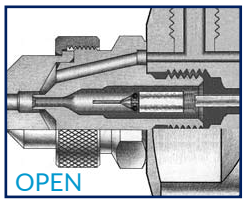
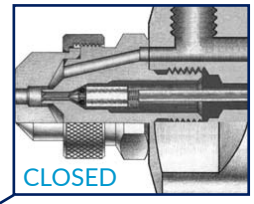
BETE®
PERFORMANCE SPRAY ENGINEERING

TROUBLESHOOTING: BETE XA NOZZLES

The BETE XA series is a multi-component air atomizing system. The XA system was designed to allow the swift exchange and replacement of caps, bodies and tips. The system provides a wide range of spray patterns and simplifies maintenance. The XA series assemblies may consist of anywhere from 6 to 11 parts.

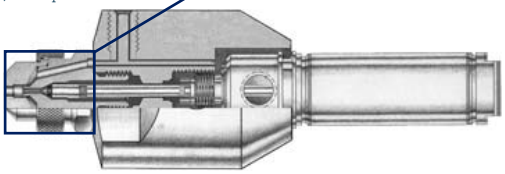
Please be certain to read all instructions carefully before assembling or disassembling the nozzle. Damage to these assemblies can occur if these procedures are not followed.





XA COMPONENTS

BETE XA nozzles consist of a body, a spray set-up, hardware assemblies, and optional mounting devices.



The body is the base component. It contains the connection ports for the liquid and air supplies, a connection for the spray set-up, and may contain a connection for a hardware assembly.

The spray set-up consists of an air cap and a fluid cap. The air cap and fluid cap combination control the spray performance, including flow rates and spray pattern. Optional hardware assemblies allow either shutoff or shutoff and clean-out of the fluid cap. Hardware assemblies may be actuated manually (B, C, and D hardware) or pneumatically (E or F hardware). Not all bodies accept all hardware.

Mounting devices offer a method of holding the nozzle in a fixed location. They attach to the fluid cap.

Operation of the air cylinder of the E or F hardware requires a minimum air pressure of 30 psi to retract the rod. Failure to provide sufficient air pressure is one of the most frequent causes of poor nozzle performance. The E or F hardware feature a built-in air cylinder which allows liquid flow to be shut off at the nozzle tip, resulting in precise, intermittent application of liquid. When air pressure is released a spring causes the cylinder to return to the closed position. For the F clean-out option, the pin pushes accumulated material from the liquid orifice as it returns. The clean-out pin is not able to remove material from the orifices in the air cap.

Standard seal materials limit the XA to use at temperatures less than 400°F. Materials allowing use at higher temperatures are available by special request. All spray set-ups fit on all bodies. All spray set-ups may be used with hardware, however the available hardware is limited by the chosen body style. The 00 and 03 bodies can accept all hardware assemblies. Complete nozzle assemblies initially sold with manual hardware (B, C, or D) may be upgraded in the field to automatic hardware (E or F).

The square 00 body with E or F hardware requires two separate air lines and more complex piping.

The 01 body features a consolidated air inlet combining both the atomizing air and cylinder air in a single line, resulting in simplified piping layouts. The 01 body can be used only for applications where the atomizing air pressure is ABOVE 30 psi.

The 01 and 02 bodies simplify external air line connections by fixing the orientation of the air, liquid and cylinder inlets.

The 01 and 02 bodies may only be used with the E or F hardware.

The 02 body requires two separate air lines, one to supply atomizing air and one to supply operating air to the cylinder. The two air lines allow the use of atomizing air at pressures both BELOW and ABOVE 30 psi, while maintaining the minimum 30 psi to the cylinder.

The 05, 06, 07, and 08 bodies do not accept any hardware.

The XA10 and XA11 bodies have a built in air-operated cylinder. This integral cylinder provides a smaller profile for use where space is limited.

INSTALLATION TIPS

1. Adequately size air and liquid lines to maintain required pressures at each nozzle. (consult air and water flow charts on page 4)

2. Each siphon nozzle must have a separate liquid feed line from the reservoir.

3. For extreme temperatures and a range of chemicals, consult chart of options for special gaskets, sealants and Loctite® adhesives.

