



Operation Manual and Replacement Parts List

Portable Nitrogen Generator MG1100 V



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Mandus Group Ltd..
2408 4th Avenue
Rock Island, IL 61201

Phone: 1-888-922-8502
E-Mail: customerservice@mandusgroup.com
Website: www.mandusgroup.com



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**WARNING**

This Operation Manual and Replacement Parts List contains safety information and instructions for the MG1100.

You must read, understand and follow all safety precautions and instructions.

Editions, Revisions, and Changes

- An Edition is the original or a complete rewriting of the entire manual.
- A Revision occurs whenever a complete section or appendix is rewritten or added.
- A Change occurs when individual pages, drawings or tables are changed.

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Rev	Chg	Date	Notes	Auth
0	1	Mar. 30, 2016	Updated Electrical Enclosure; ASY-7045	SS
0	2	May 26, 2016	Updated Oxy Sensor Calibration	SS
0	3	Aug. 12, 2016	Updated Oxy Sensor Calibration	SS
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VOLUME A: HOW TO USE

A.1 Introduction

A.1.1 How To Use This Manual

This manual contains the operating and maintenance instructions for the Mandus Groups product(s) listed on the front cover.

All instructions in this manual should be observed and carried out as written to prevent damage or premature wear to the product or the equipment served by it.

If your unit is equipped with nonstandard accessories and/or options, supplemental information is normally included in other documentation; i.e. OEM Manuals or additional Mandus Group Manuals.

Important instructions concerning the endangerment of personnel, technical safety or operator safety will be specially emphasized in this manual by placing the information in the following types of safety notices

While every effort is made to ensure the accuracy of the information contained in this manual, the Mandus Group will not, under any circumstances be held accountable for any inaccuracies or the consequences thereof.

Important instructions concerning the endangerment of personnel, technical safety or operator safety will be specially emphasized in this manual by placing the information in the following types of safety notices.



DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This is limited to the most extreme situations.



WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or injury.



CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE

NOTE advise of technical requirements that require particular attention by the operator or the maintenance technician for proper maintenance and utilization of the equipment.

A.1.2 How to Use the Replacement Parts List

- A lozenge ◇ in the Item Number column indicates the part number for a complete assembly.
- a dagger (†) in the Qty column with or without an ellipsis (...) in the Part Number column means the part is illustrated for assembly purposes only and is not available for sale as an individual component. This part can be obtained by ordering the complete assembly.
- AR in the Qty column means that the item is cut or manufactured to the size which the customer specifies.
- A dash (—) in the Item Number column indicates that there is more than one part number applicable to the preceding Item Number.

When placing an order for spare parts, please provide the following information to ensure delivery of the correct parts. The model number, date of manufacture and serial number can be found of the compressor unit identification plate on the compressor unit's frame.

Information		Example
Model Number		NGM-6
Serial Number		131057
Date of Manufacture		02/2016
Quantity required		2
Part Number		1CØ129
Part Description		Valve



WARNING

The use of repair parts other than those included in the Mandus Group Replacement Parts Lists may create unsafe conditions over which the Mandus Group has no control. Such unsafe conditions can lead to accidents that may be life-threatening, cause substantial bodily injury, and/or result in damage to the equipment. Therefore, the Mandus Group can bear no responsibility for equipment in which non-approved repair parts are installed.

A.1.3 How to Use the Appendix

Information contained in the Appendix to this manual includes the following.

- The safety instructions applicable to this product. They must be read, understood and complied with prior to operating the product.
- The instructions for installing this product. They must be read, understood and complied with prior to operating the product.
- The instructions for long term storage (over 90 days) of this product.
- A set of forms which may be reproduced as needed to record operating hours, purification cartridge adjusted operating hours, and scheduled maintenance actions.



A.2 Components & Specifications

A.2.1 Descriptions

A.2.1.1 Compressor Unit Purpose

The MG1100 is designed to convert clean dry shop air into nitrogen and compress it for industrial use.

A.2.1.2 Design

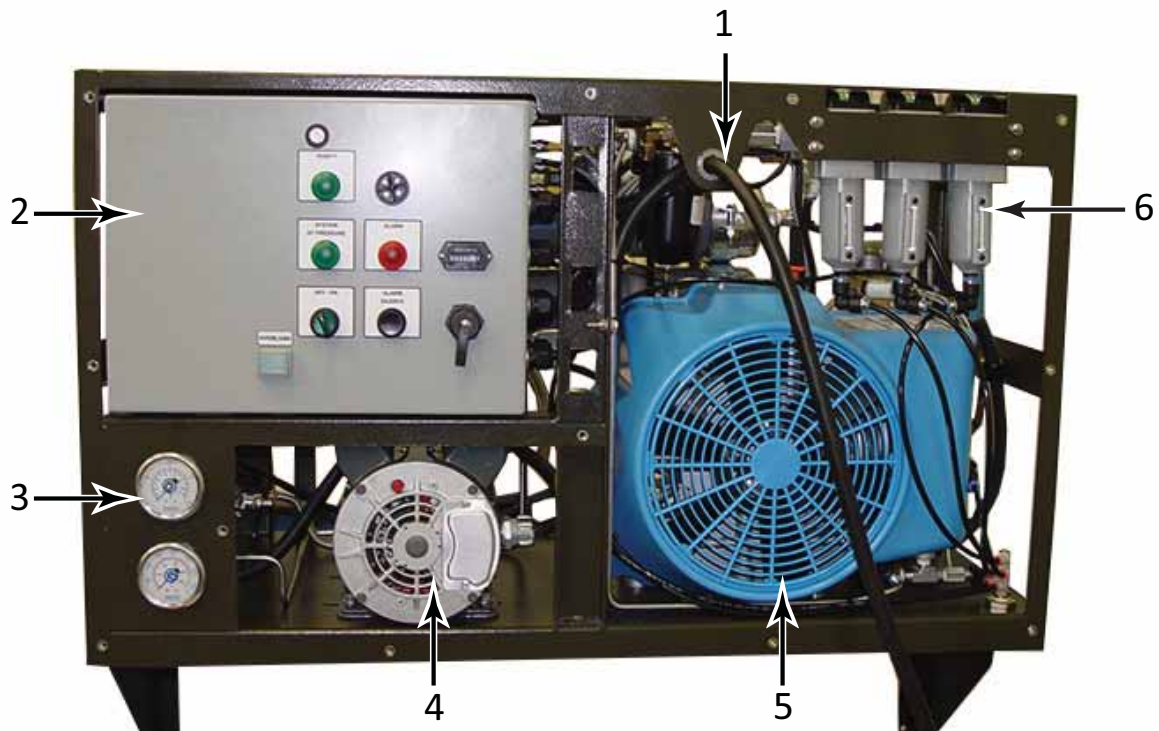
The compressor unit consists of the following major assemblies which are shown in Figure A-1 through Figure A-4.

- Purification System
- Nitrogen Membranes
- Electric Motor
- Electrical Enclosure
- High Pressure Compressor
- Low Pressure Filter Assembly

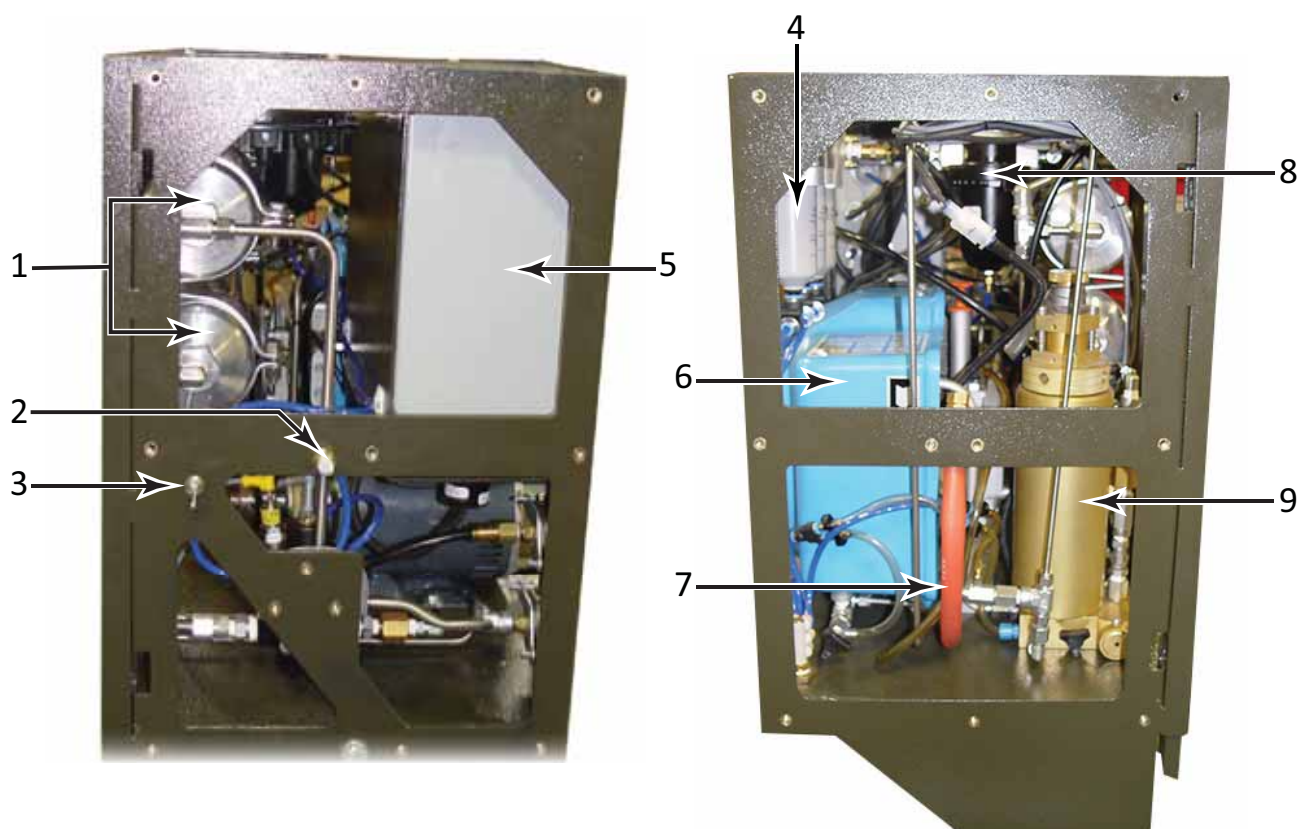
Figure A-1 MG1100 V Components, Rear View

- 1. Purification Chamber
- 2. Outlet Solenoid

- 3. Electric Motor (under Elect. Encl.)
- 4. Nitrogen Membranes

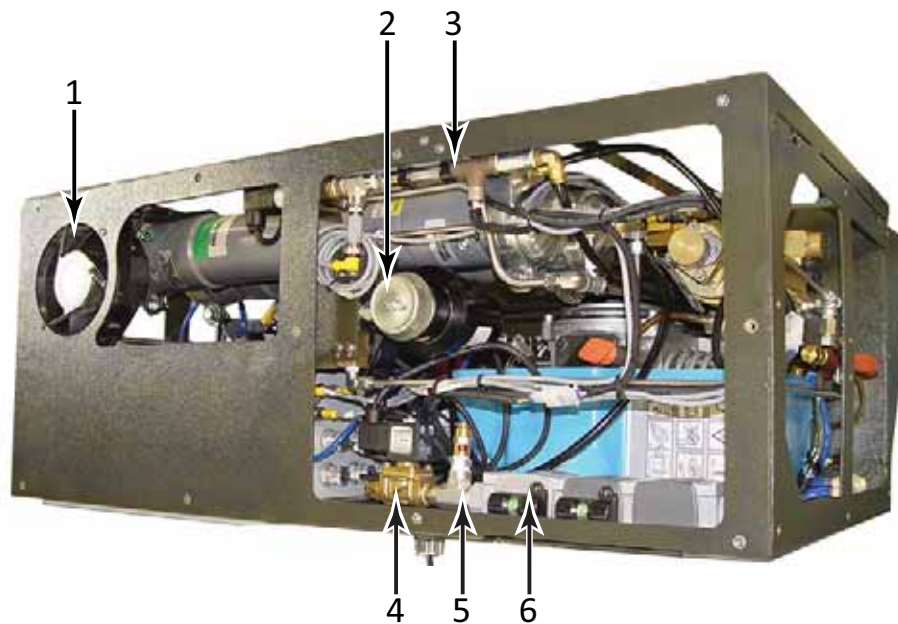
Figure A-2 MG1100 V Components, Front View

- | | |
|-------------------------------------|---------------------------------|
| 1. Power Cord | 4. Electric Motor |
| 2. Electrical Enclosure | 5. High Pressure Compressor |
| 3. Pressure Gauges (Inlet & Outlet) | 6. Low Pressure Filter Assembly |

Figure A-3 Side Views

1. Nitrogen Membranes
2. Calibration Gas Connection Port
3. Calibration Switch
4. Low Pressure Filter Assembly
5. Electrical Enclosure

6. High Pressure Compressor
7. Compressor Oil Drain Hose
8. Condensate Separator/Silencer
9. Purification Chamber

Figure A-4 Top View

- | | |
|----------------------------------|---------------------------------|
| 1. Cooling Fan | 4. Inlet Solenoid |
| 2. Condensate Separator/Silencer | 5. Inlet Safety Valve |
| 3. Heater | 6. Low Pressure Filter Assembly |

**A.2.2 Compressor Unit Technical Specifications**

All technical specifications are subject to change without prior notice.

A.2.2.1 MG1100

Medium	Nitrogen
Final Product Purity	≤96.5% to 99.5%
Intake Pressure	100 - 150 psig (7 - 10 bar)
Feed Air Quantity Required	6 SCFM (170 l/min)
Feed Air Temperature Range	40 - 115 °F (5 - 45 °C)
Charging Rate ¹	0.5 - 1.0 SCFM (15 - 30 l/min)
Maximum Operating Pressure	4,500 psig (310 bar)
Weight	≤250 lbs (113 kg)

A.2.2.2 Compressor Block Technical Specifications

Number of stages	2
Number of cylinders	2
1st Stage Cylinder Bore	1.10 in (28mm)
2nd Stage Cylinder Bore	0.47 in (12mm)
Piston Stroke	0.95 in (24 mm)
Intermediate Pressure 1st stage	655 - 800 psig (45 - 55 bar)
Compressor Block Oil Capacity	1 1/2 qts. (1.3 ltrs)
Ambient Temperature Range	40 - 115 °F (5 - 45 °C)
Maximum Permissible Inclination of Compressor ²	30°

A.2.2.3 Compressor Drive Technical Specifications

Drive Motor P/N	1CØ336
Operating Voltage	115 VAC, Single Phase, 60 Hz
Horsepower	1.5 Hp
Speed	1,800 RPM
Type	Oil Drip Proof (ODP)

1. Based on recharging an 80 cubic foot tank from 500 to 3,000 psig

2. This value is valid only if the compressor block oil in normal level position corresponds with the upper mark of the oil dipstick and may not be exceeded.



VOLUME B: OBJECTIVE

The purpose of the MG1100 is to take regulated, filtered, clean, dry shop air and separate the oxygen out of the air stream and save the nitrogen.

B.1 Feed Air Requirements

The inlet, or feed air, must meet the following criteria:

- Must be filtered, clean, dry shop air
- Maximum dewpoint: -40 °F (-40 °C)
- Maximum temperature: 115 °F (45 °C)
- Inlet pressure: 100 — 150 psig (7 — 10 bar)
- Minimum feed air requirement: 6 scfm (170 l/m)



WARNING

DO NOT OVERPRESSURIZE THE SYSTEM.
Maximum inlet pressure is 150 psig (10 bar).

B.2 Theory of Operation

(See Figure B-1)

The feed air enters the inlet port of the MG1100 and flows past a pressure gauge (1). The inlet solenoid (2) allows the air to flow into the Portable Nitrogen Generator (PNG) assembly. The assembly is protected with a safety valve (3) set at 165 psig. The air then enters the filter bank. The filter bank contains two coalescing filters (4 & 5), which remove liquid and particulate matter. An activated carbon filter (6) removes the oil and odor from the air stream. The coalescing filters both have differential pressure indicators which monitor the pressure upstream and downstream of the filter element. Once either indicator registers in the red area, all three filter elements must be replaced.

NOTICE

Always change the filter elements as a set, never just an individual filter element.

Each filter incorporates an automatic float drain in the filter collection bowl. As liquid level rises in the filter bowl, a float lifts a pin out of the drain orifice. Pressure in the system then blows the condensate out of the bowl until the liquid level drops and the pin is seated once again.

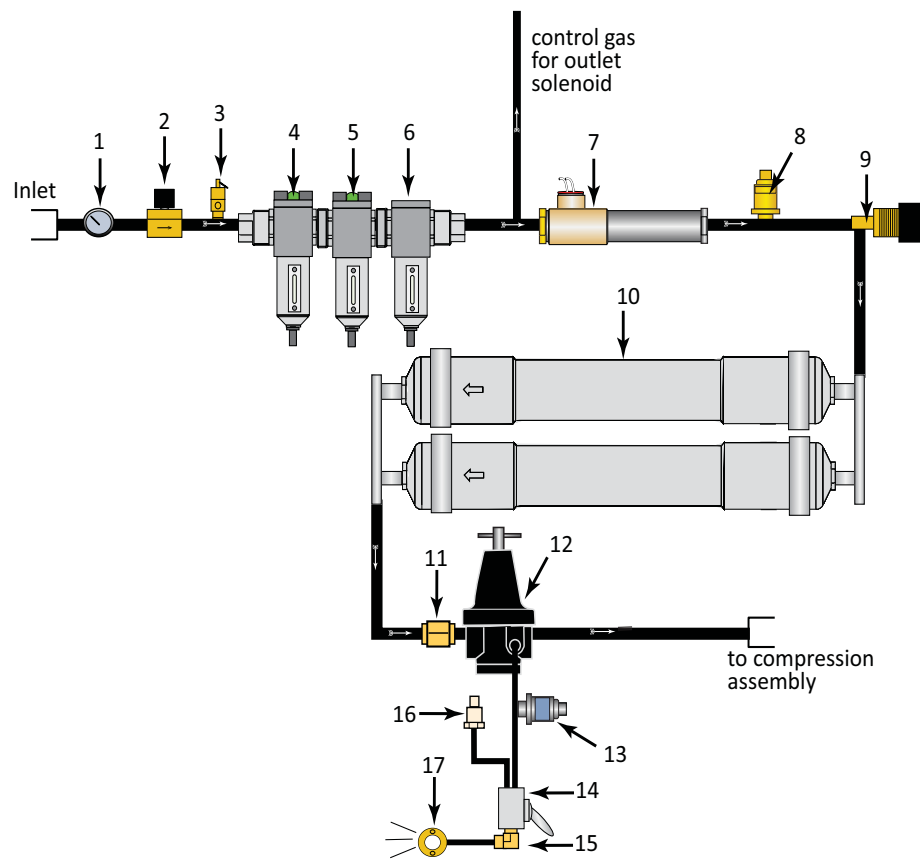
A small portion of the feed air is used for control air for the bleed off solenoid. This solenoid controls whether the compressed gas is bled off or delivered to the outlet. The PLC monitors the oxygen content of the gas to determine if it should be bled of or not.

