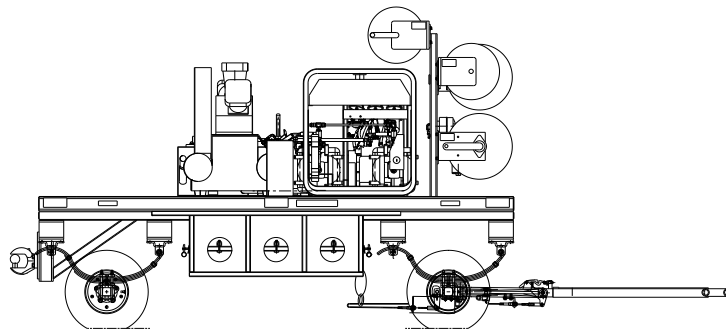




Operation & Service Manual



Model: 12-3117-9000 Multi-Purpose Cart

04/2015 - Rev. 04

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

REVISION	DATE	TEXT AFFECTED
01	01/2012	Original Release
02	04/2012	Modified Parts List
03	11/2013	Modified 4.6 Maintenance, 4.7 Trouble Shooting, Appendix IX
04	04/2015	Major revision

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This product can not be modified without the written approval of Tronair, Inc. Any modifications done without written approval voids all warranties and releases Tronair, Inc., its suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

The Tronair Multi-Purpose Cart services multiple aircraft systems including: electrical, air, nitrogen, hydraulic fluid and engine oil.

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit

1.3 MANUFACTURER

TRONAIR, Inc.
1740 Eber Road
Holland, Ohio 43528-9794 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.



WARNING! — Warning is used to indicate the presence of a hazard that **can cause severe personal injury, death, or substantial property damage** if the warning notice is ignored.

CAUTION! — Caution is used to indicate the presence of a hazard that **will or can cause minor personal injury or property damage** if the caution notice is ignored.

2.2 PERSONAL PROTECTION EQUIPMENT

- Safety glasses must be worn when operating the cart
- Additional equipment recommended by the fluid manufacturer (gloves, etc.). Reference Appendix Material Safety Data Sheet pertaining to fluid(s)

3.0 TRAINING

3.1 TRAINING REQUIREMENTS

The employer of the operator is responsible for providing a training program sufficient for the safe operation of the cart.

3.2 OPERATOR TRAINING

The operator training should provide the required training for safe operation of the cart.

NOTE: Maintenance and Trouble Shooting are to be performed by a skilled and trained technician.

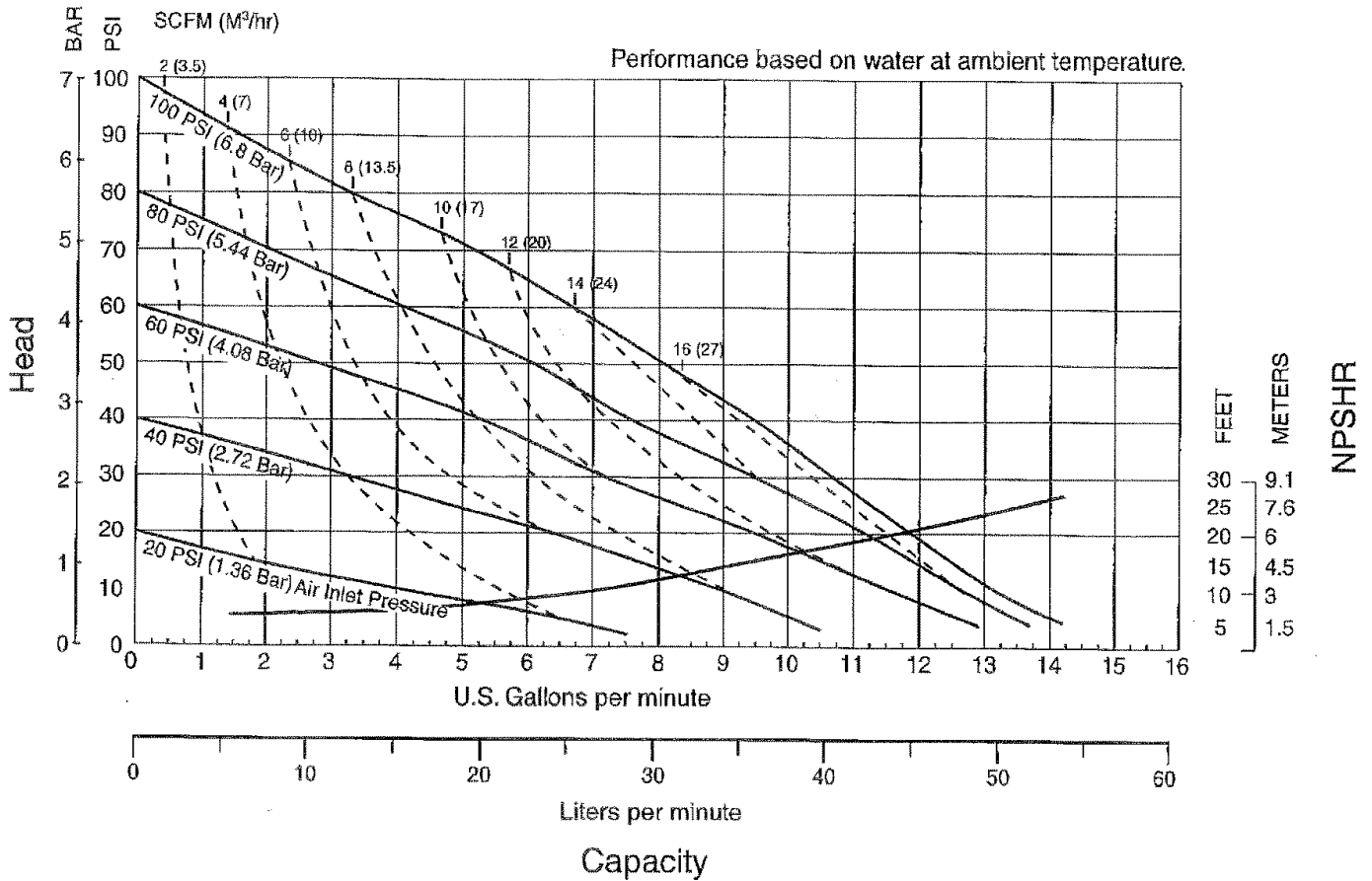
4.0 PUMP SPECIFICATIONS

Fluid: Skydrol/Mobil Oil Jet II

Maximum Air Supply Pressure: 100 psi (6.9 bar)

Pump Displacement: See Chart

Performance Curve



4.1 OPERATION

To Use the Pump:

1. Securely attach hose to reservoir
2. Open hand valve to fill aircraft

When Service Has Been Completed:

1. Turn hand valve to closed position
2. Disconnect hose from reservoir
3. Replace protective cap on hose end to prevent dirt ingestion.

5.0 FLUID SERVICE

The fluid service unit is a compact unit primarily designed to provide a source of clean fluid for filling reservoirs. It is not intended for performing any pressure testing tasks.

5.1 SPECIFICATIONS

Fluid: L-1009 Oil
Phosphate Ester, Type IV
Capacity: 10 gal (37.9 lt)
Maximum Pressure: 200 psi (13.8 bar)
Dimensions: 14.8 in (37.6 cm) Wide
14.9 in (37.8 cm) Long
10.4 in (26.4 cm) High
Pump Displacement: 4.4 cubic inch/stroke (72.11 cc/stroke)

5.2 FEATURES

- 60 ft (18.29 m) hose on reel for L-1009 Oil
- 50 ft (15.24 m) hose on reel for Phosphate Ester, Type IV
- Large filtered fill port
- Micron filter after pump

5.3 PREPARATION FOR USE

The unit is shipped fully assembled, and only the following steps are required to make it operational:

CAUTION!



Only use the type of fluid for which the unit is designed. Using other fluids will cause contamination and seal deterioration.

1. Remove the fill cap and fill reservoir.
2. Operate hand pump several times to fill line and purge air.

5.4 OPERATION

To Use the Unit:

1. Securely attach hose to aircraft.
2. Operate pump handle at a slow to moderate pace with even pressure.

NOTES:

1. *It is not necessary to operate pump rapidly. The pump moves a large volume of oil per stroke and will fill a reservoir much faster than standard pumps.*
2. *A slow movement of the pump handle with a steady pressure works best.*

When Service Has Been Completed:

1. Disconnect hose from aircraft.
2. Replace protective cap on hose end to prevent dirt ingestion.

6.0 NITROGEN BOOSTER



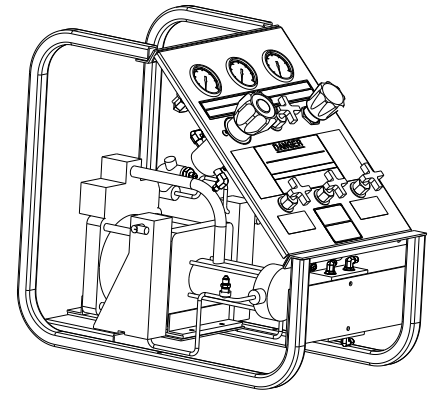
CAUTION!

It is **MANDATORY** that this instruction manual be read and understood by all persons operating this High Pressure Nitrogen Booster.

6.1 GENERAL DESCRIPTION

The system contains two regulators. The high pressure regulator is for regulating booster output pressure from 25 - 4000 psi (276 bar), and the low pressure regulator is for operating Nitrogen booster and servicing needs of 0 – 500 psi (34.5 bar).

The booster provides the capability of boosting remaining lower pressure Nitrogen from supply bottles to the required higher aircraft system pressure; up to 4000 psig maximum.



WARNING!



To Avoid Serious Injury, Loss of Limb, or Death:

1. **DO NOT** use High Pressure Regulator on Low Pressure aircraft components or systems such as tires, etc. This is a Regulated Nitrogen Source equal to supply pressure.
2. **DO NOT** use with Oxygen or gases other than Nitrogen.
3. **DO NOT** exceed 4000 psig (276 bar) Nitrogen pressure.

6.2 SPECIFICATIONS/FEATURES

Booster:

- Minimum supply bottle pressure: 250 psig (17 bar)
- Nitrogen input to booster pump: 80 SCFM at 150 psig (10.3 bar) maximum
- Booster high pressure air pilot: 4000 psig (276 bar)
- Booster high pressure relief 4400 psig (303.4 bar)

Low Pressure Regulator:

- 0-500 psi (34.5 bar) output

6.3 SAFETY INSTRUCTIONS

CAUTION!



It is mandatory that this instruction manual be read and understood by all persons operating this High Pressure Nitrogen Booster.

6.3.1 General

Information presented in this manual and on various labels, tags, and plates on the unit pertains to equipment design, installation, operation, maintenance and troubleshooting which should be read, understood, and followed for the safe and effective use of this equipment.

6.3.2 Safety

The operation, maintenance, and trouble shooting of this high pressure Nitrogen booster requires practices and procedures which ensure personal operator safety and the safety of others. Therefore, this equipment is to be operated and maintained only by qualified persons in accordance with this manual and all applicable local codes.

CAUTION!



Nitrogen equipment must be kept clean and free from contaminants at all times. It is imperative that all inspection, maintenance, testing and servicing of Nitrogen system components be done by trained and qualified personnel using approved procedures.

6.4 PREPARATION FOR USE/ASSEMBLY INSTRUCTION

CAUTION!



Only use bottles for which this unit was designed: 3000 psig (207 bars) maximum pressure with CGA 580 connection.

1. Place bottles in cart, slide bottles forward against front stop.
2. Slide bottle stop securely against the back of the bottles.
3. Install CGA fittings onto bottles.

6.0 Nitrogen booster continued on following page.

6.0 NITROGEN BOOSTER (continued)
6.5 OPERATION OF NITROGEN BOOSTER**WARNING!****To Avoid Serious Injury, Loss of Limb, or Death:**

1. **DO NOT use high pressure Nitrogen on aircraft components designed for low pressure Nitrogen.**
2. **DO NOT use with oxygen or gas other than Nitrogen.**
3. **DO NOT exceed 3000 psi (207 bar) inlet pressure.**
4. **Servicing and maintenance of Nitrogen systems shall be done by only trained and qualified personnel using approved procedures.**

General: Information presented in this manual and on various labels on this unit pertains to equipment Specifications, Installation, Operation, Maintenance and Trouble Shooting which should be read, understood and followed for the safe and effective use of this equipment.

Training: Read this entire manual prior to operation of the unit. All personnel using this Nitrogen Booster should understand and follow this manual and receive training. We encourage our customers to call Tronair to discuss any operating or testing requirements. Phone 419-866-6301 or 800-426-6301.

6.5.1 General Safety Requirements

Pressures: Gasses under pressure are a potential hazard in the form of stored energy. Accidents can occur when this energy is improperly handled. Be sure that all equipment used is compatible and designed to control the pressures encountered.

Nitrogen: Nitrogen is chemically stable, nonflammable, and does not support combustion.

Handling: Nitrogen handling must be done with care. The rapid expansion of Nitrogen gas from a high pressure source to an area of low pressure, can produce cryogenic temperatures which cause severe burns.

6.5.2 Bottle Connection Instructions

1. Rotate the Nitrogen supply bottles so that the hoses may be easily connected to the bottles. Make sure the hoses are not kinked or damaged.
2. Check that Nitrogen supply bottle shut off valve is closed. Recheck all fittings for tightness.
3. Clean out Nitrogen supply gas bottle valve outlet on one bottle and install Nitrogen booster inlet brass fitting and hose. Stop and inspect any indication of cross-threading or galling. Repeat for the remaining bottles.

6.5.3 To Read Individual Bottle Pressure

1. Open a bottle shutoff valve.
2. Read pressure on bottle pressure gauge.
3. Close bottle shutoff valve.
4. Open manifold bleed valve to relieve pressure.
5. Close manifold to bleed valve.
6. Repeat procedure for other bottles.

6.5.4 Efficient Use Of System

Maximum pressure may be removed from supply bottles if aircraft are serviced from the lowest pressure bottle first. In this manner, the most Nitrogen may be removed from each bottle. Even bottles with relatively low pressures may be used to service aircraft if the aircraft has a depleted system.

6.5.5 Nitrogen System Connection**WARNING!**

If there are any differences between the following instructions and the aircraft maintenance manual, the aircraft maintenance manual will take precedence.

Reference Illustrated Parts Lists for replacement components.

1. Be sure all needle valves are in the closed (clockwise) position.
2. Decrease all pressure regulators to the minimum pressure setting. The regulator adjustment knobs are the rotating type. Clockwise rotation of the knob increases pressure and counter-clockwise rotation reduces pressure.
3. Connect Nitrogen fill line loosely to aircraft and purge line by slowly cracking open Nitrogen supply bottle shutoff valve.
4. Tighten Nitrogen fill line connection at aircraft.
5. Generally check unit and assure the tightness of all fittings, nuts and bolts.
6. The high pressure Nitrogen booster is now ready to charge an aircraft Nitrogen system.

WARNING!

Be sure fill line is secured prior to purging the unit. This will prevent the hose end from “whipping” if too much Nitrogen is allowed to flow through the unit.

- 6.5 OPERATION OF NITROGEN BOOSTER *(continued)*
- 6.5.6 Charging Aircraft Nitrogen System (High Pressure)

Note: If the Nitrogen supply bottle pressure is lower than the aircraft Nitrogen system pressure, check valves in the Nitrogen booster will prevent back flow from the aircraft.



WARNING!
DO NOT use on low pressure Nitrogen system or components.

1. Connect the “RED” high pressure output hose from the booster to the aircraft.
2. Fully open Nitrogen supply bottles valve (250 min on bottle pressure gauges).
3. Slowly adjust low-pressure regulator valve to 140 psi (9.7 bar) max to send Nitrogen to the Nitrogen booster. Clockwise rotation increases pressure, and counter-clockwise rotation reduces pressure. Since the Nitrogen booster pump compression ratio is 30:1, 135 psi (9.3 bar) of low pressure regulator inlet will develop approximately 4000 psi (276 bar) of output Nitrogen pressure.
4. Open booster pump supply valve.
5. With output valve closed, adjust the high pressure regulator to obtain desired output Nitrogen pressure required by the chart.
6. Open booster output valve.

6.5.7 Disconnecting Nitrogen Booster From Aircraft

1. **Slowly** close Nitrogen supply bottle shut off valve and booster output valve. This will stop inlet Nitrogen flow.
2. Decrease the manifold low pressure regulator to minimum pressure setting.
3. **Slowly** open, manifold bleed valve, and disconnect aircraft Nitrogen fill line from aircraft.
4. Cap aircraft Nitrogen fill line to prevent contamination.
5. Close all needle valves and decrease pressure regulators.

6.5.8 Aircraft Nitrogen System (Low Pressure)

1. Ensure that all needle valves are in the closed (clockwise) position.
2. Ensure that all pressure regulators are decreased to minimum pressure settings (counterclockwise).
3. Connect the “BLUE” low pressure output hose to the low pressure application.
4. **Fully** open the Nitrogen supply bottle valve.
5. Slowly increase the low pressure regulator to obtain desired low pressure output. (Clockwise rotation increases pressure).
6. Open Low pressure output valve.

6.5.9 Disconnect Low Pressure

1. **Slowly** close Nitrogen supply bottle shut-off valve.
2. Decrease low pressure regulator to minimum pressure setting after completing low pressure charge. (Counter-clockwise rotation decreases pressure).
3. **Slowly** open, manifold bleed valve, and disconnect aircraft Nitrogen fill line from aircraft.
4. Cap aircraft Nitrogen fill line to prevent contamination.
5. Close all needle valves and decrease pressure regulators.

7.0 PACKAGING AND STORAGE

7.1 PACKAGING REQUIREMENTS

Store the unit in a clean, dry area when not in use.

Ensure that all hoses are capped. The unit should be covered for the duration of unit storage to ensure Nitrogen system cleanliness for future aircraft system recharging.

8.0 TROUBLE SHOOTING

Reference Appendix IX Hydraulic International Installation and Maintenance Manual

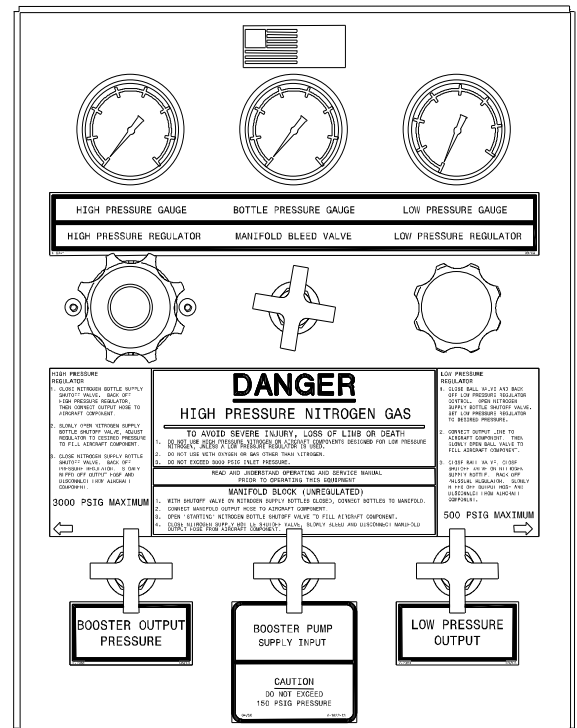


FIGURE 8 - Instrument Panel

9.0 MAINTENANCE

1. Maintain 45 to 50 psi (3.1 to 3.4 bar) tire pressure.
2. Grease wheel bearings quarterly.
3. All maintenance performed on this high pressure Nitrogen booster shall be conducted in accordance with all applicable codes governing the handling, operation, installation and trouble shooting for high pressure Nitrogen operation. Maintenance is to only be done by qualified persons.
4. See Operating & Maintenance Instructions.
5. The gauges on this unit should be inspected and calibrated annually to maintain and ensure accuracy.
6. Manifold inlet hoses should be inspected weekly for signs of cracking or kinking, replace as necessary.
7. Inspect Nitrogen output hoses prior to each use for signs of cracking or kinking, replace as necessary.
8. Generally keep the entire unit clean and free from any contaminants. Visually inspect for any system leaks or damage. Correction of any problems prior to unit operation is imperative for safe operation.



WARNING!

Never apply high pressure gas to the high pressure section of this booster whenever the air driven section of this unit is disassembled or when maintenance is being performed on unit.

10.0 PROVISION OF SPARES

10.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

TRONAIR, Inc.

1740 Eber Road

Holland, Ohio 43528-9794 USA

Telephone: (419) 866-6301 or 800-426-6301

Fax: (419) 867-0634

E-mail: sales@tronair.com

Website: www.tronair.com

10.2 RECOMMENDED SPARE PARTS LISTS

Reference the following page(s) for Replacement Parts and Kits available.

11.0 IN SERVICE SUPPORT

Contact Tronair, Inc. for technical services and information. See Section 1.3 – Manufacturer.

12.0 GAURANTEES/LIMITATION OF LIABILITY

Tronair products are warranted to be free of manufacturing or material defects for a period of one year after shipment to the original customer. This is solely limited to the repair or replacement of defective components. This warranty does not cover the following items:

- a) Parts required for normal maintenance
- b) Parts covered by a component manufacturers warranty
- c) Replacement parts have a 90-day warranty from date of shipment

If you have a problem that may require service, contact Tronair immediately. Do not attempt to repair or disassemble a product without first contacting Tronair, any action may affect warranty coverage. When you contact Tronair be prepared to provide the following information:

- a) Product Model Number
- b) Product Serial Number
- c) Description of the problem

If warranty coverage is approved, either replacement parts will be sent or the product will have to be returned to Tronair for repairs. If the product is to be returned, a Return Material Authorization (RMA) number will be issued for reference purposes on any shipping documents. Failure to obtain a RMA in advance of returning an item will result in a service fee. A decision on the extent of warranty coverage on returned products is reserved pending inspection at Tronair. Any shipments to Tronair must be shipped freight prepaid. Freight costs on shipments to customers will be paid by Tronair on any warranty claims only. Any unauthorized modification of the Tronair products or use of the Tronair products in violation of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied.

The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied and Tronair disclaims any and all liability for injury (WITHOUT LIMITATION and including DEATH), loss or damage arising from or relating to such misuse.**

13.0 APPENDICES

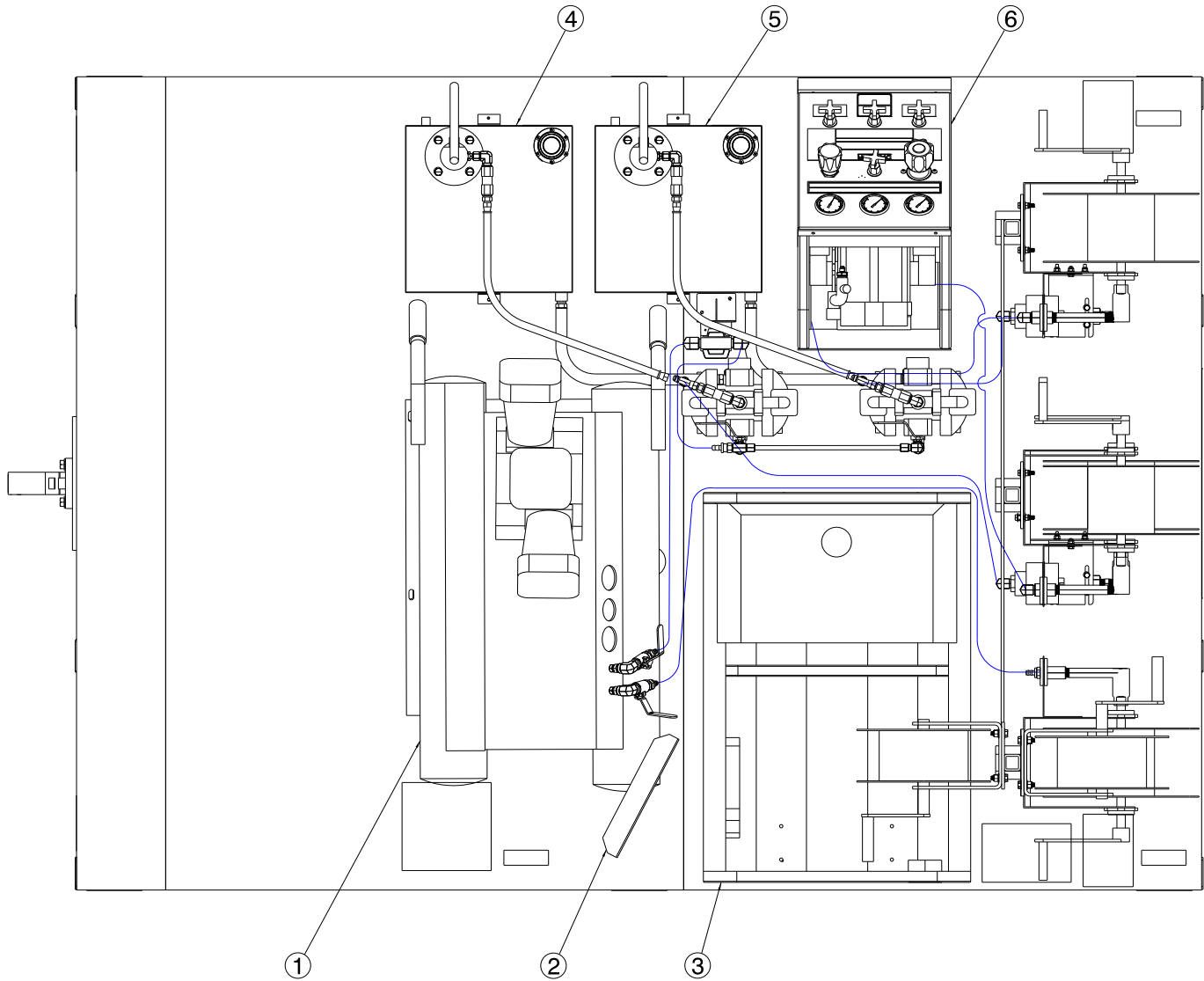
APPENDIX I	Declaration of Conformity
APPENDIX II	Instrument Certification Notice
APPENDIX III	Coxreels Series 112Y
APPENDIX IV	Hannay Reels
APPENDIX V	Smith Installation & Operator's Guide
APPENDIX VI	Lincoln Pump Service & Operating Manual
APPENDIX VII	Nitrogen Booster – Hydraulic International, Operation and Maintenance Instructions

Additional Documents:

Compressor	Industrial Air Compressor
Generator	Gillette Owner's Manual, Gillette Service Manual, Honda Owner's Manual

