

**DUAL CHAMBER BLAST MACHINE
WITH REMOTE CONTROLS
O. M. 23063**

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REVISION:

! WARNING

Do not proceed with these instructions* until you have READ the orange cover 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.

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

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

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1.0 INTRODUCTION

1.1 Scope

1.1.1 These instructions cover the set-up, operation, maintenance, troubleshooting, and replacement parts for Clemco dual chamber (continuous-action) blast machines with pressure-hold remote controls.

1.1.2 OSHA requires remote controls (valves that start and stop the blast process from a control at the nozzle) on all blast machines when a blast operator commands the nozzle. The remote control metering valve and air valve may vary from those shown in Figure 1. Some general remote control operating instructions are included in the text of this manual. These "BASIC" instructions are included for clarity. Separate owner manuals are provided, that includes operating instructions of the remote controls and control handle supplied with the machine. To ensure safe blasting, before using the machine, read the manuals for the remotes controls, control handle, and all accessories to be used.

1.1.3 These instructions also contain important information required for safe operation of the machine. 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. 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.

1.1.4 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" (Stock No. 22090) is included with every blast machine, and contains important safety information about abrasive blasting that may not be included in equipment operation manuals. Additional copies are available from Clemco Industries. Spanish translations (Stock No. 22931) are available on request.

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.

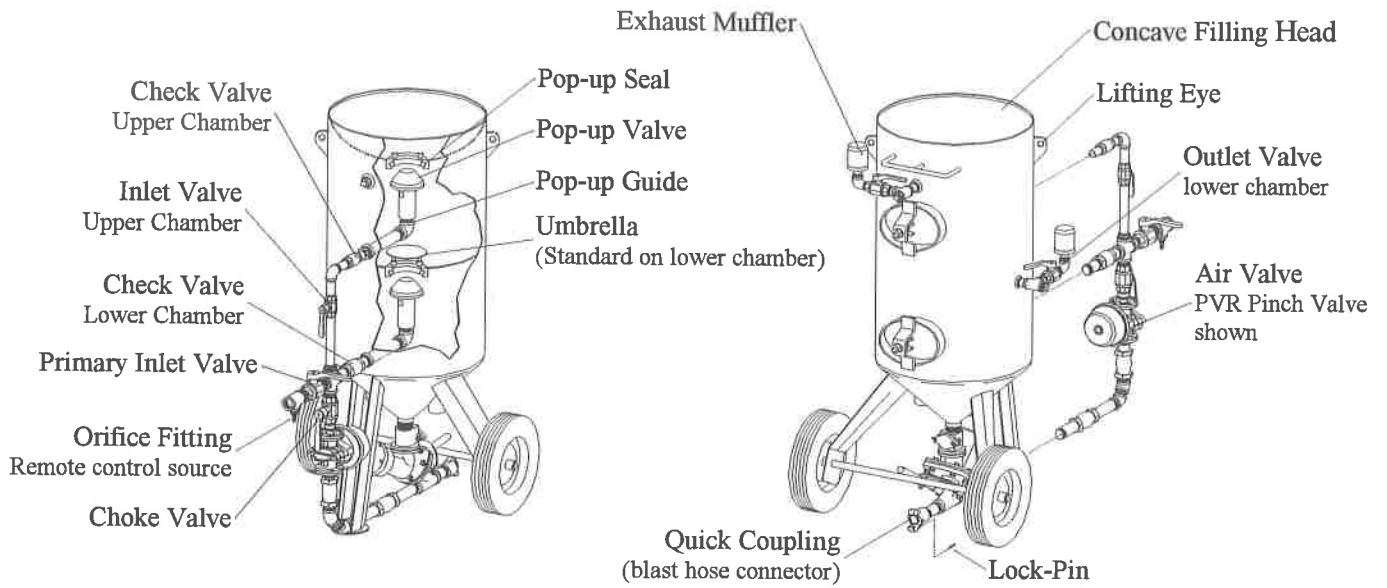
⚠ DANGER

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

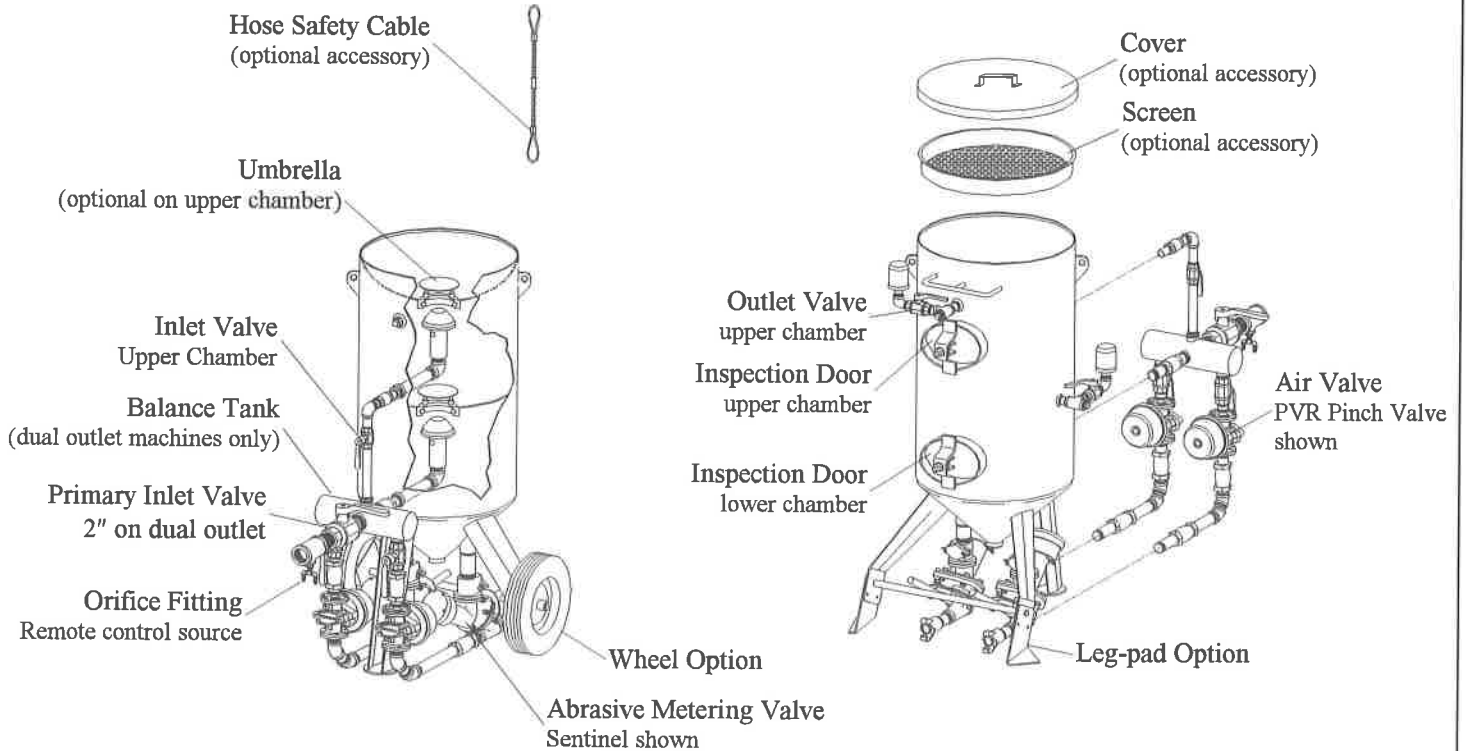
1.3 Description

1.3.1 The primary components of the blast machine are shown in Figure 1. They may be plumbed with a single outlet, for one operator, or dual outlets, for two operators. The pressurization and depressurization of the blast machine is done manually, by opening and closing hand operated valves. Blasting is controlled by the operator, from the nozzle, by use of remote controls. The dual chambers enable filling and refilling the upper chamber with abrasive while blasting continues from the lower chamber.

1.3.2 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.



Dual Chamber Shown With Single Outlet



Dual Chamber Shown With Dual Outlets

Figure 1

⚠ 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.

1.3.3 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.

1.3.4 This blast machine is rated for a maximum of 125 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.

1.3.5 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 Remote Controls

1.4.1 The remote control system is an OSHA-required safety device. The control handle, located near the blast nozzle, is the activator for the remote control system. Blasting stops when the operator intentionally or unintentionally removes hand-held pressure from the remote control handle. 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, the remote controls stops the blast process.

⚠ WARNING

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

1.4.2 Most remote controls used with dual chamber machines are pressure-hold type. The instructions in this manual cover general operating instructions for pressure-hold systems. In some cases pressure-release remote controls are used with single outlet, dual chamber machines. In either case, separate operating instructions are provided for the remote controls furnished on the machine. Refer to the remote control manual, and control handle manual for detailed set-up and operating instructions.

Pressure-Hold System: Blasting does not start and stop with pressurization and depressurization of the blast machine. Using hand operated inlet and outlet valves, the operator manually pressurizes and depressurizes the blast machine. Although the machine may be under pressure, blasting does not begin, because a normally closed air valve prevents air flow, and a normally closed abrasive valves prevents abrasive flow. When the operator presses the control handle, the valves open, and blasting begins. Pressure remains in the blast machine until it is manually depressurized. All remote controls on multiple outlet machines must be pressure-hold controls.

Pressure-Release Systems: Blasting starts and stops with pressurization and depressurization of the machine. When this system is used with a dual chamber machine, the controls operate the lower chamber only.

2.0 INITIAL SET-UP

2.1 Storage Hopper

2.1.1 When a storage hopper is installed above the blast machine, an umbrella is required above the upper chamber pop-up opening. See Section 8.2 for optional bolt-on umbrella.

2.2 Blast Machine Set-Up

⚠ WARNING

Exhaust mufflers are installed on this machine. 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.

Note: Dual chamber machines demand high volumes of compressed air when the upper chamber is cycled, or when the machine is furnished with dual outlets. Installing a receiver tank sized to the cfm requirements shown in the table in Figure 2, reduces the chance of abrasive surging and air-flow problems when cycling the upper chamber or second outlet.

2.2.1 Install an optional filter/moisture separator in front of the primary inlet valve. The filter is recommended at this location to remove moisture from air before it enters the machine. The filter must be capable of supporting the cfm as noted in the table in Figure 2.

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

2.2.3 Refer to the remote control owners manual for set-up and operation of the remote controls.

3.0 OPERATION

3.1 Transporting and moving

3.1.1 Transporting a blast machine

⚠ WARNING

- 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.
- Failure to observe these warnings could result in serious injury or death.

3.1.1.1 Use lifting eyes when moving, or loading and unloading the blast machine. Do not use a sling around the handle or piping.

3.1.1.2 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 dual chamber blast machine when it contains abrasive.
- 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.
- Do not tilt the machine on its wheels, or attempt to move the machine in hand-truck manner. Even an empty machine is too heavy to maneuver that way. The wheels are there to help maneuver an empty, upright machine into its final position.

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

3.1.2.2 Slide the machine by pushing it toward the wheels. Do not back-up while moving the machine, as potential tripping hazards cannot be seen.

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 See the compressed air and abrasive consumption table in Figure 2 for approximate air and abrasive consumption per nozzle. Connect an air line from the compressor to the air supply hose connector installed on the blast machine primary inlet. For best blasting performance, use at least the size of air line shown in the table in Figure 3. Smaller diameter hose or any restriction in the air line will cause abrasive fluctuation, particularly when the upper chamber is cycled.

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

| Nozzle Size | Number of Nozzles | CFM@125 psi | | Minimum Air Line ID |
|-------------|-------------------|-------------|------|---------------------|
| | | New | Worn | |
| 5/16" | 1 | 170 to 240 | | 1-1/2" |
| 5/16" | 2 | 340 to 480 | | 2" |
| 3/8" | 1 | 240 to 315 | | 2" |
| 3/8" | 2 | 480 to 630 | | 2-1/2" |
| 7/16" | 1 | 315 to 410 | | 2" |
| 7/16" | 2 | 630 to 820 | | 2-1/2" |
| 1/2" | 1 | 410 to 520 | | 2-1/2" |
| 1/2" | 2 | 820 to 1040 | | 3" |

Minimum ID air line recommendations for multiple nozzles. CFM shown is the approximate cfm required at 125 psi when the nozzle is new, and when worn. A nozzle is considered worn when the orifice is 1/16" larger than its original size.

Figure 3

⚠ WARNING

Where two or more blast machines (or multiple nozzles) are used, care must be taken when tracing and connecting control lines and blast hoses. Cross connecting control hose or blast hose could lead to serious injury, death, or property damage from unintentional actuation of a blast machine. To prevent cross connections, hoses should be of equal lengths, and the hoses and blast machine couplings clearly marked. Use optional hose identification kits, part no. 15890 for use with two blast machines (nozzle), or part no. 15891 for up to four machines. Mark each hose and connection per the instructions supplied with the kit, and carefully trace and verify each connection before operating.

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 blast hose and compressed-air supply hose connections are secured with safety locks and safety cables to prevent accidental separation or

disconnection. Lock pins and safety cables are listed in Sections 8.1 and 8.2.

⚠ 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.

3.2.5 Connect the ends of the remote control twinline hose to the fittings on the valves as described in the remote control manuals. Check that all fittings are tight. Leaks will cause the system to malfunction.

3.2.6 Close the primary inlet valve and upper chamber inlet valve. The valves are closed when the handle is perpendicular to the valve.

3.2.7 Check that the outlet valves and choke valve(s) (two on dual outlet machines) are open. The valves are open when the handle is in-line with the piping.

3.2.8 Close the abrasive metering valve(s) (two on dual outlet machines). The closed position for the Sentinel metering valve is when the handle is fully right. The closed position for the optional knob type valves is when the metering knob is turned fully clockwise.

3.2.9 Open the remote control safety petcock(s) (two on dual outlet machines), and check the control handles per instructions in the remote control and control handle manuals.

3.2.10 Close the compressor's air valve. Start the compressor, and bring it up to operating temperature and pressure. The pressure must not exceed 125 psi.

3.2.11 Load abrasive into the machine by following the instructions in Section 3.7.

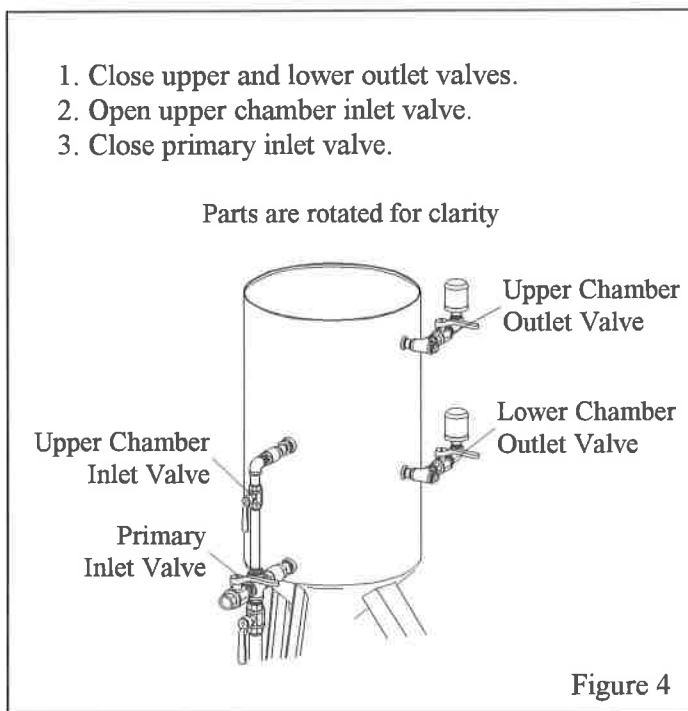
3.3 Pressurize The Machine

3.3.1 Do not allow anyone 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 tender may pressurize or depressurize the machine at any time. Noise, from the sudden release of compressed air, or abrasive venting under pressure could result in injury. The machine tender must wear a suitable, approved respirator, plus approved eye, face, and hearing protection.

3.3.2 Position the inlet and outlet valves as shown in Figure 4.



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

3.3.4 While standing back and facing away from the concave filling head, open the primary inlet valve. This action causes the upper chamber pop-up valve to seal-off the filling port, pressurizes the machine, and begins the blast process.

3.4 Blasting

3.4.1 When the blast operator is ready to blast, either the operator or the machine tender closes the remote

control safety petcock. Closing the petcock prepares the machine for remote operation and activation by the control handle.

⚠ 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.

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

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

3.4.2 Operators must wear appropriate protective gear, including: abrasive-resistant clothing, leather gloves, eye and hearing protection, and a NIOSH-approved Type CE Supplied-Air Respirator.

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

3.4.4 Pull back 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).

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

3.4.6 Adjust abrasive flow per Section 4.1.

3.5 Stop Blasting

3.5.1 To stop blasting, release the control handle lever.

3.5.2 When the control handle lever is released, the control handle safety lever will flip up to lock the handle lever in the up (no blast) position.

3.5.3 Make sure that the control handle safety lever lock is up, and that it prevents the handle lever from engaging.

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

⚠ WARNING

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

3.6 Depressurize the machine

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

3.7 Loading Abrasive into the Blast Machine
See Section 3.9 for automatic refilling.

⚠ WARNING

Obtain a material safety data sheet (MSDS) 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.

NOTE: Use only abrasive specifically manufactured for blast cleaning, and that is 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 surface being blasted.

3.7.1 Stop blasting per Section 3.5, or depressurize the upper chamber per Section 3.8.

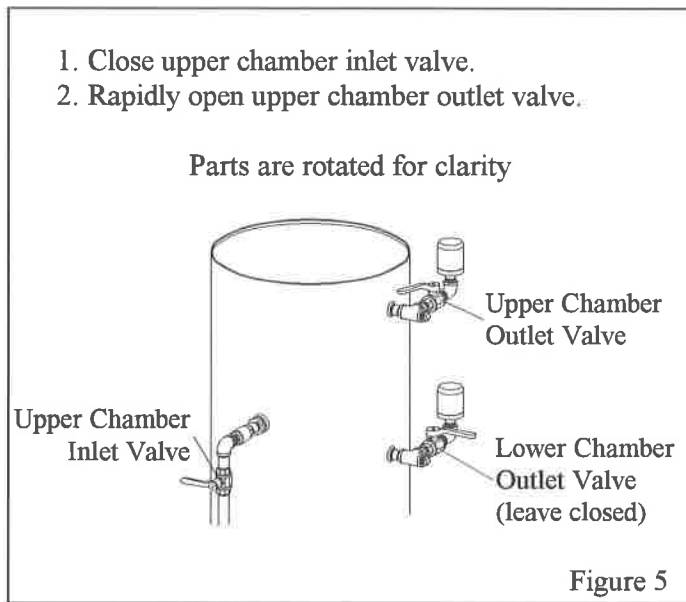
3.7.2 Load abrasive into the machine by pouring it into the concave head. Using an optional screen, placed over the head, prevents large objects from falling inside. A screen is recommended to keep objects such as pieces of abrasive bags and rocks from falling into the machine. Foreign objects will jam 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.

3.7.3 Pressurize the machine per Section 3.3 or pressurize the upper chamber per Section 3.8.

3.8 Cycling the Upper Chamber (refilling the upper chamber while blasting from the lower chamber). Ref. Figure 5. See Section 3.9 for automatic refilling.

3.8.1 During blasting, and after approximately one-half of the abrasive in the machine has been used, close the upper chamber inlet valve, and while standing back and facing away from the concave head and exhaust muffler, "quickly" open the upper chamber outlet valve. **NOTE: Air must exhaust rapidly from the upper chamber in order for the lower chamber pop-up valve**

to seal. The upper pop-up valve automatically drops when air is expelled from the upper chamber. Blasting continues from the lower chamber.



3.8.2 Load abrasive into the upper chamber per Section 3.7.

3.8.3 Pressurize the upper chamber, by closing the upper chamber outlet valve and opening the upper chamber inlet valve. When pressure in the upper and lower chambers equalize, the lower chamber pop-up valve drops, refilling the lower chamber with abrasive.

3.8.4 Repeat the process for continuous-action blasting.

3.9 Automatic Refilling

3.9.1 For hopper-fed machines, refilling can be accomplished automatically with a cycle timer. See Accessories in Section 8.1. Hopper-fed machines must have an umbrella mounted above the upper chamber pop-up opening. See Section 8.2 for bolt-on umbrella.

3.10 Emptying the Machine of Abrasive

3.10.1 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:

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

3.10.3 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.

3.10.4 Pressurize the machine.

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

3.10.6 Hold the hose securely (do not leave the hose unattended), and activate the control handle. Be prepared for surging or recoil of the hose, which can be severe.

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

3.10.8 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.

3.11 Shutdown

3.11.1 Ensure that the blast machine is depressurized.

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

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

3.11.4 Shutdown the compressor.

3.11.5 Cover the machine when not in use.

4.0 ADJUSTMENTS

4.1 Abrasive Metering Valve

NOTE: These instructions are for the Sentinel metering valve. Optional metering valves may function differently, but the process is similar.

4.1.1 Begin adjustments with the metering valve closed. Closed is when the handle is fully right.

4.1.2 While the operator is blasting, the machine tender increases abrasive flow by slowly moving the handle to the left, no more than 1/4" at a time, allowing time for the flow to stabilize before further adjusting.

4.1.3 Optimum abrasive flow depends on the type and size of abrasive and the 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. The stream of abrasive coming out of the nozzle should barely discolor the air when seen against a contrasting background.

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

5.0 PREVENTIVE MAINTENANCE

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

5.1 Daily Inspection

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

- Inspect the blast hose for wear; look for soft spots. If the hose has soft spots, the hose is worn and must be replaced.

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.

- Inspect the RLX Control Handle

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:

- 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 don't 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 moisture separator is used, inspect the filter element, and clean the bowl.

5.2.2 After blasting do 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 6.5.

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 6.3.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. See Section 6.4.

6.0 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.
-

6.1 Removing damp abrasive from the blast machine.

6.1.1 To clear a minor blockage caused from 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 for obstructions in the metering valve.

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

6.1.4 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.

6.1.5 Close the choke valve and fully open the abrasive metering valve.

6.1.6 Pressurize the machine and activate the control handle to force out damp abrasive.

6.1.7 When the obstruction has been removed, release the control handle and 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 and activate the control handle to clear the hose. When the hose is cleared, release the handle and 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. 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 erode nozzle threads. A loose fitting nozzle may eject under pressure and could cause severe injury.

6.1.8 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 3.10.

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

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

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

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

6.2.6 Make sure the inspection door gasket is in good condition, and in place before 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 compressed air supply.

6.3 Replacing the Pop-Up Valve, Figure 6

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

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

6.3.3 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.

6.3.4 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.

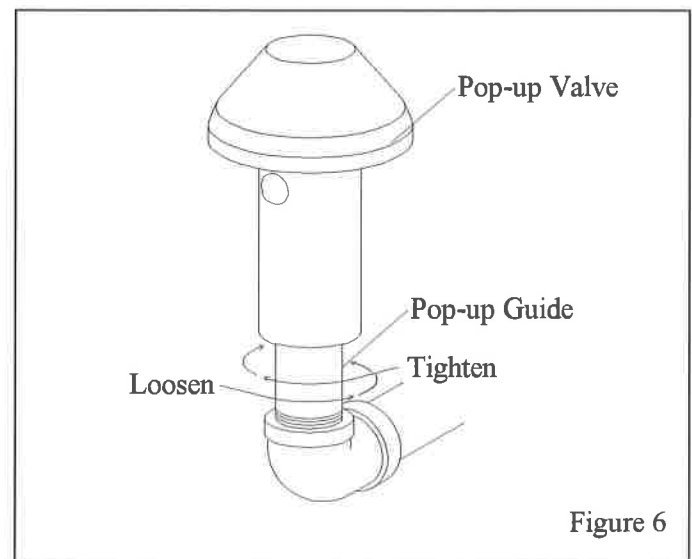
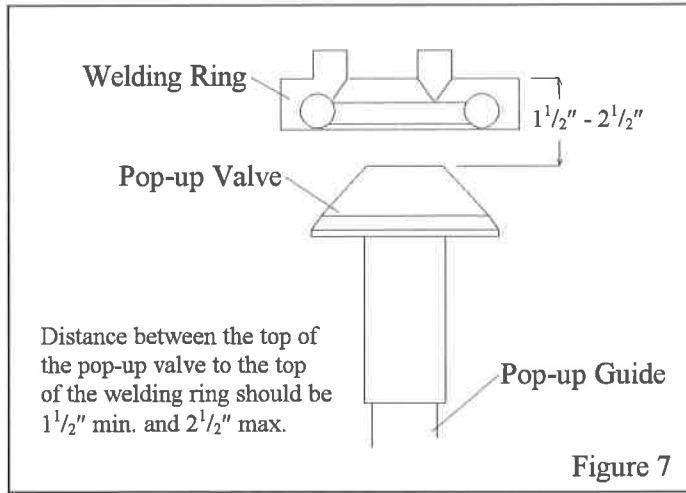


Figure 6

6.3.5 Slide the new pop-up valve over the guide, 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.

6.3.6 Refer to Figure 7 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.



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

6.4 Replacing the Pop-Up Seal

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

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

6.4.3 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.

6.5 Exhaust Muffler, Figure 8

⚠ 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.

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

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

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

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

6.5.5 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.

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

6.5.7 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 8.

6.5.8 Firmly tighten the lock-nuts.

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

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 lock-out and tag-out 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 comes out of 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 for obstruction.

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

7.2 Air only (no abrasive) comes out the nozzle

7.2.1 Abrasive metering valve may be closed or needs adjustment. Adjust the metering valve per 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 per Section 6.2.

7.2.5 Open the safety petcock on the metering valve and press the control handle. If air does not come out the petcock, check for blockage in the twinline hose to and from the control handle. If air does come out, the metering valve actuator section is not functioning. Refer to the metering valve manual for servicing the valve.

7.3 Heavy abrasive flow

7.3.1 Check that 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.

7.3.3 Check the abrasive metering valve and air valve for wear. Refer to the remote control manual for troubleshooting and servicing the remote system. If there is an internal leak in the air valve it will act as if the choke valve is partially closed.

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. See Section 4.1.

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

7.4.3 Abrasive metering valve may require service. Refer to the metering valve manual.

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 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.

7.5.2 Abrasive may be worn from recycling. Replace abrasive.

7.6 Blast machine will not pressurize

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

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

7.6.3 Dirty filter in moisture separator. Check filter element.

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

7.7 Lower chamber wont seal when upper chamber is depressurized

7.7.1 Upper chamber exhaust valve opened too slowly. Quickly open the exhaust valve. Air must exhaust rapidly from the upper chamber for the lower chamber pop-up valve to seal.

