CAVIBLASTER®

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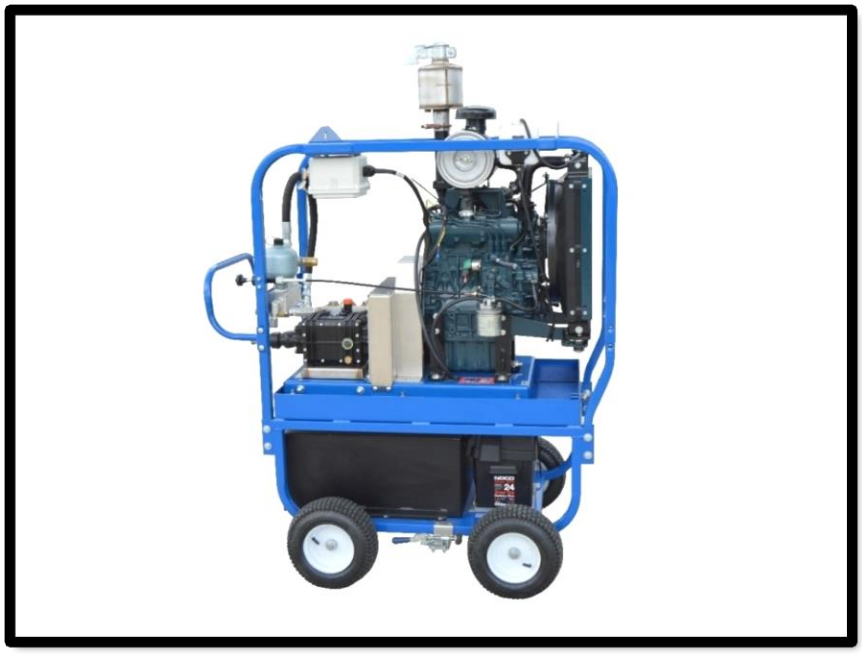
Operation & Maintenance Manual



Model 1625-D

CAVIDYNE™ LLC is not responsible for damages or injuries resulting from a failure to comply with instructions in this manual. Please read and study the entire manual carefully before use.

The CaviBlaster® 1625-D must only be operated and maintained by trained personnel.

This equipment generates high pressure water and is intended for underwater use only. **Serious personal injury or death may result from improper use.**

Commercial Diver's gear should be used to operate the CaviBlaster® system.

CAUTION: DO NOT USE THIS EQUIPMENT TO CLEAN SENSITIVE SURFACES as LED-Lights, Underwater Lights, Elecronic Equipment, Etc.

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1.0 UNIT SPECIFICATIONS

The CaviBlaster® 1625-D power unit comprises a 32.9HP (24.5 kW) Kubota D1105-E3B diesel power-pack and a UDOR NX 75/150 triplex plunger pump. Detailed performance and specifications are listed below**:**

CaviBlaster® 1625-D Specifications	
Nominal Pump Flow	16 GPM (61 LPM)
Nozzle Operating Pressure	2,500-PSI (172 BAR)
Engine	32.9 HP (24.5 kW), Diesel Powered (Kubota D1105-E3B)
Installation Environment	Outdoor enclosed or exposed *See Section 4 for installation requirements*
Fuel Requirements	Diesel fuel (ASTM Grade No. 1-D or 2-D, or EN 590)
Fuel Tank Capacity	18 Gallons (69 Liters)
Water Inlet Pressure Limits	0-PSI (Atmospheric Pressure) to **50-PSI Maximum** (0 BAR to **3.5 BAR**) *See Section 4 for further requirements*
Overall Unit Dimensions (L x W x H)	49” x 31” x 56” (124 cm x 79 cm x 137 cm)
Maximum Pressure Hose Length	328 LF (100 meters) of 3/4” (19mm) diameter thermoplastic
Power Unit Weight (Dry)	600 LBS (280 KG)
Zero-Thrust Gun Weight	11 LBS (5 KG)

Figure 1.1 – CaviBlaster® 1625-D Specifications

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2.0 GENERAL DESCRIPTION

The CaviBlaster® 1625-D high-pressure water power unit allows the operator to use the water flow and pressure to generate cavitation at the end of the proprietary nozzle.

The CaviBlaster® cleans the surface of any underwater structure using the energy released by the implosion of the cavitation bubbles during the cavitation process. When directed at the surface being cleaned, the energy released by the collapsing cavitation bubbles causes marine growth to be removed from the surface.

The system consists of a portable, zero-thrust gun, connecting high-pressure hose and a diesel-powered, high-pressure pumping unit. The zero-thrust gun uses a triggeroperated valve to control the water stream off and on. If the valve is closed, the power unit goes into bypass mode unloading the engine and the pump.

FULL LOAD is defined as the engine at full throttle / full speed. If partially throttled, the engine will stall, creating an undesirable running condition for the centrifugal clutch.

The CaviBlaster® 1625-D power unit is a complete “plug and play” system built into a self-supporting frame that allows quick deployment and/or installation of the unit. Water can be supplied from either a pressurized source, directly from the natural source via an electric booster pump supplied with the power unit, or from a gravity feed storage tank.

The unit is equipped with many features to maintain operator safety while operating at pressures of 2,550 psi (172 BAR).

For more information on the CaviBlaster® system please visit us at:
www.caviblaster.com

