

**CONTRACTOR SERIES BLAST MACHINE
4 & 6 CU. FT. WITH QUANTUM ELECTRIC
PRESSURE-HOLD REMOTE CONTROLS
O. M. 22561**

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 **WARNING**

Do not use this equipment before READING this MANUAL and UNDERSTANDING its contents.

These WARNINGS are included for the health and safety of the operator and those in the immediate vicinity. Failure to read and understand these warnings can result in injury or death.

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

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1.0 INTRODUCTION

1.1 Scope of manual

1.1.1 These instructions cover the set-up, operation, maintenance, troubleshooting, and replacement parts for the following Clemco Contractor Series Blast Machines with electric Quantum Remote Controls and abrasive cut-off (ACS):

- 20" diameter, 4 cu. ft. capacity
- 24" diameter, 6 cu. ft. capacity

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

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

1.2 Safety Alerts

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



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

NOTICE

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

CAUTION

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

WARNING

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

DANGER

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

1.3 Components and Operating Principles

1.3.1 Components

1.3.1.1 The primary components of the Contractor machines are shown in Figure 1. They include the blast machine with Quantum Remote Controls, electric control panel, with abrasive cut-off switch (ACS), Auto-Quantum abrasive metering valve, frame assembly, optional moisture separator/filter, and optional CPF particulate air filter.

1.3.2 Operation - Maintenance Manuals

1.3.2.1 Individual manuals are included with optional accessories: Manuals provided with systems include:

- CPF Particulate Air Filter
- Apollo Respirator
- Clem-Cool Air Conditioner

1.3.2.2 The front leg contains a storage area for operations manuals. After reviewing all the manuals, and start-up and adjustments are completed, remove the urethane cover plate and store manuals in the compartment, for future reference.

1.3.3 Blast Machine

1.3.3.1 Clemco certifies that its blast machines (pressure vessels) conform to the ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, Division 1. It is the owner's responsibility to maintain the integrity of the vessel in

accordance with state regulations. Regulations may include regular inspection and hydrostatic testing as described in National Board inspection code and jurisdictional regulations and/or laws.

⚠ WARNING

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

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

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

⚠ WARNING

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

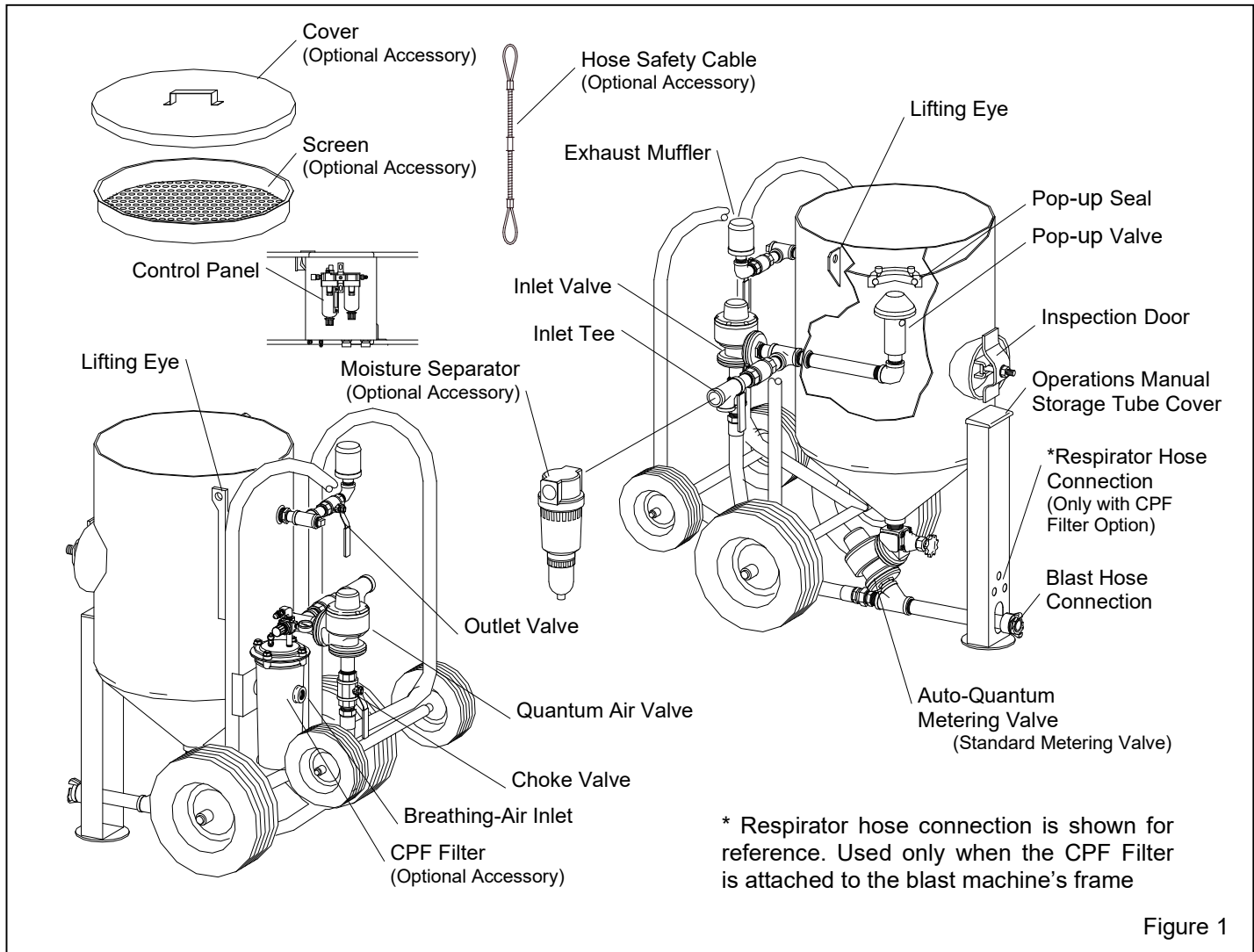


Figure 1

1.3.3.4 OSHA does not require pressure-relief valves on blast machines when air compressors supplying air to the blast machines are built to American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section VIII, Division 1 and comply with OSHA regulation 29 CFR 1910.169, which refers to the ASME code when describing the necessity of pressure-relief valves on compressed air equipment. **DO NOT** operate blast machines with air compressors that are not equipped with properly functioning pressure-relief valves with maximum pressure less than or equal to the maximum-allowable working pressure (MAWP) stamped on the vessel nameplate.

1.3.3.5 Use lifting eyes when raising, loading, and unloading the blast machine. Do not use a sling around the cart handles or piping.

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

⁽¹⁾ American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, 1989

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

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

1.3.4 Remote Controls

⚠ 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.

1.3.4.1 The components of the Quantum electric remote control system are shown in Figure 2. They include the Auto Quantum Abrasive Metering Valve, Quantum Air Valve, 120 volt or 12 volt control panel, electric RLX Control Handle, 50-ft. control cord, all interconnecting hoses, and necessary fittings.

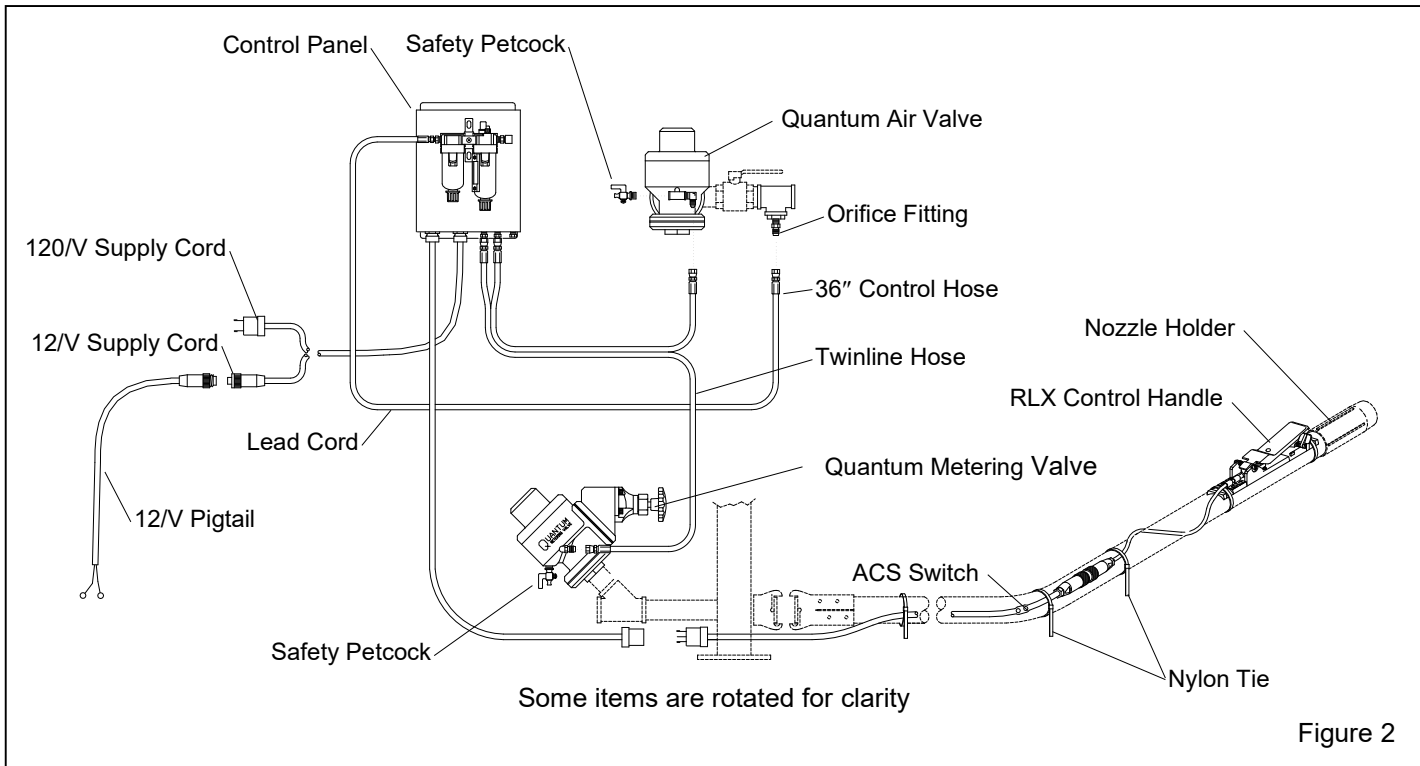
1.3.4.2 The remote control system is an OSHA-required safety device. The control handle, located near the blast nozzle, is the activator for the remote control system. When the operator intentionally or unintentionally removes hand-held pressure from the remote control handle, the abrasive metering valve and air valve close, stopping air and abrasive flow through the nozzle. The remote control system "fails to safe", which means when any interruption in the electro-pneumatic control circuit occurs, for any reasons such as a break in the cord, the compressor stops running, or the operator drops the blast hose, the remote controls stops the blasting.

1.3.4.3 Quantum Remote Controls are pressure hold systems, meaning, pressurization and depressurization of the blast machine are separate functions from the remote control. Using hand operated inlet and outlet valves, the operator manually pressurizes and depressurizes the blast machine. Although the machine is under pressure, neither air nor abrasive comes out the nozzle because the normally closed (NC) Auto-Quantum Abrasive Metering Valve shuts off abrasive flow, and the Quantum Air Valve stops air flow. Blasting will not start until the operator activates the control handle. Pressure remains in the blast machine until it is manually depressurized.

1.3.4.4 Quantum Remote Controls work well in applications requiring frequent starting and stopping. Normally, a blast machine depressurizes whenever the operator releases the remote control handle. When the remote control handle is pressed again, the operator must wait for re-pressurization before continuing to blast. With the Quantum Remote Control System, the wait is eliminated, because the machine remains pressurized until it is manually depressurized.

1.3.4.5 Compressed air enters the blast machine through the inlet piping and is split into three streams. One stream goes directly into the blast machine, the second stream goes into the pusher line, and the third stream is the control air which leads to the electric control panel.

1.3.4.6 Quantum Electric Remote Controls operate electro-pneumatically on "return air" principle (Refer to Figure 2). When the control handle lever is up, control air from the blast machine travels to the control box and stops. As long as air does not pass through the box, the remote control system remains inactive. From the box, a 12-volt electrical current is sent through the control



cord to a switch mounted under the control handle lever. When the control handle lever is pressed, it contacts the switch, engages solenoids in the control box to permit air to pass through the box, opening both the abrasive metering valve and air valve to start the blasting process. Releasing the handle immediately exhausts control air at the panel, which closes the valves so blasting stops.

1.3.4.7 Electric remote controls are used when the nozzle is farther than 100 feet from the blast machine. At that distance pressure loss and actuation time of pneumatic systems may be too great to ensure fast, safe operation. Electric systems are also used in cold weather, when moisture in the air supply of pneumatic systems may freeze and cause the remote controls to fail. For that reason, an antifreeze injector is installed on all electric remote control panels.

NOTE: The maximum recommended total length of control cord is 300 feet. Distances greater than 300 feet will offer too much electrical resistance and may cause the controls to malfunction. If an application requires greater distance, we suggest that appropriate cord with larger diameter wire must be provided by the user.

