

**INDUSTRIAL SINGLE CHAMBER BLAST MACHINE
With MILLENNIUM ACS PNEUMATIC
REMOTE CONTROLS
O.M. 23404**

**DATE OF ISSUE: 9/01
REVISION: I, 05/15**

 **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 important information.

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INDUSTRIAL
Blast Facilities
by Clemco Industries Corp.

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

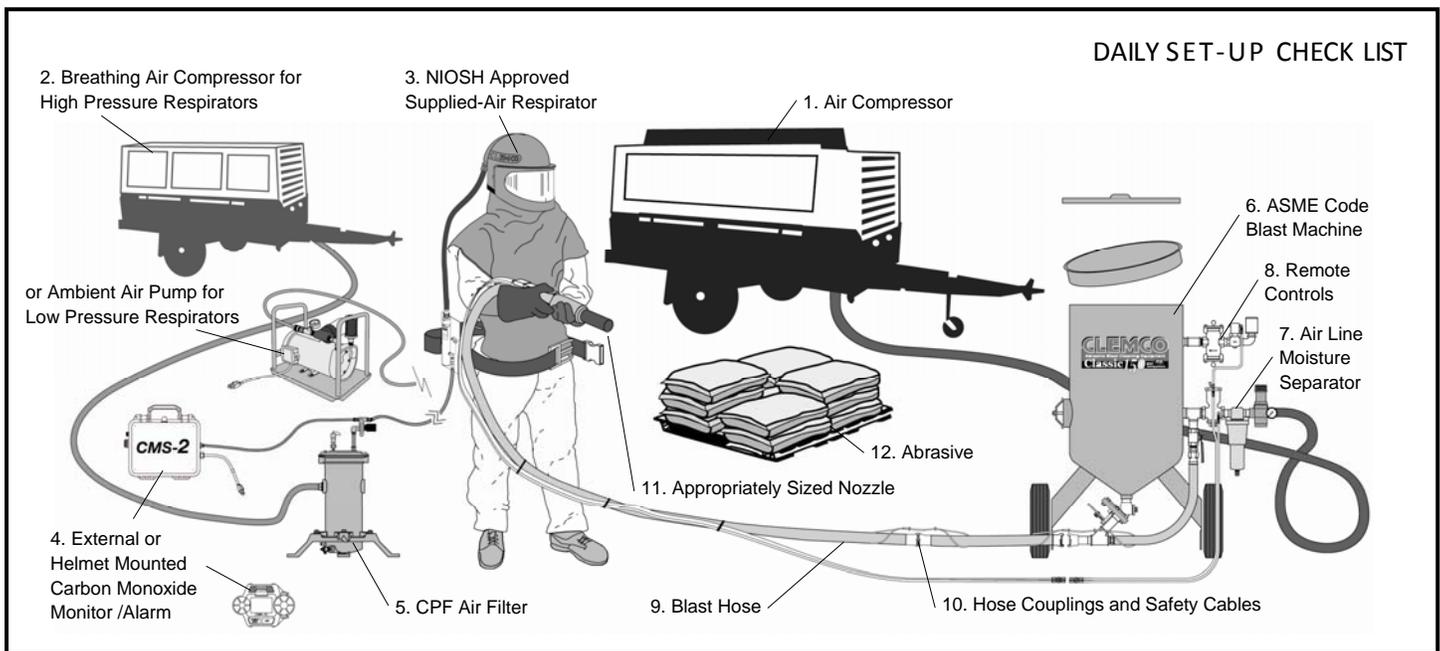
- Completely read and follow all service instructions and recommended maintenance intervals. Always shut off compressor and depressurize blast machine before performing any maintenance. At every service interval, clean all filters, screens, and alarm systems. If spring-loaded abrasive valves are used,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



DAILY SET-UP CHECK LIST

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 (sorbent 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 instructions cover the set-up, operation, maintenance, troubleshooting, and replacement parts for the Clemco industrial blast machine. Components of the standard blast machine are shown in Figure 1. Some accessories may vary slightly when the machine is provided on a project (custom equipment built to user specifications). Figure 2 shows the remote-control air circuit. Refer to the blast machine drawings supplied with the project manual for specific plumbing information for blast machine and remote controls.

1.1.2 This manual contains 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 operator is trained and qualified to safely operate the blast machine and remote controls and all other equipment used with the blast machine.

1.1.3 All personnel involved with the abrasive blasting 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. It contains important safety information about abrasive blasting that may not be included in equipment operation manuals. The booklet is available in both English and Spanish; to request copies, email 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.

1.3 Components and Operating Principles

1.3.1 Components

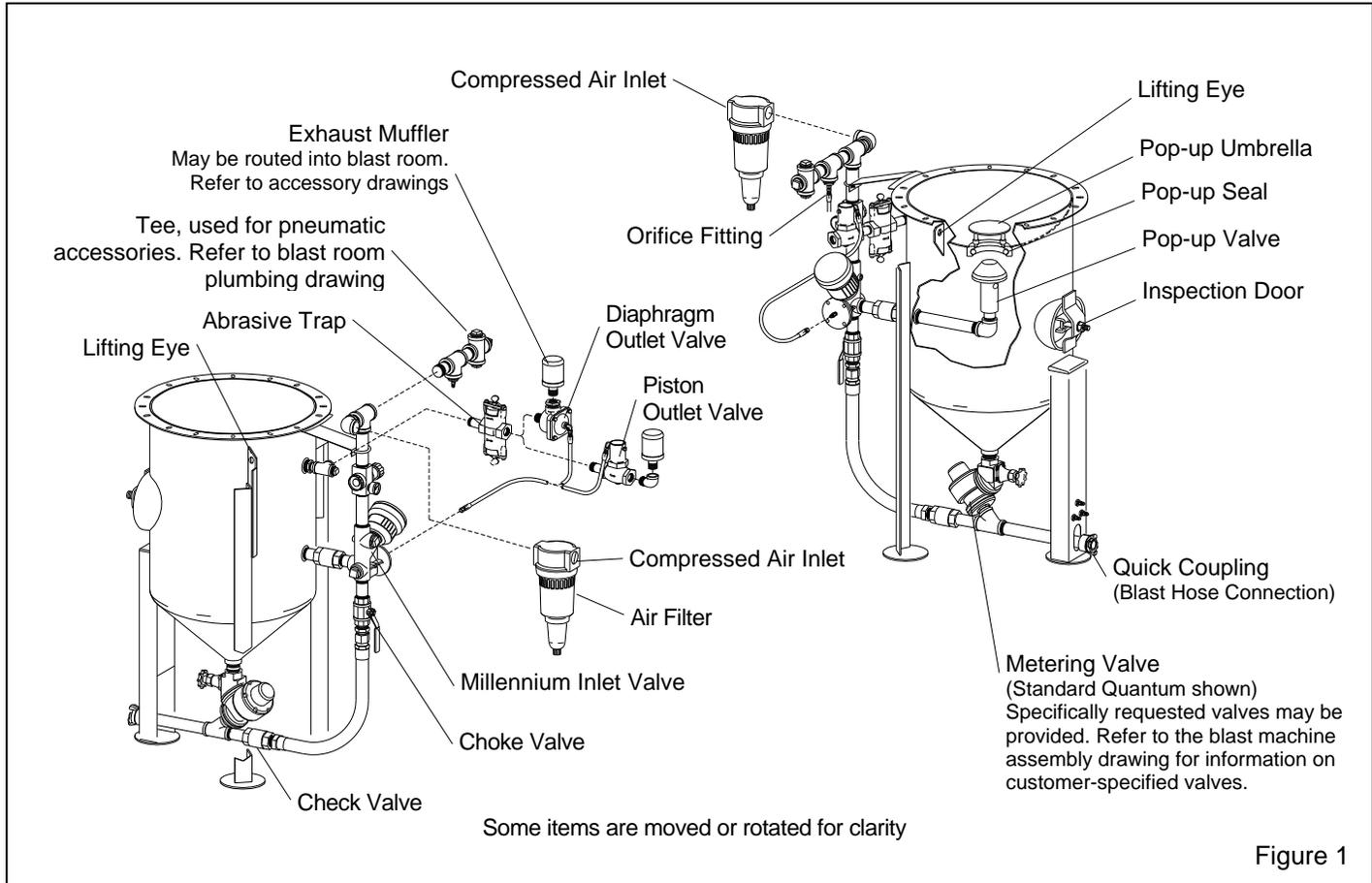
1.3.1.1 The primary components of the blast machine are shown in Figure 1. They include the blast machine with remote controls and pneumatically-operated Auto-Quantum Abrasive Metering Valve.

1.3.2 Blast Machine

1.3.2.1 Clemco blast machines (pressure vessels) are manufactured to American Society of Mechanical Engineers (ASME) standards, as described in Section VII, Div. 1, and carry a National Board certification. It is the owner's responsibility to maintain the integrity of the vessel in accordance with the requirements of 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 could weaken the vessel. Compressed air pressure could cause a weakened blast machine to rupture, resulting in death or serious injury. Welding, grinding, or drilling on the blast machine vessel, without a National Board "R" stamp voids the ASME and National Board certification.



1.3.2.2 All welding repairs done on 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 ASME and National Board certification of the vessel.

1.3.2.3 This blast machine is rated for a maximum of 150 psi (pounds per square inch); do not exceed the rated pressure.

⚠ WARNING

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

1.3.2.4 Use lifting eyes or a pallet when placing the machine. Do not use a sling around the cart handles or piping.

1.3.2.5 The blast machine is equipped with remote controls that allow the operator to start and stop blasting at the nozzle.

1.3.2.6 OSHA does not require pressure relief valves on blast machines when air compressors supplying air to the blast machines are built to ASME ⁽¹⁾ specifications and comply with OSHA ⁽²⁾ regulations. ASME Manual section VIII, Division 1, UG-125, paragraph A90 (g) states that pressure relief valves or protective devices "...need not be installed directly on a pressure vessel when the source of pressure is external to the vessel and is under such positive control that the pressure in the vessel cannot exceed the maximum allowable working pressure at the operating temperature...". OSHA regulation 1910.169 refers to the above 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, 1989

⁽²⁾ Occupational Safety and Health Administration, 29 CFR 1910, Subpart M - Compressed Gas and Compressed Air Equipment.

1.3.3 Remote Controls

1.3.3.1 The components of the remote control system are shown in Figures 1 and 2. The remote system includes the Millennium inlet valve, Auto-Quantum (AQV) abrasive metering valve, diaphragm outlet valve (for use with fine or aggressive abrasive) or a piston outlet valve (for use with coarse or non-aggressive abrasive), RLX control handle with abrasive cut-off switch (ACS), 50 ft. twinline control hose, 50 ft. single-line control hose, and all necessary interconnecting control hoses and fittings.

⚠ 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 could occur, causing serious injury

1.3.3.2 The remote control system is an OSHA-required safety device; it is required when an operator mans the nozzle. The control handle, located near the blast nozzle, is the activator of the remote control system. Standard remote controls are pressure-release-style,

which control the pressurization and depressurization of the blast machine. Pressurization, which starts the blasting, occurs when the control handle is pressed. Depressurization, which stops blasting, occurs when the handle is released. When the 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 any interruption in the control-air circuit (for reasons, such as a break in the line, the compressor stops running, or the operator drops the blast hose), deactivates the blast machine.

1.3.3.3 Remote controls operate pneumatically on the return-air principle (Refer to Figure 2). A stream of air travels from the orifice fitting, down the outbound twinline (shown shaded in Figure 2) and escapes through an opening located under the control handle lever. As long as air escapes through the opening, the remote control system remains inactive. When the lever is pressed, the opening is sealed, and air from the outbound line returns through the return line to open the Millennium inlet valve, and close the outlet valve. This pressurizes the blast machine and begins the blasting. Releasing the handle exhausts the control air, which closes the inlet valve, and opens the outlet valve to depressurize the machine and stops the blasting.