The remainder of the feed air enters the heater (7). The heater warms the air flowing into the membrane bundle to an operating temperature of 113 - 145 °F. A temperature sensor (8) monitors the temperature immediately after the heater and an inlet temperature switch (9) only allows the gas to proceed if the temperature is between 113 - 145 °F. The heated gas enters the 2 nitrogen isolating membranes (10). Oxygen and other “fast” moving molecules are allowed to diffuse through the walls of the membrane fibers and exits the membrane as permeate through the permeate outlet port. The “slower” molecules, such as nitrogen and other inert gases, continue through the membrane and exit the membrane outlet manifold

After leaving the membrane outlet manifold the mainstream flows to the regulator (11). The pressure from the regulator to the compressor should be set to 70 - 90 psig.

A sample of the nitrogen gas passes a pressure sensor (12) and through an oxygen sensor (13). The oxygen sensor is located in the electrical box. The purity of the nitrogen is monitored by the oxygen sensor. The nitrogen that flows across the sensor is vented to atmosphere. The majority of the processed nitrogen passes through the pressure regulator and on to the compression assembly.

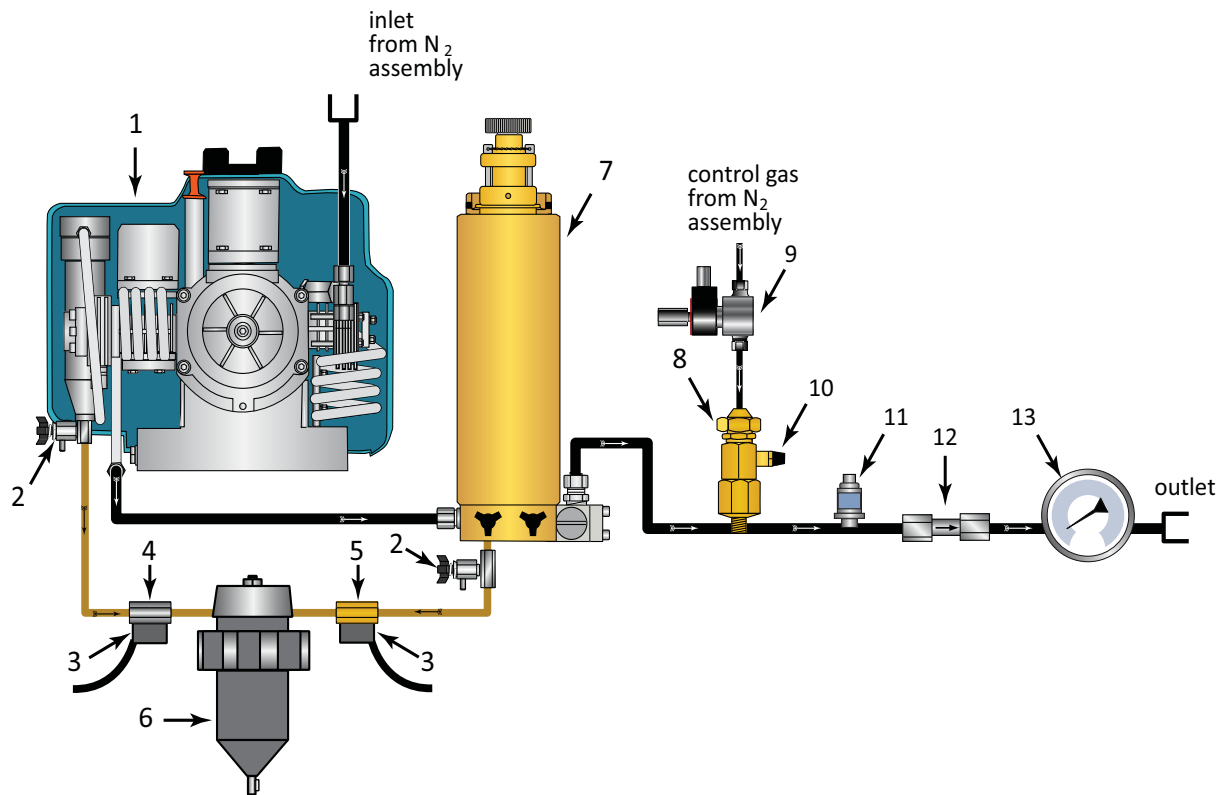
Figure B-1 Nitrogen Generation Assembly



1. Inlet Pressure Gauge (0 - 200 psi)
2. Inlet Solenoid (NC, 115 V)
3. Inlet Safety Valve (165 psi)
4. Coalescing Filter (1 micron)
5. Coalescing Filter (0.01 micron)
6. Adsorbing Filter (coal adsorption)
7. Heater (250 Watt, 120 Volt)
8. Temperature Sensor (4 - 20mA output)
9. Temperature Switch
(open @ 145 °F; closes @ 133 °F)

10. Nitrogen Membranes
11. Orifice (0.047 inch)
12. Regulator (300 psi IN; 0-250 psi OUT)
13. Pressure Sensor (0 - 150 psi, 0-10 Volt)
14. Oxygen Sensor Switch (3-way, 2 pos.)
15. Orifice (ELL, 0.004 inch)
16. Calibration Gas Connector (bulkhead)
17. Oxygen Sensor (0-35%; 4-20mA; triggers alarm at 3.5%)

Figure B-2 Compression Assembly



- | | |
|--|---|
| 1. Compressor (Oceanus Modified) | 8. Pneumatic Valve (NC) |
| 2. Manual Drain Valves | 9. Control Solenoid (3-way, NC) |
| 3. Electric Coils (115 VAC) | 10. Exhaust Muffler |
| 4. Drain Solenoid (2-way, NC) | 11. Pressure Sensor (0-8700 psig; 0 - 10 V) |
| 5. Drain Solenoid (2-way, NC) | 12. Check Valve |
| 6. Condensate Separator/Collector | 13. Outlet Pressure Gauge (0 - 7,500 psig) |
| 7. Purification Chamber (See Volume G) | |

(See Figure B-2)

The compression assembly receives the nitrogen gas from the nitrogen assembly. The gas is compressed using the compressor (1). The compressed nitrogen is then purified through the purification chamber (7). The nitrogen then passes the pneumatic valve (8) which is controlled with the outlet solenoid (9). The PLC monitors the oxygen sensor in the nitrogen assembly. When the oxygen levels are over 3.5% the PLC allows the pneumatic valve to vent the gas to the atmosphere via the muffler (10). When the oxygen level is less than 3.5% the solenoid is activated allowing the control air to engage the pneumatic valve which allows the processed nitrogen to continue on. The processed nitrogen passes the final pressure sensor (11) and a check valve (12) to the final pressure gauge (13) and the outlet orifice.

Condensate created from the compression process collects in the compressor's separator and the purification chamber. The Automatic Condensate Drain (ACD) system is designed to drain every 50 min. into the



separator/collector. The separators may be manually drained via the drain valves (2). The compressor's separator is drained by the solenoid (4) into separator (6). The purification chamber is drained with the solenoid (5). Both solenoids are operated by elect coils (3). The main separator (6) can be manually drained utilizing the petcock in the bottom.

The process of compressing the nitrogen gas produces heat. In order to cool the gas the unit is equipped with a fan which blows air across the cooling tubes of the compressor (See Figure F-11).

B.3 Unpacking, Handling and Installation

B.3.1 Unpacking

This Portable Nitrogen Generator unit is packaged according to the requirements for shipping via the requested type of carrier service. It is possible that the unit could have been damaged during transport. For this reason, we urge you to thoroughly examine the unit for possible damage as follows:

1. Dismantle and remove the crate and crating materials from around shipping pallet being careful not to damage the unit.
2. Remove all latching access panels.
3. Visually inspect the equipment for damage, missing parts, loose fittings or other obvious defects and general condition.
4. Report any damage to the shipping company immediately.

B.3.2 Documentation

Check all shipping documents and the purchase order to ensure that all items have been received.

B.3.3 Handling

The unit weighs approximately 250 lbs. Four carrying handles are provided to enable 4 man lifting and transporting.

B.3.4 Installation

B.3.4.1 Location

If it is recommended that the nitrogen generation unit be located indoors in an ambient temperature range between 40 °F and 115 °F (5 °C and 45 °C).

Should the application require that the unit be located outdoors, a shelter must be provided to protect the unit from direct sun light, rain, wind and ambient temperatures that fall outside of the temperature range listed above.

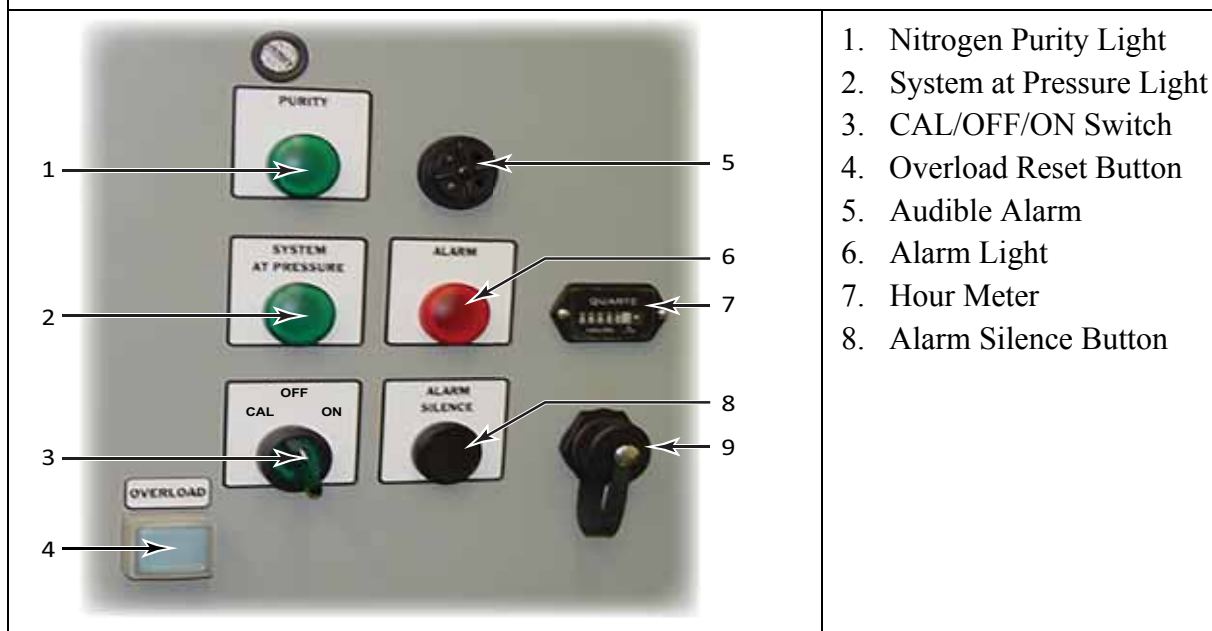
The area in which the unit will be installed should be well lit and easily accessible to facilitate servicing and routine maintenance. The sides of the nitrogen generation unit can be placed within 12 inches (305 mm) from any obstruction and the front of the unit should have at least 36 inches (915 mm) clearance from any obstructions.

B.3.4.2 Securing the Unit

The unit must be installed on a firm, flat surface that is capable of supporting the weight of the unit.

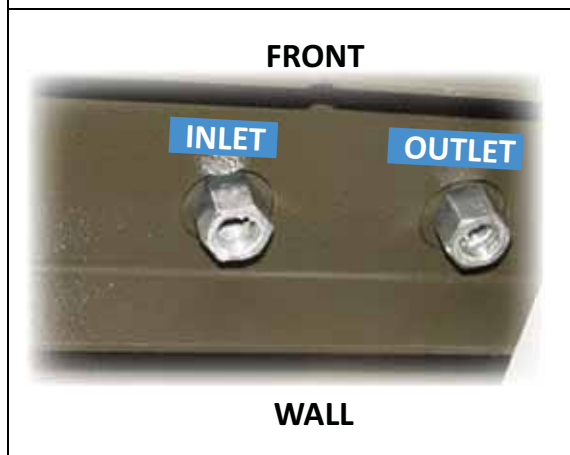
B.3.5 Electrical Power supply

The unit is factory wired for standard 120 volts, 60 Hertz, single phase, 15 Amps. If the voltage is to be changed, consult the factory for instructions and necessary parts.

Figure B-3 Electrical Controls


B.3.6 Pneumatic

The pneumatic connections for the unit consist of two, 1/4" NPTF fittings for the feed air inlet and the nitrogen outlet. The oxygen permeate releases into the atmosphere.

Figure B-4 Pneumatic Connections


B.3.6.1 Operation and Maintenance Precautions for Compressed Gas Systems

1. Always handle compressed gas with care. Pressurized gas, particularly when directed at a person's body or face, can cause serious injuries.
2. Do not use the unit discharge for breathing purposes. High purity nitrogen gas is toxic and severe injury or death can result.
3. Periodically check the inlet pressure gauge to make sure the unit is operating within proper limits. Inlet pressure should be 100 - 150 psig. Protect all gas lines from damage or puncture. Do not operate the unit if gas leaks are detected- this could indicate a loose high pressure fitting.
4. Perform all maintenance in a clean environment to prevent contaminants from entering the system.



5. Do not use flammable solvents for cleaning.
6. Check for tools, rags or loose parts left in the equipment interior before resuming operations.
7. Do not remove any guards, shields, or screens while the unit is operating.

	CAUTION
Moving parts and heated piping presents a danger to operator. DO NOT operate the unit without all guards and panels in place.	

8. Allow the system components to cool before servicing.

	CAUTION
Do not use nitrogen gas produced by the unit for purging oxygen systems.	

VOLUME C: OPERATING INSTRUCTIONS

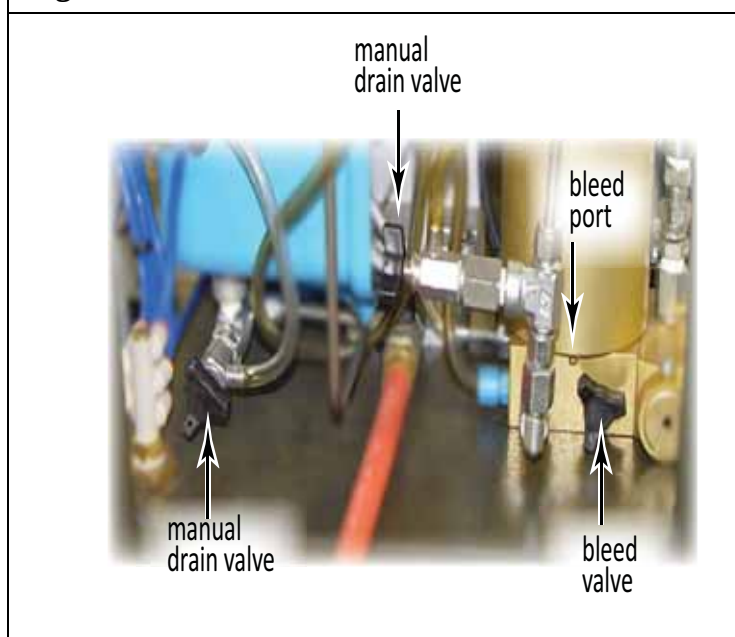
C.1 Before Starting.

1. Connect feed air supply to feed air inlet port. (See Figure B-4)
2. Connect to a 120 volt, single-phase, 60 hertz, 15 amp power source.

C.2 Starting.

1. Ensure inlet side is pressurized with clean dry shop air.
2. Turn selector switch to “ON” —all 4 lights on the electrical panel should illuminate for 5 seconds as a bulb test. Then they should all turn off except the selector switch’s power on light should remain on. The purity and alarm lights should turn off. The system at pressure light should turn on and the heater control should be energized.
3. The MG1100 will now warm-up. Until the nitrogen gas reaches the purity level set on the oxygen monitor, the gas will be vented to the atmosphere. After reaching the required purity (96%), the gas will be supplied to the outlet fitting and the purity light will turn on.
4. During operations the purification chamber and the intermediate separator of the compressor both drain automatically of condensate for 6 seconds every 50 minutes of use. To drain the purification chamber and separator, manually open the condensate drain valves pictured below.

Figure C-1 Manual Drains



5. After 30 minutes the unit should stabilize and not need further adjusting. The unit’s indicators should read as follows:

• Inlet Pressure Gauge:	100 - 150 psig
• Outlet Pressure Gauge	0 - 4,500 psig
• Selector Switch:	Position = ON and Lighted
• Purity Light:	ON
• System at Pressure Light:	ON
• Alarm Light:	OFF

C.3 To Stop Unit.

Turn selector switch to “OFF”.

C.4 System Faults

The PLC uses the alarm light to inform the operator of problems with the unit. If there is a problem (fault) the alarm light will flash a number of times, pause then flash again. To determine the problem with the unit count the flashes and consult the chart below.

