MPS MIDWEST PRESSURE SYSTEMS

Technical Manual

Model S42N5D

Dual Gas Pressure Booster System

Manufacturer - Midwest Pressure System, Inc.
Model S42N5D
Gas Pressure Booster

Customer -
Order Number -
Customer Purchase Order -
Serial Numbers -

Prepared November 14th, 2014 Revision 0

Table of Contents

1. Design Specifications

Midwest Pressure Systems, Inc. (MPS) gas pressure boosters are designed for ease of operation and maintenance. Experience has shown that an MPS booster will normally provide years of satisfactory performance with minimal maintenance. Carefully review this manual which is designed to provide information on installation, start up, operation and maintenance. If you have questions, please contact Midwest Pressure Systems, Inc.

Model S42N5D Engineering Specifications	
Maximum operating discharge pressure - psi (bar)	610 (42)
Gas temperature range - ˚F (˚C)	-15 to 300 (-26 to 149)
Maximum cycle rate - cycles per minute (Note 1)	100
Gas displacement per cycle - cf (liters)	.076 (2.152)
Maximum gas displacement - cfm (liters per minute)	7.6 (215.2)
Pressure boost (multiple of drive air pressure) (Note 2)	4
Gas inlet connection FNPT	3/8
Gas outlet connection FNPT (located on the receiver tank)	1/2
Maximum drive air pressure - psi (bar) (Note 3)	125 (8.6)
Air temperature range - ˚F (˚C)	32 to 167 (0 to 75)
Air displacement per cycle - cf (liters)	.138 (3.9)
Maximum air displacement - cfm (liters per minute)	13.8 (390)
Drive air inlet connection FNPT	3/4
Drive air exhaust connection FNPT	1/2
ASME receiver tank capacity - gallons (liters)	5.5 (20.8)
Safety relief valve (located on receiver tank) set point - psi (bar)	625 (43.1)
Overall dimensions (LxWxH) - inches (cm)	29.3x21.3x26.7 (74.4x54.1x67.8)
Weight - pounds (kilograms)	120 (54.4)
Ambient Temperature - ˚F (˚C) (Note 4)	5 to 140 (-15 to 60)

Note 1: A cycle consists of a forward and reverse stroke.
Note 2: This is a nominal operating pressure boost ratio, not the maximum pressure boost ratio.
Note 3: Nitrogen may also be used for the drive gas.
Note 4: Where ambient temperatures fall below 0˚C (32˚F) a heater is required for the drive air.

2. Materials of Construction and Torque Specifications

Process gas wetted materials
Anodized Aluminum

Pneumatic drive materials exposed to the environment
Anodized aluminum for excellent general environmental corrosion resistance

External bolts, nuts, and washers
18-8 SS for excellent marine and general environmental corrosion resistance

Dynamic seal material
Carbon-fiber-filled Teflon piston rings and rod seals

Gas wetted static seals
Viton

Air drive seals
Buna-N

5.5 gallon ASME receiver tank, 625 psi max
Steel, exterior powder-coated

Pipe fittings and components
Brass and aluminum (air filter and regulator)

Tubing
Copper (3/8” OD by 0.049” wall and 5/8” OD by 0.035“ wall)