Parts List

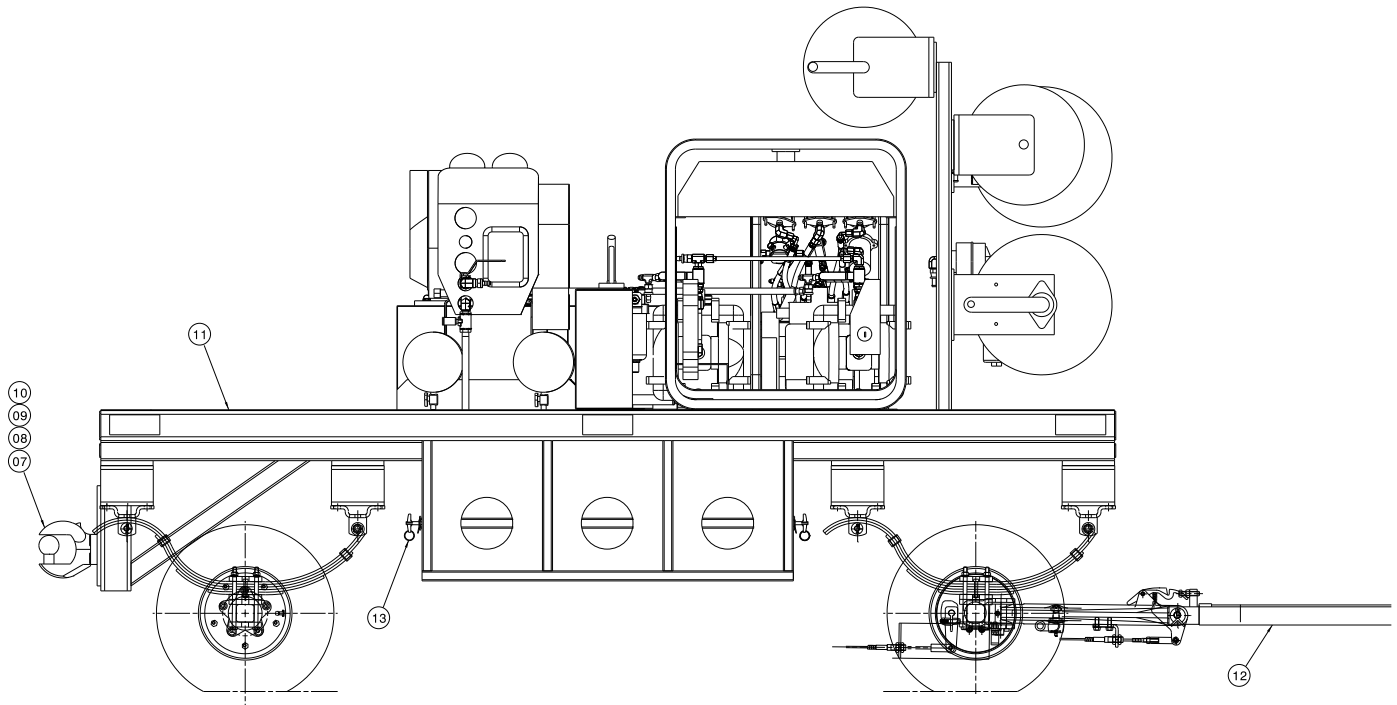
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	Z-7740	Assembly, Air Compressor	1
	EC-2854	Replacement Battery	1
2	S-2515	Shield, Exhaust	1
3	H-2917	Set, 12.5 KW Gas MTR Generator	1
	EC-1971	Replacement Battery	1
4	Z-7662-03	Reservoir, Fluid (MIL-PRF-23699)	1
5	Z-7662-02	Reservoir, Fluid (Phosphate Ester – Skydrol, Hyjet)	1
6	Z-7676	Assembly, Nitro Service w/Booster	1
	K-4724	Kit, Replacement Spark Plugs (2 plugs); consists of:	
		Replacement Foam Air Filter	
		Replacement Paper Air Filter	1
		Replacement Oil Filter	1

Parts List

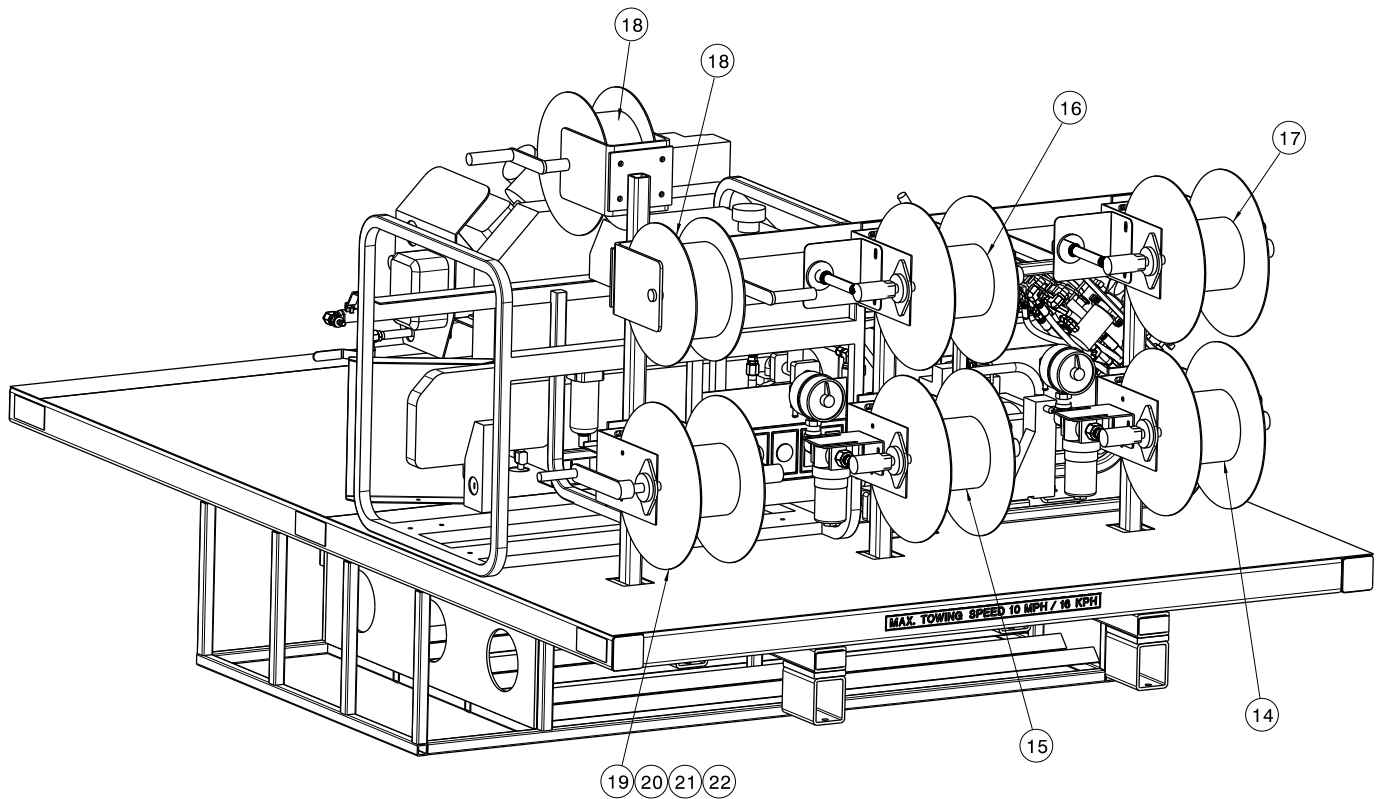
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
7	JP-241	Combo Pintle Hitch	1
8	G-1420-109020	Bolt, ½ - 13 Hex Head GR 8	4
9	G-1202-1090	Stopnut, ½ - 13 Elastic	4
10	G-1503-1090N	Flatwasher, ½ Narrow SS	4
11	Z-7646-01	Weldment, Frame	1
12	H-2693	Trailer, C Frame	1
13	Z-7732	Assembly, Bar	1

Parts List

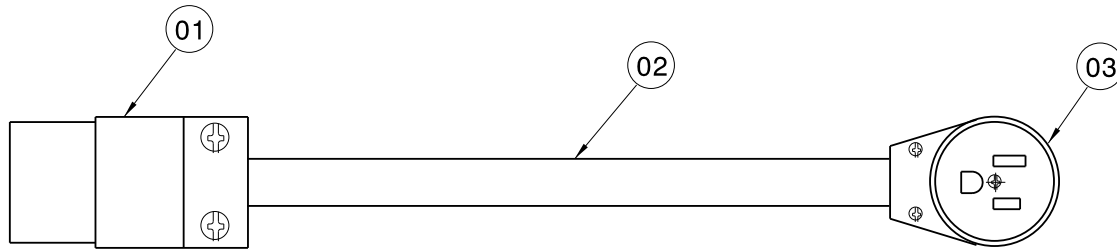
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
14	Z-7733-02	Assembly, Reel Hose Fluid (Phosphate Ester – Skydrol, Hyjet)	1
15	Z-7733-03	Assembly, Reel Hose Fluid (MIL-PRF-23699)	1
16	Z-7732-01	Reel, High Pressure Nitrogen	1
17	Z-7732-02	Reel, Low Pressure Nitrogen	1
18	H-3445	Reel, Cable Storage	2
	H-3460	Replacement Cord, 100 ft. extension	1
19	H-3442	Reel, Hose	1
20	N-2243-04-35	Nipple, Pipe	1
21	N-2204-10-SS	Connector, Pipe	1
22	N-2800-05-B	Fitting, Male Pipe	1

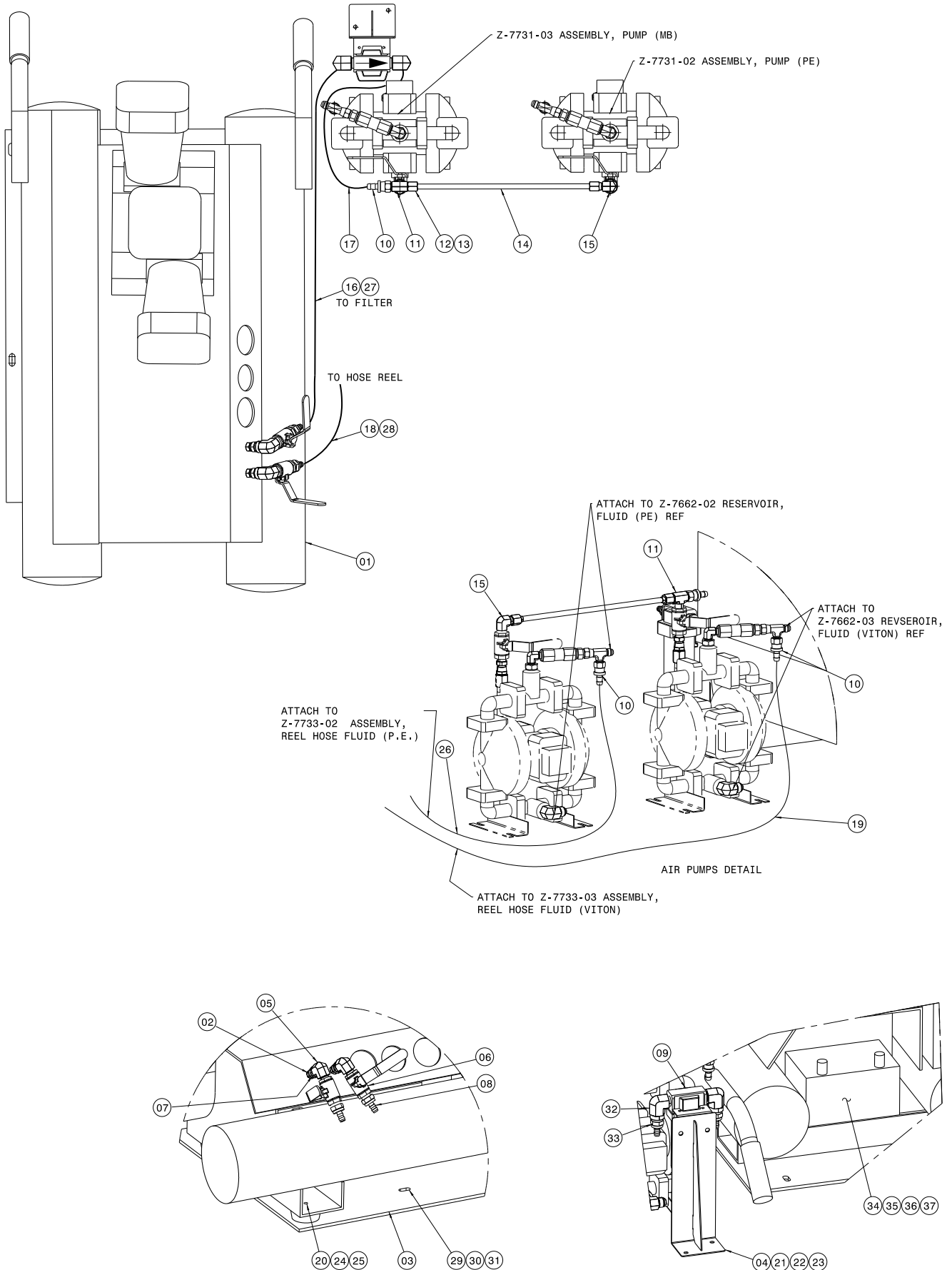
Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
	Z-7735-01	Assembly, Electrical Cord, 7 ft.; <i>consists of:</i>	
1	EC-1765	Connector, Female Plug ODY	1
2	EC-1170-02-84.0	Cable, Electrical, 7 ft	1
3	EC-2382	Plug, Male 90° 120V AC 15 AMP	1
	Z-7735-02	Assembly, Electrical Cord, 6 ft.; <i>consists of:</i>	
1	EC-1765	Connector, Female Plug ODY	1
2	EC-1170-02-72.0	Cable, Electrical, 6 ft	1
3	EC-2382	Plug, Male 90° 120V AC 15 AMP	1

Parts List – Air Compressor



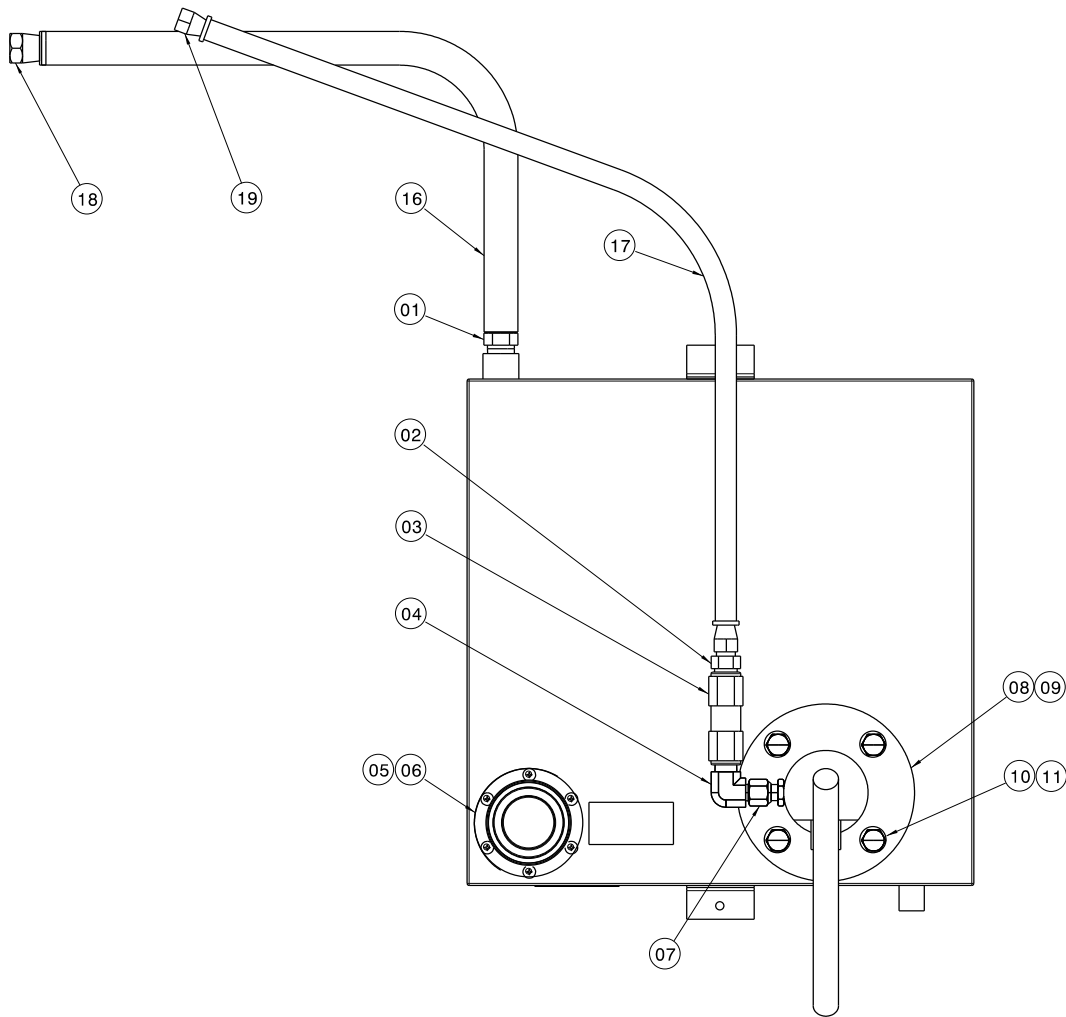
Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	H-3822	Compressor, Air	1
2	N-2203-04-B	Nipple, Pipe	2
3	J-5912-01	Plate, Compressor Mount	1
4	Z-7728-01	Weldment, Bracket Filter	1
5	N-2200-06-SS	Elbow, Street	2
6	HC-1425-02	Valve, Ball	2
7	N-2210-05-B	Fitting, Male Pipe	2
8	N-2800-05-B	Fitting, Male Pipe	2
9	PC-1032	Filter	1
	PC-1145	Replacement Filter	1
10	N-2026-03-B	Swivel, JIC 37°	3
11	N-2018-10-SS	Tee, Male Branch	1
12	N-2000-05-SS	Nut, #4 JIC x 37°	2
13	N-2019-05-SS	Sleeve, 3/8 Tube	2
14	TR375-05-14.5	TBG, SST .38 OD - .049 W	1
15	N-2005-10-SS	Elbow, Male #6 JIC x 3/8	1
16	TF-1047-04*30.0	Hose Push-On 3/8 ID	1
17	TF-1047-04*20.0	Hose Push-On 3/8 ID	1
18	TF-1047-04*96.0	Hose Push-On 3/8 ID	1
19	TF-1047-04*72.0	Hose Push-On 3/8 ID	1
20	G-1112-106022	Bolt, 5/16 – 18 x 2 1/4 SS	4
21	G-1112-105010	Bolt, 1/4 - 20 x 1 Hex Head SS	4
22	G-1439-1050-S	Nutsert, 1/4 - 20 Open End	2
23	G-1503-1050N	Flatwasher, 1/4 Narrow SS	6
24	G-1503-1060N	Flatwasher, 5/16 SS	8
25	G-1501-1060	ESN, 5/16 – 18 SS	4
26	TF-1030-02*24.0	Hose, Push- Lok (#6 PE)	1
27	H-3484-01	Tag, Identification (to Pump)	1
28	H-3484-02	Tag, Identification (to Reel)	1
29	G-1112-107010	Bolt, 3/8 - 16 x 1 Long SS	4
30	G-1503-1070N	Flatwasher, 3/8 Narrow SS	8
31	G-1501-1070	ESN, 3/8 - 16 SS	4
32	N-2200-10-B	Elbow, Street	2
33	N-2800-07-B	Fitting, Male Pipe	2
34	EC-2854	Battery, 12V	1
35	H-1052-01	Strap, Tarp	1
36	EC-1185-08	Cable, Welding #6	60
37	EC-1034-02	Terminal, Ring	4

Parts List - Reservoir

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
	Z-7662	Reservoir; consists of:	
1	N-2800-08-B	Fitting, Male Pipe, ½ NPT x ½ Hose	1
2	N-2009-10-SS	Connector, Male, 6-6	1
3	HC-1731-03-005	Valve, In-Line Check	1
4	N-2005-10-SS	Elbow, Male, 6-6	1
5	HC-1030	Filler, Breather	1
6	G-1157-103506	Screw, 10-32 Pan Head CRS REC	6
10	G-1463-1070	Nut, Acorn ¾- 16	4
11	G-1250-1070N	Flatwasher, ¼ Narrow	4
18	N-2026-05-B	Swivel, 08 Tube x ½ Hose	1
19	N-2026-03-B	Swivel, 08 Tube x ¾ Hose	1

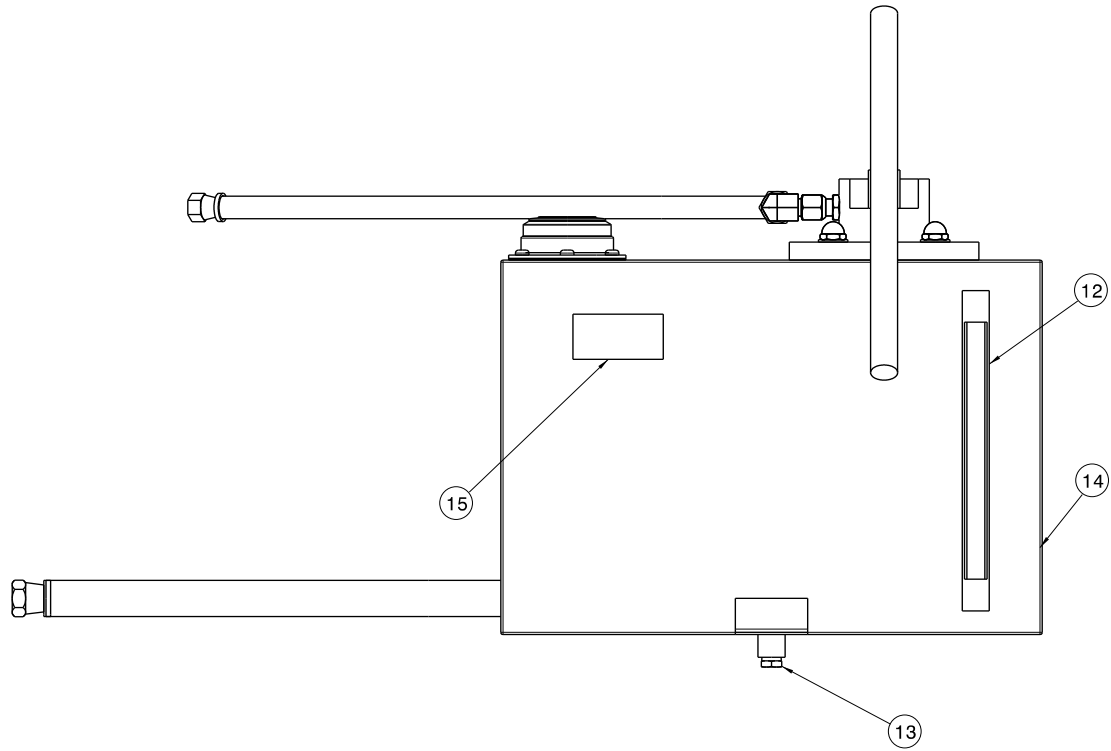
Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Fluid - Phosphate Ester – Skydrol, Hyjet			
7	N-2036-03-S-E	Swivel, 6-6	1
8	HC-2157	Pump, Hand	1
9	HC-2006-334	O-Ring, Series 2	1
16	TF-1030-03-20.0	Hose, Push-On ½ ID	1
17	TF-1030-02-20.0	Hose, Push-On ⅜ ID	1
Fluid - MIL-PRF-5606/MIL-PRF-83282			
7	N-2036-03-S-V	Swivel, 6-6	1
8	HC-2171	Pump, Hand	1
9	HC-2007-334	O-Ring, Series 2	1
16	TF-1047-05-20.0	Hose, Push-On ½ ID	1
17	TF-1047-04*20.0	Hose, Push-On ⅜ ID	1

Parts List - Reservoir

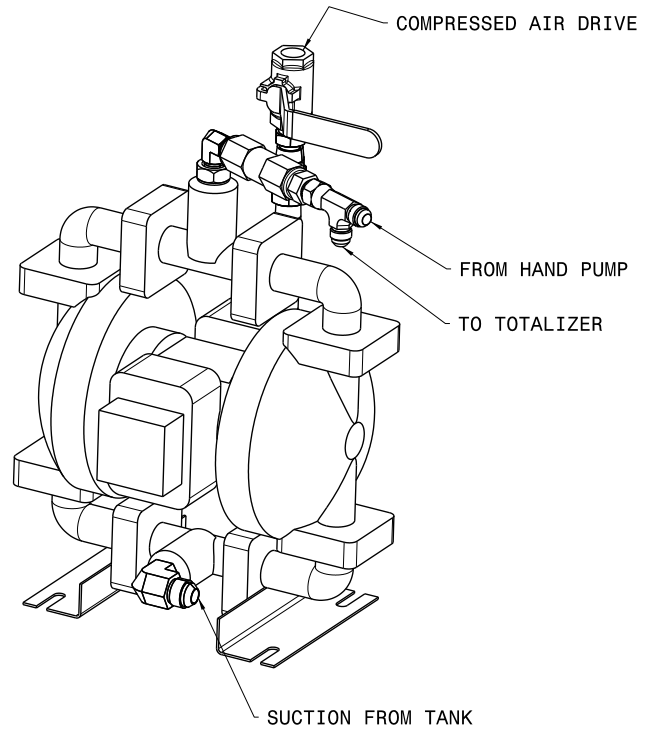
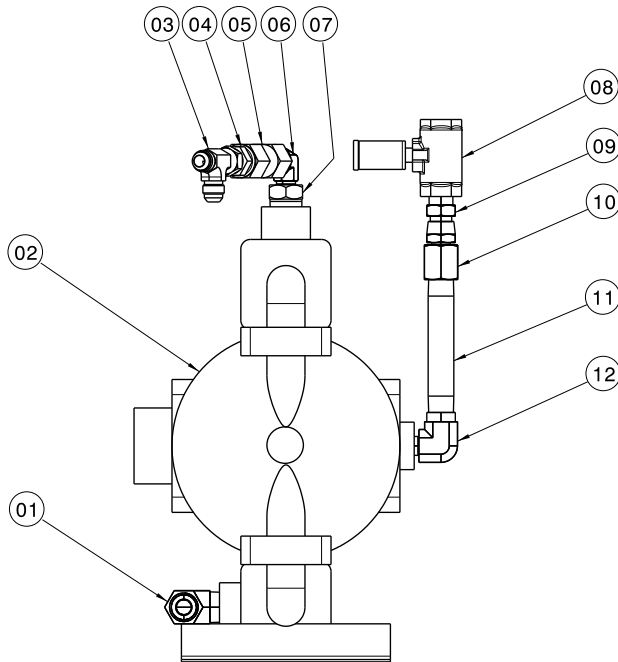
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
	Z-7662	Reservoir; consists of:	
12	HC-1382-08	Gauge, Sight	1
13	N-2206-03-SS	Plug, Pipe, ¼ NPT	1
14	Z-7660	Weldment, Reservoir	1
Fluid - Phosphate Ester – Skydrol, Hyjet			
15	V-1977	Label, Fluid	2
Fluid - MIL-PRF-23699			
15	V-2387	Label, Fluid	2

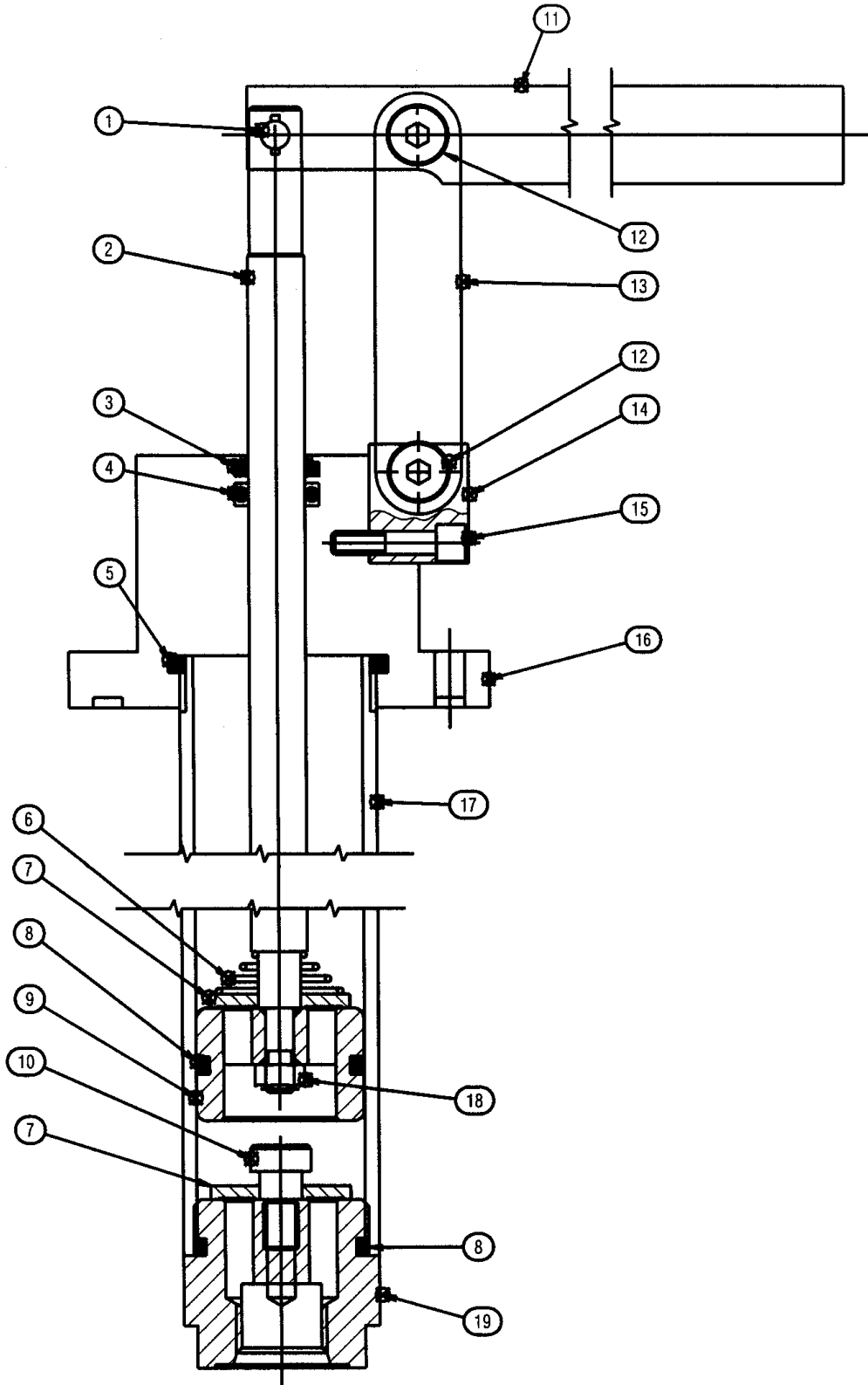
Parts List - Pump

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
	Z-7731	Assembly, Pump; consists of:	
1	N-2005-14-SS	Elbow, Male, 08 Tube x ½ NPT	1
3	N-2016-05-SS	Tee, Run Swivel Nut	1
4	N-2209-10-SS	Connector, Male, 06 Tube x ⅜ NPT	1
5	HC-1731-03-005	Valve, Check In-Line	1
6	N-2001-07-SS	Elbow, Male Pipe, ⅜ NPT	1
7	N-2210-09-B	Reducer, Pipe, ½ x ⅜ NPT	1
8	HC-1425-02	Valve, Ball	1
9	N-2030-04-SS	Swivel, 06 Tube x ⅜ NPT	1
10	N-2010-07-SS	Connector, Female	1
11	N-2243-02-32	Nipple, Pipe	1
12	N-2200-03-SS	Elbow, Street, ¼ NPT	1
Fluid - Phosphate Ester – Skydrol, Hyjet			
2	H-2661	Pump, Pneumatic	1
Fluid - MIL-PRF-23699			
2	H-2660	Pump, Pneumatic	1