FLASHES	PROBLEM	How to Fix
1	Motor Overload (drawing too many amps)	Allow motor to cool & attempt to restart
2	Compressor High Temperature	Allow compressor to cool. Ensure adequate cooling air is supplied. Restart
3	Low Feed Pressure	Increase pressure coming to the unit
4	High Feed Pressure	Lower pressure coming to the unit
5	High Feed Temperature	Cool the feed air before it reaches the unit
6	Purity Level not reached within 5 min.	Determine cause of purity level not being reached. Check O ₂ sensor calibration.
7	Over Run (ran continuously 8 hrs)	Restart
8	Purification Warning	Prepare to replace Purification Chamber & intermediate separator
9	Purification Alarm	Replace Purification Chamber & intermediate separator

C.4.1 Low Pressure

Low system pressure will be experienced if the end application (outlet) is drawing off more nitrogen than MG1100 can provide and will also result in a high oxygen content in the nitrogen gas stream.

- Check for leaks downstream of the MG1100. — Correct as required.
- Check nitrogen requirement of the end application. — Incorrect sizing of system.
- Check float drain operation in the MG1100 filters to be sure that none are leaking. — Remove to see if there is debris in the drain valve. Clean or replace as required.
- To reset the fault, turn the selector switch to “OFF” and then back to “ON”.

C.5 Maintenance Alerts

C.5.1 Filter Change Required

The two coalescing filters incorporate differential pressure indicators which are used to monitor the condition of the filter elements. When the filters become clogged, the filter indicator of one filter registers in the red field, replace all three filter elements as a set, never just a single element. The filter element change interval should be approximately 500 hours depending upon the condition of the feed air.

**VOLUME D: HIGH PRESSURE MAINTENANCE SCHEDULE****WARNING**

Always shut down and decompress the complete system prior to carrying out any work on the compressor
Never repair pressure lines by soldering or welding.

**CAUTION**

Change the purifier cartridge according to Purification chapter. The used purifier cartridge must be disposed of according to local regulations.
Use only original spare parts for maintenance or repair work.
Check the entire system for leakage by brushing all fittings with soapy water or leak test spray.

D.1 Maintenance Record

It is recommended that all maintenance work be recorded in a service record book which shows the date and details of any maintenance work carried out. It will help avoid expensive repairs caused by missed maintenance work. If necessary to claim against the warranty, it will help to have proof that regular maintenance work has been carried out and the damage is not the result of insufficient maintenance.

D.2 Maintenance Schedule

As an example for the service record book the following Maintenance Schedule is provided. It may be reproduced as needed. The heading boxes on the Maintenance Schedule show the recommended maintenance interval. Date and signature blocks are also provided.

D.2.1 After the First 25 Operating Hours	Date	Signature
Check V-belt tension and condition. [see I.1.4.2 on page 54]		
Check tightness of all cooler pipes and couplings [see Figure F-11 on page 39] #'s 14 & 15,		
Check cooler brackets [see Figure F-11 on page 39] #'s 6-9 & 9-12		
Check zero position on final pressure gauge when the system is de-pressurized. [see I.1.2 on page 54]		
Tighten all valve head bolts and studs. [see Figure F-10 on page 38]		



D.2.2 Every 125 Operating Hours	Date	Signature
Check V-belt and replace if necessary [see I.1.4.2 on page 54]		

D.2.3 Every 500 Operating Hours or Annually	Date	Signature
Change Purification Cartridge [see G.1.2.1 on page 43]		
Change Inlet Filter Elements [see E.3 on page 22]		

D.2.4 Every 2000 Operating Hours or Biennially	Date	Signature
Change synthetic based compressor oil. [see F.1.3 on page 27]		
Change valves [see F.2.1 on page 29] [see Figure F-10 on page 38]		

D.2.5 Annually or As Required	Date	Signature
Change crankcase vent filter (turns red when replacement is needed) [see E.3.3 on page 26]		



D.2.6 After Repair Work	Date	Signature
Check tension and condition of V-belt. [see I.1.4.2 on page 54]		
Check tightness of all cooler pipes and couplings. [see Figure F-11 on page 39]#’s14 & 15,		
Check cooler brackets [see Figure F-11 on page 39]#’s 6-9 & 9-12		
Check zero pressure position on the final pressure gauge when de-pressurized [see I.1.2 on page 54]		
Tighten valve head bolts and studs [see Figure F-10 on page 38]		



D.2.7 After Storage and Preservation	Date	Signature
Check tension and condition of V-belt. [see I.1.4.2 on page 54]		
Check tightness of all cooler pipes and couplings. [see Figure F-11 on page 39]#’s14 & 15,		
Check cooler brackets [see Figure F-11 on page 39]#’s 6-9 & 9-12		
Check zero pressure position on the final pressure gauge when de-presurized [see I.1.2 on page 54]		



VOLUME E: SYSTEM MAINTENANCE CHART

E.1 Scheduled Maintenance

Service / Check	Operating Hours												Daily	Monthly	Annually	Biannually
	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000	5,500	6,000				
Change low-pressure filters ^a <i>See Paragraph E.3</i>																
Change Purification Cartridge <i>See Paragraph G.1.2.1</i>																
Change Compressor Oil <i>See Paragraph F.1.4</i>																
Change Compressor Valves <i>See Paragraph F.3.3 & F.3.4</i>																
Calibrate Oxygen Sensor <i>See Paragraph E.3.2</i>																
Change Crankcase Vent Filter <i>See Paragraph E.3.3</i>																

a. Filter change interval is listed as a reference only. Refer to the filter status indicators on top of the filters. The change interval can change due to the condition of the feed air supplied to the MG1100.

E.2 Field Service Spares

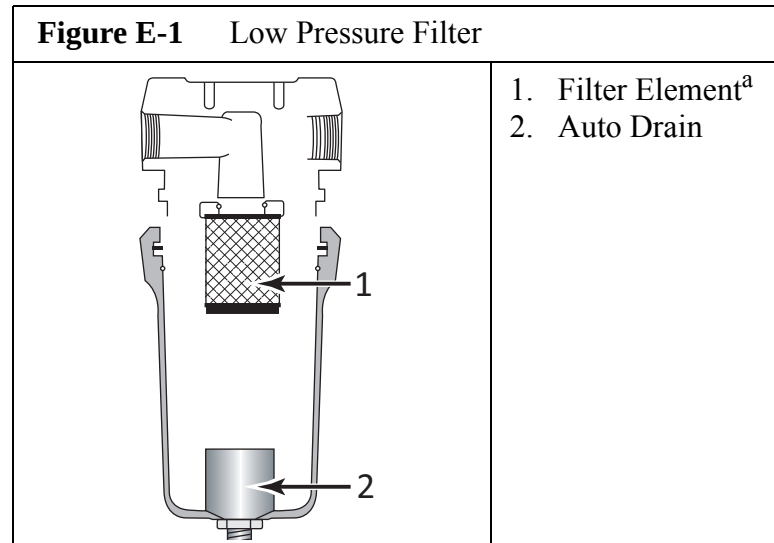
The following Spare Parts Lists apply to Model MG1100

Description	P/N	Qty
Pre-coalescer Filter Element	1CØ105	1
Post-coalescer Element	1CØ107	1
Activated Carbon Filter Element	1CØ109	1
Oxygen Monitor Sensor	1CØ116	1
Purification Cartridge	1CØ295	1
Condensate Separator Filter Element	1CØ35Ø	1
12 Amp Fuse	1CØ42Ø	1
Compressor Oil	1CØ351	1qt.

E.3 Maintenance

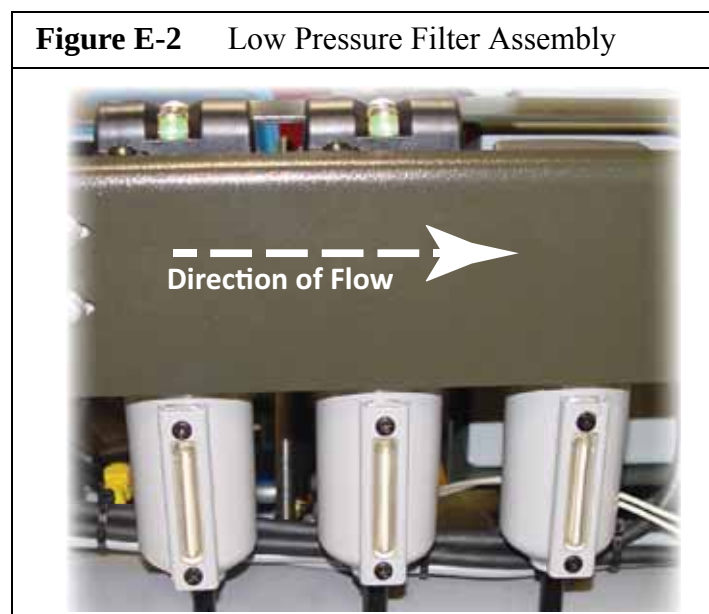
E.3.1 Low Pressure Filter Elements

If either of the differential pressure indicators on the top of the filters shows red, all three filters should be changed.



a. See Figure I-7 on page 58 for part numbers

Disconnect the MG1100 before performing any maintenance this unit. This is to ensure the unit is depressurized. The low pressure filters are pictured below:



1. There are three low pressure filters and they are arranged from inlet to outlet, 1 micron filter, 0.01 micron filter, and adsorber filter. The filter bowls have numbers on the bowls for identification purposes. In Figure E-2 the coalescing filters are located on the left, the, activated carbon filter is on the right



CAUTION

Do not handle filter elements by the body, as they can be easily damaged. Handle by the bottom cap only

NOTICE

To ensure that the correct filter element is used and the filter bowls are not installed on the wrong filter heads, only remove one filter bowl at a time

2. To remove the filter bowl push the bowl up into the filter head. Turn the bowl 1/8th of a turn to the left and then pull the bowl straight down.
3. Clean the filter bowl using a clean cloth.
4. Unscrew the old element.
5. Note: Some oil will be entrained in the filter elements. Dispose of the element according to all local, state and federal codes.
6. Screw the new filter element onto the filter head.

NOTICE

Make certain that the O-ring inside the top of the bowl is lightly lubricated with O-ring lubricant and that the O-ring is in place.

7. Reassemble filter bowl to filter head.

E.3.2 Oxygen Sensor:

The oxygen sensor has a 2 year operational lifespan. Calibration has been completed while the unit was being built and tested. Auto calibration procedure is recommended monthly under normal operating conditions. This procedure is to compensate for any drift in the sensor, from vibration and other factors. Follow the steps in E.3.2.1 for procedure.

E.3.2.1 Automatic Calibration:

1. Using calibration kit, connect calibration gas to calibration port on unit.

Figure E-3 Calibration Kit	Figure E-4 Connect	Figure E-5 Valve Open
		

2. Open the valve to the calibration gas by lifting on the part of the valve labeled “OPEN”.
3. Turn calibration toggle switch from RUN to CALIBRATE.
4. With power to the unit, turn the power switch to CAL.

Figure E-6 Toggle**Figure E-7** Power Switch to CAL**NOTICE**

The power switch will have to remain in the CAL position for 2 minutes before the auto calibration procedure will start. Only place the power switch to CAL. when performing an auto calibration procedure.

5. The purity light will flash for 2 ½ minutes while the PLC calibrates to the oxygen sensor.
6. After 2½ minutes the calibration light will stay lit indicating the calibration has finished.
7. Turn the power switch from CAL to OFF
8. The calibration toggle switch can now be returned to RUN.
9. Close the calibration gas valve, and disconnect the calibration kit from the calibration port.
10. The unit can now be operated normally by turning the power switch to ON.

If the purity light continues to flash indicating that the calibration was not valid, check the following:

- 1CØKIT must be connected to the calibration port.
- Test gas (96% N₂ or 4% O₂) must be connected to 1CØKIT.
- Calibration valve must be open.
- Test gas must have pressure.
- Toggle switch must be in CALIBRATE position.
- Power switch must be in CAL position.
- Unit must be plugged in / have power supply.

If all procedures are completed correctly, and the purity light continues to flash indicating the calibration was not valid, contact the Mandus group service department.

E.3.2.2 Manual Calibration

Manual calibration of this sensor is recommended to be done by our Mandus service department. This involves adjusting a very sensitive potentiometer in the sensor. If the machine will not auto calibrate and purity light continues to flash constantly, manual calibration OR installation of a new sensor may be needed.

Before attempting to manual calibration or replacing the sensor, do the following:

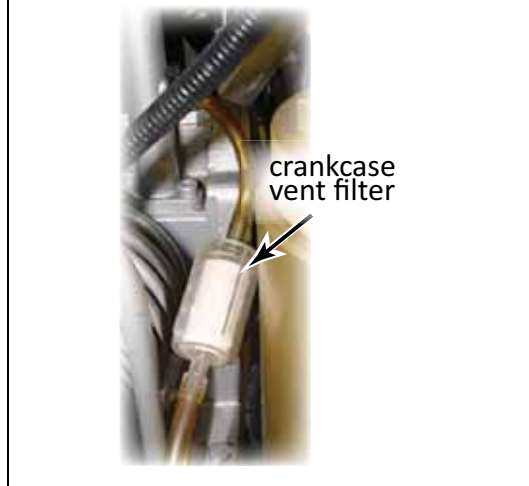
1. Verify test gas pressure. Ensure the test gas is not empty. The sensor will not calibrate correctly if the test gas is empty.
2. Verify Gas Valve is open. The unit will not calibrate correctly if closed.
3. Verify machine's toggle switch is in CALIBRATE position. The unit will not calibrate correctly in the RUN position.
4. Verify machine is plugged in and there is power to the unit. The unit will not calibrate without power.



E.3.3 Crankcase Vent Filter; 1CØ339

Crankcase pressure is vented off into the atmosphere via a clear rubber hose connected to the oil dip stick tube. This rubber hose leads to a filter which will turn red when it needs to be replaced.

Figure E-8 Crankcase Vent Filter



To replace this filter, just pull off the rubber hoses and replace with a new filter (1CØ339).

VOLUME F: HIGH PRESSURE COMPRESSOR BLOCK

F.1 Lubrication

F.1.1 Oil Level Check

Check the oil level prior to putting compressor into operation.

1. Remove dipstick and wipe dry with a clean cloth.
2. Reinsert the dipstick ensuring that it is completely seated.
3. Withdraw the dipstick again and note the oil level.
4. The level should be between the minimum and maximum marks on the dipstick. See Figure F-1



CAUTION

The oil level must not go down below the minimum mark but also must not exceed the maximum mark as this will cause excessive lubrication of the compressor and result in the valves carbonizing.

Figure F-1 Oil Dipstick Markings

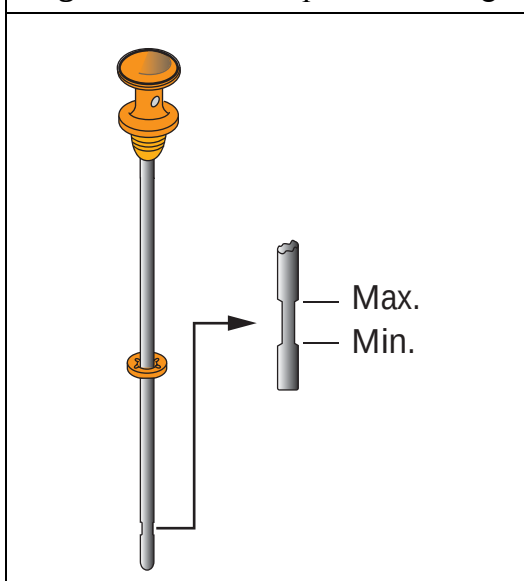
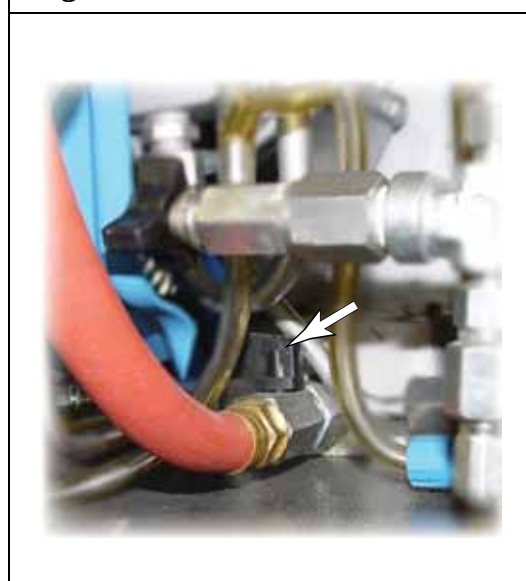


Figure F-2 Oil Drain Valve



F.1.2 Type of Oil

NOTICE

The part number for the oil delivered in all MG1100 compressor units is 1CØ351

Due to the thermal load on the compressor, only high quality oil should be used. It is recommended that you restrict oil to 1CØ351 which has a proven record of success and is specified for this compressor.

F.1.3 Oil Change Schedule

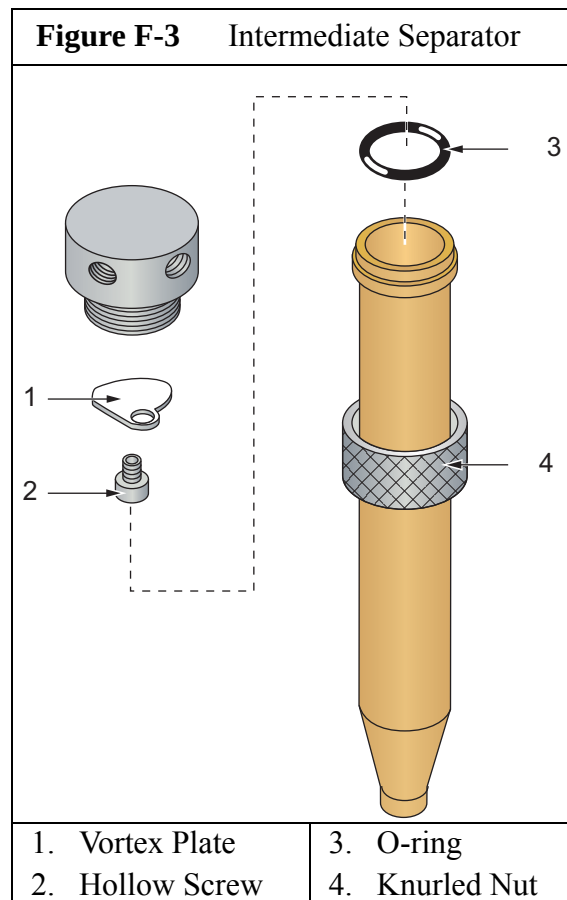
The oil must be changed every 2,000 operating hours or every two years whichever is reached first.