Figure 2.1 – CaviBlaster® 1622-D General Features

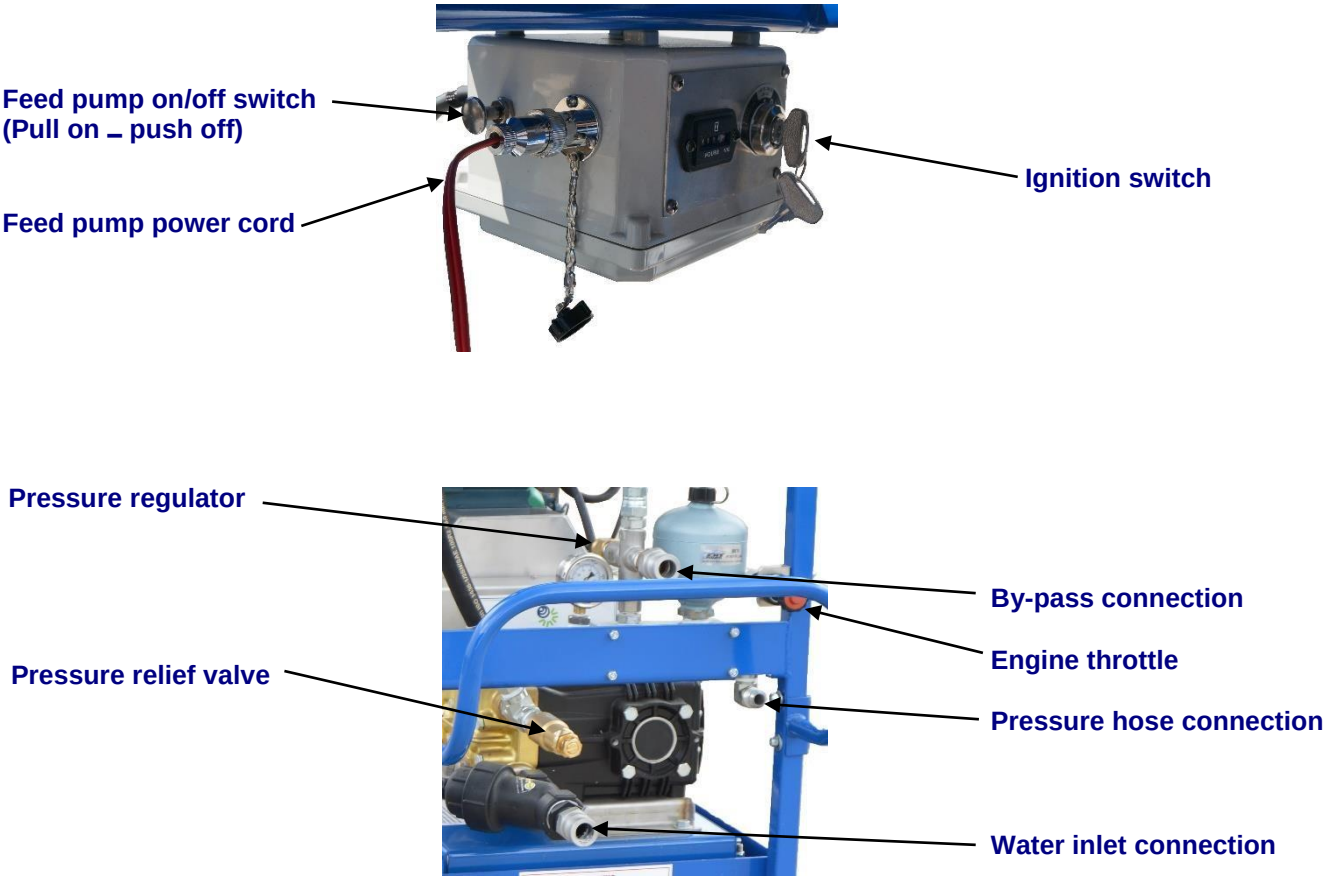

Figure 2.2 – CaviBlaster® 1625-D Ignition Box & Hose Connections

2.1 Using this Manual

Every attempt has been made to ensure that this documentation is complete and accurate at the time of publication. It is imperative; however, that anyone attempting to use this manual must have good comprehension of how this equipment operates. Further, this manual can in no way replace the common sense of an individual. If at any time this manual seems to contradict itself, or common sense, discontinue the procedure, re-read the section, and seek assistance from CaviDyne™ or other personnel familiar with the operation of this equipment.

2.2 Conventions

The first time a component is mentioned, it is typically followed by a figure reference; e.g., check fuel tank (See Figure 2.1). Figure numbers and section numbers are always coincident.

When other sections are referenced the *SECTION NAME* will appear in italic caps. The electronic version allows users to click on the section name or figure reference to jump to that section. The words "**This space intentionally left blank**" will appear where there is more than 3 inches of white space.

(EOS) will appear above the page number on the last page of each section.

2.3 Scope

This manual covers installation, operation, and maintenance of the CaviBlaster® 1625-D. It is essential that personnel who will operate and/or service this equipment familiarize themselves with this manual. Standard components, such as the unit engine and pump, are covered by the manufacturer's literature found in the Appendix.

2.4 Terms and Abbreviations

CCW	Counterclockwise
CW	Clockwise
EOS	End of Section
GPM	Gallons Per Minute
HP	Horsepower
LPM	Liters Per Minute
PPE	Personal Protective Equipment
PSI	Pounds Per Square Inch (without suffix, assumed to be gauge pressure).

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3.0 SAFETY INFORMATION

The CaviBlaster® 1625-D power unit is an inherently powerful and potentially dangerous piece of equipment; however, with proper care and training it can be operated safely. The 1625-D must only be operated by personnel that have read and understand this manual. It is intended to reinforce and review safety techniques to prevent personal injuries and property damage.

Users must comply with all local, state, and national laws concerning high-pressure water jetting equipment as well as all underwater work regulations.

It is strongly recommended that this entire manual be reviewed in-depth before operating or servicing this equipment. Service work should only be performed by individuals who are proficient in using and maintaining this equipment. Refer to the applicable section in this manual for the correct procedures prior to any installation, setup, or maintenance work.

3.1 Personal Safety

Operation of the CaviBlaster® 1625-D underwater cleaning system must only be attempted by commercial divers or other personnel who have been trained in its use. Appropriate protective equipment should always be worn. Operation of the system without the proper equipment and training can result in personal injury.

CaviDyne™, LLC is not responsible for damages resulting from a failure to comply with instructions in this manual. Please read carefully before use.

If maintenance or repair of the CaviBlaster® gun is being conducted out of the water, remember that the zero-thrust gun has front and rear jets. Never direct the jet streams at a person or animal. Never direct the jet streams toward power lines or other high voltage equipment.

Ensure that there is a safe area to work while operating the CaviBlaster® 1625-D.

Seek immediate medical attention if the operator suffers an injury as the result of contact with the high-pressure water stream. **Serious personal injury can result from an untreated water injection wound.**

3.2 Personal Protective Equipment (PPE)

Always wear appropriate Personal Protective Equipment (PPE) when operating this equipment.

Personnel operating or working in the vicinity of the power unit should wear appropriate hearing protection when the CaviBlaster® system is in use. If the diver is not wearing a diving helmet, hearing protection is recommended. CaviDyne™ suggest wearing vented earplugs, such as “Doc’s Proplugs”, for diver hearing protection.

The operators of the CaviBlaster® system should always wear neoprene or heavy rubber gloves to provide protection to the hands and, in particular, to the fingernails. The gloves will absorb most of the energy produced by bursting cavitation bubbles and prevent the cavitation bubbles from contacting the operators’ hands. The gloves will also protect operators’ hands from the initial shockwave when the gun is activated.

Failure to wear appropriate PPE may result in personal injury.

3.3 Modification to the Equipment

Do not make any unauthorized modifications or repairs to this equipment. Components used throughout this assembly were specifically designed or selected to safely meet the unique high-pressure requirements. Only replace parts with those recommended by or supplied by CaviDyne™. Any unapproved modifications will void the equipment warranty. Unauthorized modification or part substitution can result in serious personal injury or property damage.

Unauthorized replacement of any part may lead to catastrophic equipment failure and serious personal injury.

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4.0 INSTALLATION

The CaviBlaster® 1625-D must be installed in accordance with the requirements outlined below. The unit can be installed in a vehicle to allow for maximum mobility and flexibility.

4.1 Uncrating and Lifting

Unpack the equipment and inspect for damage. If damage is found, immediately contact CaviDyne™ and the shipping company. *If the unit will not be installed immediately, provide adequate indoor storage to protect against damage.*

The CaviBlaster® power unit is not designed with fork tubes and should be lifted only with the lifting eyes provided on top of the frame. Verify that lifting equipment is rated for the weight listed in Section 1.0 *UNIT SPECIFICATIONS* and that the unit is stable before lifting.

