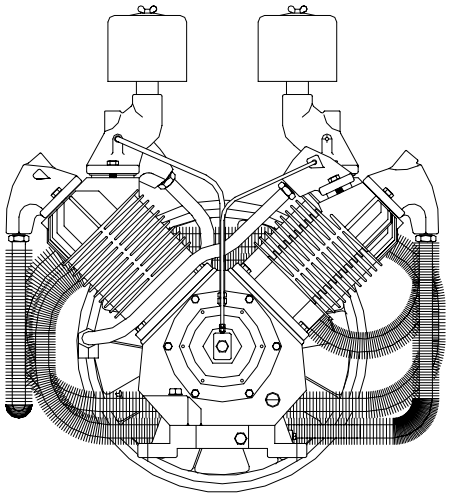
Gardner Denver

OPERATION/MAINTENANCE MANUAL & PARTS LIST

TWO STAGE/FOUR CYLINDER R70A AIR COMPRESSOR & UNITS

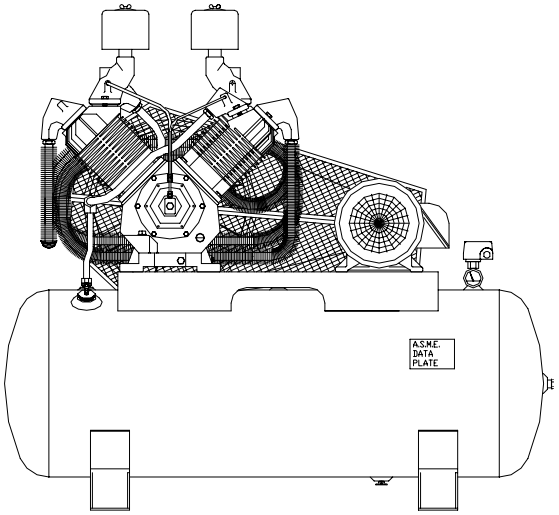
⚠ WARNING

THIS MANUAL CONTAINS IMPORTANT SAFETY INFORMATION AND SHOULD ALWAYS BE AVAILABLE TO THOSE PERSONNEL OPERATING THIS UNIT.
READ, UNDERSTAND AND RETAIN ALL INSTRUCTIONS BEFORE OPERATING THIS EQUIPMENT TO PREVENT INJURY OR EQUIPMENT DAMAGE.



C324-A
(Ref. Drawing)

MODEL R70A COMPRESSOR



C469-A
(Ref. Drawing)

MODEL HRA25-12 UNIT

Form No. GF3234 VER: 01 08/28/2003

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

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

Your authorized Gardner Denver Compressor distributor offers all the backup you'll need. A worldwide network of authorized distributors provides the finest product support in the air compressor industry. Your 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. A full line of factory tested AEON™ compressor lubricants specifically formulated for use in Gardner Denver compressors.
3. Repair and maintenance kits designed with the necessary parts to simplify servicing your compressor.

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

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

Factory:
Gardner Denver
1301 North Euclid Avenue
Princeton, IL 61356

Phone: (815) 875-3321

Fax: (815) 872-0421
E-Mail: Champion@Championpneumatic.com

INSTRUCTIONS FOR ORDERING REPAIR PARTS

When ordering parts, specify Compressor MODEL, HORSEPOWER and SERIAL NUMBER (see nameplate on unit). All orders for Parts should be placed with the nearest authorized distributor.

Order by part number and description. Reference numbers are for your convenience only.

TABLE OF CONTENTS

SAFETY AND OPERATION PRECAUTIONS

Because an air compressor is a piece of machinery with moving and rotating parts, the same precautions should be observed as with any piece of machinery of this type where carelessness in operation or maintenance is hazardous to personnel. In addition to the many obvious safety rules that should be followed with this type of machinery, the additional safety precautions as listed below must be observed:

1. Read all instructions completely before operating air compressor or unit.
2. For installation, follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).
3. Electric motors must be securely and adequately grounded. This can be accomplished by wiring with a grounded, metal-clad raceway system to the starter; by using a separate ground wire connected to the bare metal of the motor frame; or other suitable means.
4. Protect the power cable from coming in contact with sharp objects. Do not kink power cable and never allow the cable to come in contact with oil, grease, hot surfaces, or chemicals.
5. Make certain that the power source conforms to the requirements of your equipment.
6. Pull main electrical disconnect switch and disconnect any separate control lines, if used, before attempting to work or perform maintenance on the air compressor or unit. "Tag Out" or "Lock Out" all power sources.
7. Do not attempt to remove any compressor parts without first relieving the entire system of pressure.
8. Do not attempt to service any part while machine is in an operational mode.
9. Do not operate the compressor at pressures in excess of its rating.
10. Do not operate compressor at speeds in excess of its rating.
11. Periodically check all safety devices for proper operation. Do not change pressure setting or restrict operation in any way.
12. Be sure no tools, or rags or loose parts are left on the compressor or drive parts.
13. Do not use flammable solvents for cleaning the air inlet filter or element and other parts.
14. Exercise cleanliness during maintenance and when making repairs. Keep dirt away from parts by covering parts and exposed openings with clean cloth or Kraft paper.
15. Do not operate the compressor without guards, shields and screens in place.
16. Do not install a shut-off valve in the discharge line, unless a pressure relief valve, of proper design and size, is installed in the line between the compressor unit and shut-off valve.
17. Do not operate compressor in areas where there is a possibility of ingesting flammable or toxic fumes.
18. Be careful when touching the exterior of a recently run motor - it may be hot enough to be painful or cause injury. With modern motors this condition is normal if operated at rated load - modern motors are built to operate at higher temperatures.
19. Inspect unit daily to observe and correct any unsafe operating conditions found.
20. Do not "play around" with compressed air, nor direct air stream at body, because this can cause injuries.
21. Compressed air from this machine absolutely must not be used for food processing or breathing air without adequate downstream filters, purifiers and controls.
22. Always use an air pressure regulating device at the point of use, and do not use air pressure greater than marked maximum pressure of attachment.
23. Check hoses for weak or worn condition before each use and make certain that all connections are secure.
24. Always wear safety glasses when using a compressed air blow gun.

The user of any air compressor package manufactured by Gardner Denver is hereby warned that failure to follow the preceding Safety and Operation Precautions can result in injuries or equipment damage. However, Gardner Denver does not state as fact or does not mean to imply that the preceding list of Safety and Operating Precautions is all inclusive, and further that the observance of this list will prevent all injuries or equipment damage.

EXPLANATION OF SAFETY INSTRUCTION SYMBOLS AND DECALS

 **DANGER**
Indicates immediate hazards which will result in severe injury or death.

 **WARNING**
Indicates hazards or unsafe practice which could result in severe injury or death.

 **CAUTION**
Indicates hazards or unsafe practice which could result in damage to the Gardner Denver compressor or minor injury.

NOTICE
Notice is used to notify people of installation, operation or maintenance information which is important but not hazard-related.

SAFETY AND OPERATION PRECAUTIONS

OBSERVE, UNDERSTAND AND RETAIN THE INFORMATION GIVEN IN THE SAFETY PRECAUTION DECALS AS SHOWN IN THE PARTS LIST SECTION

 **DANGER**
This reciprocating compressor must not be used for breathing air. To do so will cause serious injury whether air is supplied direct from the compressor source or to breathing tanks for later use. Any and all liabilities for damage or loss due to injury, death and/or property damage including consequential damages stemming from the use of this compressor to supply breathing air, will be disclaimed by the manufacturer.

 **WARNING**
The use of this compressor as a booster pump and/or to compress a medium other than atmospheric air is strictly non-approved and can result in equipment damage and/or injury.

 **CAUTION**
This unit may be equipped with special options which may not be included in this manual. User must read, understand and retain all information sent with special options.

INTRODUCTION

Gardner Denver R Series 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.

WARRANTY

Gardner Denver Five Year Warranty
"R" Series Compressors

Gardner Denver, Inc. ("the Company") warrants each new compressor pump manufactured by the Company, mounted on a factory assembled unit, to be free from defects in material and workmanship under normal use and service for a period of sixty (60) months from date of installation or sixty-six (66) months from date of shipment by the Company or the Company distributor, whichever may occur first. **Applies to the compressor pump only, excluding head valves. Valves, controls and accessories are warranted for the first year only.** Compressor pumps purchased separately would carry a one year warranty.

This five year extended warranty will be prorated over the 5 years as follows:

First Year	-	100% Allowance, Parts and Labor
Second Year	-	90% Allowance, Parts and Labor
Third Year	-	80% Allowance, Parts and Labor
Fourth Year	-	70% Allowance, Parts and Labor
Fifth Year	-	60% Allowance, Parts and Labor

Applies to the Company logo, tank or base mounted complete compressors only.

Express Limited Warranty

The Company warrants each new air compressor unit manufactured by the Company to be free from defects in material and workmanship under normal use and service for a period of twelve (12) months from date of installation or eighteen (18) months from date of shipment by the Company or the Company distributor, whichever may occur first.