F.1.4 Oil Change Procedures

1. Run the compressor until it reaches normal operating temperature, then shut it off.
2. Remove the oil dipstick from oil filler tube.
3. While the oil is still warm, open the oil drain valve(See Figure F-2) and drain the oil into an appropriate container.
4. After oil has completely drained, close oil drain valve.
5. Refill with 1.37 quarts (1.3 liters) of oil, through the oil filler tube.
6. Check oil level using the oil dipstick.
7. Oil level is correct if it is at the upper mark. See Figure F-1

F.2 Intermediate Separator

An Intermediate separator is mounted on the compressor block. This separator is designed to remove oil and water which accumulates due to the cooling of the medium after the compression process. Separation is achieved by means of centrifugal action provided by a vortex plate (1)



**WARNING**

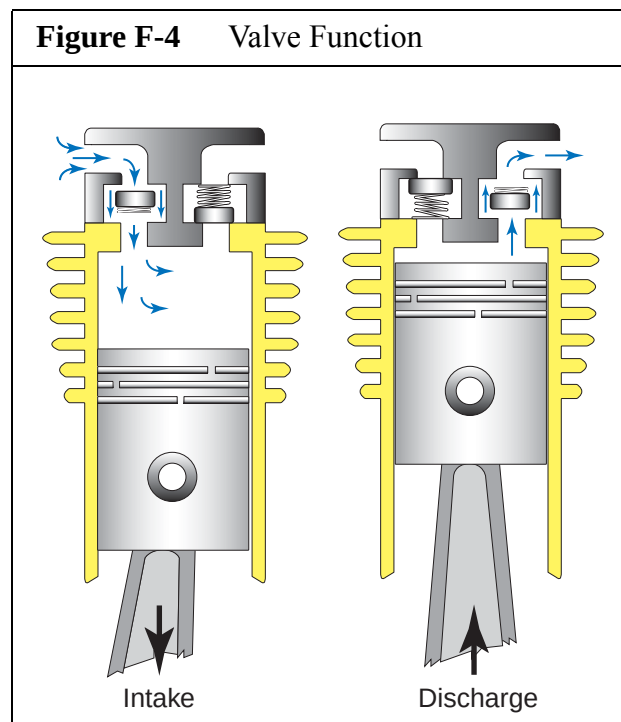
The rapid de-pressurizing and repressurizing of the Intermediate separator during condensate draining subjects it to metallurgical stresses. To prevent catastrophic failure with the possibility of damage, injury or death the Intermediate separator must be replaced after 45,000 load cycles. A load cycle equals one depressurization- repressurization. The recommended frequency of condensate draining is every fifty (50) minutes and is a balance between maximizing the life of the oil and water separator chamber and maintaining the quality of the delivered air.

F.2.1 Maintenance

The Intermediate Separator 1CØ283 requires no maintenance.

F.3 Compressor Valves**F.3.1 Description**

The valve heads of the individual stages form the top part of the cylinders. The intake and discharge valves are fitted inside the valve heads. (Note that the valves are operated by air flow. (See Figure F-4). On the suction stroke, the intake valve is opened and air flows into the cylinder. At the start of the compression stroke the intake valve closes. The end of the compression stroke the compressed air forces the discharge valve open.

**F.3.2 Initial Operational Check**

After maintenance work on the valves, the valves should be checked for proper operation. Note that the intake line to the valve heads is warm and the outlet piping should be hot. This indicates the valves are operating correctly.

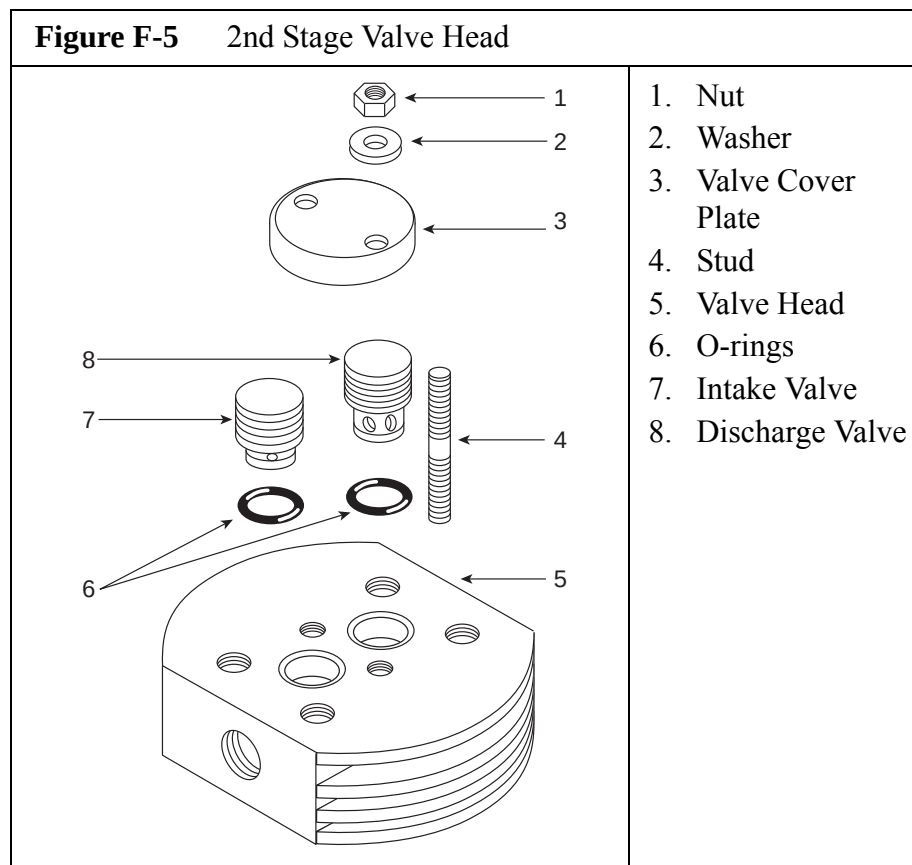
F.3.3 Changing the Valves Overview

- Always replace the valves as a complete set.
- Observe the correct sequence when reassembling.
- Check individual components for excessive wear. If the valve seat and valve disks are dented, replace the valves.
- Valve head screws must be tightened with a torque wrench.
- Check the valve space in the valve head for dirt and clean if necessary.
- Thirty minutes after restarting the compressor unit, stop the unit, let it cool to ambient temperature and retighten the valve studs and cap nuts. Otherwise valves could work loose due to the setting of the gaskets.
- After finishing all maintenance work on the valves, turn the compressor by hand using the flywheel and check that all items have been correctly installed.
- Replace the valves every 2,000 operating hours to avoid fatigue failure.

F.3.4 Changing the 2nd Stage Valves

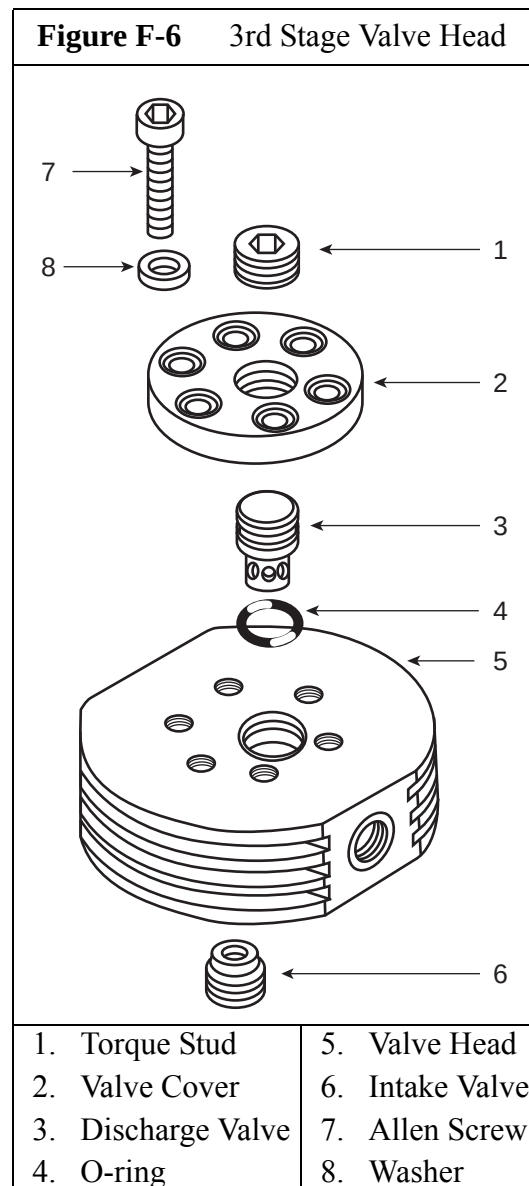
Both the intake and discharge valves can be serviced from the top of the head. See Figure F-5.

1. Remove two nuts (1) and spring washers (2)
2. Remove valve cover plate (3)
3. Remove valves (7 and 8) using two screwdrivers as shown in Figure F-7
4. Reassemble in reverse sequence. Position spring washers so the curved side is facing up. Fasten nuts so the valve cover plate is parallel to the valve head. Torque to 7 ft-lbs (10 Nm)



F.3.4.1 Changing the 3rd Stage Valves

On this valve head, the valves are arranged on the upper and lower side due to the small diameter of the 3rd stage head. See Figure F-6.

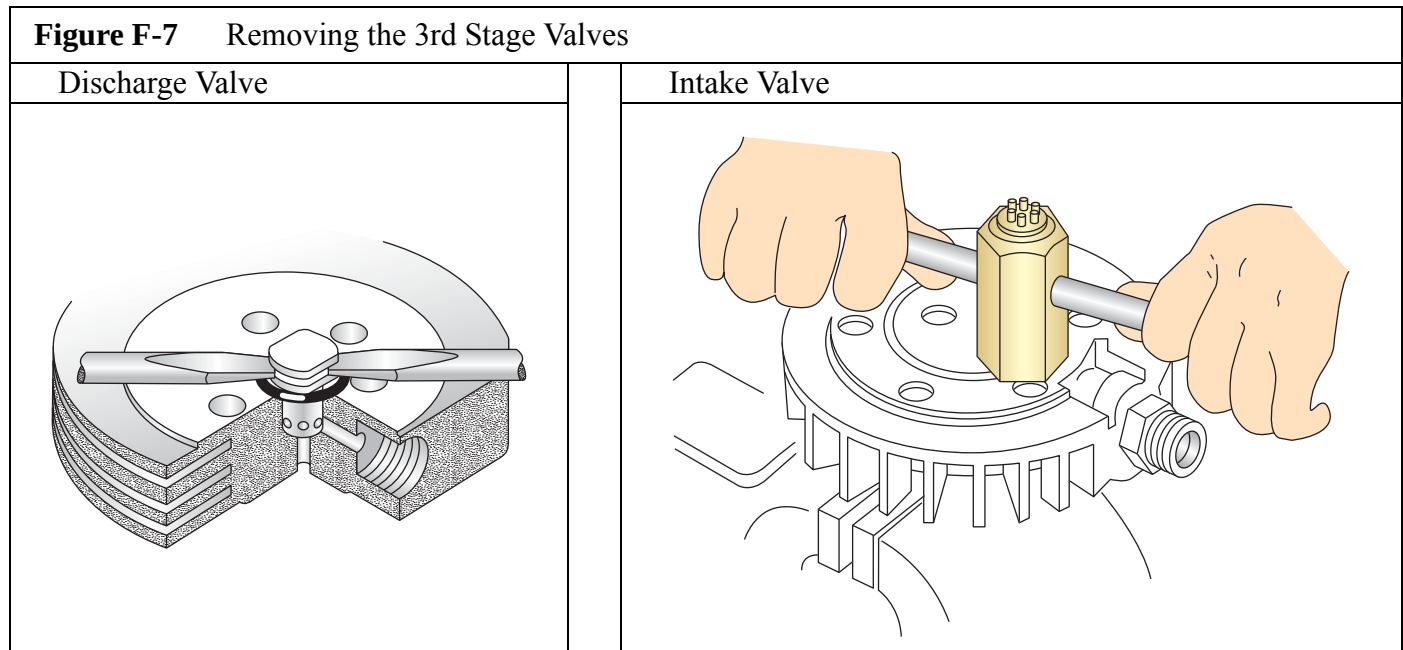


CAUTION

Always change the intake and discharge valves of the 2nd Stage at the same time.

1. To remove or install the intake valve (6) use the special valve tool. (See Figure F-7.)
2. The discharge valve (3) is merely inserted into the valve head (5). It is sealed by the O-ring (4) and fixed to the valve head by the torque stud (1).
3. Remove discharge valve by loosening torque stud (1) a couple of turns.
4. Remove Allen screws (7) and take off valve head cover (6).

5. To lift discharge valve out of valve head put two flat head screwdrivers into grooves of the pressure valve body. See Figure F-7. If necessary turn valve to loosen it, using a 13 mm open end wrench on the flat surfaces of the valve.
6. Lift out discharge valve (3) together with O-ring (4).
7. Check O-Ring for damage and wear, replace if necessary. Put O-ring into the valve head.
8. To reinstall discharge valve. Insert valve (3) and install valve head cover (6).
9. Fasten valve head cover to valve head with allen screws (7) and washers (8). Torque to 7 ft-lbs. (10 Nm).
10. Screw in torque stud (1) and torque to 14 ft-lbs (20 Nm)



F.3.5 Repair and Troubleshooting

F.3.5.1 General Repair Instructions

Preventive maintenance usually involves replacing the valves, gaskets and sealing rings as well as carrying out the maintenance work.

Repair work can be carried out on the compressor block to a certain extent but a certain experience and skill level is necessary.

It should be noted however, that

- No repair should be carried out on the crankshaft or bearings.
- Safety valves are not repaired but always replaced completely.



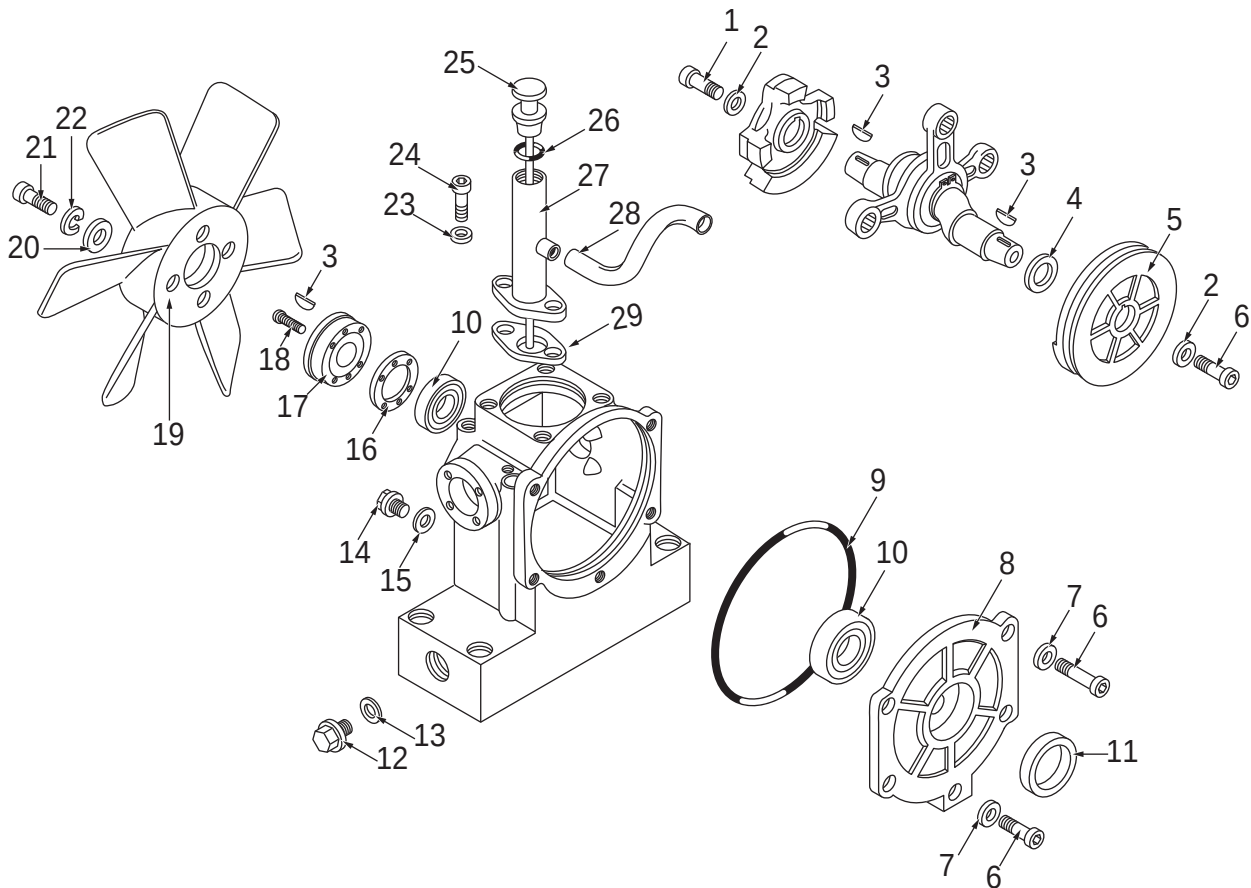
F.3.5.2 Troubleshooting Tables

F.3.5.3 Compressor Block		
TROUBLE	CAUSE	REMEDY
Compressor does not attain final pressure.	Condensate drain valves leaking	Tighten and reseal.
	Final pressure safety valve defective (blows too soon)	Replace safety valve
	No cartridge in P0 Filter system. (air escaping through the cartridge safety bore.)	Replace cartridge
	Vent screw for final pressure safety valve not in operating position.	To vent, unscrew until completely open.
Air delivery drops	Intake filter dirty	Clean or replace filter cartridge.
	Pipe coupling leaking	Retighten couplings.
	Excessive wear of the 3rd stage piston	Replace piston and sleeve of 3rd stage.
Intermediate pressure safety valve blows	Intermediate pressure too high because of defective inlet or pressure valve of the following stage.	Check and replace inlet or pressure valve.
	Safety valve leaking	Replace safety valve.
Air escaping through the cartridge safety bore on purification chamber	Cartridge missing	Replace cartridge
	Cartridge O-rings defective	Check and replace O-rings



TROUBLE	CAUSE	REMEDY
Compressor overheats	Insufficient cooling air	Inlet and pressure valve of one stage leaking, or direction of unit's v-belt rotation incorrect.
	Ambient temperature too high.	Check for a maximum ambient temperature of 115 °F (45 °C).
	Direction of rotation of unit's V-belt is incorrect.	Correct direction of rotation.
	Inlet and pressure valve of one stage is leaking	Check valves, clean and replace if necessary.