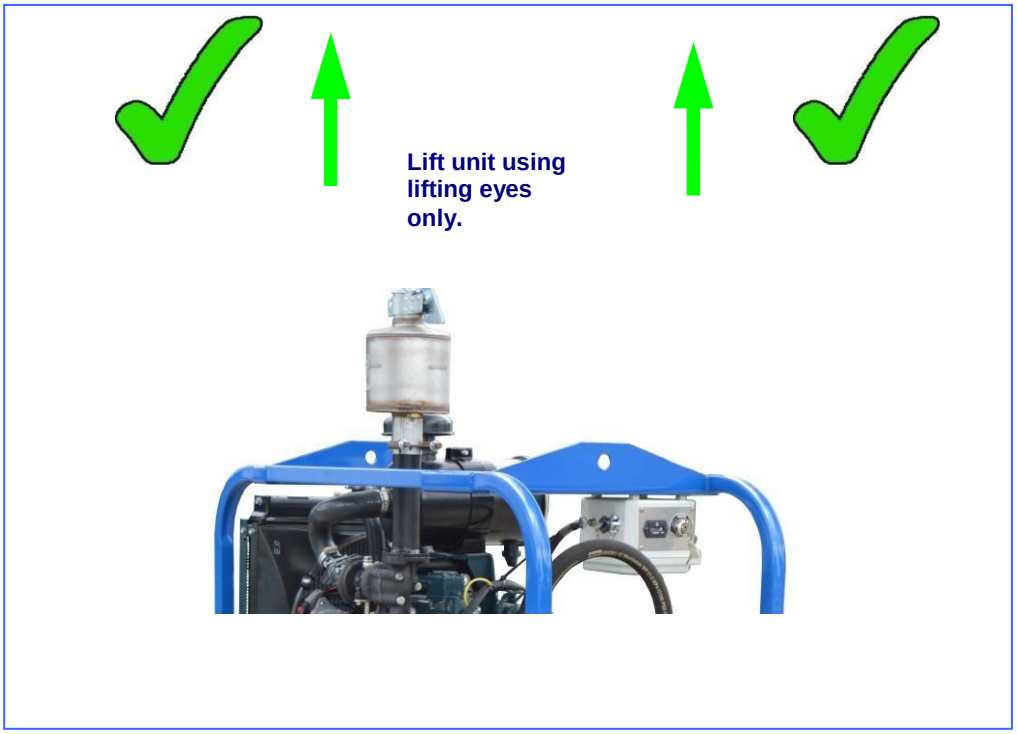

Figure 4.1 – Lifting Guidelines

4.2 Installation Location

For maximum flexibility the CaviBlaster® power unit should be installed in an area where it is capable of reaching both its water source (10ft (3 M) max lift) and anticipated cleaning targets within acceptable hose lengths (328ft (100M) max). The CaviBlaster® power unit can be installed in an enclosed* or open environment.

**** Enclosed installations will require provisions for adequate engine cooling air flow and for venting of engine exhaust. See Figure 4.2 below.***

Installation location must be a level surface able to safely support the unit weight listed in Section 1.0 *UNIT SPECIFICATIONS*. Orient unit to allow unrestricted access to the hose connection plate and control panel, located on the front of the unit. Allow a minimum of three feet around the unit and access from above to conduct service and repair work. Take note of frequently serviced areas such as the engine, belts and fuel tank.

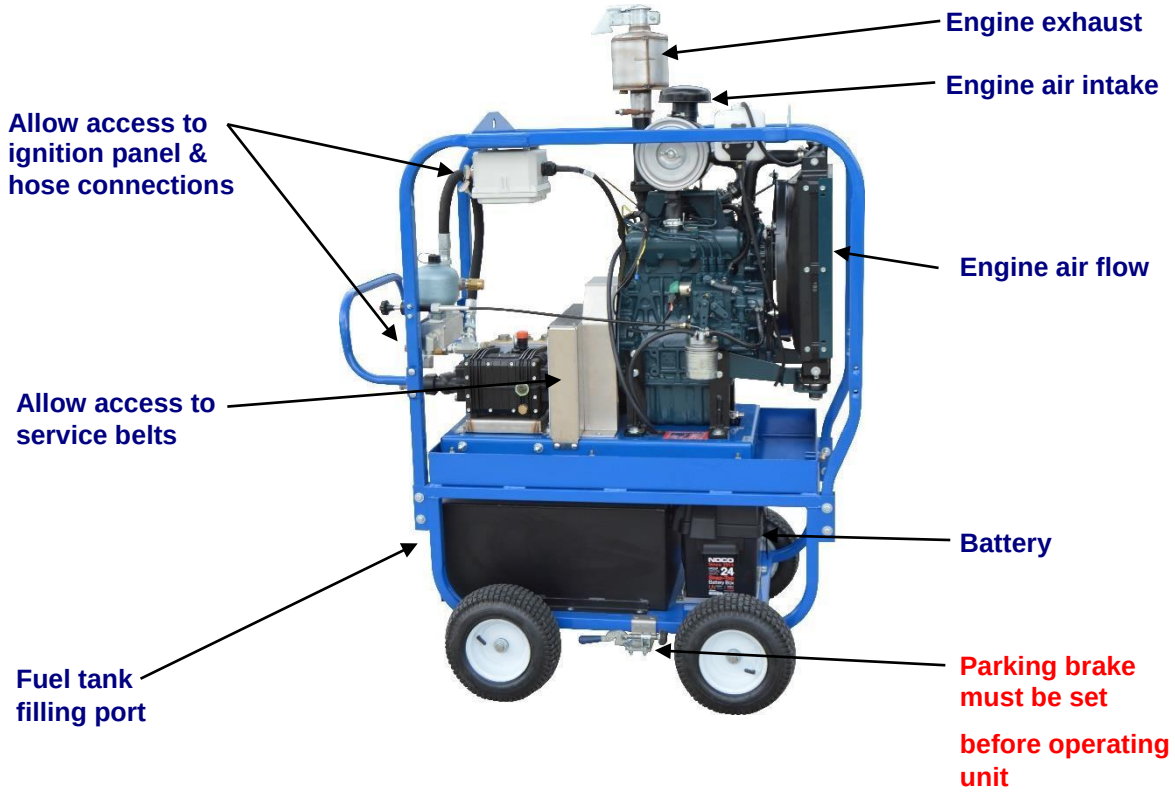

Figure 4.2 – Installation Guidelines

4.3 Initial Set-Up

After first receiving the CaviBlaster® power unit, the following must be checked and completed:

1) Connect the battery (See Section 4.3.1)
2) Add engine oil (See Engine Manual located in the *APPENDIX*)
3) Add pump oil (See Pump Manual located in the *APPENDIX*)
4) Connect the feed or suction hose (See Section 4.3.2)
5) Connect the bypass hose (See Figure 2.2)
6) Connect the pressure hose (See Figure 2.2)
7) Connect the electric feed pump (See Section 4.3.2)
8) Fill the fuel tank (Use diesel fuel ASTM Grade No. 1-D or 2-D, or EN 590 or as specified in the Engine Manual located in the *APPENDIX*).

Engine and/or pump fluids may have been removed for shipment. Check fluid levels prior to starting.

4.3.1 Connecting the Battery Terminals

For shipping purposes, the battery terminals have been disconnected. To reconnect the battery, reference Figure 4.3 and the procedure below:

1. Ensure the ignition is turned “OFF” and the keys are removed.
2. Open the battery box by loosening the strap and removing the cover.
3. Connect the battery terminals as follows:

   RED to positive terminal **BLACK to negative terminal**
4. Tighten the terminal screws securely.
5. Replace the battery cover and secure with strap.

