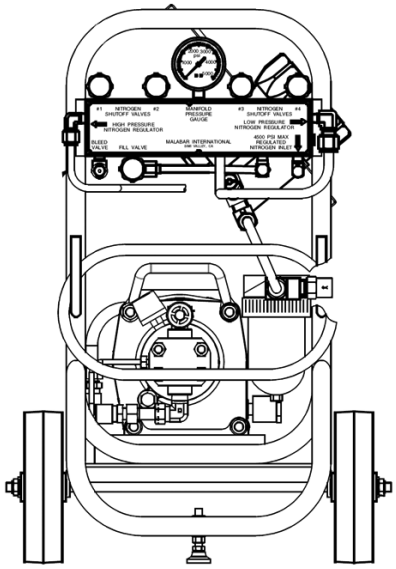
OPERATION & SERVICE MANUAL

ORIGINAL INSTRUCTIONS



Model: 896100
Part: 8961
Nitrogen Booster Pack

11/2023 – Rev. 10

For Spare Parts, Operations & Service Manuals or Service Needs
Scan the QR code or visit Tronair.com/aftermarket

Malabar International
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
Web: www.malabar.com
Email: sales@malabar.com

REVISION	DATE	TEXT AFFECTED
01	01/2019	Original release
02	06/2020	Major revision
03	09/2020	Modified 7.2 Recommended Spare Parts List
04	10/2020	Major revision
05	02/2021	Major revision
06	07/2021	Major revision
07	10/2021	Modified 1.4 Specifications and Parts List
08	04/2023	Modified Parts Lists
09	07/2023	Major revision
10	11/2023	Modified 2.2 Personal Protection Equipment, 5.2 Operating Instructions for Compressed Air as Boost Source, and 5.3 Operating Instructions for Nitrogen Bottles as Boost Source

TABLE OF CONTENTS

PAGE

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., it suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

CAUTION!

Aircraft manufacturer's specifications and instructions must be followed. In the event of contradiction between aircraft manufacturer's specifications and Malabar's, aircraft manufacturer's will prevail.

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

The Malabar Model 896100 / Part 8961 is a mobile unit designed for high pressure nitrogen service. High pressure nitrogen can be used to fill accumulators, landing gear struts and other aircraft high pressure nitrogen systems. The unit is equipped with an inlet nitrogen manifold and a charging port, a control panel with regulators and pressure gauges, a nitrogen booster with an air drive inlet and a nitrogen drive inlet, molecular sieve filter, particle filter, 15 foot long high-pressure nitrogen service hose with a hose end shutoff valve and a safety chuck, two 8 inch diameter wheels and all mounted on a tubular cage frame. The pack is designed to be transported similar to a hand truck and laid down for operational use. The primary source to drive the nitrogen booster is either a portable air compressor or fixed compressed air source. The secondary source to drive the nitrogen booster can be a 4-bottle nitrogen source.

Note: The Nitrogen Booster Pack is intended to be used on flat, level ground.

1.2 MODEL, PART & SERIAL NUMBER

Model 896100
Part.....8961
Serial Number .....Reference nameplate on unit

1.3 MANUFACTURER

Malabar International
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
E-mail: sales@malabar.com
Website: www.malabar.com

1.4 SPECIFICATIONS

Primary Boost Air Source .....Portable or Fixed Compressor,
Boost Air Max Source.....155 PSI @ 70 – 170 SCFM
Boost Air Operating Pressure.....100 PSI
Secondary Boost Air Source .....Nitrogen Supply Bottles
N2 Bottle Supply using N2 Drive .....4X size 300 at 2400 psig to 3250 psig
N2 Bottle Supply using Shop Air .....4X size 300 at 1120 psig to 3250 psig
High Pressure Nitrogen Outlet .....up to 5000 psig
N2 Booster Inlet Pilot Switch Shutoff.....750 psig
N2 Booster Outlet Pilot Switch Shutoff.....4750±50 psig
N2 Booster Outlet Relief Valve Set at .....4900±100 psig
N2 Moisture Content Filtration.....Less than 15 PPM
N2 Particle Filtration.....Less than 5 Microns
N2 Hydrocarbon Filtration .....Less than 10 PPM
Unit Weight.....300 lbs (136 kg)
Standard Finish .....Blue

Note: boost pump will not operate if inlet Nitrogen supply pressure is below 750 psig or if outlet pressure is above 4750±50 psig.

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

To ensure 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*** is the Caution Notice is ignored.

2.2 PERSONAL PROTECTION EQUIPMENT

Malabar recommends the use of safety glasses and hearing protection while using this equipment

Noise Generated:
Boost Cycle.....Leq 70 dB (A)
End of Operation Discharge.....110 dB (A)

3.0 PREPARATION PRIOR TO FIRST USE

The unit is shipped fully assembled and ready to use, with the exception of all input hoses which must be provided by the end user.

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

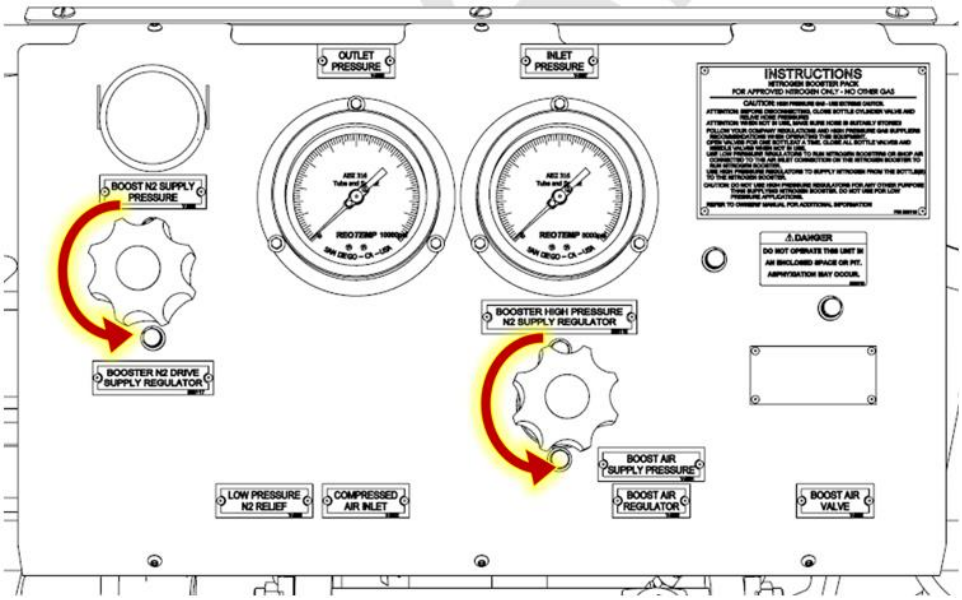
Note: The Nitrogen Booster Pack is intended to be used on flat, level ground.

5.1 PRE OPERATION INSPECTION

NOTE: Figure an Item Numbers refer to Parts Lists as well as to adjacent illustration in this section.

Each time the unit is to be used, inspect and set-up the following:

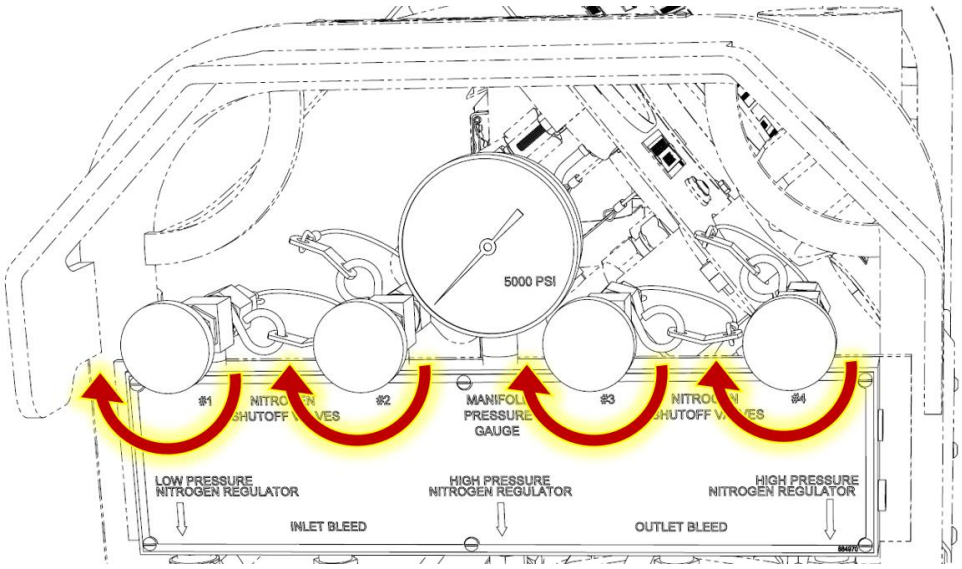
1. Check the frame structure for rigidity. Make sure all bolts are tightened, end caps on manifold are tight, gauges and tubing are secure, hose is not cracked or deteriorated and air chuck is in good working position.
2. Verify all gauges read 0 psig and are not stuck in position. There are 5 gauges total (Figure 5, item 10, 17, 18; Figure 3, item 3; Figure 2C, Item 57).
3. Verify all regulators move freely and do not hang up. There are 3 regulators total (Figure 5, items 7, 9; Figure 2C, Item 57).
4. Check manifold assembly components for proper operation (Figure 3, items 2 and 12).
5. Check to verify regulators are adjusted to the fully counter-clockwise position or fully closed. This includes the Booster High Pressure N2 Supply Regulator (Figure 5, Item 7) and the Booster N2 Drive Supply Regulator (Figure 5, Item 9).



Booster High Pressure N2 Supply Regulator (Figure 5, Item 7) and Booster N2 Drive Supply Regulator (Figure 5, Item 9)

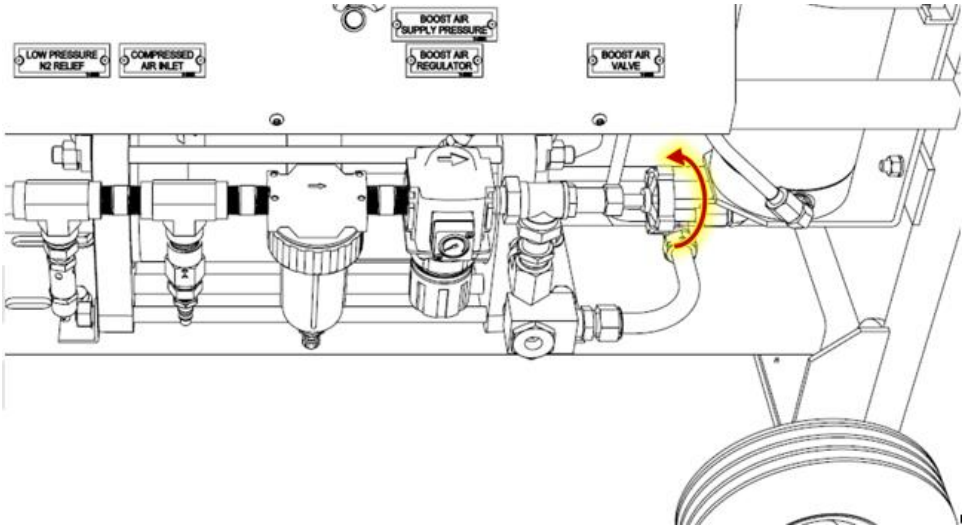
5.1 PRE OPERATION INSPECTION *(continued)*

6. Close all shut-off valves (Figure 3, Items 2) by turning fully clockwise. Close the bleed valves (Figure 3, item 12) by turning fully clockwise.



Shut-off valves (Figure 3, Items 2)

7. Completely close the boost air drive inlet valve (Figure 2C, item 35). The boost air drive inlet valve is located adjacent to the air drive regulator.



Boost air drive inlet valve (Figure 2C, Item 35)

5.1 PRE OPERATION INSPECTION *(continued)*

CAUTION!

Shutoff valves on gas bottles must be closed when not in use.

CAUTION!

DO NOT rotate boost pack to the upright position with nitrogen bottle hose(s) connected.

NOTE: The Nitrogen Boost Pump System may be powered by either air or from the boost pack nitrogen supply bottles. It is only recommended to use the boost pack supply nitrogen to power the Boost Pump when air is not available.

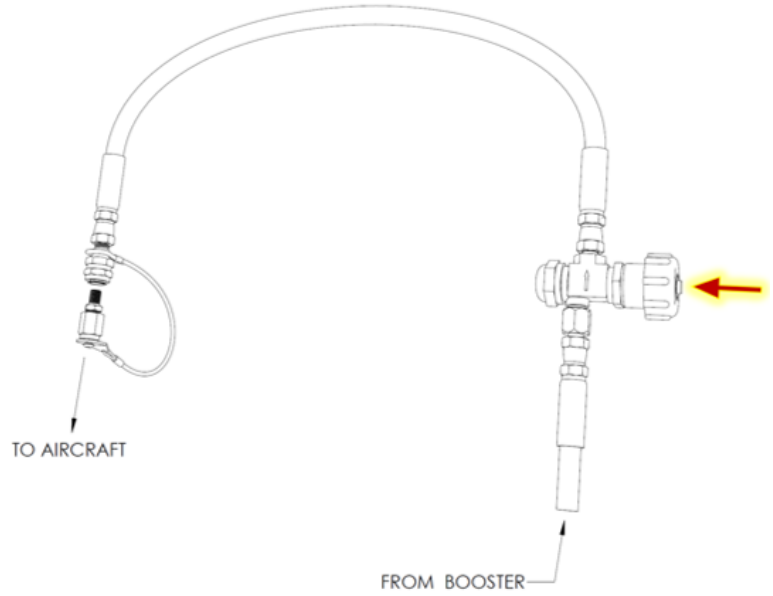
5.2 OPERATING INSTRUCTIONS FOR COMPRESSED AIR AS BOOST SOURCE (PRIMARY SOURCE)

WARNING!

DO NOT operate this unit in an enclosed space or pit. Asphyxiation may occur.

Note: Figure and Item Numbers refer to Parts Lists in the Appendix as well as to adjacent illustrations in this section.

1. Complete all steps in the pre-operation inspection, section 5.1 Pre Operation Inspection.
2. Up to four (4) Nitrogen supply bottle(s) must be at a minimum of 1120 psig up to 3250 psig combined.
3. Attach fill line (Figure 1A, Item 29) to aircraft.
4. Verify full flow ball valve (Figure 1C, Item 16) is in closed position.

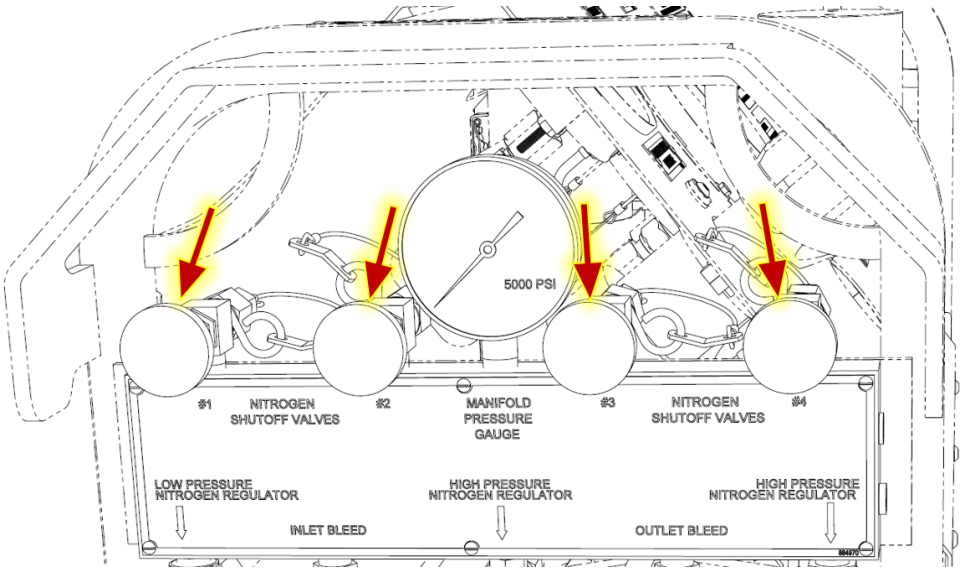


Full flow ball valve (Figure 1C, Item 16)

5. Assure valves on Nitrogen supply bottles are closed prior to connecting to booster.

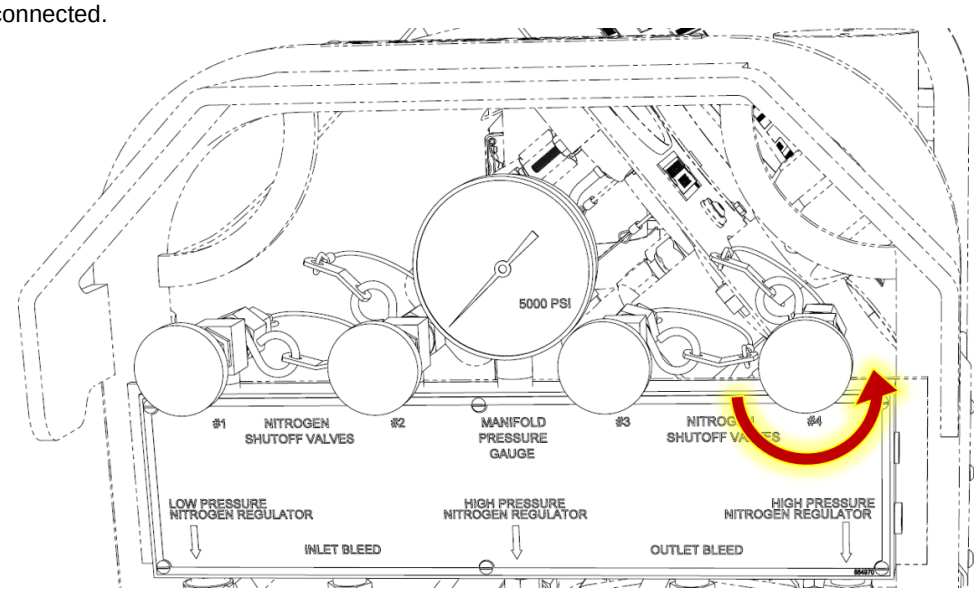
5.2 OPERATING INSTRUCTIONS FOR COMPRESSED AIR AS BOOST SOURCE (PRIMARY SOURCE) *(continued)*

6. Connect Nitrogen supply bottle(s) to shutoff valve connectors (Figure 3, Item(s) 4). Any shutoff valve connectors not in use must be tightly capped (Figure 3, Item 13). Torque hoses and/or caps 2 turns past wrench resistance (15-17 Nm / 130-150 in-lbs).



