

**CLASSIC BLAST MACHINE
WITH MANUAL CONTROLS
O. M. 06160**

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! WARNING

Do not proceed with these instructions until you have READ the preface of 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. Keep this manual for future reference.

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⚠ WARNING

- Read and follow ALL instructions before using this equipment.
- Failure to comply with ALL instructions can result in serious injury or death.
- In the event that the user, or any assistants of the user of this equipment cannot read or cannot completely understand the warnings and information contained in these instructions, the employer of the user and his assistants must thoroughly educate and train them on the proper operation and safety procedures of this equipment.

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

The products described in this material, and the information relating to those products, is intended for knowledgeable, experienced users of abrasive blasting equipment.

No representation is intended or made as to the suitability of the products described herein for any particular purpose or application. No representations are intended or made as to the efficiency, production rate, or the useful life of the products described herein. Any estimate regarding production rates or production finishes are the responsibility of the user and must be derived solely from the user's experience and expertise, and must not be based on information in this material.

The products described in this material may be combined by the user in a variety of ways for purposes determined solely by the user. No representations are intended or made as to the suitability or engineering balance of the combination of products determined by the user in his selection, nor as to the compliance with regulations or standard practice of such combinations of components or products.

Abrasive Blast Equipment is only a component of the range of equipment used in an abrasive blasting job. Other products may include an air compressor, abrasive, scaffolding, hydraulic work platforms or booms, paint spray equipment, dehumidification equipment, air filters and receivers, lights, ventilation equipment, parts handling equipment, specialized respirators, or equipment that while offered by Clemco may have been supplied by others. Each manufacturer and supplier of the other products used in the abrasive blasting job must be contacted for information, training, instruction and warnings with regard to the proper and safe use of their equipment in the particular application for which the equipment is being used. The information provided by Clemco is intended to provide instruction only on Clemco products. All operators must be trained in the proper, safe, use of this equipment. It is the responsibility of the users to familiarize themselves with, and comply with, all appropriate laws, regulations, and safe practices that apply to the use of these products. Consult with your employer about training programs and materials that are available.

Our company is proud to provide a variety of products to the abrasive blasting industry, and we have confidence that the professionals in our industry will utilize their knowledge and expertise in the safe efficient use of these products.

GENERAL INSTRUCTIONS

Described herein are some, BUT NOT ALL, of the major requirements for safe and productive use of blast machines, remote control systems, operator respirator assemblies, and related accessories. Completely read ALL instruction manuals prior to using equipment.

The user's work environment may include certain HAZARDS related to the abrasive blasting operation. Proper protection for the blaster, as well as anyone else that may be EXPOSED to the hazards generated by the blasting process, is the responsibility of the user and/or the employer. Operators MUST consult with their employer about what hazards may be present in the work environment including, but not limited to, exposure to dust that may contain TOXIC MATERIALS due to the presence of silica, cyanide, arsenic or other toxins in the abrasive, or materials present in the surface to be blasted such as lead or heavy metals in coatings. The environment may also include fumes that may be present from adjacent coatings application, contaminated water, engine exhaust, chemicals, and asbestos. The work area may include PHYSICAL HAZARDS such as an uneven work surface, poor visibility, excess noise, and electrical hazards. The operator MUST consult with his employer on the identification of potential hazards, and the appropriate measures that MUST be taken to protect the blaster and others that might be exposed to these hazards.

ALL machines, components and accessories MUST be installed, tested, operated and maintained only by trained, knowledgeable, experienced users.

DO NOT modify or substitute any Clemco parts with other types or brands of equipment. Unauthorized modification and parts substitution on supplied air respirators is a violation of OSHA regulations and voids the NIOSH approval.

OPERATIONAL INSTRUCTIONS

OPERATOR SAFETY EQUIPMENT

⚠ WARNING

- Blast operators and others working in the vicinity of abrasive blasting must always wear properly-maintained, NIOSH-approved, respiratory protection appropriate for the job site hazards.
- DO NOT USE abrasives containing more than one percent crystalline (free) silica. Ref. NIOSH Alert #92-102
- Inhalation of toxic dust (crystalline silica, asbestos, lead paint and other toxins) can lead to serious or fatal disease (silicosis, asbestosis, lead or other poisoning).

- ALWAYS wear NIOSH-approved supplied-air respirators as required by OSHA, in the presence of any dust including, but not limited to, handling or loading abrasive; blasting or working in the vicinity of blast jobs; and cleanup of expended abrasive. Prior to removing respirator, an air monitoring instrument should be used to determine when surrounding atmosphere is clear of dust and safe to breathe.

- NIOSH-approved, supplied-air respirators are to be worn ONLY in atmospheres:
 - NOT IMMEDIATELY dangerous to life or health and,
 - from which a user can escape WITHOUT using the respirator.
- Clemco supplied-air respirators **DO NOT REMOVE OR PROTECT AGAINST CARBON MONOXIDE (CO) OR ANY OTHER TOXIC GAS.** Carbon monoxide and toxic gas removal and/or monitoring device must be used in conjunction with respirator to insure safe breathing air.
- Air supplied to respirator MUST BE AT LEAST GRADE D QUALITY as described in Compressed Gas Association Commodity Specification G-7.1, and as specified by OSHA Regulation 1910.139 (d).
- ALWAYS locate compressors to prevent contaminated air (such as CO from engine exhaust) from entering the air intake system. A suitable in-line air purifying sorbent bed and filter or CO Monitor should be installed to assure breathing air quality.
- ALWAYS use a NIOSH-approved breathing air hose to connect an appropriate air filter to the respirator. Use of a non-approved air hose can subject the operator to illness caused by the release of chemical agents used in the manufacture of non-approved breathing air hose.
- ALWAYS check to make sure air filter and respirator system hoses are NOT CONNECTED to in-plant lines that contain nitrogen, acetylene or any other non-breathable gas. NEVER use oxygen with air line respirators. NEVER modify air line connections to accommodate air filter/respirator breathing hose WITHOUT FIRST testing content of the air line. **FAILURE TO TEST THE AIR LINE MAY RESULT IN DEATH TO THE RESPIRATOR USER.**
- Respirator lenses are designed to protect against rebounding abrasive. They do not protect against flying objects, glare, liquids, radiation or high speed heavy materials. Substitute lenses from sources other than the original respirator manufacturer will void NIOSH-approval of this respirator.

BLAST MACHINES AND REMOTE CONTROLS

⚠ WARNING

- **ALWAYS equip abrasive blast machines with remote controls.**
- **Abrasive blast machine operators must wear NIOSH-approved supplied-air respirators (ref: OSHA regulations 1910.94, 1910.132, 1910.139 and 1910.244).**

- NEVER modify OR substitute remote control parts. Parts from different manufacturers are NOT compatible with Clemco

equipment. If controls are altered, involuntary activation, which may cause serious injury, can occur.

- Inspect the air control orifice DAILY for cleanliness. NEVER use welding hose in place of twinline control hose. The internal diameter and rubber composition are UNSAFE for remote control use.
- UNLESS OTHERWISE SPECIFIED, maximum working pressure of blast machines and related components MUST NOT exceed National Board approved 125 psig (8.5 BAR).
- NEVER weld on blast machine. Welding may affect dimensional integrity of steel wall and WILL VOID National Board approval.
- Point nozzle ONLY at structure being blasted. High velocity abrasive particles WILL inflict serious injury. Keep unprotected workers OUT of blast area.
- NEVER attempt to manually move blast machine when it contains abrasive. EMPTY machines, up to 6 cu. ft.(270kg) capacity, are designed to be moved:
 - on flat, smooth surfaces by AT LEAST two people;
 - with the Clemco "Mule"; or
 - with other specially designed machine moving devices.
- Larger empty blast machines or ANY blast machine containing abrasive MUST be transported by mechanical lifting equipment.

