

WETBLAST FLEX™ LP
WATER-INJECTION ABRASIVE-BLAST SYSTEM
WITH MILLENNIUM ACS PNEUMATIC REMOTE CONTROLS
O. M. 28649

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! WARNING

Do not use this equipment until you have READ this MANUAL and YOU UNDERSTAND its contents. *

These WARNINGS are included for the health and safety of the operator and those in the immediate vicinity.

***If you are using a Clemco Distributor Maintenance and Parts Guide, refer to the orange warnings insert preceding the Index before continuing with the enclosed instructions.**

Electronic files include a Preface containing the same important information as the orange cover.

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WARNING

- Employers are responsible for identifying all job site hazards, educating and training all persons who will operate and maintain these products, and ensuring that all blast operators and their assistants understand the warnings and information contained in these instructions relating to safe and proper operation and maintenance of this equipment.
- Serious injury or death can result from failure to comply with all Occupational Safety and Health Administration (OSHA) regulations and all manufacturer's instructions.
- This equipment is not intended for use in any area considered hazardous per National Electric Code NFPA 70 2011, Article 500.
- Read this document and follow all instructions before using this equipment.

OSHA regulations relating to abrasive blasting are contained in the Code of Federal Regulations, Title 29 (29 CFR 1910 General Industry; 1915 Maritime; 1926 Construction). The most pertinent include: 1910.94 Ventilation, 1910.95 Occupational Noise Exposure, 1910.132 Personal Protective Equipment, 1910.133 Eye and Face Protection, 1910.134 Respiratory Protection, 1910.135 Head Protection, 1910.244 (b) Remote Controls. Consult www.osha.gov for complete information.

NOTICE TO PURCHASERS AND USERS OF OUR PRODUCTS AND THIS INFORMATIONAL MATERIAL

Clemco proudly provides products for the abrasive blast industry and is confident that industry professionals will use their knowledge and expertise for the safe and efficient use of these products.

The products described in this material, and the information relating to these products, are intended for knowledgeable, experienced users.

No representation is intended or made as to: the suitability of the products described here for any purpose or application, or to the efficiency, production rate, or useful life of these products. All estimates regarding production rates or finishes are the responsibility of the user and must be derived solely from the user's experience and expertise, not from information contained in this material.

It is possible that the products described in this material may be combined with other products by the user for purposes determined solely by the user. No representations are intended or made as to the suitability of or engineering balance of or compliance with regulations or standard practice of any such combination of products or components the user may employ.

Abrasive blast equipment is only one component of an abrasive blasting job. Other products, such as air compressors, air filters and receivers, abrasives, scaffolding, hydraulic work platforms or booms, equipment for lighting, painting, ventilating, dehumidifying, parts handling, or specialized respirators or other equipment, even if offered by Clemco, may have been manufactured or supplied by others. The information Clemco provides is intended to support the products Clemco manufactures. Users must contact each manufacturer and supplier of products used in the blast job for warnings, information, training, and instruction relating to the proper and safe use of their equipment.

GENERAL INSTRUCTIONS

This material describes some, but not all, of the major requirements for safe and productive use of blast machines, remote controls, respirator systems, and related accessories. All equipment and accessories must be installed, tested, operated and maintained only by trained, knowledgeable, experienced users.

The blast operator and all workers in the vicinity must be properly protected from all job site hazards including those hazards generated by blasting.

Work environments involving abrasive blasting present numerous hazards. Hazards relate to the blast process from many sources that include, but are not limited to, dust generated by blasting or from material present on the surface being blasted. The hazards from toxic materials may include, but are not limited to, silica, cyanide, arsenic, or other toxins in the abrasives or in the coatings, such as lead or heavy metals. Other hazards from toxins include, but are not limited to, fumes from coating application, carbon monoxide from engine exhaust, contaminated water, chemicals or asbestos. In addition, physical hazards that may be present include, but are not limited to, uneven work surfaces, poor visibility, excessive noise, and electricity. Employers must identify all job site hazards and protect workers in accordance with OSHA regulations.

Never modify Clemco equipment or components or substitute parts from other manufacturers for any Clemco components or parts. Any unauthorized modification or substitution of supplied-air respirator parts violates OSHA regulations and voids the NIOSH approval.

IMPORTANT

Contact Clemco for free booklets:

Blast Off 2 – Guide to Safe, Productive, and Efficient Abrasive Blasting, and Abrasive Blasting Safety Practices – Guide to Safe Abrasive Blasting.

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OPERATIONAL INSTRUCTIONS

OPERATOR SAFETY EQUIPMENT

WARNING

- OSHA regulation 1910.134 requires appropriate respiratory protection for blast operators and workers in the vicinity of blasting. These workers must wear properly-fitted, properly-maintained, NIOSH-approved, respiratory protection that is suitable for the job site hazards. Blast respirators are to be worn only in atmospheres not immediately dangerous to life or health from which wearers can escape without use of the respirator.
- The employer must develop and implement a written respiratory protection program with required worksite- specific procedures and elements for required respirator use. The employer must provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary.
- NEVER use abrasives containing more than one percent crystalline silica. Fatal diseases, such as silicosis, asbestosis, lead or other poisoning, can result from inhalation of toxic dusts, which include, but are not limited to, crystalline silica, asbestos, and lead paint. Refer to NIOSH Alert 92-102; and OSHA CPL 03-00-007: "National Emphasis Program – Crystalline Silica", in which OSHA describes policies and procedures for implementing a national emphasis program to identify and reduce or eliminate health hazards from exposure to crystalline silica. Numerous topics associated with the hazards of crystalline silica in silica blasting sand can be found on [http:// osha.gov/](http://osha.gov/). Clemco urges users of silica blasting sand to visit this website, and read and heed the information it contains.
- Always make sure the breathing air supply (respirator hose) is not connected to plant lines that supply gases that include, but are not limited to, oxygen, nitrogen, acetylene, or other non-breathable gas. Never modify or change respirator air line connections without first testing the content of the line for safe breathing air. Failure to test the line may result in death to the respirator user.

- Breathing air quality must be at least Grade D, as defined by the Compressed Gas Association specification G-7.1, per OSHA Regulation 29 CFR 1910.134. When compressed air is the breathing air source, a Clemco CPF (suitable sorbent bed filter) should be used. Respirator hose connecting the respirator to the filter must be NIOSH approved. Non- approved hose can cause illness from chemicals employed to manufacture the hose.

- All workers must always wear NIOSH-approved respirators when any dust is present. Exposure to dust can occur when handling or loading abrasive, blasting, cleaning up abrasive, or working in the vicinity of blasting. Before removing the respirator, test the air with a monitoring device to ensure it is safe to breathe.

- Clemco respirators DO NOT remove or protect against carbon monoxide or any other toxic gas. Monitoring devices must be used in conjunction with the respirator to ensure safe breathing air. Always locate compressors and ambient air pumps where contaminated air will not enter the air intake.

- Always use Clemco lenses with Clemco respirators; installing non-approved lenses voids the NIOSH approval. Respirator lenses are designed to protect the wearer from rebounding abrasive; they do not protect against flying objects, heavy high-speed materials, glare, liquids, or radiation.

INDUSTRY ORGANIZATIONS

For additional information, consult:

Occupational Safety and Health Administration (OSHA) - www.osha.gov

Compressed Gas Association (CGA) - www.cganet.com

The Society for Protective Coatings (SSPC) - www.sspc.org

National Association of Corrosion Engineers (NACE) - www.nace.org

American Society for Testing and Materials (ASTM) - www.astm.org

National Institute of Occupational Safety and Health (NIOSH) - www.niosh.gov

American National Standards Institute (ANSI) - www.ansi.org

PREFACE

BLAST MACHINES AND REMOTE CONTROLS

WARNING

OSHA regulation 1910.169 describes the necessity of pressure relief valves on compressed air equipment. Do not operate blast machines with air compressors that are not equipped with properly functioning pressure relief valves.

OSHA regulation 1910.244(b) requires the use of remote controls on blast machines.

Serious injury or death can result from many sources, among them:

- Involuntary activation of the remote controls. Never modify or substitute remote control parts; parts are not compatible among different manufacturers. Welding hose is not suitable for remote control hose. Its ID and material composition make it unsafe for remote control use.
- Exceeding the maximum working pressure. Clemco blast machines are built to ASME-code and carry a 'U' or 'UM' stamp, and National Board/serial number. Every machine is marked with its maximum working pressure. Never exceed the maximum working pressure limits of the blast machine.
- Uncontrolled blast stream. High-velocity abrasive particles will inflict serious injury. Always point the blast nozzle in the direction of the blast surface only. Keep unprotected workers out of the blast area.
- Welding on the blast machine. Never weld on the blast machine; welding voids the National Board approval and may affect the dimensional integrity of the vessel.
- Moving the blast machine. Never manually move a blast machine containing abrasive, any machine containing abrasive must be moved with appropriate mechanical lifting equipment.

HOSES, COUPLINGS, AND NOZZLE HOLDERS

- The inside diameter (ID) of air hoses, fittings, and connections should be at least four times larger than the nozzle orifice size. Blast hose ID should be three to four times the size of the nozzle orifice. Example: a #6 nozzle (3/8" diameter orifice) calls for 1-1/2" ID blast hose and 1-1/2" ID or larger compressor hose. All hose runs should be kept as short as possible and run in as straight a line as possible to reduce pressure loss.
- To install, squarely cut the end of the hose so that it fits snugly against the coupling or hose end shoulder. Always use the screws recommended by the manufacturer ensuring that they do not penetrate the inner wall. Make sure the couplings tightly fit the hose. Install cotter pins at every connection or use couplings with built-in lock-springs to prevent disengagement. Install safety cables at all connections to prevent whipping if hoses disengage or blow out.

MAINTENANCE AND REPAIR

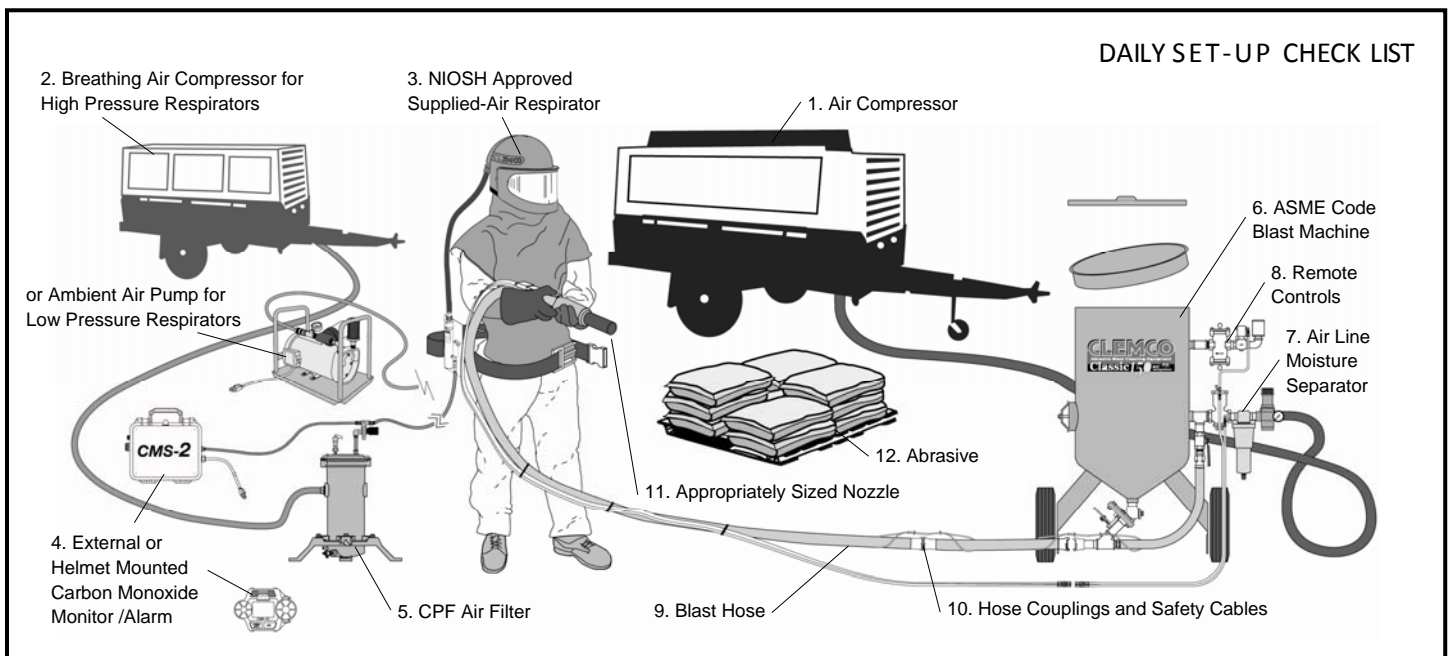
- Completely read and follow all service instructions and recommended maintenance intervals. Always shut off compressor and depressurize blast machine before performing any maintenance. At every service interval, clean all filters, screens, and alarm systems. If spring-loaded abrasive valves are used, always cage spring before disassembly.

WARRANTY

The following is in lieu of all warranties, express, implied or statutory, and in no event shall seller or its agents, successors, nominees or assignees, or either, be liable for special or consequential damage arising out of a breach of warranty. This warranty does not apply to any damage or defect resulting from negligent or improper assembly or use of any item by the buyer or its agent or from alteration or attempted repair by any person other than an authorized agent of seller. All used, repaired, modified, or altered items are purchased "as is" and with all faults. In no event shall seller be liable for consequential or incidental damages. The sole and exclusive remedy of buyer for breach of warranty by seller shall be repair or replacement of defective parts or, at seller's option, refund of purchase price, as set forth below

1. Seller makes no warranty with respect to products used other than in accordance hereunder.
 2. On products seller manufactures, seller warrants that all products are to be free from defects in workmanship and materials for a period of one year from date of shipment to buyer, but no warranty is made that the products are fit for a particular purpose.
 3. On products which seller buys and resells pursuant to this order, seller warrants that the products shall carry the then standard warranties of the manufacturers thereof, a copy of which shall be made available to the customer upon request.
 4. The use of any sample or model in connection with this order is for illustrative purposes only and is not to be construed as a warranty that the product will conform to the sample or model.
 5. Seller makes no warranty that the products are delivered free of the rightful claim of any third party by way of patent infringement or the like.
 6. This warranty is conditioned upon seller's receipt within ten (10) days after buyer's discovery of a defect, of a written notice stating in what specific material respects the product failed to meet this warranty. If such notice is timely given, seller will, at its option, either modify the product or part to correct the defect, replace the product or part with complying products or parts, or refund the amount paid for the defective product, any one of which will constitute the sole liability of the seller and a full settlement of all claims. No allowance will be made for alterations or repairs made by other than those authorized by seller without prior written consent of seller. Buyer shall afford seller prompt and reasonable opportunity to inspect the products for which any claim is made as above stated.
- Except as expressly set forth above, all warranties, express, implied or statutory, including implied warranty of merchantability, are hereby disclaimed.

PREFACE



Make sure all blast operators are properly trained and suitably attired with a blast suit, safety boots, leather gloves, respiratory and hearing protection. Every day before start up, check all equipment components, including piping, fittings, and hoses, and valves, for leaks, tightness, and wear. Repair or replace as needed. Use the following checklist.

- ☐ **1. PROPERLY-MAINTAINED AIR COMPRESSOR** sized to provide sufficient volume (cfm) at given pressure for nozzle and other tools. ADD 50% volume (cfm) reserve to allow for nozzle wear. Use large compressor outlet and air hose (at least 4 times the nozzle orifice diameter). For oil-lubricated compressors, the employer shall use a high- temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm. Follow the manufacturer's checklist and maintenance instructions.
- ☐ **2. BREATHING-AIR COMPRESSOR** (or oil-less ambient air pump) capable of providing Grade D quality air, located in a dust free area. Read # 1 above.
- ☐ **3. CLEAN, PROPERLY-MAINTAINED NIOSH-APPROVED SUPPLIED-AIR RESPIRATOR** worn by blast operators, and other workers exposed to blast dust. Make sure all respirator components are in place — all lenses, inner collar, and cape. Thoroughly inspect all components for wear. The NIOSH approval (approval number is listed in the owner's manual) is for a complete assembly from point of attachment on the CPF (sorbed bed) filter to the complete respirator. Substitution of any part voids the NIOSH approval.
- ☐ **4. CARBON MONOXIDE MONITOR/ALARM** installed at the CPF filter or inside the supplied-air respirator for monitoring for the presence of deadly CO gas and warning the operator(s) when the CO level reaches an unacceptable level. When an ambient air pump is used for breathing air, a CO monitor provides a measure of safety. Read # 1 above.
- ☐ **5. BREATHING-AIR FILTER (OSHA-REQUIRED sorbent bed filter)** for removal of moisture and particulate matter in the compressed air breathing-air supply. Monitor the condition of the cartridge and replace when odor is detected or at 3 month intervals, whichever comes sooner. The breathing air filter does NOT detect or remove carbon monoxide (CO). Always install a CO monitor/alarm.
- ☐ **6. BLAST MACHINE** (bearing U or UM stamp, National Board Number, and Maximum Working Pressure) sized to hold a 30-minute abrasive supply. Examine pop-up valve for alignment. Check piping, fittings, screens, valves for tightness, leaks, and wear. Always ground the machine to eliminate hazard of static shock. Install a blast machine screen to keep out foreign objects. Use a blast machine cover if left outdoors overnight. Never exceed the maximum working pressure of the vessel.

- ☐ **7. AIR LINE FILTER** (moisture separator) installed as close as possible to the blast machine inlet and sized to match the size of the inlet piping or larger air supply line. Clean filter and drain often. Damp abrasive causes operational problems.
- ☐ **8. REMOTE CONTROLS** are required by OSHA and must be in perfect operating condition. Test and check all components to ensure all parts are present and fully functional. Use genuine replacement parts. NEVER mix parts from different manufacturers. Never use welding hose for remote control hose.
- ☐ **9. BLAST HOSE** should have an inside diameter sized to suit the blast nozzle. The ID should be three to four times the size of the nozzle orifice diameter. Blast hose should be arranged in as straight a line as possible from the blast machine to the work area, avoiding sharp bends.
- ☐ **10. COUPLINGS AND NOZZLE HOLDERS** should fit snugly on the hose and be installed with manufacturer recommended screws. Coupling lugs must snap firmly into locking position. Gasket must always be used to form a positive seal, and cotter pins must be installed. Replace gasket when wear, softness or distortion is detected. Check nozzle holder for thread wear; replace at any sign of wear. Install safety cables at all connections.
- ☐ **11. NOZZLE** orifice size should be checked and nozzle replaced when worn 1/16" from original size. (No. 5 nozzle has 5/16" orifice diameter; replace when it measures 3/8"). Threads should be inspected daily for wear and nozzle should be replaced when wear is detected. Always use a nozzle washer.
- ☐ **12. ABRASIVE** must be a material specifically manufactured for blasting. It should be properly sized for the job. Check material safety data sheet for free-silica, cyanide, arsenic, lead and other toxins and avoid use when these toxic, harmful substances are present.
- ☐ **SURFACE TO BE BLASTED** should be examined for hazardous substances. Take appropriate protective measures as required by OSHA to ensure the blast operator, other workers in the vicinity, and any bystanders are properly protected.

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1.0 INTRODUCTION

1.1 Scope of manual

1.1.1 These instruction covers the set-up, operation, maintenance, troubleshooting, and replacement parts for Clemco's Wetblast FLEX™ LP water injection abrasive blast system with model, 2448 6-cu. ft. capacity blast machine and low-pressure blasting option.

The following manuals are for accessories provided with a FLEX™ package.

CPF Particulate Air FilterManual No. 04143
APOLLO 600 HP RespiratorManual No. 23930
Clem-Cool Air ConditionerManual No. 23837

1.1.2 Important safety information: All operators and personnel involved with the abrasive blast process must read and understand the contents of these instructions, including the orange cover. It is equally important that the blast operator is trained and qualified to safely operate the blast machine and remote controls, and all other equipment used with the blast machine system.

1.1.3 All personnel involved with the abrasive blast process must be made aware of the hazards associated with abrasive blasting. The Clemco booklet "Abrasive Blasting Safety Practices" is included with every blast machine, and contains important safety information that may not be included in equipment operation manuals. To order additional copies, visit www.clemcoindustries.com or info@clemcoindustries.com.

1.2 Safety Alerts

1.2.1 Clemco uses safety alert signal words, based on ANSI Z535.4-2011, to alert the user of a potentially hazardous situation that may be encountered while operating this equipment. ANSI's definitions of the signal words are as follows:



This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

NOTICE

Notice indicates information that is considered important, but not hazard-related, if not avoided, could result in property damage.

CAUTION

Caution indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

WARNING

Warning indicates a hazardous situation that, if not avoided, could result in death or serious injury.

DANGER

Danger indicates a hazardous situation that, if not avoided, will result in death or serious injury.

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1.4 Components

1.4.1 The primary components of the blast and injector system are shown in Figure 1. They include:

1. 6 cu. ft. capacity blast machine equipped for low pressure blasting with Millennium remote controls and pneumatically-operated Auto-Quantum abrasive metering valve.
2. Low-pressure blasting, pressure-regulator circuit.
3. Wetblast injector™ system.
4. 120-gallon capacity water tank.
5. Transport platform and frame assembly with forklift pockets and lifting eyes.
6. All interconnecting plumbing and controls.

1.4.2 Optional accessory package includes operator safety equipment, coupled blast hose, nozzle, and related spare parts.

1.5 Instruction Maintenance Manuals

1.5.1 After reviewing all the manuals, and start-up and adjustments are completed, store manuals in a convenient location for future reference.

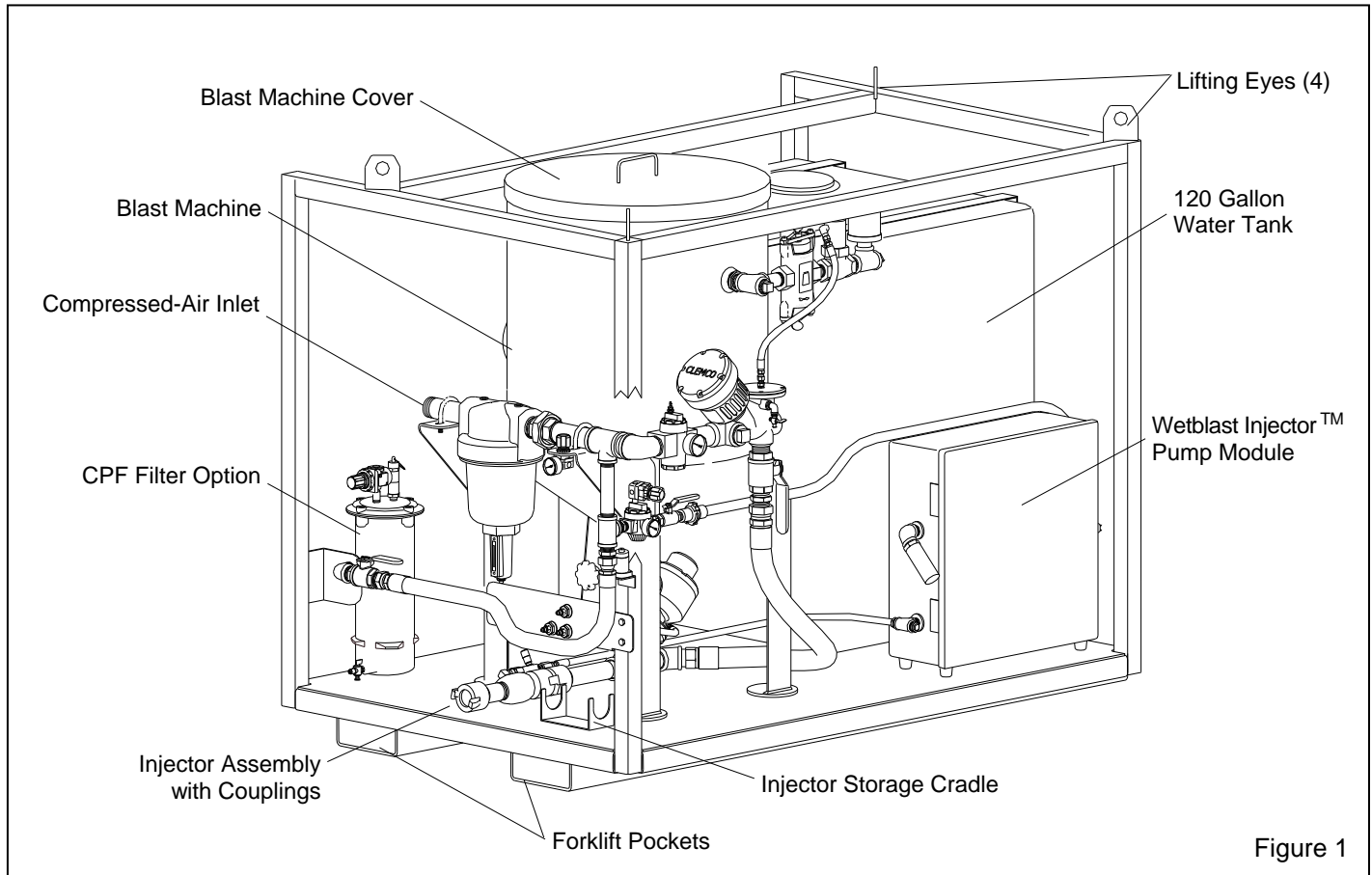


Figure 1

1.6 Description and Operating Principles

1.6.1 Blast machine Components are shown in Figure 2

1.6.1.1 Blast machine operation is controlled using pressure-release-style remote controls, which enable the pressurization and depressurization of the blast machine. Pressurization, which starts blasting, occurs when the operator presses the control handle. Depressurization, which stops blasting, occurs when the handle is released. Refer to Section 1.6.2 for remote control operating principles.

1.6.1.2 Blasting may be done at pressures as low as 5 psi to a maximum of 120 psi. The low-pressure-blasting option utilizes line pressure to initially seal the machine, but immediately drops to the pressure set at the blast-pressure pilot regulator. Refer to Section 5.2 to adjust blast pressure.

1.6.1.3 Clemco blast machines (pressure vessels) are certified to conform to the ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, Division 1. It is the owner's

responsibility to maintain the integrity of the vessel in accordance with state regulations. Regulations may include regular inspection and hydrostatic testing as described in National Board inspection code and jurisdictional regulations and/or laws.

⚠ WARNING

Welding, grinding, or drilling on the blast machine can weaken the vessel. Compressed air pressure can cause a weakened blast machine to rupture, resulting in death or serious injury. Welding, grinding, or drilling on the vessel, without a National Board R stamp, voids the Clemco ASME certification.

1.6.1.4 All welding repairs to the vessel must be performed by certified welders at shops holding a National Board R Stamp. Welding performed by any welder not properly qualified per the ASME code voids the Clemco ASME certification.

1.6.1.5 Do not exceed the maximum working pressure rating (PSI) of the blast machine. The maximum pressure rating is stamped into the ASME nameplate which is welded to the side of the vessel.

⚠ WARNING

Excessive compressed air pressure can cause a blast machine to rupture. To prevent serious injury or death, do not exceed the rated pressure of the blast machine.