7.7.2 Exhaust muffler blocked Service muffler per Section 6.5.

7.8 Blasting does not start when the control handle is pressed

7.8.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

7.9 Blasting does not stop when the control handle is released

7.9.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

8.0 ACCESSORIES and REPLACEMENT PARTS

8.1 Optional Accessories

- (-) Cycle Timer kit
 - 120 volt AC02207
 - 12 volt DC03439
- (-) Safety cable, 3/4" to 1-1/2" ID blast hose15013

8.2 Abrasive Metering Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.3 Air Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.4 Exhaust Muffler, Figure 8

| 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 |

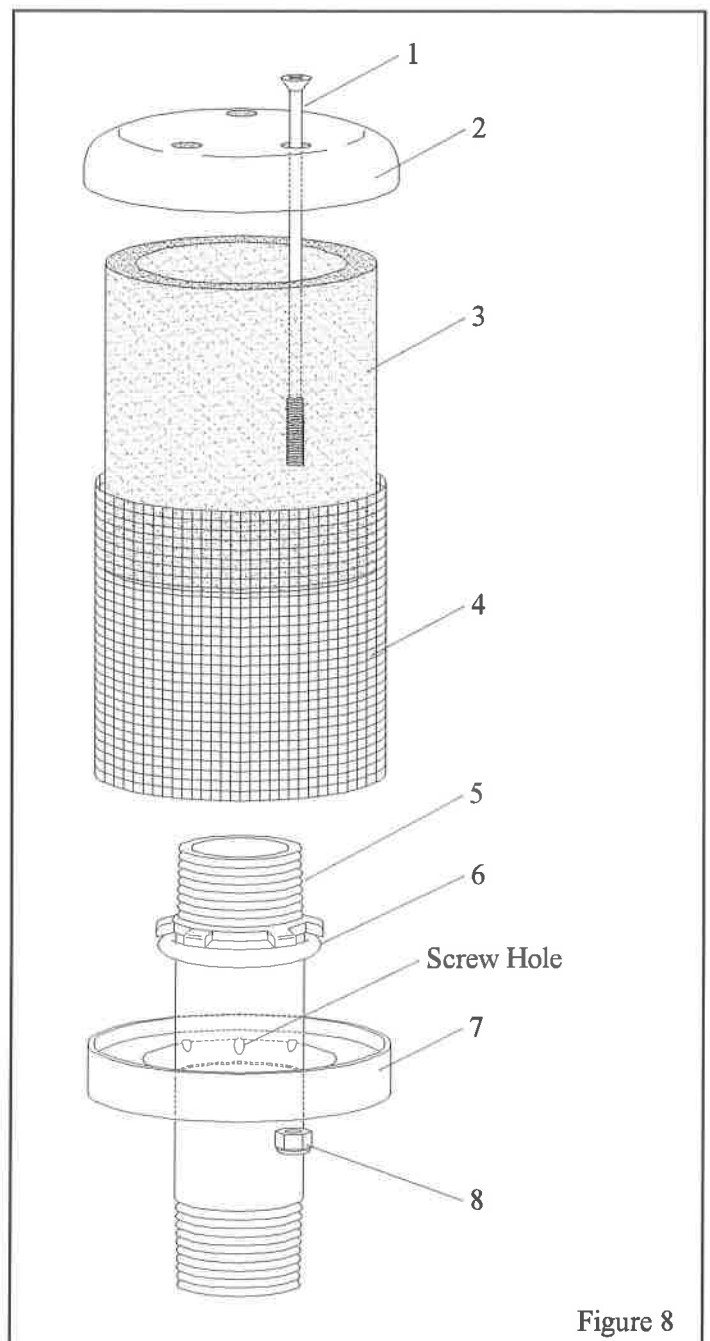


Figure 8

8.3 Blast Machine and Accessories, Figure 9

| Item | Description | Stock No. |
|------|---|-----------|
| 1. | Ball valve with handle, 1" | 02396 |
| 2. | Handle, 1" ball valve | 22531 |
| 3. | Ball valve with handle, 1-1/4" | 02397 |
| 4. | Handle, 1-1/4" ball valve | 22532 |
| 5. | Ball valve with handle, 2", dual outlet only | 02368 |
| 6. | ACE 1-1/4" air valve, valve only (no fittings) | 24074 |
| | valve assembly (with fittings) | 24044 |
| 7. | Check valve, 1" cone | 02087 |
| 8. | Check valve, 1-1/4" cone | 02088 |
| 9. | Pusher Line 1-1/4" x 18", for single outlet | 25556 |
| | 1-1/4" x 19", for dual outlet | 24168 |
| 10. | Adaptor, 1-1/4" NPT male x male JIC | 22529 |
| 11. | Coupling, 1-1/4" CF | 00551 |
| 12. | Wye, 1-1/4" | 01818 |
| 13. | Leg pad, right | 03654 |
| 14. | Leg pad, left | 03655 |
| 15. | Auto-Quantum abrasive metering valve w/fittings and 1-1/4" wye | 24447 |
| 16. | Gasket, CQG coupling, (package of 10) | 00850 |
| 17. | Balance tank, dual outlet only | 02365 |
| 18. | Wheel and tire, 400 x 16, each | 20427 |
| 19. | Axle, 24" dia. machine | 02403 |
| 20. | Retaining ring, 1" | 03824 |
| 21. | Thrust washer, 1" | 03825 |
| 22. | Inspection door assembly, 6" x 8" | 02377 |
| 23. | Gasket, 6" x 8" inspection door | 02369 |
| 24. | Seat, pop-up, gum rubber, standard use | 02325 |
| 25. | Seat, pop-up, neoprene, for hot climates | 02380 |
| 26. | Muffler, exhaust | 05068 |
| 27. | Pop-up valve, 4" with external sleeve | 03699 |
| 28.* | Internal pop-up guide, 1-1/4" NPT x 4-1/2" toe nipple | 21694 |
| | 1-1/4" NPT x 5" toe nipple | 01752 |
| 29. | Umbrella, optional, 4" bolt-on | 02318 |
| 30. | Cover, optional, 24" diameter | 02336 |
| 31. | Screen, optional, 24" recessed type | 03100 |
| 32. | Lock pin, coupling (package of 25) | 11203 |

* Pipe fittings vary, refer to Paragraph 6.3.6

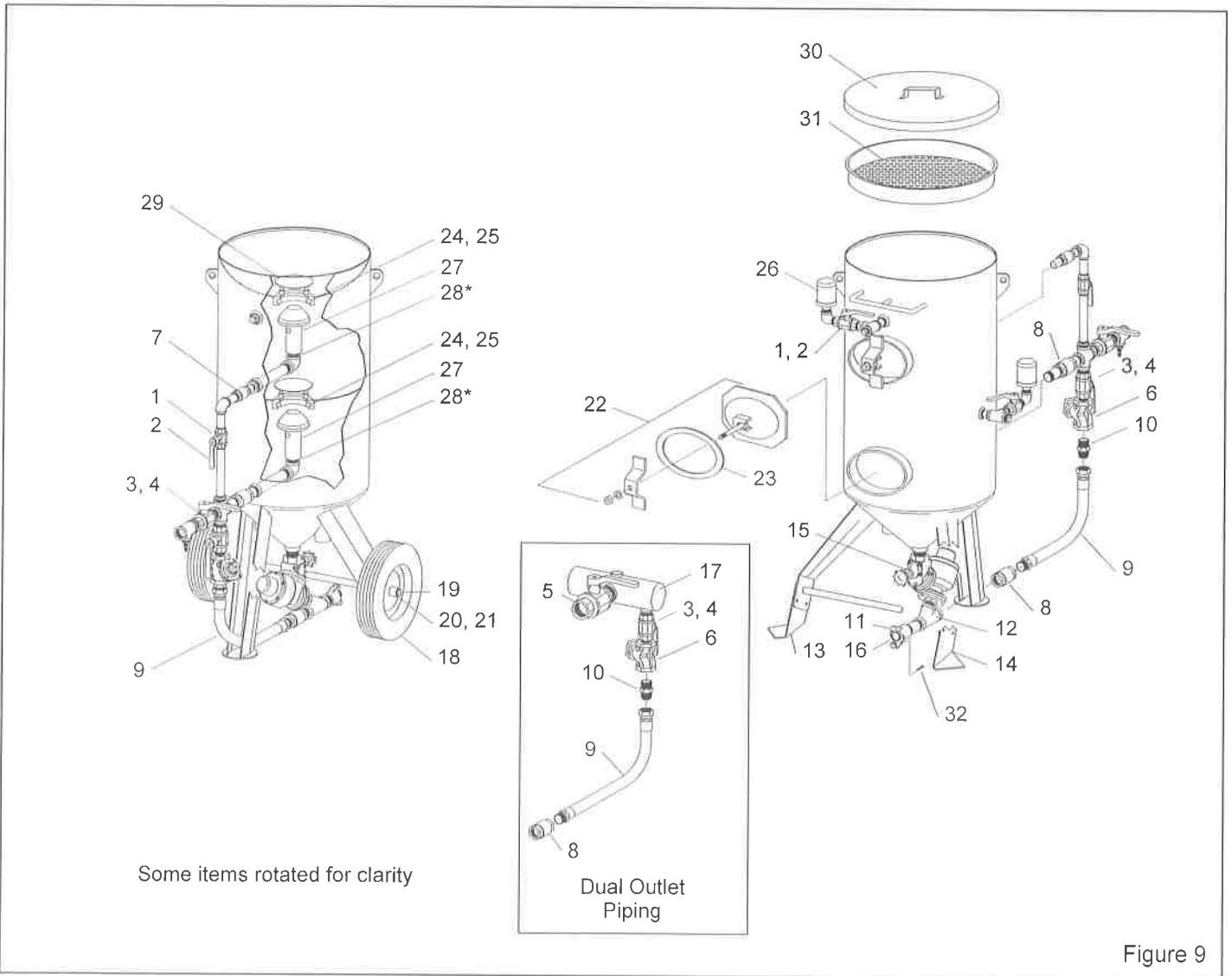


Figure 9

**DUAL CHAMBER BLAST MACHINE
WITH REMOTE CONTROL
O.M. 23063**

MC FILE NUMBER: 2131-04/01
DATE OF ISSUE: 04/03/01
REVISION:

! WARNING

Do not proceed with these instructions until you have READ the orange cover of this MANUAL and YOU UNDERSTAND its content.* 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 Parts and Maintenance Guide refer to the orange warnings insert preceding the Index before continuing with the following instructions.**

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1.0 INTRODUCTION

1.1 Scope

1.1.1 These instructions cover the set-up, operation, maintenance, troubleshooting, and replacement parts for Clemco dual chamber (continuous-action) blast machines with pressure-hold remote controls.

1.1.2 OSHA requires remote controls (valves that start and stop the blast process from a control at the nozzle) on all blast machines when a blast operator commands the nozzle. The remote control metering valve and air valve may vary from those shown in Figure 1. Some general remote control operating instructions are included in the text of this manual. These "BASIC" instructions are included for clarity. Separate owner manuals are provided, that includes operating instructions of the remote controls and control handle supplied with the machine. To ensure safe blasting, before using the machine, read the manuals for the remotes controls, control handle, and all accessories to be used.

1.1.3 These instructions also contain important information required for safe operation of the machine. 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. 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.

1.1.4 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" (Stock No. 22090) is included with every blast machine, and contains important safety information about abrasive blasting that may not be included in equipment operation manuals. Additional copies are available from Clemco Industries. Spanish translations (Stock No. 22931) are available on request.

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.

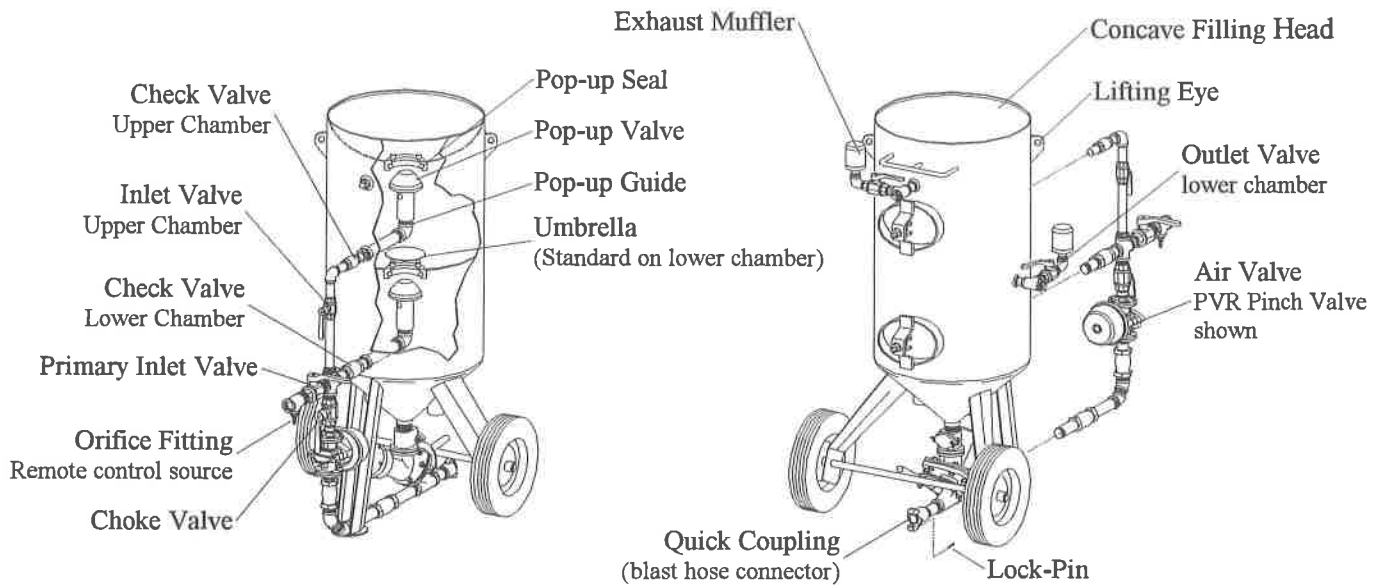
⚠ DANGER

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

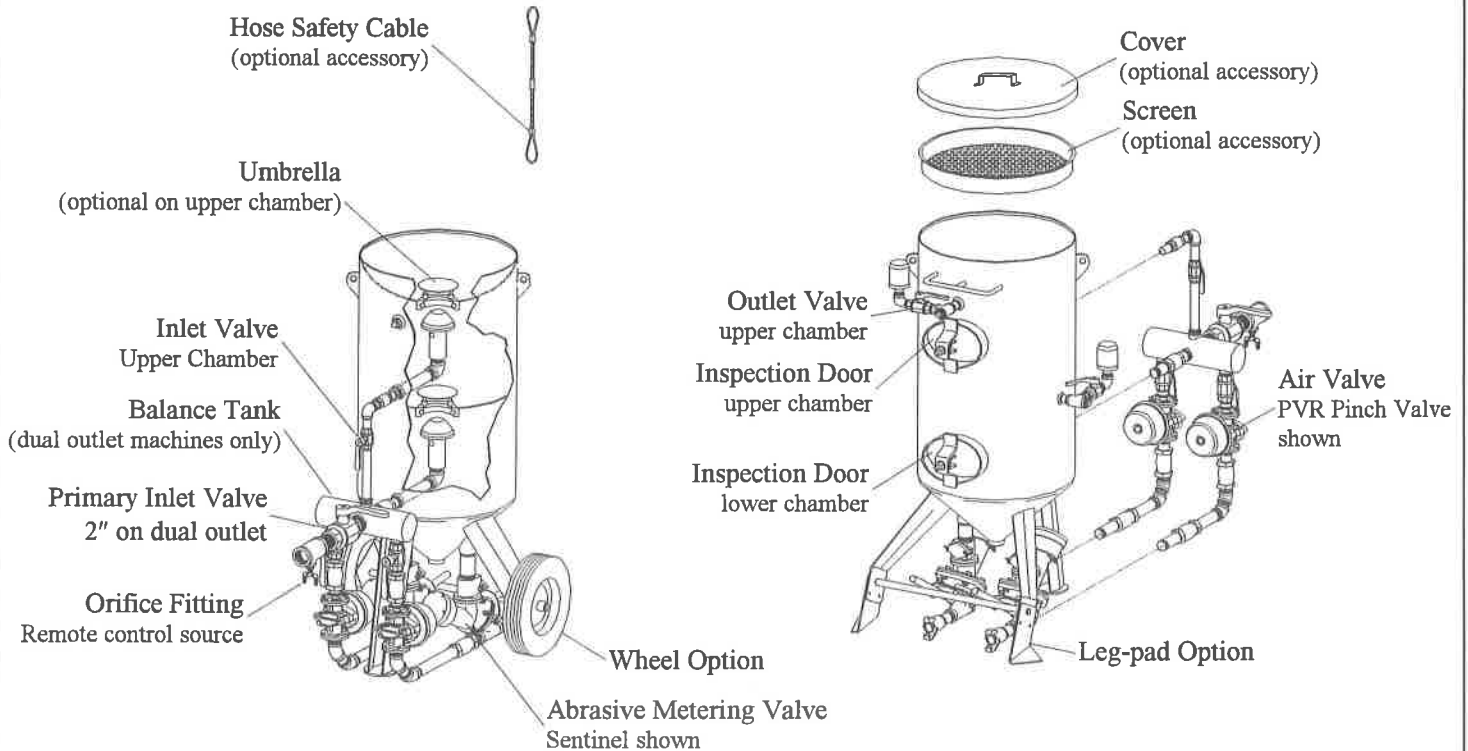
1.3 Description

1.3.1 The primary components of the blast machine are shown in Figure 1. They may be plumbed with a single outlet, for one operator, or dual outlets, for two operators. The pressurization and depressurization of the blast machine is done manually, by opening and closing hand operated valves. Blasting is controlled by the operator, from the nozzle, by use of remote controls. The dual chambers enable filling and refilling the upper chamber with abrasive while blasting continues from the lower chamber.

1.3.2 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.



Dual Chamber Shown With Single Outlet



Dual Chamber Shown With Dual Outlets

Figure 1

▲ 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.

1.3.3 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.

1.3.4 This blast machine is rated for a maximum of 125 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.

1.3.5 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 Remote Controls

1.4.1 The remote control system is an OSHA-required safety device. The control handle, located near the blast nozzle, is the activator for the remote control system. Blasting stops when the operator intentionally or unintentionally removes hand-held pressure from the remote control handle. 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, the remote controls stops the blast process.

▲ WARNING

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

1.4.2 Most remote controls used with dual chamber machines are pressure-hold type. The instructions in this manual cover general operating instructions for pressure-hold systems. In some cases pressure-release remote controls are used with single outlet, dual chamber machines. In either case, separate operating instructions are provided for the remote controls furnished on the machine. Refer to the remote control manual, and control handle manual for detailed set-up and operating instructions.

Pressure-Hold System: Blasting does not start and stop with pressurization and depressurization of the blast machine. Using hand operated inlet and outlet valves, the operator manually pressurizes and depressurizes the blast machine. Although the machine may be under pressure, blasting does not begin, because a normally closed air valve prevents air flow, and a normally closed abrasive valves prevents abrasive flow. When the operator presses the control handle, the valves open, and blasting begins. Pressure remains in the blast machine until it is manually depressurized. All remote controls on multiple outlet machines must be pressure-hold controls.

Pressure-Release Systems: Blasting starts and stops with pressurization and depressurization of the machine. When this system is used with a dual chamber machine, the controls operate the lower chamber only.

2.0 INITIAL SET-UP

2.1 Storage Hopper

2.1.1 When a storage hopper is installed above the blast machine, an umbrella is required above the upper chamber pop-up opening. See Section 8.2 for optional bolt-on umbrella.

2.2 Blast Machine Set-Up

⚠ WARNING

Exhaust mufflers are installed on this machine. 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.

Note: Dual chamber machines demand high volumes of compressed air when the upper chamber is cycled, or when the machine is furnished with dual outlets. Installing a receiver tank sized to the cfm requirements shown in the table in Figure 2, reduces the chance of abrasive surging and air-flow problems when cycling the upper chamber or second outlet.

2.2.1 Install an optional filter/moisture separator in front of the primary inlet valve. The filter is recommended at this location to remove moisture from air before it enters the machine. The filter must be capable of supporting the cfm as noted in the table in Figure 2.

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

2.2.3 Refer to the remote control owners manual for set-up and operation of the remote controls.

3.0 OPERATION

3.1 Transporting and moving

3.1.1 Transporting a blast machine

⚠ WARNING

- 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.
- Failure to observe these warnings could result in serious injury or death.

3.1.1.1 Use lifting eyes when moving, or loading and unloading the blast machine. Do not use a sling around the handle or piping.

3.1.1.2 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 dual chamber blast machine when it contains abrasive.
- 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.
- Do not tilt the machine on its wheels, or attempt to move the machine in hand-truck manner. Even an empty machine is too heavy to maneuver that way. The wheels are there to help maneuver an empty, upright machine into its final position.

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

3.1.2.2 Slide the machine by pushing it toward the wheels. Do not back-up while moving the machine, as potential tripping hazards cannot be seen.

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 See the compressed air and abrasive consumption table in Figure 2 for approximate air and abrasive consumption per nozzle. Connect an air line from the compressor to the air supply hose connector installed on the blast machine primary inlet. For best blasting performance, use at least the size of air line shown in the table in Figure 3. Smaller diameter hose or any restriction in the air line will cause abrasive fluctuation, particularly when the upper chamber is cycled.

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

| Nozzle Size | Number of Nozzles | CFM@125 psi | | Minimum Air Line ID |
|-------------|-------------------|-------------|------|---------------------|
| | | New | Worn | |
| 5/16" | 1 | 170 to 240 | | 1-1/2" |
| 5/16" | 2 | 340 to 480 | | 2" |
| 3/8" | 1 | 240 to 315 | | 2" |
| 3/8" | 2 | 480 to 630 | | 2-1/2" |
| 7/16" | 1 | 315 to 410 | | 2" |
| 7/16" | 2 | 630 to 820 | | 2-1/2" |
| 1/2" | 1 | 410 to 520 | | 2-1/2" |
| 1/2" | 2 | 820 to 1040 | | 3" |

Minimum ID air line recommendations for multiple nozzles. CFM shown is the approximate cfm required at 125 psi when the nozzle is new, and when worn. A nozzle is considered worn when the orifice is 1/16" larger than its original size.

Figure 3

⚠ WARNING

Where two or more blast machines (or multiple nozzles) are used, care must be taken when tracing and connecting control lines and blast hoses. Cross connecting control hose or blast hose could lead to serious injury, death, or property damage from unintentional actuation of a blast machine. To prevent cross connections, hoses should be of equal lengths, and the hoses and blast machine couplings clearly marked. Use optional hose identification kits, part no. 15890 for use with two blast machines (nozzle), or part no. 15891 for up to four machines. Mark each hose and connection per the instructions supplied with the kit, and carefully trace and verify each connection before operating.

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 blast hose and compressed-air supply hose connections are secured with safety locks and safety cables to prevent accidental separation or

disconnection. Lock pins and safety cables are listed in Sections 8.1 and 8.2.

⚠ 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.

3.2.5 Connect the ends of the remote control twinline hose to the fittings on the valves as described in the remote control manuals. Check that all fittings are tight. Leaks will cause the system to malfunction.

3.2.6 Close the primary inlet valve and upper chamber inlet valve. The valves are closed when the handle is perpendicular to the valve.

3.2.7 Check that the outlet valves and choke valve(s) (two on dual outlet machines) are open. The valves are open when the handle is in-line with the piping.

3.2.8 Close the abrasive metering valve(s) (two on dual outlet machines). The closed position for the Sentinel metering valve is when the handle is fully right. The closed position for the optional knob type valves is when the metering knob is turned fully clockwise.

3.2.9 Open the remote control safety petcock(s) (two on dual outlet machines), and check the control handles per instructions in the remote control and control handle manuals.

3.2.10 Close the compressor's air valve. Start the compressor, and bring it up to operating temperature and pressure. The pressure must not exceed 125 psi.

3.2.11 Load abrasive into the machine by following the instructions in Section 3.7.

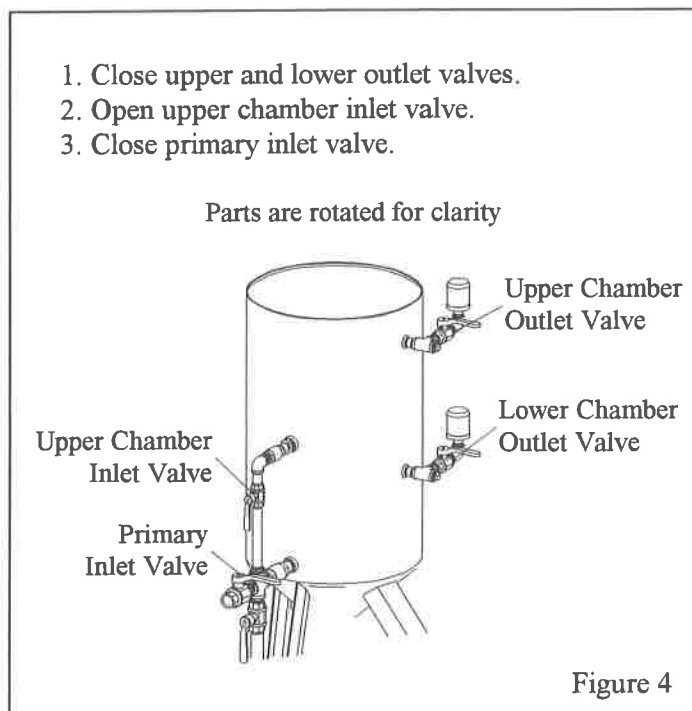
3.3 Pressurize The Machine

3.3.1 Do not allow anyone 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 tender may pressurize or depressurize the machine at any time. Noise, from the sudden release of compressed air, or abrasive venting under pressure could result in injury. The machine tender must wear a suitable, approved respirator, plus approved eye, face, and hearing protection.

3.3.2 Position the inlet and outlet valves as shown in Figure 4.



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

3.3.4 While standing back and facing away from the concave filling head, open the primary inlet valve. This action causes the upper chamber pop-up valve to seal-off the filling port, pressurizes the machine, and begins the blast process.

3.4 Blasting

3.4.1 When the blast operator is ready to blast, either the operator or the machine tender closes the remote

control safety petcock. Closing the petcock prepares the machine for remote operation and activation by the control handle.

⚠ 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.

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

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

3.4.2 Operators must wear appropriate protective gear, including: abrasive-resistant clothing, leather gloves, eye and hearing protection, and a NIOSH-approved Type CE Supplied-Air Respirator.

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

3.4.4 Pull back 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).

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

3.4.6 Adjust abrasive flow per Section 4.1.

3.5 Stop Blasting

3.5.1 To stop blasting, release the control handle lever.

3.5.2 When the control handle lever is released, the control handle safety lever will flip up to lock the handle lever in the up (no blast) position.

3.5.3 Make sure that the control handle safety lever lock is up, and that it prevents the handle lever from engaging.

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

▲ WARNING

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

3.6 Depressurize the machine

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

3.7 Loading Abrasive into the Blast Machine
See Section 3.9 for automatic refilling.**▲ WARNING**

Obtain a material safety data sheet (MSDS) 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.

NOTE: Use only abrasive specifically manufactured for blast cleaning, and that is 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 surface being blasted.

