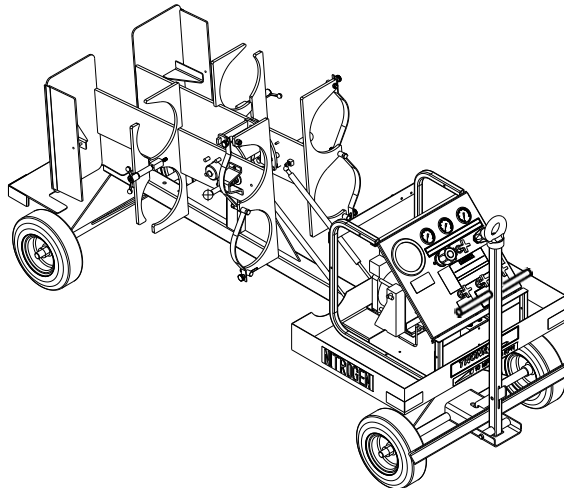




Model: 18-4319-0000
Four Cylinder Tiltable Nitrogen Cart
with Booster and Manifold/Regulator



11/2018 - Rev. 02



****CAUTION****

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

REVISION	DATE	TEXT AFFECTED
01	10/2014	Original release
02	11/2018	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.

**CAUTION!**

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

1.0 PRODUCT INFORMATION**1.1 DESCRIPTION**

The Tronair Four Cylinder Cart with Booster is designed to minimize the handling of nitrogen cylinders in loading, transporting and servicing process and to provide boosted compressed gas for an aircraft.

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 cylinders to the required higher aircraft system pressure; up to 4000 psig maximum. The booster system provides high and low regulated pressure output. The transport cart allows a single operator to load full nitrogen cylinders and transport them to service the aircraft, without ever having to lift the cylinders. The unique quality of this cart is the operator never has to lift a cylinder, which can weigh between 120 and 175 lbs., onto the cart. The cart has a very narrow footprint and a tight turning radius allowing for easy maneuverability.

WARNING!

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

- **DO NOT EXCEED 3000 PSIG (276 BAR) NITROGEN SUPPLY CYLINDER PRESSURE.**
- **DO NOT use High Pressure Nitrogen on Low Pressure aircraft components or systems such as tires, etc.**
- **DO NOT use with Oxygen or gases other than Nitrogen.**
- **Servicing and maintenance of nitrogen systems shall be done by only trained and qualified personnel using approved procedures.**

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit

1.3 MANUFACTURER

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

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

1.4 SPECIFICATIONS/FEATURES**Dimensions:**

- Height: 46 11/16 in (118.58 cm)
- Length: 92 13/16 in (235.74 cm)
- Width: 35 13/16 in (90.96 cm)
- Weight: 970 lbs (440 kg)

Rotating Cylinder Loader/Un-Loader:

- Stable and efficient rotational motion guidance under variable weights, speeds and high load conditions keeping the cylinders in the correct location
- Struts control the rotating of the cylinders from the vertical and horizontal positions
- Accommodates cylinders ¾", 60" tall and weighing less than 150 lbs
- Manufactured of high strength materials to ensure the cylinders are secure
- Locks into horizontal or vertical position by a spring loaded plunger

M

1.4 SPECIFICATIONS/FEATURES (continued)

Cart:

- CE Marked
- Easy, one person loading/unloading
- Use with $\frac{3}{4}$, 60" tall and weighing less than 150 lbs Nitrogen cylinders; CGA 580 connection with check valves, 3000 psi max
- Cylinders fully captured
- Pneumatic tires/tapered wheel bearings
- Narrow width
- Very low profile, fits under most aircraft wings
- Parking brake
- Hose compartment storage tray
- Instrument Panel
- Powder coated heavy duty steel construction
- compact frame allows for a tight turning radius

Booster:

- Output hose: 25 ft (7.6 m) long with #4, 37° JIC (female flared swivel fitting) at aircraft hook-up end
- Minimum supply cylinder 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) rated output
- 15 ft (4.6 m) service hose

Temperature Range:

- 0° to 200°F (17.7° to 93.3° C)

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, and/or substantial property damage** if the Warning Notice is ignored.



CAUTION!

Caution is used to indicate the presence of a hazard, which will or can cause **minor personal injury or property damage** if the Caution Notice is ignored.

2.2 SAFETY INSTRUCTIONS



CAUTION!

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

2.3 GENERAL

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

2.4 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.

NOTE: Safety instructions specifically pertaining to this unit appear throughout this manual highlighted by the signal words WARNING, CAUTION, DANGER which identify different levels of hazard.

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.

3.0 PREPARATION FOR USE**CAUTION!**

Only use cylinders for which this unit was designed: 9 – 9 ¾ inch diameter, 3000 psig (207 bars) maximum pressure with CGA 580 connection.

**CAUTION!**

Maximum towing speed is 10 mph (16 km/h).

3.1 LOADING/UNLOADING CYLINDERS**3.1.1 Loading Cylinders****WARNING!**

This cart is designed to carry 4 cylinders simultaneously. Failure to install all 4 cylinders will create an unstable condition. Cart must be fully loaded/unloaded before transporting.

**CAUTION!**

Do NOT transport cart with cradles in upright position. Always store cradles in horizontal position.

1. Place cart on flat, level surface
2. Ensure Towbar is in upright position
3. Rotate both cylinder cradles to upright position (empty cradles will require assistance to move into position), ensure locking mechanism is engaged
4. Lower bottom ramp
5. Remove bottom clamping handle assembly
6. Loosen only one top clamping knob and rotate strap away from cradle
7. Walk cylinder up ramp and into cradle, position cylinder valve outlet port to face directly forward, toward towbar
8. Rotate strap against cylinder and tighten top clamping knob
9. Repeat steps 6-8 for second cylinder
10. Install bottom clamping handle assembly and tighten
11. Raise bottom ramp into upright position and click into place
12. Repeat steps 6-11 for cylinders on opposite side
13. all fours are rotate cradles to horizontal position. Ensure locking mechanism is engaged
14. Attach 4 input hoses to cylinders

3.1.2 Unloading Cylinders**WARNING!**

This cart is designed to carry 4 cylinders simultaneously. Failure to install all 4 cylinders will create an unstable condition. Cart must be fully loaded/unloaded before transporting.