1.3.5 Abrasive Cut-off Feature (ACS)

1.3.5.1 An abrasive cut-off switch (ACS) is a standard feature of the Quantum electric remote control. The abrasive cut-off switch is mounted on the 50 ft. control cord behind the control handle, as shown in Figure 2. The operator uses the switch to close the abrasive valve independently of the air valve. This clears abrasive from the blast hose at the end of the work shift, and in applications that allows it, air without abrasive exits the nozzle for blow-down.

1.3.6 Moisture Separator/Filter, Optional

1.3.6.1 The optional filter removes particles and condensed moisture from the compressed air before it enters the machine. Water is drained by use of a manual drain located at the bottom of the filter.

1.3.7 Frame and Cart

1.3.7.1 The frame assembly provides added protection for the piping, valves, and accessories. This protection keeps the piping aligned and tight. The wheeled cart assists in the mobility of the machine over smooth flat surfaces. Refer to Transporting and Moving in Section 3.1.

1.4 Abrasive

WARNING

Abrasives and dust from blasting may contain toxic materials (e.g., lead paint, silica) that are hazardous to workers. Before blasting obtain a safety data sheet (SDS) for the blast abrasive and identify all substances removed by the blasting process.

- Silica sand (crystalline) can cause silicosis, lung cancer, and breathing problems in exposed workers.
- Slags can contain trace amounts of toxic metals such as arsenic, beryllium, and cadmium and have the potential to cause lung disease.

NO DUST IS SAFE TO BREATHE. DUST PRODUCED FROM ANY ABRASIVE OR FROM THE BLASTING PROCESS CAN CAUSE SERIOUS LUNG DISEASE AND DEATH WHEN INHALED. It is the employer's responsibility to train employees to identify hazardous substances and to provide suitable policies, procedures, monitoring, recordkeeping, and personal protective equipment.

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

1.4.1 Selection of blasting abrasive can play a significant part in worker health risk, job productivity, and maintenance of the blast machine. DO NOT USE abrasives containing more than 1% crystalline (free) silica. Obtain safety data sheets (SDS) for the blasting abrasive prior to blasting, paying attention to worker health risks and presence of any hazardous/toxic substances.

1.4.2 Abrasive Mesh Size

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

1.4.3 Sand: Sand should never be used because of the respiratory hazards associated with abrasives containing free silica.

1.4.4 Slag: Slag abrasives are compatible with the blast machine fitted with the MQV manual Quantum metering valve. Obtain safety data sheet (SDS) to identify hazardous substances.

1.4.5 Steel: Steel shot and steel grit may be used with this Contractor blast machine.

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

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

1.4.8 Lightweight media: Plastic media and most agricultural media may be used occasionally in a standard blast machine. Exclusive use of plastic, and some other lightweight media, requires a blast machine with a 60° conical bottom for continuous, uninterrupted media flow.

2.0 INITIAL SET-UP

2.1 Control Panel – Figure 2

WARNING

Do not use 120 volt AC systems for outdoor blasting, or in any application that exposes the control circuit, control panel or power cord to water. Use 12 volt DC controls for those applications. Ignoring this warning could cause electrical shock and possible death.

⚠ WARNING

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

2.1.1 Attach the 36 in. long control hose between the orifice fitting and the fitting on the air filter mounted on the control panel.

2.1.2 Attach the twinline control hose to the two fittings on the bottom of the panel. One fitting is marked "Grit Valve" the other is marked "Air Valve".

2.1.3 Attach the free end of the twinline hose from the fitting marked "Grit Valve" to the fitting on the Quantum abrasive metering valve. Attach the free end of the twinline hose from the fitting marked "Air Valve" to the fitting on the Quantum air valve.

2.1.4 Check that all fittings are tight. Leaks will cause the system to malfunction.

2.2 Blast Hose and Control Cord Connections Figure 2.

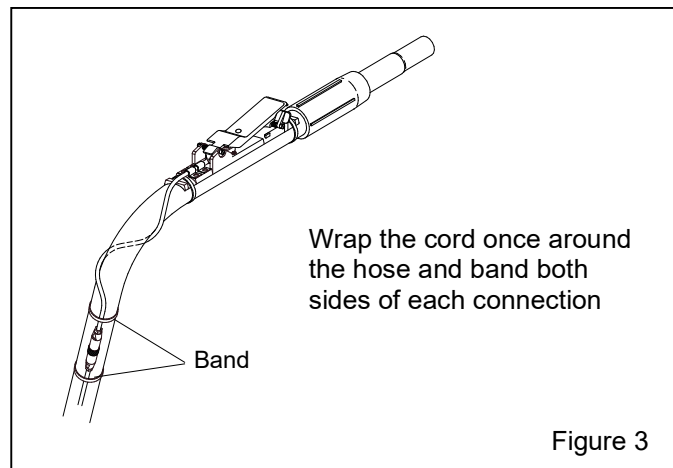
2.2.1 Uncoil the blast hose and lay the 50-ft. control cord alongside it. When additional hoses are connected, the hose and cord should be of equal lengths. **Note: The control cord has the ACS switch wired into it. Place the switch end of the cord at the nozzle end of the blast hose.**

2.2.2 Band the control handle to the blast hose close to the nozzle holder, using the two nylon ties provided. Once the control is firmly attached, clip the tie ends so they will not snag the operator's clothing or interfere with the operation of the control handle.

2.2.3 Wrap the whip cord from the electric control handle once around the blast hose, as shown in Figure 3, and then attach it to the control cord. If the cord is not wrapped as described, when the hose bends excessive strain will cause the wires to pull out of the connectors or electric switch.

NOTICE

Provide enough slack at all cord connections to prevent the cord from pulling out of the connectors when the blast hose is pulled or dragged. Band the cord to the blast hose on both sides of all connections.



2.2.4 Band the cord to the hose on both sides of the cord connections, as shown in Figure 3.

2.2.5 Band the cord to the blast hose every 4 to 6 feet. Also, band the cord on both sides of each electrical connection.

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

2.3 Set up for multiple blast machines operating from a common compressed air supply

2.3.1 Where multiple blast machines are operating from a single air source, install a check valve at the air supply on each machine. The illustration in Figure 4 shows where to install a cone check valve on the blast machine.

2.3.2 If the machines are close together, use a receiver tank or manifold and run separate air lines to each machine. The check valves may be located on the receiver tank outlets if the airline go directly to the blast machine and no place else.

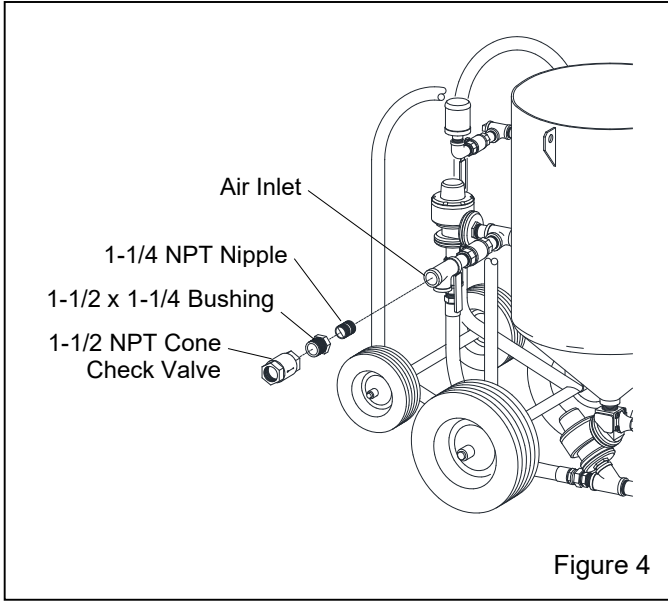


Figure 4

⚠ CAUTION

If multiple machines are operating from a common compressed air supply and a machine is under pressure, when another machine is pressurized, the sudden, increased demand for air could reverse air from the machine that is under pressure, and could contaminate the compressed air supply with abrasive laden air. Install check valves at the piping inlet to prevent the reversal of air.

2.3.3 Use a Clemco 1-1/2-NPT cone check valve, stock no. 02296. A smaller size valve could restrict air movement and reduce nozzle pressure. Do not use a swing check valve, which may break in blast machine applications. When installing the valve, make sure the directional arrow is pointing in the directions of the air flow, toward the machine.

2.4 Compressed-Air Supply Hose Connection

2.4.1 Install an air supply hose fitting that is compatible with the compressed-air supply hose from the compressor, to the inlet valve or optional compressed air filter. For best blasting performance, refer to the table in Figure 5 for the minimum recommended hose size based on the nozzle orifice size. A smaller diameter hose could result in a reduction in nozzle pressure.

AIR LINE RECOMMENDATIONS
BASED ON NOZZLE SIZE

Nozzle Orifice Size	Recommended Air Supply Line
No. 3, 3/16"	3/4" ID or larger
No. 4, 1/4"	1" ID or larger
No. 5, 5/16"	1-1/4" ID or larger
No. 6, 3/8"	1-1/2" ID or larger
No. 7, 7/16"	2" ID or larger
No. 8, 1/4"	2" ID or larger

Refer to the compressed-air and abrasive consumption table in Figure 8 for approximate air consumption.

Figure 5

2.5 Breathing Air Connections, Optional CPF Filter, Refer to CPF Operations Manual 04143

⚠ DANGER

Do not connect the CPF Filter to bottled air or any other air source that does not have a pressure-reducing valve that reduces pressure to maximum of 150 psi. Failure to comply with this warning will cause the CPF Filter to explode under the high pressure of bottled air. A rupture of this nature could cause severe injury or death.

⚠ WARNING

Air supply to the respirator system is critical to the safety of the user. Read the CPF Filter and Apollo Respirator manuals carefully. Poor quality air will cause serious respiratory injury or death to the user.

2.5.1 Breathing air must meet the requirements for Grade D or higher quality, as described in Compressed Gas Association Commodity Specification G-7.1., titled Commodity Specification For Air, Published by Compressed Gas Association Inc., Chantilly, VA. (CFR Title 30 Chapter 1).

2.5.2 Connect an air supply hose fitting that is compatible with the air supply hose from an air source that meets OSHA requirements for respirable air, to the CPF Filter inlet, as shown in Figure 1. Pressure supplied to the filter must not exceed 150 psi.

2.5.3 For models with CPF filter attached, connect the 5-ft. respirator lead hose to the fitting at the top of the CPF filter and the compatible fitting on the front leg of the blast machine. Refer to Figure 1 for the location of the fitting.

2.5.4 Refer to the Apollo Respirator and CPF Filter manuals for instructions concerning their operation.

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.**
- **Use the lifting eyes when lifting the machine. 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 secure 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 trained and experienced with the hazards associated with this type of machinery.**
- **Failure to observe these warnings could result in serious injury or death.**

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

3.1.2 Moving a blast machine

⚠ WARNING

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

⚠ WARNING

Never attempt to manually move a blast machine when it contains abrasive. An empty machine may be moved when the following criteria are met:

3.1.2.1 An empty machine may be moved manually, on level flat surfaces.

3.1.2.2 To move the machine, push it in a forward direction. Do not back-up while moving the machine, to avoid tripping hazards that may be out of view.

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

3.1.2.4 If the machine contains any abrasive, keep the machine upright. Laying down a machine containing abrasive could cause abrasive to lodge in the piping, cause the machine to malfunction, or damage valves.

3.2 Start-Up

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

3.2.2 Connect an air line from the compressor to the air supply hose connector installed on the blast machine inlet. Refer to the compressed air and abrasive consumption chart in Figure 8 for approximate air consumption.

3.2.3 Make sure the coupling gaskets are in place and in good condition before connecting the blast hose to the quick coupling on the blast machine. When connecting the hose, make sure the coupling spring lock pins are at 180 degrees (Pins should enter the open hole of the adjoining coupling). The spring lock

pins prevent accidental separation of hose couplings during blasting.

3.2.4 Make sure that all compressed-air supply hose connections are secured with safety lock pins and safety cables to prevent accidental separation or disconnection. Safety cables are listed in Section 8.1 of this manual.

⚠ WARNING

Hose disconnection while under pressure can cause serious injury or death. Use safety lock pins or safety wire to lock twist-on (claw-type) couplings together and prevent accidental separation while under pressure and use safety cables to prevent hose from whipping should separation occur.

3.2.5 Connect the control cord to the control panel lead cord marked "OPERATOR".

3.2.6 Connect an air line between a source of respirable breathing air meeting the requirements for Grade D or higher quality, and the CPF filter inlet. Refer to Section 2.5. The maximum inlet pressure for the CPF Filter must not exceed 150 psi.

⚠ DANGER

Do not connect the CPF Filter, or any other regulator or filter, to bottled air or any other air source that does not have a pressure reducing valve that reduces pressure to a maximum of 150 psi. Failure to comply with this warning will cause low pressure devices to burst from the excessive pressure of bottled air. A rupture of this nature could cause severe injury or death.

⚠ WARNING

Hose disconnection while under pressure can cause serious injury or death. Use safety lock pins or safety wire to lock twist-on (claw-type) couplings together and prevent accidental separation while under pressure and use safety cables to prevent hose from whipping should separation occur.