F.3.5.4 Electric Motor		
TROUBLE	CAUSE	REMEDY
Motor will not start	Electric circuitry faulty	Check all fuses, terminal connections, wire leads, make sure that power supply complies with motor dataplate.
Motor runs erratically	V-belt worn	Replace V-belt

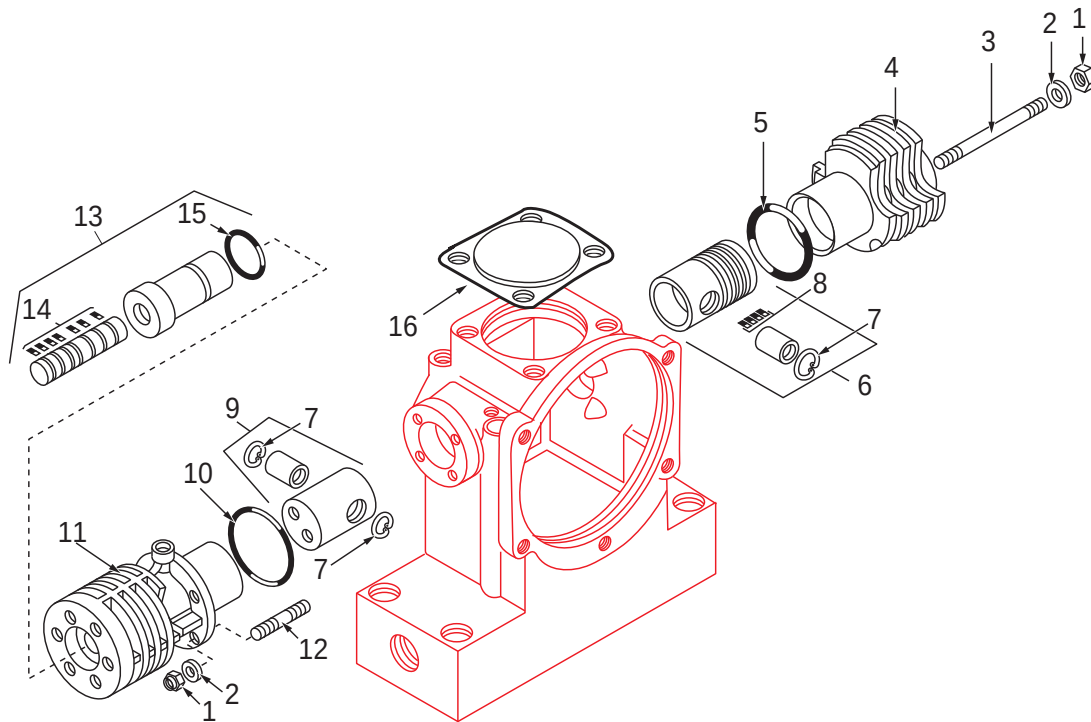
F.3.6 Replacement Parts List
Figure F-8 Crankcase, Driving Gear and Fanwheel


Item	Qty	Part No.	Description	Notes
1	4	1CØ237	Allen Screw	
2	7	1CØ238	Washer	
3	2	1CØ239	Key	
4	1	1CØ240	Thrust Washer	
5	1	1CØ241	V-belt Pulley	
6	1	1CØ242	Allen Screw	
7	5	1CØ243	Washer	
8	1	1CØ244	Cover	
9	1	1CØ245	O-ring	
10	2	1CØ246	Roller Bearing	
11	1	1CØ247	Shaft Seal	
12	1	1CØ248	Plug with plastic gasket	
13	1	1CØ249	Gasket	
14	1	1CØ250	Plug	
15	1	1CØ251	Gasket	

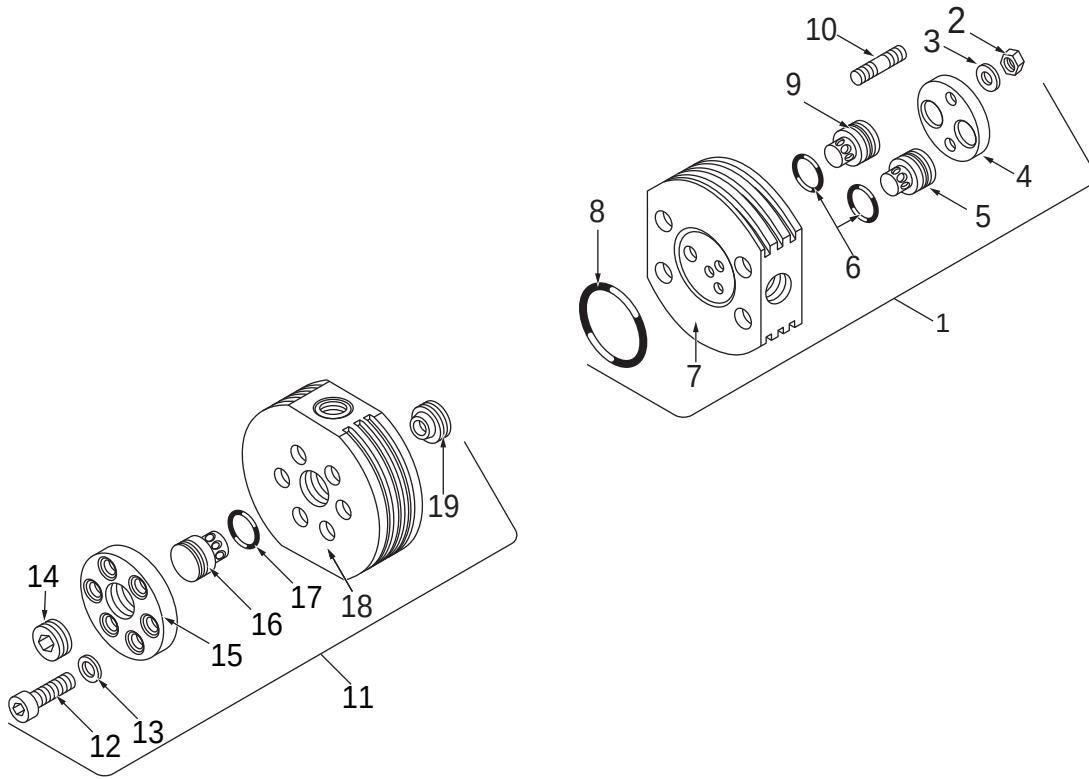
Figure 1-8 (cont.)

Crankcase, Driving Gear and Fanwheel

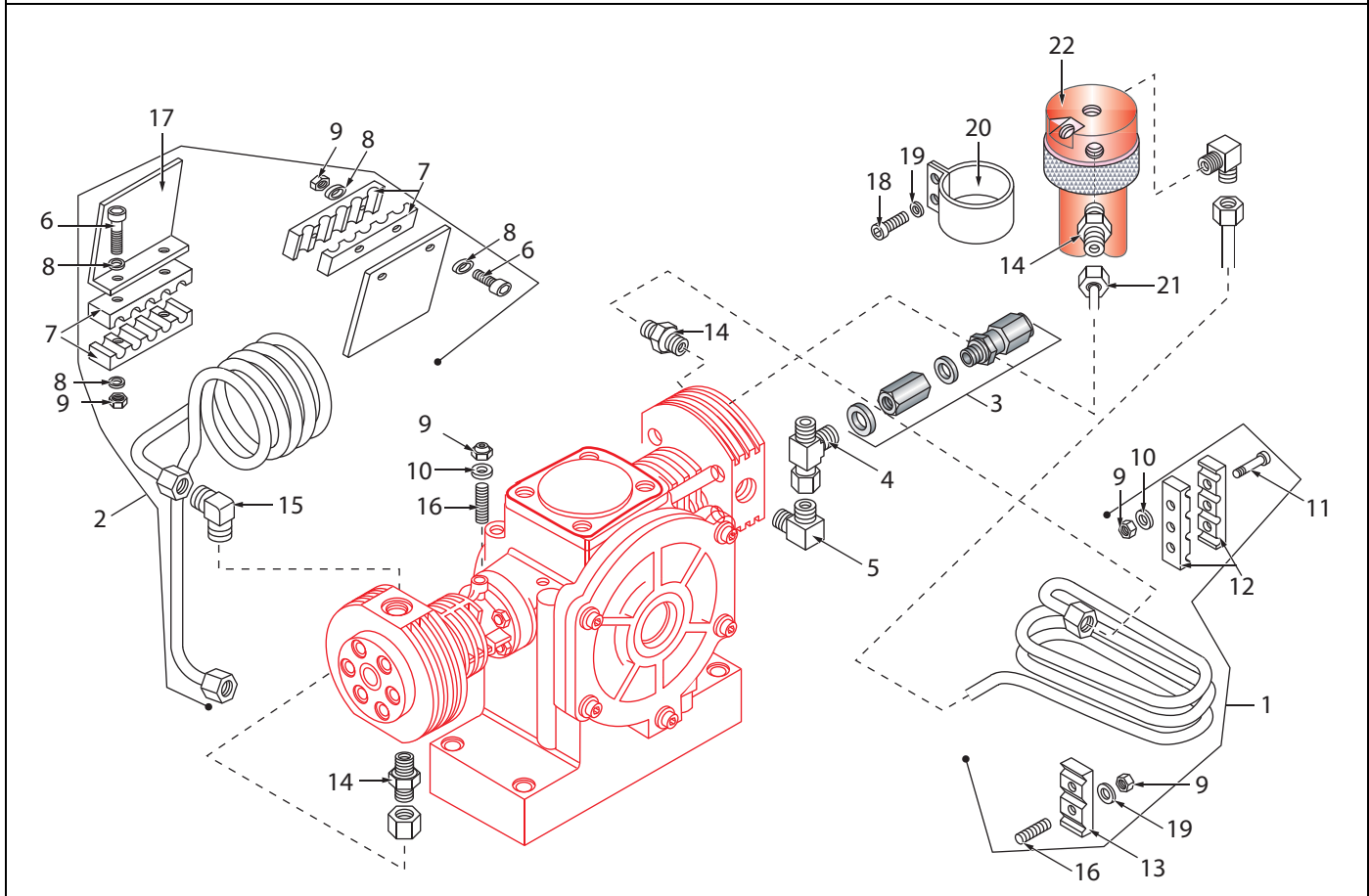
Item	Qty	Part No.	Description	Notes
16	1	1CØ252	Gasket	
17	1	1CØ253	Oil Pump	
18	6	1CØ254	Hex Head Screw	
19	1	1CØ255	Fan	
20	1	1CØ256	Washer	
21	1	1CØ257	Allen Screw	
22	1	1CØ258	Split Lock Washer	
23	2	1CØ259	Allen Screw	
24	2	1CØ260	Wave Washer	
25	1	1CØ261	Dip-stick	
26	1	1CØ262	O-ring	
27	1	1CØ263	Oil Filler	
28	1	1CØ264	Hose	
29	1	1CØ265	Paper Gasket	

Figure F-9 Pistons and Cylinders


Item	Qty	Part No.	Description	Notes
1	10	1CØ2Ø3	Hex Nut, Self Locking	
2	10	1CØ214	Flat Washer	
3	4	1CØ222	Stud	
4	1	1CØ223	Cylinder, 2nd Stage	
5	1	1CØ224	O-ring	
6	1	1CØ225	2nd Stage Piston Assembly	
7	4	1CØ226	Circlip	
8	1	1CØ227	Piston Ring Set	
9	1	1CØ229	3rd Stage Piston Assembly	
10	1	1CØ209	O-ring	
11	1	1CØ231	Cylinder, 3rd Stage	
12	6	1CØ232	Stud	
13	1	1CØ233	Piston and Sleeve Assembly	
14	1	1CØ234	Piston Ring Set	
15	1	1CØ235	O-ring	
16	1	1CØ236	Cover	

Figure F-10 Valve Heads and Valves

Item	Qty	Part No.	Description	Notes
1	1	1CØ2Ø2	2nd Stage Valve Head Assembly	
2	4	1CØ2Ø3	Hex Nut, Self Locking	
3	4	1CØ2Ø4	Spring Washer	
4	1	1CØ2Ø5	2nd Stage Valve Cover	
5	1	1CØ2Ø6	Inlet Valve Assembly	
6	2	1CØ2Ø7	O-ring	
7	1	1CØ2Ø8	2nd Stage Valve Head	
8	1	1CØ2Ø9	O-ring	
9	1	1CØ21Ø	Discharge Valve Assembly	
10	4	1CØ211	Stud	
11	1	1CØ212	3rd Stage Valve Head Assembly	
12	6	1CØ213	Allen Screw	
13	6	1CØ214	Flat Washer	
14	1	1CØ215	Plug	
15	1	1CØ216	Valve Head Cover	
16	1	1CØ217	Discharge Valve	
17	1	1CØ218	O-ring	
18	1	1CØ219	3rd Stage Valve Head	
19	1	1CØ22Ø	Intake Valve	

Figure F-11 Cooling System


Item	Qty	Part No.	Description	Notes
1	1	1CØ266	2nd-3rd Stage Intercooler Assembly	
2	1	1CØ267	Aftercooler Assembly	
3	1	1CØ268	1st Stage Safety Valve	
4	1	1CØ269	Male Run Tee	
5	2	1CØ270	Male Elbow	
6	4	1CØ271	Allen Screw	
7	2	1CØ272	Bracket	
8	8	1CØ214	Flat Washer	
9	9	1CØ203	Hex Nut, Self Locking	
10	3	1CØ273	Washer	
11	2	1CØ274	Allen Screw	
12	2	1CØ275	Bracket	
13	1	1CØ276	Bracket	
14	3	1CØ277	Connector	
15	1	1CØ278	Male Elbow	



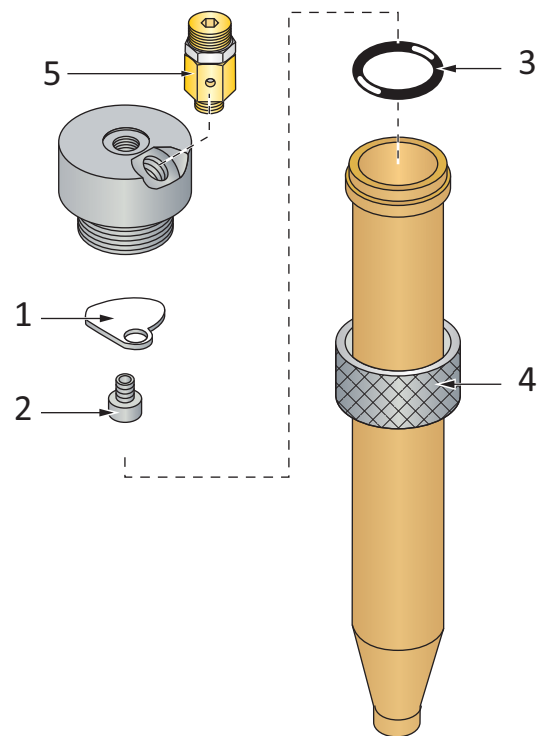
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Figure 1-11 (cont.)

Cooling System

Item	Qty	Part No.	Description	Notes
16	3	1CØ279	Stud	
17	1	1CØ280	Baffle	
18	2	1CØ259	Allen Screw	
19	4	1CØ204	Washer	
20	1	1CØ281	Clamp	
21	1	1CØ282	Tube Assembly	
22	1	1CØ283	Intermediate Separator	(See Figure F-12)

Figure F-12 Intermediate Separator



Item	Qty	Part No.	Description	Notes
◇	1	1CØ283	Intermediate Separator Assembly	
1	...	1CØ284	Plate	
2	...	1CØ285	Hollow Screw	
3	...	1CØ286	O-ring	
4	...	1CØ287	Knurled Ring	
5	...	1CØ352	Safety Valve	

VOLUME G: PURIFICATION SYSTEM

G.1 Purification Chamber

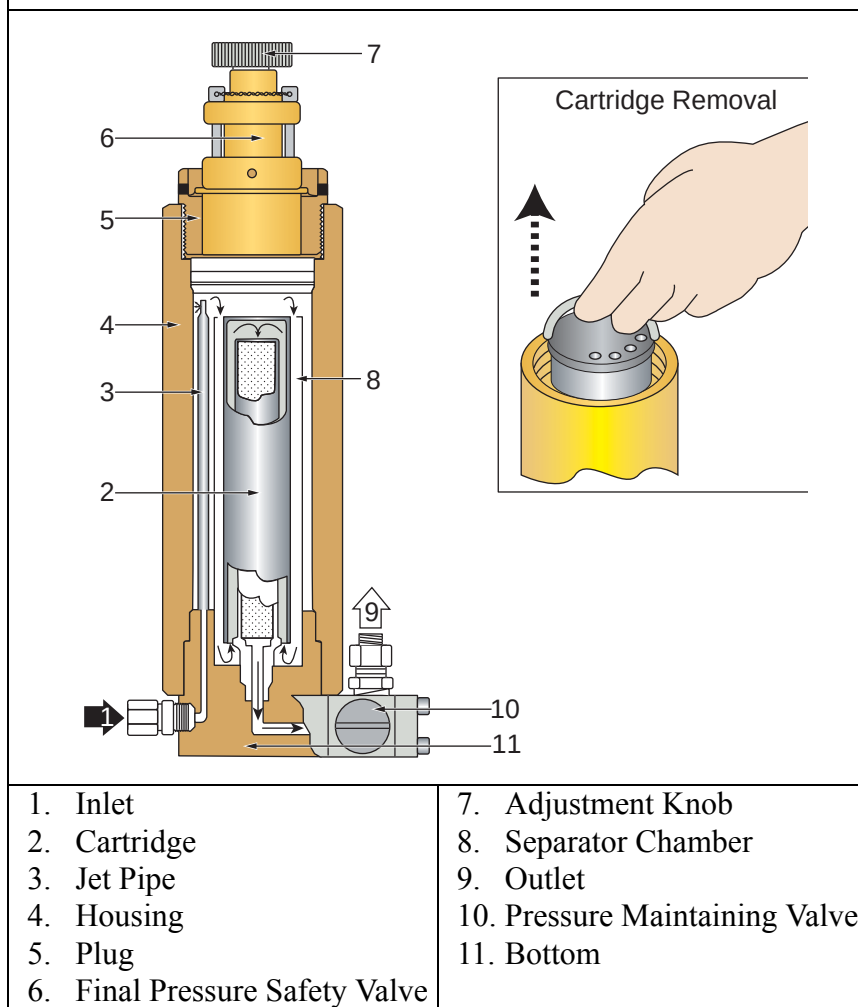
G.1.1 Description

The P0 Purification System consists of a separator and a cartridge chamber. In the separator surrounding the cartridge chamber, liquid oil and water particles are separated from the compressed air by a pipe nozzle. Residual oil and water particles are then removed by the filter cartridge and the air leaving the P0 Purification System is free of water, oil, taste and smell.