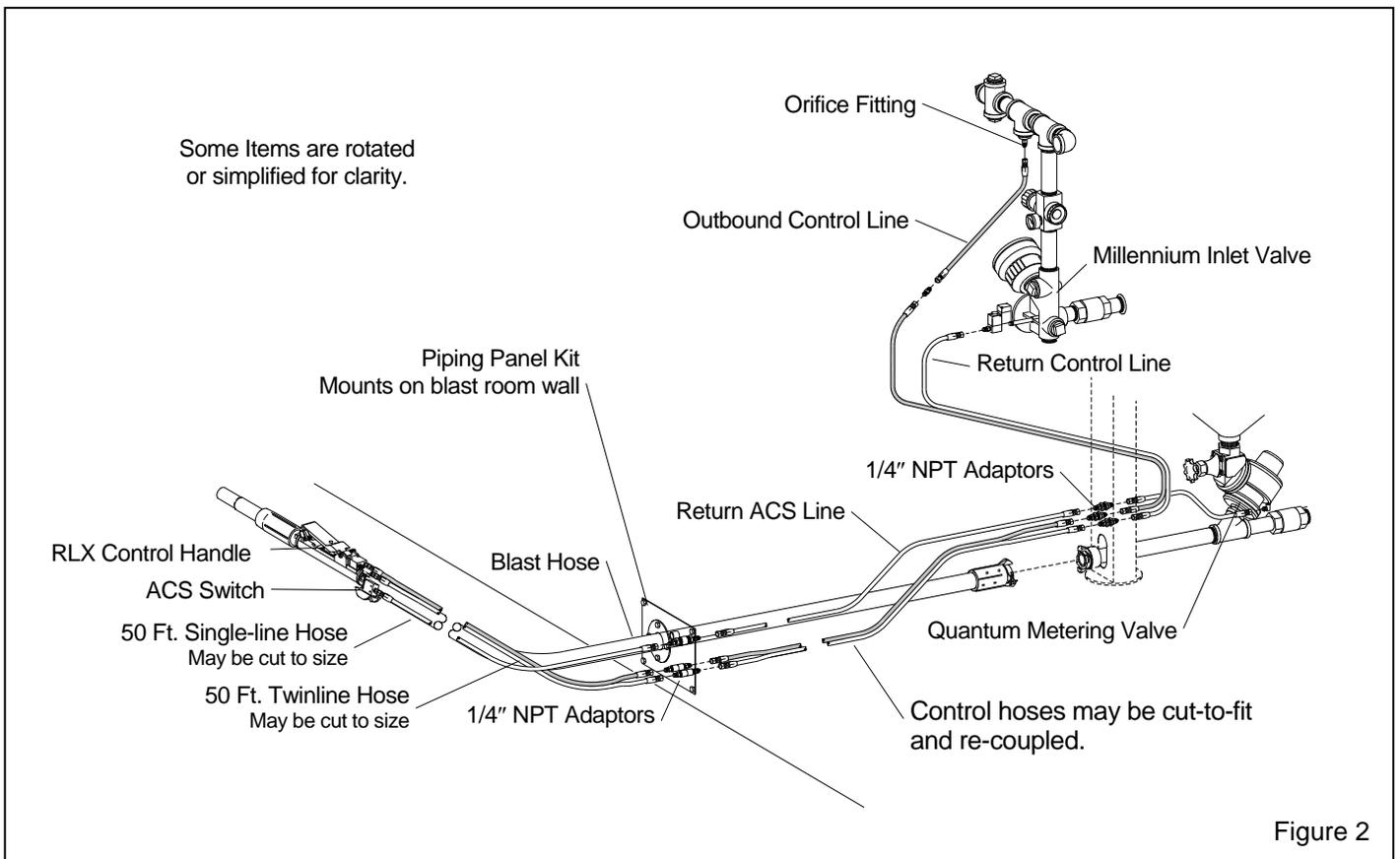


Figure 2

1.3.3.4 Air escaping from the control handle when it is in the up position indicates that the system is under pressure. Any actuation of the control handle will start the blasting.

1.3.4 Abrasive Cut-Off (ACS)

1.3.4.1 The abrasive cut-off switch is mounted on the control handle. The operator uses the switch to close the abrasive valve independently of the air valve, so air without abrasive exits the nozzle.

1.3.5 Electric Remote Control Option

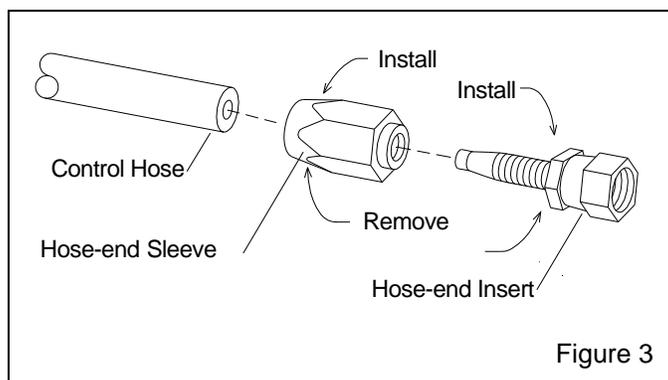
1.3.5.1 Electric remote controls (electro-pneumatic) are available. Contact your local distributor of Clemco products for more information.

2.0 SET-UP

2.1 Blast Hose and Control Hose Connections

NOTE: Control hoses may be shortened by removing the reusable hose ends as follows, ref. Figure 3:

1. Place the hose-end 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 the 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 tighten as soon as the hose bottoms 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.



2.1.1 Push the nozzle holder end of the blast hose through the piping panel, as shown in Figure 2.

2.1.2 Make sure the coupling gaskets are in place (and in good condition) before connecting the blast hose to the quick coupling on the blast machine. When connecting the hose, make sure the coupling spring lock pins are at 180 degrees (pins should enter the unused hole of the adjoining coupling). The spring lock pins help prevent accidental separation of hose couplings during blasting.

⚠ WARNING

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

2.1.3 Locate the six 1/4" NPT twinline adaptors, packaged in the accessory box. Screw the adaptors tightly into both ends of the 1/4" NPT (lower) couplings on the blast room piping panel, and on both ends of one of the upper couplings.

2.1.4 Attach the interconnecting twinline hose to the Millennium valve and 1/4" NPT adaptors on the piping panel. Either side of the hose can be attached to either fitting. Ref. Figure 2.

2.1.5 Attach the single interconnecting hose from the upper fitting on the piping panel, and the Quantum metering valve. Ref. Figure 2.

2.1.6 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.

2.1.7 Band the control handle to the blast hose close to the nozzle holder, using the two nylon ties provided. Once the 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.

2.1.8 Attach the 50 ft. twinline hose to the two fittings on the control handle. Either side of the hose can be attached to either fitting.

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

2.1.10 Working backward from the control handle, band the twinline hose to the blast hose every four to six feet.

2.1.11 Attach the ends of the 50-ft. twinline hose to the adaptors on the piping panel. Either side of the hose can be attached to either fitting. Make sure all fittings are tight; leaks will cause the system to malfunction.

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

2.2 Compressed-Air Supply

2.2.1 Install an air-supply line to the blast machine inlet. The compressed air line should contain an isolation valve near the machine, to enable depressurization for service. For best blasting performance, use 1-1/4" ID or larger air line when using up to a 5/16" orifice (No. 5) nozzle, 1-1/2" or larger when using up to a 3/8" (No. 6) nozzle, and 2" or larger when using up to a 1/2" (No. 8) nozzle.

3.0 OPERATION

3.1 Initial Tests

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

3.1.2 Close the compressed air line isolation valve.

3.1.3 Slowly pressurize the air-supply line to the isolation valve. Listen for any open lines or leaks.

3.1.4 Open the safety petcock on the Millennium valve. It is open when the lever is in-line with the petcock, as shown in Figure 4.

▲ WARNING

To prevent severe injury 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.

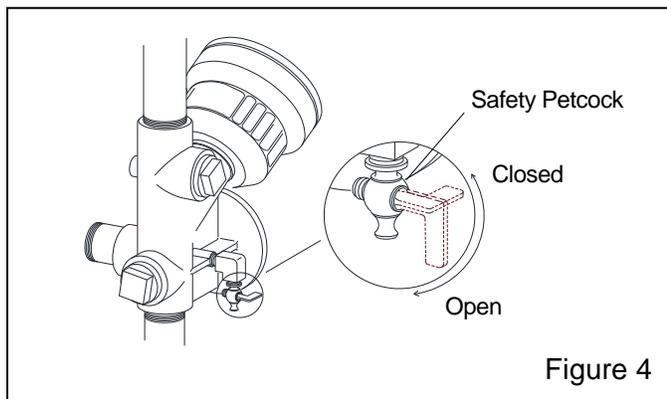


Figure 4

3.1.5 Make sure that the control handle lever is in the up (no blast) position, as shown in Figure 5, and that the handle lever and safety lock move freely.

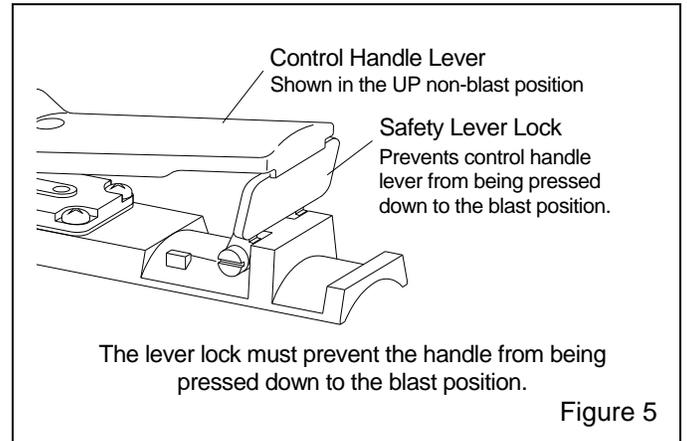


Figure 5

3.1.6 Make sure that the handle lever does not seal the opening on the control handle, unless the safety lever lock is folded down.

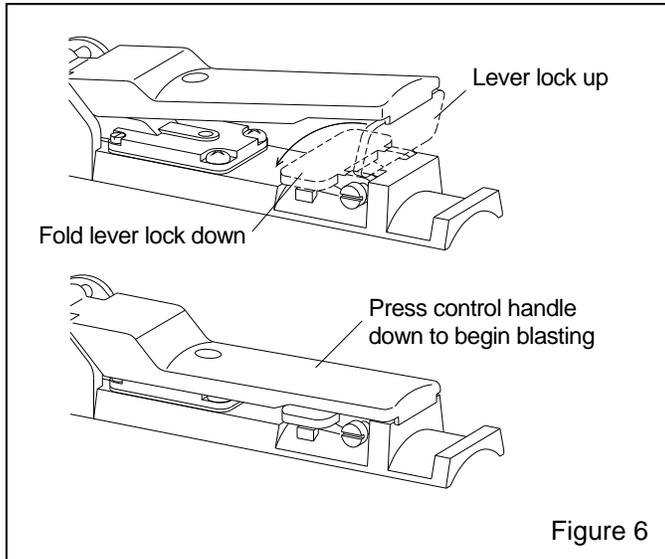
▲ WARNING

Malfunctioning control handles could 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.

3.1.7 Slowly open the compressed air isolation valve. Listen for leaks. The only air escaping from system should be from the petcock and control handle.

3.1.8 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 orifice under the control handle lever but nowhere else. The noise from air escaping at the control handle is an audible signal that means air is supplied to the blast machine, which will activate if the control handle is pressed.

3.1.9 Have another person hold the blast hose securely, and, while pointing the nozzle in a safe direction, fold down the safety lever lock and depress the remote control handle, as shown in Figure 6. Within a few seconds, the pop-up valve automatically closes, and the blast machine will pressurize to start blasting. **NOTE: If the blast room is equipped with door interlocks, the blast room doors must be closed before the machine will pressurize.**



⚠ CAUTION

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

3.1.10 Make sure the machine functions correctly, and check all hoses and piping for leaks.

3.1.11 When satisfied that the machine and all accessory equipment functions correctly, load abrasive into the system by following the instructions recommended for the recovery process.

3.2 Routine Start-up

3.2.1 Make sure the choke valve is open (handle in-line with the valve and piping).

3.2.2 Close the Quantum abrasive metering valve. Closed position is when the knob is turned fully clockwise. See Section 4.1.

3.2.3 Pressurize the breathing air-supply line, and adjust pressure on the CPF Filter outlet to the pressure stated in the respirator manual.

3.2.4 Closing the petcock prepares the machine for remote operation and activation by the control handle. Air should be heard escaping from the orifice under the control handle lever but nowhere else. The noise from air escaping at the control handle is an audible signal that air is supplied to the blast machine, which activate if the control handle is pressed.

3.3 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. Abrasive blasting produces harmful dust. Failure to wear approved respirators could 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.

This blast machine is intended for use in an enclosed blast room where only the operator is inside. If other personnel are exposed to the blasting process, they must wear properly-maintained, NIOSH-approved, respiratory protection appropriate for the job site hazards.

3.3.1 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.

3.4 Blasting

3.4.1 Don all protective blasting attire in a clean environment outside the blasting area, and where the air is safe to breathe.

3.4.2 Hold the blast hose securely and point the nozzle only at objects intended to be blast cleaned.

3.4.3 Fold down the safety lever lock and depress the remote control handle. Within a few seconds the pop-up valve automatically closes, and the blast machine will pressurize to start blasting.

⚠ CAUTION

Be prepared for the 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. To comply with OSHA regulations, the remote control handle, which starts and stops the flow of air and abrasive, must be held down manually. Do not 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 could result from uncontrolled blasting. Ref. 29 CFR 1910.244 (b).

3.4.4 If the metering valve is closed, as instructed, only air will exit the nozzle.

3.4.5 Adjust abrasive flow per Section 4.1.

3.5 Operation of Abrasive Cut-Off Switch (ACS).

 WARNING

People and the environment tolerate only a limited amount of toxic materials. OSHA limits these exposure levels. Airborne dust could 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 airborne dust created by the compressed air, 29 CFR 1926 (h). The ACS is for blowing abrasive off the blasted surface, NOT as a general area clean-up tool.

3.5.1 The ACS serves two purposes:

1. Clearing abrasive from the blast hose when blasting is finished. This is helpful in a lot of applications and necessary when blasting vertically, 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 additional blowing off or otherwise cleaning the surface outside the blasting area prior to painting.

3.5.2 The abrasive cut-off switch is mounted directly behind the control handle. The switch may be flipped ON or OFF at any time, but will not operate the metering valve unless the control handle is pressed.

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

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

3.6 Stop Blasting

3.6.1 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.

3.6.2 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 that the safety lever lock is up, and that it prevents the handle lever from engaging.

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

3.7 Loading Abrasive into the Blast Machine

 WARNING

Obtain a safety data sheet (SDS) for the blast abrasive. Abrasive blasting with sands containing crystalline (free) silica can lead to serious or fatal respiratory disease. As NIOSH recommends, do not use abrasives containing more than trace amounts (more than one percent) free silica.

3.7.1 The blast machine is part of a blast and recovery system. Load abrasive into the system by following the instructions recommended for the recovery process.

NOTE: Use only abrasives specifically manufactured for blasting, that are compatible with the surface being blasted. Abrasives produced for other applications may be inconsistent in size and shape, and contain particles that could jam the abrasive metering valve, or cause irregular wear. Some abrasives may contain salts, corrosives, or other materials that could contaminate the blast surface.

3.8 Emptying the Machine of Abrasive

3.8.1 With the blast machine OFF, turn the blast pressure to approximately 40-50 psi, close the choke valve, and set the abrasive metering valve to full open.