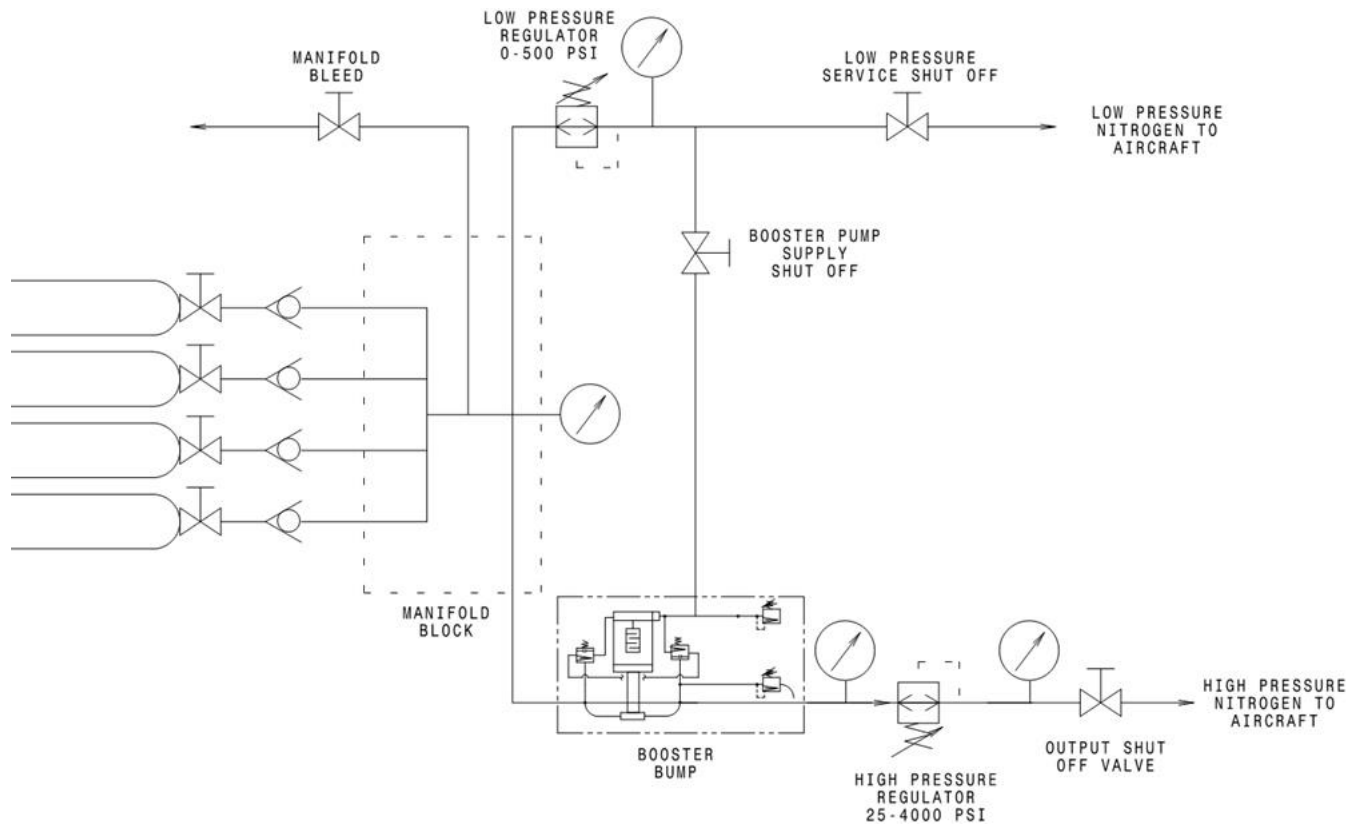
**CAUTION!**

Do NOT transport cart with cradles in upright position. Always store cradles in horizontal position.

1. Place cart on flat, level surface
2. Ensure Towbar is in upright position
3. Close cylinder valves and disconnect input hoses
4. Rotate both cylinder cradles to upright position, ensure locking mechanism is engaged
5. Lower bottom ramp
6. Remove bottom clamping handle assembly
7. Loosen only one top clamping knob and rotate strap away from cradle
8. Walk cylinder down ramp
9. Repeat steps 7 & 8 for second cylinder
10. Repeat steps 5-8 for cylinders on opposite side

3.0 PREPARATION FOR USE (continued)

3.2 SCHEMATIC



4.0 TRAINING

4.1 TRAINING REQUIREMENTS

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

4.2 TRAINING PROGRAM

The employer provided operator training program should cover safety procedures concerning use of the unit in and around the intended aircraft at the intended aircraft servicing location.

4.3 OPERATOR TRAINING

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

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

5.0 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. Telephone 419-866-6301 or 800-426-6301.

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.

5.2 TO READ INDIVIDUAL CYLINDER PRESSURE

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

5.3 EFFICIENT USE OF SYSTEM

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

5.4 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 cylinder 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.

5.0 OPERATION OF NITROGEN BOOSTER (continued)

5.5 CHARGING AIRCRAFT NITROGEN SYSTEM (High Pressure)

Note: If the Nitrogen supply cylinder 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 cylinders valve (250 min on cylinder 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.

5.7 DISCONNECTING NITROGEN BOOSTER FROM AIRCRAFT

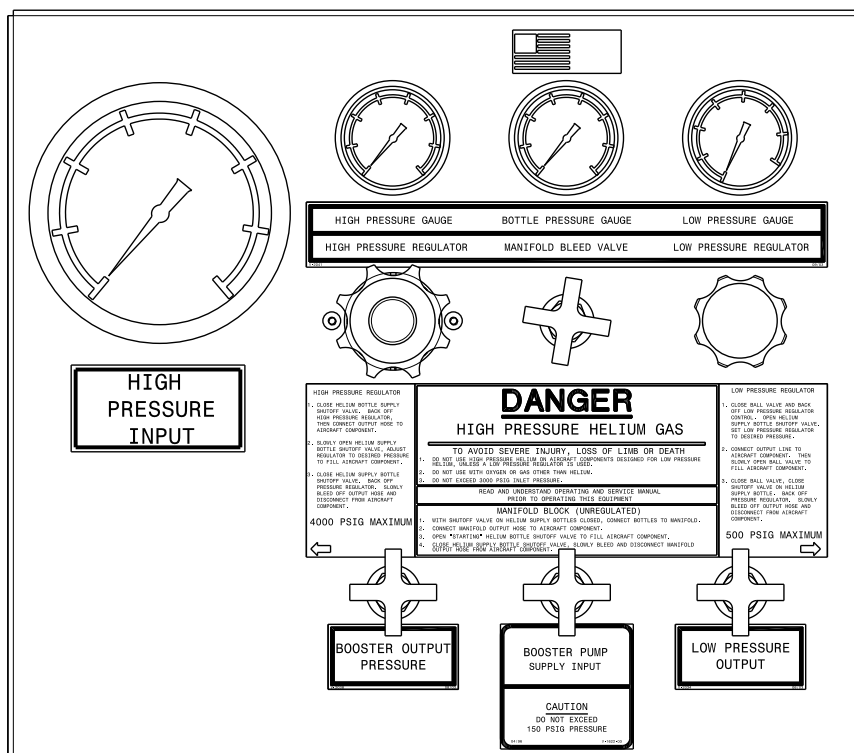
1. **Slowly** close Nitrogen supply cylinder shut off valve and booster output valve. This will stop inlet Nitrogen flow.
2. Decrease the manifold low pressure regulator to minimum pressure setting.
3. **Slowly** open, manifold bleed valve, and disconnect aircraft Nitrogen fill line from aircraft.
4.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

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 cylinder valve.
5. Slowly increase the low pressure regulator to obtain desired low pressure output. (Clockwise rotation increases pressure).
6. Open Low pressure output valve.

5.9 DISCONNECT LOW PRESSURE

1. **Slowly** close Nitrogen supply cylinder 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.



Instrument Panel

6.0 PACKAGING AND STORAGE

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.

7.0 TROUBLE SHOOTING

Reference Appendix I: Hydraulic International Installation and Maintenance Manual

8.0 MAINTENANCE

- Maintain pressure listed on tires.
- Grease wheel bearings quarterly.
- 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.
- See Appendix I Hydraulic International Installation and Maintenance Manual.
- The gauges on this unit should be inspected and calibrated annually to maintain and ensure accuracy.
- Manifold inlet hoses should be inspected weekly for signs of cracking or kinking, replace as necessary.
- Inspect Nitrogen output hoses prior to each use for signs of cracking or kinking, replace as necessary.
- 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.

9.0 PROVISION OF SPARES

9.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

TRONAIR, Inc.

