CaviDyne™ LLC

CaviBlaster™

CaviBlaster 4030-D

Operation & Maintenance Manual

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CAVIDYNE, LLC IS NOT RESPONSIBLE FOR DAMAGES OR INJURY RESULTING FROM FAILURE TO COMPLY WITH INSTRUCTIONS IN THIS MANUAL. PLEASE READ THE ENTIRE MANUAL CAREFULLY BEFORE USE.

THE CAVIBLASTER 4030-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.

DO NOT USE AIR PRESSURE HIGHER THAN 120-PSI (8 BAR) WHEN STARTING THE EQUIPMENT. SERIOUS DAMAGE TO THE EQUIPMENT WILL OCCUR.

Unit Specifications:

The CaviBlaster 4030-D Power Unit consists of a 99HP (74 kW) Kohler KDi 3404 TCR diesel power-pack and a UDOR VXX-B 160/180-R triplex plunger pump. Detailed performance and specifications are listed below:

CaviBlaster 4030-D Specifications	
Nominal Pump Flow	40 GPM (153 L/M)
Nozzle Operating Pressure	3,000-PSI (206 BAR)
Engine	99 HP (74 kW), Diesel Powered (Kohler KDi 3404 TCR)
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	50 Gallons (190 Liters)
Water Inlet Pressure Limits	0-PSI (Atmospheric Pressure) to **70-PSI Maximum** (0 BAR to **4.8 BAR**) *See Section 4 for further requirements*
Overall Unit Dimensions (L x W x H)	64” x 55” x 62” (163 cm x 140 cm x 157 cm)
Maximum Pressure Hose Length	600 LF (200 meters) of 3/4” diameter
Power Unit Weight (Dry)	2,400 LBS (1,100 KG)
Zero-Thrust Gun Weight	11 LBS (5 KG)

Figure 1.1 – CaviBlaster 4030-D Specifications

General Description:

The CaviBlaster 4030-D high-pressure waterpower 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 bubbles during the cavitation process. When directed at the surface being cleaned, the energy released by the collapsing 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 trigger operated 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 BELT DRIVE SYSTEM.

The CaviBlaster 4030-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 a belt driven 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 3,000-PSI (206 BAR).

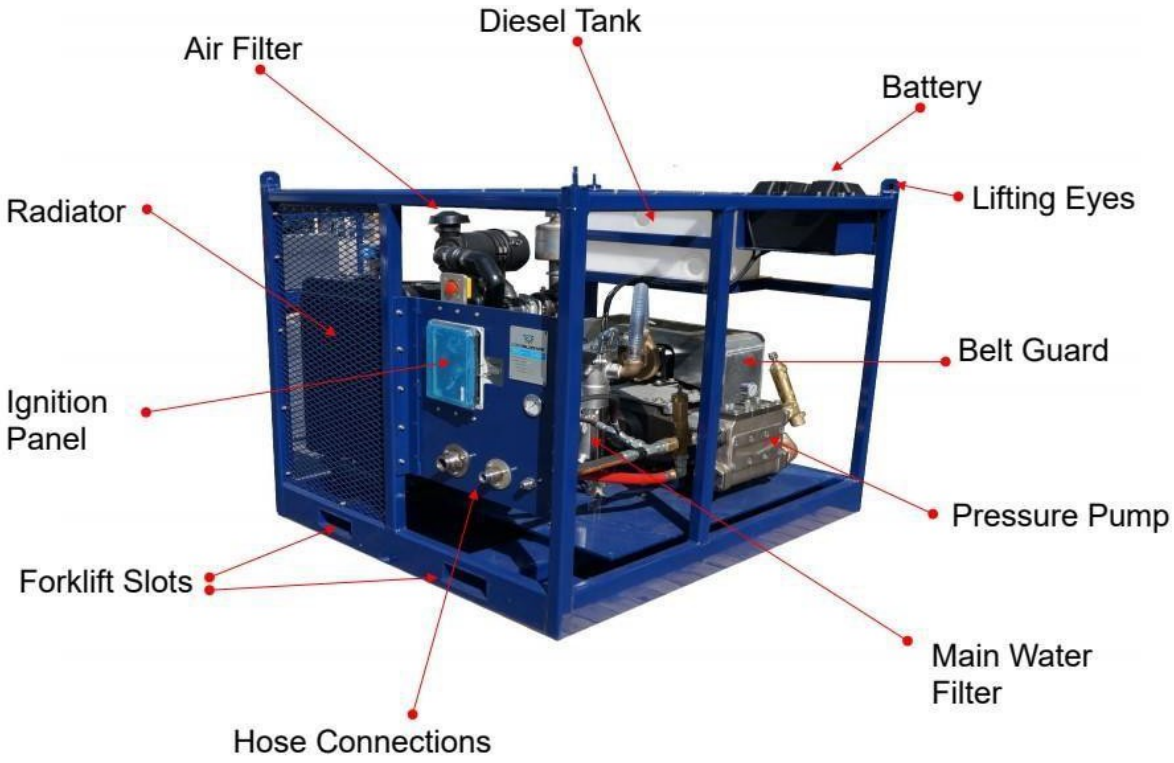


Figure 2.1 – CaviBlaster 4030-D General Features

NOTE: New generation Diesel engines with emission control requirements at a level “Tier 4F” in USA and “Stage V” in EU governed by computer systems with better electric control and higher redundancy of safety features **DO NOT** require an Emergency Stop Button.