Parts List - Hand Pump



Parts List - Hand Pump

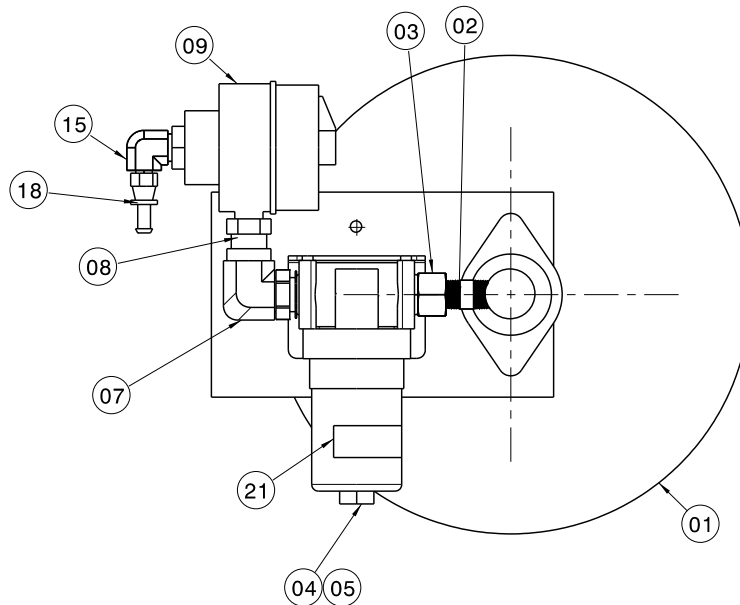
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
2	CXD-020004-004	Piston Rod	1
6	CENT-TA-2098	Spring	1
7	CXD-020004-006	Flapper	2
9	CXD-020004-005	Piston	1
13	512-000	Strap	2
14	CXD-020004-009	Mounting Block	1
15	09-ADDF-OJ-32 x 14	Socket Head Cap Screw	1
16	CXD-020004-002	Cap & Mounting Flange	1
17	CXD-020004-003	Tube	1
18	08-ADFH-04-28	Prevailing Locknut	1
19	CXD-020004-001	End Cap, Blind End	1
	HK-3717	Kit, Handle Replacement; consists of:	
1		Pin Linkage Assembly	1
11		Pump Handle	1
12		Pin Linkage Assembly	2

Item	Part Number	Description	Qty
HC-2157			
Fluid - Phosphate Ester – Skydrol, Hyjet			
	HK-3683	Kit, Pump Seal Replacement; consists of:	
3		Wiper, EPR	1
4		O-ring, EPR	1
5		O-ring, EPR	1
8		O-ring, EPR	2
HC-2171			
Fluid - MIL-PRF-23699			
	HK-3715	Kit, Pump Seal Replacement; consists of:	
3		Wiper, Viton	1
4		O-ring, Viton	1
5		O-ring, Viton	1
8		O-ring, Viton	2

Parts List – Reel Hose

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

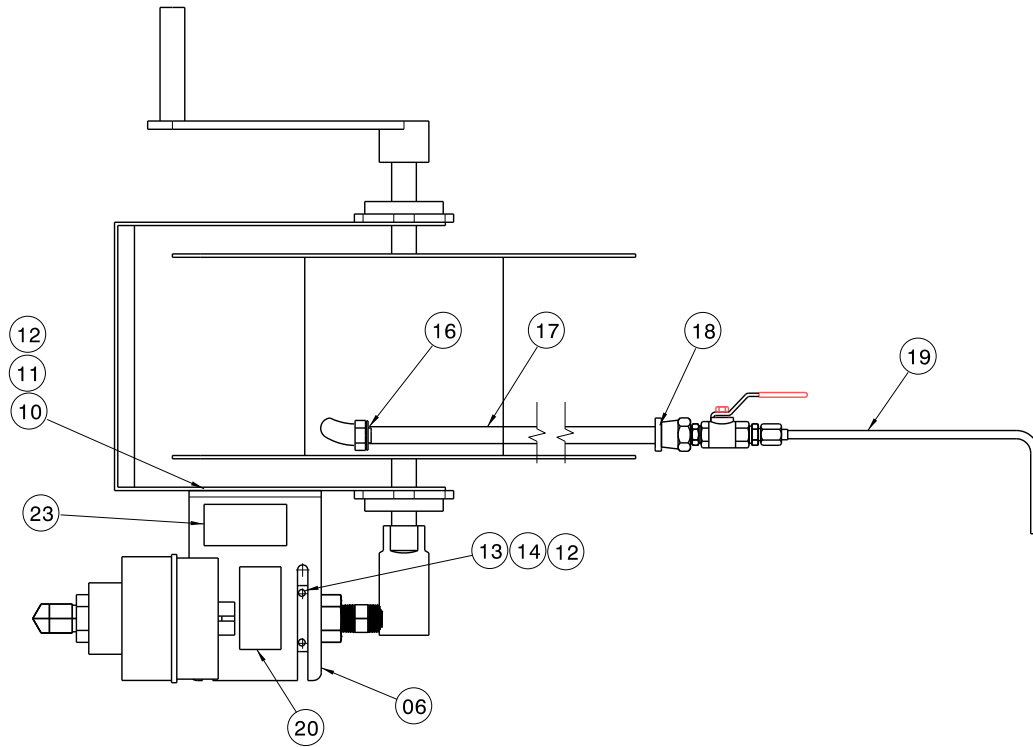


Item	Part Number	Description	Qty
	Z-7733	Assembly, Reel Hose Fluid; consists of:	
2	N-2243-04-28	Nipple, Pipe	1
8	N-2203-10-SS	Nipple, Pipe	1
15	N-2005-11-SS	Elbow, Male	1
18	N-2026-03-B	Swive, JIC 37°	1
Fluid - Phosphate Ester – Skydrol, Hyjet			
1	H-3441	Reel, Hose	1
3	N-2202-09-SS-E	Adapter, #12 SAE x ½ NPT	1
4	HC-1483	Filter	1
	K-3099	Kit, Filter Element	1
7	N-2228-06-SS-E	Elbow, 90° Female	1
9	HC-1681	Meter, Totalizer	1
21	V-1762	Label, Kit Filter Element	1
Not Shown	HC-2006-142	O-Ring, Series 2	1
Fluid - MIL-PRF-23699			
1	H-3442	Reel, Hose	1
3	N-2202-09-SS-V	Adapter, #12 SAE x ½ NPT	1
4	HC-1482	Filter	1
	K-3098	Kit, Filter Element	1
7	N-2228-06-SS-V	Elbow, 90° Female	1
9	HC-1680	Meter, Totalizer	1
21	V-1761	Label, Kit Filter Element	1

Z-7733 Assembly, reel hose fluid continued on following page

Parts List - Reel Hose

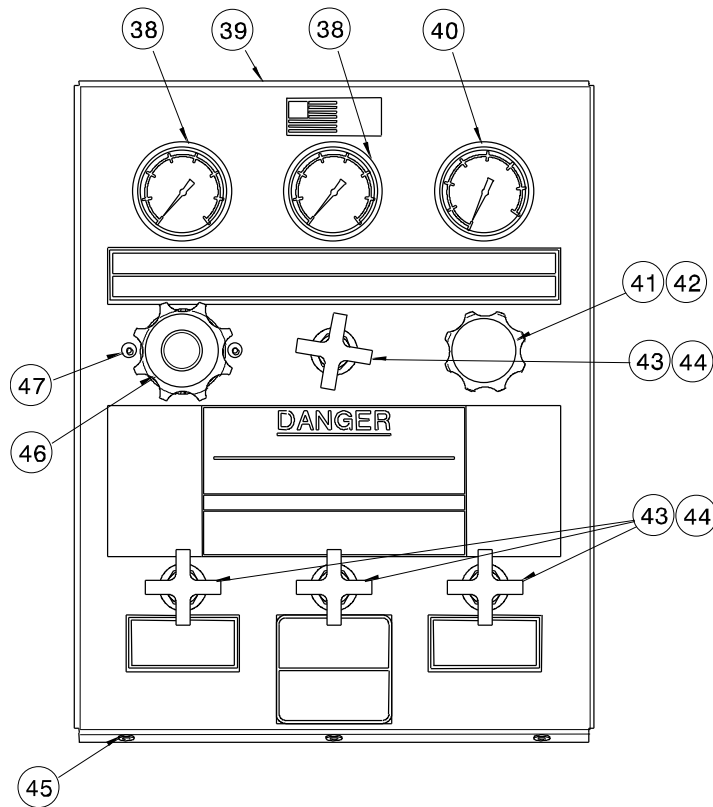
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
	Z-7733	Assembly, Reel Hose Fluid; consists of:	
6	S-2514-01	Filter, Bracket	1
10	G-1112-105010	Bolt, ¼ - 20 x 1 Hex Head SS	2
11	G-1501-1050	Stopnut, ¼ - 20 Elastic SS	2
12	G-1503-1050N	Flatwasher, ¼ Narrow SS	8
13	G-1502-1050R	Lockwasher, ¼ Regular SS	4
14	G-1112-105004	Bolt, ¼ - 20 x ½ Hex Head SS	4
16	N-2800-06-B	Fitting, Male Pipe	1
18	N-2026-05-B	Swive, JIC 37°	1
19	Z-7730	Assmebly, Fill Valve	1
Fluid - Phosphate Ester – Skydrol, Hyjet			
17	TF-1030-03-720	Hose	1
20	V-1977	Label, Fluid	1
23	V-1762	Label, Filter Element	1
Fluid - MIL-PRF-23699			
17	TF-1047-05-720	Hose	1
20	V-2387	Label, Fluid	1
23	V-1761	Label, Filter Element	1

Parts List – Instrument Panel

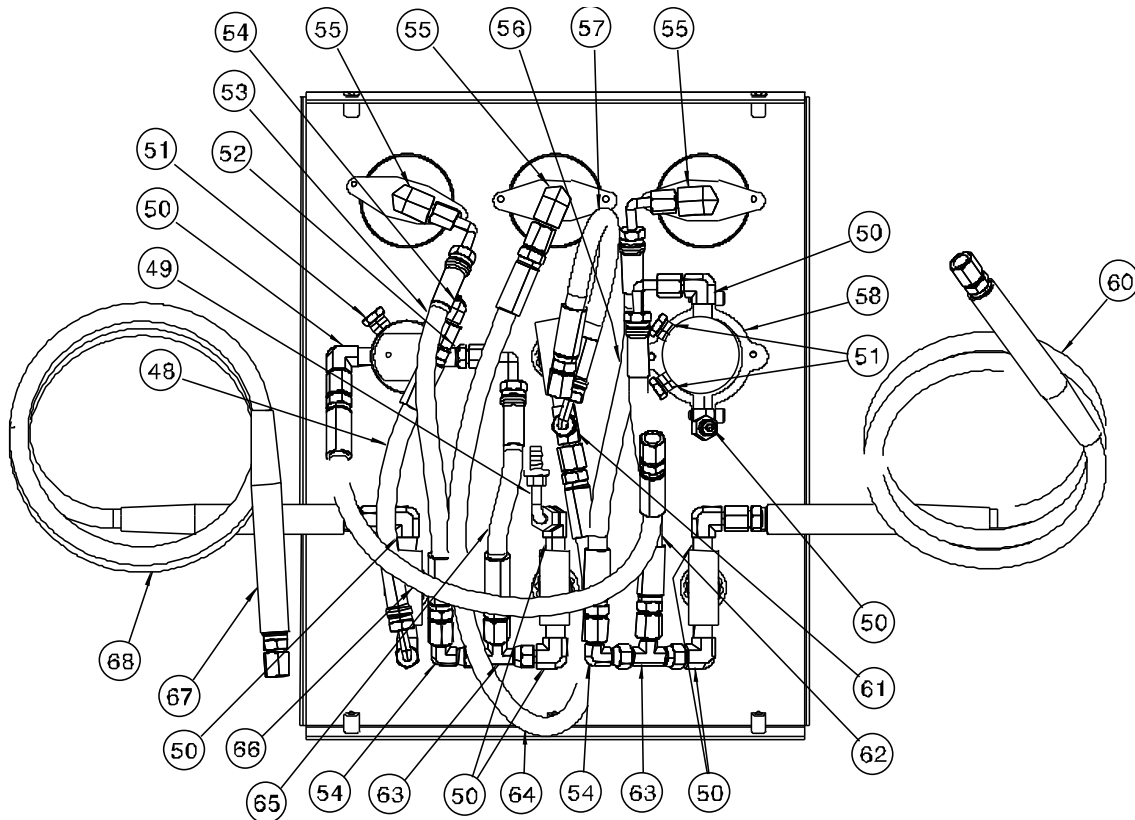
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
38	HC-2279	Gauge, Pressure 0-5000 psi	2
39	S-1906-01	Panel, Instrument	1
40	HC-2239	Gauge, Pressure 0-600 psi	1
41	PC-1089-01	Regulator, Low Pressure	1
42	H-2259	Locknut, Panel	1
43	HC-1081-01	Valve, Needle	4
44	HC-1122	Kit, Panel Mounting	4
45	G-1439-1050-S	Nutsert, ¼ - 20	5
46	PC-1037-01	Regulator, High Pressure	1
47	G-1154-105204	Screw, Socket Head Cap, ¼ - 20 x ½" long	2

Parts List - Instrument Panel

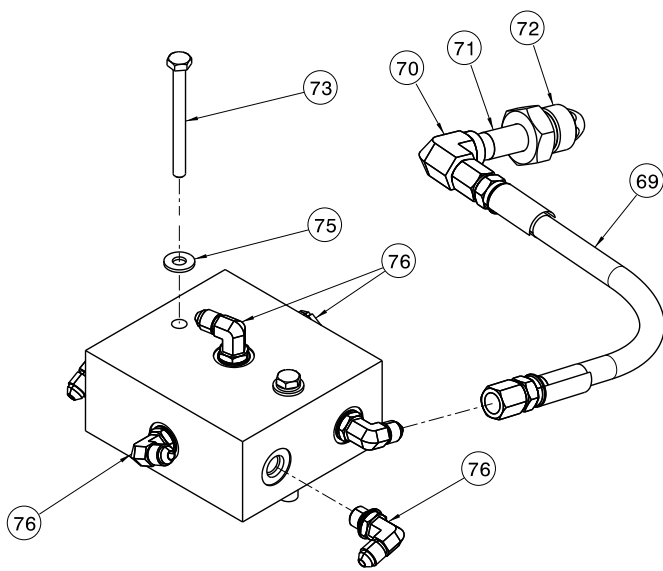
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



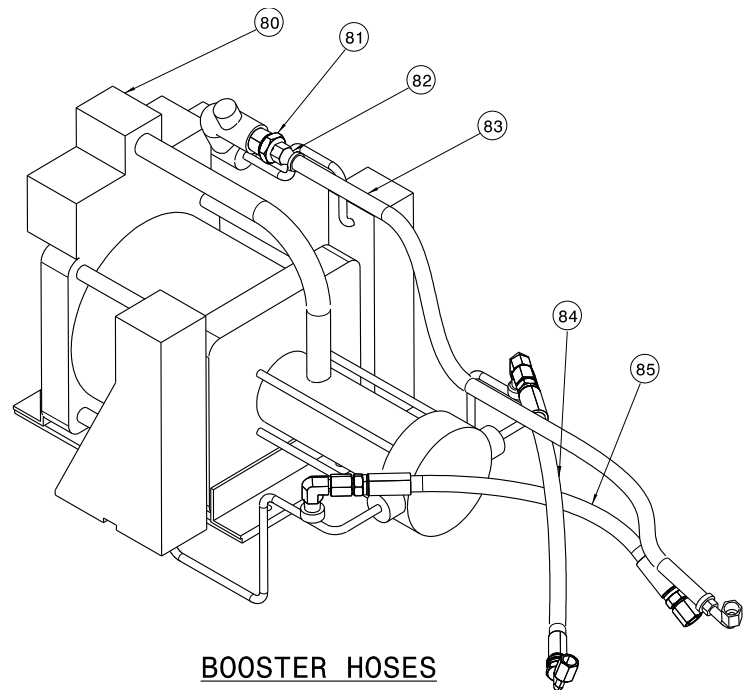
Item	Part Number	Description	Qty
48	TF-1043-11*09.5	Assembly, Hose	1
49	N-2069-01-S	Elbow, 90°, #4 JIC x #4 Hose	1
50	N-2005-04-S	Elbow, 90°, ¼ NPT x #4 JIC	10
51	N-2206-03-S	Plug, ¼ NPT	3
52	N-2009-04-S	Connector, #4 JIC x ¼ NPT	1
53	TF-1043-11*11.8	Assembly Hose	1
54	N-2002-03-S	Elbow, 90°, #4 JIC	3
55	N-2006-04-S	Elbow, 90°, ¼ NPT x #4 JIC	3
56	TF-1043-11*11.8	Assembly, Hose	1
57	TF-1043-25-11.0	Assembly, Hose	1
58	PC-1103	Clamp, Regulator Mounting	1
60	TF-1043-01*55.0	Assembly, Hose	1
61	N-2017-04-S	Tee, Male Run, ¼ NPT x #4 JIC	1
62	TF-1043-11*10.0	Assembly, Hose	1
63	N-2016-03-S	Tee, Run, #4 JIC	2
64	TF-1048-07*21*0	Assembly, Hose	1
65	TF-1043-11*07.8	Assembly, Hose	1
66	TF-1043-11-21.0PC-1105	Assembly, Hose	1
68	TF-1043-01*45.0	Assembly, Hose	1

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



MANIFOLD AND BOTTLE HOSE ASSEMBLY

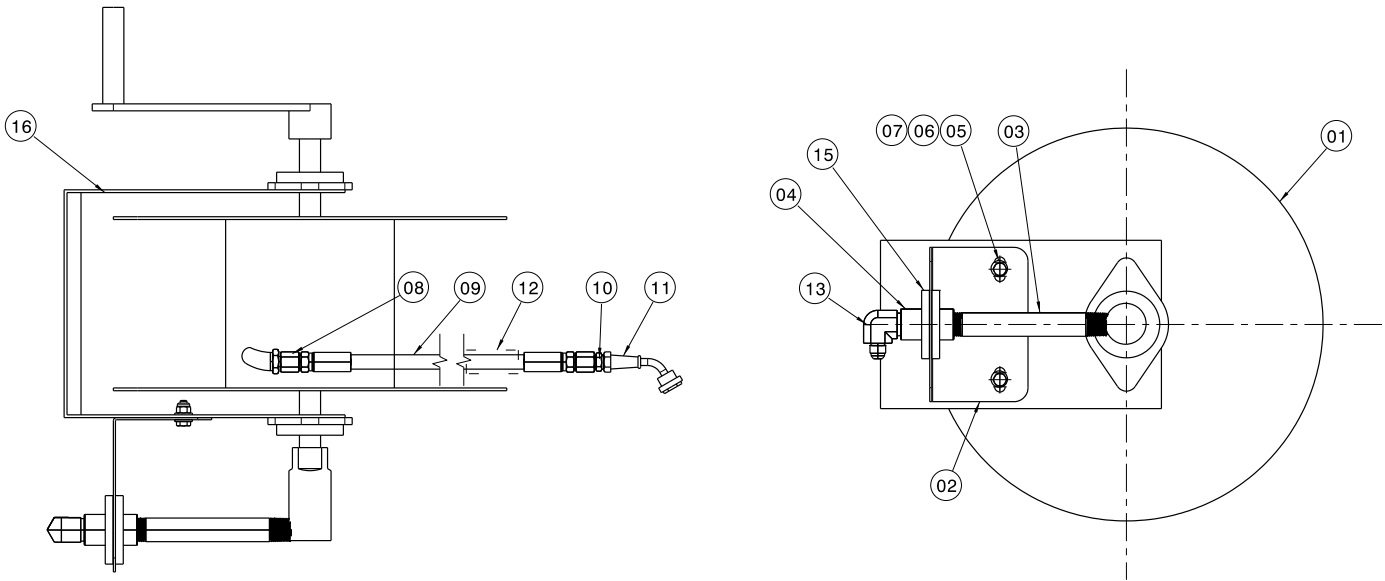


BOOSTER HOSES

Item	Part Number	Description	Qty
69	TF-1043-07*90.0	Assembly Hose	3
70	N-2006-04-S	Elbow, 90°, ¼ NPT x #4 JIC	4
71	PC-1131	Nipple, Inlet w/check	4
72	PC-1001	Nut	4
73	G-1100-105026	Bolt, Hex Head Grade 5, ¼ - 20 x 2 ¾" long	2
74	G-1202-1050	ESN, ¼ - 20	2
75	G-1250-1050N	Lockwasher, ¼ narrow	2
76	N-2001-03-S-B`	Elbow, 90°, #4 SAE x #4 JIC	7
80	PC-1186	Booster, Nitrogen	1
81	N-2009-05-S	Connector, ½ NPT x #4 JIC	1
82	N-2026-01-S	Fitting, 37° Swivel	1
83	TF-1047-01*11.5	Hose, ¼" Push On	1
84	TF-1043-11*13.5	Assembly Hose	1
85	TF-1043-11-21.0	Assembly Hose	1

Parts List – Reel Hose Nitrogen

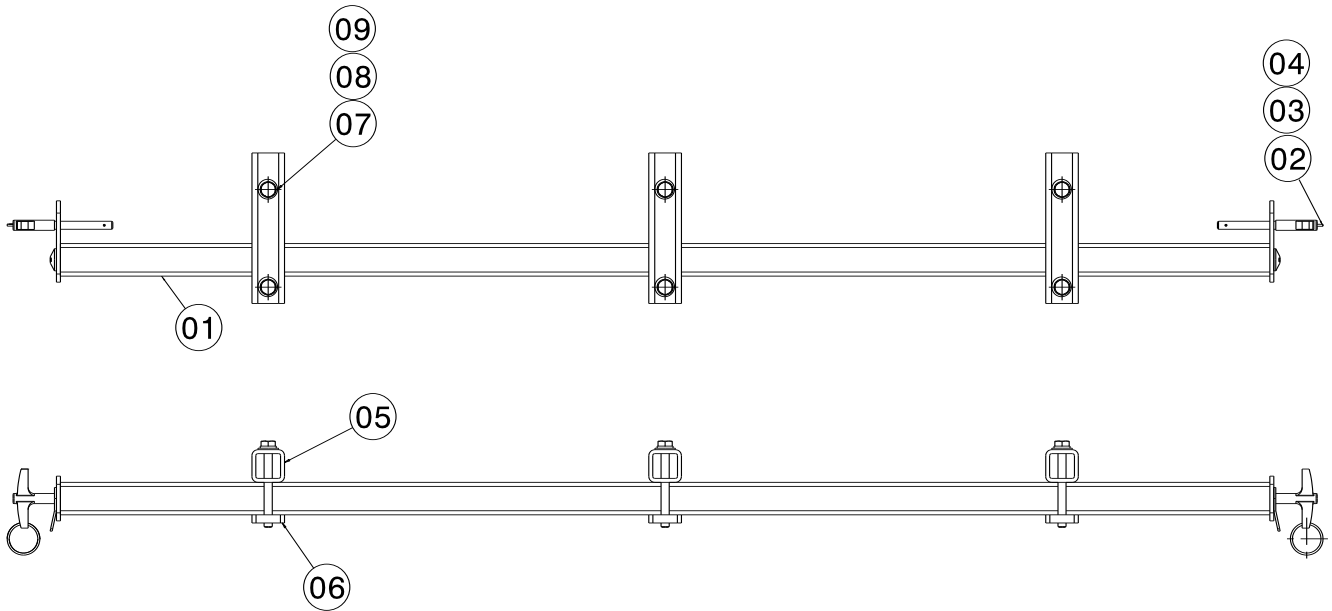
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
2	S-2513-01	Bracket	1
3	N-2905-18-SS	Nipple, 303/304 SS Pipe	2
4	N-2204-10-SS	Connector, Pipe	1
5	G-1112-105006	Bolt, ¼ - 20 x ¾ Hex Head SS	2
6	G-1501-1050	Stopnut, ¼ - 20 Elastic SS	2
7	G-1503-1050N	Flatwasher, ¼ Narrow SS	4
8	N-2009-03-SS	Connector, Male	1
9	TF-1043-01-720	Assembly Hose (MB)	1
10	N-2009-04-SS	Connector, Male	1
11	PC-1067	Coupling, High Pressure Hose	1
15	H-3472-05	Pipe, Sealing Grommet, .75 Dia	1
High Pressure			
1	H-3477	Reel, Hose	1
12	EC-1057-02*12.0	TBG, Heat Shrink	1
13	N-2005-05-SS	Elbow, Male	1
16	V-2038	Label Pressure	2
Low Pressure			
1	H-3442	Reel, Hose	1
12	EC-1057-05*12.0	TBG, Heat Shrink	1
13	N-2005-05-SS	Elbow, Male	1
16	V-2034	Label Pressure	2

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	Z-7712-01	Weldmant, Bar	1
2	H-1026*07.0	Assembly, Lanyard	2
3	G-1310-0415	Pin, ¼ x 1.5 Ball Lock-T	2
4	G-1352-07	Rivet, ⅛ Open End Aluminim	2
5	TS-2390-01	Tube, Bottle	3
6	J-5021-01	Plate, Bottom	3
7	G-1100-105024	Bolt, HH, GR 5, ¼ - 20 x 2 ½ Long	6
8	G-1503-1050N	Flatwasher, ¼ SST	6
9	G-1502-1050R	Lockwasher, ¼	6



APPENDIX I

**Declaration
of
Conformity**



DECLARATION of CONFORMITY

The design, development and manufacture is in accordance with European Community guidelines

12-3117-9000

Relevant provisions complied with by the machinery:
2006/42/EC

Relevant standards complied with by the machinery:
EN ISO 12100-1

Identification of person empowered to sign on behalf of the manufacturer:

A handwritten signature in black ink that reads "David L. Kiehl". The signature is written in a cursive style and is positioned above a solid horizontal line.

Quality Assurance Representative



APPENDIX II

**Instrument
Certification
Notice**



Instrument Certification Notice

The gauge Certificates of Calibration supplied for the gauge(s) on this unit contain the calibration data for the actual instrument calibrated, along with the calibration date of the **STANDARD** used to perform the calibration check.

The due date for re-calibration of the instrument should be based upon the date the instrument was placed in service in your facility. Re-calibration should be done on a periodic basis as dictated by the end user's quality system or other overriding requirements.

Note that Tronair, Inc. does not supply certificates of calibration on flow meters or pyrometers unless requested at the time of placed order. These instruments are considered reference indicators only and are not critical to the test(s) being performed on the aircraft.