1 Air Cargo Pkwy East

Swanton, Ohio 43558 USA

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

Fax: (419) 867-0634

E-mail: sales@tronair.com

Website: www.tronair.com

9.2 RECOMMENDED SPARE PARTS LISTS

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

10.0 IN SERVICE SUPPORT

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

11.0 GUARANTEES/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.

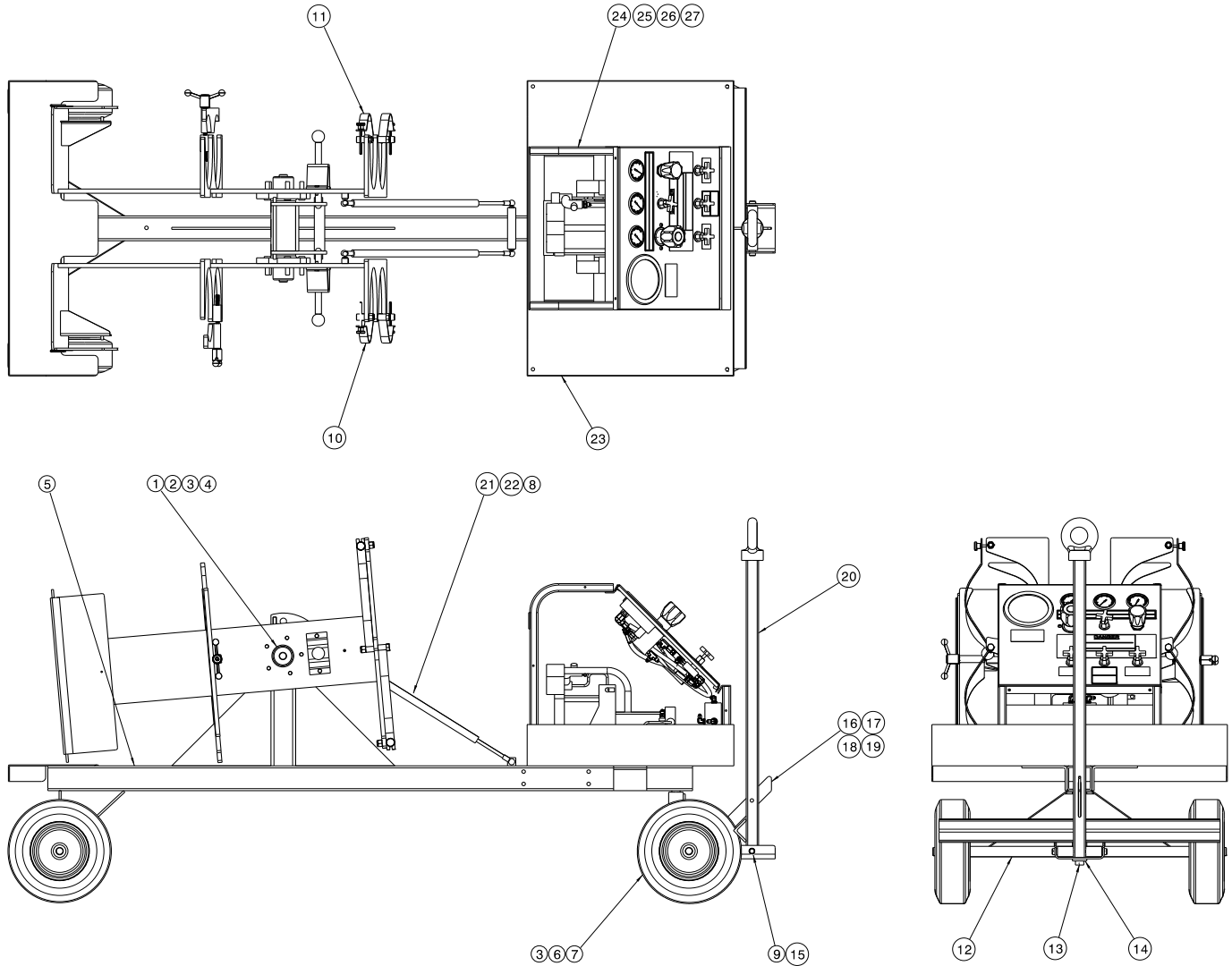
The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins 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.**

12.0 APPENDICES

APPENDIX I	Nitrogen Booster – Hydraulic International, Operation and Maintenance Instructions
APPENDIX II	Smith Installation & Operator's Guide
APPENDIX III	Instrument Certification Notice
APPENDIX IV	Declaration of Conformity

Parts List

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



Item	Part Number	Description	Qty
1	H-3424	Hub, Bearing	2
2	G-1230-01	Nut, Axle 1 1/4	2
3	G-1283	Washer, Spindle 1"	6
4	G-1301-11	Pin, Cotter 3/16 x 1 1/2	2
5	Z-8095-01	Weldment, 4-Cylinder Cart	1
6	U-1144	Assembly, Wheel w/Seal	4
7	G-1203-1120	Elastic Jamnut, 1 1/4	4
8	H-3668	Clips, Retaining	4
9	G-1301-02	Pin, Cotter 3/16 x 1 1/2	2
10	Z-8186	Assembly, Left Cylinder Support	1
11	Z-8187	Assembly, Right Cylinder Support	1
12	Z-8099-01	Weldment, Front Truck	1
13	G-1301-03	Pin, Cotter 1/8 x 1 1/2	1
14	H-2019-76	Bearing, Flange	2
15	R-2096	Pin, Towbar	1
16	J-5501	Lever	1