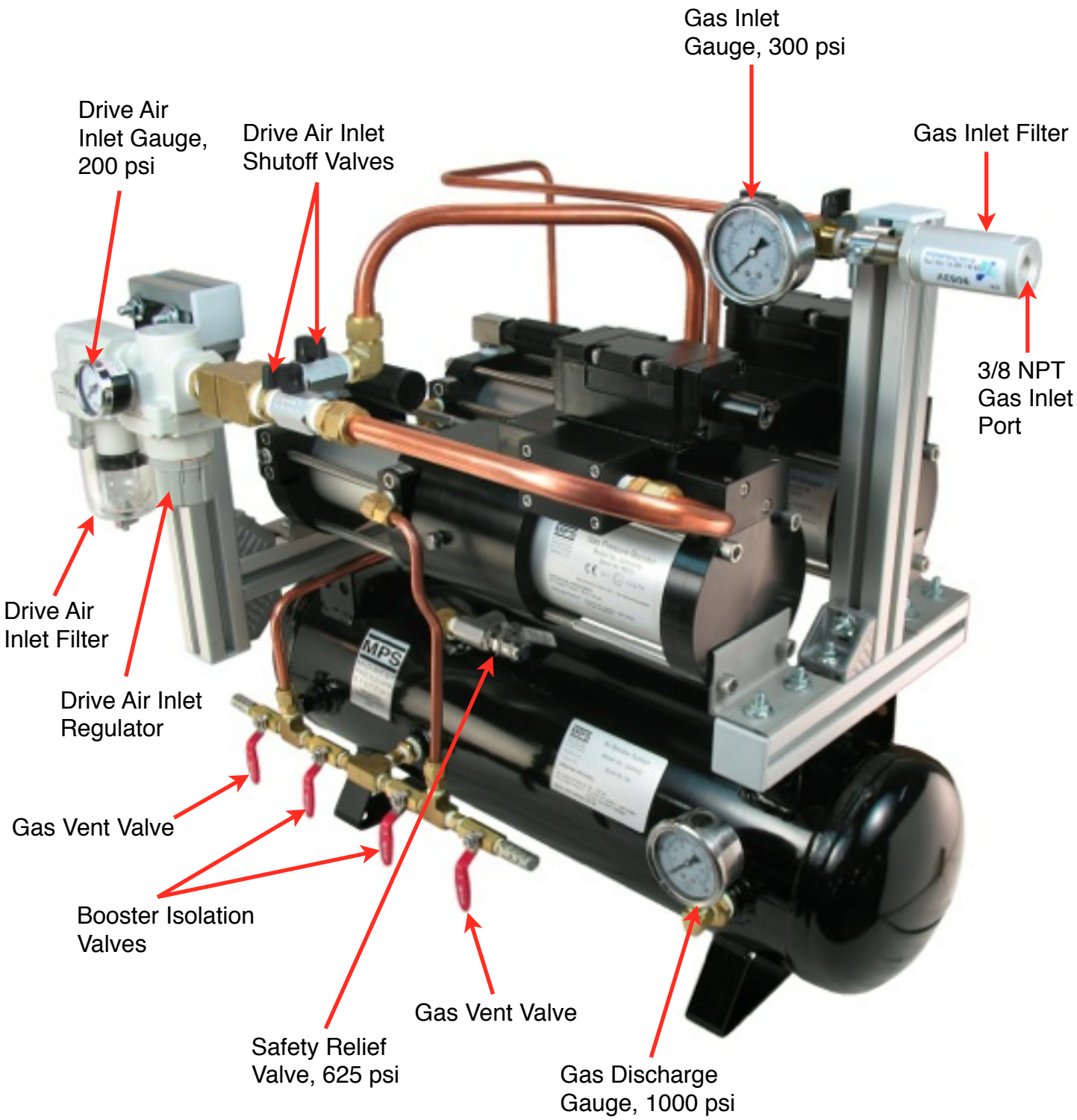
Fastener Torque Specifications

This booster utilizes high strength fasteners. Replacement fasteners must be of the same grade and material or the booster could fail.

Fastener Description	Size Inch TPI	Type	Torque Lb-Ft (N•m)
Piston Rod Nuts	3/8-16 UNC	18-8 SS hex head locknut • 11/16 wrench	30 (40.7)
1” Long SHC Screws	3/8-16 UNC	18-8 SS hex head nut • 5/16 wrench	25 (34)
7” Long SHC Screws	3/8-16 UNC	18-8 SS hex head nut • 5/16 wrench	15 (20.3)
Air Manifold Mounting Screws	10-32 UNC	18-8 SS socket head cap screw • 5/32 wrench	3 (4.1)
Control Valve Mounting Screws	1/4-20 UNC	18-8 SS socket head cap screw • 3/16 wrench	4 (5.4)