1.6.1.6 OSHA does not require pressure relief valves on blast machines when air compressors supplying air to the blast machines are built to ASME⁽¹⁾ code and comply with OSHA⁽²⁾ regulations. OSHA regulation 1910.169 refers to the ASME code when describing the necessity of pressure relief valves on compressed air equipment. **DO NOT** operate blast machines with air compressors that are not equipped with properly-functioning pressure relief valves.

⁽¹⁾ American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section VIII, Division 1,

⁽²⁾ Occupational Safety and Health Administration, 29 CFR 1910, 169.

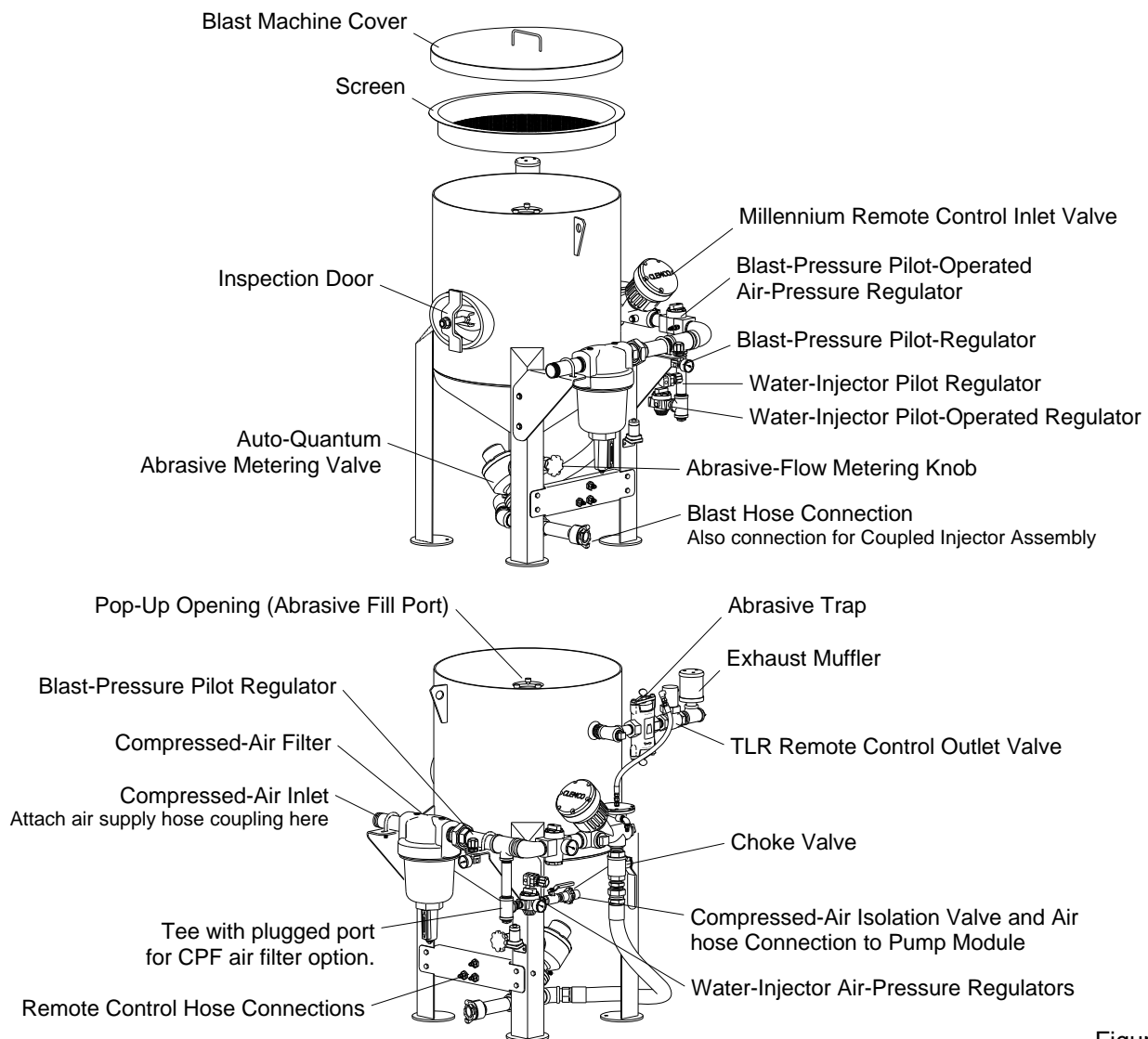


Figure 2

1.6.2 Remote controls with abrasive cut-off (ACS) Components are shown in Figure 3

1.6.2.1 The blast machine is equipped with remote controls that allow the blast operator to pressurize the machine to start blasting, and depressurize it to stop blasting, from a control handle located at the nozzle.

1.6.2.2 The remote control system is an OSHA-required safety device. The control handle, located near the blast nozzle, is the activator for the remote control system. When the blast operator intentionally or unintentionally removes hand-held pressure from the control handle, the machine depressurizes, stopping air and abrasive flow through the nozzle. The remote control system “fails to safe”, which means when any interruption in the control-air circuit occurs, for any reason such as a break in the control line, the compressor stops running, or should the operator drop the blast hose, the remote control depressurizes the blast machine and blasting stops.

⚠ WARNING

Never modify or substitute remote control parts. Parts from other manufacturers are not compatible with Clemco equipment. If ANY part of the remote control system is altered, involuntary activation, which may cause serious injury, can occur.

1.6.2.3 The components of the remote control system are shown in Figure 3. They include the Millennium inlet valve, piston-style outlet valve, RLX control handle, 50-ft. twinline and single-line control hoses and all interconnecting hoses and fittings.

⚠ WARNING

Moist air that freezes can cause blockage at the control handle or in the control lines. Blockage can cause involuntary activation of the remote controls, or prevent the controls from deactivating upon release of the control handle. This situation can result in serious injury or death. If remote controls are operated in freezing or near freezing weather, install a Clemco Anti-Freeze Injector, stock no. 05537, on the remote control air supply line.

1.6.2.4 Clemco remote controls operate pneumatically on return air. Control air travels from the orifice fitting located on the inlet end of the blast-pressure regulator, down the outbound line (shown shaded in Figure 3) and escapes through the opening located under the RLX control handle lever. The normally-closed inlet valve remains closed, and the normally-open outlet valve remains open. As long as air escapes through the handle's opening, the remote control system remains dormant.

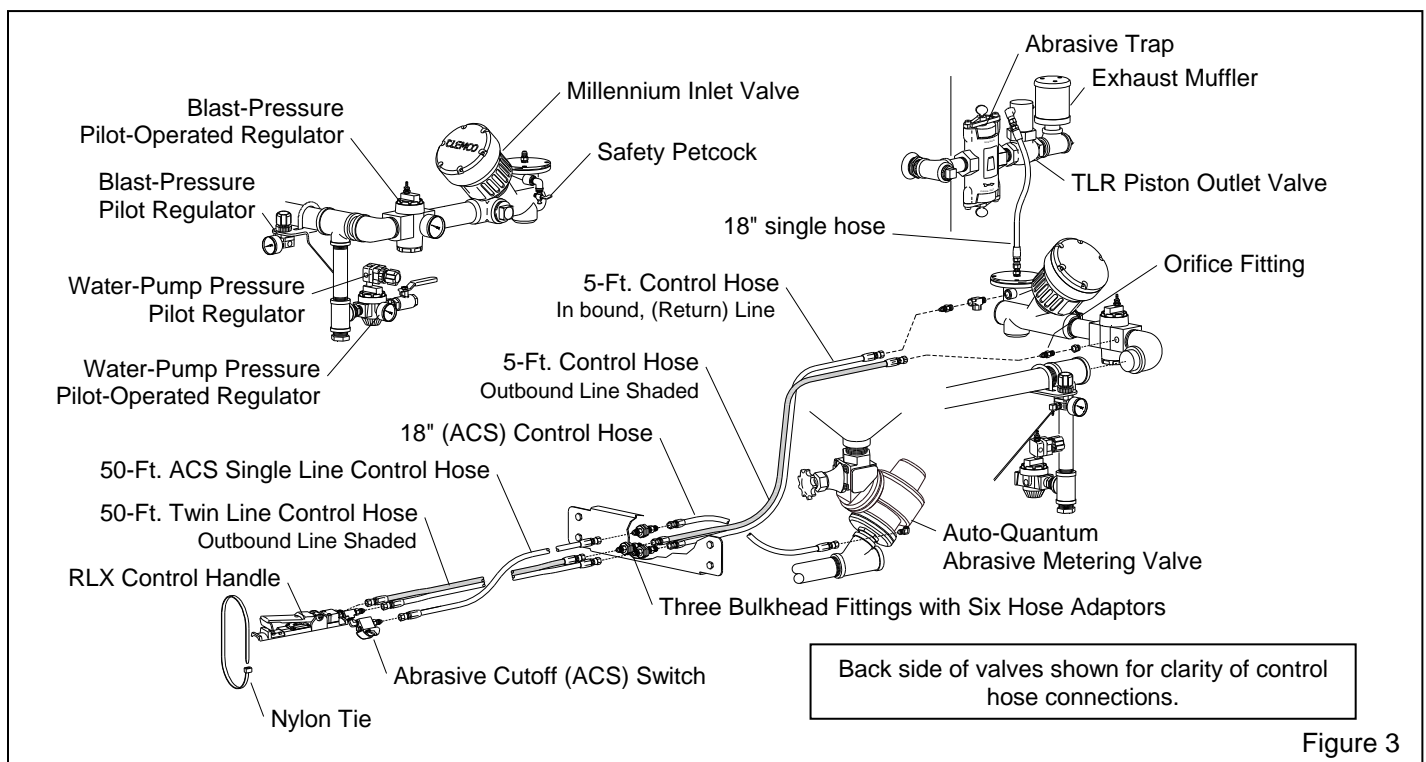


Figure 3

1.6.2.5 When the lever is pressed, a rubber button seals the opening, and outbound air returns through the inbound line to open the inlet valve and close the outlet valve. This action pressurizes the blast machine and begins the blasting. Releasing the handle exhausts the control air, which causes the inlet valve to close, and the outlet valve to open to depressurize the blast machine and stop the blasting.

1.6.2.6 Abrasive cut-off switch (ACS)

1.6.2.6.1 The abrasive cut-off switch is situated directly behind the RLX control handle. It closes the metering valve so that air alone, without abrasive exits the nozzle. This feature is used to clear the blast hose and to blow-down and wash-down the blast surface. The switch may be toggled from open to closed at any time, but will not operate the metering valve unless the control handle is pressed.

1.6.3 Injector pump module **Components are shown in Figure 4**

1.6.3.1 The pump module houses a 10:1 compressed-air driven water pump. Within the enclosure, just prior to the pump, the air line is fitted with an oil lubricator to lubricate the pump.

1.6.3.2 External inlet connections are located on the right side on the enclosure. They include the compressed air supply connection and water supply connection and strainer. The water supply hose from the water storage tank is attached; use the angled water supply connections when using pressurized water from a faucet.

1.6.3.3 External outlet connections are located on the left side of the enclosure and include the exhaust muffler and hydraulic hose connections.

1.6.3.4 The water outlet tee is for attaching the hydraulic starter hose; this hose connects to the coupled injector assembly when using the injector at the blast machine, as shown in Figure 4 and Figure 9. The tee also has a plug on the unused leg; when using the nozzle injector with a separate (additional) blast machine, remove the plug and attach the hydraulic.

1.6.3.5 The air supply for the pump comes from a set of pressure regulators located on the blast machine inlet piping. Presetting the pilot regulator permits the main, pilot-operated regulator to open and supply air to the pump when the blast machine pressurizes and stops when the blast machine depressurizes.

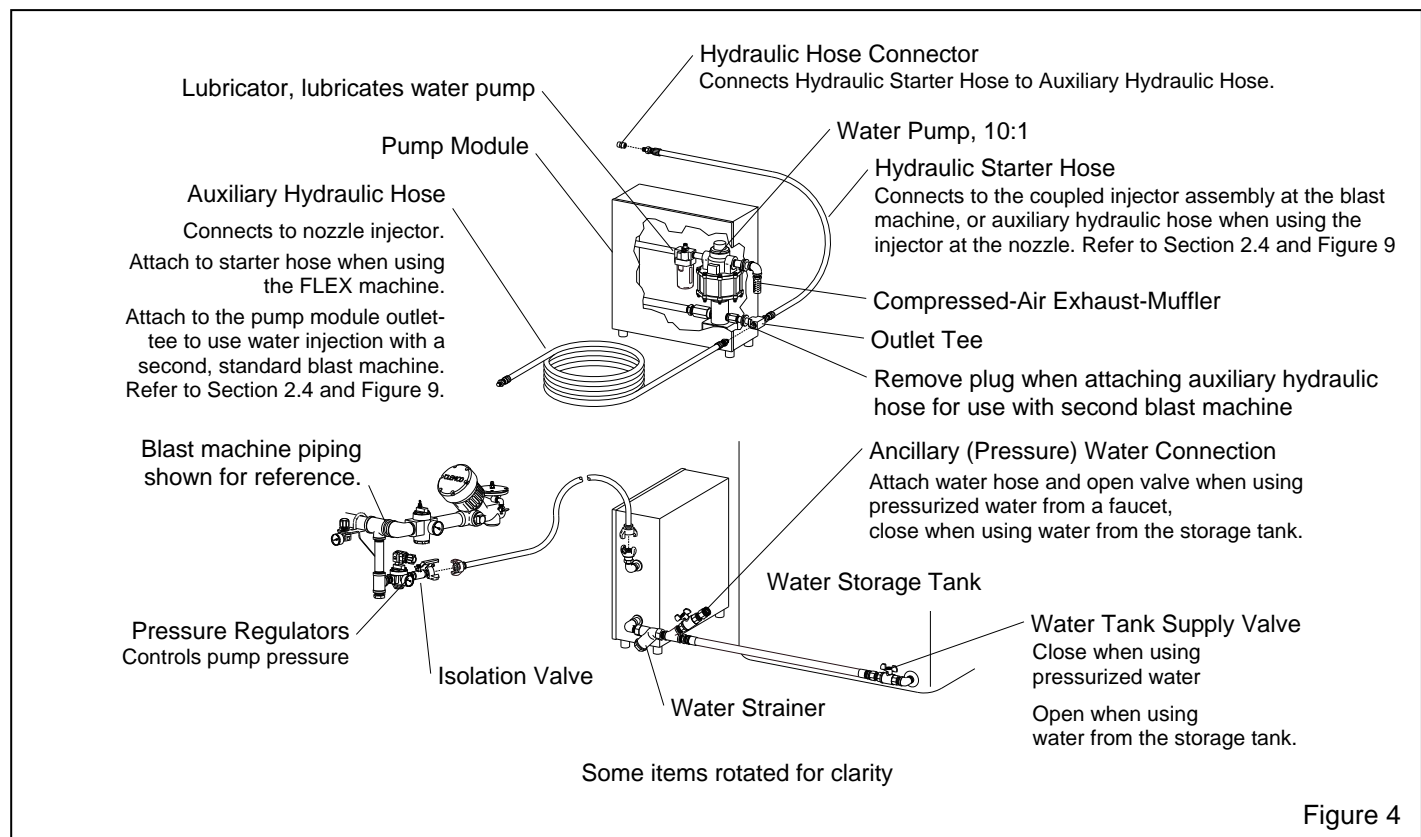
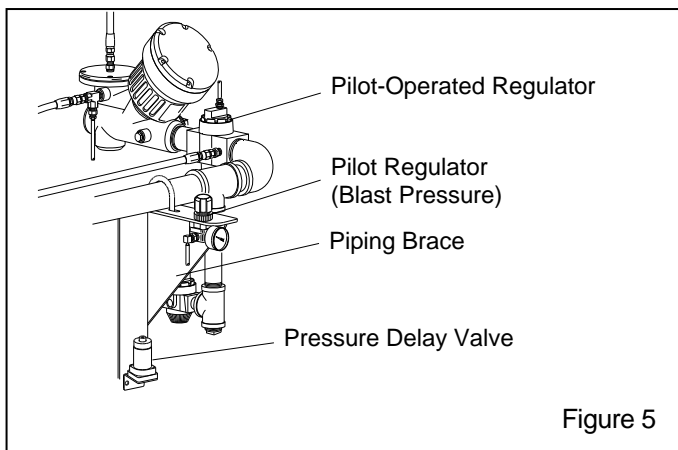


Figure 4

1.7 Low-Pressure Blasting

1.7.1 Blasting may be done at pressures lower than the 40 to 50 psi required for pressurizing the blast machine. The low-pressure-blasting feature utilizes line pressure to initially seal the machine, but before the vessel's pressure increases, it drops to the pressure set at the blast-pressure pilot regulator.

1.7.2 The primary components of the low pressure regulator assembly are shown in Figure 5.



1.8 Abrasive

⚠ WARNING

Before blasting obtain a safety data sheet (SDS) for the blast abrasive and identify all substances removed by the blasting process. Abrasive containing crystalline (free) silica or toxic metals can lead to serious or fatal lung disease. Consult OSHA regulations concerning the use of abrasive containing free silica and toxic metals.

Note: Selection of blasting abrasive can adversely affect the health risk to the operator, productivity, and maintenance of the blast machine. DO NOT USE abrasives containing more than one percent crystalline (free) silica. Obtain safety data sheets (SDS) for the blasting abrasive prior to blasting, paying particular attention to the health risks and presence of any hazardous/toxic substances.

1.8.1 The system can use any non-metallic abrasives specifically manufactured for blast cleaning, that are compatible with the surface being blasted. Abrasives commonly chosen for most applications include crushed glass or garnet.

1.8.2 Abrasive mesh size: The choice of abrasive size depends on the desired profile, cleaning rate, nozzle size and availability of clean dry air. Generally, larger and denser abrasives provide a deeper profile, while smaller abrasives clean faster. Most abrasive blasting is done with abrasive sizes between 16 and 80 mesh. Finer abrasives are especially sensitive to moisture and require very dry air to prevent bridging in the metering valve.

1.8.3 Sand: Sand should NEVER be used because of the respiratory hazards associated with the use of abrasive containing free silica.

1.8.4 Slags: Slag abrasives may be used. Obtain a safety data sheets (SDS).

1.8.5 Steel: Steel shot and steel grit are not suitable for the wetblast injector™ system.

1.8.6 Silicon carbide, aluminum oxide, and garnet: These are the most aggressive of the commonly used abrasives. Aggressive abrasives may be used, but the service life of any equipment components which come in contact with the abrasive will be reduced. Use a nozzle lined with boron carbide with these abrasives.

1.8.7 Crushed glass: Crushed glass absorbs moisture from moderately-high ambient humidity. Glass subjected to moisture may be reused only after thorough drying and breaking up of any clumps.

1.9 Transporting and Moving

⚠ WARNING

- **Make sure the water tank and all other equipment are securely attached to the platform and that tie-down straps are secure.**
- **Use lifting eyes or forklift slots when lifting or moving the machine. Never move or hoist the machine by the any other means.**
- **Always use lift equipment that is rated higher than the weight of the machine and accessories.**
- **Use a spreader for uniform, vertical lift on each lifting eye.**
- **Always secure the platform and frame to the transport vehicle.**
- **Anyone using material handling equipment to move, transport, or lift the machine must be trained and experienced with the hazards associated with this type of machinery.**
- **Failure to observe these warnings can result in serious injury or death.**

2.0 INITIAL SET-UP

WARNING

Moist air that freezes can cause blockage at the control handle or in the control lines. Blockage can cause involuntary activation of the remote controls, or prevent the controls from deactivating upon release of the control handle. This situation can result in serious injury or death. If remote controls are operated in freezing or near freezing weather, install a Clemco Anti-Freeze Injector, stock no. 05537, on the remote control air supply line.

2.1 Compressed-Air Supply and Air Hose Connection

2.1.1 Install an air supply hose coupling that is compatible with the compressed-air supply hose from the compressor, to the compressed-air filter at the blast machine inlet piping. For best blasting performance, use 1-1/4" ID or larger air line when using up to a 5/16" orifice nozzle, 1-1/2" or larger when using up to a 3/8" nozzle, and 2" or larger when using up to a 1/2" nozzle.

Refer to the compressed air table in Figure 6 for approximate air consumption.

2.2 Nozzle and Blast Hose Ratios

2.2.1 To prevent water, air, and abrasive surging at the nozzle, it is especially important that the ratio of the nozzle orifice size (smallest inside diameter) and the blast hose inside diameter are maintained. A proper ratio ensures that the velocity inside the hose is sufficient to keep the water, air, and abrasive mixture suspended and flowing evenly through the nozzle, while minimizing blast hose wear. **Proper sizing is especially important when the water injector is placed at the blast machine.**

Note: When blasting at low pressure (between 50 psi and 70 psi), reducing the ID of the hose by one size maintains velocity within the hose and help to keep abrasive suspended and flowing smoothly.

2.2.2 The recommended nozzle/hose combinations are:

No. 4, 1/4" orifice use 1" ID blast hose
No. 5, 5/16" orifice use 1" ID blast hose
No. 6, 3/8," orifice use 1-1/4" ID blast hose
No. 7, 7/16" orifice use 1-1/4" ID blast hose
No. 8, 1/2" orifice use 1-1/4" or 1-1/2" ID blast hose

COMPRESSED AIR CONSUMPTION TABLE

Nozzle Orifice Size (in.)	Pressure at the Nozzle (psi)								Air, Power Requirements
	50	60	70	80	90	100	125	140	
No. 3 3/16"	26 6	30 7	33 8	38 9	41 10	45 10	55 12	61 14	Air (cfm) Compressor (hp)
No. 4 1/4"	47 11	54 12	61 14	68 16	74 17	81 18	98 22	108 24	Air (cfm) Compressor (hp)
No. 5 5/16"	77 18	89 20	101 23	113 26	126 28	137 31	168 37	186 42	Air (cfm) Compressor (hp)
No. 6 3/8"	108 24	126 28	143 32	161 36	173 39	196 44	237 52	263 59	Air (cfm) Compressor (hp)
No. 7 7/16"	147 33	170 38	194 44	217 49	240 54	254 57	314 69	347 77	Air (cfm) Compressor (hp)
No. 8 1/2"	195 44	224 50	252 56	280 63	309 69	338 75	409 90	452 101	Air (cfm) Compressor (hp)

- * When using 3/8" to 1/2" orifice nozzles, blast machines should be equipped with 1-1/4" or larger piping and inlet valve to prevent pressure loss.
- * Air requirements were measured by a flow meter under actual blasting conditions, and are therefore lower than figures for air alone, with no abrasive.
- * Horsepower requirements are based on 4.5 cfm per horsepower.
- * Figures show approximate compressed air and abrasive consumption when nozzles are new. Consumption will increase as the nozzle wears.

Figure 6

2.3 Blast Hose and Control Hose Connections

Most accessories are factory installed; the following instructions are for those systems ordered without accessories and to install replacement hoses.

2.3.1 Uncoil the blast hose, and lay the 50-ft. twinline hose and 50-ft. single-line hose alongside it. Hoses should be of equal length.

2.3.2 Band the control handle to the blast hose close to the nozzle holder as shown in Figure 7. Use the two nylon ties provided or similar means to secure the control handle to the hose. Once the handle control is firmly attached, clip the tie ends so they do not snag the operator's clothing or interfere with the operation of the control handle.

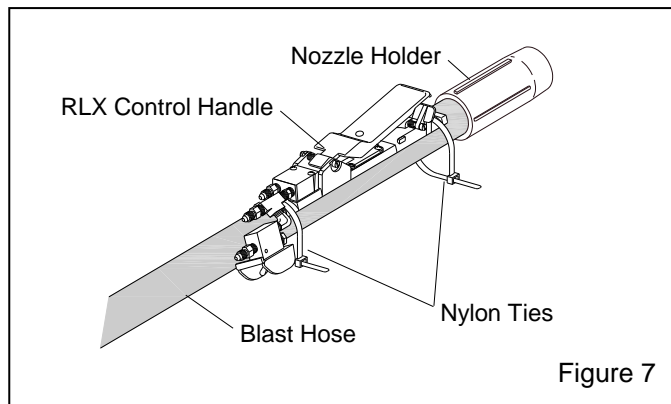


Figure 7

2.3.3 Refer to Figure 8 and attach the 50-ft. twinline hose to the two fittings on the back of the control handle. Either side of the hose can be attached to either fitting.

2.3.4 Attach the 50-ft. single-line control hose to the fitting on the ACS switch mounted on the control handle.

2.3.5 Make sure all fittings are tight. Leaks will cause the system to malfunction.

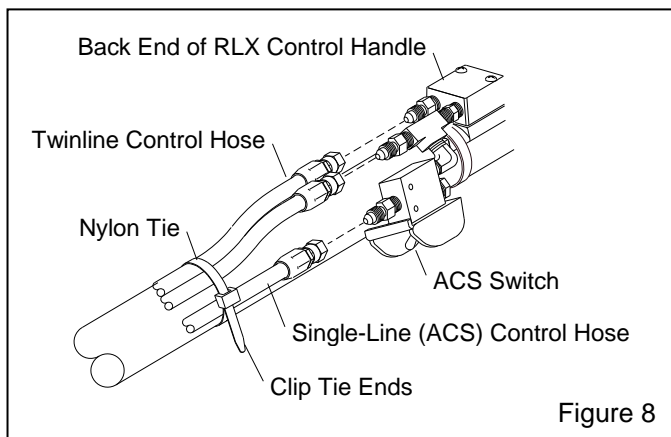


Figure 8

2.3.6 Working from the control handle back, band the twinline and single-line hoses to the blast hose every four to six feet, as shown in Figure 8, and as close to the couplings as possible.

2.3.7 Place the nozzle washer in the nozzle holder, and screw the nozzle into the holder. The nozzle must seat tightly against the nozzle washer.

2.4 Wetblast Injector™ Placement Options

2.4.1 The injector may be placed in one of two locations as follows and as shown in Figure 9.

Note: The system includes a coupled injector assembly, which is installed at the blast machine, and a threaded injector, which is installed at the nozzle. The pump module is capable of supporting two injectors; the threaded injector could be installed on the blast hose of second, separate blast machine, using the 52 ft. hydraulic hose provided, this allows water-injection wetblasting with a second blast machine. Refer to Sections 2.4.4 and 3.3.3.

2.4.2 Coupled injector at the blast machine

Refer to the upper illustration in Figure 9.

2.4.2.1 The upper illustration in Figure 9 shows the injector installed onto a pipe assembly with quick couplings, and attached to the blast machine's blast hose connection. The benefits of this installation are:

- The operator does not have to manage the additional bulk and weight of the hydraulic water hose.
- After the injector assembly is attached to the 5-ft. hydraulic starter-hose, it does not need to be removed when blasting is finished. The injector is easily attached and detached using twist-on quick couplings. When not in use it can be stored in the storage cradle on the platform.
- Connecting and disconnecting the blast hose and control hoses are fast and simple.
- The operator controls the following functions from the nozzle.
 - Starts and stops blasting.
 - Starts and stops abrasive flow. Shutting off abrasive flow allows air and water to continue from the nozzle for washing-off the blast surface. It also clears the blast hose of abrasive before shutting OFF the blast machine.