CAUTION

4. To maintain adequate air pressure (30 psig min) for cylinder operation, use the 02 body if atomizing air pressure to the nozzle is expected to fall below 30 psi.

5. For severe chemicals and abrasive liquids, consult factory for optional nozzle materials.

CAUTION

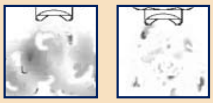
6. Flush out air and liquid lines before connecting nozzles to clear out loose material which could cause pluggage.

7. Install air and liquid pressure gauges close to the nozzle location(s) to allow accurate control of pressures.

8. As a general rule avoid spraying counter-current to reduce contamination problems from process environments.

CAUTION

9. To maintain atomization during startup and shutdown, always turn on air first and turn off air last.



10. Multiple nozzle installations are especially sensitive to line sizes and lengths. Size air and liquid lines generously and avoid large numbers of nozzles (no more than 6) on a single branch.

11. Humidification requires high air/ liquid ratios, usually in the range of 2 to 4 SCFM per gallon per hour, to produce droplets small enough for evaporation.

12. Maximum operating rate for air cylinders is 3 cycles per second. Maximum pressure is 125 psi.

CAUTION

13. In dirty process environments, a purge air pipe surrounding the nozzle can reduce contamination problems.

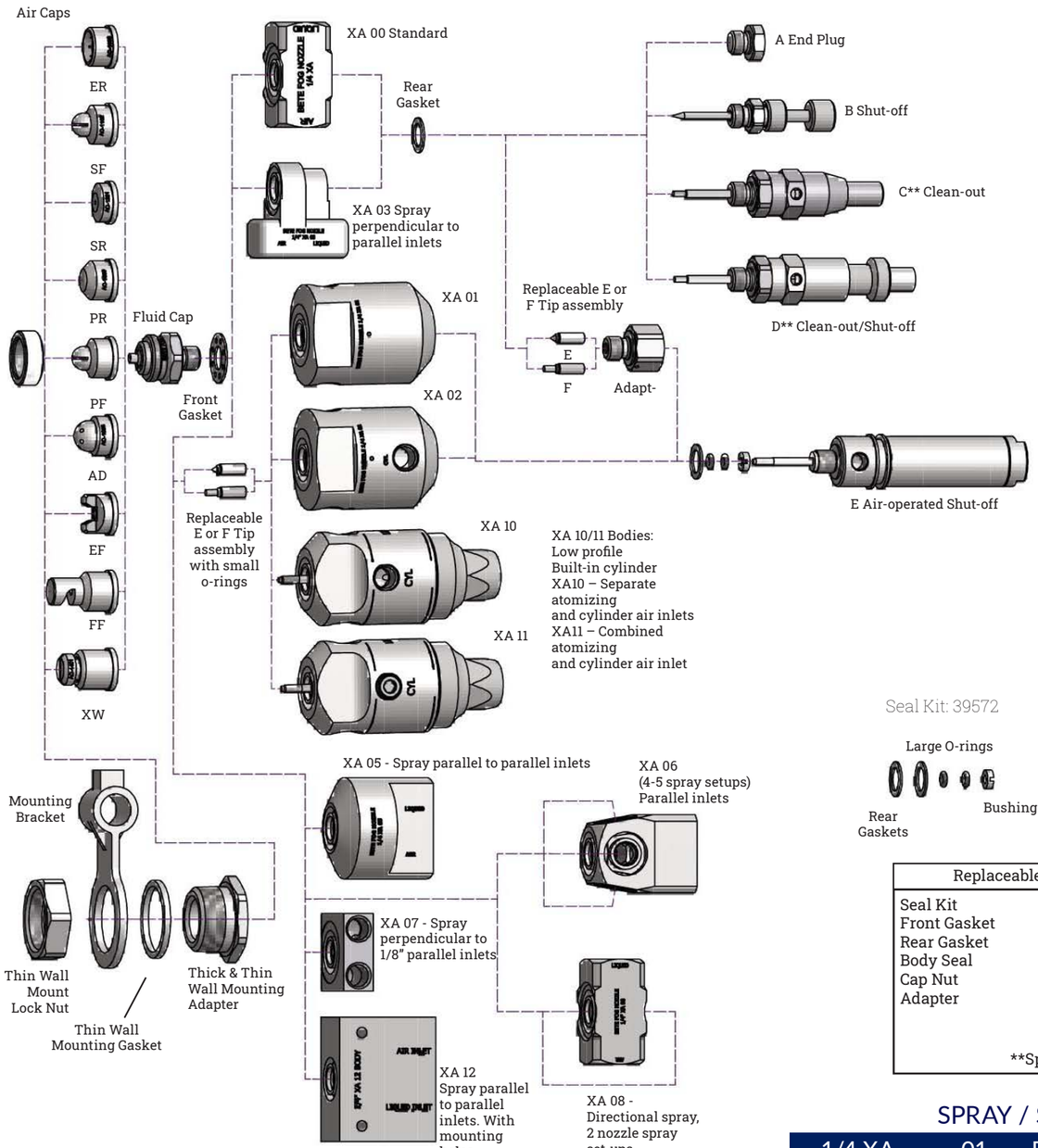
CAUTION

14. For viscosities greater than 150 cP, consider using one of the EF setups.