Figure G-1 Purification Chamber



Figure G-2 Purification Chamber Cross Section



G.1.2 Maintenance

G.1.2.1 Replacing the Cartridge

See Systems Fault Chart E.1

See Figure G-2.

1. De-pressurize system before starting any maintenance, by opening the condensate drain valve and bleed valve.
2. Unscrew plug (5) on top of the housing (4).
3. Extract old cartridge. (2)
4. Dry inside of the housing (4) with a clean cloth. Check for corrosion. Replace if necessary.
5. Lubricate threads, O-rings and threaded portion of replacement cartridge with petroleum jelly.

6. Insert new cartridge and secure in place with plug (5).

NOTICE

The used filter cartridge must be disposed of in accordance with local regulations.

G.1.2.2 Chamber Replacement Interval

See Systems Fault Chart C.4

Chamber must be replaced if fault light flashes 9 times.



WARNING

The Purification Chamber is subject to dynamic loading. It is designed for a certain number of load cycles. A load cycle equates to an abrupt pressure loss caused by draining the condensate. The Purification Chamber must be replaced after reaching the maximum number of load cycles, otherwise the housing may fail due to material fatigue.

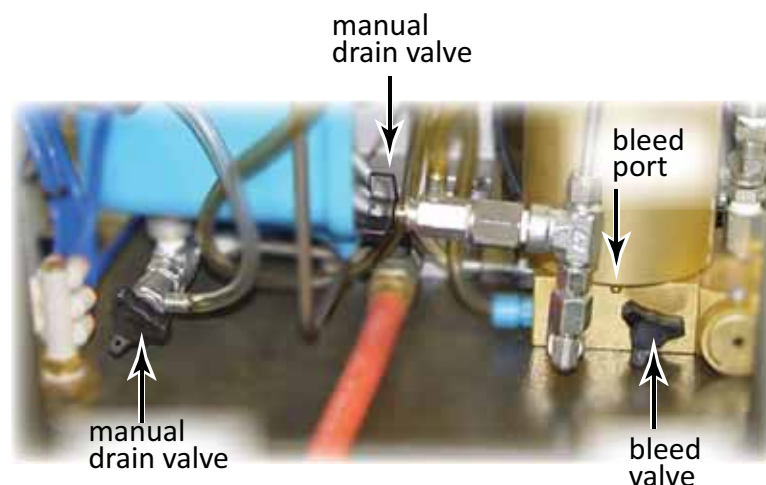
The maximum number of load cycles for the Purification Chamber is 45,000 if operated at 5,000 psi (320 bar) or 63,000 if operated at 3,200 psi (225 bar).

If the number of load cycles of one per hour (i.e. the condensate is drained every fifty (50) minutes) is not exceeded then the maximum number of operating hours before the Purification Chamber must be replaced is 45,000 hours at 5,000 psi (320 bar). To avoid exceeding the maximum number of load cycles the operating hours should always be recorded.

G.1.3 Automatic Condensate Drain

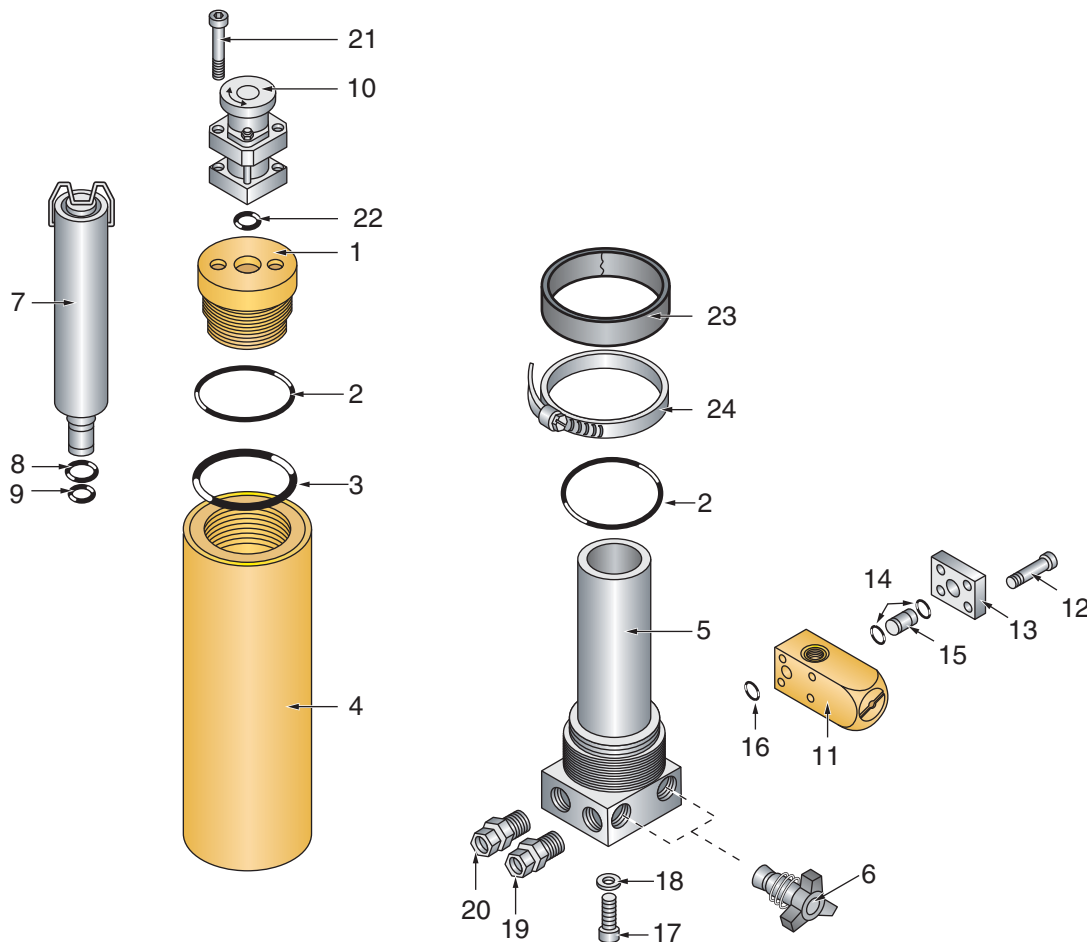
During operations the purification system and the intermediate separator of the compressor are both drained of condensate for 6 seconds every 50 minutes of use by the ACD. The length of drainage and frequency of draining can be adjusted using the portable HMI. See the maintenance manual for information on how to adjust the parameters.

Figure G-3 Manual Drains



G.1.4 Replacement Parts List

Figure G-4 Purification Chamber Parts List



Item	Qty	Part No.	Description	Notes
◆	1	1CØ288	Purification Chamber	
1	†	...	Plug	Available only with 1CØ288
2	2	1CØ290	O-ring	
3	1	1CØ291	O-ring	
4	†	...	Housing	Available only with 1CØ288
5	†	...	Bottom	Available only with 1CØ288
6	1	1CØ294	Condensate Drain Tap Assembly	
7	1	1CØ295	Cartridge Assembly	Includes Items 8 and 9
8	1	1CØ296	O-ring	
9	1	1CØ297	O-ring	
10	1	1CØ298	Safety Valve	
11	1	1CØ299	Pressure Maintaining Valve	
12	4	1CØ300	Socket Head Cap Screw	

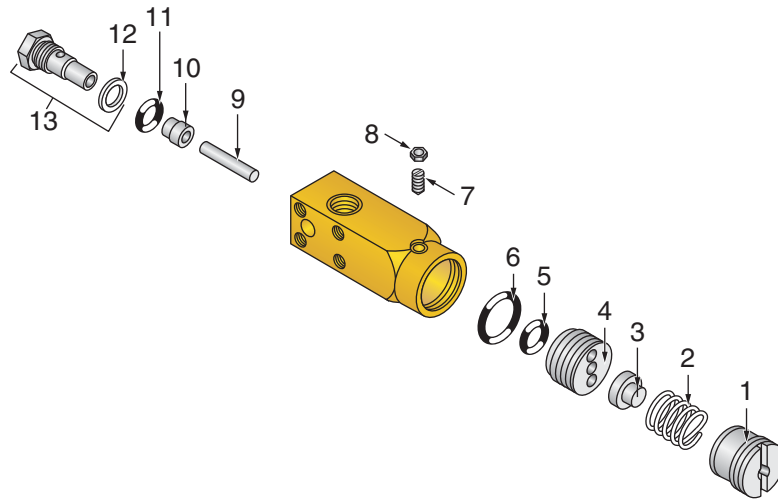


MNL-164286

Figure 1-4 (cont.)

Purification Chamber

Item	Qty	Part No.	Description	Notes
13	1	1CØ3Ø1	Cover	
14	2	1CØ3Ø2	O-ring	
15	1	1CØ3Ø3	Connection Pipe	
16	1	1CØ3Ø4	O-ring	
17	2	1CØ257	Allen Screw	
18	2	1CØ243	Washer	
19	1	1CØ3Ø5	Male Run Tee Connector	
20	1	1CØ3Ø6	Male Connector	
21	4	1CØ3Ø7	Allen Screw	
22	1	1CØ3Ø8	O-ring	
23	1	1CØ3Ø9	Rubber Wrap	
24	1	1CØ31Ø	Clamp	

Figure G-5 Pressure Maintaining Valve


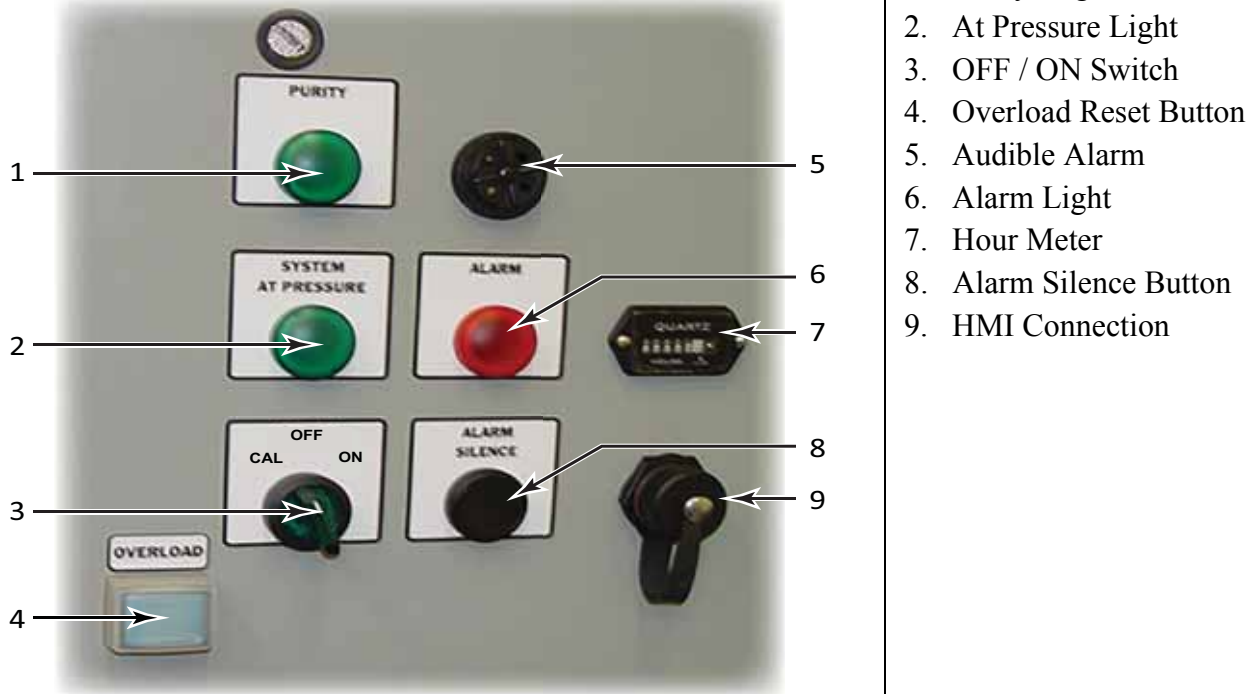
#	KIT	Qty	Part No.	Description	Notes
♦		1	1CØ299	Pressure Maintaining Valve	
1	...	1	1CØ311	Adjustment Screw	
2	...	1	1CØ312	Spring	
3	...	1	1CØ313	Seat	
4	...	1	1CØ314	Spring Seat	
5	.b.	1	1CØ315	O-ring	
6	.b.	1	1CØ316	O-ring	
7	...	1	1CØ317	Stud	
8	...	1	1CØ318	Hex Nut	
9	.b.	1	1CØ319	Pressure Pin	
10	.b.	1	1CØ320	Valve Piston	
11	.b.	1	1CØ321	O-ring	
12	.b.	1	1CØ322	Gasket	
13	...	1	1CØ323	Valve Seat	Includes Item 12

VOLUME H: ELECTRICAL

H.1 Electrical Enclosure

The electrical enclosure contains the PLC, starter, fuses, relays, and connectors which monitor and control the nitrogen generating unit. The front of the electrical enclosure houses a control switch (OFF / ON), two green lights, a red alarm light, an alarm silence push button, an audible alarm, and an hour meter.

Figure H-1 Electrical Controls



The oxygen monitor is located at the bottom of the electrical box. It monitors the oxygen content after the shop air travels through the membranes.

H.1.1 Wiring Diagram

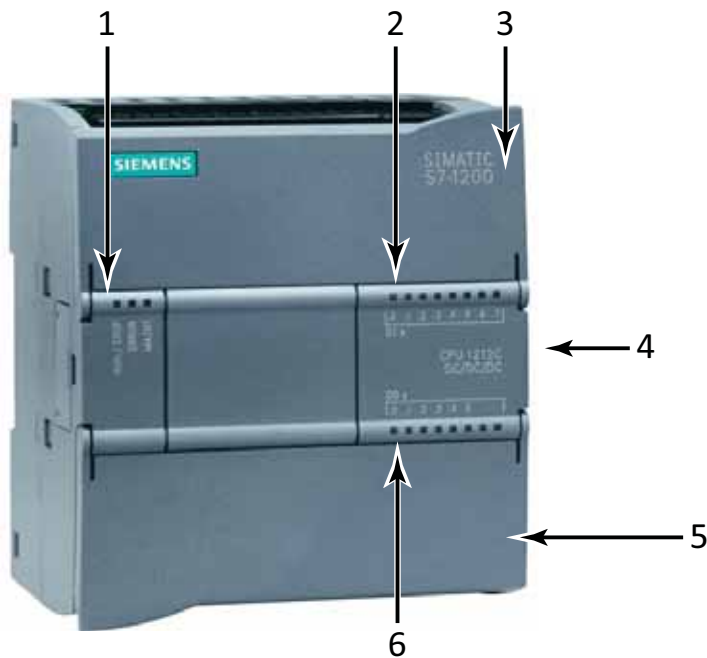
The wiring diagram for your specific Compressor Unit is stored inside the Electrical Panel. If a wiring diagram for your machine is not found inside the Electrical Panel, then please call the Mandus Group for a replacement. Please have the serial number of the compressor available.

H.1.2 Electrical Panel Interior Access

The interior of the Electrical Panel is accessed by using a coin or screwdriver to turn the latch on the front of the Electrical Panel.

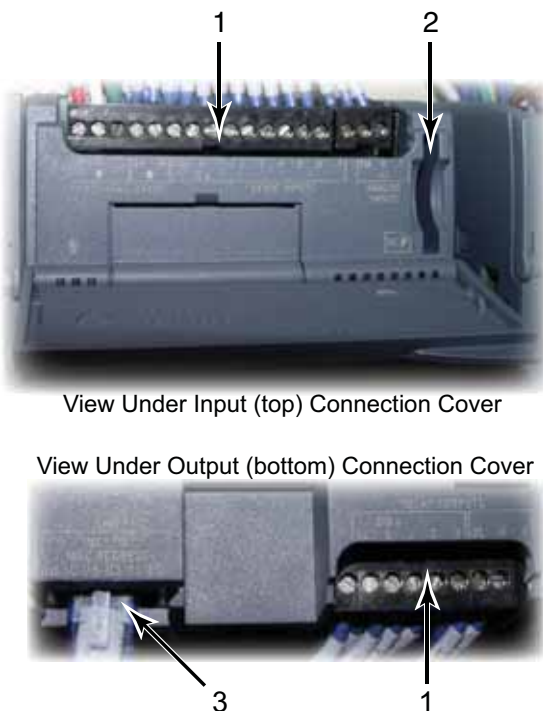
H.2 Electrical Panel Components

Figure H-2 PLC, 1CØ412



1. Status LEDs
2. Output LEDs
3. Output Connections Cover
4. Expansion Access Door
5. Input Connections Cover
6. Input LEDs

Figure H-3 Connector Block Removal



1. Notch in the Terminal Block
2. Memory Card Slot
3. Network Connection



H.2.1 Replacing the PLC

Replacing the PLC does not require removal of any wiring as the connections are made with push in Connector Blocks. To replace the PLC proceed as follows.