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

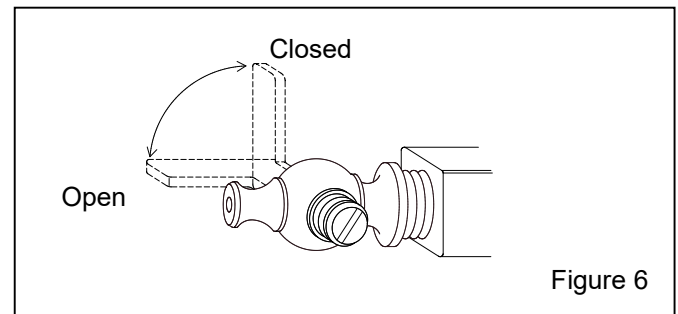
3.2.8 Make sure the choke valve is open, (handle position in-line with the valve and piping).

3.2.9 Close the Quantum abrasive metering valve. Closed position is when the knob has been turned fully clockwise. Refer to Section 4.1.

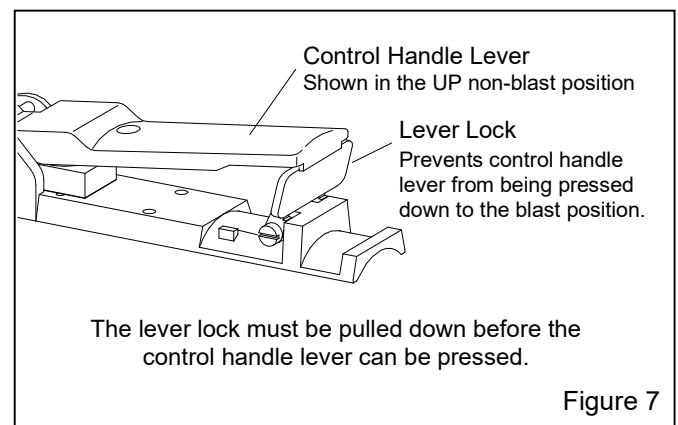
3.2.10 Open the safety petcock on the Quantum air valve and on the metering valve actuator. The petcock is open when the lever is in-line with the petcock, as shown in Figure 6.

⚠ WARNING

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



3.2.11 Make sure the control handle lever is in the up (no blast) position, as shown in Figure 7, and that the handle lever and safety lock move freely.



3.2.12 Make sure the handle lever will not engage the switch unless the safety lever lock is intentionally pulled down.

 WARNING

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

3.2.13 Plug the power cord into an appropriate power source (120-volt AC or 12-volt DC). Do not use 120 volt AC models in any application where water exposure is possible, unless the power source is protected by a ground-fault circuit interrupt. 12-volt units are furnished with a pigtail with ring terminals to attach to a battery.

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

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

Figure 8

⚠ WARNING

Do not use electrical adaptors that eliminate the ground prong on 120 volt plugs. Doing so can cause electric shock, and damage equipment.

3.2.14 Check that all hoses and electrical connections are secure.

3.2.15 Close the air valve on the compressor. Start the compressor, and bring it to operating temperature and pressure. The pressure must be more than 70 psi, but not exceed 150 psi.

3.2.16 Close the inlet valve (handle perpendicular to the valve), and open the outlet valve (handle in-line with the valve).

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

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

3.2.19 Load abrasive into the machine according to instructions in Section 3.9.

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

⚠ WARNING

Everyone except for the blast operator or blast machine tender must stay clear of the blast machine. The machine tender or blast operator may pressurize or depressurize the machine at any time, which could cause abrasive to vent under pressure, causing dust and toxins to become airborne. Noise is produced by the sudden release of compressed air when the machine is pressurized or depressurized. These conditions could cause injury. Both the operator and machine tender must wear suitable personal protective equipment including an approved respirator, plus approved eye, face, and hearing protection.

3.2.21 To pressurize the machine, stand back and face away from the concave filling head of the blast machine, close the outlet valve, and open the inlet valve.

3.2.22 When the blast operator is ready to blast, either the operator or the machine tender closes the safety petcock. Closing the petcock prepares the machine for remote operation by the control handle.

3.3 Blasting Attire

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

⚠ 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 in the vicinity of abrasive blasting must wear properly-maintained, NIOSH-approved, respiratory protection and eye protection appropriate for the job site hazards.

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

3.4 Blasting

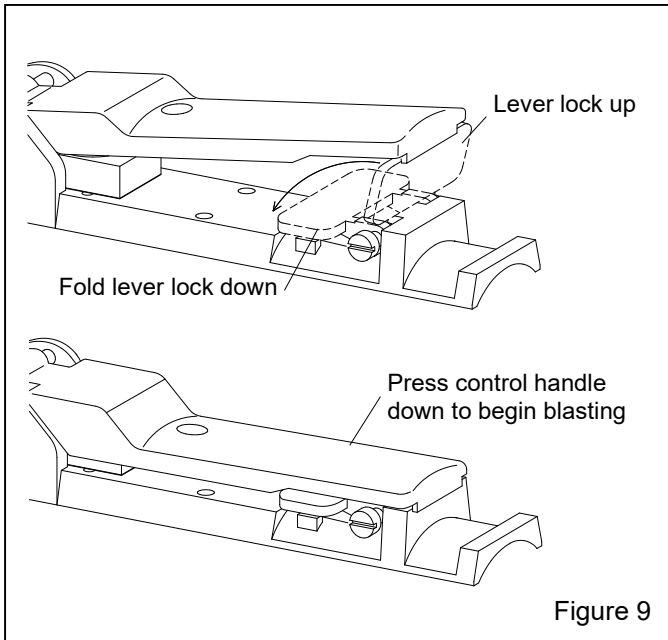
3.4.1 Don all protective, blasting attire per Section 3.3.

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

3.4.3 Fold down the safety lever lock and press the remote control handle, as shown in Figure 9. Blasting begins within a few seconds.

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

3.4.4 Press the back button (farthest from the nozzle) on the ACS switch to open the Quantum metering valve. Abrasive flow is "on" when the back push-button is pressed. Refer to Section 3.5 for operation of the ACS.

3.4.5 Adjust abrasive flow per Section 4.1.

3.5 Operation of Abrasive Cut-Off Switch (ACS) Figure 10

⚠ WARNING

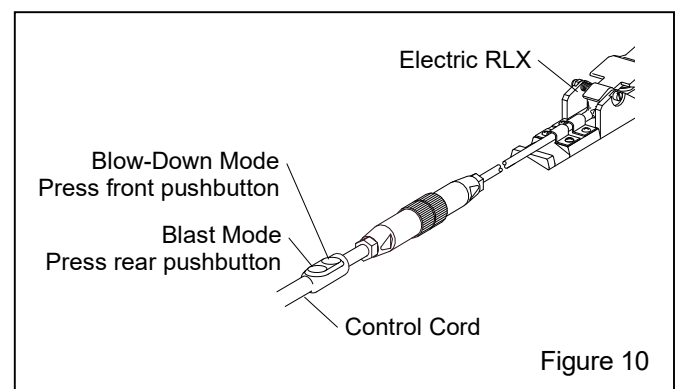
OSHA sets exposure limits for people and the environment. Airborne dust could increase the exposure levels beyond permissible limits. OSHA prohibits blowing with compressed air as a cleaning method for lead-based paint dust or other hazardous dust, unless the compressed air is used in conjunction with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

3.5.1 The ACS serves two purposes:

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

3.5.2 The ACS switch is wired into the control cord approximately 8" to 10" from the connector for the control handle. It is not easily noticed as it is under shrink tubing. The switch may be pressed "ON" or "OFF" at any, but will not operate the metering valve unless the control handle is pressed.

3.5.2.1 Blast Mode: Abrasive flow is "ON" when the rear pushbutton is pressed. This action sends control-air to the abrasive metering valve, opens the valve and the blast machine operates normally, with air and abrasive coming out the nozzle.

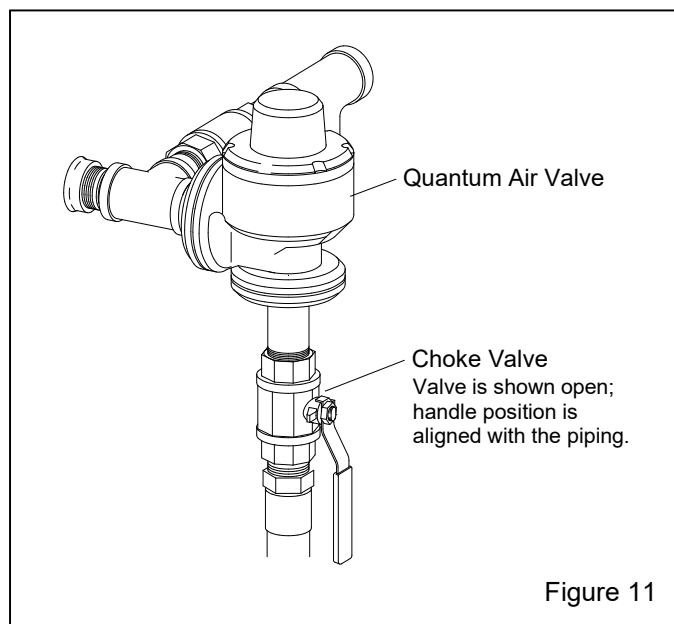


3.5.2.2 Blow-Down Mode: The ACS switch is “OFF” (no abrasive) when the front pushbutton (closest to the nozzle) is pressed, cutting off the air supply to the abrasive metering valve, closing the valve, and stopping the abrasive flow. This action allows air alone to exit the nozzle, which is useful for clearing the blast hose before shutting down, and blowing abrasive off the blasted surface.

3.6 Operation and Function of the Choke Valve Refer to Figure 11

3.6.1 Always fully open the choke valve while blasting; open is when the handle is vertical and aligned with the piping, as shown in Figure 11.

3.6.2 Closing the choke valve while blasting, lowers pressure in the pusher line from the pressure in the vessel. Closing the choke valve clears the valve of minor blockage such as damp abrasive, or it is used to rapidly empty the machine at the end of the day.



NOTICE

Do not blast with choke valve closed or partially closed. Prolonged blasting with the choke valve partially closed will accelerate wear on the metering valve.

3.7 Stop Blasting

3.7.1 Before releasing the control handle, the operator may use the ACS to stop the abrasive flow to clear the blast hose, and if conditions permit, blow-down the work piece. Refer to Section 3.5 for operation of the ACS.

3.7.2 To stop blasting, release the control handle lever. Blasting stops when the control handle is released, regardless of the position of the ACS.

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

3.7.4 Always open the safety petcock during work breaks. Opening the petcock prevent unintentional blasting.

3.7.5 It is not necessary to depressurize the machine between stopping and starting. The media valve and air valve will close when the control handle lever is released. Depressurize the blast machine during work breaks.

3.8 Depressurize the Blast Machine.

3.8.1 Close the manual inlet valve.

3.8.2 Standing back and face away from the exhaust muffler, then open the manual outlet valve. The machine will depressurize. The pop-up valve automatically drops when all pressure is expelled from the machine.

3.8.3 When finished blasting, shutdown per Section 3.11.

3.9 Loading Abrasive into the Blast Machine

3.9.1 Depressurize the blast machine per Section 3.8.

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

3.9.3 Begin blasting or resume blasting per Section 3.2.21 and 3.2.22.

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 dampens 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 and set the abrasive metering valve 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. Removing the nozzle is discouraged. If circumstances require the nozzle to be removed, also remove the nozzle washer. Purging the machine without a nozzle in place will erode the thread area of the nozzle holder, which could cause a hazardous condition.

⚠ WARNING

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

3.10.4 Using normal start-up procedures, except with the choke valve closed, pressurize the blast machine.

3.10.5 Point the nozzle (or hose end) into a drum or suitable container, or in the direction of the abrasive disposal site.

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

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

3.11 Shutdown

3.11.1 Empty the blast machine per Section 3.10.

3.11.2 When finished blasting, and after cleanup is completed, remove the respirator outside the respirator-use area where the air is safe to breathe.

3.11.3 Turn off electrical power to the control panel.

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

3.11.5 Drain receiver tank, moisture separator/filters, and water collecting devices, and bleed the compressed-air supply hose.

3.11.6 Shutdown the compressor.

3.11.7 Cover the blast machine when not in use. Refer to Section 8.1 for optional covers.

4.0 ADJUSTMENTS

4.1 Abrasive Metering – Figure 12

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

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

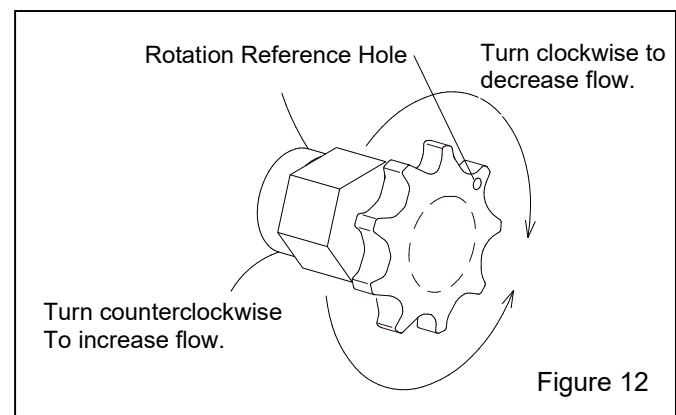


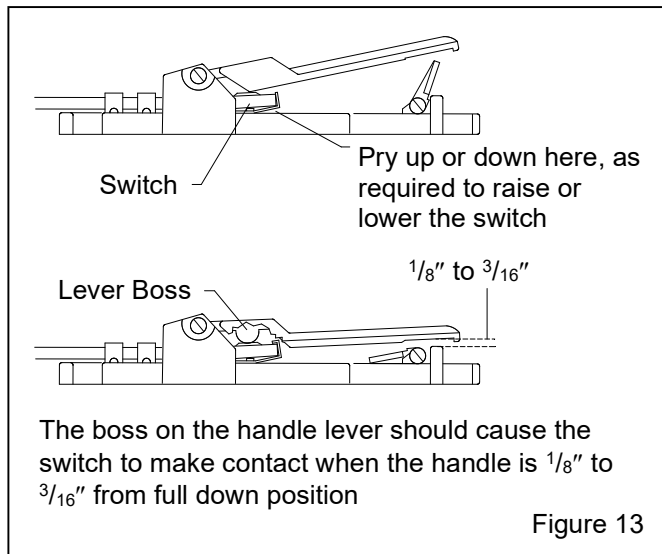
Figure 12

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

Continue adjusting as described until correct flow is attained.