AIR HOSE, BLAST HOSE, COUPLINGS, AND NOZZLE HOLDERS

- Air hose, air hose fittings and connectors at compressors and blast machines MUST be FOUR times the size of the nozzle orifice. Air hose lengths MUST be kept as short as possible AND in a straight line. Inspect DAILY and repair leakage IMMEDIATELY.
- Blast hose inside diameter MUST be THREE to FOUR times the size of the nozzle orifice. AVOID sharp bends that wear out hose rapidly. Use SHORTEST hose lengths possible to reduce pressure loss. Check blast hose DAILY for soft spots. Repair or replace IMMEDIATELY.
- ALWAYS cut loose hose ends square when installing hose couplings and nozzle holders to allow uniform fit of hose to coupling shoulder. NEVER install couplings or nozzle holders that DO NOT provide a TIGHT fit on hose. ALWAYS use manufacturers recommended coupling screws.
- Replace coupling gaskets FREQUENTLY to prevent leakage. Abrasive leakage can result in dangerous coupling failure. ALL gaskets MUST be checked SEVERAL times during a working day for wear, distortion and softness.
- Install safety pins at EVERY coupling connection to prevent accidental disengagement during hose movement.
- ALWAYS attach safety cables at ALL air hose AND blast hose coupling connections. Cables relieve tension on hose and control whipping action in the event of a coupling blow-out.

MAINTENANCE

- ALWAYS shut off compressor and depressurize blast machine BEFORE doing ANY maintenance.
- Always check and clean ALL filters, screens and alarm systems when doing any maintenance.
- ALWAYS cage springs BEFORE disassembling valves IF spring-loaded abrasive control valves are used.
- ALWAYS completely follow owner's manual instructions and maintain equipment at RECOMMENDED intervals.

ADDITIONAL ASSISTANCE

- Training and Educational Programs. Clemco Industries Corp. offers a booklet, Blast-Off 2, developed to educate personnel on abrasive blast equipment function and surface preparation techniques. Readers will learn safe and productive use of machines, components and various accessories, including selection of abrasive materials for specific surface profiles and degrees of cleanliness.
- The Society for Protective Coatings (SSPC) offers a video training series on protective coatings including one entitled "Surface Preparation." For loan or purchase information, contact SSPC at the address shown below.

TECHNICAL DATA AND RESEARCH COMMITTEES

- The following associations offer information, materials and videos relating to abrasive blasting and safe operating practices.

The Society for Protective Coatings (SSPC)

40 24th Street, Pittsburgh PA 15222-4643
 Phone: (412) 281-2331 • FAX (412) 281-9992
 Email: research@sspc.org • Website: www.sspc.org

National Association of Corrosion Engineers (NACE)

1440 South Creek Drive, Houston TX 77084
 Phone: (281) 228-6200 • FAX (281) 228-6300
 Email: msd@mail.nace.org • Website: www.nace.org

American Society for Testing and Materials (ASTM)

100 Barr Harbor Dr., West Conshohocken, PA 19428
 Phone (610) 832-9500 • FAX (610) 832-9555
 Email: service@astm.org • Website: www.astm.org

NOTICE

This equipment is not intended to be used in an area that might be considered a hazardous location as described in the National Electric Code NFPA 70 1996, article 500.

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 the 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 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 a 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 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 the 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.

DAILY SET-UP CHECK LIST

⚠ WARNING

- ALL piping, fittings and hoses MUST be checked DAILY for tightness and leakage.
- ALL equipment and components MUST be thoroughly checked for wear.
- ALL worn or suspicious parts MUST be replaced.
- ALL blast operators MUST be properly trained to operate equipment.
- ALL blast operators MUST be properly outfitted with abrasive resistant clothing, safety shoes, leather gloves and ear protection.
- BEFORE blasting ALWAYS use the following check list.

1. PROPERLY MAINTAINED AIR COMPRESSOR sized to provide sufficient volume (cfm) for nozzle and other tools PLUS a 50% reserve to allow for nozzle wear. Use large compressor outlet and large air hose (4 times the nozzle orifice size). FOLLOW MANUFACTURERS MAINTENANCE INSTRUCTIONS.

2. BREATHING AIR COMPRESSOR (oil-less air pump) capable of providing Grade D Quality air located in a dust free, contaminant free area. If oil-lubricated air compressor is used to supply respirator, it should have high temperature monitor and CO monitor or both. If CO monitor is not used, air MUST be tested FREQUENTLY to ensure proper air quality.

3. Clean, properly maintained NIOSH-APPROVED SUPPLIED-AIR RESPIRATOR. ALL components should ALWAYS be present. NEVER operate without inner lens in place. Thoroughly inspect ALL components DAILY for cleanliness and wear. ANY substitution of parts voids NIOSH approval i.e. cape, lenses, breathing hose, breathing air supply hose, air control valve, cool air or climate control devices.

4. OSHA required BREATHING AIR FILTER for removal of moisture and particulate matter from breathing air supply. THIS DEVICE DOES NOT REMOVE OR DETECT CARBON MONOXIDE (CO). ALWAYS USE CO MONITOR ALARM.

5. ASME CODED BLAST MACHINE sized to hold 1/2 hour abrasive supply. ALWAYS ground machine to eliminate static electricity hazard. Examine pop up valve for alignment. Blast machine MUST be fitted with a screen to keep out foreign objects and a cover to prevent entry of moisture overnight.

6. AIR LINE FILTER installed AS CLOSE AS POSSIBLE to machine inlet. Sized to match inlet piping or larger air supply line. Clean filter DAILY. Drain OFTEN.

7. REMOTE CONTROLS MUST be in PERFECT operating condition. ONLY use APPROVED spare parts, including twin-line hose. DAILY: test system operation and check button bumper and spring action of lever and lever lock. DO NOT USE WELDING HOSE.

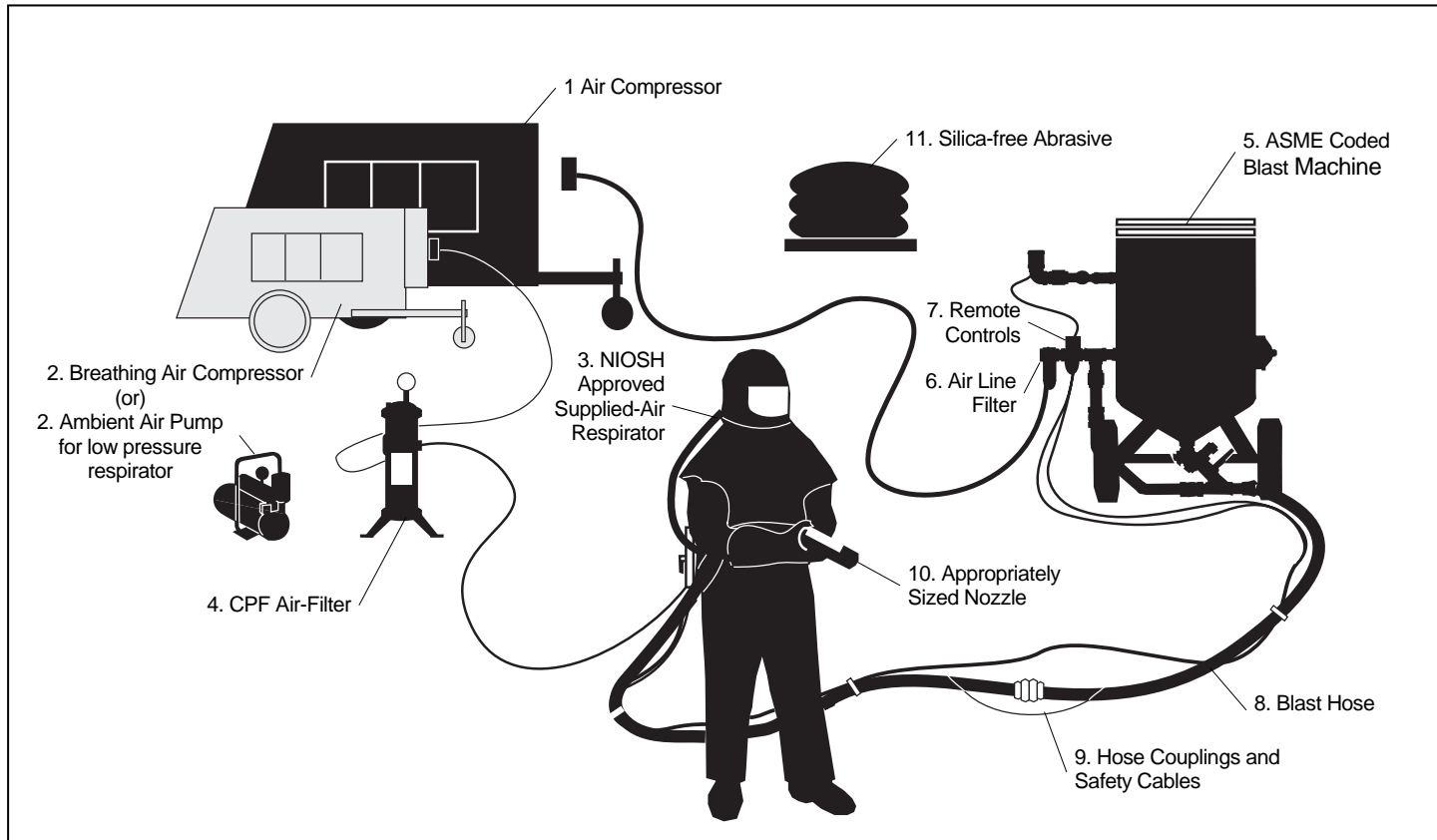
8. BLAST HOSE with ID 3 to 4 times the nozzle orifice. Lines MUST be run AS STRAIGHT AS POSSIBLE from machine to work area with NO sharp bends. Check DAILY for internal wear and external damage.