The Company makes no warranty in respect to components and accessories furnished to the Company by third parties, such as **ELECTRIC MOTORS, GASOLINE ENGINES** and **CONTROLS**, which are warranted only to the extent of the original manufacturer's warranty to the Company. To have warranty consideration, electric motors must be equipped with thermal overload protection.

The extended five year warranty will apply to ASME air receivers provided they are installed on rubber vibro isolator pads or approved equivalent.

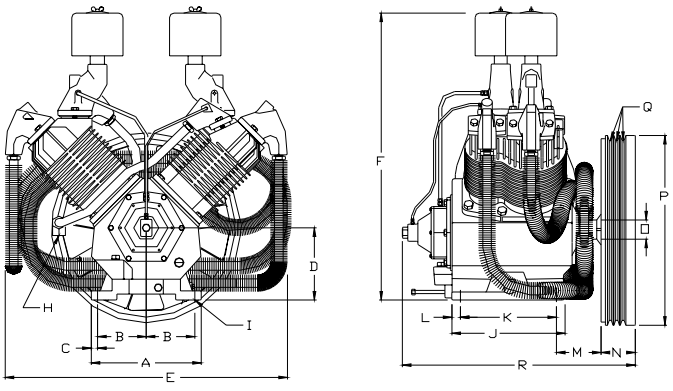
When a compressor pump, or component is changed or replaced during the warranty period, the new/replaced item is warranted for only the remainder of the original warranty period.

Repair, replacement or refund in the manner and within the time provided shall constitute the Company 's sole liability and your exclusive remedy resulting from any nonconformity or defect. THE COMPANY SHALL NOT IN ANY EVENT BE LIABLE FOR ANY DAMAGES, WHETHER BASED ON CONTRACT, WARRANTY, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, INCLUDING WITHOUT LIMITATION ANY CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES, ARISING WITH RESPECT TO THE EQUIPMENT OR ITS FAILURE TO OPERATE, EVEN IF THE COMPANY HAS BEEN ADVISED OF THE POSSIBILITY THEREOF.

THE COMPANY MAKES NO OTHER WARRANTY OR REPRESENTATION OF ANY KIND, EXCEPT THAT OF TITLE, AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY EXPRESSLY DISCLAIMED. NO SALESMAN OR OTHER REPRESENTATIVE OF THE COMPANY HAS AUTHORITY TO MAKE ANY WARRANTIES.

TWO STAGE AIR COMPRESSORS - MODEL R70A

DIMENSIONS



C-325-A
(Ref. Drawing)

	ITEM	PL70A
A	Base-Width	12-7/8”
B	Bolt Down-Width (from center line)	5-11/16”
C	Bolt Down to Edge	3/4”
D	Base to Crank Ctr	8-3/16”
E	Overall Width	33”
F	Overall Height	33-9/16”
H	HP Exhaust Opening	1-1/4NPT
I	Bolt Down Hole Dia.	9/16”
J	Base-Depth	13-1/4”
K	Bolt Down Depth	11-1/4”
L	Bolt Down to Edge	1”
M	Bolt Hole to Wheel (Max.)	5-3/4”
N	Flywheel Width	3-1/2”
O	Crank Diameter	2-1/4”
P	Flywheel Diameter	22”
Q	Flywheel Grooves	3VB
R	Overall Depth	27-1/4”

NOTE:
Flywheel Rotation – Clockwise when viewed from front, flywheel to rear.

SPECIFICATIONS

MODEL	BORE & STROKE (INCH)	NO. of CYLINDERS	OIL CAPACITY (QTS)	WEIGHT (LBS)	MAXIMUM PRESSURE (PSIG)	CU FT./REV.	MIN./MAX. RPM.
R70A	6-1/4" & 3-1/4" x 4"	4	6-1/3	450	175	.142	425/1000

PERFORMANCE

PUMP	OUTPUT PRESS. PSIG	MOTOR H.P.	PUMP RPM	DISPL. CFM	COOLING AIR FLOW CFM	HEAT REJECTION BTU/HR	APPROX. PULLEY O.D., INCHES
R70A	125	20	770	109.4	2580	44,700	8.95
R70A	125	25	890	127.8	2980	55,970	11.4
R70A	175	20	665	93.0	2195	44,700	8.35
R70A	175	25	770	109.4	2580	55,970	9.75
R70A	175	30	890	127.8	2980	67,160	11.4

All data is based on 1725 RPM electric motors as a power source.

Pulley Dia. (approx.) = $\frac{\text{Compressor RPM x Flywheel Dia.}}{\text{Motor or Engine RPM}}$

INSTALLATION

WARNING

Do not operate unit if damaged during shipping, handling or use. Operating unit if damaged may result in injury.

1. Permanently installed compressors must be located in a clean, well ventilated dry room so compressor receives adequate supply of fresh, clean, cool and dry air. It is recommended that a compressor, used for painting, be located in a separate room from that area wherein body sanding and painting is done. Abrasive particles or paint, found to have clogged the air intake filters and intake valves, shall automatically void warranty.
2. Compressors should never be located so close to a wall or other obstruction that flow of air through the fan blade flywheel, which cools the compressor, is impeded. Permanently mounted units should have flywheel at least 12" from wall.
3. Place stationary compressors on firm level ground or flooring. Permanent installations require bolting to floor. Bolt holes in tank or base feet are provided. Before bolting or lagging down, shim compressor level. Avoid putting a stress on a tank foot by pulling it down to floor. This will only result in abnormal vibration, and possible cracking of air receiver. It is recommended that unit be set on optional vibro-isolator pads. Tanks bolted directly to a concrete floor without isolators will not be warranted against cracking. Gardner Denver vibro-isolators or approved equivalent must be installed for extended warranty to apply to ASME receivers.
4. If installing a bare pump, or base mounted unit, make certain the pressure limiting controls are properly installed and operational. A pressure switch must be provided by customer for start/stop operation. If a pilot valve is used the compressor must be equipped with head unloaders.
5. A properly sized air check valve must be installed in the discharge piping between the compressor outlet and the inlet of any receiver tank(s) in the system.

DANGER

Do not install isolating valves between compressor outlet and air receiver. This will cause excessive pressure if valve is closed and cause injury and equipment damage.

WARNING

Always use an air pressure regulating device at the point of use. Failure to do so can result in injury or equipment damage.

CAUTION

- **Do not install in an area where ambient temperature is below 32 degrees F or above 100 degrees F.**
- **Do not install unit in an area where air is dirty and/or chemical laden.**
- **Unit is not to be installed outdoors.**

INSTALLATION (CONT'D)

ELECTRICAL POWER SUPPLY

It is essential that the power supply and the supply wiring are adequately sized and that the voltage correspond to the unit specifications. Branch circuit protection must be provided at installation a specified in the National Electrical Code.

All wiring should be performed by a licensed electrician or electrical contractor. Wiring must meet applicable codes for area of installation. The table gives recommended wire sizes based on the 1999 NEC.

WIRE SIZE (AWG) – 75°C COPPER – 30°C AMBIENT

MOTOR HP	3 PHASE			
	200/208V	230V	460V	575V
20	3 (0)	4 (1)	8 (6)	10 (6)
25	1 (000)	2 (00)	6 (4)	8 (6)
30	0 (0000)	1 (000)	6 (3)	8 (4)

Values in ( ) for Duplex Unit w/one incoming power line to both motors.

All models require a properly sized magnetic starter as specified in the National Electric Code (NEC). See Figure 1-1 for simplex wiring diagram and Figure 1-2 for duplex wiring diagram.

If ordered with a factory mounted magnetic starter, compressor is wired at factory. It is necessary only to bring lines from a properly sized disconnect switch to the magnetic starter mounted on the unit.