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

4.2 RLX Switch Contact – Figure 13



4.2.1 The handle lever should engage the switch when it is approximately $1/8''$ to $3/16''$ from full down position. If the handle lever is too far up when it engages, it will cause excessive pressure on the switch and damage it.

4.2.2 Use a screwdriver or similar object to pry the metal switch bracket up or down as required so the boss on the handle lever contacts the switch within $1/8''$ to $3/16''$ window.

4.2.3 Check the adjustment by listening for the switch to click as the handle lever is lowered. It should engage within the specified window. If resistance is felt after the switch is engaged, and before the handle lever bottoms, the switch is too high and should be lowered to prevent damage to the switch.

4.3 Anti-freeze Injector

4.3.1 A separate manual is supplied for operation of the antifreeze injector. It is not necessary to use the injector unless temperatures fall below freezing. Close the injector when it is not required.

5.0 PREVENTIVE MAINTENANCE

5.1 Daily Inspection

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

- Check to make sure that couplings are secure and lock pins and safety cables are in place.
- Make sure the nozzle washer is in place and not worn.

⚠ WARNING

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

- Inspect the RLX Control Handle; look for the following:
 - The lever must not engage the switch unless the safety lever lock is pulled down. Refer to Section 4.2.
 - The **handle lever** must return to the "up" position when released.
 - The **safety lever lock** must return to the "up" position when the handle lever is released.
 - Both the handle lever and safety lever lock must move freely with no drag or binding.

⚠ WARNING

Malfunctioning control handles 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 be repaired or replaced. Serious injury or death can result from unintentional blasting.

5.1.2 During blasting, inspect the following:

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

NOTICE

If blast machine leaks are not corrected, abrasive erosion could cause extensive or irreparable damage to the blast machine.

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

WARNING

Leaks around couplings and nozzle holders indicate worn or loose-fitting parts. Nozzle holders and couplings that do not fit tight on hose, and nozzles that do not fit tight in nozzle holders 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:

- Inspect the blast hose for wear; look for soft spots. Soft spots mean the hose is worn. Replace the blast hose before the tube wears as far as the fabric plies.
-

WARNING

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

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

5.2.2 During blasting do the following:

Note the time it takes to fully depressurize the machine after the control handle is released. When

depressurizing time increases noticeably, inspect the exhaust muffler per Section 6.9

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. Refer to Section 6.7.
- Inspect the rubber pop-up seal, and replace at the first sign of wear, drying, or cracking. Refer to Section 6.8.

5.4 Periodic Inspection

5.4.1 Quantum valves: For safety and to avoid unscheduled down-time, periodically inspect the internal parts of the air valve and metering valve. Inspect for wear and lubrication on O-rings, pistons, springs, seals, and castings. Refer to Service Maintenance in Sections 6.3 and 6.4.

5.4.2 RLX Electric Control Handle: Periodically clean around the springs, handle lever, and lever lock to ensure that the unit is free of abrasive and debris that may cause the handle lever or lever lock to bind. Refer to Section 6.6.

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 by damp abrasive, during operation, rapidly open and close the choke valve several times.

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

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

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

⚠ WARNING

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

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

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

6.1.2.5 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 cleanout cover.

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

6.2.5 If the metering valve is clear, remove the blast machine inspection door, and check inside 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 cleanout cover O-ring is in good condition and in place before reassembling the cleanout cover.

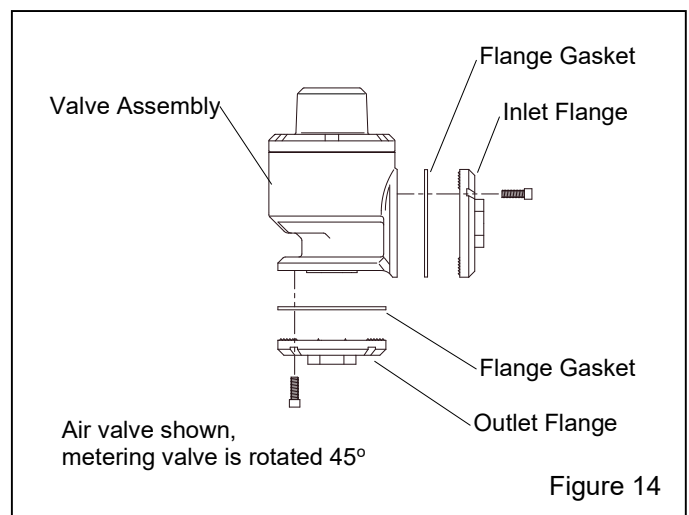
6.2.8 Check to make sure all inspection doors are secure before starting the air supply.

6.3 Quantum Air Valve and Abrasive Metering Valve Actuator – Figure 14.

Refer to Section 6.4 for the metering segment of the abrasive metering valve.

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

6.3.2 Remove the screws securing the inlet and outlet flanges to the valve assembly, and remove the valve assembly. Both flange gaskets, plus the seat retaining ring, and O-ring will be loose as the valve assembly is removed. Do not lose them.



6.3.3 Unscrew the six socket head screws and remove the cylinder cover and spring. Spring tension is removed when the cover is approximately 9/16" from the body.

6.3.4 Use a hammer handle or similar object to push the plunger assembly out the top of the cylinder.

6.3.5 Pry the seat out the bottom of the valve.

6.3.6 Remove the wear sleeve from the body.

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

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

- The wiper, located in the body, must fit snugly against the plunger. Replace if worn.
- O-rings must be round and snug fitting. Replace any that are flattened or damaged.
- The flange gaskets must be pliable and intact. Replace if hardened or damaged.
- Inspect the urethane seat. Replace if worn or damaged.
- Inspect the inlet and outlet flanges for wear. Replace if worn.

6.3.9 If the plunger and piston were separated as noted in paragraph 6.3.7, apply removable thread sealant to the threads on the piston stop, and reassemble the parts using a new O-ring.

6.3.10 If the wiper in the valve body needs replacement, the O-ring side of the wiper must face down, as shown in Figure 15.

6.3.11 Lubricate the O-ring and wiper in the valve body, and the piston U-seal, with a silicone-based lubricant.

6.3.12 Install the plunger and piston assembly into the body. Use care, making sure the piston cup does not fold back during assembly. Tucking the lip in, while applying pressure to the piston, eases assembly.

6.3.13 Place the wear sleeve in the valve body. The sleeve is correctly positioned when the alignment slot in the sleeve fits the roll pin in the valve body.

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

6.3.15 Install the valve assembly on the machine. Note that the inlet flange is secured with three screws, and the outlet flange is secured with four screws. The gaskets for both flanges are the same. Align the gaskets so the mounting holes match the pattern in the flange. Hand tighten the outlet flange screws first (this ensures that the retaining ring and O-ring won't shift). Hand tighten the inlet flange screws before tightening all screws.

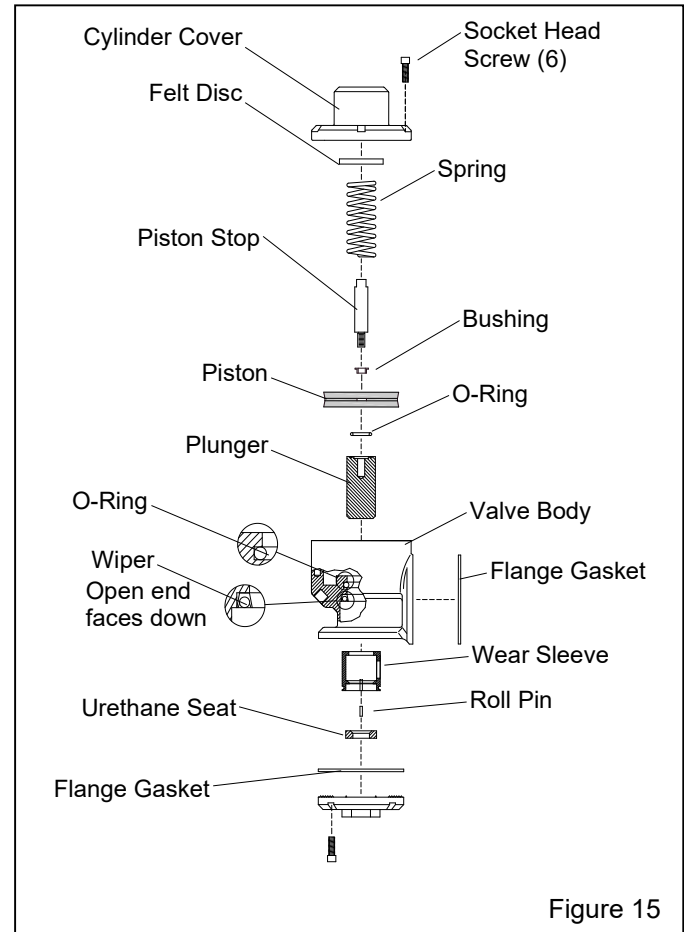


Figure 15

6.3.16 Install the spring and cylinder cover, tightening the screws in unison to secure.

6.4 Metering Segment, Auto-Quantum Metering Valve – Figure 16

Refer to Section 6.3 for the actuator segment.

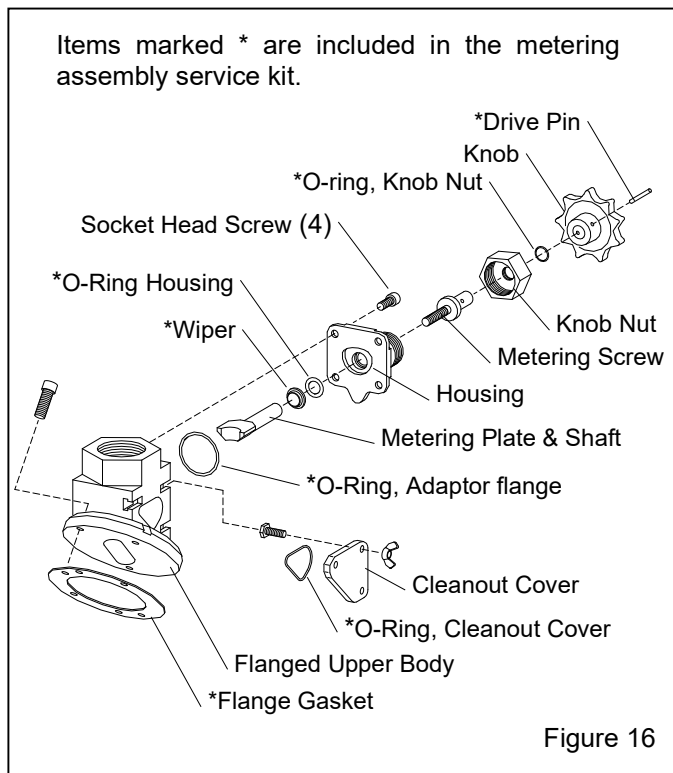
NOTE: A service kit is available for the Quantum metering segment. To avoid unscheduled down-time, a kit should be kept on-hand. Replace all the seals provided in the kit whenever the valve is opened.

6.4.1 Preparation for servicing

6.4.1.1 Empty the machine of abrasive. Turn off the compressed air supply. Lock-out and tag-out the air

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

6.4.1.2 If the valve requires immediate service, and the machine cannot be emptied of abrasive, turn the adjusting knob fully clockwise to shut-off abrasive flow. If the valve is worn so that abrasive does not shut-off, remove the cleanout cover, and insert a rag or similar object into the opening to block the flow of abrasive.



6.4.1.3 Loosen the wing nuts to remove the cleanout cover,

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

6.4.1.5 The upper body and actuator do not need to be removed from the blast machine to service the metering assembly. Inspect both parts for wear, and replace if worn.

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

6.4.1.7 Loosen the knob nut, and remove the knob assembly from the housing.

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

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

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

6.4.1.11 Clean the metering screw threads, and test the conditions of the threads with the metering plate shaft. Replace the metering screw if there is any resistance, binding, or metal filings.

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

6.4.1.13 Thoroughly clean and inspect all parts that are to be reused.

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

6.4.1.15 Place a new O-ring and wiper seal in the housing. A generous amount of silicone-based lubricant helps placement of the parts. The small side of the wiper seal faces away from the O-ring.