15. Whenever flow rate accuracy is critical, a positive displacement metering pump or flow controller should be used.

CAUTION

16. During installation, ensure the liquid and air supplies are connected to the correct port. The words "LIQUID" and "AIR" are stamped on the bodies adjacent to the correct port.



Seal Kit: 39572

Replaceable Components and Gaskets	
Seal Kit	Thick & Thin Wall Mount Adapter
Front Gasket	Thin Wall Lock Nut
Rear Gasket	Thin Wall Mounting Gasket
Body Seal	Mounting Bracket
Cap Nut	E - Replacement Tip
Adapter	F - Replacement Tip**
	**Specify fluid cap

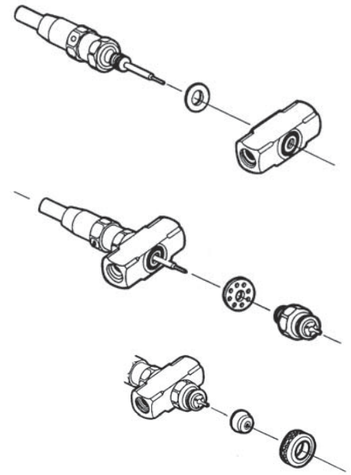
SPRAY / SET-UP NUMBER

1/4 XA | 01 | PR | 250 | E | 01 | 02

- Sizes & Series: 1/8"B, 1/4"B, 1/2"B - BSP 1/8", 1/4", 1/2" - NPT
- Body Styles: 00 01 02 03 05 06 07 08 10 11 12
- Air Cap Style: PR FF AD XW PF EF SR SF ER
- Combination Number
- Hardware Assemblies: A B C D E F
- Mounting Hardware: 01 02 03
- Extension Size: 12"

*For extensions, A hardware is standard; E and F hardware may be provided on an application specific basis.

ASSEMBLY INSTRUCTIONS FOR A, B, C AND D HARDWARE



Before disassembling or reassembling, please review the diagram on the left to make sure you have the parts necessary to complete your choice of set-up.

These instructions are applicable to the 00 and 03 body and hardware options A-D. For illustration, the figures are shown with the 00 body and the C hardware option.

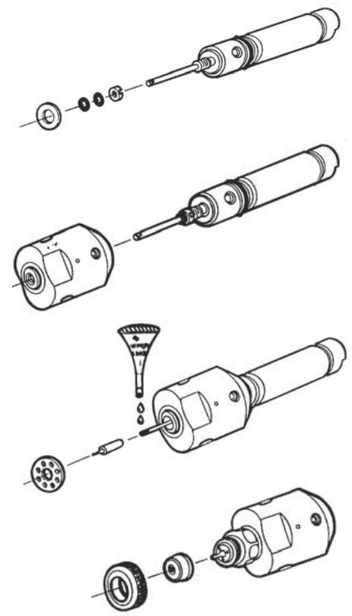
1. Attach gasket. Slide rear gasket onto A, B, C, or D hardware until it rests on the shoulder behind the threads (Figure 1).