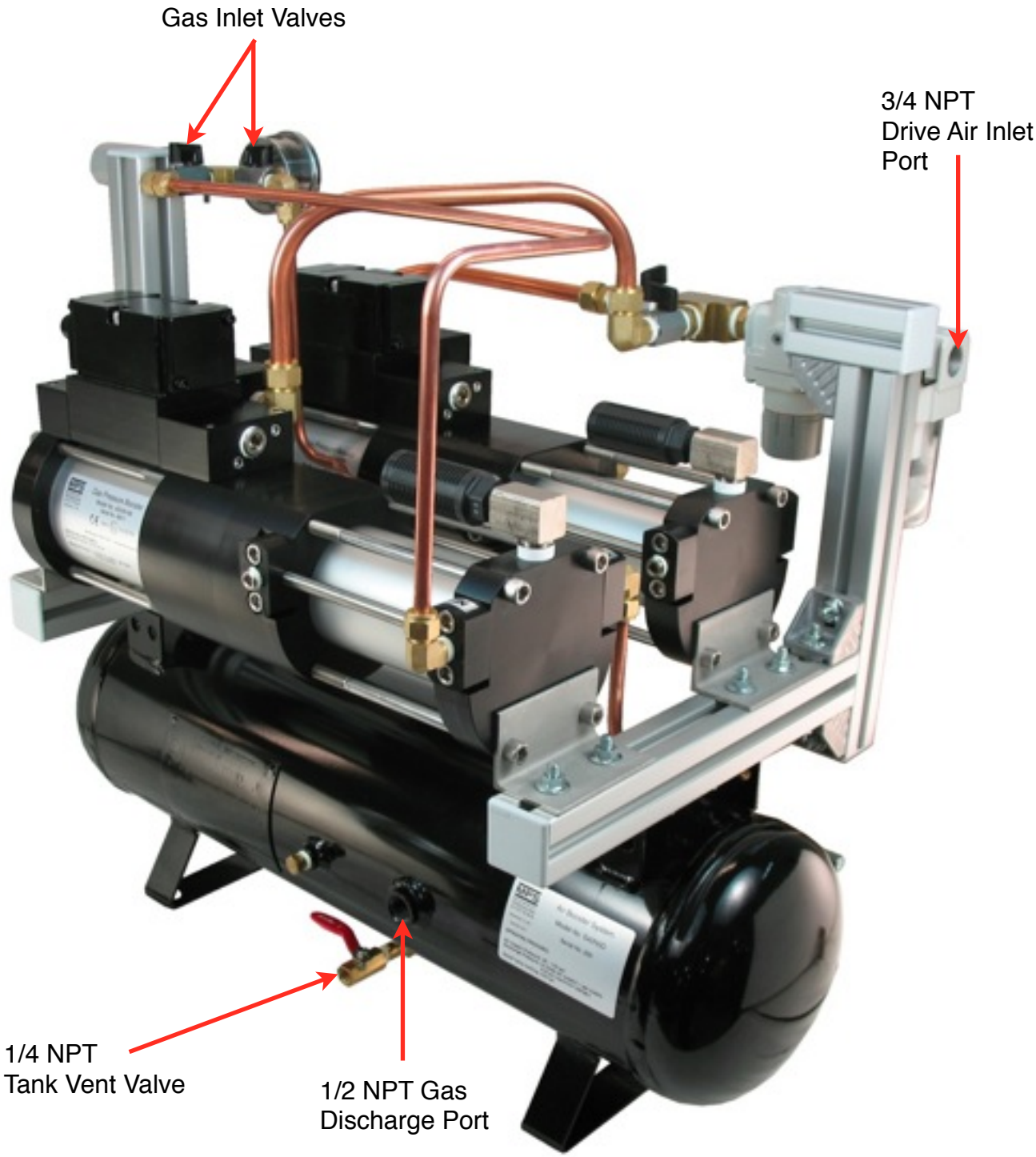
3. System Layout
FRONT-VIEW

Use this layout to learn component locations and refer back to it for topics discussed in later sections.



3. System Layout
REAR-VIEW

Use this layout to learn component locations and refer back to it for topics discussed in later sections.