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

6.4.1.17 Reassemble the metering screw, nut, knob, and drive pin. Applying a small amount of silicone-based lubricant on the straight end of the metering shaft eases insertion through the nut O-ring.

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

6.4.1.19 Before installing the housing assembly, if the upper and lower bodies have not been inspected, do so now, and replace if worn.

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

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

6.4.1.22 Install the four socket head screws to secure the metering housing. Hand-tighten all screws before tightening with a wrench.

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

6.4.1.24 Service of the metering assembly is complete. Test the machine and piping for air leaks before use.

6.6 RLX Electric Control Handle

6.6.1 Spring replacement

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

6.6.2 Lever lock replacement – Figure 17

6.6.2.1 Remove the lock nut from the shoulder screw. Before removing the screw, note the positions of the spacers and spring, as shown in Figure 17. The bent end of the spring is toward the inside, forcing the lever lock up. The straight end is toward the outside, facing down and against the tab.

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

6.6.2.3 Check that the lever lock moves freely, raises to full up position, and that the handle lever will not engage unless the lever lock is pulled down.

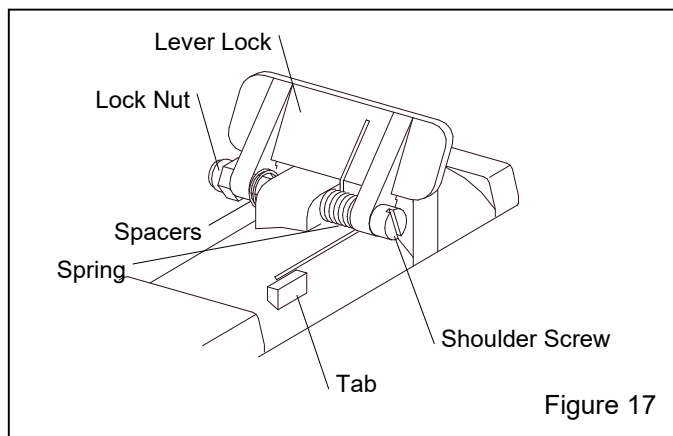


Figure 17

6.6.3 Handle lever replacement, Figure 18

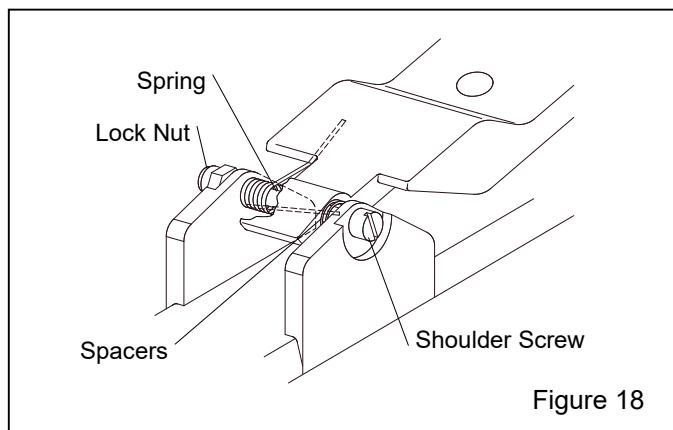


Figure 18

6.6.3.1 Remove the lock nut from the shoulder screw. Before removing the screw, note the positions of the

spacers and spring, as shown in Figure 18. The bent end of the spring is against the handle lever, facing up. The straight end is against the body, facing down.

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

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

6.6.4 Switch replacement

6.6.4.1 Remove the handle lever per Section 6.6.3.

6.6.4.2 Remove screws holding the switch and cord clamps.

6.6.4.3 Remove the compression nut, thrust washer and gasket from the connector shell per Figure 19.

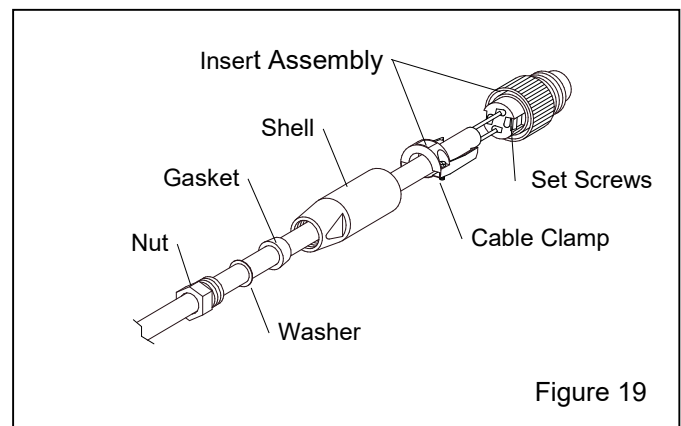


Figure 19

6.6.4.4 Remove the shell from the coupling insert assembly.

6.6.4.5 Loosen the cable clamp and set screws holding the cord, and remove the cord from the assembly.

6.6.4.6 Install a new switch and cord assembly using Terminals No. 1 and 3.

6.6.4.7 Adjust switch per Section 4.2.

6.6.4.8 Reassemble in reverse order. Check that the springs are in place, the handle lever and lever lock move freely, and the handle lever will not engage unless the lever lock is down.

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

6.6.4.10 Check that the handle lever moves freely, raises to full up position, and will not engage unless the lever lock is pulled down.

6.7. Replacing the Pop-Up Valve – Figure 20

6.7.1 Empty the machine of abrasive as described in Section 3.10.

6.7.2 Depressurize the blast machine, and lockout and tagout the air supply.

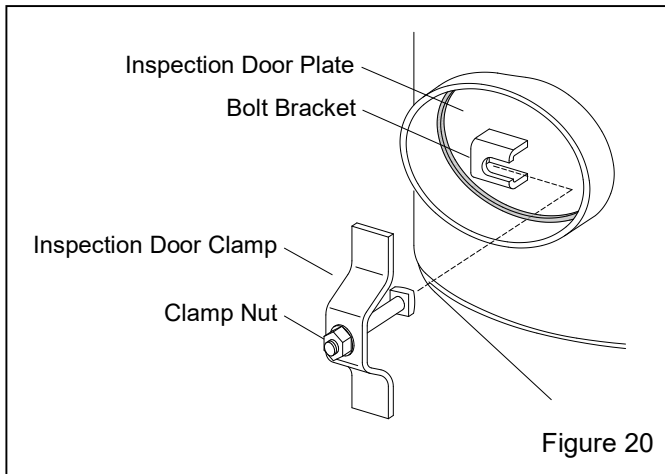
⚠ WARNING

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

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

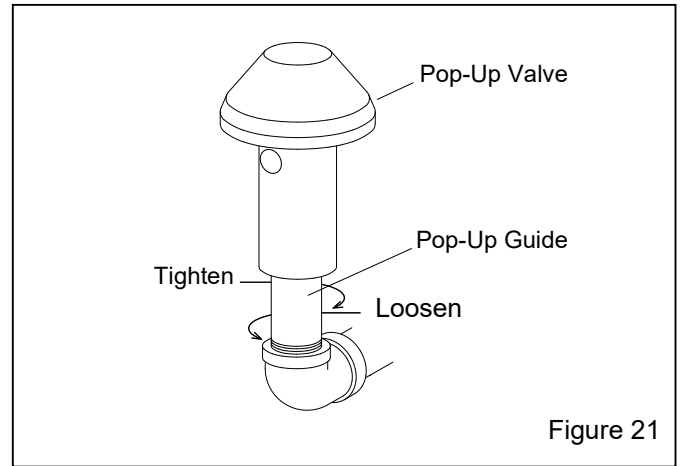
6.7.3 To gain access to the pop-up valve, remove the inspection door plate as follows:

1. Loosen the inspection door clamp nut enough to slide the clamp bolt from behind the bolt bracket and then remove the clamp and bolt assembly, as shown in Figure 20.
2. Push the inspection door plate into the blast machine and rotate it so it can be removed through the inspection door. If the plate is stuck to the inspection hole ring, rap the plate with a rubber mallet or similar tool to loosen it.



6.7.4 Remove the door gasket if it is cracked, dry, or otherwise damaged, and clean the surface of the inspection-door plate. Use rubber-based glue to adhere the new gasket to the plate. Allow the adhesive to cure before bolting the plate onto the machine.

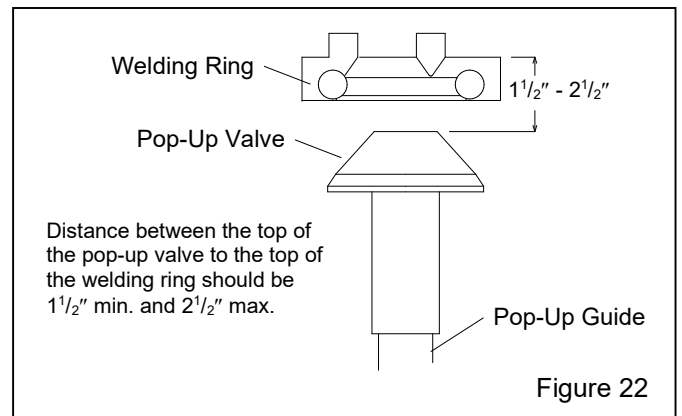
6.7.5 Use a short pipe wrench to unscrew the pop-up valve guide from the elbow by turning it counterclockwise, as shown in Figure 21. Remove the pop-up valve and guide from the machine.



6.7.6 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.

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

6.7.8 Refer to Figure 22 to check the pop-up height. If the pop-up sits too low, misalignment could occur when the pop-up comes up against the seal. If the pop-up sits too high, it will take longer for abrasive to flow through the opening when filling. Adjust the height by replacing the guide with one that is longer or shorter.



6.7.9 Bolt the plate onto the machine.

6.8 Replacing the Pop-Up Seal - Figure 23

6.8.1 Observe the warning in Paragraph 6.7.2; all service on the blast machine must be done with the compressed air OFF and the air supply locked out and tagged out.

6.8.2 Remove the old seal by using a finger, screwdriver, or similar object to work the seal out of the retainer groove. If for any reason replacement cannot be made from the top of the machine, observe the warning at the beginning of this section, and empty the machine and bleed the air supply line. Remove the inspection door plate and work through the inspection door opening.

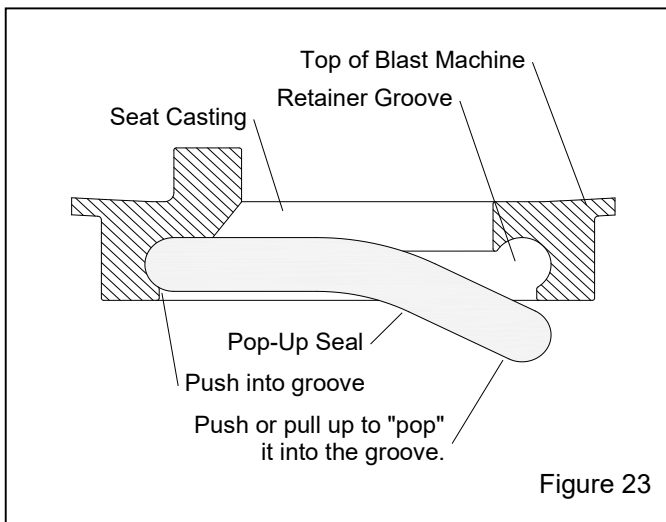


Figure 23

6.8.3 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.

6.9 Exhaust Muffler – Figure 24

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

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

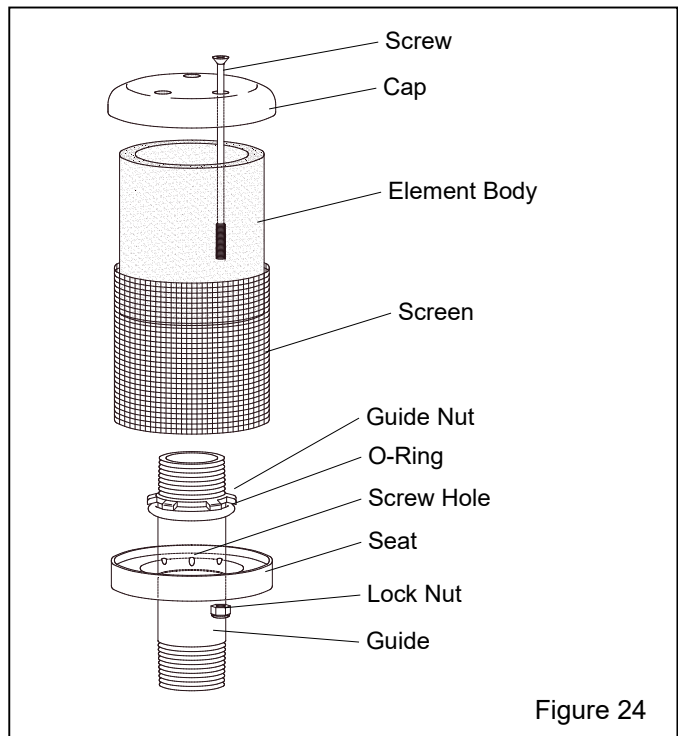


Figure 24

6.9.3 Remove the three locknuts and screws, and separate all parts.

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

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

⚠ 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

⚠ 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.

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

6.9.7 Reassemble, taking care to correctly insert the screws in the seat plate. The screw holes are the three closest to the center, as shown in Figure 24.