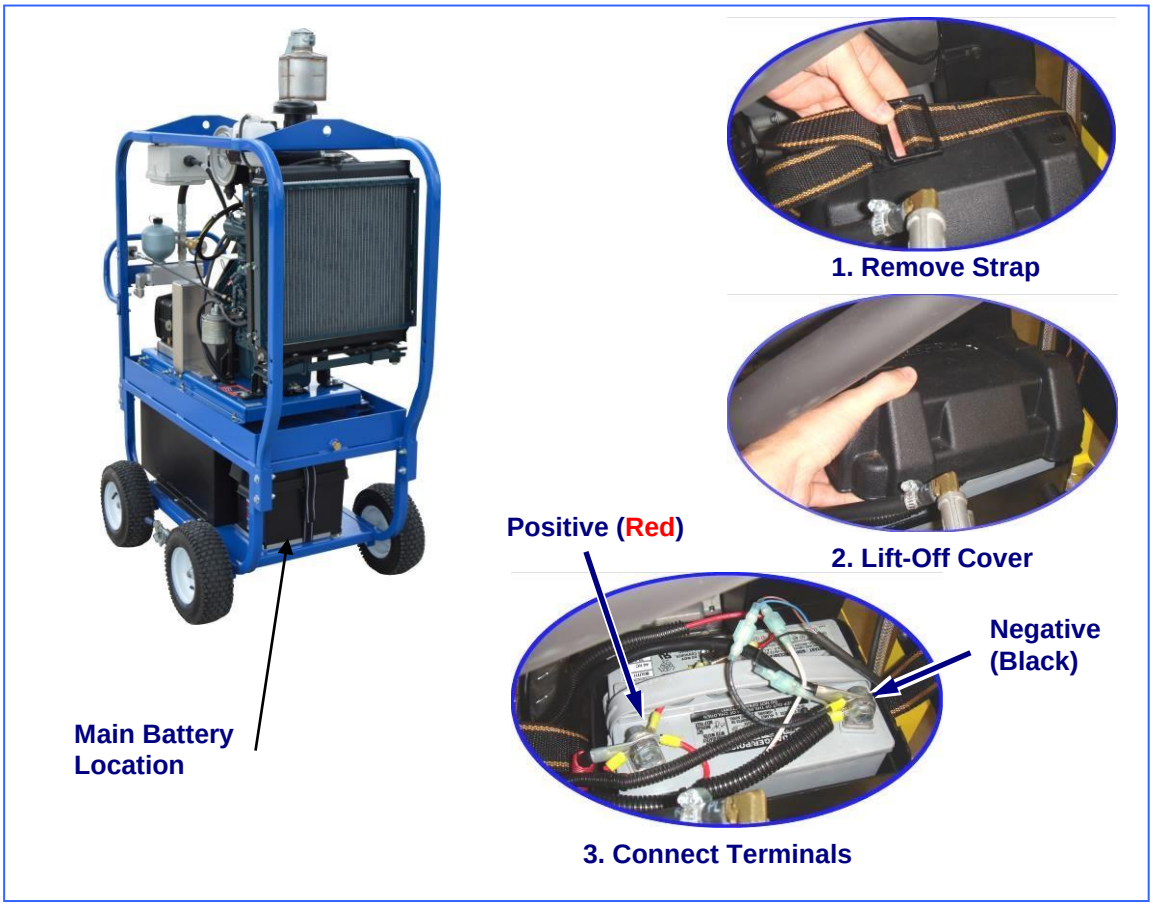

Figure 4.3 – Reconnecting the Battery Terminals

4.3.2 Connecting the Water Source

The CaviBlaster® power unit can be used with seawater or fresh water. It must be flushed with fresh water for a minimum of 1-2 minutes after each use in seawater to ensure long service life.

The CaviBlaster® 1625-D must be flushed and rinsed with fresh water after every use in seawater.

Failure to flush and rinse the power unit after use in seawater will result in increased wear and tear on components and in decreased service life.

Failure to flush and rinse the unit can cause the pump valve(s) to stick in the open position. This will prevent the system from producing the correct operating pressure.

The feed water inlet connection is located on the control panel (See Figure 2.2). An electric submersible water pump is supplied to provide positive inlet water pressure to the main pressure pump. Two water supply conditions are acceptable for the CaviBlaster® power unit.

- Forced inlet water condition using the supplied electric water pump or an outside water source capable of supplying at least 20 GPM (75 LPM) at a **maximum pressure of 50-PSI (3.5 BAR)**.

- Gravity feeding water source (See Figure 4.4). In this case the electric pump is not required. Use a hose with a diameter of at least 1-1/4” to connect the water tank to the power unit

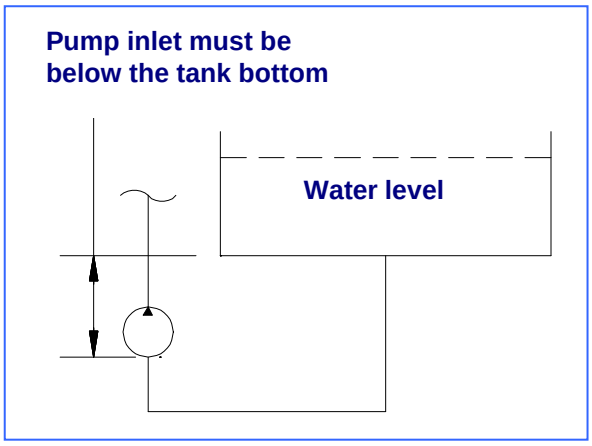

Figure 4.4 – Gravity Feeding Source

To use the feed pump supplied with the system:

- Turn the engine ignition to OFF (See Figure 2.2).
- Connect the cam-lock socket on the 1-1/4” clear PVC feed hose to the water inlet connection (See Figure 2.2).
- Connect the electrical plug on the feed pump power cable to the matching receptacle (See Figure 2.2).
- Connect a hose to the bypass connection (See figure 2.2).
- Submerse the feed pump into the water source.
- Pull the feed pump ON/OFF switch out to activate the feed pump (See Figure 2.2).
- It is important not to operate the feed pump for long periods of time without the engine operating as this will discharge the battery.

To use force feed from an alternate source:

- Turn the engine ignition to OFF (See Figure 2.2).
- When feeding the CaviBlaster® with an alternate water source, the source must supply water at a volume of greater than 16 gallons per minute at a maximum pressure of 50-psi.
- Connect a 1-1/4” cam-lock socket on the water supply hose to the water inlet connection (See Figure 2.2).
- Connect a hose to the bypass connection (See figure 2.2).
- Turn on the alternate water source.

Ensure that the feed hose is connected to the inlet connection and the water supply is on prior to starting the pressure pump. Failure to supply water to the pressure pump will cause damage to the pump.

To use gravity feed:

- Locate the water supply tank so that the bottom of the tank is higher than the water inlet connection (See Figures 2.2 and 4.4).
- Turn the engine ignition to OFF (See Figure 2.2).
- Connect a minimum 1-1/4" hose to the water inlet 1-1/4" cam-lock plug.
- Connect the other end of the hose to the water supply tank.
- Make sure the lowest point in the hose line is the connection with the power unit.
- It is essential that adequate water is supplied to the water supply tank to maintain the water level several inches above the bottom of the tank. Failure to maintain an adequate water level in the supply tank could starve the pressure pump of water causing damage to the seals or other components of the pressure pump.

Ensure that the water source can reliably deliver the maximum pump flow of 16 GPM (60 LPM). A minimum flow of 20 GPM (75 LPM) is recommended to ensure that the pump is not starved of water. If connecting to a gravity feed tank, locate the bottom of the tank above the water inlet connection on the power unit to ensure a flooded suction line. (See Figure 4.4)

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5.0 OPERATION

The CaviBlaster® 1625-D should be operated by two (2) properly trained individuals. One, the diver, operates the zero-thrust gun, while the other operates the power unit. Both operators should be in audio or visual communication with each other.

The CaviBlaster® 1625-D should only be operated by properly trained personnel who are familiar with the contents of the manual. Review the safety requirements found in Section 3 before operating.

5.1 Preparing the CaviBlaster® for Operation

The following checklist should be completed in advance, so that the unit is always ready for immediate use. This should be completed after each use.

1) Inspect the CaviBlaster® power unit, hoses, JIC fittings and gun for any signs of damage.
2) Inspect the inline strainer to ensure that it is not clogged (See Figure 6.1). Clean if necessary.
3) Check for proper engine oil level (See engine Owner's Manual found in the *Appendix*). Add lubricating oil (SAE 10W40) if necessary.
4) Check for proper pressure pump oil level (See pump Owner's Manual found in the *Appendix*). Add hydraulic oil (SAE 30 non-detergent) if necessary.
5) Check fuel tank (See Figure 2.1) for proper diesel fuel level. Add diesel fuel (ASTM Grade No. 1-D or 2-D, or EN 590) if necessary.