2.4.2.2 Apply thread sealant to the male threads on the hydraulic starter hose and screw the hose into the flow control valve (installed on the injector assembly) as shown in the upper illustration in Figure 9.

2.4.3 Injector at the nozzle

Refer to the lower illustration in Figure 9.

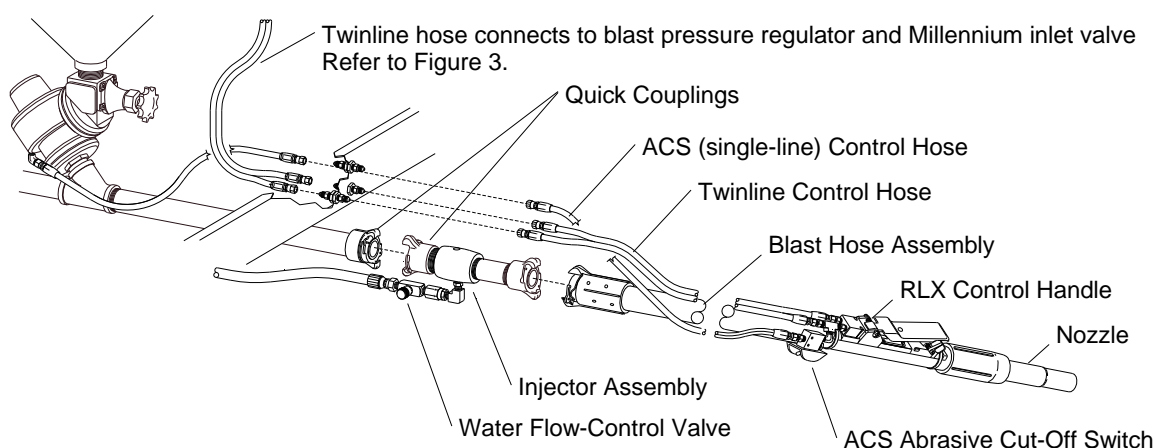
Note: The nozzle injector may also be installed on the blast hose of a second blast machine, refer to Sections 2.4.4, 3.3.3 and 4.10.

2.4.3.1 The lower illustration in Figure 9 shows the injector installed at the nozzle. The benefits of this set up are:

- The operator controls the following functions from the nozzle.
 - Starts and stops blasting.

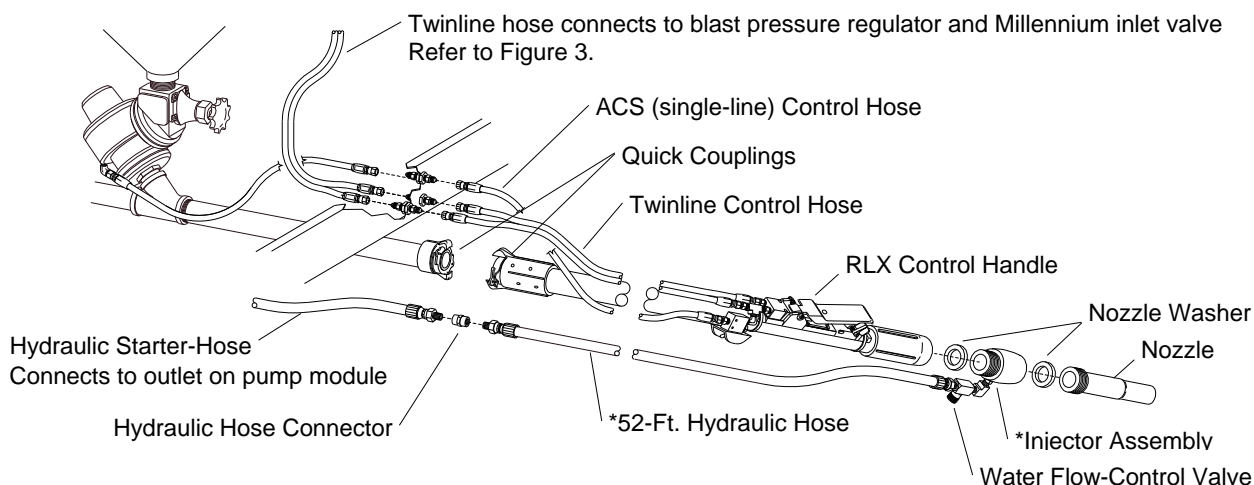
- Starts and stops abrasive flow. Shutting off abrasive flow allows air and water to continue from the nozzle for washing-off the blast surface. It also clears the blast hose of abrasive before shutting OFF the blast machine.
- Controls water flow from start and stop to adjusting water flow rate.

2.4.3.2 Apply thread sealant to the male threads on one end of the 52-ft. hydraulic hose and to the 5-ft. hydraulic starter hose, then connect the hoses using the connector as shown in the illustration.



Injector Installed at the Blast Machine

Some items are removed or rotated for clarity



* This hose and injector could be connected to the outlet tee on the pump module for use on a second blast machine as noted in Section 2.4.4, while the coupled injector is installed at the blast machine as shown in upper illustration.

Injector Installed at the Nozzle

Some items are removed or rotated for clarity

Figure 9

2.4.4 Using injector with separate blast machine

NOTICE

For both injectors to work independent of the other, the pump-pressure pilot-regulator must be equipped with the optional shuttle valve kit. Without the shuttle valve, water injection to the separate blast machine will stop when the FLEX machine operator stops blasting.

2.4.4.1 When using the injector system to provide wetblasting capability to a second blast machine, refer to the following instructions to install a shuttle valve on the air supply side of the water-pump pilot-regulator.

2.4.4.2 Make sure the compressed air supply is locked out and tagged out and the air line is bled.

WARNING

Failure to observe the following before performing any maintenance can cause serious injury or death from the sudden release of compressed air.

- **Depressurize the blast machine.**
- **Lockout and tagout the compressed air supply**
- **Bleed the air supply line to the blast machine.**

2.4.4.3 Temporarily remove the existing urethane control tubing and 1/8-NPT barb fitting from the bushing on the water-pump pilot-regulator as shown in Figure 10.

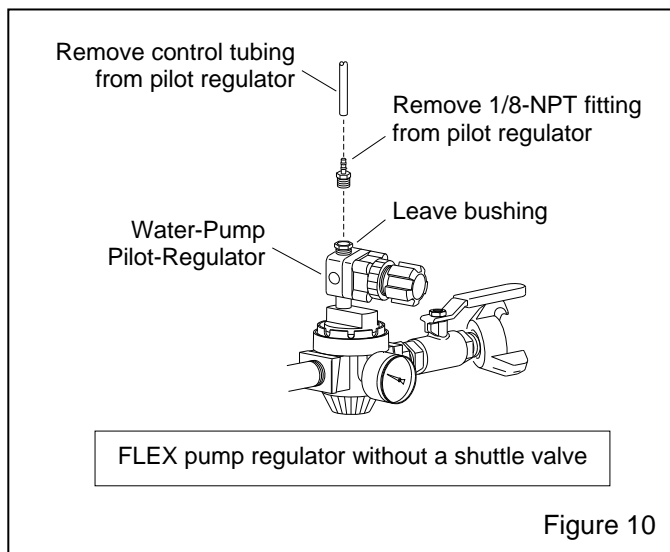


Figure 10

2.4.4.4 Apply pipe thread sealant on all male pipe threads and install shuttle valve and fittings as shown in Figure 11.

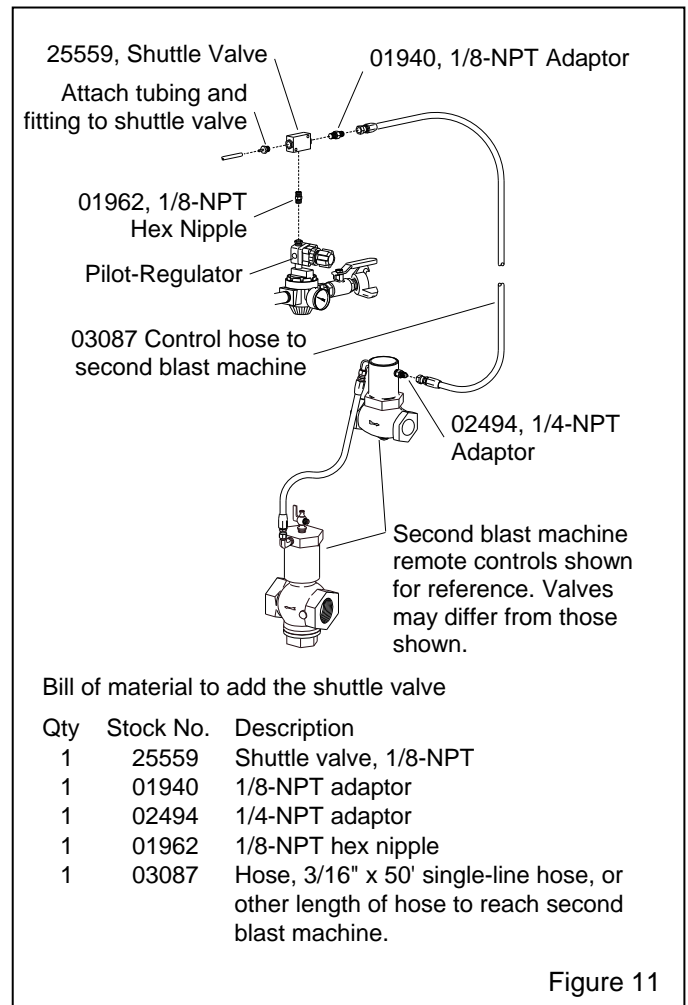


Figure 11

2.5 Breathing Air Connections, Optional CPF Filter, Refer to Figure 12.

Refer to CPF Owner's Manual 04143 for operating instructions.

Note: Use pipe thread sealant on all male pipe threads. Sealant is not required on JIC threads.

2.5.1 Make sure the compressed air supply is locked out and tagged out and the air line is bled.

2.5.2 Remove the pipe plug from the accessory tee and install the 1"-NPT x 1"-JIC adaptor.

2.5.3 Thread the 1" lock nut onto the elbow; make sure the concave side of the nut is facing toward the air filter.

2.5.4 Insert the elbow through the mounting bracket and tighten it into the CPF inlet port.

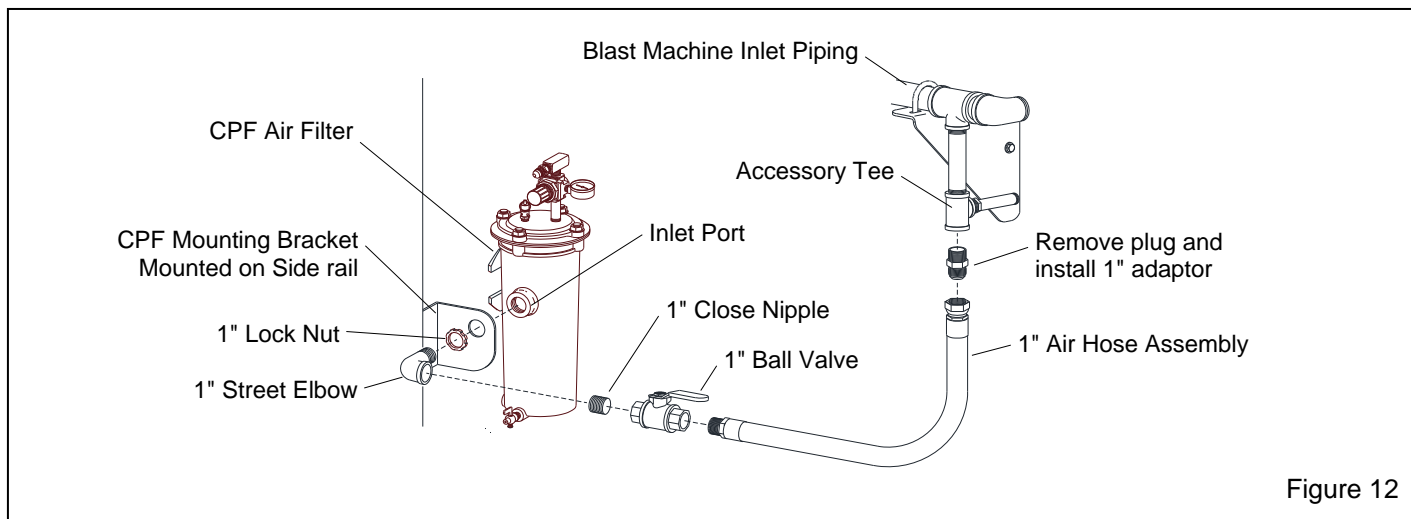


Figure 12

2.5.5 Tighten the lock nut against the mounting bracket to secure.

2.5.6 Install the close nipple, ball valve and male end of the hose assembly into the elbow, as shown in Figure 12.

2.5.7 Attach the female end of the air hose assembly to the adaptor on the accessory tee.

2.5.8 Open and close the ball valve as needed to supply air to the CPF filter.

3.1.1 Make sure the water tank supply valve and ancillary water supply valves are shut OFF; valves are off when the handles are perpendicular (90°) of the valve.

3.1.2 Unscrew the lid and fill the tank with water. Securely attach lid when the tank is full.

Note: When rust inhibitor or other additives are required they should be mixed with the water at the recommended dilution.

3.0 ROUTINE SET-UP

3.1 Filling Water Tank

Note: If pressurized water (water from a faucet) is available, a water hose may be attached directly to the ancillary water connection on the platform as shown in Figure 4. When using pressurized water, make sure the water tank supply valve is closed. Water supply from a pressurized source must not exceed 150 psi.

NOTICE

Pressurized water can pass through the pump when the pump is not running. When water from a pressure source (faucet) is used, the flow control valve must be turned off as soon as the operator stops blasting. Failure to shut off the flow control valve can cause water to enter the blast hose and possibly the blast machine.

3.2 Attach Compressed-Air Supply

3.2.1 Locate the compressor upwind from the blasting operation to prevent contaminated air from entering the compressor intake.

3.2.2 Connect an air supply line from the compressor to the air hose connector previously installed on the blast machine's inlet filter.

3.2.3 Make sure that all compressed-air supply hose connections are secured with safety lock pins and safety cables to prevent accidental separation or disconnection. Safety cables are listed in Section 9.1 of this manual.

⚠ WARNING

Hose disconnection while under pressure can cause serious injury or death. Use safety lock pins and safety cables on all coupling connections to help prevent hose couplings from accidental disconnection.

3.3 Wetblast Injector™ Placement Options

3.3.1 Injector at the blast machine

Refer to the upper illustration in Figure 9.

3.3.1.1 Make sure the coupling gaskets are in place and in good condition before connecting the injector assembly with couplings to the blast machine's hose coupling. Note that the coupling on the flow-control end of the assembly connects to the blast machine.

3.3.1.2 Make sure the coupling gaskets are in place and in good condition before connecting the blast hose to the quick coupling on the injector assembly.

3.3.1.3 Make sure that all blast hose connections and compressed-air supply hose connections are secured with safety lock pins and safety cables to prevent accidental separation or disconnection. Safety cables are listed in Section 9.1 of this manual.

WARNING

Hose disconnection while under pressure can cause serious injury or death. Use safety lock pins and safety cables on all coupling connections to help prevent hose couplings from accidental disconnection.

3.3.1.4 Attach the twinline control hose to the two lower fittings on the blast machine's cross-panel. Either side of the hose can be attached to either fitting.

3.3.1.5 Attach the single ACS line to the upper fitting on the panel.

3.3.1.6 Make sure all fittings are tight. Leaks will cause the system to malfunction.

3.3.1.7 Place the nozzle washer in the nozzle holder, and screw the nozzle into the holder. The nozzle must seat tightly against the nozzle washer.

3.3.1.8 Proceed to Section 4.0.

3.3.2 Injector at the nozzle

Refer to the lower illustration in Figure 9.

Note: The Nozzle injector may also be installed on the blast hose of another separate blast machine, refer to the lower illustration in Figure 9, Figures 10 and 11, and Sections 2.4 and 4.10.

3.3.2.1 Make sure the coupling gaskets are in place and in good condition before connecting the blast hose to the quick coupling on the blast machine.

3.3.2.2 Make sure that all blast hose connections and compressed-air supply hose connections are secured with safety lock pins and safety cables to prevent accidental separation or disconnection. Safety cables are listed in Section 9.1 of this manual.

WARNING

Hose disconnection while under pressure can cause serious injury or death. Use safety lock pins and safety cables on all coupling connections to help prevent hose couplings from accidental disconnection.

3.3.2.3 Attach the twinline control hose to the two lower fittings on the blast machine's cross-panel. Either side of the hose can be attached to either fitting.

3.3.2.4 Attach the single ACS line to the upper fitting on the panel.

3.3.2.5 Make sure all fittings are tight. Leaks will cause the system to malfunction.

3.3.2.6 Place a nozzle washer in the nozzle holder and screw the injector assembly into the holder. The injector must seat tightly against the nozzle washer.

3.3.2.7 Apply pipe thread sealant to the male threads on the hydraulic hose and screw the hose into the flow control valve (installed on the injector assembly) as shown in the lower illustration in Figure 9.

3.3.2.8 Place the nozzle washer in the injector, and screw the nozzle into the holder. The nozzle must seat tightly against the nozzle washer.

3.3.2.9 Proceed to Section 4.0.

3.3.3 Using injector with separate blast machine

3.3.3.1 Make sure the shuttle valve is installed on the air supply side of the water pump pressure regulator, as shown in Figure 11. Refer to Section 2.4.4.

3.3.3.2 When ready for operation, open the isolation valve.

3.3.3.3 Set up the FLEX machine with the coupled injector at the blast machine as noted in Section 2.4.2. Note: Air must be supplied to the FLEX system in order for the pump to operate.

3.3.3.4 Set up the second machine with the injector at the nozzle, as noted in Section 2.4.3.

3.3.3.5 Proceed to Section 4.0.

4.0 OPERATION

4.1 Pre-Blast Inspection and Settings

4.1.1 Blasting segment inspection and settings

Refer to Section 4.1.2 to inspect the water (wetblast) segment

4.1.1.1 Make sure the choke valve is open, (handle position aligned with the valve and piping).

4.1.1.2 Make sure that all blast hose and compressed-air hose connections are secure, and that coupling lock pins and safety cables are in place.

⚠ WARNING

If twist-on type air hose couplings are used, they must be secured by safety pins or wires to prevent accidental disconnection. Hose disconnection while under pressure can cause serious injury or death.

4.1.1.3 Close the Quantum abrasive metering valve. Closed position is when the knob has been turned fully clockwise. Refer to Section 5.1.

4.1.1.4 Open the safety petcock on the Millennium inlet valve. The valve is open when the lever is in-line with the petcock, as shown in Figure 13.

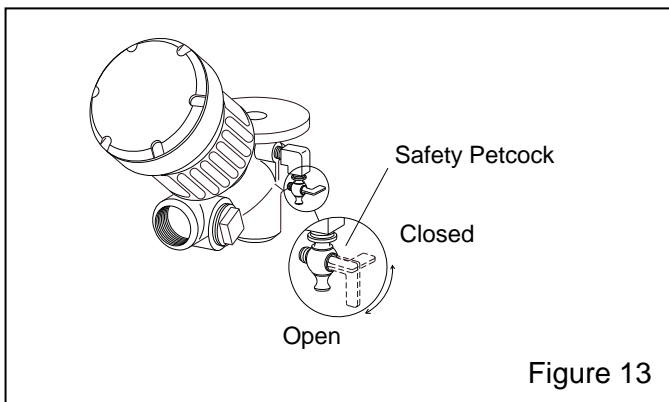


Figure 13

⚠ WARNING

To prevent severe injury or death from accidental activation of the blast machine, open the safety petcock when the blast machine is not in use. Opening the petcock prevents unintentional blasting. The control handle cannot activate the machine when the petcock is open.

4.1.1.5 Make sure the control handle lever is in the up (no blast) position, as shown in Figure 14, and that the handle lever and safety lever lock move freely.

4.1.1.6 Make sure the handle lever does not seal the opening on the control handle, unless the safety lever lock is intentionally pulled down.

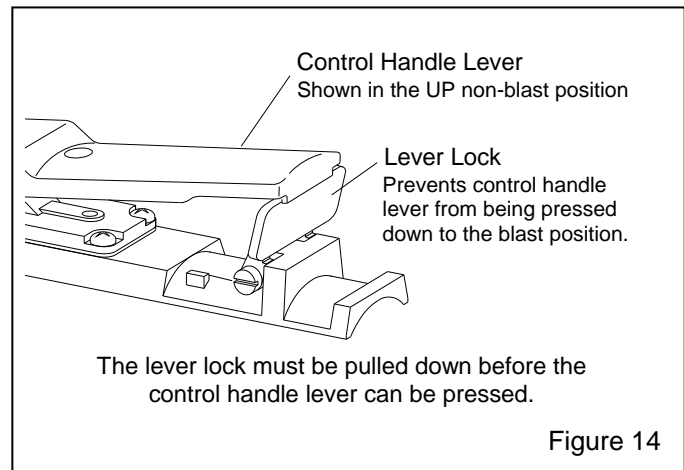


Figure 14

⚠ WARNING

Malfunctioning control handles can cause unintentional actuation of a blast machine, or prevent a machine from deactivating upon release. Malfunctioning control handles must be taken out of service immediately and repaired or replaced. Serious injury or death can result from unintentional blasting.

4.1.1.7 Make sure all operator safety equipment is set up per instructions in the applicable manual. Refer to Section 1.1.1 for a list of manuals for accessories provided with a systems package.

4.1.2 Water segment inspection and settings

4.1.2.1 Make sure the water tank is full.

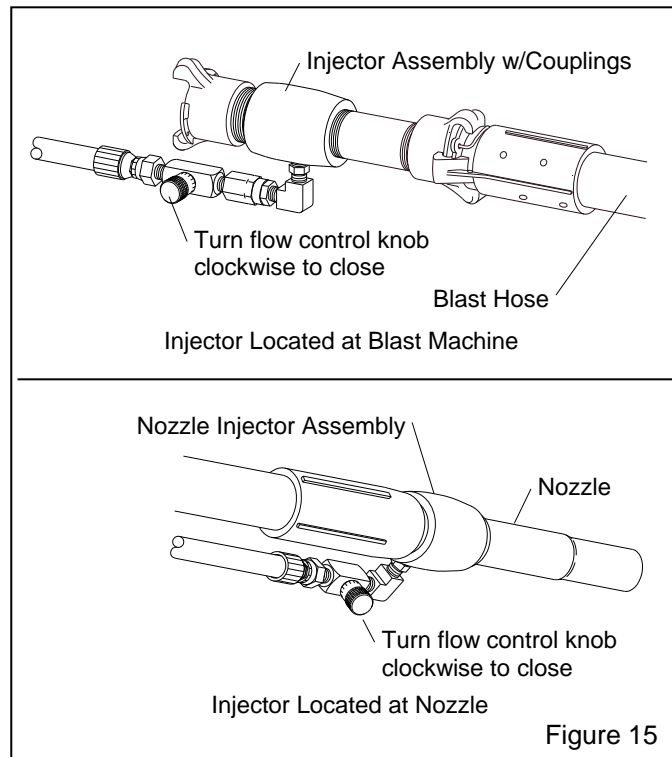
4.1.2.2 Make sure the water pump lubricator is filled with approved lubricant such a Castrol Brayco Micronic 783, AeroShell Fluid 71 or equivalent. A good quality oil specifically manufactured for air tools may be used if the recommended lubricants are not available. Refer to Section 5.4 to fill and adjust the lubricator.

NOTICE

Lack of lubrication can cause premature failure of the pump. Pump damaged caused by lack of lubrication is not covered under warranty.

4.1.2.3 Make sure the injector is set-up at the machine as noted in Section 3.3.1 or at the nozzle as noted in Section 3.3.2.

4.1.2.4 Make sure the water flow-control valve is closed (knob turned fully clockwise) as shown in Figure 15.



4.1.2.5 Open the water tank's supply valve.

4.1.2.6 Open the ancillary water valve, shown in Figure 16, to purge air from the water line; close the valve as soon as water comes out. Note: All air must be purged from the water supply line for the pump to self-prime.

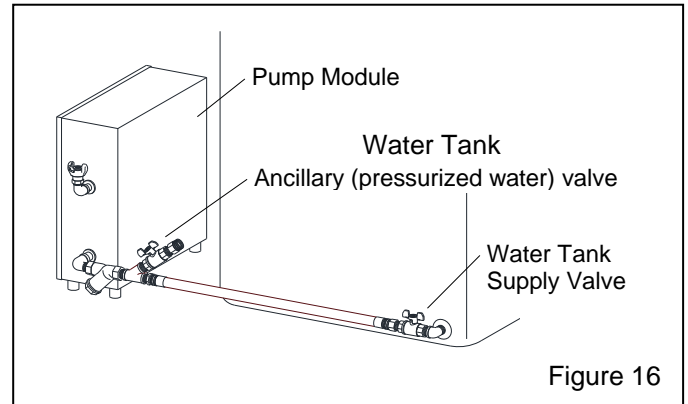


Figure 16

4.1.2.7 Make sure the air supply isolation valve, located on the outlet side of the water pump pilot-operated regulator as shown in Figure 17, to the pump module is closed.

4.1.2.8 Refer to Figure 17 and turn the pilot regulator control knob counterclockwise to approximate "0" psi.

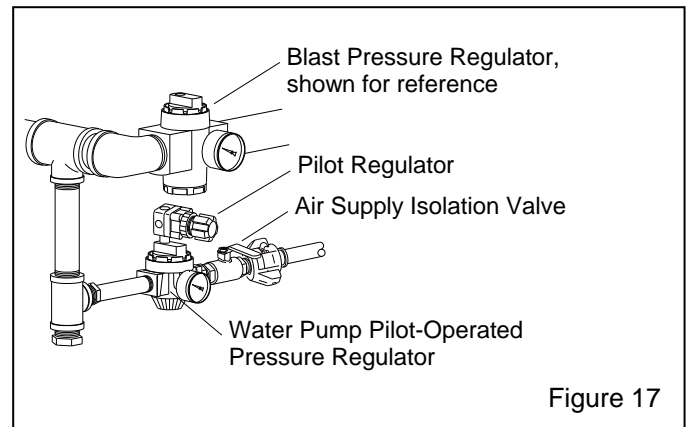


Figure 17

4.1.3 Compressed air supply

4.1.3.1 Close the air valve on the compressor. Start the compressor, and bring it to operating temperature and pressure. The pressure must be at least 50 psi, but not exceed 150 psi.

4.1.3.2 Slowly open the compressor air valve to pressurize the air supply line. Listen for any open lines or leaks.

4.1.3.3 Set blast pressure pilot regulator to preferred blasting pressure, between 5 and 120 psi. Refer to Section 5.2.

4.1.3.4 After respirators and respirator accessories are set up, pressurize the breathing air supply line, and adjust pressure on the CPF Filter outlet to the pressure stated in the respirator manual.