3.8.2 To prevent rapid wear of the nozzle holder threads, the nozzle should be firmly attached to the nozzle holder. Removal of the nozzle is not recommended. Purging the machine without a nozzle in place will erode the thread area of the nozzle holder, which could cause a hazardous condition when the nozzle is reattached.

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 could 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 could erode nozzle threads.

3.8.3 Point the nozzle into a drum or suitable storage or disposal container or in the directional the abrasive is to be disposed.

3.8.4 Hold the hose securely (do not leave the hose unattended), and pressurize the machine by activating the control handle. Be prepared for surging, or recoil of the hose, which can be severe.

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

3.8.6 If the nozzle was removed, thoroughly inspect the nozzle holder threads for wear before installing the nozzle washer and attaching the nozzle.

3.9 Shutdown

3.9.1 Close the compressor-air supply valve.

3.9.2 Drain receiver tank, moisture separators (filters), and water collecting devices, and bleed the compressed-air supply hose.

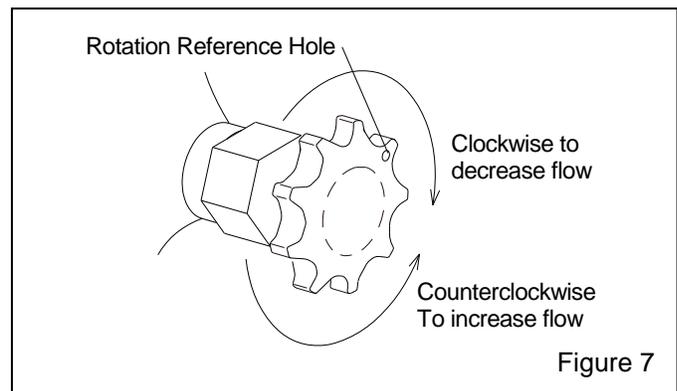
3.9.3 Shutdown the compressor.

4.0 ADJUSTMENTS

4.1 Abrasive Metering, Figure 7

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

4.1.2 The hole in the knob enables the operator to monitor its rotation and count turns as the knob is turned. This helps to return the setting to its original position, if temporary adjustments are required.



4.1.3 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.

4.1.4 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.

5.0 PREVENTIVE MAINTENANCE

5.1 Daily Inspection

5.1.1 With the air OFF, before blasting, do the following:

- 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. See Section 6.10.
- 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. Make sure the threads are not worn, and that the nozzle holder securely grips the nozzle. The nozzle washer must also be inspected for wear. Worn nozzle washers cause thread erosion. A loose fitting nozzle may eject from the holder under pressure and could cause severe injury.

- Inspect the RLX control handle; look for the following:
 - The control handle lever must not seal the opening on the control, unless the safety lever lock is folded down.
 - The control **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 could 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.

5.1.2 During blasting, 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, or pipe fittings at the bottom of the cone, stop blasting immediately and repair or replace worn parts. If leaks are allowed to continue, abrasive erosion could cause 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 repair or replace worn parts.

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 could disconnect while under pressure. Impact from nozzles, couplings, hoses, or abrasive, from parts disconnected by pressure during operation could cause severe injury.

5.2 Weekly Inspection

5.2.1 With the air OFF, before blasting, do the following:

- Remove the nozzle for inspection. Replace if the orifice diameter is worn 1/16" or more, or if the liner is cracked.
- If the optional compressed-air filter is used, inspect the filter element, and clean the bowl.
- Inspect the blast hose for wear; look for soft spots. Soft spots mean the hose is worn. Replace the blast hose before the tube wears as far as the fabric plies.

WARNING

Worn blast hose could suddenly fail by bursting. 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, could cause severe injury.

5.2.2 During blasting, do the following:

- Inspect all control hoses and valves for leaks. If leaks are found, stop blasting and repair.
- 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.

5.3 Monthly Inspection

5.3.1 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. See Section 6.8.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. See Section 6.9.
- Inspect exhaust muffler for blockage and wear.

5.4 Periodic Inspection

5.4.1 Remote control valves: For safety and to prevent unnecessary 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. See Service Maintenance in Sections 6.3, 6.4 or 6.5, and 6.10.

5.4.2 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. See Section 6.6.

6.0 SERVICE MAINTENANCE

 WARNING

To avoid serious injury from the sudden release of compressed air, observe the following before performing any maintenance.

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

6.1 Removing Damp Abrasive from Blast Machine

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

6.1.2 For more difficult blockages, proceed as follows: See Section 6.2 to check obstructions in metering valve.

6.1.2.1 With the blast machine depressurized, close the choke valve and fully open the abrasive metering valve. Remove the nozzle and nozzle washer. Pressurize the machine to force out any damp abrasive. When the hose is cleared, depressurize the machine and attach 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. Make sure the threads are not worn, and that the nozzle holder securely holds the nozzle. The nozzle washer must also be inspected for wear. Worn nozzle washers could cause thread erosion. A loose fitting nozzle may eject under pressure and could cause severe injury.

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

6.2 Clearing Obstructions in the Abrasive Metering Valve and Blast Machine

6.2.1 If the nature of the obstruction permits emptying the machine of abrasive, do so by following the instructions per Section 3.8.

6.2.2 Turn OFF the compressed air supply. Lockout and tagout the air supply, and bleed the air supply.

6.2.3 Remove the metering valve inspection plate by removing the wing nuts securing it.

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

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

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

6.2.7 Make sure the abrasive metering valve inspection plate o-ring is in good condition and in place before reassembling the inspection plate.

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

6.3 Millennium Inlet Valve, Ref. Figure 8

NOTE: Two service kits are available for the Millennium inlet segment. To prevent unnecessary downtime, both kits should be kept on-hand. Replace all the seals provided in the seal service kit whenever the valve is opened. Use the plunger tip kit when replacing the plunger tip.

6.3.1 Unscrew the six socket head screws to remove the cylinder cap, cylinder cap gasket, and spring.

6.3.2 Remove the cylinder sleeve by screwing two 1/4-NC screws into the holes in the end of the sleeve and by pulling the screws to remove the sleeve from the body. If the sleeve is too tight to remove by hand, use a puller. Remove the screws after the sleeve is removed.

6.3.3 To remove the piston, screw a 1/4-NC screw into the 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. Remove the screw after the piston is removed.

6.3.4 It is not necessary to separate the plunger from the piston unless the metal of either part is scored. To remove the plunger, insert a rod through the hole in the lower part of the plunger and hold the rod to prevent the plunger from turning, while using a 5/16" hex key to remove the socket screw from inside the piston.

6.3.5 If the plunger tip is worn, use a 3/16" hex key to remove the button screw, washer and tip.

6.3.6 Clean all items and inspect for wear. Replace all seals and o-rings (they are included in the service kit), and replace all worn or damaged parts.

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

6.3.7 If the plunger and piston were separated as noted in paragraph 6.3.4, apply removable thread sealant to the socket head screw, and reassemble the parts using a new o-ring supplied with the service kit.

6.3.8 Lubricate the o-rings and all u-seals with a silicone-based lubricant.

6.3.9 Replace both o-rings in the valve body.

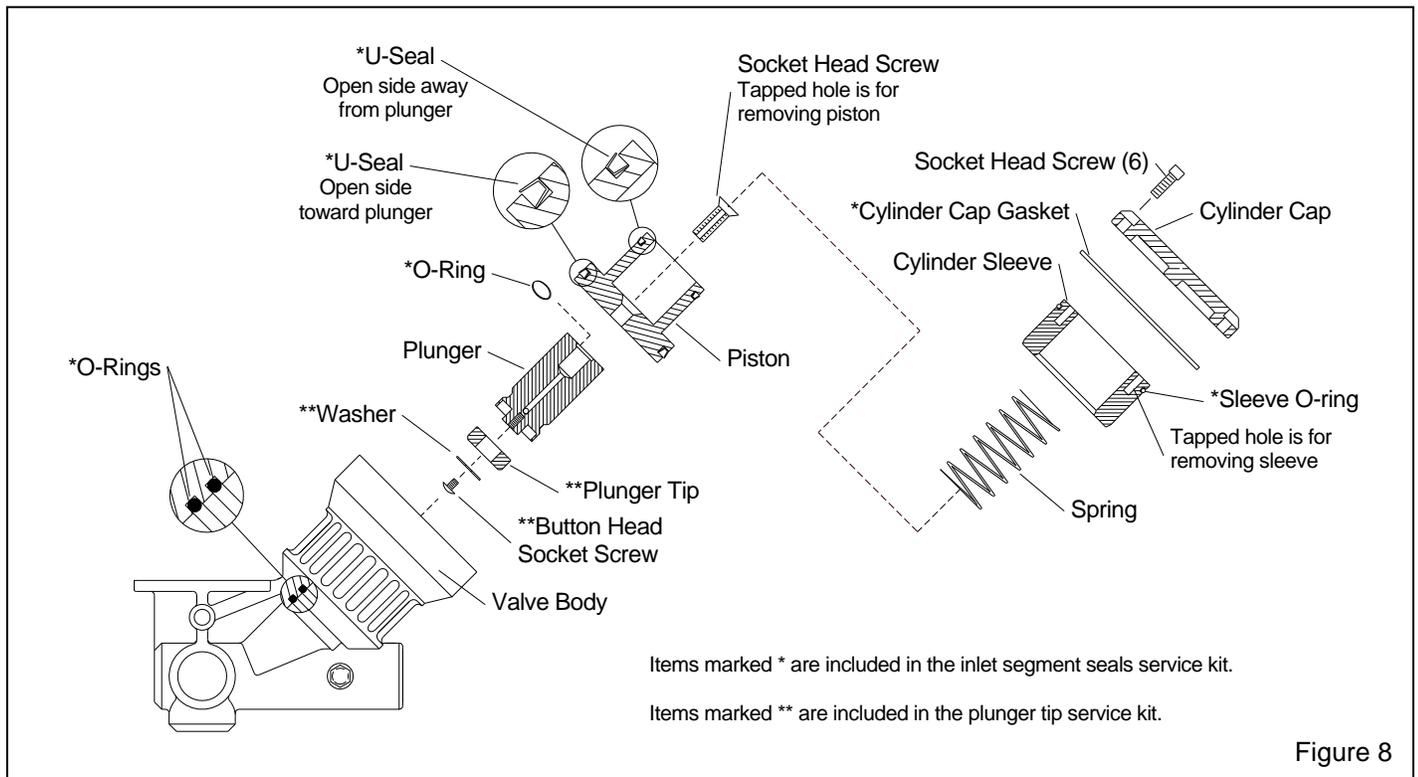


Figure 8

6.3.10 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 8.

6.3.11 Install the plunger and piston assembly into the body. Use care, making sure the open side of the large (lower) u-seal does not fold back during assembly. Tucking the lip of the seal in, while applying pressure to the piston eases assembly.

6.3.12 Place the o-ring on the cylinder sleeve, and insert the sleeve (o-ring end faces up) into the body, making sure the open side of the small (upper), piston u-seal does not fold back during assembly.

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

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

6.4 Piston Outlet Valve (standard), Ref. Figure 9
Refer to Section 6.5 for the optional diaphragm outlet valve.

6.4.1 All service on the outlet valve must be done with the compressed air OFF and the air supply locked-out and tagged-out.

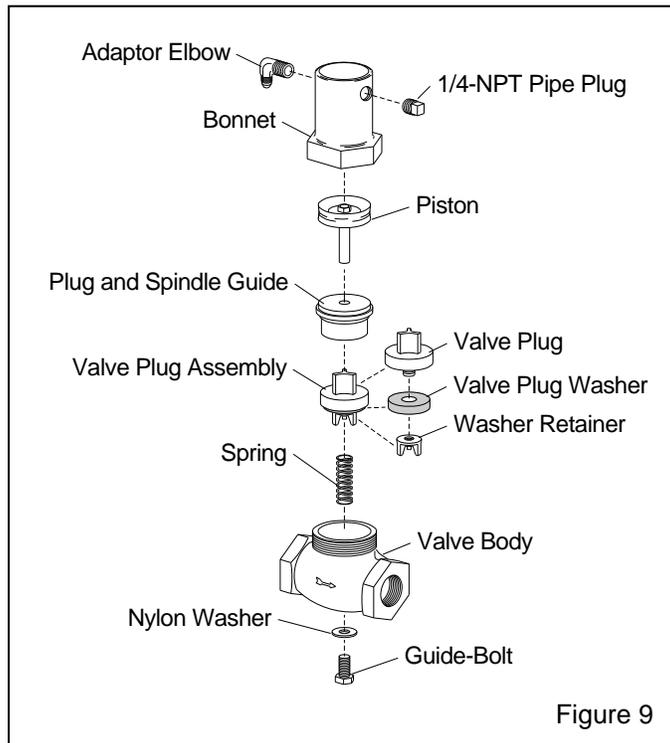


Figure 9

6.4.2 Remove the control hose from the adaptor elbow.

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

6.4.4 As the bonnet is removed, lift it straight up until the piston stem clears the plug and spindle guide.

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

6.4.6 Remove the piston from the bonnet, by pulling the piston stem.

6.4.7 Inspect all parts for wear and damage:

- 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 worn, rusted 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 stem should be free of deep abrasion and move freely in the spindle bore. If it is badly abraded, drags in the bore, or is loose in the bore, replace the piston assembly.

6.4.8 Lubricate the bonnet's cylinder wall and piston cup with lightweight machine oil, pneumatic tool oil, or equivalent.

6.4.9 Install the piston into the bonnet 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 stem should be flush with the opening.

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

6.4.11 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.