9. HOSE COUPLINGS, NOZZLE HOLDERS fitted SNUGLY to hose end and installed using PROPER coupling screws. Coupling lugs MUST be snapped FIRMLY into locking position. Gasket MUST form positive seal with safety pins inserted through pin holes. Check gaskets and replace if ANY sign of wear, softness or distortion. ALWAYS install safety cables at every connection to prevent disengagement. Check nozzle holder for worn threads. NEVER MIX DIFFERENT BRANDS OF COMPONENTS. Check each of these components DAILY.

10. Inspect NOZZLE and GASKET DAILY for wear. Replace nozzle when 1/16" larger than original size or if liner appears cracked. Check nozzle threads for wear.

11. Use abrasive that is properly sized and free of harmful substances; such as, free silica, cyanide, arsenic or lead. Check material data sheet for presence of toxic or harmful substances.

12. Test surface to be blasted for toxic substances. Take appropriate, and NIOSH required, protective measures for operator and bystanders which pertain to substances found on the surface to be blasted.



1.0 INTRODUCTION

1.1 Scope

1.1.1 These instructions cover set-up, operation, maintenance, troubleshooting, and replacement parts for Clemco manually controlled blast machines. These instructions also contain important safety information required for safe operation of the machine.

1.1.2 OSHA requires remote controls (valves that start and stop the blast process from a handle at the nozzle) on all blast machines when a blast operator (the person who operates the remote control handle and who performs the blasting by holding and directing the nozzle) commands the nozzle. Manually controlled blast machines (a blast machine fitted with simple ball valves at the inlet and outlet, that must be manually opened and closed to start and stop the blast process) is allowed only in cases where a machine is connected to a fixed nozzle or tool that is enclosed and separated from the operator and surrounding personnel. If this machine is intended for use with a blast operator, contact a Clemco distributor for the remote control system.

1.1.3 All blast machine tenders (the person who opens and closes the manual inlet and outlet ball valves to pressurize and depressurize the blast machine) must be trained in the safe operation of the blast machine and all blasting accessories. Tenders and all personnel involved with the blast machine operation must know about the hazards associated with abrasive blasting. Before using the machine, all personnel involved with the blast machine operation must read this entire manual, including the orange cover, and all accessory manuals.

1.2 Hazard Alerts

1.2.1 Clemco uses signal words, based on ANSI Z535.4-1998, 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 the user of this equipment of potential personal injury hazards.

Obey all safety messages that follow this symbol to avoid possible injury or death.

CAUTION

Caution used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

⚠ CAUTION

Caution indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

⚠ WARNING

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

⚠ DANGER

Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

1.3 Components and Operating Principles

1.3.1 The primary components of the blast machine are shown in Figure 1.

1.3.2 This blast machine is a manually controlled machine. This means a machine tender pressurizes and depressurizes the machine, by opening and closing valves on the blast machine.

1.3.3 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 as may be required by some states. This 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.

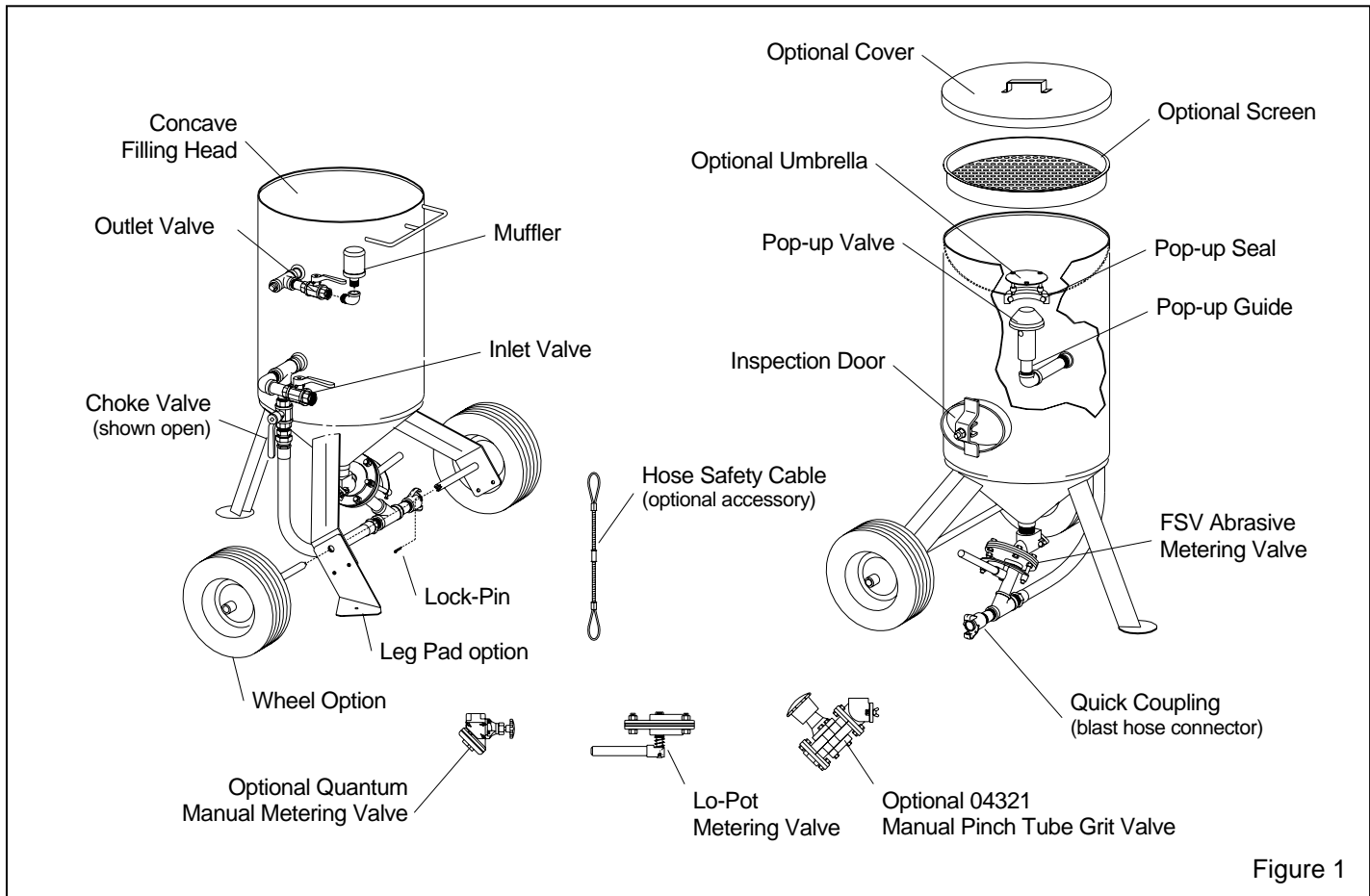


Figure 1

1.3.4 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.