3.7.1 Stop blasting per Section 3.5, or depressurize the upper chamber per Section 3.8.

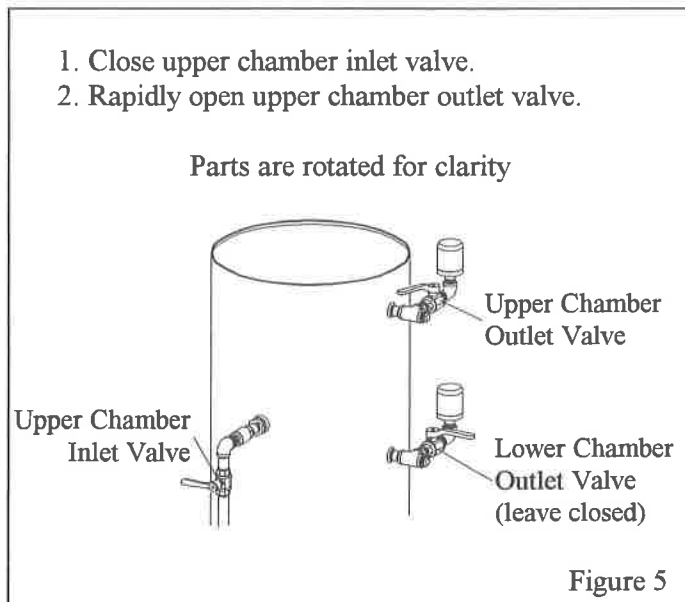
3.7.2 Load abrasive into the machine by pouring it into the concave head. Using an optional screen, placed over the head, prevents large objects from falling inside. A screen is recommended to keep objects such as pieces of abrasive bags and rocks from falling into the machine. Foreign objects will jam 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.

3.7.3 Pressurize the machine per Section 3.3 or pressurize the upper chamber per Section 3.8.

3.8 Cycling the Upper Chamber (refilling the upper chamber while blasting from the lower chamber). Ref. Figure 5. See Section 3.9 for automatic refilling.

3.8.1 During blasting, and after approximately one-half of the abrasive in the machine has been used, close the upper chamber inlet valve, and while standing back and facing away from the concave head and exhaust muffler, "quickly" open the upper chamber outlet valve. **NOTE: Air must exhaust rapidly from the upper chamber in order for the lower chamber pop-up valve**

to seal. The upper pop-up valve automatically drops when air is expelled from the upper chamber. Blasting continues from the lower chamber.



3.8.2 Load abrasive into the upper chamber per Section 3.7.

3.8.3 Pressurize the upper chamber, by closing the upper chamber outlet valve and opening the upper chamber inlet valve. When pressure in the upper and lower chambers equalize, the lower chamber pop-up valve drops, refilling the lower chamber with abrasive.

3.8.4 Repeat the process for continuous-action blasting.

3.9 Automatic Refilling

3.9.1 For hopper-fed machines, refilling can be accomplished automatically with a cycle timer. See Accessories in Section 8.1. Hopper-fed machines must have an umbrella mounted above the upper chamber pop-up opening. See Section 8.2 for bolt-on umbrella.

3.10 Emptying the Machine of Abrasive

3.10.1 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:

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

3.10.3 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.

3.10.4 Pressurize the machine.

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

3.10.6 Hold the hose securely (do not leave the hose unattended), and activate the control handle. Be prepared for surging or recoil of the hose, which can be severe.

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

3.10.8 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.

3.11 Shutdown

3.11.1 Ensure that the blast machine is depressurized.

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

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

3.11.4 Shutdown the compressor.

3.11.5 Cover the machine when not in use.

4.0 ADJUSTMENTS

4.1 Abrasive Metering Valve

NOTE: These instructions are for the Sentinel metering valve. Optional metering valves may function differently, but the process is similar.

4.1.1 Begin adjustments with the metering valve closed. Closed is when the handle is fully right.

4.1.2 While the operator is blasting, the machine tender increases abrasive flow by slowly moving the handle to the left, no more than 1/4" at a time, allowing time for the flow to stabilize before further adjusting.

4.1.3 Optimum abrasive flow depends on the type and size of abrasive and the 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. The stream of abrasive coming out of the nozzle should barely discolor the air when seen against a contrasting background.

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

5.0 PREVENTIVE MAINTENANCE

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

5.1 Daily Inspection

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

- Inspect the blast hose for wear; look for soft spots. If the hose has soft spots, the hose is worn and must be replaced.

⚠ 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.

- Inspect the RLX Control Handle

⚠ 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:

- 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 don't 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 moisture separator is used, inspect the filter element, and clean the bowl.

5.2.2 After blasting do 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 6.5.

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 6.3.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. See Section 6.4.

6.0 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.

6.1 Removing damp abrasive from the blast machine.

6.1.1 To clear a minor blockage caused from 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 for obstructions in the metering valve.

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

6.1.4 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.

6.1.5 Close the choke valve and fully open the abrasive metering valve.

6.1.6 Pressurize the machine and activate the control handle to force out damp abrasive.

6.1.7 When the obstruction has been removed, release the control handle and 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 and activate the control handle to clear the hose. When the hose is cleared, release the handle and 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. 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 erode nozzle threads. A loose fitting nozzle may eject under pressure and could cause severe injury.

6.1.8 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 3.10.

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

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

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

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

6.2.6 Make sure the inspection door gasket is in good condition, and in place before 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 compressed air supply.

6.3 Replacing the Pop-Up Valve, Figure 6

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

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

6.3.3 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.

6.3.4 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.

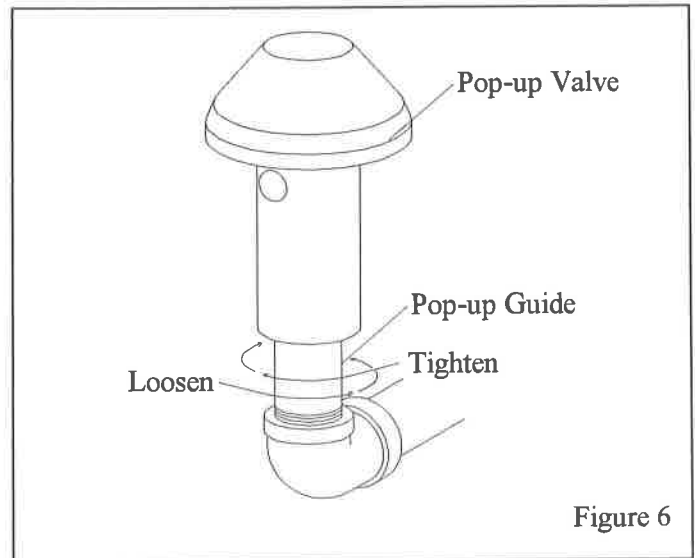
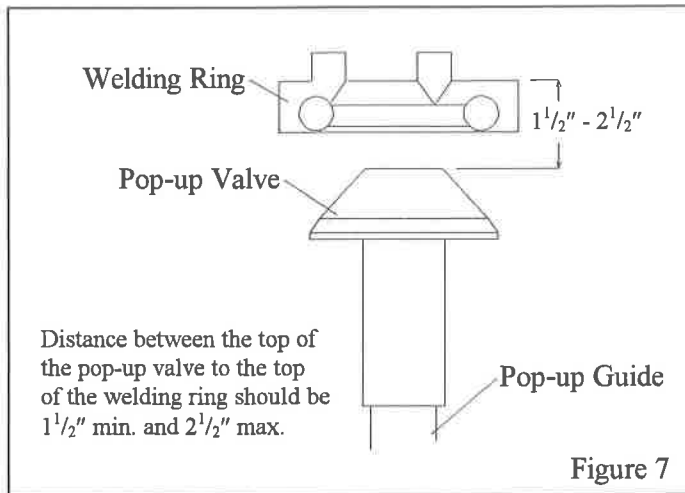


Figure 6

6.3.5 Slide the new pop-up valve over the guide, 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.

6.3.6 Refer to Figure 7 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.



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

6.4 Replacing the Pop-Up Seal

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

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

6.4.3 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.

6.5 Exhaust Muffler, Figure 8

⚠ 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.

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

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

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

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

6.5.5 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.

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

6.5.7 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 8.

6.5.8 Firmly tighten the lock-nuts.

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

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 lock-out and tag-out 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 comes out of 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 for obstruction.

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

7.2 Air only (no abrasive) comes out the nozzle

7.2.1 Abrasive metering valve may be closed or needs adjustment. Adjust the metering valve per 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 per Section 6.2.

7.2.5 Open the safety petcock on the metering valve and press the control handle. If air does not come out the petcock, check for blockage in the twinline hose to and from the control handle. If air does come out, the metering valve actuator section is not functioning. Refer to the metering valve manual for servicing the valve.

7.3 Heavy abrasive flow

7.3.1 Check that 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.

7.3.3 Check the abrasive metering valve and air valve for wear. Refer to the remote control manual for troubleshooting and servicing the remote system. If there is an internal leak in the air valve it will act as if the choke valve is partially closed.

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. See Section 4.1.

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

7.4.3 Abrasive metering valve may require service. Refer to the metering valve manual.

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 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.

7.5.2 Abrasive may be worn from recycling. Replace abrasive.

7.6 Blast machine will not pressurize

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

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

7.6.3 Dirty filter in moisture separator. Check filter element.

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

7.7 Lower chamber wont seal when upper chamber is depressurized

7.7.1 Upper chamber exhaust valve opened too slowly. Quickly open the exhaust valve. Air must exhaust rapidly from the upper chamber for the lower chamber pop-up valve to seal.

7.7.2 Exhaust muffler blocked Service muffler per Section 6.5.

7.8 Blasting does not start when the control handle is pressed

7.8.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

7.9 Blasting does not stop when the control handle is released

7.9.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

8.0 ACCESSORIES and REPLACEMENT PARTS

8.1 Optional Accessories

- (-) Cycle Timer kit
 - 120 volt AC02207
 - 12 volt DC03439
- (-) Safety cable, 3/4" to 1-1/2" ID blast hose15013

8.2 Abrasive Metering Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.3 Air Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.4 Exhaust Muffler, Figure 8

| 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 |

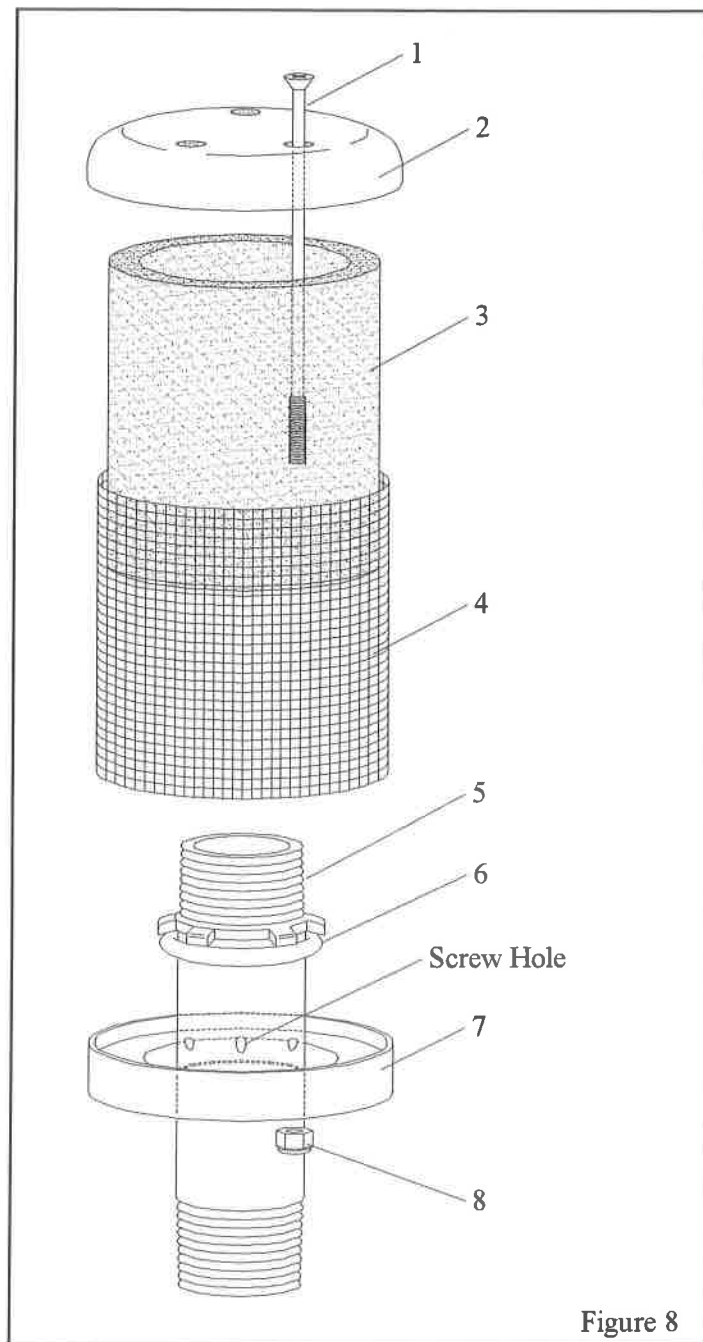


Figure 8

8.5 Blast Machine and Accessories, Figure 9

| Item | Description | Stock No. |
|------|---|-----------|
| 1. | Ball valve with handle, 1" | 02396 |
| 2. | Handle, 1" ball valve | 22531 |
| 3. | Ball valve with handle, 1-1/4" | 02397 |
| 4. | Handle, 1-1/4" ball valve | 22532 |
| 5. | Ball valve with handle, 2", dual outlet only .. | 02368 |
| 6. | Air valve, 1-1/4" (PVR pinch tube shown) ... | 04320 |
| 7. | Check valve, 1" cone | 02087 |
| 8. | Check valve, 1-1/4" cone | 02088 |
| 9. | Compression coupling, 1-1/4" | 01857 |
| 10. | Gasket, 1-1/4" compression coupling | 01886 |
| 11. | Coupling, 1-1/4" CF | 00551 |
| 12. | Wye, 1-1/4" | 01818 |
| 13. | Leg pad, right | 03654 |
| 14. | Leg pad, left | 03655 |

| | | |
|-----|--|-------|
| 15. | Metering valve, (Sentinel shown) | 20608 |
| 16. | Gasket, CQG coupling, (package of 10) | 00850 |
| 17. | Balance tank, dual outlet only | 02365 |
| 18. | Wheel and tire, 400 x 16, each | 02338 |
| 19. | Axle, 24" dia. machine | 02403 |
| 20. | Retaining ring, 1" | 03824 |
| 21. | Thrust washer, 1" | 03825 |
| 22. | Inspection door assembly, 6" x 8" | 02377 |
| 23. | Gasket, 6" x 8" inspection door | 02369 |
| 24. | Seat, pop-up, gum rubber, standard use | 02325 |
| 25. | Seat, pop-up, neoprene, for hot climates | 02380 |
| 26. | Muffler, exhaust | 05068 |
| 27. | Pop-up valve, 4" with external sleeve | 03699 |
| 28. | Internal pop-up guide, 4-1/2" toe nipple | 21694 |
| 29. | Umbrella, optional, 4" bolt-on | 02318 |
| 30. | Cover, optional, 24" diameter | 02336 |
| 31. | Screen, optional, 24" recessed type | 03100 |
| 32. | Lock pin, coupling (package of 25) | 11203 |

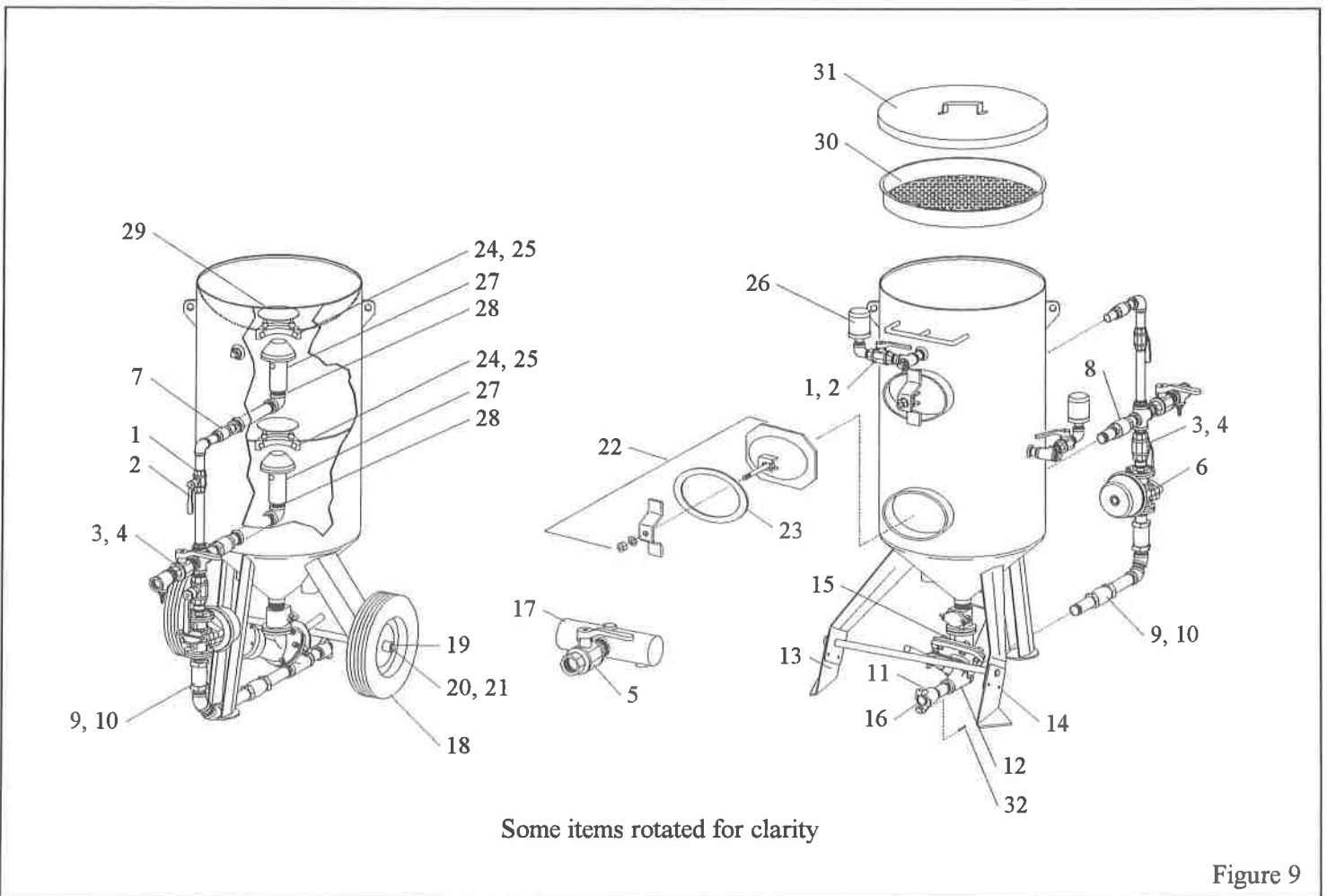


Figure 9

**DUAL CHAMBER BLAST MACHINE
WITH REMOTE CONTROL
O.M. 23063**

**MC FILE NUMBER: 2131-04/01
DATE OF ISSUE: 04/03/01
REVISION:**

 WARNING

Do not proceed with these instructions until you have READ the orange cover of this MANUAL and YOU UNDERSTAND its content.* 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 Parts and Maintenance Guide refer to the orange warnings insert preceding the Index before continuing with the following instructions.**

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1.0 INTRODUCTION

1.1 Scope

1.1.1 These instructions cover the set-up, operation, maintenance, troubleshooting, and replacement parts for Clemco dual chamber (continuous-action) blast machines with pressure-hold remote controls.

1.1.2 OSHA requires remote controls (valves that start and stop the blast process from a control at the nozzle) on all blast machines when a blast operator commands the nozzle. The remote control metering valve and air valve may vary from those shown in Figure 1. Some general remote control operating instructions are included in the text of this manual. These "BASIC" instructions are included for clarity. Separate owner manuals are provided, that includes operating instructions of the remote controls and control handle supplied with the machine. To ensure safe blasting, before using the machine, read the manuals for the remotes controls, control handle, and all accessories to be used.

1.1.3 These instructions also contain important information required for safe operation of the machine. 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. 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.

1.1.4 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" (Stock No. 22090) is included with every blast machine, and contains important safety information about abrasive blasting that may not be included in equipment operation manuals. Additional copies are available from Clemco Industries. Spanish translations (Stock No. 22931) are available on request.

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.

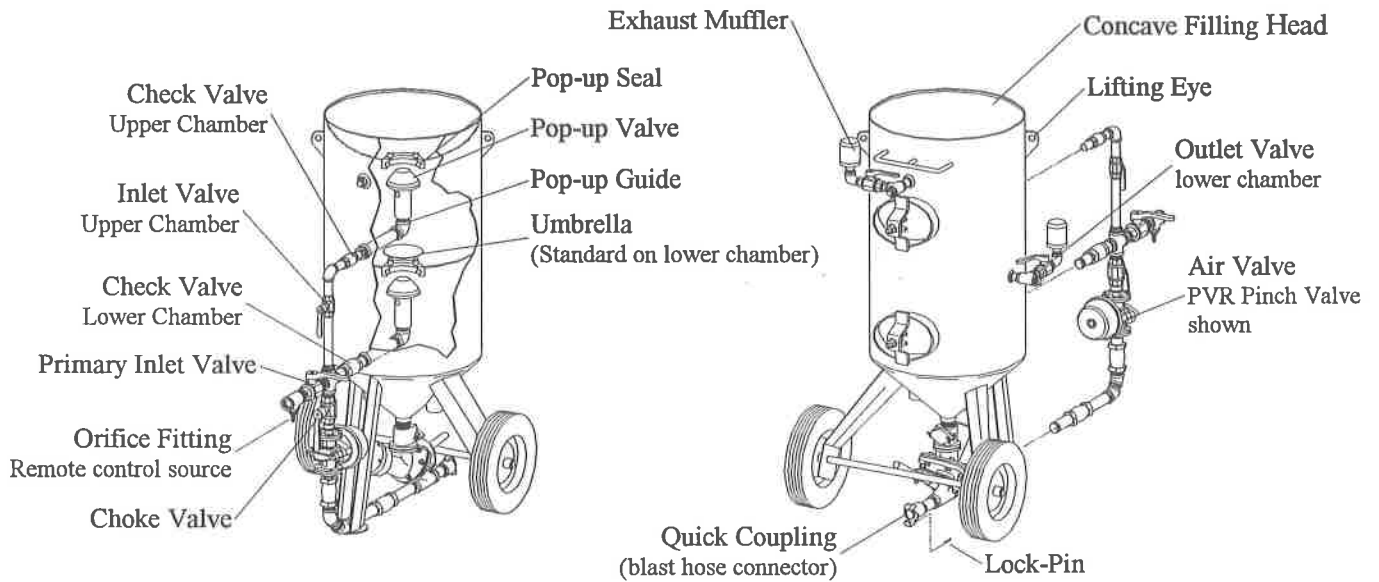
⚠ DANGER

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

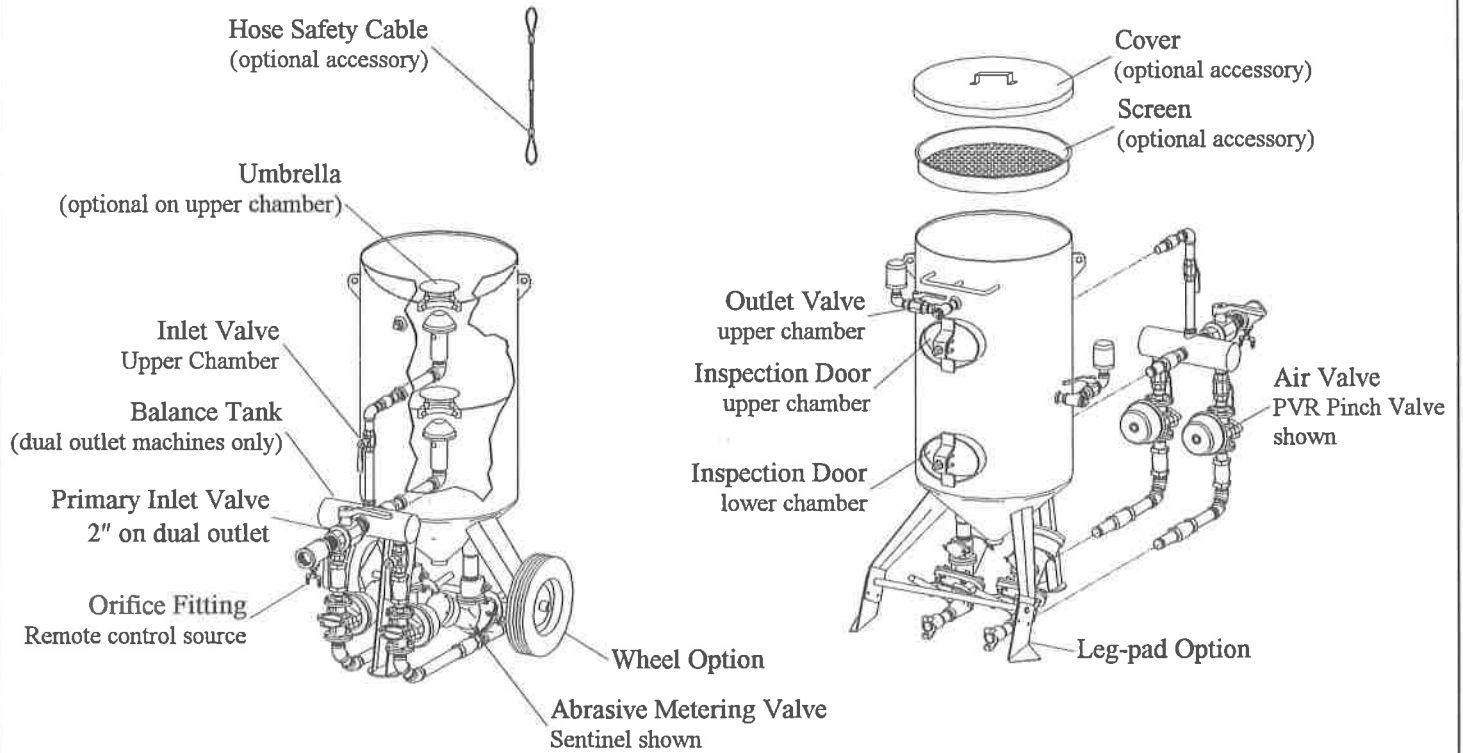
1.3 Description

1.3.1 The primary components of the blast machine are shown in Figure 1. They may be plumbed with a single outlet, for one operator, or dual outlets, for two operators. The pressurization and depressurization of the blast machine is done manually, by opening and closing hand operated valves. Blasting is controlled by the operator, from the nozzle, by use of remote controls. The dual chambers enable filling and refilling the upper chamber with abrasive while blasting continues from the lower chamber.

1.3.2 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.



Dual Chamber Shown With Single Outlet



Dual Chamber Shown With Dual Outlets

Figure 1

⚠ 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.

1.3.3 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.

1.3.4 This blast machine is rated for a maximum of 125 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.

1.3.5 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 Remote Controls

1.4.1 The remote control system is an OSHA-required safety device. The control handle, located near the blast nozzle, is the activator for the remote control system. Blasting stops when the operator intentionally or unintentionally removes hand-held pressure from the remote control handle. 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, the remote controls stops the blast process.

⚠ WARNING

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

1.4.2 Most remote controls used with dual chamber machines are pressure-hold type. The instructions in this manual cover general operating instructions for pressure-hold systems. In some cases pressure-release remote controls are used with single outlet, dual chamber machines. In either case, separate operating instructions are provided for the remote controls furnished on the machine. Refer to the remote control manual, and control handle manual for detailed set-up and operating instructions.

