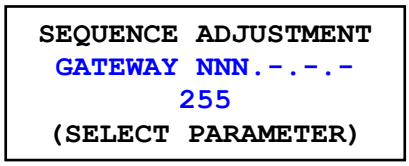
The next four items in the Sequence Adjust menu make up the four octets (eight bit segments) of the Sub-Network (Subnet) Mask used by the Ethernet port for remote monitoring. Contact the network administrator to obtain the value for the Subnet Mask.



Min Value: 0.0.0.0
Max Value: 255.255.255.255

13. Gateway Address

The next four items in the Sequence Adjust menu make up the four octets (eight bit segments) of the Gateway Address used by the Ethernet port for remote monitoring. A gateway is a device (usually a computer) that serves as an access point to other networks outside the local network. Contact the network administrator to obtain the network Gateway Address. A gateway address is only necessary for communications beyond the local network.



Min Value: 0.0.0.0
Max Value: 255.255.255.255

3.2.3 Time Adjustment Menu

The Time Adjustment menu provides access to the parameters that control the real time clock operation of the compressor or blower. This menu is only visible if the AirSmart Communications Module is installed.

```
ADJUSTMENT MENU
  TIME ADJUST

(SELECT SUB MENU)
```

1. Set Year

The first item in the Time Adjust menu is the year setting for the real time clock.

```
    TIME ADJUST
SET YEAR (20XX)
      2005
(SELECT PARAMETER)
```

Min Value: 2000
Max Value: 2063

2. Set Month

The next item in the Time Adjust menu is the month setting for the real time clock.

```
    TIME ADJUST
SET MONTH (1 - 12)
         1
(SELECT PARAMETER)
```

Min Value: 1
Max Value: 12

3. Set Date

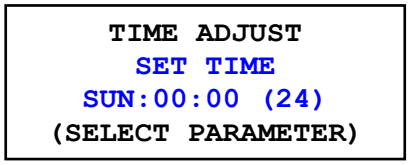
The next item in the Time Adjust menu is the date setting for the real time clock.

```
    TIME ADJUST
SET DATE (1 - 31)
         1
(SELECT PARAMETER)
```

Min Value: 1
Max Value: 31

4. Set Time

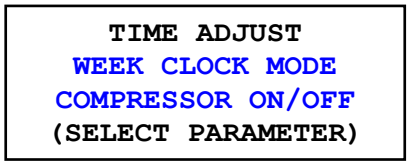
The next item in the Time Adjust menu is the time setting for the real time clock.



Day of Week range: SUN, MON, TUE, WED, THU, FRI, SAT
Hour range: 00 to 23
Minute range: 00 to 59

5. Week Clock Mode (Used in compressor application only)

The next item in the Time Adjust menu is the Week Clock Mode setting which controls how the seven start/stop timers are used in the compressor application. Refer to the AirSmart User's manual for the compressor application (Gardner Denver document 13-17-600) for more information about using the secondary pressure settings.



Min Value: COMPRESSOR ON/OFF
Max Value: SECONDARY PRESSURES

6. Start/Through Times 1 through 7

The next fourteen items in the Time Adjust menu make up the week clock for starting and stopping the compressor or blower up to seven times inside a period of one week. In order for the week clock to be active, Week Clock Control under the Operation Adjustment menu must set to ON. The START and THROUGH time parameters must be programmed as a pair, the compressor will not start at a designated START time if the associated THROUGH time parameter has not also been programmed.

```
TIME ADJUST
START ON #1
MON:08:00 (24)
(SELECT PARAMETER)
```

```
TIME ADJUST
THROUGH #1
MON:16:59 (24)
(SELECT PARAMETER)
```

Day of Week range: SUN, MON, TUE, WED, THU, FRI, SAT
Hour range: 00 to 23
Minute range: 00 to 59

The THROUGH time parameter tells the compressor to run through the programmed time and then stop. If the compressor is programmed to run through 16:59, as shown in the display above, the machine will actually stop at 17:00 (5:00 PM).

The concept of “through” time is used instead of stop time so that it is possible to have run periods that span from the week’s end through the week’s beginning. For example, with a START / THROUGH time of SAT: 23:00 / SUN: 00:59, the compressor will run exactly 120 minutes centered around midnight on Saturday

4 Using The Real Time Clock

The AirSmart Communications Module has a built-in battery-backed real time clock, which can be used to automatically start and stop a compressor or blower up to seven times inside of one week. The programmable week clock is similar that found in a home video recorder and used to record your favorite television programs. Follow the simple steps below for setting up the programmable week clock.

4.1 Programming the Real Time Clock

Program the year, month, date and time parameters using the first four pages of the Time Adjust menu as shown above. Once these values are set, they do not need to be entered again, even if the power is removed from the machine.

4.1.1 Program the Year

1. Press the Enter  key on the display to access the Adjustment menu tree.
2. Use the Left  or Right  keys to navigate to the Time Adjust menu.
3. Press the Enter  key to enter the Time Adjust menu.
4. The Year parameter will be the first item in the Time Adjust menu. Press the Enter  key to edit the Year.
5. Use the Plus  and Minus  keys the change the value of each digit.
6. Use the Left  or Right  keys to select individual digits.
7. Press the Enter  key to program the new Year value.

4.1.2 Program the Month

1. Press the Down  key once to access the Month parameter.
2. Press the  key to edit the Month.
3. Use the Plus  and Minus  keys the change the parameter value.
4. Press the  key to program the new Month value.

4.1.3 Program the Date

1. Press the Down  key once to access the Date parameter.
2. Press the Enter  key to edit the Month.
3. Use the Plus  and Minus  keys the change the parameter value.
4. Press the Enter  key to program the new Date value.

4.1.4 Program the Time

1. Press the Down  key once to access the Time parameter.
2. Press the Enter  key to edit the Time.
3. Use the Plus  and Minus  keys the change the day of the week or the value of each digit.
4. Use the Left  or Right  keys to select individual digits.
5. Press the Enter  key to program the new Date value.
6. Press the Stop/Reset  key twice to return to the Main display screen.

4.2 Programming Start/Trough Times

The Start/Trough times control when the compressor or blower will and stop during a period of one week. The next fourteen parameters after the Year, Month Date and Time are the seven Start/Through time pairs.

- **Important Note:** The START and THROUGH time parameters must be programmed as a pair, the compressor will not start at a designated START time if the associated THROUGH time parameter has not also been programmed.

4.2.1 Program the Start Time

1. Press the Enter key on the display to access the Adjustment menu tree.
2. Use Left or Right keys to navigate to the Time Adjust menu.
3. Press the Enter key to enter the Time Adjust menu.
4. The Year parameter will be the first item in the Time Adjust menu. Press the Down key until Start Time #1 shows in the display. If the Real Time Clock has just been set, you will only have to press the Down key once.
5. Press the Enter key to edit the Start time.
6. Use the Plus and Minus keys the change the day of the week or the value of each digit.
7. Use the Left or Right keys to select individual digits.
8. Press the Enter key to program the new Start time.

4.2.2 Program the Through Time

1. Press the Down key once to access the Through time #1 parameter.
2. Press the Enter key to edit the Through time.
3. Use the Plus and Minus keys the change the day of the week or the value of each digit.
4. Use the Left or Right keys to select individual digits.
5. Press the Enter key to program the new Date value.
7. Press the Stop/Reset key twice.
8. Press the Enter key to permanently save the programmed parameters in the controller's memory.

4.2.3 Enable Week Clock Control

After programming the Start and Through times under the Time Adjust menu, it will be necessary to enable the Week Clock so that it may control the compressor or blower. The Week Clock enable is found under the Operation Adjustment menu.

Automatic starting of the compressor or blower can cause injury or death

1. Press the Enter ENTER key on the display to access the Adjustment Menu tree.
2. Use Left ◄ or Right ► keys to navigate to the Operation Adjustment menu.
3. Press the Enter ENTER key to enter the Operation Adjustment menu.
4. The Language setting will be the first item in the Operation Adjustment menu. Press the Up ▲ key once to get to Week Clock Control.
5. Press the Enter ENTER key to edit the Week Clock Control parameter.
6. Use the Up ▲ or Down ▼ keys to change the parameter from OFF to ON.
7. Press the Enter ENTER key to save the new setting.
8. Press the Stop/Reset STOP/RESET key twice.
9. Press the Enter ENTER key to permanently save the programmed parameters in the controller's memory.
10. To start the compressor or blower under Week Clock control, press the Run RUN key.

When the compressor is enabled to run under Week Clock control and the Run RUN key has been pressed, the display will appear as shown below. The third line of the display will show the next start time and the fourth line of the display will show the current time.

```
0 PSI            75°F
125 HRS    AUTOMATIC
START ON THU 08:00
08/12/15 13:45 WED
```

- **Important Note:** If the Week Clock Control is turned ON and there are no Start/Through times programmed, the machine will not start when the Run RUN key is pressed. Be sure that the Week Clock Control is turned OFF to operate the compressor or blower normally.
- **Important Note:** The Run RUN and Stop/Reset STOP/RESET keys will function normally when the Week Clock is operating inside of a Start/Through time window.

4.3 Real Time Clock Battery

The Real Time Clock on the AirSmart Communications Module is equipped with a backup battery, which enables the clock to keep time when the no power is applied to the AirSmart Controller. The battery that has been installed is a type CR2016 Lithium coin battery and has an expected life of ten years.

Should the battery become exhausted (clock no longer keeps time when power removed), it can be removed from its socket and replaced. First remove power from the compressor or blower. Next remove the Communications Module from the AirSmart Controller and replace the battery located on the backside of the module. Be sure to follow the instructions for replacement silk-screened onto the module circuit board cover.

5 Sequencing

The AirSmart Communications Module will allow up to eight compressors or blowers to be connected together in a sequence group. The Lead machine of the group will seamlessly start and stop other machines as necessary to meet the plant air demand. In order to equalize machine run time during periods of low system demand, the Lead machine can also trade with a dormant machine in the group.

A proper sequencing installation requires two or more compressors or blowers piped into a common air delivery system and connected as described in the sections to follow. For best results, connect each machine directly to a common manifold or receiver without any intervening dryers, filters or other restrictions. If any equipment must be installed on individual compressors or blowers, select equipment with as minimal of a pressure drop as possible. If filters are installed, establish a maintenance procedure to prevent clogged filters from upsetting the system. There should be no check valves or other devices, which isolate any member from the air system. During operation, be sure that any unit is taken off line before closing its service valve.

For compressor networks, the receiver should be sized to prevent excessive drops or rapid rises in pressure during operation. Note that “receiver” applies to the entire storage volume of a physical receiver and the air delivery pipe network installed in the plant. Sequenced systems of Gardner Denver VS/VST Series variable speed air compressors work best when the receiver size is at lest one-half gallon for the rated CFM of the entire sequence group.

All standard practices common to sound air compressor and blower installations such as proper sizing of piping, proper electrical supply, conductor sizing and grounding should be observed.

5.1 Sequencing Operation (Compressor application)

Each member compressor in a sequence group operates similarly to the Automatic mode of operation. It will start, load, modulate, unload, blowdown and automatically stop as necessary to meet the system demand for air. There are several differences, however, when running in the Sequence mode.

Normally, in Automatic mode, each compressor would respond to pressure changes seen at the discharge of each individual machine. In Sequence mode, each compressor responds to the system pressure as seen by the Lead compressor in the group. Each Lag compressor will be commanded by the group Leader to run the same percentage of full capacity. In other words, the Lag compressors do not use their own internal modulation algorithm to govern their speed. Instead, the Lead compressor dictates the operating speed of all compressors in the group based on the pressure seen at the system sample point on the receiver or manifold.

The Lead compressor will automatically show the system pressure in the fourth line of the display unless the operator chooses a different parameter from the front panel or an Advisory Fault needs to be displayed by the controller. The following sections describe the different possible scenarios during sequencing operation.

- **Important Note:** It is very important that the Target, Load and Unload pressure values under the Operation Adjustment menu are programmed identically in all members of a sequence group.

- **Important Note:** Fixed speed compressors that are equipped with an AirSmart Controller and a Communications Module can be added to any sequencing network, however, they will always operate at full speed (100%) when commanded to start.

5.1.1 Increasing Air Demand

As the plant demand for air increases, the speed of the Lead compressor will also increase to meet the demand. When the speed of the Lead compressor reaches the **Transfer Load Increment** value (usually 80%), it will not increase any further. If the demand continues to increase, the system pressure will drop below the **Load Pressure** value programmed into the Lead compressor and the next Lag compressor is brought on-line provided that the **Lag Start Delay** timer has expired. The Lag Start Delay timer begins counting down as soon as the Lead (or most recently started Lag) compressor begins modulation. As each Lag compressor is started, the operating speed of the sequence group decreases due to the increased air capacity of the sequence group. Each compressor in the group will be commanded by the Leader to run the same percentage of individual full speed regardless of compressor size. If the air demand continues to increase, the Lead will start another Lag machine when the group speed reaches the Transfer Load Increment value. When all possible Lag compressors are running, the speed of the sequence group is allowed to rise above the Transfer Load Increment value up to 100%.

5.1.2 Decreasing Air Demand

As the plant demand for air decreases, the speed of the sequence group will also decrease down to the **Transfer Load Decrement** value (usually 35%) and freeze. If the demand for air continues to decrease, the system pressure will increase until it reaches the **Unload Pressure** value programmed into the Lead compressor at which time the Lag machine with the largest **Unit Number** will be commanded to stop. As each Lag compressor is stopped, the operating speed of the sequence group increases due to the loss of total air capacity in the sequence group. As the air demand continues to decrease, the Lead will drop off all Lag compressors in a similar fashion until only the Lead compressor remains. After all Lag compressors have stopped, the Lead machine is allowed to operate below the Transfer Load Decrement level down to 20%.

5.1.3 Transfer of Lead Control

The transfer of lead control of the sequence group can occur in three different ways. The first method of control transfer occurs when the **Transfer Interval** parameter under the Sequence Adjust menu is set to an hour value other than zero. During long periods of low plant air demand when compressor(s) in the group are sitting idle, the Lead compressor will transfer its control to an equal sized Lag compressor after the Transfer Interval time elapses.

The second method of control transfer occurs when the operator presses the Stop/Reset button on the display panel stopping the current Lead compressor. In this case, control is transferred to the compressor with the next largest **Unit Number**, regardless of compressor size.

The third method of control transfer occurs when a shutdown fault stops the current Lead compressor. In this case, control is transferred to the compressor with the next largest **Unit Number**, regardless of compressor size.

5.2 Sequencing Operation (Blower application)

Each member blower in a sequence group operates similarly to the Automatic mode of operation. It will start, load, and automatically stop (lead machine will not stop) as necessary to meet the system demand for air. There are several differences, however, when running in the Sequence mode.

Normally, in Automatic mode, each blower would respond to pressure changes seen at the discharge or inlet of each individual machine. In Sequence mode, each blower responds to the system pressure as seen by the Lead blower in the group. Each Lag blower will be commanded by the group Leader to run the same percentage of full capacity. In other words, the Lag blowers do not use their own internal

modulation algorithm to govern their speed. Instead, the Lead blower dictates the operating speed of all blowers in the group based on the pressure seen at the system sample point on the manifold.

- **Important Note:** It is very important that the Target and Release pressure values under the Operation Adjustment and Sequence Adjustment menus are programmed identically in all members of a sequence group.

- **Important Note:** Fixed speed blowers that are equipped with an AirSmart Controller and a Communications Module can be added to any sequencing network, however, they will always operate at full speed (100%) when commanded to start.

5.2.1 Increasing Air Demand

As the plant demand for air increases, the speed of the Lead blower also increases to meet the demand. When the speed of the Lead blower reaches the **Transfer Load Increment** value (usually 80%), it will not increase any further. If the demand continues to increase, the system pressure will drop below the **Target Pressure** value programmed into the Lead blower and the next Lag blower is brought on-line provided that the **Lag Start Delay** timer has expired. The Lag Start Delay timer begins counting down as soon as the Lead (or most recently started Lag) blower begins modulation. As each Lag blower is started, the operating speed of the sequence group decreases due to the increased air capacity of the sequence group. Each blower in the group will be commanded by the Leader to run the same percentage of individual full speed regardless of blower size. If the air demand continues to increase, the Lead will start another Lag machine when the group speed reaches the Transfer Load Increment value. When all possible Lag blowers are running, the speed of the sequence group is allowed to rise above the Transfer Load Increment value up to 100%.

5.2.2 Decreasing Air Demand

As the plant demand for air decreases, the speed of the sequence group will also decrease down to the **Transfer Load Decrement** value (usually 40%) and freeze. If the demand for air continues to decrease, the system pressure will increase until it reaches the **Release Pressure** value programmed into the Lead blower at which time the Lag machine with the largest **Unit Number** will be commanded to stop. As each Lag blower is stopped, the operating speed of the sequence group increases due to the loss of total air capacity in the sequence group. As the air demand continues to decrease, the Lead will drop off all Lag blowers in a similar fashion until only the Lead blower remains. After all Lag compressors have stopped, the Lead machine is allowed to operate below the Transfer Load Decrement level down to 20%.

5.2.3 Transfer of Lead Control

The transfer of lead control of the sequence group can occur in three different ways. The first method of control transfer occurs when the **Transfer Interval** parameter under the Sequence Adjust menu is set to an hour value other than zero. During long periods of low plant air demand when blower(s) in the group are sitting idle, the Lead blower will transfer its control to an equal sized Lag blower after the Transfer Interval time elapses.

The second method of control transfer occurs when the operator presses the Stop/Reset button on the display panel stopping the current Lead blower. In this case, control is transferred to the blower with the next largest **Unit Number**, regardless of blower size.

The third method of control transfer occurs when a shutdown fault stops the current Lead blower. In this case, control is transferred to the blower with the next largest **Unit Number**, regardless of blower size.

5.3 Install Pressure Transducers

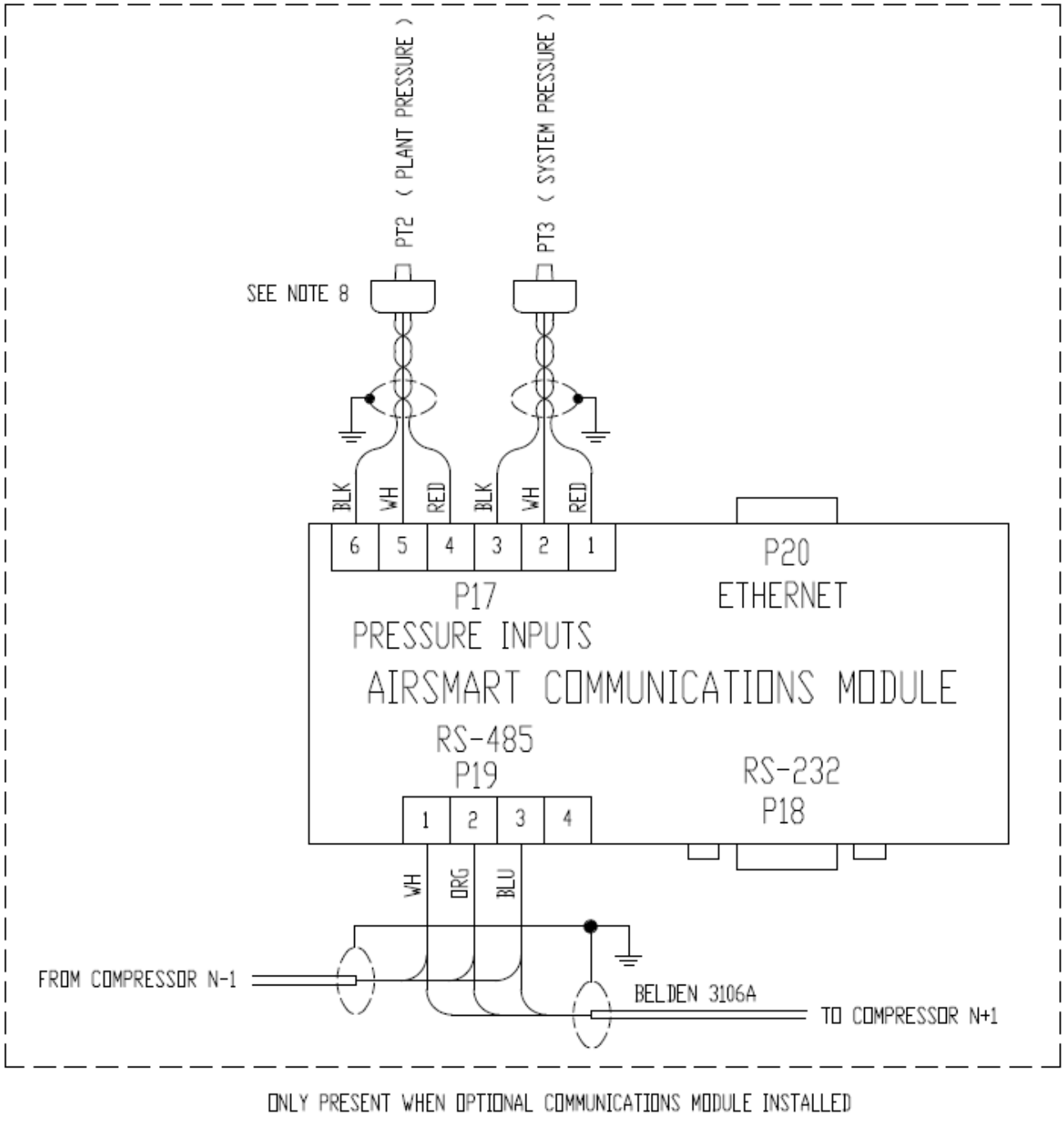


Figure 5 – Sequencing Connections

5.3.1 Install System Pressure Transducer

In order for the Communications Module to properly control the sequencing of multiple compressors or blowers, it requires an additional pressure reading from the air system receiver or manifold. Each member of the sequence group is to become a Lead machine is required to have a system pressure transducer so that lead control transfers can occur.

The transducer is installed into either the roof or the side of the control box or package. A typical compressor installation is shown in **Error! Reference source not found.** below. For a typical blower installation, see Figure 7. Refer to the Operators Manual of the machine being sequenced for the proper location. Item 2, in the figure below, is a weatherproof bulkhead (GDI Part No. 64EB368) in which the pressure transducer, item 3 (GDI Part No. VP1011577 for a compressor or VP1033786 for a blower) is installed. In addition, a ¼ inch pressure sample tube is connected from the plant air system receiver or manifold to the system pressure transducer in the control box.

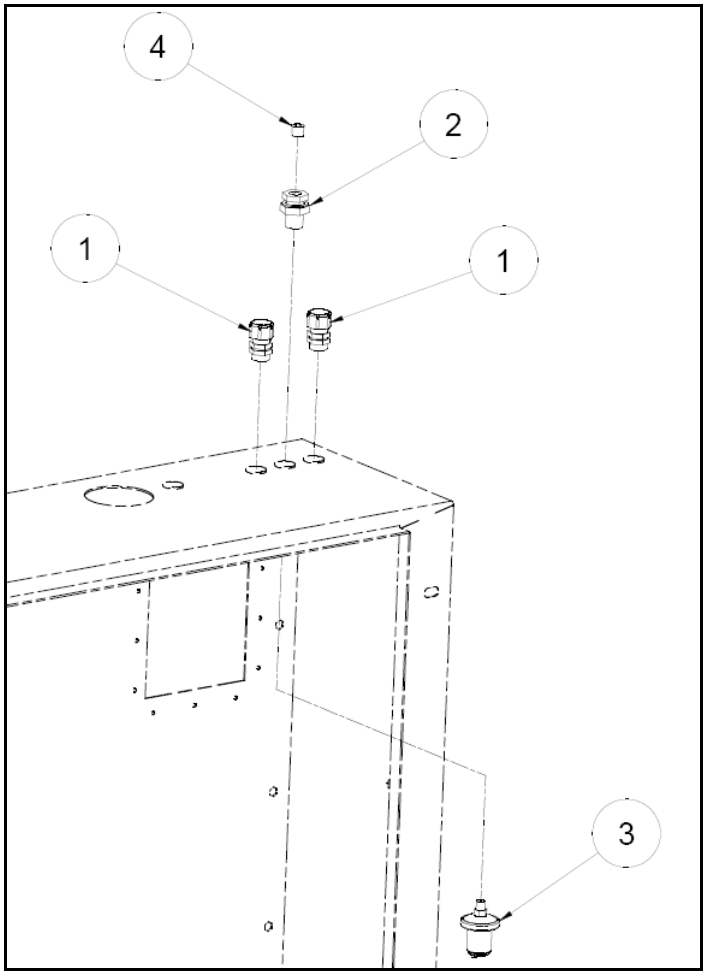


Figure 6 – Typical System Pressure Transducer Installation (Compressor)

The cable harness from the system pressure transducer is connected to pins 1 through 3 of connector P17 on the Communications Module as shown in Figure 5**Error! Reference source not found.** above.