4.1.3.5 Load abrasive into the machine according to the instructions in Section 4.12.

4.1.4 Prime pump

4.1.4.1 Complete the water segment inspection and setting as noted in Section 4.1.2.

4.1.4.2 Refer to Figure 17 and open the pump's air supply isolation valve.

4.1.4.3 Slowly increase the pump air pressure to 10 - 15 psi, per Section 5.5. The pump should begin to stroke rapidly as soon as air is supplied.

4.1.4.4 Open the flow control valve, the pump should prime itself and water flow should start within a few seconds, and the stroke should slow as water pressure builds between the pump and injector.

NOTICE

Make sure the water supply reaches pump within a few seconds of starting. Running the pump dry will damage the hydraulic piston and cylinder assembly.

4.1.4.5 Slowly increase air pressure to 30 - 40 psi and let pump run until all air has been purged from the system.

4.1.4.6 Close the flow control valve.

4.1.4.7 If pump does not self-prime from the water tank, and if pressurized water (from a faucet) supply is available, repeat the process using pressurized water.

4.2 Blasting Attire

WARNING

Before blasting, test the coating and substrate for toxic materials (such as lead or other heavy metals, or asbestos). These hazards require special measures to protect the operators and the environment.

No dust is safe to breathe. Dry abrasive blasting produces harmful dust. Although blasting with water injection reduces dust at the blast surface, supplied air respirators are required for the safety of the operator. Evaporation can cause dust to become airborne. Failure to wear approved respirators can result in serious lung disease or death. Blast operators must wear properly-fitted and maintained NIOSH-approved, type-CE

supplied-air respirators approved for abrasive blasting.

During abrasive blasting, abrasive particles and dust in the area around the blast machine and blast nozzle become airborne. Everyone working in the vicinity of abrasive blasting must wear properly-maintained, NIOSH-approved, respiratory protection and eye protection appropriate for the job site hazards.

Loud noise generated by the use of compressed air can cause hearing damage. Everyone in the blasting area must wear approved hearing protection.

4.2.1 Operators and anyone else that may be exposed to the hazards generated by the blasting process must wear appropriate protective gear, including abrasive-resistant clothing, leather gloves, eye and hearing protection, and a NIOSH-approved Type CE Supplied-Air Respirator.

WARNING

Everyone except for the blast operator or blast machine tender must stay clear of the blast machine. The machine tender or blast operator may pressurize or depressurize the machine at any time, which can cause abrasive to vent under pressure, causing dust and toxins to become airborne. Both the operator and machine tender must wear suitable personal protective equipment including an approved respirator, plus approved eye, face, and hearing protection.

4.2.2 Do not allow anyone around the blast machine except machine tenders, who are appropriately attired in approved protective equipment.

4.3 Pressurize Blast Machine to Start Blasting

4.3.1 Don all protective, blasting attire, per Section 4.2.

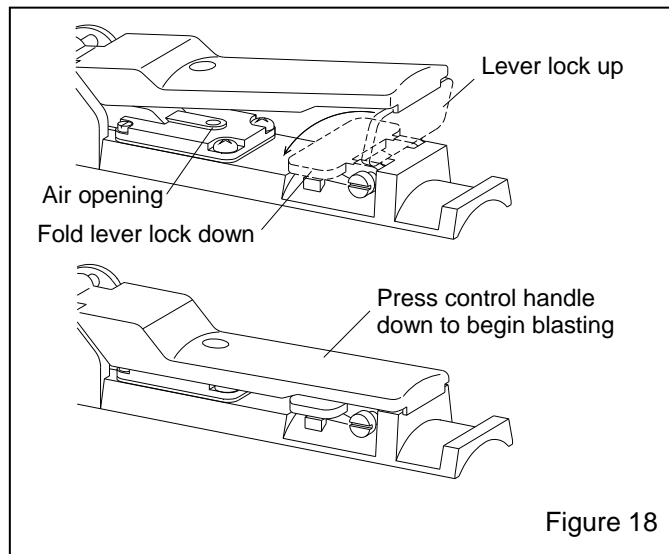
4.3.2 When the blast operator is ready to blast, the operator or the machine tender must close the safety petcock. Closing the petcock prepares the machine for remote operation and activation by the control handle. Air should be heard escaping from the opening under the control handle lever, as shown in Figure 18, but nowhere else. The air escaping at the control handle is an audible signal meaning air is supplied to the blast machine, which will activate when the control handle is pressed.

4.3.3 Hold the blast hose securely and point the nozzle only toward objects intended to be blasted.

4.3.4 Fold down the safety lever lock and press the remote control handle as shown in Figure 18. Within a few seconds, the pop-up valve will automatically close, and the blast machine will pressurize to start blasting.

⚠ CAUTION

Be prepared for recoil from the blast hose. Blasting should begin within a few seconds after pressing the control handle lever.



⚠ WARNING

OSHA requires the use of remote controls on all blast machines when an operator controls the nozzle. To comply with OSHA regulations, the remote control handle, which starts and stops the flow of air and abrasive, must be held down manually. Never tie down the control handle lever or attempt to bypass any part of the remote control system. Doing so will defeat the purpose of the fail-to-safe feature of the remote control. Serious injury or death can result from uncontrolled blasting. Ref. 29 CFR 1910.244 (b).

4.4 Check Abrasive Flow

4.4.1 Make sure the toggle on the ACS switch is pointing away from the nozzle to open the Quantum metering valve. Refer to Section 4.6 for operation of the ACS.

4.4.2 Adjust abrasive flow per Section 5.1.

4.5 Check Water Flow

It is helpful to have another person check the water system while the operator mans the nozzle.

4.5.1 Adjust the pump's pilot regulator to approximately 30 psi. Open the air supply valve to the pump module. The pump will rapidly stroke. Immediately open the water flow-control valve about one turn. The pump should prime within a few seconds; the stroke should slow down, and water will exit the adaptor. **Note:** When the injector is placed at the nozzle, hold the end of the hose down to prevent water from accumulating inside the hose.

4.5.2 Close the water flow-control valve and set the pressure regulator to about 40 psi.

4.5.3 When ready to blast proceed to Section 4.8 when using the injector at the blast machine, or Section 4.9 when using the injector at the nozzle.

4.6 Operation of the Abrasive Cut-Off Switch (ACS), Refer to Figure 19

4.6.1 The ACS serves three purposes:

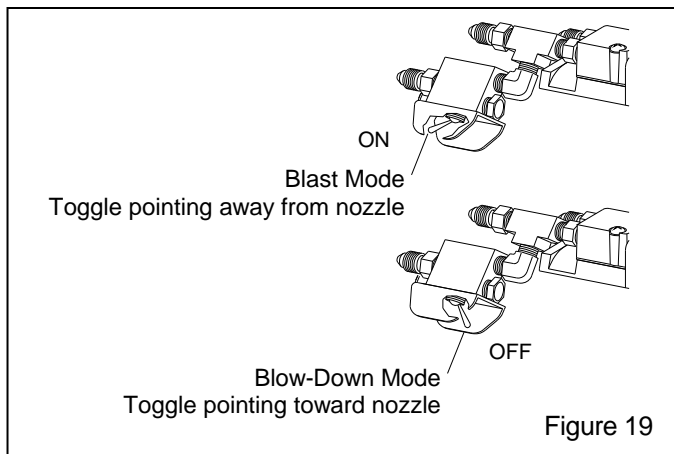
1. Clearing abrasive from the blast hose when blasting is finished. This is helpful in a lot of applications and necessary when the blast hose is vertical to prevent abrasive from collecting in low spots in the blast hose, eliminating excessive abrasive slugging at startup.
2. Blowing abrasive off the blasted surface. Note: Small amounts of residual abrasive may exit the nozzle with the air, requiring blowing off or otherwise cleaning surface outside the blasting area prior to painting.
3. Assisting in drying the surface after it is washed-down.

⚠ WARNING

OSHA sets exposure limits for people and the environment. Airborne dust can increase the exposure levels beyond permissible limits. OSHA prohibits blowing with compressed air as a cleaning method for lead-based paint dust or other hazardous dust, unless the compressed air is used in conjunction with a ventilation system designed to capture the volume of airborne dust created by the compressed air, 29 CFR 1926 (h). The ACS is for blowing off abrasive from a blasted surface, NOT for general area clean-up.

4.6.2 The abrasive cut-off switch is situated directly behind the control handle. The switch may be flipped open or closed at any time, but will not operate the metering valve unless the control handle is pressed.

4.6.2.1 Blast Mode: Moving the ACS toggle away from the nozzle to the "ON" ("CYL" port) position sends control-air to the abrasive metering valve, opens the valve so that the blast machine operates normally, with air and abrasive coming out the nozzle.



4.6.2.2 Blow-Down Mode: Moving the ACS toggle toward the nozzle, to the "OFF" position, cuts off the control-air to the abrasive metering valve, closes the valve and stops the abrasive flow. This action allows air alone to exit the nozzle, useful for clearing the blast hose before shutting down, and blowing abrasive and water off the blasted surface.

4.7 Dry Blasting

The system provides means to dry blast when wetblast is not required.

⚠ WARNING

Dry abrasive blasting produces harmful dust. Blast operators must wear properly-fitted and maintained NIOSH-approved, type-CE supplied-air respirators approved for abrasive blasting. Failure to wear approved respirators can result in serious lung disease or death.

During abrasive blasting, abrasive particles and dust in the area around the blast machine and blast nozzle become airborne. Everyone working in the vicinity of abrasive blasting must wear properly-maintained, NIOSH-approved, respiratory protection, hearing and eye protection appropriate for the job site hazards.

NOTICE

When dry blasting, the wetblast system must be isolated as noted below. Failure to isolate the water system can result in abrasive backing up into the water system.

4.7.1 Perform routine start up except:

1. Remove the injector assembly; this will avoid unnecessary wear on the injector.
2. Make sure the air supply isolation valve (shown in Figure 17) to the pump module is closed.
3. Make sure the water supply valve to the pump module is closed.

4.8 Wetblasting with Injector at the Blast Machine

4.8.1 Set-up per Section 3.3.1.

4.8.2 Do all set-up and preliminary operations described in Section 4.1 through Section 4.6.

4.8.3 Begin dry blasting and open the water flow-control valve approximately 1/2 turn. It is easier if another person opens and adjusts the flow-control valve while the operator mans the nozzle.

4.8.4 Adjust abrasive flow per Section 5.1 and water flow per Section 5.6.

4.9 Wetblasting with Injector at the Nozzle

4.9.1 Set-up per Section 3.3.2.

4.9.2 Do all set-up and preliminary operations described in Section 4.1 through Section 4.6.

4.9.3 Begin dry blasting and open the water flow-control valve approximately 1/2 turn.

4.9.4 Adjust abrasive flow per Section 5.1 and water flow per Section 5.6.

4.10 Using FLEX Injector with Separate Blast Machine

Note: A shuttle valve must be attached to the top of the pump-pressure pilot-regulator per Section 2.4.4.

4.10.1 Operation of the FLEX blast machine

4.10.1.1 Set-up per Section 2.4.2 and 3.3.3.

4.10.1.2 Do all set-up and preliminary operations described in Section 4.1 through Section 4.6.

4.10.1.3 Begin dry blasting and open the water flow-control valve approximately 1/2 turn. It is easier if another person opens and adjusts the flow-control valve while the operator mans the nozzle.

4.10.1.4 Adjust abrasive flow per Section 5.1 and water flow per Section 5.6.

4.10.2 Operation of second, separate blast machine
Note: Air must be supplied to the FLEX in order for the second machine to control the pump.

4.10.2.1 Set-up per Section 2.4.4 and 3.3.3.

4.10.2.2 Set up the second machine per the operation instructions for the machine.

4.10.2.3 Begin dry blasting and open the water flow-control valve approximately 1/2 turn.

4.10.2.4 Adjust abrasive flow per operating instructions for the machine.

4.10.2.5 Adjust water flow per Section 5.6.

4.11 Stop Blasting

4.11.1 Before releasing the control handle, the operator may use the ACS to stop the abrasive flow to clear the blast hose, and if conditions permit, blow-down the work piece. Refer to Section 4.6 for operation of the ACS.

4.11.2 To stop blasting; release the control handle lever. The outlet valve opens, and the blast machine depressurizes. The pop-up valve automatically drops when air is expelled from the machine and pressure equalizes. The air supply to the pump module also shuts off, stopping the pump.

4.11.3 When the control handle lever is released, the safety lever-lock will flip up to lock the handle lever in the up (no blast) position. Make sure the safety lever-lock is up to prevent the handle lever from engaging.

4.11.4 The air supply to the pump automatically shuts off when the control handle is released. The operator or machine tender should close the water flow-control valve to prevent water saturation in the blast hose, especially when using pressurized water.

NOTICE

Pressurized water can pass through the pump when the pump is not running. When water from a pressure source (faucet) is used, the flow control valve must be turned off as soon as the operator stops blasting. Failure to shut off the flow control valve can cause water to enter the blast hose and possibly the blast machine.

4.11.5 Always open the safety petcock during work breaks and before filling the blast machine. Opening the petcock prevents unintentional blasting.

4.11.6 When finished blasting, shutdown per Section 4.14.

4.12 Loading Abrasive into the Blast Machine

WARNING

When approaching an idle blast machine, and before loading the blast machine with abrasive, always make sure the safety petcock is open. If it is closed, open it while standing back and facing away from the concave head and exhaust muffler. This step is especially important if one worker (a machine tender) loads the machine with abrasive while another worker (the blast operator) controls the blasting. The blast operator can pressurize the machine before the machine tender has moved away from the machine. During pressurization, abrasive can be forced out of the top of the machine, and cause injury.

4.12.1 Load abrasive by pouring it into the concave head. Use the screen placed over the head to prevent objects from falling inside. Foreign objects will jam the machine. Abrasive flows through the filling port into the machine. Keep the abrasive level below the pop-up valve to prevent abrasive above the pop-up valve from being forced up and out of the machine when it pressurizes.

4.12.2 When the ready to blast, the operator or machine tender, while standing back and facing away from the concave filling head and exhaust muffler, closes the safety petcock.

4.12.3 Begin blasting or resume blasting per Section 4.3.

4.13 Emptying the Machine of Abrasive

4.13.1 Emptying the blast machine produces minimal dust; do not use water when purging the blast machine of abrasive.

1. Remove the injector assembly; this will avoid unnecessary wear on the injector.
2. Make sure the air supply valve to the pump module is closed.
3. Make sure the water supply valve to the pump module is closed.

4.13.2 When working in environments subject to extreme temperature changes, or very humid conditions, condensation may develop inside the machine. Condensation dampens abrasive and causes flow problems. To prevent this, empty the machine of abrasive when shutting down for the day. This will eliminate trouble from moist abrasive when starting a new day's blasting. One way to avoid having to empty the machine is to load only as much abrasive as will be used during the work period. If the machine must be purged of abrasive, do the following.

4.13.3 With the blast machine off, adjust blast pressure to approximately 50 psi, per Section 5.2, close the choke valve and set the abrasive metering valve to full open.

4.13.4 To prevent rapid wear of the nozzle holder threads, the nozzle should be firmly attached to the nozzle holder. Removing the nozzle is discouraged. If circumstances require the nozzle to be removed, also remove the nozzle washer. Purging the machine without a nozzle in place will erode the thread area of the nozzle holder, which can cause a hazardous condition.

WARNING

The threads on the nozzle and nozzle holder must be inspected each time the nozzle is secured to the holder. A loose-fitting nozzle may eject under pressure and can cause severe injury. Check the threads for wear, and make sure the nozzle holder securely holds the nozzle. The nozzle washer must also be inspected for wear. Worn nozzle washers can cause nozzle thread erosion.

4.13.5 Point the nozzle into a drum or suitable container, or in the direction of the abrasive disposal site.

4.13.6 Hold the hose securely and pressurize the machine by activating the control handle. Be prepared for severe surging, or recoil of the hose.

4.13.7 When the machine is empty, release the control handle lever, open the safety petcock, and open the choke valve.

4.13.8 If the nozzle was removed, thoroughly inspect the nozzle holder threads for wear before reinstalling the nozzle washer and nozzle.

4.14 Shutdown

4.14.1 Empty the blast machine per Section 4.13.

4.14.2 When finished blasting, and after cleanup is completed, remove the respirator outside the blasting area, in a clean environment where the air is safe to breathe.

4.14.3 Close the compressed-air supply valve at the compressor.

4.14.4 Drain receiver tank, air filter, and water collecting devices, and bleed the compressed-air supply hose.

NOTICE

If there is any chance of the machine being subject to freezing temperature, drain all water from the pump and open the pressure-water supply valve. Failure to drain water from the system can cause irreparable damage to the pump and water connections. Refer to Section 6.6 for additional information for operating in cold temperature.

4.14.5 Shutdown the compressor.

4.14.6 Cover the blast machine when not in use.

5.0 ADJUSTMENTS

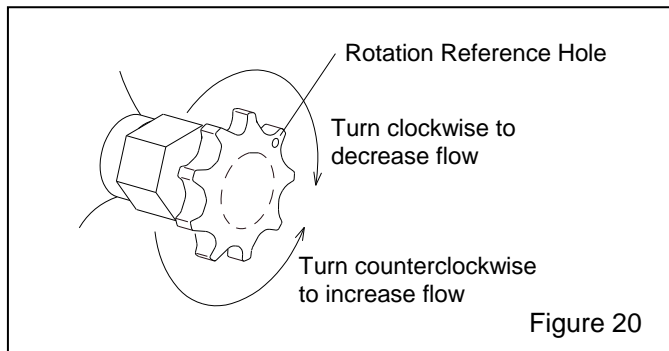
5.1 Abrasive Metering, Figure 20

5.1.1 Optimum abrasive flow depends on the type and size of abrasive and blasting pressure, and can best be determined by experience. Use as little abrasive as possible while maintaining the maximum cleaning rate. The air/abrasive mixture should be mainly air. As a rule, the stream of abrasive coming out of the nozzle should barely discolor the air when seen against a contrasting background.

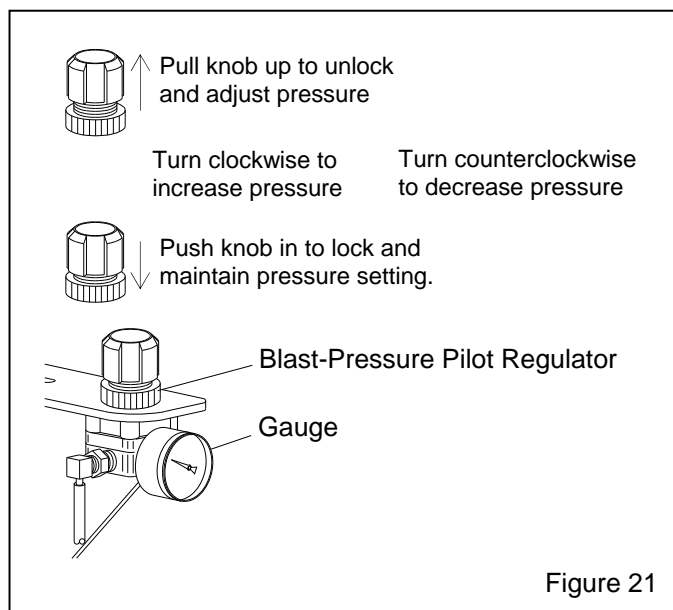
5.1.2 Abrasive flow is adjusted at the metering valve located at the bottom of the blast machine. Use the metering knob to adjust abrasive flow.

5.1.3 The hole in the knob enables the operator to monitor its rotation. Counting turns is helpful for returning to the original setting if temporary adjustments are required.

5.1.4 The valve is closed when the knob is turned fully clockwise. Begin with the knob set 1-1/2 turns from fully closed. While the operator is blasting, the machine tender turns the knob no more than 1/4 turn counterclockwise to increase abrasive flow. Allow 10 to 15 seconds for the flow to stabilize before readjusting. Continue making adjustments as described until correct flow is attained.



5.2 Blast Pressure Regulator, Figure 21



5.2.1 Note: The blast machine is initially pressurized at line pressure and then drops to the pressure at which the pilot regulator is set. The delay (time between initial pressurization to when pressure changes to the

pressure set at the blast-pressure regulator) is set by the adjusting pressure delay valve, as noted in Section 5.3.

5.2.2 Set blast pressure to the desired pressure, using the pilot pressure regulator located on the piping brace, as shown in Figure 20.

5.2.3 To set blast pressure, pull up the regulator knob to unlock it, turn clockwise to increase pressure or counterclockwise to decrease pressure. After pressure is set, push the knob down to lock it and maintain the setting.

5.3 Blast Pressure Delay Valve, Refer to Figure 22

Adjust blast pressure per Section 5.2 before adjusting the pressure delay valve.

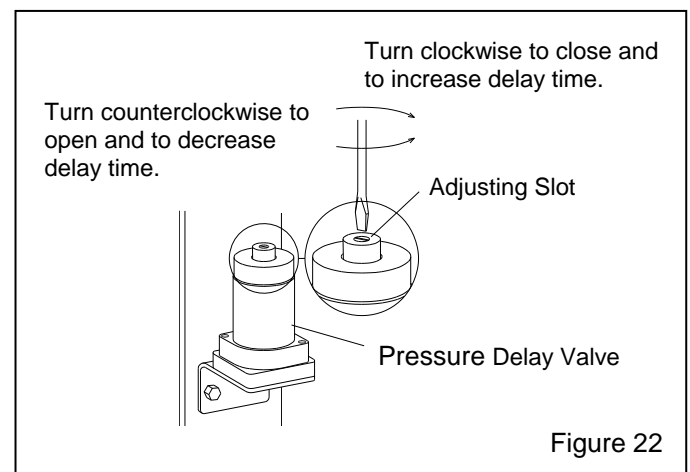
5.3.1 The delay valve located on the blast machine leg, adjusts the time it takes from the initial pressurization of the machine to when pressure changes to the pressure set at the blast-pressure pilot regulator.

5.3.2 Use a screwdriver inserted into the adjustment slot at the top of the delay valve and turn it fully clockwise to close.

5.3.3 Turn the slot one half turn counterclockwise for the initial adjustment.

5.3.4 Pressurize the blast machine and observe the blast pressure gauge.

- If the machine does not pressurize turn the slot a few degrees clockwise to increase the delay.
- If the machine pressurizes and the gauge needle increases above the set pressure, turn the slot a few degrees counterclockwise to decrease the delay.
- If the machine pressurizes and the needle does not increase above set pressure, the delay is set correctly.



5.4 Lubricator, Water Pump, Figure 23

NOTICE

Lack of lubrication can cause premature failure of the pump. Pump damaged caused by lack of lubrication is not covered under warranty.

5.4.1 The lubricator is located within the pump module enclosure. Open the enclosure door to access the lubricator.

WARNING

The air supply to the pump module must be turned off and the line bled before removing the lubricator filler cap or bowl. Failure to eliminate internal air pressure can cause severe injury from the sudden release of compressed air.

5.4.2 Make sure the pump module air supply valve is closed and the line is bled.

5.4.3 Remove the filler cap and fill the lubricator with a good grade of petroleum-based lubricating oil such as Castrol Brayco Micronic 783, AeroShell Fluid 71 or equivalent. A good quality oil specifically manufactured for air tools may be used if the recommended lubricants are not available.

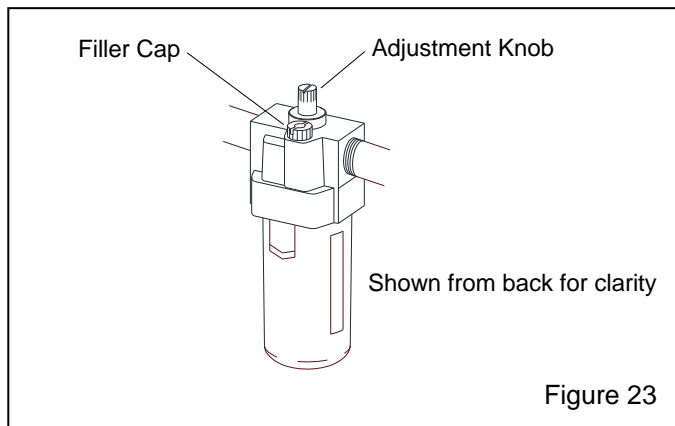


Figure 23

5.4.4 Turn the adjustment knob to provide one drop of oil for every twenty strokes of the pump. If excessive amounts of oil appear to be flowing through the pump during operation, as noted at the module's exhaust muffler, reduce the lubrication rate.

5.5 Water Pressure, Figure 24

5.5.1 Water pressure is controlled using the pilot regulator located on the blast machine piping as shown in Figure 24.

5.5.2 Maximum operating pressure for the pump is 100 psi. The pump ratio is 10 to 1, meaning water outlet pressure is ten times air inlet pressure. For example if the air regulator is set at 30 psi, water outlet pressure will be 300 psi. Operating pressure is usually set between 30 and 40 psi.

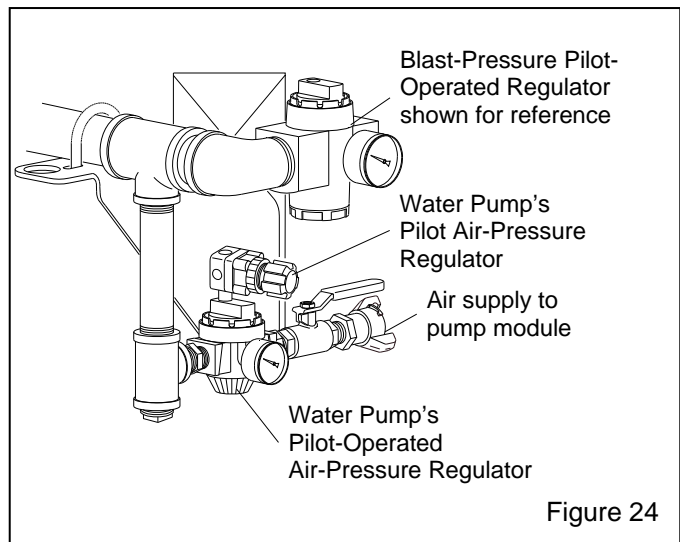


Figure 24

5.5.3 To adjust, refer to Figure 25 and pull the control knob on the pilot regulator to unlock it, turn it clockwise to increase pressure or counter-clockwise to decrease pressure. Once operating pressure is set, push in on the knob to lock it and maintain the setting.