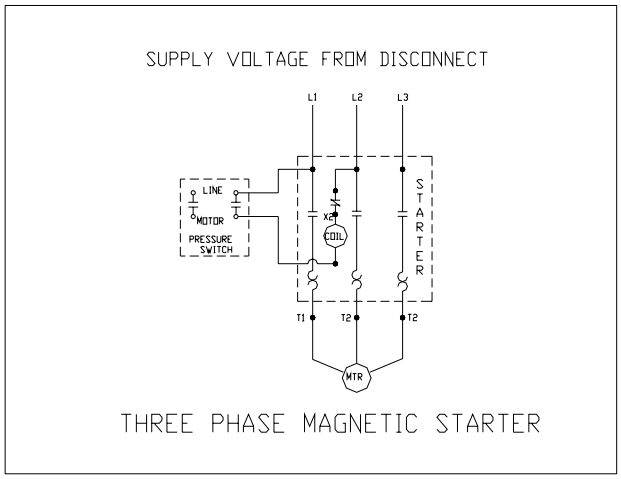
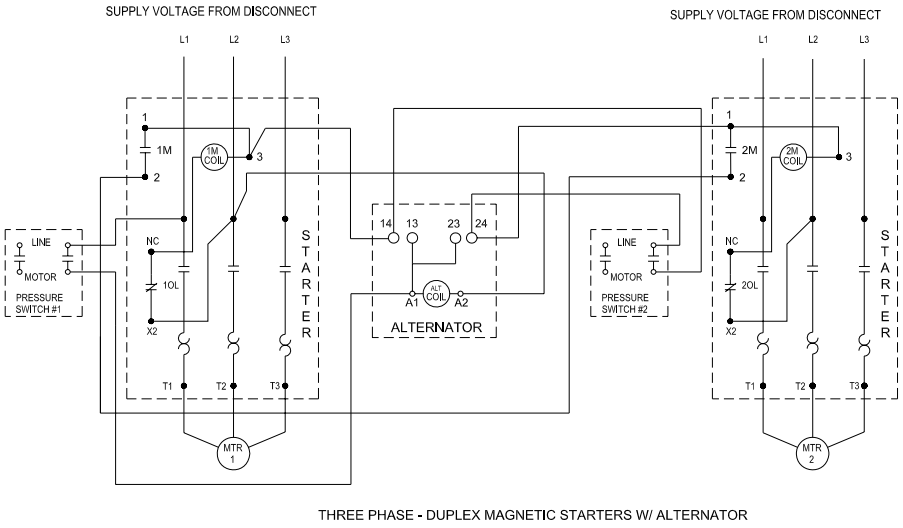


Figure 1-1 Simplex Wiring Diagram

ELECTRICAL POWER SUPPLY (CONT'D)



THREE PHASE - DUPLEX MAGNETIC STARTERS W/ ALTERNATOR

B1258-A
(Ref. Drawing)

Figure 1-2 Duplex Wiring Diagram

⚠ CAUTION
Wiring must be such that when viewing compressor from opposite shaft end, rotation of shaft is clockwise as shown by arrow on guard. Wrong direction rotation for any length of time will result in damage to compressor.

GROUNDING INSTRUCTIONS

This product should be connected to a grounded, metallic, permanent wiring system, or an equipment-grounding terminal or lead on the product.

AIR LINE PIPING

Connection to air system should be of the same size, or larger, than discharge pipe out of unit. The table gives recommended minimum pipe sizes. A union connection to the unit and water drop leg is recommended. Install a flexible connector between the discharge of the unit and the plant air piping. Plant air piping should be periodically inspected for leaks using a soap and water solution for detection on all pipe joints. Air leaks waste energy and are expensive.

Minimum Pipe Sizes For Compressor Air Lines
(Based on clean Smooth Schedule 40 Pipe)

MODEL	25'	50'	100'	200'	300'
R70A	1-1/4" (1-1/2")	1-1/4" (1-1/2")	1-1/4" (1-1/2")	1-1/2" (2")	1-1/2" (2")

Values in ( ) are for duplex unit.

⚠ WARNING
Never use plastic pipe or improperly rated metal pipe. Improper piping material can burst and cause injury or property damage.

OPERATION

This compressor has been inspected, thoroughly tested and approved at the factory. For this unit to give long satisfactory service it must be installed and operated properly.

Simplex units have a pressure switch that senses changes in receiver pressure and automatically starts and stops the compressor at preset pressure limits. If the receiver pressure falls below the cut-in pressure setting of the pressure switch the compressor will run until the cut-out pressure setting of the pressure switch has been reached.

Duplex units have lead and lag pressure switches and an automatic alternating system to evenly distribute the load between the two compressors. The pressure switches sense changes in receiver pressure and automatically start and stop the compressor at preset pressure levels. If the receiver pressure falls below the cut-in pressure setting of the lead pressure switch but remains above the cut-in pressure setting of the lag pressure switch, only one compressor will run until receiver pressure reaches the cut-out pressure of the lead pressure switch. The next time the pressure in the receiver drops, the system automatically starts the compressor that was idle. If the receiver pressure falls below the cut-in pressure setting of the lag pressure switch, both compressors run until receiver pressure reaches the cut-out pressure setting of the lead pressure switch.

Units furnished with head unloaders are equipped with a needle valve, pilot valve and head unloaders to provide continuous run capabilities. The pilot valve acts as an automatic air switch allowing air to flow from the receiver to the head unloader mechanism, thus actuating it. To operate unit in continuous run, open needle valve located next to pilot valve. The pilot valve is now able to sense receiver pressure. When the receiver pressure reaches the cut-out pressure setting of the pilot valve, the pilot valve opens and air is released to the unloader mechanism. The compressor stops compressing air and runs unloaded until the cut-in pressure setting of the pilot valve has been reached. At this time air released from the unloader mechanism and the compressor starts compressing again. Continuous run is recommended if motor starts exceed 8 starts/hour.

Initial Start Up

1. Inspect unit for any visible signs of damage that would have occurred in shipment or during installation.
2. Pull main disconnect switch to unit to assure that no power is coming into the unit. “Lock Out” or “Tag Out” switch. Connect power leads to start.

⚠ WARNING
Do not attempt to operate compressor on voltage other than that specified on order or on compressor motor.

3. Check compressor oil level. Add oil as required. See “Compressor Oil Specifications” Section. **NOTE**: Do not mix oil type, weights or brands.
4. Activate main disconnect switch.
5. “Jog” motor and check for proper rotation by direction arrow. If rotation is wrong, reverse input connections on the magnetic starter.
6. Close receiver outlet hand valve and start.
7. With receiver hand valve closed, let machine pump up to operating pressure. At this stage the automatic controls will take over. Check for proper cycling operation.
8. Check for proper operation of any options. Refer to individual option instruction sheet.
9. When the initial run period has shown no operating problems, shut unit down and recheck oil level.
10. Open receiver hand valve. The air compressor unit is now ready for use.

⚠ WARNING
This unit can start automatically without warning.

GUIDE TO MAINTENANCE

For Service contact an authorized Gardner Denver distributor. All requests should include model number and serial number. To obtain reliable and satisfactory service, this unit requires a consistent preventive maintenance schedule. Maintenance schedule form is included to aid in keeping the proper records.

⚠ WARNING
Before performing any maintenance function, switch main disconnect switch to "off" position to assure no power is entering unit. "Lock Out" or "Tag Out" all sources of power. Be sure all air pressure in unit is relieved. Failure to do this may result in injury or equipment damage.

DAILY MAINTENANCE

1. Check oil level of compressor. Add AEON recip lubricant as required. See “Compressor Oil Specifications” Section. **NOTE**: Do not mix oil type, weight, or brands.
2. Drain moisture from tank by opening tank drain cock located in bottom of tank. Do not open drain valve if tank pressure exceeds 25 PSIG.
3. Turn off compressor at the end of each day's operation. Turn off power supply at wall switch.

WEEKLY MAINTENANCE

1. Clean dust and foreign matter from cylinder head, motor, fan blade, air lines, intercooler and tank.
2. Remove and clean intake air filters.

⚠ WARNING
Do not exceed 15 PSIG nozzle pressure when cleaning element parts with compressed air. Do not direct compressed air against human skin. Serious injury could result. Never wash elements in fuel oil, gasoline or flammable solvent.

3. Check V-belts for tightness. The V-belts must be tight enough to transmit the necessary power to the compressor. Adjust the V-belts as follows:
   a. Remove bolts and guard to access compressor drive.
   b. Loosen mounting hardware which secures motor to base. Slide motor within slots of baseplate to desired position.
   c. Apply pressure with finger to one belt at midpoint span. Tension is correct if top of belt aligns with bottom of adjacent belt. Make further adjustments if necessary.
   d. Check the alignment of pulleys. Adjust if necessary.
   e. Tighten mounting hardware to secure motor on base.
   f. Re-install guard and secure bolts.

⚠ WARNING
Never operate unit without belt guard in place. Removal will expose rotating parts which can cause injury or equipment damage.

EVERY 90 DAYS OR 500 HOURS MAINTENANCE

1. Change crankcase oil. Use only AEON recip lubricant.

2. Check entire system for air leakage around fittings, connections, and gaskets, using soap solution and brush.

3. Tighten nuts and cap screws as required.

4. Check and clean compressor valves as required. Replace when worn or damaged parts.

CAUTION
Valves must be replaced in original position. Valve gaskets should be replaced each time valves are serviced.