Shutoff valve connectors (Figure 3, Item(s) 4)

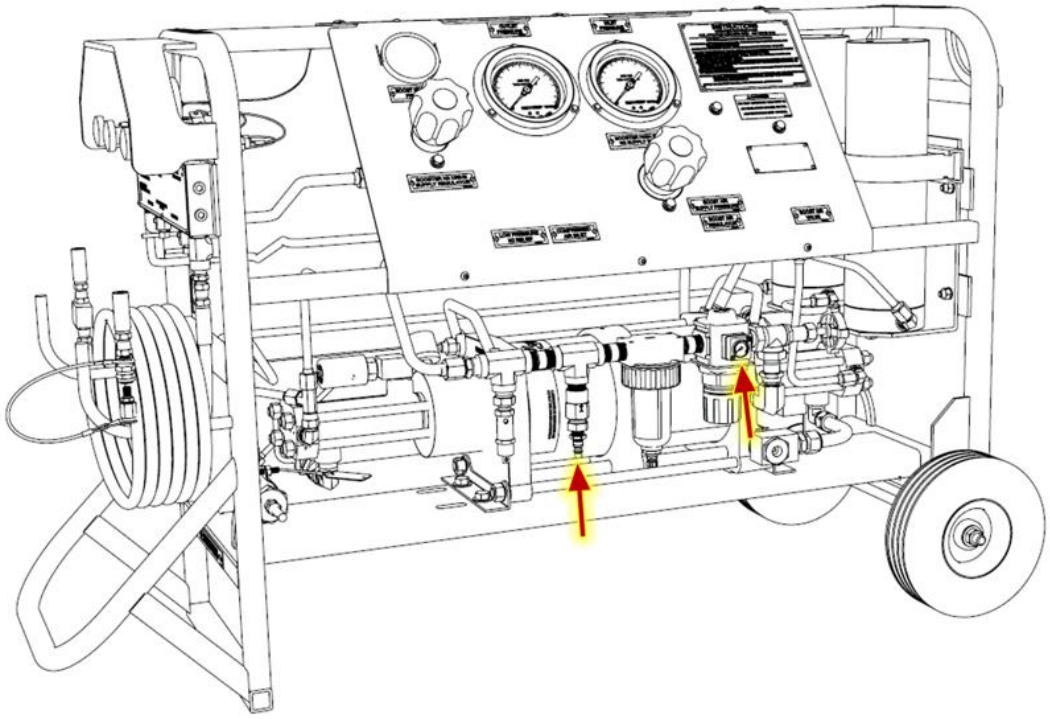
7. After the Nitrogen bottles are connected to the shutoff valve connectors, open all valves on the Nitrogen bottles. While opening valves, check for leaks in hoses and connections using Snoop or equivalent. Tighten all leaky connections.
8. Slowly open only the nitrogen shutoff valve(s) that are connected to bottle(s) (Figure 3, Item(s) 2) by turning counterclockwise until fully open – this will require multiple full turns of the knob(s) until fully open. Check inlet pressure gauge (Figure 3, Item 3) for expected supply pressure. Open only the valves with nitrogen supply connected.



Nitrogen shutoff valves Figure 3, (Item(s) 2)

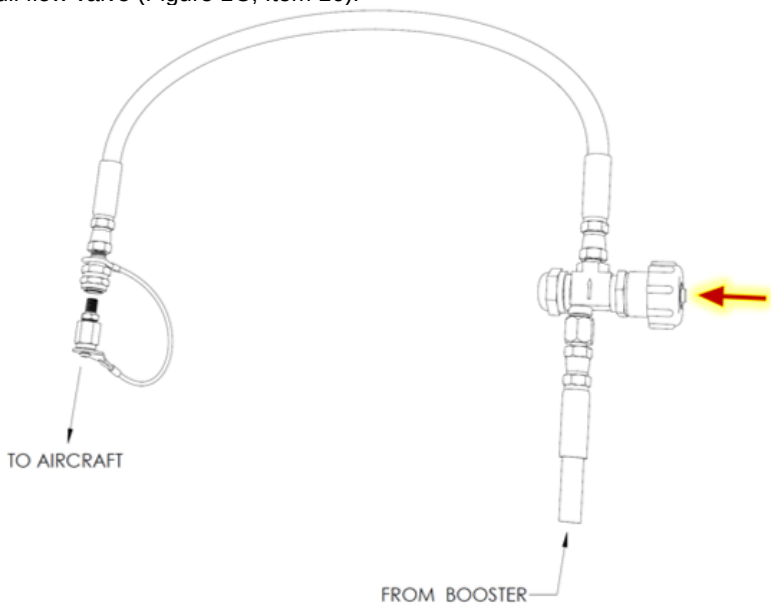
5.2 OPERATING INSTRUCTIONS FOR COMPRESSED AIR AS BOOST SOURCE (PRIMARY SOURCE) *(continued)*

9. Connect shop airline to the boost pump air drive inlet (Figure 2C, item 58). Set air drive regulator (Figure 2C, item 57) so that the adjacent pressure gauge mounted to the regulator reads 100 psi.



Air drive inlet (Figure 2C, Item 58), Air drive regulator (Figure 2C, Item 57)

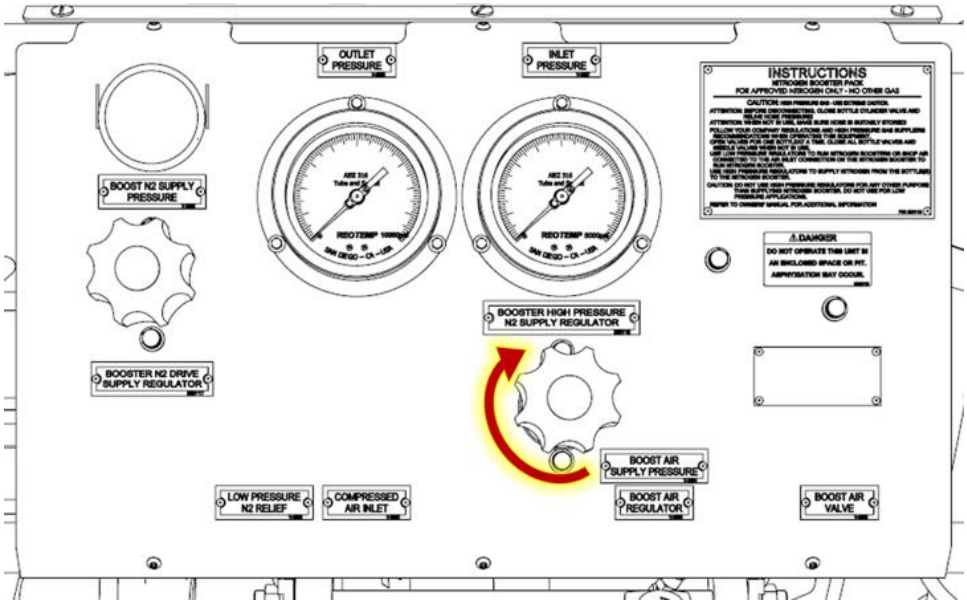
10. Open the full flow valve (Figure 1C, Item 16).



Full flow valve (Figure 1C, Item 16)

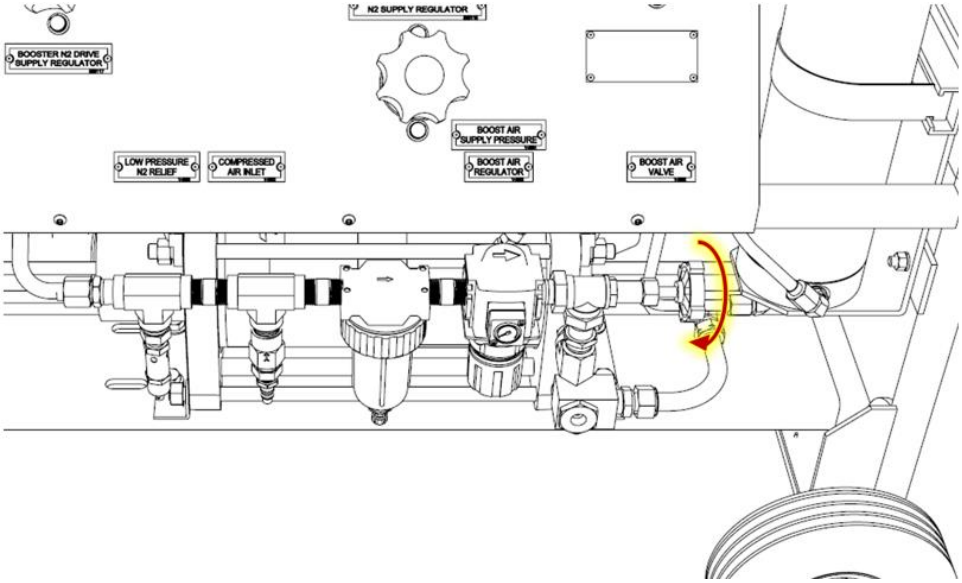
5.2 OPERATING INSTRUCTIONS FOR COMPRESSED AIR AS BOOST SOURCE (PRIMARY SOURCE) *(continued)*

11. Rotate the Booster High Pressure N2 Supply Regulator (Figure 5, Item 7) all the way clockwise and the supply/inlet and outlet pressures should take some time to nearly equalize. These pressures are displayed on the inlet and outlet pressure gauges (Figure 5, items 17, 18). The pressures may not fully equalize but should come close to each other. Note the full scale on the inlet and outlet pressure gauges are different.



High Pressure N2 Supply Regulator (Figure 5, Item 7)

12. After the inlet and outlet pressures have nearly equalized, completely open the boost air drive inlet valve. (Figure 2C, item 35). The boost air drive inlet valve is located adjacent to the air drive regulator. The boost pump will then pump to the set pressure. A constant exhaust of air from the boost pump is normal in this mode.



Boost air drive inlet valve (Figure 2C, item 35)

13. The boost pump should continue to increase the outlet pressure until the Outlet Pilot Switch Shutoff set point of 4750±50 psig. If an outlet pressure lower than 4750 psi is desired, observe the outlet pressure gauge (Figure 1D, item 17) and continue to the next step (step n) when desired pressure is achieved. When the boost pump reaches the outlet set point, it will stop boosting. If the set point is not achieved, then check the supply bottle pressure is not at or below 750 psi.

Note: see Appendix I for expected fill times based on supply pressures and volume.

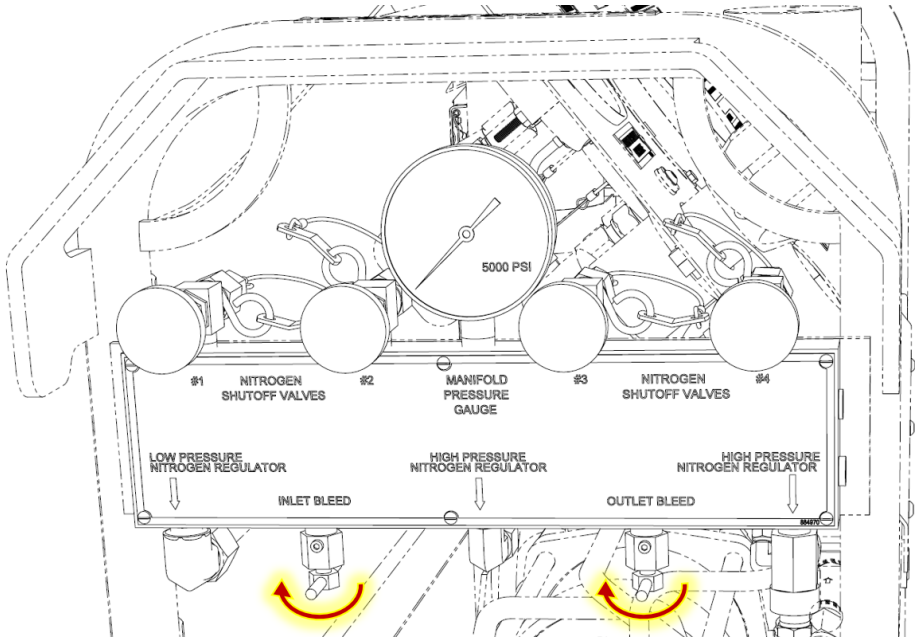
5.2 OPERATING INSTRUCTIONS FOR COMPRESSED AIR AS BOOST SOURCE (PRIMARY SOURCE) *(continued)*

14. When the desired outlet pressure is achieved, close the full flow valve (Figure 1C, Item 16) and disconnect the fill line from the aircraft (Figure 1A, Item 29) Then discharge all pressurized air from the boost pump, as follows:
    - Disconnect shop air line from the boost pump air drive inlet (Figure 2C, item 58).
    - Rotate the Booster High Pressure N2 Supply Regulator (Figure 5, Item 7) all the way counter-clockwise and the boost pump should exhaust air trapped in the system.
    - Close the boost air drive inlet valve all the way (Figure 2C, Item 35).

CAUTION!

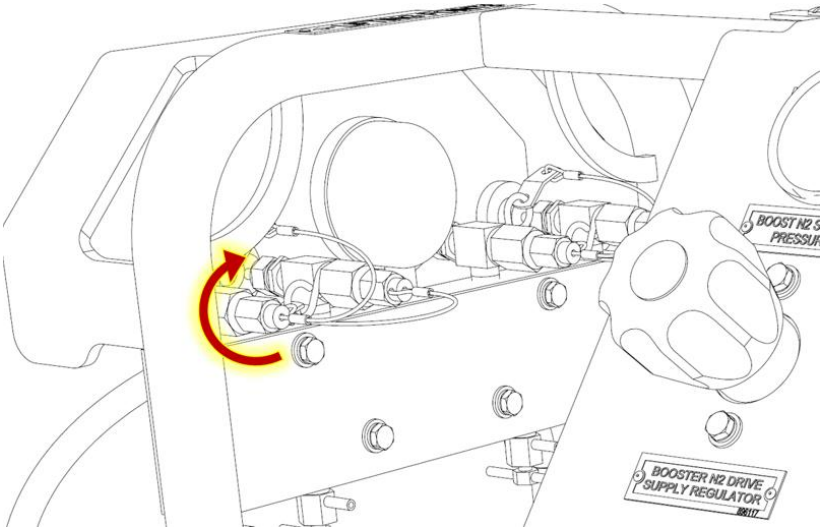
Take caution as adjacent hard line tubing may be hot.

- Open/adjust the air drive regulator (Figure 2C, item 57) until the adjacent pressure gauge mounted to it reads 0 psi.
- Close individual valves on the nitrogen supply bottles. Slowly open both bleed valves (Figure 3, Items 12). After air is exhausted, close both Bleed Valves. Check that all gauges read 0 psi.



Bleed valve (Figure 3, Item 12)

- Close all nitrogen shutoff valve(s) in use (Figure 3, Item(s) 2).
- Slowly loosen hose end connectors when disconnecting from the shutoff valve connectors as there may be pressurized Nitrogen trapped in the hoses. (Re-)cap all shutoff valve connectors (Figure 3, Items 13).