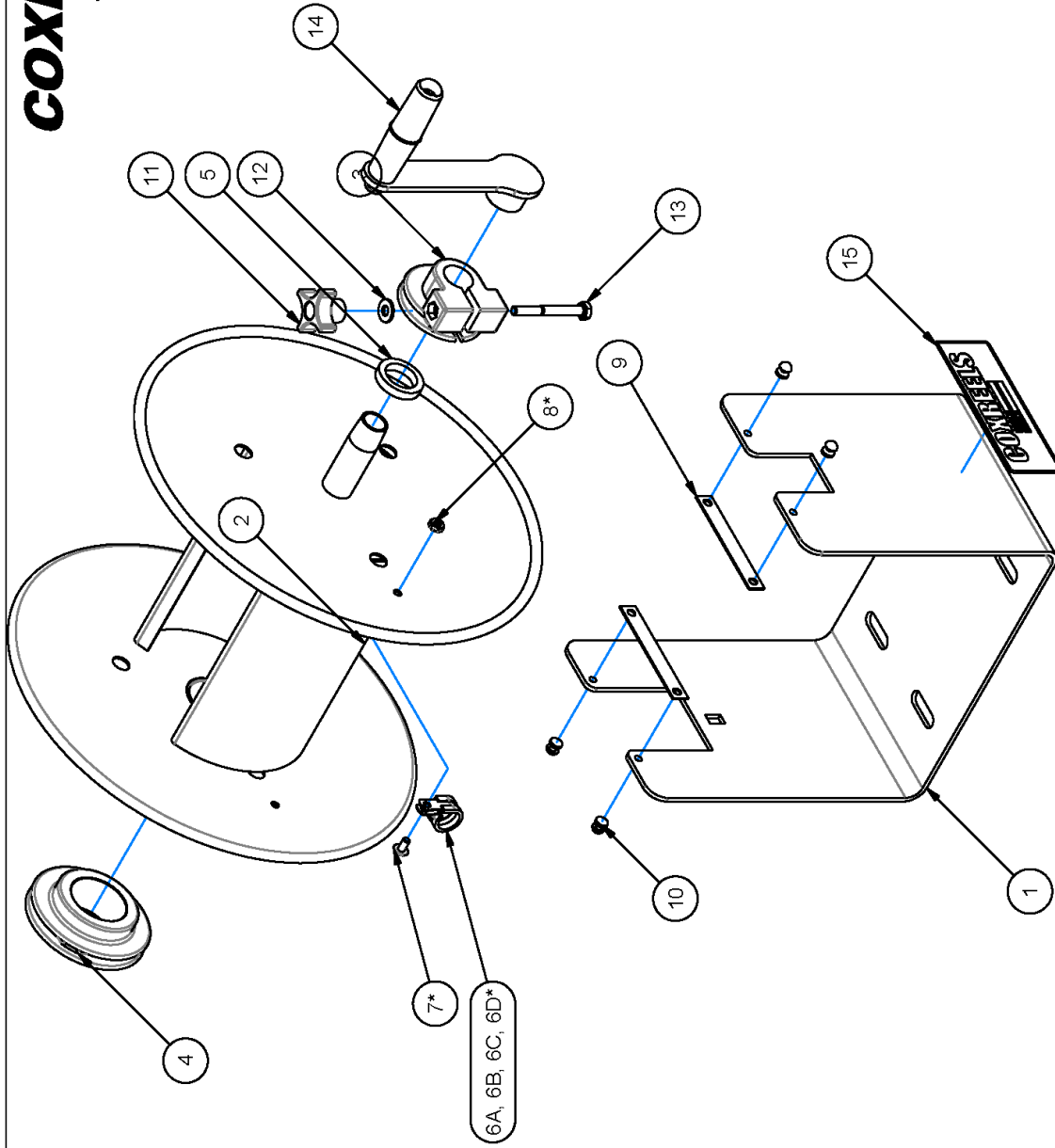
APPENDIX III

**Coxreels
Series 112Y**

EXP-40Y

REVISION: -
ECO NO.: -
BY: -
DATE: -

COXREELS
SERIES 112Y



* ITEMS ARE PLACED
IN A SEPERATE BAG
AND PLACED IN FINAL
PACKAGING.

DETAIL ITEM NO.	PART NO.	DESCRIPTION	112Y-4	112Y-8	112Y-12
1	8553-4	FRAME, "U", CHALLENGER	1		
	8553-8	FRAME, "U", CHALLENGER		1	
	8553-12	FRAME, "U", CHALLENGER			1
2	8590-4.5	ASSY. DRUM: STORAGE CABLE	1		
	8590-8	ASSY. DRUM: STORAGE CABLE		1	
	8590-12.5	ASSY. DRUM: STORAGE CABLE			1
3	6329-1-1	BEARING, EPDM, .877" ID, CRANK SIDE	1	1	1
4	8552	BEARING, EPDM, 1.010" ID, PLUMBING SIDE	1	1	1
5	7145	SPACER	1	1	1
6A	7199	CLAMP, HOSE/CABLE, #7	1	1	1
6B	7199-1	CLAMP, HOSE/CABLE, #6	1	1	1
6C	381	CLAMP, HOSE/CABLE, #10	1	1	1
6D	383	CLAMP, HOSE/CABLE, #12	1	1	1
7	245	SCREW, TRUSS HD, 10-32 X 3/8"	1	1	1
8	130	NUT, KEPS, 10-32	1	1	1
9	15711-1	PLATE, KEEPER, BEARING	2	2	2
10	7105	RIVET, POP, ALUMINUM	4	4	4
11	15719	KNOB, BLACK, PHENOLIC	1	1	1
12	688	WASHER, FLAT, 1/4" SAE	1	1	1
13	7146	BOLT, HEX, 1/4-20 X 2-1/4", GR 5	1	1	1
14	7272-1	CRANK ARM ASSEMBLY	1	1	1
15	10925-5	NAMEPLATE, PRODUCT, STD DECAL	1	1	1

REVISION: - ECO: - DATE: 7/12/2006 Name: M. LLOYD



APPENDIX IV

**Hannay
Reels**



Hannay Reels®

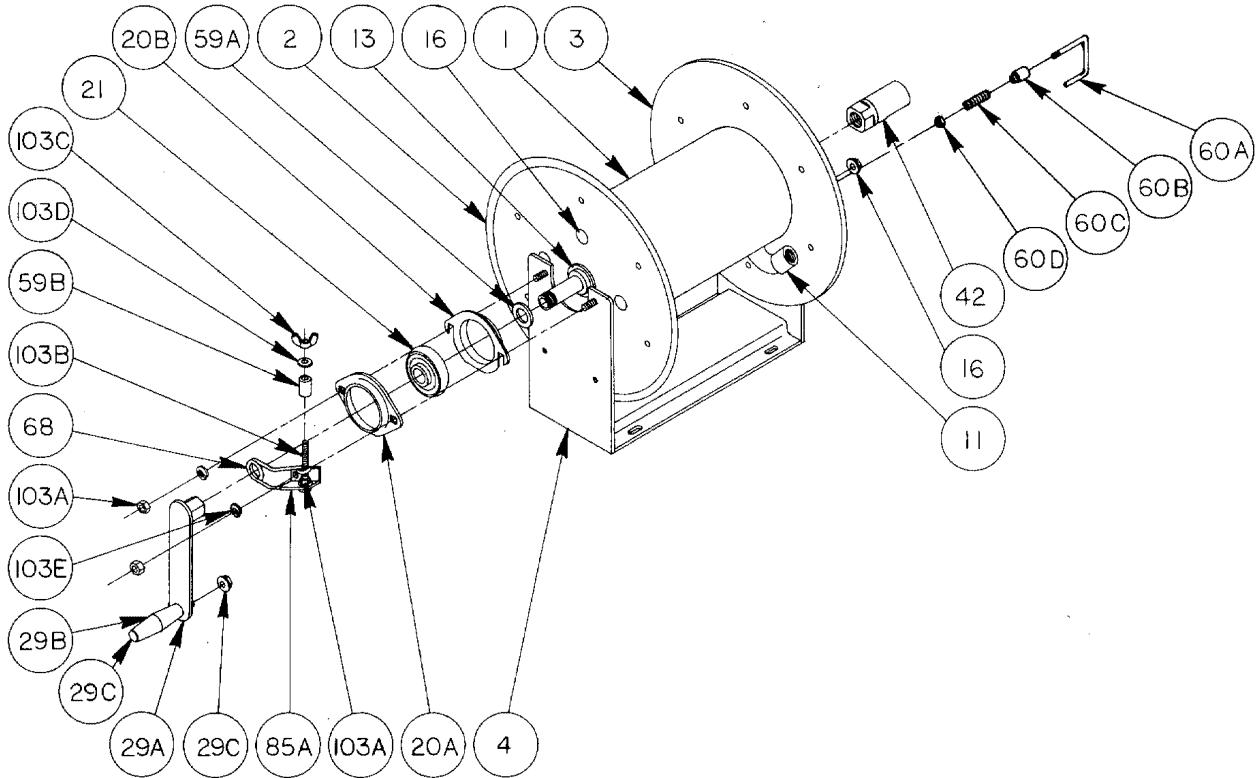
The reel leader.

Clifford B. Hannay & Son, Inc., 600 East Main Street
P.O. Box 159, Westerlo, New York 12193-0159
Telephone 518-797-3791
FAX 1-800-REELING (733-5464)

ISO 174

PARTS LIST

SERIES SS1000



PARTS LIST
ISO-174
SERIES SS1000

When ordering parts

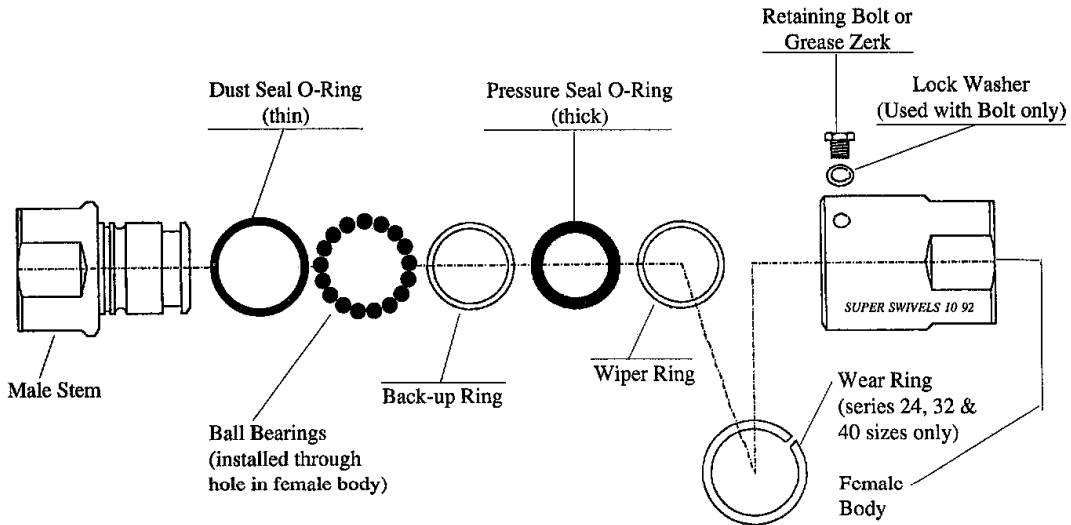
BE SURE TO SPECIFY COMPLETE MODEL NUMBER and SERIAL NUMBER OF REEL....
USE PART NUMBER!

<u>Drawing No.</u>	<u>Description</u>	<u>PART NUMBER</u>	<u>Quantity</u>
ISO-174-1	SST Drum, 6" Dia. (Specify Model)	9905.1114	1
ISO-174-2	SST Disc, 14" Dia. (Front)	9903.6014	1
ISO-174-3	SST Disc, 14" Dia. (Back)	9903.6014	1
ISO-174-4	SST Frame Assembly	(Specify Model)	1
ISO-174-11	1/2" SST Hub Assy., 3/8" FIPT Outlet Riser (Specify Model)	9901.0604	1
ISO-174-13	SST Disc Washer	9961.0001	2
ISO-174-16	3/8"-16 SST Carriage Bolt w/Nut	(Specify Model)	2
ISO-174-20A	Self-Aligning Bearing Holder	9902.2800	2
ISO-174-20B	Self-Aligning Bearing Holder, Slotted for "N" Series	9902.2801	2
ISO-174-21	1/2" Self-Aligning Bearing Insert	9902.1300	1
ISO-174-29A	SST Hand Crank (permanently attached)	9914.0024	1
ISO-174-29B	Hand Crank Handle	9914.0505	1
ISO-174-29C	Hand Crank Handle Bolt w/Nut	9914.0511	1
ISO-174-42	1/2" 90 Deg. FxF SST Superswivel Joint	9927.8554	1
ISO-174-59A	1/2" SST Hub Spacer Washer	9960.0060	2
ISO-174-59B	SST Tension Brake Spacer	9960.0050	1
ISO-174-60A	SST Pinlock Pin, (standard)	9965.0136	1
ISO-174-60B	SST Pinlock Mounting Sleeve	9965.0142	1
ISO-174-60C	SST Pinlock Spring	9965.0138	1
ISO-174-60D	1/4"-20 SST ENSA Type Nut	9960.0001	1
ISO-174-68	Tension Brake Spring	9965.0001	1
ISO-174-85A	Tension Brake Mounting Bracket	9961.0002	1
ISO-174-103A	3/8"-16 SST Hex Nut	9960.0007	5
ISO-174-103B	3/8"-16 x 3" SST Round Head Cap Screw	9960.0011	1
ISO-174-103C	3/8"-16 SST Wing Nut	9960.0006	1
ISO-174-103D	3/8" SST Flat Washer	9960.0010	1
ISO-174-103E	3/8" SST Lock Washer	9960.0008	5



HYDRAULIC INLINE AND 90° LIVE SWIVELS

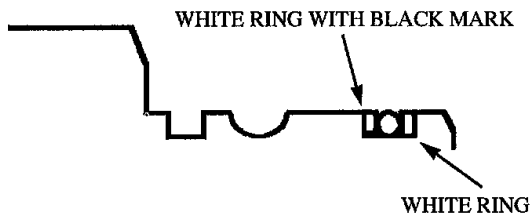
AFLAS* (AL)



1. Remove plug or grease zerk.
2. Wash swivel in solvent and rotate while immersed to remove grease from ball groove.
3. Remove balls by rotating swivel with ball loading hole pointed down. If grease in ball groove prevents balls from falling free when centered over loading hole, tap swivel on work bench with loading hole face down to bench.
4. With all balls removed (check by rotating while looking into ball loading hole), pull the two halves apart.
5. Clean swivel thoroughly; install seals, wear ring when required, and lubricate the female bore and male outside diameter, before assembly. Load retainer balls and insert grease zerk. Use Lithium based grease with moly. (Do not over-grease). Note: Grease zerk must be removed and bolt and washer replaced on swivels without a permanent grease fitting.

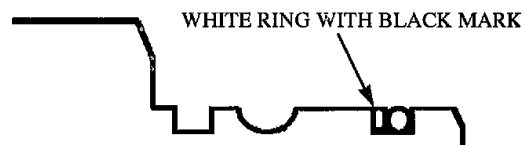
IF YOUR SWIVEL HAS:

A RING ON BOTH SIDES OF THE "O"-RING
THEN, INSTALL AS PICTURED BELOW



IF YOUR SWIVEL HAS:

ONE RING ON THE BALL GROOVE SIDE
OF THE "O"-RING THEN,
INSTALL AS PICTURED BELOW.



*AFLAS is a registered trademark of Asahi Glass Co. Ltd.

SAFETY GUIDELINES

READ THIS FIRST.

These guidelines provide general safety recommendations for using hose and cable reels. However, the employer should assess and determine if any additional safety measures are required for its particular application and operation, and fully instruct employees on those safety measures.

Additionally, the employer should make a copy of this safety manual available to all employees working with reels. Additional copies of this safety manual may be obtained upon request. No warranty of the correctness or sufficiency of the information in this manual is made by Hannay Reels.

Read all relevant manuals and safety instructions prior to unpacking reels. If there is ANYTHING you do not understand about the safe installation and use of your Hannay reel, please contact Hannay Reels (Attn: Customer Service). We are always glad to help.

NOTICE

Hannay Reels will not assume any liability for any alterations and/or modifications to Hannay Reels or products supplied by Hannay Reels nor for uses other than for which these products are intended. All warranties expressed or implied will become null and void.



Hannay Reels
553 State Route 143
Westerlo, NY 12193-0159
(518) 797-3791
USA Toll Free 1-877-GO REELS (467-3357)
FAX: 1-800-REELING (733-5464)
Int'l. Fax: (518) 797-3259

50M HP 11-04

H-9602-ISG
REV 4

WARNING: PINCH POINT AREAS USE CAUTION WHEN OPERATING NEAR CHAIN AND SPROCKETS.

Where chain guards are furnished, the reels should not be operated with them removed.

NOTE:

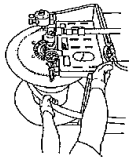
OSHA indicates the appropriate guarding of chains and sprockets is at least partly the responsibility of the final installer or equipment user based on the fact that equipment can be installed in so many different positions and so many different degrees of accessibility to the operator.

Please make sure that you have thoroughly reviewed this issue when making the installation of the reel.

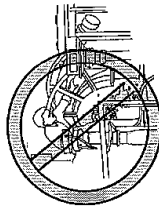


USE CAUTION WHEN GUIDING HOSE OR CABLE BACK ONTO POWER REELS.

Keep the hand guiding the hose back onto the reel several inches away from the drum so that there is no possibility of trapped or pinched fingers. Use proper personal protection equipment.



KEEP HANDS AWAY FROM SPOKED DISCS WHEN TURNING.



INSTRUCTIONS FOR SAFE FLUID HANDLING USE A HOSE REEL AND HOSE PROPERLY RATED FOR THE JOB.

Never exceed the pressure rating (psi) specified for a particular reel and hose. Also, make sure that the size and material of both the reel and hose are designed for the intended use.

USE A FLEXIBLE CONNECTOR BETWEEN A SWIVEL JOINT AND INLET PIPING.



CHECK FOR POSSIBLE LEAKS AT FLUID CONNECTIONS PRIOR TO USE.

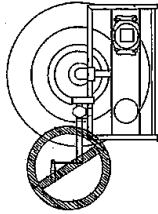
RELEASE PRESSURE IN HOSE BEFORE REMOVING FITTINGS OR PERFORMING ANY MAINTENANCE.

BEFORE WINDING COLLAPSIBLE HOSE ONTO A LIVE REEL, HOSE MUST BE EVACUATED OF ALL FLUID.

POWER REWIND REELS USE CIRCUIT BREAKERS FOR ELECTRIC REWIND MOTORS.

Make sure that the circuit breaker is properly sized for the motor. Also, check all electrical connections for proper installation prior to use.

REMOVE AUXILIARY CRANK REWIND HANDLE BEFORE USING POWER REWIND.

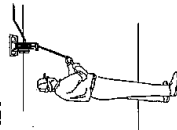


DISCONNECT POWER SOURCE BEFORE PERFORMING MAINTENANCE.

This applies to both electric and air-powered reels. Also, disconnect electrical power before removing junction box covers or collector ring housings.

SPRING REWIND REELS

USE CAUTION WHEN SPRING REEL RATCHET ASSEMBLY LOCK IS DISENGAGED.



When the lock is disengaged, always hold onto the hose or cable and guide it onto the reel as it rewinds.

ON SPRING REELS, NEVER REMOVE THE COVER CONTAINING THE SPRING.

Coiled springs are under tension and removal of cover can result in severe personal injury.





**APPENDIX V
Tescom**

**Smith's
Installation &
Operation Guide**

Pressure Regulators



INSTALLATION & OPERATION GUIDE FOR SMITH PRESSURE REGULATORS

Important safety and operational information contained in this booklet are emphasized by a system of classification using the words: **DANGER, WARNING, CAUTION, NOTICE.**

DANGER! Danger is used to indicate the presence of a hazard which will cause severe personal injury, death or substantial property damage, if the warning is ignored.

WARNING! Warning is used to indicate the presence of a hazard which can cause severe personal injury, death or substantial property damage, if the warning is ignored.

CAUTION! Caution is used to indicate the presence of a hazard which will or can cause minor personal injury, death or substantial property damage, if the warning is ignored.

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

SPECIALTY GASES ~ SAFETY AND TECHNICAL INFORMATION

Gaseous and liquefied compressed gases may be categorized in the following classifications: flammable, oxidant, corrosive, inert or toxic. Because these products may also be gases or liquids under pressure, the hazards accompanying high pressure and low temperature may also be present. The properties of a gas place it in one or a number of categories. Certain basic rules must be followed in order to handle specialty gases safely.

- A. Know the hazards associated with the gas.
- B. Know and understand the physical and chemical properties of the gas.
- C. Observe the necessary general precautions to be taken in the use of specialty gases and the precautions specific to the gas.

In addition to the safe handling and storage procedures presented in this section, the Compressed Gas Association and the Department of Transportation provide detailed gas safety information and regulations.

A. FLAMMABLE

Flammable gases when mixed with air, oxygen or other oxidants burn or explode upon ignition, depending upon the degree of confinement. Each flammable gas has a gas-in-oxidant concentration range within the limits of which the gas may be ignited. Flammable ranges are expressed in terms of air at ambient temperature and atmospheric pressure. A change in temperature, pressure or oxidant concentration may vary the flammable range considerably. Mixtures above and below the flammable range do not ignite. As a precaution in handling flammables, care must be taken to eliminate all possible sources of

ignition through the proper design of facilities, the installation of approved electrical systems, and the restriction of smoking and use of open flames. An explosimeter should be used to determine the existence of a flammable mixture in areas of suspected leakage.

B. OXIDANT

A number of gases, although nonflammable, may initiate and support combustion. Materials that burn in air burn more vigorously or even explosively in oxygen and certain other oxidants. All possible sources of ignition must be eliminated when handling oxidants. Oxidants must not be stored with combustible materials. Oil, grease, or other readily combustible substances must not come in contact with cylinders or equipment used in oxidant service.

C. CORROSIVE

Corrosives are those products that erode and deteriorate materials with which they come in contact; such as metals, fabrics, and human tissue. Some gases, although not corrosive in their anhydrous form, become corrosive in the presence of water. Special Care must be taken when selecting the proper construction materials for equipment in which corrosives are handled. Gases that do not cause deterioration but induce inflammation of human tissue are irritants. Inflammation of the tissue may occur after immediate, prolonged or repeated contact with the irritant. Protective clothing and equipment must be used to minimize exposure to corrosive or irritating materials.

D. INERT

Gases that at ordinary temperatures and pressure do not react with other materials are classified as inert. If released in a confined area, inert gases may displace the oxygen content of the air below the level necessary to sustain life. Asphyxiation, therefore, is the hazard associated with inert products. Adequate ventilation and monitoring of the oxygen content of confined areas minimizes the possibility of asphyxiation.

E. TOXIC

Toxic materials are those substances that may chemically produce injurious or lethal effects. The degree of toxicity and the effects vary with the compound. Some gases are especially noxious because they do not provide adequate warning of their presence (by color, odor, etc.) at low levels of concentration. Also, some products that are non-toxic in themselves may react with certain chemicals or decompose at elevated temperatures to produce toxic materials. Adequate ventilation, protective clothing, and suitable breathing equipment must be used to minimize exposure.

F. HIGH PRESSURE

Specialty gases are compressed to pressures up to 6000 psig. A sudden release of pressure may cause serious damage to personnel and equipment by propelling a cylinder or whipping a line. Factors that must be considered when choosing construction materials and designing gas-handling systems are the temperature, the pressure of the gas and the possibility of pressure buildup in the system.

NOTICE!

If you have a requirement or concern not covered in the booklet, contact your equipment supplier for assistance.

WARNING!

Read and observe all warnings and instructions before installing or operating any pressure regulating equipment. Improper application and operation of equipment with high pressure media (inerts, flammables, oxidizers or toxics) can result in damage to equipment or severe personal injury.

INTRODUCTION

Prior to installing or operating any pressure regulation equipment, read and follow the information in this booklet. Improper application and operation of regulators can result in damage to equipment or severe personal injury. All possible hazards and precautionary measures are not covered in this booklet. It is recommended that prior to using gas regulation equipment, you fully understand and comply with all established safety regulations.

SECTION I PRE-INSTALLATION PROCEDURES: COMPRESSED GAS CYLINDERS

WARNING!

Serious accidents can result from improper use and handling of high pressure compressed gas cylinders. Always follow instructions and safety precautions provided by your gas supplier.

WARNING!

Read and observe all warnings and instructions before installing or operating any pressure regulating equipment. Improper application and operation of equipment with high pressure media (inerts, flammables, oxidizers or toxics) can result in damage to equipment or severe personal injury.

Refer to CGA pamphlet page 1 for all regulations which apply to the safe handling and storage of combined gas cylinders.

1. Cylinders should always be kept in the vertical position and secured from falling.
2. Never use compressed gas cylinders without an approved gas pressure reducing regulator attached to the outlet of the cylinders.
3. Do not lubricate compressed gas fittings, gauges, regulators or regulator components.
4. Do not apply sealing tape to cylinder connections.
5. Do not use cylinders with damaged threads. Return the cylinder to your supplier indicating the problem.
6. Do not use cylinder connection adaptors. Use a regulator with the proper compressed gas fitting.

SECTION II PRE-INSTALLATION PROCEDURES: REGULATORS

WARNING

Regulators must be used only with the gases and pressures for which they are designed. Consult a material safety data sheet (MSDS) for media used to determine compatibility of gases and regulator components (available from your gas supplier). Failure to do this can result in an explosion, damage to equipment or severe personal injury.

1. Check the designed pressure rating of the regulator (stamped on the regulator body) and the scale range of the pressure gauges. They must be adequate for the cylinder pressure and the operating pressure.
2. Check that the materials used in the construction of the regulator are compatible with the intended media service.
3. Check that the regulator inlet connection is compatible with the cylinder outlet valve connections.
4. Fit the operating system with a check valve purge assembly and pressure relief devices as required.
5. Do not interchange pressure regulators or other equipment with different gases unless there is knowledge of the compatibility properties of the gases.
6. Do not use regulator equipment for oxygen service that has been in other gas service.

SECTION III INSTALLATION & OPERATION TEST FOR LEAKAGE

WARNING

Check cylinder valve connections and regulator inlet connections for foreign material before connecting. Use a clean dry lint-free cloth to remove contamination. When using oxygen or other oxidizers, it is extremely important that connections are clean and maintained. Failure to do this can result in an explosion, damage to equipment or severe personal injury.

1. Inspect the cylinder valve threads for damage and be sure the cylinder valve is free of oil, grease, dirt or any foreign material.
2. Attach the regulator to the cylinder valve and secure tightly using a wrench.
3. Connect the operation system to the regulator outlet.
4. Turn the regulator adjusting screw counterclockwise until the adjusting screw turns freely (no spring load) or until the adjusting screw is against the mechanical stop. (This allows the regulator valve to close).
5. Close the regulator outlet valve if one is used.

WARNING

Do not place yourself in front of or behind the regulator when opening the cylinder. Place yourself with the cylinder between you and the regulator.

6. Slowly open the cylinder valve until the full cylinder pressure is indicated on the high pressure regulator gauge. Then, open the cylinder valve all the way. This high pressure gauge should read the cylinder pressure. The delivery gauge should read zero.
7. With the valve at the outlet of the regulator closed and the

adjusting screw tension released, leave pressure on the inlet for 5 to 10 minutes. Delivery pressure gauge should not indicate any pressure increase. A pressure increase indicates leakage past the regulator valve seat.

WARNING

If leakage occurs, do not use the regulator.

8. Turn the adjusting screw clockwise to set a normal delivery pressure. If you are unable to attain a desired pressure or the pressure continues to rise above the setpoint, the regulator should not be used.
9. If the unit functioned properly in the previous step, close the cylinder valve and note the readings of both the inlet and delivery pressure gauges. After 5 to 10 minutes, a drop in the reading of either gauge indicates a leak in the system.

NOTICE!

Use an approved oil-free leak detection fluid to locate possible leaks at the inlet, threaded parts, through the regulator diaphragm or through the outlet valve.

10. If a leak is indicated at the inlet or at a threaded port, relieve all pressures from the regulator and retighten the connections. If a leak continues or is found at the diaphragm or outlet valve, do not use the regulator.
11. If the system is determined to be leak free, turn the adjusting screw clockwise until the desired pressure setting is indicated on the delivery pressure gauge.
12. Open the outlet valve to purge the system. Adjust the regulator adjusting screw to obtain the desired pressure setting at the flow conditions.