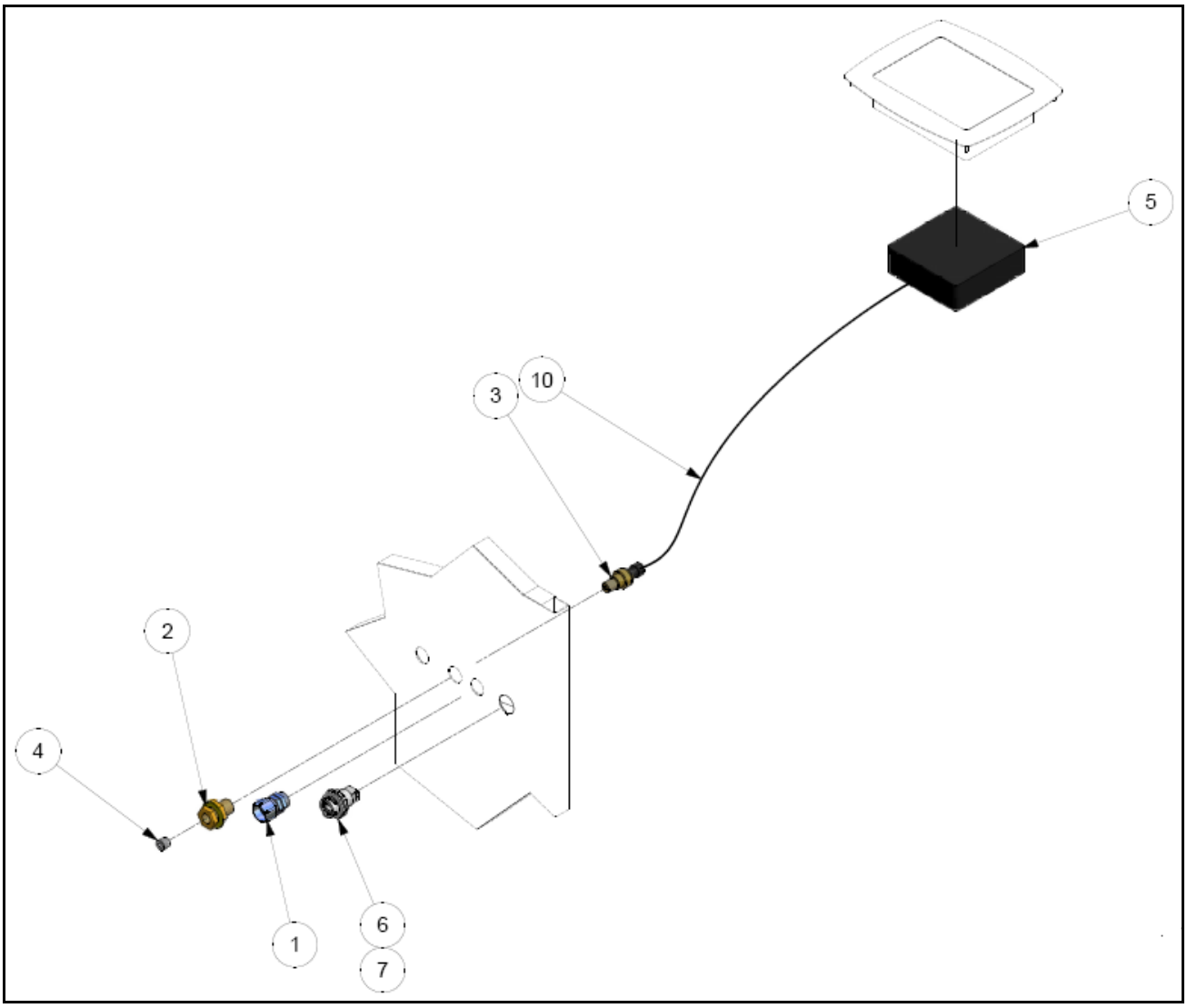


Figure 7 – Typical System Pressure Transducer Installation (Blower)

5.3.2 Move Plant Pressure Transducer Connection

The Plant Pressure transducer, which is already installed in the compressor or blower, must also be connected to the Communications Module in order to eliminate the error in the signal when used in a sequenced system. The Plant Pressure transducer is normally connected to pins 4 through 6 of connector P5 on a Value Controller or pins 7 through 9 of connector P14 on a Full-sized Controller. Move the Plant Pressure transducer connection to pins 4 through 6 of P17 on the Communications Module as shown in Figure 5 above. Be sure to observe the wire colors shown in Figure 5.

5.4 Configure Controller I/O Map

After installing the pressure transducers, the AirSmart Controller must be configured to read the new signals. Follow the steps below to configure the I/O map in the controller.

1. Press the Enter ENTER key on the display to access the Adjustment menu tree.
2. Use Left ◄ or Right ► keys to navigate to the Unit Setup Adjust menu.
3. Press the Enter ENTER key to enter the Unit Setup Adjust menu.
4. The Unit Password parameter will be the first item in the Unit Setup Adjust menu. Press the Enter ENTER key to change the Password to **8412**.
5. Use the Plus + and Minus − keys the change the value of each digit.
6. Use the Left ◄ or Right ► keys to select individual digits.
7. Press the Enter ENTER key to confirm the password value.
8. Press the Stop/Reset STOP/RESET key to return to the Adjustment menu tree.
9. Press the Right ► key twice to navigate to the Prog I/O Adjust menu.
10. Press the Enter ENTER key to access the Prog I/O Adjust menu.
11. Press the Up ▲ key to navigate to the System Pres Analog Input address. The display should read as shown below.

```
PROG I/O ADJUST
  SYSTEM PRES
  0 ANALOG IN
(SELECT PARAMETER)
```

12. Press the Enter ENTER key to change the System Pres Analog Input address to **113**.
13. Use the Plus + and Minus − keys the change the value of each digit.
14. Use the Left ◄ or Right ► keys to select individual digits.
15. Press the Enter ENTER key to confirm the address value.
16. Press the Up ▲ key to navigate to the Plant Pres Analog Input address. The display should read as shown below.(the I/O address shown may be different depending on machine type)

```
PROG I/O ADJUST
  PLANT PRES
 35 ANALOG IN
(SELECT PARAMETER)
```

17. Press the Enter 

key to change the Plant Pres Analog Input address to **114**
18. After changing the address, press the Enter 

key to confirm the address value.
19. Press the Stop/Reset 

key twice.
20. Press the Enter 

key to permanently save the programmed parameters in the controller's memory.

- **Important Note: DO NOT** change any other I/O address parameters or the controller and compressor will not operate correctly.

5.5 Install Communications Network

The final step in the sequencing setup is to install the communications network so that the Lead compressor or blower can communicate with and control the Lag machines. **Error! Reference source not found.** shows a typical control box installation where item 1 is a weatherproof bulkhead (GDI Part No. 24CA615) through which the network wires (Belden 3106A or equivalent – GDI Part No. 97J93) may pass. **Error! Reference source not found.** above and Figure 10 below show the wire connections to connector P19 on the Communications Module.

Figure 8– Serial (P18) and Network (P19) Connectors

5.5.1 Dip Switch Settings

The communications module has eight DIP switches which configure the function of one of the analog inputs and the RS-485 sequencing network terminations. The switches are located on the end of the module behind a round plastic plug. The switches should be set as shown in the table and Figure 10 below.

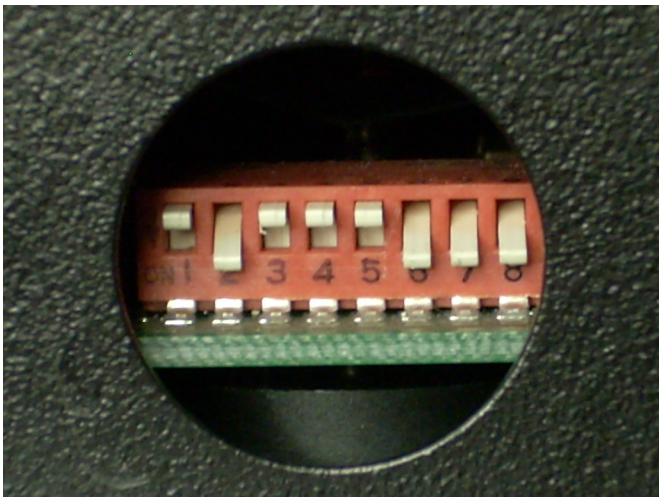


Figure 9 – DIP Switch Positions

DIP Switch (Left to Right)	Function and Position
1	Configure analog input on P17, pins 4 – 6 as: ON (down) - Thermistor input. Note: DIP switch 2 must be OFF (up)
2	Configure analog input on P17, pins 4 – 6 as: ON (down) - Pressure transducer input. Note: DIP switch 1 must be OFF (up)
3	OFF (up) - Not used
4	OFF (up) - Not used
5	OFF (up) - Not used
6	Pull down for RS-485 differential negative. ON (down) - Module is 1st in chain. OFF (up) - Module is not 1st in chain.
7	Pull up for RS-485 differential positive. ON (down) - Module is 1st in chain. OFF (up) - Module is not 1st in chain.
8	Termination for RS-485 sequencing network. ON (down) - Module is 1st or last in chain. OFF (up) - Module is not 1st or last in chain.

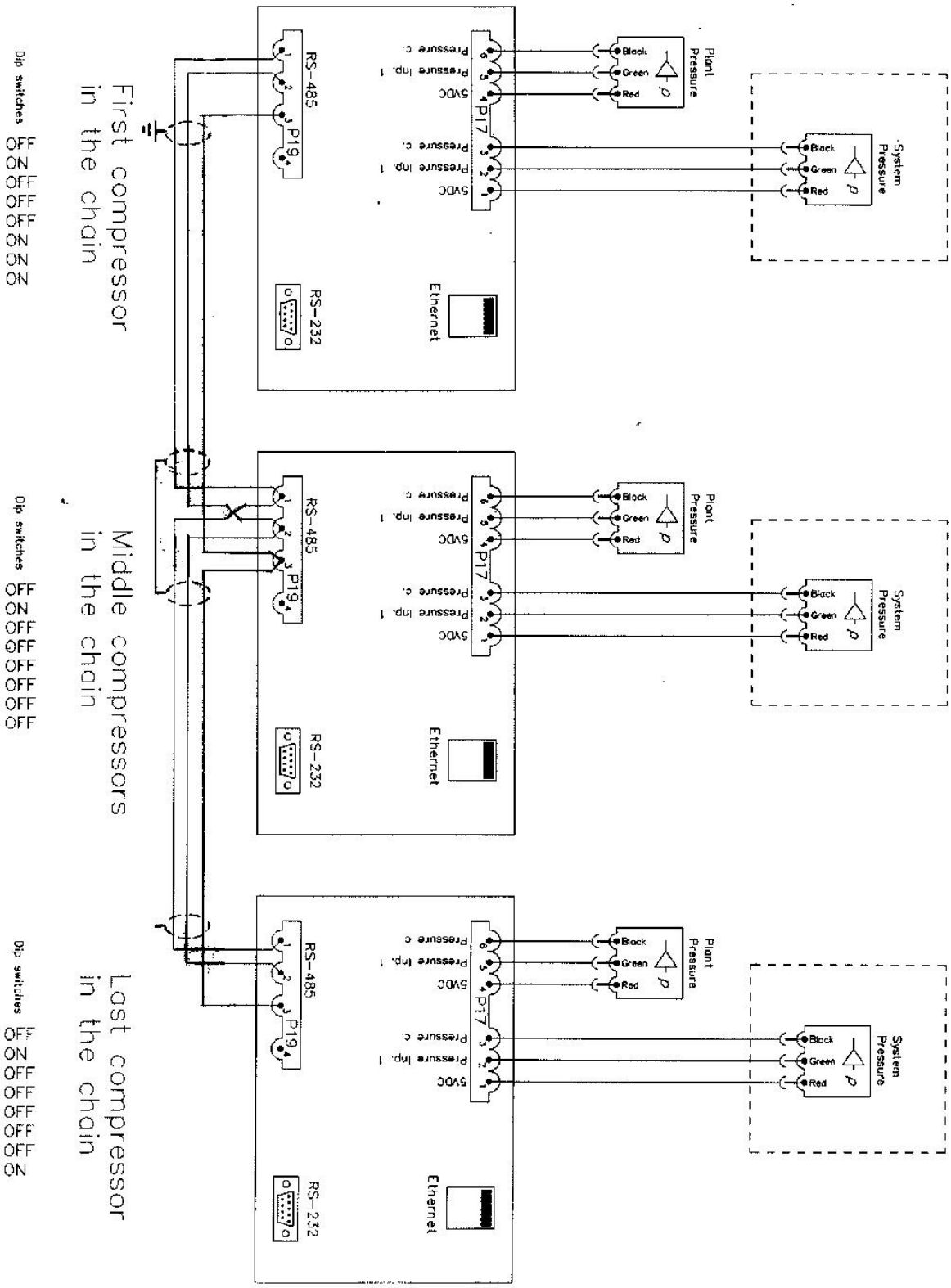


Figure 10 – Example of Sequencing Electrical Connections

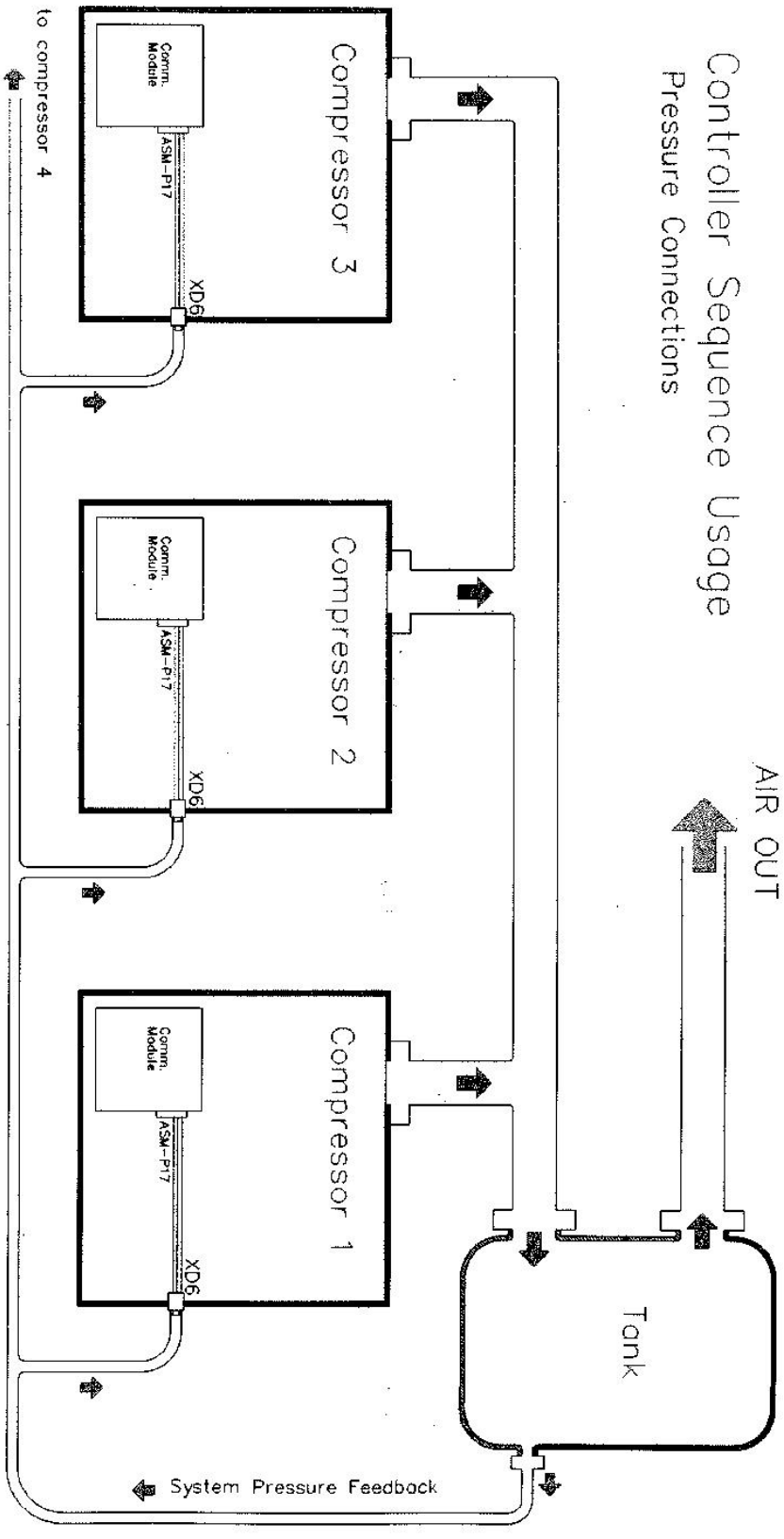


Figure 11 – Example of Sequencing Pressure Connections

6 Remote Monitoring

Remote monitoring allows the user to observe the operation of the compressor or blower from a remote location using the serial and/or Ethernet connection on the Communications Module. The serial port uses the Modbus RTU protocol while the Ethernet port uses Modbus RTU over UDP/IP.

Important Note: The serial port and the Ethernet port should **NOT** be used at the same time.

6.1 Modbus RTU over Serial Line

The Modbus RTU protocol used on the serial port uses Function code `0x03` (03 decimal) to read all the registers listed in the following pages. The Modbus address used to communicate with the Communications Module is equal to the least significant byte of the IP address set in the Sequencing Adjust menu. For more information about Modbus, the Modbus Application Protocol Specification can be downloaded free of charge at www.Modbus-IDA.org.

The following shows an example of reading Registers 1001 – 1005 from the Communications Module.

Query

Field Name	Decimal	Hexadecimal
Slave Address	IP Address LSB	0x--
Function Code	03	0x03
Starting Address High	03	0x03
Starting Address Low	233	0xE9
Number of Points High	00	0x00
Number of Points Low	05	0x05
CRC Low	--	0x--
CRC High	--	0x--

Response

Field Name	Decimal	Hexadecimal
Slave Address	IP Address LSB	0x--
Function Code	03	0x03
Byte Count	10	0x0A
Data High (Addr 1001)	11	0x0B
Data Low (Addr 1001)	208	0xD0
Data High (Addr 1002)	04	0x04
Data Low (Addr 1002)	176	0xB0
Data High (Addr 1003)	05	0x05
Data Low (Addr 1003)	80	0x50
Data High (Addr 1004)	12	0x0C
Data Low (Addr 1004)	48	0x30
Data High (Addr 1005)	12	0x0C
Data Low (Addr 1005)	128	0x80
CRC Low	--	0x--
CRC High	--	0x--

6.2 Modbus RTU over UDP/IP

The Modbus RTU protocol used on the Ethernet port is identical to that described in the serial port section above except that the Modbus data packet is wrapped inside of a UDP datagram before being sent over the network.

The Communications Module (server) automatically opens UDP port number 2001 for receiving data packets from the client. The client, in turn, must open UDP port number 2000 to receive data from the Communications Module. The Communications Module does not support Dynamic Host Configuration Protocol (DHCP) so it is necessary for each unit to be programmed with a unique IP address.

The response time for the Communications Module over Ethernet will be determined mostly by network traffic and how many network devices (switches, routers, etc.) the data must pass through. A typical response time over a local network is around two seconds.

Figure 12 – Analog Input (P17) and Ethernet (P20) Connectors

6.3 Modbus Address Map (Compressor application)

Address	Parameter	Units / Range / Description	Data Type	Access
1000	Controller State	0x0000 = ADJUSTMENT 0x0100 = AUTO RESTART 0x0200 = SHUTDOWN 0x0300 = READY 0x0400 = ENABLED 0x0800 = START 0x0900 = PAUSE 0x0A00 = BLOWDOWN 0x0B00 = UNLOAD 0x0D00 = MODULATE 0x0E00 = NORMAL STOP 0x1000 = REMOTE HALT 0x1100 = SEQ SHUTDOWN 0x1200 = POWER ON RESET	unsigned short (16 bits)	Read Only Note: This register is not contiguous with other registers and must be read as a single 16-bit register.
12000	Controller Status Flags 1	Use the following masks to isolate flag bits: 0x0001 = VALVE ACT COMM ERROR 0x0002 = ADVISORY ACTIVE 0x0004 = STOP KEY LATCH 0x0008 = CAME FROM MODULATE 0x0010 = BLOWDOWN LATCH 0x0020 = INTERNAL ERROR 0x0040 = AUTO ALTERNATE DISPLAY 0x0080 = FAN START RELAY 0x0100 = STATE TIMER EXPIRED 0x0200 = MOTORS RUNNING 0x0400 = LOADED 0x0800 = WRITE DECIHOUR COUNTER 0x1000 = EXP BRD COMM ERROR 0x2000 = DRIVE 1 COMM ERROR 0x4000 = DRIVE 2 COMM ERROR 0x8000 = DRIVE 3 COMM ERROR	unsigned short (16 bits)	Read Only

Address	Parameter	Units / Range / Description	Data Type	Access
12001	Controller Status Flags 2	Use the following masks to isolate flag bits: 0x0001 = DRIVE 2 AT FREQUENCY 0x0002 = CHECK DISCHARGE TEMP 0x0004 = EXP BRD NEEDED 0x0008 = RESET ALARM EDGE 0x0010 = LAST RESET ALARM 0x0020 = HVY CONSUM START EDGE 0x0040 = LAST HVY CONSUM START 0x0080 = HVY CONSUM LOAD EDGE 0x0100 = AUTO RESTART ENABLED 0x0200 = PROGRAM FLASH CRC OK 0x0400 = LANGUAGE TABLE CRC OK 0x0800 = EEPROM PARAMS RESTORED 0x1000 = EEPROM PARAMS RESET 0x2000 = BACKUP PARAMS UPDATED 0x4000 = ADC ERROR 0x8000 = DRIVE 1 AT FREQUENCY	unsigned short (16 bits)	Read Only
12002	Controller Status Flags 3	Use the following masks to isolate flag bits: 0x0001 = LAST MOTOR RUNNING 0x0002 = MANTENANCE ADVISORY 0x0004 = REMOTE LOAD ENABLE 0x0008 = REMOTE LOAD 0x0010 = REMOTE UNLOAD 0x0020 = VALVE ACT NEEDED 0x0040 = DRIVE1 AT MAX SPEED 0x0080 = IN MODULATION 0x0100 = LAST HVY CONSUM LOAD 0x0200 = MODEL TABLE VALID 0x0400 = INVALID LANGUAGE TABLE 0x0800 = SAVING EEPROM PARAMS 0x1000 = DRIVES BEING RESET 0x2000 = COMM MODULE INSTALLED 0x4000 = MOTORS JUST STARTED 0x8000 = MOTORS JUST STOPPED	unsigned short (16 bits)	Read Only

Address	Parameter	Units / Range / Description	Data Type	Access
12003	Controller Status Flags 4	Use the following masks to isolate flag bits: 0x0001 = DOUT ADVISORY ALARM 0x0002 = DOUT MANTENANCE ALARM 0x0004 = DOUT ANY ALARM 0x0008 = ALARM CHANGE PULSE 0x0010 = RTC SECONDARY PRESSURE 0x0020 = IV PID UNLOAD 0x0040 = RATE OF RISE EVENT 0x0080 = NOT USED 0x0100 = GOOD TO GO 0x0200 = GENERAL PURPOSE 1Hz 0x0400 = LOW DISCHARGE TEMP 0x0800 = RTC DRYER 0x1000 = RTC RUN 0x2000 = RTC STOP 0x4000 = MAINTENANCE CTRS RESET 0x8000 = RUNTIME EDIT PROGRESS	unsigned short (16 bits)	Read Only