Shutoff valve connectors (Figure 3, Item 13)

5.3 OPERATING INSTRUCTIONS FOR NITROGEN BOTTLES AS BOOST SOURCE

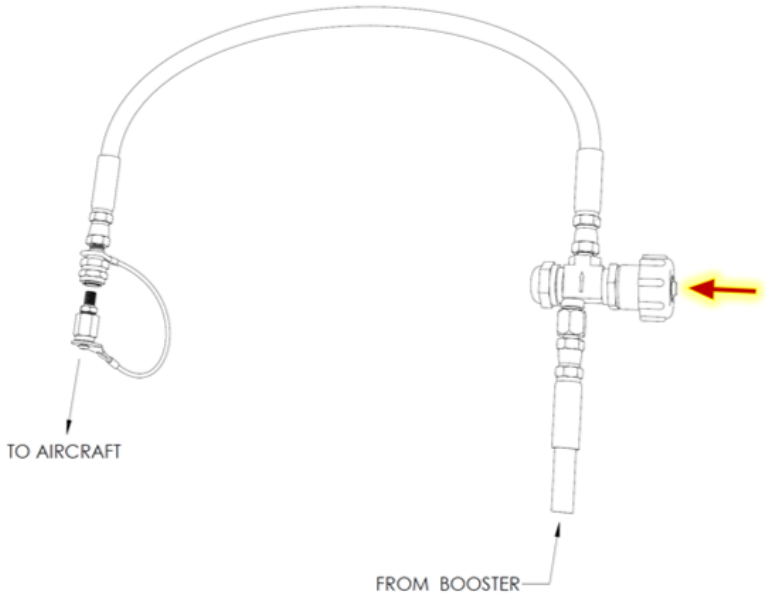
WARNING!

DO NOT operate this unit in an enclosed space or pit. Asphyxiation may occur.

Note: fill times will be longer when using Nitrogen supply to run the boost pump:

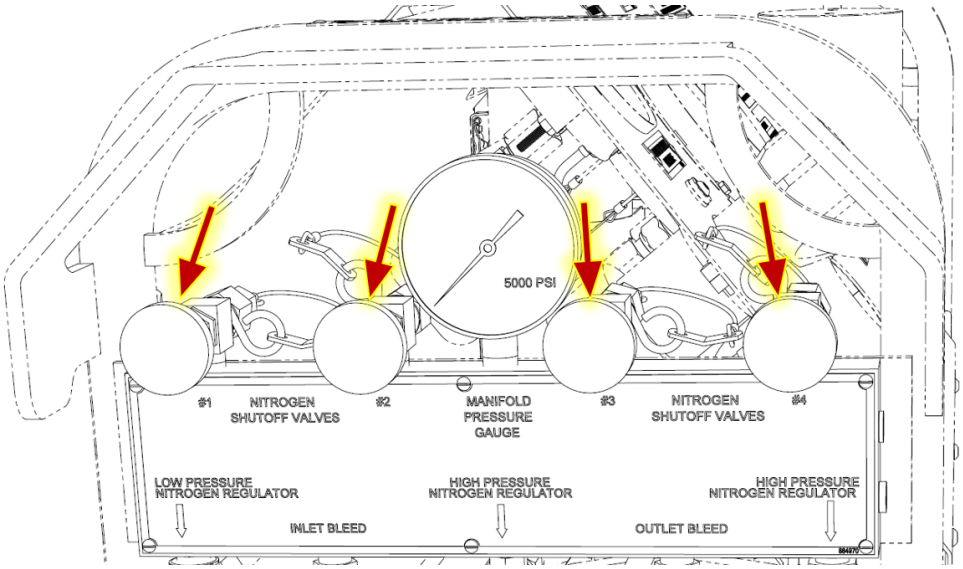
Note: Figure and Item Numbers refer to Parts Lists in the Appendix as well as to adjacent illustrations in this section.

1. Complete all steps in the pre-operation inspection, section 5.1 Pre-Operation Inspection
2. Up to four (4) Nitrogen supply bottle(s) must be at a minimum of 2000 psig up to 3250 psig combined
3. Assemble fill line connector (Figure 1A, Item 29) to aircraft.
4. Verify full flow valve (Figure 1C, Item 16) is in closed position.



Full flow ball valve (Figure 1C, Item 16)

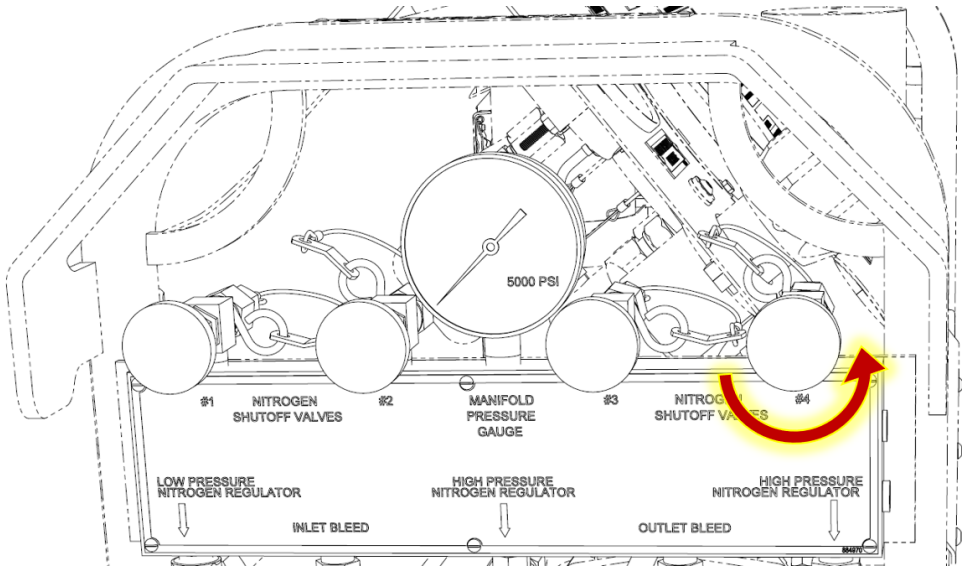
5. Assure valves on Nitrogen supply bottles are closed prior to connecting to booster.
6. Connect Nitrogen supply bottle(s) to shutoff valve connectors (Figure 3, Item(s) 4). Any shutoff valve connectors not in use must be tightly capped (Figure 3, Items 13). Torque hoses and/or caps 2 turns past wrench resistance (15-17 Nm / 130-150 in-lbs).



Shutoff valve connectors (Figure 3, Item(s) 4)

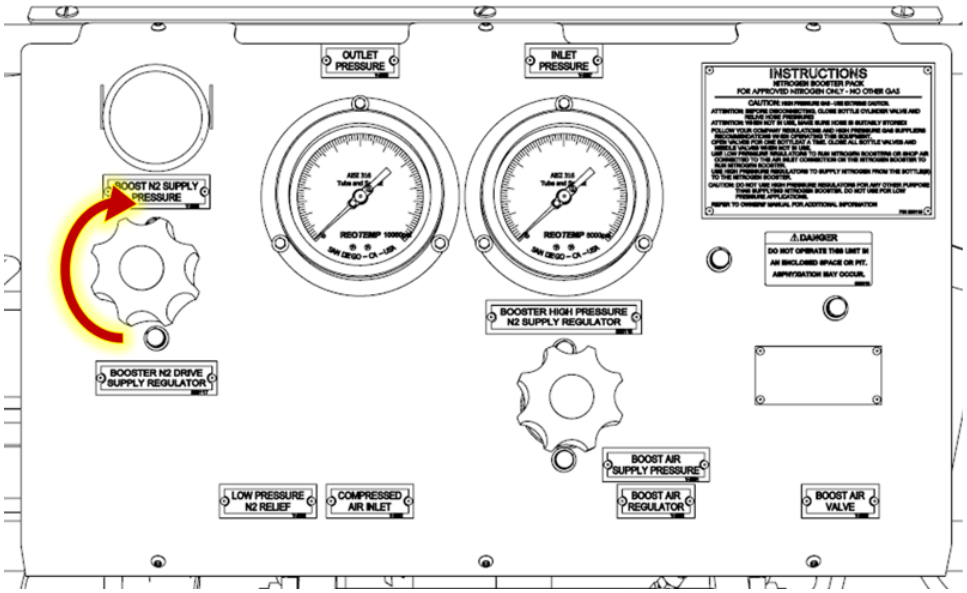
5.3 OPERATING INSTRUCTIONS FOR NITROGEN BOTTLES AS BOOST SOURCE *(continued)*

7. After the Nitrogen bottles are connected to the shutoff valve connectors, open all valves on the Nitrogen bottles. While opening valves, check for leaks in hoses and connections using Snoop or equivalent. Tighten all leaky connections.
8. Slowly open nitrogen shutoff valve(s) (Figure 3, Item(s) 2) by turning counterclockwise until fully open – this will require multiple full turns of the knob until fully open. Check manifold inlet pressure gauge (Figure 3, Item 3) for expected supply pressure. Open only the valves with nitrogen supply connected.



Nitrogen shutoff valves Figure 3, (Item(s) 2)

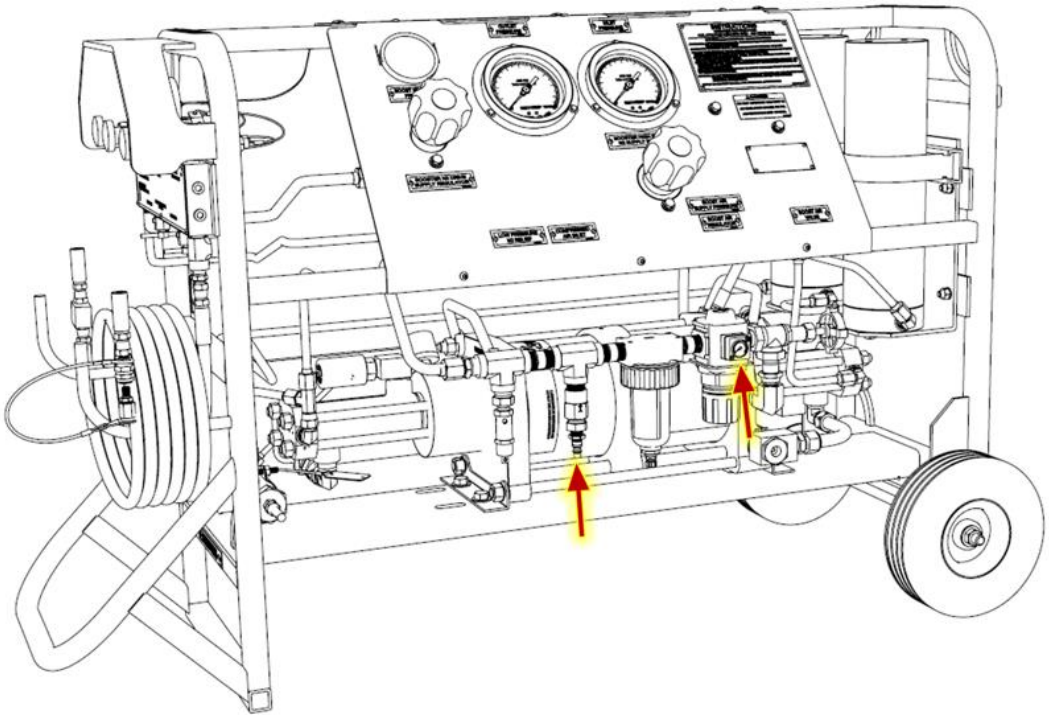
9. Disconnect shop airline that might be connected to the boost pump air drive inlet (Figure 2C, item 51).
10. Rotate the Booster N2 Drive Supply Regulator (Figure 5, Item 9) clockwise until the corresponding pressure gauge (Figure 5, item 10) reads 100 to 120 psi.



Booster N2 Drive Supply Regulator (Figure 5, Item 7)

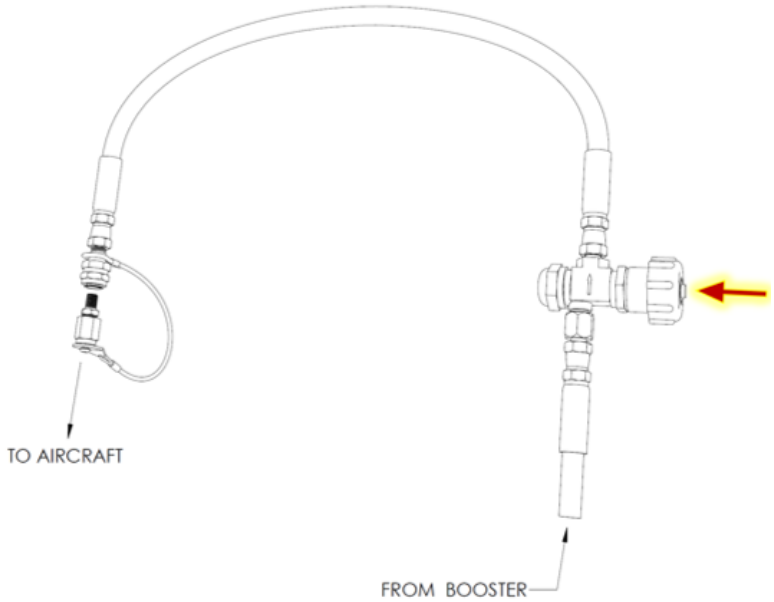
5.3 OPERATING INSTRUCTIONS FOR NITROGEN BOTTLES AS BOOST SOURCE *(continued)*

11. Set air drive regulator (Figure 2C, item 57) so that the adjacent pressure gauge mounted to it reads to 100 psi.



Air drive inlet (Figure 2C, Item 58), Air drive regulator (Figure 2C, Item 57)

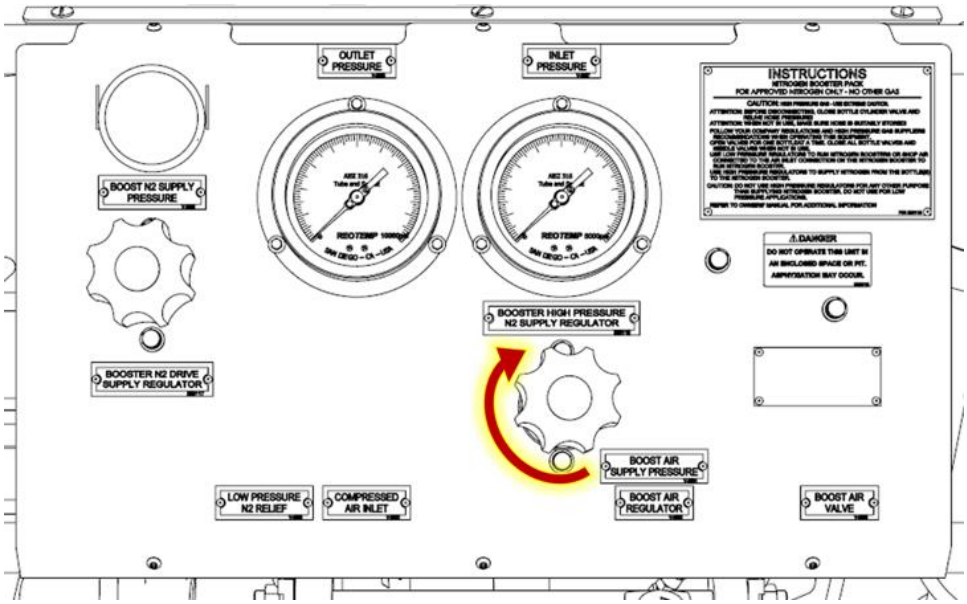
12. Open the full flow valve (Figure 1C, Item 16).



Full flow valve (Figure 1C, Item 16)

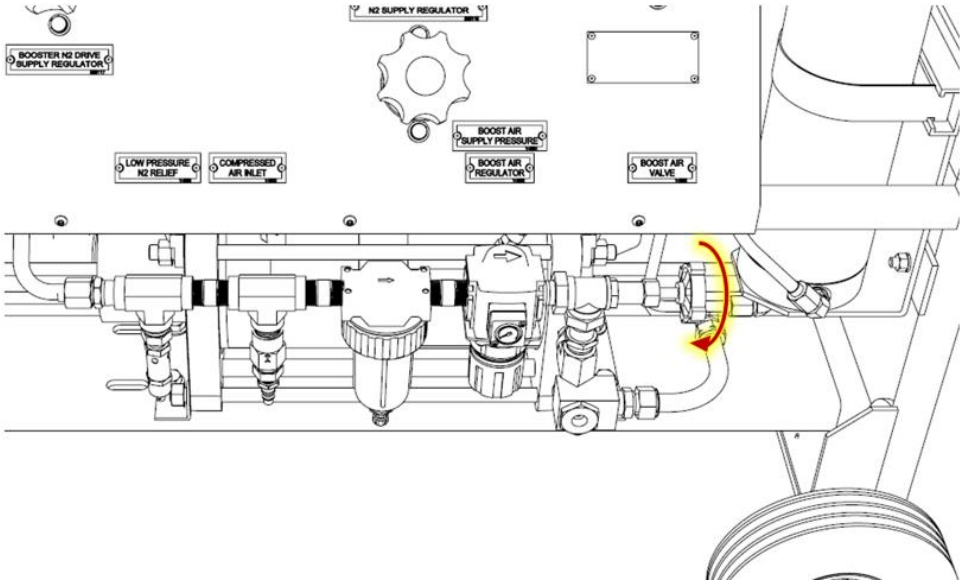
5.3 OPERATING INSTRUCTIONS FOR NITROGEN BOTTLES AS BOOST SOURCE *(continued)*

13. Rotate the Booster High Pressure N2 Supply Regulator (Figure 5, Item 7) all the way clockwise and the supply/inlet and outlet pressures should take some time to nearly equalize. These pressures are displayed on the inlet and outlet pressure gauges (Figure 5, items 17, 18). The pressures may not fully equalize but should come close to each other. Note the scale on the inlet and outlet pressure gauges are different.