6.4.12 To assemble the bonnet to the valve body, first insert the piston stem 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.**

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

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

6.5 Diaphragm Outlet Valve, Figure 10
 Refer to Section 6.4 for the piston outlet

6.5.1 All service must be done with the compressed air OFF and the air supply locked-out and tagged-out.

6.5.2 Remove the four cap screws that secure the cap.

6.5.3 Remove the diaphragm and inspect it for damage. Replace as necessary.

6.5.4 Inspect the seat area in the body. If worn, replace the body.

6.5.5 Reassemble in reverse order.

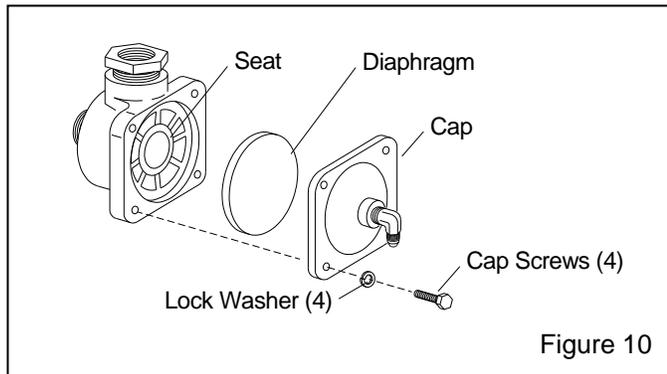


Figure 10

6.6 RLX Control Handle

NOTE: A service kit is available for the control handle. Keep a kit on-hand to prevent unnecessary downtime.

6.6.1 Spring replacement

6.6.1.1 To replace the lever lock spring, follow the instructions in Section 6.6.2. To replace the handle lever spring, follow the instructions in Section 6.6.3.

6.6.2 Lever lock replacement, Figure 11

6.6.2.1 Remove the lock nut from the shoulder screw. Before removing the screw, note the positions of the spacers and spring, as shown in Figure 11. The bent end of the spring is toward the inside and forcing the lever lock up. The straight end is toward the outside facing down and against the tab.

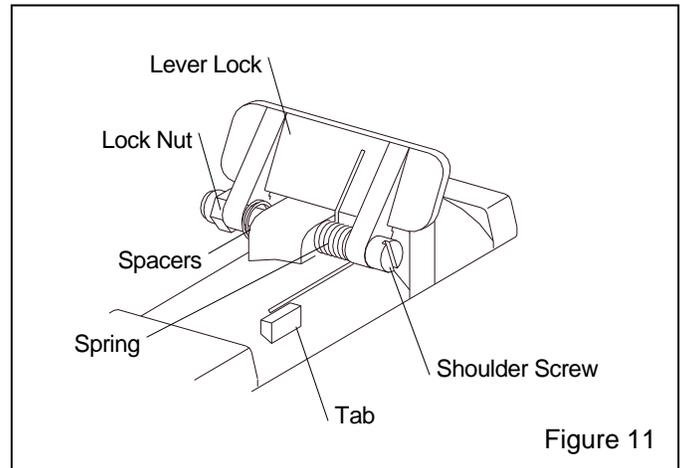


Figure 11

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

6.6.2.3 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 folded down.

6.6.3 Handle lever replacement, Figure 12

6.6.3.1 Remove the lock nut from the shoulder screw. Before removing the screw, note the positions of the spacers and spring as shown in Figure 12. The bent end of the spring is against the handle lever and facing up. The straight end is against the body and facing down.

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

6.6.3.1 Remove the lock nut from the shoulder screw. Before removing the screw, note the positions of the spacers and spring as shown in Figure 12. The bent end of the spring is against the handle lever and facing up. The straight end is against the body and facing down.

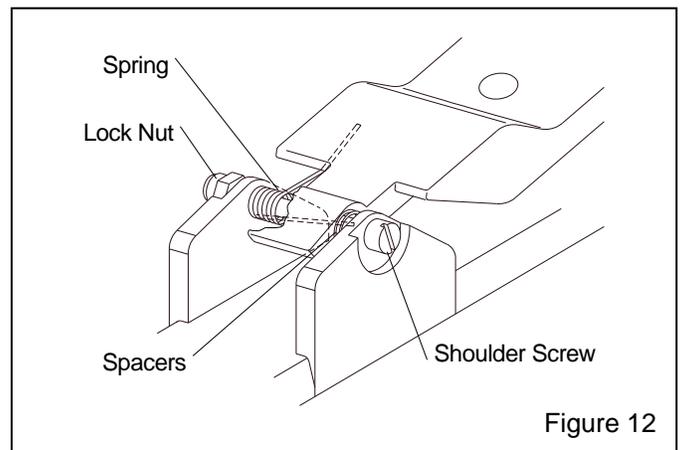


Figure 12

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

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

6.6.4 Rubber button replacement

6.6.4.1 Remove the old rubber button.

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

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

6.6.5 Gasket replacement

6.6.5.1 Remove the handle lever per Section 6.6.3.

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

6.6.5.3 Install a new gasket.

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

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

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

6.7 Quantum Metering Valve

6.7.1 Metering assembly, Ref. Figure 13
Refer to Section 6.7.2 to service the actuator segment.

NOTE: Service kits are available for the Quantum metering assembly and actuator segment. Keeping kit(s) on-hand will prevent 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.

6.7.1.1 Empty the machine of abrasive. Turn OFF the compressed-air supply. Lockout and tagout the air

supply, and bleed the air-supply line to the blast machine.

6.7.1.2 Remove the inspection plate wing nuts and inspection plate.

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

6.7.1.4 The adaptor flange and actuator do not need to be removed from the blast machine to service the metering assembly. Thoroughly inspect the adaptor flange for wear, and replace it if worn.

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

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

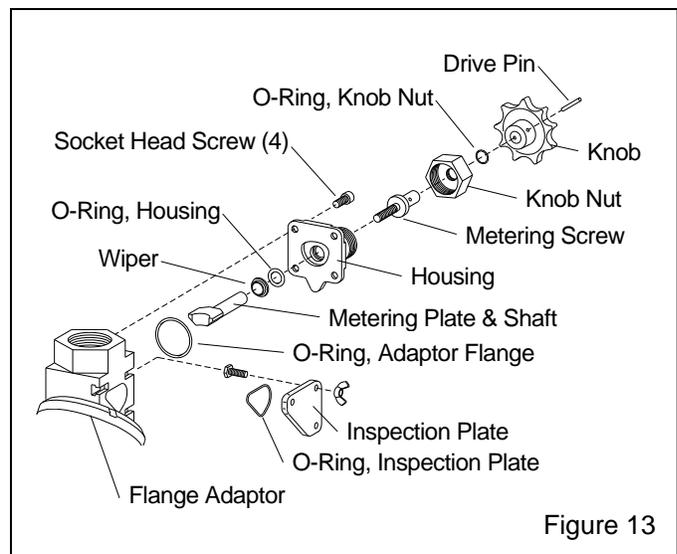


Figure 13

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

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

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

6.7.1.10 Clean the metering screw threads, 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.

6.7.1.11 Remove the o-ring from the knob nut, and remove the o-ring and wiper from the housing.

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

6.7.1.13 Place a new o-ring in the knob nut.

6.7.1.14 Place a new o-ring and wiper seal in the housing. The small side of the wiper seal faces away from the o-ring. A generous amount of silicone-based lubricant eases installation.

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

6.7.1.16 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.

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

6.7.1.18 Place a new o-ring in the groove on the face of the adaptor flange.

6.7.1.19 Insert the metering plate (flat side up) through the adaptor flange opening; be careful not to displace the o-ring.

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

6.7.1.21 Place a new o-ring on the inspection plate, and securely attach the plate.

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

6.7.2 Actuator segment, Ref. Figures 14 and 15

Refer to Section 6.7.1 to service the metering assembly.

6.7.2.1 Empty all abrasive from the machine per instructions supplied with the blast machine. NOTE: If the metering assembly does not require service, abrasive flow may be stopped by closing the metering valve.

6.7.2.2 Turn OFF the compressed-air supply. Lockout and tagout the air supply, and bleed the air-supply line to the blast machine.

6.7.2.3 Disconnect the control line from the fitting on the actuator assembly.

6.7.2.4 Refer to Figure 14 and remove the screws securing the adaptor flange and outlet flange to the actuator assembly, and then remove the actuator assembly.

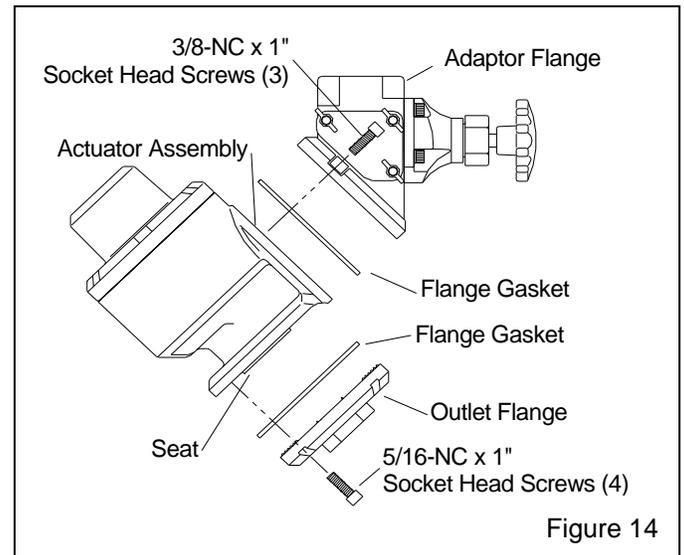


Figure 14

6.7.2.5 Refer to Figure 15, and unscrew the six socket head screws, and remove the cylinder cover and spring. Spring compression is removed when the cover is approximately 9/16" from the body.

6.7.2.6 Remove the felt disc from inside the cylinder cap.

6.7.2.7 Use a hammer handle or similar object to push the plunger from the bottom, forcing the plunger/piston assembly out the top of the valve body cylinder.

6.7.2.8 Pry the urethane seat from the bottom of the valve body.

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

6.7.2.10 It is not necessary to separate the plunger from the piston unless either part is scored or worn. The piston cup should fit snugly against the cylinder wall. If it does not, replace the piston-cup and bushing. 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 doesn't matter if the vise jaws mar the plunger). Using a wrench placed on the flats of the piston stop, unscrew the stop.

6.7.2.11 Remove the wiper and the wiper and o-ring located in the valve body.

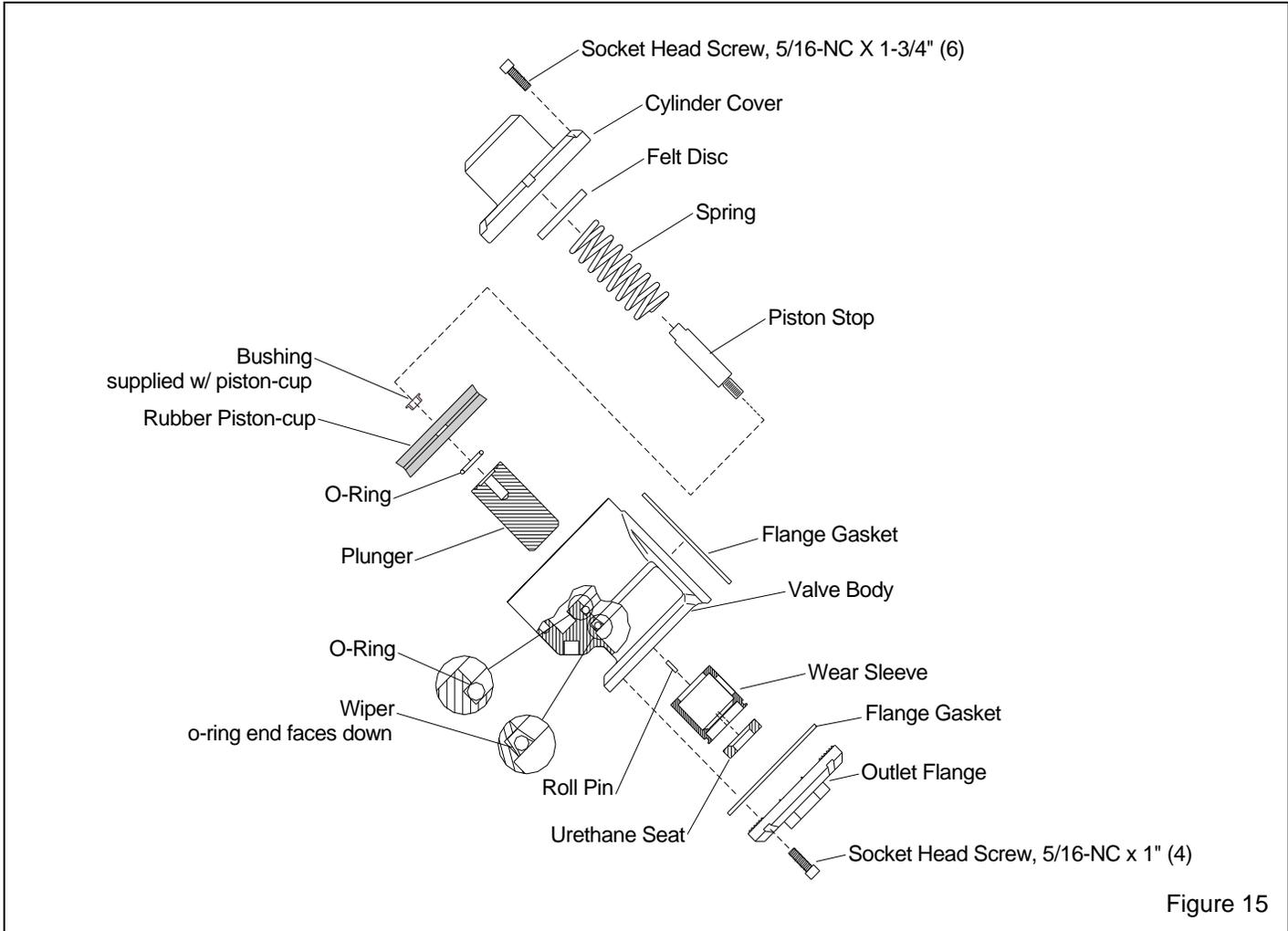


Figure 15

6.7.2.12 Inspect the urethane seat. Replace if worn or damaged.

6.7.2.13 Inspect the abrasive path in the actuator, adaptor flange, and outlet flange for wear. Replace if worn.

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

6.7.2.15 If the plunger and piston were separated as noted in Section 6.7.2.10, apply removable thread sealant to the threads on the piston stop, and reassemble the parts using a new o-ring.