Maintenance Information

Address	Parameter	Units / Range / Description	Data Type	Access
13000	Total Hours	LSB = 6 minutes (1/10 hour)	signed long (32 bits)	Read Only
13002	Loaded Hours	LSB = 6 minutes (1/10 hour)	signed long (32 bits)	Read Only
10050	Last Oil Change	**Total Hours** at last oil change.	signed long (32 bits)	Read Only
10052	Oil Change Interval	Units: Hours Min/Max: 1000 - 12000	signed short (16 bits)	Read Only
10053	Last Oil Filter Change	**Total Hours** at last oil filter change.	signed long (32 bits)	Read Only
10055	Oil Filter Change Interval	Units: Hours Min/Max: 100 - 4000	signed short (16 bits)	Read Only
10056	Last Oil Separator Change	**Total Hours** at last oil separator element change.	signed long (32 bits)	Read Only
10058	Oil Separator Change Interval	Units: Hours Min/Max: 1000 - 9000	signed short (16 bits)	Read Only
10059	Last Air Filter Change	**Total Hours** at last air filter change.	signed long (32 bits)	Read Only
10061	Air Filter Change Interval	Units: Hours Min/Max: 1000 - 4000	signed short (16 bits)	Read Only
10148	Last Control Box Filter Change	**Total Hours** at last control box filter change	signed long (32 bits)	Read Only
10150	Control Box Filter Change Interval	Units: Hours Min/Max: 400 - 1000	signed short (16 bits)	Read Only
10062	Last Motor Lube	**Total Hours** at last motor lubrication	signed long (32 bits)	Read Only
10064	Motor Lube Interval	Units: Hours Min/Max: 500 - 10000	signed short (16 bits)	Read Only
2057	Controller Firmware Version	Units: 1/100 (203 = version 2.03)	signed short (16 bits)	Read Only

Real Time Pressures and Temperatures

Address	Parameter	Units/Range	Data Type	Access
1001	Interstage Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
1002	Inlet Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
1003	Plant Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
1004	Separator Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
1005	Discharge Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
1006	Dryer Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
1007	Oil Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
1008	Interstage Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
1009	Inlet Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
1010	Plant Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
1011	Separator Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
1012	Reservoir Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
1013	Oil Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
1014	System Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only

Variable Frequency Drive and Motor Parameters

Address	Parameter	Units/Range	Data Type	Access
2003	V1 Frequency Command	Units: 1/100 Hz VFD frequency command from controller.	signed short (16 bits)	Read Only
2004	V2 Frequency Command	Units: 1/100 Hz VFD frequency command from controller.	signed short (16 bits)	Read Only
2005	V3 Frequency Command	Units: 1/100 Hz VFD frequency command from controller.	signed short (16 bits)	Read Only
2006	V1 Status	Use the following masks to isolate status bits: 0x0001 = READY 0x0002 = RUNNING 0x0004 = COMMAND FWD 0x0008 = ROTATE FWD 0x0010 = ACCELERATING 0x0020 = DECELERATING 0x0040 = ALARM 0x0080 = FAULT 0x0100 = AT FREQUENCY 0x0200 = WARNING 0x0400 = NOT USED 0x0800 = NOT USED 0x1000 = DIN1 BIT 0x2000 = DIN2 BIT 0x4000 = NOT USED 0x8000 = NOT USED	unsigned short (16 bits)	Read Only
2007	V2 Status	See **V1 Status** bit masks above	unsigned short (16 bits)	Read Only
2008	V3 Status	See **V1 Status** bit masks above	unsigned short (16 bits)	Read Only
2009	V1 Fault Code	See VFD User's Manual for fault code listing.	signed short (16 bits)	Read Only
2010	V2 Fault Code	See VFD User's Manual for fault code listing.	signed short (16 bits)	Read Only
2011	V3 Fault Code	See VFD User's Manual for fault code listing.	signed short (16 bits)	Read Only
2012	V1 Actual Frequency	Units: 1/100 Hz Actual motor operating frequency.	signed short (16 bits)	Read Only

Address	Parameter	Units/Range	Data Type	Access
2013	V2 Actual Frequency	Units: 1/100 Hz Actual motor operating frequency.	signed short (16 bits)	Read Only
2014	V3 Actual Frequency	Units: 1/100 Hz Actual motor operating frequency.	signed short (16 bits)	Read Only
2018	V1 Current	Units: 1/10 Amp	signed short (16 bits)	Read Only
2019	V2 Current	Units: 1/10 Amp	signed short (16 bits)	Read Only
2020	V3 Current	Units: 1/10 Amp	signed short (16 bits)	Read Only
2021	V1 DC Bus Voltage	Units: Volts	signed short (16 bits)	Read Only
2022	V2 DC Bus Voltage	Units: Volts	signed short (16 bits)	Read Only
2023	V3 DC Bus Voltage	Units: Volts	signed short (16 bits)	Read Only
2024	V1 Motor Speed	Units: RPM	signed short (16 bits)	Read Only
2025	V2 Motor Speed	Units: RPM	signed short (16 bits)	Read Only
2026	V3 Motor Speed	Units: RPM	signed short (16 bits)	Read Only
2033	V1 Motor Power	Units: 1/10 kW	signed short (16 bits)	Read Only
2034	V2 Motor Power	Units: 1/10 kW	signed short (16 bits)	Read Only
2035	V3 Motor Power	Units: 1/10 kW	signed short (16 bits)	Read Only
2036	V1 Heat Sink Temperature	Units: Deg. C	signed short (16 bits)	Read Only
2037	V2 Heat Sink Temperature	Units: Deg. C	signed short (16 bits)	Read Only
2038	V3 Heat Sink Temperature	Units: Deg. C	signed short (16 bits)	Read Only
2048	V1 Firmware Version	See VFD User's Manual for data format.	signed short (16 bits)	Read Only
2049	V2 Firmware Version	See VFD User's Manual for data format.	signed short (16 bits)	Read Only
2050	V3 Firmware Version	See VFD User's Manual for data format.	signed short (16 bits)	Read Only
2054	V1 Motor Voltage	Units: Volts	signed short (16 bits)	Read Only
2055	V2 Motor Voltage	Units: Volts	signed short (16 bits)	Read Only

Address	Parameter	Units/Range	Data Type	Access
2056	V3 Motor Voltage	Units: Volts	signed short (16 bits)	Read Only
2074	V1 Motor Nameplate Volts	Units: Volts	signed short (16 bits)	Read Only
2075	V2 Motor Nameplate Volts	Units: Volts	signed short (16 bits)	Read Only
2076	V3 Motor Nameplate Volts	Units: Volts	signed short (16 bits)	Read Only
2077	V1 Motor Nameplate Hertz	Units: 1/100 Hz	signed short (16 bits)	Read Only
2078	V2 Motor Nameplate Hertz	Units: 1/100 Hz	signed short (16 bits)	Read Only
2079	V3 Motor Nameplate Hertz	Units: 1/100 Hz	signed short (16 bits)	Read Only
2080	V1 Motor Nameplate FLA	Units: 1/10 Amp	signed short (16 bits)	Read Only
2081	V2 Motor Nameplate FLA	Units: 1/10 Amp	signed short (16 bits)	Read Only
2082	V3 Motor Nameplate FLA	Units: 1/10 Amp	signed short (16 bits)	Read Only

Front Panel Display

Address	Parameter	Units/Range	Data Type	Access
4096	Front Panel LEDs	Use the following masks to isolate LED bits: 0x0001 = POWER 0x0002 = AUTOMATIC 0x0004 = SERVICE 0x0008 = SHUTDOWN	unsigned short (16 bits)	Read Only
4097 – 4106	Front Panel Display Line 1	20 characters / line 2 characters / 16-bit word	unsigned short (16 bits)	Read Only
4107 – 4116	Front Panel Display Line 2	20 characters / line 2 characters / 16-bit word	unsigned short (16 bits)	Read Only
4117 – 4126	Front Panel Display Line 3	20 characters / line 2 characters / 16-bit word	unsigned short (16 bits)	Read Only
4127 – 4136	Front Panel Display Line 4	20 characters / line 2 characters / 16-bit word	unsigned short (16 bits)	Read Only

Operational Settings

Address	Parameter	Units/Range	Data Type	Access
10000	Target Pressure Setting	Units: 1/16 PSI Min/Max: 45 – 250 (x 16)	signed short (16 bits)	Read Only
10001	Unload Pressure Setting	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
10002	Load Pressure Setting	Units: 1/16 PSI Min/Max: 30 – 250 (x 16)	signed short (16 bits)	Read Only
10008	Operating Mode	0 = Constant, 1 = Automatic, 2 = Sequence	signed short (16 bits)	Read Only
10009	Compressor Type	0 = Fixed Speed, 1 = Variable Speed	signed short (16 bits)	Read Only
10034	Local Capacity	Units: CFM Min/Max: 0 - 5000	signed short (16 bits)	Read Only
10035 (LSB)	Remote Halt Enabled	Units: None Min/Max: 0 = OFF, 1 = ON	unsigned char (8 bits)	Read Only
10038 (MSB)	Auto Restart	Units: None Min/Max: 0 = OFF, 1 = ON	unsigned char (8 bits)	Read Only
10039 (LSB)	Oil Type	0 = Standard, 1 = High Temp 2 = Food Grade	unsigned char (8 bits)	Read Only
10042 (MSB)	Week Clock Enabled	Units: None Min/Max: 0 = OFF, 1 = ON	unsigned char (8 bits)	Read Only
10043	Blowdown Timer Setting	Units: Seconds Min/Max: 1 - 1200	unsigned short (16 bits)	Read Only
10044	Blowdown Counter Setting	Units: None Min/Max: 0 - 10	unsigned short (16 bits)	Read Only
10045	Auto Timer Setting	Units: 1/10 Minutes Min/Max: 0 - 200	unsigned short (16 bits)	Read Only
10046	Start Timer Setting	Units: Seconds Min/Max: 0 - 600	unsigned short (16 bits)	Read Only
10047	High Plant Pressure Limit	Units: 1/16 PSI Min/Max: 70 – 200 (x 16)	signed short (16 bits)	Read Only
10048	Over Temperature Shutdown Limit	Units: 1/16 Deg. F Min/Max: 175 - 240 (x 16)	signed short (16 bits)	Read Only
10049	Auto Restart Delay Time	Units: Seconds Min/Max: 5 - 30	signed short (16 bits)	Read Only
10065	System Voltage	Units: Volts Min/Max: 115 - 1000	signed short (16 bits)	Read Only
10067	Over Temperature Alarm Limit	Units: 1/16 Deg. F Min/Max: 175 - 240 (x 16)	signed short (16 bits)	Read Only

Address	Parameter	Units/Range	Data Type	Access
10068	Plant Temperature Shutdown Limit	Units: 1/16 Deg. F Min/Max: 122 - 176 (x 16)	signed short (16 bits)	Read Only
10069	Plant Temperature Alarm Limit	Units: 1/16 Deg. F Min/Max: 104 - 176 (x 16)	signed short (16 bits)	Read Only
10132	Dryer Temperature Shutdown Limit	Units: 1/16 Deg. F Min/Max: 50 - 250 (x 16)	signed short (16 bits)	Read Only
10133	Dryer Temperature Alarm Limit	Units: 1/16 Deg. F Min/Max: 50 - 250 (x 16)	signed short (16 bits)	Read Only
10137	Stop Timer Setting	Units: 1/10 Minutes Min/Max: 0 - 120	unsigned short (16 bits)	Read Only
10147	Idle Timer Setting	Units: 1/10 Minutes Min/Max: 0 - 120	unsigned short (16 bits)	Read Only
10151	Elevation	Units: Feet Min/Max: 0 - 30000	signed short (16 bits)	Read Only

Sequencing Settings

Address	Parameter	Units/Range	Data Type	Access
10003	Number of Sequenced Units	Units: None Min/Max: 1 – 8	signed short (16 bits)	Read Only
10004	Sequence Unit Number	Units: None Min/Max: 1 – 8	signed short (16 bits)	Read Only
10005	Sequence Group	Units: None Min/Max: 0 – 7 (A – H)	signed short (16 bits)	Read Only
10006	Transfer Interval	Units: Hours Min/Max: 0 – 5000	signed short (16 bits)	Read Only
10007	Lag Start Delay	Units: Seconds Min/Max: 1 - 60	signed short (16 bits)	Read Only
10025	Transfer Load Decrement	Units: % of Full Speed Min/Max: 20 - 100	signed short (16 bits)	Read Only
10026	Transfer Load Increment	Units: % of Full Speed Min/Max: 70 - 100	signed short (16 bits)	Read Only

Remote Monitoring Settings

Address	Parameter	Units/Range	Data Type	Access
10028	IP Address	Min/Max: 0x00000000 – 0xFFFFFFFF	signed short (x 2) (16 bits)	Read Only
10030	Subnet Mask	Min/Max: 0x00000000 – 0xFFFFFFFF	signed short (x 2) (16 bits)	Read Only
10032	Gateway Address	Min/Max: 0x00000000 – 0xFFFFFFFF	signed short (x 2) (16 bits)	Read Only

Shutdown / Advisory History

Address	Parameter	Units/Range	Data Type	Access
11000 – 11029	Shutdown Data Structure #1	See structure below		Read Only
11002 (MSB)	Shutdown Code	Refer to document No. 13-17-600 for Shutdown & Advisory codes	signed char (8 bits)	Read Only
11004	Interstage Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
11005	Inlet Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
11006	Plant Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
11007	Separator Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
11008	Discharge Temperature	Units: 1/16 Deg. F Min/Max: 31 – 257 (x 16)	signed short (16 bits)	Read Only
11009	Interstage Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
11010	Inlet Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
11011	Plant Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
11012	Separator Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
11013	Reservoir Pressure	Units: 1/16 PSI Min/Max: 0 – 250 (x 16)	signed short (16 bits)	Read Only
11014	Total Hours	LSB = 6 minutes (1/10 hour)	signed long (32 bits)	Read Only

Address	Parameter	Units/Range	Data Type	Access
11016	Real Time Stamp	32-bits of real time data as: YYYYYYMMMMTTTTTHHH HHNNNNNNDDDDDD Where: Y = 6 bits representing year 0 - 63 M = 4 bits representing month 1 - 12, T = 5 bits representing date 1 - 31, H = 5 bits representing hour 0 - 23, N = 6 bits representing minute 0 - 59, D = 6 bits representing day of week 1 - 7.	unsigned long (32 bits)	Read Only
11018	V1 Status	Use the following masks to isolate status bits: 0x0001 = READY 0x0002 = RUNNING 0x0004 = COMMAND FWD 0x0008 = ROTATE FWD 0x0010 = ACCELERATING 0x0020 = DECELERATING 0x0040 = ALARM 0x0080 = FAULT 0x0100 = AT FREQUENCY 0x0200 = WARNING 0x0400 = NOT USED 0x0800 = NOT USED 0x1000 = DIN1 BIT 0x2000 = DIN2 BIT 0x4000 = NOT USED 0x8000 = NOT USED	unsigned short (16 bits)	Read Only
11019	V1 Actual Frequency	Units: 1/100 Hz Actual motor operating frequency.	signed short (16 bits)	Read Only
11020	V1 Motor Speed	Units: RPM	signed short (16 bits)	Read Only
11021	V1 Current	Units: 1/10 Amp	signed short (16 bits)	Read Only
11022	V1 Heat Sink Temperature	Units: Deg. C	signed short (16 bits)	Read Only

Address	Parameter	Units/Range	Data Type	Access
11023	V1 DC Bus Voltage	Units: Volts	signed short (16 bits)	Read Only
11024	V2 Status	See **V1 Status** bit masks above	unsigned short (16 bits)	Read Only
11025	V2 Actual Frequency	Units: 1/100 Hz Actual motor operating frequency.	signed short (16 bits)	Read Only
11026	V2 Motor Speed	Units: RPM	signed short (16 bits)	Read Only
11027	V2 Current	Units: 1/10 Amp	signed short (16 bits)	Read Only
11028	V2 Heat Sink Temperature	Units: Deg. C	signed short (16 bits)	Read Only
11029	V2 DC Bus Voltage	Units: Volts	signed short (16 bits)	Read Only
11030 - 11059	Shutdown Data Structure #2	Same a **Shutdown #1** structure above		Read Only
11060 - 11089	Shutdown Data Structure #3	Same a **Shutdown #1** structure above		Read Only
11090 - 11119	Shutdown Data Structure #4	Same a **Shutdown #1** structure above		Read Only
11120 - 11149	Shutdown Data Structure #5	Same a **Shutdown #1** structure above		Read Only
11150 - 11179	Shutdown Data Structure #6	Same a **Shutdown #1** structure above		Read Only
11180 - 11209	Advisory Data Structure #1	Same a **Shutdown #1** structure above		Read Only
11210 - 11239	Advisory Data Structure #2	Same a **Shutdown #1** structure above		Read Only
11240 - 11269	Advisory Data Structure #3	Same a **Shutdown #1** structure above		Read Only
11270 - 11299	Advisory Data Structure #4	Same a **Shutdown #1** structure above		Read Only
11300 - 11329	Advisory Data Structure #5	Same a **Shutdown #1** structure above		Read Only
11330 - 11359	Advisory Data Structure #6	Same a **Shutdown #1** structure above		Read Only

6.4 Modbus Address Map (Blower application)

Address	Parameter	Units / Range / Description	Data Type	Access
1000	Controller State	0x0000 = ADJUSTMENT 0x0001 = POWER ON RESET 0x0004 = SHUTDOWN 0x0007 = REMOTE HALT 0x0008 = AUTO RESTART 0x000A = ENABLED 0x000B = READY 0x000C = START 0x000F = PAUSE 0x0010 = MODULATE 0x0012 = NORMAL STOP	unsigned short (16 bits)	Read Only
12000	Controller Status Flags 1	Use the following masks to isolate flag bits: 0x0001 = DELAY TIMER EXPIRED 0x0002 = MOTORS RUNNING 0x0004 = LOADED 0x0008 = WRITE DECIHOUR COUNTER 0x0010 = EXP BRD COMM ERROR 0x0020 = DRIVE1 COMM ERROR 0x0040 = NOT USED 0x0080 = NOT USED 0x0100 = NOT USED 0x0200 = ADVISORY ACTIVE 0x0400 = STOP SOURCE 0x0800 = NOT USED 0x1000 = AIR FILTER CLOGGED 0x2000 = INTERNAL ERROR 0x4000 = AUTO ALTERNATE DISPLAY 0x8000 = NOT USED	unsigned short (16 bits)	Read Only

Address	Parameter	Units / Range / Description	Data Type	Access
12001	Controller Status Flags 2	Use the following masks to isolate flag bits: 0x0001 = AUTO RESTART ENABLED 0x0002 = PROGRAM FLASH CRC OK 0x0004 = LANGUAGE TABLE CRC OK 0x0008 = EEPROM PARAMS RESTORED 0x0010 = EEPROM PARAMS RESET 0x0020 = BACKUP PARAMS UPDATED 0x0040 = ADC ERROR 0x0080 = DRIVE1 AT FREQUENCY 0x0100 = NOT USED 0x0200 = NOT USED 0x0400 = XB1 CALLED FOR 0x0800 = RESET ALARM EDGE 0x1000 = LAST RESET ALARM 0x2000 = STOP KEY STATE 0x4000 = NOT USED 0x8000 = NOT USED	unsigned short (16 bits)	Read Only
12002	Controller Status Flags 3	Use the following masks to isolate flag bits: 0x0001 = NOT USED 0x0002 = MODEL TABLE VALID 0x0004 = NOT USED 0x0008 = SAVING EEPROM PARAMS 0x0010 = DRIVES BEING RESET 0x0020 = COMM MODULE INSTALLED 0x0040 = NOT USED 0x0080 = NOT USED 0x0100 = NOT USED 0x0200 = NOT USED 0x0400 = NOT USED 0x0800 = NOT USED 0x1000 = NOT USED 0x2000 = NOT USED 0x4000 = NOT USED 0x8000 = IN MODULTAION	unsigned short (16 bits)	Read Only

Address	Parameter	Units / Range / Description	Data Type	Access
12003	Controller Status Flags 4	Use the following masks to isolate flag bits: 0x0001 = NOT USED 0x0002 = GENERAL PURPOSE 1Hz 0x0004 = NOT USED 0x0008 = NOT USED 0x0010 = RTC RUN 0x0020 = RTC STOP 0x0040 = MAINTENACE CNTR RESET 0x0080 = RUNTIME EDIT PROGRSS 0x0100 = DOUT ADVISORY ALARM 0x0200 = NOT USED 0x0400 = DOUT ANY ALARM 0x0800 = ALARM CHANGE PULSE 0x1000 = NOT USED 0x2000 = FAN RUNNING 0x4000 = ENTER TO CLR ADVISORY 0x8000 = VFD OVERCURRENT	unsigned short (16 bits)	Read Only

Maintenance Information

Address	Parameter	Units / Range / Description	Data Type	Access
13000	Total Hours	LSB = 6 minutes (1/10 hour)	signed long (32 bits)	Read Only
13002	Total Hours	LSB = 6 minutes (1/10 hour)	signed long (32 bits)	Read Only
10066	Oil Change Interval	Units: Hours Min/Max: 1000 - 12000	signed short (16 bits)	Read Only
14000	Last Oil Change	**Total Hours** at last oil change.	signed long (32 bits)	Read Only
10065	Air Filter Change Interval	Units: Hours Min/Max: 1000 - 4000	signed short (16 bits)	Read Only
14002	Last Air Filter Change	**Total Hours** at last air filter change.	signed long (32 bits)	Read Only
10068	Motor Lube Interval	Units: Hours Min/Max: 500 - 10000	signed short (16 bits)	Read Only
14004	Last Motor Lube	**Total Hours** at last motor lubrication	signed long (32 bits)	Read Only
10067	Control Box Filter Change Interval	Units: Hours Min/Max: 400 - 1000	signed short (16 bits)	Read Only
14006	Last Control Box Filter Change	**Total Hours** at last control box filter change	signed long (32 bits)	Read Only
2057	Controller Firmware Version	Units: 1/100 (203 = version 2.03)	signed short (16 bits)	Read Only

Real Time Pressures and Temperatures

Address	Parameter	Units/Range	Data Type	Access
1001	Inlet Temperature	Units: 1/16 Deg. F Min/Max: 15 – 250 (x 16)	signed short (16 bits)	Read Only
1002	Discharge Temperature	Units: 1/16 Deg. F Min/Max: 15 – 400 (x 16)	signed short (16 bits)	Read Only
1003	Enclosure Temperature	Units: 1/16 Deg. F Min/Max: 15 – 250 (x 16)	signed short (16 bits)	Read Only
1004	Drive End Oil Temperature	Units: 1/16 Deg. F Min/Max: 15 – 250 (x 16)	signed short (16 bits)	Read Only
1005	Gear End Oil Temperature	Units: 1/16 Deg. F Min/Max: 15 – 250 (x 16)	signed short (16 bits)	Read Only
1006	Discharge Pressure	Units: 1/16 PSI Min/Max: -15 – 35 (x 16)	signed short (16 bits)	Read Only
1007	Inlet Pressure	Units: 1/16 PSI Min/Max: -15 - 35 (x 16)	signed short (16 bits)	Read Only
1008	Differential Pressure	Units: 1/16 PSI Min/Max: 0 - 50 (x 16)	signed short (16 bits)	Read Only
1012	Drive End Oil Level	Units: Min/Max:	signed short (16 bits)	Read Only
1013	Gear End Oil Level	Units: Min/Max:	signed short (16 bits)	Read Only
1014	System Pressure	Units: 1/16 PSI Min/Max: -15 - 35 (x 16)	signed short (16 bits)	Read Only

Variable Frequency Drive and Motor Parameters

Address	Parameter	Units/Range	Data Type	Access
2003	V1 Frequency Command	Units: 1/100 Hz VFD frequency command from controller.	signed short (16 bits)	Read Only
2006	V1 Status	Use the following masks to isolate status bits: 0x0001 = READY 0x0002 = RUNNING 0x0004 = COMMAND FWD 0x0008 = ROTATE FWD 0x0010 = ACCELERATING 0x0020 = DECELERATING 0x0040 = ALARM 0x0080 = FAULT 0x0100 = AT FREQUENCY 0x0200 = WARNING 0x0400 = NOT USED 0x0800 = NOT USED 0x1000 = DIN1 BIT 0x2000 = DIN2 BIT 0x4000 = NOT USED 0x8000 = NOT USED	unsigned short (16 bits)	Read Only
2009	V1 Fault Code	See VFD User's Manual for fault code listing.	signed short (16 bits)	Read Only
2012	V1 Actual Frequency	Units: 1/100 Hz Actual motor operating frequency.	signed short (16 bits)	Read Only
2018	V1 Current	Units: 1/10 Amp	signed short (16 bits)	Read Only
2021	V1 DC Bus Voltage	Units: Volts	signed short (16 bits)	Read Only
2024	V1 Motor Speed	Units: RPM	signed short (16 bits)	Read Only
2033	V1 Motor Power	Units: 1/10 kW	signed short (16 bits)	Read Only
2036	V1 Heat Sink Temperature	Units: Deg. C	signed short (16 bits)	Read Only
2048	V1 Firmware Version	See VFD User's Manual for data format.	signed short (16 bits)	Read Only
2054	V1 Motor Voltage	Units: Volts	signed short (16 bits)	Read Only