5. Pull ring on all pressure relief valves to assure proper operation.

GENERAL MAINTENANCE NOTES

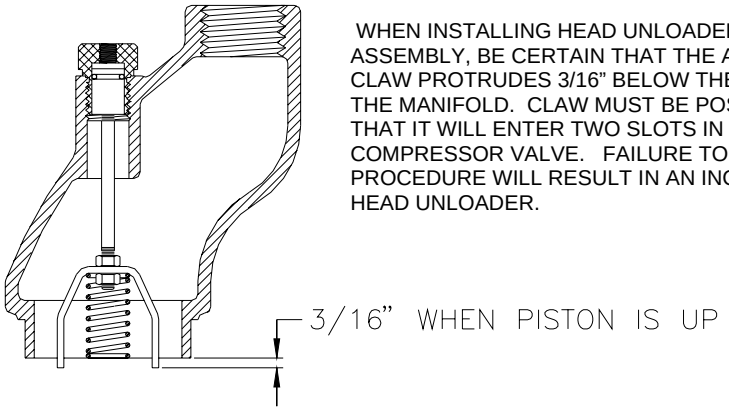
PRESSURE RELIEF VALVE: The pressure relief valve is an automatic pop valve. Each valve is properly adjusted for the maximum pressure of the unit on which it is installed. If it should pop, it will be necessary to drain all the air out of the tank in order to reseat properly, or drop pressure in line. Do not readjust.

PRESSURE SWITCH: The pressure switch is automatic and will start compressor at the low pressure and stop when the maximum pressure is reached. It is adjusted to start and stop compressor at the proper pressure for the unit on which it is installed. Do not readjust.

BELTS: Drive belts must be kept tight enough to prevent slipping. If belts slip or squeak, see V-belt maintenance in preceding section.

CAUTION
If belts are too tight, overload will be put on motor and motor bearings.

COMPRESSOR VALVES: If compressor fails to pump air or seems slow in filling up tank, disconnect unit from power source and remove valves and clean thoroughly, using compressed air and a soft wire brush. After cleaning exceptional care must be taken that all parts are replaced in exactly the same position and all joints must be tight or the compressor will not function properly. See instructions below for manifold assembly. When all valves are replaced and connections tight, close hand valve at tank outlet for final test. Valve gaskets should be replaced each time valves are removed from pump.



WHEN INSTALLING HEAD UNLOADER MAINFOLD ASSEMBLY, BE CERTAIN THAT THE ACTUATING CLAW PROTRUDES 3/16" BELOW THE BOTTOM OF THE MANIFOLD. CLAW MUST BE POSITIONED SO THAT IT WILL ENTER TWO SLOTS IN THE COMPRESSOR VALVE. FAILURE TO FOLLOW THIS PROCEDURE WILL RESULT IN AN INOPERATIVE HEAD UNLOADER.

C374-A
(Ref. Drawing)

TYPICAL MANIFOLD ASSEMBLY

GENERAL MAINTENANCE (Cont'd.)

CENTRIFUGAL UNLOADER AND UNLOADER PRESSURE RELEASE VALVE: The centrifugal unloader is operated by two governor weights. It is totally enclosed and lubricated from the crankcase of the compressor. When compressor starts, the governor weights automatically open compressing the main spring, allowing the unloader pressure release valve to close. When the compressor stops, the main spring returns the governor weights to normal position opening the unloader pressure release valve and unloading the compressor. This prevents overloading the motor when starting. If air continues to escape through the governor or unloader pressure release valve while operating, this is an indication that the unloader pressure release valve is not closing tightly and may be held open by foreign substance which has lodged on the seat. In order to correct this, remove the governor release valve cap, giving access to unloader pressure release valve spring and ball. Clean thoroughly and return parts in the same order in which they were removed. Loose drive belts can also cause unloader to leak by preventing the compressor from reaching proper speed. (See “BELTS” above.)

CHECK VALVE: The check valve closes when the compressor stops operating, preventing air from flowing out of the tank through the pressure release valve. After the compressor stops operating, if air continues to escape through the release valve, it is an indication that the check valve is leaking. This can be corrected by removing check valve and cleaning disc and seat. If check valve is worn badly, replace same.

WARNING
Before removing check valve be sure all air is drained out of tank and power is disconnected. Failure to do so may result in injury or equipment damage.

THE INTERSTAGE PRESSURE RELIEF VALVE is provided to protect against interstage over pressure and is factory set for maximum pressure of 75 PSIG. **DO NOT RESET**
If the pressure relief valve pops, it indicates trouble. Shut down the unit immediately and determine and correct the malfunction. Inspect the head valves. Serious damage can result if not corrected and can lead to complete destruction of the unit. Tampering with the interstage pressure relief valve, or plugging the opening destroys the protection provided and voids all warranty.

COMPRESSOR LUBRICATION: Fill crankcase to proper level as indicated by oil sight gauge. Keep crankcase filled as required by usage. It is recommended that only AEON recip lubricant be used. This is a 30-weight, non-detergent industrial oil with rust and oxidation inhibitors specially formulated for reciprocating compressors. Do not mix oil types, weights or brands.

MOTOR LUBRICATION: Long time satisfactory operation of an electric motor depends in large measure on proper lubrication of the bearings. Bearing grease will lose its lubricating ability overtime, not suddenly. Refer to the motor manufacturer’s instructions for the type of grease and lubrication intervals.

PILOT VALVE: The pilot valve actuates the head unloader mechanism to provide a means of stopping or starting the compression of air by the compressor without stopping or starting the electric motor.

COMPRESSOR PILOT VALVE PRESSURE ADJUSTMENT
Proceed with the following instructions while compressor is running:

1. Loosen locknut (4) and back off several turns. Do not turn differential pressure adjustment nut (3).

2. Check reading on the tank pressure gauge. Set the compressor maximum pressure by turning threaded cap (1) clockwise to increase pressure or counter clockwise to decrease pressure. Pressure setting must be 5 psig less than setting of pressure switch.

3. After pressure is set, tighten locknut (4). Be careful not to move threaded cap (1).

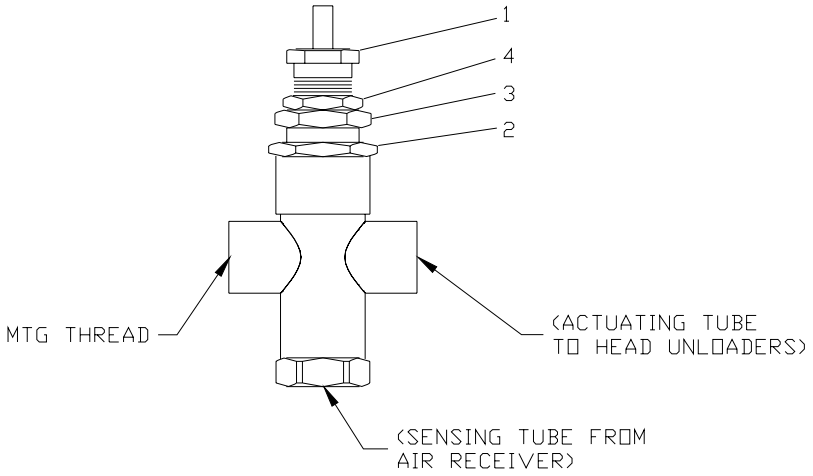
COMPRESSOR PILOT VALVE DIFFERENTIAL PRESSURE ADJUSTMENT

Proceed with the following instructions while compressor is running.

1. Loosen locknut (2) and back off several turns.

2. Check reading on the tank pressure gauge. Set the pressure to 30 psig differential (unload at 170 psig, reload at 140 psig). Turn nut (3) clockwise to increase differential pressure or counter clockwise to decrease differential pressure.

3. After pressure is set, tighten locknut (2). Be careful not to move nut (3).



B980-B
(Ref. Drawing)

COMPRESSOR OIL SPECIFICATIONS

Compressors are factory filled with AEON hydrocarbon based recip lubricant. This is an ISO 100 non-detergent industrial lubricant with rust and oxidation inhibitors specially formulated for reciprocating compressors. It is recommended this compressor be maintained using this oil for ambient temperatures above 32°F.

AEON synthetic is a premium grade diester based synthetic lubricant providing excellent performance in high temperature applications.

⚠ CAUTION
Do not mix oil types, weights or brands.

NOTES:

1. Normal break-in period of Gardner Denver air compressors is 25 hours.
2. For the first 100 hours of compressor operation, a careful and regular check of the oil level should be made. Maintain oil level at the full line.

CHANGING TO SYNTHETIC LUBRICANT

(Applies to diester based synthetic lubricant only)

1. Compressor must run for a 25 hour break-in period using AEON ISO 100 oil
2. Thoroughly drain existing oil from crankcase.
3. Fill crankcase with a full charge of synthetic lubricant.
4. Run compressor for 200 hours.
5. Stop compressor and thoroughly drain the synthetic lubricant.
6. Add a full charge of synthetic lubricant.
7. Compressor now ready to run for extended period before next lubricant change.