4. Installation

1 Mounting

1a Mount the S42N5D gas booster system on a horizontal and stable surface. Other mounting orientations are not recommended. The booster system vibrates while operating, so use the four 1/2" mounting holes spaced in a rectangular pattern of 18" (45.7 cm) long by 6.5" (16.5 cm) to bolt it to a solid surface.

⚠ The booster must be well-supported. The booster vibrates during operation. Inadequate mounting supports can put stress on the piping connections. Piping stresses can cause a leak or component failure.

2 Air Supply Connection

2a First remove the red port plugs on the tank vent valve, safety relief valve, drive air inlet port, gas inlet port, and gas discharge port (refer to the photos in Section 3 for these port locations). Connect your shop air pressure to the female 3/4 inch NPT port on the drive air filter, shown in the REAR VIEW photo in Section 3. A shutoff valve should be installed upstream of the 3/4 inch NPT port on the drive air filter for convenient removal of the system for maintenance.

2b The booster drive air must be ISO 8573.1 CLASS 2 or better. Lower quality air can cause the formation of ice in the cycling valve and exhaust muffler, which will cause the booster stop running, or run erratically. If ambient temperatures fall below freezing, the drive air must be dried or heated to prevent ice formation in the cycling valve and exhaust muffler. Maximum drive air inlet pressure is 125 psi (8.6 bar).

⚠ The air controls and drive portion of the booster are rated for a maximum pressure of 125 psi (8.6 bar). Inlet pressures higher than 125 psi (8.6 bar) could result in an air leak, control malfunction, or an air component failure.

2c The unit is permanently lubricated. Use of an inlet lubricator will void the warranty.

2d Make sure the drive air exhaust silencers are installed. Boosters without silencers can produce sound levels above 85 decibels.

⚠ Operation of the booster without drive air exhaust silencers may cause hearing damage to exposed workers.

3 Gas Supply Connection

3a Connect your gas supply line to the 3/8 inch NPT gas inlet filter located on top of the system, shown in the REAR VIEW photo in Section 3. A gas supply shutoff valve should be installed upstream of the 3/8 inch FNPT gas inlet filter for convenient removal of the system for maintenance. Supply piping should have an inside diameter of 3/8" or greater.

4 Discharge Connection

4a This system is protected by a safety relief valve set at 625 psi (43.1 bar). The maximum working pressure of the system is rated for 610 psi (42 bar). If the maximum working pressure can exceed the pressure rating of downstream components or piping, an additional safety relief valve must be installed.

4b Connect your gas discharge line to the female 1/2 inch NPT gas discharge port located on the backside of the 5.5 gallon ASME receiver tank seen in the REAR-VIEW photo in Section 3. A gas discharge shutoff valve for the system should be installed downstream of the 1/2 inch NPT discharge port on the receiver tank for easy removal of the system.

4c A 5 μ or better filter should also be installed downstream of the system to protect downstream components from seal/booster wear particles and scale from the tank.

4. Installation Continued…

4d For more precise gas discharge pressure control, install a pressure regulator on the gas discharge line downstream of the filter and gas discharge shutoff valve you installed on the 1/2 inch NPT gas discharge port on the receiver tank. Refer to step 4e below for how to calculate your gas discharge pressure and the steps to set the pressure regulator for more precise gas discharge pressure control.

4e The gas discharge pressure of the S42N5D booster system is calculated by multiplying your regulated air drive pressure by four and adding the gas supply pressure to that number. For example, with 60 psi drive air and an 80 psi gas supply, your maximum gas discharge pressure would be calculated as: 4x(60 psi) + (80 psi) = 320 psi. Set the drive air regulator for a higher gas discharge pressure than desired (not to exceed 610 psi). For example, increase the drive air pressure from 60 psi to 80 psi, resulting in a maximum gas discharge pressure of 400 psi. Then set the pressure regulator that was installed downstream of the system to your original desired gas discharge pressure of 320 psi. This method allows for greater accumulator storage capacity, and minimizes pressure fluctuations downstream of the system.

⚠ This booster system can reach a maximum design pressure of 610 psi (42 bar). Downstream components must be rated to meet this pressure or be protected by an additional safety relief device.