Address	Parameter	Units/Range	Data Type	Access
2074	V1 Motor Nameplate Volts	Units: Volts	signed short (16 bits)	Read Only
2077	V1 Motor Nameplate Hertz	Units: 1/100 Hz	signed short (16 bits)	Read Only
2080	V1 Motor Nameplate FLA	Units: 1/10 Amp	signed short (16 bits)	Read Only

Front Panel Display

Address	Parameter	Units/Range	Data Type	Access
4096	Front Panel LEDs	Use the following masks to isolate LED bits: 0x0001 = POWER 0x0002 = AUTOMATIC 0x0004 = SERVICE 0x0008 = SHUTDOWN	unsigned short (16 bits)	Read Only
4097 – 4106	Front Panel Display Line 1	20 characters / line 2 characters / 16-bit word	unsigned short (16 bits)	Read Only
4107 – 4116	Front Panel Display Line 2	20 characters / line 2 characters / 16-bit word	unsigned short (16 bits)	Read Only
4117 – 4126	Front Panel Display Line 3	20 characters / line 2 characters / 16-bit word	unsigned short (16 bits)	Read Only
4127 – 4136	Front Panel Display Line 4	20 characters / line 2 characters / 16-bit word	unsigned short (16 bits)	Read Only

Operational Settings

Address	Parameter	Units/Range	Data Type	Access
10000	Target Pressure Setting	Units: 1/16 PSI Min/Max: 45 – 250 (x 16)	signed short (16 bits)	Read Only
10008	Operating Mode	0 = Constant, 1 = Automatic, 2 = Sequence	signed short (16 bits)	Read Only
10009	Blower Type	0 = Fixed Speed, 1 = Variable Speed	signed short (16 bits)	Read Only
10010	Start Timer Setting	Units: Seconds Min/Max: 0 - 600	unsigned short (16 bits)	Read Only
10011	Stop Timer Setting	Units: Seconds Min/Max: 0 - 600	unsigned short (16 bits)	Read Only
10034	Local Capacity	Units: CFM Min/Max: 0 - 5000	signed short (16 bits)	Read Only
10038	Differential Temp Fault Limit	Units: 1/16 Deg. F Min/Max: 0 - 250 (x 16)	signed short (16 bits)	Read Only
10039	Differential Temp Alarm Limit	Units: 1/16 Deg. F Min/Max: 0 - 250 (x 16)	signed short (16 bits)	Read Only
10040	Discharge Temp Fault Limit	Units: 1/16 Deg. F Min/Max: 0 - 350 (x 16)	unsigned short (16 bits)	Read Only
10041	Discharge Temp Alarm Limit	Units: 1/16 Deg. F Min/Max: 0 - 350 (x 16)	unsigned short (16 bits)	Read Only
10042	Enclosure Temp Fault Limit	Units: 1/16 Deg. F Min/Max: 15 - 250 (x 16)	unsigned short (16 bits)	Read Only
10043	Enclosure Temp Alarm Limit	Units: 1/16 Deg. F Min/Max: 15 - 250 (x 16)	unsigned short (16 bits)	Read Only
10044	Inlet Temp High Limit	Units: 1/16 Deg. F Min/Max: 15 -150 (x 16)	unsigned short (16 bits)	Read Only
10045	Inlet Temp Low Fault Limit	Units: 1/16 Deg. F Min/Max: 15 -150 (x 16)	signed short (16 bits)	Read Only
10046	Inlet Temp Low Alarm Limit	Units: 1/16 Deg. F Min/Max: 15- 150 (x 16)	signed short (16 bits)	Read Only
10047	Differential Pres Fault Limit	Units: 1/16 PSI Min/Max: 0 – 50 (x 16)	signed short (16 bits)	Read Only
10048	Differential Pres Alarm Limit	Units: 1/16 PSI Min/Max: 0 – 50 (x 16)	signed short (16 bits)	Read Only
10049	Control Pressure Fault Limit	Units: 1/16 PSI Min/Max: 0 – 20 (x 16)	signed short (16 bits)	Read Only
10050	Control Pressure Alarm Limit	Units: 1/16 PSI Min/Max: 0 – 20 (x 16)	signed short (16 bits)	Read Only

Address	Parameter	Units/Range	Data Type	Access
10051	Oil Temperature Fault Limit	Units: 1/16 Deg. F Min/Max: 15 - 350 (x 16)	signed short (16 bits)	Read Only
10052	Oil Temperature Alarm Limit	Units: 1/16 Deg. F Min/Max: 15 - 350 (x 16)	signed short (16 bits)	Read Only
10053	Drive End Low Oil Level Fault limit	Units: Min/Max:	signed short (16 bits)	Read Only
10054	Drive End Low Oil Level Alarm limit	Units: Min/Max:	unsigned short (16 bits)	Read Only
10055	Drive End High Oil Level Fault limit	Units: Min/Max:	unsigned short (16 bits)	Read Only
10056	Gear End Low Oil Level Fault limit	Units: Min/Max:	signed short (16 bits)	Read Only
10057	Gear End Low Oil Level Alarm limit	Units: Min/Max:	unsigned short (16 bits)	Read Only
10058	Gear End High Oil Level Fault limit	Units: Min/Max:	signed short (16 bits)	Read Only

Sequencing Settings

Address	Parameter	Units/Range	Data Type	Access
10004	Sequence Unit Number	Units: None Min/Max: 1 – 8	signed short (16 bits)	Read Only
10005	Sequence Group	Units: None Min/Max: 0 – 7 (A – H)	signed short (16 bits)	Read Only
10006	Transfer Interval	Units: Hours Min/Max: 0 – 5000	signed short (16 bits)	Read Only
10007	Lag Start Delay	Units: Seconds Min/Max: 1 - 60	signed short (16 bits)	Read Only
10020	Number of Sequence Units	Units: None Min/Max: 1 – 8	signed short (16 bits)	Read Only
10025	Transfer Load Decrement	Units: % of Full Speed Min/Max: 20 - 100	signed short (16 bits)	Read Only
10026	Transfer Load Increment	Units: % of Full Speed Min/Max: 70 - 100	signed short (16 bits)	Read Only
10027	Release Pressure Setting	Units: 1/16 PSI Min/Max: -15 – 35 (x 16)	signed short (16 bits)	Read Only

Remote Monitoring Settings

Address	Parameter	Units/Range	Data Type	Access
10028	IP Address	Min/Max: 0x00000000 – 0xFFFFFFFF	signed short (x 2) (16 bits)	Read Only
10030	Subnet Mask	Min/Max: 0x00000000 – 0xFFFFFFFF	signed short (x 2) (16 bits)	Read Only
10032	Gateway Address	Min/Max: 0x00000000 – 0xFFFFFFFF	signed short (x 2) (16 bits)	Read Only

Shutdown / Advisory History

Address	Parameter	Units/Range	Data Type	Access
11000 - 11017	Shutdown Data Structure #1	See structure below		Read Only
11000 (MSB)	Shutdown Code	Refer to document No. IQ-7-200 for Shutdown & Advisory codes	signed char (8 bits)	Read Only
11001	Not used		signed short (16 bits)	Read Only
11002	Inlet Temperature	Units: 1/16 Deg. F Min/Max: 15 – 250 (x 16)	signed short (16 bits)	Read Only
11003	Discharge Temperature	Units: 1/16 Deg. F Min/Max: 15 – 400 (x 16)	signed short (16 bits)	Read Only
11004	Discharge Pressure	Units: 1/16 PSI Min/Max: -15 – 35 (x 16)	signed short (16 bits)	Read Only
11005	Inlet Pressure	Units: 1/16 PSI Min/Max: -15 - 35 (x 16)	signed short (16 bits)	Read Only
11006	Differential Pressure	Units: 1/16 PSI Min/Max: 0 – 50 (x 16)	signed short (16 bits)	Read Only
11007	Total Hours	LSB = 6 minutes (1/10 hour)	signed long (32 bits)	Read Only
11009	Real Time Stamp	32-bits of real time data as: YYYYYYMMMMTTTTTHHHHHNNNNNNDDDDDD Where: Y = 6 bits representing year 0 - 63 M = 4 bits representing month 1 - 12, T = 5 bits representing date 1 - 31, H = 5 bits representing hour 0 - 23, N = 6 bits representing minute 0 - 59, D = 6 bits representing day of week 1 - 7.	unsigned long (32 bits)	Read Only

Address	Parameter	Units/Range	Data Type	Access
11011	V1 Status	Use the following masks to isolate status bits: 0x0001 = READY 0x0002 = RUNNING 0x0004 = COMMAND FWD 0x0008 = ROTATE FWD 0x0010 = ACCELERATING 0x0020 = DECELERATING 0x0040 = ALARM 0x0080 = FAULT 0x0100 = AT FREQUENCY 0x0200 = WARNING 0x0400 = NOT USED 0x0800 = NOT USED 0x1000 = DIN1 BIT 0x2000 = DIN2 BIT 0x4000 = NOT USED 0x8000 = NOT USED	unsigned short (16 bits)	Read Only
11012	V1 Actual Frequency	Units: 1/100 Hz Actual motor operating frequency.	signed short (16 bits)	Read Only
11013	V1 Motor Speed	Units: RPM	signed short (16 bits)	Read Only
11014	V1 Current	Units: 1/10 Amp	signed short (16 bits)	Read Only
11015	V1 Heat Sink Temperature	Units: Deg. C	signed short (16 bits)	Read Only
11016	V1 DC Bus Voltage	Units: Volts	signed short (16 bits)	Read Only
11017	Not Used		unsigned short (16 bits)	Read Only
11018 - 11035	Shutdown Data Structure #2	Same a **Shutdown #1** structure above		Read Only
11036 - 11053	Shutdown Data Structure #3	Same a **Shutdown #1** structure above		Read Only
11054 - 11071	Shutdown Data Structure #4	Same a **Shutdown #1** structure above		Read Only
11072 - 11089	Shutdown Data Structure #5	Same a **Shutdown #1** structure above		Read Only
11090 - 11107	Shutdown Data Structure #6	Same a **Shutdown #1** structure above		Read Only

Address	Parameter	Units/Range	Data Type	Access
111108 - 11125	Shutdown Data Structure #7	Same a **Shutdown #1** structure above		Read Only
11126 - 11143	Shutdown Data Structure #8	Same a **Shutdown #1** structure above		Read Only
11144 - 11161	Shutdown Data Structure #9	Same a **Shutdown #1** structure above		Read Only
11162 - 11179	Shutdown Data Structure #10	Same a **Shutdown #1** structure above		Read Only
11180 - 11197	Advisory Data Structure #1	Same a **Shutdown #1** structure above		Read Only
11198 - 11215	Advisory Data Structure #2	Same a **Shutdown #1** structure above		Read Only
11216 - 11233	Advisory Data Structure #3	Same a **Shutdown #1** structure above		Read Only
11234 - 11251	Advisory Data Structure #4	Same a **Shutdown #1** structure above		Read Only
11252 - 11269	Advisory Data Structure #5	Same a **Shutdown #1** structure above		Read Only
11270 - 11287	Advisory Data Structure #6	Same a **Shutdown #1** structure above		Read Only
11288 - 11305	Advisory Data Structure #7	Same a **Shutdown #1** structure above		Read Only
11306 - 11323	Advisory Data Structure #8	Same a **Shutdown #1** structure above		Read Only
11324 - 11341	Advisory Data Structure #9	Same a **Shutdown #1** structure above		Read Only
11342 - 11359	Advisory Data Structure #10	Same a **Shutdown #1** structure above		Read Only

Gardner Denver

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For additional information contact your local representative or

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1800 Gardner Expressway, Quincy, Illinois 62305

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AEON® 9000SP

Superior Protection Lubricant

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SESQUICENTENNIAL

Synthetic Lubricant & Coolant
for Rotary Screw Air Compressors

- AEON 9000SP is a PAO (polyalphaolefin)/MFSE (multifunctional synthetic ester) synthetic blend tested and proven to provide optimum operating and service-life results.
- A highly robust blend formulated to withstand high temperatures, varnish/sludge formation, and environmental contamination.
- A unique additive package designed specifically to maximize compressor efficiency and provide optimum lubricity.
- A proven track record of superior service-life in the most rugged operating environments.

***Don't** Take a Chance...*
Use Only Original Gardner Denver
AEON Lubricants!

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Experience Proven Results™

AEON® 9000SP Advantages

- Superior thin-film protection for compressor internal components.
- Extended service life to 8,000 hours*, reduces downtime and disposal costs.
- Superior oxidation stability vs. other competitive brands.
- Free Oil Analysis Program.
- Completely demulsible - separates quickly, reduces condensate disposal costs.
- Minimizes oil carryover, reduces "make-up" costs.
- Compatible with all common air system seals.
- High flash point improves your safety margin.
- Non-hazardous, disposable with mineral-based compressor lubricants.

All compressed air systems require dry, clean air and environmentally sound disposal of by products. That is why Gardner Denver's support does not stop at the compressor.

Rust, oil vapors, wear particles, air pollution, industrial gases and humidity all can foul pressurized air flows. Proper removal of these contaminates is essential in preventing costly damage to tools, and equipment.

To ensure total system reliability, Gardner Denver provides a broad range of dryers, coalescing filters, oil/water separators, drains, cleaning fluids, and aftercoolers. ONE-STOP shopping from Gardner Denver assures that all components of the system are designed to work together and are backed by customer support today and for years to come.

Selected Physical Properties

Property	Test Method/Results
Viscosity	ASTM D445
at 40C, cST	49.01
at 100C, cST	7.83
at 100F, SUS	251
at 210F, SUS	52.5
ISO Viscosity Grade	46
Pour Point F/C	ASTM D97 - -65/-54
Flash Point F/C	ASTM D92 - 500/260
Demulsibility	ASTM D1401 - 40/40/0 (<1min.)
Color	Lilac

* Recommended service intervals depend on (1) clean ambient conditions, (2) filter and separator changes as required in compressor service and operating manual, and (3) "normal" compressor temperature conditions. NOTE: Laboratory analysis of compressor fluids should be used to determine lubricant service life.

Convenient Package Sizes

Package Size	Part #
5 Gallon	28H109
55 Gallon	28H110
6 — 1 Gallon	28H254

HMIS Hazard ID

Health: 0	Reactivity: 0
Flammability: 1	Handling: B

Not a controlled product under Canadian WHMIS criteria

A complete family of compressors and ancillary products is offered by Gardner Denver.

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ENERGY STAR PARTNER

ISO 9001 CERTIFIED QUALITY SYSTEM

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Customer Service Department
Telephone: (800) 682-9868 FAX: (217) 224-7814

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AEON™ 4000
Lubricant

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1859 2009
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Hydrocarbon Lubricant & Coolant
for Rotary Screw Air Compressors

- Aeon 4000 is a premium quality lubricant formulated with severely hydrotreated base oils and a unique additive system for maximum resistance to fluid breakdown providing superior protection and durability.
- Provides service intervals up to three times longer than that of comparable petroleum based lubricants.
- Non-toxic, non-hazardous and can be mixed in any amount with mineral oils for ease of disposal. Recyclable and re-refinable.
- Specifically formulated to provide optimum lubricity for rotary screw air compressors.
- Performs much like a full synthetic thus offering a better economical option.

Don't Take a Chance...
Use Only Original Gardner Denver
AEON Lubricants!

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Experience Proven Results™

AEON 4000 Advantages

- Excellent thermal and oxidative stability over a wide temperature range.
- Resists oxidative breakdown thus reducing oil thickening which can improve compressor efficiency and lower energy consumption costs
- Free Oil Analysis Program.
- Excellent demulsibility to maximize condensate separator efficiency.
- Improve equipment reliability by eliminating harmful varnish and carbon deposits on rotors and separators.
- Formulated from low volatility, highly purified base fluids to minimize carryover and make-up oil costs.
- Compatible with all common air system seals and equipment.
- 4000 hours operation life*, delivers long efficient performance.

All compressed air systems require dry, clean air and environmentally sound disposal of by products. That is why Gardner Denver's support does not stop at the compressor.

Rust, oil vapors, wear particles, air pollution, industrial gases and humidity all can foul pressurized air flows. Proper removal of these contaminates is essential in preventing costly damage to tools, and equipment.

To ensure total system reliability, Gardner Denver provides a broad range of dryers, coalescing filters, oil/water separators, drains, cleaning fluids, and aftercoolers. ONE-STOP shopping from Gardner Denver assures that all components of the system are designed to work together and are backed by customer support today and for years to come.

Selected Physical Properties

Property	Test Method/Results
Viscosity, cSt	ASTM D445
at 40C (100 F)	46.6
at 100C (210 F)	7
ISO Viscosity Grade	46
Pour Point F/C	ASTM D97... -27/-33
Flash Point F/C	ASTM D92... 475/246
Fire Point F/C	ASTM D92... 496/258
Demulsibility, 130° F	ASTM D1401 - 41/39/0 (5 min.)
Color	Clear Pale Green
Service Interval	4000 hours

* Recommended service intervals depend on (1) clean ambient conditions, (2) filter and separator changes as required in compressor service and operating manual, and (3) "normal" compressor temperature conditions. NOTE: Laboratory analysis of compressor fluids should be used to determine lubricant service life.

Convenient Package Sizes

Package Size	Part #
5 Gallon	28H57
55 Gallon	28H36
6 — 1 Gallon	28H253

HMIS Hazard ID

Health: 0	Reactivity: 0
Flammability: 1	Handling: B

Not a controlled product under Canadian WHMIS criteria

A complete family of compressors and ancillary products is offered by Gardner Denver.

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Customer Service Department
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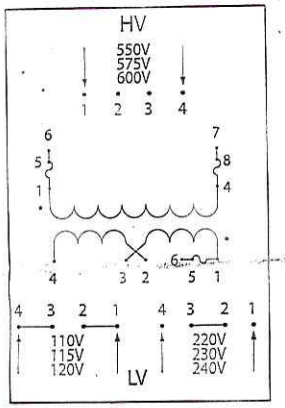
Hammond Power Solutions Inc.

HPS IMPERATOR® Industrial Control Transformer Wiring Diagrams

Literature Code: PHWD1

The **HPS IMPERATOR®** series of machine tool industrial molded control transformers are available in many standard offerings. This wiring hook-up instruction sheet refers to all standard *HPS IMPERATOR®* series part number suffixes. (Note: standard secondary fuse kits (not installed) supplied with each transformer unless otherwise indicated; field installed primary fuse kits sold separately; fuses not available from HPS.) If you have any questions regarding these wiring diagrams or are having any difficulty correctly installing our transformers, please contact HPS customer service or technical support in the U.S. at 1-866-705-4684 or in Canada at 1-888-798-8882.

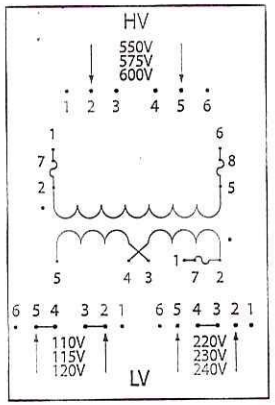
HPS IMPERATOR® Series - Wiring Schematic Drawings



PH***AJ Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)			Install Supplied Jumpers/ Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
600	575	550	None	1, 4	Unfused
600	575	550	None	6, 7	1-5, 4-8

Low Voltage (LV) (Secondary Volts)			Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120	115	110	3-4, 1-2	1, 4	Unfused
240	230	220	2-3	1, 4	Unfused
120	115	110	3-4, 1-2	4, 6	1-5
240	230	220	2-3	4, 6	1-5



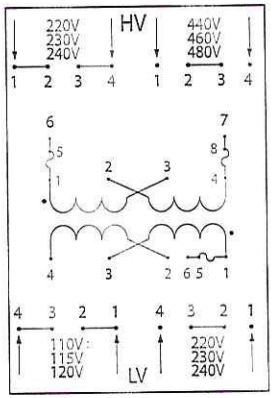
PH***AJ Schematic for 150VA to 1500VA Units

High Voltage (HV) (Primary Volts)			Install Supplied Jumpers/ Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
600	575	550	None	2, 5	Unfused
600	575	550	None	1, 6	2-7, 5-8

Low Voltage (LV) (Secondary Volts)			Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120	115	110	4-5, 2-3	2, 5	Unfused
240	230	220	3-4	2, 5	Unfused
120	115	110	4-5, 2-3	1, 5	2-7
240	230	220	3-4	1, 5	2-7

Issue Date: April 2009 rev5

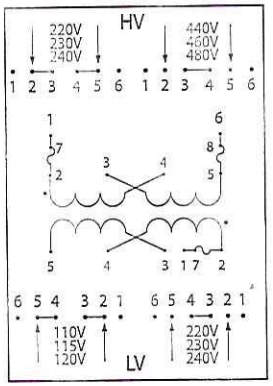
HPS IMPERATOR® Series - Wiring Schematic Drawings continued



PH***MQMJ Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)			Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
240	230	220	1-2, 3-4	1, 4	Unfused
480	460	440	2-3	1, 4	Unfused
240	230	220	1-2, 3-4	6, 7	1-5, 4-8
480	460	440	2-3	6, 7	1-5, 4-8

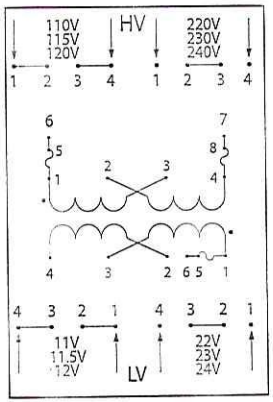
Low Voltage (LV) (Secondary Volts)			Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120	115	110	3-4, 1-2	1, 4	Unfused
240	230	220	2-3	1, 4	Unfused
120	115	110	3-4, 1-2	4, 6	1-5
240	230	220	2-3	4, 6	1-5



PH***MQMJ Schematic for 150VA to 1500VA Units

High Voltage (HV) (Primary Volts)			Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
240	230	220	2-3, 4-5	2, 5	Unfused
480	460	440	3-4	2, 5	Unfused
240	230	220	2-3, 4-5	1, 6	2-7, 5-8
480	460	440	3-4	1, 6	2-7, 5-8

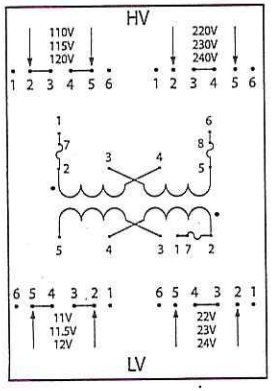
Low Voltage (LV) (Secondary Volts)			Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120	115	110	4-5, 2-3	2, 5	Unfused
240	230	220	3-4	2, 5	Unfused
120	115	110	4-5, 2-3	1, 5	2-7
240	230	220	3-4	1, 5	2-7.