1.3.5 The blast machine's pressure rating (psi) is stamped into the National Board Label which is welded onto the side of the vessel. Do not exceed the rated pressure.

▲ WARNING

Excessive compressed 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.

1.3.6 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.

1.4 Abrasive

1.4.1 Selection of blasting abrasive can play a significant part in the health risk, productivity, and maintenance of the blast machine. **DO NOT USE** abrasives containing more than one percent crystalline (free) silica. Obtain material safety data sheets (MSDS) for the blasting abrasive prior to blasting, paying particular attention the health risks and presence of any hazardous/toxic substances. Use only abrasives specifically manufactured for blast cleaning, and that are compatible with the surface being blasted. Abrasive

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 abrasive may contain salts, corrosives, or other materials that could contaminate the blast surface.

1.4.2 Abrasive Size

1.4.2.1 The choice of abrasive size depends on the desired profile, cleaning rate, nozzle size and availability of clean dry air. Generally, larger and denser abrasive provide a deeper profile, while smaller abrasives clean faster. Most abrasive blasting is done with abrasive between 16 and 80 mesh. Larger size may be used if the nozzle orifice is large enough to prevent multiple particles to pass without jamming. Finer abrasive requires clean dry air to prevent bridging in the metering valve.

1.4.3 Sand: Sand should never be used because of the health hazards of using abrasive containing free silica.

1.4.4 Slags: Slag abrasives are compatible with the blast machine and accessories. Obtain a material safety data sheets (MSDS).

1.4.5 Steel: Steel shot and steel grit may be used with machines fitted with an optional Quantum or manual pinch-tube metering valve. See optional valves in Section 7.2. Shot applications may require the use of a pneumatically operated metering valve such as the Sentinel or Auto-Quantum, to prevent surging at startup.

1.4.6 Silicon Carbide, Aluminum Oxide, and Garnet: These are the most aggressive, high volume abrasive in the blasting industry. Aggressive abrasive such as these may be used, but the service life will be reduced on any equipment components which come in contact with the abrasive. To avoid unscheduled down time, periodically inspect hoses, and nozzle for abrasive wear. Use a nozzle lined with boron carbide with these abrasives.

1.4.7 Glass Bead: Most beads are treated to ensure free-flow operation even under moderately high humidity conditions. Glass beads subjected to excessive moisture may be reused after thorough drying and breaking up any lumps. Clean dry air is a necessary. Glass bead applications may require the use of a pneumatically operated metering valve such as the Sentinel or Auto-Quantum, to prevent surging at startup.

1.4.8 Lightweight Abrasive: Periodic use of plastic media, and most agricultural media is okay. Exclusive use of plastic, or other lightweight media may require a blast machine with a 60° conical bottom.

2.0 INITIAL SET-UP

2.1 Storage Hopper

2.1.1 When a storage hopper is installed above the blast machine, an umbrella, mounted above the pop-up opening, is required. See Section 7.2 for optional bolt-on umbrella.

2.2 Blast Machine Set-Up

WARNING

Clemco supplies an exhaust muffler with all blast machines of 2 cu. ft. capacity and larger. The muffler reduces exhaust noise and prevents abrasive from exhausting upward or sideways into the air. When the blast machine is depressurized, the muffler body pops up to diffuse the air and abrasive. When the machine is fully depressurized, the muffler body drops, permitting trapped abrasive to empty. For the muffler to work properly, it must be installed with the body facing up, as shown in Figure 1.

If an application requires the muffler be removed, the exhaust piping must be plumbed to direct exhausting air in a direction that ensures no persons will be exposed to possible injury from high velocity air and abrasive, which escapes when the blast machine is depressurized.

2.2.1 Install an optional filter/moisture separator to the inlet valve. The filter is recommended at this location to remove moisture from air before it enters the machine.

2.2.2 Install an air supply hose fitting to the inlet valve (or moisture separator), that is compatible with the compressed-air supply hose. See Section 3.2.2.

3.0 OPERATION

3.1 Transporting and moving

WARNING

Failure to observe the following warnings before transporting or moving a blast machine could result in serious injury or death.

- Always empty the blast machine before lifting or hoisting.
 - Never hoist the machine by the handle or piping, or with a sling through the handle or piping.
 - Always use lift equipment that is rated higher than the weight of the machine and accessories.
 - When transporting a machine on a pallet, always securely attach the machine to a sturdy pallet.
 - Always securely anchor the machine to the transport vehicle.
 - Anyone using material handling equipment to move, transport, or lift the machine must be experienced, and able to recognize and avoid hazards associated with handling this type of machinery, and to safely operate the equipment.
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3.1.1 Transporting a blast machine

3.1.1.1 Always empty the machine before transporting. Transporting a machine containing abrasive may increase the weight to an unsafe handling limit, and could cause abrasive to settle in the piping.

3.1.2 Moving a blast machine

WARNING

Never attempt to manually move a blast machine when it contains abrasive. Empty machines, up to 6 cu. ft. capacity, may be moved when the following criteria are met:

3.1.2.1 An empty machine may be moved manually, on level flat surfaces, by at least two people.

WARNING

Do not manually move the machine on an incline, or on a slippery or irregular surface that could cause the operator to slip or lose balance. Sudden weight shifts when the machine is tilted on an incline, and slipping or tripping while moving the machine will cause the operator to lose control of the machine, causing severe injury and property damage.

3.1.2.2 Move the machine by pushing it in a forward direction. Do not back-up while moving the machine, as potential tripping hazards cannot be seen.

3.1.2.3 The Clemco Mule (Stock No. 20331) is designed to assist in moving empty 1.5 cu. ft. to 6 cu. ft. capacity Clemco blast machines. Contact a Clemco Distributor for additional information.

3.2 Set-Up for Operation

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

3.2.2 Connect an air line from the compressor to the air supply hose connector installed on the blast machine inlet. For best blasting performance, use 1-1/4" ID or larger air line when using up to a 5/16" orifice nozzle, 1-1/2" or larger when using a 3/8" nozzle, and 2" or larger when using up to a 1/2" nozzle. See the compressed air and abrasive consumption table in Figure 4 for approximate air consumption.

3.2.3 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. Use safety lock-pins or safety wire to lock the couplings together, to prevent accidental separation during blasting.

3.2.4 Make sure that all compressed-air supply hose connections are secured with safety lock pins and safety cables to prevent accidental disconnection. Lock pins and safety cables are listed in Section 7.1.

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.