2. Thread into body. Thread the hardware and gasket from step 1 into the back of the 00 or 03 body. Snug the hardware in place.

3. Attach fluid cap. Slide front gasket onto fluid cap until it rests on the shoulder behind the threads. Screw the fluid cap into the body and tighten to 75 in-lb [8.5 Nm] (Figure 2).

4. Attach air cap. Rest the air cap on the fluid cap and secure it in place with the cap nut (Figure 3).

ASSEMBLY INSTRUCTIONS FOR E AND F AUTOMATIC HARDWARE



!WARNING! The needle assembly can be severely damaged if excessive torque is applied during disassembly or reassembly.

1. Install bushing and o-rings. Slide relief bushing onto cylinder rod with slotted side toward the cylinder body. Slide the two larger o-rings onto the cylinder rod. Push the bushing and the o-rings all the way down the rod (Figure A).

2. Attach adapter. For 00 and 03 bodies only, slide the adapter down the cylinder rod and thread it onto the cylinder body.

3. Install rear gasket and connect hardware. Slide the rear gasket down the cylinder rod, resting it on the shoulder behind the threads of the cylinder (01 and 02 bodies) or the threads of the adapter (00 and 03 bodies). `Insert cylinder rod through body. HAND TIGHTEN into the body (Figure B).

4. Attach tip and small o-ring. Use supplied Loctite® per manufacturer's directions to coat threads on end of cylinder rod as shown in Figure C. Screw tip to cylinder rod. HAND TIGHTEN. Roll smaller o-ring onto tip (note that the smaller o-ring may already be installed on the tip at the factory). WARNING: Do not mar or gouge tip surface when assembling; be sure to keep tip surface smooth.

5. Attach fluid cap. Slide front gasket onto fluid cap until it rests on the shoulder behind the threads. Screw the fluid cap into the body and tighten to 75 in-lb [8.5 Nm].

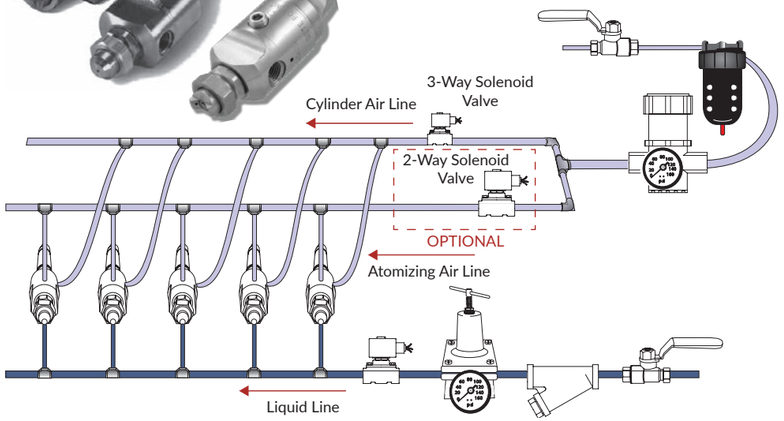
6. Attach air cap. Rest the air cap on the fluid cap and secure it in place with the cap nut (Figure D).