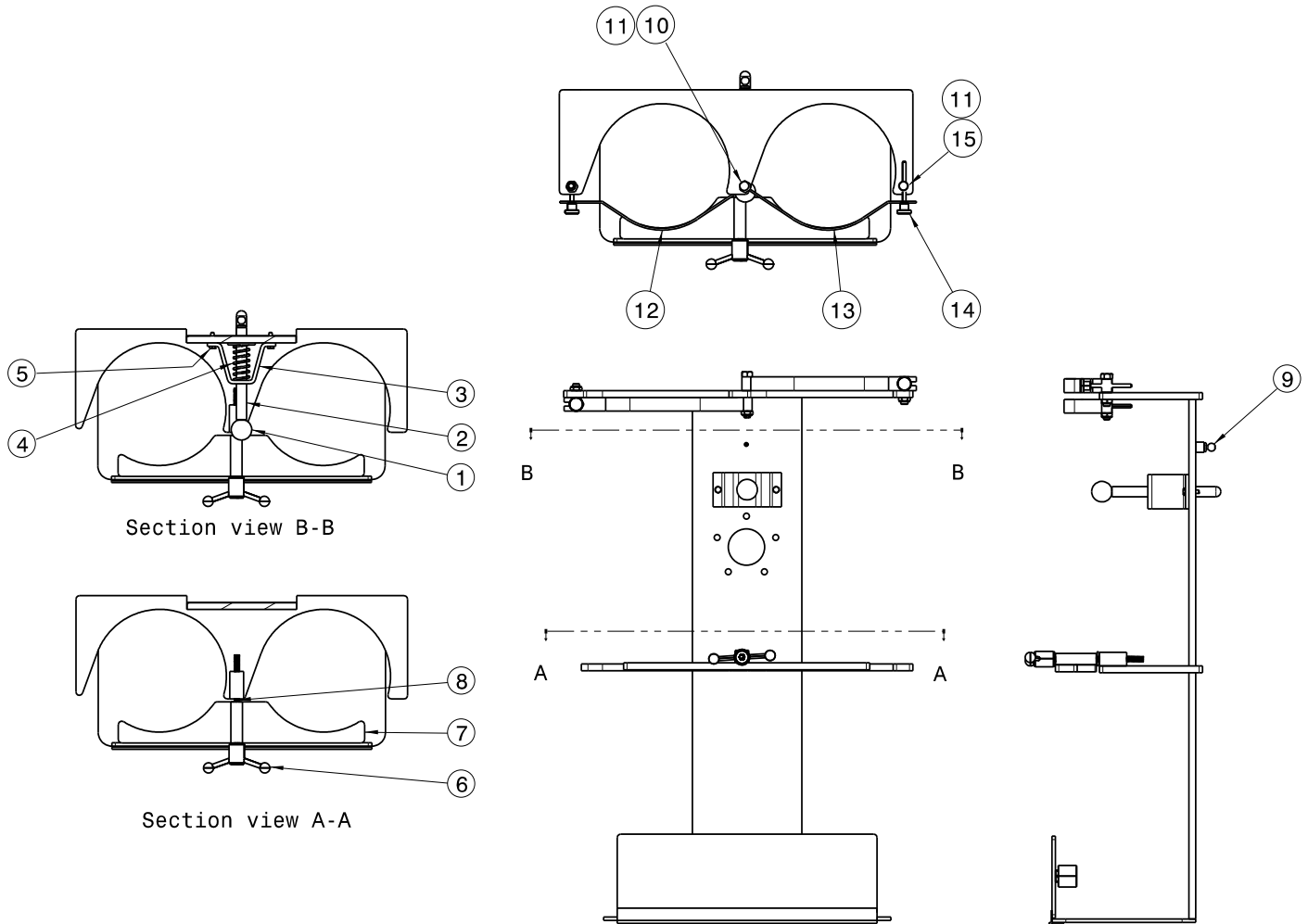
Parts List

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

Item	Part Number	Description	Qty
17	G-1503-1090N	Flatwasher, ½ Narrow, SST	2
18	G-1112-109500	Bolt, HH SST, ½ - 20 X 2 ½ Long	1
19	G-1203-1095	Elastic Jamnut, ½ - 20	1
20	Z-8173-01	Weldment, Towbar	1
21	H-3687	Dampner	2
22	H-3666	Stud, Ball 5/16 – 18	2
23	S-2735-01	Hose Tray	1
24	Z-8548	Assembly, Nitrogen Booster	1
25	G-1112-105022	Bolt, HH SST, ¼ - 20 x 2 ¼ Long	2
26	G-1501-1050	ESN, SST, ¼ - 20	2
27	G-1503-1050n	Flatwasher, SST, ¼ Narrow	4

Parts List

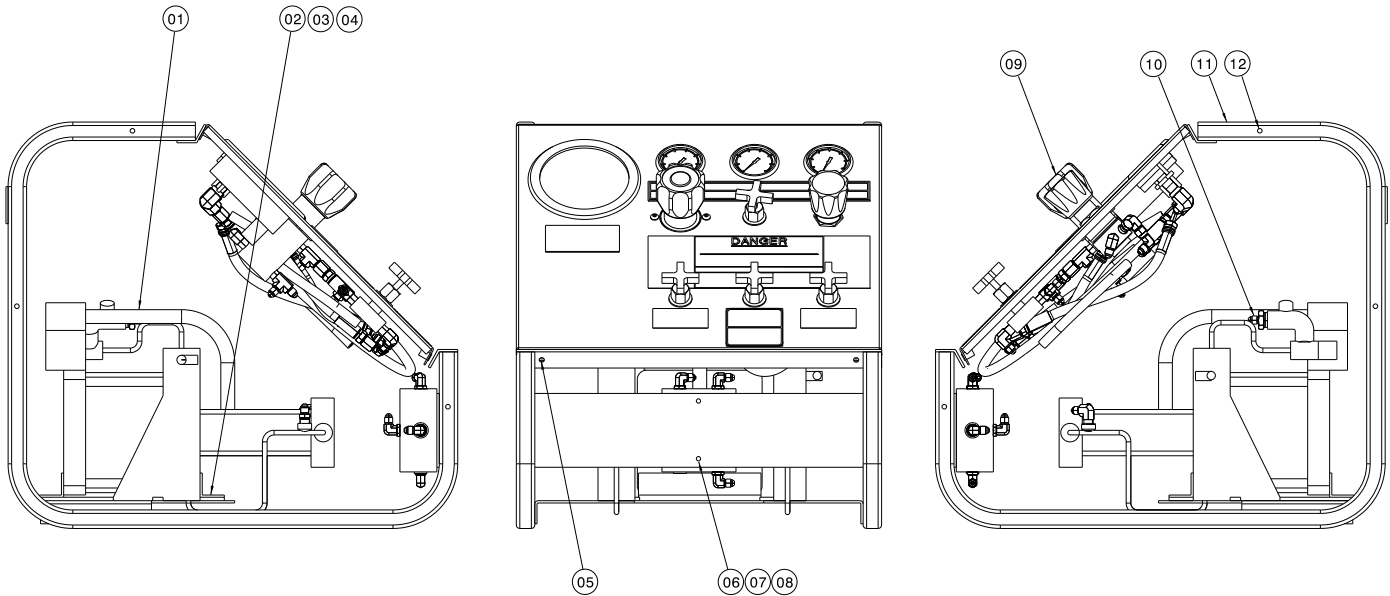
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	H-3673	Knob, Ball	1
2	Z-8171-01	Weldment, Pin	1
3	S-2626-01	Bracket, Cradle Stop	1
4	H-3674	Spring	1
5	G-1112-105010	Bolt, HH SST, 1/4 - 20 x 1 Long	2
6	Z-8188-01	Machining, Clamping Handle	1
7	Z-8103-01	Weldment, Cylinder Support Handle	1
8	G-1303-13100	Pin, Roll SST, 1/8 x 1 Long	1
9	H-3666	Stud, Ball 5/16 - 18	2
10	G-1112-109030	Bolt, HH SST, 1/2 - 13 X 3 Long	1
11	G-1203-1090	Elastic Jamnut, 1/2 - 13	3
12	S-2629-01	Strap	1
13	S-2628-01	Srap	1
14	H-2677-08	Assembly, Knurled Knob, SST	2
15	R-2800	Threaded Pivot	2