6.9.8 Firmly tighten the locknuts.

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

⚠ WARNING

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

6.10 Remove and Install Reusable Control Hose Fittings – Figure 25

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

1. Remove the hose end by placing the sleeve in a vise or use a backup wrench on the sleeve to prevent it from turning. Unscrew the insert by turning it counterclockwise.
2. Turn sleeve clockwise to remove from the hose.
3. Cut hose to length.
4. Lubricate inside and outside of hose with SAE 20 or equal oil.
5. Turn sleeve counterclockwise to install on hose. Do not over tighten the sleeve; stop tightening as soon as the hose bottoms out against the sleeve's internal shoulder, and back it out 1/4 turn. Over tightening will cause the hose to curl inward and could cause blockage.
6. Push end of insert into sleeve and turn clockwise to tighten until the insert hex is against the sleeve.

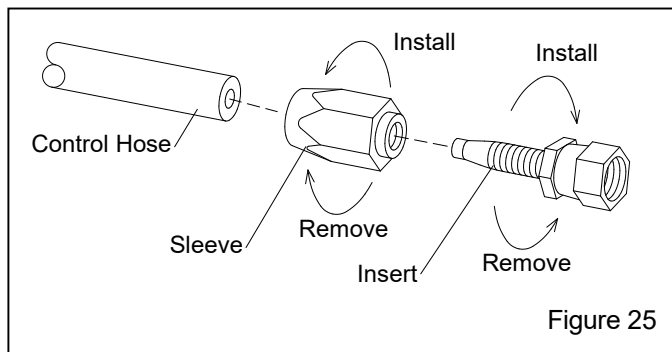


Figure 25

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.

Shorting electrical components could result in serious electrical shocks, or damage equipment. All electrical troubleshooting must be performed by a qualified electrician.

7.1 Neither Abrasive nor Air Comes out of the Nozzle When the Control Handle is Pressed

7.1.1 Check to make sure the machine is pressurized.

7.1.2 Make sure the safety petcock is closed.

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

7.1.4 Listen to the control box to determine if it clicks when the control handle is pressed and released. If it does, the fault probably is not in the electrical system. Confirm this by pushing the white manual override button on the solenoid valves. This should operate the valve if the fault is electrical. If the valves do not operate, proceed to section 7.1.8 for pneumatic checks.

7.1.5 Check for faults in the control panel by removing the control cord from the 5' lead cord coming from the panel. Hold the lead cord socket so the angled slot is facing up. The slot to the left (counter-clockwise of the angled slot) carries the power from the panel (hot line). Jump between the hot line and the angled slot (media valve solenoid), and listen for the click from the lower solenoid valve. Then jump between the hot line

and the slot to the right (air valve solenoid) of the angled slot. The upper solenoid valve should click. If both valves click, check the control cord and electric RLX control handle per Sections 7.1.6 and 7.1.7. If one solenoid does not click it is most likely defective. If neither solenoid clicks the problem may be in both solenoids, but more likely one of the following.

- Check for faulty fuse or loose connections in the control panel.
- Check for inadequate power to the control panel.
- Check continuity of all panel wiring and solenoids.
- Check for faulty transformer (120 volt systems only),

7.1.6 Check each control cord extension, by connecting them one at a time to the panel, and jump across the extension cord socket as explained in section 7.1.5. Continue to check all extension cords in like manner.

7.1.7 Check the end control cord (with ACS switch) by jumping across terminals No. 1 and 3 on the lo-profile connector. The upper solenoid (air valve) should click. With the jump in place, push the ACS switch on and off. Moving the ACS switch should cause the lower (media valve) solenoid to click. If does not click, the cord, connectors or switch are faulty and should be repaired or replaced. If the panel does click, the remote control handle is the probable cause and should be repaired. Refer to Section 6.6.4.

7.1.8 Check control lines and fittings for leaks or breaks.

7.1.9 Open the safety petcock, and press the control handle lever. Air should come out the petcock. If it does not, Check the air filter and 3/16" supply hose, and orifice fitting for blockage. Clean, as necessary.

7.1.10 Check that the abrasive metering valve and choke valve are both open.

7.2 Air Only (no abrasive) Comes Out of the Nozzle

7.2.1 Quantum abrasive metering valve may be closed or needs adjustment. Refer to Section 4.1.

7.2.2 Check that the ACS is in the on position (rear button on ACS Switch is pushed in).

7.2.3 Blast machine may be empty.

7.2.4 Abrasive may be damp. Refer to Section 6.1 to clear damp abrasive.

7.2.5 Check the media metering valve for obstructions. Refer to Section 6.2.

7.2.6 Open the safety petcock on the Quantum metering valve and press the control handle. If air does not come out the petcock, check for blockage in the hose from the panel. If air does come out, the metering valve actuator section is not functioning. Turn off the compressed air supply and inspect the actuator per Section 6.3.

7.2.7 Check for air leaks in hose between the panel and metering valve.

7.3 No Abrasive Flow When the ACS Switch "ON" Button Is Pressed

7.3.1 Quantum abrasive metering valve may be closed. The valve is closed when the handle is turned fully clockwise. Adjust per Section 4.1.

7.3.2 Leak or blockage in hose or fittings from the control panel to the abrasive valve.

7.3.3 Obstruction in metering valve. Refer to Section 6.1 and 6.2.

7.3.4 Quantum metering valve actuator requires service. Refer to Section 6.3.

7.3.5 Blast machine may be empty.

7.3.6 Do electrical tests per Section 7.1.

7.4 Abrasive flow does not stop when ACS switch "OFF" button is pressed

7.4.1 Do electrical tests per Section 7.1.

7.4.2 Quantum metering valve actuator requires service. Refer to Section 6.3.

7.5 Blasting Does Not Stop When the Control Handle is Released

7.5.1 Quantum metering valve or air valve malfunctioning.

7.5.1.1 To determine which valve is malfunctioning, close the choke valve. If air stops exiting the nozzle the air valve is malfunctioning. If air does not stop, check abrasive valve.

7.5.2 Do electrical tests per Section 7.1.

7.6 Heavy Abrasive Flow

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

7.6.2 Adjust abrasive metering valve per Section 4.1.

7.6.3 Check the abrasive metering valve and air valve for wear. Look for wear on the abrasive valve metering plate. Inspect the air valve seals. If there is an internal leak in the air valve it will act as if the choke valve is partially closed.

7.7 Abrasive Surging

7.7.1 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. Refer to Section 4.1.

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

7.7.3 Abrasive metering valve may require service. Refer to Sections 6.3 and 6.4.

7.8 Intermittent Abrasive Flow

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

7.8.2 Abrasive may be worn from recycling. Replace abrasive.

7.9 Blast Machine will not Pressurize

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

7.9.2 Insufficient-size air supply hose or reduced-size fittings between the compressor and blast machine. Refer to Section 2.4.

7.9.3 Dirty filter in the optional moisture separator. Check filter element.

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

7.10 Blast Machine will not Depressurize or Depressurizes too Slowly

7.10.1 Exhaust muffler blocked. Refer to Section 6.9.

7.11 RLX Control Handle Lever Fails To Return to the Non-Blast Position (Up) When Released

7.11.1 Check the handle lever for damage that may cause binding against the body. Replace damaged parts.

7.11.2 Check the spring for damage or fatigue. Replace.

7.12 RLX Control Handle Lever Lock Fails to Pop Up When the Handle is Released

7.12.1 Check the lever lock for damage, or build up of debris or abrasive. Replace damaged parts.

7.12.2 Check the lever lock return spring for damage or fatigue. Replace.

8.0 ACCESSORIES AND REPLACEMENT PARTS

8.1 Accessories

- (-) Cover, blast machine, steel, for
4 cu. ft., 20" dia. 20358
6 cu. ft., 24" dia. 02336
- (-) Cover, poly bag with Clemco logo for
4 and 6 cu. ft. machines, large 15143
- (-) Screen, for
4 cu. ft., 20" diameter 20357
6 cu. ft., 24" diameter 03100
- (-) Safety cable, 1-1/2" to 3" OD hose 15013
- (-) Safety cable, 1-1/2" to 4" OD hose 27405

8.2 Blast Machine – Figure 26

Item	Description	Stock No.
1.	Ball valve, 1-1/4" with handle	02397
2.	Handle, 1-1/4" ball valve	22532
3.	Pusher line assembly, 1-1/4" x 31"	23675
4.	Adaptor, 1-1/4" NPT x JIC	22529
5.	Ball valve, 1" with handle	02396
6.	Coupling, 1-1/4" CF, for 4 cu. ft. w/12" nipple	27720
	6 cu. ft. w/16.5" nipple	24197
7.	Metering valve, Auto-Quantum	22760
8.	Wheel, primary, for 4 cu. ft., 12" dia. x 300	20426
	6 cu. ft., 16" dia. x 400	20427
9.	Inspection door assembly, 6" x 8"	02377
10.	Gasket, inspection door, 6" x 8"	02369
11.	Seal, pop-up valve	02325
12.	Pop-up valve, 4", with external sleeve	03699
13.*	Moisture separator, optional, 1-1/2" manual drain	22363
14.	Air valve, Quantum	21350
15.*	Gasket, CQG, pack of 10	00850
16.	Wye, standard 1-1/4"	01818
17.	Internal pop-up guide, 1-1/4" x 6" toe	01753
18.	Leg cap	21517
19.	Axle, 1" dia x 30.5"	02402
20.	Washer, 1" thrust	03825

21.	Retaining ring, 1"	03824
22.	Muffler, exhaust	05068
23.	Wheel, secondary, 10" x 2.75	20349
24.	CPF-20 Air filter, optional	03578
25.	Cartridge, CPF filter	03547
26.*	Coupling, nylon, for 4 cu. ft., CQPS-1	21088
	6 cu. ft., CQPS-2	08413
27.*	Nozzle holder, nylon, for 4 cu. ft., NHP-1	04106
	6 cu. ft., NHP-2	04127
28.*	Hose, Supa-T blast, for 4 cu. ft., 1" ID x 50 ft.	23104
	6 cu. ft., 1-1/4" ID x 50 ft.	23106
29.*	Nozzle, for 4 cu. ft., TMP-5	23521
	6 cu. ft., TXP-6	23525
30.*	Washer, nozzle, for 4 cu. ft., NW-25, pack of 10	91024
	6 cu. ft., NW-32, pack of 10	91026
31.	Handle, 1" ball valve	01212
32.*	Casket, hose coupling, package of 10 CQGP-2, for 4 cu. ft. (Item 26)	08852
	CQGP-3, for 6 cu. ft. (Item 26)	08853

* Models shown are supplied with original blast machine systems.