XA SYSTEMS

AA

Fastest Response - No Drips or Sputtering After Shutoff

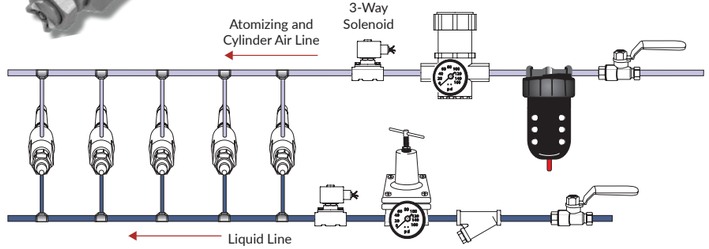
00, 02 or 10 Body - E or F Hardware
Liquid Fed Under Pressure



BB

Fastest Response - No Drips or Sputtering After Shutoff, Simplified Piping

01 or 11 Body - E or F Hardware
Liquid Fed Under Pressure



For Systems AA and BB

Liquid flow is shut off in the nozzle with a poppet valve operated by an air cylinder controlled by a 3-way solenoid valve. The 00, 02, and 10 bodies respond faster than the 01 and 11 bodies.

AA

02 and 10 Bodies

Use a 3-way valve on the cylinder air line for the fastest response. Use an optional 2-way solenoid valve on the atomizing air line to conserve air when the liquid flow is shut off. Note that the atomizing air valve must open before the 3-way cylinder air valve.

00 Body

The operation is the same as for the 02 body, but the piping is more difficult because the location of the cylinder air inlet is independent of the atomizing air inlet. Flexible tubing may be used for some applications.

An additional regulator is required for either the 02 or 00 body if the atomizing air is to be less than 30 psi.

BB

01 and 11 Bodies

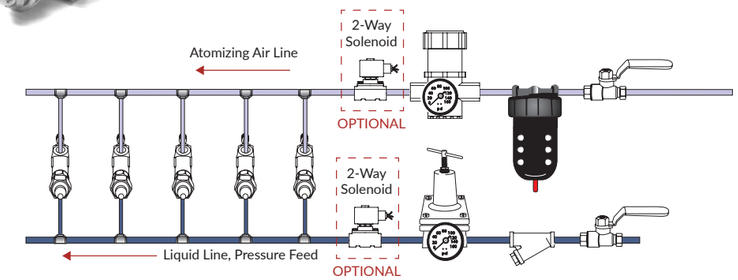
Because this body has a single inlet for cylinder and atomizing air, it requires only one 3-way solenoid valve for control. The response of the 01 body is slower than for the 02 and 00 bodies because the liquid flow doesn't stop until the air has drained from the line.

Atomizing air pressure must be greater than 30 psi to provide adequate cylinder pressure.

CC

Slow Response - Some Drips or Sputtering After Shutoff, Simple Piping

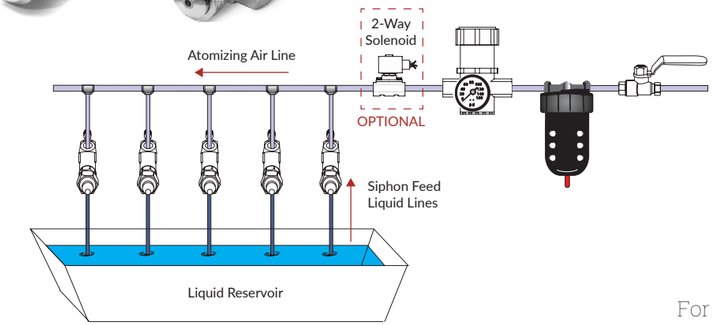
00 Body - A, B, C or D Hardware
Liquid Fed Under Pressure



DD

Slow Response - Some Drips or Sputtering After Shutoff, Simple Piping

00 Body - A, B, C or D Hardware
Liquid Siphoned from Container



For Systems CC and DD

Using 00, 03, or 05 bodies, manual ball valves or electric solenoid valves control the fluid flow.

CC

00 Body

Liquid is fed under pressure to the 00 body, which uses A, B, C or D hardware. Note that systems similar to CC can be designed using the 03, 05, 06, 07, and 08 bodies.