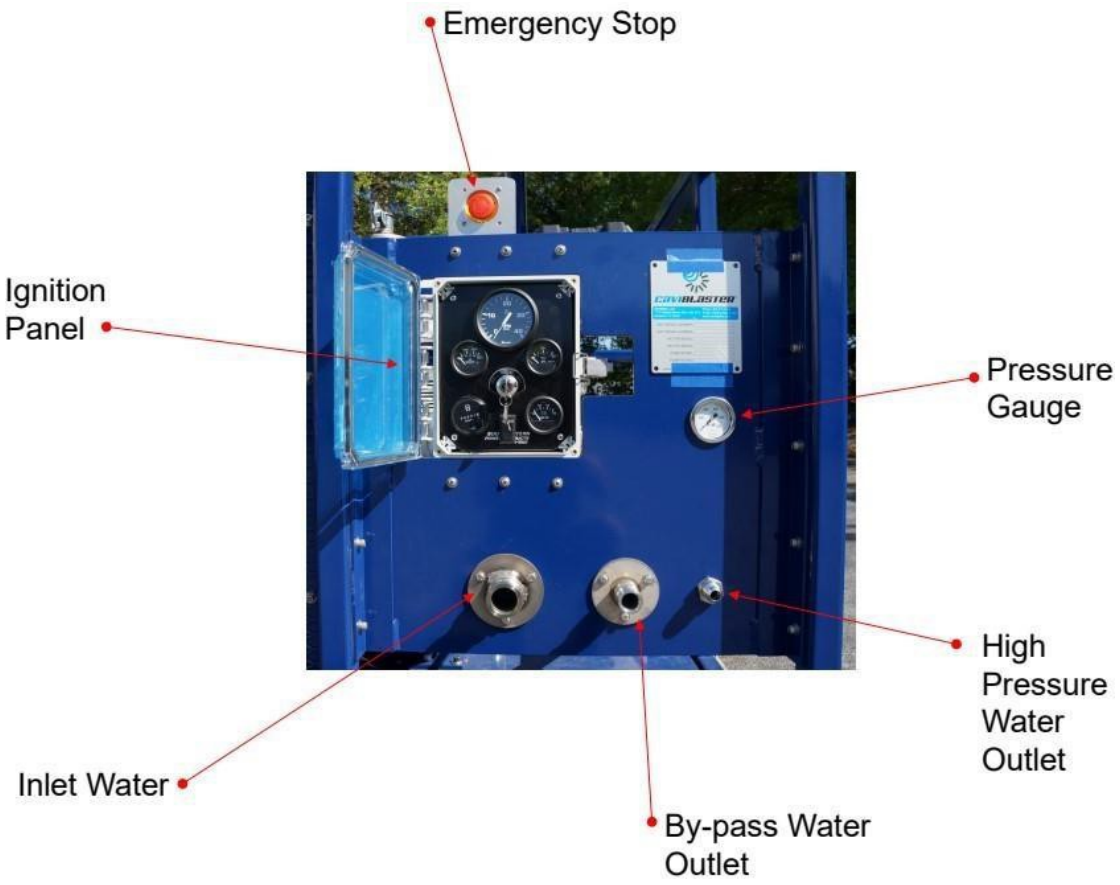


Figure 2.2 – CaviBlaster 4030-D Control Panel

NOTE: New generation Diesel engines with emission control requirements at a level “Tier 4F” in USA and “Stage V” in EU governed by computer systems with better electric control and higher redundancy of safety features **DO NOT** require an Emergency Stop Button.

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, LLC or other personnel familiar with the operation of this equipment.

Safety Information:

The CaviBlaster 4030-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 4030-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 this equipment. Refer to the applicable section in this manual for the correct procedures prior to any installation, setup, or maintenance work.

Personal Safety:

Operation of the CaviBlaster 4030-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.

Personal Protective Equipment:

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 recommends 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 nails. 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 lance is activated.

FAILURE TO WEAR APPROPRIATE PPE MAY RESULT IN PERSONAL INJURY.

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.

Installation:

The CaviBlaster 4030-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.

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 should be lifted from underneath the frame using the forklift channels or by using 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

Installation Location:

For maximum flexibility the CaviBlaster Power Unit should be installed in an area where it can reach both its water source and anticipated cleaning targets within acceptable hose lengths. 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 behind 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.