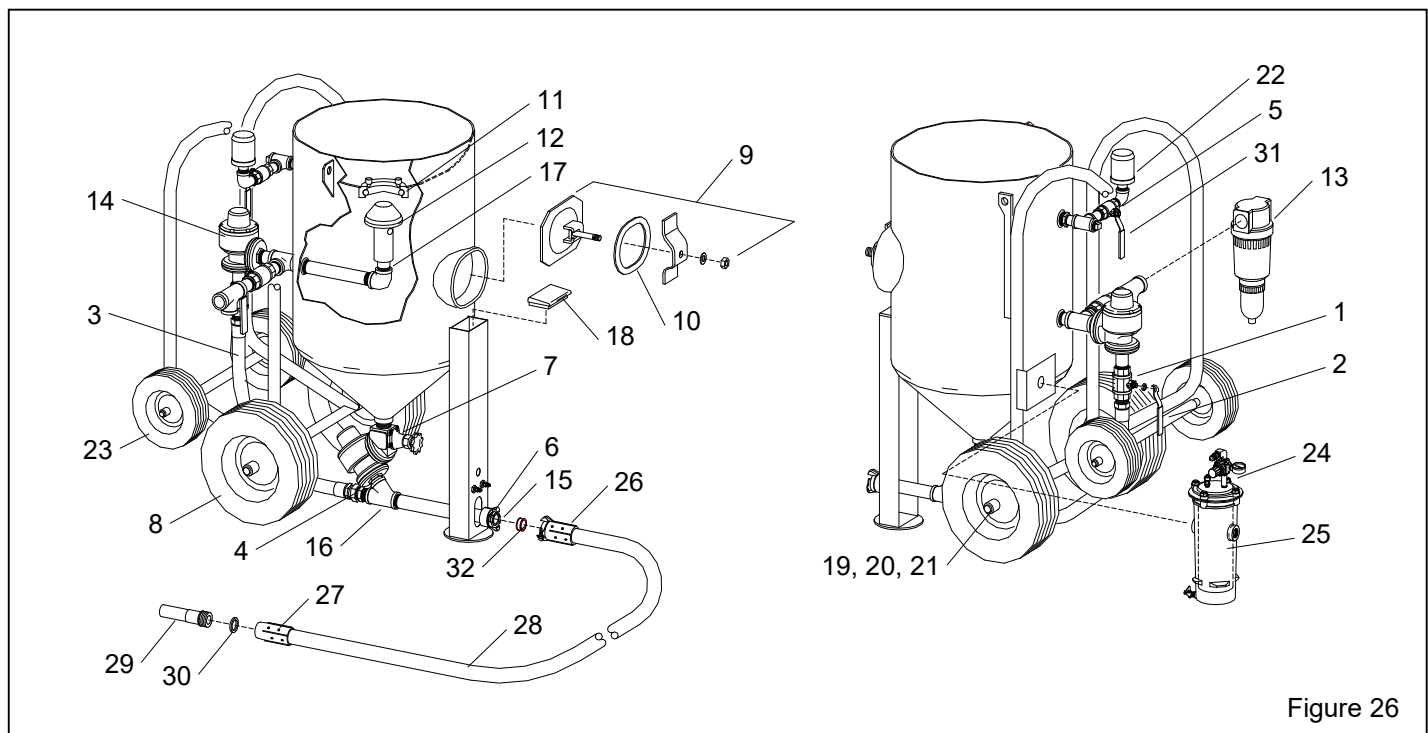


Figure 26

8.3 Exhaust Muffler – Figure 27

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	05815

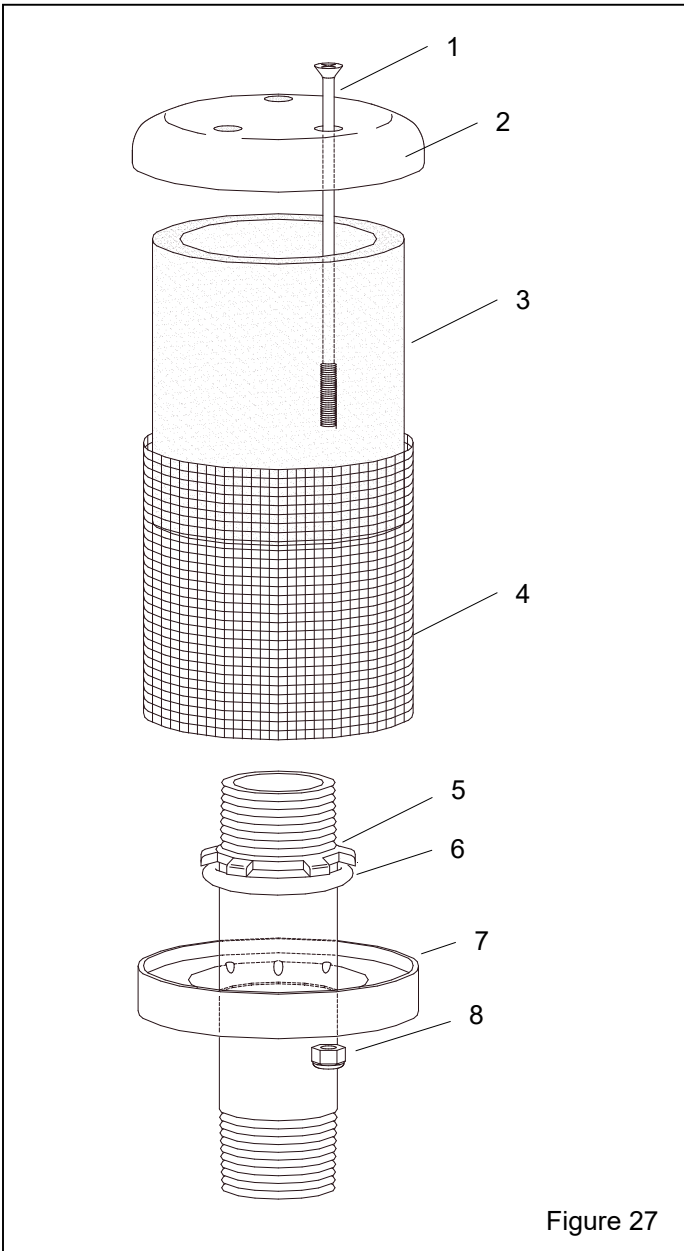


Figure 27

8.4 Remote Control System Parts – Figure 28

Item	Description	Stock No.
1.	Air valve, Quantum	21350
2.	Metering valve, Auto-Quantum	22760
3.	RLX Electric control handle, lo-profile	10840
4.	Hose, 3/16" x 4' twinline cpld.	21619
5.	Hose, 3/16" x 5'	03083
6.	Cord, 50' control w/ ACS switch.....	10847
7.	Extension cord, 50' twist-lock for ACS	15138
8.	Extension cord, 100' twist-lock for ACS	19528
9.	Adaptor, 1/8" NPT w/ 1/16" orifice	01945
10.	Pigtail, 12 volt systems only	10831
11.	Tie, nylon	02195
12.	Control panel, complete	
	12 volt	05621
	120 volt.....	07650
13.	Adaptor, 90° swivel brass elbow	20425
14.	Adaptor, 1/4" NPT	02494
15.	Petcock, 1/4" NPT	01993
16.	Tee, 1/4" NPT brass	02025
17.	Hex reducing nipple, 1/4" x 1/8" NPT	02026

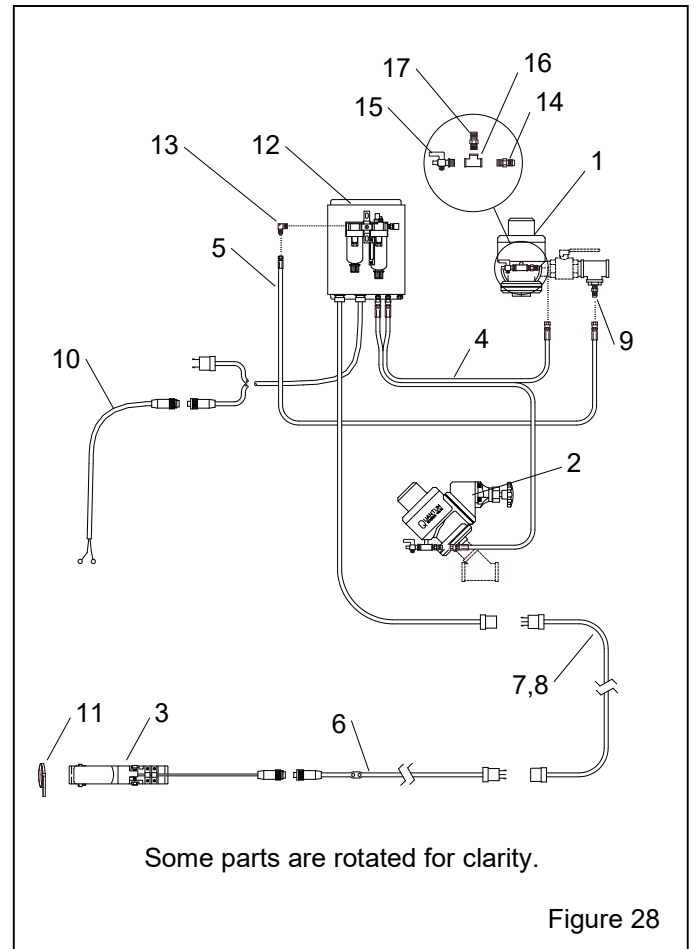
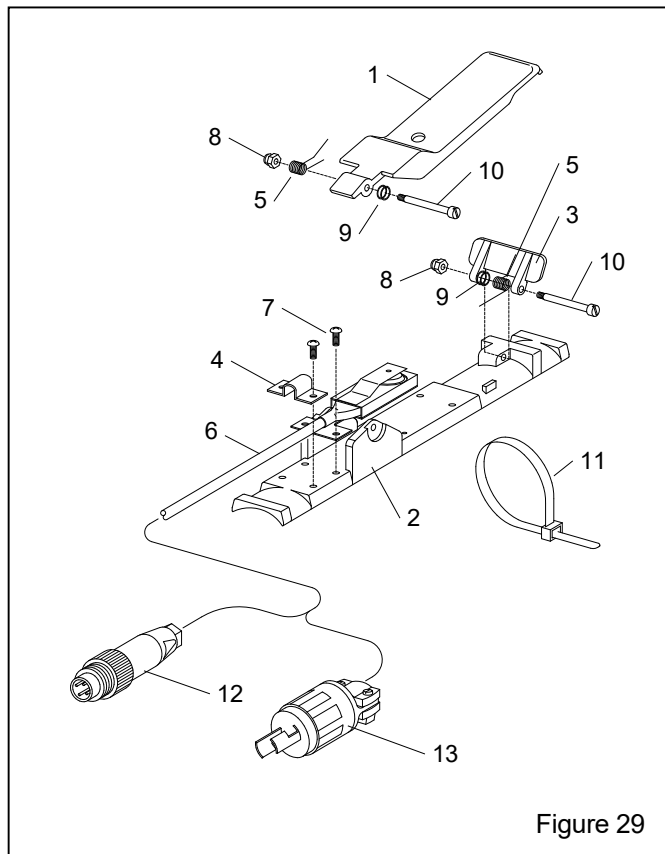


Figure 28

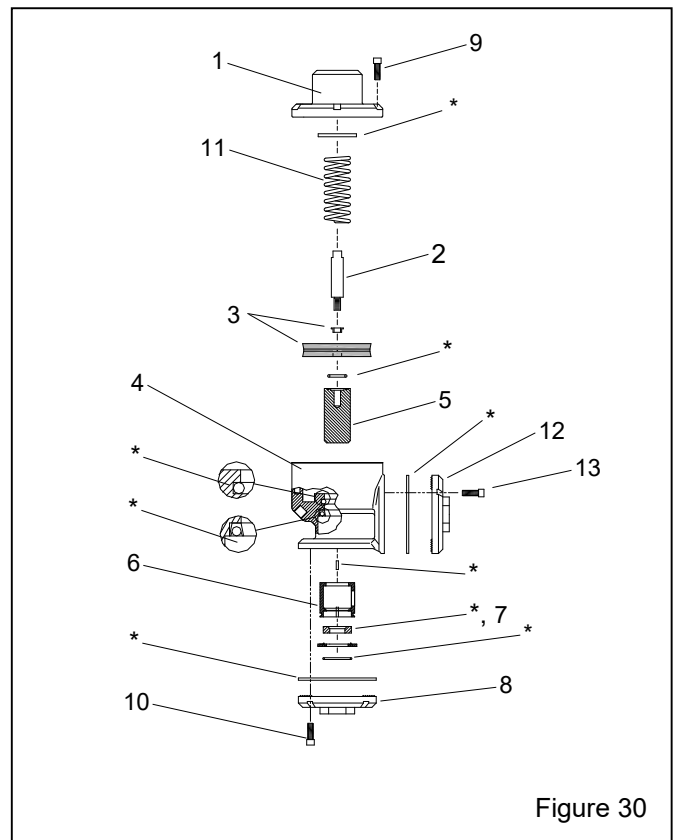
8.5 RLX Electric Control Handle – Figure 29

Item	Description	Stock No.
(-)	RLX electric control handle w/Lo-profile connector.....	10840
1.	Handle lever	10573
2.	Body.....	10568
3.	Lever lock	10564
4.	Clamp, switch cord	05810
5.	Spring, lever (2 required).....	05823
6.	Switch with cord	24842
7.	Screw, 8-32 X 3/8" rd. hd. (4 required).....	05814
8.	Nut, 8-32 lock, ss (2 required)	05815
9.	Spacer washer, stainless steel (4 required)....	05434
10.	Screw, 3/16" X 1-1/4" shoulder (2 required).....	05817
11.	Tie, nylon wire	02195
12.	Connector, Lo-profile male (for 10840 only)	10828
13.	Connector, Twist-lock male (for 05801 only)	02899



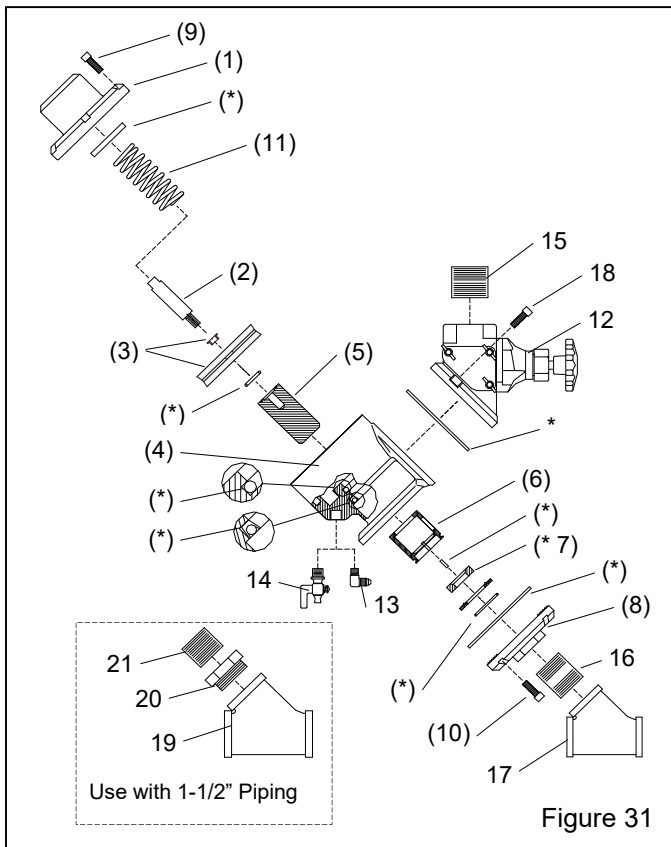
8.6 Quantum Air Valve – Figure 30

Item	Description	Stock No.
(-)	Quantum Air Valve	21350
*	Service kit, Quant. actuator, see Fig. 31a....	24446
1.	Cover, cylinder	21317
2.	Stop, piston	21323
3.	Piston-cup w/bushing	21329
4.	Body, valve	21349
5.	Plunger, air valve	21343
6.	Wear sleeve	21342
7.	Seat, urethane,	21344
8.	Flange, threaded outlet	22077
9.	Screw, 5/16-NC x 1-3/4" socket head	21321
10.	Screw, 5/16-NC x 1" socket head	21318
11.	Spring	20600
12.	Flange, threaded inlet	22078
13.	Screw, 3/8-NC x 1" socket head	22655