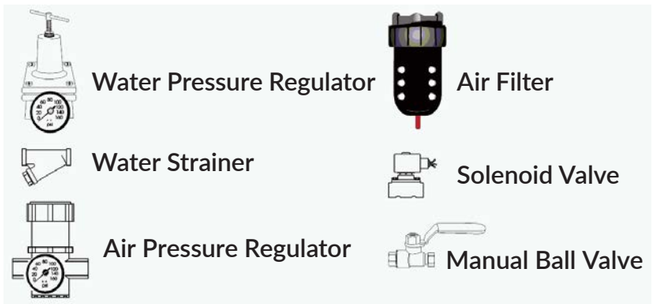
DD

00 Body

SR or SF set-ups siphon liquid from a container to the
00 body, which uses A, B, C or D hardware.

Note that sytems similar to DD can be designed using the 03, 05, and 07 bodies.

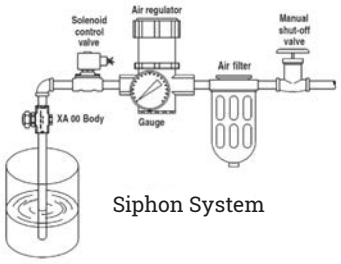
LEGEND



If you need assistance designing your XA system, please email or fax your questions and a sketch to BETE Applications Engineering at appeng@bete.com, or 413-772-6729.

WHAT YOU NEED TO CONSIDER WHEN DESIGNING YOUR XA SYSTEM

- Confirm that the correct nozzle flow rate, spray pattern, and operating pressures have been selected and supplied for the application, that the correct mounting and accessory hardware such as thick wall adapters and clean out needles are installed on the nozzle and that the correct number of nozzles is available.
- The header (for a multiple nozzle installation) and supply lines should be sized generously to prevent imbalance between liquid and air pressures for each nozzle and excessive pressure losses along the header that could cause erratic nozzle operation.
- Size the header to accommodate the total flow to all the nozzles on the header. Headers that are longer than 10 feet or that have more than 10 nozzles may be fed from both ends to minimize pressure differences along their length.
- Be sure to account for the air pressure according to the instructions on the chart when sizing the air piping.
- The line supplying air to an automatic cylinder can usually be 1/8" even when multiple nozzles are used since the volume flow of air to the cylinders is very small.
- When the nozzles are supported by at least one rigid pipe or wall, plastic tubing often makes connections fast and easy, but be certain the inside diameters of the tubing to be used are as large as those in the corresponding pipe size.
- Filters for the air and water lines should be placed upstream of pressure regulators and solenoid valves. Regulators and pressure gauges should be placed as close to the nozzles or header inlet as possible to allow the regulator to respond rapidly to pressure changes, especially when the nozzles are being cycled on and off automatically.
- Solenoid valves are generally installed downstream of the pressure regulator and as close to the nozzle as possible, especially if they are to be used to cycle the nozzles on and off.
- Automatic operation requires at least one three-way valve so that air can escape from the cylinder and allow the spring to push the clean-out or clean-out/shut-off needle into place. Faster operation is usually possible when you control the cylinder separately using the 00, 02, or 03 body. Using the 01 body requires the air to be exhausted from the larger atomizing air supply piping to allow the cylinder to return to the closed position.
- A complete XA system diagram with filters, regulators and solenoid valves is shown to the right and in the XA Accessories brochure.
- You must correctly size the supply piping to ensure that adequate air and water are supplied to the nozzle. Correct size is especially important in multi-nozzle systems where differences in air and water pressures from one nozzle to the next can cause erratic operation.
- Several charts are included to help you choose the correct pipe sizes.

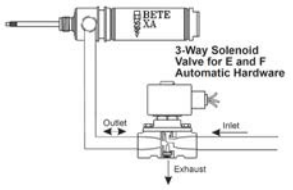


Siphon System

Flow of air through schedule 40 steel pipe
For lengths of pipe other than 100 feet, the pressure drop is proportional to the length. Thus, for 50 feet of pipe, the pressure drop is one-half the value given in the table; for 300 feet, three times the given value, etc.

The cubic feet per minute of compressed air at any pressure is inversely proportional to the absolute pressure and directly proportional to the absolute temperature.

The pressure drop is also inversely proportional to the absolute pressure and directly proportional to the absolute temperature. .