1. Turn off unit and disconnect from main power supply.
2. Lift the input connections cover. See Figure H-2.
3. Insert a small flat bladed screwdriver in the notch in the back center of the terminal block. Gently pry the terminal block loose. See Figure H-3.
4. Repeat Steps 2 and 3 for the to the terminal block on the output side of the PLC.
5. Unclip the PLC from the DIN rail by using a small flat bladed screwdriver to pull the DIN rail clip out until the PLC is free.
6. The terminal blocks are replaced by pushing them gently down onto corresponding pins until they click into place.
7. Restore power and operate the unit.

H.2.2 Installing a New Program

The PLC program can be updated in two ways. If a Mandus technician is on-site, they will connect directly to the PLC using a notebook computer. Another method to install a new program is to use an external memory card. The memory card would be programmed at the Mandus factory and shipped either to the customer or to a authorized distributor.

1.2.2.1 Installing a Memory Card

To install or replace a memory card proceed as follows:

1. Turn off unit and disconnect from main power supply.
2. The memory card is keyed to fit only one way and requires minimal force to insert it.
3. Push the memory card into the slot until it snaps into place.
4. If the memory card is being retained in the PLC, restore power to the unit and operate as normal.
5. If the memory card is for a software update and is to be returned to Mandus or a distributor continue as follows.
6. Restore power to the unit.
7. After the software has initialized and the run screen is displayed, shutdown the unit and disconnect from the main power source.
8. Restore power to the unit again. After the software has initialized a second time and the run screen is displayed, shutdown the unit and disconnect from the main power source.
9. Remove the memory card and close the protective cover.
10. Restore power and operate the unit.

H.2.3 Hour Meter

The panel is equipped with an hour meter. The hour meter is not resettable and used to monitor the run hours of the compressor. It is powered by 120 VAC.

Figure H-4 Hour Meter



H.2.4 Motor Starter.

See Figure H-5. This application will require an across the line IEC starter with thermal overloads and its size will be based on the voltage and motor horsepower. Control voltage is 120 VAC.

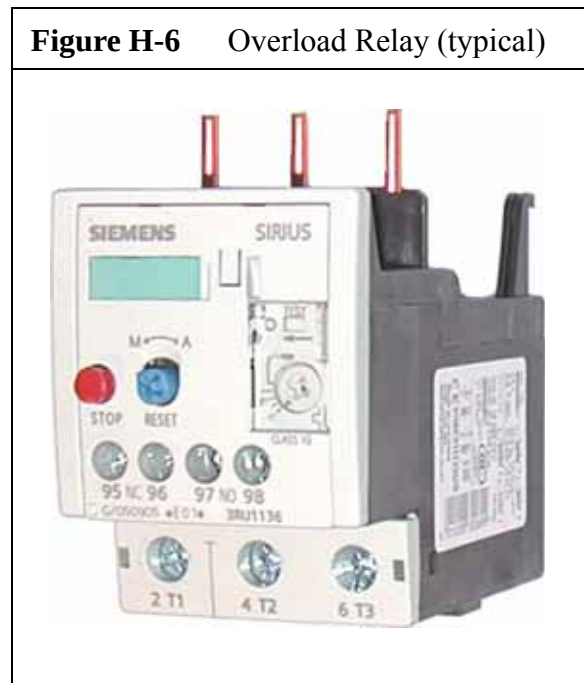
H.2.5 Overload Relay

See Figure H-6. The overload relay provides thermal overload protection and its size will be based on the voltage and motor horsepower. The dial is set to the Full Load Amperage (FLA) of the electric motor at the factory. If the Overload Relay is replaced set the dial to the FLA listed on the motor nameplate or the label inside the Electrical Panel. The Overload Relay plugs into the Motor Starter.

Figure H-5 Motor Starter (typical)



Figure H-6 Overload Relay (typical)

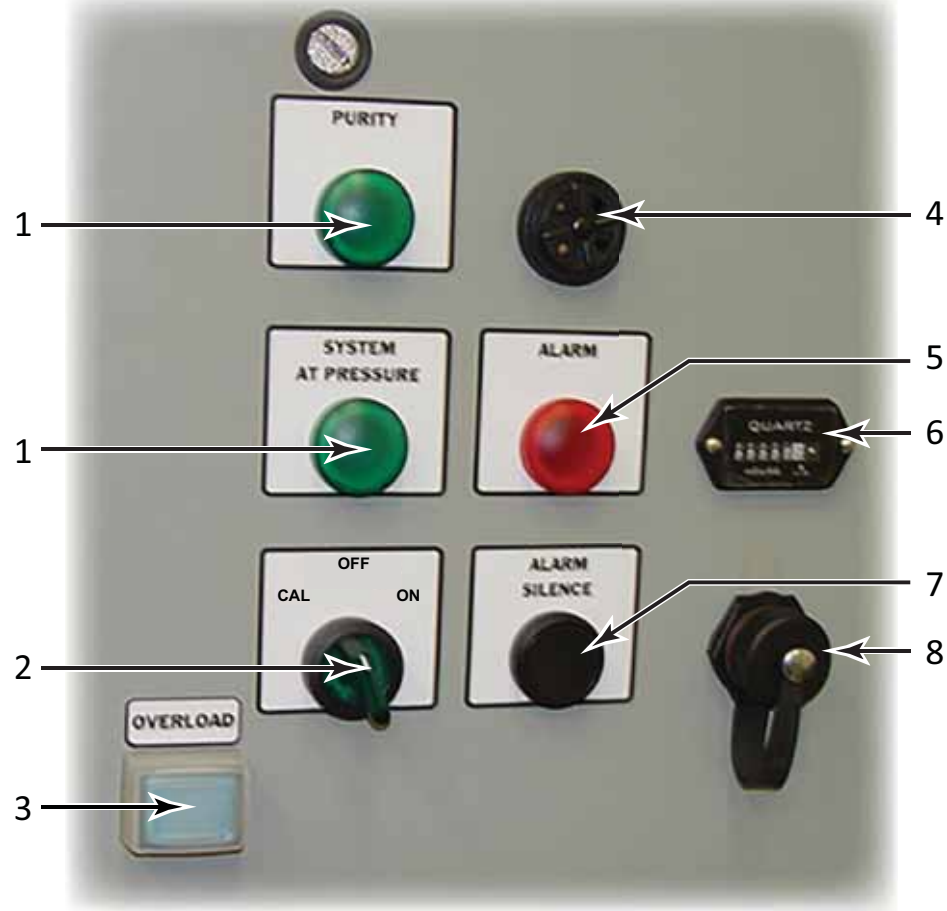


H.2.6 Starter Reset

There is a starter reset push button on the front of the Electrical Panel. Should the electric motor have overloaded and tripped out during normal operation, then depressing this button after giving the motor some time to cool, will reset the overload relay.

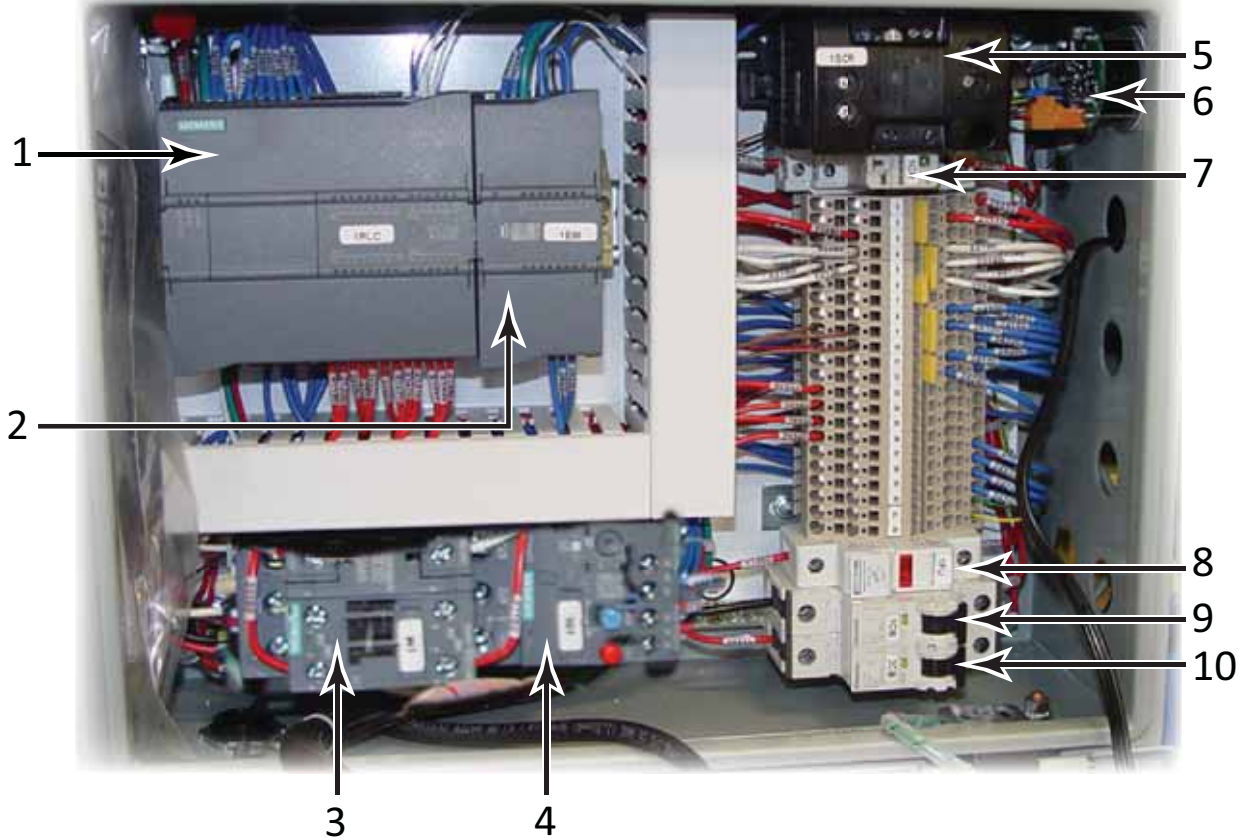
H.3 Replacement Parts

Figure H-7 Electrical Box, External



Item	Qty	Part No.	Description	Notes
1	2	1CØ4Ø1	Lens, Green	<i>Purity & At System Pressure</i>
&	2	1CØ4Ø2	LED, Green	
2	1	1CØ4Ø3	CAL/OFF/ON Switch	Green, Lighted
3	1	1CØ4Ø4	Overload Reset Button	
4	1	1CØ4Ø5	Audible Alarm	
5	1	1CØ4Ø6	Lens, Red	<i>Fault/Alarm light</i>
&	1	1CØ4Ø7	LED, Red	
6	1	1CØ4Ø8	Hour Meter	non-resettable
7	1	1CØ4Ø9	Push button, Switch	<i>Alarm silencer</i>
8	1	1CØ41Ø	Bulkhead Connector	RJ45
&	1	1CØ411	Dust Cap	

Figure H-8 Electrical Box, Internal



Item	Qty	Part No.	Description	Notes
1	1	1CØ412	PLC	Siemens
2	1	1CØ413	Analog Expansion Module	Siemens
3	1	1CØ414	Motor Contactor	25 Amp, 120 V
4	1	1CØ415	Overload Relay	11 - 16 Amp
5	1	1CØ416	Heater Control	
6	1	1CØ417	Oxygen Sensor	
7	1	1CØ418	Circuit Relay	10 Amp
8	1	1CØ419	Fuse Holder	12 - 25 Amp
&	1	1CØ420	Fuse	25 Amp
9	1	1CØ421	Circuit Breaker	6 Amp
10	1	1CØ422	Circuit Breaker	20 Amp

VOLUME I: MISCELLANEOUS

I.1 Safety Valves

I.1.1 Description

Both stages of compression are protected by safety valves. The 1st stage and final safety valves are adjusted to the correct pressure and sealed at the factory. The final stage safety valve is mounted on top of the purification chamber and is adjusted to the operating pressure of the unit. The pressure settings are as follows: 1st stage - 1,160 psi (80 bar); Final stage - As noted on order.

I.1.2 Pressure Gauge

I.1.2.1 Maintenance

We recommend checking the accuracy of Final Pressure Gauge from time to time. Slight deviations during operation are normal and can be ignored. Excessive inaccuracy will require the pressure gauge to be replaced.

Figure I-1 Pressure Gauges



I.1.3 Cooling System

The cylinders of the compressor block, the Intermediate coolers, and the after-cooler are all air cooled. For this purpose the compressor is equipped with a fanwheel connected to the crankshaft at the end opposite the V-belt pulley. It draws cooling air through the fanwheel cover from the surrounding atmosphere. To ensure maximum compressor unit life, provisions must be made for an adequate supply of cooling air during installation of the compressor unit. For the same reasons the unit must not be operated above the maximum ambient temperature.

I.1.4 Compressor Drive System

I.1.4.1 Description

The prime mover, which is either a single or three phase electric motor, drives the compressor with a V-belt. The prime mover is mounted on an adjustable base plate and requires periodic adjustment to ensure proper V-belt tension.

I.1.4.2 Checking the Drive Belt

1. The proper belt tension for the V-belt is where the belt does not slip under a full load.
2. A rough value for this is when the V-belt deflects Approximately $3/8$ " (10 mm) when pressed with thumb pressure between the two pulleys. See Figure I-2.
3. Readjust a new V-belt after the first twenty-five operating hours.
4. Check for damage or wear every 125 operating hours.

Figure I-2 Checking V-belt Tension

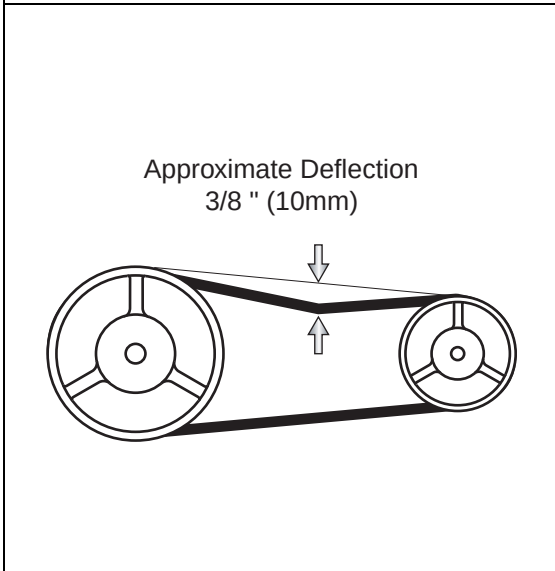
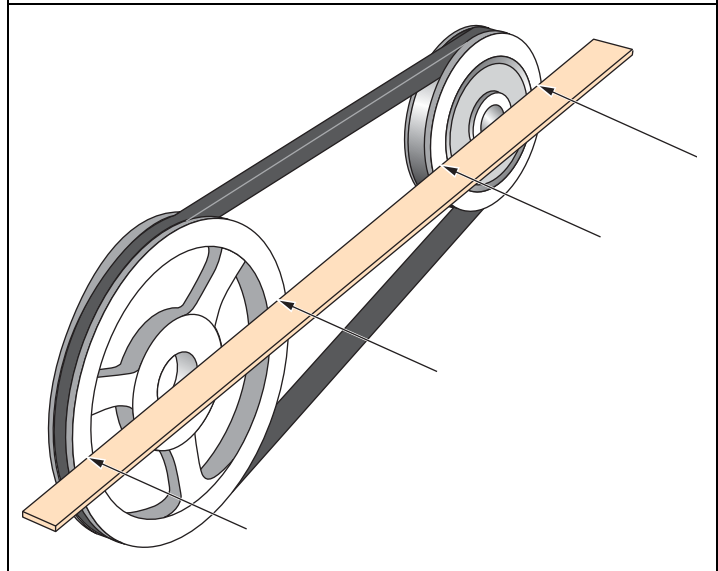


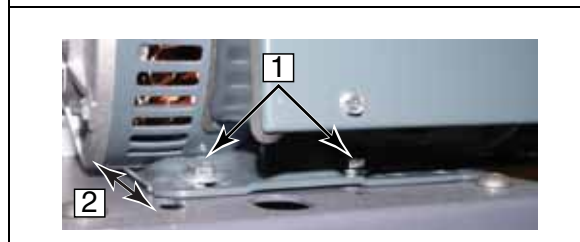
Figure I-3 V-belt Pulley Alignment



I.1.4.3 V-belt Tension Adjustment

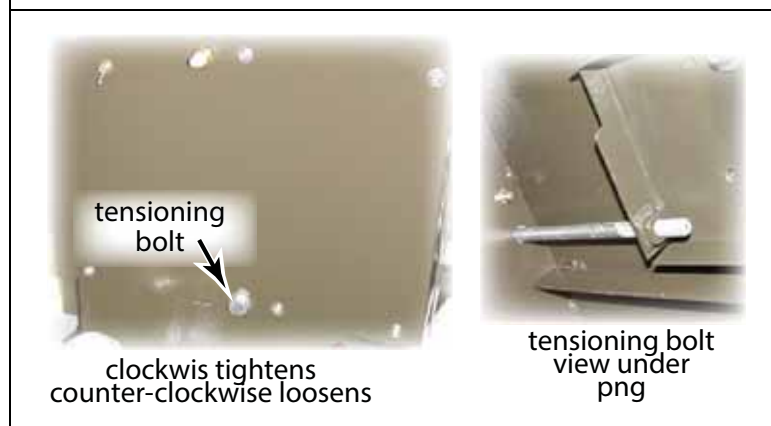
1. Slightly loosen but don't remove the 4 bolts (1) [2 on each side of motor] holding the electric motor onto the base plate.

Figure I-4 Electric Motor Adjustment



1. Adjust motor position, using the adjustment bolt on the motor side of the unit, until the V-belt tension is correct (2).