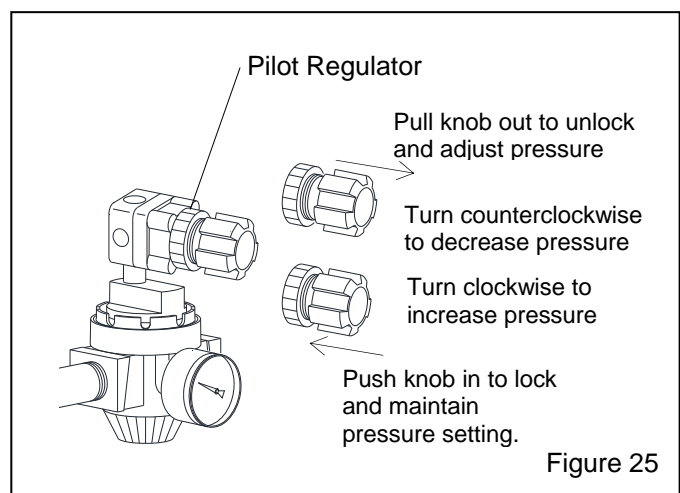
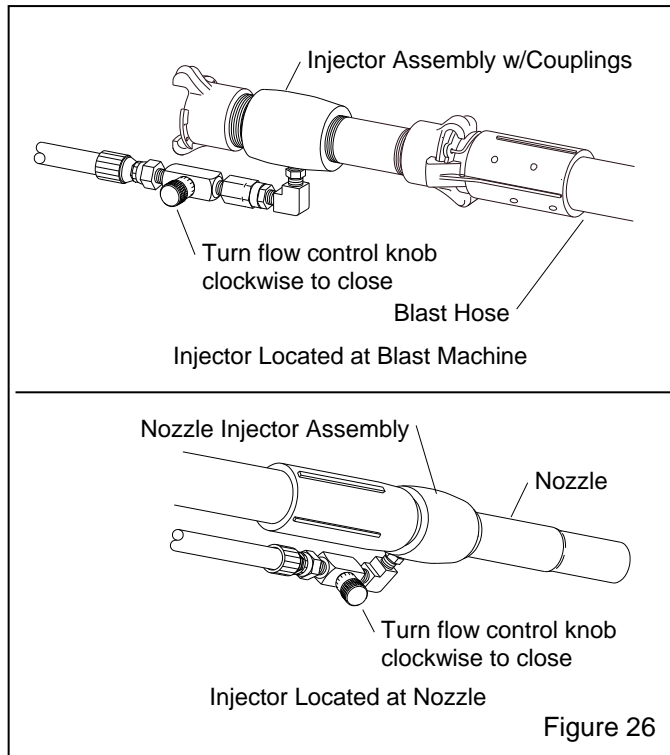


Figure 25

5.6 Water Flow

5.6.1 Adjust water flow by turning the flow control valve knob. The valve is closed when the knob is turned fully clockwise as shown in Figure 26.

5.6.2 Begin with the flow valve fully closed. Start blasting and slowly open the valve until the correct water to air and abrasive mixture is attained. Usually the flow will be set with the valve about 1/2 to 3/4 turns open.



6.0 PREVENTIVE MAINTENANCE

6.1 Water Pump Lubricator

6.1.1 Refer to Section 5.4 and fill the lubricator with a good grade of petroleum based lubricating oil such as Castrol Brayco Micronic 783, AeroShell Fluid 71, or equivalent.

6.2 Daily Inspection

6.2.1 With the air off, before blasting, do the following:

- Make sure the lubricator is filled with recommend lubricating oil.
- Make sure the water tank is filled.
- Empty the abrasive trap and clean the abrasive trap screen. **Do this at least twice a day, or more often if the machine is frequently cycled.** Failure to clean the abrasive trap on a regular basis is a major cause of system malfunction. Refer to Section 7.5.
- Check to make sure that couplings are secure and lock pins and safety cables are in place.
- Make sure the nozzle washer is in place and not worn.

⚠ WARNING

The threads on the nozzle and nozzle holder must be inspected each time the nozzle is secured to the holder. A loose-fitting nozzle may eject under pressure and can cause severe injury. Check the threads for wear, and make sure the nozzle holder securely holds the nozzle. The nozzle washer must also be inspected for wear. Worn nozzle washers can cause nozzle thread erosion.

- Inspect the RLX control handle; look for the following:
 - The lever must not seal the opening on the control, unless the safety lever lock is pulled down.
 - The **handle lever** must return to the "up" position when released.
 - The **safety lever lock** must return to the "up" position when the handle lever is released.
 - Both the handle lever and safety lever lock must move freely with no drag or binding.

WARNING

Malfunctioning control handles can cause unintentional actuation of a blast machine, or prevent a machine from deactivating upon release. Malfunctioning control handles must be taken out of service immediately and be repaired or replaced. Serious injury or death can result from unintentional blasting.

6.2.2 Before blasting but with the blast machine pressurized, do the following:

- Check the control handle for leaks.
- Inspect all couplings and coupling gaskets for leaks.
- Check the blast machine for leaks. If leaks are found around the pop-up valve, inspection door, pipe fitting ports on the side of the machine or at the bottom of the machine's cone, stop blasting immediately and repair or replace worn parts.

NOTICE

If leaks are allowed to continue, abrasive erosion can cause extensive or irreparable damage to the blast machine.

- Check all external piping, control hoses, and valves for leaks. If leaks are found, stop blasting and repair.
- Inspect blast hose, couplings, and nozzle holders for leaks. At the first sign of a leak, stop blasting and inspect all items for wear.

WARNING

Leaks around couplings and nozzle holders indicate worn or loose-fitting parts. Nozzle holders and couplings that do not fit tight on hose, and nozzles that do not fit tight in nozzle holders can disconnect while under pressure. Impact from nozzles, couplings, hoses, or abrasive, from parts disconnected by pressure during operation can cause severe injury.

6.3 Weekly Inspection

6.3.1 With the air off, before blasting, do the following:

- Inspect the blast hose for wear by squeezing the hose every three to four feet, feel for soft spots. Replace the blast hose before the tube wears as far as the fabric plies.

WARNING

Worn blast hose can suddenly burst. Couplings and nozzle holders may not adequately grip worn hose causing them to blow-off under pressure. Compressed air and abrasive escaping from a burst hose, or disconnected coupling or nozzle holder, can cause severe injury.

- Remove the nozzle for inspection. Replace with a new nozzle if the orifice diameter is worn 1/16" or more, or if the liner is cracked.
- When an optional air filter is used, inspect the filter element, and clean the bowl.

6.3.2 During blasting, do the following:

- Note the time it takes to fully depressurize the machine after the control handle is released. When depressurizing time increases noticeably, inspect the exhaust muffler for blockage and replace as needed.

6.4 Monthly Inspection

6.4.1 With the air off, before blasting, do the following:

- Check the pop-up valve's urethane coating for cracks and grooves. Replace the pop-up valve at the first sign of wear. Refer to Section 7.9.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. Refer to Section 7.10.

6.5 Periodic Inspection

6.5.1 Remote control valves: For safety and to avoid unscheduled downtime, periodically inspect the internal parts of the inlet and outlet valves, and abrasive trap. Inspect for wear and lubrication on O-rings, pistons, springs, seals, and castings. Refer to Service Maintenance Sections 7.3, 7.4, 7.5.

6.5.2 Auto Quantum metering: For safety and to avoid unscheduled downtime, periodically inspect the internal parts of the Quantum actuator and metering assembly. Inspect for wear and lubrication on O-rings, pistons, springs, seals, and castings. Refer to the Service Maintenance in Sections 7.6 and 7.7.

6.5.3 RLX control handle: Periodically clean around the springs, handle lever, and lever lock to ensure that the unit is free of abrasive and debris that may cause the handle lever or lever lock to bind. Refer to Section 7.8.

6.6 Operating or Storing the Unit in Freezing or Near Freezing Temperature

NOTICE

If there is any chance of the machine being subject to freezing temperature, drain all water from the storage tank and pump, and open the pressure-water supply valve. Failure to drain water from the system can cause irreparable damage to the pump and water connections.

6.6.1 Water freezes and expands at 32° F. When shutting down be sure to drain the water tank; refer to Figure 27 and open the water tanks supply valve and ancillary water valve to allow for expansion. Drain all water from the pump module by removing the plug on the inlet strainer.

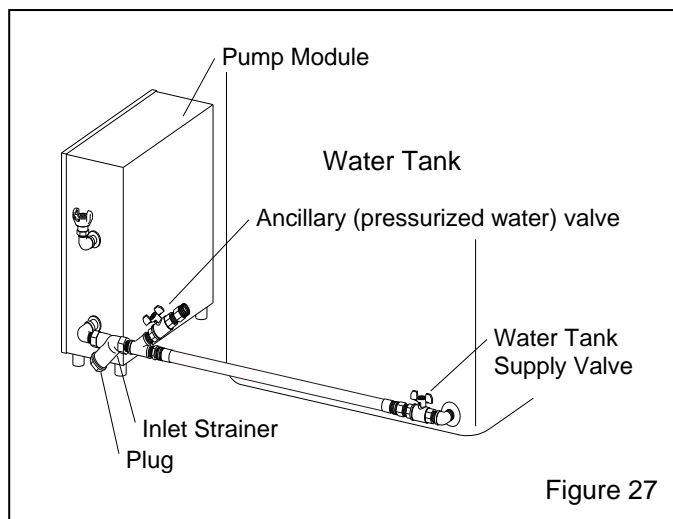


Figure 27

6.6.2 Avoid storing the machine where it will subject to freezing conditions unless all water has been purged from the water tank, water lines, pump and hoses. All valves should be open to allow for expansion.

7.0 SERVICE MAINTENANCE

⚠ WARNING

Failure to observe the following before performing any maintenance can cause serious injury or death from the sudden release of compressed air.

- Depressurize the blast machine.
- Lockout (be certain the air supply is off and that it cannot be started while work is in process) and tagout (be certain the air supply is clearly marked to prevent re-starting while work is in process) the compressed air supply.
- Bleed the air supply line to the blast machine.

7.1 Removing Damp Abrasive from the Blast Machine.

7.1.1 To clear a minor blockage caused by damp abrasive, during operation, rapidly open and close the choke valve several times.

7.1.2 For more difficult blockages, proceed as follows:
Refer to Section 7.2 to check for obstructions in the metering valve.

7.1.2.1 With the blast machine depressurized, disconnect the blast hose and remove the gasket from the quick coupling on the machine.

7.1.2.2 Place the machine so that the outlet is pointed away from any objects or persons.

⚠ WARNING

The machine's outlet must be pointed away from any objects or persons. Stand clear of the path of exiting abrasive. It may come out at high velocity. Impact from exiting abrasive can cause severe injury.

7.1.2.3 Close the choke valve and fully open the abrasive metering valve. Pressurize the machine to force out any damp abrasive.

7.1.2.4 When the obstruction has been removed, depressurize the machine. Remove the nozzle and nozzle washer, and reconnect the hose. Open the choke valve and close the abrasive metering valve. Pressurize

the machine to clear the hose. When the hose is cleared, depressurize the machine and reattach the nozzle washer and nozzle.

⚠ WARNING

The threads on the nozzle and nozzle holder must be inspected each time the nozzle is secured to the holder. A loose-fitting nozzle may eject under pressure and can cause severe injury. Check the threads for wear, and make sure the nozzle holder securely holds the nozzle. The nozzle washer must also be inspected for wear. When nozzle washers are worn, abrasive can erode nozzle threads.

7.1.2.5 With the hose cleared, start the machine using normal procedures.

7.2 Clearing Obstructions in the Abrasive Metering Valve and Blast Machine.

7.2.1 If the nature of the obstruction permits emptying the machine of abrasive, do so by following the instructions per Section 4.13.

7.2.2 Turn off the compressed air supply. Lockout and tagout the air supply, and bleed the air supply line to the blast machine.

7.2.3 Remove the wing nuts securing the abrasive metering valve's cleanout cover.

7.2.4 Check the metering valve for blockage, by inserting fingers into the opening to feel for an obstruction or foreign object.

7.2.5 If the metering valve is clear, remove the blast machine inspection door, and check inside for foreign objects.

7.2.6 Make sure the inspection door gasket is in good condition and in place before bolting the door onto the machine.

7.2.7 Make sure the abrasive metering valve cleanout cover O-ring is in good condition and in place before reassembling the cleanout cover.

7.2.8 Check to make sure all inspection doors are secure before starting the air supply.

7.3 Millennium Inlet Valve

NOTE: Two service kits are available for the Millennium valve inlet segment. To avoid unscheduled down-time, both kits should be kept on-hand. Replace all the seals provided in the seal service kit whenever the valve is opened. Items shown with a single asterisk (*) are included with the seal kit, refer to Page 43, Figure 53. Use the plunger tip kit when replacing the plunger tip.

7.3.1 Inlet Valve Disassembly

7.3.1.1 Make sure the machine is depressurized. Turn OFF the compressed air supply. Lockout and tagout the air supply, and bleed the air supply line to the blast machine.

7.3.1.2 Unscrew the six socket-head screws to remove the cylinder cap, cylinder cap gasket, and spring, as shown in Figure 28.

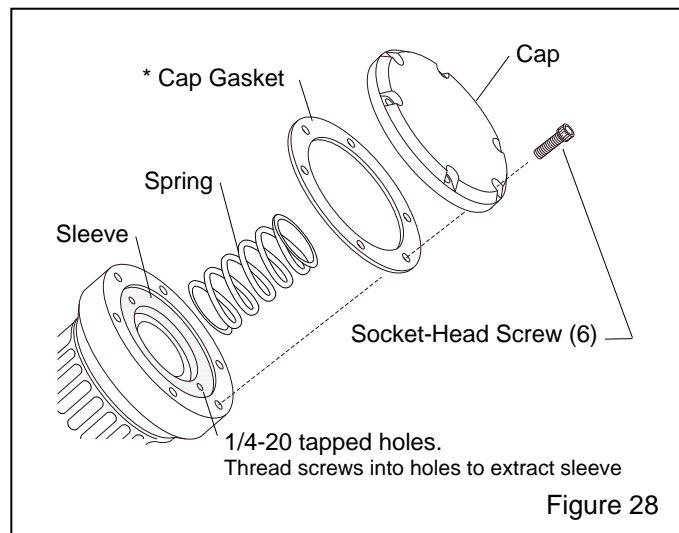
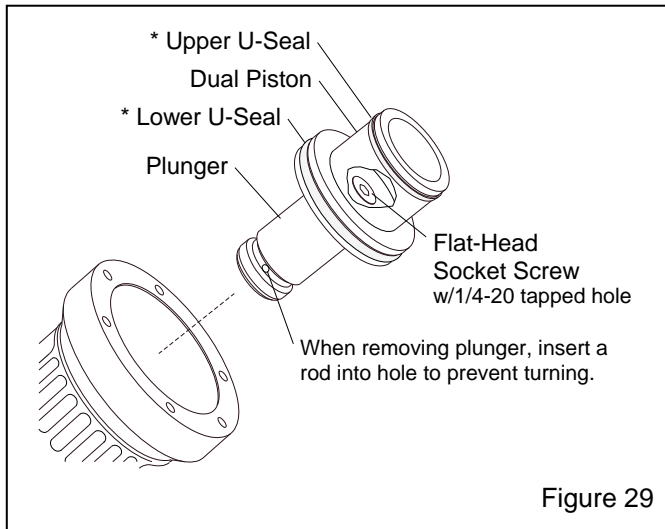


Figure 28

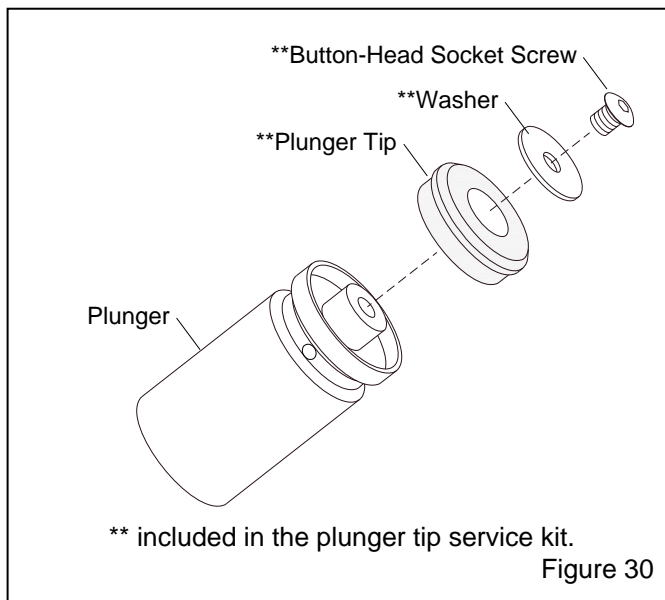
7.3.1.3 If the cylinder sleeve cannot be removed by hand, screw two 1/4-NC screws into the holes in the end of the sleeve and pull the screws to remove the sleeve from the body. If the sleeve is too tight to remove by hand, use a puller attached to the screws. Remove the screws after the sleeve is removed.

7.3.1.4 Refer to Figure 29 and grip the edge of the dual piston, and pull the piston/plunger assembly from the body. If unable to remove the piston by hand, screw a long 1/4-NC screw into the threaded center of the socket-head screw, grip the screw, and pull out. If the piston is too tight to remove by hand, use a puller attached to the screw. Remove the screw after the piston is removed.

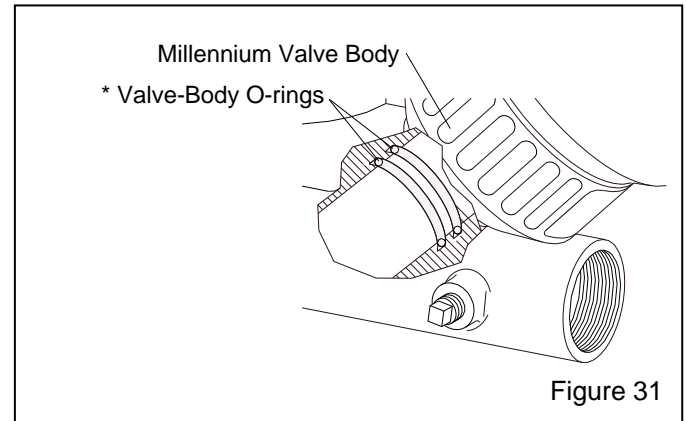
7.3.1.5 It is not necessary to separate the plunger from the piston unless the metal of either part is scored or otherwise needs to be replaced. To remove the plunger, insert a rod through the hole in the lower part of the plunger. Hold the rod to prevent the plunger from turning, while using a 5/16" hex key to remove the flat-head socket screw from inside the piston.



7.3.1.6 If the plunger tip is worn, use a 3/16" hex key to remove the button screw, washer, and tip as shown in Figure 30.



7.3.1.7 Refer to Figure 31 and remove both O-rings from the inside the valve body.



7.3.2 Inlet Valve Reassembly

Reassembly is done in reverse order. Refer to the illustration used for disassembly to reassemble. Clean and inspect for wear all parts to be reused; replace worn parts. Lubricate all O-rings and U-seals with O-ring lubricant or light-weight tool oil at assembly.

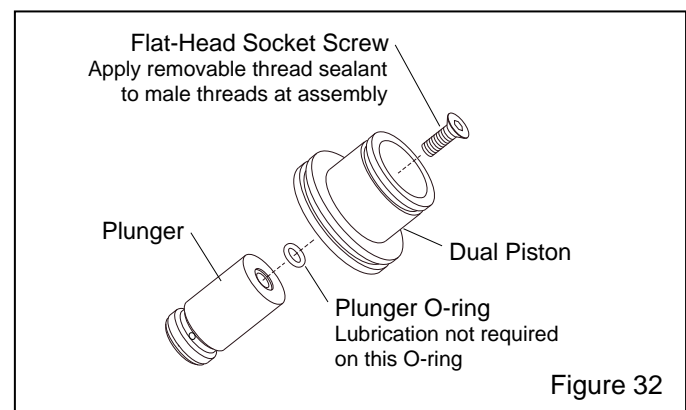
7.3.2.1 Clean all items and inspect for wear. Replace all seals and O-rings (included in the service kit).

- Inspect the plunger tip. Replace the tip if worn or damaged.
- Inspect the machined plunger seat in the valve body for wear. Replace the body if the seat is worn.

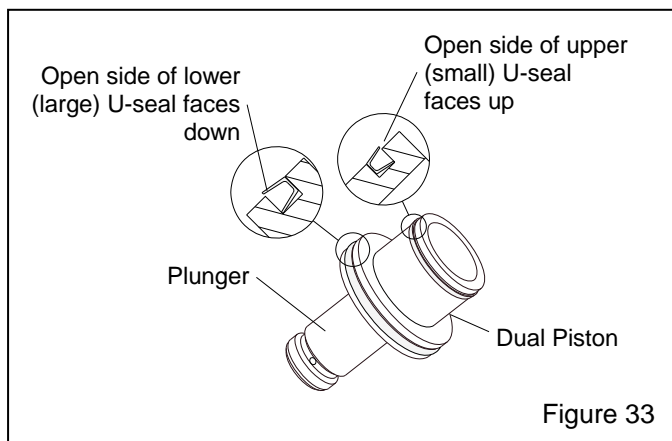
7.3.2.2 Refer to Figure 31 and install new valve-body O-rings.

7.3.2.3 Refer to Figure 30 and install new plunger tip.

7.3.2.4 If the plunger and piston were separated as noted in paragraph 7.3.1.5, refer to Figure 32 and apply removable thread sealant to the threads on the flat-head socket screw, and reassemble the parts using the new O-ring supplied with the service kit.

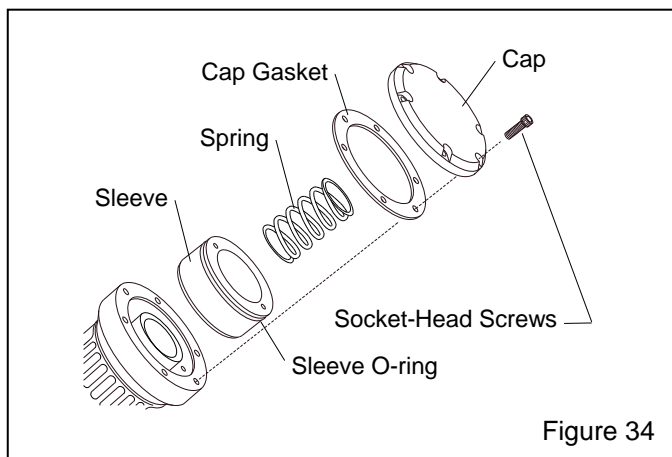


7.3.2.5 Place the U-seals into the grooves on the piston; the open side of the large seal faces the plunger, and the open side of the small one faces away from the plunger, as shown in Figure 33.



7.3.2.6 Install the plunger and dual piston assembly into the body. Make sure the open side of the large (lower) U-seal does not fold back during assembly. The cylinder is chamfered to help slip the lip in. Tucking the lip of the seal in, while applying pressure to the piston, eases assembly.

7.3.2.7 Refer to Figure 34 and place the O-ring on the cylinder sleeve, and insert the sleeve (O-ring end up) into the body. Make sure the open side of the upper (small) U-seal does not fold back during assembly, the sleeve is chamfered to make assembly easier.



7.3.2.8 Install the spring, cylinder cap gasket, and cylinder cap.

7.3.2.9 Tighten the six socket-head screws in sequence to secure the cap.

7.4 Piston Outlet Valve, Refer to Figure 35

7.4.1 All service on the outlet valve must be done with the air OFF and the air supply locked-out and tagged-out. It is not necessary to remove the valve from the blast machine.

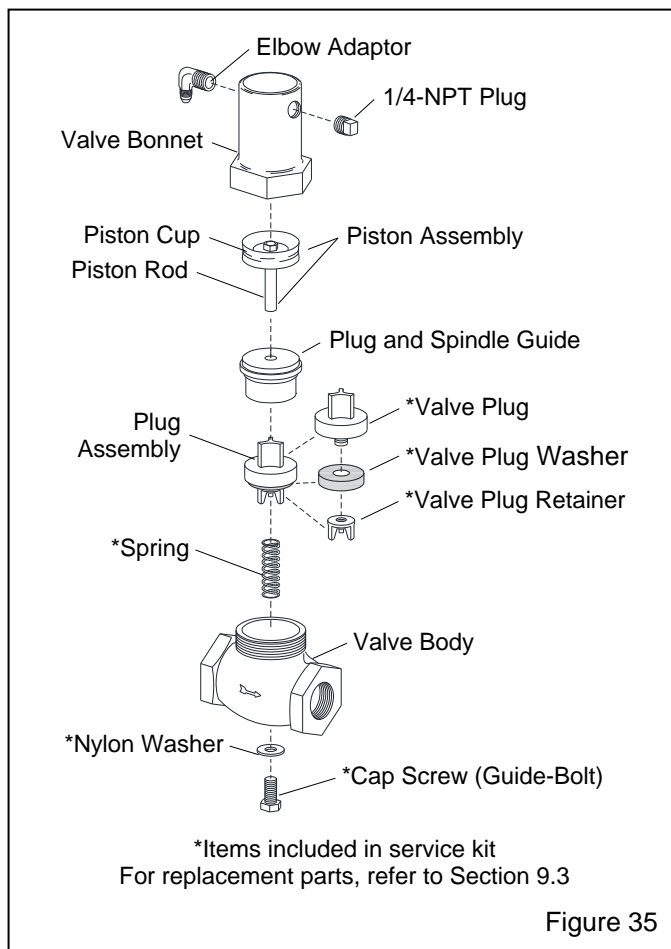
7.4.2 Remove the control hose from the valve bonnet's elbow adaptor. Note: The elbow adaptor and plug do not need to be removed unless they need to be replaced.

7.4.3 Use a large wrench to loosen the bonnet from the valve body, until it can be removed by hand.

7.4.4 To remove the bonnet, lift it straight up until the piston rod clears the spindle guide.

7.4.5 Remove the spindle, plug assembly, and spring from the valve body.

7.4.6 Remove the piston from the bonnet by pulling the piston rod.



7.4.7 Inspect all parts for wear and damage as follows:

- Inspect the valve plug washer, valve plug, and plug retainer for damage. Replace all damaged parts. When reassembling the valve plug assembly, tighten the retainer enough to compress the washer, but not so tight to cause it to bulge.
- Examine the body casting for wear. If the body or the machined seat is worn, replace the body.
- Examine the spring guide-bolt and nylon washer. If either is worn, replace both.
- The spring is approximately 1-5/8" long; if it is abrasive-worn, rusty, or compressed, replace it.
- The piston cup should fit snugly against the bonnet's cylinder wall. If it does not, replace the piston assembly.
- The piston rod should be free of deep abrasion and move freely in the spindle guide's bore. If it is badly abraded, drags in the bore, or is loose in the bore, replace the piston assembly.

7.4.8 Lubricate the cylinder wall and piston cup with lightweight machine oil or tool oil.

7.4.9 Install the piston into the bonnet's cylinder. Cocking the piston so it enters the bonnet at a slight angle, and rotating it while applying pressure makes assembly easier. Do not push the piston fully into the bonnet; the rod should be even with the opening.

7.4.10 Place the spring over the guide-bolt, and place the plug assembly (retainer down) on the spring.

7.4.11 Place the spindle in the body. The large opening faces down, and fits over the plug fins. The spindle shoulder will not rest on the valve body due to the force of the spring.

7.4.12 To assemble the bonnet to the valve body, first insert the piston rod into the spindle guide hole. While keeping the bonnet, spindle, and body aligned, screw the bonnet onto the body. If all parts are correctly aligned, the body will screw on hand-tight until it is seated. **Note: If the bonnet does not screw on hand tight, do not force it. Recheck alignment and repeat assembly.**

7.4.13 After the bonnet is fully seated on the body, tighten the assembly with a wrench.

7.4.14 Attach the control hose to the fitting on the bonnet.

7.5 Abrasive Trap, Refer to Figure 36

⚠ WARNING

To avoid serious injury from the sudden release of compressed air, all service on the abrasive trap must be done with the air OFF and the air supply locked-out and tagged-out.