PH***PG Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)			Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
120	115	110	1-2, 3-4	1, 4	Unfused
240	230	220	2-3	1, 4	Unfused
120	115	110	1-2, 3-4	6, 7	1-5, 4-8
240	230	220	2-3	6, 7	1-5, 4-8

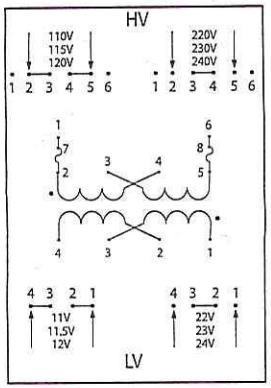
Low Voltage (LV) (Secondary Volts)			Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
12	11.5	11	3-4, 1-2	1, 4	Unfused
24	23	22	2-3	1, 4	Unfused
12	11.5	11	3-4, 1-2	4, 6	1-5
24	23	22	2-3	4, 6	1-5



PH***PG Schematic for 150VA to 500VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
120 115 110	2-3, 4-5	2, 5	Unfused
240 230 220	3-4	2, 5	Unfused
120 115 110	2-3, 4-5	1, 6	2-7, 5-8
240 230 220	3-4	1, 6	2-7, 5-8

Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
12 11.5 11	4-5, 2-3	2, 5	Unfused
24 23 22	3-4	2, 5	Unfused
12 11.5 11	4-5, 2-3	1, 5	2-7
24 23 22	3-4	1, 5	2-7

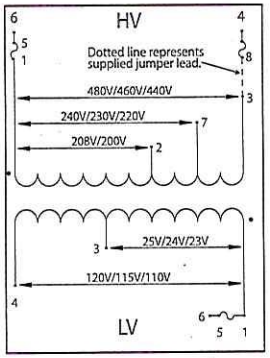


PH***PG Schematic for 750VA and 1000VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
120 115 110	2-3, 4-5	2, 5	Unfused
240 230 220	3-4	2, 5	Unfused
120 115 110	2-3, 4-5	1, 6	2-7, 5-8
240 230 220	3-4	1, 6	2-7, 5-8

Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
12 11.5 11	3-4, 1-2	1, 4	Unfused
24 23 22	2-3	1, 4	Unfused

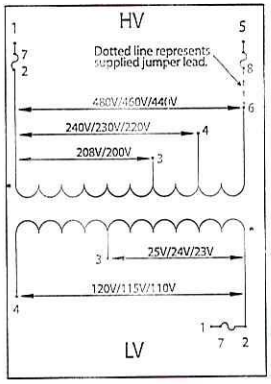
Note: secondary fuse clips not available on PH750PG or PH1000PG.



PH***MLI Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
480 460 440	None	1, 3	Unfused
240 230 220	None	1, 7	Unfused
208 200	None	1, 2	Unfused
480 460 440	3-8	6, 4	1-5, 4-8
240 230 220	8-7	6, 4	1-5, 4-8
208 200	2-8	6, 4	1-5, 4-8

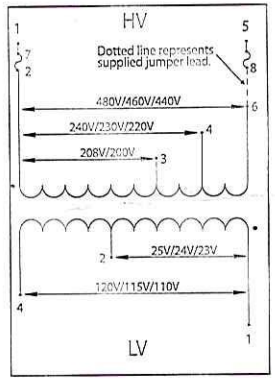
Low Voltage (LV) (Secondary Volts)	Install Supplied Jumpers Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	None	1, 4	Unfused
25 24 23	None	1, 3	Unfused
120 115 110	None	4, 6	1-5
25 24 23	None	3, 6	1-5



PH***MLI Schematic for 150VA to 500VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
480 460 440	None	2, 6	Unfused
240 230 220	None	2, 4	Unfused
208 200	None	2, 3	Unfused
480 460 440	8-6	1, 5	2-7, 5-8
240 230 220	4-8	1, 5	2-7, 5-8
208 200	3-8	1, 5	2-7, 5-8

Low Voltage (LV) (Secondary Volts)	Install Supplied Jumpers Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	None	2, 4	Unfused
25 24 23	None	2, 3	Unfused
120 115 110	None	1, 4	2-7
25 24 23	None	1, 3	2-7

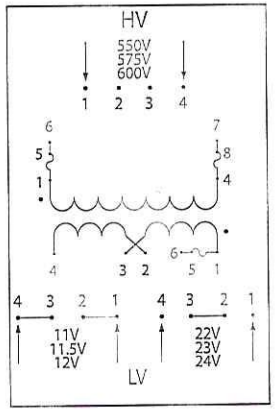


PH***MLI Schematic for 750VA and 1000VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
480 460 440	None	2, 6	Unfused
240 230 220	None	2, 4	Unfused
208 200	None	2, 3	Unfused
480 460 440	8-6	1, 5	2-7, 5-8
240 230 220	4-8	1, 5	2-7, 5-8
208 200	3-8	1, 5	2-7, 5-8

Low Voltage (LV) (Secondary Volts)	Install Supplied Jumpers Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	None	1, 4	Unfused
25 24 23	None	1, 2	Unfused

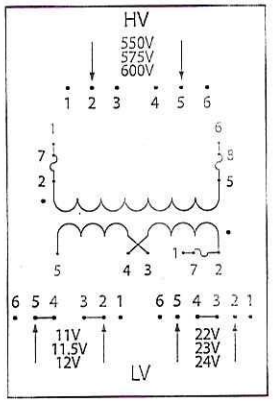
Note: secondary fuse clips for 24V tap not available on the PH750MLI or PH1000MLI units.



PH***AR Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers/ Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
600 575 550	None	1, 4	Unfused
600 575 550	None	6, 7	1-5, 4-8

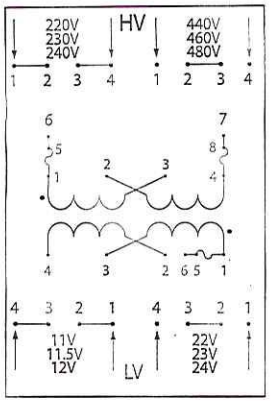
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
12 11.5 11	3-4, 1-2	1, 4	Unfused
24 23 22	2-3	1, 4	Unfused
12 11.5 11	3-4, 1-2	4, 6	1-5
24 23 22	2-3	4, 6	1-5



PH***AR Schematic for 150VA to 500VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers/ Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
600 575 550	None	2, 5	Unfused
600 575 550	None	1, 6	2-7, 5-8

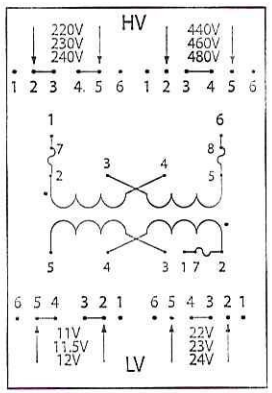
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
12 11.5 11	4-5, 2-3	2, 5	Unfused
24 23 22	3-4	2, 5	Unfused
12 11.5 11	4-5, 2-3	1, 5	2-7
24 23 22	3-4	1, 5	2-7



PH***QR Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
240 230 220	1-2, 3-4	1, 4	Unfused
480 460 440	2-3	1, 4	Unfused
240 230 220	1-2, 3-4	6, 7	1-5, 4-8
480 460 440	2-3	6, 7	1-5, 4-8

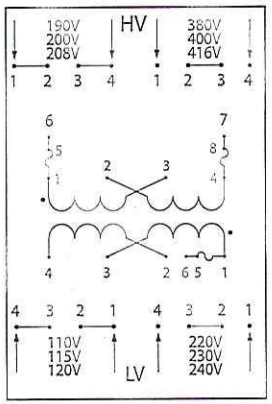
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
12 11.5 11	3-4, 1-2	1, 4	Unfused
24 23 22	2-3	1, 4	Unfused
12 11.5 11	3-4, 1-2	4, 6	1-5
24 23 22	2-3	4, 6	1-5



PH***QR Schematic for 150VA to 500VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
240 230 220	2-3, 4-5	2, 5	Unfused
480 460 440	3-4	2, 5	Unfused
240 230 220	2-3, 4-5	1, 6	2-7, 5-8
480 460 440	3-4	1, 6	2-7, 5-8

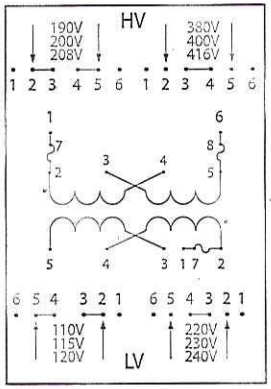
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
12 11.5 11	4-5, 2-3	2, 5	Unfused
24 23 22	3-4	2, 5	Unfused
12 11.5 11	4-5, 2-3	1, 5	2-7
24 23 22	3-4	1, 5	2-7



PH***SP Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
208 200 190	1-2, 3-4	1, 4	Unfused
416 400 380	2-3	1, 4	Unfused
208 200 190	1-2, 3-4	6, 7	1-5, 4-8
416 400 380	2-3	6, 7	1-5, 4-8

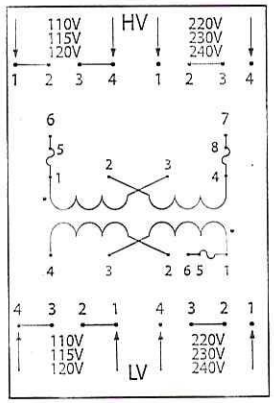
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	3-4, 1-2	1, 4	Unfused
240 230 220	2-3	1, 4	Unfused
120 115 110	3-4, 1-2	4, 6	1-5
240 230 220	2-3	4, 6	1-5



PH***SP Schematic for 150VA to 1000VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
208 200 190	2-3, 4-5	2, 5	Unfused
416 400 380	3-4	2, 5	Unfused
208 200 190	2-3, 4-5	1, 6	2-7, 5-8
416 400 380	3-4	1, 6	2-7, 5-8

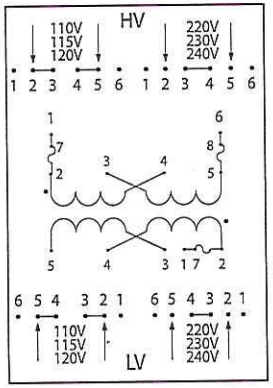
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	4-5, 2-3	2, 5	Unfused
240 230 220	3-4	2, 5	Unfused
120 115 110	4-5, 2-3	1, 5	2-7
240 230 220	3-4	1, 5	2-7



PH***PP Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
120 115 110	1-2, 3-4	1, 4	Unfused
240 230 220	2-3	1, 4	Unfused
120 115 110	1-2, 3-4	6, 7	1-5, 4-8
240 230 220	2-3	6, 7	1-5, 4-8

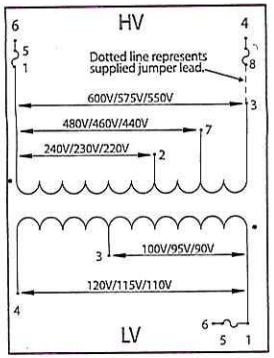
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	3-4, 1-2	1, 4	Unfused
240 230 220	2-3	1, 4	Unfused
120 115 110	3-4, 1-2	4, 6	1-5
240 230 220	2-3	4, 6	1-5



PH***PP Schematic for 150VA to 1500VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Links Between Terminals	Supply Lines Connect To	Install Fuse Clips To
120 115 110	2-3, 4-5	2, 5	Unfused
240 230 220	3-4	2, 5	Unfused
120 115 110	2-3, 4-5	1, 6	2-7, 5-8
240 230 220	3-4	1, 6	2-7, 5-8

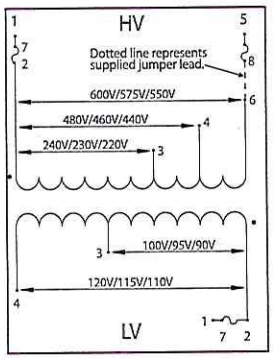
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	4-5, 2-3	2, 5	Unfused
240 230 220	3-4	2, 5	Unfused
120 115 110	4-5, 2-3	1, 5	2-7
240 230 220	3-4	1, 5	2-7



PH***MBMH Schematic for 50 and 75VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
600 575 550	None	1, 3	Unfused
480 460 440	None	1, 7	Unfused
240 230 220	None	1, 2	Unfused
600 575 550	3-8	6, 4	1-5, 4-8
480 460 440	8-7	6, 4	1-5, 4-8
240 230 220	2-8	6, 4	1-5, 4-8

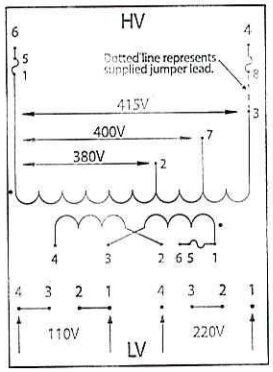
Low Voltage (LV) (Secondary Volts)	Install Supplied Jumpers/ Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	None	1, 4	Unfused
100 95 90	None	1, 3	Unfused
120 115 110	None	4, 6	1-5
100 95 90	None	3, 6	1-5



PH***MBMH Schematic for 100VA to 1500VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
600 575 550	None	2, 6	Unfused
480 460 440	None	2, 4	Unfused
240 230 220	None	2, 3	Unfused
600 575 550	8-6	1, 5	2-7, 5-8
480 460 440	4-8	1, 5	2-7, 5-8
240 230 220	3-8	1, 5	2-7, 5-8

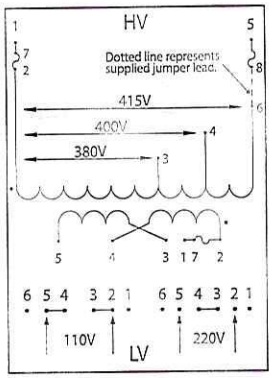
Low Voltage (LV) (Secondary Volts)	Install Supplied Jumpers/ Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120 115 110	None	2, 4	Unfused
100 95 90	None	2, 3	Unfused
120 115 110	None	1, 4	2-7
100 95 90	None	1, 3	2-7



PH***MEMX Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
415	None	1, 3	Unfused
400	None	1, 7	Unfused
380	None	1, 2	Unfused
415	3-8	6, 4	1-5, 4-8
400	8-7	6, 4	1-5, 4-8
380	2-8	6, 4	1-5, 4-8

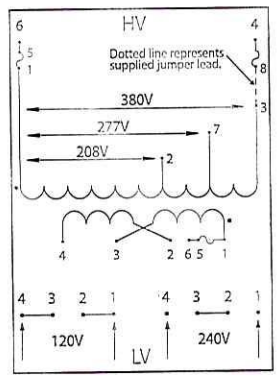
Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
110	3-4, 1-2	1, 4	Unfused
220	2-3	1, 4	Unfused
110	3-4, 1-2	4, 6	1-5
220	2-3	4, 6	1-5



PH***MEMX Schematic for 150VA to 1000VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
415	None	2, 6	Unfused
400	None	2, 4	Unfused
380	None	2, 3	Unfused
415	8-6	1, 5	2-7, 5-8
400	4-8	1, 5	2-7, 5-8
380	3-8	1, 5	2-7, 5-8

Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
110	4-5, 2-3	2, 5	Unfused
220	3-4	2, 5	Unfused
110	4-5, 2-3	1, 5	2-7
220	3-4	1, 5	2-7

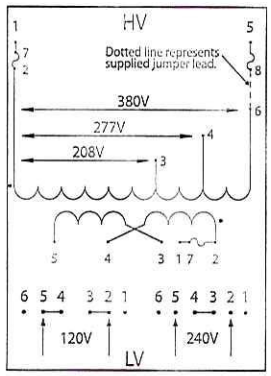


PH***MGJ Schematic for 50, 75 and 100VA Units

High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
380	None	1, 3	Unfused
277	None	1, 7	Unfused
208	None	1, 2	Unfused
380	3-8	6, 4	1-5, 4-8
277	8-7	6, 4	1-5, 4-8
208	2-8	6, 4	1-5, 4-8

Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120	3-4, 1-2	1, 4	Unfused
240	2-3	1, 4	Unfused
120	3-4, 1-2	4, 6	1-5
240	2-3	4, 6	1-5

PH***MGJ Schematic for 150VA to 1000VA Units



High Voltage (HV) (Primary Volts)	Install Supplied Jumpers Between Terminals	Supply Lines Connect To	Install Fuse Clips To
380	None	2, 6	Unfused
277	None	2, 4	Unfused
208	None	2, 3	Unfused
380	8-6	1, 5	2-7, 5-8
277	4-8	1, 5	2-7, 5-8
208	3-8	1, 5	2-7, 5-8

Low Voltage (LV) (Secondary Volts)	Install Supplied Links Between Terminals	Load Lines Connect To	Install Fuse Clips To
120	4-5, 2-3	2, 5	Unfused
240	3-4	2, 5	Unfused
120	4-5, 2-3	1, 5	2-7
240	3-4	1, 5	2-7

Hammond Power Solutions Inc.

HPS IMPERATOR™ Industrial Control Transformer Accessory Kits Instructions

Patent Pending

Literature Code: PHAK1

The ***HPS IMPERATOR™*** series of machine tool industrial molded control transformers are available with standard secondary fuse kits or optional accessories such as primary fuse kits and optional finger guard kits. This accessory kits instruction sheet details the standard and optional accessories available and examples of detailed assembly drawings.

If you have any questions regarding what accessories are available or are having any difficulty correctly installing these accessories, please contact HPS customer service or technical support in the U.S. at 1-866-705-4684 or in Canada at 1-888-798-8882.

Standard and Optional Accessory Kits Available

Standard Secondary Fuse Kits - supplied with each ***HPS IMPERATOR™*** transformer up to 1500VA (excluding PH750PG, PH1000PG, PH750MLI and PH1000MLI)

Kit P/N	Parts Included in Kit
SFK1	2 fuse clips, 2 mtg. screws, 4 voltage links, PHAK1 instruction sheet
SFK2	2 fuse clips, 2 mtg. screws, 6 voltage links, PHAK1 instruction sheet
SFK3	2 fuse clips, 2 mtg. screws, 6 voltage links, PHAK1 instruction sheet
SFK4	2 fuse clips, 2 mtg. screws, 2 voltage links, PHAK1 instruction sheet
SFK5	2 fuse clips, 2 mtg. screws, 2 voltage links, PHAK1 instruction sheet
SFK6	2 fuse clips, 2 mtg. screws, 3 voltage links, PHAK1 instruction sheet
SFK7	2 fuse clips, 2 mtg. screws, 3 voltage links, PHAK1 instruction sheet

Optional Primary Fuse Kits

Kit P/N	Applicable P/N Suffix's	Applicable VA Size	Parts Included in Kit
PFK1	AJ, AR, MQMJ, QR, SP, PG, PP	50, 75, 100	4 fuse clips, 4 mtg. screws, PHAK1 instruction sheet
PFK2	AJ, AR, MQMJ, QR, SP, PG, PP	150, 250	4 fuse clips, 4 mtg. screws, PHAK1 instruction sheet
PFK3	AJ, AR, MQMJ, QR, SP, PG, PP	350 to 1500	4 fuse clips, 4 mtg. screws, PHAK1 instruction sheet
PFK4	MBMH, MEMX, MGJ, MLI	50	4 fuse clips, 4 mtg. screws, 1 jumper, 1 finger guard, PHAK1 instruction sheet
PFK5	MBMH, MEMX, MGJ, MLI	75	4 fuse clips, 4 mtg. screws, 1 jumper, 1 finger guard, PHAK1 instruction sheet
PFK5	MEMX, MGJ, MLI	100	4 fuse clips, 4 mtg. screws, 1 jumper, 1 finger guard, PHAK1 instruction sheet
PFK6	MBMH	100	4 fuse clips, 4 mtg. screws, 1 jumper wire, PHAK1 instruction sheet
PFK6	MBMH, MEMX, MGJ, MLI	150, 250	4 fuse clips, 4 mtg. screws, 1 jumper wire, PHAK1 instruction sheet
PFK7	MBMH, MEMX, MGJ, MLI	350 to 1500	4 fuse clips, 4 mtg. screws, 1 jumper wire, PHAK1 instruction sheet
N/A	N/A	2000 to 5000	

Optional Unfused Finger Guard Kits

Kit P/N	Applicable P/N Suffix's	Applicable VA Size	Parts Included in Kit
FG1	AJ, AR, MQMJ, MEMX, QR, SP, PG, PP	50	1 finger guard (unfused), PHAK1 instruction sheet
FG2	MBMH, MGJ, MLI	50	1 finger guard (unfused), PHAK1 instruction sheet
FG2	All	75	1 finger guard (unfused), PHAK1 instruction sheet
FG2	All (excluding PH100MBMH)	100	1 finger guard (unfused), PHAK1 instruction sheet
	refer to FG3, FG4 or FG5 below	*150 to 1500*	
N/A	All	2000 to 5000	

Optional Fused Finger Guard Kits

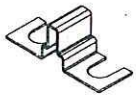
Kit P/N	Applicable P/N Suffix's	Applicable VA Size	Parts Included in Kit
FGF1	AJ, AR, MQMJ, MEMX, QR, SP, PG, PP	50	1 finger guard (fused), PHAK1 instruction sheet
FGF2	MBMH, MGJ, MLI	50	1 finger guard (fused), PHAK1 instruction sheet
FGF2	All	75	1 finger guard (fused), PHAK1 instruction sheet
FGF2	All (excluding PH100MBMH)	100	1 finger guard (fused), PHAK1 instruction sheet
FG3	MBMH	100	1 finger guard, PHAK1 instruction sheet
FG3	All	150	1 finger guard, PHAK1 instruction sheet
FG3	AJ, AR, MQMJ, MEMX, QR, SP, PG, PP	250	1 finger guard, PHAK1 instruction sheet
FG4	MBMH, MGJ, MLI	250	1 finger guard, PHAK1 instruction sheet
FG4	All	350, 500	1 finger guard, PHAK1 instruction sheet
FG4	AJ, AR, MQMJ, QR, SP, PP	750	1 finger guard, PHAK1 instruction sheet
FG5	MBMH, MEMX, MGJ, MLI, PG	750	1 finger guard, PHAK1 instruction sheet
FG5	All	1000, 1500	1 finger guard, PHAK1 instruction sheet
N/A	All	2000 to 5000	

Note: Maximum allowable current rating on all primary/secondary fuse kits is 30 Amps.

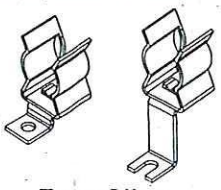
Important Installation Notes:

1) Torque all terminal screws between 12 to 14 inch-lbs.
2) For all bare wire connections, the recommended wire size range is: 18 AWGto 14 AWG for solid wire and 14 AWG for stranded. A ring or spade connector must be used if using a wire size outside the range listed above.
3) Ensure mounting screws used for installation (screws not supplied), are properly sized for transformer weight and mounting application.
4) When mounting fuse clips, remove the appropriate captive washer screw(s) from terminal block and install fuse clip(s) and new terminal screw(s).
5) For connection details, please refer to wiring instructions supplied with your HPS Imperator machine tool industrial control transformer.
6) Primary and secondary fuse kits are not suitable for *branch circuit* applications!

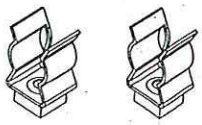
Accessory Sample Identifier Drawings



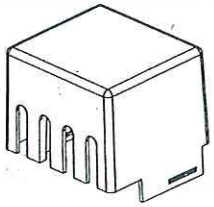
Voltage Link



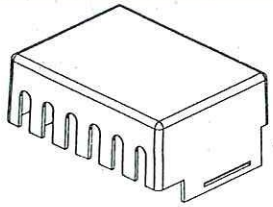
Fuse Clips
(for 50, 75 and 100VA)



Fuse Clips
(for 150VA to 1500VA)

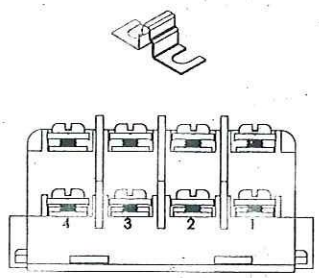


Finger Guard
(for 50, 75 and 100VA)

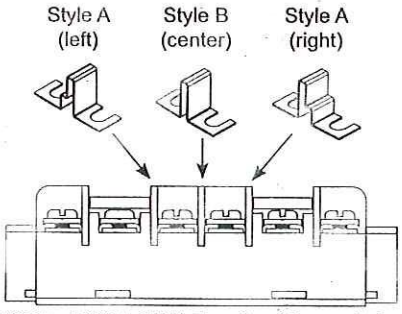


Finger Guard
(for 150VA to 1500VA)

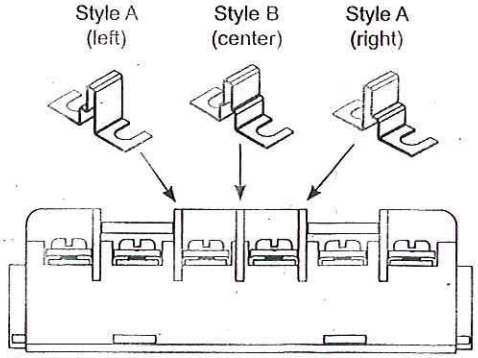
Sample Assembly Drawings for Voltage Link Installation



For units from 50VA to 100VA, the voltage links supplied can be installed between any two primary or secondary terminal bays. Please refer to PHWD1 or PHWD2 instruction sheet included with your transformer for connection for details.