Compressed Air and Abrasive Consumption									
Consumption rates are based on abrasive that weigh 100 pounds per cubic foot									
Nozzle Orifice Size (in.)	Pressure At The Nozzle (psi)								Air, Power and Abrasive Requirements
	50	60	70	80	90	100	125	140	
No. 2 1/8"	11	13	15	17	19	20	25	28	Air (cfm)
	67	77	88	101	112	123	152	169	Abrasive (lbs/hr)
	2.5	3	3.5	4	4.5	5	5.5	6.5	Compressor (hp)
No. 3 3/16"	26	30	33	38	41	45	55	61	Air (cfm)
	150	171	196	216	238	264	319	353	Abrasive (lbs/hr)
	6	7	8	9	10	10	12	14	Compressor (hp)
No. 4 1/4"	47	54	61	68	74	81	98	108	Air (cfm)
	268	312	354	408	448	494	608	676	Abrasive (lbs/hr)
	11	12	14	16	17	18	22	24	Compressor (hp)
No. 5 5/16"	77	89	101	113	126	137	168	186	Air (cfm)
	468	534	604	672	740	812	982	1085	Abrasive (lbs/hr)
	18	20	23	26	28	31	37	42	Compressor (hp)
No. 6 3/8"	108	126	143	161	173	196	237	263	Air (cfm)
	668	764	864	960	1052	1152	1393	1538	Abrasive (lbs/hr)
	24	28	32	36	39	44	52	59	Compressor (hp)
No. 7 7/16"	147	170	194	217	240	254	314	347	Air (cfm)
	896	1032	1176	1312	1448	1584	1931	2138	Abrasive (lbs/hr)
	33	38	44	49	54	57	69	77	Compressor (hp)
No. 8 1/2"	195	224	252	280	309	338	409	452	Air (cfm)
	1160	1336	1512	1680	1856	2024	2459	2718	Abrasive (lbs/hr)
	44	50	56	63	69	75	90	101	Compressor (hp)

- For nozzle sizes 3/8" to 1/2", blast machines should be equipped with 1-1/4" or larger piping and inlet valve to prevent pressure loss.
- Air requirements were measured by a flow meter under actual blasting conditions, and are therefore lower than figures for air alone, with no abrasive.
- Horsepower requirements are based on 4.5 cfm per horsepower.
- Figures are for reference only, and may vary for different working conditions. Several variables, including metering valve adjustments, can affect abrasive flow.
- Figures show approximate compressed air and abrasive consumption when nozzles are new. Consumption will increase as the nozzle wears.

Figure 2

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

3.2.6 Make sure the ventilation system is running, the nozzle fixture is secure, and the blasting area is contained.

⚠ WARNING

This machine is NOT equipped with remote controls. Do not use the machine without OSHA required remote controls, if a blast operator is controlling the nozzle. Contact a Clemco distributor for a compatible remote control system. Ignoring this warning places the operator at risk of severe injury or death from accidents that could occur from an uncontrolled blast nozzle.

3.2.7 Close the inlet valve (handle perpendicular to the valve).

3.2.8 Make sure the outlet valve open (handle in-line with the piping).

3.2.9 Close the abrasive metering valve. The closed position for the FSV and Lo-Pot valve are when the handle is all the way to either side of center. The optional manual PVR grit valve and Quantum metering valves are closed when the metering knob is turned fully clockwise.

3.2.10 Close the air valve on the compressor. Start the compressor, and bring it to operating temperature and pressure. The pressure must be more than 40 psi, but must not exceed the blast machine's rated pressure.

3.2.11 Slowly open the compressor air valve to pressurize the air supply line. Listen for noise that indicates any open lines or leaks.

3.2.12 Load abrasive into the machine by following the instructions in Section 3.6.

3.2.13 No one is allowed within 10 feet of the blast machine except machine tenders, who are appropriately fitted with approved protective equipment.

⚠ WARNING

All persons except for the machine tender must stay clear of the blast machine. The blast operator may pressurize or depressurize the machine at any time. The noise generated by the sudden release of compressed air when the machine is pressurized or depressurized, may startle bystanders, and may vent abrasive under pressure. Either condition could result in injury. The machine tender must wear a suitable, approved respirator, plus approved eye, face, and hearing protection.

3.3 Blasting

3.3.1 Verify that the blast nozzle is secure and directed only at objects intended to be blast cleaned.

3.3.2 The machine tender closes the outlet valve, and while standing back and facing away from the concave filling head, opens the inlet valve. This action causes the pop-up valve to seal off the filling port and the machine will pressurize.

3.3.3 If the abrasive metering valve is closed as instructed, in 3.2.9, only air will exit the nozzle.

⚠ WARNING

Do not leave the machine unattended. If an emergency occurs, such as a burst in the blast hose, shut-down the machine immediately.

3.4 Adjusting Abrasive Flow

NOTE: The following instructions explain the adjustment of an FSV metering valve. Valves with knobs are adjusted by turning the knob clockwise for less abrasive, or

counterclockwise for more abrasive. Separate manuals are provided with optional valves.

3.4.1 Abrasive flow is adjusted at the metering valve located at the bottom of the blast machine.

3.4.2 Begin with the metering valve closed. Closed, for the FSV and Lo-Pot metering valves, is when the handle is turned to either side of center until it hits the stops. The closed position for the optional Quantum or PVR grit valve is when the metering knob is turned fully clockwise.

3.4.3 While the operator is blasting, the machine tender increases abrasive flow by moving the handle toward center, no more than 1/4" at a time, allowing time for the flow to stabilize before readjusting.

3.4.4 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, abrasive coming out of the nozzle should barely discolor the air when seen against a contrasting background.

3.4.5 Once the correct flow is obtained, loosen the wing nut on the gauge unit and move the handle spacer against the metering handle. This allows the handle to be moved (opened or closed) and returned to the same setting.

3.5 Stop Blasting

3.5.1 To depressurize the machine and stop blasting, the machine tender closes the inlet valve, and while standing back and facing away from the concave head and exhaust muffler, quickly opens the outlet valve. The pop-up valve automatically drops when air is expelled from the machine and pressure equalizes.

3.6 Loading Abrasive into the Blast Machine

3.6.1 Depressurize the machine per Section 3.5

3.6.2 Load abrasive into the machine by pouring it into the concave head. Using an optional screen, placed over the head, prevents large objects from falling inside. A screen is recommended to keep objects such as pieces of abrasive bags and rocks from falling into the machine. Foreign objects will jam the machine. Abrasive flows through the filling port into the machine. Keep the abrasive level below the pop-up valve. Abrasive on the pop-up valve could be forced up and out of the top of the machine when the machine is pressurized.

3.6.3 After the machine is filled, pressurize the machine per Section 3.3.

3.7 Emptying the Machine of Abrasive

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

3.7.2 With the blast machine off, turn the blast pressure down to approximately 40-50 psi, close the choke valve and set the abrasive metering valve at full open.

3.7.3 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. If circumstances require the nozzle to be removed, also remove the nozzle washer. Purging the machine without a nozzle, will eventually erode the thread area of the nozzle holder, which could cause a hazardous condition.

3.7.4 Point the nozzle into a drum or suitable container, or in the direction the abrasive is to be disposed.

3.7.5 Insure that the hose is secure, and pressurize the machine.

3.7.6 Depressurize the machine when empty, and open the choke valve.

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

WARNING

The threads on the nozzle and nozzle holder must be inspected each time the nozzle is secured to the holder. Check that 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.

3.8 Shutdown

3.8.1 Make sure the blast machine is depressurized.

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

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

3.8.4 Shutdown the compressor.

3.8.5 Cover the machine when not in use.

4.0 PREVENTIVE MAINTENANCE

NOTE: These preventive maintenance instructions pertain to the blast machine. Read the owners manuals for all blast accessories, for their inspection and maintenance schedules.

4.1 Daily Inspection

4.1.1 With the air off, before blasting, inspect the following:

- 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.

- 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. Check that 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.

- Check that the nozzle holding fixture is secure.

4.1.2 During blasting, inspect the following:

- 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 inspect all items for wear.

⚠ WARNING

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

4.2 Weekly Inspection

4.2.1 With the air off, before blasting, inspect the following:

- Remove the nozzle for inspection. Replace if the diameter is worn 1/16" or more, or if the liner is cracked.
- When a moisture separator is used, inspect the filter element, and clean the bowl.

4.2.2 During blasting inspect the following:

- Note the time it takes to fully depressurize the machine after the outlet valve is opened. When depressurizing time increases noticeably inspect the exhaust muffler per Section 5.5.

4.2.3 Monthly Inspection

With the air off, before blasting, inspect 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 5.3.

- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. See Section 5.4.
- Inspect the exhaust muffler for blockage and wear, per Section 5.5.

5.0 SERVICE MAINTENANCE

⚠ WARNING

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

- Depressurize the blast machine.
- Lock-out and tag-out the compressed air supply.
- Bleed the air supply line to the blast machine.

5.1 Removing Damp Abrasive From the Blast Machine.

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

5.1.2 For more difficult blockages, proceed as follows: See Section 5.2 to check for obstructions in the metering valve.

5.1.3 With the blast machine off, disconnect the blast hose and remove the gasket from the quick coupling on the machine.

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

⚠ WARNING

Place the machine so that the outlet is pointed away from any objects or persons. Stand clear of the path of exiting abrasive. It may come out at high velocity. Impact from exiting abrasive could cause severe injury.

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

5.1.6 When the obstruction has been removed, depressurize the machine. Remove the nozzle and

nozzle washer, and reconnect the hose. Open the choke valve and close the abrasive metering valve. Pressurize the machine to clear the hose. When the hose is cleared, depressurize the machine so the nozzle and nozzle washer can be attached.

⚠ WARNING

The threads on the nozzle and nozzle holder must be inspected each time the nozzle is secured to the holder. Check that 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 erode nozzle threads. A loose fitting nozzle may eject under pressure and could cause severe injury.

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

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

5.2.1 If the nature of the obstruction permits emptying the machine of abrasive, follow the instructions per Section 3.7.

5.2.2 Turn off the compressed air supply. Lock-out and tag-out the air supply, and bleed the air supply line to the blast machine.

5.2.3 Remove the wing nuts securing the abrasive metering valve's inspection plate.

5.2.4 Check the metering valve for blockage, by inserting a finger into the opening, and feel for an obstruction or foreign object.

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

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

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

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

5.3. Replacing the Pop-Up Valve, Figure 3

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

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

5.3.3 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.

5.3.4 While the pop-up valve is out, check alignment as follows: Screw a 1-1/4" nipple that 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.

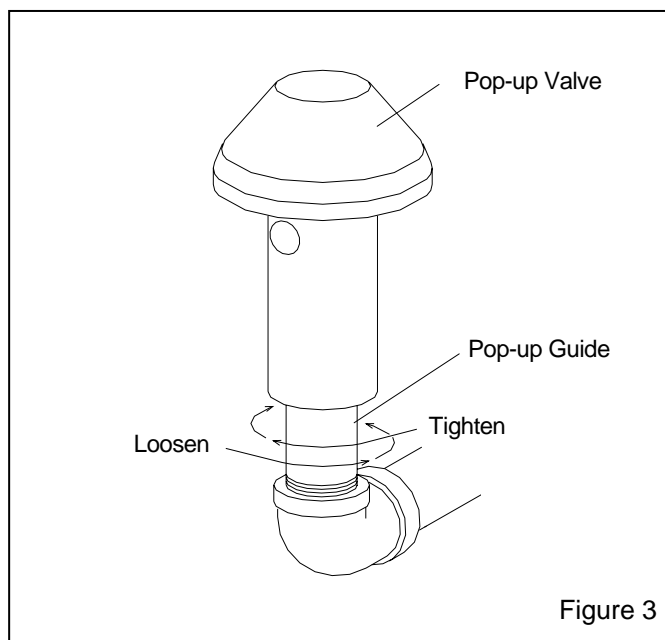
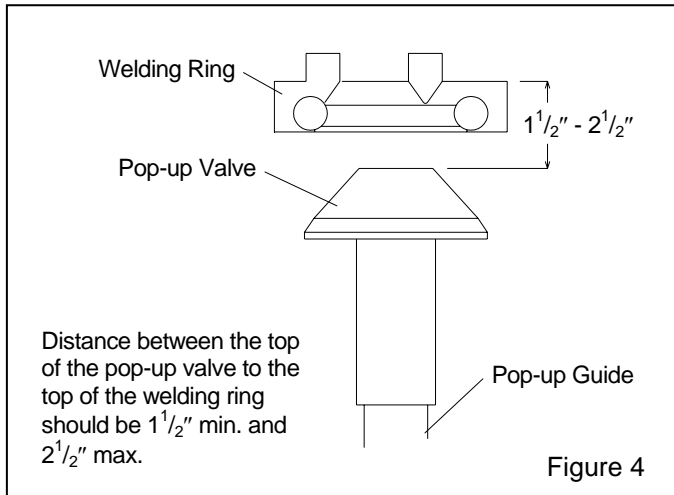


Figure 3

5.3.5 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.

5.3.6 Refer to Figure 4 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.



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

5.4 Replacing the Pop-Up Seal

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

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

5.4.3 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.

5.5 Exhaust Muffler, Figure 7

⚠ WARNING

Service the muffler, and replace the element body as soon as the time it takes to depressurize the blast machine increases noticeably. Longer depressurization time indicates the porous element body is becoming clogged. If the element becomes plugged, excessive air pressure could build up inside the element, and cause it to burst, which could result in injury

5.5.1 All service on the muffler must be done with the compressed air off and the air supply locked-out and tagged-out.

5.5.2 Using a pipe wrench, remove the muffler assembly from the exhaust elbow by unscrewing the 1" pipe guide.

5.5.3 Remove the three lock-nuts and screws, and separate all parts.

5.5.4 Inspect for wear. Replace parts that show signs of wear. Replace the cap if the urethane coating is worn. Always replace the element body.

5.5.5 Ensure that the guide nut is fastened tightly to the guide.

⚠ WARNING

Replace the guide and guide nut if the nut is not tightly fused to the guide. A loose fitting nut could work off the guide, permitting the muffler assembly to launch under pressure, and cause severe injury.

5.5.6 Clean parts to be reused, with a non-caustic solvent or detergent, and dry thoroughly.

5.5.7 Reassemble, taking care to correctly insert the screws in the seat plate. The screw holes are the three closest to the center. See the illustration in Figure 7.

5.5.8 Firmly tighten the lock-nuts.

5.5.9 Use a pipe wrench to attach the muffler assembly to the exhaust elbow. In its final position, the muffler must face up.

⚠ WARNING

When installed on the machine, the muffler must face up. The muffler reduces exhaust noise, and prevents abrasive from exhausting upward or sideways when the blast machine is depressurized. To reduce risk of injury from abrasive carried by high velocity air, the muffler must be installed with the body facing up.

6.0 TROUBLESHOOTING

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

⚠ WARNING

To avoid serious injury when troubleshooting the machine, turn off the compressed air, and lock-out and tag-out the air supply.

6.1 Neither Abrasive Nor Air Comes Out of the Nozzle While the Machine is Under Pressure.

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

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

6.2 Air Only (no abrasive) Comes Out the Nozzle

6.2.1 Abrasive metering valve may be closed or needs adjustment. Adjust the metering valve per Section 3.4.

6.2.2 Blast machine may be empty.

6.2.3 Abrasive may be damp. See Section 5.1 to clear damp abrasive.

6.2.4 Check the abrasive metering valve for obstructions per Section 5.2.

6.3 Heavy Abrasive flow

6.3.1 Check that the choke valve is open. The valve is open when the handle is in-line with the piping.

6.3.2 Abrasive metering valve may be open too far. See Section 3.4.

6.4 Abrasive Surging

6.4.1 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. See Section 3.4.

6.4.2 Check the exhaust muffler for blockage. Slow depressurization will load the blast hose with abrasive, and cause surging at start-up.

6.4.3 See Section 6.7.

6.5 Intermittent Abrasive Flow.

6.5.1 Moisture in the blast machine or in the air supply. Drain moisture from the compressor's receiver tank, and if so equipped, the blast machine's moisture separator. If moisture continues to be a problem, a dryer or aftercooler may be required in the air supply line.