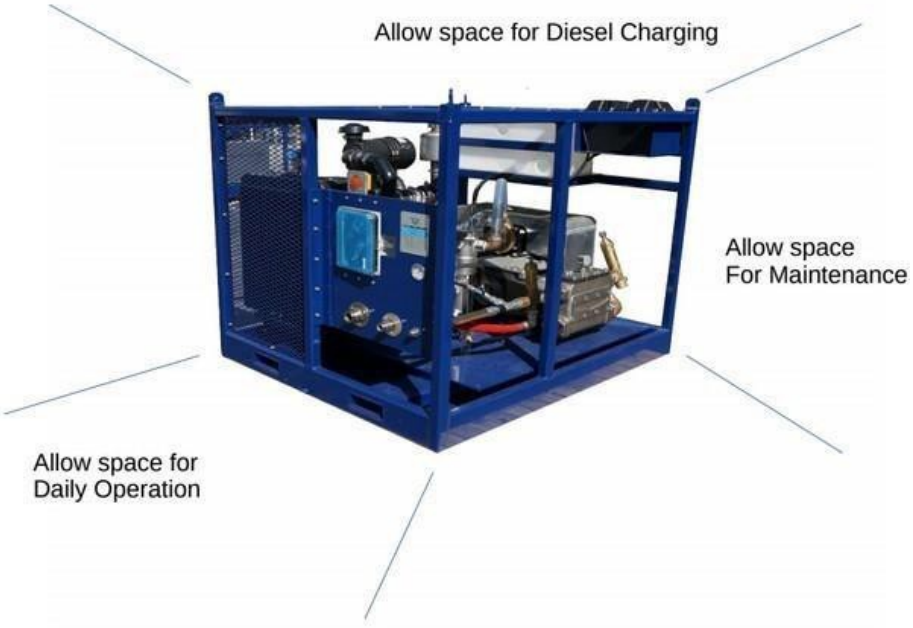


Figure 4.2 – Installation Guidelines

NOTE: New generation Diesel engines with emission control requirements at a level “Tier 4F” in USA and “Stage V” in EU governed by computer systems with better electric control and higher redundancy of safety features **DO NOT** require an Emergency Stop Button.

Initial Set-Up:

After first receiving the CaviBlaster Power Unit, the following must be checked and completed:

1. Add engine oil (See ***Engine Manual***)
2. Add engine coolant (See ***Engine Manual***)
3. Add pump oil (See ***Pump Manual***)
4. Connect the feed or suction hose (See ***Section 4.3.1***)
5. Connect the bypass hose (See ***Figure 2.2***)
6. Connect the pressure hose (See ***Figure 2.2***)
7. **Offshore Unit**: Connect the air starter hose (See ***Figure 2.2***)
8. **Electric Start Unit**: Connect battery terminals.
9. 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***).

ENGINE AND/OR PUMP FLUIDS MAY HAVE BEEN REMOVED FOR SHIPMENT. CHECK FLUID LEVELS PRIOR TO STARTING.

Connecting the Water Source:

The CaviBlaster Power Unit can be used with seawater or fresh water. It must be flushed with fresh water for 1-2 minutes after each use in seawater to ensure long service life.

THE CAVIBLASTER 4030-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***). A belt driven self-priming centrifugal 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 centrifugal water pump or an outside water source capable of supplying at least 45 GPM (170 L/M) (flow plus 50%) at a maximum pressure of 70-PSI (4.8 BAR).

- Gravity feeding water source (See ***Figure 4.3***). Use a hose with a diameter of at least 1-1/2” to connect the water tank to the power unit

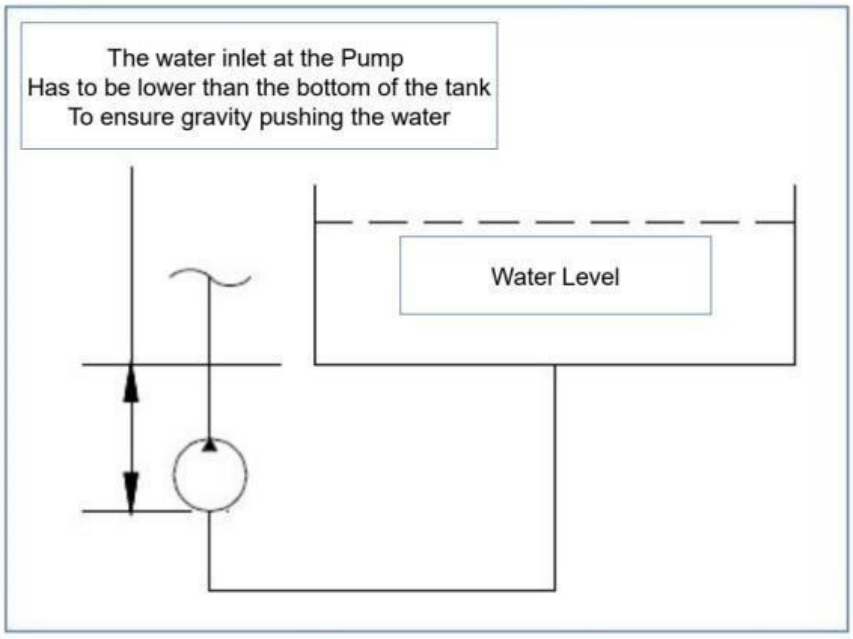


Figure 4.3 – Gravity Feeding Source

To Use the Feed Pump Supplied with the System:

1. Connect the cam-lock socket on the 1-1/2” clear PVC feed hose to the water inlet connection on the control panel (See ***Figure 2.2***).
2. Submerse the feed hose into the water source.
3. Prime the pump by filling the pump body with water.
4. It is important to keep the feed hose in the water source when the engine is running, and the clutch is engaged or damage to the pressure pump will result.

To Use Force Feed from an Alternate Source:

1. When feeding the CaviBlaster with an alternate water source, the source must supply water at a volume of greater than 45 gallons (170 liters) per minute at a maximum pressure of 70-PSI (4.8 BAR).
2. Connect a 1-1/2” cam-lock socket on the water supply hose to the water inlet connection on the control panel (See ***Figure 2.2***).
3. Turn on the alternate water source.
4. It is important to keep the water source on when the engine is running or damage to the feed pump shaft seal will result.

ENSURE THAT HE 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:

1. Locate the water supply tank so that the supply tank outlet is higher than the water inlet on the power unit control panel (See ***Figure 2.2***).
2. Connect a minimum 1-1/2” hose to the water inlet 1-1/2” cam-lock plug.
3. Connect the other end of the hose to the water supply tank outlet.
4. Make sure the lowest point in the hose line is the connection with the power unit.
5. It is essential that adequate water is supplied to the water supply tank to maintain the water level several inches above the tank outlet. 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 more than the required pump flow of 30 GPM (114 L/M). A minimum delivery of 45 GPM (170 L/M) is required to ensure that the pump is not starved of water. If connecting to a gravity feed tank, locate the tank outlet above the water inlet

Operation:

The CaviBlaster 4030-D should be operated by two (2) properly trained individuals. One, the diver (or ROV operator), operates the zero-thrust gun(s), while the other operates the power unit. Both operators should be in audio or visual communication with each other.

THE CAVIBLASTER 4030-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.

Preparing the CaviBlaster for Operation:

The following checklist should be completed in advance of operation, 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 and filter cartridges to ensure that they are not clogged (See ***Figure 6.1***). Clean or change cartridge(s) if necessary.
3. Check for proper engine oil level (See ***Engine Owner's Manual***). Add lubricating oil (SAE 10W40) if necessary.
4. Check for proper pressure pump oil level (See ***Pump Owner's Manual***). Add lubricating 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. 1D or 2-D, or EN 590) if necessary.

INCORRECT FULES SHOULD NOT BE USED AS THEY MAY PROVE HAZARDOUS AND CAUSE DAMAGE TO THE ENGINE.

Startup of the CaviBlaster:

Before starting the CaviBlaster 4030-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. Connect the gun to the high-pressure hose and unroll sufficient length of hose to reach the operating location.
3. **Offshore Units:** Verify that the Emergency Air Shut-Off valve is open by pulling the handle out. Verify that the throttle cable is at more than half throttle and the clutch (PTO) is disengaged by pulling the PTO lever back.
4. Apply appropriate hearing protection prior to starting engine.
5. **Offshore Units:** Open the air supply valve at the source being used to power the air starter. Push the black Engine Start knob (See ***Figure 2.2***) “IN” to activate the air starter. If the engine does not start within 10 seconds, turn the air supply off and wait at least 30 seconds before operating the air starter again. Once the engine starts, turn off the air supply to the air starter. Warning – air supply to the starter should not exceed 120-PSI (8 BAR).
6. **Electric Starter Units:** Disengage the PTO clutch. Insert the key into the ignition switch on the ignition panel. 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.
7. 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 at idle speed for a minimum of one minute (1’).

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

THE ENGINE MUST BE RAN AT FULL THROTTLE / FULL SPEED. IF PARTIALLY THROTTLED, THE ENGINE WILL STALL, CREATING AN UNDESIERABLE RUNNING CONDITION FOR THE BELT DRIVE SYSTEM.

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 4030-D Power Unit is designed to operate at full throttle. Less than full throttle will result in malfunction of the belt drive system and less than optimum cleaning performance.

REVIEW THE SAFETY REQUIREMENTS FOR PPE AND SAFE OPERATION BEFORE PROCEEDING.