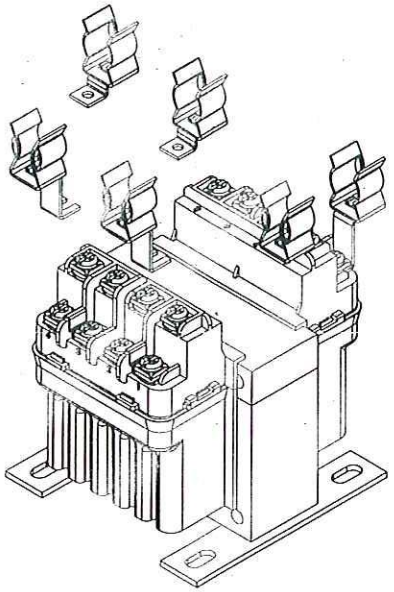


For units from 150VA to 250VA, the voltage links supplied must be installed between the primary or secondary terminal bays as indicated above Please refer to PHWD1 or PHWD2 instruction sheet included with you transformer for connection details.

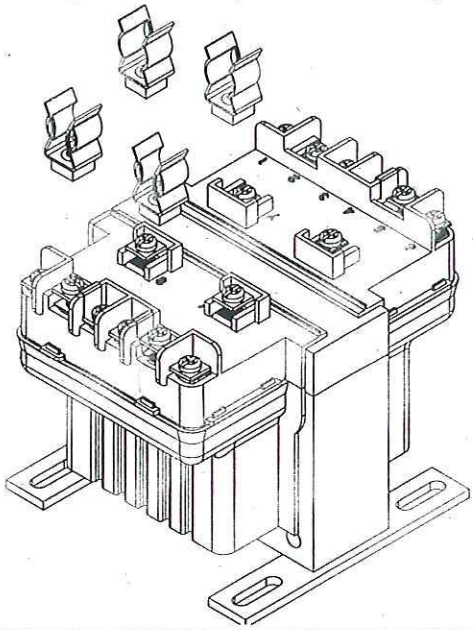


For units from 350VA to 1500VA, the voltage links supplied must be installed between the primary or secondary terminal bays as indicated above Please refer to PHWD1 or PHWD2 instruction sheet included with you transformer for connection details.

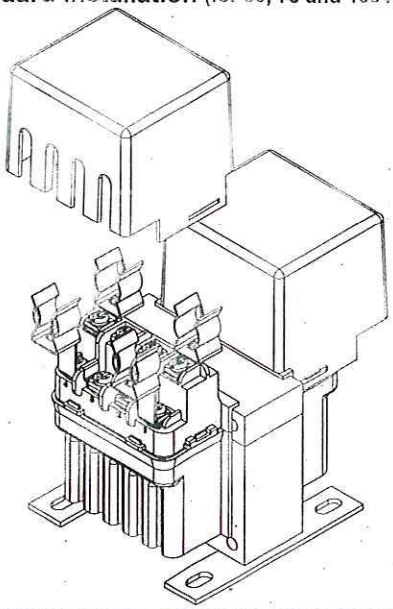
Sample Assembly Drawing for Fuse Clip Installation (for 50, 75 and 100VA)



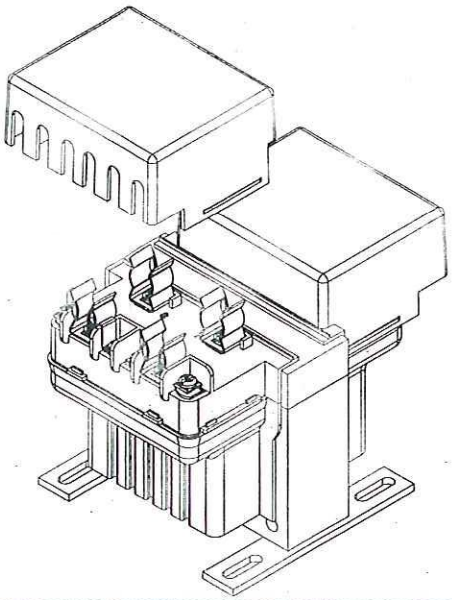
Sample Assembly Drawing for Fuse Clip Installation (for 150VA to 1500VA)



Sample Assembly Drawing for Finger Guard Installation (for 50, 75 and 100VA)



Sample Assembly Drawing for Finger Guard Installation (for 150VA to 1500VA)



Dangerous Electrial Current!
Only skilled or qualified persons may carry out the following operations.

Lebensgefahr durch elektrischen Strom!
Nur Elektrofachkräfte und elektrotechnisch unterwiesene Personen dürfen die im Folgenden beschriebenen Arbeiten ausführen.

Tension électrique dangereuse !
Seules les personnes qualifiées et averties doivent exécuter les travaux ci-après.

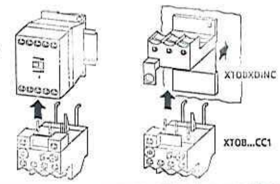
Tensione elettrica: Pericolo di morte!
Solo persone abilitate e qualificate possono eseguire le operazioni di seguito riportate.

¡Corriente eléctrica! ¡Peligro de muerte!
El trabajo a continuación descrito debe ser realizado por personas cualificadas y advertidas.

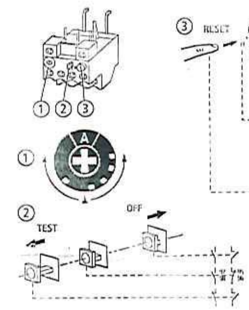
Электрический ток! Опасно для жизни!
Только специалисты или проинструктированные лица могут выполнять следующие операции.

XTOB
Overload Relay
Frames B and C.

Pub51222 April 2005



Warning! Motor may start automatically. Automatic start may injure persons and damage machines. Automatic restart is possible when "automatic reset" is active.



auto "without manual reset"
Auto „ohne Wiedereinschaltsperre"
automatique „sans réarmement manuel"
„senza riarmo manuale"
„sin rearme manual"

Manual "with manual reset"
Hand „mit Wiedereinschaltsperre"
manuel „avec réarmement manuel"
„con riarmo manuale"
„con rearme manual"

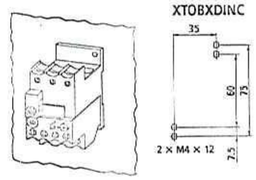
XTOB...BC1 XTOB...CC1	11,12,13	
Nm	1.8	0.8 – 1.2
lb-in	16	7 – 11

Pub51222 April 2005
12277411/DE03 FD
Printed in
the Federal Republic of Germany

XTOB...BC1 XTOB...CC1	11,12,13 mm² min.	11,12,13 mm² max.	95/96, 97/98 mm² min.	95/96, 97/98 mm² max.
	1	6	0,75	4
	1	6	0,75	2,5
	1	4	0,75	4
	1	6	0,75	2,5

XTOB...BC1 XTOB...CC1	11,12,13 AWG min.	11,12,13 AWG max.	95/96, 97/98 AWG min.	95/96, 97/98 AWG max.
	14	8	16	12
	14	8	16	12

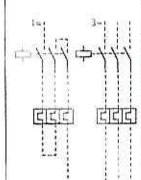
XTOB...CC1 with XTOBXDINC



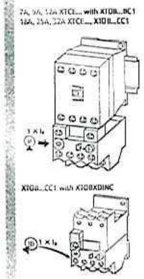
EATON

Installation Instructions
Montageanweisung
Notice d'installation
Istruzioni per il montaggio
Instrucciones de montaje
Инструкция по монтажу
安装说明

→ MN03402001E



XTOB...BC1, XTOB...CC1 Cat. No.		"1" gL max. A	"2" gL max. A	"1" aM max. A
XTOBP16...	0.1 – 0.16	25	0.5	–
XTOBP24...	0.16 – 0.24	25	1	–
XTOBP40...	0.24 – 0.4	25	2	–
XTOBP60...	0.4 – 0.6	25	4	–
XTOB001...	0.6 – 1.0	25	4	–
XTOB1P6...	1.0 – 1.6	25	6	–
XTOB2P4...	1.6 – 2.4	25	10	–
XTOB004...	2.4 – 4	25	16	–
XTOB006...	4 – 6	25	20	–
XTOB010...	6 – 10	50	25	20
XTOB012...	9 – 12	50	25	25
XTOB016...	10 – 16	63	35	25
XTOB024...	16 – 24	100	35	50
XTOB032...	24 – 32	125	63	50



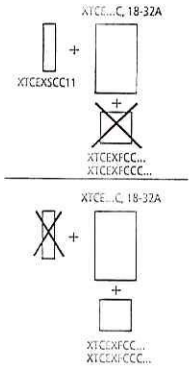
Pub51211 May 2006

Installation Instructions
Montageanweisung
Notice d'installation
Istruzioni per il montaggio
Instrucciones de montaje
Инструкция по монтажу
安装说明

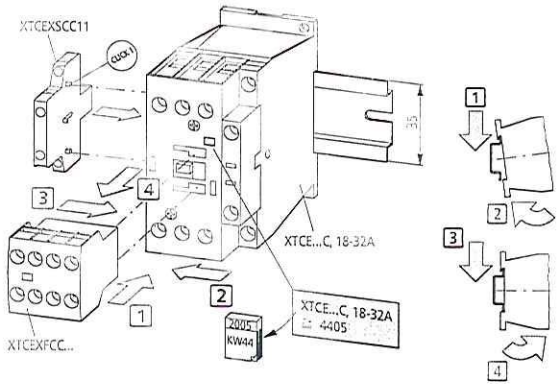
EATON

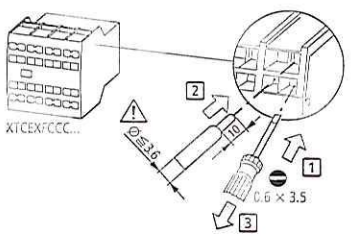
XTCE...C, 18-32A

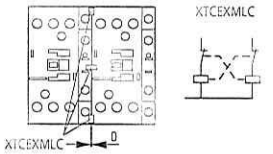
XTCEXFCC...
XTCEXSCC11
Auxiliary contact module
Hilfsschalterbaustein
Module de contacts auxiliaires
Modulo contatti ausiliari
Módulo de contactos auxiliares
Модуль вспомогательных выключателей
辅助开关组



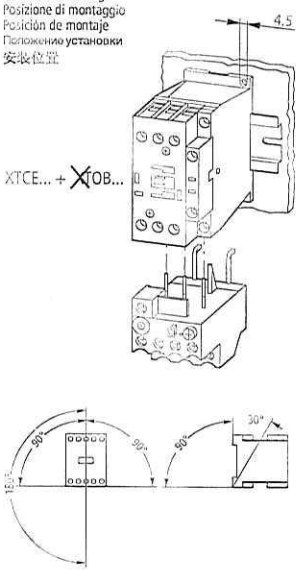
Mounting **Montage** **Montage** **Montaggio** **Montaje** **Монтаж** 安装	① place in position ② latch in	① aufsetzen ② rasten	① mettre en place ② encliqueter	① 装配 ② 装上嵌入
	① appoggiare ② inserire a scatto	① colocar en posición ② enclavar	① вождить ② зафиксировать	
Dismantling **Demontage** **Démontage,** **Smontaggio** **Desmontaje** **Разборка** 拆卸	③ push ④ remove	③ schieben ④ abziehen	③ pousser ④ retirer	③ 推 ④ 拔出
	③ inserire ④ estrarre	③ desplazar ④ extraer	③ задвинуть ④ снять	





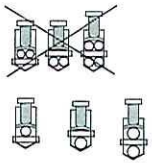


Mounting position
Einbaulage
Position de montage
Posizione di montaggio
Posición de montaje
Положение установки
安装位置

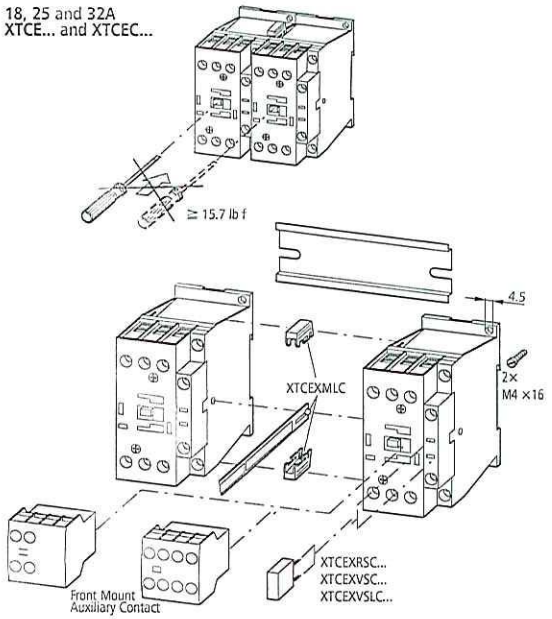


	mm²	AWG ≅ – ≅	Nm	lb-in
	1 × (0.75 – 16) 2 × (0.75 – 10)	14 – 8	3.2	28
	1 × (0.75 – 10) 2 × (0.75 – 10)			
	1 × 16			

A1/A2 13/14 21/22	mm²	AWG	Nm	lb-in
	0.75 – 2.5	18 – 14	1.2	10.6



18, 25 and 32A
XTCE... and XTCEC...



XTCR...

www.eatonelectrical.com

Pub51211 May 2006 Doku

1 EN Instruction Manual — DC Power Supply
2 DE Bedienungsanleitung — DC Stromversorgung
3 FR Manual d'instructions — DC Alimentation d'Énergie
4 ES Manual de instrucciones — DC Fuente De Alimentación
5 IT Manuale di Istruzione — DC Gruppo di alimentazione
6 PT Manual de Instruções — DC Fonte De Alimentação

PULS

MiniLine

ML90 / ML95 / ML100

Read first ! — English 1

Before operating this unit please read this manual thoroughly. Retain this manual for future reference! The power supply may only be installed and put into operation by qualified personnel.

Intended Use:

This device is designed for installation in an enclosure and is intended for the general use such as in industrial control, communication, and instrumentation equipment. Do not use this device in aircraft, trains and nuclear equipment where malfunction of the power supply may cause severe personal injury or threaten human life.

WARNING !

Risk of electrical shock, fire, personal injury or death.
(1) Do not use the unit without proper grounding (Protective earth)
(2) Turn power off before working on the power supply. Protect against inadvertent repowering.
(3) Make sure that the wiring is correct by following all local and national codes.
(4) Do not modify or repair the unit.
(5) Do not open the unit as high voltages are present inside.
(6) Use caution to prevent any foreign objects from entering into the housing.
(7) Do not expose the unit to wet locations.
(8) Do not use the unit in area where moisture or condensation can be expected

CAUTION !

Reduction of output power may be necessary when:
(1) Minimum installation clearance can not be met
(2) Altitudes higher than 2000m
(3) Power supply is used above 60°C ambient
(4) Mounting orientation is other than input terminal located at the bottom and output at the top.
(5) Airflow for convection cooling is obstructed
Details for de-rating can be found in this manual.
Do not touch during power-on, and immediately after power-off. Hot surface may cause heat injury.
The unit does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect. If damage or malfunction should occur during operation, immediately turn power off and send unit for inspection to the factory!

The information presented in this document is believed to be accurate and reliable and may change without notice. The English text applies in cases of doubt.

Notes for use in hazardous locations

WARNING EXPLOSION HAZARDS
Units which are marked with "**Class I** Div 2" are suitable for use in non-hazardous or Class I Division 2 Groups A, B, C, D locations only.
Substitution of components may impair suitability for Class I Division 2 environment. Do not disconnect equipment unless power has been switched off.
Wiring must be in accordance with Class I, Division 2 wiring methods of the National Electrical Code, NFPA 70, and in accordance with other local or national codes.

Vor Inbetriebnahme lesen ! — Deutsch 2

Bitte lesen Sie diese Warnungen und Hinweise sorgfältig durch bevor Sie die Stromversorgung in Betrieb nehmen. Bewahren Sie die Anleitung zum Nachlesen auf. Die Stromversorgung darf nur durch fachkundiges und qualifiziertes Personal installiert werden.

Bestimmungsgemäßer Gebrauch:

Dieses Gerät ist für den Einbau in ein Gehäuse konzipiert und zur Verwendung für allgemeine elektronische Geräte, wie z.B. Industriesteuerungen, Kommunikationsgeräte oder Messgeräte geeignet. Benutzen Sie dieses Gerät nicht in Steuerungsanlagen von Flugzeugen, Zügen oder atomaren Einrichtungen, in denen eine Funktionsstörung zu schweren Verletzungen führen oder Lebensgefahr bedeuten kann.

WARNUNG !

Missachtung nachfolgender Punkte kann einen elektrischen Schlag, Brände, schwere Unfälle oder Tod zur Folge haben.
(1) Betreiben Sie die Stromversorgung nie ohne Schutzleiter!
(2) Schalten Sie die Netzspannung vor Installations-, Wartungs- oder Änderungsarbeiten ab und sichern Sie gegen unbeabsichtigtes Wiedereinschalten.
(3) Sorgen Sie für eine ordnungsgemäße und fachgerechte Verdrahtung.
(4) Führen Sie keine Änderungen oder Reparaturversuche am Gerät durch.
(5) Gerät niemals öffnen. Im Inneren befinden sich gefährliche Spannungen.
(6) Verhindern Sie das Eindringen von Fremdkörpern, wie z.B. Büroklammern und anderen Metallteilen.
(7) Betreiben Sie das Gerät nicht in feuchter Umgebung.
(8) Betreiben Sie das Gerät nicht in einer Umgebung, bei der mit Betauung oder Kondensation zu rechnen ist.

VORSICHT !

Rücknahme der Ausgangsleistung kann erforderlich sein:
(1) wenn die minimalen Einbauabstände nicht eingehalten werden können.
(2) bei Aufstellhöhen über 2000m.
(3) Betrieb bei Umgebungstemperaturen über 60°C.
(4) bei Einbaulagen abweichend von der Standardeinbaulage (Eingang unten, Ausgang oben).
(5) bei behinderter Luftzirkulation.

Weitere Informationen zur Leistungsrücknahme befindon sich in dieser Betriebsanleitung.
Gehäuse nicht während des Betriebes oder kurz nach dem Abschalten berühren. Heiße Oberflächen können Verletzungen verursachen. Das Gerät beinhaltet keine Servicebauteile. Interne Sicherungen lösen nur bei Gerätedefekt aus. Bei Funktionsstörungen oder Beschädigungen schalten Sie sofort die Versorgungsspannung ab und senden das Gerät zur Überprüfung ins Werk.

Die angegebenen Daten dienen allein der Produktbeschreibung und sind nicht als zugesicherte Eigenschaften im Rechtssinne aufzufassen. Im Zweifelsfall gilt der englische Text

Hinweise für den Betrieb in explosionsgefährdeter Umgebung

ACHTUNG EXPLOSIONSGEFAHR !
Geräte die am Leistungsschild mit "**Class I Div 2**" gekennzeichnet sind, sind für den Einsatz in Klasse I Division 2 Gruppen A,B,C,D oder für explosions-ungefährliche Aufstellorte geeignet. Veränderungen an Bauteilen können die Tauglichkeit für Klasse I Division 2 beeinträchtigen. Anschlüsse nicht trennen solange Spannung anliegt. Anschluss muss unter Berücksichtigung der Anforderungen nach Klasse I Division 2 Artikel 501-4(b) des National Electrical Code, NFPA 70 erfolgen.

A lire avant mise sous tension ! — Français 3

Merci de lire ces instructions de montage et d'entretien avant de mettre l'alimentation sous tension. Conservez ce manuel qui vous sera toujours utile. Cette alimentation doit être installée par du personnel qualifié et compétent.

Utilisation:

Cet appareil est conçu pour être installé dans une armoire et pour tous les équipements électroniques, tel que l'équipement industriel de commande, l'équipement de bureau, le matériel de communication et les instruments de mesures. N'utilisez pas cet appareil pour l'équipement de commandes dans les avions, les trains et l'équipement atomique où un problème de fonctionnement de l'alimentation pourrait causer des blessures graves ou menacer la vie humaine.

ATTENTION !

Prendre en compte les points suivants, afin d'éviter toute détérioration électrique, incendie, dommage aux personnes ou mort.
(1) ne jamais faire fonctionner l'alimentation sans raccordement à la terre !
(2) débrancher l'installation avant toute intervention sur l'alimentation (ou démontage) et s'assurer qu'il n'y a pas risque de redémarrage.
(3) s'assurer que le câblage a été fait selon les prescriptions
(4) ne pas effectuer de réparations ou modifications sur l'alimentation
(5) ne pas ouvrir l'appareil. Des tensions importantes passent à l'intérieur.
(6) veiller à ce qu'aucun objet ne rentre en contact avec l'intérieur de l'alimentation (trombonnes, pièces métalliques)
(7) ne pas faire fonctionner l'appareil dans un environnement humide ou à l'extérieur, non protégé
(8) ne pas utiliser l'appareil dans un environnement où il peut y avoir de la condensation.

ATTENTION !

Des limitations de puissance de sortie peuvent apparaître si :
(1) les distances d'installation mini. ne peuvent être observées
(2) installation à une altitude > 2000 m
(3) pour des fonctionnements en charge et avec une température ambiante > 60°C
(4) pour des positions de montage différentes de la préconisation standard (entrée dessous, sortie en haut)
(5) lorsque la circulation d'air est génée
D'autres informations sont disponibles dans la documentation de mise en service
Ne pas toucher le carter pendant le fonctionnement ou après la mise sous tension. Surface chaude risquant d'entraîner des blessures.
Le déclenchment du fusible interne traduit très probablement un défaut au niveau de l'appareil. Si un défaut quelconque apparaît en cours de fonctionnement, débrancher au plus vite l'alimentation. Dans ce deux cas de figure, il convient de faire contrôler l'alimentation en usine!

Les données indiquées dans ce document servent uniquement à donner une description du produit et n'ont aucune valeur juridique. En cas de doute, veuillez vous reporter au texte anglais.

Utilisation Class I Div 2

ATTENTION RISQUE D' EXPLOSION Les appareils portant la marque '**Class I Div 2**' au niveau de la plaque signalétique sont prévus pour fonctionner en Classe I, Division 2, Groupes A,B,C,D ou pour un environnement non explosif et non dangereux.
Le remplacement de composants peut rendre le matériel impropre à une utilisation en Classe 1, Division 2.
Ne déconnecter l'équipement qu' hors tension ou en zone connue comme non dangereuse.
Le raccordement doit obligatoirement tenir compte des exigences de la classe 1, division 2, article 501-4(b) du National Electrical Code, NFPA 70.

Lea primero!

Español 4

Conserve este manual como referencia para futuras consultas. La fuente de alimentación solo puede ser instalada y puesta en funcionamiento por personal cualificado. Por favor lea detenidamente este manual antes de conectar la fuente de alimentación.

Uso apropiado:

Este equipo ha sido diseñado para su instalación en un ambiente cerrado y ha sido concebido para uso general en instalaciones de control industrial, oficinas, comunicaciones y equipos de instrumentación. No emplee este equipo en aeronaves, trenes e instalaciones atómicas, donde un mal funcionamiento de la fuente de alimentación puede ocasionar lesiones graves o riesgo mortal.

⚠ ADVERTENCIA !

Riesgo de descarga eléctrica, incendio, accidente grave o muerte.
(1) No conectar nunca la unidad sin conexión de puesta a tierra.
(2) Desconectar la tensión de red antes de trabajar en la fuente de alimentación. Evite una posible reconexión involuntaria.
(3) Asegurarse de que el cableado es correcto de acuerdo a los códigos locales y nacionales.
(4) No realizar ninguna modificación o reparación de la unidad.
(5) No abrir nunca la unidad. En el interior existe riesgo de altas tensiones.
(6) Evitar la introducción en la carcasa de objetos extraños.
(7) No usar el equipo en ambientes húmedos.
(8) No operar el equipo en ambientes donde se espere la formación de rocío o condensación.

⚠ CUIDADO !

La deriva en la tensión de salida se produce:
(1) cuando no pueden mantenerse las distancias mínimas de montaje.
(2) en caso de que el montaje se realice en altitudes superiores a los 2000 m.
(3) en caso de funcionamiento a plena carga y temperaturas ambientales superiores a 60° C.
(4) En caso de posiciones de montaje diferentes a la posición de montaje estándar (terminales de entrada abajo y terminales de salida arriba).
(5) en caso de que la circulación de aire para la refrigeración por conducción esté obstruida.
Puede encontrar más detalles del caso de deriva en este manual.
No tocar durante el funcionamiento ni inmediatamente después del apagado. El calor de la superficie puede causar quemaduras graves.
Cuando se funde un fusible interno, existe gran probabilidad de un fallo interno en el equipo.Si se produce un fallo o mal funcionamiento durante la operación, desconecte inmediatamente la tensión de alimentación. En ambos casos, el equipo debe ser inspeccionado en fábrica.