Incorrect fuels should not be used as they may prove hazardous.

5.2 Startup of the CaviBlaster®

Before starting the CaviBlaster® 1625-D power unit, review all safety requirements found in Section 3.0 *SAFETY INFORMATION*. This equipment should only be operated by individuals who have read and understand the CaviBlaster® Operation and Maintenance Manual.

1) Verify that the unit has been properly prepared for operation as described in Section 4.
2) Verify that the parking brake is applied.
3) Verify that the gun is properly connected and the mechanical trigger is released.
4) Apply appropriate hearing protection prior to starting engine.
5) Insert the key into the ignition switch on the ignition panel (See Figure 2.1). Turn the key clockwise one position to heat the glow plugs. Once the plug preheat light (the top right light on the panel) turns off, turn the key farther clockwise to start the engine. If the engine does not start within 10 seconds, return the key to the “OFF” position and wait at least 30 seconds before operating the starter again. Once, the engine starts, release the key, allowing it to return to the “ON” or running position.
6) Run the engine at idle speed for a minimum of 20 seconds (20”) at operating temperatures above 41˚F (5˚C). For lower operating temperatures, run engine at idle speed for a minimum of one minute (1’).

DO NOT THROTTLE UP THE ENGINE UNTIL THE DIVER IS READY FOR UNDERWATER OPERATION.

The engine must be run at full throttle / full speed. If partially throttled, the engine will stall, creating an undesirable running condition.

5.3 Normal Operation

Normal operation of the CaviBlaster® system is defined as user control of water flow via the gun trigger. Control of the power unit from the gun trigger is accomplished by a mechanical shut-off valve in the gun. Should a problem develop with the control valve, discontinue using the CaviBlaster® until fixed.

The CaviBlaster® 1625-D power unit is designed to operate in two modes: idle and full throttle. Less than full throttle will result in reduced or no cavitation.

Review the safety requirements for PPE and safe operation before proceeding.

1) Ensure parking brake is applied.
2) Connect the gun to the high-pressure hose and unroll sufficient length of hose to reach the operating location.
3) When the diver is ready to commence cleaning operations, ensure that the gun is submerged in water. Ensure that the power unit operator and other persons working in the vicinity of the power unit wear appropriate hearing protection when the engine is running. If the diver is not wearing a helmet, hearing protection is recommended. CaviDyne suggests vented earplugs such as “Doc’s Proplugs” for diver hearing protection. 4) Start up the power unit as described in section 5.2.
5) Wear neoprene or rubber gloves to protect the hands and follow all safety regulations that may be applicable to the work being performed.
6) The gun trigger should be in open or “ON” position (See Figure 5.3) when throttling up the engine to engage the pressure pump. This will prevent the pressure pump from being in a loaded condition which will cause the clutch and belt to slip while they are engaging the pressure pump.
7) Throttle the engine completely up by pulling the black throttle cable knob all the way out and twisting the knob to lock it (See Figure 5.1).
8) Activate the cleaning cavitation stream by squeezing the trigger to the open or “ON” position (See Figure 5.3). Release trigger to stop the water flow and direct to bypass.
9) If the diver operating the unit must be replaced or the cleaning operation must be interrupted or terminated, disengage the pressure pump by pushing the throttle lever

in to the idle position (See Figure 5.1) and then release the water pressure in the hose(s) by squeezing the gun trigger to the open or “ON” position (See Figure 5.3) **while under water**. Revert back to step 3 of the operating instructions when the diver or replacement is ready to continue cleaning.

Although the CaviBlaster® system is safe to use when submerged in water, the system generates a high-pressure (up to 2,550 psi [172 BAR]) water stream, which can cause injury when the gun is out of the water. *ALWAYS* keep the gun submerged when the pressure pump is engaged.

Throttle cable knob

Push on the red knob to release, pull the cable all the way out and twist the black knob to lock.

Figure 5.1 –Throttle Control

5.4 Adjusting the CaviBlaster® for Maximum Performance

The pressure at the nozzle of the zero-thrust gun has to be maintained within certain limits to achieve cavitation and for best performance results. If using a calibration pressure gauge situated between the pressure hose and the CaviBlaster® gun, the water pressure should be 2,550 psi (172 BAR) with the gun submerged and the gun trigger in the open or "ON" position. For best results, repeat this calibration procedure if cleaning performance degrades, or every 3 months at a maximum.

A CALIBRATION GAUGE IS RECOMMENDED WITH EVERY UNIT. CONNECT BETWEAN THE END OF THE THERMOPLASTIC HOSE AND THE WHIP HOSE OR GUN.

To calibrate the pressure at the zero-thrust gun, follow the procedure below:

- Stop the power unit and pull the gun trigger to discharge any residual pressure in the hose lines.
- Disconnect the gun with its whip hose from the main hose line.
- Attach the calibration gauge and tighten the JIC connections.
- Submerge the gun. Because of the danger of the operator coming in contact with either of the water streams from the cavitating or zero-thrust nozzles, CaviDyne™ does NOT recommend calibrating the gun out of the water. Use extra care to avoid both water streams if doing so.
- Ensure that both the cavitation and zero-thrust nozzles are pointed away from the diver's or operator's hands, arms and body. - Start the power unit (See Section 5.2).
- Pull the gun trigger to the open or "ON" position (See Figure 5.3). - Throttle the engine to full speed (See Section 5.3).
- Hold the gun tight and observe the calibration gauge (See Figure 5.2).
- The power unit operator should turn the knob on top of the pressure regulating valve until pressure reads 2,550 psi, on the calibration gauge. Turning the knob clockwise will increase the pressure and turning it counter clockwise will decrease the pressure.

To calibrate the pressure at the CaviBlaster® power unit, the water pressure at the power unit will need to be higher to account for sidewall friction loss in the pressure hose. The pressure at the pump should be 2,550 psi plus 0.5psi per foot (0.11 bar per meter) of thermoplastic pressure hose. For example, if using the CaviBlaster® with 100 feet (30

meters) of pressure hose, the pressure gauge located next to the pump should indicate 2,250-psi (172 BAR). Pressure adjustments are made by turning the knob on top of the pressure regulating valve in the same manner as described above.

DO NOT ADJUST THE PRESSURE AT THE GUN TO MORE THAN 2,550 psi. HIGHER PRESSURE WILL NOT IMPROVE PEFORMANCE.

PUMP AND HOSES ARE RATED FOR 2,500-PSI. PRESSURES ABOVE 2,500-PSI COULD RESULT IN PUMP AND / OR HOSE FAILURE.