⚠ With discharge pressures above 625 psi (43.1 bar), the safety relief valve will open and make a loud noise. The loud noise may cause hearing damage to exposed workers.

⚠ Operating temperatures or pressures outside the recommended range for the booster can cause a leak or the system to operate sporadically.

5. Startup

1 Supply Gas to the System

1a Refer to the photos in Section 3 for the valves mentioned in this section. Close the gas discharge shutoff valve you installed downstream of the system. Then open the gas inlet valves and open the booster isolation valves. Next, open the gas supply shutoff valve you installed upstream of the 3/8 inch NPT gas inlet filter to the system. Gas will flow through the booster's check valves and pressurize the tank.

2 Supply Air to the System

2a Make sure the drive air inlet shutoff valves on the system, shown in the FRONT-VIEW photo in Section 3, are open. Set the drive air regulator pressure. The drive air regulator is located next to the drive air filter, seen in the FRONT-VIEW photo in Section 3. To set the drive air regulator, pull down on the knob to unlock it. Look underneath the knob to find the direction of the increase/decrease arrows for the regulator. Turn the knob in the direction of the decrease arrow until the knob stops (at this position the regulated drive air pressure is set to 0 psi). Next, supply air to the drive air regulator by opening the drive air shutoff valve that you installed upstream of the system. Now set the drive air regulator to the desired drive air pressure, which is read on the 200 psi pressure gauge attached to the drive air regulator. Turn the knob in the direction of the increase arrow until the desired drive air pressure is reached. Push up on the regulator knob to lock it into position.

5. Startup Continued…

2b Both boosters will start to cycle and pressurize the tank. The tank pressure can be read on the gas discharge gauge, shown in the FRONT-VIEW photo in Section 3. The boosters will start to slow down and stop as the maximum gas discharge pressure (calculated in Section 4d) is reached. This is referred to as a stalled condition for the boosters.

2c After the maximum discharge pressure is reached in the tank, check the entire booster system for leaks.

2d Open the gas discharge shutoff valve installed downstream of the system to supply the pressurized gas to downstream components. If a pressure regulator was installed downstream of the system for more precise discharge pressure control, set that regulator to the desired gas discharge pressure.

6. Operation

1 Operating Characteristics

1a The booster will reciprocate as long as drive air is supplied and process gas flow is required. The booster cycle rate will automatically adjust to meet the required flow rate.

2 Operating Conditions

2a The S42N5D system is designed to be be operated with one or both boosters. If a high gas discharge flowrate is required it is recommend that the system be operated with both boosters. If a low flowrate is required, or a booster needs to be removed for repairs, one booster can be operated while the other booster is shutdown or removed. Refer to the system photos in Section 3 for the valves mentioned in the following booster shutdown procedure. To operate with just one booster follow these steps: First, close the drive air shutoff valve to the desired booster to be shut down. Next, close both the gas inlet valve and the booster isolation valve. Now open the gas vent valve to depressurize the booster to be shutdown or removed. The system will now continue to operate with the remaining booster cycling.

3 Operating Life

3a The operating life of the booster seals is related to the distance the seals travel. At a 70 cycle per minute operating speed, the booster seals can provide over 2000 hours of service.

7. Maintenance and Warranty

1 Lubrication

1a All of the booster dynamic seals are carbon fiber filled Teflon and the control valve dynamic components are made from honed and lapped stainless steel with no elastomeric seals. No lubrication of any kind is required for the booster.

2 Filters

2a The drive air inlet supply and gas inlet supply filters should be checked and replaced as necessary.

3 Repairs

3a The S42N5D system has the capability to operate one booster while the other is removed for repairs. Refer to Section 6, 2a for instructions to isolate a booster from the system. Once the booster has been isolated and vented, remove the 5/8” copper inlet air tubing and the 3/8” copper inlet and discharge gas tubing of the idle booster. Remove the nuts and tee screws attaching the booster to the aluminum rails. The booster can now be removed from the system for repairs.

3b When rebuilding the booster, consult the 42AAV48 Technical Manual. The booster seals and valves can be replaced after they have worn out. Use seal kit Model Number K42AAV48. Always perform pressure, leak and functional tests on a repaired booster before returning it to service.