La información presentada en este documento es exacta y fiable en cuanto a la descripción del producto y puede cambiar sin aviso. En casa de duda, prevalece el texto inglés.

Uso apropiado Class I Div 2	**ATENCIÓN PELIGRO DE EXPLOSIÓN!** Los equipos marcados con la expresión "**Class I** Div 2" son adecuados para su uso en ambientes no peligrosos y en entornos con la Clase I División 2 Grupos A, B, C, D. La sustitución de componentes puede perjudicar la idoneidad para la Clase I División 2. No desconecte el equipo a menos que la tensión de alimentación esté desconectada. El conexionado debe cumplir con la Clase I División 2 métodos de conexión del Código Nacional Eléctrico NFPA 70 o con el resto de códigos locales o nacionales.

Leggere prima questa parte!

Italiano 5

Prima di collegare il sistema di alimentazione elettrica si prega di leggere attentamente le seguenti avvertenze. Conservare le istruzioni per la consultazione futura. Il sistema di alimentazione elettrica deve essere installato solo da personale competente e qualificato.

Uso previsto:

Questo apparecchio è previsto per il montaggio in un rack per moduli elettronici, ad esempio per controllori industriali, apparecchiature per ufficio, unità di comunicazione o apparecchi di misura. Non utilizzare l'apparecchio in impianti di controllo di aerei, di treni o di impianti nucleari in cui il suo eventuale guasto può comportare gravi lesioni o la morte di persone.

⚠ AVVERTENZA!

Il mancato rispetto delle seguenti norme può provocare folgorazione elettrica, incendi, gravi incidenti e perfino la morte.
(1) Non far funzionare in nessun caso il sistema di alimentazione elettrica senza conduttore di protezione!
(2) Prima di eseguire interventi di installazione, di manutenzione o di modifica scollegare la tensione di rete ed adottare tutti i provvedimenti necessari per impedirne il ricollegamento non intenzionale.
(3) Assicurare un cablaggio regolare e corretto.
(4) Non tentare di modificare o di riparare da soli l'apparecchio.
(5) Non aprire l'apparecchio. Al suo interno sono applicate tensioni elettriche pericolose.
(6) Impedire la penetrazione di corpi estranei nell'apparecchio, ad esempio fermagli o altri oggetti metallici.
(7) Non far funzionare l'apparecchio in un ambiente umido.
(8) Non far funzionare l'apparecchio in un ambiente soggetto alla formazione di condensa o di rugiada.

⚠ CAUTELA !

È necessario ridurre la potenza di uscita se:
(1) non è possibile rispettare le distanze minime di montaggio;
(2) l'apparecchio viene installato in un luogo di altitudine maggiore di 2000 m;
(3) il funzionamento è a pieno carico a temperatura ambiente maggiore di 60 °C;
(4) la posizione di montaggio differisce da quella standard (ingresso in basso, uscita in alto);
(5) è ostacolata la libera circolazione dell'aria.
Ulteriori informazioni sono riportate in questo manuale.
Non toccare quando acceso e subito dopo lo spegnimento. La superficie calda può causare scottature.
In caso di intervento del fusibile interno, molto probabilmente l'apparecchio è guasto.
Se durante il funzionamento si verificano anomalie o guasti, scollegare immediatamente la tensione di alimentazione.
In entrambi i casi è necessario far controllare l'apparecchio dal produttore!

I dati sono indicati solo a scopo descrittivo del prodotto e non vanno considerati come caratteristiche garantite dell'apparecchio.In caso di differenze o problemi è valido il testo inglese

Uso previsto Class I Div 2	**ATTENZIONE: PERICOLO DI ESPLOSIONE!** Gli apparecchi la cui targhetta riporta "**Class I Div 2**" sono adatti per l'impiego in ambienti di classe I, divisione 2, gruppi A, B, C e D o non soggetti al pericolo di esplosione. La modifica dei componenti possono influenzare negativamente l'idoneità per ambienti di classe I, divisione 2.Non aprire i morsetti con tensione di alimentazione collegata. Il collegamento deve essere eseguito nel rispetto dei requisiti previsti dalla classe I, divisione 2, articolo 501-4(b) del National Electrical Code, NFPA 70.

Leia primeiro!

Português 6

Recomendamos a leitura cuidadosa das seguintes advertências e observações, antes de colocar em funcionamento a fonte de alimentação. Guarde as Instruções para futura consulta, em casos de dúvida. A fonte de alimentação deverá ser instalada apenas por profissionais da área, tecnicamente qualificados.

Utilize:

apenas para o fim pré-estabelecido. Este aparelho foi concebido para ser montado dentro de invólucros, caixas ou armários para aparelhos eletrônicos em geral, como, por exemplo, comandos de instalações industriais, aparelhos para escritórios, aparelhos de comunicação ou instrumentos de medida e quadros eléctricos. Não utilize este aparelho em sistemas de comando de aviões, de comboios ou em instalações movidas por energia nuclear, nos quais um defeito de funcionamento poderá causar danos graves ou significar risco de morte.

⚠ ATENÇÃO !

A não observância ou o incumprimento dos pontos a seguir mencionados, poderá causar uma descarga elétrica, incêndios, acidentes graves ou morte.
(1) Não use a fonte de alimentação sem o condutor de proteção terra!
(2) Antes de trabalhos de instalação, manutenção ou modificação, desligue a tensão de alimentação, protegendo-a contra uma nova ligação involuntária.
(3) As ligações devem ser efectuadas apenas por profissionais competentes.
(4) Não efectue nenhuma modificação ou tentativa de reparação no aparelho. Quando necessário contacte o seu distribuidor.
(5) Não abra o aparelho mesmo quando desligado. No seu interior existem condensadores que podem estar carregados electricamente.
(6) Proteger a fonte de alimentação contra a introdução inadvertida de corpos metálicos, como por ex., clipes ou outras peças de metal.
(7) Não usar o aparelho em ambientes húmidos.
(8) Não usar o aparelho em ambientes propensos a condensações.

⚠ CUIDADO !

Será necessário reduzir a potência de saída nos seguintes casos:
(1) Quando não forem observadas as distâncias mínimas de montagem.
(2) Quando instaladas a altitudes superiores a 2000m.
(3) Existencia de temperatura ambiente superior a 60°C, em plena carga do aparelho.
(4) Montagem invertida do aparelho (Entrada em baixo, saída em cima).
(5) Montagem em ambiente sem ventilação.
No presente manual de funcionamento encontram-se ainda outras informações.
Não tocar enquanto estiver em funcionamento, nem após a desligar. A superficie poderá estar quente e provocar lesões.
Se o fusível interno se fundir, é grande a possibilidade de existir um defeito no aparelho. Se por acaso, durante a utilização ocorrer algum defeito de funcionamento ou dano, desligue imediatamente a tensão de alimentação.
Em ambos os casos, será necessária uma verificação na Fábrica!

Os dados mencionados têm como finalidade somente a descrição do produto, e não devem ser interpretados como propriedades garantidas no sentido jurídico. Em caso de dúvidas, aplica-se o texto em Inglês.

Utilize Class I Div 2	**ATENÇÃO, RISCO DE EXPLOSÃO !** Aparelhos que contêm na sua placa de dados elétricos o texto "**Class I Div 2**" são apropriados para a aplicação na Classe I, divisão 2, Grupos A, B, C, D ou também para locais de instalação isentos de riscos de explosão. Modificações efetuadas em componentes podem restringir ou reduzir a adequação para aplicação na Classe I, Divisão 2. As ligações não devem ser separadas enquanto estiverem ligadas a uma fonte de alimentação elétrica. As ligações devem ser efetuadas levando-se em consideração as exigências normativas da Classe I, Divisão 2.

Germany	**PULS in Munich**	+49 89 9278 0	www.pulspower.com
China	**PULS in Shanghai**	+86 21 6432 7680	www.puls-power.cn
France	**PULS in Limonest / Lyon**	+33 478 668 941	www.pulspower.com/fr
North America	**PULS in St. Charles / Chicago**	+1 630 587 9780	www.puls-power.us
Austria	**PULS in Rohrbach**	+43 27 64 32 13	www.pulspower.com
Switzerland	**PULS in Oberflachs / Aargau**	+41 56 450 18 10	www.puls-power.ch
United Kingdom	**PULS in Bedfordshire**	+44 845 130 1080	www.puls.co.uk

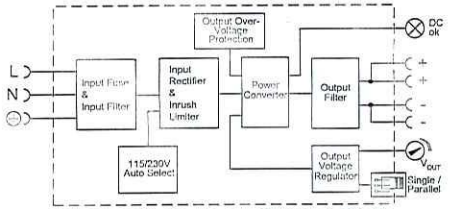
Headquarters:
PULS GmbH
Arabellastrasse 15
D-81925 Munich
Germany

Technical Data	Technische Daten		Single Phase Input ML95.100	ML100.100	ML100.102	ML100.105	ML100.109		380-480V Input ML90.200	ML100.200	
Output Voltage	Ausgangsspannung		24-28V	24-28V	12-15V	48-56V	24-28V		24-28V	24-28V	
Factory Set [1]	Werkseinstellung [1]	typ.	24.5V	24.5V	12.0V	48.0V	24.5V		24.5V	24.5V	
Output Current	Ausgangsstrom	nom.	3.95-3.4A	4.2-3.6A	7.5-6A	2.1-1.8A	4.2-3.6A		3.75-3.2A	4.2-3.6A	
Output Power	Ausgangsleistung	nom.	95W	100W	90W	100W	100W		90W	100W	
Output Ripple [2]	Ausgangswelligkeit [2]	max.	50mVpp	50mVpp	50mVpp	100mVpp	50mVpp		50mVpp	50mVpp	
AC Input Voltage	AC Eingangsspannung	-	100-120V / 220-240V -15% +10%	100-120V / 220-240V -15% +10%	100-120V / 220-240V -15% +10%	100-120V / 220-240V -15% +10%	100-120V / 220-240V -15% +10%		380-480Vac ±15%	380-480Vac ±15%	
			Auto-Select	Auto-Select	Auto-Select	Auto-Select	Auto-Select		--	--	
AC Input Current [1]	AC Eingangsstrom [1]	typ.	1.63 / 0.95A	1.72 / 1.0A	1.57 / 0.91A	1.72 / 1.0A	1.72 / 1.0A	120 / 230Vac	0.42 / 0.36A	0.46 / 0.4A	400 / 480Vac
DC Input Voltage	DC Eingangsspannung	-	220-375Vdc	220-375Vdc	220-375Vdc	220-375Vdc	220-375Vdc		--	--	
Power Factor [1]	Leistungsfaktor.[1]	typ.	0.56 / 0.5	0.56 / 0.5	0.56 / 0.5	0.56 / 0.5	0.56 / 0.5	120 / 230Vac	0.6 / 0.55	0.6 / 0.55	400 / 480Vac
EN 61000-3-2 [5]	EN 61000-3-2 [5]		yes / ja	yes / ja	yes / ja	yes / ja	yes / ja		yes / ja	yes / ja	
Inrush Current [3]	Einschaltspitzenstrom [3]	typ.	22A; 0.4A²s	22A; 0.4A²s	22A; 0.4A²s	22A; 0.4A²s	22A; 0.4A²s	120Vac	36A; 1A²s	36A; 1A²s	400Vac
		typ.	42A; 1.4A²s	42A; 1.4A²s	42A; 1.4A²s	42A; 1.4A²s	42A; 1.4A²s	230Vac	45A; 1A²s	45A; 1A²s	480Vac
Efficiency [1]	Wirkungsgrad [1]	typ.	88.5 / 90.0%	87.7 / 88.5%	88.5 / 90.0%	90.4 / 91.8%	88.5 / 90.0%	120 / 230Vac	89.5 / 89.0%	89.5 / 89.0%	400 / 480Vac
Losses [1]	Verlustleistung [1]	typ.	11.6 / 9.9W	12.6 / 11.7W	13.0 / 11.1W	10.6 / 8.9W	11.6 / 9.9W	120 / 230Vac	10.5 / 11.1W	11.7 / 12.3W	400 / 480Vac
Hold-up Time [1]	Pufferzeit [1]	typ.	41 / 46ms	38 / 44ms	41 / 46ms	38 / 44ms	41 / 46ms	120 / 230Vac	52 / 93ms	48 / 85ms	400 / 480Vac
Single/Parallel Jumper	Einzel/Parallelbetr. Brücke		no / nein	yes / ja	yes / ja	yes / ja	yes / ja		no / nein	no / nein	
Dimensions (wxhxd) [4]	Abmessungen (BxHxT) [4]		73x75x103mm	73x75x103mm	73x75x103mm	73x75x103mm	73x75x103mm		73x75x103mm	73x75x103mm	
Weight	Gewicht	max.	360g / 0.79lb	360g / 0.79lb	360g / 0.79lb	360g / 0.79lb	360g / 0.79lb		360g / 0.79lb	360g / 0.79lb	
Special Features	Besonderheiten		NEC Class 2	--	--	--	conf. coated Schutzlack		NEC Class 2	--	
Limited Warranty (Years)	Gewährleistung (Jahre)	-	3	3	3	3	3		3	3	

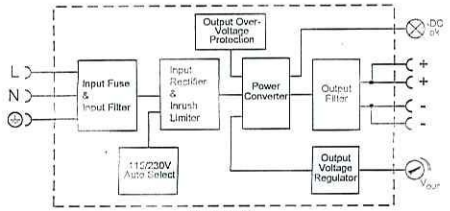
1) At full load
2) 50Ohm measurement, bandwidth 20MHz
3) Peak value and inrush energy at an ambient temperature of 40°C and cold start.
4) Without DIN-rail
5) EN 61000-3-2 is the European standard for harmonic current emission (PFC)

1) bei Nennlast
2) 50 Ohm Messung, Bandbreite 20MHz
3) Spitzenstrom und Einschaltenergie bei einer Umgebungstemperatur von 40°C und Kaltstart.
4) Tiefe ohne DIN-Schiene
5) Die EN 61000-3-2 ist der EU Standard zur Festlegung der zulässigen Oberwellenströme die ein Gerät erzeugen darf.

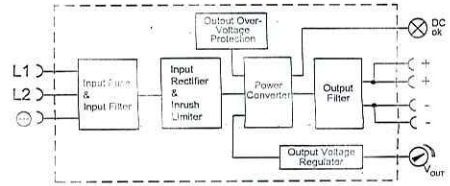
Functional Diagrams / Funktionsschaltbilder



ML100.100, ML100.102, ML100.105, ML100.109

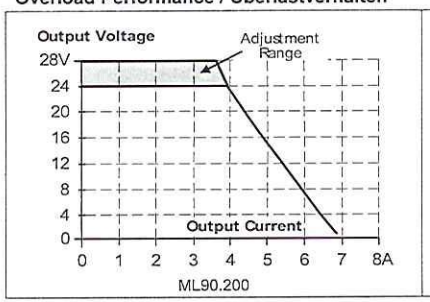


ML95.100

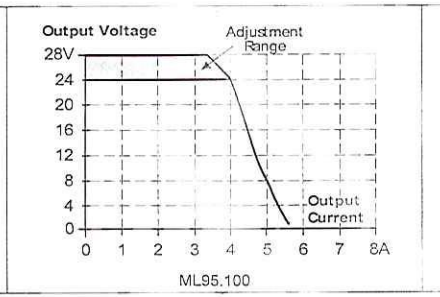


ML90.200, ML100.200

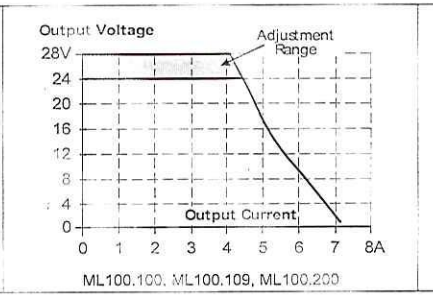
Overload Performance / Überlastverhalten



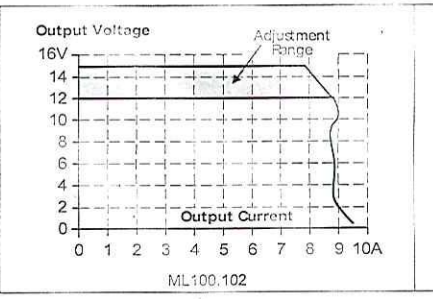
ML90.200



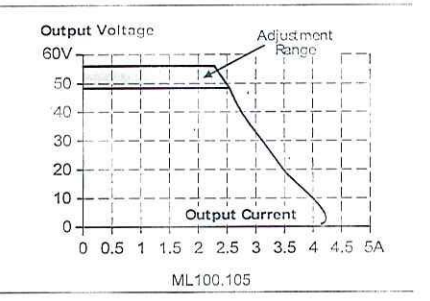
ML95.100



ML100.100, ML100.109, ML100.200



ML100.102



ML100.105

EMC Electromagnetic Compatibility

These devices are suitable for applications in industrial environment as well as in residential, commercial and light industry environment without any restrictions.
These devices comply with FCC Part 15 rules. Operation is subjected to following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
CE mark is in conformance with EMC guideline 89/336/EEC, 93/68/EEC and the low-voltage directive (LVD) 73/23/EEC, 93/68/EEC.

EMV Elektromagnetische Verträglichkeit

Diese Geräte erfüllen die Anforderungen für Anwendungen in industrieller Umgebung als auch für den Wohn-, Geschäfts- und Gewerbebereich ohne Einschränkungen.
Die Geräte erfüllen auch die Anforderungen der FCC Teil 15.
Das CE Zeichen ist angebracht und erklärt die Erfüllung der EMC Richtlinien 89/336/EWG, 93/68/EWG und der Niederspannungsrichtlinie 73/23/EWG, 93/68/EWG.

EMC Immunity	EMV Störfestigkeit	EN 61000-6-1, EN 61000-6-2
EMC Emission	EMV Störaussendung	EN 61000-3-2, EN 61000-3-3, EN 61000-6-3, EN 61000-6-4, FCC Part 15 Class B

MiniLine Power Supply Instruction Manual

Environmental conditions	Umgebungsbedingungen	
Operational temperature range	Betriebstemperaturbereich	-10 to +70°C
Output Derating	Leistungsrücknahme	2,5%/°C, >60°C
Storage temperature	Lagertemperaturbereich	-40 to +85° C
Humidity, IEC 60068-2-30 *)	Feuchte, IEC 60068-2-30 *)	< 95% r .H.
Vibration, IEC 60068-2-6	Schwingen, IEC 60068-2-6	2g
Shock, IEC 60068-2-27	Schocken, IEC 60068-2-27	30g 6ms, 20g 11ms
Degree of pollution, EN 50178	Verschmutzungsgrad, EN 50178	2

Fuses

Internal input fuse: 3.15A time lag (Device protection, not externally accessible)

The unit is tested and approved for branch circuits up to 20A. External protection is only required if the supplying branch has an ampacity greater than this. In some countries local regulations might apply. Check also local codes and local requirements. If an external fuse is necessary or utilized, minimum requirements need to be considered. To avoid nuisance tripping of the circuit breaker, use a min. value of 6A C-Characteristic.

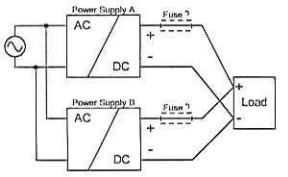
*) Do not energize while condensation is present / Nicht betreiben solange das Gerät Kondensation aufweist

Protections	Schutzfunktionen	
Overload, short-circuit proof	Überlast, Kurzschlussschutz	yes / ja
Degree of protection	Schutzart	IP 20, EN/IEC 60529
Class of protection	Schutzklasse	I
Over-voltage category	Überspannungskategorie	III, EN 50178
Over-temperature protection	Übertemperaturschutz	no / nein
Output over-voltage protection	Überspannungsschutz Ausgang	yes / ja
Penetration protection	Fremdkörper Eindringschutz	>3.5mm

Sicherungen

Interne Gerätesicherung: 3.15A träge (Gerätesicherung, nicht austauschbar durch Anwender)

Das Gerät ist geprüft und zugelassen zum Anschluss an Stromkreisen bis max. 20A. Zusätzlicher externer Schutz ist nur erforderlich wenn der Speisestromkreis mit einem höheren Wert abgesichert ist oder nationale Richtlinien es vorschreiben. Falls ein externes Schutzelement verwendet wird, soll dieses nicht kleiner als 6A (C- Charakteristik) sein um ein fehlerhaftes Auslösen zu vermeiden.



Parallel Operation

All units except ML90.200 and ML95.100 can be used in parallel to get redundancy or to gain higher output power.

(1) Use only power supplies from the same series.

(2) Adjust the power supplies to parallel mode if a single/parallel mode jumper is available.

(3) A fuse (or diode) on the output is only required if more than three units are paralleled.

(4) Keep an installation clearance of 15mm (left/right) between two power supplies and avoid installing the power supplies on top of each other.

Parallel Betrieb

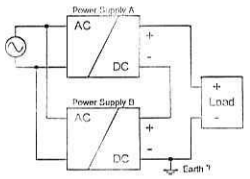
Alle Geräte mit Ausnahme des ML90.200 und ML95.100 können zur Erhöhung der Ausgangsleistung oder für Redundanzzwecke parallel betrieben werden.

(1) Verwenden Sie nur gleiche Stromversorgungen.

(2) Stellen Sie die Stromversorgung in den „Parallel Mode" wenn ein Single/Parallel Mode Jumper vorhanden ist.

(3) Eine Sicherung oder Diode wird nur benötigt, wenn mehr als drei Geräte parallel geschaltet werden.

(4) 15mm seitlicher Installationsabstand (links/rechts) zwischen den einzelnen Stromversorgungen sind einzuhalten. Verwenden Sie die Geräte nicht übereinander.



Series Operation

All units except ML90.200, ML95.100 and ML100.102 can be used in series to get a sum voltage of up to 150Vdc max.

(1) Voltages with a potential above 60Vdc must be installed with a protection against touching.

(2) For serial operation use only power supplies of the same type.

(3) Earthing of the output is required when the sum of the output voltage is above 60Vdc.

(4) Keep an installation clearance of 15mm (left/right) between two power supplies and avoid installing the power supplies on top of each other.

Betrieb in Serienschaltung

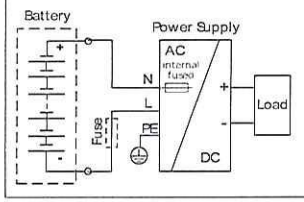
Alle Geräte mit Ausnahme ML90.200, ML95.100 und ML100.102 können bis zu einer Gesamtspannung von 150Vdc in Serie geschaltet werden.

(1) Spannungen über 60Vdc müssen berührgeschützt installiert werden.

(2) Verwenden Sie bei Serienschaltung nur gleiche Geräte

(3) Wenn die Gesamtspannung 60Vdc übersteigt, muss der Ausgang geerdet werden.

(4) 15mm seitlicher Installationsabstand (links/rechts) zwischen den einzelnen Stromversorgungen sind einzuhalten. Verwenden Sie die Geräte nicht übereinander.



Operation with DC Input

All units except ML90.200 and ML100.200 will operate with a DC input voltage.

(1) Use a battery or similar DC source.

(2) Connect -pole to L and +pole to N

(3) Connect the ground terminal of the power supply to a PE wire or to machine ground.

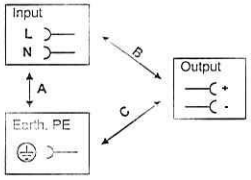
Betrieb an einer DC Eingangsspannung

Alle Geräte mit Ausnahme des ML90.200 und ML100.200 können an einer DC Eingangsspannung betrieben werden.

(1). Verwenden Sie eine Batterie oder ähnliche Quelle

(2) Schließen Sie den -Pol an L und +Pol an N an

(3) Schließen Sie den Schutzleiteranschluss an die Schutzerde oder an die Maschinenmasse an.



Dielectric Strength

The output voltage is floating and separated from the input according to SELV / PELV requirements.

Isolationsfestigkeit

Die Ausgangsspannung hat keinen Bezug zur Erde oder Schutzleiter und ist zum Eingang nach den SELV und PELV Richtlinien getrennt.