Pressure-Hold System: Blasting does not start and stop with pressurization and depressurization of the blast machine. Using hand operated inlet and outlet valves, the operator manually pressurizes and depressurizes the blast machine. Although the machine may be under pressure, blasting does not begin, because a normally closed air valve prevents air flow, and a normally closed abrasive valves prevents abrasive flow. When the operator presses the control handle, the valves open, and blasting begins. Pressure remains in the blast machine until it is manually depressurized. All remote controls on multiple outlet machines must be pressure-hold controls.

Pressure-Release Systems: Blasting starts and stops with pressurization and depressurization of the machine. When this system is used with a dual chamber machine, the controls operate the lower chamber only.

2.0 INITIAL SET-UP

2.1 Storage Hopper

2.1.1 When a storage hopper is installed above the blast machine, an umbrella is required above the upper chamber pop-up opening. See Section 8.2 for optional bolt-on umbrella.

2.2 Blast Machine Set-Up

⚠ WARNING

Exhaust mufflers are installed on this machine. 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.

Note: Dual chamber machines demand high volumes of compressed air when the upper chamber is cycled, or when the machine is furnished with dual outlets. Installing a receiver tank sized to the cfm requirements shown in the table in Figure 2, reduces the chance of abrasive surging and air-flow problems when cycling the upper chamber or second outlet.

2.2.1 Install an optional filter/moisture separator in front of the primary inlet valve. The filter is recommended at this location to remove moisture from air before it enters the machine. The filter must be capable of supporting the cfm as noted in the table in Figure 2.

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

2.2.3 Refer to the remote control owners manual for set-up and operation of the remote controls.

3.0 OPERATION

3.1 Transporting and moving

3.1.1 Transporting a blast machine

⚠ WARNING

- 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.
- Failure to observe these warnings could result in serious injury or death.

3.1.1.1 Use lifting eyes when moving, or loading and unloading the blast machine. Do not use a sling around the handle or piping.

3.1.1.2 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 dual chamber blast machine when it contains abrasive.
- 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.
- Do not tilt the machine on its wheels, or attempt to move the machine in hand-truck manner. Even an empty machine is too heavy to maneuver that way. The wheels are there to help maneuver an empty, upright machine into its final position.

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

3.1.2.2 Slide the machine by pushing it toward the wheels. Do not back-up while moving the machine, as potential tripping hazards cannot be seen.

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 See the compressed air and abrasive consumption table in Figure 2 for approximate air and abrasive consumption per nozzle. Connect an air line from the compressor to the air supply hose connector installed on the blast machine primary inlet. For best blasting performance, use at least the size of air line shown in the table in Figure 3. Smaller diameter hose or any restriction in the air line will cause abrasive fluctuation, particularly when the upper chamber is cycled.

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

disconnection. Lock pins and safety cables are listed in Sections 8.1 and 8.2.

| Nozzle Size | Number of Nozzles | CFM@125 psi | | Minimum Air Line ID |
|-------------|-------------------|-------------|------|---------------------|
| | | New | Worn | |
| 5/16" | 1 | 170 to 240 | | 1-1/2" |
| 5/16" | 2 | 340 to 480 | | 2" |
| 3/8" | 1 | 240 to 315 | | 2" |
| 3/8" | 2 | 480 to 630 | | 2-1/2" |
| 7/16" | 1 | 315 to 410 | | 2" |
| 7/16" | 2 | 630 to 820 | | 2-1/2" |
| 1/2" | 1 | 410 to 520 | | 2-1/2" |
| 1/2" | 2 | 820 to 1040 | | 3" |

Minimum ID air line recommendations for multiple nozzles. CFM shown is the approximate cfm required at 125 psi when the nozzle is new, and when worn. A nozzle is considered worn when the orifice is 1/16" larger than its original size.

Figure 3

⚠ WARNING

Where two or more blast machines (or multiple nozzles) are used, care must be taken when tracing and connecting control lines and blast hoses. Cross connecting control hose or blast hose could lead to serious injury, death, or property damage from unintentional actuation of a blast machine. To prevent cross connections, hoses should be of equal lengths, and the hoses and blast machine couplings clearly marked. Use optional hose identification kits, part no. 15890 for use with two blast machines (nozzle), or part no. 15891 for up to four machines. Mark each hose and connection per the instructions supplied with the kit, and carefully trace and verify each connection before operating.

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 blast hose and compressed-air supply hose connections are secured with safety locks and safety cables to prevent accidental separation or

⚠ 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.

3.2.5 Connect the ends of the remote control twinline hose to the fittings on the valves as described in the remote control manuals. Check that all fittings are tight. Leaks will cause the system to malfunction.

3.2.6 Close the primary inlet valve and upper chamber inlet valve. The valves are closed when the handle is perpendicular to the valve.

3.2.7 Check that the outlet valves and choke valve(s) (two on dual outlet machines) are open. The valves are open when the handle is in-line with the piping.

3.2.8 Close the abrasive metering valve(s) (two on dual outlet machines). The closed position for the Sentinel metering valve is when the handle is fully right. The closed position for the optional knob type valves is when the metering knob is turned fully clockwise.

3.2.9 Open the remote control safety petcock(s) (two on dual outlet machines), and check the control handles per instructions in the remote control and control handle manuals.

3.2.10 Close the compressor's air valve. Start the compressor, and bring it up to operating temperature and pressure. The pressure must not exceed 125 psi.

3.2.11 Load abrasive into the machine by following the instructions in Section 3.7.

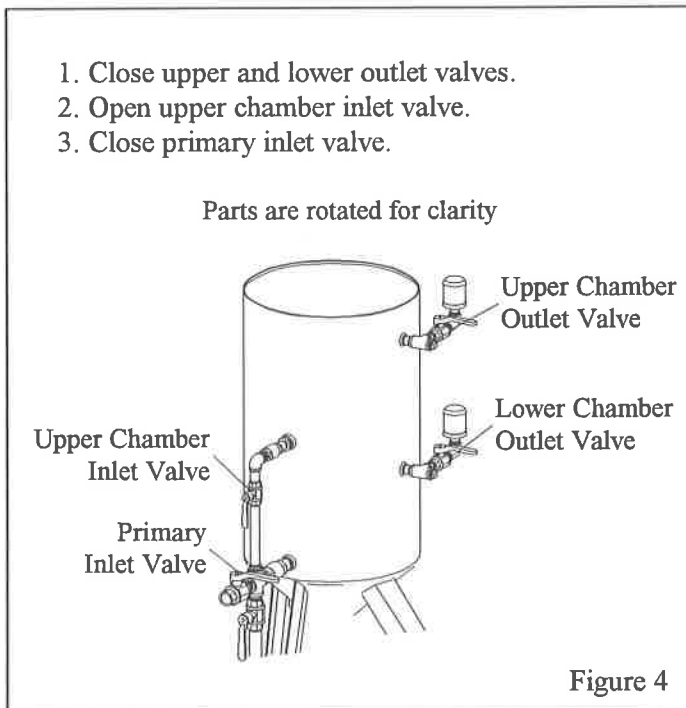
3.3 Pressurize The Machine

3.3.1 Do not allow anyone 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 tender may pressurize or depressurize the machine at any time. Noise, from the sudden release of compressed air, or abrasive venting under pressure could result in injury. The machine tender must wear a suitable, approved respirator, plus approved eye, face, and hearing protection.

3.3.2 Position the inlet and outlet valves as shown in Figure 4.



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

3.3.4 While standing back and facing away from the concave filling head, open the primary inlet valve. This action causes the upper chamber pop-up valve to seal-off the filling port, pressurizes the machine, and begins the blast process.

3.4 Blasting

3.4.1 When the blast operator is ready to blast, either the operator or the machine tender closes the remote

control safety petcock. Closing the petcock prepares the machine for remote operation and activation by the control handle.

⚠ 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.

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

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

3.4.2 Operators must wear appropriate protective gear, including: abrasive-resistant clothing, leather gloves, eye and hearing protection, and a NIOSH-approved Type CE Supplied-Air Respirator.

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

3.4.4 Pull back 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).

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

3.4.6 Adjust abrasive flow per Section 4.1.

3.5 Stop Blasting

3.5.1 To stop blasting, release the control handle lever.

3.5.2 When the control handle lever is released, the control handle safety lever will flip up to lock the handle lever in the up (no blast) position.

3.5.3 Make sure that the control handle safety lever lock is up, and that it prevents the handle lever from engaging.

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

⚠ WARNING

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

3.6 Depressurize the machine

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

3.7 Loading Abrasive into the Blast Machine
See Section 3.9 for automatic refilling.

⚠ WARNING

Obtain a material safety data sheet (MSDS) 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.

NOTE: Use only abrasive specifically manufactured for blast cleaning, and that is 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 surface being blasted.

3.7.1 Stop blasting per Section 3.5, or depressurize the upper chamber per Section 3.8.

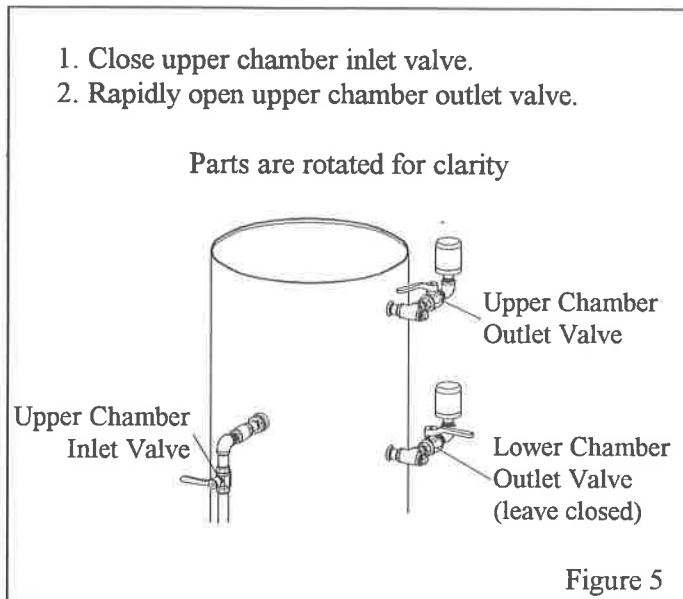
3.7.2 Load abrasive into the machine by pouring it into the concave head. Using an optional screen, placed over the head, prevents large objects from falling inside. A screen is recommended to keep objects such as pieces of abrasive bags and rocks from falling into the machine. Foreign objects will jam 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.

3.7.3 Pressurize the machine per Section 3.3 or pressurize the upper chamber per Section 3.8.

3.8 Cycling the Upper Chamber (refilling the upper chamber while blasting from the lower chamber). Ref. Figure 5. See Section 3.9 for automatic refilling.

3.8.1 During blasting, and after approximately one-half of the abrasive in the machine has been used, close the upper chamber inlet valve, and while standing back and facing away from the concave head and exhaust muffler, "quickly" open the upper chamber outlet valve. **NOTE:** Air must exhaust rapidly from the upper chamber in order for the lower chamber pop-up valve

to seal. The upper pop-up valve automatically drops when air is expelled from the upper chamber. Blasting continues from the lower chamber.



3.8.2 Load abrasive into the upper chamber per Section 3.7.

3.8.3 Pressurize the upper chamber, by closing the upper chamber outlet valve and opening the upper chamber inlet valve. When pressure in the upper and lower chambers equalize, the lower chamber pop-up valve drops, refilling the lower chamber with abrasive.

3.8.4 Repeat the process for continuous-action blasting.

3.9 Automatic Refilling

3.9.1 For hopper-fed machines, refilling can be accomplished automatically with a cycle timer. See Accessories in Section 8.1. Hopper-fed machines must have an umbrella mounted above the upper chamber pop-up opening. See Section 8.2 for bolt-on umbrella.

3.10 Emptying the Machine of Abrasive

3.10.1 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:

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

3.10.3 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.

3.10.4 Pressurize the machine.

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

3.10.6 Hold the hose securely (do not leave the hose unattended), and activate the control handle. Be prepared for surging or recoil of the hose, which can be severe.

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

3.10.8 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.

3.11 Shutdown

3.11.1 Ensure that the blast machine is depressurized.

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

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

3.11.4 Shutdown the compressor.

3.11.5 Cover the machine when not in use.

4.0 ADJUSTMENTS

4.1 Abrasive Metering Valve

NOTE: These instructions are for the Sentinel metering valve. Optional metering valves may function differently, but the process is similar.

4.1.1 Begin adjustments with the metering valve closed. Closed is when the handle is fully right.

4.1.2 While the operator is blasting, the machine tender increases abrasive flow by slowly moving the handle to the left, no more than 1/4" at a time, allowing time for the flow to stabilize before further adjusting.

4.1.3 Optimum abrasive flow depends on the type and size of abrasive and the 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. The stream of abrasive coming out of the nozzle should barely discolor the air when seen against a contrasting background.

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

5.0 PREVENTIVE MAINTENANCE

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

5.1 Daily Inspection

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

- Inspect the blast hose for wear; look for soft spots. If the hose has soft spots, the hose is worn and must be replaced.

⚠ 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.

- Inspect the RLX Control Handle

⚠ 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:

- 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 don't 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 moisture separator is used, inspect the filter element, and clean the bowl.

5.2.2 After blasting do 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 6.5.

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 6.3.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. See Section 6.4.

6.0 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.

6.1 Removing damp abrasive from the blast machine.

6.1.1 To clear a minor blockage caused from 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 for obstructions in the metering valve.

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

6.1.4 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.

6.1.5 Close the choke valve and fully open the abrasive metering valve.

6.1.6 Pressurize the machine and activate the control handle to force out damp abrasive.

6.1.7 When the obstruction has been removed, release the control handle and 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 and activate the control handle to clear the hose. When the hose is cleared, release the handle and 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. 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 erode nozzle threads. A loose fitting nozzle may eject under pressure and could cause severe injury.

6.1.8 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 3.10.

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

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

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

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

6.2.6 Make sure the inspection door gasket is in good condition, and in place before 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 compressed air supply.

6.3 Replacing the Pop-Up Valve, Figure 6

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

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

6.3.3 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.

6.3.4 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.

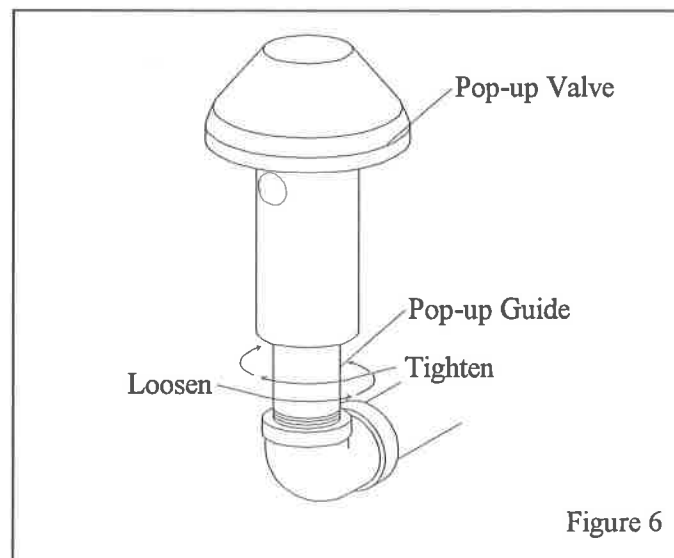
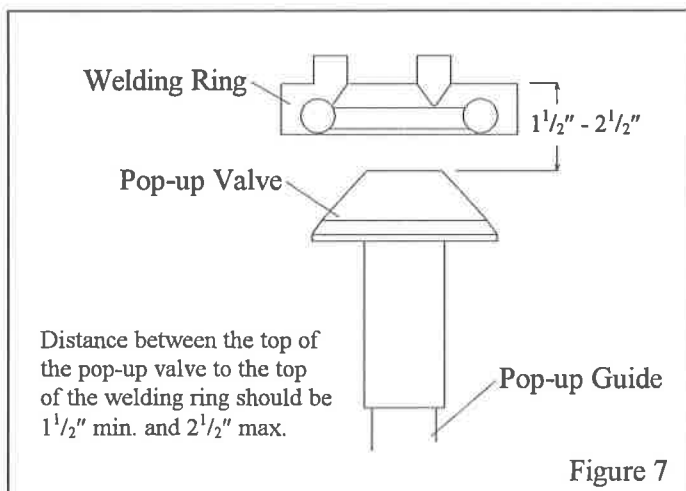


Figure 6

6.3.5 Slide the new pop-up valve over the guide, 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.

6.3.6 Refer to Figure 7 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.



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

6.4 Replacing the Pop-Up Seal

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

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

6.4.3 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.

6.5 Exhaust Muffler, Figure 8

⚠ 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.

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

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

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

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

6.5.5 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.

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

6.5.7 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 8.

6.5.8 Firmly tighten the lock-nuts.

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

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 lock-out and tag-out 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 comes out of 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 for obstruction.

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

7.2 Air only (no abrasive) comes out the nozzle

7.2.1 Abrasive metering valve may be closed or needs adjustment. Adjust the metering valve per 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 per Section 6.2.

7.2.5 Open the safety petcock on the metering valve and press the control handle. If air does not come out the petcock, check for blockage in the twinline hose to and from the control handle. If air does come out, the metering valve actuator section is not functioning. Refer to the metering valve manual for servicing the valve.

7.3 Heavy abrasive flow

7.3.1 Check that 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.

7.3.3 Check the abrasive metering valve and air valve for wear. Refer to the remote control manual for troubleshooting and servicing the remote system. If there is an internal leak in the air valve it will act as if the choke valve is partially closed.

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. See Section 4.1.

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

7.4.3 Abrasive metering valve may require service. Refer to the metering valve manual.

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 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.

7.5.2 Abrasive may be worn from recycling. Replace abrasive.

7.6 Blast machine will not pressurize

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

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

7.6.3 Dirty filter in moisture separator. Check filter element.

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

7.7 Lower chamber wont seal when upper chamber is depressurized

7.7.1 Upper chamber exhaust valve opened too slowly. Quickly open the exhaust valve. Air must exhaust rapidly from the upper chamber for the lower chamber pop-up valve to seal.

7.7.2 Exhaust muffler blocked Service muffler per Section 6.5.

7.8 Blasting does not start when the control handle is pressed

7.8.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

7.9 Blasting does not stop when the control handle is released

7.9.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

8.0 ACCESSORIES and REPLACEMENT PARTS

8.1 Optional Accessories

- (-) Cycle Timer kit
 - 120 volt AC02207
 - 12 volt DC03439
- (-) Safety cable, 3/4" to 1-1/2" ID blast hose15013

8.2 Abrasive Metering Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.3 Air Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.4 Exhaust Muffler, Figure 8

| 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 |

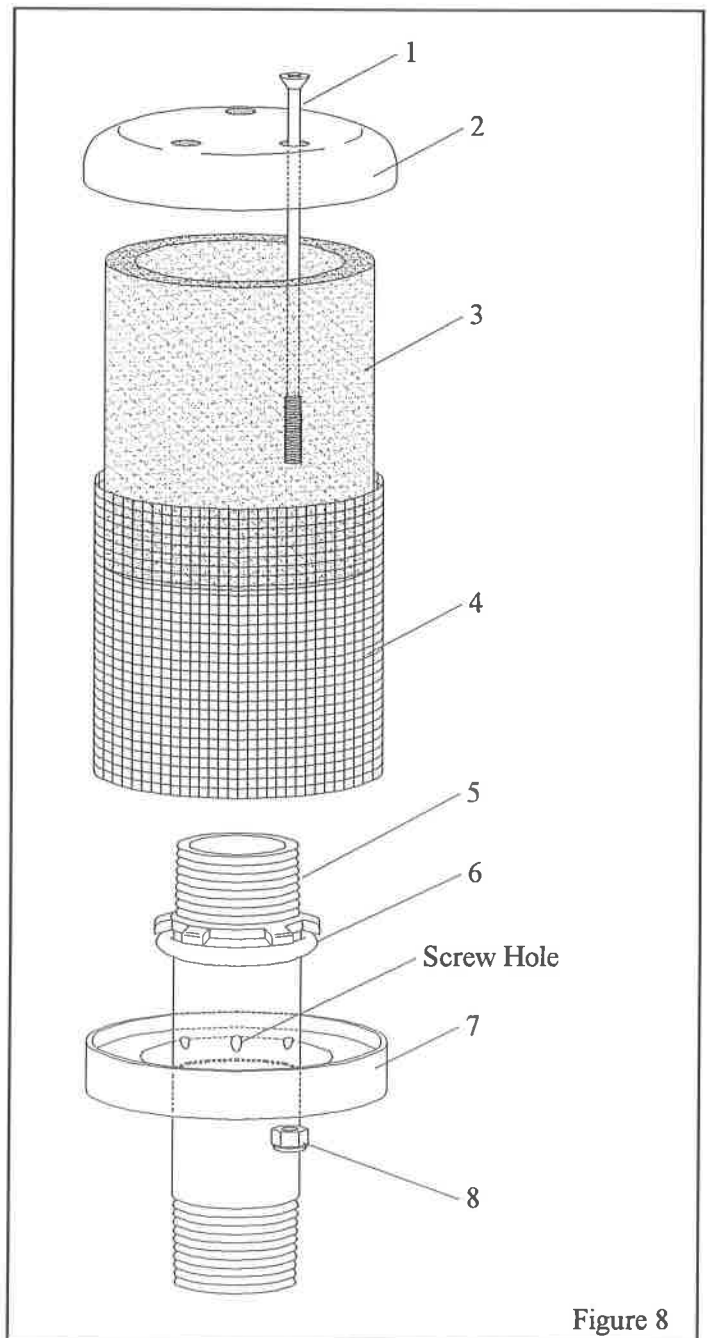


Figure 8

8.5 Blast Machine and Accessories, Figure 9

| Item | Description | Stock No. |
|------|---|-----------|
| 1. | Ball valve with handle, 1" | 02396 |
| 2. | Handle, 1" ball valve | 22531 |
| 3. | Ball valve with handle, 1-1/4" | 02397 |
| 4. | Handle, 1-1/4" ball valve | 22532 |
| 5. | Ball valve with handle, 2", dual outlet only .. | 02368 |
| 6. | Air valve, 1-1/4" (PVR pinch tube shown).... | 04320 |
| 7. | Check valve, 1" cone | 02087 |
| 8. | Check valve, 1-1/4" cone | 02088 |
| 9. | Compression coupling, 1-1/4" | 01857 |
| 10. | Gasket, 1-1/4" compression coupling | 01886 |
| 11. | Coupling, 1-1/4" CF | 00551 |
| 12. | Wye, 1-1/4" | 01818 |
| 13. | Leg pad, right | 03654 |
| 14. | Leg pad, left | 03655 |

| | | |
|-----|--|-------|
| 15. | Metering valve, (Sentinel shown) | 20608 |
| 16. | Gasket, CQG coupling, (package of 10) | 00850 |
| 17. | Balance tank, dual outlet only | 02365 |
| 18. | Wheel and tire, 400 x 16, each | 02338 |
| 19. | Axle, 24" dia. machine | 02403 |
| 20. | Retaining ring, 1" | 03824 |
| 21. | Thrust washer, 1" | 03825 |
| 22. | Inspection door assembly, 6" x 8" | 02377 |
| 23. | Gasket, 6" x 8" inspection door | 02369 |
| 24. | Seat, pop-up, gum rubber, standard use | 02325 |
| 25. | Seat, pop-up, neoprene, for hot climates | 02380 |
| 26. | Muffler, exhaust | 05068 |
| 27. | Pop-up valve, 4" with external sleeve | 03699 |
| 28. | Internal pop-up guide, 4-1/2" toe nipple | 21694 |
| 29. | Umbrella, optional, 4" bolt-on | 02318 |
| 30. | Cover, optional, 24" diameter | 02336 |
| 31. | Screen, optional, 24" recessed type | 03100 |
| 32. | Lock pin, coupling (package of 25) | 11203 |

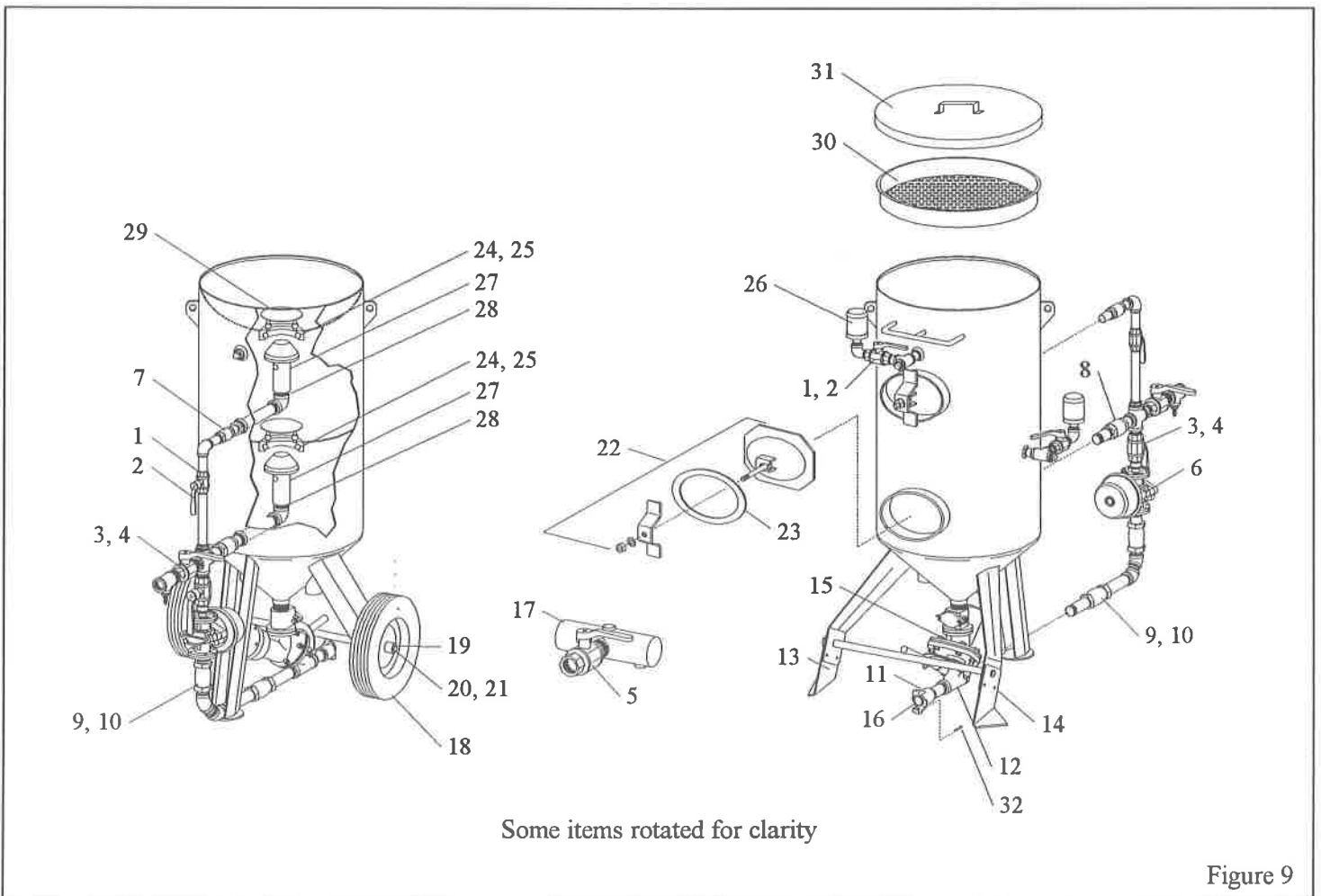


Figure 9

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**DUAL CHAMBER BLAST MACHINE
WITH REMOTE CONTROL
O.M. 23063**

**MC FILE NUMBER: 2131-04/01
DATE OF ISSUE: 04/03/01
REVISION:**

 WARNING

Do not proceed with these instructions until you have READ the orange cover of this MANUAL and YOU UNDERSTAND its content.* 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 Parts and Maintenance Guide refer to the orange warnings insert preceding the Index before continuing with the following instructions.**

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1.0 INTRODUCTION

1.1 Scope

1.1.1 These instructions cover the set-up, operation, maintenance, troubleshooting, and replacement parts for Clemco dual chamber (continuous-action) blast machines with pressure-hold remote controls.