High Pressure N2 Supply Regulator (Figure 5, Item 7)

14. After the inlet and outlet pressures have nearly equalized, completely open the boost air drive inlet valve (Figure 2C, item 35). The boost air drive inlet valve is located adjacent to the air drive regulator. The boost pump will then pump to the set pressure. A constant exhaust of air from the boost pump is normal in this mode.



Boost air drive inlet valve (Figure 2C, item 35)

15. The boost pump should continue to increase the outlet pressure until the Outlet Pilot Switch Shutoff set point of 4750±50 psig. If an outlet pressure lower than 4750 psi is desired, observe the outlet pressure gauge (Figure 5, item 17) and continue to the next step (step 16) when desired pressure is achieved. When the boost pump reaches the outlet set point, it will stop boosting. If the set point is not achieved, then check the supply bottle pressure is not at or below 750 psi.

Note: see Appendix II for expected fill times based on supply pressures and volume.

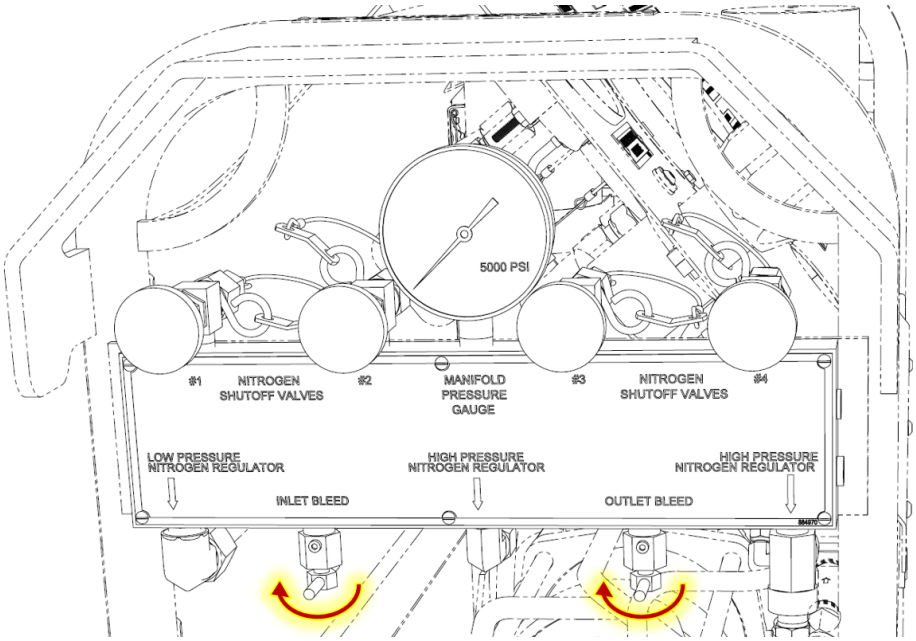
5.3 OPERATING INSTRUCTIONS FOR NITROGEN BOTTLES AS BOOST SOURCE *(continued)*

16. When the desired outlet pressure is achieved, close the full flow valve (Figure 1C, Item 16) and disconnect the fill line (Figure 1A, Item 29) from the aircraft. Then discharge all pressurized air from the boost pump, as follows:
17. If connected, disconnect shop air line from the boost pump air drive inlet (Figure 2C, item 58).
18. Rotate the Booster High Pressure N2 Supply Regulator (Figure 2C, Item 57) all the way counter-clockwise and the boost pump should exhaust air trapped in the system.
19. Close the boost air drive inlet valve (Figure 2C, item 35) all the way.

CAUTION!

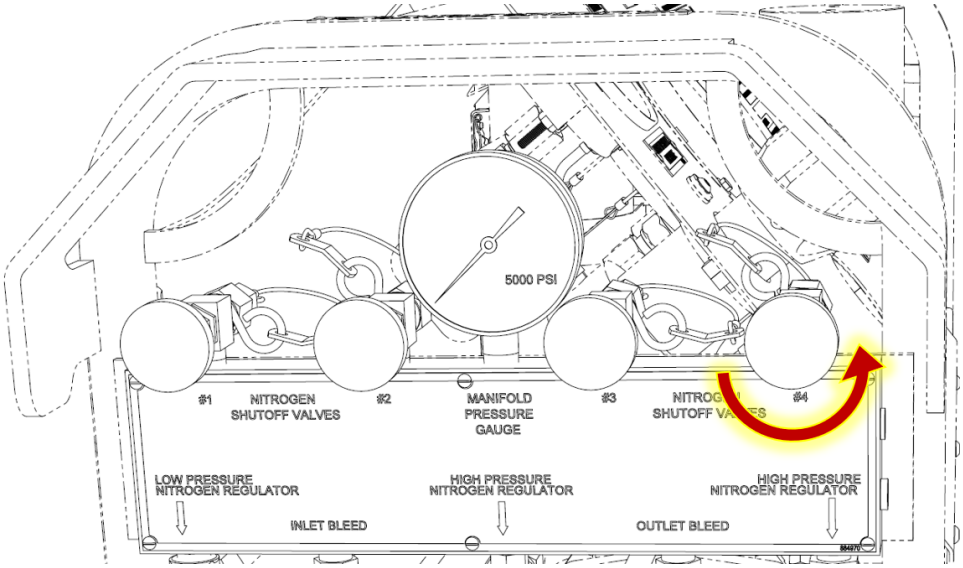
Take caution as adjacent hard line tubing may be hot.

20. Close individual valves on the Nitrogen supply bottles.
21. Slowly open bleed valves (Figure 3, Item 12). After air is exhausted, close both Bleed Valves. Check that all gauges read 0 psi.



Bleed valve (Figure 3, Item 12)

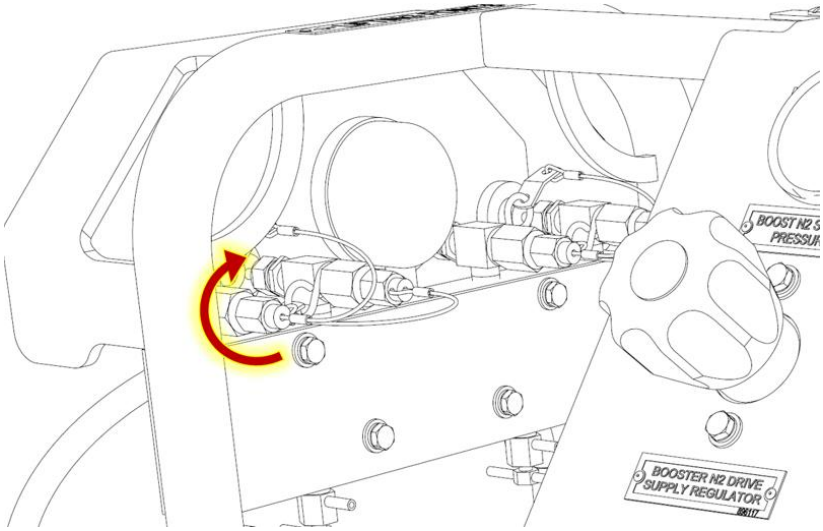
22. Close all nitrogen shutoff valve(s) in use (Figure 3, Item(s) 2).



Nitrogen shutoff valves Figure 3, (Item(s) 2)

5.3 OPERATING INSTRUCTIONS FOR NITROGEN BOTTLES AS BOOST SOURCE *(continued)*

23. Slowly loosen hose end connectors when disconnecting from the shutoff valve connectors as there may be pressurized Nitrogen trapped in the hoses. (Re-)cap all shutoff valve connectors (Figure 3, Items 13).



Shutoff valve connectors (Figure 3, Item 13)

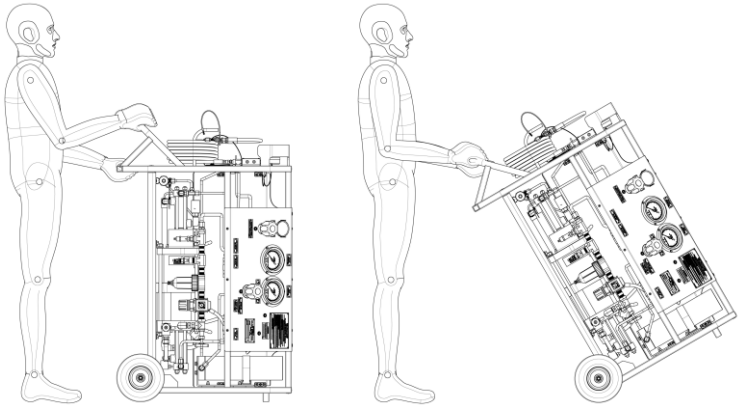
6.0 PACKAGING AND STORAGE

6.1 STORAGE REQUIREMENTS

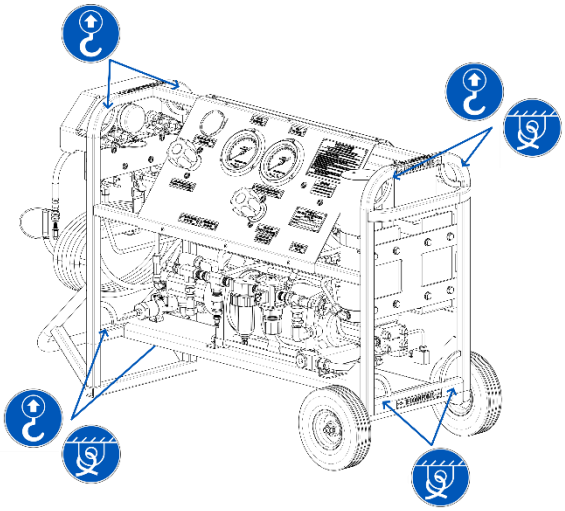
- Ensure components are dry and free of condensation. Wipe down with a clean, dry rag if required.
- Store in a clean, dry area. Cover if these conditions cannot be met.

7.0 TRANSPORTATION

- The Nitrogen Booster Pack is intended to be transported for short distances by hand in an upright orientation. See the figure below.
- Do not attempt to wheel the equipment over soft or uneven terrain.
- Take care when standing the booster up and when laying it down to prevent unnecessary jarring of the unit.



- The Nitrogen Booster Pack also contains tie down and lift locations for securing the unit if transported by means other than as mentioned above. Tie and lift locations are labeled on the unit and shown in the figure below.



- If at any time the booster has been dropped, a full inspection must take place to verify all components are working as intended and that there are no leaking components or connections.

8.0 TROUBLE SHOOTING

SYMPTOM	PROBABLE CAUSE	REMEDY
GAUGE NEEDLE NOT RETURNING TO 0	DEFECTIVE GAUGE	REPLACE
BOOSTER SYMPTOMS	SEE APPENDIX III	

9.0 MAINTENANCE

Before servicing, ensure that all pressure has been bled from the system.

- Open both purge valves (Figure 3, Item 12) located on the inlet manifold
- Open the air regulator (Figure 2C, Item 57) and verify the attached pressure gauge reads zero

ITEM	AS REQUIRED	EVERY 180 DAYS	EVERY 365 DAYS
DRAIN AIR FILTER	X		
GREASE WHEEL HUBS (NLGI 2 or equivalent)			X
CALIBRATE GAUGES			X
REPLACE PARTICLE FILTER (481-149)		X	
REPLACE MOLECULAR CARTRIDGE (481-148)		X	
REPLACE AIR DRIVE ELEMENT (PC-1217)		X	
REPLACE GAS IN/OUT ELEMENT (PC-1218)		X	
GAS BOOSTER		SEE APPENDIX III	

10.0 PROVISION OF SPARES

10.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

Malabar International
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
E-mail: sales@malabar.com
Website: www.malabar.com

For Spare Parts, Operations & Service Manuals or Service Needs:
Scan the QR code or visit Tronair.com/aftermarket

10.2 RECOMMENDED SPARE PARTS LIST

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

The following spare parts are recommended and available upon request.

Part Number	Description	Qty
837724	HOSE STRAP	1
420-004	RELIEF POP OFF	1
424-032	NEEDLE VALVE	4
473-002	HI PRESSURE REGUATOR	1
473-083	N2 DRIVE REGULATOR	1
481-148	MOLECULAR SEIVE CARTRIDGE	1
481-149	PARTICLE FILTER CARTRIDGE	1
482-025	PRESSURE GAUGE, N2 INLET	1
482-121	N2 SUPPLY PRESSURE GAUGE	1
837721-23	OUTPUT HOSE, LONG	1
837721-6	OUTPUT HOSE, SHORT	1
HC-2926	HAND VALVE	1
HC-2927	OUTLET PRESSURE GAUGE	1
HC-2928	INLET PRESSURE GAUGE	1
PC-1217	AIR DRIVE ELEMENT	1
PC-1218	GAS INLET & OUTLET ELEMENT	2
PC-1223	PARTICULATE FILTER	1
PC-1224	REGULATOR	1
PC-1225	QUICK DISCONNECT	1
PC-1232	NEEDLE VALVE, OUTLET HOSE	1
PC-1233	BLEED VALVE	2
Z-11208	SCHRADER CHUCK AND PLUG	1
Z-11221	DUST CAP LANYARD ASSEMBLY	4
U-1214	WHEEL	2