6.5.2 Abrasive may be worn from recycling. Replace abrasive.

6.6 Blast Machine Will Not Pressurize.

6.6.1 Check that the compressor is on and all air supply valves to the machine are open.

6.6.2 Insufficient-size air supply hose or reduced-size fittings between the compressor and blast machine. See Section 3.2.2.

6.6.3 Dirty filter in moisture separator. Check filter element.

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

6.7 Blast Machine Will Not Depressurize or Depressurizes Too Slowly.

6.7.1 Exhaust muffler blocked. See Section 5.5.

7.0 REPLACEMENT PARTS

7.1 Blast Machine Accessories

Description	Stock No.
Cover, for	
14" diameter machine	02334
16" diameter machine	02335
20" diameter machine	20358
24" diameter machine	02336
30" diameter machine	02337
Screen, recessed type, for	
14" diameter machine	03098
16" diameter machine	03099
20" diameter machine	20357
24" diameter machine	03100
30" diameter machine	03101
Safety cable, 3/4" to 1-1/2" ID blast hose	15013
Lock pin, coupling (package of 25)	11203

7.2 Blast Machine and Accessories, Figure 5

Item	Description	Stock No.
1.	Ball valve with handle, 1-inch NPT	02396
	1-1/4-inch NPT	02397
2.	Handle, 1" ball valve,	22531
	1-1/4" ball valve.....	22532
3.	Pop-up valve, 4" with external sleeve	03699
4.	Internal pop-up guide, toe nipple, for 2 and 3 cu. ft. 1-1/4" x 6-1/2"	01754
	6 cu. ft. 1-1/4" x 6"	01753
5.	Adaptor, male NPT x male JIC 1" NPT	11720
	1-1/4" NPT	22529
6.	Pusher line, coupled 1" ID x 21" (2 cu ft machine).....	22508
	1" ID x 28" long (3 cu ft & larger).....	23673
	1-1/4" ID x 28" long (3 cu ft & larger)	23674
	1" x 19" long (Lo-Pot machines).....	24167
	1-1/4" x 19" long (Lo-Pot machines)	24168
7.	Coupling, 1-1/4" CF	00551
8.	Wye, 1-1/4" standard	01818
9.	Leg pad, right, for 1.5 cu ft, 3 cu ft, and 6 cu ft machine	03654
	2 cu ft machine	20735
10.	Leg pad, left, for 1.5 cu ft, 3 cu ft, and 6 cu ft machine	03655
	2 cu. ft. machine	20736

11.	Metering valve, FSV w/ wye.....	02427
12.	Gasket, CQG coupling, (package of 10)	00850
13.	Wheel and tire, 10 x 2.75, for 2 cu. ft.	20349
14.	Axle, 2 cu. ft. 10" Wheel	20734
15.	Wheel and tire, 16 x 400	02338
16.	Axle and 16" wheel set for 3 cu. ft. machine	02822
	6 cu. ft. machine	02350
17.	Washer, 1" thrust	03825
18.	Retaining ring, 1"	03824
19.	Inspection door assembly, 6" x 8"	02377
20.	Gasket, 6" x 8" inspection door	02369
21.	Seat, pop-up gum rubber, standard use.....	02325
	neoprene, for hot climates	02380
22.	Umbrella, optional, 4" bolt-on	02318
23.	Muffler, exhaust	05068
24.	Metering valve, optional manual pinch tube	04321
25.	Metering valve, for Lo-pot machines	05680
26.	Metering valve, optional manual Quantum ..	22845
27.	Lock pin, coupling (package of 25)	11203
28.*	Formed pipe pusher line, 1"	01865
29.*	Formed pipe pusher line, 1-1/4"	01866
30.*	Compression coupling, 1"	01856
31.*	Gasket, 1" compression coupling,	01885
32.*	Compression coupling, 1-1/4"	01857
33.*	Gasket, 1-1/4" compression coupling	01886

* Used on 30" & larger machines, & all machines shipped prior to Jan 2003

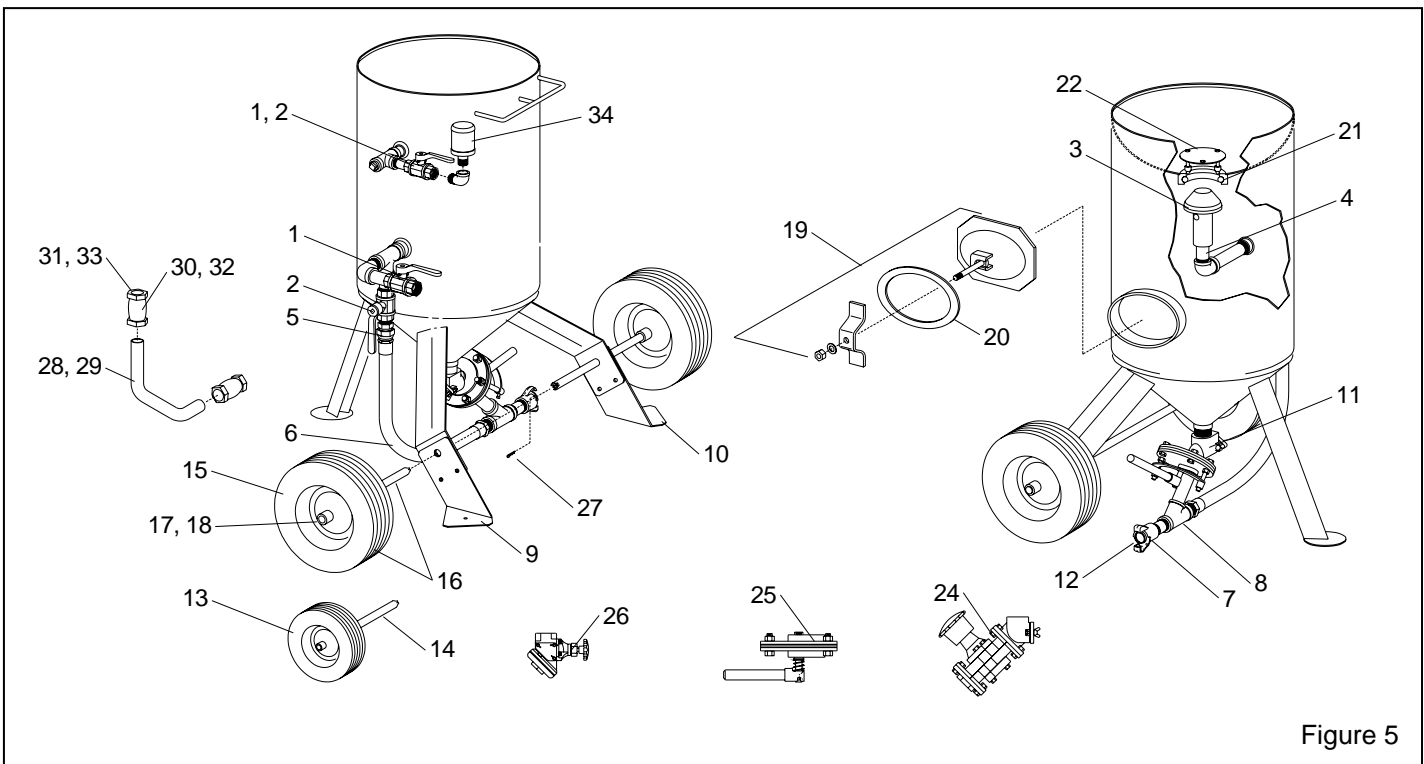


Figure 5

7.3 FSV Abrasive Metering Valve, Figure 6

Item	Description	Stock No.
(-)	Metering valve, complete	02427
1.	Upper body	02422
2.	Valve disc w/ stem	02423
3.	Gasket, rubber, 2 required	02424
4.	Disc-stainless	02425
5.	Lower body	02426
6.	Metering handle, heavy duty	20498
7.	Cap screw, 1/4-NC x 1" hex head	03053
8.	Wing nut, 1/4-NC	03113
9.	Handle bolt spacer	02431
10.	Valve handle pin	20246
11.	Gauge unit	02433
12.	Set screw, 1/4-NC x 1/2" square head	03080