8.7 AQV Auto Quantum Valve – Figure 31

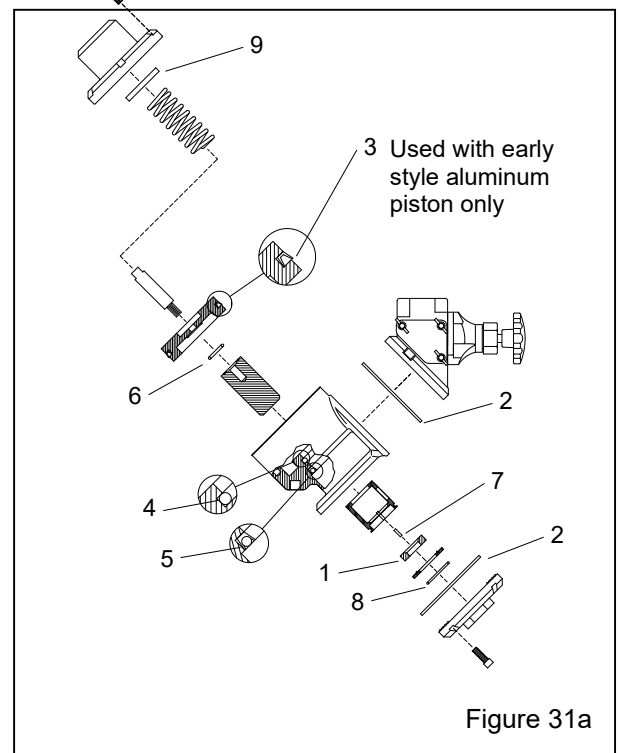
Item	Description	Stock No.
(-)	Actuator assembly, AQV (Items w/().....	22775
*	Service kit, Quant. actuator, see Fig. 31a.....	24446
1.	Cover, cylinder	21317
2.	Stop, piston	21323
3.	Piston cup w/bushing	21329
4.	Valve body, actuator	21349
5.	Plunger, grit valve	21326
6.	Wear sleeve, grit valve	21342
7.	Seat, urethane	21344
8.	Flange, threaded outlet w/retaining ridge	21319
9.	Screw, 5/16-NC x 1-3/4" socket head	21321
10.	Screw, 5/16-NC x 1" socket head	21318
11.	Spring	20600
12.	Metering assembly, Quantum	24587
Refer to Section 8.8 for replacement parts		
13.	Adaptor, 1/4" NPT elbow	02513
14.	Petcock, 1/4" NPT	01993
15.	Nipple, 1-1/2" x close, schedule 80	01791
16.	Nipple, 1-1/4" x 2"	01718
17.	Wye, 1-1/4" NPT	01818
18.	Screw, 3/8-NC x 1" socket head	22655
19.	Wye, 1-1/2" NPT	01819
20.	Bushing, 1-1/2 NPT x 1-1/4 NPT	01805
21.	Nipple, 1-1/4 x close HD	01854



**24446 SERVICE KIT
QUANTUM ACTUATOR ASSEMBLY**

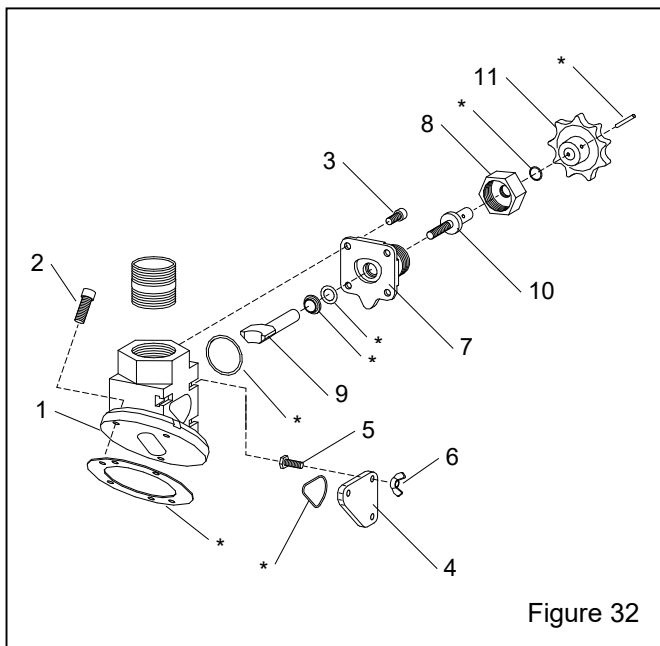
Item	Qty	Description
1.	1	Seat, urethane
2.	2	Flange gasket
3.	1	U-seal, 3-1/2" ID (used only w/ alum piston)
4.	1	O-ring, 1-1/2" ID x 3/16" nom.
5.	1	Wiper, plunger
6.	1	O-ring, 31/64" ID
7.	1	Roll pin, 1/8" x 1/2"
8.	1	O-ring, 1-1/2" ID x 3/32" nom.
9.	1	Felt disc

NOTE: Item 8 is not required with current 21319 outlet flange with integrated retaining ridge. Used only with earlier style 22077 flange, requiring a separate 22429 Retaining Ring.



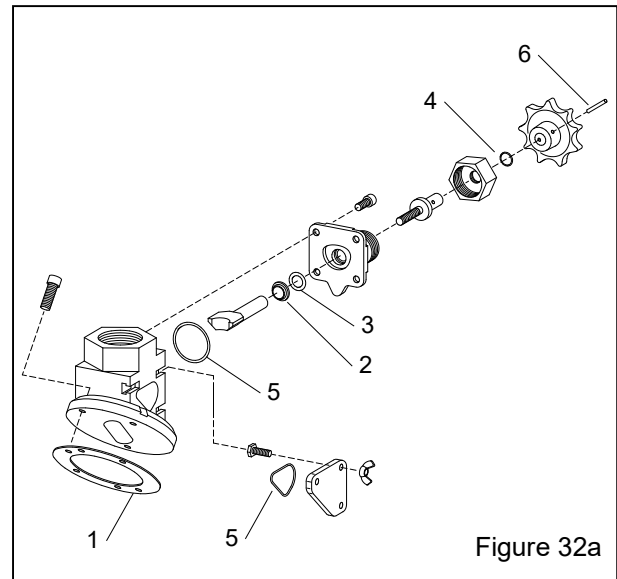
8.8 Quantum Metering Segment – Figure 32

Item	Description	Stock No.
*	Service kit, metering section (Fig. 32a).....	22854
1.	Upper body, flanged	21314
2.	Screw, 3/8-NC x 1" socket head	22655
3.	Screw, 5/16-NC x 3/4" socket head	22767
4.	Cover, cleanout	22620
5.	Screw, 1/4-NC x 3/4" hex head cap	03052
6.	Nut, 1/4-NC wing	03113
7.	Housing, knob	22761
8.	Nut, knob-housing	22762
9.	Metering plate and shaft	22763
10.	Metering screw	22764
11.	Knob, adjustment	22766



**22854 SERVICE KIT
QUANTUM METERING SECTION**

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



8.9 Control Panel – Figure 33

Item	Description	Stock No.
(-)	Control panel, single operator	
	12-volt DC	05621
	120-volt AC	07650
1.	Air filter, 1/4-NPT	05617
2.	Antifreeze injector, 1/4-NPT	05616
3.	Valve, 3-way air	
	12-volt DC (for 12-volt DC panel)	07664
	12-volt AC (for 120-volt AC panel)	07662
4.	Terminal block, 5 pole	02268
5.	Adaptor, 1/4-NPT	02494
6.	Hex nipple, 1/4-NPT	02808
7.	Elbow, 1/4-NPT brass street	02027
8.	Fitting, 1/4-NPT female bulkhead	05605
9.	Bushing, 1/4-NPT x 1/8 (exhaust port)	02010
10.	Adaptor, 1/8-NPT fem bulkhead x JIC	03432
11.	Supply cord, 5-foot	
	12-volt, with lo-profile connector	10833
	120-volt, with twist-lock connector	02216

12.	Cord, control whip	07675
13.	Connector, 1/2" strain relief	02213
14.	Locknut, 1/2" conduit	12713
15.	Elbow, male 1/4-NPT x 1/4" tube	03428
16.	Tee, 1/4" tube	03351
17.	Connector, 1/8-NPT x 1/4" tube	03430
18.	Tubing, 1/4" white, specify feet required	03427
19.	Tubing, 1/4" red, specify feet required	05612
20.	Tubing, 1/4" blue, specify feet required	05613
21.	Tubing, 1/4" green, specify feet required	05614
22.	Tubing, 1/4" orange, specify feet required	05615
23.	Bracket, panel top mount	21614
24.	Bracket, panel bottom mount	21676
25.	Fuse, 2-amp 1/4" x 1-1/4", 120-volt only	03039
26.	Fuse block, 120-volt only	03040
27.	Transformer, 12.6-volt, 120-volt only	02198
28.	Connector, lo-profile male	10828
29.	Plug, 15 amp twist-lock	02275
30.	Connector, female twist-lock	06327
31.	Bracket, air filter/antifreeze injector	21908

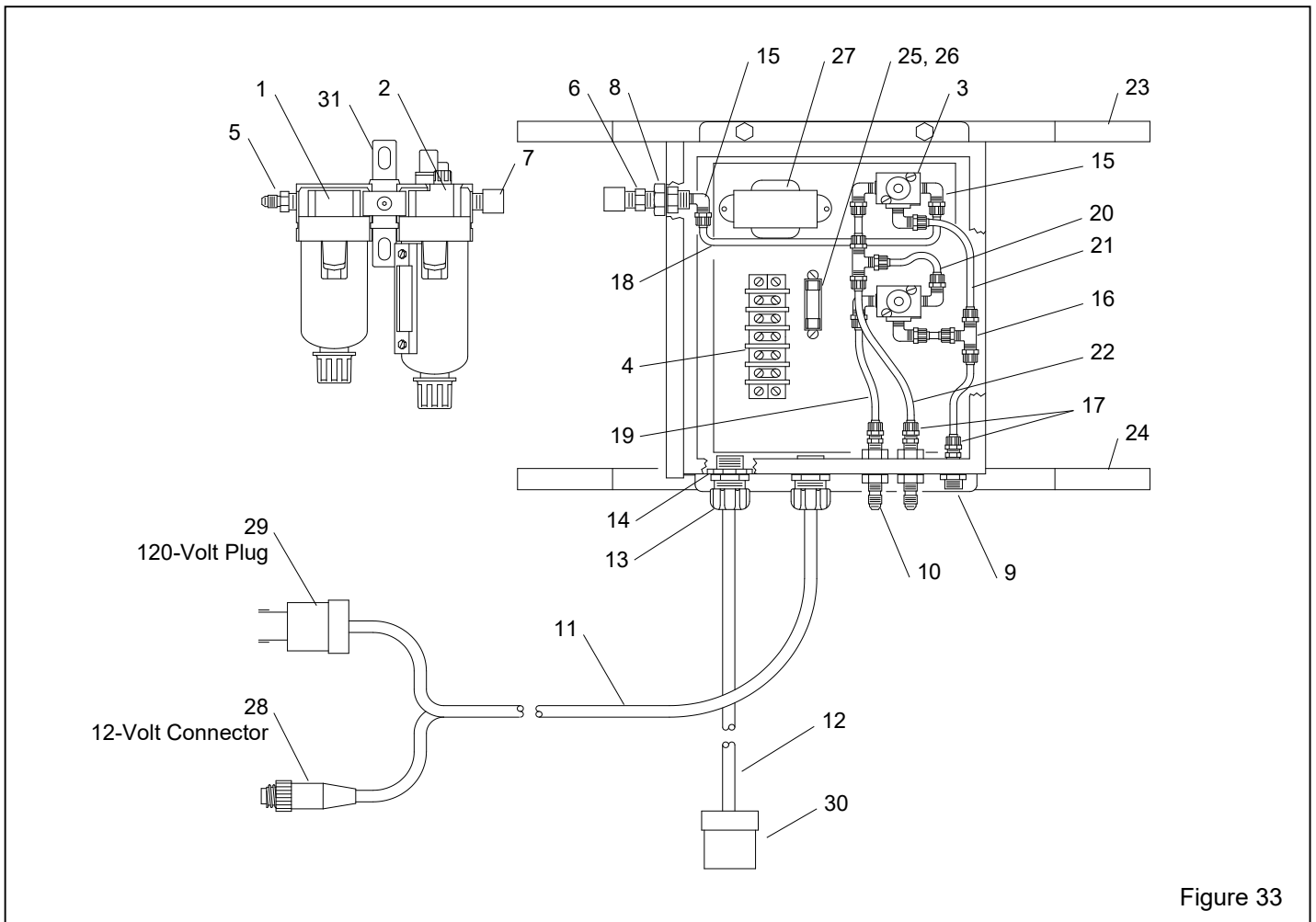


Figure 33