LUBRICANT

AEON

DESCRIPTION	PART NUMBER
1 – Quart Case (12/case)	28H213
1 – Gallon Case (4/case)	28H212
5 – Gallon Pail	28H211
55 – Gallon Drum	28H210

AEON SYNTHETIC

DESCRIPTION	PART NUMBER
1 – Quart Case (12/case)	28H216
1 – Gallon Case (4/case)	28H215
5 – Gallon Pail	28H214

TORQUE VALVES

SPECIFIC APPLICATION	FASTENER SIZE & THREAD	TORQUE INCH-POUNDS
BEARING HOUSING BOLT	7/16 – 20	540
CYLINDER FLANGE BOLT	1/2 – 13	900
CONNECTING ROD BOLT	7/16 – 20	400
MANIFOLD BOLT	7/14 – 14	230
FLYWHEEL BOLT	7/16 – 20	600

TROUBLE SHOOTING CHART FOR COMPRESSOR

WARNING

Always disconnect unit from power supply and relieve all pressure from air tank before performing any maintenance. "Tag Out" or "Lock Out" all power sources. Failure to do so may result in equipment damage or injury.

Never operate unit without belt guard in place.

Never use gasoline or flammable solvent on or around compressor unit. Explosion may result.

Troubleshooting Chart

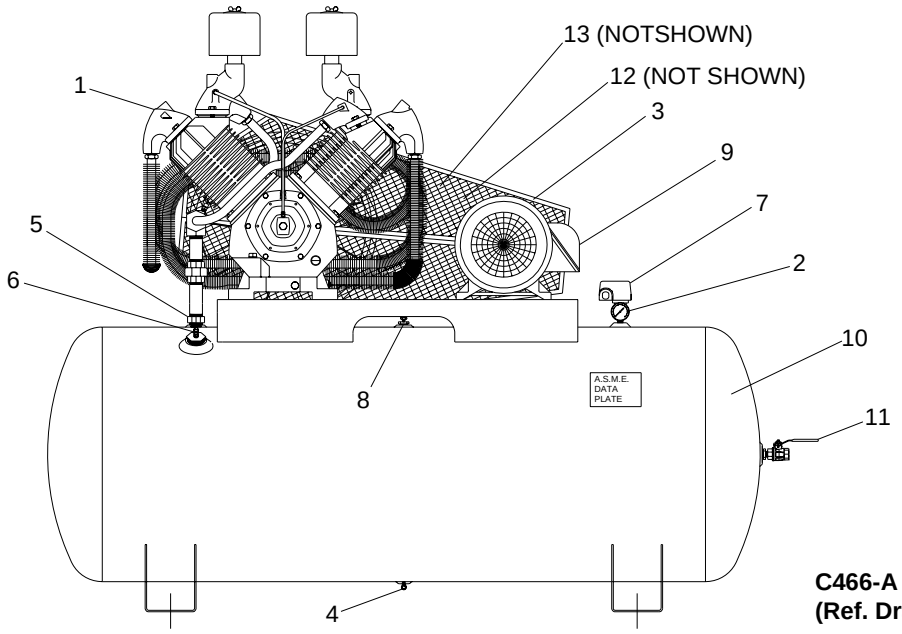
Symptom	Possible Cause(s)	Corrective Action
Motor will not start.	1. Main switch and fuses open.	1. Check all fuses and switches. Check for loose or faulty wires.
	2. Starter heater coils open.	2. Check overload relay in starter. Reset starter.
	3. Starter tripped	3. Reset starter. If starter trips repeatedly, have electrical system inspected by an electrician.
	4. Defective pressure switch-contacts will not close	4. Repair or replace pressure switch. **Warning –** Relieve tank pressure before servicing.
	5. Low voltage.	5. Check with voltmeter. Be sure voltage corresponds to unit specifications.
Starter trips repeatedly.	1. Improperly adjusted pressure switch.	1. Adjust or replace. **Warning –** Relieve tank pressure before servicing.
	2. Faulty check valve.	2. Clean or replace **Warning –** Relieve tank pressure before servicing.
	3. Incorrect fuse size or magnetic starter heaters.	3. Be sure that fuses and heaters are properly rated.
	4. Low voltage.	4. Check with voltmeter. Be sure voltage corresponds to unit specifications.
	5. Defective motor.	5. Replace motor.
Tank pressure builds up slowly.	1. Air leaks.	1. Tighten fittings.
	2. Dirty air filter.	2. Clean or replace.
	3. Defective compressor valves	3. Install new valve plate assembly.
Tank pressure builds up quickly.	1. Excessive water in tank.	1. Drain tank.
Discharge pressure relief valve pops off while compressor is running.	1. Wrong pressure switch setting.	1. Adjust to correct setting.
	2. Defective ASME relief valve.	2. Replace valve. **Warning** – Relieve tank pressure before servicing.
Compressor will not unload (Units with head unloaders)	1. Wrong pilot valve setting.	1. Adjust to correct stting
	2. Defective pilot valve.	2. Replace pilot valve.
	3. Lack of air to pilot valve..	3. Open needle valve to pilot valve.
Excessive belt wear.	1. Pulley out of alignment.	1. Realign motor pulley.
	2. Belts too tight or too loose.	2. Adjust belt tension.
Compressor runs hot.	1. Improper flywheel rotation	1. Check for correct rotation. (Counter clockwise when viewed from drive side.)
	2. Defective compressor valves.	2. Install new valve plate assembly.
	3. Dirty air filter.	3. Clean or replace.
	4. Dirty cylinder and/or intercooler.	4. Clean cylinder fins and/or intercooler.
Interstage pressure relief valve pops off.	1. Defective compressor valves.	1. Install new valves.
Excessive oil consumption.	1. Dirty air filter.	1. Clean or replace.
	2. Wrong oil viscosity.	2. Refill with proper viscosity oil.
	3. Oil leaks.	3. Tighten bolts. Replace gaskets.
	4. Worn piston rings.	4. Replace rings.
	5. Scored cylinder	5. Replace cylinder.

Troubleshooting Chart (cont'd)

Symptom	Possible Cause(s)	Corrective Action
Air escapes from centrifugal unloader when unit is running.	1. Centrifugal unloader release valve dirty or defective.	1. Clean or replace valve.
Air escapes from centrifugal unloader when unit is stopped.	1. Check valve stuck in open position.	1. Replace check valve. ⚠ **Warning –** Relieve tank pressure before servicing.
System does not alternate (Duplex units only)	1. Starter tripped. 2. Loose wiring in alternator. 3. Defective alternator. 4. Defective motor.	1. Reset starter. If starter trips repeatedly, have electrical system inspected by an electrician. 2. Check and tighten all wiring connections. 3. Replace alternator. 4. Replace motor.

UNIT REPAIR PARTS ILLUSTRATION

MODELS: HRA20-12, HRA20-25, HRA25-12, HRA25-25, HRA30-12, & HRA30-25

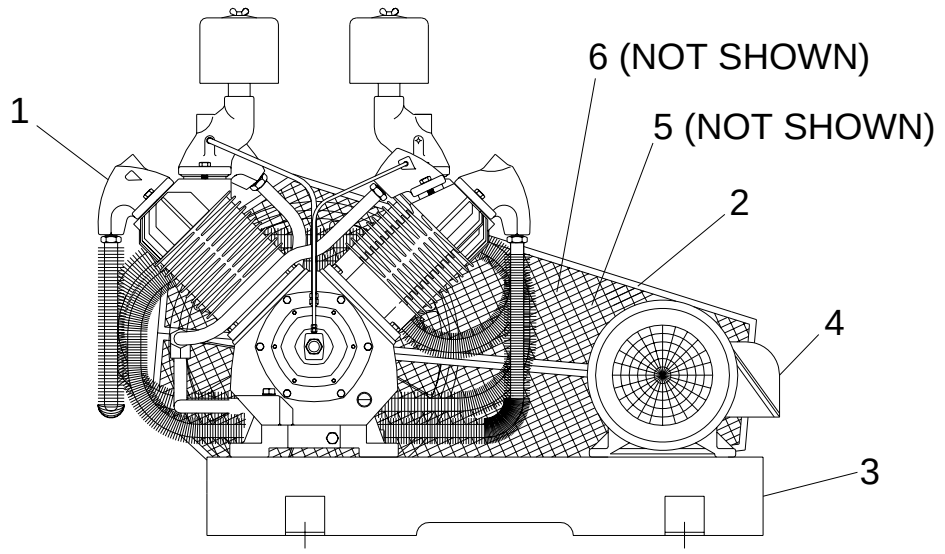


C466-A
(Ref. Drawing)