← CAUTION →

A regulator is not intended to be used as a shut-off device. When not in use, the cylinder valve should be closed. A pressure relief device should be installed downstream of the regulator or outlet valve to protect the process equipment in the case of a rise in operating pressures.

SECTION IV SYSTEM SHUTDOWN

1. Close the cylinder valve.
2. Release all media from the regulator and/or system so that both gauges read zero. If the gas is flammable, an oxidant, corrosive, or toxic, take appropriate measures to render it innocuous by employing suitable disposable system before venting the gas to the atmosphere.
3. Turn the adjusting screw counterclockwise until all spring load is released or the adjusting screw reaches the mechanical stop.
4. Close the outlet valve.
5. Disconnect the regulator.
6. If the regulator is to remain out of service, protect the inlet and outlet fittings from dirt, contamination or mechanical damage.
7. Replace the cylinder valve cap.

SECTION V PERFORMANCE CHARACTERISTICS

The following information is intended to assist you in identifying whether or not your regulator is performing properly.

A. Proper Performance

1. The delivery pressure will drop when flow is started and/or increased.
2. The delivery pressure will rise when flow is stopped. This difference in delivery pressure between flow and no flow condition is called lockup.
3. The delivery pressure of a single stage regulator will increase as the supply/cylinder pressure decays (as the cylinder is emptied). This will not happen with a 2-stage regulator until the supply pressure drops below the first stage set pressure of 250 psig (except 250 psig delivery range regulators, which are set at 400 psig).

B. Improper Performance

1. The delivery pressure continues to rise when flow is stopped (lock-up) without a change in adjusting screw position. This indicates valve seat wear or contamination with foreign materials allowing media to leak to the delivery side. This condition is referred to as "creep". Regulators that creep leakage must not be used until repaired.
2. A significant drop in delivery pressure during normal flow conditions, indicates internal blockage. Check inlet connection filters for contamination. If condition persists, regulator must be repaired.

SECTION VI CARE AND MAINTENANCE

WARNING!

Periodic inspection and maintenance of your pressure regulator is essential for continued safe and satisfactory operation. The frequency of servicing will depend on duty cycle and type of media.

Equipment should have monthly inspection and annual maintenance (removing any deposits left by media and replacing any worn or damaged parts) under normal non-corrosive use and conditions. It is also recommended that when the system has high duty cycle or is used in corrosive service, more frequent inspection and maintenance may be necessary. Regulators requiring service repair should be sent to your equipment supplier.

A. Inspection

Use the following steps for regulator inspection:

1. Inspect gauges to assure they read zero when all pressure is released from the system.
2. With adjusting screw turned counterclockwise, to release all spring tension, slowly open cylinder valve. The high pressure gauge should read cylinder pressure and the delivery gauge should read zero.
3. With valve at outlet of regulator closed and adjusting screw tension released, leave pressure on inlet for 5 to 10 minutes. The delivery pressure gauge should not indicate any pressure

increase. A pressure increase indicates leakage past the regulator valve seat.

WARNING!

If leakage is indicated, the regulator must be repaired and must not be used.

4. Then, turn adjusting screw clockwise to set a nominal delivery pressure. If unable to attain desired pressure setting or if delivery pressure continues to rise above setpoint, regulator should be repaired.
5. If unit functions properly in the previous step, close cylinder valve and note the readings of both the inlet and delivery pressure gauges. After 5 to 10 minutes a drop in reading of either gauge indicates a leak in the system.

NOTICE!

Use an approved oil-free leak detection fluid to locate possible leaks at the inlet, any threaded port, through the regulator diaphragm or through the outlet valve.

6. If leak is at the inlet or at a threaded port, relieve all pressure from the regulator and then tighten. If leak continues or is found at the diaphragm and outlet valve, the regulator must be repaired and must not be used.

B. Storage

1. Regulators taken out of service for extended periods should receive proper care to extend their service life.
2. Regulators used in a non-corrosive media service should be wiped clean with a clean, dry, lint-free cloth and sealed in a plastic bag for storage in a dry area at room temperature.
3. Regulators used in a corrosive media service should be well flushed with dry nitrogen and sealed in a plastic bag. Regulators used for corrosive service may continue to corrode in storage after exposed to atmospheric oxygen and moisture.

C. Repair Service

Any regulator in need of service should be returned to your equipment supplier for evaluation.



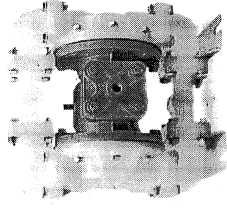
APPENDIX VI

**Lincoln Pump
Service &
Operating Manual**

SERVICE & OPERATING MANUAL



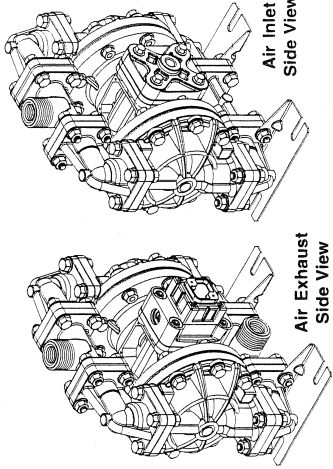
**Models 85622, 85622Z, 85623
1/2" Air-Powered Diaphragm Pump**



CE

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**Models 85626,
85622, 85623**
**Air-Powered
Double-Diaphragm Pump**

U.S. Patent #
5,996,627; 6,241,487
Other U.S. Patents
Applied for



ENGINEERING, PERFORMANCE
& CONSTRUCTION DATA

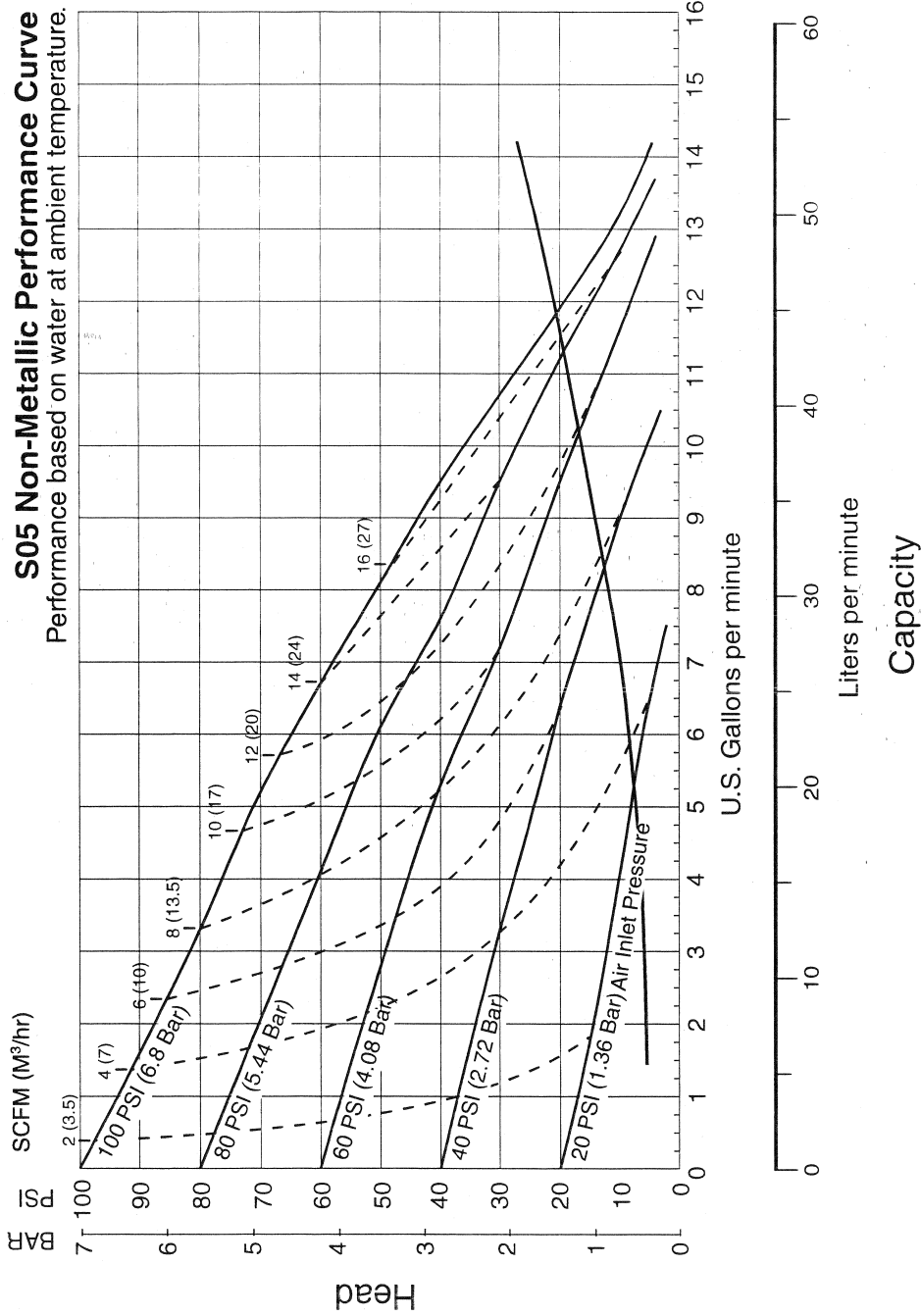
INTAKE/DISCHARGE PIPE SIZE 1/2" NPT (Internal) or 1/2" BSPT (Tapered) 1" NPT (External) or 1" BSPT (Tapered)	CAPACITY 0 to 14 gallons per minute (0 to 52 liters per minute)	AIR VALVE No-lube, no-stall design	SOLIDS-HANDLING Up to .125 in. (3mm)	HEADS UP TO 100 psi or 23' ft. of water (7 Kg/cm ² or 70 meters)	DISPLACEMENT/STROKE .026 Gallon / .098 liter
CAUTION! Operating temperature limitations are as follows:					
MATERIALS					
Operating Temperatures					
			Maximum*	Minimum*	Optimum**
Buna: General purpose, oil-resistant. Shows good solvent, oil, water and hydraulic fluid resistance. Should not be used with highly polar solvents like acetone and MEK, ozone, chlorinated hydrocarbons and nitro hydrocarbons.					
Conductive Acetal:					
Nylon:					
PVDF:					
Virgin PTFE: Chemically inert, virtually impervious. Very few chemicals are known to react chemically with PTFE. molten alkali metals, turbulent liquid or gaseous fluorine and a few fluoro-chemicals such as chlorine trifluoride or oxygen difluoride which readily liberate free fluorine at elevated temperatures.					
Polyurethane: High tensile material with excellent abrasion resistance. A general purpose material with excellent resistance to most oils.					
Polypropylene:					
Santoprene®: Injection molded thermoplastic elastomer with no fabric layer. Long mechanical flex life. Excellent abrasion resistance.					

*Definite reduction in service life.
**Minimal reduction in service life at ends of range.

For specific applications, always consult "Chemical Resistance Chart" Technical Bulletin

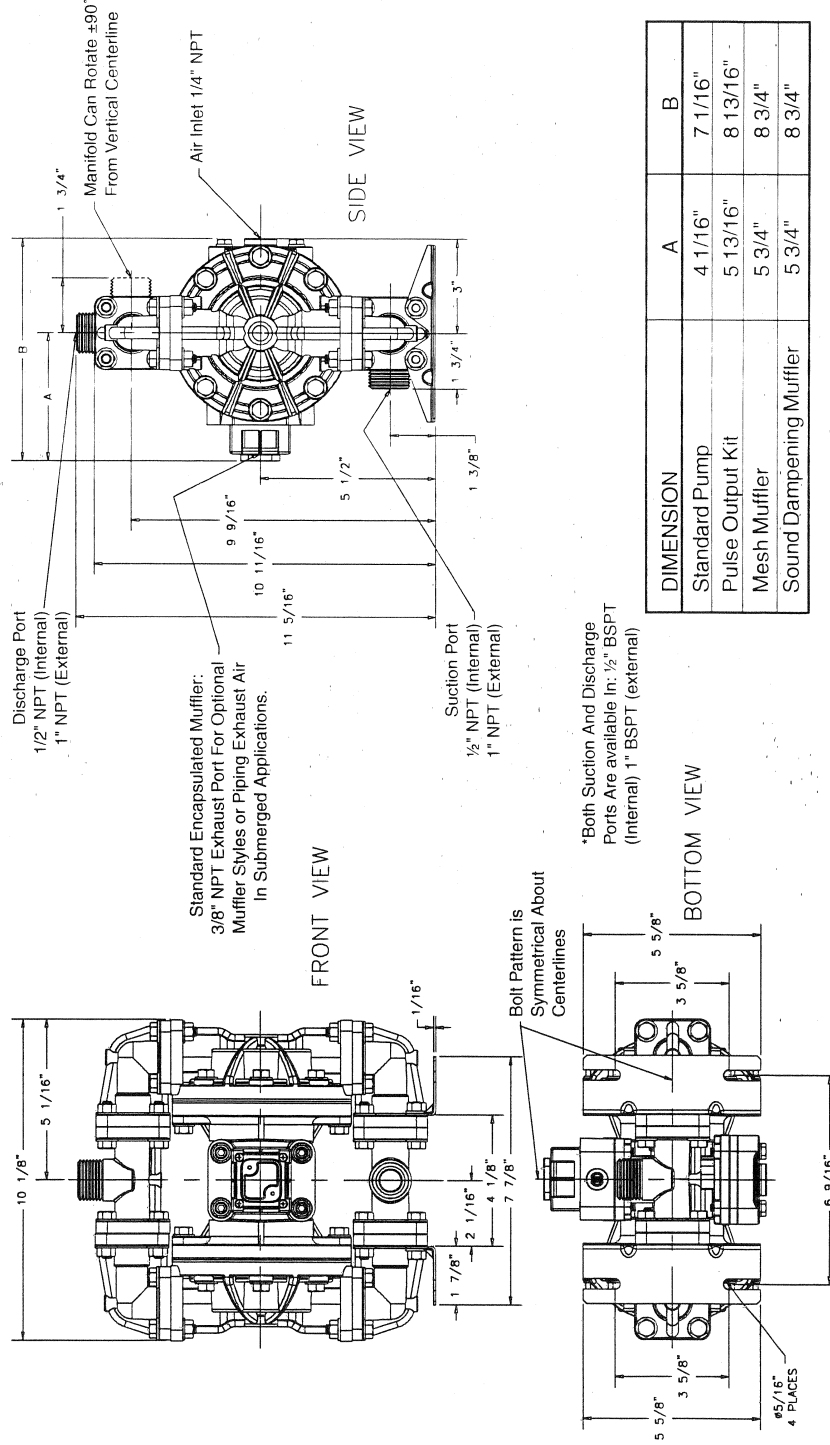
Lincoln pumps are designed to be powered only by compressed air.

Performance Curve



Dimensions:

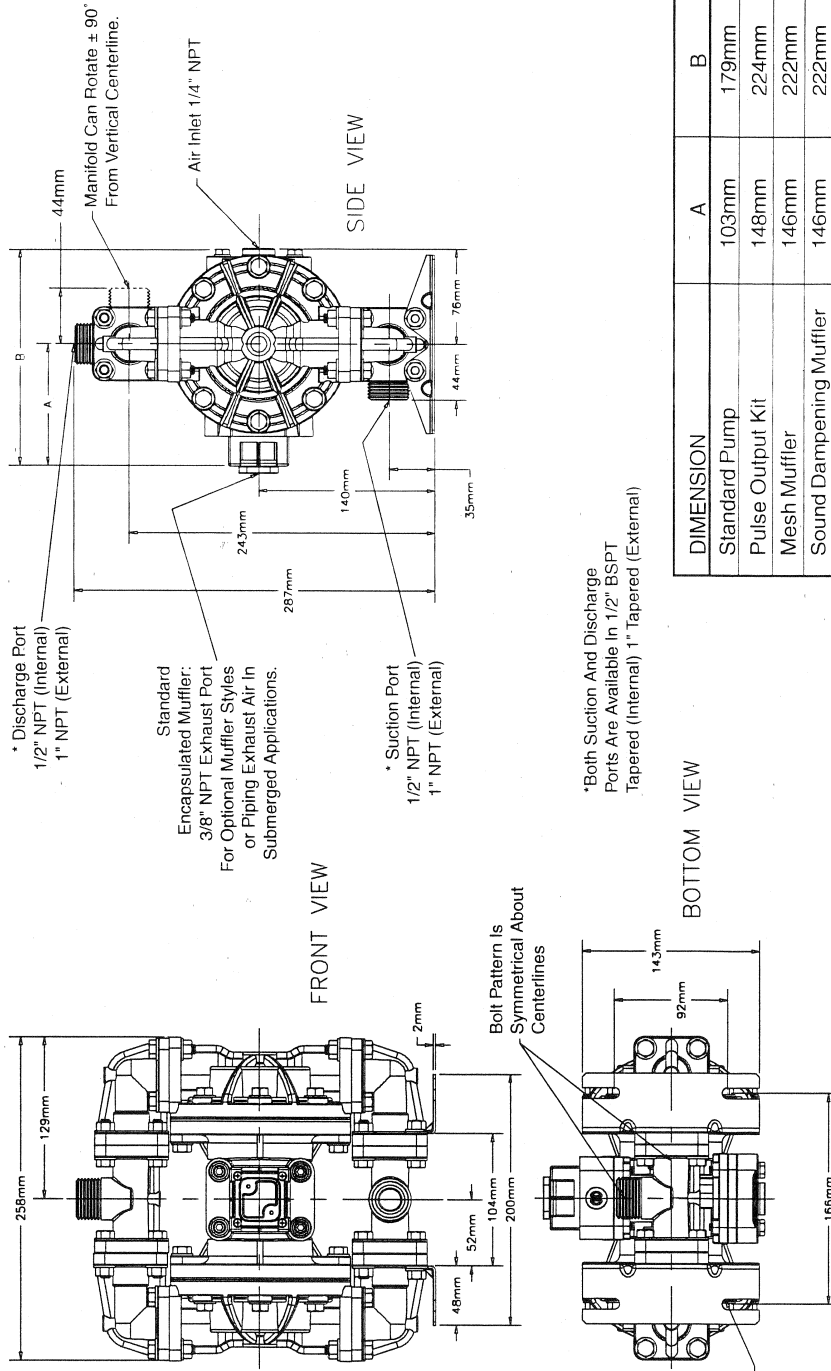
Dimensions in Inches
Dimensional tolerance: $\pm 1/8"$



DIMENSION	A	B
Standard Pump	4 1/16"	7 1/16"
Pulse Output Kit	5 13/16"	8 13/16"
Mesh Muffler	5 3/4"	8 3/4"
Sound Dampening Muffler	5 3/4"	8 3/4"

Metric Dimensions:

Dimensions in millimeters
Dimensional tolerance: $\pm 3\text{mm}$



DIMENSION	A	B
Standard Pump	103mm	179mm
Pulse Output Kit	148mm	224mm
Mesh Muffler	146mm	222mm
Sound Dampening Muffler	146mm	222mm

PRINCIPLE OF PUMP OPERATION

This ball type check valve pump is powered by compressed air and is a 1:1 ratio design. The inner side of one diaphragm chamber is alternately pressurized while simultaneously exhausting the other inner chamber. This causes the diaphragms, which are connected by a common rod secured by plates to the centers of the diaphragms, to move in a reciprocating action. (As one diaphragm performs the discharge stroke the other diaphragm is pulled to perform the suction stroke in the opposite chamber.) Air pressure is applied over the entire inner surface of the diaphragm while liquid is discharged from the opposite side of the diaphragm. The diaphragm operates in a balanced condition during the discharge stroke which allows the pump to be operated at discharge heads over 200 feet (61 meters) of water.

For maximum diaphragm life, keep the pump as close to the liquid being pumped as possible. Positive suction head in excess of 10 feet of liquid (3.048 meters) may require a back pressure regulating device to maximize diaphragm life.

Alternate pressurizing and exhausting of the diaphragm chamber is performed by an externally mounted, pilot operated, four way spool type air distribution valve. When the spool shifts to one end of the valve body, inlet pressure is applied to one diaphragm chamber and the other diaphragm chamber exhausts. When the spool

shifts to the opposite end of the valve body, the pressure to the chambers is reversed. The air distribution valve spool is moved by an internal pilot valve which alternately pressurizes one end of the air distribution valve spool while exhausting the other end. The pilot valve is shifted at each end of the diaphragm stroke when an actuator plunger is contacted by the diaphragm plate. This actuator plunger then pushes the end of the pilot valve spool into position to activate the air distribution valve.

The chambers are connected with manifolds with a suction and discharge check valve for each chamber, maintaining flow in one direction through the pump.

INSTALLATION AND START-UP

Locate the pump as close to the product being pumped as possible. Keep the suction line length and number of fittings to a minimum. Do not reduce the suction line diameter.

For installations of rigid piping, short sections of flexible hose should be installed between the pump and the piping. The flexible hose reduces vibration and strain to the pumping system. A Warren Rupp Tranquillizer® surge suppressor is recommended to further reduce pulsation in flow.

AIR SUPPLY

Air supply pressure cannot exceed 125 psi (8.6 bar). Connect the pump air inlet to an air supply of sufficient capacity and pressure required for desired performance. When the air

supply line is solid piping, use a short length of flexible hose not less than 1/2" (13mm) in diameter between the pump and the piping to reduce strain to the piping. The weight of the air supply line, regulators and filters must be supported by some means other than the air inlet cap. Failure to provide support for the piping may result in damage to the pump. A pressure regulating valve should be installed to insure air supply pressure does not exceed recommended limits.

AIR VALVE LUBRICATION

The air distribution valve and the pilot valve are designed to operate WITHOUT lubrication. This is the preferred mode of operation. There may be instances of personal preference or poor quality air supplies when lubrication of the compressed air supply is required. The pump air system will operate with properly lubricated compressed air supply. Proper lubrication requires the use of an air line lubricator (available from Warren Rupp) set to deliver one drop of SAE 10 non-detergent oil for every 20 SCFM (9.4 liters/sec.) of air the pump consumes at the point of operation. Consult the pump's published Performance Curve to determine this.

AIR LINE MOISTURE

Water in the compressed air supply can create problems such as icing or freezing of the exhaust air, causing the pump to cycle erratically or stop operating. Water in the air supply can be reduced by using a point-of-use air dryer

to supplement the user's air drying equipment. This device removes water from the compressed air supply and alleviates the icing or freezing problems.

AIR INLET AND PRIMING

To start the pump, open the air valve approximately 1/2" to 3/4" turn. After the pump primes, the air valve can be opened to increase air flow as desired. If opening the valve increases cycling rate, but does not increase the rate of flow, cavitation has occurred. The valve should be closed slightly to obtain the most efficient air flow to pump flow ratio.

BETWEEN USES

When the pump is used for materials that tend to settle out or solidify when not in motion, the pump should be flushed after each use to prevent damage. (Product remaining in the pump between uses could dry out or settle out. This could cause problems with the diaphragms and check valves at restart.) In freezing temperatures the pump must be completely drained between uses in all cases.



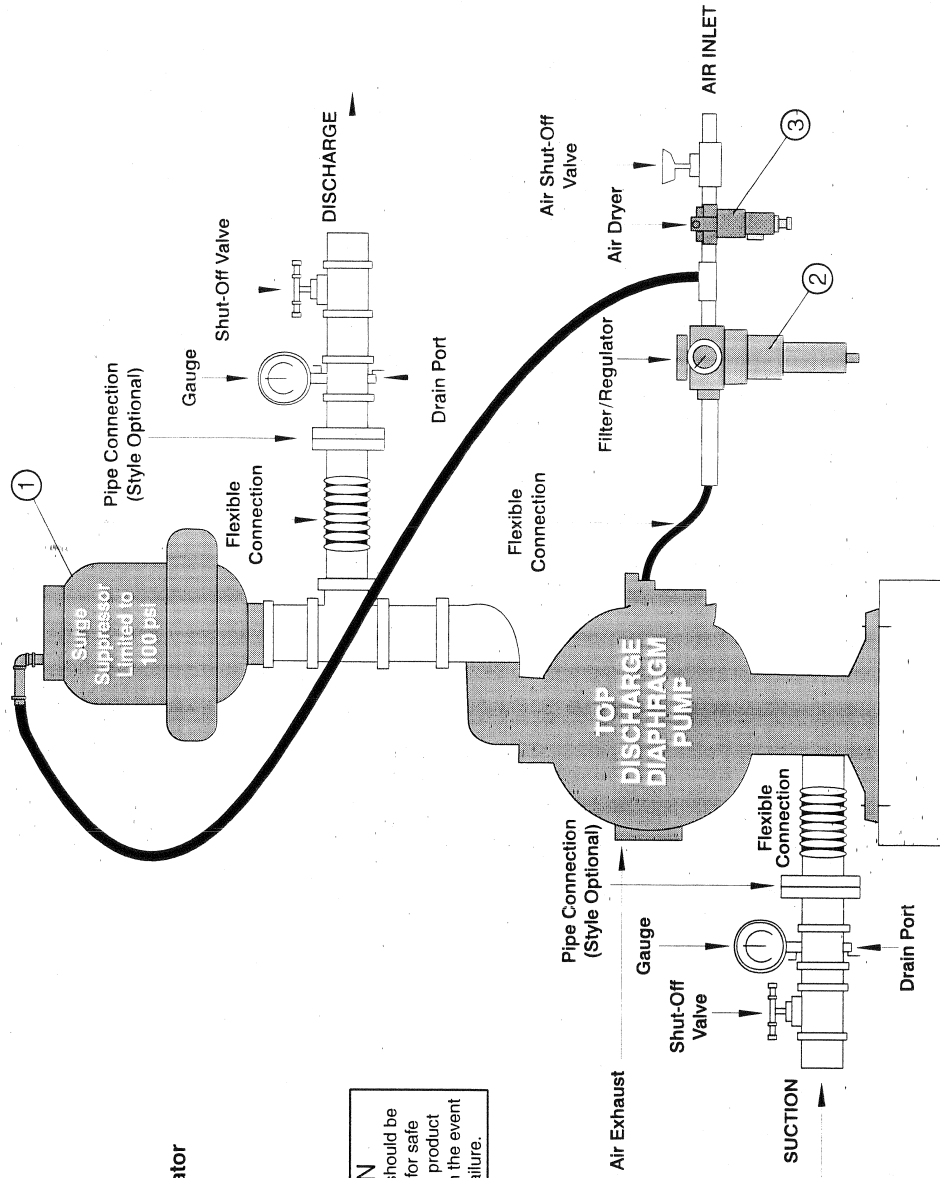

INSTALLATION GUIDE

Top Discharge Ball Valve Unit

Available from
Warren Rupp

- ① DA05 Surge Suppressor
- ② 020-049-000 Filter/Regulator
- ③ 020-049-001 Lubricator

CAUTION
The air exhaust should be piped to an area for safe disposition of the product being pumped, in the event of a diaphragm failure.



TROUBLESHOOTING

Possible Symptoms:

- Pump will not cycle.
- Pump cycles, but produces no flow.
- Pump cycles, but flow rate is unsatisfactory.
- Pump cycle seems unbalanced.
- Pump cycle seems to produce excessive vibration.

What to Check: Excessive suction lift in system.

Corrective Action: For lifts exceeding 20 feet (6 meters), filling the pumping chambers with liquid will prime the pump in most cases.

What to Check: Excessive flooded suction in system.

Corrective Action: For flooded conditions exceeding 10 feet (3 meters) of liquid, install a back pressure device.

What to Check: System head exceeds air supply pressure.

Corrective Action: Increase the inlet air pressure to the pump. Most diaphragm pumps are designed for 1:1 pressure ratio at zero flow.

What to Check: Air supply pressure or volume exceeds system head.

Corrective Action: Decrease inlet air pressure and volume to the pump as calculated on the published PERFORMANCE CURVE. Pump is cavitating the fluid by fast cycling.

What to Check: Undersized suction line.

Corrective Action: Meet or exceed pump connection recommendations shown on the DIMENSIONAL DRAWING.

What to Check: Restricted or undersized air line.

Corrective Action: Install a larger air line and connection. Refer to air inlet recommendations shown in your pump's SERVICE MANUAL.

What to Check: Check ESADS, the Externally Serviceable Air Distribution System of the pump.