1. Startup the power unit as described in ***Section 5.2***.
2. Verify that the gun is properly connected and that the mechanical trigger is released.
3. Confirm the pump system is fully primed with no air pockets visible in the clear supply lines.
4. 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.
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 engaging the PTO and throttling up the engine. 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. Pull the PTO handle to the on position to engage the pressure pump.
8. Throttle the engine completely by activating the throttle run switch at the control panel. (See ***Figure 5.1***).
9. Activate the cleaning cavitation stream by squeezing the gun trigger to the open or “ON” position (See ***Figure 5.3***). Release the gun trigger to stop the water flow at the gun. Flow will then direct to bypass.
10. 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 control to the idle position and pushing the PTO handle to the off position (See ***Figure 5.2***). 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 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 3,000-PSI {206 BAR}) WATER STREAM, WHICH CAN CAUSE INJURY WHEN THE LANCE IS OUT OF THE WATER. ALWAYS KEEP THE LANCE SUBMERGED WHEN THE PRESSURE PUMP IS ENGAGED.

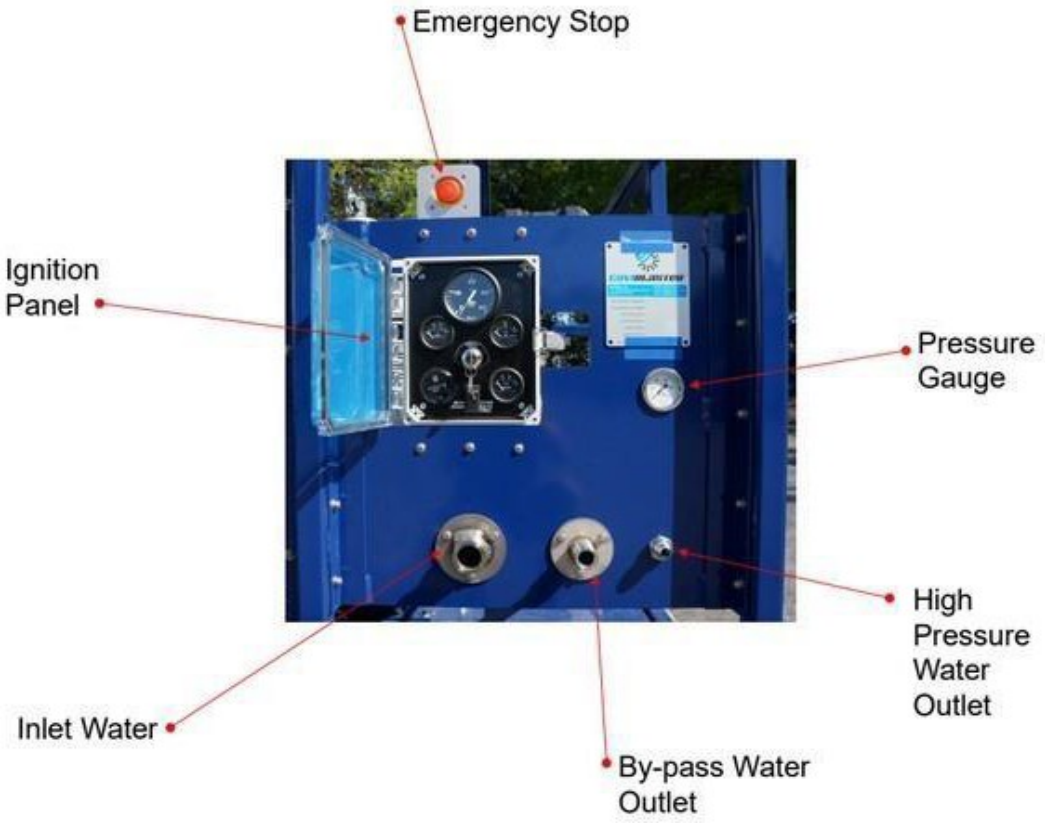


Figure 5.1 – Engine Shut Down and Throttle Up Control

NOTE: New generation Diesel engines with emission control requirements at a level “Tier 4F” in USA and “Stage V” in EU governed by computer systems with better electric control and higher redundancy of safety features **DO NOT** require an Emergency Stop Button.

Adjusting the CaviBlaster for Maximum Performance:

The pressure at the nozzle of the zero-thrust gun must be maintained within certain limits to achieve cavitation and best performance results. Using a calibration pressure gauge situated between the pressure hose and the CaviBlaster gun, the water pressure should be 3,000-PSI (206 BAR) with the gun submerged and the gun trigger in the open or “ON” position. For best results, repeat the calibration procedure if cleaning performance degrades, or every 3 months at a maximum.