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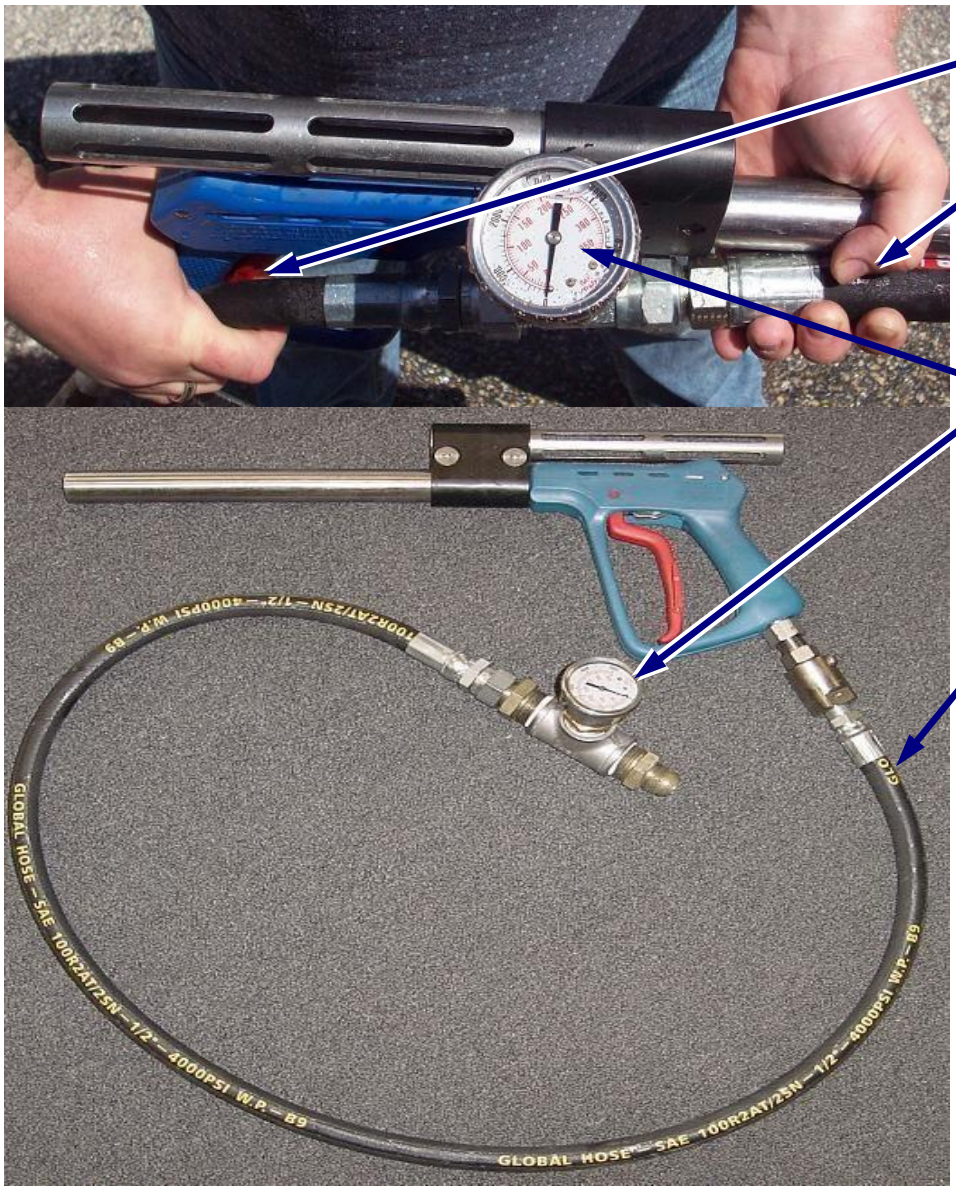

Figure 5.2 – Gun Pressure Calibration

5.5 Recommendations for Effective Results

Once the engine is throttled up to operating speed and the water trigger is pulled, the diver has to find the most effective distance between the gun nozzle and the surface being cleaned.

When the diver is ready to commence cleaning operations, ensure that the gun trigger is in the open or “ON” position (See Figure 5.3), the gun is submerged in the water and the feed pump is operating prior to throttling up the engine. Ensure that the power unit operator and other people working in the vicinity of the power unit wear appropriate hearing protection when the engine is running.

1. Engage the pressure pump by pulling the throttle cable knob (See Figure 5.1) to the operating speed position (fully extended) to engage the centrifugal clutch. Tighten the black knob to hold the throttle in operating speed position.

2. The most efficient operating technique is to hold the nozzle 2-5 inches (5-12 cm) away from the surface to be cleaned and at a 25 to 45 degree angle to the surface being cleaned (See Figure 5.3). The diver needs to observe the shape of the cavitating jet cone. At greater depths, the higher ambient pressure will cause the jet cone to be shorter. The widest zone of the cone is the most efficient part of the cavitating jet. Placing the nozzle closer than 2 inches (5 cm) from the surface being cleaned will not allow for efficient cavitation performance and will degrade the cleaning capability of the CaviBlaster® system.

3. Follow all safety regulations that may be applicable to the work being performed.

4. If the diver operating the CaviBlaster® unit must be replaced or the cleaning operation must be terminated, disengage the pressure pump by pushing the throttle lever in to the idle position (See Figure 5.1) and release the water pressure remaining in the hose(s) by moving the gun trigger to the open or “ON” position while under water. Revert to step 1 of the operating instructions when the diver or replacement is ready to continue cleaning.

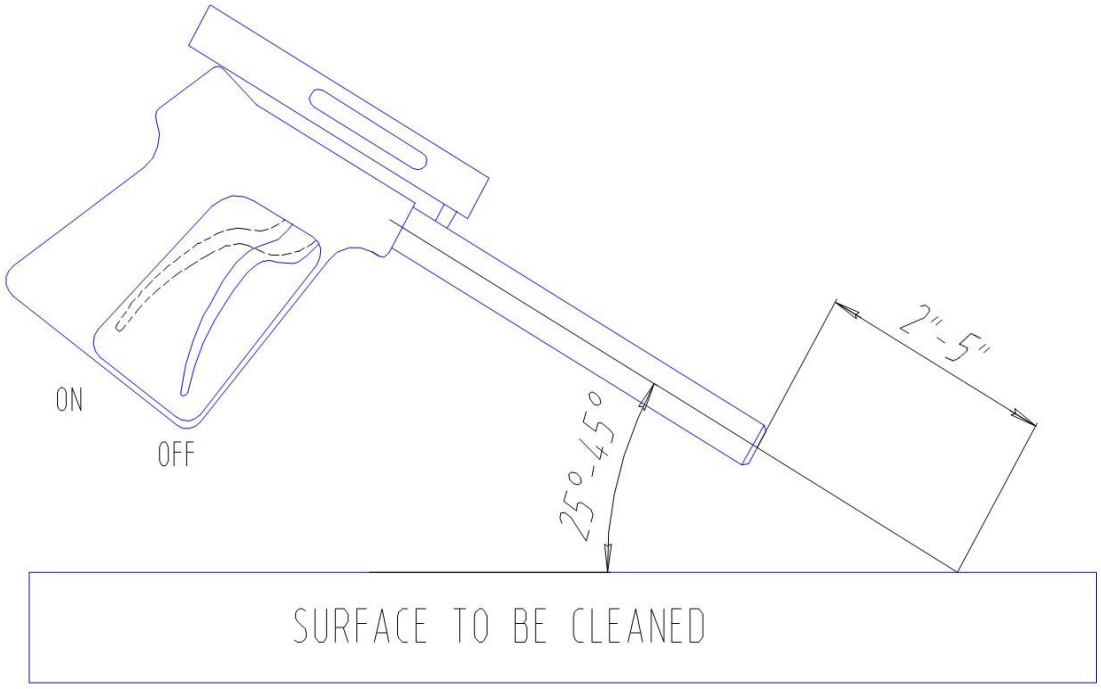

Figure 5.3 – Gun Position for Best Results

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5.6 Shutting Down the CaviBlaster®

1. Adjust the engine speed to idle by pushing on the red throttle cable knob (See Figure 5.1).

2. Run the engine at idle speed for a few minutes.

3. Push the feed pump ON/OFF switch in to stop the feed pump (See Figure 2.2). If using force feed from an alternate source or if using gravity feed, shut off the supply of water to the pressure pump.

4. Shut off the engine by turning the key counter- or anti-clockwise or to the "OFF" position (See Figure 2.1).

5. Squeeze the gun trigger to the open or "ON" position (See Figure 5.3) to release the water pressure remaining in the hose(s) **while the gun is submerged**.