REPAIR PARTS LIST

			MODEL					
			HRA20-12	HRA20-25	HRA25-12	HRA25-25	HRA30-12	HRA30-25
1	Pump		R70A	R70A	R70A	R70A	R70A	R70A
2	Pressure Gauge		M519C	M519C	M519C	M519C	M519C	M519C
3	Belt Guard		Z674	Z674	Z674	Z674	Z674	Z674
4	Drain Valve		M2684	M2684	M2684	M2684	M2684	M2684
5	Check Valve		P03590A	P03590A	P03590A	P03590A	P03590A	P03590A
6	Bucket High Drain		Z1542	Z1542	Z1542	Z1542	Z1542	Z1542
7	Pressure Switch	125 PSIG	P14205A	P14205A	P14205A	P14205A	P14205A	P14205A
		175 PSIG	P14202A	P14202A	P14202A	P14202A	P14202A	P14202A
8	Pressure Relief Valve		M2843	M2843	M2843	M2843	M2843	M2843
9	Motor		20 HP	20 HP	25 HP	25 HP	30 HP	30 HP
10	Tank		P03665D	P03564D	P03665D	P03564D	P03665D	P03564D
11	Isolation Valve		M2688	M2688	M2688	M2688	M2688	M2688
12	Pulley	125 PSIG	P005345A PULLEY P05622A BUSHING	P005345A PULLEY P05622A BUSHING	P03710A PULLEY P05621A BUSHING	P03710A PULLEY P05621A BUSHING	P03710A PULLEY P05621A BUSHING	P03710A PULLEY P05621A BUSHING
12	Pulley	175 PSIG	P05634A PULLEY P05622A BUSHING	P05634A PULLEY P05622A BUSHING	P09311B	P09311B	P03710A PULLEY P05621A BUSHING	P03710A PULLEY P05621A BUSHING
13	Belts	125 PSIG	B100 (3)	B100 (3)	B103 (3)	B103 (3)	B103 (3)	B103 (3)
		175 PSIG	B100 (3)	B100 (3)	B100 (3)	B100 (3)	B103 (3)	B103 (3)

UNIT REPAIR PARTS ILLUSTRATION
MODELS: BRA-20, BRA-25, & BRA-30

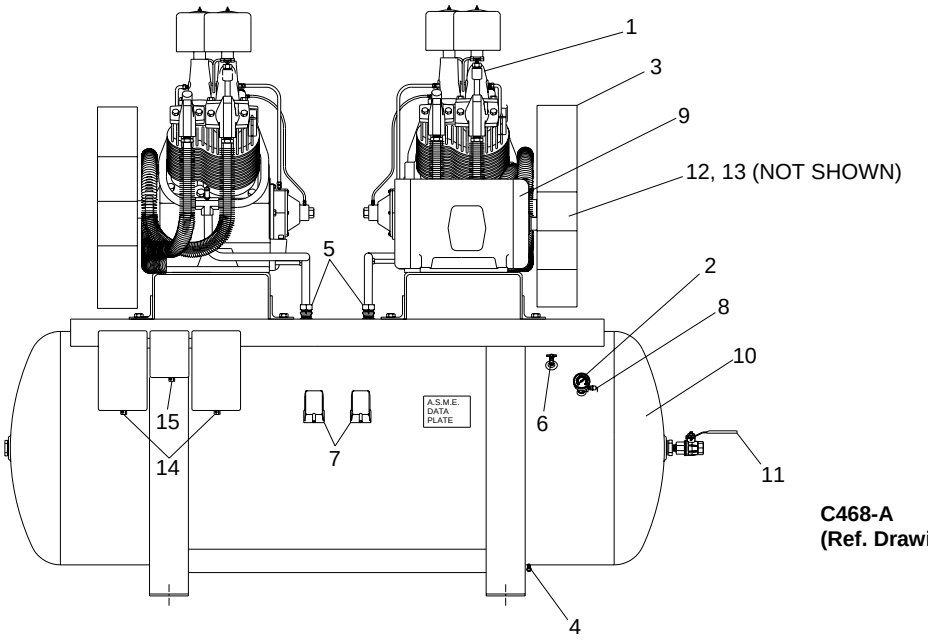


C467-A
(Ref. Drawing)

REPAIR PARTS LIST

			MODEL		
			BRA-20	BRA-25	BRA-30
1	Pump		R70A	R70A	R70A
2	Belt Guard		Z674	Z674	Z674
3	Base Plate		P03538C	P03538C	P03538C
4	Motor		20 HP	25 HP	30 HP
5	Pulley	125 PSIG	P05345A Pulley P05622A Bushing	P03710A Pulley P05621A Bushing	P03710A Pulley P05621A Bushing
5	Pulley	175 PSIG	P05634A Pulley P05622A Bushing	P09311B	P03710A Pulley P05621A Bushing
6	Belts	125 PSIG	B100 (3)	B103 (3)	B103 (3)
		175 PSIG	B100 (3)	B100 (3)	B103 (3)

UNIT REPAIR PARTS ILLUSTRATION
MODELS: HRA20D-25, HRA25D-25, & HRA30D-25



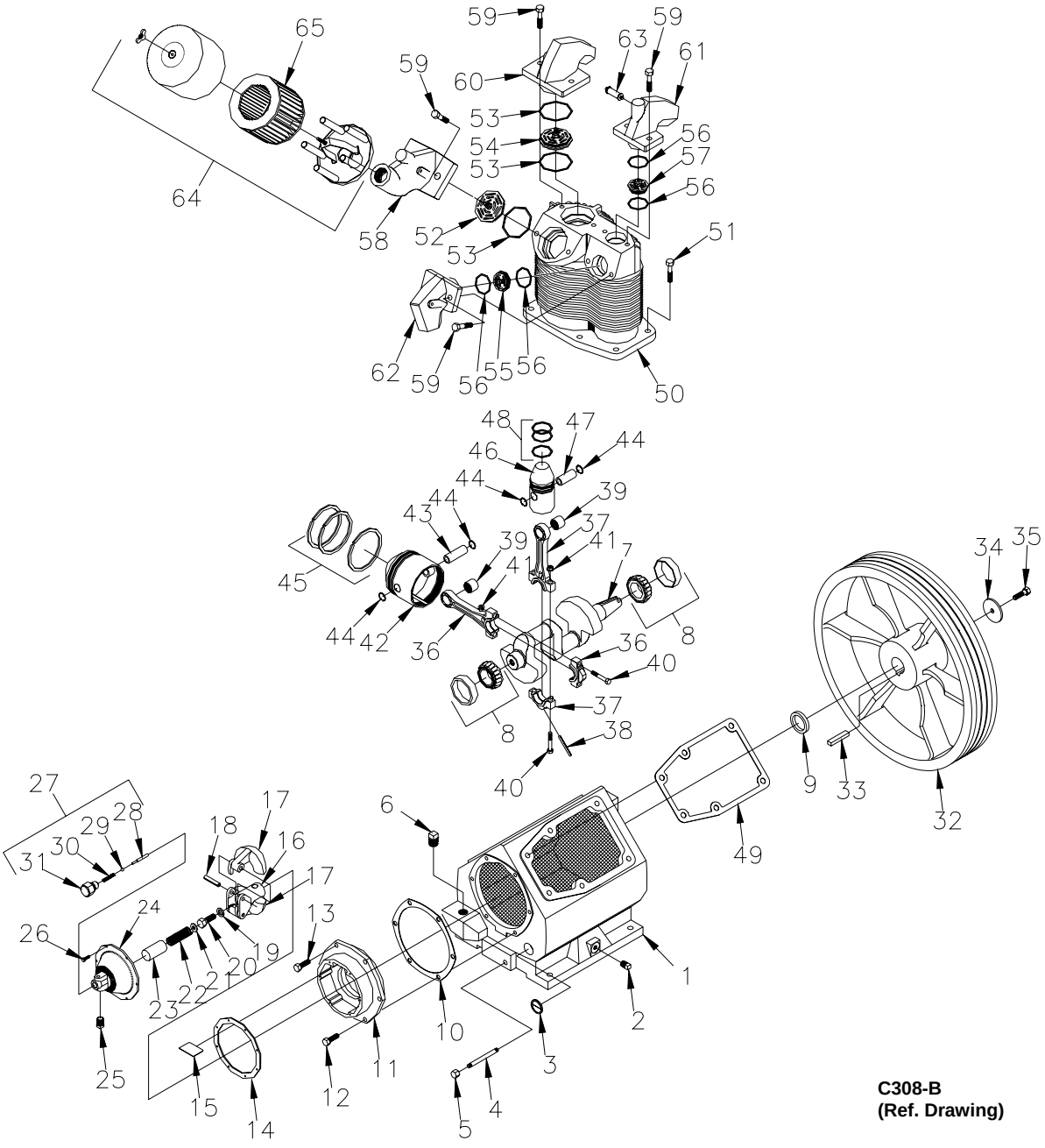
C468-A
(Ref. Drawing)

REPAIR PARTS LIST

			MODEL		
			HRA20D-25	HRA25D-25	HRA30D-25
1	Pump		R70A	R70A	R70A
2	Pressure Gauge		M519C	M519C	M519C
3	Belt Guard		Z674	Z674	Z674
4	Drain Valve		M2684	M2684	M2684
5	Check Valve		P03590A	P03590A	P03590A
6	Bucket High Drain		Z1542	Z1542	Z1542
7	Pressure Switch	125 PSIG	P14205A	P14205A	P14205A
		175 PSIG	P14202A	P14202A	P14202A
8	Pressure Relief Valve		M2847	M2487	M2487
9	Motor		20 HP	25 HP	30 HP
10	Tank		P12127D	P12127D	P12127D
11	Isolation Valve		M2688	M2688	M2688
12	Pulley	125 PSIG	P05345A Pulley (2) P05622A Bushing (2)	P03710A Pulley (2) P05621A Bushing (2)	P03710A Pulley (2) P05621A Bushing (2)
12	Pulley	175 PSIG	P05634A Pulley (2) P05622A Bushing (2)	P09311B (2)	P03710A Pulley (2) P05621A Bushing (2)
13	Belts	125 PSIG	B100 (6)	B103 (6)	B103 (6)
		175 PSIG	B100 (6)	B100 (6)	B103 (6)
14	Starter		Consult Factory		
15	Alternator		Consult Factory		