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

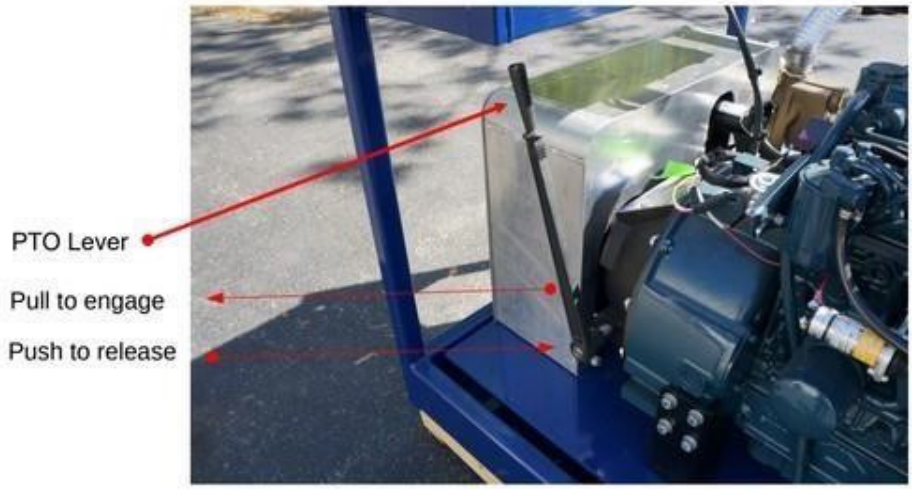
To Calibrate the Pressure at the Zero-Thrust Gun, Follow the Procedure Below:

1. With the Power Unit turned off, pull the gun trigger to discharge any residual pressure in the hose lines.
2. Disconnect the whip hose with the gun from the pressure hose.
3. Attach the calibration gauge to the pressure hose and tighten the JIC connections.
4. Reattach the whip hose with the gun to the calibration gage.
5. Submerge the gun. As the danger of the operator encountering 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.
6. 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***).
7. Pull the gun trigger to the open or "ON" position (See ***Figure 5.3***).
8. Engage the PTO.
9. Throttle the engine to full speed (See ***Section 5.3***).
10. Hold the gun tight and observe the gauge (See ***Figure 5.3***).
11. The power unit operator should turn the knob on top of the pressure regulating valve until pressure reads 3,000-PSI (206 BAR) on the test gauge set at the gun. Turning the knob clockwise will increase the pressure and turning it counterclockwise will decrease the pressure.

To calibrate the pressure at the CaviBlaster power unit without the use of the test gauge set, 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 3,000-PSI (206 BAR) plus 0.5-PSI per foot (0.11 BAR per meter) of 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 4,050-PSI (279 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 3,000-PSI (206 BAR). HIGHER PRESSURE WILL NOT IMPROVE PERFORMANCE.

HOSES ARE RATED FOR MAXIMUM 5,000-PSI (345 BAR). PRESSURES ABOVE 5,000-PSI COULD RESULT IN HOSE FAILURE.



PTO Lever To Engage and Disengage Clutch

Figure 5.2 – PTO Lever

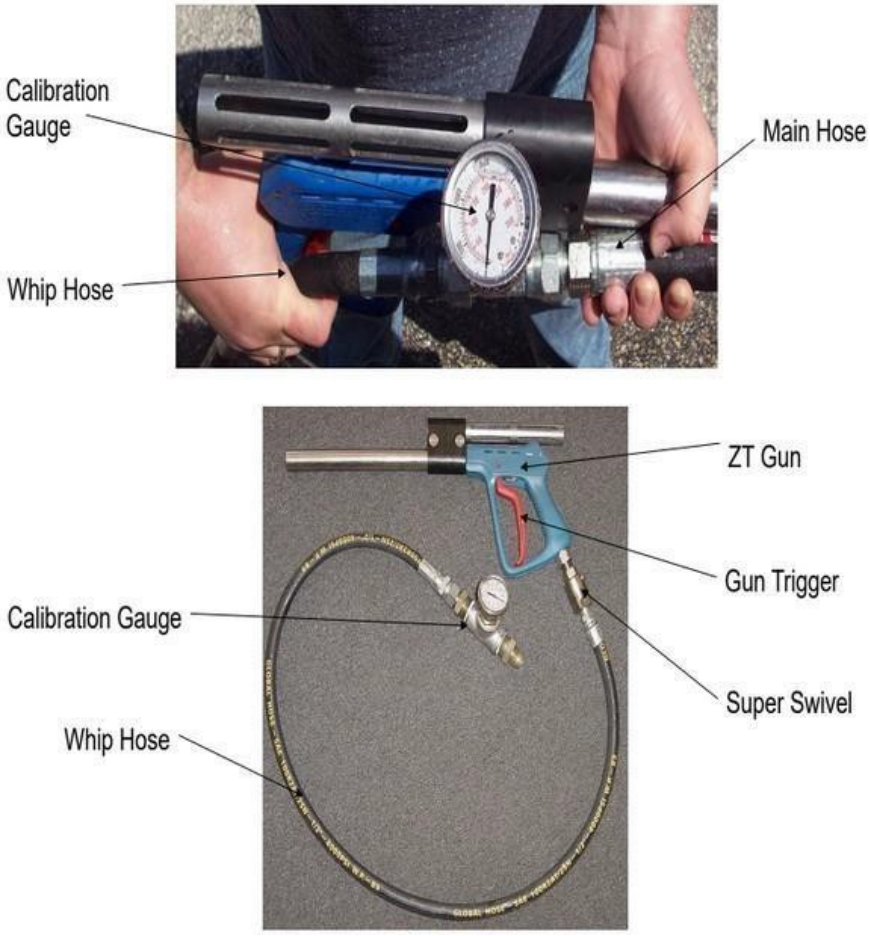


Figure 5.3 – Gun Pressure Calibration

Recommendations for Effective Results:

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

1. Engage the pressure pump by pulling the PTO lever (See ***Figure 5.2***) to the “ON” position to engage the clutch. Push the Throttle Up switch on the control panel (See ***Figure 5.1***).