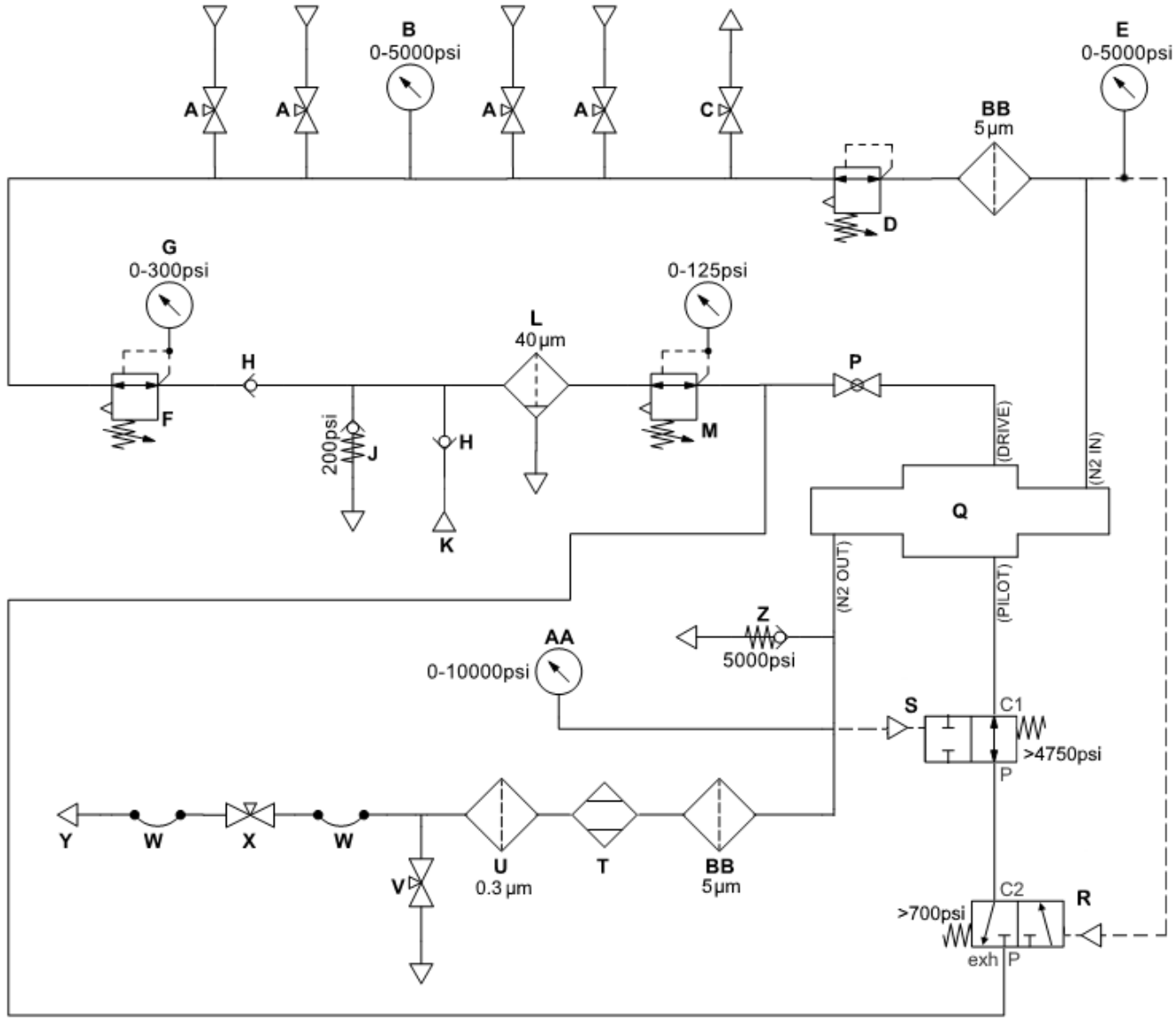
11.0 GUARANTEES/LIMITATION OF LIABILITY

I. Seller warrants each new product of its manufacture to be free from defects in material or workmanship, under proper, reasonable, and normal use and service.
II. The warranty period shall be as follows:
    A. For Malabar equipment the warranty period is one (1) year after date of shipment.
III. Where Buyer claims an alleged defect in material or workmanship and so advises Seller in writing within ten (10) days after discovery thereof, then and in such event, Buyer shall return said equipment, transportation prepaid, to the Seller, provided such return is timely and within the above-mentioned warranty period. This warranty and liability of the Seller is expressly limited solely to replacement or repair of defective parts or goods, and return at Buyer's expense to Buyer after finding by Seller the product was defective prior to original shipment or, at the option of Seller, to providing refund to Buyer of the purchase price for said product.
IV. It is further expressly understood and agreed that:
    A. THERE IS NO WARRANTY, REPRESENTATION OF CONDITION OF ANY KIND, EXPRESS OR IMPLIED, (INCLUDING NO WARRANTY OF MERCHANTABILITY OR OF FITNESS) EXCEPT THAT THE MATERIAL SHALL BE OF THE QUALITY SPECIFIED IN APPLICABLE SPECIFICATIONS, AND NONE SHALL BE IMPLIED BY LAW. Except as otherwise provided herein, quality shall be in accordance with Seller's specifications. Final determination of the material for the use contemplated by Buyer is the sole responsibility of Buyer and Seller shall have no responsibility in connection with such suitability, and
    B. Buyer's sole and exclusive remedy shall be repair or replacement of defective parts or goods by the Seller. Should the goods, in the judgment of Seller, preclude the remedying of the warranted defects by repair or replacement, the Buyer's sole and exclusive remedy shall be the refund of the purchase price, and
    C. Seller shall not be liable for prospective profits or special, indirect or consequential damages, nor shall any recovery of any kind against Seller be greater in amount than the purchase price of the specific material sold and causing the alleged loss, damage or injury. Buyer assumes all risk and liability for loss, damage or injury to persons or property of Buyer or others arising out of use or possession of any product or part sold hereunder, and
    D. Seller shall in no way be deemed or held to be obligated, liable or accountable upon or for any guarantees or warranties, express or implied, or created by statute or by operation of law or otherwise, in any manner of form beyond its express agreement above set forth, and
    E. No warranty herein shall apply to any product which shall have been repaired or altered, unless such alteration or repair has been made by Seller or if, after return to and inspection by Seller, the product is found by Seller to have been subject to misuse, negligence or accident, and
    F. No warranty of any nature is made by Seller as to any component forming a part of the product sold and Buyer shall receive only such warranties offered by such other manufacturer of such component, and
    G. Seller does not assume nor does Seller authorize any other person to assume for it any other liability or make any warranty in connection with the sale of its products.

12.0 APPENDICIES

APPENDIX I Calculated Time-To-Fill Aircraft Reservoir Based On Aircraft System Specifications – Shop Air Drive
APPENDIX II Calculated Time-To-Fill Aircraft Reservoir Based On Aircraft System Specifications – N2 Drive
APPENDIX III Haskel Air Driven Gas Booster

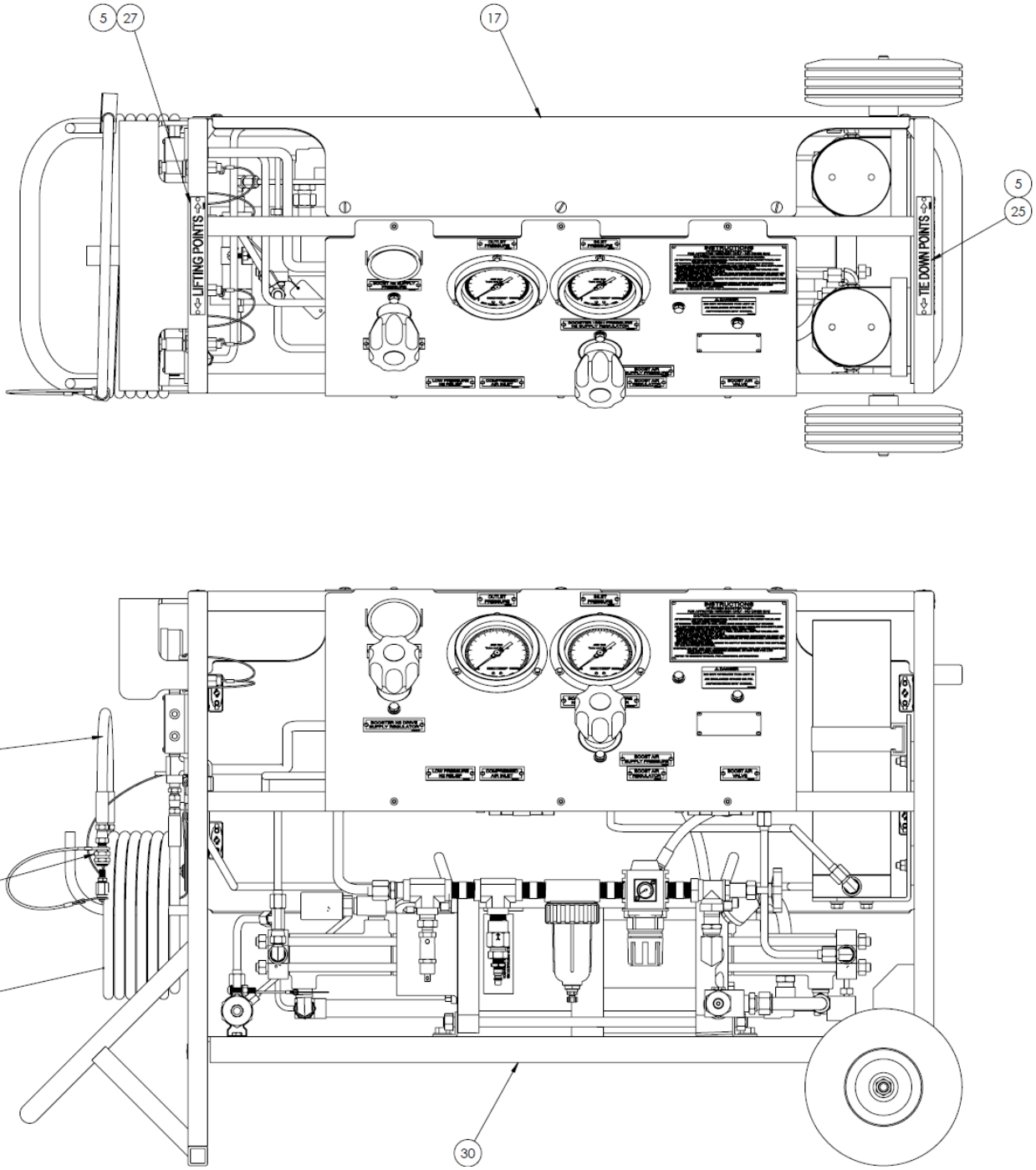
Pneumatic Diagram



A	INLET VALVE
B	INLET PRESSURE GAUGE
C	INLET PURGE VALVE
D	SUPPLY PRESSURE REGULATOR
E	SUPPLY PRESSURE GAUGE
F	LOW PRESSURE REGULATOR
G	LOW PRESSURE GAUGE
H	CHECK VALVE
J	LOW PRESSURE RELIEF
K	COMPRESSED AIR INLET
L	COALESCING FILTER
M	DRIVE AIR REGULATOR
N	DRIVE AIR GAUGE
P	DRIVE AIR VALVE
Q	NITROGEN BOOST PUMP
R	INLET PRESSURE PILOT
S	OUTLET PRESSURE PILOT
T	DRYER/HYDROCARBON FILTER
U	PARTICLE FILTER
V	OUTLET PURGE VALVE
W	FLEXIBLE HOSE
X	OUTLET PRESSURE RELIEF VALVE
Y	AIR CHUCK TO AIRCRAFT
Z	OUTLET PRESSURE RELIEF
AA	OUTLET PRESSURE GAUGE
BB	PARTICLE FILTER