1.1.2 OSHA requires remote controls (valves that start and stop the blast process from a control at the nozzle) on all blast machines when a blast operator commands the nozzle. The remote control metering valve and air valve may vary from those shown in Figure 1. Some general remote control operating instructions are included in the text of this manual. These "BASIC" instructions are included for clarity. Separate owner manuals are provided, that includes operating instructions of the remote controls and control handle supplied with the machine. To ensure safe blasting, before using the machine, read the manuals for the remotes controls, control handle, and all accessories to be used.

1.1.3 These instructions also contain important information required for safe operation of the machine. 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. 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.

1.1.4 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" (Stock No. 22090) is included with every blast machine, and contains important safety information about abrasive blasting that may not be included in equipment operation manuals. Additional copies are available from Clemco Industries. Spanish translations (Stock No. 22931) are available on request.

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.

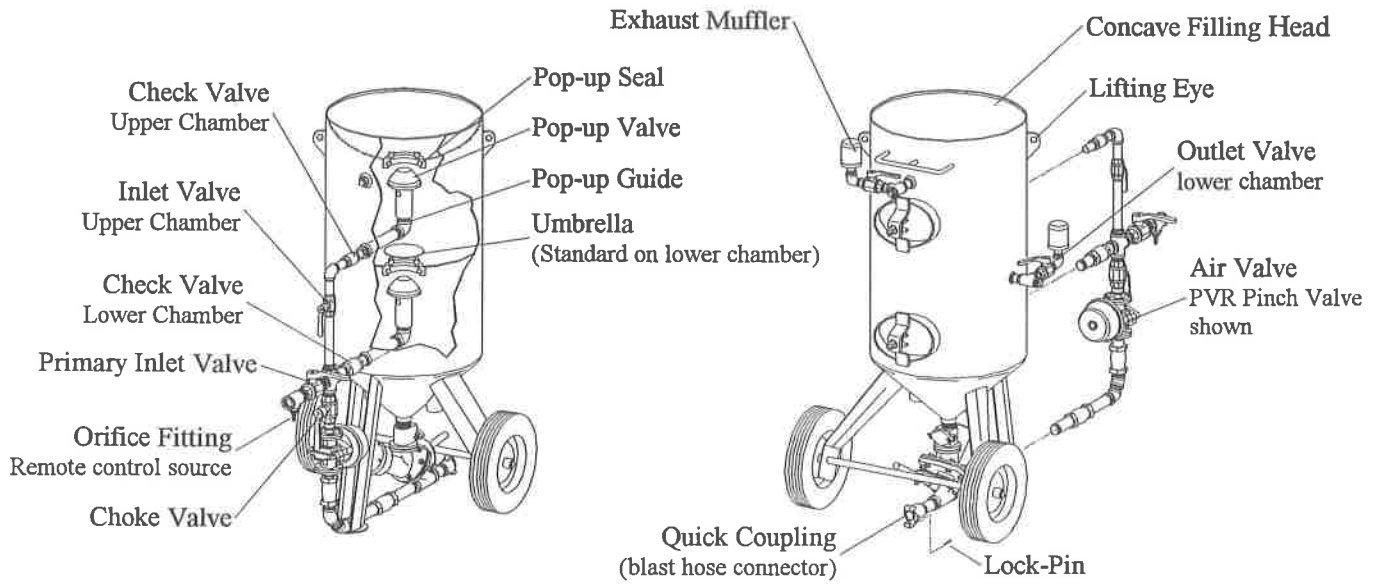
⚠ DANGER

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

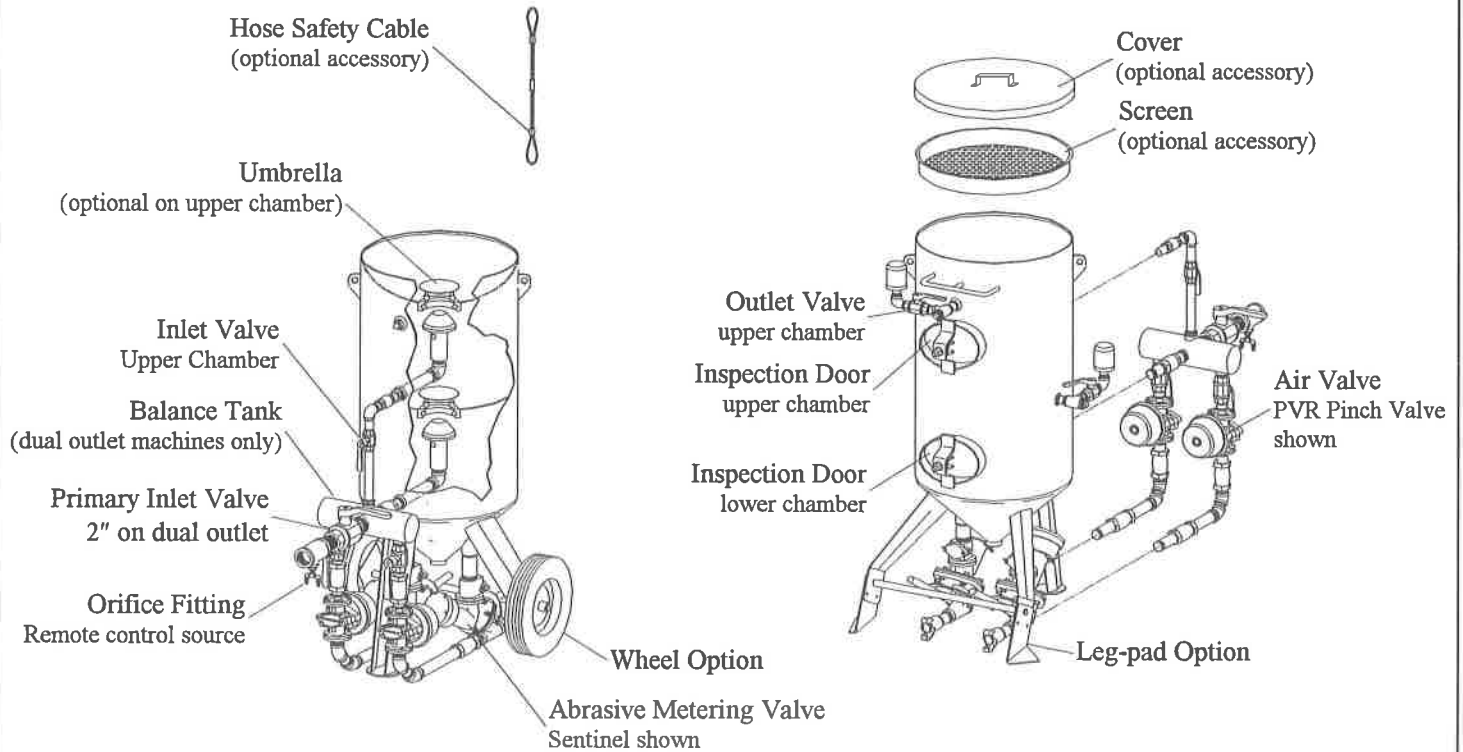
1.3 Description

1.3.1 The primary components of the blast machine are shown in Figure 1. They may be plumbed with a single outlet, for one operator, or dual outlets, for two operators. The pressurization and depressurization of the blast machine is done manually, by opening and closing hand operated valves. Blasting is controlled by the operator, from the nozzle, by use of remote controls. The dual chambers enable filling and refilling the upper chamber with abrasive while blasting continues from the lower chamber.

1.3.2 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.



Dual Chamber Shown With Single Outlet



Dual Chamber Shown With Dual Outlets

Figure 1

⚠ 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.

1.3.3 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.

1.3.4 This blast machine is rated for a maximum of 125 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.

1.3.5 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 Remote Controls

1.4.1 The remote control system is an OSHA-required safety device. The control handle, located near the blast nozzle, is the activator for the remote control system. Blasting stops when the operator intentionally or unintentionally removes hand-held pressure from the remote control handle. 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, the remote controls stops the blast process.

⚠ WARNING

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

1.4.2 Most remote controls used with dual chamber machines are pressure-hold type. The instructions in this manual cover general operating instructions for pressure-hold systems. In some cases pressure-release remote controls are used with single outlet, dual chamber machines. In either case, separate operating instructions are provided for the remote controls furnished on the machine. Refer to the remote control manual, and control handle manual for detailed set-up and operating instructions.

Pressure-Hold System: Blasting does not start and stop with pressurization and depressurization of the blast machine. Using hand operated inlet and outlet valves, the operator manually pressurizes and depressurizes the blast machine. Although the machine may be under pressure, blasting does not begin, because a normally closed air valve prevents air flow, and a normally closed abrasive valves prevents abrasive flow. When the operator presses the control handle, the valves open, and blasting begins. Pressure remains in the blast machine until it is manually depressurized. All remote controls on multiple outlet machines must be pressure-hold controls.

Pressure-Release Systems: Blasting starts and stops with pressurization and depressurization of the machine. When this system is used with a dual chamber machine, the controls operate the lower chamber only.

2.0 INITIAL SET-UP

2.1 Storage Hopper

2.1.1 When a storage hopper is installed above the blast machine, an umbrella is required above the upper chamber pop-up opening. See Section 8.2 for optional bolt-on umbrella.

2.2 Blast Machine Set-Up

⚠ WARNING

Exhaust mufflers are installed on this machine. 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.

Note: Dual chamber machines demand high volumes of compressed air when the upper chamber is cycled, or when the machine is furnished with dual outlets. Installing a receiver tank sized to the cfm requirements shown in the table in Figure 2, reduces the chance of abrasive surging and air-flow problems when cycling the upper chamber or second outlet.

2.2.1 Install an optional filter/moisture separator in front of the primary inlet valve. The filter is recommended at this location to remove moisture from air before it enters the machine. The filter must be capable of supporting the cfm as noted in the table in Figure 2.

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

2.2.3 Refer to the remote control owners manual for set-up and operation of the remote controls.

3.0 OPERATION

3.1 Transporting and moving

3.1.1 Transporting a blast machine

⚠ WARNING

- 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.
- Failure to observe these warnings could result in serious injury or death.

3.1.1.1 Use lifting eyes when moving, or loading and unloading the blast machine. Do not use a sling around the handle or piping.

3.1.1.2 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 dual chamber blast machine when it contains abrasive.
- 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.
- Do not tilt the machine on its wheels, or attempt to move the machine in hand-truck manner. Even an empty machine is too heavy to maneuver that way. The wheels are there to help maneuver an empty, upright machine into its final position.

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

3.1.2.2 Slide the machine by pushing it toward the wheels. Do not back-up while moving the machine, as potential tripping hazards cannot be seen.

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 See the compressed air and abrasive consumption table in Figure 2 for approximate air and abrasive consumption per nozzle. Connect an air line from the compressor to the air supply hose connector installed on the blast machine primary inlet. For best blasting performance, use at least the size of air line shown in the table in Figure 3. Smaller diameter hose or any restriction in the air line will cause abrasive fluctuation, particularly when the upper chamber is cycled.

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

disconnection. Lock pins and safety cables are listed in Sections 8.1 and 8.2.

| Nozzle Size | Number of Nozzles | CFM@125 psi | | Minimum Air Line ID |
|-------------|-------------------|-------------|------|---------------------|
| | | New | Worn | |
| 5/16" | 1 | 170 to 240 | | 1-1/2" |
| 5/16" | 2 | 340 to 480 | | 2" |
| 3/8" | 1 | 240 to 315 | | 2" |
| 3/8" | 2 | 480 to 630 | | 2-1/2" |
| 7/16" | 1 | 315 to 410 | | 2" |
| 7/16" | 2 | 630 to 820 | | 2-1/2" |
| 1/2" | 1 | 410 to 520 | | 2-1/2" |
| 1/2" | 2 | 820 to 1040 | | 3" |

Minimum ID air line recommendations for multiple nozzles. CFM shown is the approximate cfm required at 125 psi when the nozzle is new, and when worn. A nozzle is considered worn when the orifice is 1/16" larger than its original size.

Figure 3

▲ WARNING

Where two or more blast machines (or multiple nozzles) are used, care must be taken when tracing and connecting control lines and blast hoses. Cross connecting control hose or blast hose could lead to serious injury, death, or property damage from unintentional actuation of a blast machine. To prevent cross connections, hoses should be of equal lengths, and the hoses and blast machine couplings clearly marked. Use optional hose identification kits, part no. 15890 for use with two blast machines (nozzle), or part no. 15891 for up to four machines. Mark each hose and connection per the instructions supplied with the kit, and carefully trace and verify each connection before operating.

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 blast hose and compressed-air supply hose connections are secured with safety locks and safety cables to prevent accidental separation or

▲ 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.

3.2.5 Connect the ends of the remote control twinline hose to the fittings on the valves as described in the remote control manuals. Check that all fittings are tight. Leaks will cause the system to malfunction.

3.2.6 Close the primary inlet valve and upper chamber inlet valve. The valves are closed when the handle is perpendicular to the valve.

3.2.7 Check that the outlet valves and choke valve(s) (two on dual outlet machines) are open. The valves are open when the handle is in-line with the piping.

3.2.8 Close the abrasive metering valve(s) (two on dual outlet machines). The closed position for the Sentinel metering valve is when the handle is fully right. The closed position for the optional knob type valves is when the metering knob is turned fully clockwise.

3.2.9 Open the remote control safety petcock(s) (two on dual outlet machines), and check the control handles per instructions in the remote control and control handle manuals.

3.2.10 Close the compressor's air valve. Start the compressor, and bring it up to operating temperature and pressure. The pressure must not exceed 125 psi.

3.2.11 Load abrasive into the machine by following the instructions in Section 3.7.

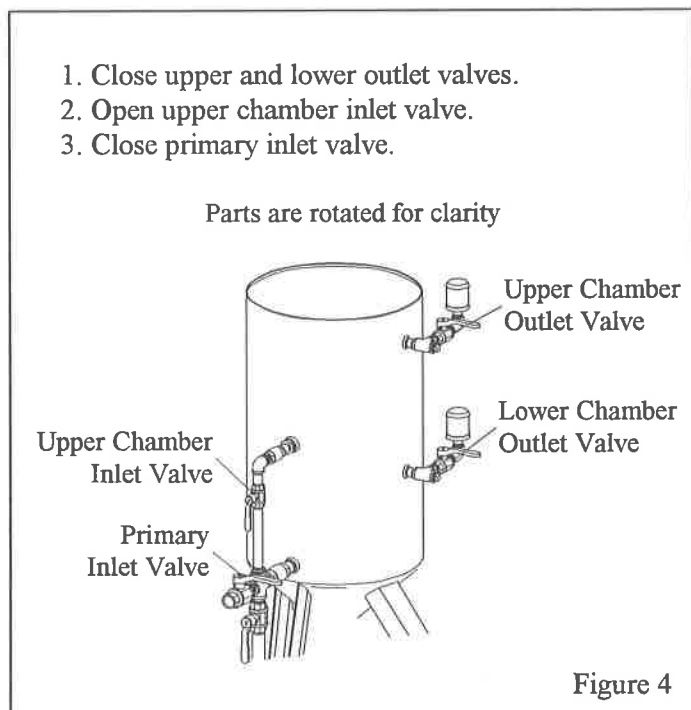
3.3 Pressurize The Machine

3.3.1 Do not allow anyone 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 tender may pressurize or depressurize the machine at any time. Noise, from the sudden release of compressed air, or abrasive venting under pressure could result in injury. The machine tender must wear a suitable, approved respirator, plus approved eye, face, and hearing protection.

3.3.2 Position the inlet and outlet valves as shown in Figure 4.



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

3.3.4 While standing back and facing away from the concave filling head, open the primary inlet valve. This action causes the upper chamber pop-up valve to seal-off the filling port, pressurizes the machine, and begins the blast process.

3.4 Blasting

3.4.1 When the blast operator is ready to blast, either the operator or the machine tender closes the remote

control safety petcock. Closing the petcock prepares the machine for remote operation and activation by the control handle.

⚠ 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.

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

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

3.4.2 Operators must wear appropriate protective gear, including: abrasive-resistant clothing, leather gloves, eye and hearing protection, and a NIOSH-approved Type CE Supplied-Air Respirator.

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

3.4.4 Pull back 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).

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

3.4.6 Adjust abrasive flow per Section 4.1.

3.5 Stop Blasting

3.5.1 To stop blasting, release the control handle lever.

3.5.2 When the control handle lever is released, the control handle safety lever will flip up to lock the handle lever in the up (no blast) position.

3.5.3 Make sure that the control handle safety lever lock is up, and that it prevents the handle lever from engaging.

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

⚠ WARNING

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

3.6 Depressurize the machine

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

3.7 Loading Abrasive into the Blast Machine

See Section 3.9 for automatic refilling.

⚠ WARNING

Obtain a material safety data sheet (MSDS) 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.

NOTE: Use only abrasive specifically manufactured for blast cleaning, and that is 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 surface being blasted.

3.7.1 Stop blasting per Section 3.5, or depressurize the upper chamber per Section 3.8.

3.7.2 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.

3.7.3 Pressurize the machine per Section 3.3 or pressurize the upper chamber per Section 3.8.

3.8 Cycling the Upper Chamber (refilling the upper chamber while blasting from the lower chamber). Ref. Figure 5. See Section 3.9 for automatic refilling.

3.8.1 During blasting, and after approximately one-half of the abrasive in the machine has been used, close the upper chamber inlet valve, and while standing back and facing away from the concave head and exhaust muffler, "quickly" open the upper chamber outlet valve. **NOTE: Air must exhaust rapidly from the upper chamber in order for the lower chamber pop-up valve**

to seal. The upper pop-up valve automatically drops when air is expelled from the upper chamber. Blasting continues from the lower chamber.

1. Close upper chamber inlet valve.
2. Rapidly open upper chamber outlet valve.

Parts are rotated for clarity

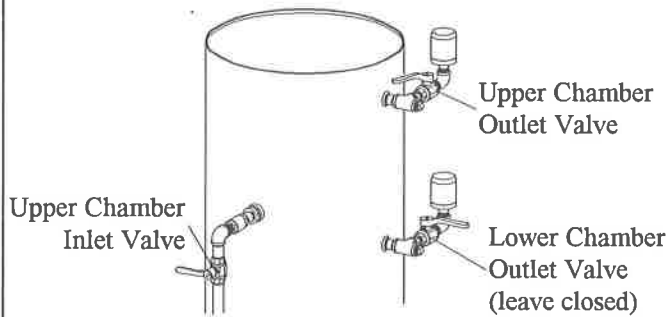


Figure 5

3.8.2 Load abrasive into the upper chamber per Section 3.7.

3.8.3 Pressurize the upper chamber, by closing the upper chamber outlet valve and opening the upper chamber inlet valve. When pressure in the upper and lower chambers equalize, the lower chamber pop-up valve drops, refilling the lower chamber with abrasive.

3.8.4 Repeat the process for continuous-action blasting.

3.9 Automatic Refilling

3.9.1 For hopper-fed machines, refilling can be accomplished automatically with a cycle timer. See Accessories in Section 8.1. Hopper-fed machines must have an umbrella mounted above the upper chamber pop-up opening. See Section 8.2 for bolt-on umbrella.

3.10 Emptying the Machine of Abrasive

3.10.1 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:

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

3.10.3 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.

3.10.4 Pressurize the machine.

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

3.10.6 Hold the hose securely (do not leave the hose unattended), and activate the control handle. Be prepared for surging or recoil of the hose, which can be severe.

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

3.10.8 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.

3.11 Shutdown

3.11.1 Ensure that the blast machine is depressurized.

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

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

3.11.4 Shutdown the compressor.

3.11.5 Cover the machine when not in use.

4.0 ADJUSTMENTS

4.1 Abrasive Metering Valve

NOTE: These instructions are for the Sentinel metering valve. Optional metering valves may function differently, but the process is similar.

4.1.1 Begin adjustments with the metering valve closed. Closed is when the handle is fully right.

4.1.2 While the operator is blasting, the machine tender increases abrasive flow by slowly moving the handle to the left, no more than 1/4" at a time, allowing time for the flow to stabilize before further adjusting.

4.1.3 Optimum abrasive flow depends on the type and size of abrasive and the 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. The stream of abrasive coming out of the nozzle should barely discolor the air when seen against a contrasting background.

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

5.0 PREVENTIVE MAINTENANCE

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

5.1 Daily Inspection

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

- Inspect the blast hose for wear; look for soft spots. If the hose has soft spots, the hose is worn and must be replaced.

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.

- Inspect the RLX Control Handle

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:

- 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 don't 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 moisture separator is used, inspect the filter element, and clean the bowl.

5.2.2 After blasting do 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 6.5.

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 6.3.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. See Section 6.4.

6.0 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.

6.1 Removing damp abrasive from the blast machine.

6.1.1 To clear a minor blockage caused from 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 for obstructions in the metering valve.

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

6.1.4 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.

6.1.5 Close the choke valve and fully open the abrasive metering valve.

6.1.6 Pressurize the machine and activate the control handle to force out damp abrasive.

6.1.7 When the obstruction has been removed, release the control handle and 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 and activate the control handle to clear the hose. When the hose is cleared, release the handle and 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. 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 erode nozzle threads. A loose fitting nozzle may eject under pressure and could cause severe injury.

6.1.8 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 3.10.

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

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

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

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

6.2.6 Make sure the inspection door gasket is in good condition, and in place before 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 compressed air supply.

6.3 Replacing the Pop-Up Valve, Figure 6

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

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

6.3.3 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.

6.3.4 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.

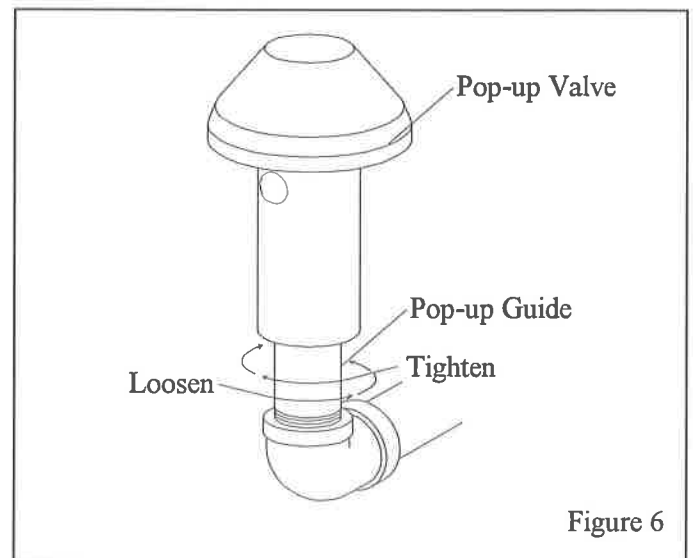


Figure 6

6.3.5 Slide the new pop-up valve over the guide, 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.

6.3.6 Refer to Figure 7 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.

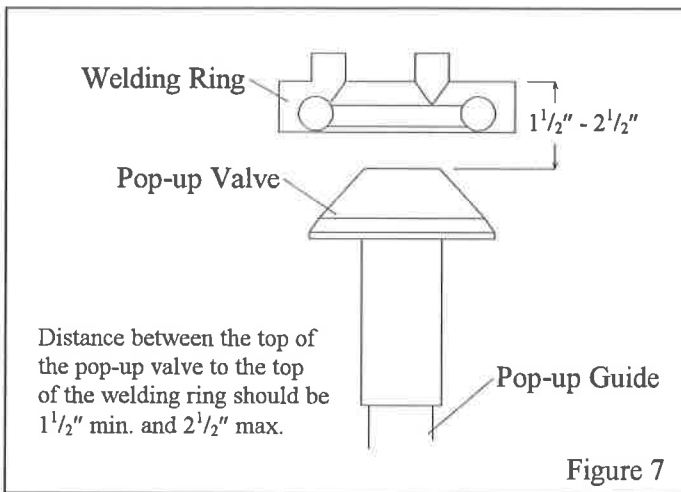


Figure 7

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

6.4 Replacing the Pop-Up Seal

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

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

6.4.3 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.

6.5 Exhaust Muffler, Figure 8

▲ 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.

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

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

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

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

6.5.5 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.

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

6.5.7 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 8.

6.5.8 Firmly tighten the lock-nuts.

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

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 lock-out and tag-out 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 comes out of 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 for obstruction.

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

7.2 Air only (no abrasive) comes out the nozzle

7.2.1 Abrasive metering valve may be closed or needs adjustment. Adjust the metering valve per 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 per Section 6.2.

7.2.5 Open the safety petcock on the metering valve and press the control handle. If air does not come out the petcock, check for blockage in the twinline hose to and from the control handle. If air does come out, the metering valve actuator section is not functioning. Refer to the metering valve manual for servicing the valve.

7.3 Heavy abrasive flow

7.3.1 Check that 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.

7.3.3 Check the abrasive metering valve and air valve for wear. Refer to the remote control manual for troubleshooting and servicing the remote system. If there is an internal leak in the air valve it will act as if the choke valve is partially closed.

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. See Section 4.1.

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

7.4.3 Abrasive metering valve may require service. Refer to the metering valve manual.

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 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.

7.5.2 Abrasive may be worn from recycling. Replace abrasive.

7.6 Blast machine will not pressurize

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

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

7.6.3 Dirty filter in moisture separator. Check filter element.

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

7.7 Lower chamber wont seal when upper chamber is depressurized

7.7.1 Upper chamber exhaust valve opened too slowly. Quickly open the exhaust valve. Air must exhaust rapidly from the upper chamber for the lower chamber pop-up valve to seal.