COMPRESSOR REPAIR PARTS ILLUSTRATION

Models: R70A



C308-B
(Ref. Drawing)

Repair Parts List
Compressor Model R70A

Ref. No.	Description	Part Number	Qty.
1	Crankcase	M1386	1
2	Pipe plug	M2326	1
3	Oil level gauge	RE714	1
4	Pipe nipple	M492	1
5	Pipe cap	M461	1
6	Pipe plug	M459	1
7	Crankshaft	M1387	1
8	Main bearing	P03431A	1
9	Oil seal	P03433A	1
10	Governor housing gasket set	Z775	1
11	Governor housing	P12274C	1
12	Hex head cap screw	M2345	4
13	Hex head cap screw	SE594	2
14	Governor housing cover gasket	SE1489	1
15	Baffle plate	P12381A	1
16	Governor weight spindle	SE583B	1
17	Governor weight	SE582B	2
18	Governor weight pin	SE592A	2
19	Lock washer	M3468	1
20	Hex head cap screw	M2345	1
21	Flat washer	M912A	1
22	Main governor spring	SE590	1
23	Governor spring sleeve	SE587	1
24	Governor housing cover	RE10100A	1
25	Unloader muffler assembly	Z4593	1
26	Hex head machine screw	M3473	6
27	Release valve kit (includes items 28, 29, 30 & 31)	Z12414A	1
28	Release valve plunger	SE586B	1
29	Release valve ball	P07841A	1
30	Release valve spring	SE591	1
31	Release valve cap	NR101	1
32	Flywheel	P05723C	1
33	Key	M1506	1
34	Flywheel washer	M1394	1
35	Hex head cap screw	M2265	1
36	Low pressure connecting rod assembly (includes 39, 40 & 41)	Z621	2
37	High pressure connecting rod assembly (includes 38, 39, 40 & 41)	Z622	2
38	Oil dipper (high pressure connecting rod only)	P03440A	2
39	Piston pin bearing	P03430A	4
40	Connecting rod bolt	P03458A	8
41	Connecting rod nut	P03459A	8
42	Low pressure piston with pin	ZM1906	2
43	Low pressure piston pin	M1395	2
44	Piston pin retaining ring	P03434A	8
45	Low pressure piston ring set	Z9087	2
46	High pressure piston with pin	ZM1393	2
47	High pressure piston pin	M1383	2
48	High pressure piston ring set	Z9088	2
49	Cylinder flange gasket	M1391	2

.

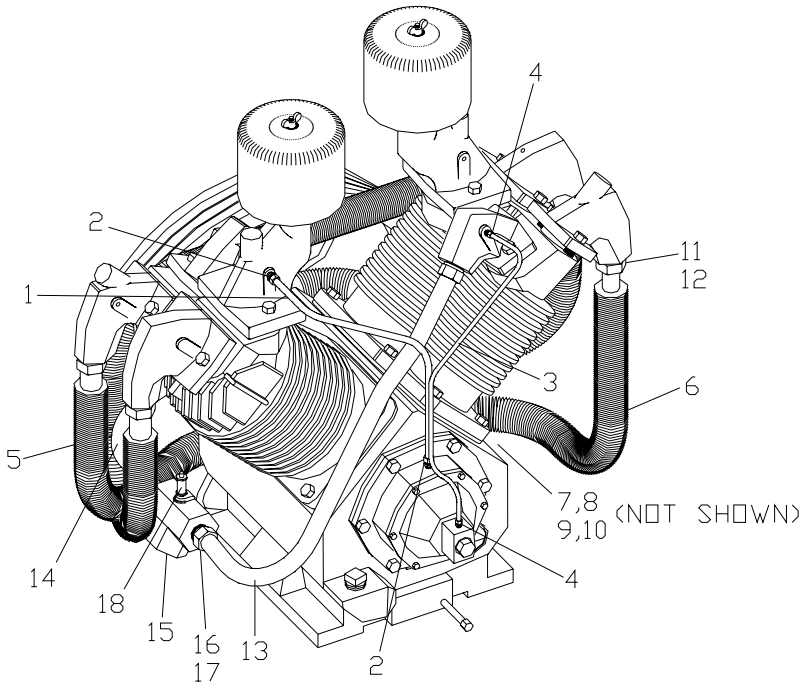
Repair Parts List
Compressor Model R70A

Ref. No.	Description	Part Number	Qty.
50	Cylinder	P05863D	2
51	Hex head cap screw	M3461	12
52	Low pressure intake valve assembly	Z273	2
53	Low pressure valve gasket	P07352A	6
54	Low pressure discharge valve assembly	Z274	2
55	High pressure discharge valve assembly	Z785	2
56	High pressure valve gasket	P07353A	8
57	High pressure intake valve assembly	Z784	2
*58	Low pressure intake manifold	P09711D	2
59	Hex head cap screw	P04779A	16
60	Low pressure discharge manifold	M1423	2
*61	High pressure intake manifold	M1431	2
62	High pressure discharge manifold	M1508	2
63	Interstage pressure relief valve	M3685	2
64	Intake filter	P07447A	2
65	Intake filter element	P05051A	2
	Complete compressor pump gasket set (items 10, 14 & 49)	Z10889	1
	Low pressure piston kit (items 42, 43, 44 & 45)	Z9108	2
	High pressure piston kit (items 44, 46, 47 & 48)	Z9107	2
	Complete compressor pump ring set (item 45 & 48)	Z9123	1
	Valve set gasket (items 52, 53, 54, 55, 56 & 57)	Z614	1
	Valve gasket kit (items 53 & 56)	Z615	1

* Intake manifolds shown for Start-Stop units only.
See page 26 for Head Unloader Manifolds

COMPRESSOR REPAIR PARTS ILLUSTRATION
Model: R70A

TUBE ASSEMBLIES



C470-A
(Ref. Drawing)

Repair Parts List
Models R70A

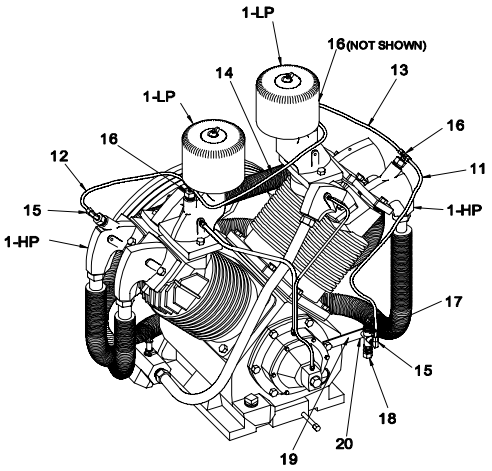
Ref. No.	Description	Part Number	Qty.
1	Breather tube (includes compression fittings)	ZM1420	1
2	3/8 x 1/4 NPT straight compression fittings	M2864	2
3	Release valve tube (includes compression fittings)	ZM1421	1
4	1/4 x 1/8 NPT straight compression fitting	M2863	2
5	Left intercooler (includes compression fittings)	ZM1432	1
6	Right intercooler (includes compression fittings)	ZM1433	1
7	Intercooler clamp	M1537	1
8	Intercooler clamp	M1538	1
9	Hex head cap screw	M1380	2
10	Speednut	P03699A	2
11	Compression nut	M1418	4
12	Ferrule	P06064A	4
13	Right discharge tube (includes compression fittings)	ZM1532	1
14	Left discharge tube (includes compression fittings)	ZM1533	1
15	Discharge tee	M1516	1
16	Compression nut	M1418	4
17	Ferule	P06064A	4
18	Discharge pressure relief valve	P09704A	1

CONSTANT SPEED HEAD UNLOADER
FOR AIR COMPRESSOR MODEL R70A

NOTE: This is optional equipment and may not be included on your unit. It is recommended constant speed unloading be used if motor starts exceed 6 starts/hour.

The purpose of constant speed unloading is to provide a means of stopping or starting the compression of air by the compressor without stopping or starting the electric motor or gasoline engine after each cycle.