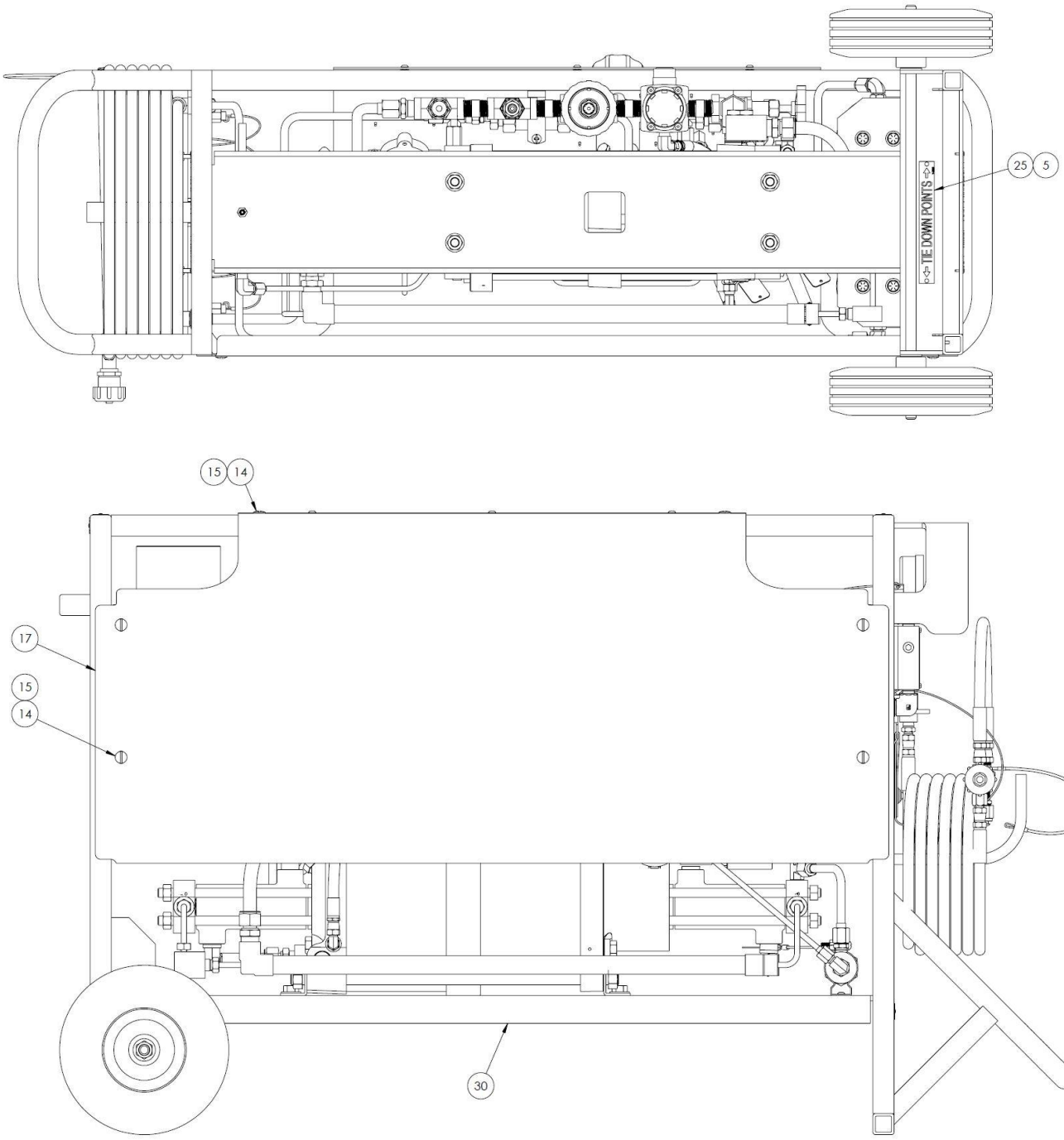
Parts List – Figure 1A

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



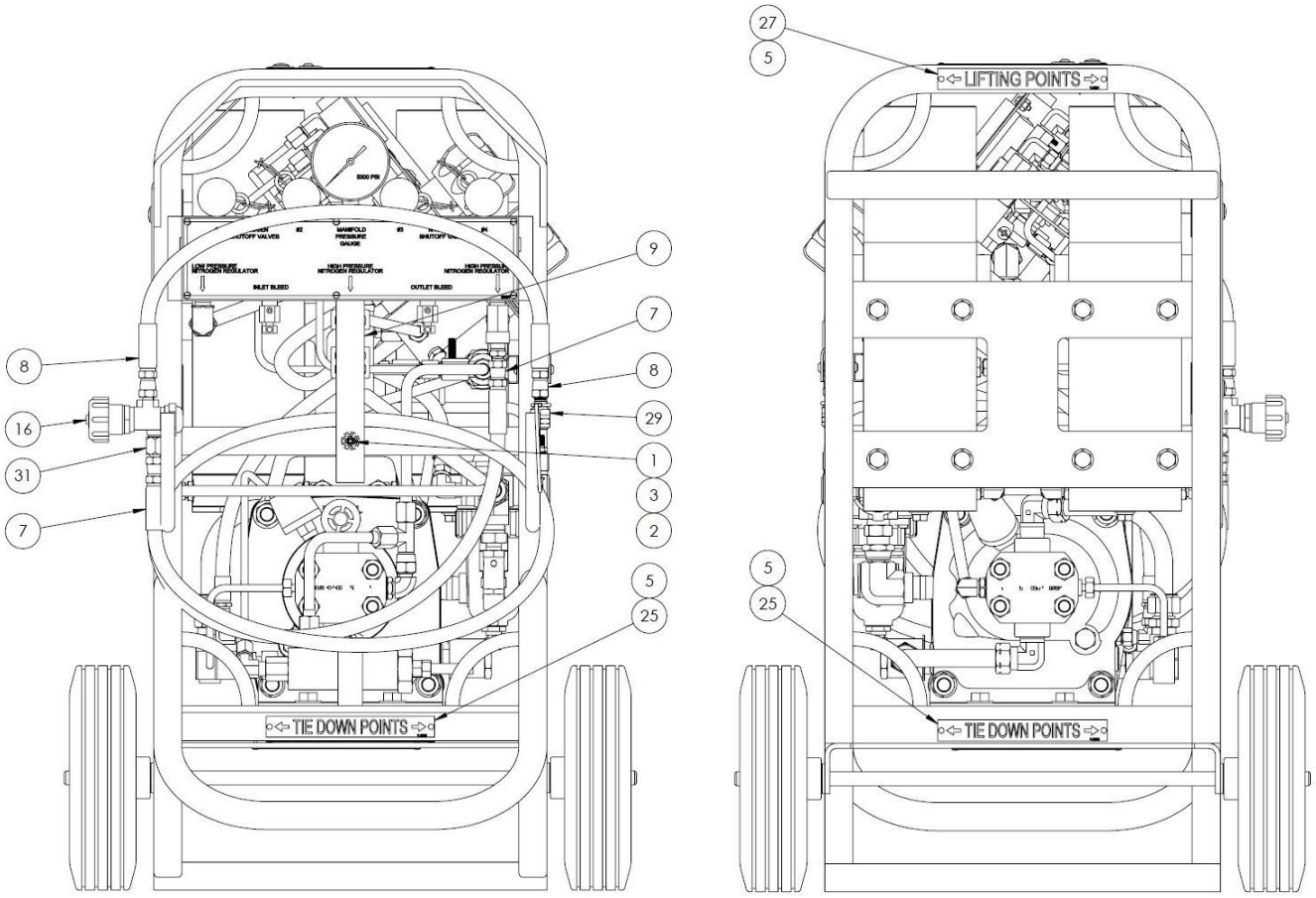
Parts List – Figure 1B

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



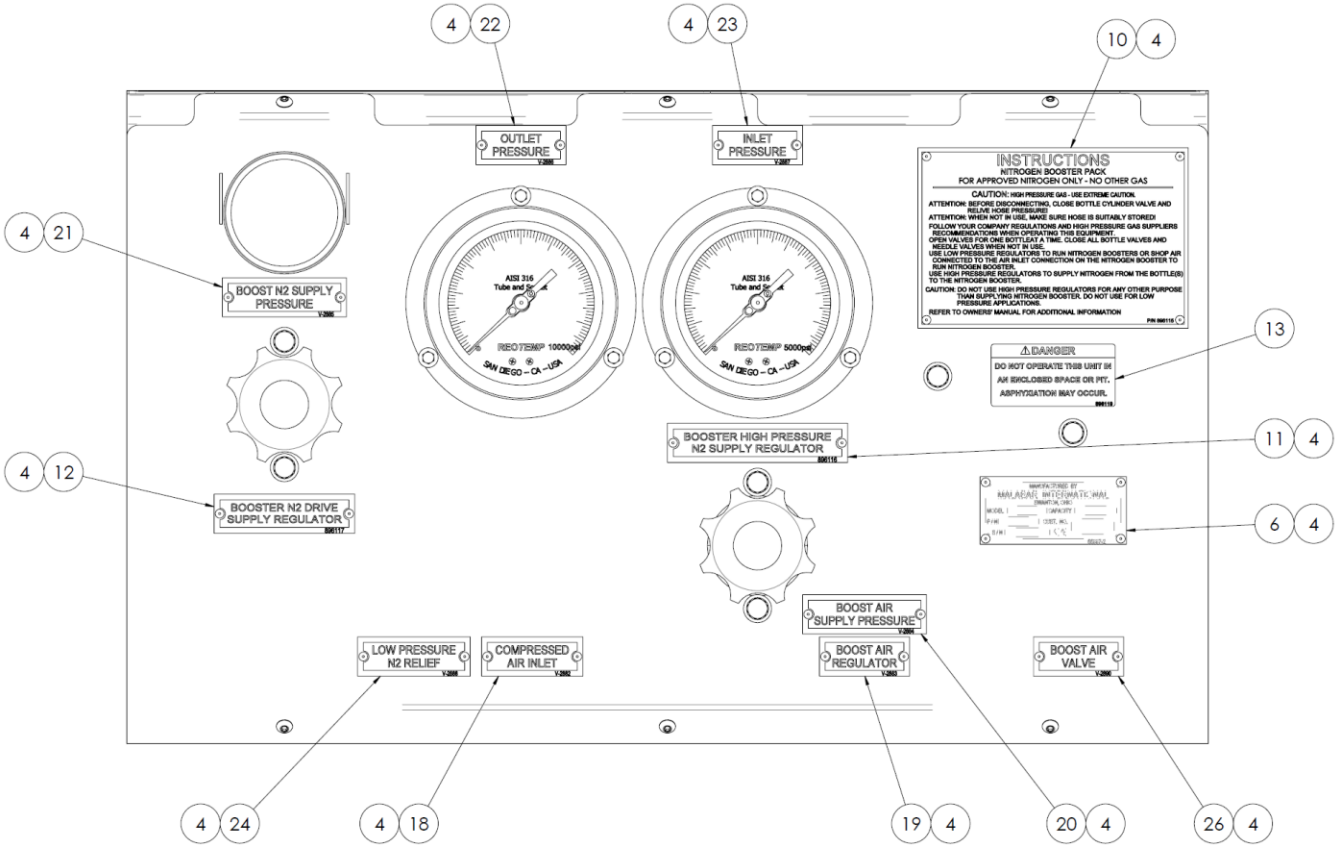
Parts List – Figure 1C

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



Parts List – Figure 1D

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



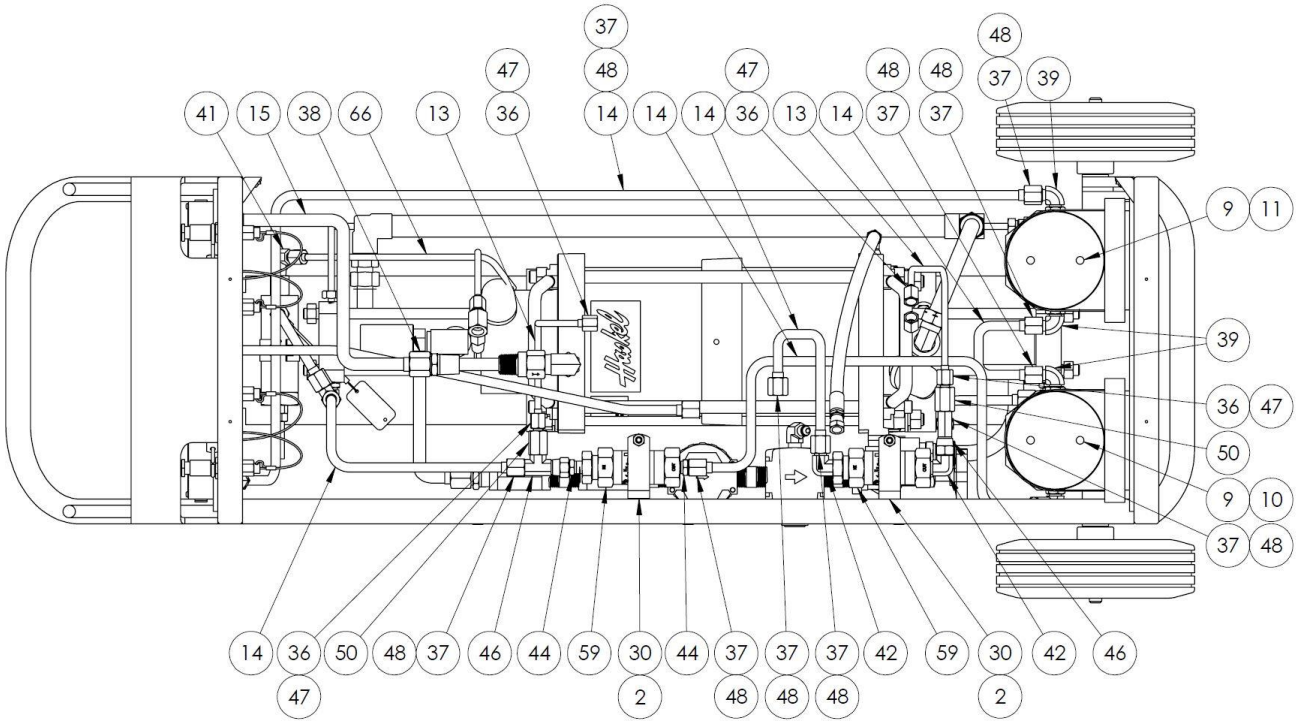
Parts List – Figure 1A, 1B, 1C, 1D

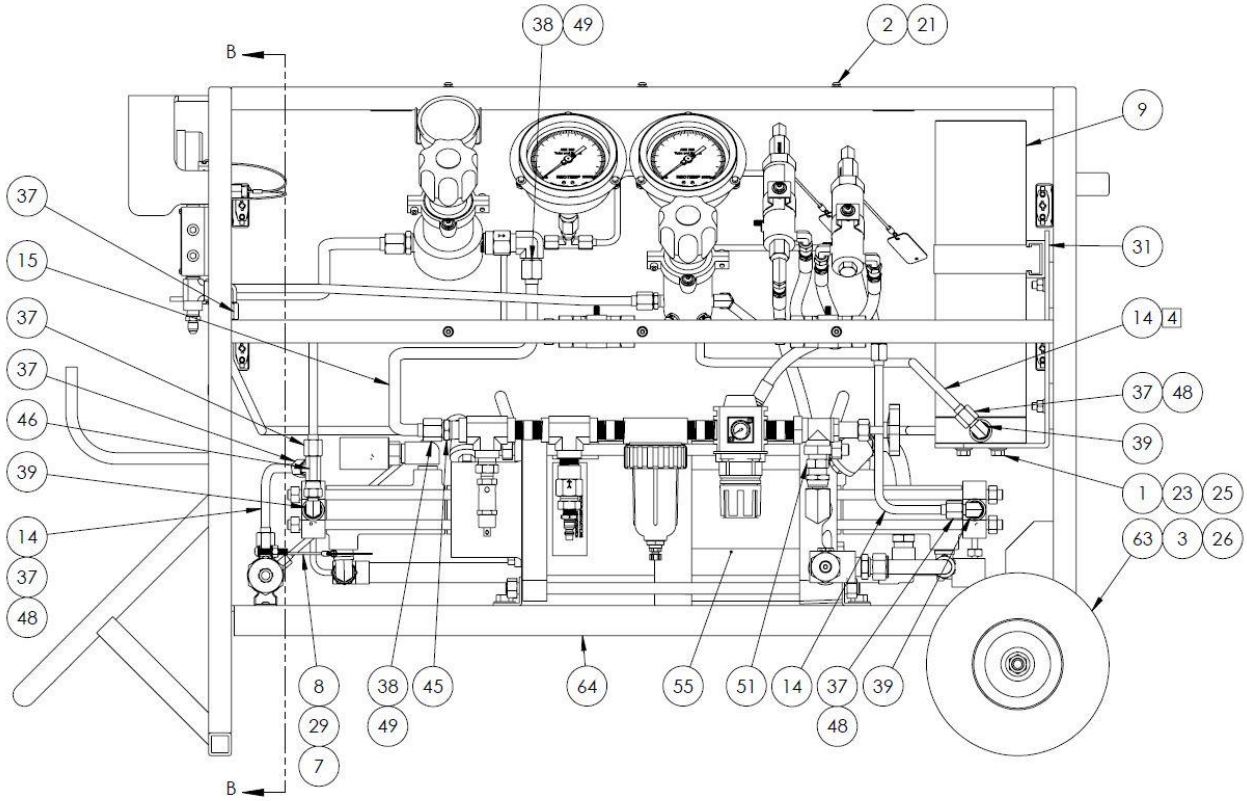
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
	896100	**BOOSTER ASSEMBLY;** *consist of:*	
1	324-020	SBHCS, SS, 1/4-20 x 3/4 LG	1
2	G-1503-1050N	FLAT WASHER, 1/4, SS	1
3	G-1502-1050R	SPLIT LOCKWASHER, 1/4, SS	1
4	390-062	RIVET, 3/32 DIA X 1/8 GRIP	28
5	390-088	RIVET, 3/32 DIA x 1/4 GRIP	14
6	55997-6	NAME PLATE	1
7	837721-23	OUTPUT HOSE	1
8	837721-6	OUTPUT HOSE	1
9	837724	HOSE STRAP	1
10	896115	INSTRUCTION PLACARD	1
11	896116	BOOSTER SUPPLY PLACARD	1
12	896117	BOOSTER N2 DRIVE PLACARD	1
13	896119	DANGER ASPHYXIATION STICKER	1
14	G-1410-03	FASTENER, 1/4 TURN	7
15	G-1578	PUSH ON RETAINER	7
16	PC-1232	NEEDLE VALVE	1
17	S-4030-00	PANEL, REAR	1
18	V-2882	PLACARD, COMPRESSED AIR INLET	1
19	V-2883	PLACARD, BOOST AIR REGULATOR	1
20	V-2884	PLACARD, BOOST AIR SUPPLY PRES	1
21	V-2885	PLACARD, BOOST N2 SUPPLY PRES	1
22	V-2886	PLACARD, OUTLET PRESSURE	1
23	V-2887	PLACARD, INLET PRESSURE	1
24	V-2888	PLACARD, LOW PRES N2 RELIEF	1
25	V-2889	PLACARD, TIE DOWN POINTS	4
26	V-2890	PLACARD, BOOST AIR VALVE	1
27	V-2891	PLACARD, LIFTING POINT	3
28	W-1097	CRATE, 896100	1
29	Z-11208	SCHRADER CHUCK & PLUG	1
30	Z-11214	ASSEMBLY, PNUEMATIC	1
31	N-2055-29-SS	REDUCER TUBE	1

Parts List – Figure 2A

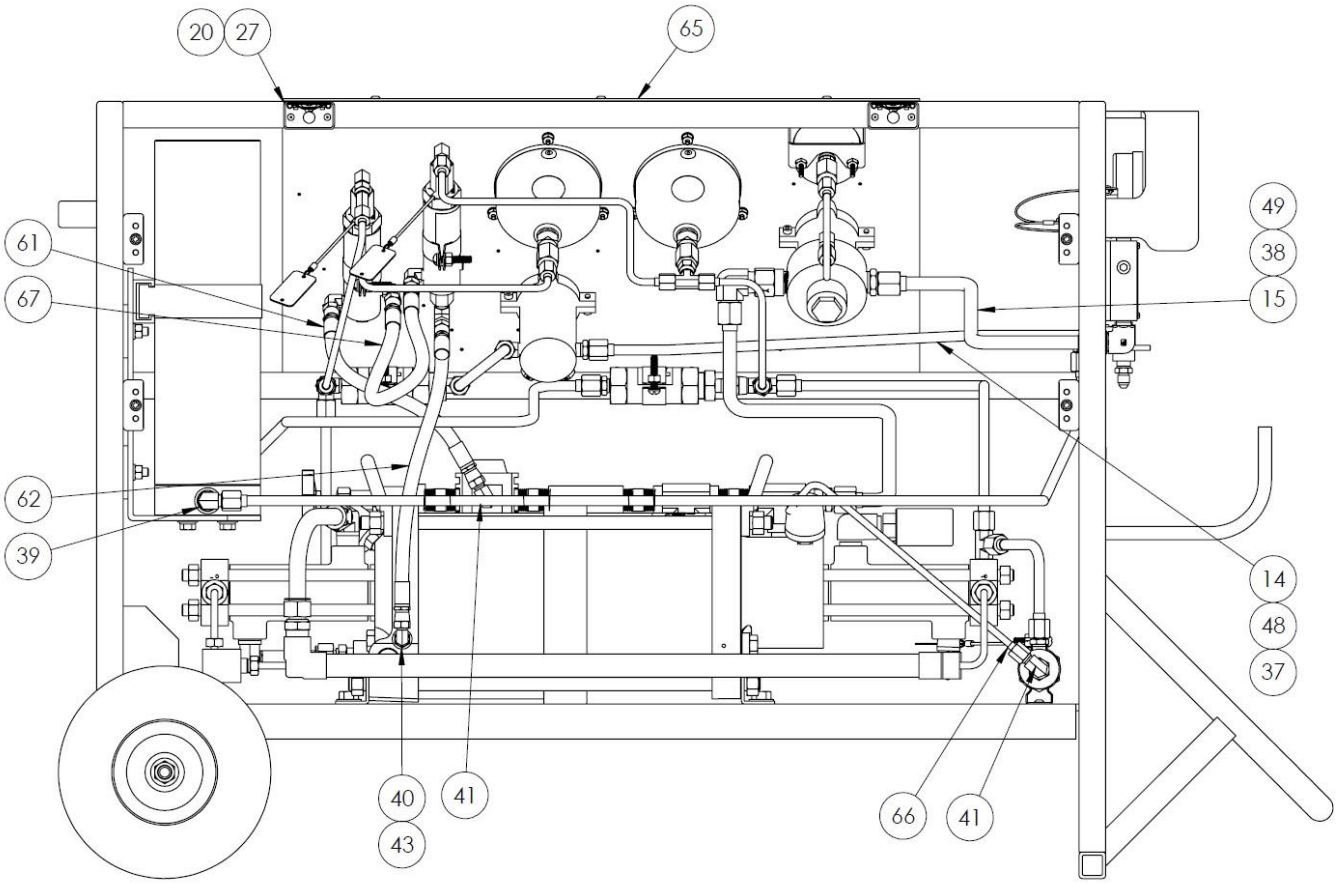
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