Parts List

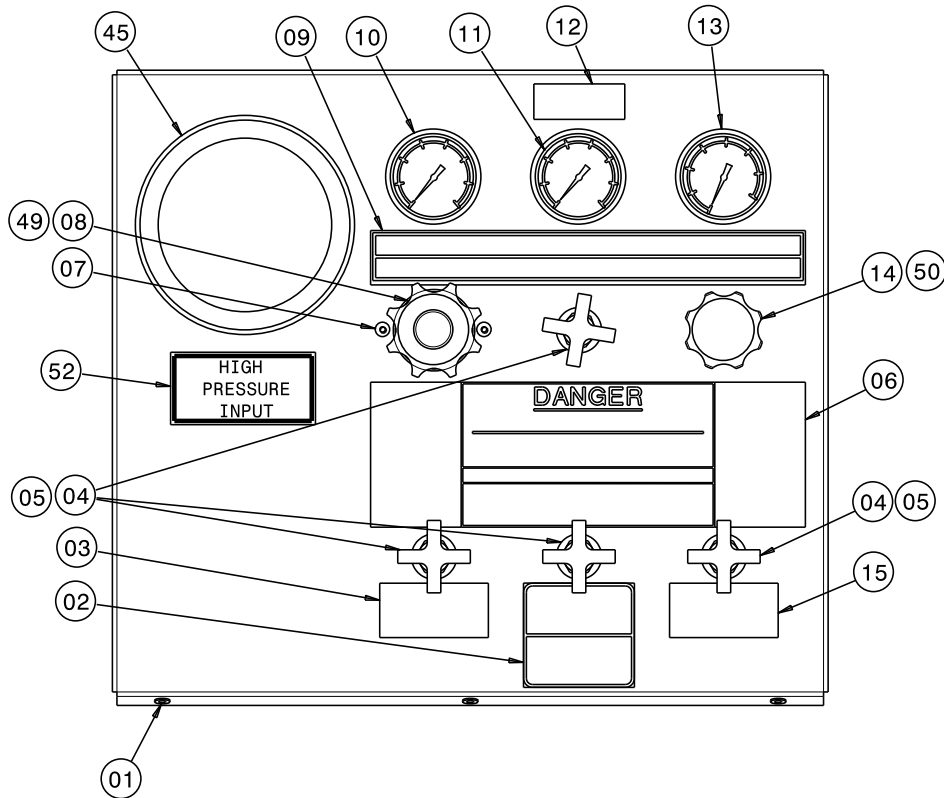
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	PC-1195	Booster, Nitrogen	1
2	G-1100-106510	Screw, Oval HD MACH, 5/16 – 24 x ¾ Long	4
3	G-1250-1060N	Flatwasher, 5/16 Narrow	8
4	G-1202-1065	Elastic Stopnut, 5/16 - 24	4
5	G-1157-105006	Screw, PAN HD CRS REC, ¼ - 20 x ¾ Long	4
6	G-1100-105026	Bolt, ¼ - 20 x 2 ¾ Long	2
7	G-1250-1050N	Flatwasher, ¼ narrow	2
8	G-1202-1050	ESN, ¼ - 20	2
9	Z-8549	Assembly, Nitrogen Panel	1
10	N-2009-05-S	Connector, Male (04 Tube ½ NPT)	1
11	Z-8550-01	Weldment, Frame	1
12	G-1440-1035-S	Nutsert, Open End 10 – 32	6

Parts List

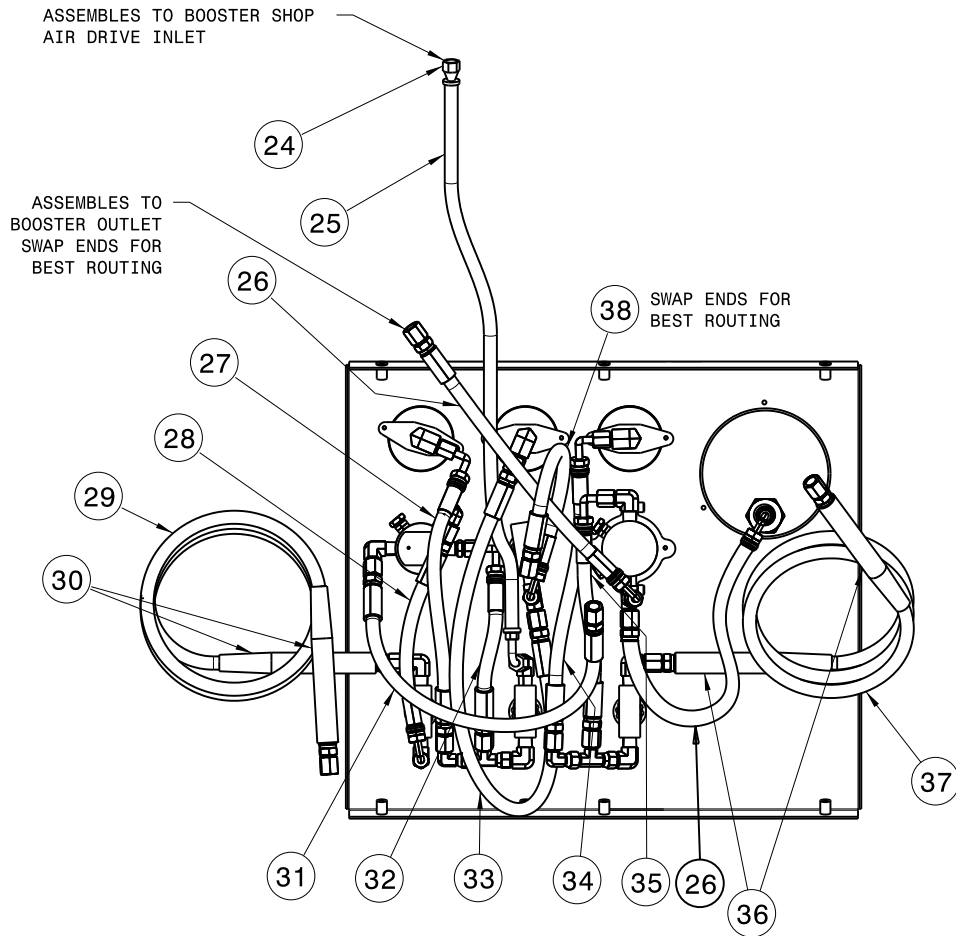
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	G-1439-1050-S	Nutsert, ¼ - 20	5
2	V-1622	Label, Supply Warning	1
3	V-2038	Label, Booster Output	1
4	HC-1081-01	Valve, Needle	4
5	HC-1122	Kit, Panel Mounting	4
6	V-2121	Label, Nitrogen Operation	1
7	G-1154-105204	Screw, Socket Head Cap, ¼ - 20 x ½" long	2
8	PC-1103	Clamp, Regulator Mounting	1
9	V-2041	Label, Operator	1
10	HC-2279	Gauge, Pressure 0-5000 psi	2
11	S-2734-01	Panel, Instrument	1
12	V-1001	Label, Made In USA	1
13	HC-2239	Gauge, Pressure 0-600 psi	1
14	H-2259	Locknut, Panel	1
15	V-2034	Label, Low Pressure	1
45	HC-2635	Gauge	1
49	PC-1037-01	Regulator, High Pressure	1
50	PC-1089-01	Regulator, Low Pressure	1
52	V-2576	Label, High Pressure Input	1

Parts List

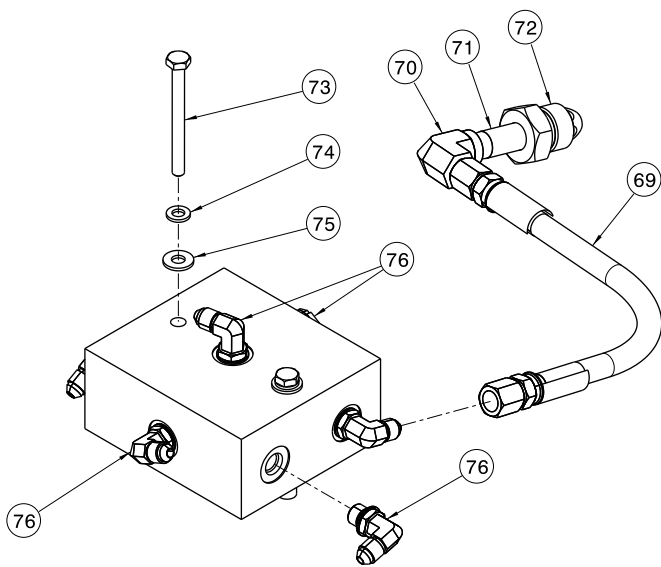
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