3c To reinstall the booster, fasten the booster back into place using the tee screws, before tightening the nuts on the tee screws, reinstall the 5/8” and 3/8” copper tubing. Then make sure the gas vent valve for that booster is closed. Next, open the booster isolation valve for the booster. Open the gas inlet valve to allow gas to flow through the copper tubing and pressurize the booster. Lastly, open the drive air inlet shutoff valve to the booster. The repaired booster should start cycling.

4 Warranty

4a Midwest Pressure Systems, Inc. warrants these booster systems to be free of defects in material and workmanship for a period of one year after installation. We will either repair or replace a failed unit returned by the customer. No other warranty is expressed or implied. Proof of the installation date is required. This warranty does not apply to equipment which has been abused, and is voided by failure to use a well-maintained inlet filter.

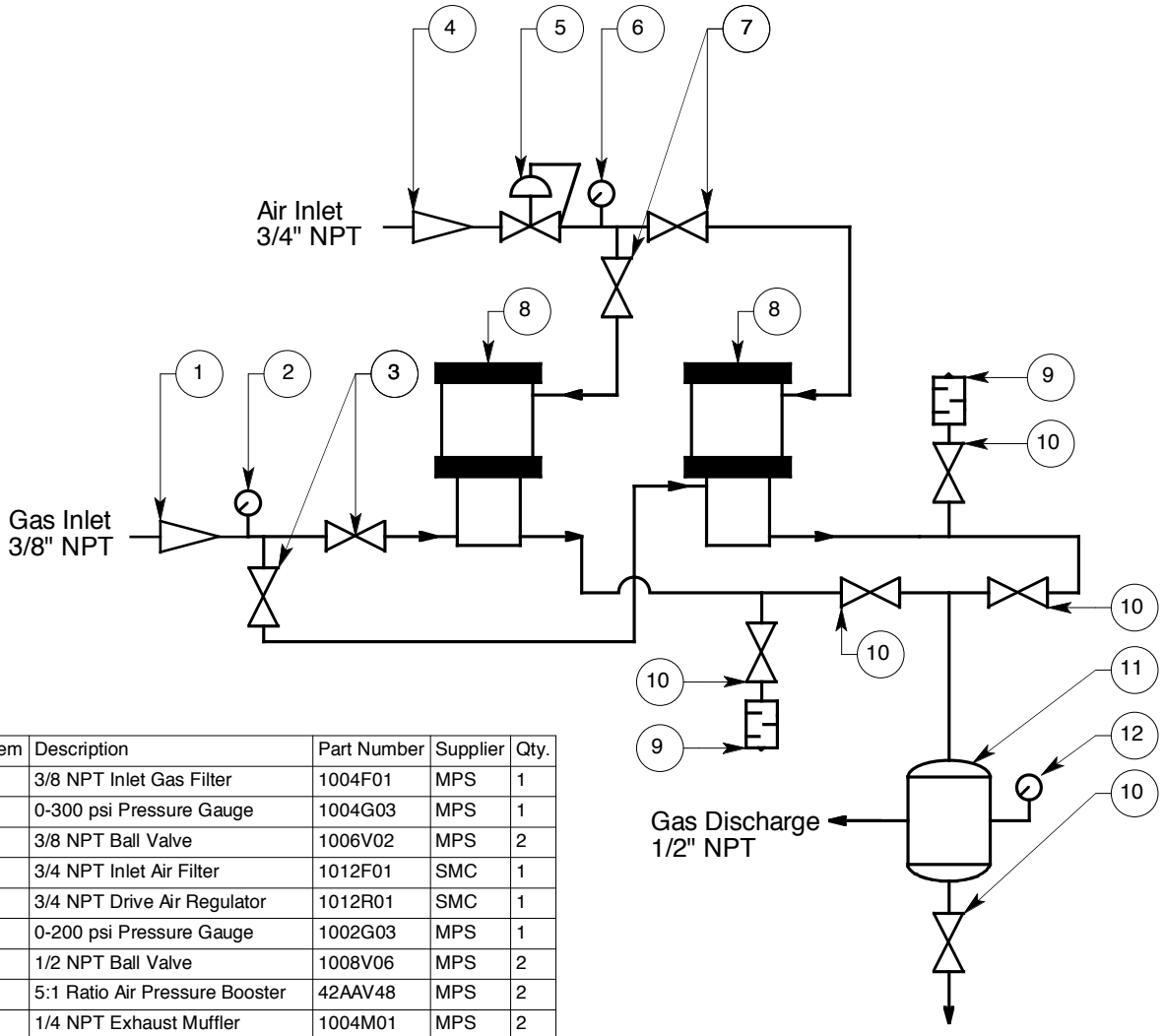
An improperly assembled booster could cause a leak or component failure.