6. It is now safe to remove the gun from the water.

7. Flush the system and rinse the power unit with fresh water at the end of the day.

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6.0 MAINTENANCE

Maintenance on this unit should be restricted to authorized personal that have been properly trained. Review this manual, especially Section 3.0 *SAFETY INFORMATION*, prior to performing any service on this equipment.

Equipment must be OFF and pressure released from all hoses prior to performing any service work.

Only replace parts with those supplied or approved by CaviDyne™. Use of any other parts may lead to loss of warranty, equipment failure and severe personal injury.

CAVIBLASTER® MUST BE FLUSHED AND RINSED WITH FRESH WATER DAILY AFTER EACH USE IN SEA WATER.

FAILURE TO FLUSH AND RINSE THE UNIT WILL RESULT IN PREMATURE WEAR AND TEAR ON THE COMPONENTS AND DECREASED SERVICE LIFE.

Failure to flush and rinse the unit can cause the pump valve(s) to stick in the open position. This will prevent the system from producing the correct operating pressure.

6.1 Basic Preventive Maintenance Recommendations

	After Every Use	Every 6 Months or 125 Hours*	Every 12 Months or 250 Hours*	Every 12 Months or 500 Hours*	Every 1,000 Hours
Check engine oil level and add if low	X				
Check pump oil level and add if low	X				
Check drive belt for wear and replace if worn	X				
Check feed pump base plate strainer and clean if necessary	X				
Check in-line strainer cartridge and clean if necessary	X				
Inspect hoses for wear or damage [1]	X				
Check gun trigger for leakage and repair if necessary [2]		X			
Clean engine cooling fins		X			
Replace engine oil and oil filter [3]			X		
Replace engine fuel filter			X		
Replace engine air filter			X		
Check rocker arm valve clearance				X	
Clean and set injectors				X	
Replace pump oil [4]				X	
Check pump valves and seals for wear & change if necessary					X

* Whichever occurs first.

1) If any hose damage if found, replace hose immediately.

2) Remove gun from water with system at operating pressure and trigger in the closed or “OFF” position. If water is leaking out of barrel or handle, the valve is worn and should be replaced.

3) The initial oil change is after 50 hours of operation. The oil change interval is every 125 hours if oil of a quality lower than prescribed by the manufacturer is used. See engine manufacturer’s literature in the Appendix for additional recommendations.

4) The initial oil change is after 50 hours of operation. See pump manufacturer’s literature in the Appendix for additional recommendations.

6.2 Diesel Engine Service

The diesel engine requires routine maintenance. Oil must be checked and changed regularly. Oil, air and fuel filters must be checked and changed regularly. The engine crankcase holds 1.35 gal (5.1 L) and the oil filter an additional 10 oz. (0.3 L) of SAE 10W40 viscosity lubricating oil. For detailed information on these routine maintenance requirements as well as other service recommendations, see the engine manufacturer's literature found in the *APPENDIX*.

6.3 Pump Service

The high pressure water pump requires minimal maintenance. The pump oil should be checked on a regular basis. The pump crankcase holds 44 oz. (1.3 L) of SAE 30 viscosity non-detergent hydraulic oil. See pump manufacturer's literature found in the *APPENDIX* for further information.

6.4 Inspection/Cleaning of Water Inlet Strainer

The water inlet strainer should be inspected after each use of the CaviBlaster® 1625-D. To inspect and clean this strainer, follow the procedure below:

1) Isolate or disconnect the water source from the inlet connection to the power unit.
2) Unscrew the filter housing (turn CCW) (See Figure 6.1).
3) Pull filter bowl off.
4) Remove the strainer.
5) Inspect the strainer and flush any debris clean with clean water.
6) Push strainer back into housing.
7) Push the bowl back into filter housing.
8) Thread the housing nut CW by hand to tighten.

Water strainer service

Unscrew filter cap
Remove filter and inspect
Clean and/or replace filter
Screw in filter cap

Figure 6.1 – Inspection / Cleaning Water Filter

6.5 Inspection / Maintenance of the Belt Drive System

The CaviBlaster® 1625-D is equipped with belt power transmission

FULL ENGINE SPEED IS REQUIRED FOR PROPER OPERATION OF THE CAVIBLSTER® ZERO-THRUST GUN.

To inspect the belt:

1. Remove the belt cover (See Figure 6.2).
2. Inspect the belts for fraying and/or shredding. Replace as necessary.
3. Replace the belt cover.

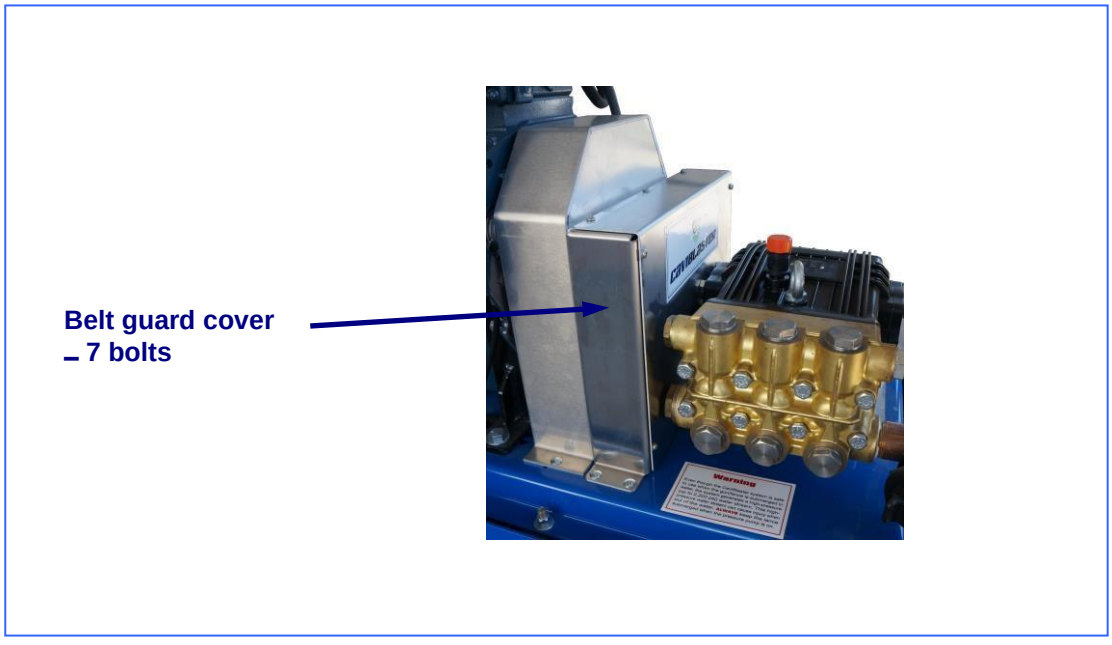

Figure 6.2 – Inspection / Belt tension.

(EOS)

6.6 Inspection / Maintenance of the Zero-Thrust Gun

In order to minimize potential problems with the Zero-Thrust Gun it is recommended that the gun be cleaned and flushed at the end of each work period:

1. Flush and rinse the gun with fresh water after each use in sea water.
2. Place the gun in a container of clean, fresh water if it will be used in the next 24 hours. Ensure the gun is completely submerged.
3. If the gun will not be used for a period of several days, remove the whip hose from the super swivel and, with the gun turned upside-down, pour approx. 5ml of lubricating oil into the water inlet while opening and closing the trigger. This will allow oil to reach the positioning pin and valve cone to minimize the possibility of corrosion or mineral crystals forming that would freeze the pin or valve cone.
4. Do not use WD-40 for long term storage.