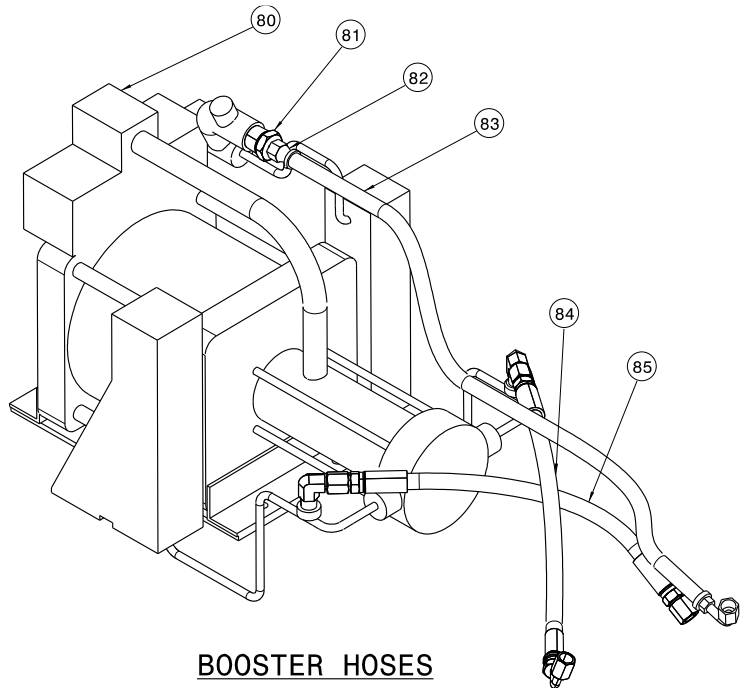
Item	Part Number	Description	Qty
24	N-2026-01-S	Fitting, 37 Flare - .25 Hose Barb	1
25	TF-1047-01*12.0	Hose, Grey Push-On, ¼ x 12 Long	1
26	TF-1043-25-12.0	Assembly, Hose	2
27	TF-1043-11*11.8	Assembly, Hose	2
28	TF-1043-11*09.5	Assembly, Hose	1
29	TF-1043-01*300	Assembly, Hose	1
30	EC-1057-05*12.0	Tubing, Blue Heat Shrink	2
31	TF-1043-11-21.0	Assembly, Hose	1
32	TF-1043-11*07.8	Assembly, Hose	1
33	TF-1043-11*21.0	Assembly, Hose	1
35	TF-1043-11*10.0	Assembly, Hose	1
36	EC-1057-02*12.0	Tubing, Heat Shrink (Red)	2
37	TF-1043-01*180	Assembly, Hose	1
38	TF-1043-11-13.3	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-1043-01*36.0	Assembly Hose	4
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-1251-1050R	Lockwasher, ¼ regular	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*14.0	Hose, ¼" Push On	1
84	TF-1043-25-12.0	Assembly Hose	1
85	TF-1043-11-13.3	Assembly Hose	1
	♦ K-2147	Kit, CGA 580 Fittings; consist of:	
70		Elbow, Female (4-DTX-S)	1
71		Nipple, Inlet	1
72		Nut	1

♦ Standard Nitrogen cylinder fittings.



APPENDIX I

Hydraulics International Operation and Maintenance Instructions



HYDRAULICS INTERNATIONAL, INC.

OM-G105A

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
	☐ 5G-SS-7	5G-SS-7 5 Pages	80275	80082 80217 80287 80289	80626 80628
	☐ 5G-SS-14	5G-SS-14 5 Pages	80200	80082 80209 80212 80217	80626 80629
	☒ 5G-SS-30	5G-SS-30 5 Pages	80201	80082 80210 80213 80217	80626 80630
	☐ 5G-SS-50	5G-SS-50 5 Pages	80960	80082 80217 80969 80976	80626 80636
	☐ 5G-SS-75	5G-SS-75 5 Pages	80202	80082 80211 80214 80217	80626 80631

☐ Supplementary Data Attached:

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 - 1.1.2.2 Potential Pressures
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 - 1.1.2.4 Basic Formulas Potential Outlet Pressures
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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

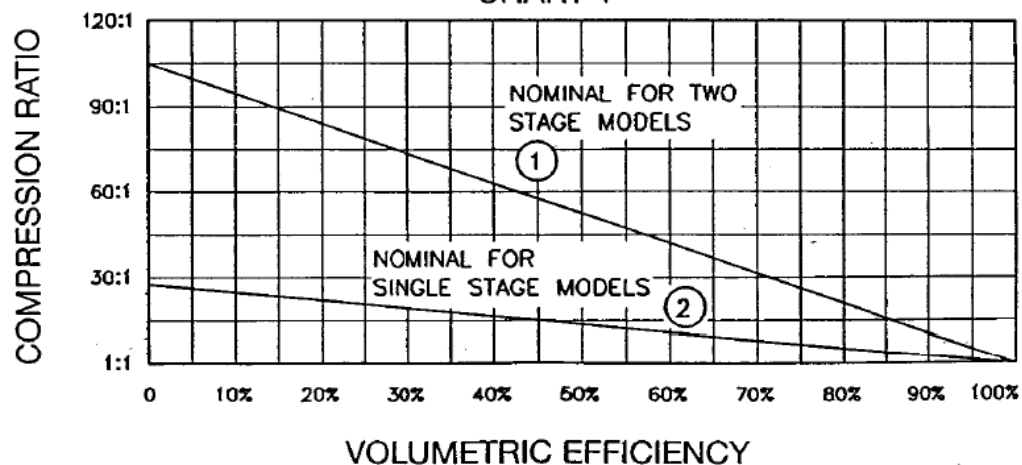
1.1.2.4 Basic Formulas – Potential Pressures By Model.

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 $30 \times 150 = 4500$ PSI. (4514.7 PSIA). $\frac{4514.7}{28:1} = 161$ PSIA = 147 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

CHART 1



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 implied 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.

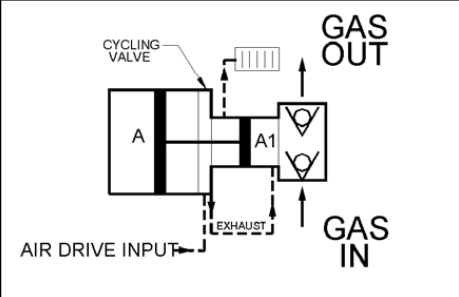
5.2 Boost Section.

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.

CAUTION

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.

CAUTION

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).	A) Drive shut off. B) “X” Mod. Not plumbed. C) Spool valve (30) stuck due to friction of swollen O-rings due to chemical carryover from shop compressor oil. D) Unlikely, but possible: Poppet valves (2) or (8) may be short or springs (4) or (6) broken. Ref. Drawings 80217, 80082.	A) Open drive valve. B) Connect external pilot port to air source. 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. CAUTION: Retainer (32) should not be highly torqued. D) Remove hex caps (2) or (3). Inspect springs and poppets. Replace as needed.

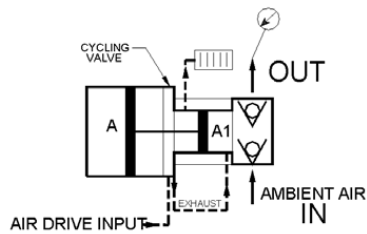
Symptom	Possible Cause	Suggested Remedy
2. Unit will not cycle and air bleeds out exhaust muffler.	A) Insufficient internal air pilot volume due to long, small air drive line. B) Spool valve (30) stuck in center position due to friction of swollen or dry O-rings (see 1-C above).	A) Increase size of air 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.
CAUTION 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.		
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).	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. B) Pilot valve stem seal assembly with retaining ring has vibrated loose resulting in nonconcentric valve action. C) Drive air leaking into the pilot chamber.	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. 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. C) Ref item 4 above.