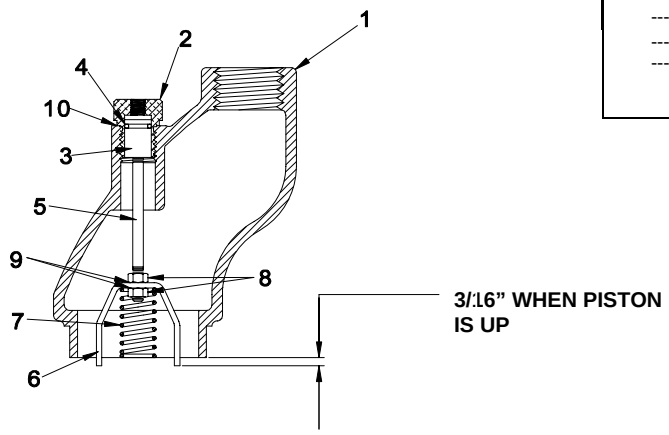
The parts called out below replace or are substituted for those parts found in the regular parts list of the Owner's Manual for this compressor.



C437-A
(Ref. Drawing)

REPAIR PARTS LIST FOR CONSTANT SPEED HEAD UNLOADER

REF .NO.	DESCRIPTION	QTY..	PART NO.
1	LP Intake Manifold (Replaces P09711D)	2	P09712D
1	HP Intake Manifold (Replaces M1431)	2	M1426
2	Cylinder	4	P02306B
3	Piston	4	P02287A
4	O-Ring	4	P02547A
5	Piston Rod - LP	2	M1448
	Piston Rod - HP	2	M1452
6	Claw - LP	2	M1815
	Claw - HP	2	M1447
7	Spring - LP	2	M1449
	Spring - HP	2	M1450
8	Nut, Nex	8	M926A
9	Lock Washer	12	M919A
10	Gasket - HP Only	2	P0746A
11	Actuating Tube	1	M1509
12	Manifold Tube	1	M1510
13	Manifold Tube	1	M1510
14	Intermediate Tube	1	M1512
15	Compression Fitting 1/4"x1/8" NPTx90 °	2	M2868
16	Compression Tee 1/4"x1/4"x1/8" NPT	3	M2879
17	Pilot Valve	1	M2853
18	Straight Compression Fitting 1/4"x1/8" NPT	1	M2863
19	Mounting Bracket	1	M807
20	Cap Screw	1	M3465
---	LP HU Manifold Assembly (items 1-9)	2	Z1587
---	HP HU Manifold Assembly (items 1-10)	2	Z1588
---	Needle Valve, (Dual Control) (Not Shown)	1	M547
---	Constant Speed Head Unloader Kit (includes all of the above)	1	HUK504



C429-A
(Ref. Drawing)

WHEN INSTALLING HEAD UNLOADER MANIFOLD ASSEMBLY, BE CERTAIN THAT THE ACTUATING CLAW (#6) PROTRUDES 3/16" BELOW THE BOTTOM OF THE MANIFOLD (#1) AS SHOWN. CLAW MUST BE POSITIONED SO THAT IT WILL ENTER TWOSLOTS IN THE COMPRESSOR VALVE. FAILURE TO FOLLOW THIS PROCEDURE WILL RESULT IN AN INOPERATIVE HEAD UNLOADER.

TYPICAL MANIFOLD ASSEMBLY

UNIT HAZARD DECAL LISTING

PAGE	DESCRIPTION	PART NO.
28	PRODUCT LIABILITY DECAL SHEET - MASTER	P10157A
	Unit Pressure Setting	1
	NOT USED	2
	DANGER – Breathing Air	3
	DANGER – Drain Tank Daily	4
	WARNING – Pressure/Safety Valve	5
	NOT USED	6
	DANGER – Valve Maintenance	7
	DANGER – High Voltage	8
	WARNING – Hot Surfaces	9
	WARNING – Do Not Remove Fan Guard	10
	NOT USED	11a
	NOTICE - Lubricant	11b
	NOT USED	12
	DECAL – Synthetic or Food Grade Inserts	13
	DECAL – Pressure Setting: 95-125PSIG	14
	DECAL – Pressure Setting: 140-175PSIG	14
	NOTICE – Read and Retain Manuals	15
	INSTRUCTIONS – Dual Control	16
	DECAL – Rotation Direction	17
	NOT USED	18
	DECAL – Pressure Switch	P14677A

PUMP HAZARD DECAL LISTING

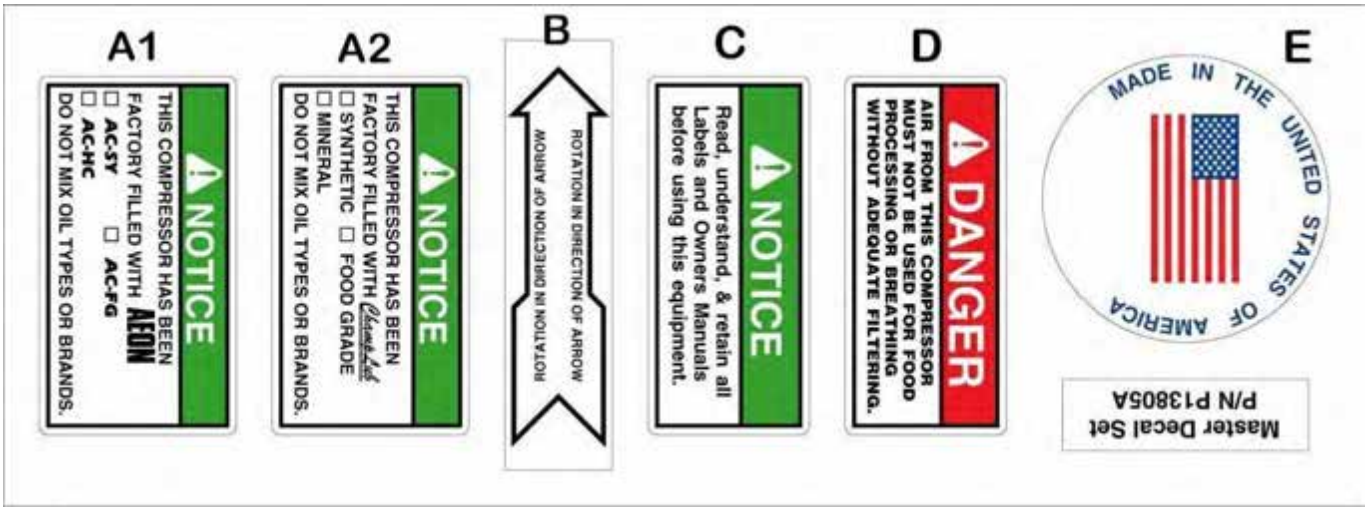
PAGE	DESCRIPTION	PART NO.
29	PUMP DECAL SHEET – MASTER	P13805A
	NOTICE - Lubricants	A1
	NOT USED	A2
	DECAL – Rotation Direction	B
	NOTICE – Read and Retain Manuals	C
	DANGER – Breathing Air	D
	DECAL – Made in the United States of America	E
	IMPORTANT NOTICE – Motor Burn-outs	F

DO NOT CONNECT
INCOMING POWER
SUPPLY TO PRESSURE
SWITCH.

P14677A

UNIT HAZARD DECALS

PUMP HAZARD DECALS



F

IMPORTANT NOTICE!

THIS UNIT IS WIRED FOR AN AC CIRCUIT OF

☐ 115 VOLT ☐ 60 CYCLE ☐ 1 PHASE
☐ 230 VOLT ☐ OTHER ☐ 3 PHASE
☐ 460 VOLT

OTHER ELECTRICAL SPECS _____

P05257A

IMPORTANT

MOTOR BURN-OUTS ARE NOT COVERED BY WARRANTY - Unless Motor is Equipped with Factory Installed thermal overload protection (in either motor or starting device)

P05257A

RECORD OF MAINTENANCE SERVICE

DAILY
- CHECK OIL LEVEL
- DRAIN MOISTURE FROM TANK

WEEKLY ● CLEAN FILTER ● CLEAN COMPRESSOR ● CHECK V-BELTS					**MONTHLY** ● INSPECT AIR SYSTEM		**EVERY 3 MONTHS** ● CHANGE OIL ● INSPECT VALVE ASSEMBLIES ● TIGHTEN ALL FASTENERS ● TEST PRESSURE RELIEF VALVE

RECORD OF MAINTENANCE SERVICE

DAILY
- CHECK OIL LEVEL
- DRAIN MOISTURE FROM TANK

WEEKLY ● CLEAN FILTER ● CLEAN COMPRESSOR ● CHECK V-BELTS					**MONTHLY** ● INSPECT AIR SYSTEM		**EVERY 3 MONTHS** ● CHANGE OIL ● INSPECT VALVE ASSEMBLIES ● TIGHTEN ALL FASTENERS ● TEST PRESSURE RELIEF VALVE

FOR PARTS: REFER TO PARTS DEPOT LIST ACCOMPANYING THIS MANUAL.

Gardner Denver
1301 North Euclid Avenue
Princeton, Illinois 61356 USA
Phone (815) 875-3321
Fax (815) 872-0421

Plants in Princeton, IL, and Manteca, CA

Due to Gardner Denver's continuing product development program, specifications and materials are subject to change without notice or obligation