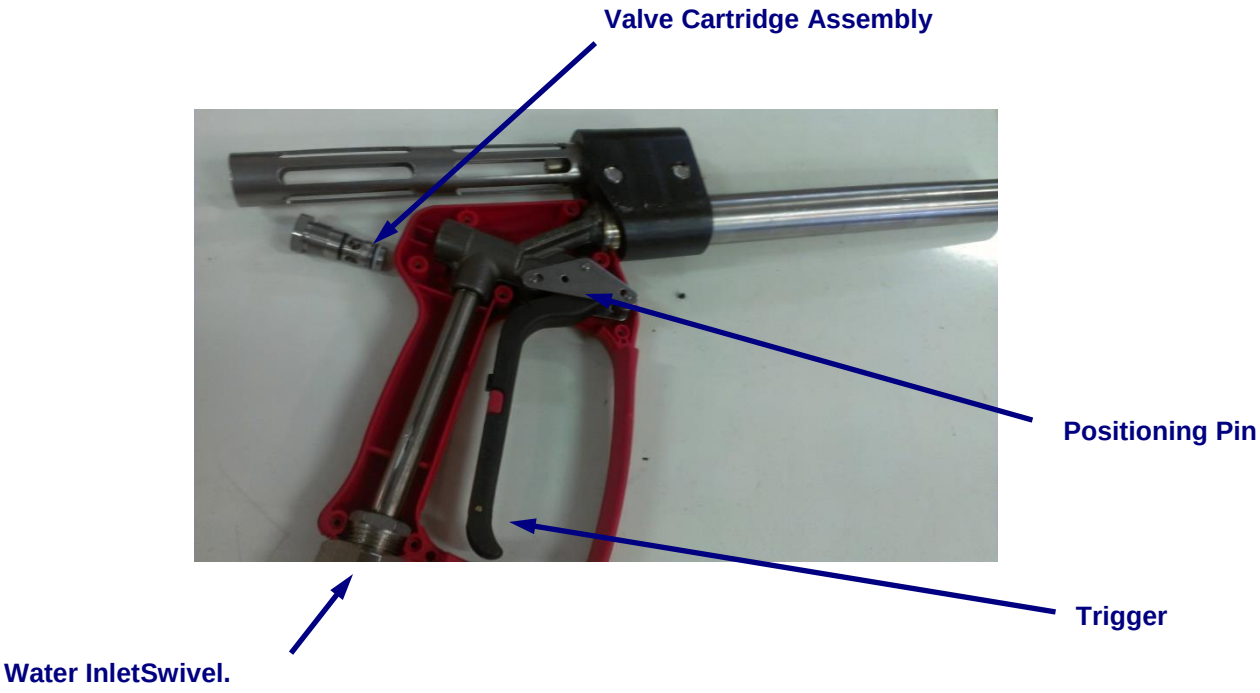

Figure 6.3 – Zero-Thrust Gun

(EOS)

7.0 WINTERIZATION

The power unit should be winterized if stored at temperatures below 32 degrees Fahrenheit (0 degrees Celsius).

Total system displacement with 100 ft of hose (optional): 4.3 gallons.
Total system displacement without hose: 2.0 gallons.

To winterize the CaviBlaster® 1625-D power unit:

1. Fill a 5 gallon or larger tank with appropriate antifreeze solution.
2. Insert a feed pump into the antifreeze tank.
3. Start the unit and make sure the pump is primed.
4. Attach a minimal amount of pressure hose and direct the outlet of the hose into the antifreeze tank.
5. Run the unit without gun attached until antifreeze comes out of the end of the hose for 10 seconds.
6. Stop the unit.

Following this procedure will ensure that all the critical system components exposed to water have been flushed with antifreeze.

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8.0 TROUBLESHOOTING

1. ENGINE DOES NOT TURN OVER

- Verify that the Emergency Engine Shut-Down knob is released
- Verify that the battery terminals are clean and tight
- Verify battery charge
- Check the alternator belt tension

2. ENGINE TURNS OVER BUT DOES NOT START

- Check fuel level
- Check fuel filter
- Check fuel line for air lock
- Verify that fuel pump solenoid is not stuck

3. ENGINE THROTTLES UP, BUT STALLS AFTER FEW SECONDS

- Verify that drive belts are tensioned (follow procedures in Section 6.5)
- Check that pressure regulator / unloader switches to by-pass mode - Check mechanical stop on the throttle cable if at end position

4. ENGINE SPEEDS UP, BUT WATER DOES NOT GO OUT THE GUN

- Verify inlet water supply is functioning
- Ensure that the power unit is not located too far above the water level, exceeding the capacity of the feed pump
- Check that feed pump and inlet water strainers are clear
- Check for leaks in the water lines
- Check for an air-lock in the water inlet lines
- Verify that the feed pump is delivering water
  Pump mechanical failure
  Bad electrical connections
- Check that pressure pump inlet and discharge valves are not stuck open (common problem if not flushed after use with sea water)
- Check for water going out of the bypass – pressure regulator failure

5. WATER IN CRANK CASE

- Check the pump seals for damage (feeding water at greater than 50-psi (3.4 bar) can force water past the seals and damage the seals and starving the pressure pump of water can overheat and damage the seals)
- Check the plungers for cracks
- Check the plunger rod O-ring for damage

6. AFTER RELEASING THE MECHANICAL TRIGGER, WATER IS STILL LEAKING OUT OF THE GUN

- Replace the mechanical trigger valve assembly in the gun handle

4. GUN IS NOT CLEANING PROPERLY

- Verify that the system is operating at the correct pressure (2,550 psi)
- Remove the gun from water with the system at operating pressure and trigger in the closed or “OFF” position. If water is leaking out of the barrel or handle, the trigger valve assembly should be replaced.
- Check cavitation and zero-thrust nozzles for foreign particles

Visual inspection

Insert a small wire into nozzle orifices to check for obstruction(s) Remove trigger valve assembly and “backflush” with compressed air or pressurized water

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9.0 REPLACEMENT PARTS

CaviBlaster® 1625-D POWER UNIT REPLACEMENT PARTS			
RECOMMENDED ORDER QTY	**QUANTITY PER ASSEMBLY**	**PART DESCRIPTION**	**PART NUMBER**
1	1	Feed pump base plate / strainer	54264
1	1	Inlet strainer cartridge - Banjo	LS-140
1	1	Engine fuel filter	70000-43081
1	1	Engine air filter	15741-11083
2	1	Engine oil filter	HH160-32093
2	1	Engine fan belt	16282-97013
2	1	Pressure pump drive belt	8MGT-640-36
1	1	Pump seal kit	UD-12
1	1	Pump valve kit	UD-93
1	1	Pump brass kit	UD-19
1	1	Pump plunger rod O-ring kit	UD-123
1	1	Regulating unloader repair kit	UB 502 / K
1	1	Relief valve repair kit	UB 502 / K
1	1	Trigger valve repair kit	202710490

All parts can be ordered from:

CAVIDYNE™, LLC
1715 Independence Blvd., Suite B-4
Sarasota, FL 34234
Phone: (352) 275-5319
Email: support@cavidyne.com
www.caviblaster.com

(EOS)

APPENDIX - COMPONENT LITERATURE

Kubota Diesel Engine Model D1105-E3B	Engine Spec Sheet Engine Owner's Manual Engine Work Shop Manual Engine Troubleshooting Guide
Udor Pump Model NX 75/150	Pump Spec Sheet Pump Exploded View Pump Dimensions Pump Service Guide Pump Torque Specs
Udor Pressure Regulating Unloader & Relief Valve Model UB 402	Valve Spec Sheet
Suttner Small Trigger Gun Model ST-2720	Gun Schematic Drawing

Warranties	Cavidyne Kubota Engines Udor USA Suttner

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