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

9.1 Gas Section.

Setup and Steps:



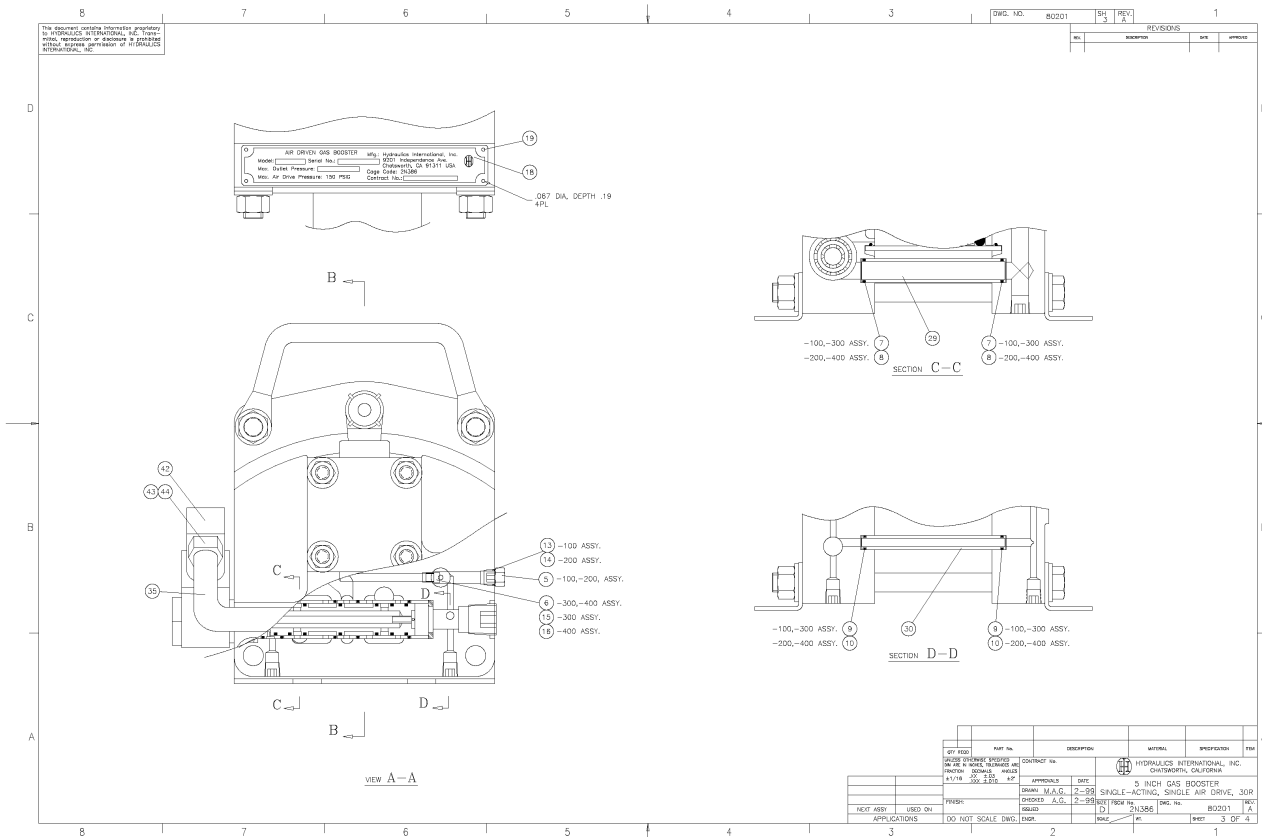
9.1.1 Install 0-500 PSI (minimum) pressure gauge at outlet.

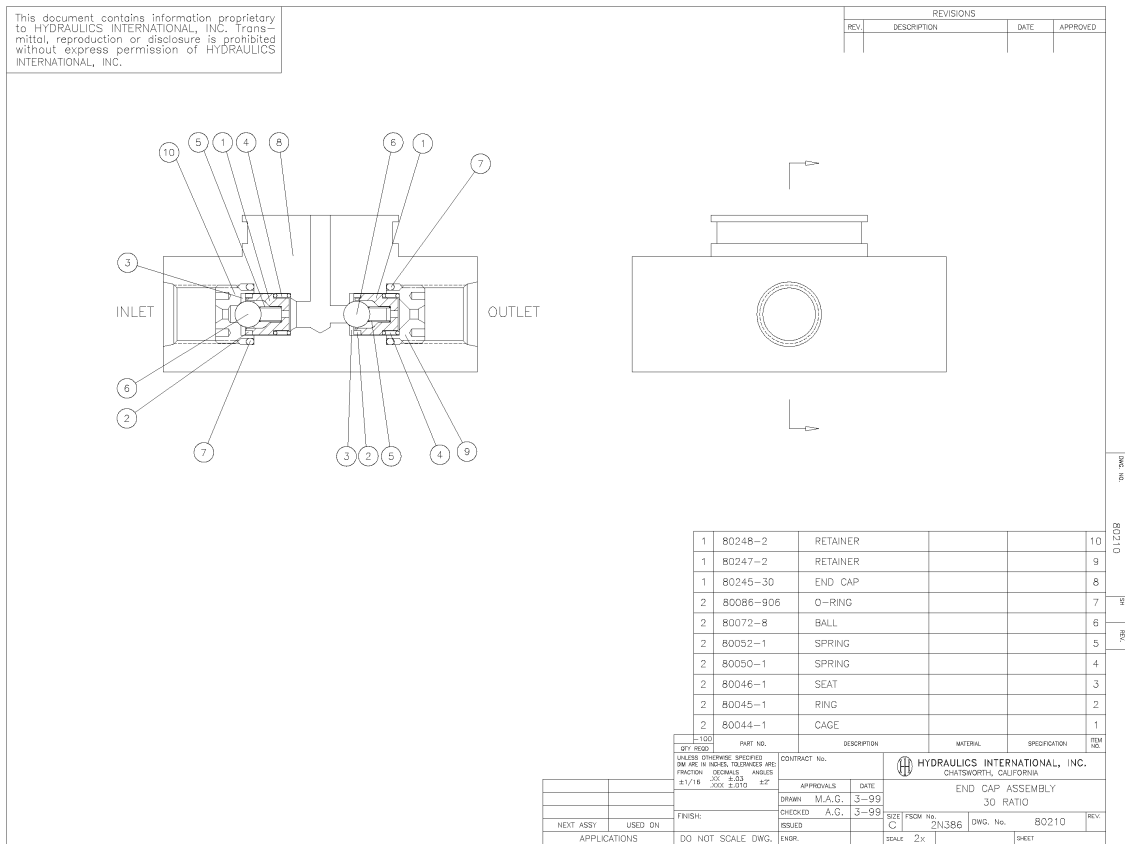
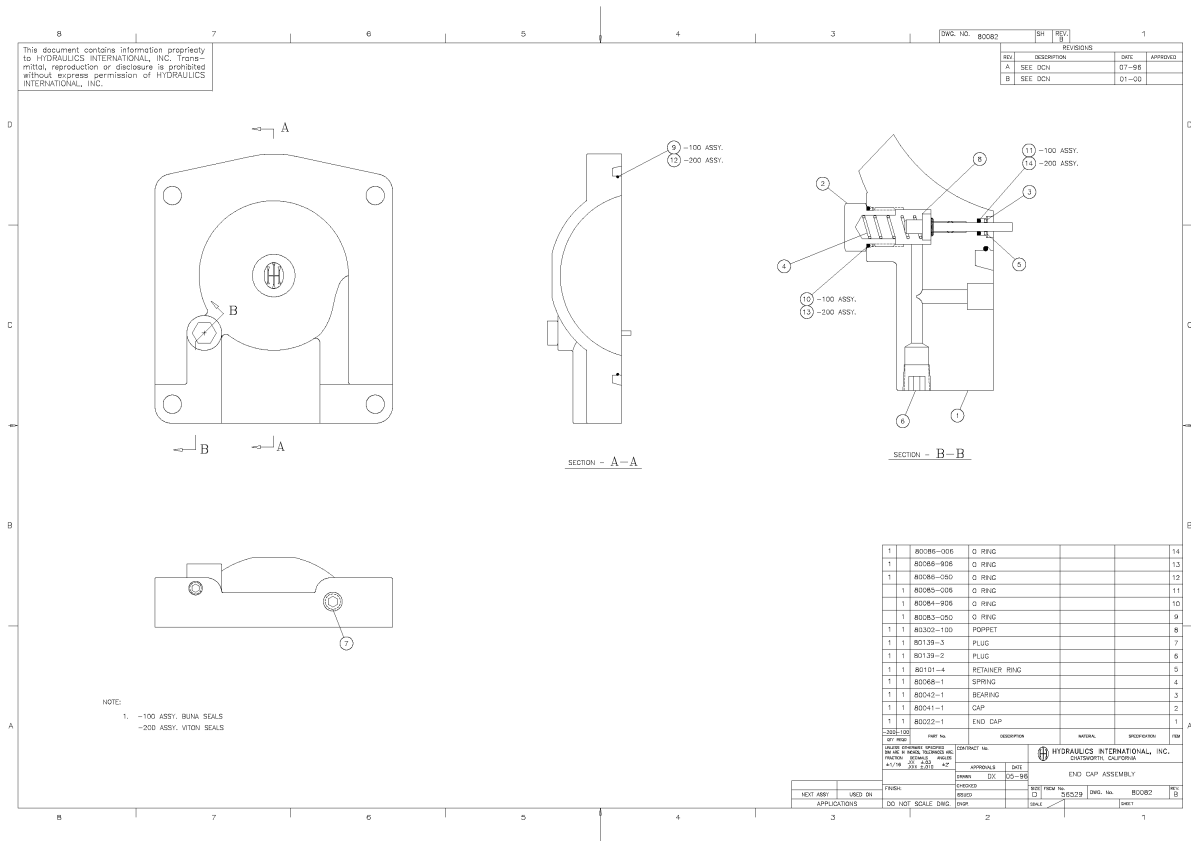
9.1.2 Cycle Booster. If check valves and piston are operating properly, it should be able to boost **AMBIENT AIR** to 250-300 PSI.