13.	Spring, compression	01982
14.	Stud	02436
15.	Packing gland	02437
16.	O-ring, 7/8" OD	21165
17.	Gasket, shaft	02439
18.	Inspection plate	02440
19.	Cap screw 5/16-NC x 1" hex head	03152
20.	Wing nut, 5/16-NC	03213
21.	O-Ring	01990
22.	Nipple, heavy wall 1-1/2" x close	01791
23.	Wye, 1-1/4" standard	01818
24.	Nipple, heavy wall 1-1/4" x 5"	01860
25.	Nut, 1/2-NC hex	03511
26.	Cap screw, 1/2-NC x 1-3/4" hex head	03455
27.	Washer, 1/4" flat	03116
28.	Hitch pin	20245

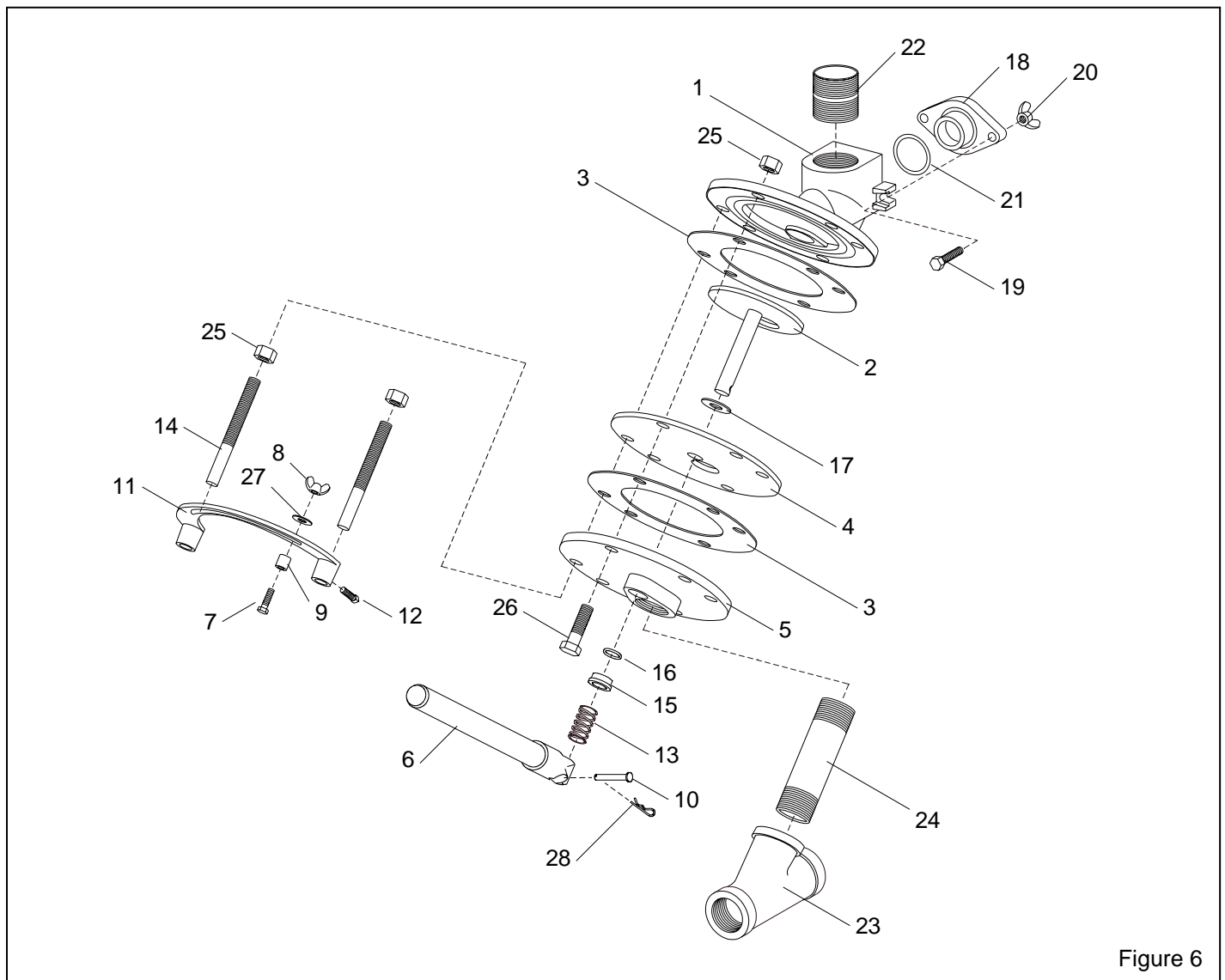


Figure 6

7.4 Exhaust Muffler, Figure 7

Item	Description	Stock No.
(-)	Muffler, complete	05068
1.	Screw, 8-32 x 4"	05061
2.	Cap, coated	05067
3.	Body, element	05065
4.	Screen	05060
5.	Guide w/ guide nut	22344
6.	O-ring, 1-1/4" ID	05069
7.	Seat	05062
8.	Lock-nut, 8-32 stainless steel	05815

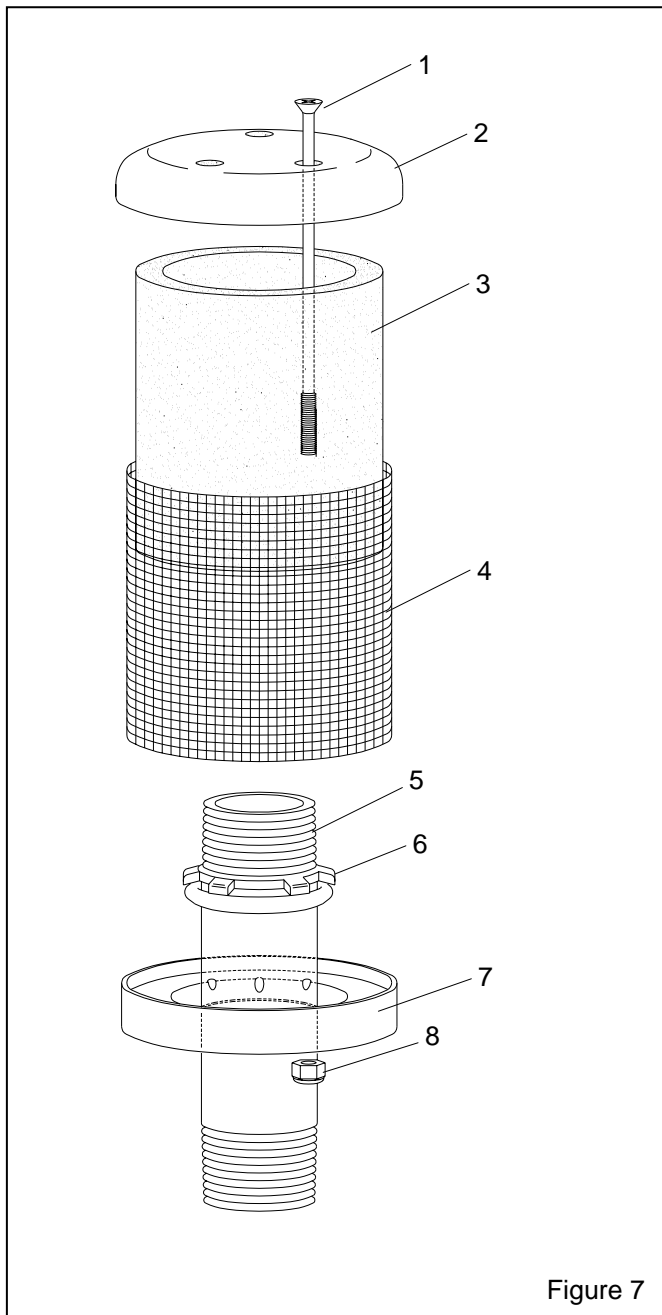


Figure 7