Corrective Action: Disassemble and inspect the main air distribution valve; pilot valve and pilot valve actuators. Refer to the parts drawing and air valve section of the SERVICE MANUAL. Check for clogged discharge or closed valve before reassembly.

What to Check: Rigid pipe connections to pump.

Corrective Action: Install flexible connectors and a Warren Rupp Tranquilizer® Surge Suppressor.

What to Check: Blocked air exhaust muffler.

Corrective Action: Remove muffler screen, clean or de-ice and reinstall. Refer to the Air Exhaust section of your pump SERVICE MANUAL.

What to Check: Pumped fluid in air exhaust muffler.

Corrective Action: Disassemble pump chambers. Inspect for diaphragm rupture or loose diaphragm plate assembly. Refer to the Diaphragm Replacement section of your pump SERVICE MANUAL.

What to Check: Suction side air leakage or air in product.

Corrective Action: Visually inspect all suction side gaskets and pipe connections.

What to Check: Obstructed check valve.

Corrective Action: Disassemble the wet end of the pump and manually dislodge obstruction in the check valve pocket. Refer to the Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

What to Check: Worn or misaligned check valve or check valve seat.

Corrective Action: Inspect check valves and seats for wear and proper seating. Replace if necessary. Refer to Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

What to Check: Blocked suction line.

Corrective Action: Remove or flush obstruction. Check and clear all suction screens and strainers.

What to Check: Blocked discharge line.

Corrective Action: Check for obstruction or closed discharge line valves.

What to Check: Blocked pumping chamber.

Corrective Action: Disassemble and inspect the wetted chambers of the pump. Remove or flush any obstructions. Refer to the pump SERVICE MANUAL for disassembly instructions.

What to Check: Entrained air or vapor lock in one or both pumping chambers.

Corrective Action: Purge chambers through tapped chamber vent plugs. PURGING THE CHAMBERS OF AIR CAN BE DANGEROUS! Contact the Technical Services Department before performing this procedure. Any model with top-ported discharge will reduce or eliminate problems with entrained air.

If your pump continues to perform below your expectations, contact your local Distributor or factory Technical Services Group for a service evaluation.

Recycling

Many components of Non-Metallic AODD pumps are made of recyclable materials (see chart on page 10 for material specifications). We encourage pump users to recycle worn out parts and pumps whenever possible, after any hazardous pumped fluids are thoroughly flushed.

Important Safety Information



IMPORTANT

Read these safety warnings and instructions in this manual completely, before installation and start-up of the pump. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.



WARNING

Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.



WARNING

This pump is pressurized internally with air pressure during operation. Always make certain that all bolting is in good condition and that all of the correct bolting is reinstalled during assembly.



CAUTION

Before pump operation, inspect all gasketed fasteners for looseness caused by gasket creep. Re-torque loose fasteners to prevent leakage. Follow recommended torques stated in this manual.



WARNING

When used for toxic or aggressive fluids, the pump should always be flushed clean prior to disassembly.



WARNING

Before maintenance or repair, shut off the compressed air line, bleed the pressure, and disconnect the air line from the pump. The discharge line may be pressurized and must be bled of its pressure.



WARNING

Before doing any maintenance on the pump, be certain all pressure is completely vented from the pump, suction, discharge, piping, and all other openings and connections. Be certain the air supply is locked out or made non-operational, so that it cannot be started while work is being done on the pump. Be certain that approved eye-protection and protective clothing are worn all times in the vicinity of the pump. Failure to follow these recommendations may result in serious injury or death.



WARNING

In the event of diaphragm rupture, pumped material may enter the air end of the pump, and be discharged into the atmosphere. If pumping a product which is hazardous or toxic, the air exhaust must be piped to an appropriate area for safe disposition.



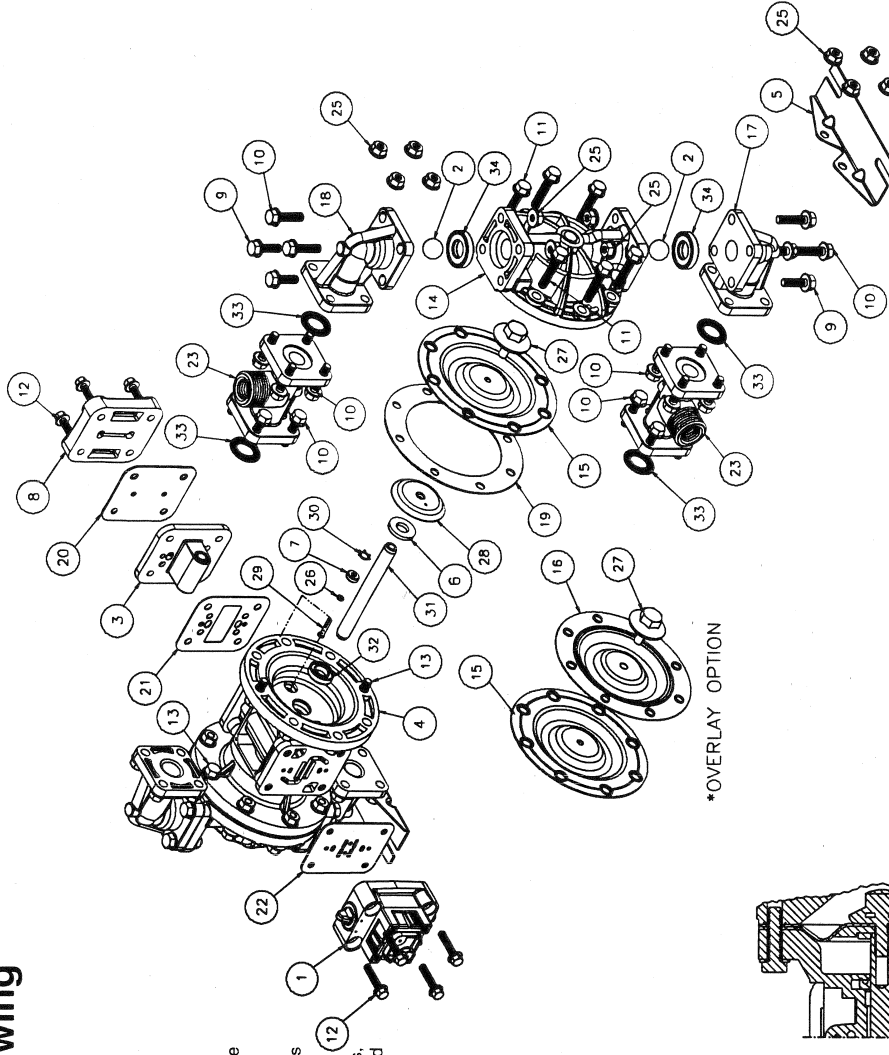
WARNING

Airborne particles and loud noise hazards. Wear ear and eye protection.

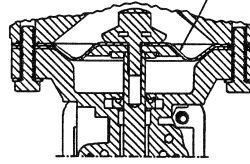
Composite Repair Parts Drawing

Available Service And Conversion Kits

- | | |
|-------------|--|
| Updated TBA | AIR END KIT
Seals, O-ring, Gaskets, Retaining Rings, Air Valve Assembly and Pilot Valve Assembly |
| 271871 | WET END KIT
Buna Diaphragms, Buna Check Balls, PTFE Seats and PTFE Seals |
| 271873 | WET END KIT
Santoprene Diaphragms, Nitrile Spacer Gaskets, Santoprene Check Balls, PTFE Seats and PTFE Seals |
| 271872 | WET END KIT
Santoprene Diaphragms, PTFE Overlay Diaphragm, PTFE Check Balls, PTFE Seats and PTFE Seals |



*OVERLAY OPTION



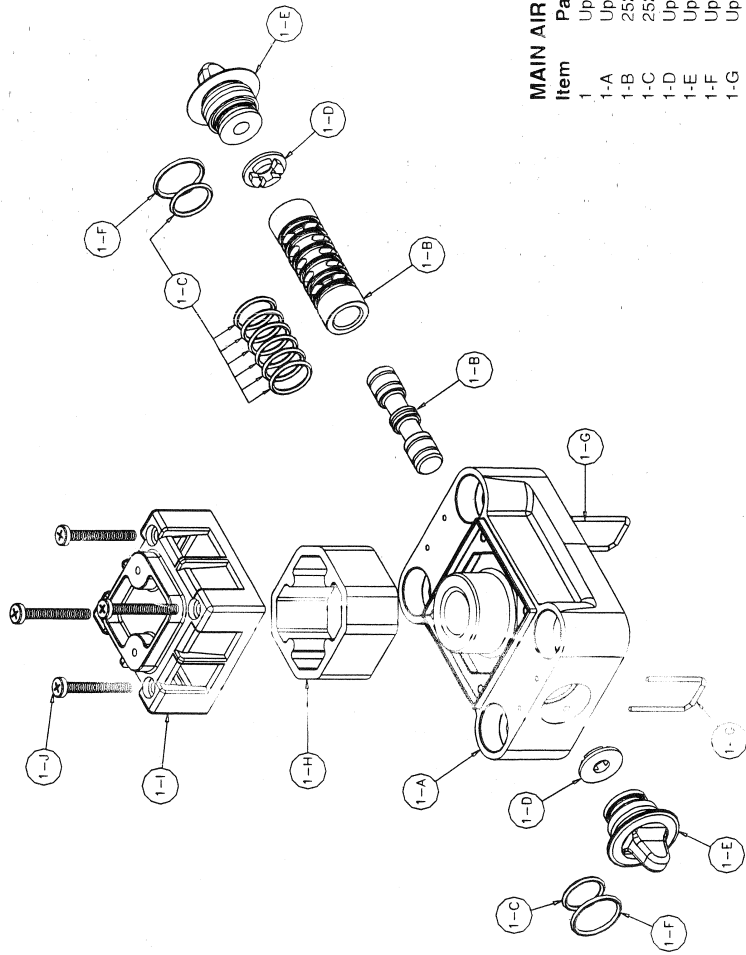
DIAPHRAGM CONFIGURATION DETAIL

NOTE TO ASSEMBLY:
THE DIAPHRAGM CONFIGURATION SHOWN ABOVE ARE TO BE INSTALLED WITH CONVOLUTIONS FACING TOWARDS CENTER OF PUMP

Composite Repair Parts List

ITEM	DESCRIPTION	QTY	MODEL 85623	MODEL 85622	MODEL 85626
1	Air Valve Assembly	1	Updated TBA	Updated TBA	Updated TBA
2	Ball, Check	4	252896 PTFE	252895 Santoprene	272208
3	Pilot Valve Assembly	1	252897	252897	252897
4	Intermediate Assembly	1	271986	271986	271986
5	Bracket, Mounting	2	271996	271996	271996
6	Bumper, Diaphragm	2	252900	252900	252900
7	Bushing, Plunger	2	252901	252901	252901
8	Cap, Air Inlet	1	271987	271987	271987
9	Capscrew, Flanged 5/16-18 x 1.00	8	271988	271988	271988
10	Capscrew, Flanged 5/16-18 x 1.25	24	271989	271989	271989
11	Capscrew, Flanged 5/16-18 x 1.50	12	271990	271990	271990
12	Capscrew, Flanged 1/4-20 x 1.25	8	271991	271991	271991
13	Capscrew, Flanged 5-16-18 x .88	4	271992	271992	271992
14	Chamber, Outer	2	271985	271985	271985
15	Diaphragm	2	252907	252907	271865
16	Diaphragm, Overlay	2	252908		
17	Elbow, Suction	2	252909	252909	252909
18	Elbow, Discharge	2	271994	271994	271994
19	Gasket, Spacer	2	252910	252910	252910
20	Gasket, Air Inlet	1	252911	252911	252911
21	Gasket, Pilot Valve	1	252912	252912	252912
22	Gasket, Air Valve	1	252913	252913	252913
23	Manifold	2	252914	252914	252914
25	Nut, Hex 5/16-13"	36	271993	271993	271993
26	O-Ring	2	240655	240655	240655
27	Plate, Outer Diaphragm	2	240768	240768	240768
28	Plate, Inner Diaphragm	2	252917	252917	252917
29	Plunger, Actuator	2	252918	252918	252918
30	Ring, Retaining	2	240717	240717	240717
31	Rod, Diaphragm	1	252920	252920	252920
32	Seal, Diaphragm Rod	2	252921	252921	252921
33	Seal, Manifold	4	252922	252922	252922
34	Seat, Check Valve	4	271995	271995	271995

Air Distribution Valve Assembly Drawing



MAIN AIR VALVE ASSEMBLY PARTS LIST

Item	Part Number	Description	Qty
1	Updated TBA	Air Valve Assembly	1
1-A	Updated TBA	Body, Air Valve	1
1-B	252929	Sleeve and Spool Set	1
1-C	252927	O-Ring	8
1-D	Updated TBA	Bumper	2
1-E	Updated TBA	End Cap	2
1-F	Updated TBA	O-Ring	2
1-G	Updated TBA	End Cap Retainer	2
1-H	Updated TBA	Muffler	1
1-I	252931	Muffler Cap	1
1-J	252932	Self-Tapping Screw	4

AIR DISTRIBUTION VALVE SERVICING

To service the air valve first shut off the compressed air, bleed pressure from the pump, and disconnect the air supply line from the pump.

Step #1: See COMPOSITE REPAIR PARTS DRAWING.

Using a 3/8" wrench or socket, remove the four hex flanged capscrews (item 12). Remove the air valve assembly from the pump.

Step #2: Disassembly of the air distribution valve.

To access the internal air valve components first remove the two end cap retainers (item 1-G) by inserting a small flat screwdriver into the two slotted grooves on the valve body and gently lifting the retainers out.

Next remove the two end caps (item 1-E) by grasping the pull tab with finger and thumb or pliers and tugging. Inspect the two o-rings (items 1-C and 1-F) on each end cap for wear or cuts. Replace the o-rings if necessary.

Remove the two bumpers (items 1-D) and inspect for wear or damage. Be careful not to scratch or damage the outer diameter of the spool. Wipe spool with a soft cloth and inspect for scratches or wear.

Remove the spool (part of item 1-B) from the sleeve. Be careful not to scratch or damage the outer diameter of the spool. Wipe the spool with a soft clean cloth and inspect for scratches or abrasive wear.

Inspect the inner diameter of the sleeve (part of item 1-B) for dirt, scratches, or other contaminants. Remove the sleeve if needed and replace with a new sleeve and spool set (item 1-B). **Note:** The sleeve and spool set is match-ground to a specified clearance. Sleeves and spools cannot be interchanged.

Step #3: Reassembly of the air distribution valve.

Install one bumper (item 1-D) and one end cap with o-rings (items 1-E, 1-C, and 1-F) into one end of the air valve body (item 1-A). Insert one end cap retainer (item 1-G) into the two smaller holes, align with groove in the end cap, and push until the closed end of the retainer is below the flat surface of the valve body.

Remove the new sleeve and spool set (item 1-B) from the plastic bag. Carefully remove the spool from the sleeve. Install the six o-rings (item 1-C) into the six grooves on the sleeve. Apply a light coating of grease to the o-rings before installing the sleeve into the valve body, align the slots in the sleeve with the slots in the valve body. Insert the spool into the sleeve. Be careful not to scratch or damage the spool during installation. Push the spool in until it touches the bumper on the opposite end. Install the remaining bumper, end cap with o-rings, and retainer.

Fasten the air valve assembly (item 1) and gasket (item 22) to the pump, using the four hex flanged capscrews (item 12).

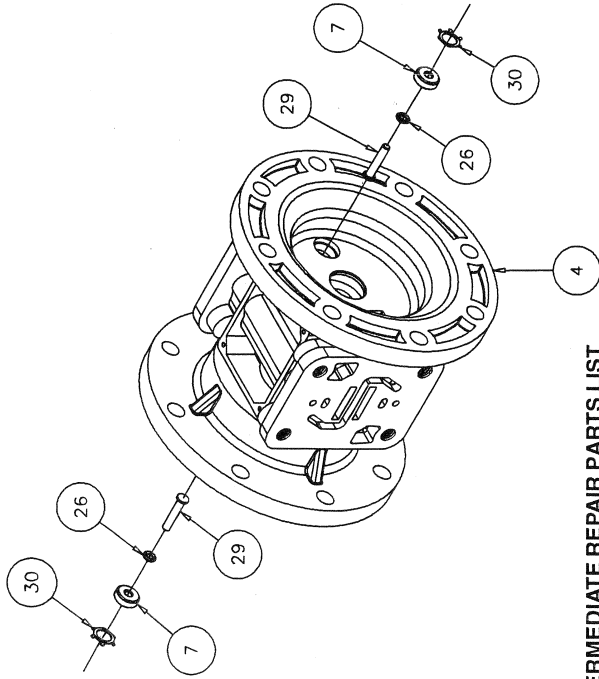
Connect the compressed air line to the pump. The pump is now ready for operation.



▲ IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

Intermediate Assembly Drawing



INTERMEDIATE REPAIR PARTS LIST

Item	Part Number	Description	Qty
4	271986	Bracket, Intermediate	1
7	252901	Bushing, Plunger	2
26	240655	O-Ring	2
29	252918	Plunger, Actuator	2
30	240717	Ring, Retaining*	2

*Note: It is recommended that when plunger components are serviced, new retaining rings be installed.

Intermediate Assembly Servicing

ACTUATOR PLUNGER SERVICING

To service the actuator plunger first shut off the compressed air supply, bleed the pressure from the pump, and disconnect the air supply line from the pump.

Step #1: See PUMP ASSEMBLY DRAWING.

Using a 3/8" wrench or socket, remove the four capscrews (items 12). Remove the air inlet cap (item 8) and air inlet gasket (item 20). The pilot valve assembly (item 3) can now be removed.

Step #2: Servicing the actuator plungers.

See PUMP ASSEMBLY DRAWING. The actuator plungers (items 29) can be reached through the stem cavity of the pilot valve in the intermediate bracket (item 4). To service bushings, o-rings and retaining rings, see Intermediate Drawing.

Remove the plungers (items 29) from the bushings (item 7) in each end of the intermediate cavity. Inspect for wear or damage. Replace plunger as needed. Apply a light coating of grease to each o-ring and re-install the plungers in to the bushings. Push the plungers in as far as they will go.

Step #3: Re-install the pilot valve assembly into the intermediate assembly.

Be careful to align the ends of the stem between the plungers when inserting the stem of the pilot valve into the cavity of the intermediate.

Re-install the gasket (item 20), air inlet cap (item 8) and capscrews (items 12).

Connect the air supply to the pump. The pump is now ready for operation.

PLUNGER BUSHING, O-RING, AND RETAINING RING SERVICING

To service the plunger bushing components first remove the two retaining rings (items 30) using a small flat screwdriver. *Note: It is recommended that new retaining rings be installed.

Next remove the two plunger bushings (items 7). Inspect the bushings for wear or scratches. Replace the bushings as necessary.

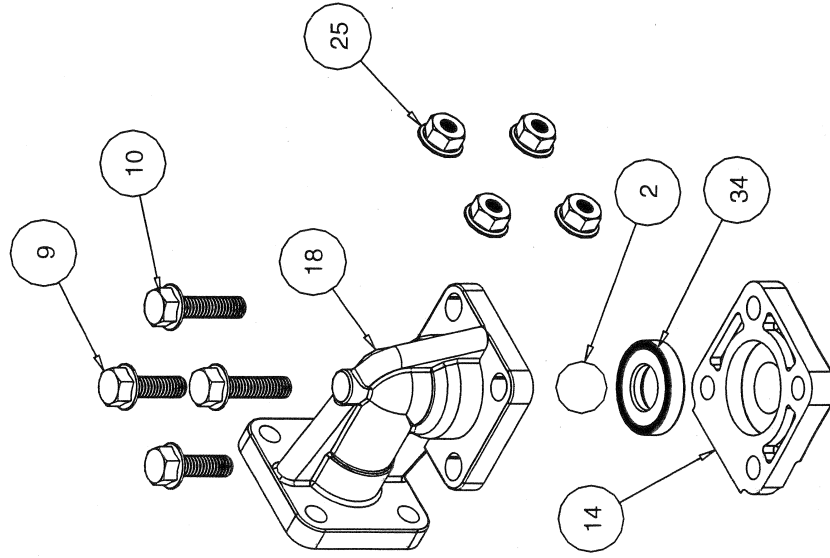
Inspect the two o-rings (26) for cuts and/or wear.



IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

Check Ball Valve Drawing



MODULAR CHECK BALL VALVE SERVICING

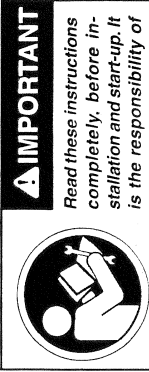
Before servicing the check valves, first shut off the suction line and then the discharge line to the pump. Next, shut off the compressed air supply, bleed air pressure from the pump, and disconnect the air supply line from the pump. Drain any remaining fluid from the pump. The pump can now be removed for service.

To access the modular check valve, remove the elbows (items 17 and 18 from pump composite repair parts drawing). Use a 1/2" wrench or socket to remove the fasteners. Once the elbows are removed, the modular check valves can be seen in the cavities of the outer chamber (items 14).

Inspect the check balls (items 2) for wear, abrasion, or cuts on the spherical surface. The check valve seats (items 34) should be inspected for cuts, abrasive wear, or embedded material on the surfaces of both the external and internal chamfers. The spherical surface of the check balls must seat flush to the surface of the inner chamfer on the check valve seats for the pump to operate to peak efficiency. Replace any worn or damaged parts as necessary.

RE-ASSEMBLE THE CHECK VALVE

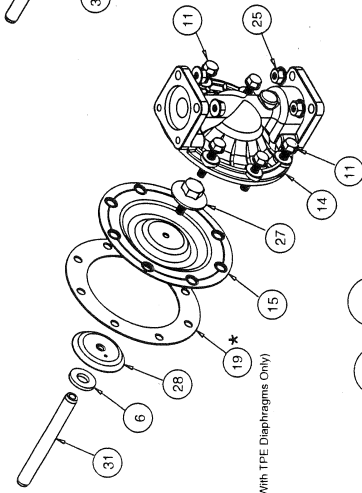
Place a check ball (item 2) in the ball cage of either the discharge elbow or the outer chamber. Install a check valve seat in the counter on each end of the chamber. Refasten the elbows to the chamber.



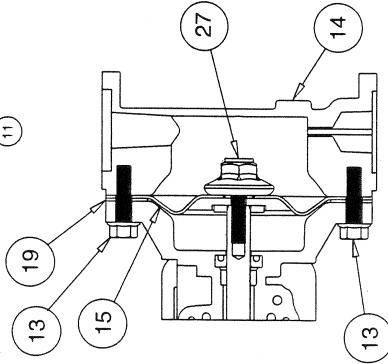
IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

Diaphragm Service Drawing

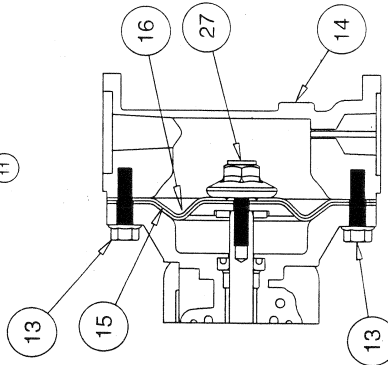
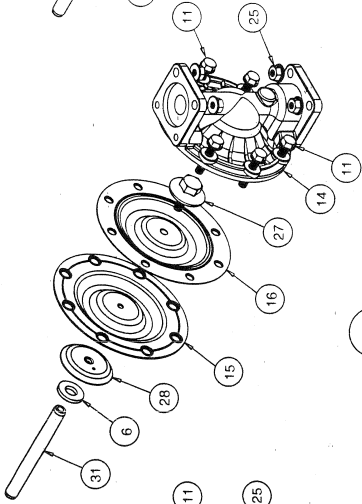


* (Use With TPE Diaphragms Only)



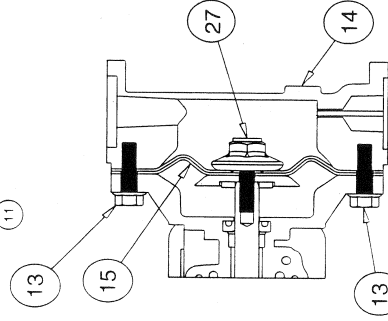
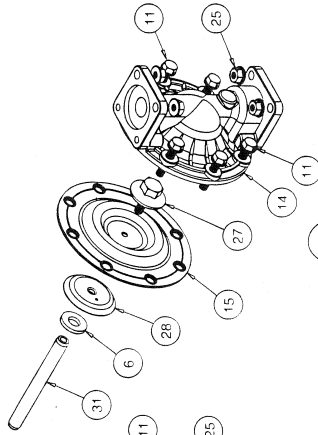
Diaphragm Orientation
Install diaphragm and spacer
as shown above.

Diaphragm Service Drawing,
with Overlay



Diaphragm Orientation
Install diaphragm and overlay
as shown above.

Diaphragm Service Drawing
with uniRupp®



Diaphragm Orientation
Install diaphragm (286-095-650 only)
as shown above.

DIAPHRAGM SERVICING

To service the diaphragms first shut off the suction, then shut off the discharge lines to the pump. Shut off the compressed air supply, bleed the pressure from the pump, and disconnect the air supply line from the pump. Drain any remaining liquid from the pump.

Step #1: See the pump composite repair parts drawing, and the diaphragm servicing illustration.

Using a 1/2" wrench or socket, remove the 16 capscrews (items 9 & 10), and flanged nuts that fasten the elbows (items 17 and 18) to the outer chambers (items 14). Remove the elbows with the manifolds and spacers attached.

Step #2: Removing the outer chambers.

Using a 1/2" wrench or socket, remove the 16 capscrews (items 11 and 13), and flanged nuts that fasten the outer chambers, diaphragms, and intermediate (item 4) together.

Step #3: Removing the diaphragm assemblies.

Use a 3/4" (19mm) wrench or six pointed socket to remove the diaphragm assemblies (outer plate, diaphragm, and inner plate) from the diaphragm rod (item 31) by turning counterclockwise.

Insert a 6-32 set screw into the smaller tapped hole in the inner diaphragm plate (item 28). Insert the protruding stud and the 6-32 fastener loosely into a vise. Use a 3/4" wrench or socket to remove the outer diaphragm

plate (item 27) by turning counterclockwise. Inspect the diaphragm (item 15) for cuts, punctures, abrasive wear or chemical attack. Replace the diaphragms if necessary.

Step #4: Installing the diaphragms.
Push the threaded stud of the outer diaphragm plate through the center hole of the diaphragm. Thread the inner plate clockwise onto the stud. Insert the loose assembly with the above 6-32 fastener back into the vise. Use a torque wrench to tighten the diaphragm assembly together to 90 in lbs. (10.17 Newton meters) 120 in lbs. Santoprene (13.56 Newton meters). Allow a minimum of 15 minutes to elapse after torquing, then re-torque the assembly to compensate for stress relaxation in the clamped assembly.

Step #5: Installing the diaphragm assemblies to the pump.

Make sure the bumper (item 6) is installed over the diaphragm rod.

Thread the stud of the one diaphragm assembly clockwise into the tapped hole at the end of the diaphragm rod (item 31) until the inner diaphragm plate is flush to the end of the rod. Insert rod into pump.

Align the bolt holes in the diaphragm with the bolt pattern in the intermediate (item 4).

Fasten the outer chamber (item 14) to the pump, using the capscrews (items 11 and 13) and flanged nuts.

On the opposite side of the pump, pull the diaphragm rod out as far as

possible. Make sure the bumper (item 6) is installed over the diaphragm rod.

Thread the stud of the remaining diaphragm assembly clockwise into the tapped hole at the end of the diaphragm rod (item 31) as far as possible and still allow for alignment of the bolt holes in the diaphragm with the bolt pattern in the inner chamber. Install diaphragms with convolutions facing towards center of pump. See sectional view on previous page.

Fasten the remaining outer chamber (item 14) to the pump, using the capscrews (items 11 and 13) and flanged nuts.

Step #6: Re-install the elbow/spacer/manifold assemblies to the pump, using the capscrews (items 9 & 10) and flanged nuts.

The pump is now ready to be re-installed, connected and returned to operation.

OVERLAY DIAPHRAGM SERVICING

The overlay diaphragm (item 16) is designed to fit snugly over the exterior of the standard TPE diaphragm (item 15).

uniRupp® DIAPHRAGM SERVICING

Follow the same procedures described for the standard diaphragm for removal and installation. **Note:** The uniRupp diaphragm is installed in the direction as shown in the lower right illustration above.



IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

PUMPING HAZARDOUS LIQUIDS

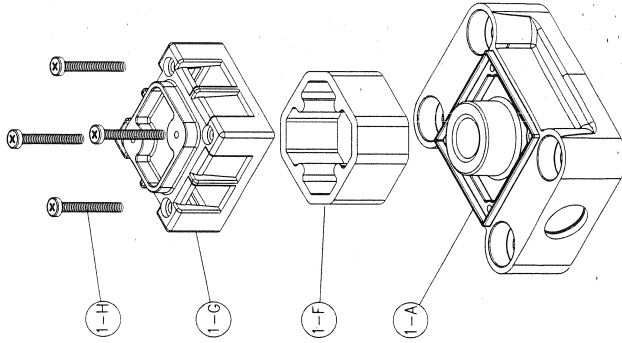
When a diaphragm fails, the pumped liquid or fumes enter the air end of the pump. Fumes are exhausted into the surrounding environment. When pumping hazardous or toxic materials, the exhaust air must be piped to an appropriate area for safe disposal. See illustration #1 at right.

This pump can be submerged if the pump materials of construction are compatible with the liquid being pumped. The air exhaust must be piped above the liquid level. See illustration #2 at right. Piping used for the air exhaust must not be smaller than 1" (2.54 cm) diameter. Reducing the pipe size will restrict air flow and reduce pump performance. When the pumped product source is at a higher level than the pump (flooded suction condition), pipe the exhaust higher than the product source to prevent siphoning spills. See illustration #3 at right.

IMPORTANT INSTALLATION NOTE:

The manufacturer recommends installing a flexible hose or connection between the pump and any rigid plumbing. This reduces stresses on the molded plastic threads of the air exhaust port. Failure to do so may result in damage to the air distribution valve body.

Any piping or hose connected to the pump's air exhaust port must be physically supported. Failure to support these connections could also result in damage to the air distribution valve body.



CONVERTED EXHAUST ILLUSTRATION

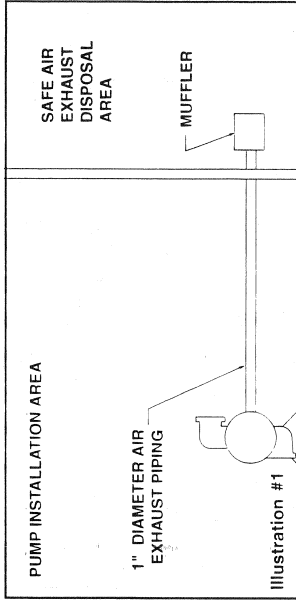


Illustration #1

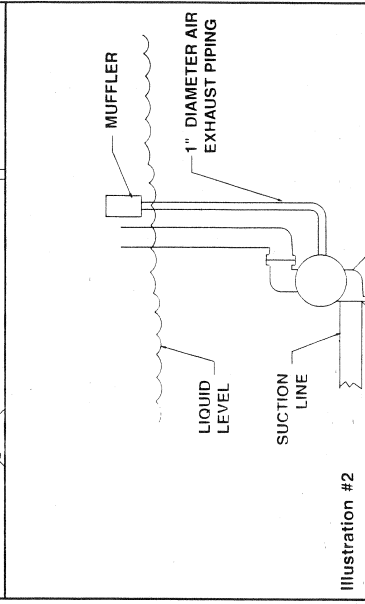


Illustration #2

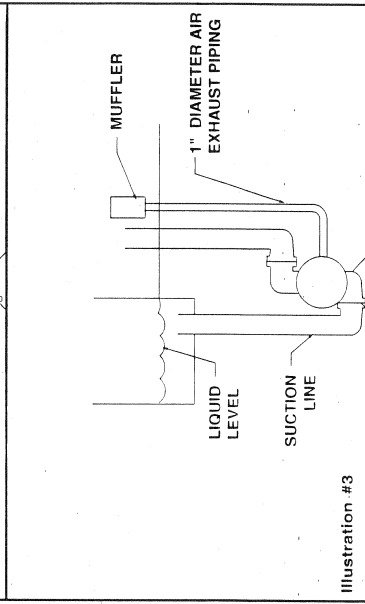


Illustration #3

CONVERTING THE PUMP FOR PIPING THE EXHAUST AIR

The following steps are necessary to convert the pump to pipe the exhaust air away from the pump.

Use a #8 Torx or flat screwdriver to remove the four self-tapping screws (item 1-J) (Plastic Valves). Use a Phillips screwdriver to remove four machine screws (item 1-I) (Aluminum Valves).

Remove the muffer cap and muffer. The air distribution valve body has 1" NPT threads for installation of alternate mesh or sound dampening mufflers or piped exhaust.



APPENDIX VII

Hydraulic International Operation and Maintenance Instructions




HYDRAULICS INTERNATIONAL, INC.

OPERATION AND MAINTENANCE INSTRUCTIONS FOR **AIR DRIVEN GAS BOOSTER SINGLE ACTING, SINGLE AIR DRIVE**

AS CHECKED BELOW:

OM-GSS-100 (7 Pages) APPLIES TO ALL MODELS BELOW:

	MODEL	SPECIFIC			
		Trouble-shooting	Drawings		
			Unit	Sub-assy	Seal Kits
	<input type="checkbox"/> 5G-SS-7	5G-SS-7 5 Pages	80275	80082 80217 80287 80289	80626 80628
	<input type="checkbox"/> 5G-SS-14	5G-SS-14 5 Pages	80200	80082 80209 80212 80217	80626 80629
	<input checked="" type="checkbox"/> 5G-SS-30	5G-SS-30 5 Pages	80201	80082 80210 80213 80217	80626 80630
	<input type="checkbox"/> 5G-SS-50	5G-SS-50 5 Pages	80960	80082 80217 80969 80976	80626 80636
	<input type="checkbox"/> 5G-SS-75	5G-SS-75 5 Pages	80202	80082 80211 80214 80217	80626 80631

Supplementary Data Attached:

CONTENTS

A. GENERAL INSTRUCTIONS – OM-GSS-100

- 1.0 SAFETY INFORMATION
 - 1.1 High Pressure Gas
 - 1.1.1 Mishandling
 - 1.1.2 Misapplication
 - 1.1.2.1 Published Ratings
 - 1.1.2.2 Potential Pressures
 - 1.1.2.3 Basic Data Maximum Safe Pressures By Model
 - 1.1.2.4 Basic Formulas Potential Outlet Pressures
 - 1.1.2.5 Compression Ratings
- 2.0 LIMITED WARRANTY – RETURN GOODS AUTHORIZATION (RGA)
- 3.0 ASSEMBLY DRAWINGS AND PARTS LISTS
 - 3.1 Unit Assembly
 - 3.2 Subassembly Detail
 - 3.3 Seal Kit Assembly Detail
- 4.0 PORT CONFIGURATION DETAIL
- 5.0 THEORY OF OPERATION
 - 5.1 Drive Section
 - 5.2 Boost Section
 - 5.3 Cycling Section
 - 5.4 Operational and Area Relationships
- 6.0 STARTUP/SHUTDOWN
 - 6.1 Controls
 - 6.2 Operation
- 7.0 MAINTENANCE
 - 7.1 Periodic
 - 7.2 Special Tools

B. SPECIFIC ATTACHMENTS BY MODEL

- 8.0 TROUBLESHOOTING BY SPECIFIC MODEL
 - 8.1 Understanding How It Works
 - 8.2 The Basic Drive System
 - 8.3 The Basic Gas Boosting System
 - 8.4 The Basic Air Cycling System
 - 8.5 Chart: Symptoms and Suggested Remedies
- 9.0 TESTING
 - 9.1 Gas Section
 - 9.2 Drive Section

A. GENERAL INSTRUCTIONS

1.0 SAFETY INFORMATION

1.1 High Pressure Gas.

These units are designed to accept shop air inlet pressures up to 150 PSI for drive and boost an independent source of clean gas to a higher pressure.

CAUTION

Compressed gas is hazardous if mishandled or misapplied. Installation and operation must always be in a well ventilated area, preferably outdoors weather permitting. All gases (except compressed air) become hazardous in a poorly ventilated area due to their potential for displacing the ambient air needed for normal respiration.

1.1.1 Mishandling.

Attempting to dismantle the unit or any part of the system without

First shutting off the incoming gas source and venting all sections of the unit and the system that have the potential to contain gas under pressure.

This can be done using vent valves if they are installed or,

Loosening appropriate tube connections to dissipate pressure at any point.

1.1.2 Misapplication.

Exceeding the published maximum pressure rating of either the gas booster unit (drive section or boost section); or downstream components such as receivers, piping, valves, or gauges.

1.1.2.1 Be aware of published ratings. If questionable, contact the applicable manufacturer.

1.1.2.2 Be aware of the maximum output (boost) pressure potential of the individual model to be used. Install pressure gauge at critical points.

Maximum can be predetermined by:

The pressure to the drive section input combined with the pressure to the boost section inlet. Ref: 1.1.2.4.

1.1.2.3 Basic Data-Maximum Safe Pressures By Model.

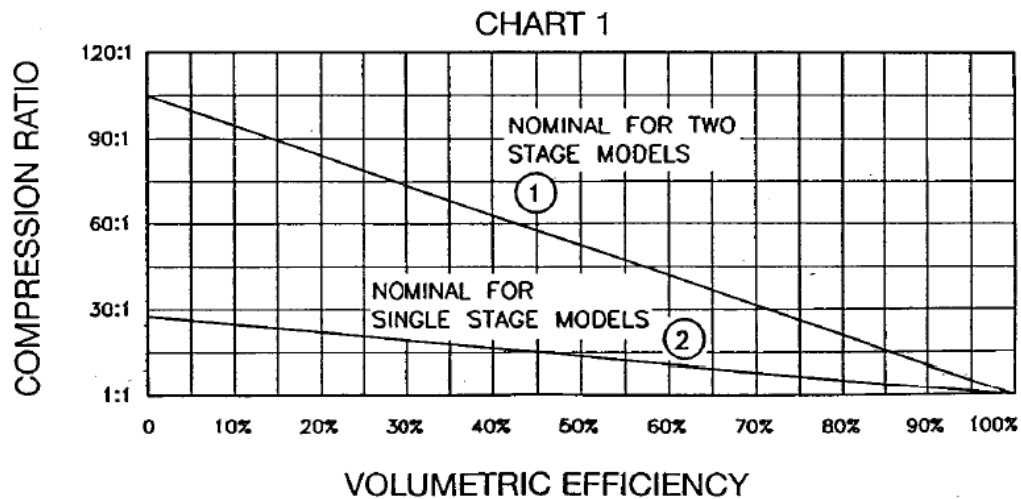
MODEL	GAS BOOSTING SECTION – MAXIMUM SAFE PSI	
	INLET	OUTLET
5G-SS-7	2,500	2,500
5G-SS-14	4,500	4,500
5G-SS-30	9,000	9,000
5G-SS-50	15,000	15,000
5G-SS-75	25,000	25,000

1.1.2.4 Basic Formulas – Potential Pressures By Model.

MODEL	OUTLET	NOTE: Outlet pressure can also be limited by the compression ratio: $\frac{\text{Outlet psia}}{\text{Inlet psia}}$
5G-SS-7	7 x Drive Air	
5G-SS-14	14 x Drive Air	
5G-SS-30	30 x Drive Air	
5G-SS-50	50 x Drive Air	
5G-SS-75	75 x Drive Air	

Curve #2 on Chart 1 below shows that efficiency drops to zero (no flow) when the C.R. reaches about 28:1, e.g. Model 5G-SS-30 with 150 PSI drive air potentially can boost to 30 x 150 = 4500 PSI. (4514.7 PSIA). $\frac{4514.7}{28:1} = 161 \text{ PSIA} = 147 \text{ PSI}$. Therefore any inlet pressure less than 147 PSI will prevent reaching a 4500 PSI outlet. In practice, 60% efficiency minimum is recommended for most applications (C.R. = 10:1). In this example, about 450 PSI would be recommended minimum inlet pressure to reach 4550 PSI.

1.1.2.5



2.0 LIMITED WARRANTY

Hydraulics International manufactured products are warranted free of original defects in material and workmanship for a period of one year from date of purchase to first user. This warranty does not include O-rings, seals or failures caused by lack of proper maintenance, incompatible fluids, foreign contaminants in the drive section, in the pump section or application of pressures beyond catalog ratings. Products believed to be originally defective may be returned, freight prepaid, for repair and/or replacement to the distributor or to the factory. If upon inspection by the factory or distributor the problem is found to be originally defective material or workmanship, repair or replacement will be made at no charge for labor or materials, F.O.B. the point of repair or replacement. Permission to return under warrant should be requested before shipment and include the following: A Return Goods Authorization Number (RGA), the original purchase date, purchase order number, serial number, model number, reason for return or other pertinent data to establish warranty claim and to expedite the return or replacement to the owner.

If the unit has been disassembled and reassembled in a facility other than HYDRAULICS INTERNATIONAL without prior written authorization, warranty is void if it has been improperly reassembled or substitute parts have been used in place of factory manufactured parts.

Any modification to any HYDRAULICS INTERNATIONAL product that you have made or may make in the future has been and will be at your sole risk and responsibility, and without HYDRAULICS INTERNATIONAL's approval or consent. HYDRAULICS INTERNATIONAL disclaims any and all liability obligation, or responsibility for the modified product. And for any claims, demands or causes of action for damage or for personal injuries resulting from the modification and/or use of such a modified HYDRAULICS INTERNATIONAL product.

HYDRAULICS INTERNATIONAL obligation with respect to its products shall be limited to replacement, and in no event shall HYDRAULICS INTERNATIONAL be liable for any loss or damage, consequential or special, of whatever kind or nature, or any other expense which may arise in connection with or as a result of such products or the use or incorporation thereof in a job. This warranty is expressly made in lieu of all other warranties of merchantability and fitness for a particular purpose. No express warranty and no implies warranties whether of merchantability or fitness for a particular purpose or otherwise, other than those expressly set forth above, shall apply to HYDRAULICS INTERNATIONAL products.

3.0 ASSEMBLY, PARTS LIST, AND SUBASSEMBLY DRAWINGS

The DRAWINGS that apply are listed on the front cover page, and are also attached.

3.1 Unit Assembly Drawing.

- Lists all parts in your unit by Item No. vs Part No.
- Lists any subassemblies by their own drawing number.
- Lists all seal kits by their own drawing number.
- Provides a detailed cross section of your unit which will be the major reference in a subsequent discussion of operation, maintenance, and troubleshooting.

3.2 Subassembly Drawings provide subassembly cross section detail plus piece part item numbers whose part numbers are listed on page 1 of the subassembly drawing.

3.3 Seal Kit Drawings provide cross section detail with item numbers showing where each seal kit item fits. Part numbers are listed on both the seal kit drawing and on the unit assembly drawing, but item numbering will differ.

4.0 PORT CONFIGURATION DETAIL

Refer to current catalog GB500 under selection table and notes.

5.0 THEORY OF OPERATION

All units consist of 3 basic sections, each with their specific function;

5.1 Drive Section.

Provides the reciprocating force to the boost section.

5.2 Boost Section.

Provides the compressing (pumping) action for high pressure output.

5.3 Cycling Section.

Consists of the directional control air valving built into the drive enabling the drive to reciprocate continuously whenever air is applied to the drive input.

5.4 Operational and Area Relationships.

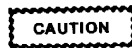
	MODEL	PISTON AREA RATIOS-NOMINAL
		A:A ₁
	5G-SS-7	7:1
	5G-SS-14	14:1
	5G-SS-30	30:1
	5G-SS-50	50:1
5G-SS-75	75:1	

6.0 START UP/SHUT DOWN

Preferably, the incoming gas source should be turned on first so that incoming pressure is allowed to equalize throughout the downstream system, including any receiver tanks, before the drive on the unit is allowed to cycle. Then the drive is turned on permitting the unit to boost the downstream system to the desired pressure and stop. At shut down for overnight or longer periods, we recommend that the incoming gas and the drive air be shutoff.

6.1 Controls.

The incoming air supply may be unregulated (unless it exceeds 150 PSI). In most applications, the boosted gas from an output receiver is regulated. The incoming gas should incorporate an on/off valve and a particle filter, nominal 5 mic. The pipe size should be equivalent to the booster inlet port.



All installations must include a safety relief valve suitable for gas service installed immediately downstream of the booster outlet, upstream of any shut-off valves, and set at the safe working pressure of the lowest rated component in the outlet system.

The air supply to the drive input should also include a manual on/off valve and an air filter/water separator unit, nominal 20 mic ½ NPT or larger. An air regulator in this line is optional. An efficient control of maximum output pressure is an HII PCV (pilot control valve) normally open, installed in the output system adjusted to close external pilot air to the drive when desired maximum output is reached. This must be backed up by a safety relief valve set approximately 5% higher. For external pilot air porting modification "X" must be specified on new units, or it can be field-installed using kit P/N 80528-100.

6.2 Operation.

In most applications, the sequence is:

- Equalize the system with the source gas pressure.
- Turn on air to the drive (or external pilot).
- Allow unit to charge the system and stop at preselected pressure (either with PCV valve or manually shutting off drive or external pilot air, or setting stall pressure with a drive air regulator).
- Regulate the boosted gas to precisely the pressure required for the job.

For a further description of various applications and suggested controls, consult current HII catalog GB500.

7.0 MAINTENANCE.

7.1 Periodic.

All HII models incorporate a spool-type directional control valve that is the heart of the cycling system for the drive. The standard valve depends on dynamic O-rings which are lubricated with light grease at original assembly. *Periodically, these valve O-rings should be wiped clean and regreased for reliable operation. The frequency will be determined by many variables such as air moisture content, contamination, cycle rates, and overall duty cycle of individual applications. All HII units are designed so that this spool/O-ring assembly is easily accessible with simple hand tools without disassembling any other sections of the drive. The typical symptom indicating need for regreasing the O-rings is slow, erratic cycling. It is suggested that a note be made of the frequency of this slow down, so that it can be predicted, and then the O-rings cleaned and regreased at a convenient shut down to insure uninterrupted operation when the unit is needed.

The detailed assembly drawing attached clearly shows the cycling spool/O-ring assembly and its accessibility.



Be sure the incoming air is shut off before removing any parts.

Periodic lubrication of any OTHER PARTS of the unit is NOT REQUIRED nor recommended.

* If the booster is equipped with modification “N”, a lapped, match fit spool and sleeve assembly replaces the O-ring sealed spool and is further explained on service bulletin SB02-NMOD.

7.2 Special Tools. Available at low cost from HII Service Dept.

P/N 80273-100 - Sleeve Extractor. Used for pulling the valve sleeve 80028-1 (Item 1, Drawing 80217) out of end cap assembly 80217. This is done only if it is necessary to replace the 4 each O-rings, Item 8 on the sleeve O.D., or the bumper, Item 7 behind the sleeve.

P/N 80844-100 - Spanner Wrench. Used for removal or installation of check valve retainer nuts 80248, 80247, Items 9 and 10 on the Gas Section End Cap Assembly Drawing.

B. SPECIAL ATTACHMENTS BY MODEL

8.0 TROUBLESHOOTING. Model 5G-SS-30 Gas Booster – 5 Pages

8.1 Understanding How It Works.

NOTE: For consistency, all item numbers in this text will refer to assembly drawings (not seal kit drawings).

8.2 The Basic Drive System. Refer to Pages 3 and 4, Drawing 80201.

There are two drive chambers: Left and right. The left chamber is enclosed by end cap item (25) (Page 4) and piston (21). The right chamber is enclosed by end cap (23) (Page 4), piston (21).

The cycling valve (30), (Drawing 80217) alternately pressurizes and exhausts these two chambers causing the piston (21) and connecting rod to reciprocate in drive barrel (27).

8.3 The Basic Gas Boosting System. Refer to Drawing 80201.

Page 4 shows the mechanical connecting rod arrangement between the drive piston (21) and the gas section (20), -30 ratio. Page 3 shows the exhaust air cooling line, item (35). This assembly picks up cooling air from the drive exhaust and routes it into the cooling sleeve (13), Drawing 80213 and out the exhaust muffler (32). Note: Page 3 and Page 4, Drawing 80201, Sections C-C and D-D are opposite assembly views. Therefore, on Page 3, end cap (23) is on the left; the end cap (25) on the right; Page 4, vice versa. Note also the basic operational schematic, Paragraph 5.4.

8.4 The Basic Air Cycling System. Refer to Drawing 80217 and Page 3, Drawing 80201.

View C-C shows flow tube (29). This tube pressurizes or exhausts the left drive chamber, Page 4 depending on the position of the cycling valve (30), Drawing 80217. The right drive chamber is pressurized or exhausted directly through end cap (23).

NOTE: Views C-C and D-D are the reverse (backside) of Page 4. Therefore, the valve end cap (23), is on the left and the opposite cap (25) is on the right in views C-C and D-D.

When the cycling valve (30) is pressurizing the flow tube (29) (Page 3, Drawing 80201) and the left drive chamber, Page 4, it is simultaneously connecting the right drive chamber to the exhaust system. When valve (30) connects the flow tube (29) to exhaust, it simultaneously pressurizes the right drive chamber.

The cycling spool valve (30) receives input drive air at its center (Ref. Drawing 80217) from which it directs drive air left or right. Drawing 80217 shows that when it shifts right, drive air flows left to the flow tube (29), view C-C; when it shifts left, drive air flows right directly to the right drive chamber. Drawing 80217 and Page 3, Drawing 80201 both show the valve shifted left.

The cycling spool shifts right or left due to the action of the air pilot poppet valves (2), Drawing 80217 and (8) 80082. Note also that a small passage, off the drive-air-in channel Drawing 80217 provides constant air pressure to a small chamber on the left hand end of the spool (30). Therefore, as soon as drive air is turned on, spool (30) is biased to shift to the right. In this position, drive air flows left to flow tube (29) and the left drive chamber driving the piston (21) and the gas piston assembly right. This unseats pilot poppet (2)

Drawing 80217. This pilot poppet (2) receives a constant supply of pilot air either from the upper internal passage connected to the drive-air-in channel, Drawing 80217; or, if modification “X” is used, the external pilot port, plug (5), Page 3, Drawing 80201.

When the drive piston (21) opens the pilot poppet (2) in the end cap, pilot air is injected into the large pilot chamber on the right hand end of the spool. This chamber provides the force necessary to shift the spool valve (30) to the left overcoming the bias from the small air chamber on the left hand end of the spool.

With spool valve (30) shifted left, drive air is connected to the right drive chamber Page 4 Drawing 80201 and the left drive chamber is connected to exhaust. Thus the piston (21) and the gas piston assembly move left; pilot valve (2) Drawing 80217 springs closed. Pilot air is now trapped in the large pilot chamber, right hand end of spool valve (30), and in the pilot tube (30) Page 3, Drawing 80201. This tube connects the large pilot chamber to the opposite pilot poppet (8) Drawing 80082. The spool valve remains shifted left due to the trapped pilot air. The drive piston (21) then reaches the opposite pilot poppet (8), and opens it. This connects the pilot tube (30) and the large pilot chamber to a pilot vent port (not shown) in end cap, Drawing 80082.

With the large pilot chamber, right hand end of spool valve, now vented, the spool valve shifts right (due to the bias force from the small left hand chamber). In the shifted-right position, drive air pressurizes flow tube (29) and the cycle described above repeats.

8.5 Chart: Symptoms vs Suggested Remedies.

Symptom	Possible Cause	Suggested Remedy
1. Unit will not cycle after gas pressure is equalized (no sound).	<p>A) Drive shut off.</p> <p>B) “X” Mod. Not plumbed.</p> <p>C) Spool valve (30) stuck due to friction of swollen O-rings due to chemical carryover from shop compressor oil.</p> <p>D) Unlikely, but possible: Poppet valves (2) or (8) may be short or springs (4) or (6) broken. Ref. Drawings 80217, 80082.</p>	<p>A) Open drive valve.</p> <p>B) Connect external pilot port to air source.</p> <p>C) See Drawing 80201, Page 3. Disconnect exhaust tube (35) from fitting (42). Unscrew retainer (32), Drawing 80217; then remove (30) spool and inspect 8 O-rings, item (22). If swollen, they will be longer (not fatter) and droop down off the spool. Replace with Viton O-rings (seal kit SK5GAV, Drawing 80626). Apply light grease. Reassemble.</p> <p>CAUTION: Retainer (32) should not be highly torqued.</p> <p>D) Remove hex caps (2) or (3). Inspect springs and poppets. Replace as needed.</p>

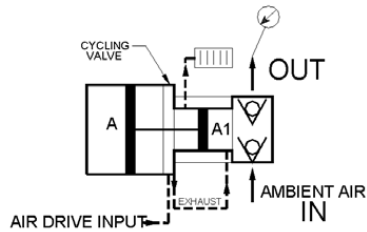
Symptom	Possible Cause	Suggested Remedy
2. Unit will not cycle and air bleeds out exhaust muffler.	A) Insufficient internal air pilot volume due to long, small air drive line. B) Spool valve (30) stuck in center position due to friction of swollen or dry O-rings (see 1-C above).	A) Increase size of air drive line. B) See 1-C above.
3. Unit cycles but bleeds air out exhaust muffler at stall or at shut off of external pilot ("X" modification).	A) Drive piston O-ring (12) or barrel (27), Page 4, Drawing 80201, damaged, or shrinkage of drive O-ring (12).	A) Remove drive tie rod nuts (3), pull drive end caps (25), (23) apart. Inspect (12) and (27). If damaged, install new (12) or (27). NOTE: Always test O-ring (12) new or used, for shrinkage: Remove all grease from (12) and (27). Place (12) on flat surface. Put (27) down over (12). Lift (27). If (12) does not pick up inside (27), <u>discard it as undersize</u> . Lightly regrease (12) and (27) before reassembly. Review integrity of air drive filtration.
4. Unit stops or "hunts" and air bleeds out pilot vent passage in air cap (25), Page 4, Drawing 80201.	A) <u>Drive</u> air leaking into large pilot chamber on right end of spool valve (30) and pilot vent poppet (8) cannot dissipate it.	A) Remove retainer (32) Ref. 1-C above, and valve (30) and replace the 8 th (far right) item (22) O-ring, Drawing 80217. Grease. Reinstall valve and retainer and test. If not cured, remove (32), (30) and sleeve (1) (using HII extractor tool P/N 80273-100). Replace all 4 O-rings, item (8) on sleeve. Grease. Reinstall.
5. Audible air bleeds out 1/8 NPT breather (33), Page 2, Drawing 80201 at stall, or pilot air shut off.	A) Gas piston rod seal wear due to contaminated air source. Ref. (20) Drawing 80213.	A) Remove drive tie rod nuts (3), Page 4, Drawing 80201. Pull unit apart to expose drive piston (21). Remove cotters (17) and pin (28). Remove four gas section tie rod nuts (39) and end cap (11). See Gas Section Drawing 80213. Push gas section rod (14) past seal (20). Remove seal retainers. Inspect rod for scratches. Polish or replace rod. Reassemble with new seal (20). Review air source filtration.

Symptom	Possible Cause	Suggested Remedy
6. Unit cycles but output performance is questionable. Audible gas leakage from breather (34) Page 2, Drawing 80201, when unit is stopped with gas supply on.	A) Ref. Drawing 80213. Worn gas piston seal (18) or scored barrel (12), due to contaminated gas source.	A) Disassemble per 5-A above. Inspect and replace all worn parts. Review gas source filtration and/or source of contaminants.
<div style="border: 1px dashed black; padding: 2px; display: inline-block; margin-bottom: 5px;">CAUTION</div> <p>Ref. Drawings 80213, 80630. Gas piston seal & supporting parts must be confined inside gas barrel <u>before</u> tightening piston nut and installing cotter pin.</p>		
6a. Questionable output performance, yet not audible gas breather (34) leakage.	A) Check valves, Drawing 80210 hanging up due to failed springs or contamination.	A) Test gas section per Paragraph 9.0. If under performing, remove check cartridge parts. Note: Use spanner tool P/N 80844-100 to remove and reinstall retainer (9) and (10). Inspect all parts. Clean and/or replace as needed. Reassemble.
7. Unit false cycles (short strokes).	<p>A) Pilot air venting prematurely due to damage or contamination of pilot vent poppet (8) in air cap (1), Drawing 80082; or external pilot air leaks from static O-rings sealing the pilot tube (30), Drawing 80201, Page 3, or the pilot poppet hex cap (2) in air cap (1), or leakage at threaded plugs (27) ½ NPT, Drawing 80217 or (6) 1/8 NPT, Drawing 80082.</p> <p>B) Pilot valve stem seal assembly with retaining ring has vibrated loose resulting in nonconcentric valve action.</p> <p>C) Drive air leaking into the pilot chamber.</p>	<p>A) Inspect pilot vent poppet, spring and seat in air cap. Replace if damaged. Check pilot tube ends and hex cap (2) in end cap (1), Drawing 80082, with soap solution for external leaks. Replace static seal O-rings if soap bubbles are detected. Check NPT plugs with soap solution. Tighten or retape if leaking.</p> <p>B) Disassemble drive cylinders and look for loose parts items (2), (3), and (28) (seal kit drawing 80626). Replace item (2), (3) and (28). To insure concentricity, use pilot valve as a centering tool and, by tapping with a light hammer, a tool to evenly deflect the legs of retainer (28), P/N 80101-4.</p> <p>C) Ref item 4 above.</p>

9.0 TESTING. Use Ambient Air only. Do not use compressed gas or air at “IN” port.

9.1 Gas Section.

Setup and Steps:



9.1.1 Install 0-500 PSI (minimum) pressure gauge at outlet.

9.1.2 Cycle Booster. If check valves and piston are operating properly, it should be able to boost **AMBIENT AIR** to 250-300 PSI.