Use of the wrong fasteners on the booster could cause a gas leak or component failure.

Improper torque values can cause a failure.

8. Piping and Instrumentation Diagram

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



Item	Description	Part Number	Supplier	Qty.
1	3/8 NPT Inlet Gas Filter	1004F01	MPS	1
2	0-300 psi Pressure Gauge	1004G03	MPS	1
3	3/8 NPT Ball Valve	1006V02	MPS	2
4	3/4 NPT Inlet Air Filter	1012F01	SMC	1
5	3/4 NPT Drive Air Regulator	1012R01	SMC	1
6	0-200 psi Pressure Gauge	1002G03	MPS	1
7	1/2 NPT Ball Valve	1008V06	MPS	2
8	5:1 Ratio Air Pressure Booster	42AAV48	MPS	2
9	1/4 NPT Exhaust Muffler	1004M01	MPS	2
10	1/4 NPT Ball Valve	1004V27	MPS	5
11	5.5 Galllon ASME Receiver Tank	P0252	MPS	1
12	0-1000 psi Pressure Gauge	1004G01	MPS	1

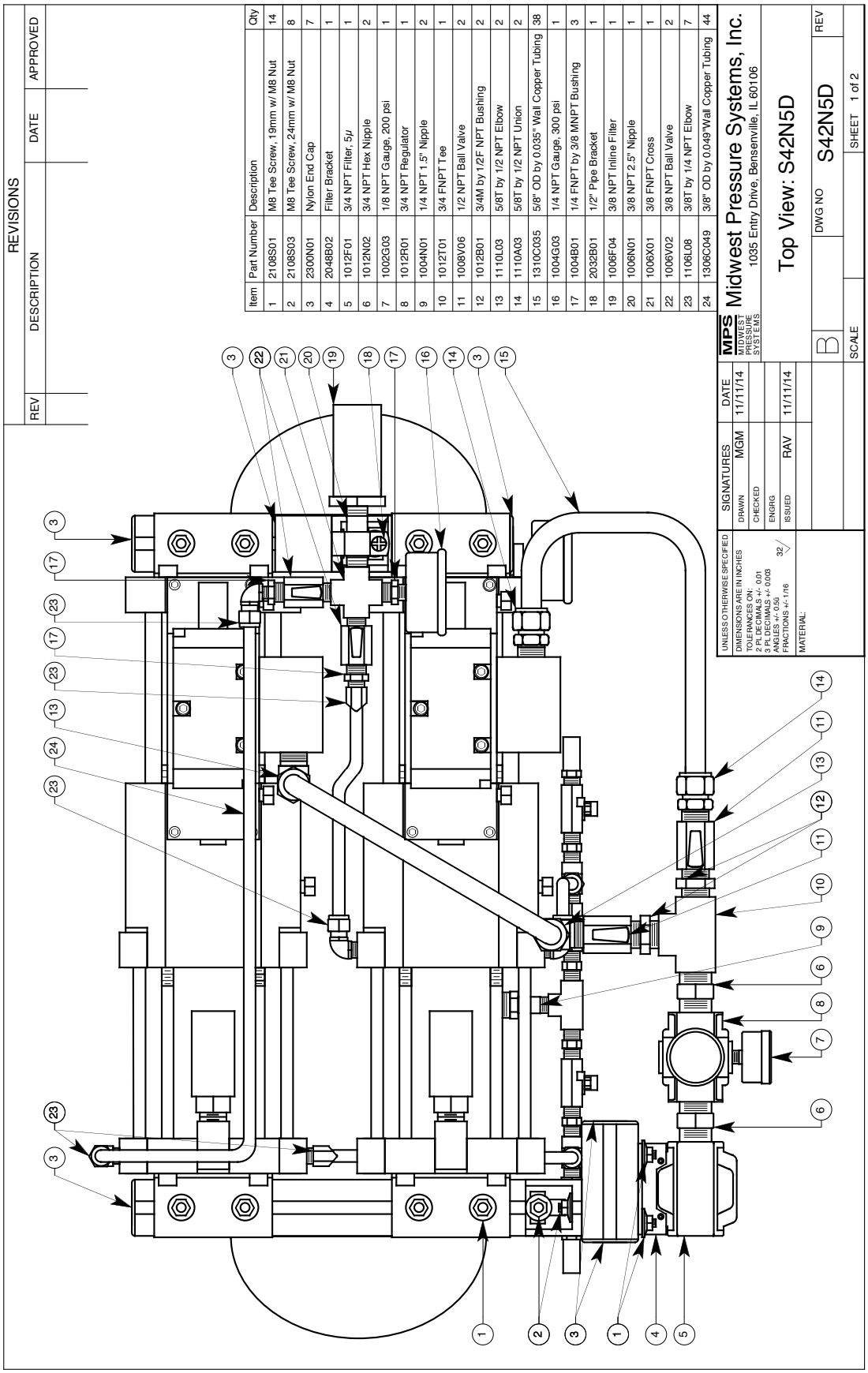
UNLESS OTHERWISE SPECIFIED	SIGNATURES		DATE
DIMENSIONS ARE IN INCHES	DRAWN	MGM	10/24/14
TOLERANCES ON:	CHECKED		
2 PL DECIMALS +/- 0.01	ENGRG		
3 PL DECIMALS +/- 0.003	ISSUED	RAV	11/11/14
ANGLES +/- 0.5û			
FRACTIONS +/- 1/16 32			
MATERIAL:			