Note: Clean the abrasive trap screen and empty the trap at least twice daily. Failure to clean the trap on a regular basis is a major cause of system malfunction.

7.5.1 To check the abrasive trap screen, loosen the thumb screw on the upper lock bar, swing the lock bar off the cap, and remove the cap.

7.5.2 Remove the screen and inspect it for wear and blockage. Replace it when it is clogged or worn. Keep spare screens on hand. Do not install the screen in the trap until the bottom section of the trap is cleaned per the following instructions.

7.5.3 To clean the bottom section of the trap, loosen the thumb screw on the lower lock bar, swing the lock bar off the lower cap, and then remove the cap.

7.5.4 Empty all abrasive from the bottom and top sections.

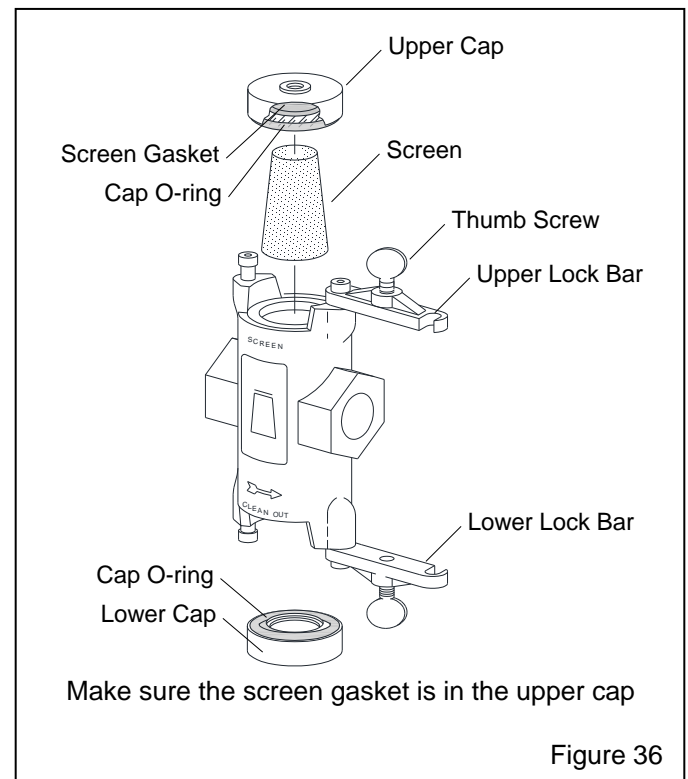


Figure 36

7.5.5 Install the screen in the top section. The smallest diameter end of the screen must face up as shown in Figure 36.

7.5.6 Reassemble the upper and lower caps.

Note: The upper and lower caps are identical except the screen gasket is glued into the upper cap. Make sure the screen gasket is in place in the upper cap, and the O-rings are in place on both caps before assembly.

7.6 Auto Quantum Metering Segment, Figure 37 **Refer to Section 7.7 to service the actuator segment.**

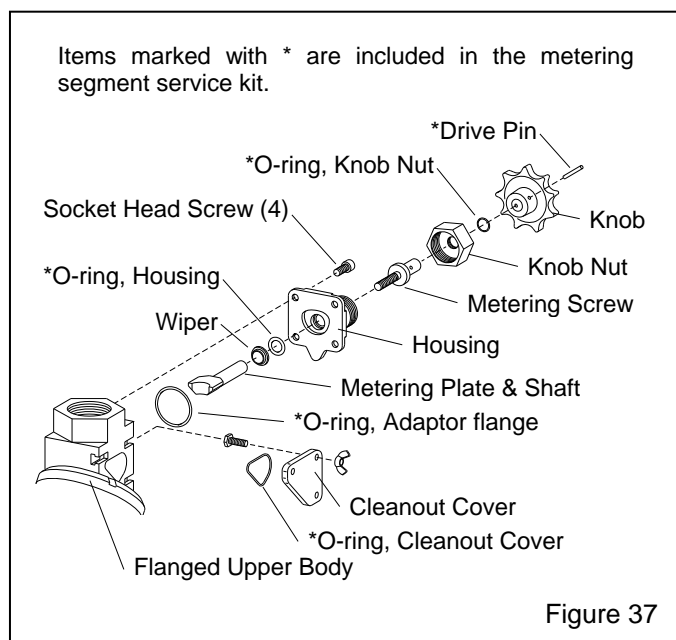
Note: Service kits are available for the Quantum metering assembly and actuator segment. Keeping kit(s) on-hand will avoid unnecessary downtime. Replace all seals provided in the kit whenever the valve is opened.

If immediate service is required and a service kit is not readily available, take extreme care not to misplace or damage O-rings, gaskets, or other seals. Thoroughly clean all reusable parts.

7.6.1 Empty the machine of abrasive per Section 4.13. Turn off the compressed air supply, lockout and tagout the air supply, and bleed the supply line to the blast machine.

7.6.2 Remove the cleanout cover wing nuts and cleanout cover.

7.6.3 Remove the four socket head screws securing the metering housing, and remove the housing assembly.



7.6.4 The flanged upper body and actuator do not need to be removed from the blast machine to service the metering assembly. Thoroughly inspect both items for wear, and replace if worn.

7.6.5 Turn the metering shaft clockwise to remove the shaft from the metering screw.

7.6.6 Loosen the knob nut, and pull the knob assembly from the housing.

7.6.7 Use a drive pin and hammer to force the roll pin from the knob, and remove the knob.

7.6.8 Remove the metering screw by pushing it out the front of the knob nut.

7.6.9 Inspect the metering screw for damage and any signs of abrasive ingress or metal filings.

7.6.10 Clean the threads on the metering screw, and test the condition of the threads by screwing it into the metering plate shaft. Replace the metering screw if there is any resistance, binding or metal filings.

7.6.11 Remove the O-ring from the knob nut, and remove the O-ring and wiper from the housing.

7.6.12 Thoroughly clean and inspect all parts that are to be reused. Replace all worn parts.

7.6.13 Place a new O-ring in the knob nut.

7.6.14 Place a new O-ring and wiper seal in the housing, as shown in Figure 37. The small side of the wiper seal faces away from the O-ring. A generous amount of silicone-based lubricant eases installation.

7.6.15 Insert the metering plate shaft through the housing bore, and wipe off any lubricant on the metering plate side of the bore.

7.6.16 Reassemble the metering screw, nut, knob, and drive pin. Note: applying a small amount of silicone-based lubricant on the unthreaded end of the metering shaft eases insertion through the nut O-ring.

7.6.17 Apply molybdenum disulfide or graphite-based anti-seize lubricant to the metering shaft and metering screw threads, and thread the shaft onto the screw.

7.6.18 Place a new O-ring in the groove on the face of the upper body.

7.6.19 Insert the metering plate (flat side up) through the upper body opening. Take care not to displace the internal O-ring.

7.6.20 Secure the metering housing finger tight before tightening all screws.

7.6.21 Place a new O-ring on the cleanout cover, and securely attach the cover.

7.6.22 Service of the metering assembly is complete. Test the machine and piping for air leaks before putting into service.

7.7 Auto Quantum Actuator Segment, Ref. Figures 38 and 39

Refer to Section 7.6 to service the metering segment.

Note: Service kits are available for the Quantum metering assembly and actuator segment. Keeping kit(s) on-hand will avoid unnecessary downtime. Replace all seals provided in the kit whenever the valve is opened.

If immediate service is required and a service kit is not readily available, take extreme care not to misplace or damage O-rings, gaskets, or other seals. Thoroughly clean all reusable parts.

7.7.1 Empty all abrasive from the machine per Section 4.13. Note: If the metering assembly does not require service, abrasive flow may be stopped by closing the metering valve.

7.7.2 Turn off the compressed air supply. Lockout and tagout the air supply, and bleed the air supply line to the blast machine.

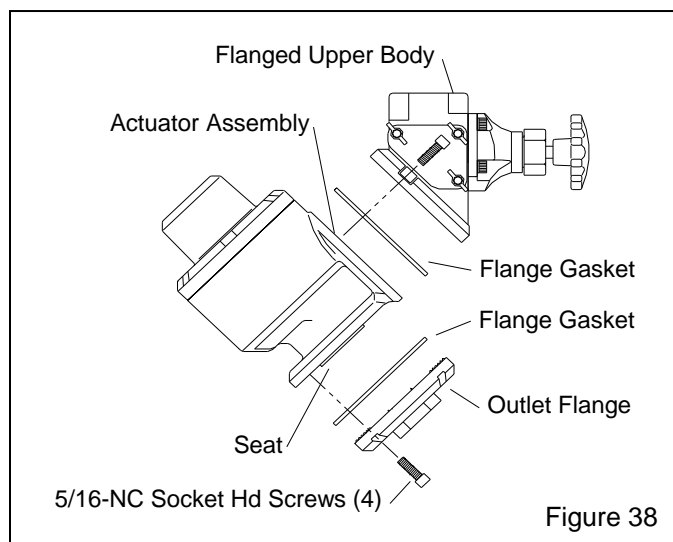


Figure 38

7.7.3 Refer to Figure 38 and remove the screws securing the upper body and outlet flange to the valve actuator assembly, and then remove the actuator assembly.

7.7.4 Refer to Figure 39 and unscrew the six socket head screws, and then remove the cylinder cover, spring and felt disc. Spring compression is removed when the cover is approximately 9/16" from the actuator body.

7.7.5 Use a hammer handle or similar object to push the plunger from the bottom (wear sleeve), forcing the plunger/piston assembly out the top of the body.

7.7.6 Pry the urethane seat from the bottom of the wear sleeve.

7.7.7 Remove the wear sleeve and roll pin from the body.

7.7.8 It is not necessary to separate the plunger from the piston unless either part is scored or worn. To separate the parts, hold the plunger in a vise with the vise jaws covered with copper or similar protection (if the plunger is damaged it does not matter if the vise jaws mar the plunger). Using a wrench placed on the flats of the piston stop, unscrew the stop.

7.7.9 Remove the wiper and O-ring from the actuator body.

- Inspect the urethane seat. Replace if worn or damaged.
- Inspect the body and outlet flange for wear. Replace if worn.

7.7.10 Clean all items and inspect for wear. Replace worn or damaged parts.

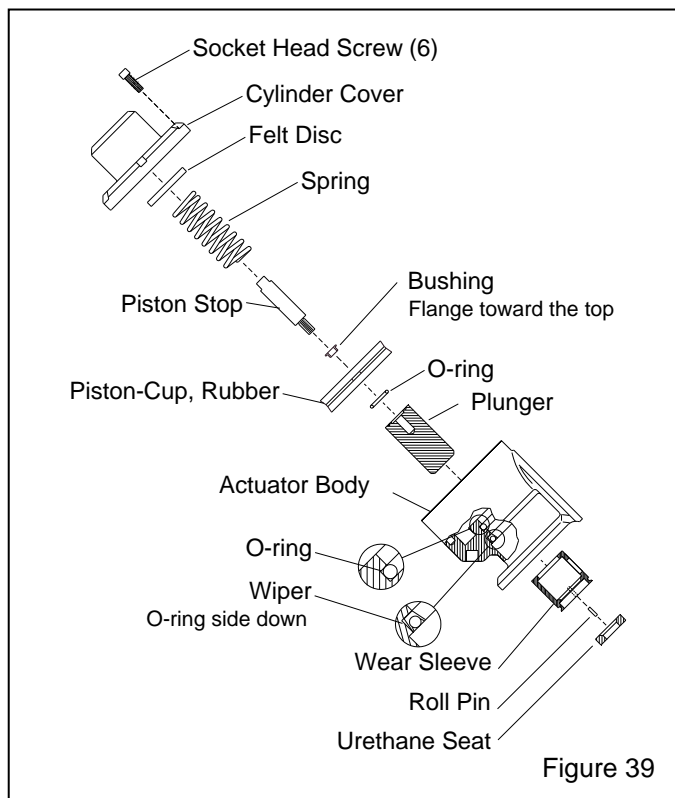
7.7.11 Replace the wiper and O-ring in the actuator body, the O-ring side of the wiper must face toward the bottom of the body, as shown in Figure 39.

7.7.12 Lubricate the O-ring and wiper in the actuator body, with a silicone-based lubricant.

7.7.13 If the plunger and piston were separated as noted in Section 7.7.8, apply removable thread sealant to the threads on the piston stop, and reassemble the parts using a new O-ring.

7.7.14 Install the plunger and piston assembly into the actuator body. Tuck in the lip of the piston cup while applying pressure to the piston, to make sure the leading lip on the piston does not curl.

7.7.15 Place the roll pin and wear sleeve in the actuator body. The sleeve is correctly positioned when the alignment slot in the sleeve fits the roll pin in the body.



7.7.16 Place the urethane seat into the wear sleeve, with the beveled side toward the sleeve.

7.7.17 Assemble the actuator assembly onto the upper body and outlet flange. Note: The upper body is secured with three screws, and the outlet flange is secured with four screws. The gaskets are the same for both parts. Align the gaskets so the mounting holes match the pattern in the flange. Hand-tighten the upper body and outlet flange screws before tightening all screws.

7.7.18 Install the felt disc, spring, and cylinder cover, and tighten the screws to secure.

7.7.19 Connect the control line to the compatible fitting on the actuator assembly, and test the operation before putting the valve in service.

7.8 RLX Control Handle

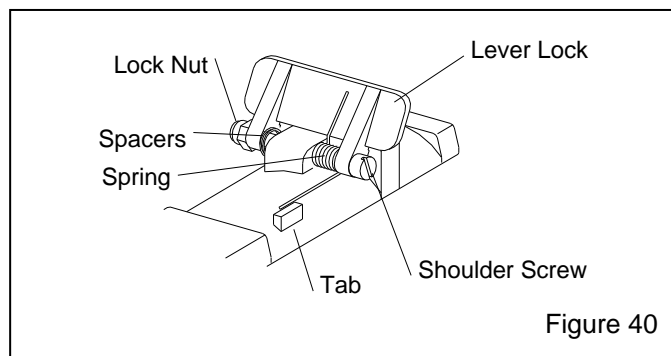
Note: A service kit is available for the RLX control handle. To avoid unscheduled downtime, a kit should be kept on-hand.

7.8.1 Spring replacement

7.8.1.1 To replace the lever lock spring, follow the instructions in Section 7.8.2. To replace the handle lever spring, follow the instructions in Section 7.8.3.

7.8.2 Lever lock replacement, Figure 40

7.8.2.1 Remove the lock nut from the shoulder screw. Before removing the screw, note the positions of the spacers and spring, as shown in Figure 40. The bent end of the spring is toward the inside, forcing the lever lock up. The straight end is toward the outside, facing down and against the tab.

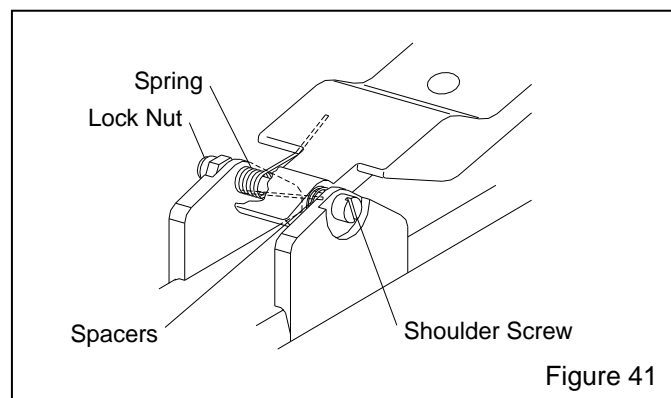


7.8.2.2 Install a new lever lock and spring, and reassemble in reverse order.

7.8.2.3 Make sure the lever lock moves freely, raises to full up position, and that the handle lever does not engage unless the lever lock is pulled down.

7.8.3 Handle lever replacement, Figure 41

7.8.3.1 Remove the lock nut from the shoulder screw. Before removing the screw, note the positions of the spacers and spring as shown in Figure 41. The bent end of the spring goes against the handle lever, facing up. The straight end goes against the body, facing down.



7.8.3.2 Install a new handle lever and spring, and reassemble in reverse order.

7.8.3.3 Make sure the handle lever moves freely, raises to full up position, and does not engage unless the lever lock is pulled down.

7.8.4 Rubber button replacement

7.8.4.1 Remove the old rubber button.

7.8.4.2 Install the new button, stem first, by pushing it from the bottom side of the handle lever. Pull the stem to seat the button.

7.8.4.3 Trim the button stem flush with the top of the handle lever.

7.8.5 Gasket replacement

7.8.5.1 Remove the handle lever per Section 7.8.3.

7.8.5.2 Remove the six screws holding the pneumatic adaptor to the body.

7.8.5.3 Install a new gasket.

7.8.5.4 Place the pneumatic adaptor on the gasket and hand tighten all screws before tightening them in sequence to uniformly compress the gasket.

7.8.5.5 Reassemble the handle lever, making sure the spacer washers and spring are in place.

7.8.5.6 Make sure the handle lever moves freely, raises to full up position, and does not engage unless the lever lock is pulled down.

7.9 Replacing the Pop-Up Valve, Figure 42

7.9.1 All service on the pop-up valve must be done with the compressed air off and the air supply locked-out and tagged-out.

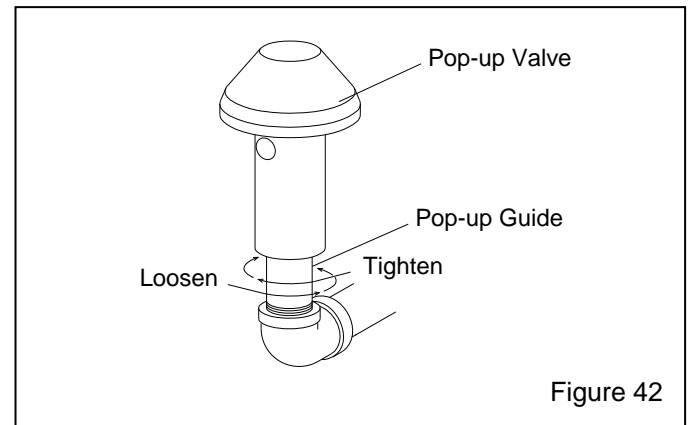
7.9.2 To gain access to the pop-up valve, remove the inspection door assembly.

7.9.3 Using a small pipe wrench, unscrew the pop-up valve guide by turning it counterclockwise. Remove the pop-up valve and guide from the machine.

7.9.4 While the pop-up valve is out, check alignment as follows: Screw a 1-1/4" nipple, which is at least 12" long, into the elbow in place of the pop-up guide. Check the alignment through the pop-up filling port. The nipple

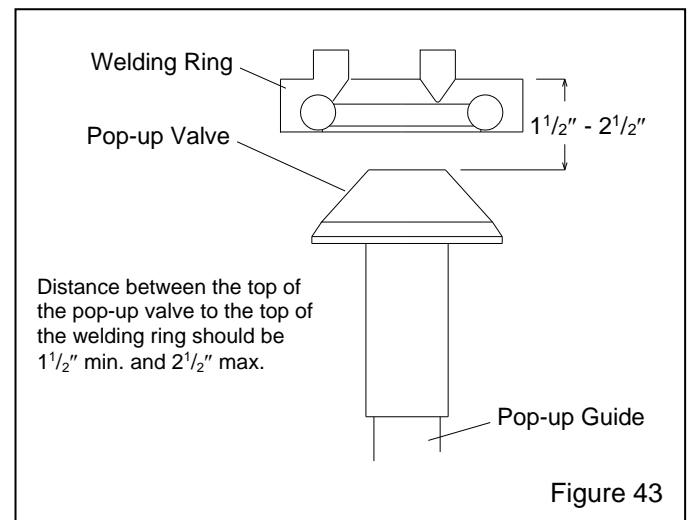
should be close to the center of the port. If it is not, adjust the horizontal pipe. A misaligned pop-up valve could result in early valve failure, or abrasive leakage when the machine is pressurized or depressurized.

7.9.5 Slide the new pop-up valve over the guide, and then screw the valve guide (with the pop-up valve on it) into position inside the machine. Tighten the guide, it should be wrench-snug, but not wrench-tight. Over-tightening the guide will make it difficult to remove the next time the pop-up valve needs replacement.



7.9.6 Refer to Figure 43 to check the pop-up height. If the pop-up sits too low, misalignment could occur when the pop-up comes up against the seal. If the pop-up sits too high, it will take longer for abrasive to flow through the opening when filling. Adjust the height by replacing the guide with one that is longer or shorter.

7.9.7 Put a new gasket on the inspection door assembly before bolting the door onto the machine.



7.10 Replacing the Pop-Up Seal

7.10.1 All service on the blast machine must be done with the compressed air off and the air supply locked-out and tagged-out.

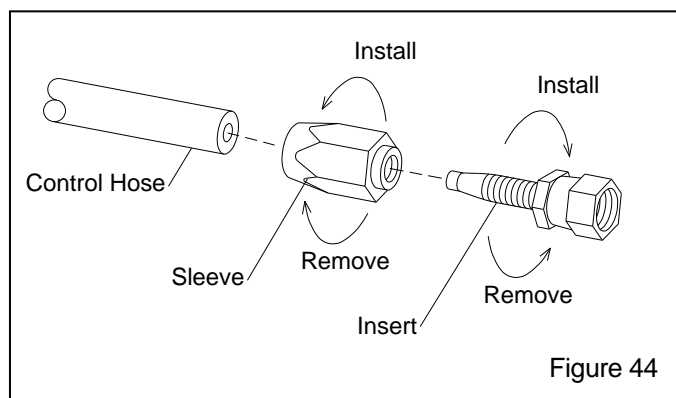
7.10.2 Remove the old seal using fingers, screwdriver, or similar object, to work the seal out of the retaining groove.

7.10.3 Push the new seal all the way through the port and then fit it into the retaining groove. For the last few inches, pull up on the seal and allow it to pop into position.

7.11 Remove and Install Reusable Control Hose Ends, Refer to Figure 44

7.11.1 Control hoses may be shortened and cut to length as follows:

1. Remove the hose end by placing the sleeve in a vise or use a backup wrench on the sleeve to prevent it from turning. Unscrew the insert by turning it counterclockwise.
2. Turn sleeve clockwise to remove from the hose.
3. Cut hose to length.
4. Turn sleeve counterclockwise to install on hose. Do not over-tighten the sleeve, stop tightening as soon as the hose bottoms-out against the sleeve's internal shoulder. Over tightening will cause the hose to curl inward and could cause blockage.
5. Push end of insert into sleeve, and turn clockwise to tighten until the insert hex is against the sleeve.



7.12 Water Pump

Refer to the water pump manual to service the pump

8.0 TROUBLESHOOTING

Note: This section only identifies conditions and problems in the blast machine and remote control system. Always refer to the appropriate section of this manual, or manuals for accessory equipment when troubleshooting and before servicing the equipment.

⚠ WARNING

To avoid serious injury, observe the following when troubleshooting the machine and remote controls.

- Turn off the compressed air and Lockout (be certain the air supply is off and that it cannot be started while work is in process) and tagout (be certain the air supply is clearly marked to prevent re-starting while work is in process) the compressed air supply.
- When checking the controls requires air, always enlist the aid of another person to operate the control handle while holding the nozzle securely and pointing it in a safe direction.
- Never strap the remote control handle lever down in the operating position.

8.1 Neither abrasive nor air exits the nozzle while the machine is under pressure

8.1.1 Nozzle may be obstructed. Depressurize the blast machine. After the pop-up valve has dropped, remove the nozzle, and check it for obstruction.

8.1.2 Valves may be closed. Make sure that both the abrasive metering valve and choke valve are open.

8.2 Air only (no abrasive) exits the nozzle

8.2.1 Abrasive metering valve may be closed or needs adjustment. Adjust abrasive flow per Section 5.1.

8.2.2 The ACS switch may be OFF. Make sure the ACS is in the blast position (toggle pointing away from nozzle).

8.2.3 Blast machine may be empty.

8.2.4 Abrasive may be damp. Refer to Section 7.1 to clear damp abrasive.

8.2.5 Obstruction in abrasive metering valve. Check the abrasive metering valve for obstructions. Refer to Section 7.2.

8.2.6 The abrasive metering valve actuator may require service. Refer to Section 7.7.

8.2.7 Air leak. Check for air leaks in the single-line hose between the ACS and metering valve.

8.3 Heavy abrasive flow

8.3.1 Make sure the choke valve is fully open. The valve is open when the handle position is aligned with the piping.

8.3.2 Abrasive metering valve may be open too far. Adjust abrasive flow per Section 5.1.

8.3.3 Check the abrasive metering valve for wear. Look for wear on the abrasive valve metering plate.

8.4 Abrasive surging

8.4.1 A moderate amount of abrasive surge is normal at start-up. Should the flow of abrasive continue to surge, reduce the amount of abrasive in the air stream by adjusting the metering valve per Section 5.1.

8.4.2 Blockage in outlet passage. Check the abrasive trap and exhaust muffler for blockage. Slow depressurization will load the blast hose with abrasive, and cause surging at start-up. See Section 8.7.

8.4.3 Choke valve closed or partially closed. Make sure the choke valve is fully open. The valve is open when the handle position is aligned with the piping.

8.5 Intermittent abrasive flow

8.5.1 Moisture in the blast machine or in the air supply. Drain moisture from the compressor's receiver tank, and the blast machine's air filter. If problem with moisture persists, an after-cooler or air dryer may be required in the air supply line.

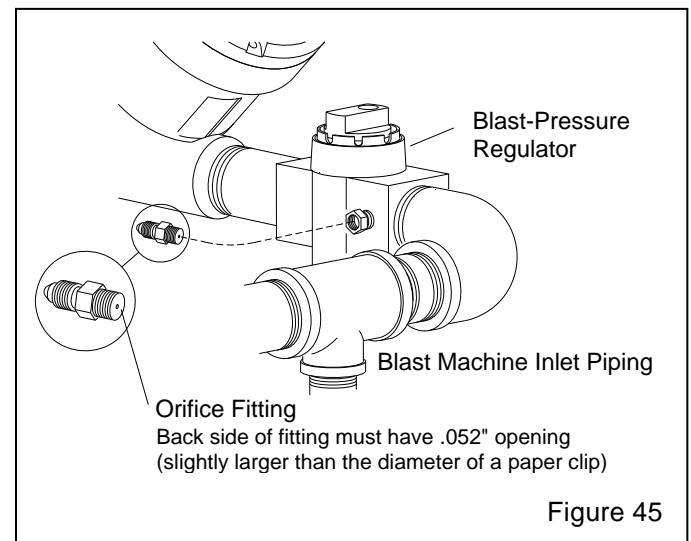
8.6 Blast machine does not pressurize

8.6.1 Make sure the compressor is ON and all air supply valves to the machine are open.

8.6.2 Make sure the safety petcock on the inlet valve is closed.

8.6.3 Inspect the rubber button on the control handle for wear or damage, and make sure the opening on the control handle seals when the handle is pressed.

8.6.4 Check for air escaping through the opening under the control handle lever. If no air is escaping, the orifice fitting on the blast-pressure regulator (shown in Figure 45) is blocked, or the line from the orifice to the control handle is blocked and must be cleared.