The standard liquid pressure regulators supplied by BETE are the unbalanced type and the downstream pressure may fluctuate with variations in inlet pressure regardless of the pressure setting. The air regulators are the relieving type and pressures can be set without the air actually flowing through the nozzles. In addition these are less sensitive to variations in upstream pressure.

If you have further questions, please do not hesitate to call our customer service department at 413-772-0846 or visit our website at: www.bete.com.

FILTERS, REGULATORS & VALVES

BETE recommends that filters be used on both the air and liquid lines supplying XA nozzles to minimize the potential for clogging. The air filters supplied by BETE remove both water and particulates and are equipped with an automatic drain. The water filters remove particulates larger than 100 mesh and can be equipped with a quick flush drain valve to remove accumulated deposits.

Liquid strainers for siphon setups should have large areas to minimize pressure losses across the strainer itself. It is also preferable to install the strainer below the liquid level.

To determine the cubic feet per minute of compressed air at any temperature and pressure other than standard conditions, use the equation:

(14.7 / p + 14.7) (460 + T / 520) (**SCFM**) = **ACFM**

Therefore, to determine the pressure drop for inlet or average pressure other than 100 psi and at temperatures other than 60°F, multiply the values given in the table by the ratio:

(100 + 14.7 / P + 14.7) (460 + T / 520)

Where:

"P" is the inlet or average gauge pressure in pounds per square inch, and, T is the temperature in degrees Fahrenheit under consideration.

Example: Suppose you need to supply two XAPR300 nozzles with 60 psi water and 50 psi air as shown in the diagram below.

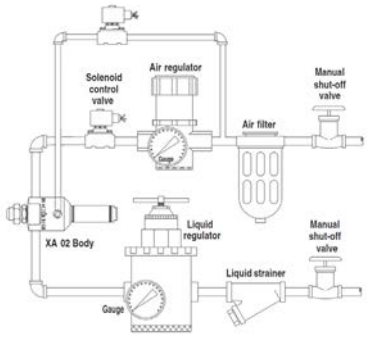
Water
Total flow = (59 gph) x 2 / 60 = 1.96 gpm
Select 3/8" or larger pipe

Air
Total Flow = (4.6) x 2 = 9.2 scfm

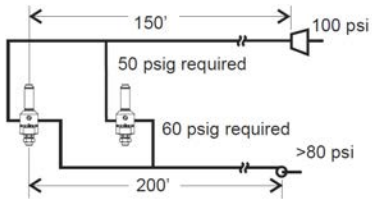
Note that tabulated pressure losses will need to be multiplied by

(100 + 14.7 / P + 14.7) = (114.7 / 50 + 14.7) = 1.77

to obtain losses at 50 psi. Select 3/8" or larger pipe.