6.7.2.16 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 15.

6.7.2.17 Lubricate the o-ring and wiper in the actuator body with a silicone-based lubricant.

6.7.2.18 Lubricate the cylinder wall and piston-cup, with lightweight machine oil or tool oil.

6.7.2.19 Install the plunger and piston assembly into the body. Make sure the bottom side of the piston cup does not fold back during assembly. Tucking the lip of the piston-cup in, while applying pressure to the piston eases assembly.

6.7.2.20 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.

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

6.7.2.22 Assemble the actuator assembly onto the adaptor flange and outlet flange. Note: The adaptor flange 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. First hand-tighten

the outlet flange screws. Hand-tighten the adaptor flange screws before tightening all screws.

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

6.7.2.24 Attach the control line to the fitting or port on the actuator assembly, and test the operation before putting the valve in service.

6.8 Replacing the Pop-Up Valve, Figure 16

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

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

6.8.3 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.

6.8.4 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.

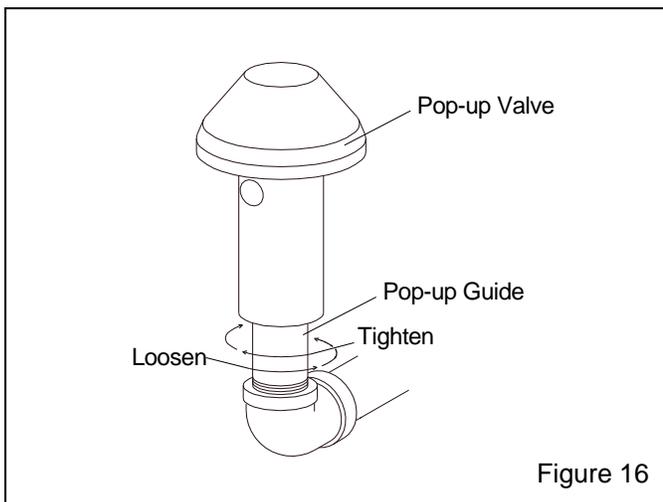


Figure 16

6.8.5 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 snug, but not wrench-tight. Over-tightening the guide will make it difficult to remove the next time the pop-up valve needs replacement.

6.8.6 Refer to Figure 17 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. Adjust the height by replacing the guide with one that is longer or shorter.

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

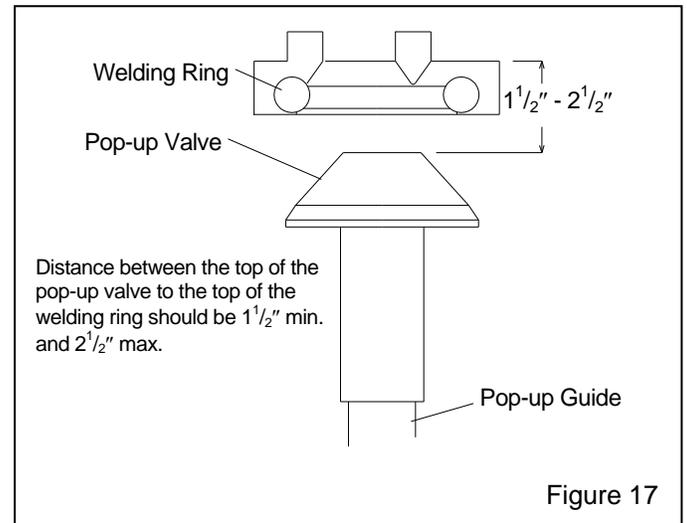


Figure 17

6.9 Replacing the Pop-Up Seal

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

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

6.9.3 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.

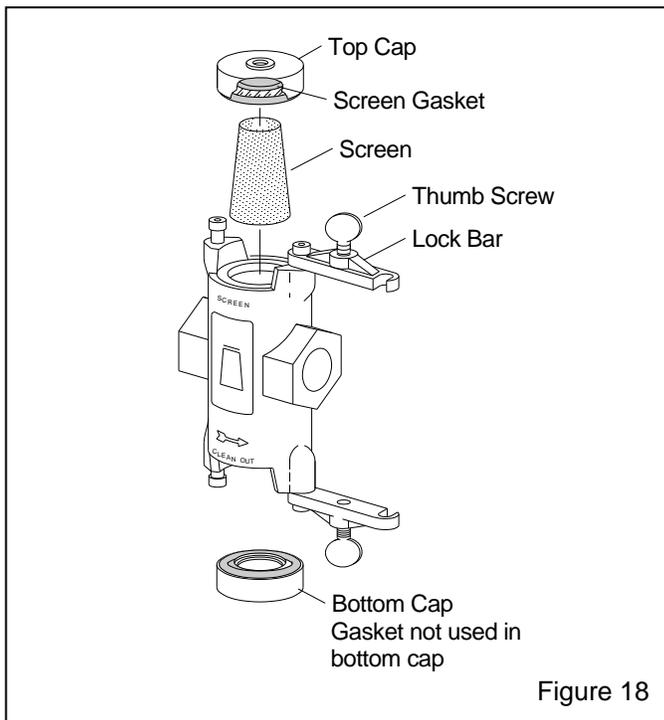
6.10 Abrasive Trap

NOTE: A service kit is available for the abrasive trap. To prevent unscheduled downtime, always keep a kit on-hand.

6.10.1 All service on the abrasive trap must be done with the compressed air OFF and the air supply locked-out and tagged-out.

6.10.2 Clean the abrasive trap screen and trap at least twice a day. **NOTE:** Failure to clean the abrasive trap on a regular basis is a major cause of system malfunction.

6.10.3 To check the abrasive trap screen, loosen the top thumbscrew and swing the lock bar off the cap, and remove the cap as shown in Figure 18.



6.10.4 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.

6.10.5 To clean the bottom section of the trap, loosen the bottom thumbscrew, and swing the lock bar off the bottom cap, and then remove the cap.

6.10.6 Empty all abrasive from the bottom and top sections.

6.10.7 Install the screen in the top section. The small end of the screen must face up.

6.10.8 Reassemble the top and bottom caps. Make sure the o-rings are in place on the caps before assembly, and the screen gasket is in place in the top cap.

7.0 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, 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 and tagout the 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.

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

7.1.1 Depressurize the blast machine. After the pop-up valve has dropped, remove the nozzle, and check it for obstruction.

7.1.2 Make sure that both the abrasive metering valve and choke valve are open.

7.2 Air only (no abrasive) exits the nozzle

7.2.1 Abrasive metering valve may be closed or needs adjustment. See Section 4.1.

7.2.2 Blast machine may be empty.

7.2.3 Abrasive may be damp. See Section 6.1 to clear damp abrasive.

7.2.4 Check the abrasive metering valve for obstructions. See Section 6.2.

7.3 Heavy abrasive flow

7.3.1 Make sure the choke valve is open. The valve is open when the handle is in-line with the piping.

7.3.2 Abrasive metering valve may be open too far. See Section 4.1.

7.4 Abrasive surging

7.4.1 A certain 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 4.1.

7.4.2 Check the abrasive trap and exhaust muffler for blockage. Slow depressurization loads the blast hose with abrasive, and causes surging at start-up. See Section 7.7.

7.5 Intermittent abrasive flow

7.5.1 Moisture in the blast machine or in the air supply. Drain moisture from the compressor's receiver tank, and the blast machine's filter. If moisture in the air is a recurring problem, a dryer or after cooler may be required in the air-supply line.

7.5.2 Abrasive may be worn from recycling. Replace abrasive.

7.6 Blast machine does not pressurize

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

7.6.2 Check to make sure that the safety petcock on the inlet valve is closed.

7.6.3 Check 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.

7.6.4 Check for air escaping through the opening under the control handle lever. If no air is escaping, the orifice fitting (shown in Figure 2) is blocked, or the line from the orifice to the control handle is blocked and must be cleared.

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

7.6.6 Check control lines and fittings for leaks or breaks.

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

- The opening on the control handle is not being sealed off.
- The control handle leaks.
- The line from the control handle to the upper fitting on the inlet valve is blocked.

If air does come out, the Millennium inlet valve is not functioning. Turn OFF the compressed-air supply and service the valve per Section 6.3.

7.6.8 Close the safety petcock, and press the control handle lever. Verify that no air escapes through the vent hole on the cylinder body of the inlet valve body. Air escaping from this vent indicates worn seals in the inlet valve. See Section 6.3.

7.6.9 Inlet valve malfunctioning. Inspect internal parts for wear and lubrication. See Section 6.3.

7.6.10 Insufficient-size air-supply hose or reduced-size fittings between the compressor and blast machine. See Section 2.2.

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

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

7.7 Blast machine does not depressurize, or depressurizes too slowly

7.7.1 Abrasive trap screen blocked, or abrasive trap needs cleaning. Clean the trap at least twice daily.

7.7.2 Exhaust muffler blocked.

7.7.3 Check the pneumatic adaptor gasket on the control handle for swelling, restricting air flow.

7.7.4 Check for blockage in the control hose.

7.7.5 Check the orifice fitting on the inlet plumbing, (Item 17 in Figure 20). The back side must have a .052" orifice.

7.7.6 Remote control valves malfunctioning. Inspect the inlet and outlet valves per Section 6.3 and 6.4 or 6.5.

7.8 Outlet valve does not seal

7.8.1 Outlet valve requires service. For piston outlet valve refer to Section 6.4, for diaphragm outlet valve refer to Section 6.5.

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

7.9.1 Inspect the handle lever for damage that may cause binding against the body.

7.9.2 Check the spring for damage or fatigue.

7.9.3 Replace the handle lever or spring as necessary.

7.10 Lever lock fails to pop up when the handle is released

7.10.1 Inspect the lever lock for damage, or build up of debris or abrasive.

7.10.2 Check the lever lock return spring for damage or fatigue.

7.10.3 Replace lever lock or spring as necessary.

8.0 ACCESSORIES AND REPLACEMENT PARTS

8.1 Accessories

- (-) Safety cable, 1-1/2" to 3" OD hose15013
- (-) Safety cable, 1-1/2" to 4" OD hose27405

8.2 Blast Machine, Figure 19

| Item | Description | Stock No. |
|------|---|-----------|
| 1. | Ball valve, 1-1/4" with handle | 02397 |
| 2. | Handle, 1-1/4" ball valve | 22532 |
| 3. | Coupling, 1-1/4" CFP w/16.5" nipple | 24197 |
| 4. | Metering valve, Auto-Quantum | 22760 |
| 5. | Inspection door assembly, 6" x 8" | 02377 |
| 6. | Gasket, inspection door, 6" x 8" | 02369 |

| | | |
|-----|--|-------|
| 7. | Seal, pop-up valve | 02325 |
| 8. | Pop-up valve, 4", with external sleeve | 03699 |
| 9. | Millennium inlet valve | 23620 |
| 10. | Cap, owner's manual storage tube | 21517 |
| 11. | Air filter, 1-1/2" automatic drain | 01282 |
| 12. | Gasket, nylon coupling, package of 10 | 08853 |
| 13. | Wye, standard 1-1/4" | 01818 |
| 14. | Internal pop-up guide, 1-1/4" x 6" toe | 01753 |
| 15. | Plumbing support assembly | 27002 |
| 16. | Pressure regulator w/gauge, 1-1/2" | 01906 |
| 17. | Check valve, 1-1/4" | 02088 |
| 18. | Pusher line, coupled, 1-1/4" x 28 in. | 23674 |
| 19. | Adaptor, 1-1/4" male NPT x male JIC | 22529 |
| 20. | U-bolt w/nuts | 13854 |

Refer to the plumbing drawing supplied with project (custom) blast machines for all other parts.