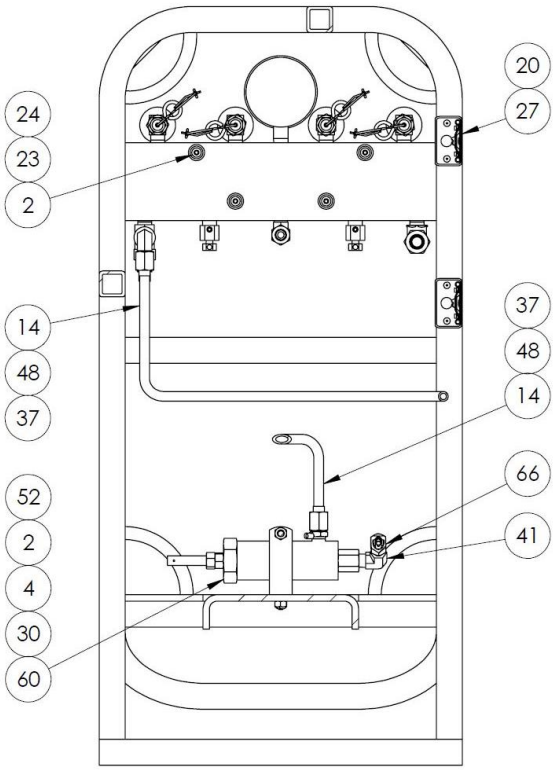




Parts List – Figure 2B

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

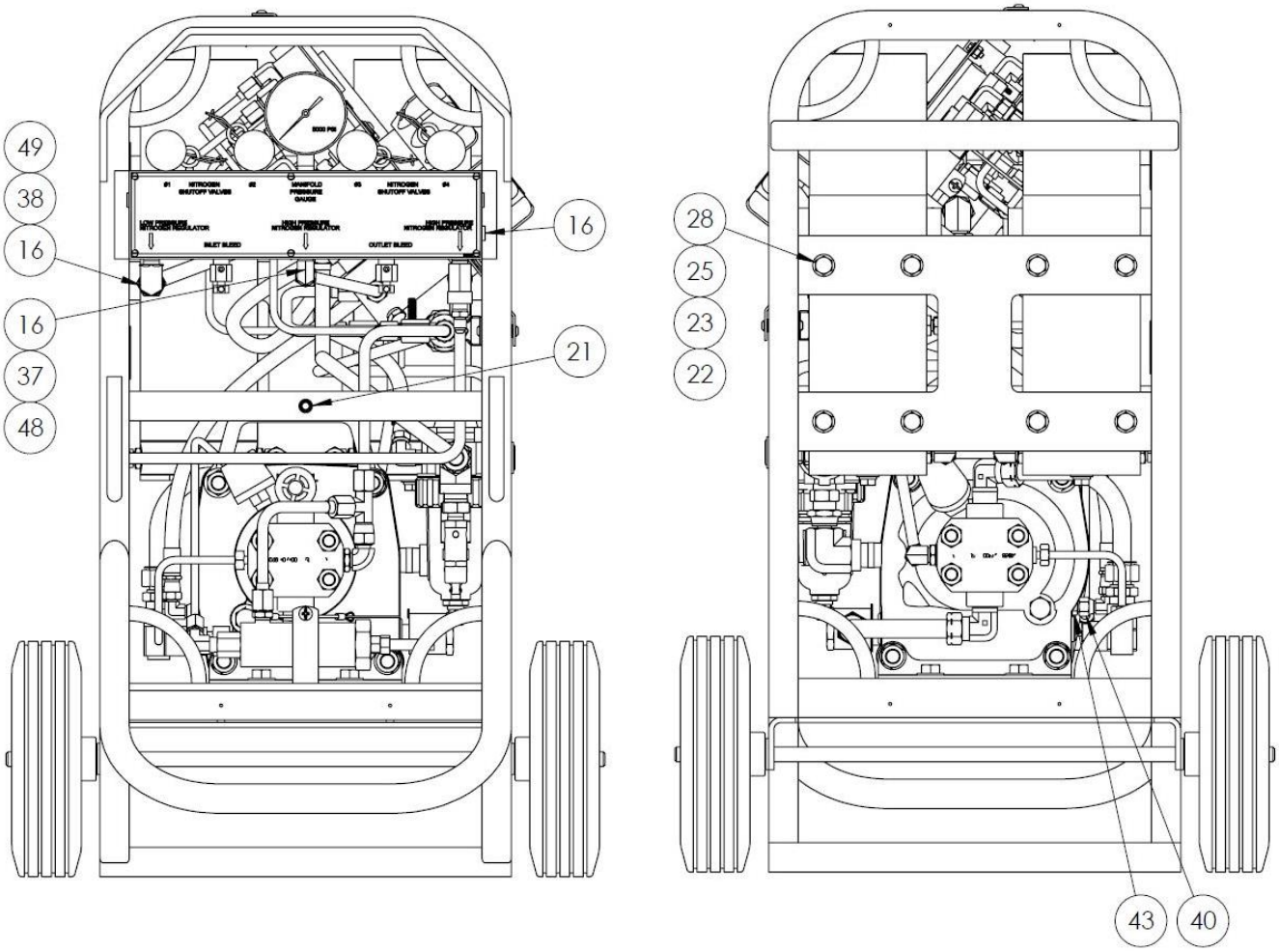


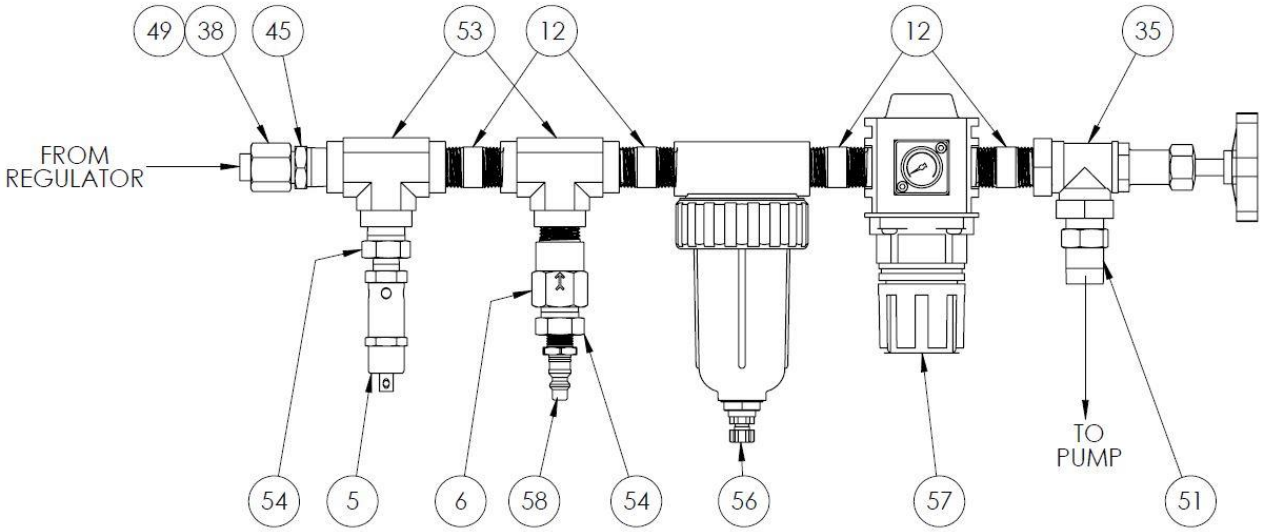


SECTION B-B

Parts List – Figure 2C

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





Parts List – Figure 2A, 2B, 2C

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

Item	Part Number	Description	Qty
	Z-11214	**PNEUMATIC ASSEMBLY;** *consist of:*	
1	N/A	HHCS, 5/16-24 X 3/4 LG SS (PART OF FILTER)	4
2	324-020	SBHCS, SS, 1/4-20 x 3/4 LG	13
3	353-051	LOCKNUT, 1/2 - 20, SS	2
4	355-030	LOCKNUT, STD, 1/4-20 SS	1
5	420-004	AIR RELIEF VALVE	1
6	422-113	CHECK VALVE, 1/2 MPT OUT X 1/2 FPT IN	1
7	450A5888	FERRULE	2
8	450A6211	CABLE, NYLON COATED	1
9	481-147	PURIFIER CHAMBER	2
10	481-148	MOLECULAR SIEVE CARTRIDGE	1
11	481-149	PARTICLE FILTER CARTRIDGE	1
12	711-046	NIPPLE, SS, 1/2 MPT X 2" LG	4
13	732-003	TUBING, S.S., 1/4 O.D. X .035 WALL	A/R
14	732-010	TUBE SS, 3/8" OD X .065" WALL	A/R
15	732-001	TUBE SS, 1/2" OD X .049 WALL	A/R
16	896105	MANIFOLD ASSEMBLY	1
17	G-1112-108112	BOLT, 7/16-20 X 1-1/4" HEX HD SS	4
18	G-1501-1085	STOPNUT, 7/16-20 ELASTIC SS	4
19	G-1503-1080N	FLATWASHER, 7/16 NARROW SS	4
20	G-1351-02-SS	RIVET, 1/8 OPEN-END STL	12
21	G-1439-1050-SS	NUTSERT, THIN WALL 1/4-20	9
22	G-1500-1060	HEX NUT, 5/16-18 UNC-2B	8
23	G-1502-1060R	LOCKWASHER, 5/16 SST REGULAR	16
24	G-1503-1050N	FLATWASHER. 1/4 SST NARROW	4
25	G-1503-1060N	FLATWAHER, 5/16 NARROW S.S.	12
26	G-1503-1090N	FLATWASHER, 1/2 NARROW S.S.	4
27	G-1580	RECEPTACLE, SIDE MOUNT	6
28	G-1706-106010	BOLT, 5/16-18 X 1.0" LG. SST HEX HD	8
29	H-1497	PLATE, BLANK	1
30	H-4827	BRACKET, FILTER	3
31	H-4865	WALL MOUNT BRACKET	2
32	HC-1951-04	SEAL, CONICAL (-04)	11
33	HC-1951-06	SEAL, CONICAL (-06)	18
34	HC-1951-08	SEAL, CONICAL (-04)	4
35	HC-2926	VALVE, NEEDLE	1
36	N-2000-03-SS	NUT, #4 JIC X 37 DEG	4
37	N-2000-05-SS	NUT, 37 DEG FLARE	16
38	N-2000-06-SS	NUT, #8 JIC X 37 DEG	4
39	N-2001-08-SS-B	ELBOW, STRAIGHT THREAD	6
40	N-2002-03-SS	ELBOW, SWIVEL NUT	1
41	N-2005-04-SS	ELBOW, MALE	2

Parts List – Figure 2A, 2B, 2C

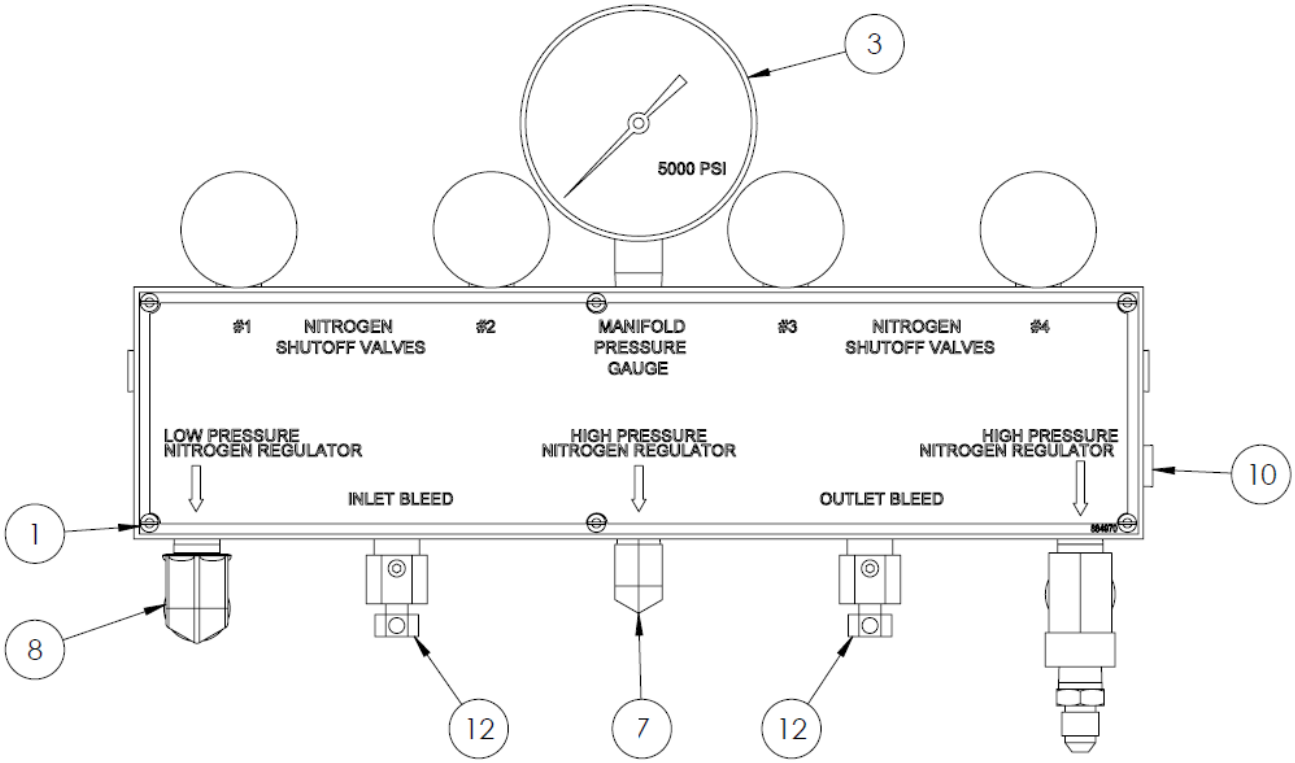
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

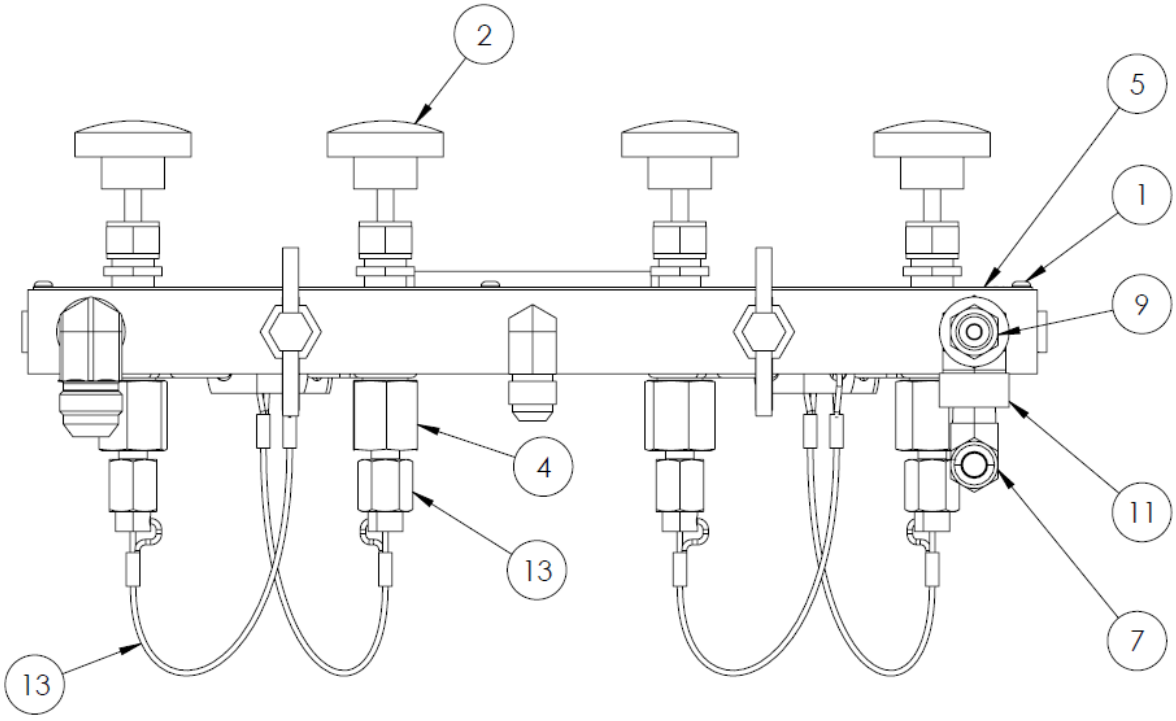
Item	Part Number	Description	Qty
42	N-2005-08-SS	ELBOW, MALE 3/8T X 1/4P	2
43	N-2009-03-SS	CONNECTOR, MALE	1
44	N-2009-08-SS	CONNECTOR, MALE	3
45	N-2009-14-SS	CONNECTOR, MALE	1
46	N-2016-05-SS	TEE, RUN SWIVEL NUT	3
47	N-2019-03-SS	SLEEVE, 1/4 TUBE (#4) SS	4
48	N-2019-05-SS	SLEEVE, 3/8 TUBE (#6)	16
49	N-2019-06-SS	SLEEVE, 1/2 TUBE (#8)	4
50	N-2055-01-SS	REDUCER, TUBE	2
51	N-2203-09-SS	NIPPLE, PIPE	1
52	N-2205-03-SS	HOLLOW HEX PLUG 1/4 MPT	1
53	N-2207-10-SS	TEE, FEMALE PIPE SS	2
54	N-2210-08-SS	REDUCER, 1/2 MPT x 1/4 FPT	2
55	PC-1222	PUMP, NITROGEN	1
56	PC-1223	FILTER, PARTICULATE	1
57	PC-1224	REGULATOR/FILTER	1
58	PC-1225	QUICK DISCONNECT	1
59	PC-1226	FILTER, NITROGEN	2
60	PC-1227	VALVE, RELIEF	1
61	TF-1043-24-12.0	HOSE ASSEMBLY	1
62	TF-1043-24-18.0	HOSE ASSEMBLY	1
63	U-1214	WHEEL, 8" FLAT FREE	2
64	Z-11212-00	BOOSTER FRAME (WLD) (P)	1
65	Z-11213	ASSEMBLY, CONTROL PANEL	1
66	Z-11298	RELIEF TUBE ASSEMBLY	1
67	TF-1043-24-12.0	HOSE ASSEMBLY	1