9.2 Drive Section.

Shut off and trap drive air when ambient air has been boosted to 250-300 PSI. Check all external surfaces and connections with soap solution or “Leak Tec”. All must be bubble tight except breathers. Reduce drive air pressure to 15 PSI. Bleed air at gauge. Unit should cycle smoothly.

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DWG. NO.	80201	SH	REV	1
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REV.				

QTY	REV.	PART No.	DESCRIPTION	MATERIAL	REFERENCES	REV.
2	2	2	80497-3	NUT		44
2	2	2	80497-2	SLEEVE		43
2	2	2	80497-1	FITTING		42
4	4	4	80496-1	FLAT WASHER		41
4	4	4	80495-1	LOCK WASHER		40
4	4	4	80494-1	NUT		39
1	1	1	80493-1	GLYVW		38
8	8	8	80308-2	FLAT WASHER		37
4	4	4	80307-2	LOCK WASHER		36
1	1	1	80269-1	TUBE		35
1	1	1	80266-2	BREATHER		34
1	1	1	80266-1	BREATHER		33
1	1	1	80265-1	MUFFLER		32
1	1	1	80223-1	HANDLE		31
1	1	1	80257-2	PILOT TUBE		30
1	1	1	80257-1	FLOW TUBE		29
1	1	1	80245-1	PIN		28
1	1	1	80227-1	BARREL		27
4	4	4	80226-1	TIE ROD		26
1	1	1	80082-200	CAP ASSY.		25
1	1	1	80082-100	CAP ASSY.		24
1	1	1	80217-200	ASSY.-VALVE CAP		23
1	1	1	80217-100	ASSY.-VALVE CAP		22
1	1	1	80215-100	ASSY.-AIR PISTON		21
1	1	1	80213-100	ASSY.-GAS SECTION,3OR		20
4	4	4	80199-1	PIVET		19
1	1	1	80198-2	MANIFOLD		18
2	2	2	80102-2	COTTER PIN		17
1	1	1	80086-020	O-RING		16
1	1	1	80083-009	O-RING		15
1	1	1	80086-904	O-RING		14
1	1	1	80084-904	O-RING		13
1	1	1	80086-431	O-RING		12
1	1	1	80085-431	O-RING		11
2	2	2	80088-010	O-RING		10
2	2	2	80083-010	O-RING		9
2	2	2	80086-014	O-RING		8
2	2	2	80083-014	O-RING		7
1	1	1	80075-1	PLUG		6
1	1	1	80514-1	PLUG		5
2	2	2	80058-1	BRACKET		4
4	4	4	80056-2	NUT		3
2	2	2	80055-4	BOLT		2
2	2	2	80055-3	BOLT		1

NOTE:

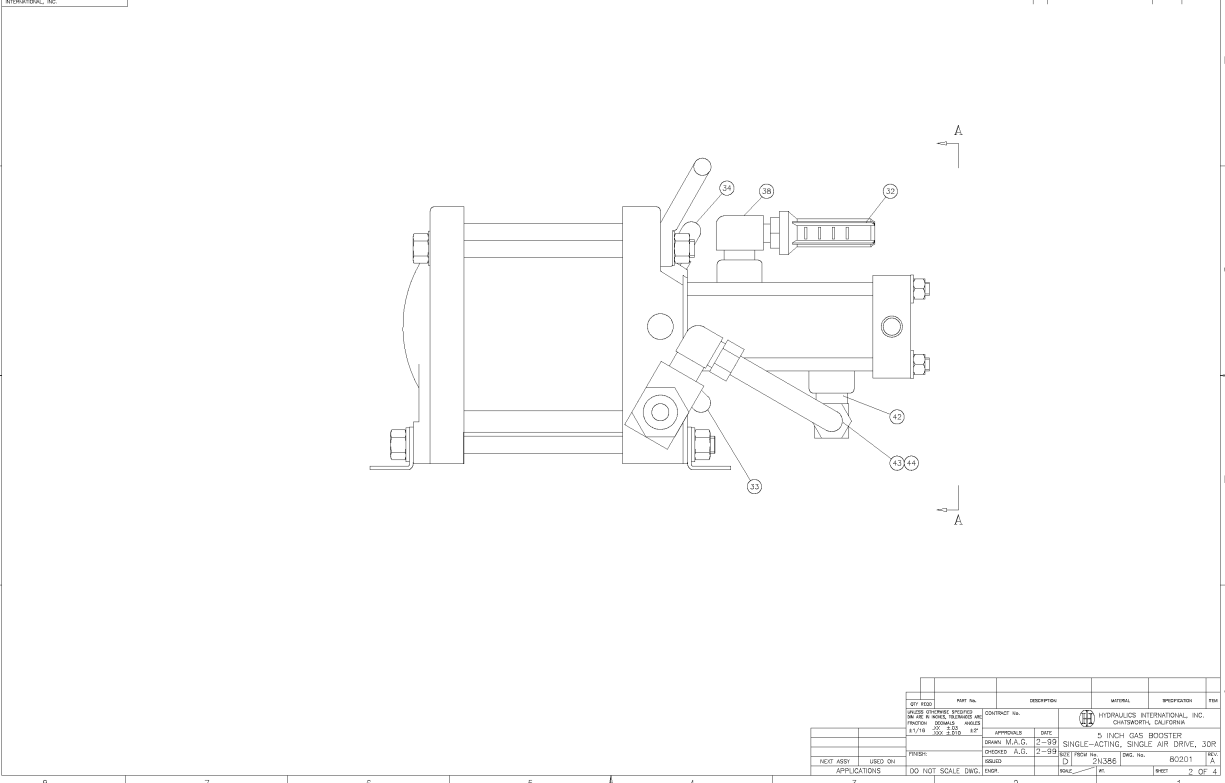
1.	ASSY.	AIR SECTION SEALS	GAS SECTION SEALS	EXTERNAL PILOT	MODEL No.
-100	BUHA	VITON			50-55-30
-200	VITON	VITON			50-55-30-V
-300	BUHA	VITON	X		50-55-30-X
-400	VITON	VITON	X		50-55-30-VX

- AIR SECTION SEAL KIT.
BUHA: P/N 80636-100, MODEL NO. SH5GA
VITON: P/N 80626-200, MODEL NO. SH5GAV
- GAS SECTION SEAL KIT.
VITON: P/N 80630-100, MODEL NO. SH5G-30V
- TORQUE TO 25 FOOT POUNDS
- TORQUE TO 30 FOOT POUNDS
- REFER TO DWG. NO. 810133, FOR MODIFICATIONS

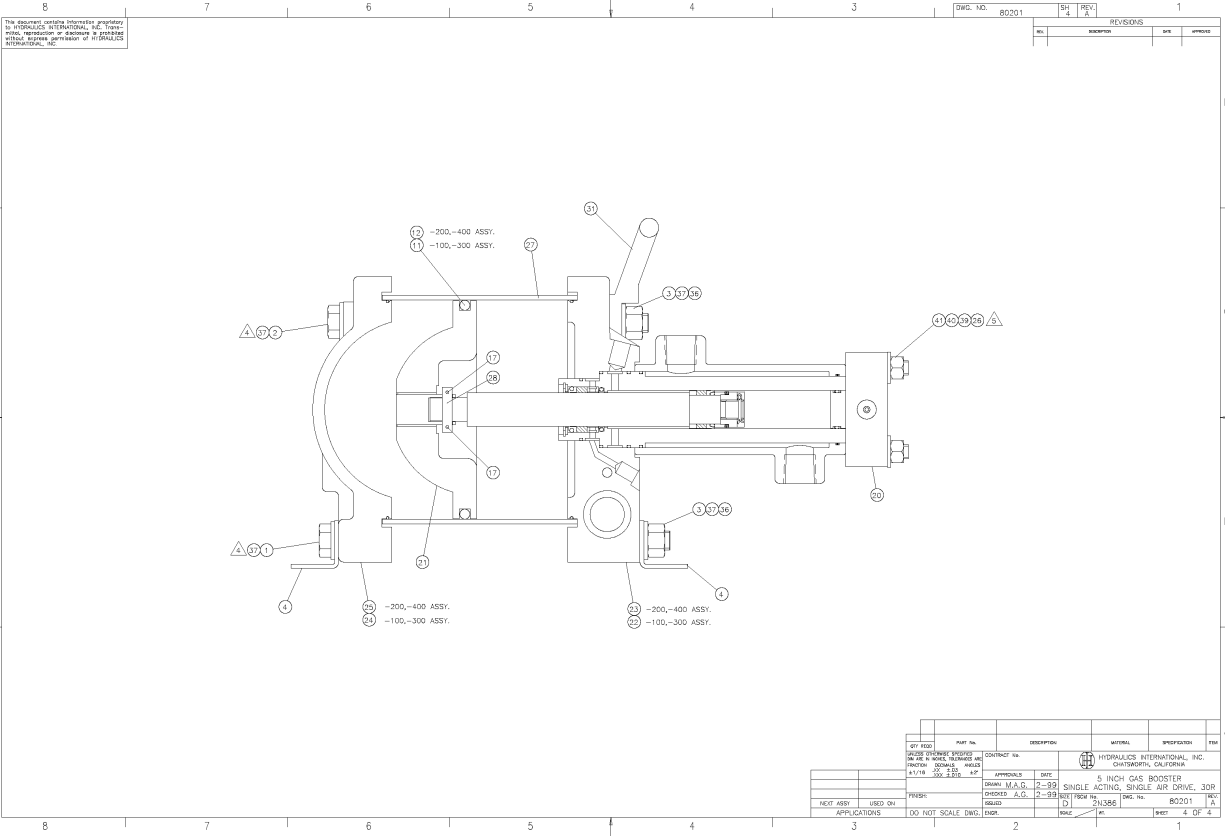
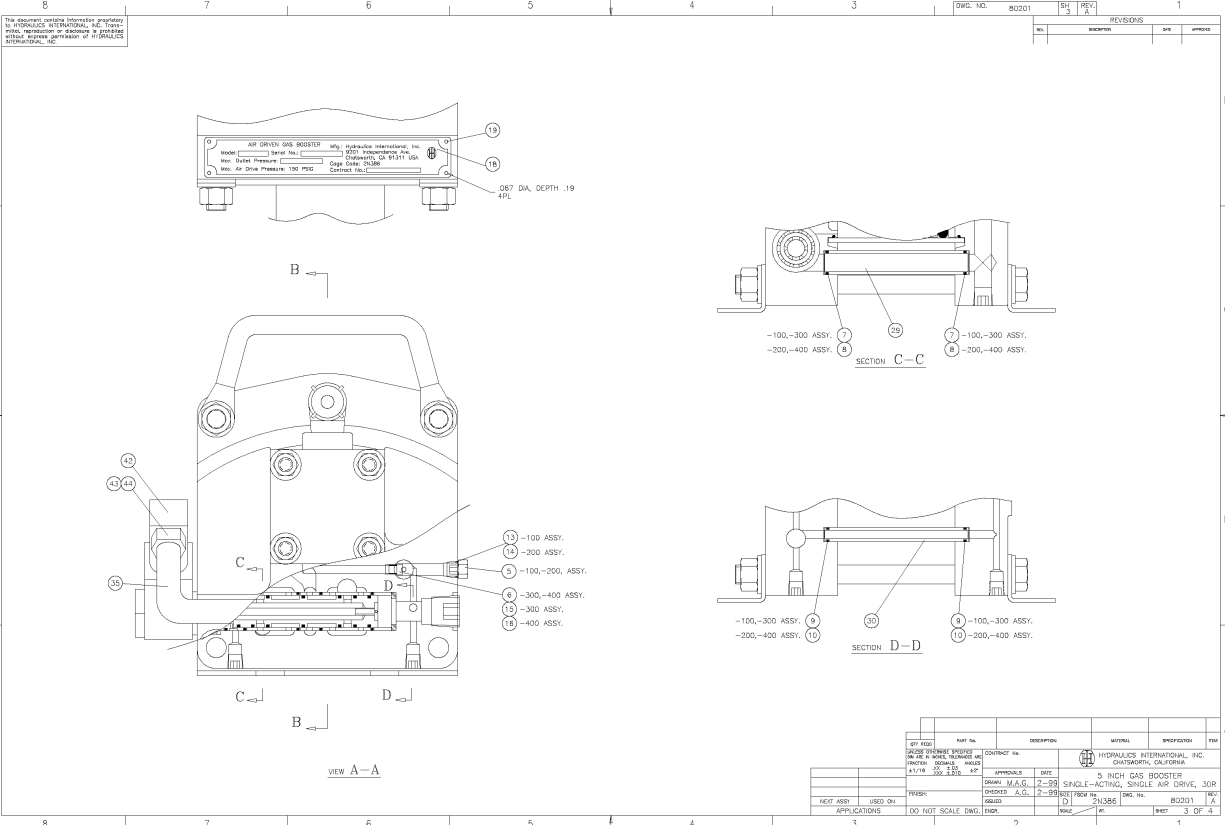
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1	1	80217-100	ASSY.-VALVE CAP			22
1	1	80215-100	ASSY.-AIR PISTON			21
1	1	80213-100	ASSY.-GAS SECTION,3OR			20
4	4	80199-1	PIVET			19
1	1	80198-2	MANIFOLD			18
2	2	80102-2	COTTER PIN			17
1	1	80086-020	O-RING			16
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1	1	80086-431	O-RING			12
1	1	80085-431	O-RING			11
2	2	80088-010	O-RING			10
2	2	80083-010	O-RING			9
2	2	80086-014	O-RING			8
2	2	80083-014	O-RING			7
1	1	80075-1	PLUG			6
1	1	80514-1	PLUG			5
2	2	80058-1	BRACKET			4
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2	2	80055-4	BOLT			2
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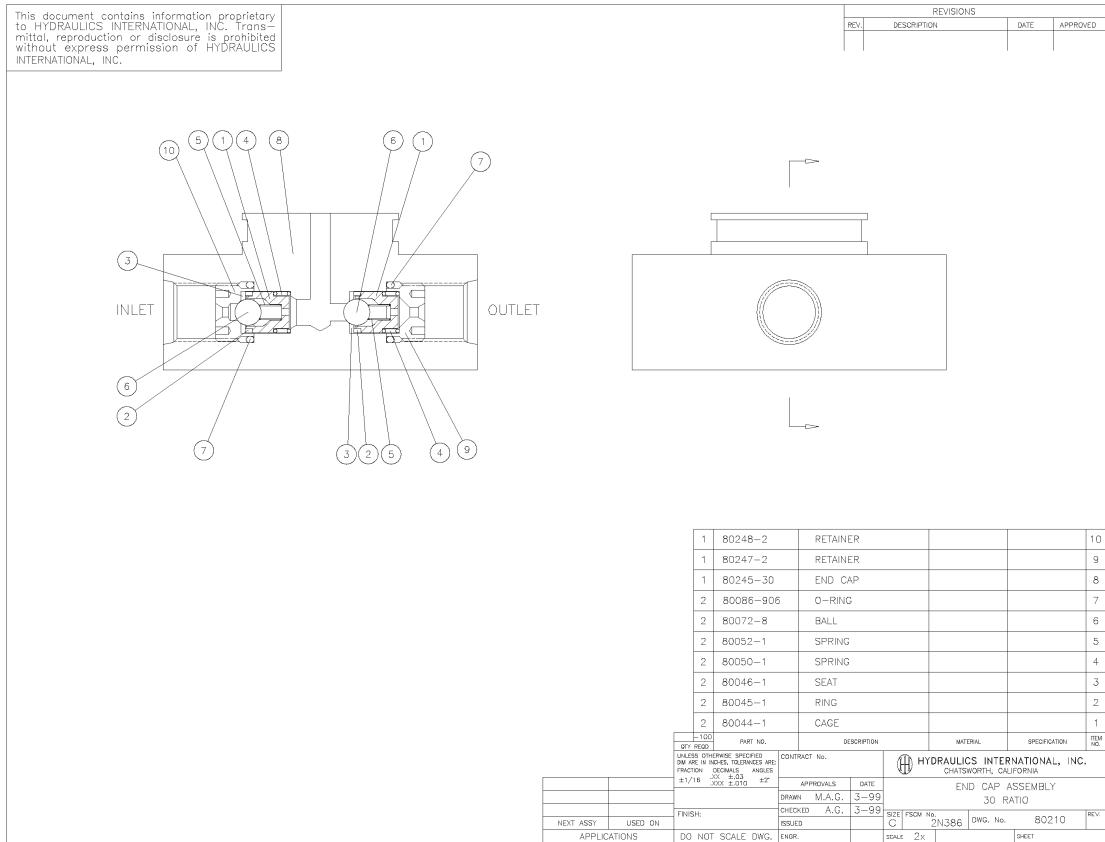
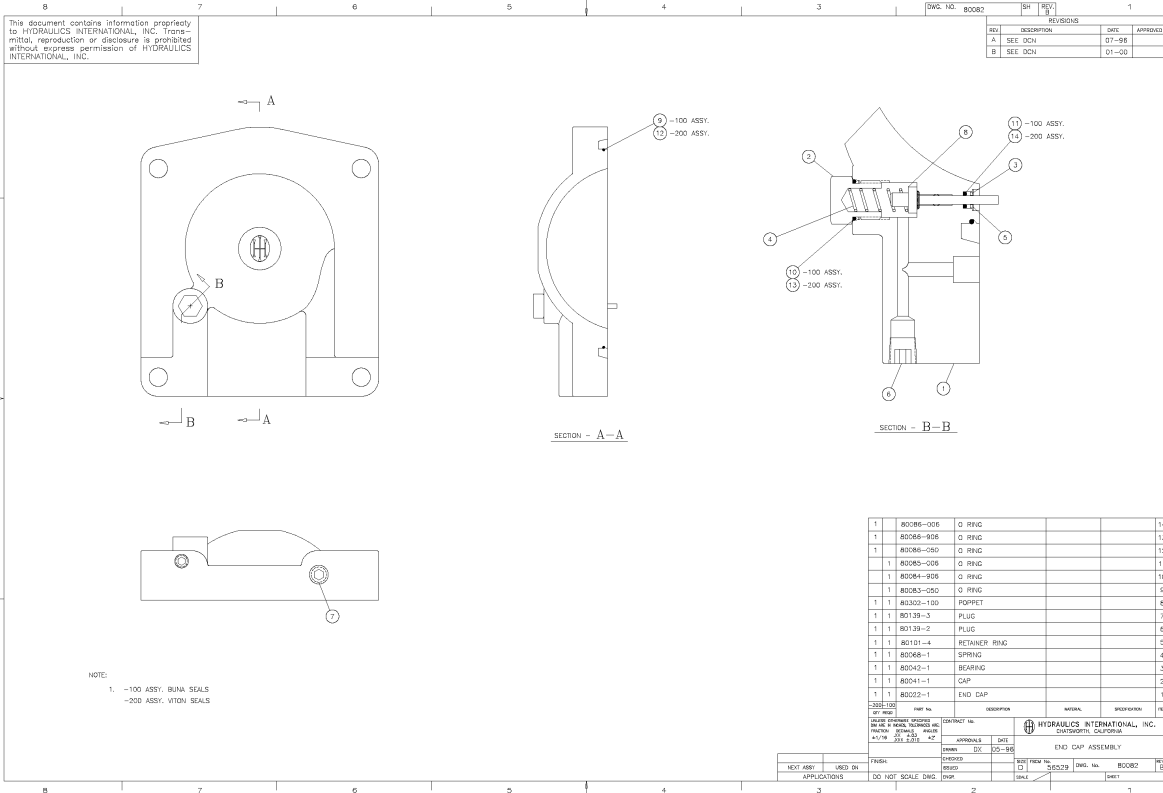
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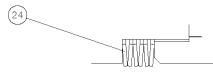
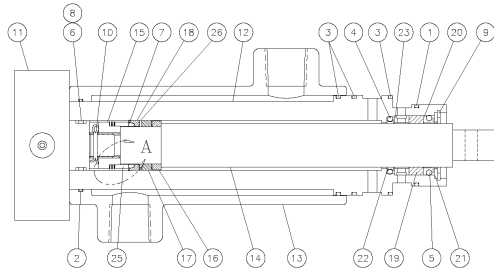
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1	1	80217-100	ASSY.-VALVE CAP			22
1	1	80215-100	ASSY.-AIR PISTON			21
1	1	80213-100	ASSY.-GAS SECTION,3OR			20
4	4	80199-1	PIVET			19
1	1	80198-2	MANIFOLD			18
2	2	80102-2	COTTER PIN			17
1	1	80086-020	O-RING			16
1	1	80083-009	O-RING			15
1	1	80086-904	O-RING			14
1	1	80084-904	O-RING			13
1	1	80086-431	O-RING			12
1	1	80085-431	O-RING			11
2	2	80088-010	O-RING			10
2	2	80083-010	O-RING			9
2	2	80086-014	O-RING			8
2	2	80083-014	O-RING			7
1	1	80075-1	PLUG			6
1	1	80514-1	PLUG			5
2	2	80058-1	BRACKET			4
4	4	80056-2	NUT			3
2	2	80055-4	BOLT			2
2	2	80055-3	BOLT			1





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REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	SEE DCN	1-99	
B	SEE DCN	7-99	
C	SEE DCN	8-99	
D	SEE DCN	05-02	



VIEW A

QTY	PART NO.	DESCRIPTION	MATERIAL	SPECIFICATION	REV. NO.
1	80264-30	BACK-UP			26
1	80249-30	SPACER			25
6	80225-30	SPRING - BELLEVILLE			24
1	80241-1	SPACER			23
1	80240-1	RING			22
1	80239-1	RING			21
1	80238-1	SEAL			20
1	80237-1	BEARING			19
1	80236-30	SEAL			18
1	80235-30	BEARING			17
1	80234-30	PISTON			16
1	80233-30	NUT			15
1	80230-1	ROD			14
1	80229-1	COOLING SLEEVE			13
1	80228-30	BARREL-GAS			12
1	80210-100	END CAP ASSY.			11
1	80102-1	COTTER PIN			10
1	80101-3	RETAINING RING			9
2	80100-020	BACKUP RING			8
1	80086-116	O-RING			7
1	80086-020				6
1	80086-120				5
1	80086-119				4
3	80086-032				3
1	80086-031				2
1	80086-029	O-RING			1

ST. 100	PART NO.	DESCRIPTION	MATERIAL	SPECIFICATION	REV. NO.
VALS	DRNGM	SPEDR	DR	AR	FR
FRAC	DRNGM	SPEDR	DR	AR	FR
1/1/16	XXX	1/16	XXX	1/16	1/16

CONTRACT NO.	DATE	APPROVALS
DRWN: M.A.G.	9-99	
CHECKED: A.G.	05-02	
DRWN: M.A.G.	9-99	
CHECKED: A.G.	05-02	
DRWN: M.A.G.	9-99	
CHECKED: A.G.	05-02	

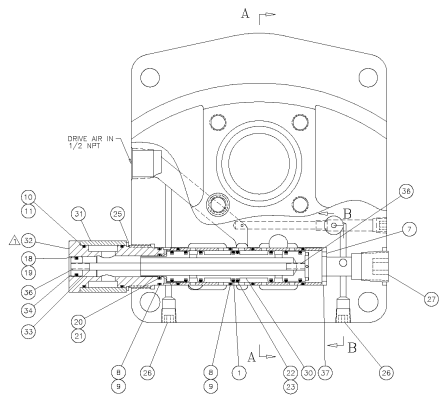
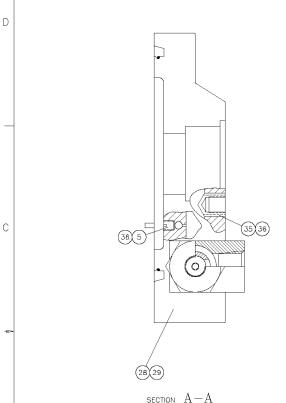
HYDRAULICS INTERNATIONAL, INC.
CHATSWORTH, CALIFORNIA

GAS SECTION ASSY - 30 RATIO

SEC FROM No. N386 DWG. No. 80213 REV. D

DO NOT SCALE DWG. ENGR.

14. Reserved system information provided to HYDRAULICS INTERNATIONAL, INC. Transmittal, reproduction or disclosure is prohibited without express permission of HYDRAULICS INTERNATIONAL, INC.



NOTE:
▲ TORQUE TO 10 - 15 INCH POUND

ASSY.	SEALS	USED ON
-100	BRNA	50-55, 50-50
-200	VITON	50-05, 50-75
-300	BRNA	50-00
-400	VITON	50-10

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	SEE DCN	09-99	
B	SEE DCN	03-99	
C	SEE DCN	10-01	
D	SEE DCN	01-05	

QTY	PART NO.	DESCRIPTION	MATERIAL	SPECIFICATION	REV. NO.
1	1	1	80028-2	SLEEVE	
AR	AR	AR	265	ADHESIVE	LOCITE COPP. ROCKY-HILL, CT
1	1	1	80256-1	INSERT	
1	1	1	80255-1	PISTON	
1	1	1	80254-1	ROD	
1	1	1	80253-1	RETAINER	
1	1	1	80252-1	FITTING	
1	1	1	80229-2	SPOOL	
1	1	1	80223-2	VALVE END CAP	
1	1	1	80223-1	VALVE END CAP	
1	1	1	80139-5	PLUG	
2	2	2	80139-2	PLUG	
1	1	1	80101-5	RETAINING RING	
1	1	1	80101-4	RETAINING RING	
8	8	8	80089-017	O-RING	
8	8	8	80089-017	O-RING	
1	1	1	80089-015	O-RING	
1	1	1	80089-015	O-RING	
1	1	1	80089-013	O-RING	
1	1	1	80089-013	O-RING	
1	1	1	80089-008	O-RING	
1	1	1	80089-008	O-RING	
1	1	1	80084-908	O-RING	
1	1	1	80089-908	O-RING	
1	1	1	80083-050	O-RING	
1	1	1	80086-050	O-RING	
2	2	2	80083-022	O-RING	
2	2	2	80086-022	O-RING	
5	5	5	80083-020	O-RING	
5	5	5	80086-020	O-RING	
1	1	1	80069-1	BUMPER	
1	1	1	80068-1	SPRING	
1	1	1	80043-1	SET SCREW	
1	1	1	80042-1	BEARING	
1	1	1	80041-1	CAP	
1	1	1	80302-100	POWERT	
1	1	1	80028-1	SLEEVE	

ST. 100	PART NO.	DESCRIPTION <td>MATERIAL</td> <td>SPECIFICATION</td> <td>REV. NO.</td>	MATERIAL	SPECIFICATION	REV. NO.
VALS	DRNGM	SPEDR	DR	AR	FR
FRAC	DRNGM	SPEDR	DR	AR	FR
1/1/16	XXX	1/16	XXX	1/16	1/16

CONTRACT NO.	DATE	APPROVALS
DRWN: M.A.G.	3-99	
CHECKED: A.G.		
DRWN: M.A.G.	3-99	
CHECKED: A.G.		

HYDRAULICS INTERNATIONAL, INC.
CHATSWORTH, CALIFORNIA

VALVE CAP ASSEMBLY

SEC FROM No. N386 DWG. No. 80213 REV. D

DO NOT SCALE DWG. ENGR.