9.2 Drive Section.

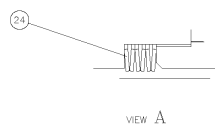
Shut off and trap drive air when ambient air has been boosted to 250-300 PSI. Check all external surfaces and connections with soap solution or “Leak Tec”. All must be bubble tight except breathers. Reduce drive air pressure to 15 PSI. Bleed air at gauge. Unit should cycle smoothly.

[illegible]



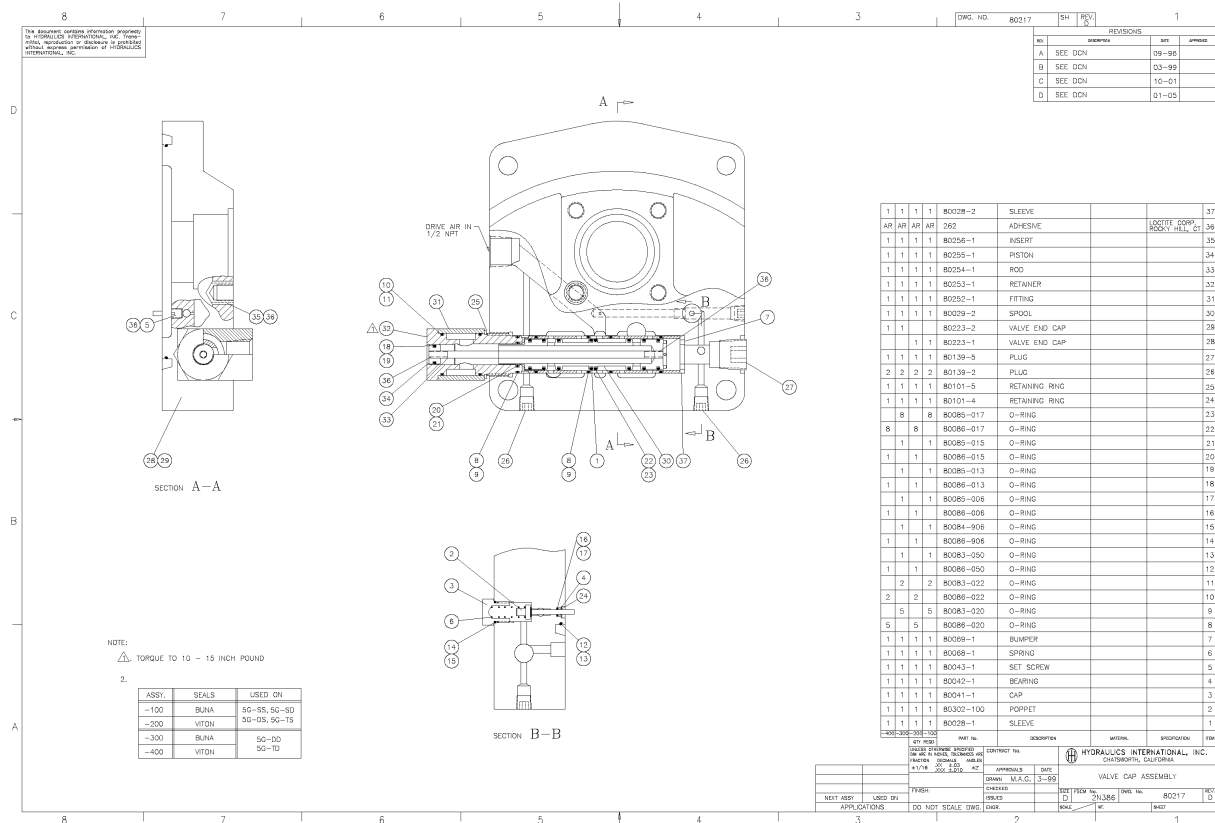


REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	SEE DCN	1-99	
B	SEE DCN	7-99	
C	SEE DCN	8-99	
D	SEE DCN	05-02	



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

QTY 100 PART NO. DESCRIPTION MATERIAL SPECIFICATION		CONTRACT NO. HYDRAULIC INTERNATIONAL, INC. CHATSWORTH, CALIFORNIA	
UNLESS OTHERWISE SPECIFIED USE AS IN NOTES, DIMENSIONS AND TOLERANCES SHOWN FINISH XXX 4.00 ± 0.10		APPROVALS DRAWN M.A.G. 9-98 CHECKED A.G. 05-02 DATE	
FINISH:		GAS SECTION ASSY - 30 RATIO	
NEXT ASSY USED ON:		SIZE FROM NO. 23N36 DWG. NO. 80213	
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APPENDIX II

Smith's Pressure Regulators Installation & Operation Guide



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 III

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 IV

Declaration of Conformity



DECLARATION of CONFORMITY

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

18-4319-0000

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 cursive script, reading "Patrick Finch". The signature is written in dark ink and is positioned above a horizontal line.

Quality Assurance Representative