This page left blank intentionally

Parts List – Figure 3

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





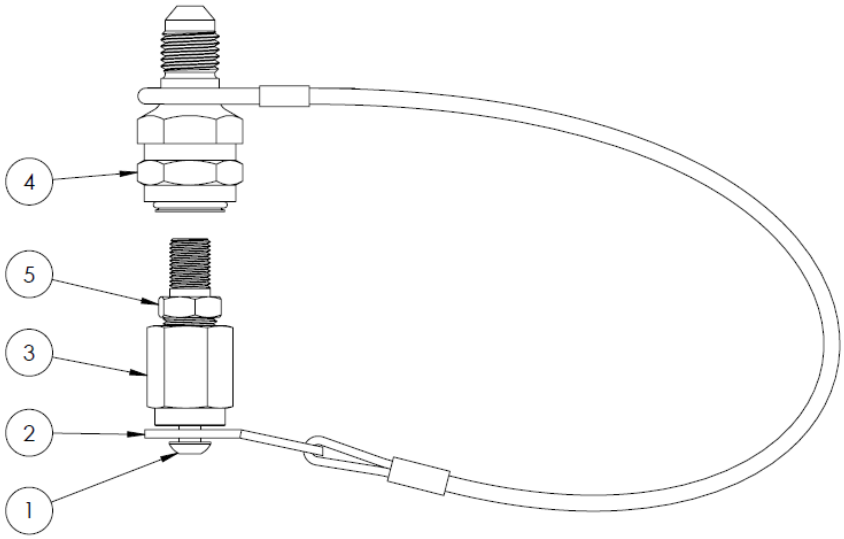
Parts List – Figure 3

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

Item	Part Number	Description	Qty
	896105	**Manifold Assembly;** *consist of:*	
1	397-016	SELF TAPPING SCREW, #4 x 3/16 LG, SS	6
2	424-032	NEEDLE VALVE, 90°, 1/4 MPT	4
3	482-025	PRESSURE GAUGE, 5000 PSI	1
4	721-047	CONNECTOR, 1/4 M 37° x 1/4 FPT	4
5	884970	CONTROL PLACARD	1
6	J-7788	MANIFOLD BLOCK	1
7	N-2005-08-SS	ELBOW, MALE 3/8T X 1/4P	2
8	N-2005-13-SS	ELBOW, MALE	1
9	N-2009-04-SS	CONNECTOR, MALE, #4 (SS)	1
10	N-2205-03-SS	HOLLOW HEX PLUG 1/4 MPT	2
11	N-2209-03-SS	TEE, STREET	1
12	PC-1233	VALVE, BLEED	2
13	Z-11221	DUST CAP LANYARD ASSEMBLY	4

Parts List – Figure 4

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

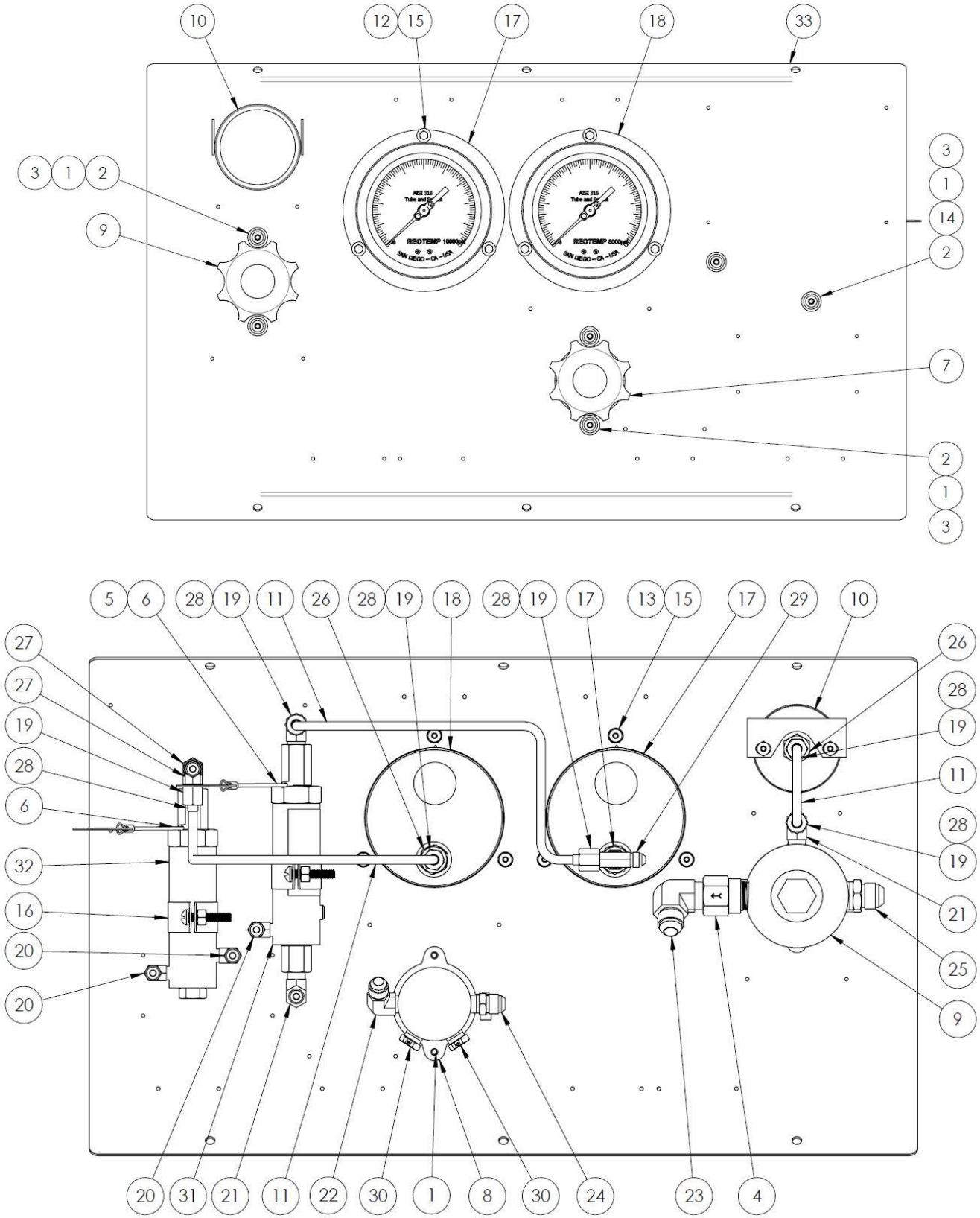


Item	Part Number	Description	Qty
	Z-11208	**Air Chuck Assembly;** *consist of:*	
1	G-1476-102003	SCREW, #8-32 X .38" LG. SST SOC BUTT. HD CAP	1
2	H-1424-12.0	ASSEMBLY, LANYARD	1
3	N-3171-02-SS	CAP, WITH TAPPED HOLE	1
4	PC-1230	SCHRADER CHUCK	1
5	PC-1231	SCHRADER VALVE	1

This page is left blank intentionally

Parts List – Figure 5

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



Parts List – Figure 5

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

Item	Part Number	Description	Qty
	Z-11213	**Control Panel Assembly;** *consist of:*	
1	324-020	SBHCS, SS, 1/4-20 x 3/4 LG	6
2	G-1503-1050N	FLATWASHER. 1/4 SST NARROW	8
3	G-1502-1050R	LOCKWASHER, 1/4 SST REGULAR	6
4	422-107	CHECK VALVE, 1/2 MPT IN X 1/2 FPT OUT	1
5	450A5888	FERRULE	4
6	450A6211	CABLE, NYLON COATED	12
7	473-002	REGULATOR, 0-4000 PSIG	1
8	473-082	PANEL MOUNTING BRACKET	2
9	473-083	REGULATOR, 0-300 PSIG	1
10	482-121	PRESSURE GAUGE	1
11	732-003	TUBING, S.S., 1/4 O.D. X .035 WALL	A/R
12	G-1476-102006	SCREW, #8-32 X 1/2" LG HEX HD MACHINE, SS	6
13	G-1501-1020	STOPNUT, #8-32 ELASTIC, SS	6
14	G-1501-1050	STOPNUT, 1/4-20 ELASTIC, SS	2
15	G-1503-1020N	FLATWASHER, #8 NARROW, SS	12
16	H-4827	BRACKET, FILTER	2
17	HC-2927	GAUGE, HIGH PRESSURE	1
18	HC-2928	GAUGE, LOW PRESSURE	1
19	N-2000-03-SS	NUT, #4 JIC X 37 DEG	6
20	N-2005-03-SS	ELBOW, MALE	3
21	N-2005-04-SS	ELBOW, MALE	4
22	N-2005-08-SS	ELBOW, MALE 3/8T X 1/4P	1
23	N-2005-14-SS	ELBOW, MALE	1
24	N-2009-08-SS	CONNECTOR, MALE	1
25	N-2009-14-SS	CONNECTOR, MALE	1
26	N-2010-04-SS	CONNECTOR, FEMALE	3
27	N-2016-03-SS	TEE, RUN SWIVEL NUT	1
28	N-2019-03-SS	SLEEVE, 1/4 TUBE (#4) SS	6
29	N-2091-01-SS	SWIVEL, BRANCH TEE (-4)	1
30	N-2206-03-SS	PLUG, HEX HEAD	2
31	PC-1228	SWTICH, AIR PILOT	1
32	PC-1229	SWITCH, PRESSURE	1
33	S-4028-00	CONTROL PANEL (P)	1

MALABAR™
INTERNATIONAL
A TRONAIR COMPANY

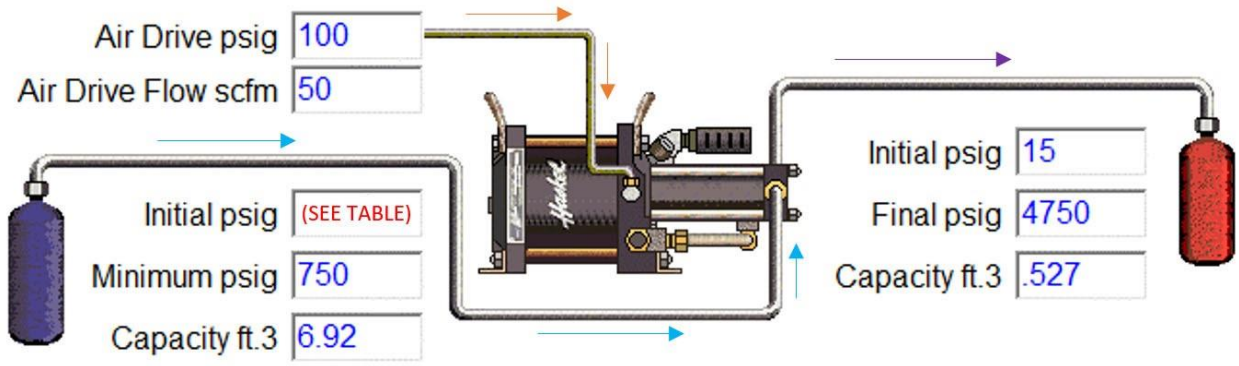
APPENDIX I

Calculated Time-To-Fill Aircraft Reservoir Based On Aircraft System Specifications – Shop Air Drive

Calculated Time-To-Fill Based On Aircraft System Specifications – Shop Air Drive

Time to fill is dependent on multiple system factors and may vary based on actual conditions. Below are estimated fill times given the following conditions:

SUPPLY BOTTLE SIZE .....4 BOTTLES x 2980 CU IN EACH; 6.92 CUBIC FEET TOTAL
AIRCRAFT SYSTEM SIZE.....910 CUBIC INCHES; 0.527 CUBIC FEET
INITIAL AIRCRAFT SYSTEM PRESSURE.....15 PSIG
FINAL AIRCRAFT SYSTEM PRESSURE.....4750±50 PSIG
COMPRESSED AIR DRIVE (OIL FREE) .....100 PSIG x 50 SCFM



SELECTED TIME-TO-FILL CALCULATIONS BASED ON STARTING SUPPLY PRESSURE

STARTING SUPPLY PRESSURE [1]	**2450 PSIG**	**1800 PSIG**	**1500 PSIG**					
EQUALIZATION PRESSURE [2]	2260 PSIG	1660 PSIG	1390 PSIG					
TIME TO EQUALIZE PRESSURES [3]	3 MIN	3 MIN	3 MIN					
TIME TO FILL AFTER EQUALIZATION [4]	6 MIN	8 MIN	12 MIN					
TOTAL TIME TO FILL [5]	9 MIN	11 MIN	15 MIN					
ENDING SUPPLY PRESSURE [6]	1800 PSIG	1500 PSIG	1100 PSIG					

[1] Pressure of the 4 supply bottles at the start of the fill. Aircraft system at the start of the fill is assumed at 15 psig.
[2] Pressure at which the supply and the aircraft system will equalize, approximate.
[3] Time for the supply bottles and the aircraft system to equalize pressures is determined by hose/tube size/length, orifice size, regulator capacity, and valve position.
[4] Time required to boost the final aircraft system pressure after the supply and aircraft system have equalized.
[5] Total time to fill = time to equalize + time to fill.
[6] Remaining pressure in the supply bottles after the fill cycle is complete.

Time to fill calculations do not account for:
- Leaks and system losses.
- Variations in air drive pressure and flow rate
- Use of Nitrogen supply to power the air drive. See appendix B for calculations.
- Aircraft system pressure is above 15 psig before start of fill cycle.
- Less than the volume of supply as stated, above.

MALABAR™
INTERNATIONAL
A TRONAIR COMPANY

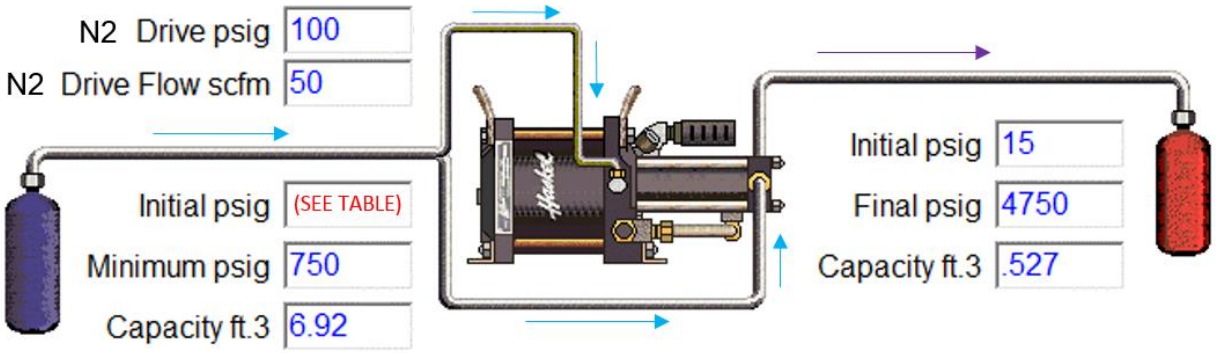
APPENDIX II

Calculated Time-To-Fill Aircraft Reservoir Based On Aircraft System Specifications – N2 Drive

Calculated Time-To-Fill Based On Aircraft System Specifications – N2 Drive

Time to fill is dependent on multiple system factors and may vary based on actual conditions. Below are estimated fill times given the following conditions:

SUPPLY BOTTLE SIZE .....4 BOTTLES x 2980 CU IN EACH; 6.92 CUBIC FEET TOTAL
AIRCRAFT SYSTEM SIZE.....10 CUBIC INCHES; 0.527 CUBIC FEET
INITIAL AIRCRAFT SYSTEM PRESSURE.....15 PSIG
FINAL AIRCRAFT SYSTEM PRESSURE.....4750±50 PSIG
NITROGEN SUPPLY DRIVE .....100 PSIG x 50 SCFM



SELECTED TIME-TO-FILL CALCULATIONS BASED ON STARTING SUPPLY PRESSURE

STARTING SUPPLY PRESSURE [1]	**2550 PSIG**							
EQUALIZATION PRESSURE [2]	2300 PSIG							
TIME TO EQUALIZE PRESSURES [3]	3 MIN							
TIME TO FILL AFTER EQUALIZATION [4]	8 MIN							
TOTAL TIME TO FILL [5]	11 MIN							
ENDING SUPPLY PRESSURE [6]	950 PSIG							

[1] Pressure of the 4 supply bottles at the start of the fill. Aircraft system at the start of the fill is assumed at 15 psig.
[2] Pressure at which the supply and the aircraft system will equalize.
[3] Time for the supply bottles and the aircraft system to equalize pressures is determined by hose/tube size/length, orifice size, regulator capacity, and valve position.
[4] Time required to boost the final aircraft system pressure after the supply and aircraft system have equalized.
[5] Total time to fill = time to equalize + time to fill.
[6] Remaining pressure in the supply bottles after the fill cycle is complete.

Time to fill calculations do not account for:
- Leaks and system losses.
- Variations in N2 drive pressure and flow rate
- Use of shop air supply to power the air drive. See appendix A for calculations.
- Aircraft system pressure is above 15 psig before start of fill cycle.
- Less than the volume of supply as stated, above.

MALABAR™
INTERNATIONAL
A TRONAIR COMPANY

APPENDIX III

Haskel Air Driven Gas Booster
Operating and Maintenance Instructions