8.6.5 Press the control handle lever. Feel for and listen for air leaks on the handle. No air should escape when the handle lever is pressed. If there is a leak, it must be located and repaired.

8.6.6 Check control lines and fittings for air leaks.

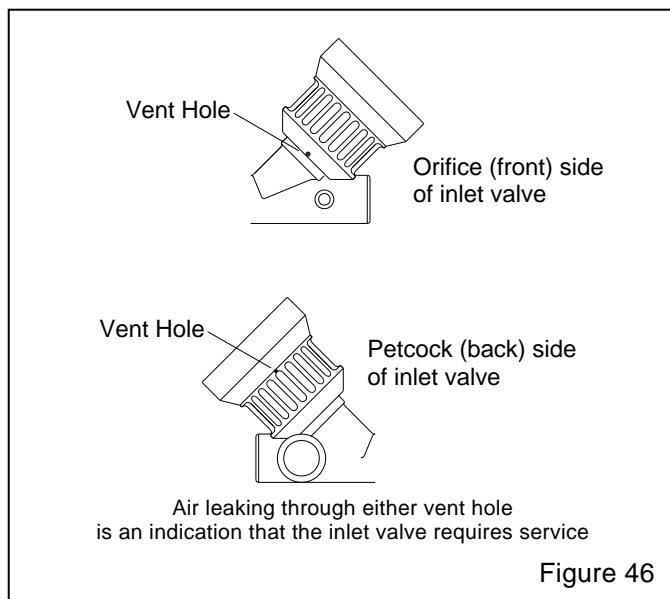
8.6.7 Open the safety petcock, and press the control handle lever; air should come out of the petcock. If it does not, check for the following:

- Opening on the control handle is not sealed off.
- Air leaks in control handle.
- Line from the control handle to the upper fitting on the inlet valve is blocked.

If air comes out the petcock, the Millennium valve is not functioning. Turn off the compressed air supply and service the Millennium valve per Section 7.3.

8.6.8 Pressure delay valve closed or shifts too fast, adjust per Section 5.3.4.

8.6.9 Close the safety petcock, and press the control handle lever. Make sure that no air escapes through either of the two vent holes in the inlet valve body, shown in Figure 46. Air escaping from either of the vents indicates worn seals in the inlet valve. Service the valve per Section 7.3.



8.6.10 Inlet valve malfunctioning. Inspect internal parts for wear, and lubrication. Refer to Section 7.3.

7.6.11 Compressor too small for the nozzle. Refer to the compressed air and abrasive consumption table in Figure 6 for nozzle air consumption.

8.6.12 Insufficient-size air supply hose or reduced-size fittings between the compressor and blast machine. Refer to Section 2.1.

8.6.13 Dirty element in compressed-air filter. Inspect filter element.

8.6.14 Pop-up valve stuck, or internal piping worn or out of alignment. Inspect internal piping.

8.7 Blast machine does not depressurize or depressurizes too slowly

8.7.1 Abrasive trap screen blocked, or abrasive trap needs cleaning. Inspect the screen and empty the trap at least twice daily

8.7.2 Exhaust muffler blocked. Replace muffler.

8.7.3 After releasing the control handle, open the safety petcock on the inlet valve.

- If the machine does depressurizes, control air remains in the control lines, refer to Paragraphs 8.7.4, 8.7.5, 8.7.6, and 8.7.7.
- If the machine does not depressurize, the inlet valve is not fully closing or the outlet valve is not fully opening, refer to Paragraph 8.7.8.

8.7.4 Check the pneumatic adaptor gasket on the control handle for swelling, which restricts air flow through the handle.

8.7.5 Check for blockage in the control hose.

8.7.6 Check the orifice fitting on the blast machine's blast-pressure regulator (shown in Figure 45). The orifice on the 1/8-NPT end of the fitting (the end that threads into the bushing on the regulator) must have a 0.052" opening. A full port fitting will cause the remote controls to malfunction.

8.7.7 Make sure the inlet valve closes. If it does not seal-off incoming air, service the Millennium valve per Section 7.3.

8.7.8 Disassemble the piston outlet valve, clean and lubricate it. Replace all worn or broken parts. Refer to Section 7.4.

8.8 Outlet valve does not seal

8.8.1 Outlet valve requires service. Refer to Section 7.4.

8.9 RLX control handle fails to return to the non-blast position (up) when released

8.9.1 Inspect the handle for damage and accumulation of debris or abrasive that could cause binding. Clean and replace as necessary.

8.9.2 Check the spring for damage or fatigue. Replace as necessary.

8.10 RLX lever lock fails to return (up) to the lock position when the handle is released

8.10.1 Inspect the lever lock for damage, or accumulation of debris or abrasive that could cause binding. Clean and replace as necessary.

8.10.2 Check the lever lock return spring for damage or fatigue. Replace as necessary.

8.11 No water from the injector

8.11.1 Observe pump stroke. If pump rapidly strokes, pump is not properly primed. Refer to Section 4.1.4 to prime pump.

8.11.2 Water flow-control valve closed or blocked. Open flow control or inspect the valve for blockage.

8.11.3 Air supply (isolation) valve to pump module closed. Make sure the air supply valve is open.

8.11.4 Water supply valve to pump module closed. Make sure water supply valve is open.

8.11.5 Pump-module pressure-regulator set too low or turned off. Check pressure; set to between 30 and 40 psi.

8.11.6 Inlet strainer screen blocked. Inspect screen; clean or replace as needed.

8.11.7 Pump requires service. Refer to the pump operations manual.

8.12 Pump does not prime, pump rapidly strokes, but does not pump water

8.12.1 Make sure all air is bled from water supply, refer to Sections 4.1.2.

8.12.2 If pump does not self-prime from the water tank, and if pressurized water (from a faucet) supply is available, repeat the priming process using pressurized water. Once primed, switch supply back to the water tank.

8.12.3 Inspect the needle valve and check valve for blockage.

8.12.4 Make sure the check valve (located on the coupled injector assembly) is installed correctly; the arrow should point toward the outlet in the direction of water flow.

9.0 ACCESSORIES AND REPLACEMENT PARTS

9.1 Blast Machine and Accessories, Figure 47

Item	Description	Stock No.
1.	Ball valve, 1-1/4" with handle	02397
2.	Handle, 1-1/4" ball valve	22532
3.	Pusher line assembly, 1-1/4" x 31"	23675
4.	Air filter, 1-1/2-NPT manual drain	01284
5.	Coupling, 1-1/4" CF	00551
6.	Gasket, CQG for 00551 coupling, pk. 10	00850
7.	Metering valve, Auto-Quantum w/fittings ..	24447
8.	Inspection door assembly, 6" x 8"	02377
9.	Gasket, inspection door, 6" x 8"	02369
10.	Seal, pop-up valve	02325
11.	Pop-up valve, 4", with external sleeve	03699
12.	Wye, standard 1-1/4"	01818
13.	Internal pop-up guide, 1-1/4" x 9.5" toe	01757
14.	Adaptor, 1-1/4-NPT x JIC	22529
15.	Safety cable, 1-1/2" to 3" OD hose	15013
16.	Lock pin, coupling (package of 25)	11203
17.	Cover, 24" diameter	02336

18.	Screen, 24" diameter	03100
19.	Muffler, 1" exhaust	05068
20.*	CPF air filter	03578
	refer to CPF filter manual No. 04143 for parts	
21.*	Nut, 1" lock	11917
22.*	Elbow, 1" 90° street	01775
23.*	Nipple, 1" x close	01701
24.*	Ball valve, 1" with handle	02396
25.*	Adaptor, 1-NPT x JIC	11720
26.*	Hose assembly, 1" ID x 32", coupled	22864
27.**	Coupling, nylon, CQPS-2	08413
28.**	Gasket, CQGP-3, pack of 10, for item 28 ...	08853
29.**	Nozzle holder, with	
	Contractor threads, NHP-2	04127
	1-1/4 nozzle threads, HEP-2	07721
30.**	Hose, Supa blast, 1-1/4" ID x 50 ft.	23106
31.**	Nozzle, with	
	Contractor threads, SXS-7	100867
	1-1/4 threads, SAS-7	28082
32.**	Washer, nozzle, pack of 10	
	NW-32, for SXS nozzles	91026
	NW-4, for SAS nozzles	00869

* Supplied with factory-installed CPF air filter option

** Supplied with accessory kit

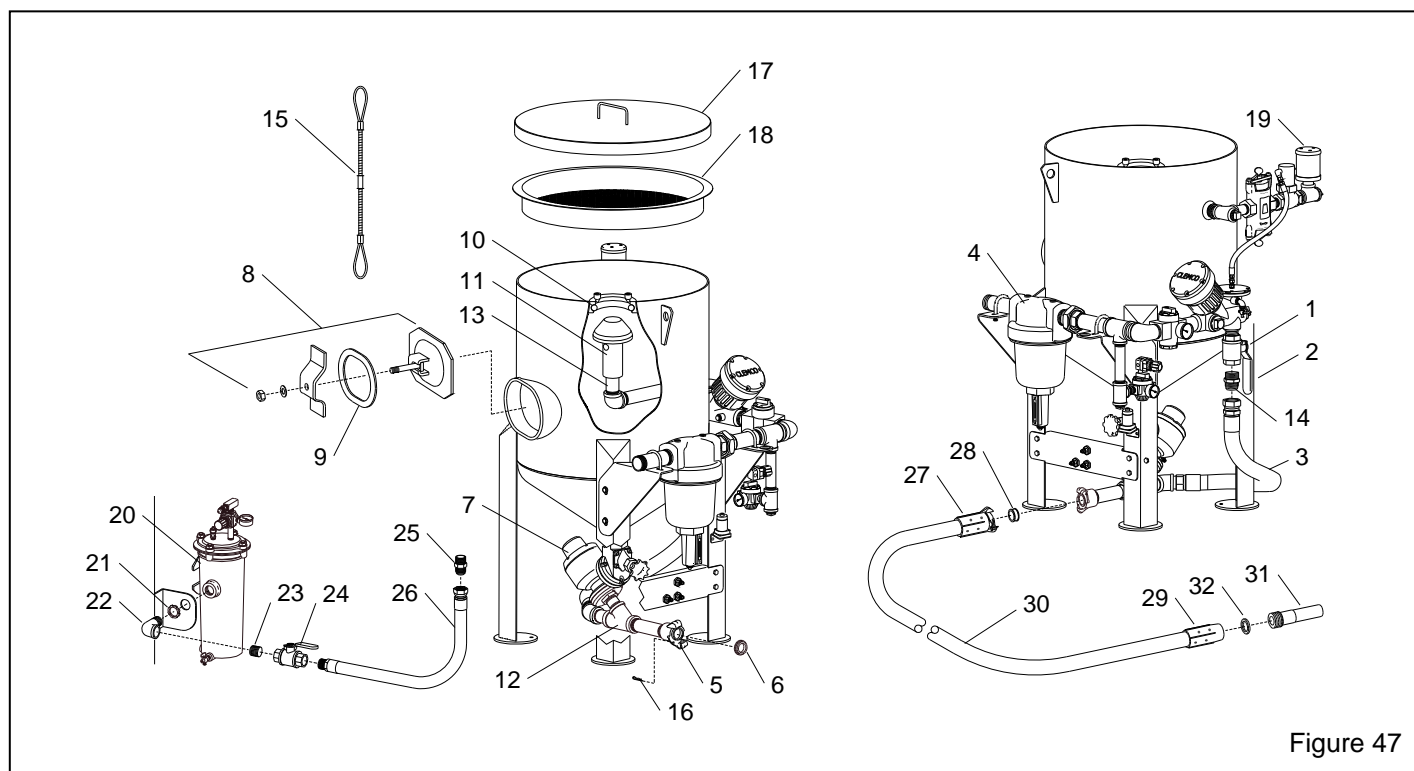
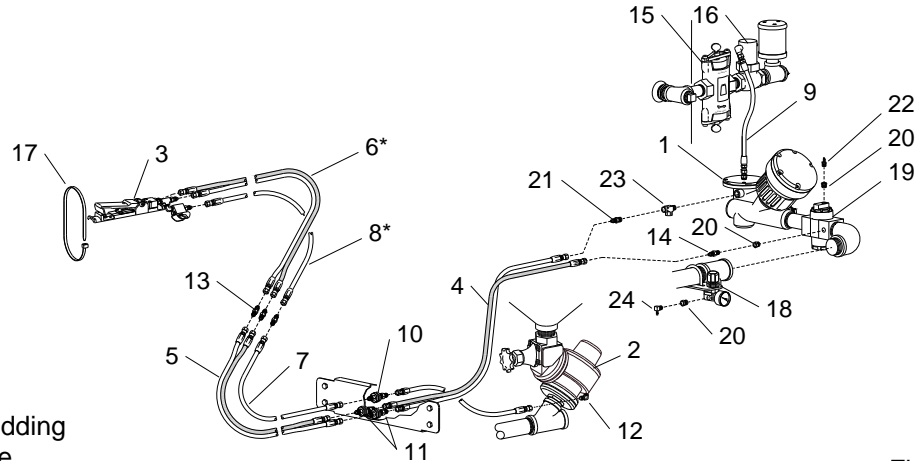
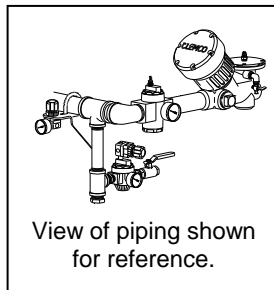


Figure 47

9.2 Remote Control System, Figure 48

Item	Description	Stock No.
1.	Millennium inlet valve	23620
2.	Metering valve, Auto-Quantum w/fittings	24447
3.	RLX control handle w/ ACS	07625
4.	Hose, 4' twinline coupled	21619
5.	Hose, 52' twinline coupled, first hose	28569
6.*	Hose, 50' twinline coupled, extension	01951
7.	Hose, 52' 3/16" single-line, first hose	28570
8.*	Hose, 50' 3/16" single-line, extension	03087
9.	Hose, 3/16" x 18"	02454
10.	Fitting, 1/4-NPT bulkhead each, 3 used ...	05605

11.	Adaptor, 1/4-NPT each, 6 used	02494
12.	Adaptor, 1/8-NPT elbow	02827
13.	Union, 3/16" hose	01944
14.	Orifice, .052"	20429
15.	Abrasive trap, 1-NPT	02011
16.	Outlet valve, TLR 1-NPT piston	01967
17.	Tie, nylon	02195
18.	Regulator, 1/4" pilot w/gauge	12050
19.	Regulator, 1-1/2" pilot-operated w/gauge ..	12051
20.	Bushing, 1/4 x 1/8-NPT	02010
21.	Adaptor, 1/4-NPT	02494
22.	Fitting, 1/8-NPT x 1/8" barb, straight	11732
23.	Tee, 1/4-NPT M/F/F	20847
24.	Fitting, 1/8-NPT x barb, elbow	11733



* Use 50-ft extensions when adding additional lengths of blast hose.

Figure 48

9.3 TLR Piston Outlet Valve, Figure 49

Item	Description	Stock No.
(-)	Outlet valve, 1" piston-type, complete	01967
(-)	Service kit, includes items marked *, quantities shown in ()	01928
1.	Elbow, 1/4-NPT adaptor	02513
2.	Plug, 1/4-NPT	01950
3.	Bonnet	01970
4.	Piston and rod assembly	01976
5.	Plug and spindle guide	01971
6.*	Valve plug (1)	01972
7.*	Washer, valve plug (2)	01969
8.*	Retainer, valve plug washer (1)	01986
9.	Valve body	01968
10.*	Spring, 7/16" x 1-5/8" long (1)	01974
11.*	Washer, nylon (1)	01979
12.*	Cap screw, 3/8-NC x 3/4" (1)	03251

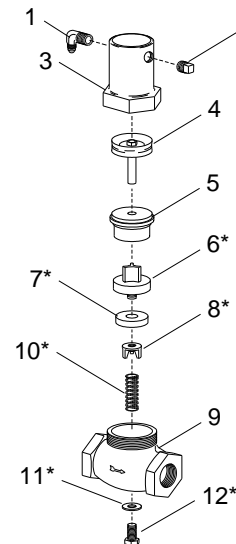


Figure 49

9.4 Low Pressure Delay System, Figure 50

Refer to Section 9.2 for remote control system parts.

Item	Description	Stock No.
1.	Valve, pressure delay	28625
2.	Sub-plate, pressure delay valve	28624
3.	Regulator, 1/4" pilot with gauge	12050
4.	Tubing, 1/8" urethane, specify ft. required	12475
5.	Orifice, .052"	20429
6.	Bushing, 1/4 x 1/8-NPT	02010

7.	Fitting, 1/8-NPT x 1/8" barb	11732
8.	Nipple, 1/4-NPT hex	02808
9.	Fitting, 1/8-NPT elbow x 1/8" barb	11733
10.	Tee, 1/4-NPT M/F/F	20847
11.	Adaptor, 1/4-NPT	02494
12.	Regulator, 1/2" pilot-operated	11345
13.	Regulator, 1-1/2" pilot-operated w/gauge	12051
14.	Fitting, tube, 10-32 thread x 1/8" barb	11731
15.	Bracket, pressure delay valve mounting	28650
16.	Tee, 1/8" barb	11734

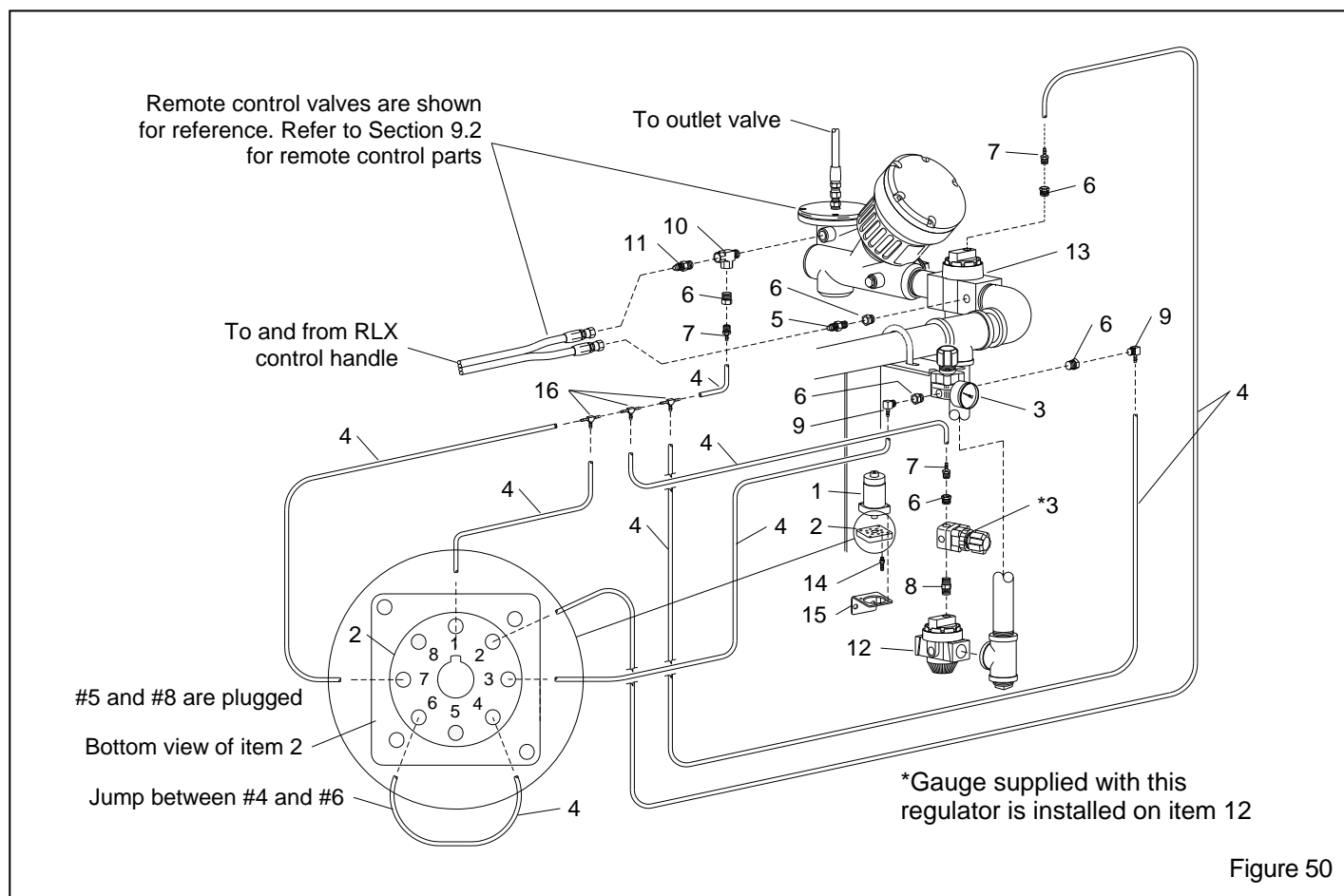
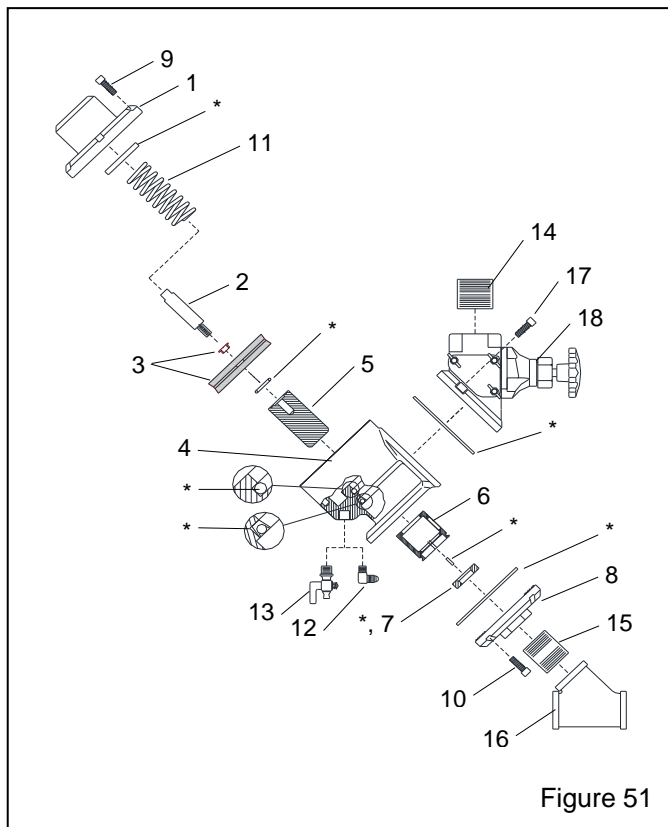


Figure 50

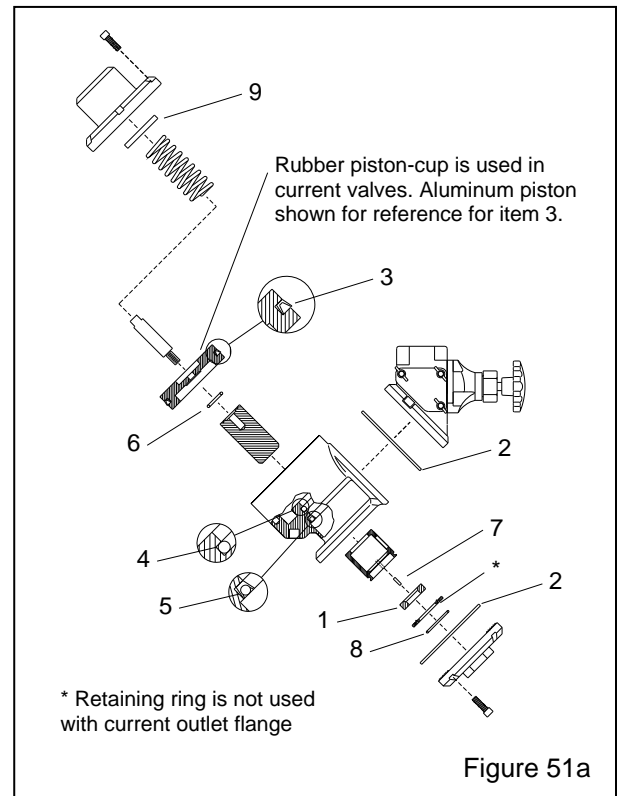
9.5 Auto-Quantum Actuator Segment, Figure 51

Item	Description	Stock No.
(-)	Auto-Quantum metering valve w/fittings	24447
(-)	Service kit, Quantum actuator Includes items called out in Figure 51a ..	24446
1.	Cover, cylinder	21317
2.	Stop, piston	21323
3.	Piston-cup w/bushing	21329
4.	Valve body	21349
5.	Plunger, grit valve	21326
6.	Wear sleeve, grit valve	21342
7.	Seat, urethane	21344
8.	Flange, outlet w/retaining ridge	21319
9.	Screw, 5/16-NC x 1-3/4" socket head	21321
10.	Screw, 5/16-NC x 1" socket head	21318
11.	Spring	20600
12.	Adaptor, 1/4-NPT elbow	02513
13.	Petcock, 1/4-NPT	01993
14.	Nipple, 1-1/2" x close schedule 80	01791
15.	Nipple, 1-1/4" x 2"	01718
16.	Wye, 1-1/4"	01818
17.	Screw, 3/8-NC x 1" socket head	22655
18.	Metering assembly	Refer to Section 9.6



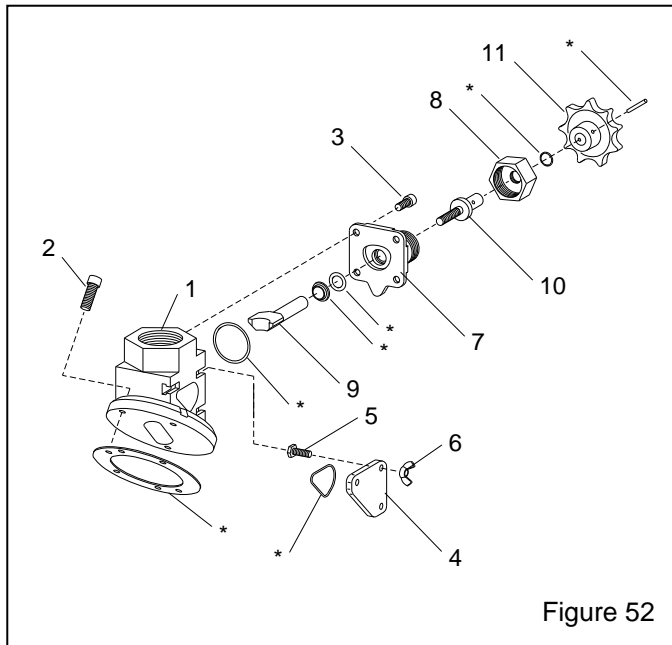
24446 SERVICE KIT QUANTUM ACTUATOR

Item	Qty	Description
1.	1	Seat, urethane
2.	2	Gasket, flange
3.	1	U-seal, 3-1/2" ID For early style with aluminum piston
4.	1	O-ring, 1-1/2" ID x 3/16" nom.
5.	1	Wiper, plunger
6.	1	O-ring, 31/64" ID
7.	1	Roll pin, 1/8" x 1/2"
8.	1	O-ring, 1-1/2" ID x 3/32" nom. For early style with separate retaining ring
9.	1	Felt disc



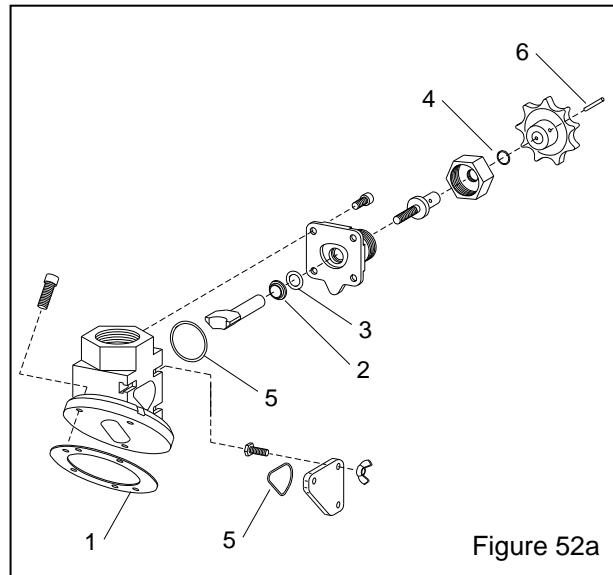
9.6 Auto-Quantum Metering Segment, Figure 52

Item	Description	Stock No.
(-)	Service kit, metering section Includes items called out in Figure 52a ...	22854
(-)	Metering assembly, Includes all items shown in Figure 52	24587
1.	Upper body, flanged	21314
2.	Screw, 3/8-NC x 1" socket head	22655
3.	Screw, 5/16-NC x 3/4" socket head	22767
4.	Cover, cleanout	22620
5.	Screw, 1/4-NC x 3/4" hex head cap	03052
6.	Nut, 1/4-NC wing	03113
7.	Housing, knob	22761
8.	Nut, knob-housing	22762
9.	Metering plate and shaft	22763
10.	Metering screw	22764
11.	Knob, adjustment	22766



22854 SERVICE KIT QUANTUM METERING SECTION

Item	Qty	Description
1.	1	Flange gasket
2.	1	Wiper seal
3.	1	O-ring, 3/4" OD nominal
4.	1	O-ring, 5/8" OD nominal
5.	2	O-ring 1-1/2" ID nominal
6.	1	Roll pin



9.7 Millennium Inlet Valve, Figure 53

Item	Description	Stock No.
*	Service kit, Millennium inlet seals Includes items called out in Figure 53a ..	22856
**	Service kit, Millennium plunger tip Includes items called out in Figure 53b ..	22898
(-)	Millennium inlet valve	23620
1.	Plunger	22600
2.	Dual piston	22602
3.	Spring, 4" long	22604
4.	Screw, socket, w/internal threads	22650
5.	Sleeve, cylinder	22603
6.	Screw, 5/16-NC x 1-1/4", socket head	22611
7.	Body, inlet valve	21338
8.	Cap, cylinder	21339
9.	Plug, 1-1/2-NPT	02477
10.	Nipple, 1/4-NPT hex	02808
11.	Elbow, 1/4-NPT 90° female	06373
12.	Petcock, 1/4-NPT	01993
13.	Plug, 1/4-NPT	01950
14.	Adaptor, 1/4-NPT	02494
15.	Plug, 1-1/4-NPT	01762
16.	Plate, remote outlet adaptor	23597
17.	Gasket, adaptor plate	23261

Refer to Section 9.2,
Figure 48 for additional
fittings.