7.7.2 Exhaust muffler blocked Service muffler per Section 6.5.

7.8 Blasting does not start when the control handle is pressed

7.8.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

7.9 Blasting does not stop when the control handle is released

7.9.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

8.0 ACCESSORIES and REPLACEMENT PARTS

8.1 Optional Accessories

- (-) Cycle Timer kit
 - 120 volt AC02207
 - 12 volt DC03439
- (-) Safety cable, 3/4" to 1-1/2" ID blast hose15013

8.2 Abrasive Metering Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.3 Air Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.4 Exhaust Muffler, Figure 8

| 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 |

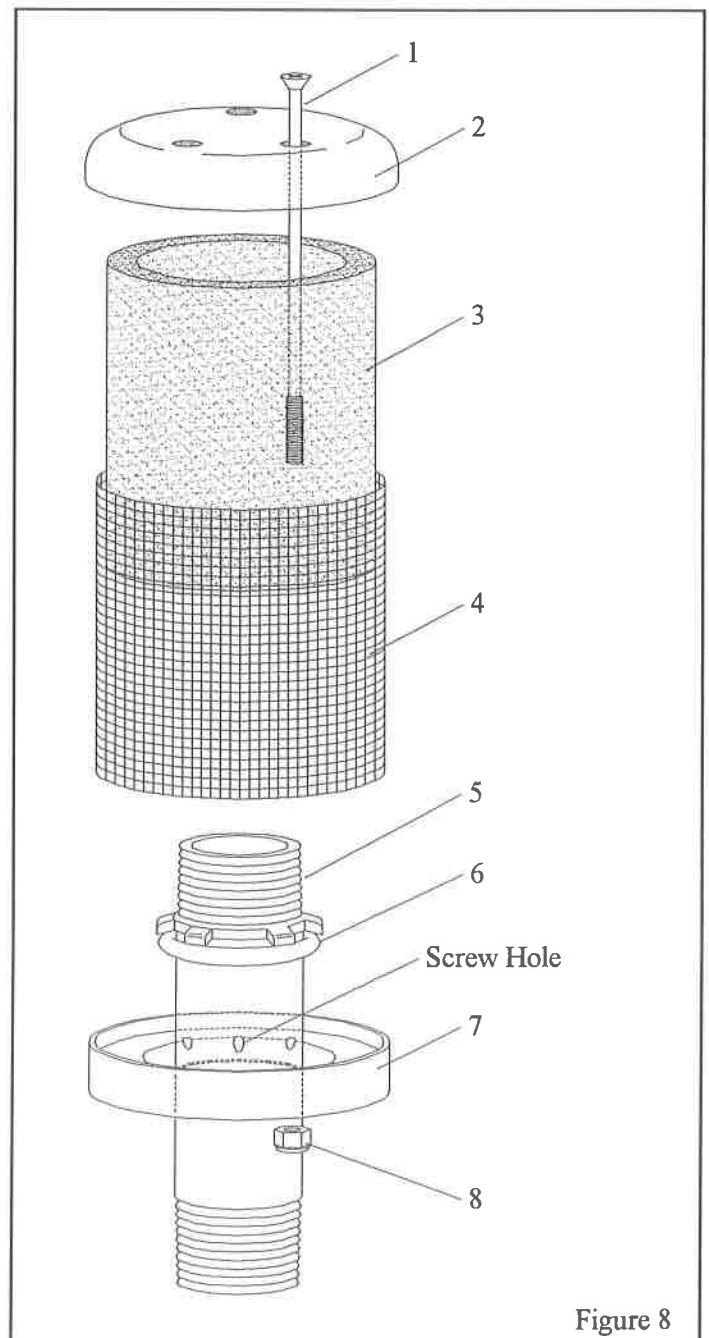


Figure 8

8.5 Blast Machine and Accessories, Figure 9

| Item | Description | Stock No. |
|------|---|-----------|
| 1. | Ball valve with handle, 1" | 02396 |
| 2. | Handle, 1" ball valve | 22531 |
| 3. | Ball valve with handle, 1-1/4" | 02397 |
| 4. | Handle, 1-1/4" ball valve | 22532 |
| 5. | Ball valve with handle, 2", dual outlet only .. | 02368 |
| 6. | Air valve, 1-1/4" (PVR pinch tube shown).... | 04320 |
| 7. | Check valve, 1" cone | 02087 |
| 8. | Check valve, 1-1/4" cone | 02088 |
| 9. | Compression coupling, 1-1/4" | 01857 |
| 10. | Gasket, 1-1/4" compression coupling | 01886 |
| 11. | Coupling, 1-1/4" CF | 00551 |
| 12. | Wye, 1-1/4" | 01818 |
| 13. | Leg pad, right | 03654 |
| 14. | Leg pad, left | 03655 |

| | | |
|-----|--|-------|
| 15. | Metering valve, (Sentinel shown) | 20608 |
| 16. | Gasket, CQG coupling, (package of 10) | 00850 |
| 17. | Balance tank, dual outlet only | 02365 |
| 18. | Wheel and tire, 400 x 16, each | 02338 |
| 19. | Axle, 24" dia. machine | 02403 |
| 20. | Retaining ring, 1" | 03824 |
| 21. | Thrust washer, 1" | 03825 |
| 22. | Inspection door assembly, 6" x 8" | 02377 |
| 23. | Gasket, 6" x 8" inspection door | 02369 |
| 24. | Seat, pop-up, gum rubber, standard use | 02325 |
| 25. | Seat, pop-up, neoprene, for hot climates | 02380 |
| 26. | Muffler, exhaust | 05068 |
| 27. | Pop-up valve, 4" with external sleeve | 03699 |
| 28. | Internal pop-up guide, 4-1/2" toe nipple | 21694 |
| 29. | Umbrella, optional, 4" bolt-on | 02318 |
| 30. | Cover, optional, 24" diameter | 02336 |
| 31. | Screen, optional, 24" recessed type | 03100 |
| 32. | Lock pin, coupling (package of 25) | 11203 |

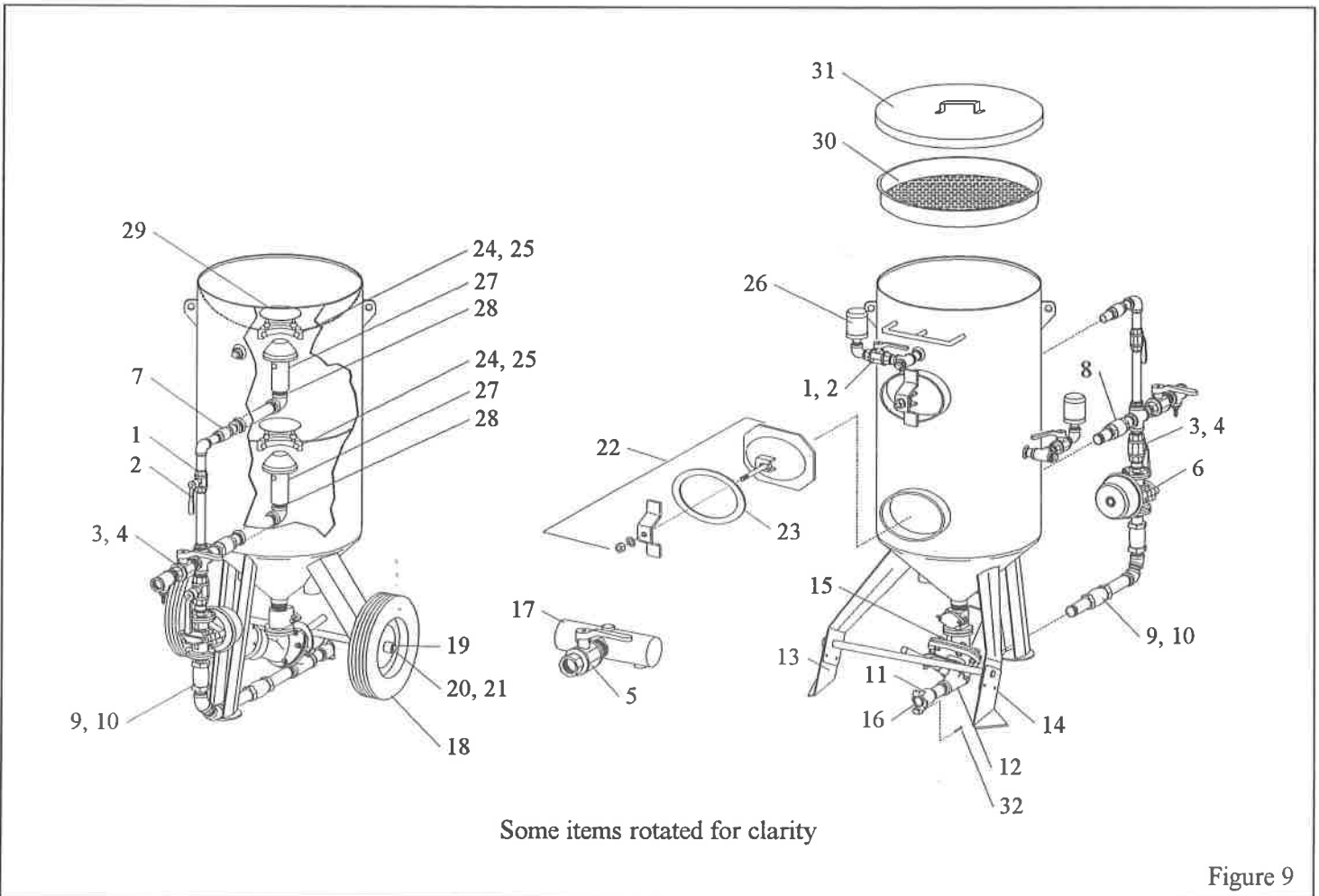


Figure 9

**DUAL CHAMBER BLAST MACHINE
WITH REMOTE CONTROL
O.M. 23063**

MC FILE NUMBER: 2131-04/01

DATE OF ISSUE: 04/03/01

REVISION:

 WARNING

Do not proceed with these instructions until you have READ the orange cover of this MANUAL and YOU UNDERSTAND its content.* 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 Parts and Maintenance Guide refer to the orange warnings insert preceding the Index before continuing with the following instructions.**

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1.0 INTRODUCTION

1.1 Scope

1.1.1 These instructions cover the set-up, operation, maintenance, troubleshooting, and replacement parts for Clemco dual chamber (continuous-action) blast machines with pressure-hold remote controls.

1.1.2 OSHA requires remote controls (valves that start and stop the blast process from a control at the nozzle) on all blast machines when a blast operator commands the nozzle. The remote control metering valve and air valve may vary from those shown in Figure 1. Some general remote control operating instructions are included in the text of this manual. These "BASIC" instructions are included for clarity. Separate owner manuals are provided, that includes operating instructions of the remote controls and control handle supplied with the machine. To ensure safe blasting, before using the machine, read the manuals for the remotes controls, control handle, and all accessories to be used.

1.1.3 These instructions also contain important information required for safe operation of the machine. 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. 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.

1.1.4 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" (Stock No. 22090) is included with every blast machine, and contains important safety information about abrasive blasting that may not be included in equipment operation manuals. Additional copies are available from Clemco Industries. Spanish translations (Stock No. 22931) are available on request.

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.

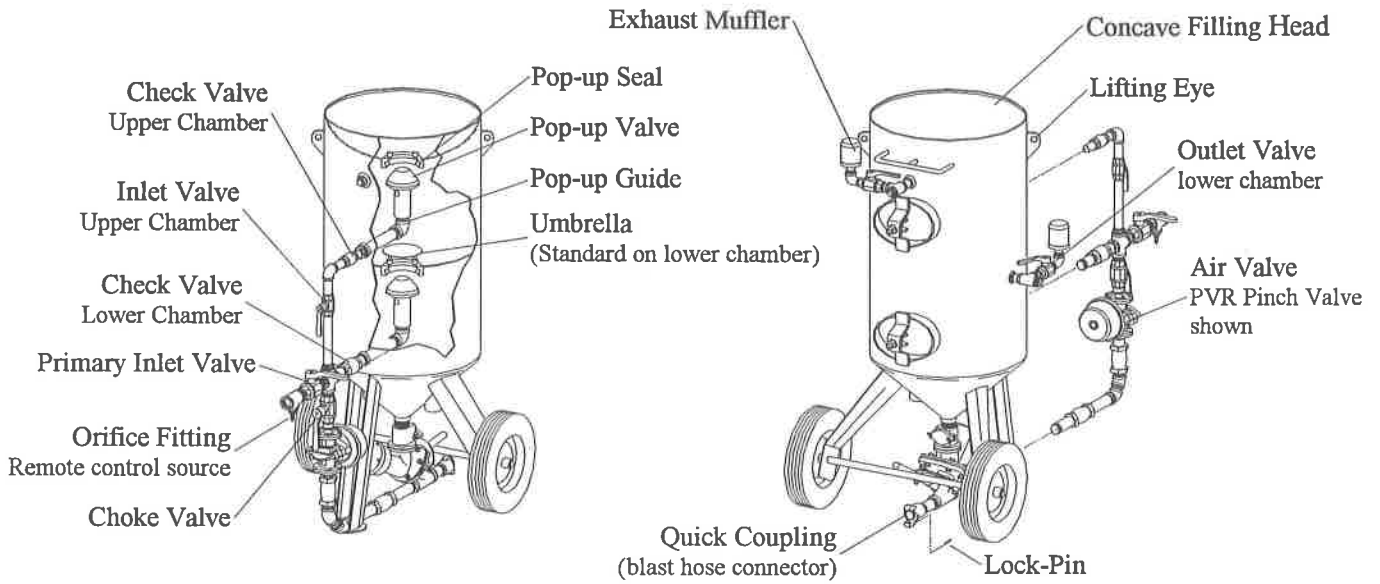
⚠ DANGER

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

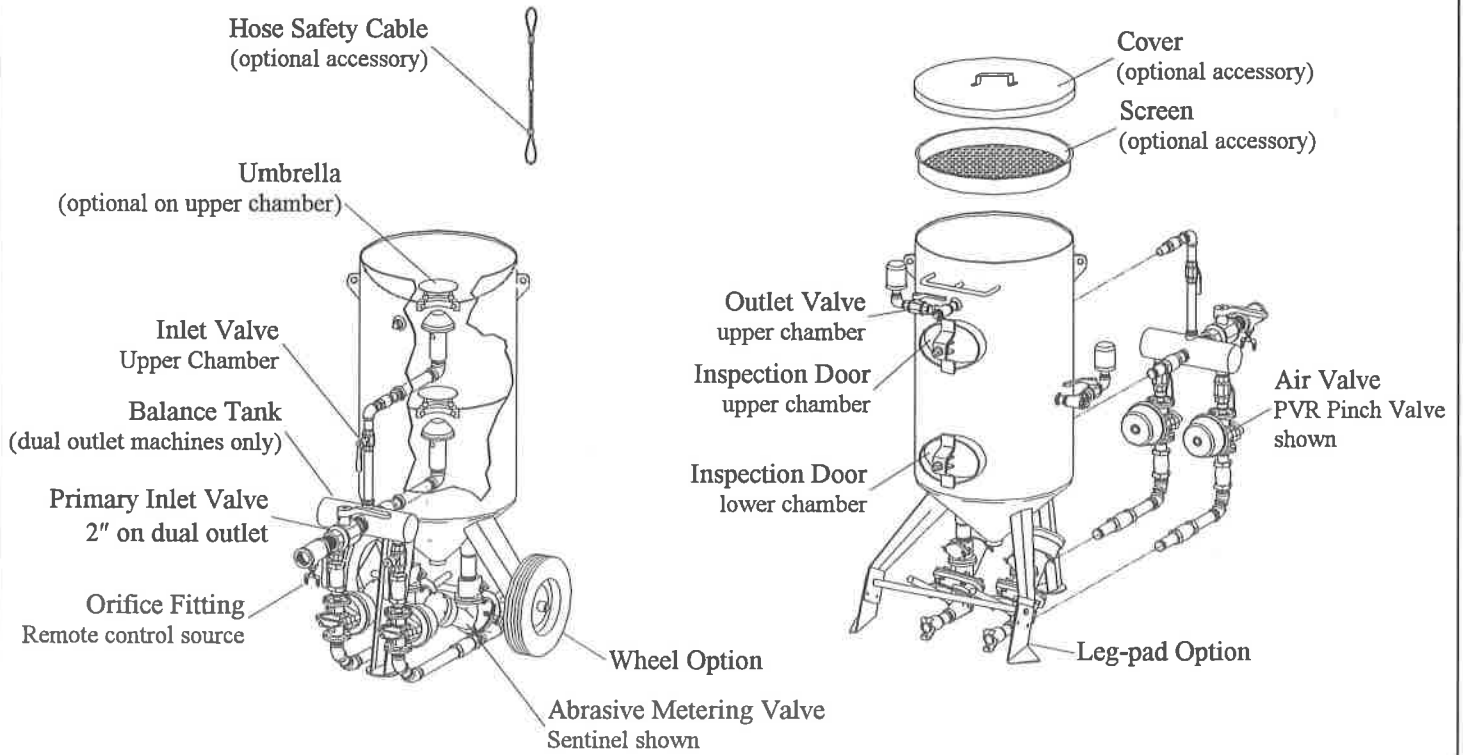
1.3 Description

1.3.1 The primary components of the blast machine are shown in Figure 1. They may be plumbed with a single outlet, for one operator, or dual outlets, for two operators. The pressurization and depressurization of the blast machine is done manually, by opening and closing hand operated valves. Blasting is controlled by the operator, from the nozzle, by use of remote controls. The dual chambers enable filling and refilling the upper chamber with abrasive while blasting continues from the lower chamber.

1.3.2 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.



Dual Chamber Shown With Single Outlet



Dual Chamber Shown With Dual Outlets

Figure 1

⚠ 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.

1.3.3 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.

1.3.4 This blast machine is rated for a maximum of 125 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.

1.3.5 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 Remote Controls

1.4.1 The remote control system is an OSHA-required safety device. The control handle, located near the blast nozzle, is the activator for the remote control system. Blasting stops when the operator intentionally or unintentionally removes hand-held pressure from the remote control handle. 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, the remote controls stops the blast process.

⚠ WARNING

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

1.4.2 Most remote controls used with dual chamber machines are pressure-hold type. The instructions in this manual cover general operating instructions for pressure-hold systems. In some cases pressure-release remote controls are used with single outlet, dual chamber machines. In either case, separate operating instructions are provided for the remote controls furnished on the machine. Refer to the remote control manual, and control handle manual for detailed set-up and operating instructions.

Pressure-Hold System: Blasting does not start and stop with pressurization and depressurization of the blast machine. Using hand operated inlet and outlet valves, the operator manually pressurizes and depressurizes the blast machine. Although the machine may be under pressure, blasting does not begin, because a normally closed air valve prevents air flow, and a normally closed abrasive valves prevents abrasive flow. When the operator presses the control handle, the valves open, and blasting begins. Pressure remains in the blast machine until it is manually depressurized. All remote controls on multiple outlet machines must be pressure-hold controls.

Pressure-Release Systems: Blasting starts and stops with pressurization and depressurization of the machine. When this system is used with a dual chamber machine, the controls operate the lower chamber only.

2.0 INITIAL SET-UP

2.1 Storage Hopper

2.1.1 When a storage hopper is installed above the blast machine, an umbrella is required above the upper chamber pop-up opening. See Section 8.2 for optional bolt-on umbrella.

2.2 Blast Machine Set-Up

⚠ WARNING

Exhaust mufflers are installed on this machine. 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.

Note: Dual chamber machines demand high volumes of compressed air when the upper chamber is cycled, or when the machine is furnished with dual outlets. Installing a receiver tank sized to the cfm requirements shown in the table in Figure 2, reduces the chance of abrasive surging and air-flow problems when cycling the upper chamber or second outlet.

2.2.1 Install an optional filter/moisture separator in front of the primary inlet valve. The filter is recommended at this location to remove moisture from air before it enters the machine. The filter must be capable of supporting the cfm as noted in the table in Figure 2.

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

2.2.3 Refer to the remote control owners manual for set-up and operation of the remote controls.

3.0 OPERATION

3.1 Transporting and moving

3.1.1 Transporting a blast machine

⚠ WARNING

- 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.
- Failure to observe these warnings could result in serious injury or death.

3.1.1.1 Use lifting eyes when moving, or loading and unloading the blast machine. Do not use a sling around the handle or piping.

3.1.1.2 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 dual chamber blast machine when it contains abrasive.
- 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.
- Do not tilt the machine on its wheels, or attempt to move the machine in hand-truck manner. Even an empty machine is too heavy to maneuver that way. The wheels are there to help maneuver an empty, upright machine into its final position.

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

3.1.2.2 Slide the machine by pushing it toward the wheels. Do not back-up while moving the machine, as potential tripping hazards cannot be seen.

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 See the compressed air and abrasive consumption table in Figure 2 for approximate air and abrasive consumption per nozzle. Connect an air line from the compressor to the air supply hose connector installed on the blast machine primary inlet. For best blasting performance, use at least the size of air line shown in the table in Figure 3. Smaller diameter hose or any restriction in the air line will cause abrasive fluctuation, particularly when the upper chamber is cycled.

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

disconnection. Lock pins and safety cables are listed in Sections 8.1 and 8.2.

| Nozzle Size | Number of Nozzles | CFM@125 psi | | Minimum Air Line ID |
|-------------|-------------------|-------------|------|---------------------|
| | | New | Worn | |
| 5/16" | 1 | 170 to 240 | | 1-1/2" |
| 5/16" | 2 | 340 to 480 | | 2" |
| 3/8" | 1 | 240 to 315 | | 2" |
| 3/8" | 2 | 480 to 630 | | 2-1/2" |
| 7/16" | 1 | 315 to 410 | | 2" |
| 7/16" | 2 | 630 to 820 | | 2-1/2" |
| 1/2" | 1 | 410 to 520 | | 2-1/2" |
| 1/2" | 2 | 820 to 1040 | | 3" |

Minimum ID air line recommendations for multiple nozzles. CFM shown is the approximate cfm required at 125 psi when the nozzle is new, and when worn. A nozzle is considered worn when the orifice is 1/16" larger than its original size.

Figure 3

⚠ WARNING

Where two or more blast machines (or multiple nozzles) are used, care must be taken when tracing and connecting control lines and blast hoses. Cross connecting control hose or blast hose could lead to serious injury, death, or property damage from unintentional actuation of a blast machine. To prevent cross connections, hoses should be of equal lengths, and the hoses and blast machine couplings clearly marked. Use optional hose identification kits, part no. 15890 for use with two blast machines (nozzle), or part no. 15891 for up to four machines. Mark each hose and connection per the instructions supplied with the kit, and carefully trace and verify each connection before operating.

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 blast hose and compressed-air supply hose connections are secured with safety locks and safety cables to prevent accidental separation or

⚠ 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.

3.2.5 Connect the ends of the remote control twinline hose to the fittings on the valves as described in the remote control manuals. Check that all fittings are tight. Leaks will cause the system to malfunction.

3.2.6 Close the primary inlet valve and upper chamber inlet valve. The valves are closed when the handle is perpendicular to the valve.

3.2.7 Check that the outlet valves and choke valve(s) (two on dual outlet machines) are open. The valves are open when the handle is in-line with the piping.

3.2.8 Close the abrasive metering valve(s) (two on dual outlet machines). The closed position for the Sentinel metering valve is when the handle is fully right. The closed position for the optional knob type valves is when the metering knob is turned fully clockwise.

3.2.9 Open the remote control safety petcock(s) (two on dual outlet machines), and check the control handles per instructions in the remote control and control handle manuals.

3.2.10 Close the compressor's air valve. Start the compressor, and bring it up to operating temperature and pressure. The pressure must not exceed 125 psi.

3.2.11 Load abrasive into the machine by following the instructions in Section 3.7.

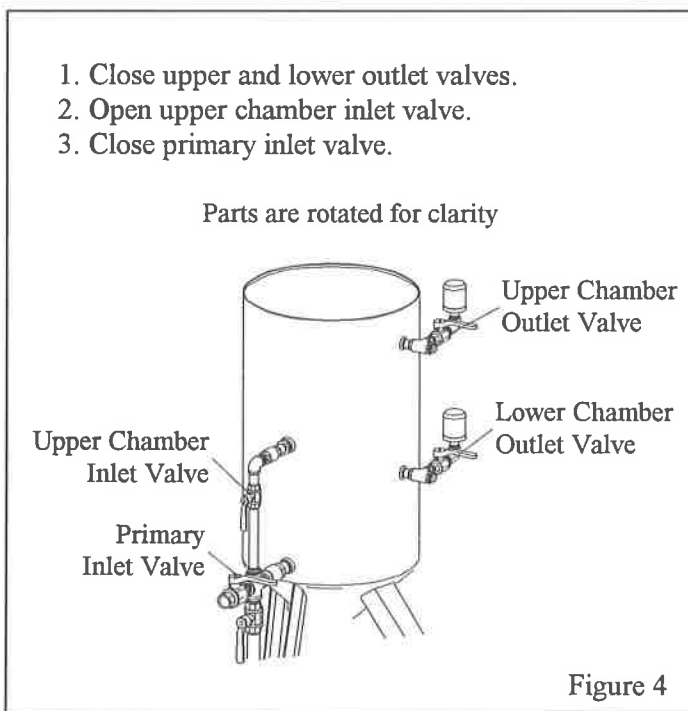
3.3 Pressurize The Machine

3.3.1 Do not allow anyone 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 tender may pressurize or depressurize the machine at any time. Noise, from the sudden release of compressed air, or abrasive venting under pressure could result in injury. The machine tender must wear a suitable, approved respirator, plus approved eye, face, and hearing protection.

3.3.2 Position the inlet and outlet valves as shown in Figure 4.



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

3.3.4 While standing back and facing away from the concave filling head, open the primary inlet valve. This action causes the upper chamber pop-up valve to seal-off the filling port, pressurizes the machine, and begins the blast process.

3.4 Blasting

3.4.1 When the blast operator is ready to blast, either the operator or the machine tender closes the remote

control safety petcock. Closing the petcock prepares the machine for remote operation and activation by the control handle.

⚠ 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.

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

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

3.4.2 Operators must wear appropriate protective gear, including: abrasive-resistant clothing, leather gloves, eye and hearing protection, and a NIOSH-approved Type CE Supplied-Air Respirator.

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

3.4.4 Pull back 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).

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

3.4.6 Adjust abrasive flow per Section 4.1.

3.5 Stop Blasting

3.5.1 To stop blasting, release the control handle lever.

3.5.2 When the control handle lever is released, the control handle safety lever will flip up to lock the handle lever in the up (no blast) position.

3.5.3 Make sure that the control handle safety lever lock is up, and that it prevents the handle lever from engaging.

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

⚠ WARNING

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

3.6 Depressurize the machine

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

3.7 Loading Abrasive into the Blast Machine
See Section 3.9 for automatic refilling.**⚠ WARNING**

Obtain a material safety data sheet (MSDS) 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.

NOTE: Use only abrasive specifically manufactured for blast cleaning, and that is 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 surface being blasted.

3.7.1 Stop blasting per Section 3.5, or depressurize the upper chamber per Section 3.8.

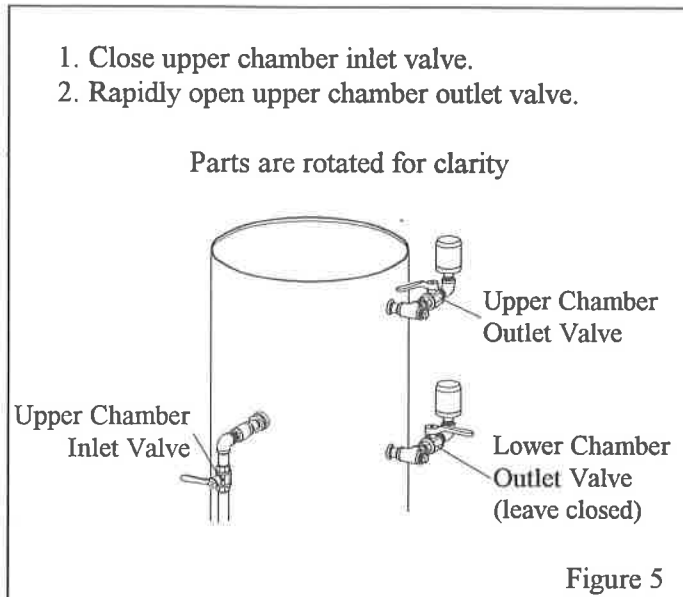
3.7.2 Load abrasive into the machine by pouring it into the concave head. Using an optional screen, placed over the head, prevents large objects from falling inside. A screen is recommended to keep objects such as pieces of abrasive bags and rocks from falling into the machine. Foreign objects will jam 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.