MPS MIDWEST PRESSURE SYSTEMS — Midwest Pressure Systems, Inc.
1035 Entry Drive, Bensenville, IL 60106

Section 8: Piping & Instrumentation

A		DWG NO S42N5D P&ID	REV
SCALE		SHEET	

9. Booster System Assembly Drawing



Item	Part Number	Description	Qty
1	2108S01	M8 Tee Screw, 19mm w/ M8 Nut	14
2	2108S03	M8 Tee Screw, 24mm w/ M8 Nut	8
3	2300N01	Nylon End Cap	7
4	2048B02	Filter Bracket	1
5	1012F01	3/4 NPT Filter, 5μ	1
6	1012N02	3/4 NPT Hex Nipple	2
7	1002G03	1/8 NPT Gauge, 200 psi	1
8	1012R01	3/4 NPT Regulator	1
9	1004N01	1/4 NPT 1.5" Nipple	2
10	1012T01	3/4 FNPT Tee	1
11	1008V06	1/2 NPT Ball Valve	2
12	1012B01	3/4M by 1/2F NPT Bushing	2
13	1110L03	5/8T by 1/2 NPT Elbow	2
14	1110A03	5/8T by 1/2 NPT Union	2
15	1310C035	5/8" OD by 0.035" Wall Copper Tubing	38
16	1004G03	1/4 NPT Gauge, 300 psi	1
17	1004B01	1/4 FNPT by 3/8 MNPT Bushing	3
18	2032B01	1/2" Pipe Bracket	1
19	1006F04	3/8 NPT Inline Filter	1
20	1006N01	3/8 NPT 2.5" Nipple	1
21	1006X01	3/8 FNPT Cross	1
22	1006V02	3/8 NPT Ball Valve	2
23	1106L08	3/8T by 1/4 NPT Elbow	7
24	1306C049	3/8" OD by 0.049"Wall Copper Tubing	44

9. Booster System Assembly Drawing Continued...