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 5.4***). 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.

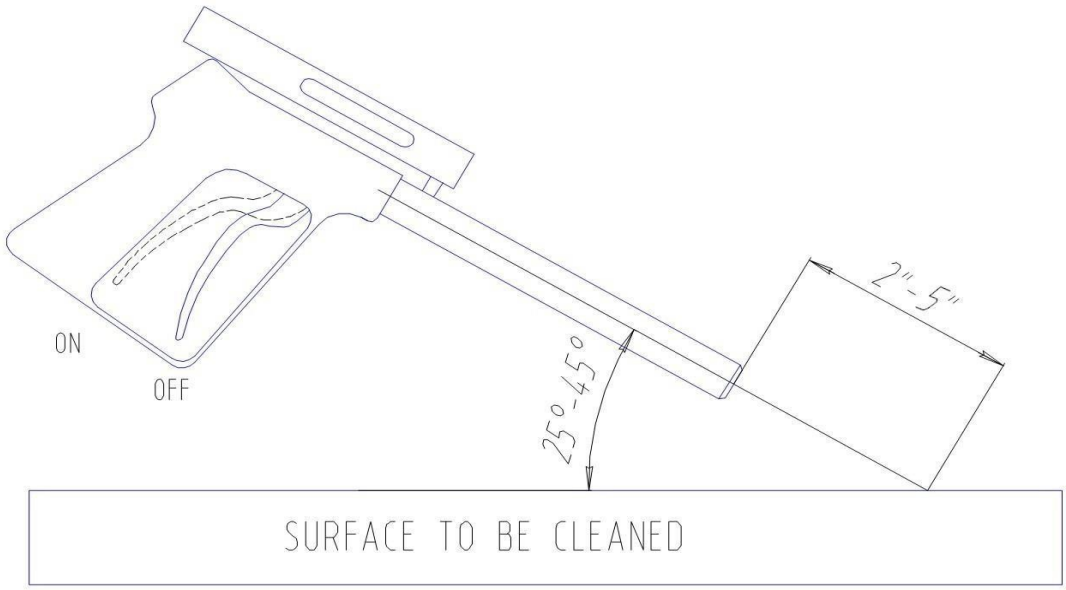


Figure 5.4 – Gun Position for Best Results

Shutting Down the CaviBlaster:

1. Adjust the engine speed to idle by pushing the throttle switch to idle position (See ***Figure 5.1***).
2. Push the PTO handle to the off position. This will disengage the pressure pump.
3. Turn the Ignition Key to the Off position (See ***Figure 5.1***).
4. If using force feed from an alternate source or if using gravity feed, shut off the supply of water to the pressure pump.
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.

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 ANY SERVICE WORK.

ONLY REPLACE PARTS WITH THOSE SUPPLIED OR APPROVED BY CAVIDYNE. USE OF ANY OTHER PARTS MAY LEAD TO EQUIPMENT FAILURE AND SEVERE PERSONAL INJURY AND WILL VOID ALL WARRANTIES.

THE CAVIBLASTER 4030-D MUST BE FLUSHED AND RINSED AFTER EACH USE IN SEA WATER

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.

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

Basic Preventive Maintenance Recommendations:

Task	After Every Use	Monthly	Every 12 Months or 250 Hours	Every 12 Months or 500 Hours	Every 3 Years or 1500 Hours
Check engine oil level and add if low	X				
Check pump oil level and add if low	X				
Check coolant level and add if low	X				
Check drive belt for wear and replace if worn	X				
Check in-line strainer cartridge and filter and clean if necessary	X				
Inspect hoses for wear or damage [1]	X				
Check gun trigger for leakage and replace if necessary [2]		X			
Check feed pump belt tension		X			
Replace engine oil [3]			X		
Replace engine fuel filter cartridge				X	
Replace engine air filter				X	
Replace engine oil filter [3]				X	
Replace pump oil [4]				X	
Replace engine fan and feed pump belts				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 and filter 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 or high-sulfur fuel is used. See engine manufacturer’s literature in the Appendix for additional recommendations.
4) The initial pump oil change is required after 50 hours of operation. The oil change interval is every 300 hours if oil other than recommended pump oil is used. See pump manufacturer’s literature in the Appendix for additional recommendations.

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 and oil filter hold 3.5 gal. (13.2 L) of SAE 10W30 or 15W40 viscosity lubricating oil. For detailed information on these routine maintenance requirements as well as other service recommendations, see the engine manufacturer's literature.