	A	B	C
Type Test (60s)	2500Vac	3000Vac	500Vac
Factory Test (5s)	2500Vac	2500Vac	500Vac
Field Test (5s)	2000Vac	2000Vac	500Vac

Installation:

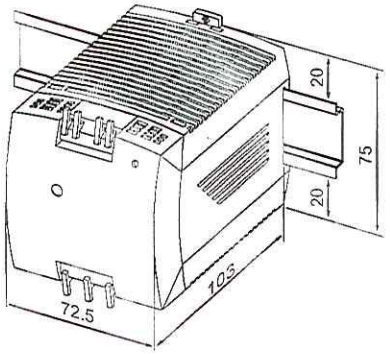
Use DIN-rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm. Mounting orientation must be output terminals on top and input terminals on the bottom. For other orientations see datasheet. Do not obstruct air flow! The unit is convection cooled. Ventilation grid must be kept free of any obstructions. The following installation clearances must be kept when permanently full loaded:

- Left / right: 0mm (15mm in case the adjacent device is a heat source)
- 40mm on top, 20mm on the bottom

Installation:

Geeignet für DIN-Schienen entsprechend EN 60715 oder EN 50022 mit einer Höhe von 7,5 oder 15mm. Der Einbau hat so zu erfolgen, dass sich die Eingangsklemmen unten, und die Ausgangsklemmen oben befinden. Für andere Einbaulagen siehe Datenblatt. Luftzirkulation nicht behindern! Das Gerät ist für Konvektionskühlung ausgelegt. Es ist für ungehinderte Luftzirkulation zu sorgen. Die folgende Einbauabstände sind bei dauerhafter Volllast einzuhalten:

- Links / rechts: 0mm (15mm wenn das benachbarte Geräte eine Wärmequelle ist)
- Oben: 40mm, unten 20mm



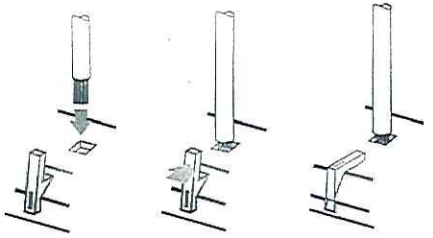
Terminals and Wiring:

Do not use the unit without PE (Ground) connection! Use appropriate copper cables that are designed for an operating temperatures of 60°C (for ambient up to 45°C) and 75°C (for ambient up to 60°C), minimum. Follow national installation codes and regulations! Ensure that all strands of a stranded wire enter the terminal connection! Up to two stranded wires with the same cross section are permitted in one connection point (except PE wire). Ferrules are allowed, but not required.

Spring-clamp terminals	Federkraftklemmen	
Solid wire	Starrdraht	0.3-4mm²
Stranded wire	Litze	0.3-2.5mm²
American wire gauge	AWG	26-12 AWG
Wire stripping length	Abisolierlänge	6mm / 0.25inch
Pull-out force	Ausziehkraft	50N (14AWG, UL486E)

Anschlussklemmen und Verdrahtung:

Betreiben Sie das Gerät nie ohne Schutzleiter. Verwenden Sie geeignete Kupferkabel, die mindestens für 60°C (bei einer Umgebungstemperatur bis zu 45°C) und 75°C (bei einer Umgebungstemperatur bis zu 60°C) zugelassen sind. Beachten Sie nationale Bestimmungen und Installationsvorschriften! Stellen Sie sicher, dass keine einzelnen Drähte von Litzen abstehen. Bis zu zwei Leiter mit gleichem Querschnitt sind in einem Anschlusspunkt zulässig (außer für den Schutzleiter). Aderendhülsen sind erlaubt, aber nicht erforderlich.



Gardner Denver

GARDNER DENVER
EXTENDED AIREND WARRANTY

New Compressor Packages: The extended warranty is available on all new approved oil-flooded Gardner Denver Rotary Screw air compressor packages up to 150 psi. To receive the extended warranty the requirements listed below are required to be performed and documented during the full **5-years**.

Factory Remanufactured Airends: The extended warranty is available on approved models of Gardner Denver (GDI) oil-flooded factory remanufactured airends. The standard 2-year warranty can be extended to **5**-years when the requirements listed below are performed and documented.

GDI shall warranty any new airend (approved models) or factory remanufactured airends (approved models) to be free of defects in material and/or workmanship for a full 5-years, including labor when the requirements listed below are met. Routine maintenance items in the inlet valves and shaft seals are excluded.

This extended warranty is supplemental to the standard warranty outlined in Form AU-20 and shall apply only to the equipment specified above. GDI makes no other warranty or representation of any kind, either express or implied. The foregoing warranty is exclusive and it is expressly agreed that, except as to the title, GDI makes no other warranties expressed, implied, or statutory, including any implied warranty of merchantability.

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 be 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.

EXTENDED AIREND WARRANTY REQUIREMENTS
New Compressor Packages or Factory Remanufactured Airends

First Requirement:
The extended warranty registration form (BM-24) must be completed by the owner and returned to the local GDI distributor within 30 days of the compressor package start-up date (approved models) or GDI factory remanufactured airend (approved models) installation date. When submitting registration via electronic format the package owner or remanufactured airend owner must submit the registration form. Contact your authorized local GDI distributor for all of the details of the program and to register your compressor package or remanufactured airend.

Second Requirement:
A maintenance kit can be purchased from an authorized local GDI distributor, which has the appropriate air filters, oil filters, separator, and lubricant included in the kit. The kits will be drop shipped directly to the package owner. The first kit must be purchased within 30 days of the compressor package start-up or remanufactured airend installation date. A **minimum of one kit must be purchased on an annual basis, which is defined as every 12 months.** The annual maintenance kit must be purchased within 60 days of the anniversary date of the compressor package startup or remanufactured airend installation date. Additional maintenance parts and/or lubricant may be required to meet the operating hours on the compressor package or remanufactured airend. These additional items may be purchased from your authorized local GDI distributor. Consult the service manual for proper maintenance schedules.

OR

Individual Genuine GDI OEM parts and lubricant as specified in the service manual must be purchased from the authorized local GDI distributor. Maintenance must be performed in accordance with the maintenance schedules in the service manual for the appropriate compressor package. This includes the regular maintenance of the oil filter, air filter, separator and lubricant. Consult the service manual for proper maintenance schedules.

Proof of purchase will be required in the event a warranty claim is filed and these purchases must correlate with the recommended maintenance guidelines in the service manual.

The use of GDI lubricants; AEON9000SP, AEON9000TH, AEON6000FG, AEON4000, AEON2000, or AEON BIO is required. The lubricant must be changed in accordance with; the lubricant operational guidelines, the oil sampling report recommendations indicating a change or a minimum of every 12 months. Oil filter and separator elements must be changed during the annual lubricant change.

Third Requirement:
Gardner Denver's oil analysis program must be used. An oil sample must be sent to our lubricant analysis laboratory every 2000 hours or six months, whichever comes first. Any recommendations detailed in the oil analysis report must be followed as outlined in the report. Oil sample bottles are to be obtained from your authorized local GDI distributor.

Fourth Requirement:
A log of all maintenance performed to the compressor package and/or airend must be maintained. This must include air filter and oil filter changes, separator changes, lubricant changes, and all other maintenance and repairs to the package with the corresponding operation hours noted.

ALL OF THE ABOVE REQUIREMENTS MUST BE PERFORMED AND DOCUMENTED TO ENSURE THAT THE EXTENDED WARRANTY IS IN EFFECT FOR THE FULL WARRANTY PERIOD.

GDI reserves the right to change the extended warranty program and/or requirements as deemed appropriate by the company. GDI reserves the right to refuse participation in the extended airend warranty program to any distributor and/or owner of the compressor package or factory remanufactured airend.

Complete the registration form on the reverse side of this document to register for the extended warranty.

Extended Airend Warranty Registration Form

I have read and agree to the terms and conditions listed on this **BM-24** form relating to the conditions of warranty and Gardner Denver's liability in the event of a claim. By sending this form via electronic format, I agree to the terms and conditions.

PLEASE TYPE OR PRINT FOR LEGIBILITY PURPOSES

Machine Information:
Machine S/N:
Machine Model:
Startup Date:

Distributor:
Company Name:
Contact Name:
Address:
City:
State:
Zip:
E-mail Address:
Phone:
Fax:

Customer:
Company Name:
Contact Name: Title:
Address:
City:
State:
Zip:
E-mail Address:
Phone:
Fax:
Signature:
Date:

Compressor package owner or factory remanufactured airend owner:
Return this form to your authorized local Gardner Denver Distributor.

Gardner Denver distributor: Return this form to the Gardner Denver Service Department, fax 217-222-5838.

Gardner Denver

NOTE: USE BALL POINT PEN - PRESS HARD!

ROTARY SCREW COMPRESSORS
START-UP LIST - WARRANTY REGISTRATION

To Validate Warranty, Complete and Return to Factory
Within (10) Days of Initial Operation

To Be Completed By
Authorized Start Up Personnel

MAIL TO:
Gardner Denver
1800 Gardner Expressway
Quincy, IL 62305
(ATTN: Service Manager)

Company Name: _____ Machine S/N: _____

Address: _____ Machine Model: _____

City: _____ Start-Up Date: _____

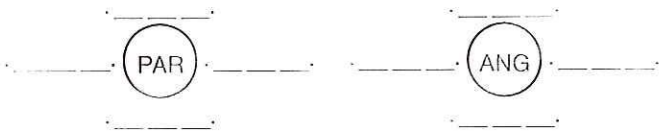
State: _____ Zip: _____

This is a Check List Only! It does not replace the instructions contained in the Service Manual. ALWAYS refer to the Service Manual for proper procedures, methods, and operating instructions.

Provide Data and (✓) Box as Reviewed: Review for Correctness of Assembly, Tightness, Proper and/or Safe Operation.

INSPECTION

- ☐ Overall appearance and condition of unit is good, except as noted below.
- ☐ Ample space around compressor for air circulation, maintenance, and repairs.
- ☐ Surface supports the weight of the compressor.
- ☐ Floor makes 100% of contact with rails of the compressor base.
- ☐ Hold down bolts/capscrews properly torqued.
- ☐ All pipe fittings and connections checked.
- ☐ Pressure relief valve(s) installed where needed and properly sized.
- ☐ Inlet piping is properly sized, inspected, and cleaned.
- ☐ Inlet filter, if used, is properly sized.
- ☐ Air filter properly assembled.
- ☐ Oil at proper level.
- ☐ Proper oil poured into inlet (oil-flooded units only)
- ☐ Air end rolled over by hand; all parts move freely.
- ☐ Coupling/belts alignment checked.



Water Cooled Units

- ☐ Water shutoff valve installed.
- ☐ Inlet water temperature between 60-90°F.
- ☐ Piping sized for adequate flow rate.
- ☐ Water PSIG between 40-75 PSIG at full flow rate.
- ☐ Discharge water temperature = _____ °F (not to exceed 110°F)

Electrical Connections

- ☐ Wiring checked per print and machine properly grounded.
- ☐ All connections checked for tightness and good contact.
- ☐ Motor leads properly connected, taped and wrapped.
- ☐ Correct heater size for motor protection.
- ☐ Voltage (at rest) AB-_____ BC-_____ AC-_____

OPERATION

- ☐ Controller programmed for proper operation
- ☐ Controls set properly for machine rating
- ☐ Pressure regulator on units with ES+ controller set 25-30 PSIG
- ☐ Main motor rotation checked
- ☐ Fan motor rotation checked
- ☐ Minimum pressure valve maintains 65 PSIG minimum reservoir pressure
- ☐ Safety and shutdown devices checked and functional
- ☐ Gauges, meters, and panel; lights operational
- ☐ START UNIT: Check operating pressure on unit, observe and adjust controls for proper operation and system pressure.

Discharge Air PSIG _____ A.P.S. Setting _____ to _____

Separator Delta P _____ Discharge Air Temp _____

Voltage loaded: AB- _____ BC- _____ AC- _____

Full load amps: T1- _____ T2- _____ T3- _____

Unloaded amps: T1- _____ T2- _____ T3- _____

Unloaded & BD amps: T1- _____ T2- _____ T3- _____

Motor Mfg. _____ Frame _____ HP _____

Serial Number _____

Volts _____ Service Factor _____ Motor Nameplate Amps _____

Starter Mfg. _____ Size _____ Heater Size _____

No _____ Bul No _____

Series _____ Date Code _ _ _ _ _ _ _ _

Review the following with owner personnel:

- ☐ Correct operating Procedures
- ☐ Safety precautions
- ☐ Recommended routine maintenance
- ☐ Programming controller
- ☐ Each section of the Operator's Manual
- ☐ Leave a set of manuals at the compressor
- ☐ Machine is leak free. Note: Within 10 days, owner should inspect for any leaks, that may have developed, and retighten connections.

Describe the operating environment _____

_____

Please initial the following:

_____ It has been explained to me, and I understand the standard warranty offered with this rotary screw compressor package.

_____ It has been explained to me, and I understand the terms and conditions of the optional, extended warranty offered with this rotary screw compressor package.

UNIT STARTED AND PERFORMING WELL? Yes _____ No _____ Remarks _____

_____

Please Print or Type

Customer Contact: _____ _____

Phone: _____ Started By: _____

Owner Signature: _____ Company Represented: _____

WHITE - Factory Copy YELLOW - Engr. Systems Copy PINK - Distributor Copy (When started by Distributor) GOLDENROD - Owner Copy BE-56 6/09

Gardner Denver

START UP PROCEDURES

FOR GARDNER DENVER ROTARY SCREW COMPRESSORS

IMPORTANT! These procedures cover the basic steps to follow, when starting up a Gardner Denver Rotary Screw Compressor. For full details and complete safety precautions, consult the operator's manual for the machine that you are starting up.

1.	SERVICE MANUAL AND PARTS LIST	Have a copy – and be familiar with the operator's manual for the machine you are starting up.
2.	START-UP CHECKLIST	Carefully fill out – the official Gardner Denver Start Up Check List/Warranty Registration Form.
3.	OVERALL APPEARANCE	Examine the overall appearance – of the compressor. Check for damage that may have occurred during transit. Repair and report any damage or missing parts as soon as possible. Any transportation damage must be resolved with the carrier.
4.	INSTALLATION	Is the unit serviceable? – The compressor should be installed in a clean, well lighted area, with ample space for air circulation, maintenance and repairs. Is there adequate space? – for an overhead hoist or tow motor to properly operate? Is there space to remove the air end or motor if needed?
5.	FOUNDATION	A smooth, solid surface – is needed. It must be able to support the weight of the compressor. The floor should make 100% contact with the rails of the base of the compressor.
6.	FASTENERS	Check bolts – for tightness.
7.	PIPING	Visually inspect – piping. No weight should be bearing on the unit. Piping should run down and away from the compressor, to drain condensate. If inlet piping is used – thoroughly clean and shot blast welded lines. Coat internally, by galvanizing or painting with moisture and oil proof sealing lacquer (PVC may be used). For proper inlet size – refer to the operator's manual.
8.	PRESSURE RELIEF VALVE	Must be installed – anywhere in front of piping that can be obstructed or closed. Also, on the receiver – and before any aftercooler or dryer. Sizing – Make sure it is sized correctly.
9.	MOTOR NAMEPLATE	Write down – the motor manufacturer, serial number, horsepower, voltage, service factor and nameplate amps.
10.	STARTER NAMEPLATE	Record – starter manufacturer, starter size and heater size.
11a.	ON COUPLED UNITS	Check the spacing – between the coupling halves. Needs to be between 1/8" and 5/32".
11b.	ON BELT DRIVEN UNITS	Check the drive alignment & belt tension. Sheaves should align straight across the front with a straight edge or string. To check tension, use a spring scale. Apply a perpendicular force to each belt at the midpoint of the span. Acceptable deflection readings are in the manual.
12.	ROLL THE AIR END	Over by hand – check for tight spots or drag on the motor air end. CAUTION: Turn in the direction of the arrow stamped on the housing.
13.	AIR FILTER	Disassemble air filter – to make sure all parts are present. If remote filter is used – make sure ambient conditions are clean and acceptable and that there is access for servicing. Orifice may be needed, with units that have Auto Sentry S controller.

14.	POUR OIL IN THE INLET (Oil flooded units)	With air filter removed – pour oil, drained from the unit into the inlet opening. Make sure brass inlet valve is in the open position. Do not pour oil down the inlet of an oil free Twistair, since it is water injected!
15.	CHECK OIL	Recommended Lubricant – is clearly marked on the decals on the separator. There is also a decal with fill instructions and information on when to check the oil level. DO NOT OVERFILL. Never mix lubricants.
	ON OIL FLOODED UNITS	Remote coolers – will require more oil to fill the lines. Consult the factory.
	ON WATER INJECTED UNITS	Oil breather cap – must be installed on start up.
16.	ROLL THE AIR END	Over by hand, again – to pre-lube the compressor.
17.	CHECK WIRING	Compare the wiring diagram – to the wiring on the machine. Trace wiring numbers and verify that the unit is wired correctly. Check for loose wires.
18.	RECORD VOLTAGE	Check and record line voltage – making sure all three legs are checked.
19.	GROUNDING	The unit must be grounded – in accordance with Table 250-95 of the National Electrical Code.
20.	JOG THE MOTOR	To check for correct rotation – as indicated by the arrow on the unit. To change rotation – interchange any two incoming wire leads. WARNING! Do not interchange the wrong motor leads or you will damage the motor.
21a.	FAN ROTATION AIR COOLED UNITS	Fan should blow through – the cooler.
21b.	FAN ROTATION WATER COOLED UNITS	On Oil flooded units – the air is drawn into the unit at the top of the enclosure and is exhausted out the motor side. On Oil-free units – the fan exhausts the air out of the cabinet. A water shutoff valve – should be installed. See the manual for proper installation instructions. Valve should open when compressor runs, and close when compressor stops.
22.	START THE COMPRESSOR	With service valve closed – start the unit by pushing one of the operation made buttons.
23.	RUN THE UNIT	For about one minute – then open the service valve. When operating temperature – is reached, check to see if proper pressure is being achieved.
24a.	SETTING PRESSURE WITH S CONTROLLER	By adjusting the subtractive pilot: 1. Turn the unit off. 2. Loosen locknut on the pilot. 3. Back out the adjusting screw several turns, so the subtractive pilot fully unloads the compressor before the unload pressure set point of the microprocessor is reached. 4. Close the service valve. 5. Start the unit in constant run. 6. Allow the subtractive pilot to fully unload the compressor. 7. Turn in the adjusting screw until the unload set point is reached and the microprocessor controller allows the unit to blow down. 8. Turn the adjusting screw an additional 1/8 turn and tighten locknut. 9. Using the service valve, cycle the unit between load & unload several times to be sure unit blows down when it reaches unload pressure setpoint.

24b.	SETTING PRESSURE WITH ES CONTROLLER	Program the set pressure at nameplate and no higher.
25a.	CHECK AUTOMATIC START/ STOP FUNCTION WITH S CONTROLLER	1. Start the unit in the automatic mode. 2. Close the service valve and allow the unit to unload. 3. Unit will shut down in 10 minutes, provided unit does not reload.
25b.	CHECK AUTOMATIC START/ STOP FUNCTION WITH ES CONTROLLER	1. Start the unit in the automatic mode. 2. Close the service valve and allow the unit to unload. 3. Unit will shut down as pragrammed (between 5 and 30 minutes) but only after the compressor has blow down, and is timed out.
26.	CHECK SAFETY FEATURES	**High temperature shutdown** – can he checked on units with auto sentry ES controllers by lowering the High Temp volue. When the compressor reaches this temperature and shuts down, you know the shutdown device is working. **Manually trip fan and motor overloads** – The display should show a shut down and prevent unit from starting. To start unit, reset the overloads and controller and push an operation mode button.
27.	MINIMUM PRESSURE VALVE	**Must maintain 65 psig** – minimum pressure. On units with adjustable minimum pressure valves: 1. Loosen the locknut on the adjusting screw. 2. Turn the adjusting screw in to increase, and out to decrease the pressure.
28.	CHECK WATER TEMPERATURE (WATER COOLED UNITS) WATER INJECTED UNITS	**Incoming water** – should be between 60–90°F. **Discharge water** – must not exceed 110°F. **Recirculating water** – Must meet EPA standards for drinking water, and he within hardness limits, as stated in the manual. **The minimum pressure** – for injection water supply is 30 psig.
29.	CHECK OIL TEMPERATURE	**Minimum inlet oil temperature** – See the Operator's Manual for the minimum inlet temperature for your compressor.
30.	SET PRESSURE REGULATOR ON UNITS WITH ES CONTROLLER	**Set pressure regulator** – between 25–30 psig.
31a.	MEASURE PRESSURE DIFFERENTIAL WITH S CONTROLLERS (Oil Flooded Units) (Oil-free Units)	**Follow these steps:** 1. Make sure the unit is at full load. 2. Press the operation mode that the unit is currently running in. 3. The alternate reading will appear in the pressure display, indicated by a decimal point in the lower right hand corner. This is pressure measured before the separator. 4. Subtract the discharge pressure reading from this alternate reading (separator reading) to get the Delta P. (Pressure Differential). **There is no separator element** – in the oil-free units. Instead, the pressure differential is measured across the recirculating water filter. The change water filter light will flash as advisory at 30 psid, with the unit shutting down at 40 psid.
31b.	MEASURE PRESSURE DIFFERENTIAL WITH ES CONTROLLERS	**Follow these steps –** 1. Make sure the unit is at full load. 2. Simply push either arrow key until the separator differential pressure appears in the display.

32.	RUN UNIT, FULL LOAD, FOR ½ HOUR	Then record - - Discharge pressure. Discharge air temperature. Amperage on the three legs going into the overloads. Compare this amperage to what full load amps should be. To determine full load amps – use this formula: $\text{Full Load Amps} = \frac{\text{BHP}}{\text{Motor Nameplate HP}} \times \text{Nameplate Amps}$ NOTE: Brake HP can be found in an Engineering Data sheet or in the sales literature. Record phase to phase voltage – by measuring all 3 legs.
33.	CHECK UNLOADED AMPERAGE	With the compressor unloaded – check unloaded amperage.
34.	DESCRIBE OPERATING ENVIRONMENT	Record ambient conditions – Is the room clean? What is the ambient temperature? Record everything around the compressor and quality of the incoming air.
35.	LEAKS LEAKS (Oil-free Units)	Make sure the unit is leak free – check all connections for tightness. Floating carbon rings – are designed to allow some leakage, which is captured by a tray and piped to drain out.
36.	REVIEW OPERATING PROCEDURES AND MAINTENANCE	With the operator –make sure to cover 1. Starting and stopping procedures. 2. How to program the controller. 3. Safety precautions. 4. Basic Maintenance procedures, emphasizing that daily maintenance is based on 8 hours of operation not 24. 5. Review each section of the manual, emphasizing the need to sit down, read and become familiar with the manual.
37.	LEAVE A SET OF MANUALS	In the control cabinet.
38.	DISCUSS WITH THE OWNER	Or the owner's representative – any discrepancies that you have noticed when performing the start up.
39.	OBTAIN A SIGNATURE	From the owner – or owner's representative. The signature should be written at the bottom of the Start Up Checklist/Warranty Registration form.
29.	MAIL FORM	To the factory---A start up is not complete until the form has been completed and mailed to the factory service department.

Gardner Denver

Rotary Screw Maintenance Log

Month _____ Year _____

Inspection & Service	Shift	Days of the Month															
		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
1. **Every 8 Hours** a. Check for advisories or shutdowns (record any)	1																
	2																
	3																
Every 8 Hours b. Check reservoir oil level Oil added? (N=No Y=Yes)	1																
	2																
	3																
Every 8 Hours c. Check for proper loading/ unloading. (✓= done)	1																
	2																
	3																
Every 8 Hours d. Check discharge pressure (✓= done)	1																
	2																
	3																
Every 8 Hours e. Check discharge temperature (Record temperature)	1																
	2																
	3																
Every 8 Hours f. Drain condensate traps (✓= done)	1																
	2																
	3																
2. **Every 125 Hours** Check cooler and fan for dirt accumulation (✓= done)																	
3. **Every 1000 Hours** Change oil filter. Record hourmeter reading.																	
4. **Change AEON Lubricant**** Change when advisory appears or when oil analysis indicates. Record hourmeter reading.																	
5. **Every 12 Months** Check pressure relief valve. (✓= done)																	
6. **Every 18 Months** Regrease motor. (✓= done)																	
7. **Change Air Filter** When advisory appears, change air filter. Record hourmeter reading.																	

*Or sooner, as indicated by advisory. **Advisory for AEON 9000 SP is programmed to appear at 8000 hours (earlier, if high discharge temperature exists.)