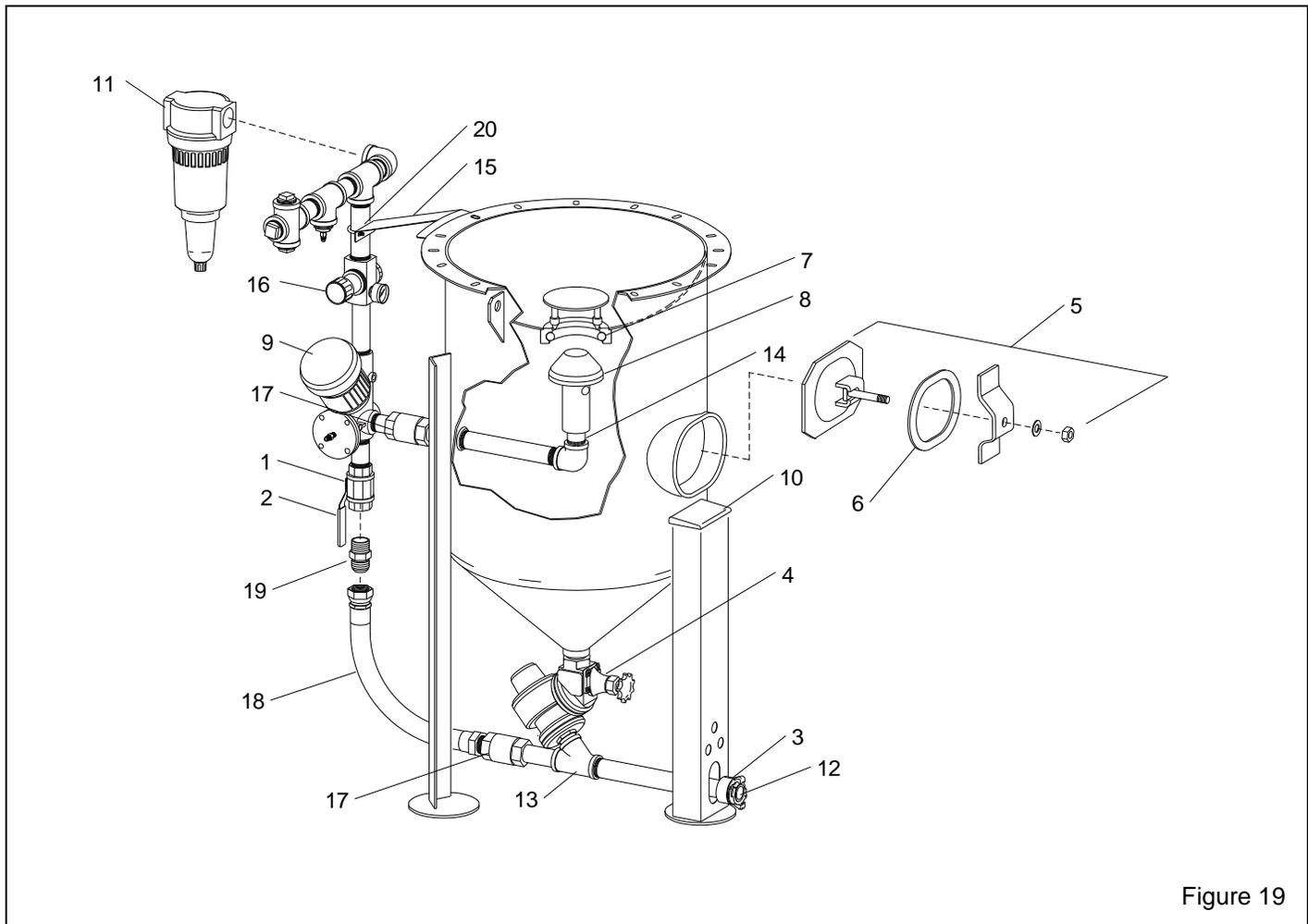


Figure 19

8.3 Remote Control System Parts, Figure 20

| Item | Description | Stock No. |
|------|---|-----------|
| 1. | Millennium inlet valve | 23620 |
| 2. | RLX II Control handle with ACS | 07625 |
| 3. | Abrasive trap | 02011 |
| 4. | Piston outlet valve (standard) | 01967 |
| 5. | Diaphragm outlet valve (option) | 03371 |
| 6. | Metering valve, Auto-Quantum | 22760 |
| 7. | Hose, 50 ft. twinline, coupled. | 01951 |
| 8. | Hose, 3/16" x 50 ft. single, coupled | 03087 |
| 9. | Hose, 25 ft. twinline, coupled (cut to fit) ... | 02128 |
| 10. | Hose, 3/16" x 25 ft. cpld. (cut to fit) | 21757 |

| | | |
|-----|---|-------|
| 11. | Hose, 3/16" x 3 ft. coupled | 02498 |
| 12. | Adaptor, 1/8" NPT elbow | 02827 |
| 13. | Adaptor, 1/4" NPT elbow | 02513 |
| 14. | Adaptor, 1/4" NPT straight | 02494 |
| 15. | Tie, nylon | 02195 |
| 16. | Fitting, 1/4" NPT bulkhead | 05605 |
| 17. | Adaptor, 1/8" NPT w/.052" orifice | 20429 |
| 18. | Hose, 4 ft. twinline, coupled | 21619 |
| 19. | Hose, 3/16" x 18 in. coupled | 02454 |
| 20. | Union, 3/16" hose | 01944 |
| 21. | Solenoid, 3-way door interlocks | 20739 |
| 22. | Adaptor, 1/8" NPT straight | 01940 |
| 23. | Muffler, blast machine exhaust | 05068 |
| 24. | Hose assembly, remote mount exhaust.... | 19189 |
| 25. | Piping panel kit, blast room | 22288 |

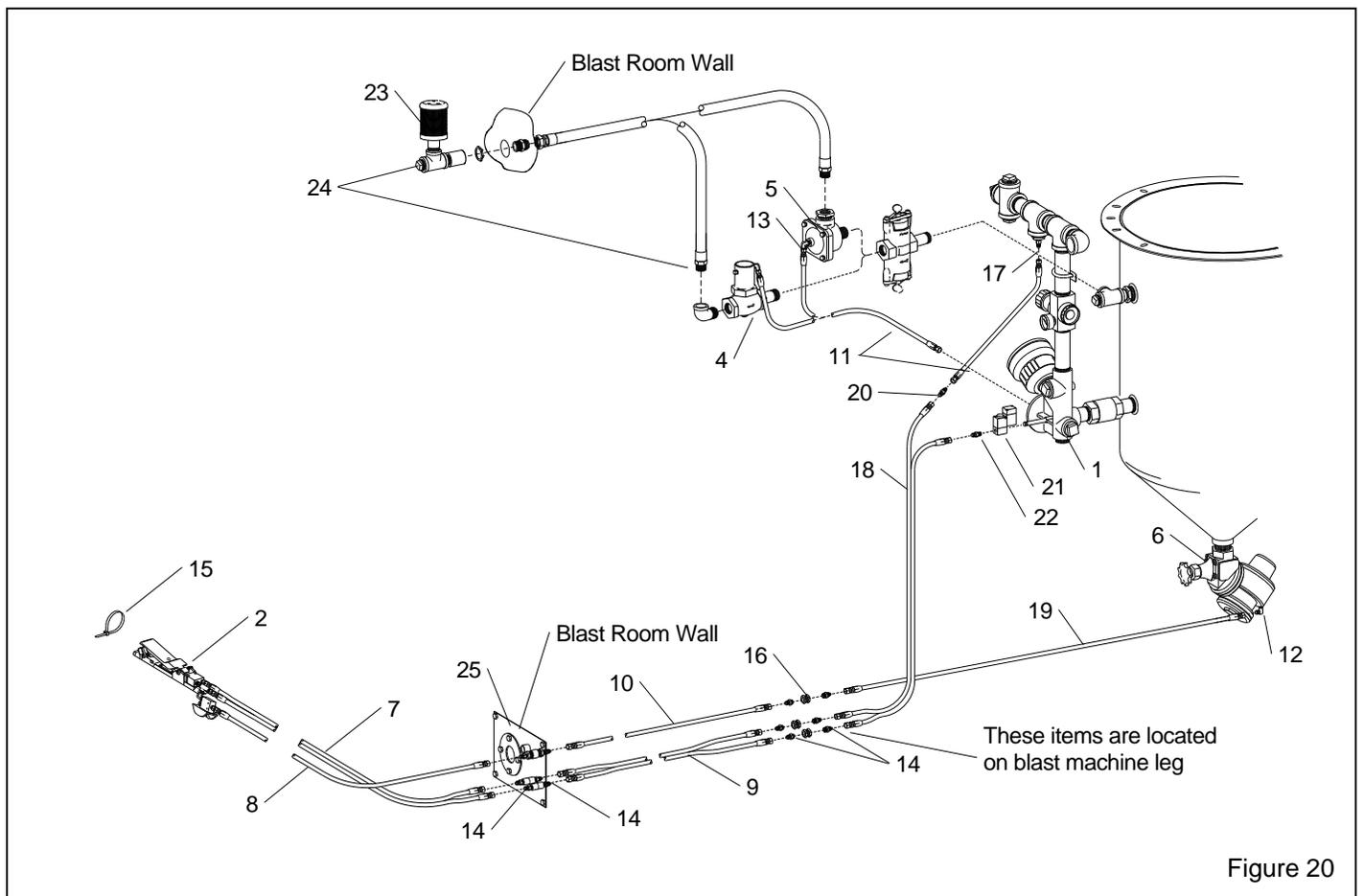
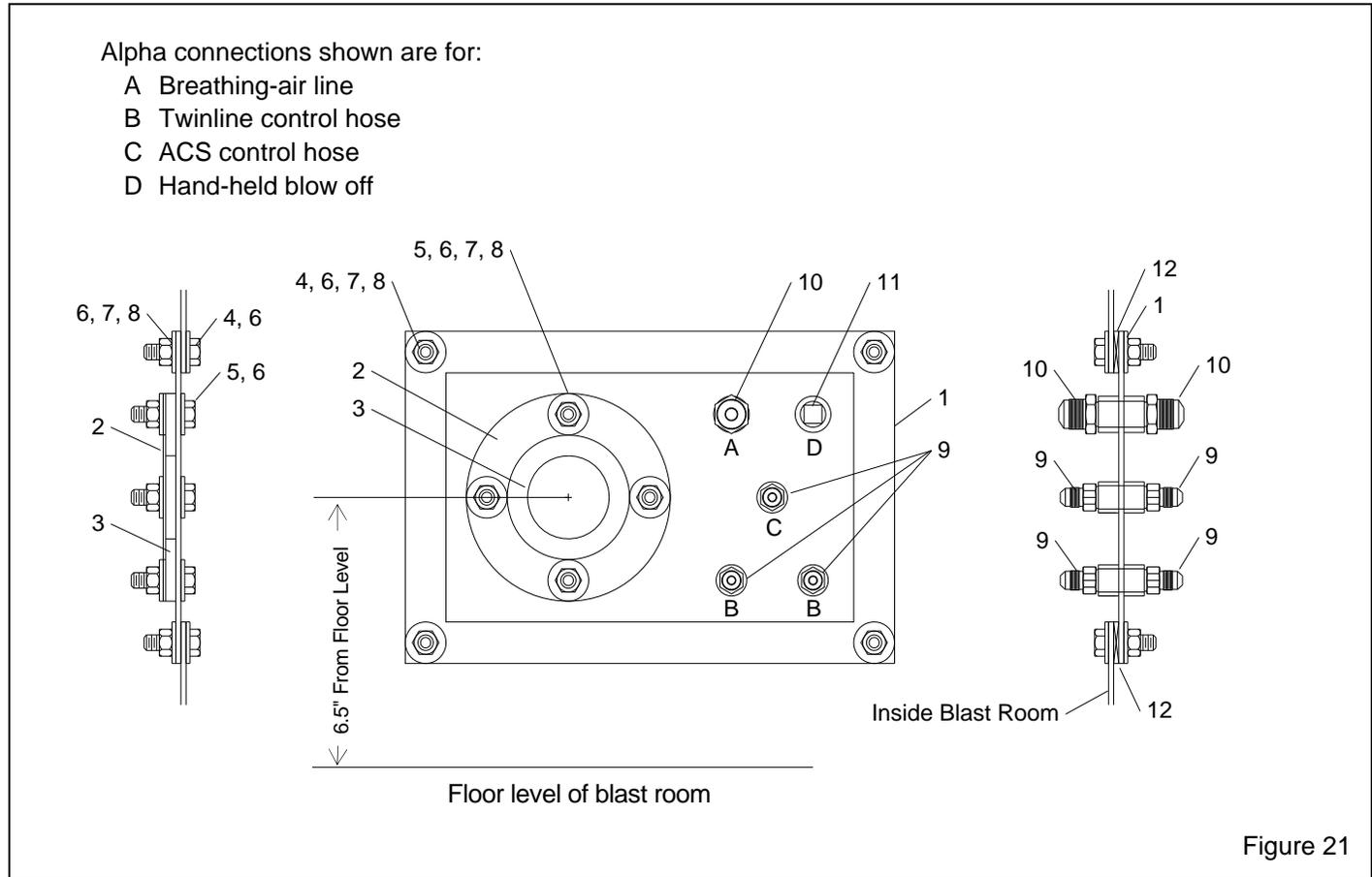


Figure 20

8.4 Blast Room Piping Panel Kit
Figure 21

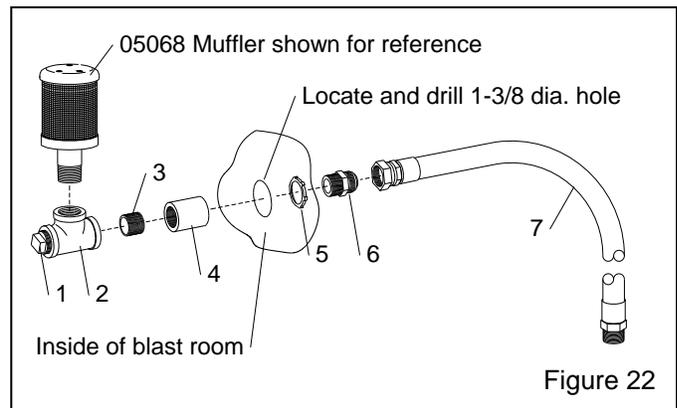
| Item | Description | Stock No. |
|------|---------------------------------------|-----------|
| (-) | Piping panel kit, blast room | 22288 |
| 1. | Plate, piping panel | 22279 |
| 2. | Ring, hose inlet | 06229 |
| 3. | Gasket, hose inlet | 06230 |
| 4. | Screw, 3/8-NC x 1" hex head cap | 03252 |

| | | |
|-----|---|-------|
| 5. | Screw, 3/8-NC x 1-1/4" hex head cap | 03253 |
| 6. | Washer, 3/8 flat | 03317 |
| 7. | Washer, 3/8 lock | 03318 |
| 8. | Nut, 3/8-NC hex | 03311 |
| 9. | Adaptor, 1/4-NPT x male JIC | 02494 |
| 10. | Adaptor, 3/8-NPT x male SAE | 00022 |
| 11. | Plug, 3/8-NPT | 01740 |
| 12. | Gasket, 3/16" x 1" strip, per ft. Specify feet required, 3 feet used | 00186 |