3.7.3 Pressurize the machine per Section 3.3 or pressurize the upper chamber per Section 3.8.

3.8 Cycling the Upper Chamber (refilling the upper chamber while blasting from the lower chamber). Ref. Figure 5. See Section 3.9 for automatic refilling.

3.8.1 During blasting, and after approximately one-half of the abrasive in the machine has been used, close the upper chamber inlet valve, and while standing back and facing away from the concave head and exhaust muffler, "quickly" open the upper chamber outlet valve. **NOTE: Air must exhaust rapidly from the upper chamber in order for the lower chamber pop-up valve**

to seal. The upper pop-up valve automatically drops when air is expelled from the upper chamber. Blasting continues from the lower chamber.



3.8.2 Load abrasive into the upper chamber per Section 3.7.

3.8.3 Pressurize the upper chamber, by closing the upper chamber outlet valve and opening the upper chamber inlet valve. When pressure in the upper and lower chambers equalize, the lower chamber pop-up valve drops, refilling the lower chamber with abrasive.

3.8.4 Repeat the process for continuous-action blasting.

3.9 Automatic Refilling

3.9.1 For hopper-fed machines, refilling can be accomplished automatically with a cycle timer. See Accessories in Section 8.1. Hopper-fed machines must have an umbrella mounted above the upper chamber pop-up opening. See Section 8.2 for bolt-on umbrella.

3.10 Emptying the Machine of Abrasive

3.10.1 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:

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

3.10.3 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.

3.10.4 Pressurize the machine.

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

3.10.6 Hold the hose securely (do not leave the hose unattended), and activate the control handle. Be prepared for surging or recoil of the hose, which can be severe.

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

3.10.8 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.

3.11 Shutdown

3.11.1 Ensure that the blast machine is depressurized.

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

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

3.11.4 Shutdown the compressor.

3.11.5 Cover the machine when not in use.

4.0 ADJUSTMENTS

4.1 Abrasive Metering Valve

NOTE: These instructions are for the Sentinel metering valve. Optional metering valves may function differently, but the process is similar.

4.1.1 Begin adjustments with the metering valve closed. Closed is when the handle is fully right.

4.1.2 While the operator is blasting, the machine tender increases abrasive flow by slowly moving the handle to the left, no more than 1/4" at a time, allowing time for the flow to stabilize before further adjusting.

4.1.3 Optimum abrasive flow depends on the type and size of abrasive and the 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. The stream of abrasive coming out of the nozzle should barely discolor the air when seen against a contrasting background.

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

5.0 PREVENTIVE MAINTENANCE

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

5.1 Daily Inspection

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

- Inspect the blast hose for wear; look for soft spots. If the hose has soft spots, the hose is worn and must be replaced.

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.

- Inspect the RLX Control Handle

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:

- 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 don't 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 moisture separator is used, inspect the filter element, and clean the bowl.

5.2.2 After blasting do 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 6.5.

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 6.3.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. See Section 6.4.

6.0 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.

6.1 Removing damp abrasive from the blast machine.

6.1.1 To clear a minor blockage caused from 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 for obstructions in the metering valve.

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

6.1.4 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.

6.1.5 Close the choke valve and fully open the abrasive metering valve.

6.1.6 Pressurize the machine and activate the control handle to force out damp abrasive.

6.1.7 When the obstruction has been removed, release the control handle and 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 and activate the control handle to clear the hose. When the hose is cleared, release the handle and 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. 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 erode nozzle threads. A loose fitting nozzle may eject under pressure and could cause severe injury.

6.1.8 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 3.10.

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

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

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

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

6.2.6 Make sure the inspection door gasket is in good condition, and in place before 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 compressed air supply.

6.3 Replacing the Pop-Up Valve, Figure 6

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

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

6.3.3 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.

6.3.4 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.

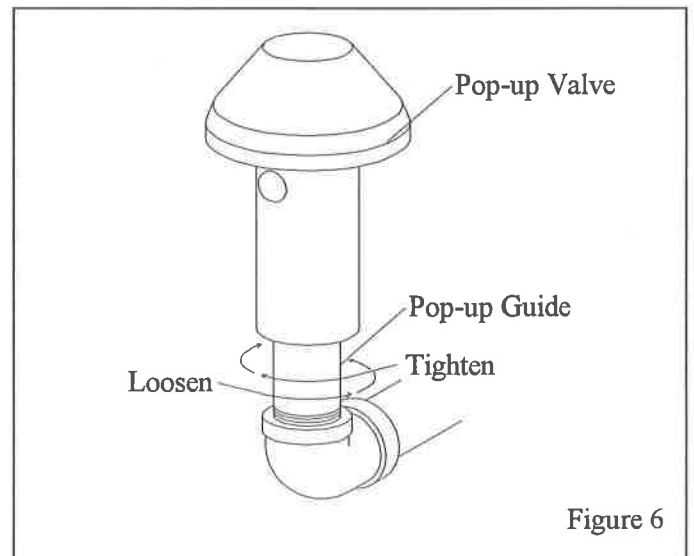
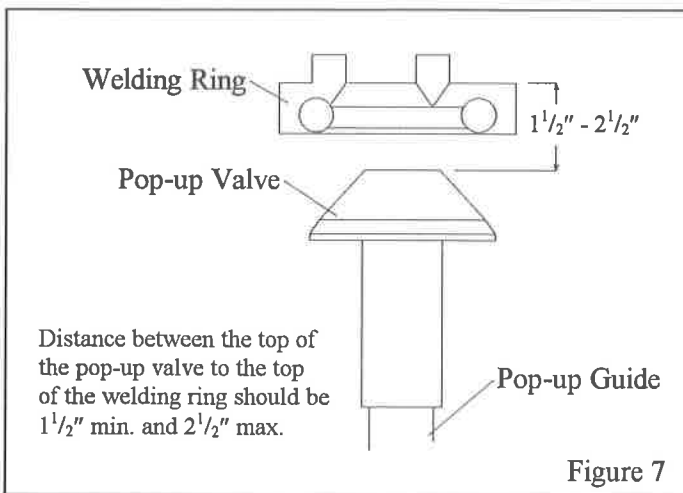


Figure 6

6.3.5 Slide the new pop-up valve over the guide, 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.

6.3.6 Refer to Figure 7 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.



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

6.4 Replacing the Pop-Up Seal

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

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

6.4.3 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.

6.5 Exhaust Muffler, Figure 8

⚠ 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.

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

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

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

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

6.5.5 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.

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

6.5.7 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 8.

6.5.8 Firmly tighten the lock-nuts.

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

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 lock-out and tag-out 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 comes out of 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 for obstruction.

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

7.2 Air only (no abrasive) comes out the nozzle

7.2.1 Abrasive metering valve may be closed or needs adjustment. Adjust the metering valve per 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 per Section 6.2.

7.2.5 Open the safety petcock on the metering valve and press the control handle. If air does not come out the petcock, check for blockage in the twinline hose to and from the control handle. If air does come out, the metering valve actuator section is not functioning. Refer to the metering valve manual for servicing the valve.

7.3 Heavy abrasive flow

7.3.1 Check that 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.

7.3.3 Check the abrasive metering valve and air valve for wear. Refer to the remote control manual for troubleshooting and servicing the remote system. If there is an internal leak in the air valve it will act as if the choke valve is partially closed.

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. See Section 4.1.

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

7.4.3 Abrasive metering valve may require service. Refer to the metering valve manual.

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 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.

7.5.2 Abrasive may be worn from recycling. Replace abrasive.

7.6 Blast machine will not pressurize

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

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

7.6.3 Dirty filter in moisture separator. Check filter element.

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

7.7 Lower chamber wont seal when upper chamber is depressurized

7.7.1 Upper chamber exhaust valve opened too slowly. Quickly open the exhaust valve. Air must exhaust rapidly from the upper chamber for the lower chamber pop-up valve to seal.

7.7.2 Exhaust muffler blocked Service muffler per Section 6.5.

7.8 Blasting does not start when the control handle is pressed

7.8.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

7.9 Blasting does not stop when the control handle is released

7.9.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

8.0 ACCESSORIES and REPLACEMENT PARTS

8.1 Optional Accessories

- (-) Cycle Timer kit
 - 120 volt AC02207
 - 12 volt DC03439
- (-) Safety cable, 3/4" to 1-1/2" ID blast hose15013

8.2 Abrasive Metering Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.3 Air Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.4 Exhaust Muffler, Figure 8

| 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 |

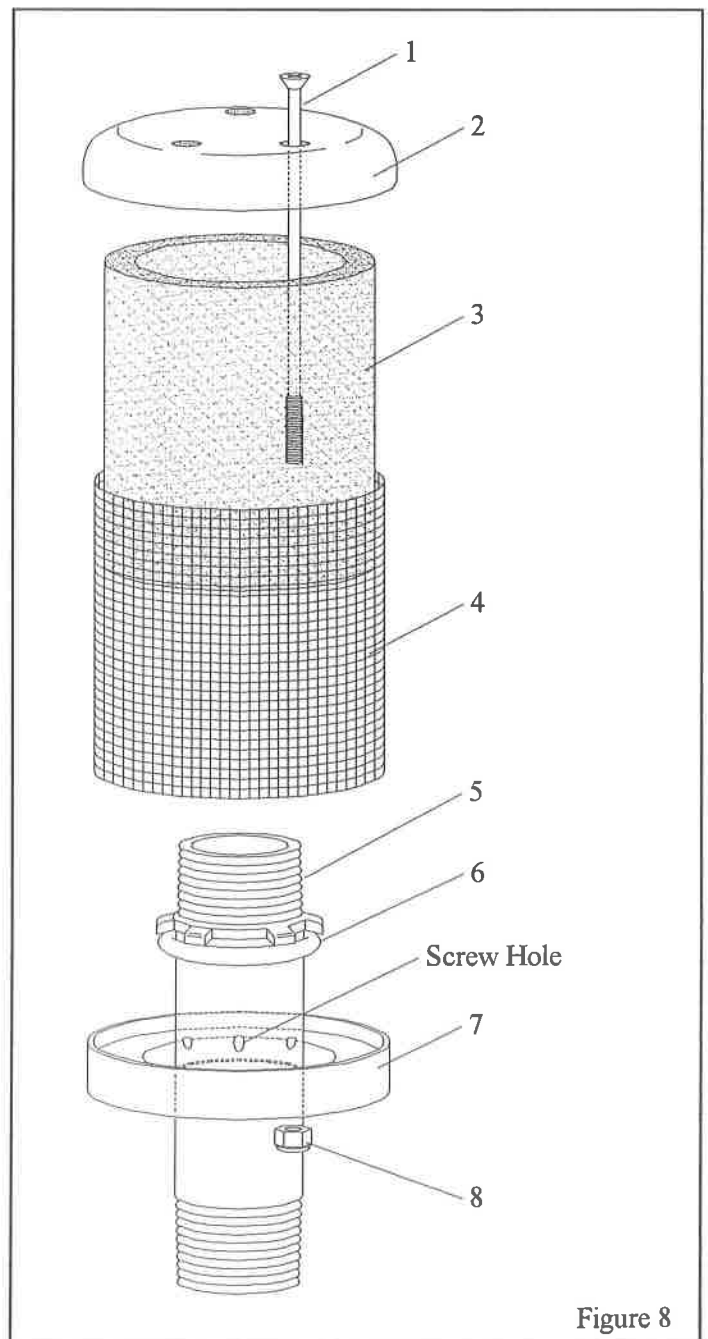


Figure 8

8.5 Blast Machine and Accessories, Figure 9

| Item | Description | Stock No. |
|------|---|-----------|
| 1. | Ball valve with handle, 1" | 02396 |
| 2. | Handle, 1" ball valve | 22531 |
| 3. | Ball valve with handle, 1-1/4" | 02397 |
| 4. | Handle, 1-1/4" ball valve | 22532 |
| 5. | Ball valve with handle, 2", dual outlet only .. | 02368 |
| 6. | Air valve, 1-1/4" (PVR pinch tube shown)... | 04320 |
| 7. | Check valve, 1" cone | 02087 |
| 8. | Check valve, 1-1/4" cone | 02088 |
| 9. | Compression coupling, 1-1/4" | 01857 |
| 10. | Gasket, 1-1/4" compression coupling | 01886 |
| 11. | Coupling, 1-1/4" CF | 00551 |
| 12. | Wye, 1-1/4" | 01818 |
| 13. | Leg pad, right | 03654 |
| 14. | Leg pad, left | 03655 |

| | | |
|-----|--|-------|
| 15. | Metering valve, (Sentinel shown) | 20608 |
| 16. | Gasket, CQG coupling, (package of 10) | 00850 |
| 17. | Balance tank, dual outlet only | 02365 |
| 18. | Wheel and tire, 400 x 16, each | 02338 |
| 19. | Axle, 24" dia. machine | 02403 |
| 20. | Retaining ring, 1" | 03824 |
| 21. | Thrust washer, 1" | 03825 |
| 22. | Inspection door assembly, 6" x 8" | 02377 |
| 23. | Gasket, 6" x 8" inspection door | 02369 |
| 24. | Seat, pop-up, gum rubber, standard use | 02325 |
| 25. | Seat, pop-up, neoprene, for hot climates | 02380 |
| 26. | Muffler, exhaust | 05068 |
| 27. | Pop-up valve, 4" with external sleeve | 03699 |
| 28. | Internal pop-up guide, 4-1/2" toe nipple | 21694 |
| 29. | Umbrella, optional, 4" bolt-on | 02318 |
| 30. | Cover, optional, 24" diameter | 02336 |
| 31. | Screen, optional, 24" recessed type | 03100 |
| 32. | Lock pin, coupling (package of 25) | 11203 |

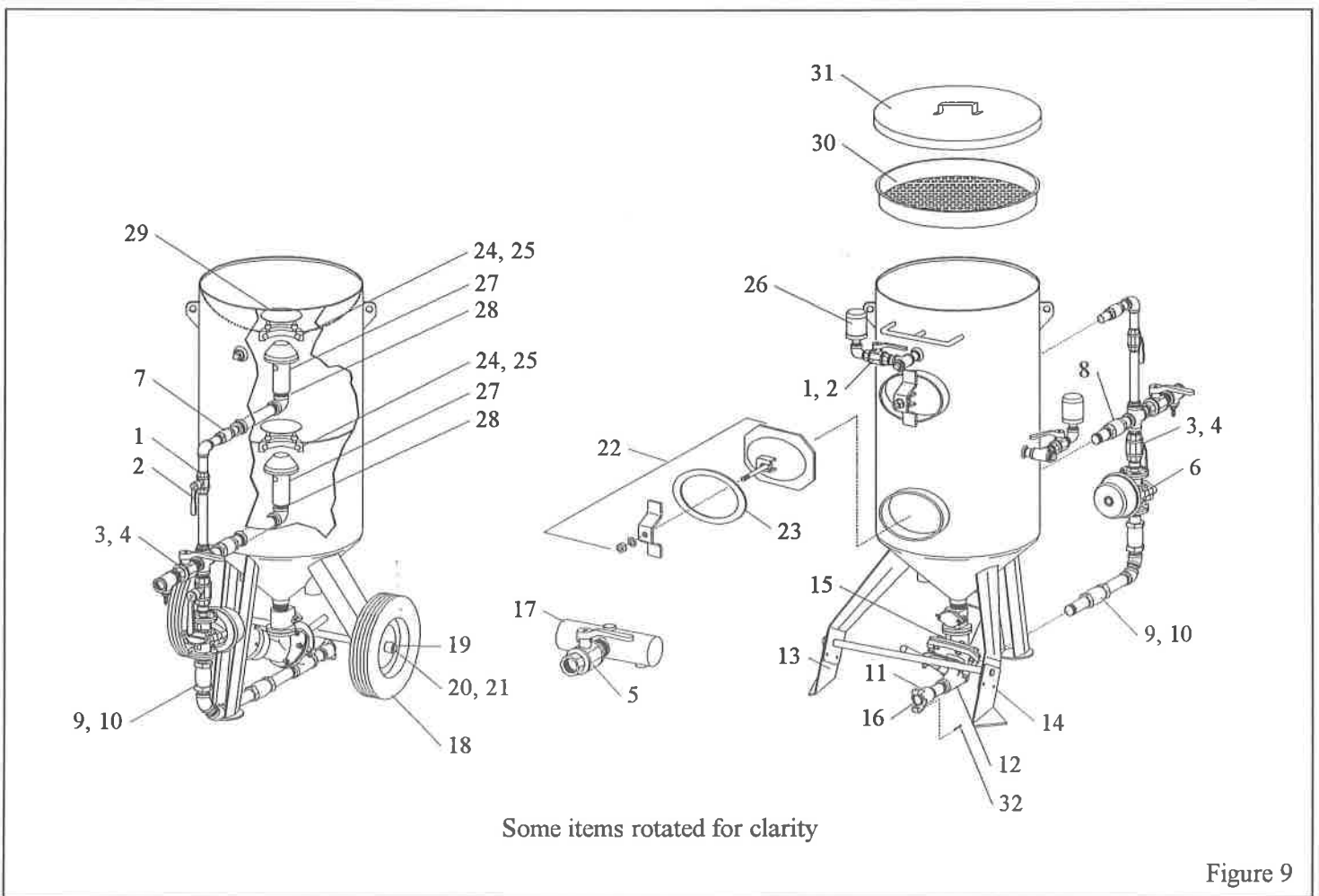


Figure 9

**DUAL CHAMBER BLAST MACHINE
WITH REMOTE CONTROL
O.M. 23063**

**MC FILE NUMBER: 2131-04/01
DATE OF ISSUE: 04/03/01
REVISION:**

 WARNING

Do not proceed with these instructions until you have READ the orange cover of this MANUAL and YOU UNDERSTAND its content.* 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 Parts and Maintenance Guide refer to the orange warnings insert preceding the Index before continuing with the following instructions.**

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1.0 INTRODUCTION

1.1 Scope

1.1.1 These instructions cover the set-up, operation, maintenance, troubleshooting, and replacement parts for Clemco dual chamber (continuous-action) blast machines with pressure-hold remote controls.

1.1.2 OSHA requires remote controls (valves that start and stop the blast process from a control at the nozzle) on all blast machines when a blast operator commands the nozzle. The remote control metering valve and air valve may vary from those shown in Figure 1. Some general remote control operating instructions are included in the text of this manual. These "BASIC" instructions are included for clarity. Separate owner manuals are provided, that includes operating instructions of the remote controls and control handle supplied with the machine. To ensure safe blasting, before using the machine, read the manuals for the remotes controls, control handle, and all accessories to be used.

1.1.3 These instructions also contain important information required for safe operation of the machine. 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. 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.

1.1.4 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" (Stock No. 22090) is included with every blast machine, and contains important safety information about abrasive blasting that may not be included in equipment operation manuals. Additional copies are available from Clemco Industries. Spanish translations (Stock No. 22931) are available on request.

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.

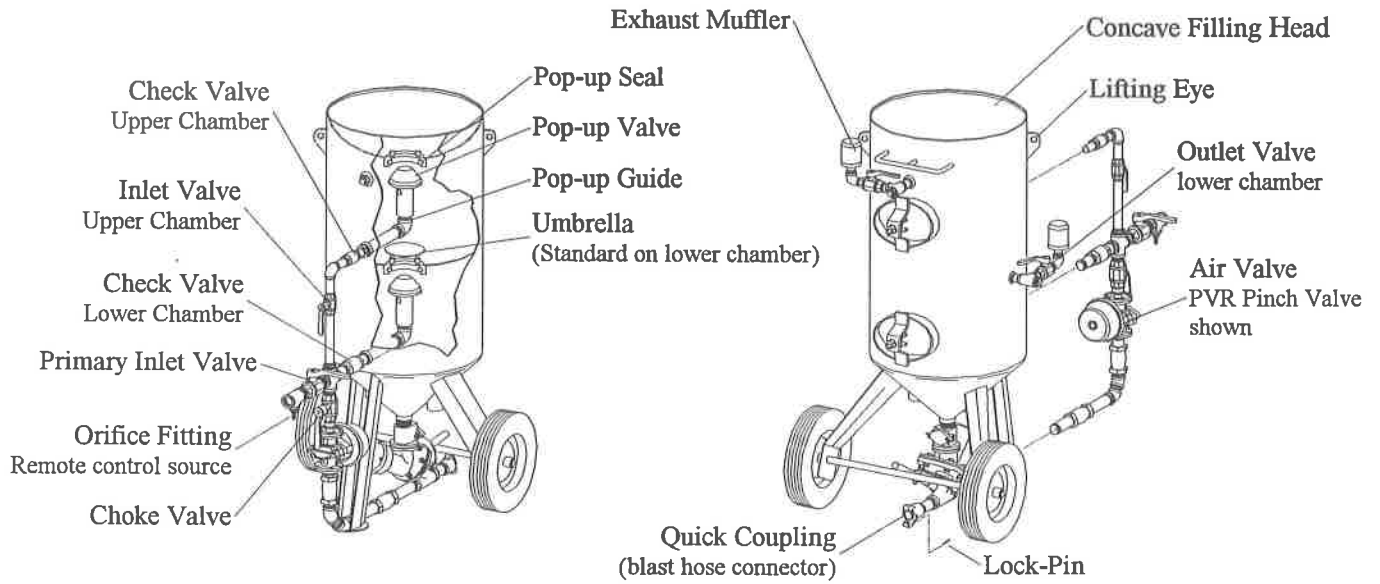
⚠ DANGER

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

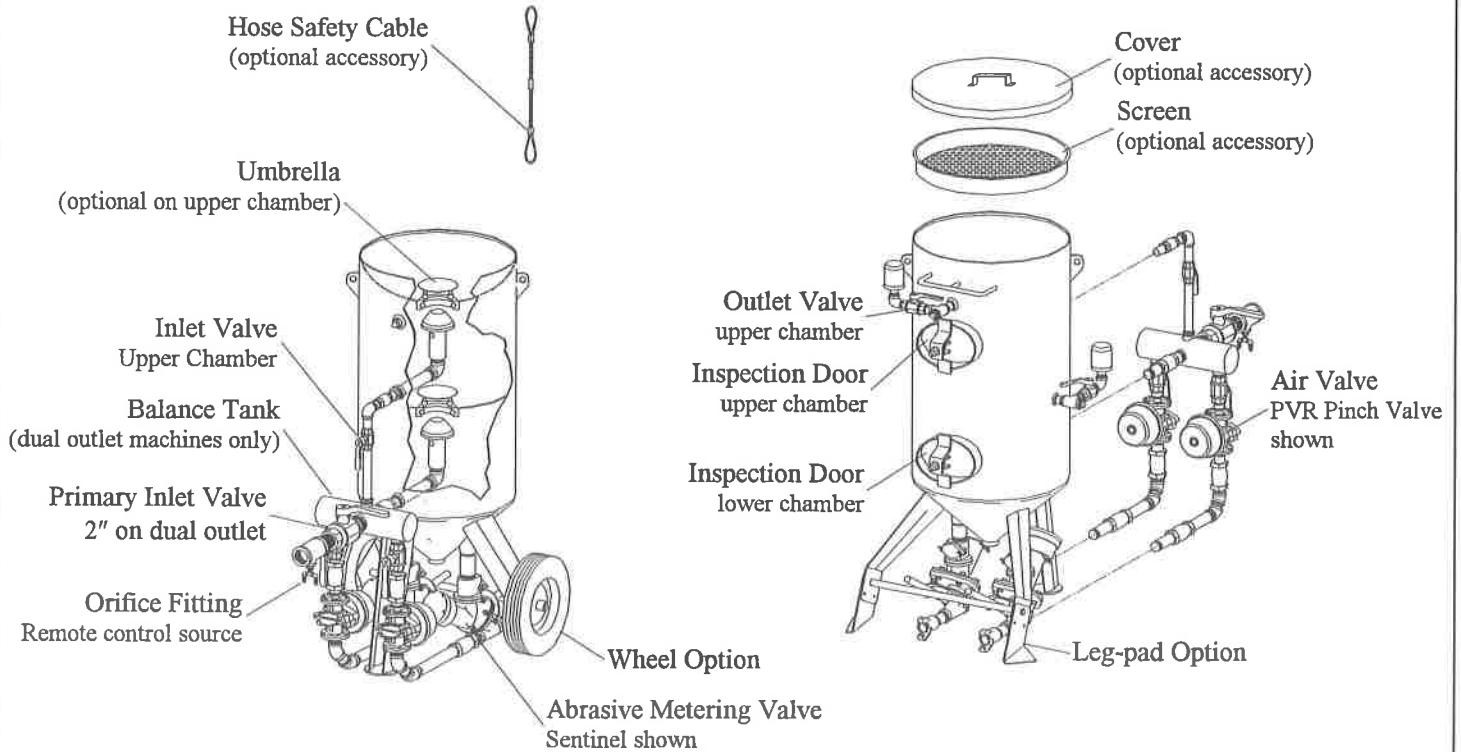
1.3 Description

1.3.1 The primary components of the blast machine are shown in Figure 1. They may be plumbed with a single outlet, for one operator, or dual outlets, for two operators. The pressurization and depressurization of the blast machine is done manually, by opening and closing hand operated valves. Blasting is controlled by the operator, from the nozzle, by use of remote controls. The dual chambers enable filling and refilling the upper chamber with abrasive while blasting continues from the lower chamber.

1.3.2 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.



Dual Chamber Shown With Single Outlet



Dual Chamber Shown With Dual Outlets

Figure 1

⚠ 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.

1.3.3 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.

1.3.4 This blast machine is rated for a maximum of 125 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.

1.3.5 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 Remote Controls

1.4.1 The remote control system is an OSHA-required safety device. The control handle, located near the blast nozzle, is the activator for the remote control system. Blasting stops when the operator intentionally or unintentionally removes hand-held pressure from the remote control handle. 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, the remote controls stops the blast process.

⚠ WARNING

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

1.4.2 Most remote controls used with dual chamber machines are pressure-hold type. The instructions in this manual cover general operating instructions for pressure-hold systems. In some cases pressure-release remote controls are used with single outlet, dual chamber machines. In either case, separate operating instructions are provided for the remote controls furnished on the machine. Refer to the remote control manual, and control handle manual for detailed set-up and operating instructions.

Pressure-Hold System: Blasting does not start and stop with pressurization and depressurization of the blast machine. Using hand operated inlet and outlet valves, the operator manually pressurizes and depressurizes the blast machine. Although the machine may be under pressure, blasting does not begin, because a normally closed air valve prevents air flow, and a normally closed abrasive valves prevents abrasive flow. When the operator presses the control handle, the valves open, and blasting begins. Pressure remains in the blast machine until it is manually depressurized. All remote controls on multiple outlet machines must be pressure-hold controls.