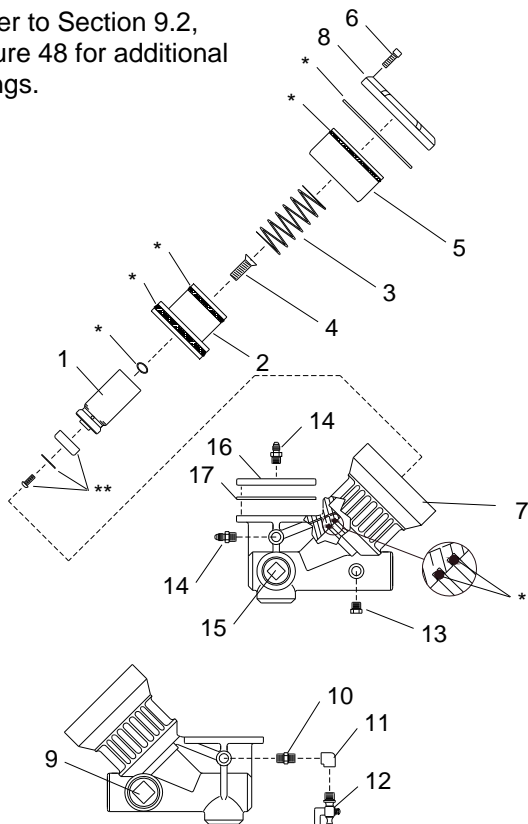


Figure 53

22856 SERVICE KIT MILLENNIUM INLET VALVE SEALS

Item	Qty	Description
1.	2	O-ring, 2-1/8" OD, nominal
2.	1	U-seal, dual piston lower, 3-1/2" ID
3.	1	U-seal, dual piston upper, 2-3/8" ID
4.	1	O-ring, 4-1/8" OD, nominal
5.	1	O-ring, 31/64" ID, nominal
6.	1	Gasket, cylinder cap

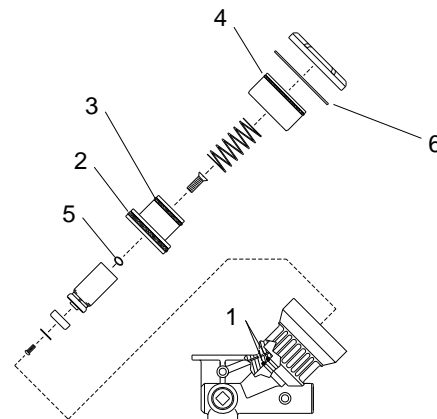


Figure 53a

22898 SERVICE KIT MILLENNIUM PLUNGER TIP

Item	Qty	Description
1.	1	Screw, 5/16-NC button head
2.	1	Washer, plunger tip
3.	1	Tip, replaceable plunger

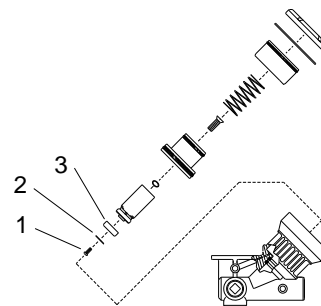


Figure 53b

9.8 RLX Pneumatic Control Handle with ACS, Figure 54

Note: Refer to Section 9.9 for RLX replacement parts

Item	Description	Stock No.
(-)	RLX control handle assembly w/ ACS	.....07625
1.	RLX control handle, standard	.....10565
2.	Switch assembly, ACS pneumatic	.....07654
3.	Elbow, 1/8-NPT male	.....03085
4.	Tee, 1/8-NPT brass	.....02171
5.	Adaptor, 1/8-NPT	.....01940
6.	Guard, ACS pneumatic switch	.....07655
7.	Breather muffler, 1/8-NPT	.....07657
8.	Switch only, ACS	.....07658
9.	Connector, 1/8-NPT brass	.....01962

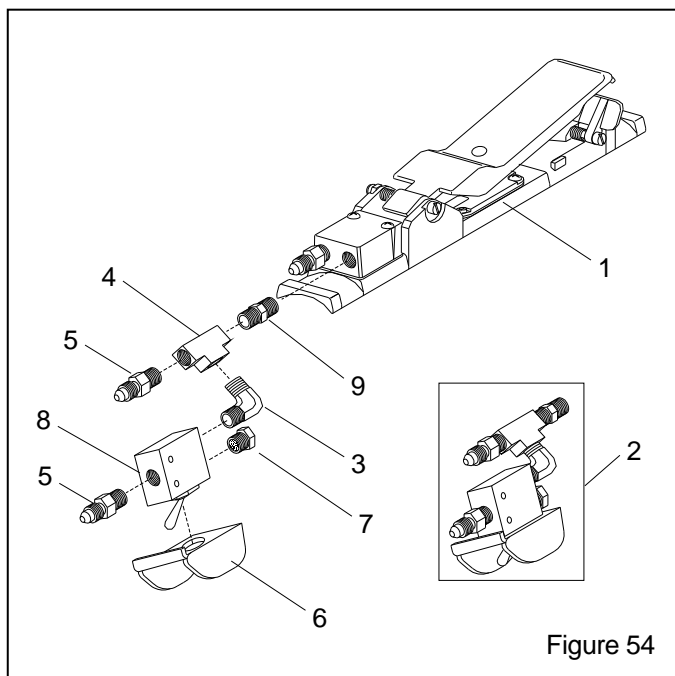


Figure 54

9.9 RLX Pneumatic Control Handle, Figure 55

Item	Description	Stock No.
(-)	RLX pneumatic control handle assembly	.... 10565
(-)	Service kit, pneumatic RLX	
	Includes items called out in Figure 55a	... 22859
1.	Handle lever	..... 10573
2.	Body	..... 10568
3.	Pneumatic adaptor	..... 10562
4.	Adaptor, 1/8-NPT (2 required)	..... 01940
5.	Tie, nylon wire	..... 02195

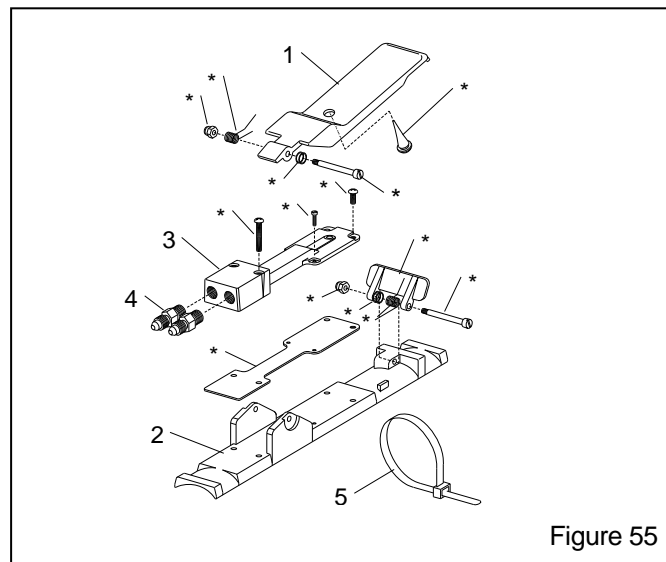


Figure 55

22859 SERVICE KIT RLX PNEUMATIC CONTROL HANDLE

Item	Qty	Description
1.	1	Lever lock
2.	2	Spring
3.	2	Nut, 8-32 lock, ss
4.	4	Spacer washer, stainless steel
5.	2	Screw, 3/16" x 1-1/4" shoulder
6.	2	Screw, 8-32 x 1"
7.	2	Screw, 4-40 x 3/8"
8.	3	Rubber button
9.	1	Gasket, pneumatic adaptor
10.	2	Screw, 8-32 x 3/8"

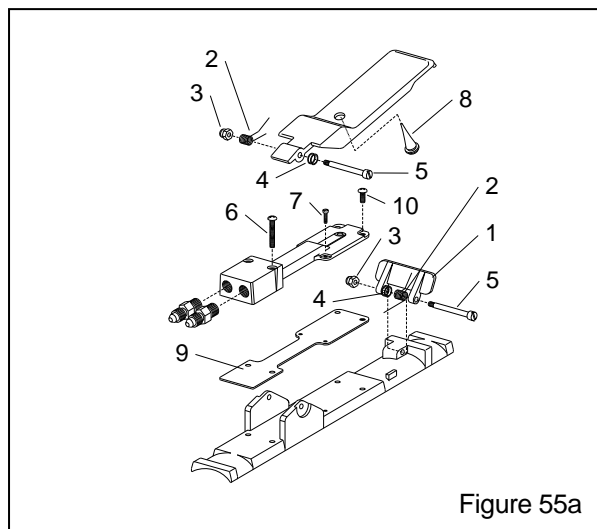
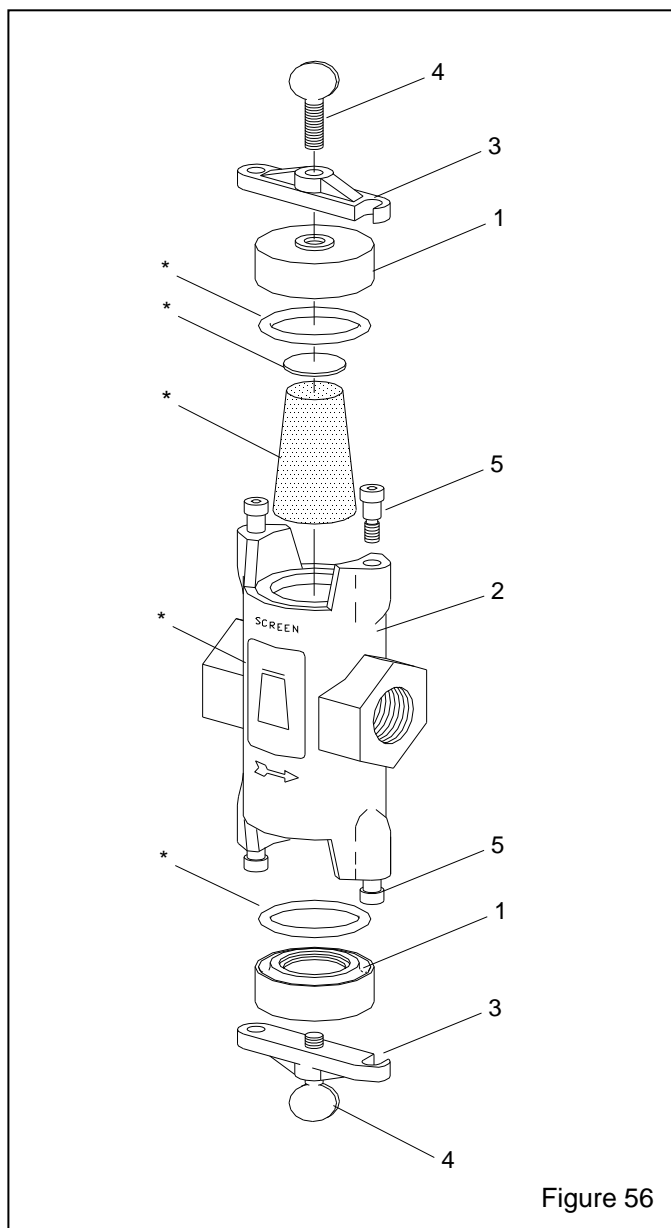


Figure 55a

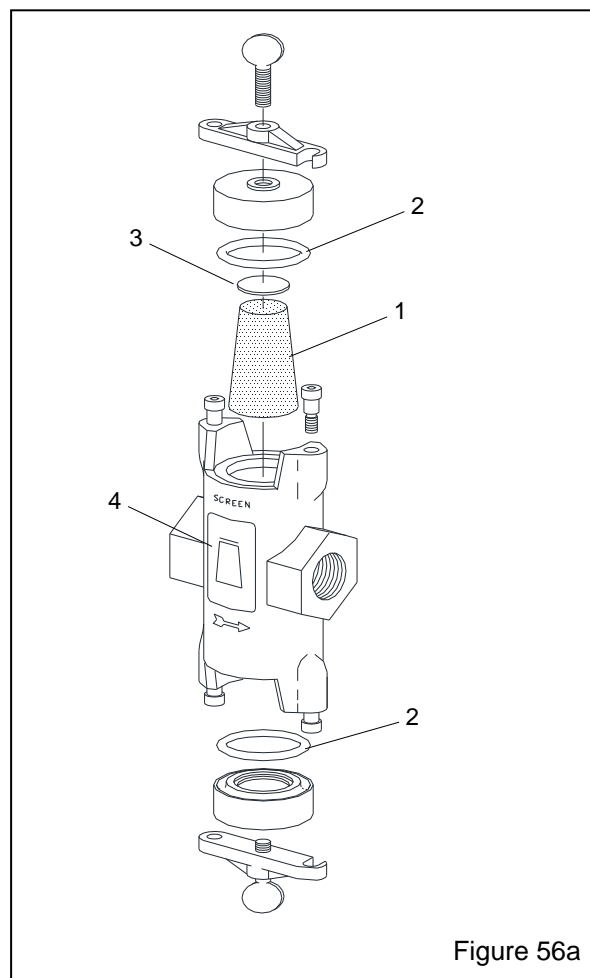
9.10 Abrasive Trap, Figure 56

Item	Description	Stock No.
(-)	Abrasive trap	02011
(-)	Service kit, abrasive trap Includes items called out in Figure 56a ..	01925
1.	Cap	02014
2.	Body	02015
3.	Lock bar	02016
4.	Screw, 3/8-NC x 1" thumb	03289
5.	Shoulder screw, 3/8" x 3/8"	03291



**01925 SERVICE KIT
 ABRASIVE TRAP**

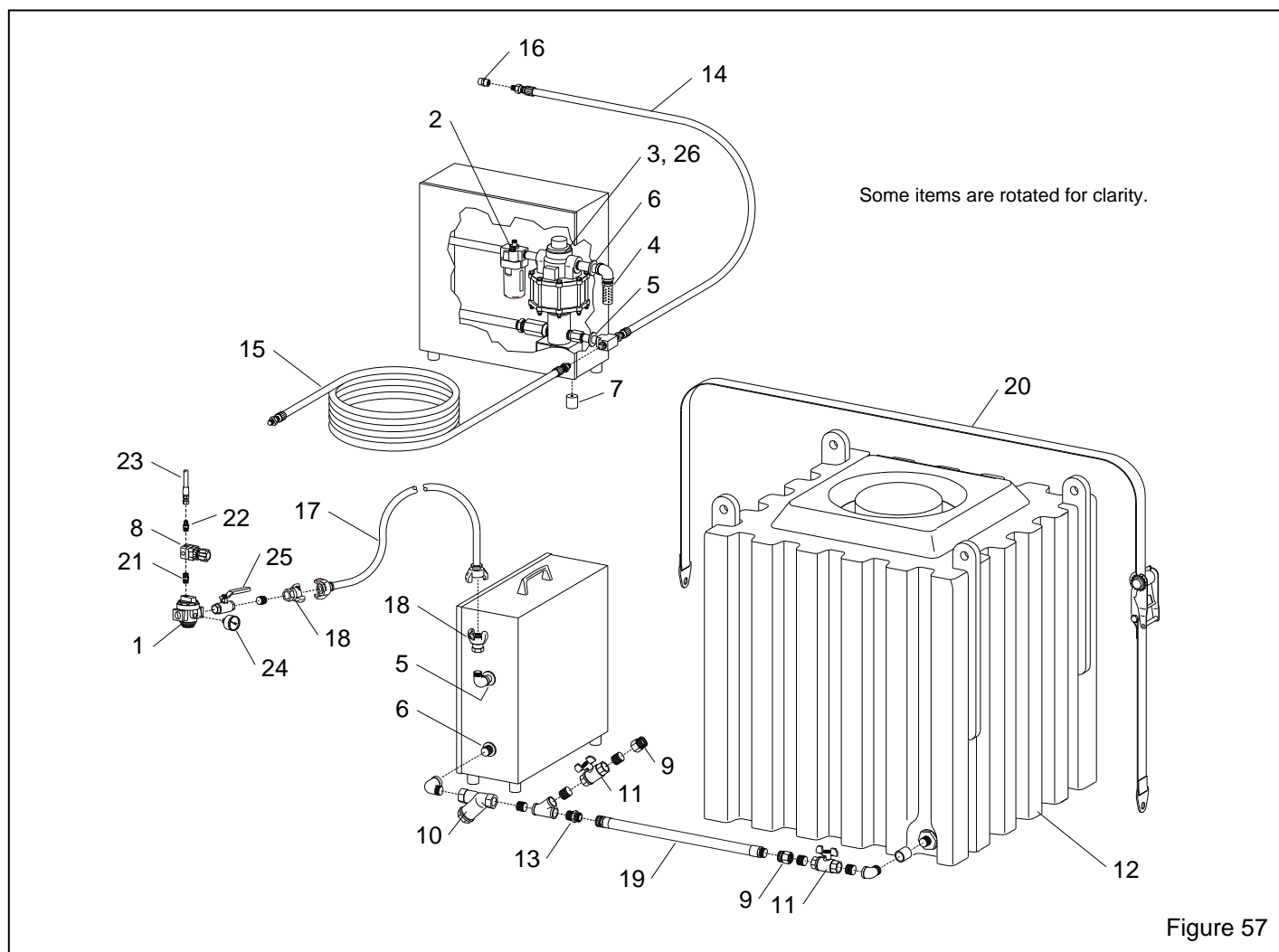
Item	Qty	Description
1.	3	Screen
2.	2	O-ring
3.	1	Gasket, screen, 1/8" thick
4.	1	Label, "clean screen twice daily"



9.11 Pump Module and Water Tank, Figure 57

Item	Description	Stock No.
1.	Pressure regulator, 1/2" pilot-operated	11345
2.	Lubricator, 1/2-NPT	05531
3.	Pump, water injector	05532
4.	Muffler, 3/4-NPT air	05529
5.	Grommet, 7/8" ID rubber	00183
6.	Grommet, 1" ID rubber	00184
7.	Foot, cabinet enclosure, each	05525
8.	Regulator, 1/4" pilot w/gauge	12050
9.	Adaptor, 3/4-FPT x fem water swivel	05524
10.	Strainer, 3/4-NPT water, 100 mesh	15011
11.	Ball valve, 3/4-NPT with handle	28551
12.	Tank, 120-gallon water	28550
13.	Adaptor nipple, 3/4-NPT x 3/4" water	28554

14.	Hose, hydraulic, 3/8" ID x	28565
15.	Hose, hydraulic 52-ft. long, 3/8" ID first hose	28559
	50-ft. long, 3/8" ID extension hose	05527
16.	Connector, 1/4-FNP hydraulic hose	02162
17.	Air hose assembly, 1/2" x 82" coupled	28566
18.	Coupling, 1/2-FPT twist-on	00594
19.	Hose, 3/4" x 19" water	28553
20.	Strap, 2" x 10' tie-down, each	28552
21.	Nipple, 1/4-NPT hex	02808
22.	Adaptor, 1/4-NPT	02494
23.	Hose, 3/16" x 18"	02454
24.	Gauge, 1/4-NPT CBM	11830
25.	Valve, 1/2-NPT ball, with handle	01241
26.	Service kit, water pump, includes air motor kit and hydraulic kit	05484



9.12 Injector Assemblies, Figure 58

Item	Description	Stock No.
1.	Adaptor-injector assembly w/couplings for use at the blast machine	28580
2.	Nozzle adaptor-injector assembly 1-1/4" nozzle thread, 1" ID injector sleeve	05540
3.	Nozzle adaptor-injector assembly, option 50mm nozzle thread, 1" ID injector sleeve	05541
4.	Nozzle adaptor-injector assembly, option 50mm nozzle thread, 1-1/4" ID injector sleeve	05598
5.	Body, 1-1/2-NPSM entry injector	28573
6.	Body, 1-1/4" threaded injector adaptor.....	05506
7.	Body, 50mm threaded injector adaptor	05507
8.	Injector assembly, 1" ID for 5540 includes items 11, 15, & one from 16	05536
9.	Injector assembly, 1" ID for 5541 includes items 12, 14, & one from 17	05534

10.	Injector assembly, 1-1/4" ID for 5598 includes items 13, 14, & one from 18	05535
11.	Sleeve, 1" ID injector, for 1-1/4" body	05508
12.	Sleeve, 1" ID injector for 50mm body	05509
13.	Sleeve, 1-1/4" ID injector for 50mm body ..	05510
14.	O-ring, 1-3/8 ID	05516
15.	O-ring, 1-1/4" ID	05523
16.	Washer, NW-4 nozzle, pack of 10	00869
17.	Washer, NW-25 nozzle, pack of 10	91024
18.	Washer, NW-32 nozzle, pack of 10	91026
19.	Elbow, 1/4-NPT 90° street	02027
20.	Nipple, 1/4-NPT hex	02808
21.	Valve, 1/4-NPT flow control	05528
22.	Coupling, CF-2, 1-1/2-NPT	00553
23.	Gasket, CQG, pack of 10	00850
24.	Coupling, CF, 1-1/4-NPT	00551
25.	Nipple, 1-1/4-NPT x 4" galv.	01924
26.	Elbow, 1/4-NPT x 90°	06373
27.	Valve, 1/4-NPT check	28557
28.	Lock pin, coupling (package of 25)	11203
29.	Hose, hydraulic starter, 5-ft coupled	28565
30.	Cradle, injector assembly storage	On request

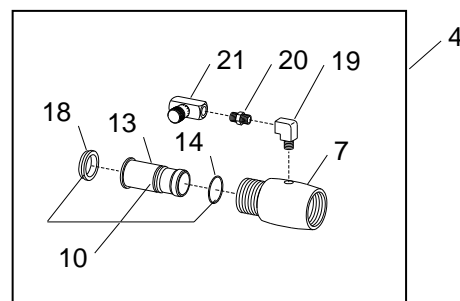
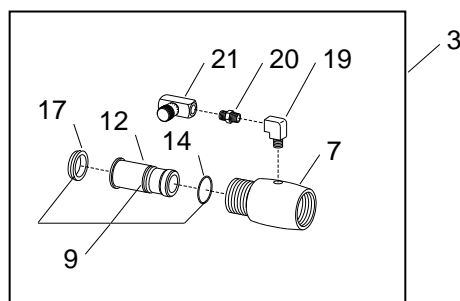
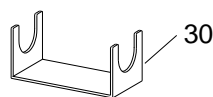
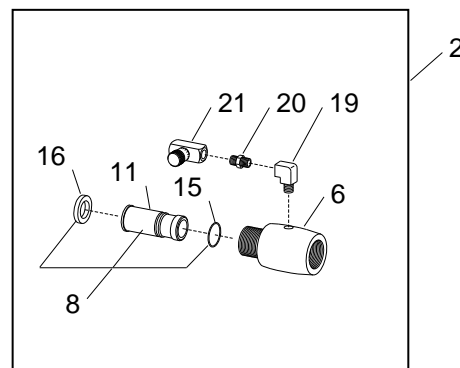
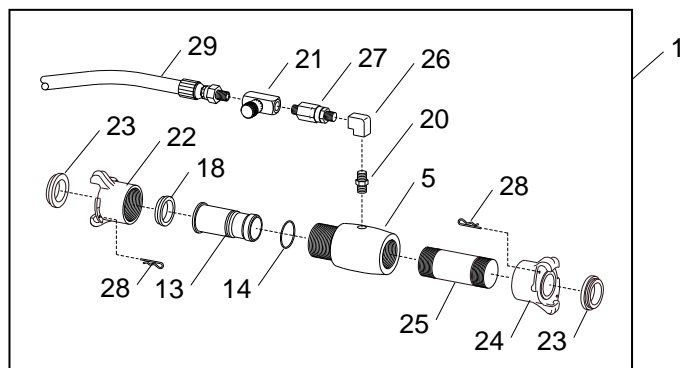


Figure 58