8.5 Remote Mount Exhaust Assembly
Figure 22

| Item | Description | Stock No. |
|------|---|-----------|
| (-) | Hose assembly, remote mount exhaust.... | 19189 |
| 1. | Plug, 1" NPT | 01761 |
| 2. | Tee, 1" NPT | 01789 |
| 3. | Nipple, 1" NPT x close | 01701 |
| 4. | Coupling, 1" NPT pipe | 01830 |
| 5. | Nut, 1" NPT lock | 11917 |
| 6. | Adaptor, 1" NPT x 1" JIC | 11720 |
| 7. | Hose assembly, (for safety, when hose wears, replace 19189 assembly) | |



8.6 Millennium Valve, Inlet Segment, Figure 23

| Item | Description | Stock No. |
|------|---|-----------|
| * | Service kit, inlet seals (Figure 23a) | 22856 |
| ** | Service kit, plunger tip (Figure 23b) | 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 |

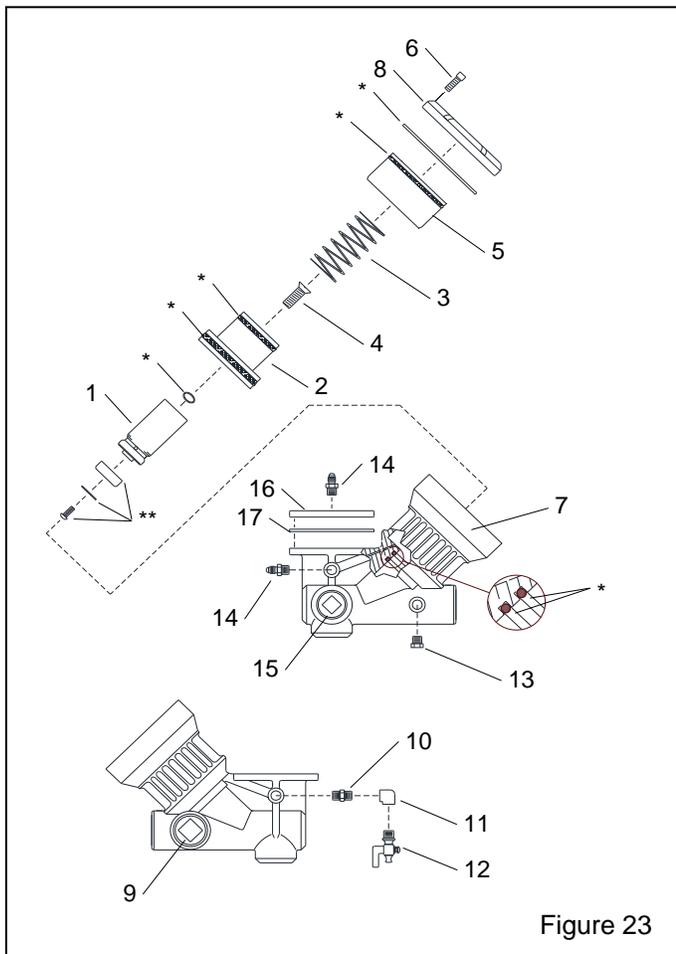


Figure 23

22856 SERVICE KIT
MILLENNIUM INLET SEGMENT SEALS

Refer to owner's manual for service instruction.

| 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 |

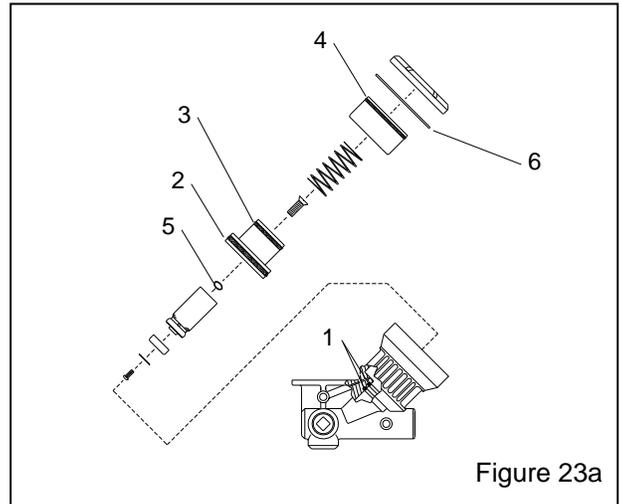


Figure 23a

22898 SERVICE KIT
MILLENNIUM PLUNGER TIP

Refer to owner's manual for service instruction.

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

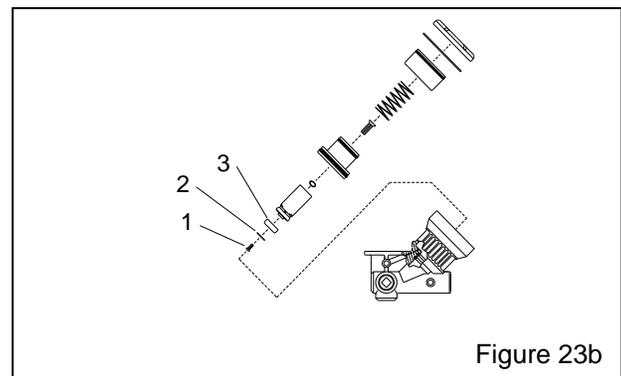
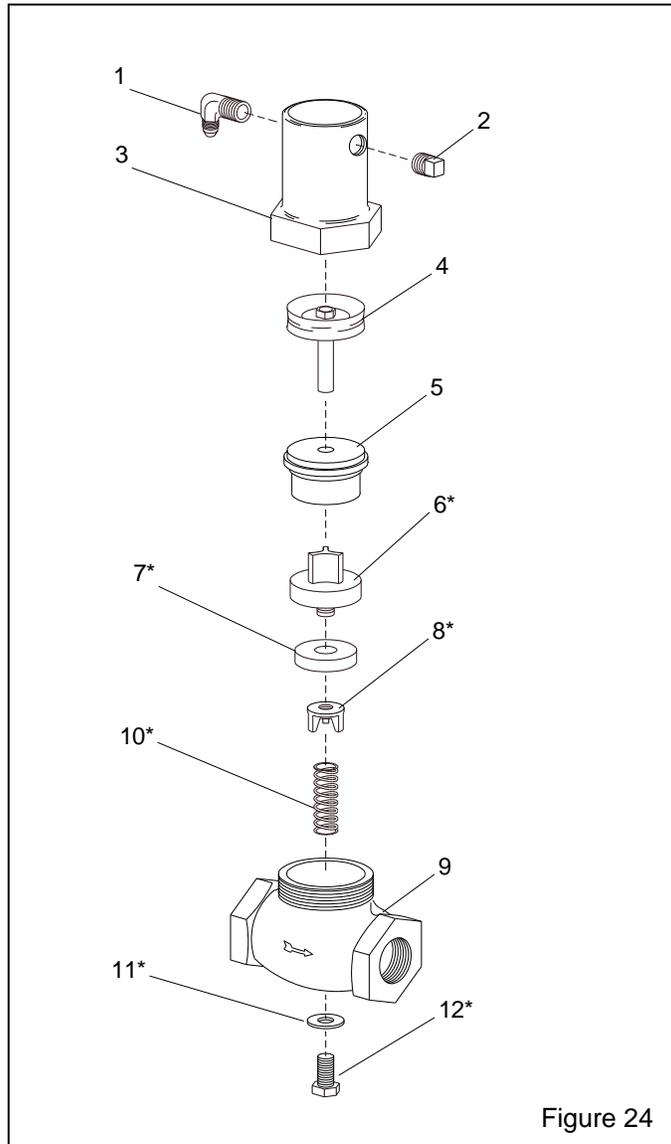


Figure 23b

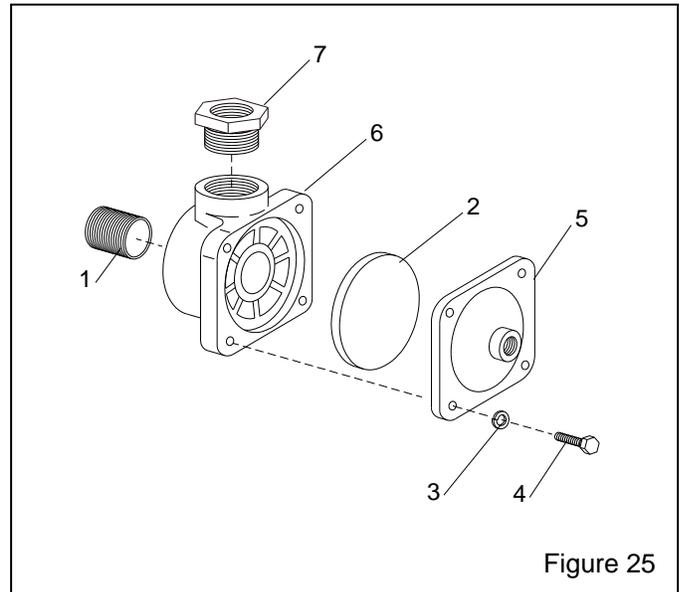
8.7 1" Piston Outlet Valve, Figure 24

| Item | Description | Stock No. |
|------|--|-----------|
| (-) | 1" Piston outlet valve, complete | 01967 |
| 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.* | Nylon washer | 01979 |
| 12.* | Cap screw, 3/8-NC x 3/4" | 03251 |
| (-) | Service kit, includes items marked *, quantities are shown in () | 01928 |



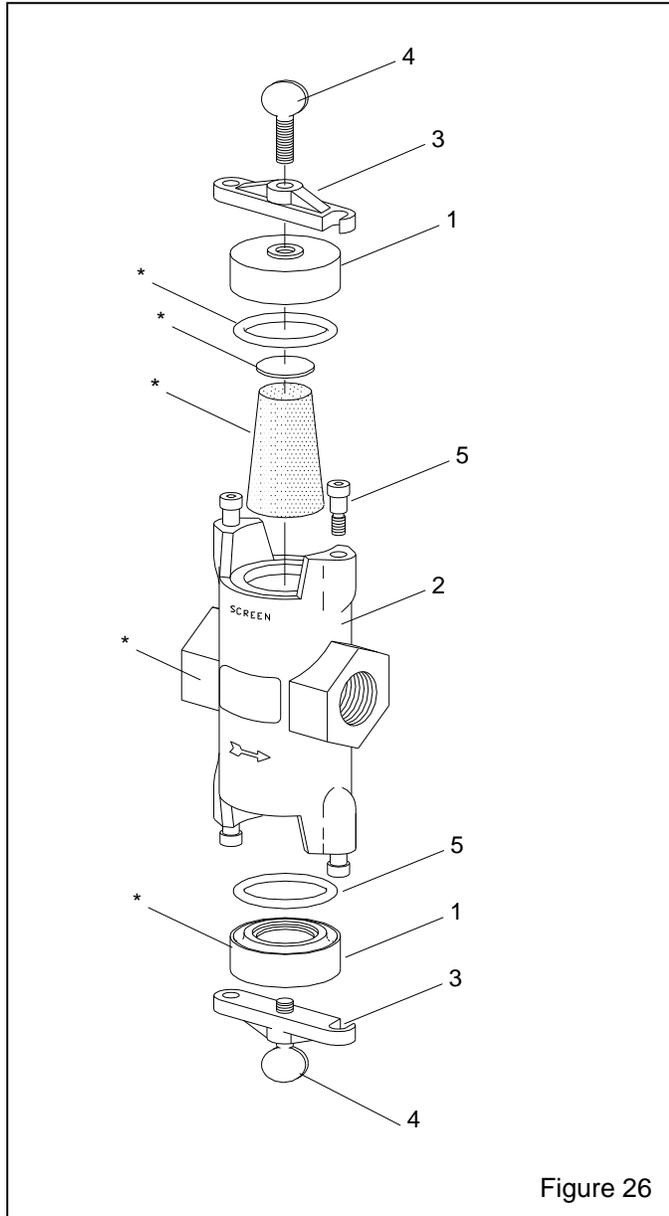
8.8 1" Diaphragm Outlet Valve, Figure 25

| Item | Description | Stock No. |
|------|---|-----------|
| (-) | 1" Diaphragm outlet valve, complete | 03371 |
| 1. | Nipple, 1" x close | 01701 |
| 2. | Diaphragm | 06149 |
| 3. | Lockwasher, 1/4" | 03117 |
| 4. | Cap screw, 1/4-NC x 1" hh | 03053 |
| 5. | Cap, diaphragm outlet | 03393 |
| 6. | Body, diaphragm outlet | 06135 |
| 7. | Bushing, 1-1/4" x 1" NPT | 01804 |