Figure I-5 Tensioning Drive Belt





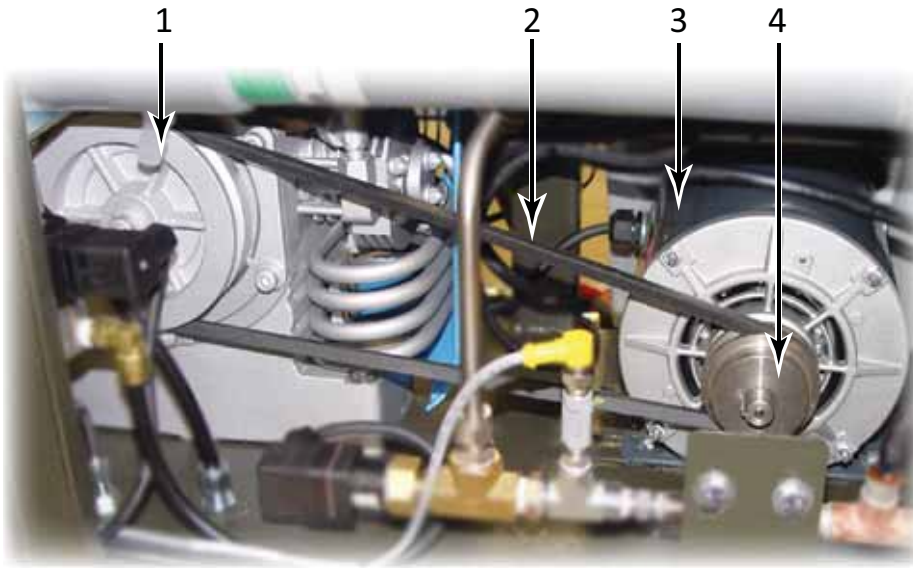
2. Tighten the electric motor mounting bolts.
3. Operate the unit for approximately five minutes. Stop the prime mover, check V-belt tension and readjust if necessary.
4. After the V-belt tension is correct and the prime mover mounting bolts are tight, check to verify that both pulleys are aligned. This is necessary to avoid excessive wear on the V-belt and pulleys.
5. Hold a straight edge against the compressor and prime mover pulleys as shown in Figure I-3. The straight edge must touch the pulleys at the four points indicated by the arrows. If it does not, adjust the prime mover position until it does.

I.1.5 Electric Motor Maintenance

The electric motors require no maintenance except for external cleaning.

I.1.6 Electric Drive Replacement Parts

Figure I-6 MG1100, Drive Assembly



Item	Qty	Part No.	Description	Notes
♦			MG1100 Drive	
1	1	1CØ201	High Pressure Compressor	<i>minus 1st stage</i>
2	1	1CØ335	V-belt	
3	1	1CØ336	Electric Motor	1.5 Hp
4	1	1CØ337	V-belt Sheave	

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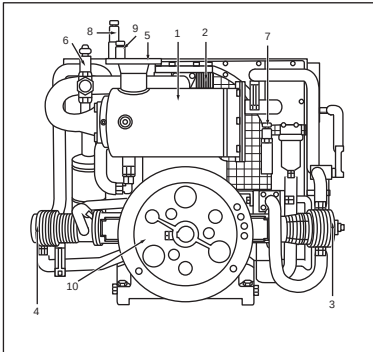
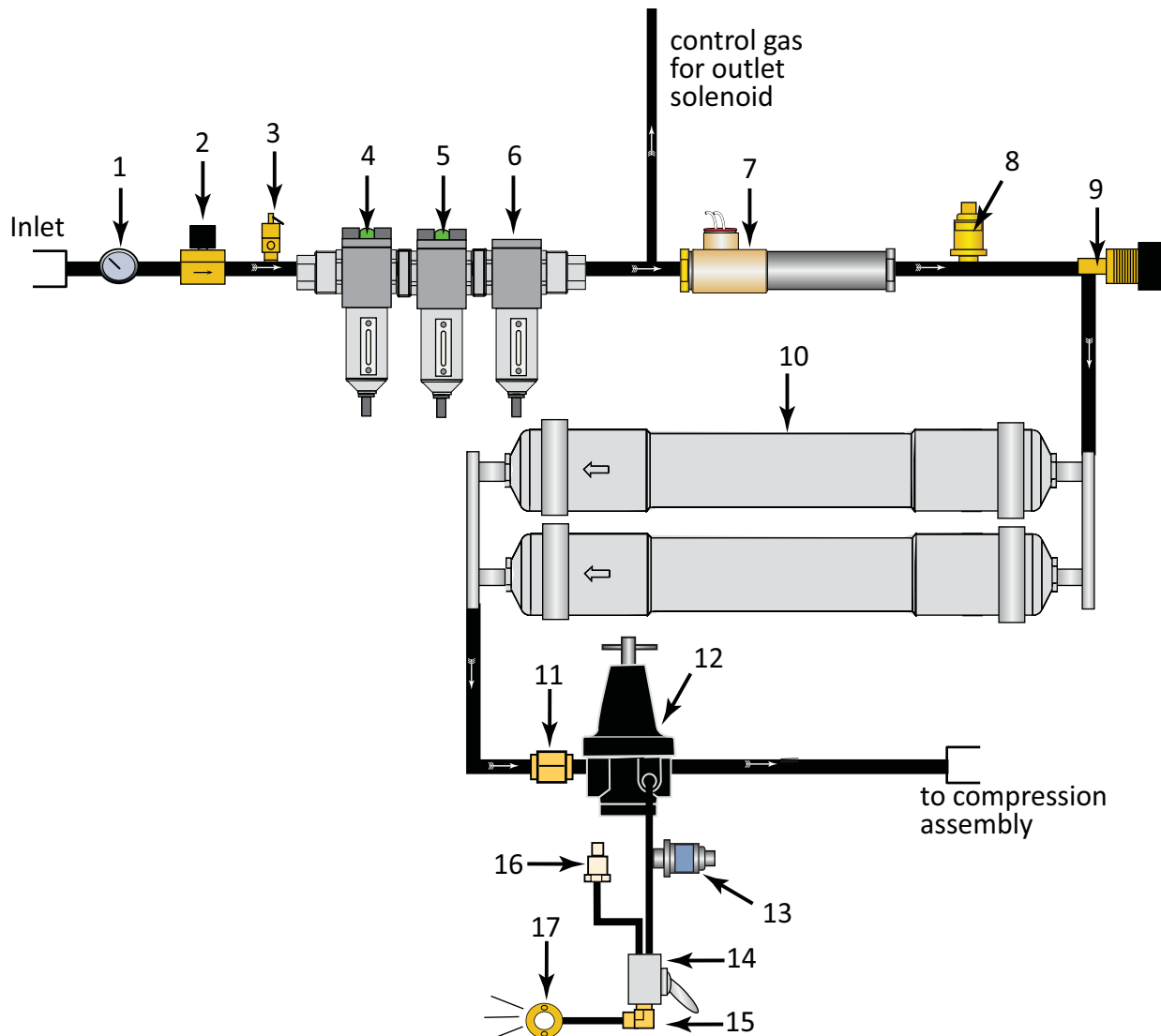
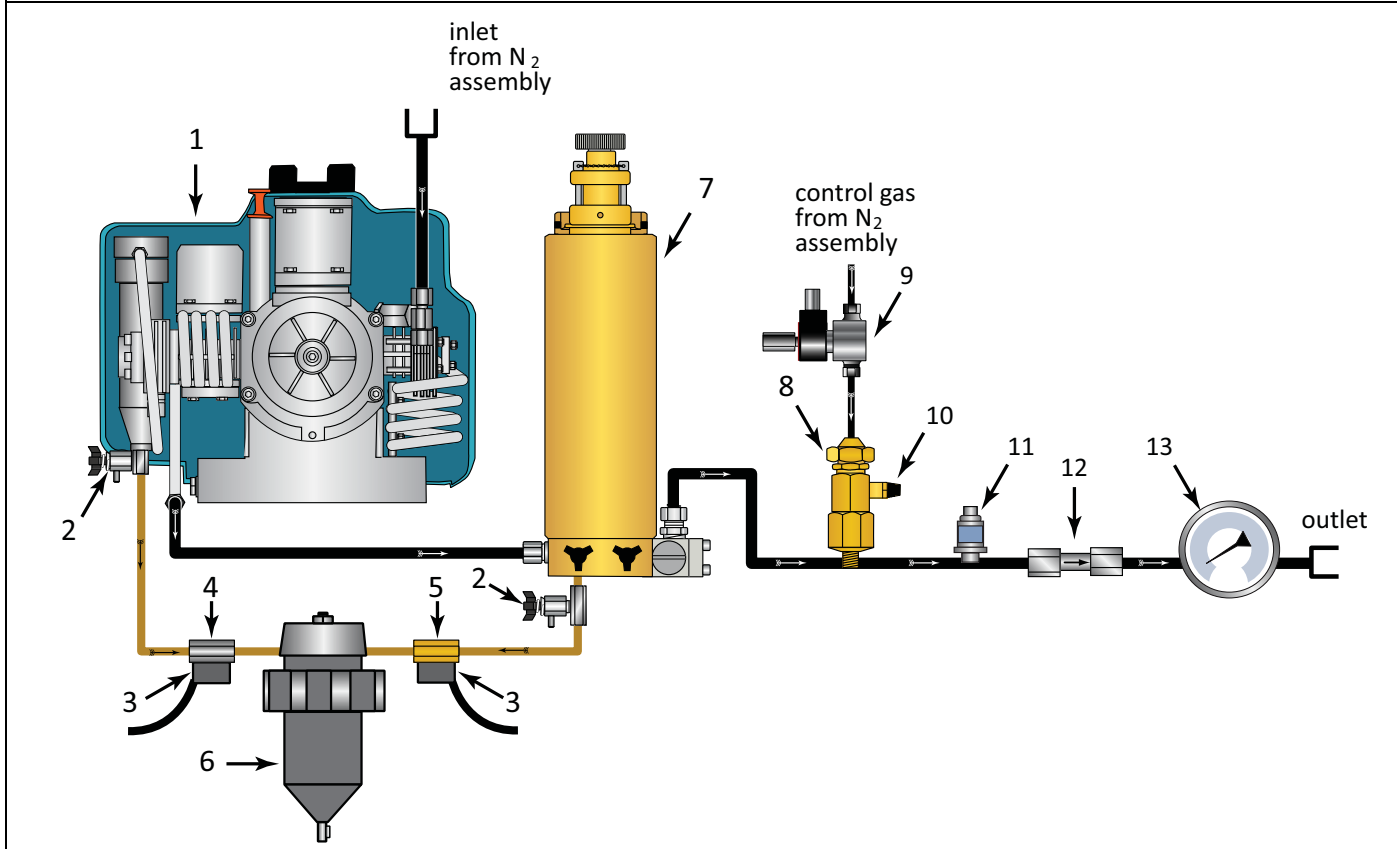


Figure I-7 N₂ Component Replacement Parts


Item	Qty	Part No.	Description	Notes
1	1	1CØ1Ø1	Inlet Pressure Gauge	0 - 200 psi
2	1	1CØ1Ø2	Isolation Solenoid	NC,
3	1	1CØ1Ø3	Safety Valve	165 psi
4	1	1CØ1Ø4	Filter, Coalescing	
with	1	1CØ1Ø5	Coalescing Filter Element	1 micron
5	1	1CØ1Ø6	Filter, Coalescing	
with	1	1CØ1Ø7	Coalescing Filter Element	0.01 micron
6	1	1CØ1Ø8	Filter, Coal Adsorb	
with	1	1CØ1Ø9	Adsorbing Filter Element	
7	1	1CØ11Ø	Heater, Inline	250 Watt, 120 Volt
8	1	1CØ111	Sensor, Temperature	4 - 20mA output

**Figure 1-7 (cont.)** N₂ Component Replacement Parts

Item	Qty	Part No.	Description	Notes
9	1	1CØ112	Temperature Switch	open @145 °; close @ 133 °F
10	2	1CØ113	Separators, Nitrogen Membrane	
11	1	1CØ128	Orifice	0.047"
12	1	1CØ114	Regulator	300 psi IN; 0-250 psi OUT
13	1	1CØ115	Pressure Sensor	0 - 150 psig; 0 - 10 V
14	1	1CØ129	RUN/CAL Switch	3-way, 2 position
15	1	1CØ13Ø	Orifice, ELL	0.004"
16	1	1CØ131	Connector, Calibration Gas	bulkhead
17	1	1CØ116	Oxygen Sensor	0 - 35%; 4 - 20 mA

Figure I-8 Compressor Components


Item	Qty	Part No.	Description	Notes
1	1	1CØ2Ø1	High Pressure Compressor	<i>minus 1st stage</i>
2	2	1CØ324	Manual Drain Valve	
3	2	1CØ325	Electric Coil	
4	1	1CØ326	Drain Solenoid	NC
5	1	1CØ327	Drain Solenoid	NC
6	1	1CØ328	Condensate Separator	
7	1	1CØ289	Purification Chamber	(See Volume G)
8	1	1CØ329	Pneumatic Valve	NC
9	1	1CØ33Ø	Solenoid, 3-way	NC
10	1	1CØ331	Muffler, Exhaust	
11	1	1CØ332	Pressure Sensor	0 - 8,700 psig; 0 - 10 V
12	1	1CØ333	Check Valve	one direction
13	1	1CØ334	Pressure Gauge	0 - 7,500 psig



VOLUME J: APPENDIX**J.1 Safety****J.1.1 General Safety Precautions**

- Read the operating manual before installing or operating this compressor unit. Follow appropriate handling, operation and maintenance procedures from the very beginning. The maintenance schedule contains measures required to keep this compressor unit in good condition. Maintenance is simple, but must be executed regularly to achieve safe operation, maximum efficiency and long service life.
- We recommend that all maintenance work be recorded in a service book, showing the date and details of the work carried out. This will help to avoid expensive repairs caused by missed maintenance work. If it is necessary to make a claim against the warranty, it will help to have proof that regular maintenance has been carried out and that the damage has not been caused by insufficient maintenance.
- This unit must be installed, operated, maintained and repaired only by authorized, trained and qualified personnel.
- Consult and follow all OSHA, NEMA, ASME and local regulations, laws and codes covering the installation and operation before operating the unit.
- Do not operate this unit in excess of its rated capacity, speed, pressure, temperature, or otherwise than in accordance with the instructions contained in this manual. Operation of this unit in excess of the conditions set forth in this manual will subject the unit to limits which it may not be designed to withstand.
- Keep safety guards in place.
- Do not modify the system.
- Provide adequate fire protection. Make sure fire extinguishers are accessible. Select alternate routes of escape and post such routes.
- Make sure you are equipped with all required safety equipment; hearing protection, safety glasses, hard hats, safety shoes and fire extinguisher.
- Visually inspect the unit before starting. Remove and /or replace any loose or broken components, tools, valves, missing equipment, etc.
- Do not tamper with, modify, or bypass safety and shutdown equipment.
- Do not tighten or adjust fitting or connections under pressure.
- The use of plastic pipe or rubber hose in place of steel tube or iron pipe, soldered joints or failure to insure system compatibility of flex joints and flexible hose can result in mechanical failure, property damage, and serious injury or death.
- The use of plastic or nonmetallic bowls on line filters without metal guards can be dangerous.
- Before doing any work involving maintenance or adjustment, be sure the electrical supply has been disconnected, and the complete system has been vented of all internal pressure. Failure to follow these warnings may result in an accident causing personal injury and/or property damage.



- Before working on the electrical system, be sure to disconnect the electrical supply from the system at the circuit breaker or other manual disconnect. Do not rely on the ON/OFF switch to disconnect the electrical supply.
- Installer must provide an earth ground and maintain proper clearance for all electrical components.
- All electrical installation must be in accordance with recognized national, state, and local electrical codes.
- Do not use gasoline, diesel fuel or other flammable products as a cleaning solution.
- The use of repair parts other than those listed in this manual may create unsafe conditions over which the Mandus Group has no control. Such unsafe conditions can lead to accidents that may be life-threatening, cause substantial bodily injury, and/or result in damage to the equipment. Therefore, the Mandus Group can bear no responsibility for equipment in which non-approved repair parts are installed

J.1.2 Safety Warning Labels

Notes, labels and warning signs are displayed on the compressor unit according to model, application or equipment and may include any of the following.

	HOT SURFACES DO NOT TOUCH! Danger of burning if cylinders, cylinder heads, or pressure lines of individual compressor stages are touched.
	HIGH VOLTAGE! Life threatening danger of electrical shock. Maintenance work on electric units or operating equipment should be carried out by a qualified electrician or by a person supervised by a qualified electrician according to electrical regulations.
	AUTOMATIC COMPRESSOR CONTROL UNIT MAY START WITHOUT WARNING! Before carrying out maintenance and repair work, switch off at the main switch and ensure the unit will not restart.
	THE INSTRUCTIONS MUST BE READ BEFORE OPERATING UNIT! The instruction manual and all other applicable instructions, regulations, etc. must be read and understood by the operating personnel before using the machine.
	HEARING PROTECTION MUST BE WORN! Hearing protectors must be worn when working on a machine which is running.
	DIRECTION OF ROTATION! When switching on the machine, check the arrow to ensure correct direction of rotation by the drive motor.

**J.2 Approved Lubricants Chart**

Unless otherwise specified in text, use the lubricants in Table 2.

Table J- 1: Lubricant Chart

Usage	Lubricants
O-rings, rubber and plastic parts; filter housing threads, sealing rings	Parker Super “O” Lube (1CØLUBE)
Bolts, nuts, studs, valve parts, copper gaskets and tube connection parts (threads, cap nut and compression rings)	Never-Seez NSWLT, Pipe Dope or teflon tape (1CØSEEZ)
Paper gaskets	1CØSEAL or equivalent silicon compound applied on both sides before assembly,
High temperature connections	1CØSEAL or equivalent temperature resistant compound,
Tube connection ferrules,	Never-Seez NSWLT (1CØSEEZ)

J.3 Abbreviations and Acronyms

†	Available Only as Part of a Complete Assembly
AC	Activated Charcoal, removes odor and taste
ACD	automatic condensate drain
ASME	American Society of Mechanical Engineers
CW	clockwise
CCW	counterclockwise
CGA	Compressed Gas Association
DIN	Deutsches Institut für Normung
DOT	Department of Transportation
E1	single phase electrical supply
E3	three phase electrical supply
HP	Chemical Catalyst, converts Carbon Monoxide to Carbon Dioxide
IAW	In Accordance With
MS	Molecular Sieve, removes moisture
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety & Health Administration
ODP	open drip-proof (motor)
OEM	Original Equipment Manufacturer
PCB	printed circuit board
PLC	Programable Logic Controller
PMV	pressure maintaining valve
SC	Securus® Moisture Sensing Device