Pressure-Release Systems: Blasting starts and stops with pressurization and depressurization of the machine. When this system is used with a dual chamber machine, the controls operate the lower chamber only.

2.0 INITIAL SET-UP

2.1 Storage Hopper

2.1.1 When a storage hopper is installed above the blast machine, an umbrella is required above the upper chamber pop-up opening. See Section 8.2 for optional bolt-on umbrella.

2.2 Blast Machine Set-Up

⚠ WARNING

Exhaust mufflers are installed on this machine. 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.

Note: Dual chamber machines demand high volumes of compressed air when the upper chamber is cycled, or when the machine is furnished with dual outlets. Installing a receiver tank sized to the cfm requirements shown in the table in Figure 2, reduces the chance of abrasive surging and air-flow problems when cycling the upper chamber or second outlet.

2.2.1 Install an optional filter/moisture separator in front of the primary inlet valve. The filter is recommended at this location to remove moisture from air before it enters the machine. The filter must be capable of supporting the cfm as noted in the table in Figure 2.

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

2.2.3 Refer to the remote control owners manual for set-up and operation of the remote controls.

3.0 OPERATION

3.1 Transporting and moving

3.1.1 Transporting a blast machine

⚠ WARNING

- 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.
- Failure to observe these warnings could result in serious injury or death.

3.1.1.1 Use lifting eyes when moving, or loading and unloading the blast machine. Do not use a sling around the handle or piping.

3.1.1.2 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 dual chamber blast machine when it contains abrasive.
- 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.
- Do not tilt the machine on its wheels, or attempt to move the machine in hand-truck manner. Even an empty machine is too heavy to maneuver that way. The wheels are there to help maneuver an empty, upright machine into its final position.

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

3.1.2.2 Slide the machine by pushing it toward the wheels. Do not back-up while moving the machine, as potential tripping hazards cannot be seen.

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 See the compressed air and abrasive consumption table in Figure 2 for approximate air and abrasive consumption per nozzle. Connect an air line from the compressor to the air supply hose connector installed on the blast machine primary inlet. For best blasting performance, use at least the size of air line shown in the table in Figure 3. Smaller diameter hose or any restriction in the air line will cause abrasive fluctuation, particularly when the upper chamber is cycled.

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

| Nozzle Size | Number of Nozzles | CFM@125 psi | | Minimum Air Line ID |
|-------------|-------------------|-------------|------|---------------------|
| | | New | Worn | |
| 5/16" | 1 | 170 to 240 | | 1-1/2" |
| 5/16" | 2 | 340 to 480 | | 2" |
| 3/8" | 1 | 240 to 315 | | 2" |
| 3/8" | 2 | 480 to 630 | | 2-1/2" |
| 7/16" | 1 | 315 to 410 | | 2" |
| 7/16" | 2 | 630 to 820 | | 2-1/2" |
| 1/2" | 1 | 410 to 520 | | 2-1/2" |
| 1/2" | 2 | 820 to 1040 | | 3" |

Minimum ID air line recommendations for multiple nozzles. CFM shown is the approximate cfm required at 125 psi when the nozzle is new, and when worn. A nozzle is considered worn when the orifice is 1/16" larger than its original size.

Figure 3

⚠ WARNING

Where two or more blast machines (or multiple nozzles) are used, care must be taken when tracing and connecting control lines and blast hoses. Cross connecting control hose or blast hose could lead to serious injury, death, or property damage from unintentional actuation of a blast machine. To prevent cross connections, hoses should be of equal lengths, and the hoses and blast machine couplings clearly marked. Use optional hose identification kits, part no. 15890 for use with two blast machines (nozzle), or part no. 15891 for up to four machines. Mark each hose and connection per the instructions supplied with the kit, and carefully trace and verify each connection before operating.

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 blast hose and compressed-air supply hose connections are secured with safety locks and safety cables to prevent accidental separation or

disconnection. Lock pins and safety cables are listed in Sections 8.1 and 8.2.

⚠ 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.

3.2.5 Connect the ends of the remote control twinline hose to the fittings on the valves as described in the remote control manuals. Check that all fittings are tight. Leaks will cause the system to malfunction.

3.2.6 Close the primary inlet valve and upper chamber inlet valve. The valves are closed when the handle is perpendicular to the valve.

3.2.7 Check that the outlet valves and choke valve(s) (two on dual outlet machines) are open. The valves are open when the handle is in-line with the piping.

3.2.8 Close the abrasive metering valve(s) (two on dual outlet machines). The closed position for the Sentinel metering valve is when the handle is fully right. The closed position for the optional knob type valves is when the metering knob is turned fully clockwise.

3.2.9 Open the remote control safety petcock(s) (two on dual outlet machines), and check the control handles per instructions in the remote control and control handle manuals.

3.2.10 Close the compressor's air valve. Start the compressor, and bring it up to operating temperature and pressure. The pressure must not exceed 125 psi.

3.2.11 Load abrasive into the machine by following the instructions in Section 3.7.

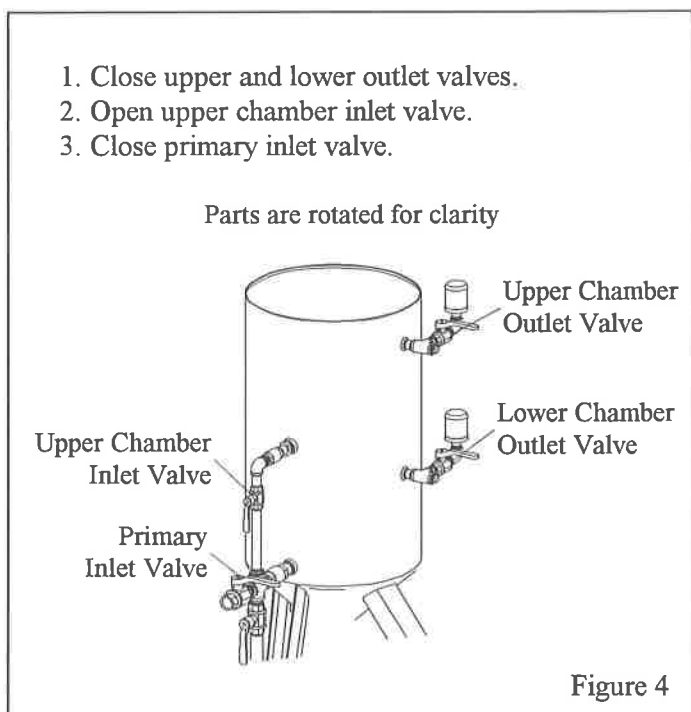
3.3 Pressurize The Machine

3.3.1 Do not allow anyone 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 tender may pressurize or depressurize the machine at any time. Noise, from the sudden release of compressed air, or abrasive venting under pressure could result in injury. The machine tender must wear a suitable, approved respirator, plus approved eye, face, and hearing protection.

3.3.2 Position the inlet and outlet valves as shown in Figure 4.



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

3.3.4 While standing back and facing away from the concave filling head, open the primary inlet valve. This action causes the upper chamber pop-up valve to seal-off the filling port, pressurizes the machine, and begins the blast process.

3.4 Blasting

3.4.1 When the blast operator is ready to blast, either the operator or the machine tender closes the remote

control safety petcock. Closing the petcock prepares the machine for remote operation and activation by the control handle.

⚠ 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.

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

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

3.4.2 Operators must wear appropriate protective gear, including: abrasive-resistant clothing, leather gloves, eye and hearing protection, and a NIOSH-approved Type CE Supplied-Air Respirator.

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

3.4.4 Pull back 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).

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

3.4.6 Adjust abrasive flow per Section 4.1.

3.5 Stop Blasting

3.5.1 To stop blasting, release the control handle lever.

3.5.2 When the control handle lever is released, the control handle safety lever will flip up to lock the handle lever in the up (no blast) position.

3.5.3 Make sure that the control handle safety lever lock is up, and that it prevents the handle lever from engaging.

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

▲ WARNING

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

3.6 Depressurize the machine

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

3.7 Loading Abrasive into the Blast Machine
See Section 3.9 for automatic refilling.

▲ WARNING

Obtain a material safety data sheet (MSDS) 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.

NOTE: Use only abrasive specifically manufactured for blast cleaning, and that is 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 surface being blasted.

3.7.1 Stop blasting per Section 3.5, or depressurize the upper chamber per Section 3.8.

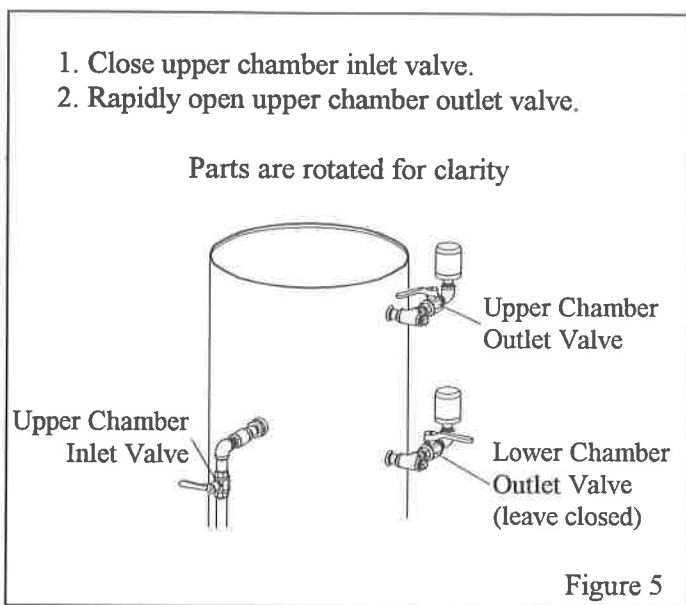
3.7.2 Load abrasive into the machine by pouring it into the concave head. Using an optional screen, placed over the head, prevents large objects from falling inside. A screen is recommended to keep objects such as pieces of abrasive bags and rocks from falling into the machine. Foreign objects will jam 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.

3.7.3 Pressurize the machine per Section 3.3 or pressurize the upper chamber per Section 3.8.

3.8 Cycling the Upper Chamber (refilling the upper chamber while blasting from the lower chamber). Ref. Figure 5. See Section 3.9 for automatic refilling.

3.8.1 During blasting, and after approximately one-half of the abrasive in the machine has been used, close the upper chamber inlet valve, and while standing back and facing away from the concave head and exhaust muffler, "quickly" open the upper chamber outlet valve. **NOTE: Air must exhaust rapidly from the upper chamber in order for the lower chamber pop-up valve**

to seal. The upper pop-up valve automatically drops when air is expelled from the upper chamber. Blasting continues from the lower chamber.



3.8.2 Load abrasive into the upper chamber per Section 3.7.

3.8.3 Pressurize the upper chamber, by closing the upper chamber outlet valve and opening the upper chamber inlet valve. When pressure in the upper and lower chambers equalize, the lower chamber pop-up valve drops, refilling the lower chamber with abrasive.

3.8.4 Repeat the process for continuous-action blasting.

3.9 Automatic Refilling

3.9.1 For hopper-fed machines, refilling can be accomplished automatically with a cycle timer. See Accessories in Section 8.1. Hopper-fed machines must have an umbrella mounted above the upper chamber pop-up opening. See Section 8.2 for bolt-on umbrella.

3.10 Emptying the Machine of Abrasive

3.10.1 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:

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

3.10.3 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.

3.10.4 Pressurize the machine.

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

3.10.6 Hold the hose securely (do not leave the hose unattended), and activate the control handle. Be prepared for surging or recoil of the hose, which can be severe.

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

3.10.8 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.

3.11 Shutdown

3.11.1 Ensure that the blast machine is depressurized.

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

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

3.11.4 Shutdown the compressor.

3.11.5 Cover the machine when not in use.

4.0 ADJUSTMENTS

4.1 Abrasive Metering Valve

NOTE: These instructions are for the Sentinel metering valve. Optional metering valves may function differently, but the process is similar.

4.1.1 Begin adjustments with the metering valve closed. Closed is when the handle is fully right.

4.1.2 While the operator is blasting, the machine tender increases abrasive flow by slowly moving the handle to the left, no more than 1/4" at a time, allowing time for the flow to stabilize before further adjusting.

4.1.3 Optimum abrasive flow depends on the type and size of abrasive and the 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. The stream of abrasive coming out of the nozzle should barely discolor the air when seen against a contrasting background.

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

5.0 PREVENTIVE MAINTENANCE

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

5.1 Daily Inspection

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

- Inspect the blast hose for wear; look for soft spots. If the hose has soft spots, the hose is worn and must be replaced.

⚠ 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.

- Inspect the RLX Control Handle

⚠ 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:

- 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 don't 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 moisture separator is used, inspect the filter element, and clean the bowl.

5.2.2 After blasting do 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 6.5.

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 6.3.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. See Section 6.4.

6.0 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.

6.1 Removing damp abrasive from the blast machine.

6.1.1 To clear a minor blockage caused from 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 for obstructions in the metering valve.

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

6.1.4 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.

6.1.5 Close the choke valve and fully open the abrasive metering valve.

6.1.6 Pressurize the machine and activate the control handle to force out damp abrasive.

6.1.7 When the obstruction has been removed, release the control handle and 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 and activate the control handle to clear the hose. When the hose is cleared, release the handle and 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. 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 erode nozzle threads. A loose fitting nozzle may eject under pressure and could cause severe injury.

6.1.8 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 3.10.

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

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

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

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

6.2.6 Make sure the inspection door gasket is in good condition, and in place before 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 compressed air supply.

6.3 Replacing the Pop-Up Valve, Figure 6

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

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

6.3.3 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.

6.3.4 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.

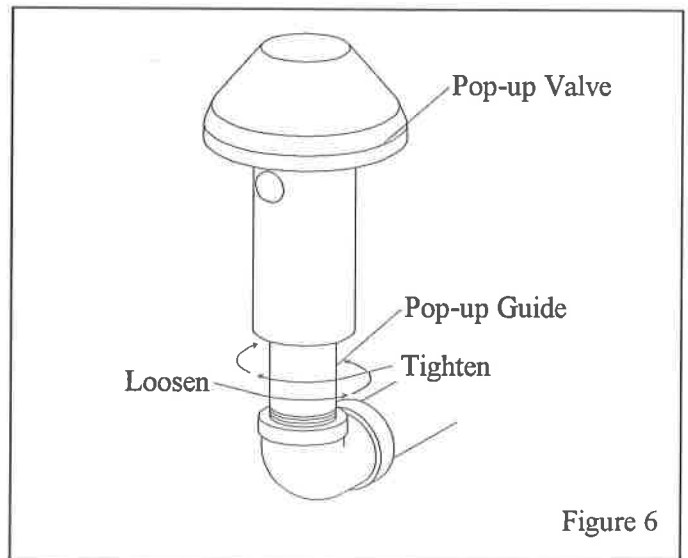
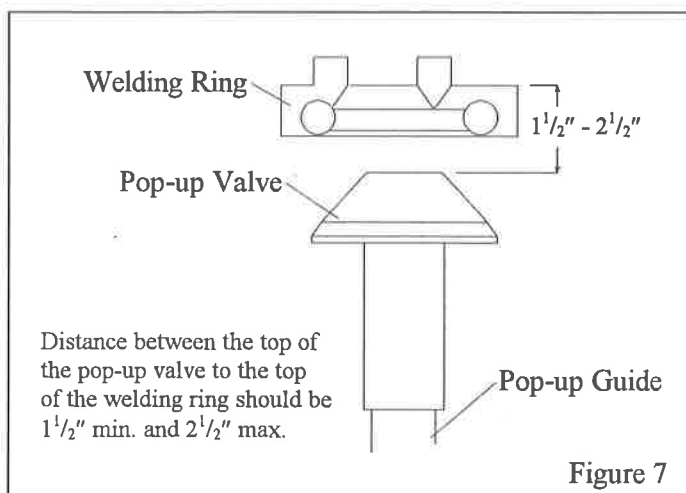


Figure 6

6.3.5 Slide the new pop-up valve over the guide, 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.

6.3.6 Refer to Figure 7 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.



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

6.4 Replacing the Pop-Up Seal

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

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

6.4.3 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.

6.5 Exhaust Muffler, Figure 8

⚠ 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.

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

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

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

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

6.5.5 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.

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

6.5.7 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 8.

6.5.8 Firmly tighten the lock-nuts.

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

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 lock-out and tag-out 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 comes out of 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 for obstruction.

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

7.2 Air only (no abrasive) comes out the nozzle

7.2.1 Abrasive metering valve may be closed or needs adjustment. Adjust the metering valve per 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 per Section 6.2.

7.2.5 Open the safety petcock on the metering valve and press the control handle. If air does not come out of the petcock, check for blockage in the twinline hose to and from the control handle. If air does come out, the metering valve actuator section is not functioning. Refer to the metering valve manual for servicing the valve.

7.3 Heavy abrasive flow

7.3.1 Check that 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.

7.3.3 Check the abrasive metering valve and air valve for wear. Refer to the remote control manual for troubleshooting and servicing the remote system. If there is an internal leak in the air valve it will act as if the choke valve is partially closed.

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. See Section 4.1.

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

7.4.3 Abrasive metering valve may require service. Refer to the metering valve manual.

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 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.

7.5.2 Abrasive may be worn from recycling. Replace abrasive.

7.6 Blast machine will not pressurize

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

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

7.6.3 Dirty filter in moisture separator. Check filter element.

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

7.7 Lower chamber wont seal when upper chamber is depressurized

7.7.1 Upper chamber exhaust valve opened too slowly. Quickly open the exhaust valve. Air must exhaust rapidly from the upper chamber for the lower chamber pop-up valve to seal.

7.7.2 Exhaust muffler blocked Service muffler per Section 6.5.

7.8 **Blasting does not start when the control handle is pressed**

7.8.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

7.9 **Blasting does not stop when the control handle is released**

7.9.1 Fault in the remote control system. Refer to the remote control, and control handle manuals.

8.0 ACCESSORIES and REPLACEMENT PARTS

8.1 Optional Accessories

- (-) Cycle Timer kit
 - 120 volt AC02207
 - 12 volt DC03439
- (-) Safety cable, 3/4" to 1-1/2" ID blast hose15013

8.2 Abrasive Metering Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.3 Air Valve Replacement Parts

Refer to the remote control owner's manual for replacement parts.

8.4 Exhaust Muffler, Figure 8

| 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 |

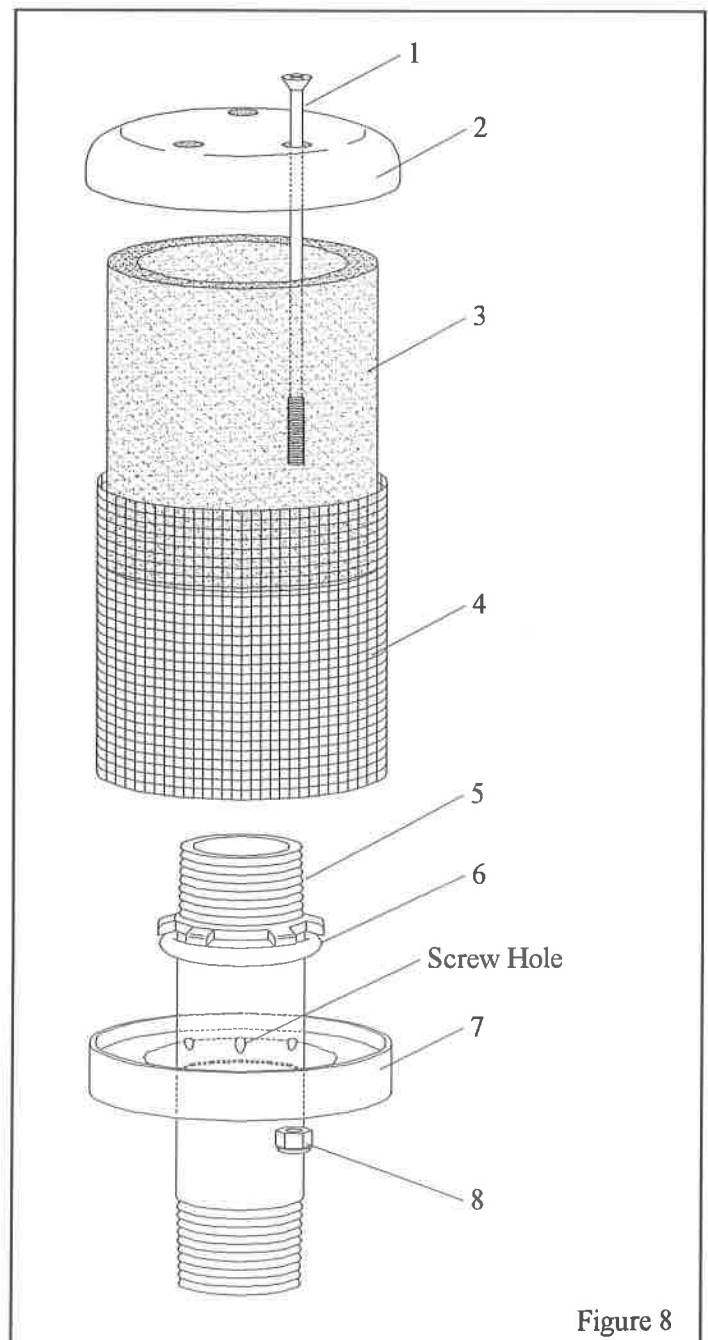


Figure 8

8.5 Blast Machine and Accessories, Figure 9

| Item | Description | Stock No. |
|------|---|-----------|
| 1. | Ball valve with handle, 1" | 02396 |
| 2. | Handle, 1" ball valve | 22531 |
| 3. | Ball valve with handle, 1-1/4" | 02397 |
| 4. | Handle, 1-1/4" ball valve | 22532 |
| 5. | Ball valve with handle, 2", dual outlet only .. | 02368 |
| 6. | Air valve, 1-1/4" (PVR pinch tube shown).... | 04320 |
| 7. | Check valve, 1" cone | 02087 |
| 8. | Check valve, 1-1/4" cone | 02088 |
| 9. | Compression coupling, 1-1/4" | 01857 |
| 10. | Gasket, 1-1/4" compression coupling | 01886 |
| 11. | Coupling, 1-1/4" CF | 00551 |
| 12. | Wye, 1-1/4" | 01818 |
| 13. | Leg pad, right | 03654 |
| 14. | Leg pad, left | 03655 |

| | | |
|-----|--|-------|
| 15. | Metering valve, (Sentinel shown) | 20608 |
| 16. | Gasket, CQG coupling, (package of 10) | 00850 |
| 17. | Balance tank, dual outlet only | 02365 |
| 18. | Wheel and tire, 400 x 16, each | 02338 |
| 19. | Axle, 24" dia. machine | 02403 |
| 20. | Retaining ring, 1" | 03824 |
| 21. | Thrust washer, 1" | 03825 |
| 22. | Inspection door assembly, 6" x 8" | 02377 |
| 23. | Gasket, 6" x 8" inspection door | 02369 |
| 24. | Seat, pop-up, gum rubber, standard use | 02325 |
| 25. | Seat, pop-up, neoprene, for hot climates | 02380 |
| 26. | Muffler, exhaust | 05068 |
| 27. | Pop-up valve, 4" with external sleeve | 03699 |
| 28. | Internal pop-up guide, 4-1/2" toe nipple | 21694 |
| 29. | Umbrella, optional, 4" bolt-on | 02318 |
| 30. | Cover, optional, 24" diameter | 02336 |
| 31. | Screen, optional, 24" recessed type | 03100 |
| 32. | Lock pin, coupling (package of 25) | 11203 |

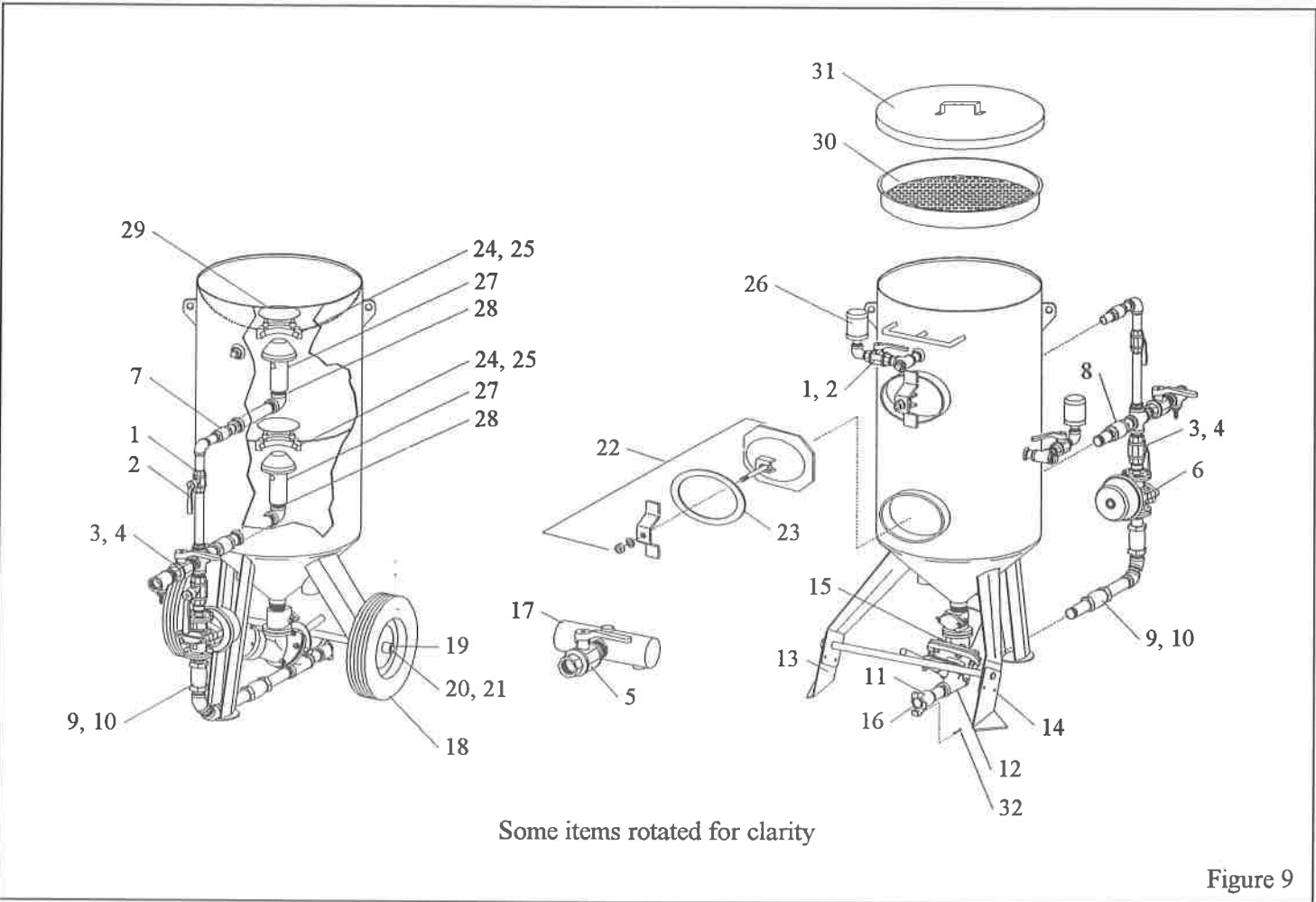


Figure 9