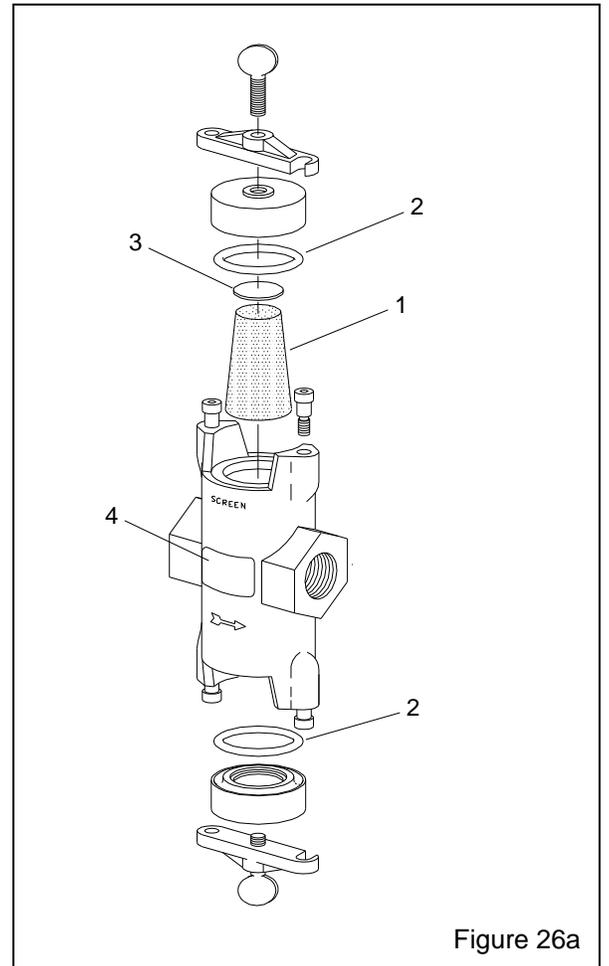
8.9 Abrasive Trap, Figure 26

| Item | Description | Stock No. |
|------|---|-----------|
| (-) | Abrasive trap | 02011 |
| * | Service kit, abrasive trap (Figure 26a) | 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 |



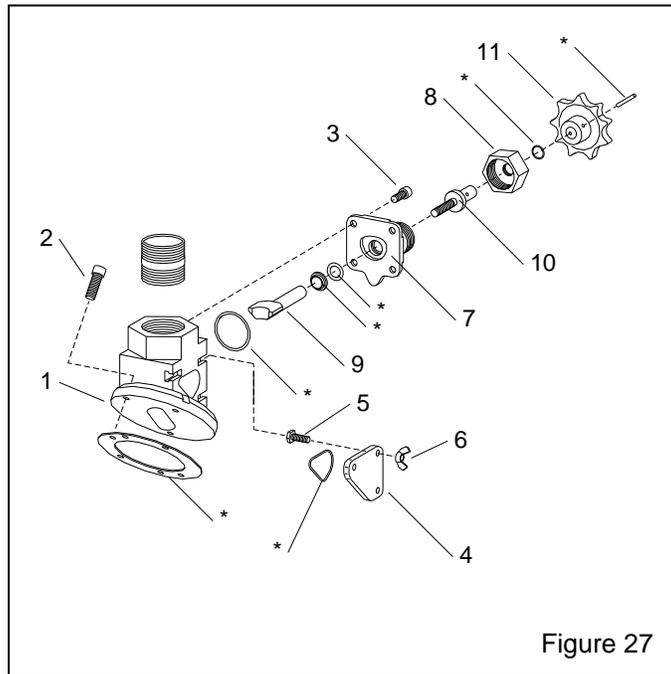
**01925 SERVICE KIT
 ABRASIVE TRAP**

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



8.10 Auto-Quantum Abrasive Metering Segment, Figure 27

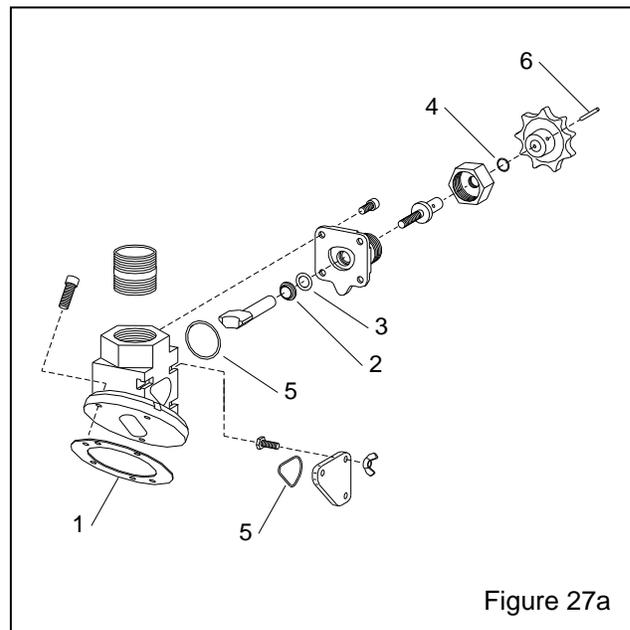
| Item | Description | Stock No. |
|------|---|-----------|
| * | Service kit, Quantum metering segment shown in Figure 27a | 22854 |
| 1. | Adaptor flange | 21314 |
| 2. | Screw, 3/8-NC x 1" socket head | 22655 |
| 3. | Screw, 5/16-NC x 3/4" socket head | 22767 |
| 4. | Inspection plate | 22620 |
| 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 SEGMENT**

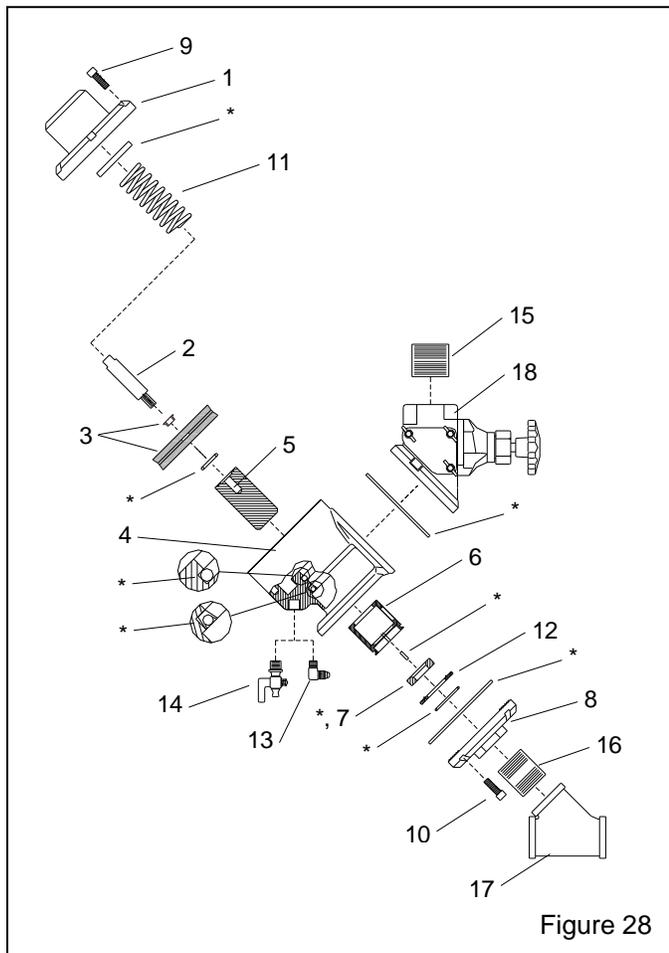
Refer to owner's manual for service instruction.

| 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 |



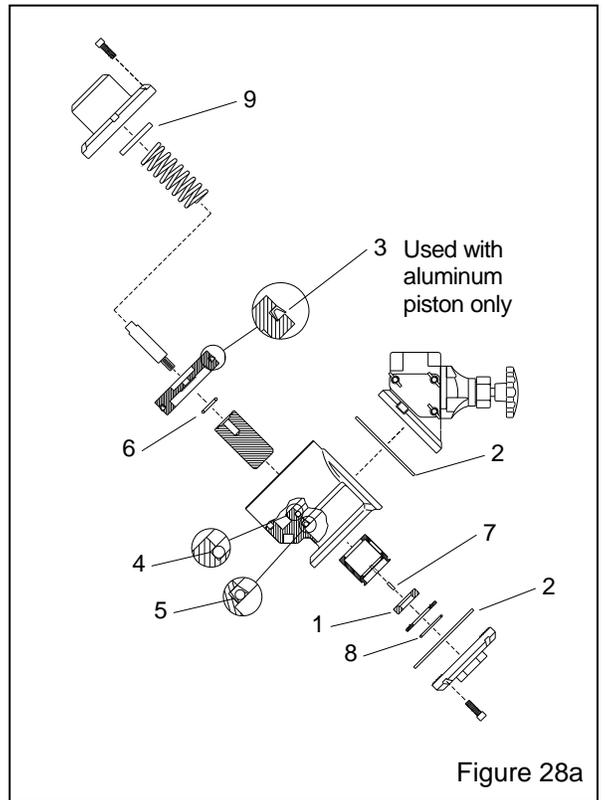
8.11 Quantum Metering Valve Actuator, Figure 28

| Item | Description | Stock No. |
|------|---|-----------------------|
| (-) | Auto-Quantum, metering valve w/wye..... | 24447 |
| * | Service kit, actuator, (Figure 28a) | 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, threaded outlet | 22077 |
| 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. | Retaining ring | 22429 |
| 13. | Adaptor, 1/4" NPT elbow | 02513 |
| 14. | Petcock, 1/4" NPT | 01993 |
| 15. | Nipple, 1-1/2" x close, Schedule 80 | 01791 |
| 16. | Nipple, 1-1/4" x 2" | 01718 |
| 17. | Wye, 1-1/4" | 01818 |
| 18. | Metering assembly | refer to Section 8.10 |



**24446 SERVICE KIT
 QUANTUM ACTUATOR ASSEMBLY**

| Item | Qty | Description |
|------|-----|--|
| 1. | 1 | Seat, urethane |
| 2. | 2 | Flange gasket |
| 3. | 1 | U-seal, 3-1/2" ID Used with old style aluminum piston only |
| 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. |
| 9. | 1 | Felt disc |



8.12 RLX Pneumatic Control Handle with ACS, Figure 29

Refer to Section 8.13 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. | Adapter, 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 |

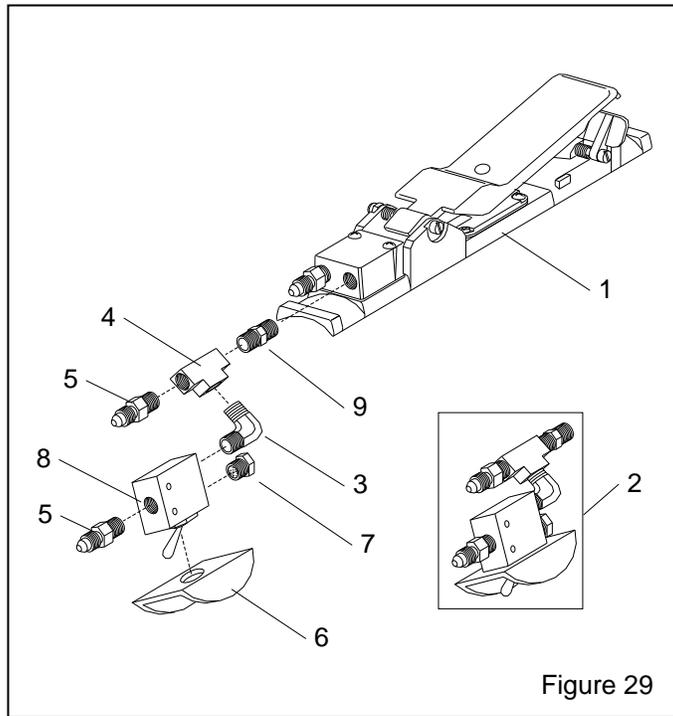


Figure 29

8.13 RLX Pneumatic Control Handle, Figure 30

| Item | Description | Stock No. |
|------|---|------------|
| (-) | RLX control handle assembly |10565 |
| * | Service kit, pneumatic RLX (Figure 30a) | ..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 |

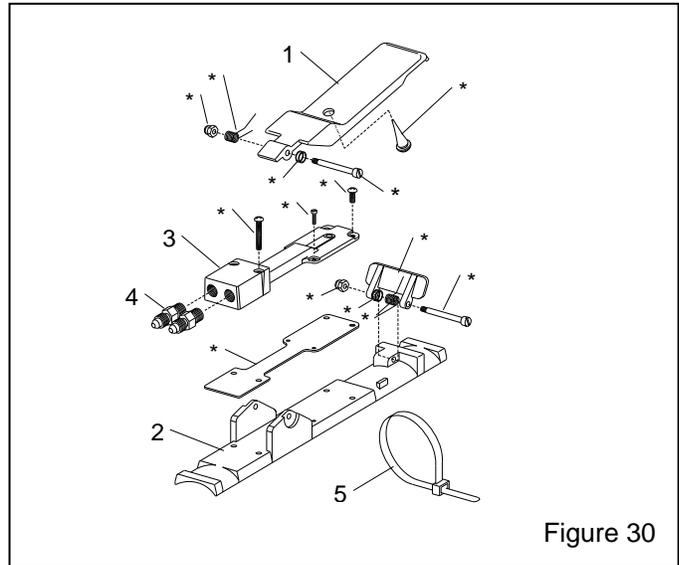


Figure 30

**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" |

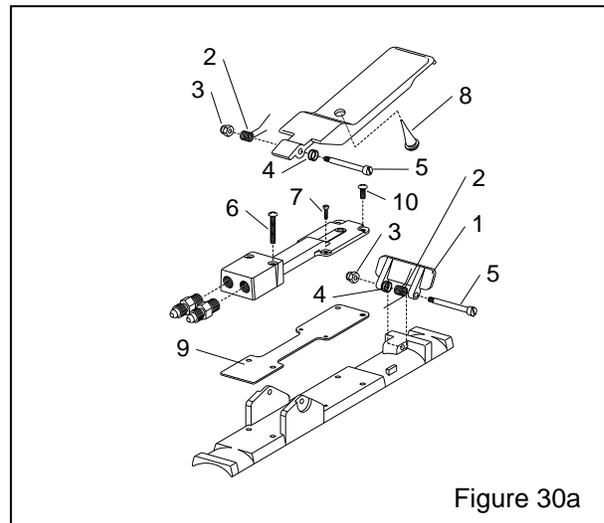


Figure 30a