Pressure System with XA02 Body



WATER AND AIR FLOW DATA

FLOW OF WATER THROUGH SCHEDULE 40 STEEL PIPE

Discharge		Pressure Drop per 100 feet and Velocity in Schedule 40 Pipe for Water at 60°F															
		Veloc-ity	Press. Drop	Veloc-ity	Press. Drop	Veloc-ity	Press. Drop	Veloc-ity	Press. Drop	Veloc-ity	Press. Drop	Veloc-ity	Press. Drop	Veloc-ity	Press. Drop	Veloc-ity	Press. Drop
Gallons per Minute	Cubic Ft. per Second	feet per Second	Lbs. per Sq. In.	feet per Second	Lbs. per Sq. In.	feet per Second	Lbs. per Sq. In.	feet per Second	Lbs. per Sq. In.	feet per Second	Lbs. per Sq. In.	feet per Second	Lbs. per Sq. In.	feet per Second	Lbs. per Sq. In.	feet per Second	Lbs. per Sq. In.
		1/8"		1/4"		3/8"		1/2"		3/4"		1"		1 1/4"		1 1/2"	
0.2	0.000446	1.13	1.86	0.616	0.359												
0.3	0.000668	1.69	4.22	0.924	0.903	0.504	0.159	0.317	0.061								
0.4	0.000891	2.26	6.98	1.23	1.61	0.672	0.345	0.422	0.086								
0.5	0.00111	2.82	10.5	1.54	2.39	0.840	0.539	0.528	0.167	0.301	0.033						
0.6	0.00178	3.39	14.7	1.85	3.29	1.01	0.751	0.633	0.240	0.361	0.041						
0.8	0.00178	4.52	25.0	2.46	5.44	1.34	1.25	0.844	0.408	0.481	0.102						
1	0.00223	5.65	37.2	3.08	8.28	1.68	1.85	1.06	0.600	0.602	0.155	0.371	0.048				
2	0.00446	11.29	134.4	6.16	30.1	3.36	6.58	2.11	2.10	1.20	0.526	0.743	0.164	0.429	0.044		
3	0.00668			9.25	64.1	5.04	13.9	3.17	4.33	1.81	1.09	1.114	0.336	0.644	0.09	0.473	0.043
4	0.00891			12.33	111.2	6.72	23.9	4.22	7.42	2.41	1.83	1.49	0.565	0.856	0.150	0.630	0.071
5	0.01114	2"				8.40	36.7	5.28	11.2	3.01	2.75	1.86	0.835	1.073	0.223	0.788	0.104
6	0.01337	0.574	0.044	2 1/2"		10.08	51.9	6.33	15.8	3.61	3.84	2.23	1.17	1.29	0.309	0.946	0.145
8	0.01782	0.765	0.073			13.44	91.1	8.45	27.7	4.81	6.60	2.97	1.99	1.72	0.518	1.26	0.241
10	0.02228	0.956	0.108	0.670	0.046			10.56	42.4	6.02	9.99	3.71	2.99	2.15	0.774	1.58	0.361
15	0.03342	1.43	0.224	1.01	0.094	3"				9.03	21.6	5.57	6.36	3.22	1.63	2.37	0.755
20	0.04456	1.91	0.375	1.34	0.158	0.868	0.056	3 1/2"		12.03	37.8	7.43	10.9	4.29	2.78	3.16	1.28
25	0.05570	2.39	0.561	1.68	0.234	0.090	0.083	0.812	0.041			9.28	16.7	5.37	4.22	3.94	1.93

FLOW OF AIR THROUGH SCHEDULE 40 STEEL PIPE

SCFM at 60°F & 14.7 psia	ACFM at 60°F at 100 psig	Pressure Drop of Air per 100 ft of Sch 40 Pipe For Air at 60°F and 100 psig								
		1/8"	1/4"	3/8"	1/2"					
1	0.128	0.361	0.083	0.018						
2	0.256	1.31	0.285	0.064	0.020	3/4"				
3	0.384	3.06	0.605	0.133	0.042					
4	0.513	4.83	1.04	0.226	0.071					
5	0.641	7.45	1.58	0.343	0.106	0.027				
6	0.769	10.6	2.23	0.408	0.148	0.037	1"	1 1/4"		
8	1.025	18.6	3.89	0.848	0.255	0.062	0.019		1 1/2"	
10	1.282	28.7	5.96	1.26	0.356	0.094	0.029			
15	1.922		13.0	2.73	0.834	0.201	0.062			
20	2.563		22.8	4.76	1.43	0.345	0.102	0.026		
25	3.204		35.6	7.34	2.21	0.526	0.156	0.039	0.019	
30	3.845			10.5	3.15	0.748	0.219	0.055	0.026	
35	4.486			14.2	4.24	1.00	0.293	0.073	0.035	
40	5.126			18.4	5.49	1.30	0.379	0.095	0.044	
45	5.767			23.1	6.90	1.62	0.474	0.116	0.055	2"
50	6.408			28.5	8.49	1.99	0.578	0.149	0.067	0.019
60	7.690	2 1/2"		40.7	12.2	2.85	0.819	0.200	0.094	0.027
70	8.971				16.5	3.83	1.10	0.270	0.126	0.036
80	10.25	0.019			21.4	4.96	1.43	0.350	0.162	0.046
90	11.53	0.023			27.0	6.25	1.80	0.437	0.203	0.058