Pump Service:

The high-pressure water pump requires minimal maintenance. The pump oil should be checked on a regular basis. The pump crankcase holds 4.2 qt. (4 L) of SAE 30 (ISO-68) viscosity non-detergent lubricating oil. See pump manufacturer's literature for further information.

Inspection/Cleaning of Water Inlet Strainer:

The CaviBlaster 4030-D is equipped with a water strainer before the water feed pump and a media 'sock' filter system between the feed pump and the pressure pump. The process for inspecting and cleaning is as follows:

Feed Water Strainer:

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

Filter Media 'Sock':

1. Remove filter assembly cap by unscrewing the three cap retainers.
2. Lift out and inspect for debris and/or damage. Clean by flushing with clean water or replace 'sock' media.
3. Inspect cover O-ring for damage, replace if necessary.
4. Replace cap and tighten securely.

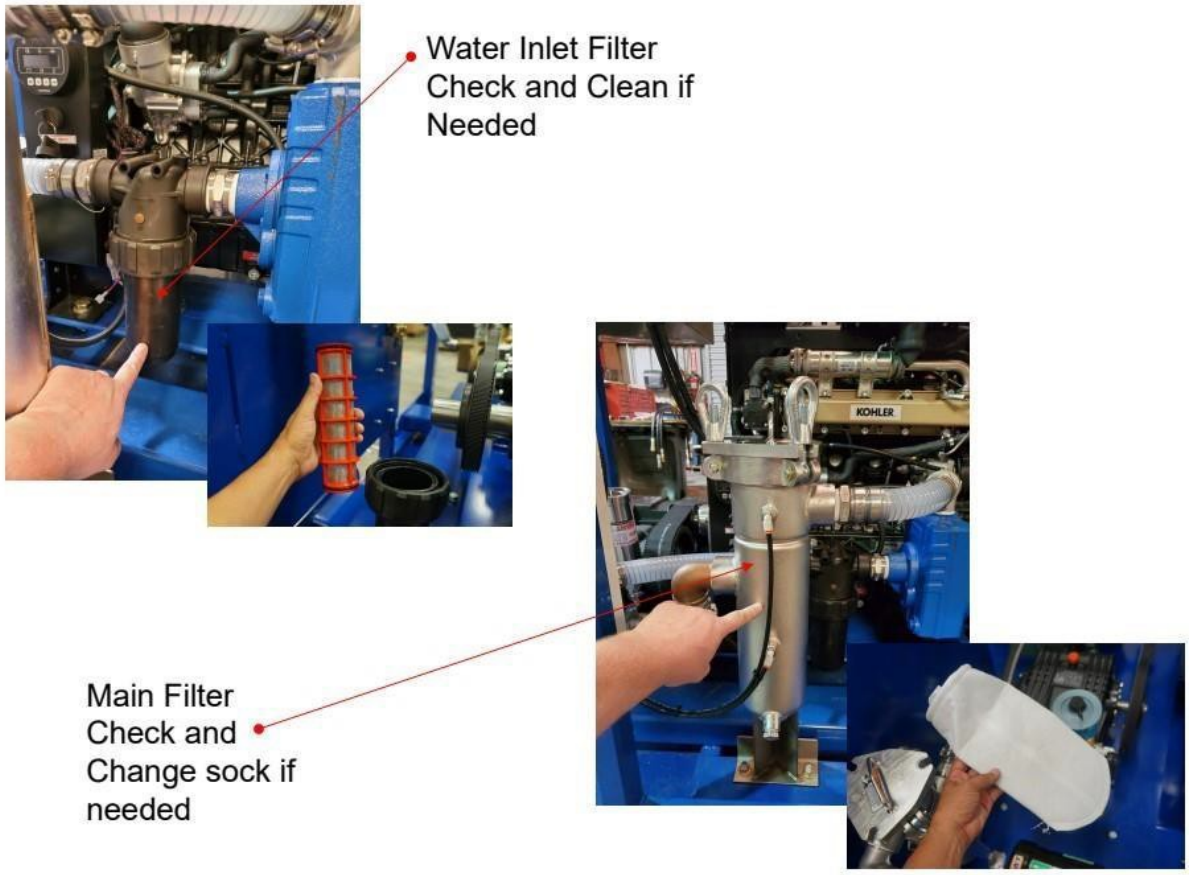


Figure 6.1 – Water Filter Inspection / Cleaning

Inspection / Maintenance of the Belt Drive System:

The CaviBlaster 4030-D is equipped with belt power transmission. The driver shaft has a manually operated power take-off.

FULL ENGINE SPEED IS REQUIRED FOR PROPER OPERATION OF THE GUN.

To Inspect the Belt:

1. Remove the belt guard cover supported by bolts.
2. If belts need tightening, use the tightening nut to adjust.
3. Release the bolts holding the pump rails.
4. Adjust Belt tension.
5. Tighten pump rail bolts.
6. Replace belt guard cover.

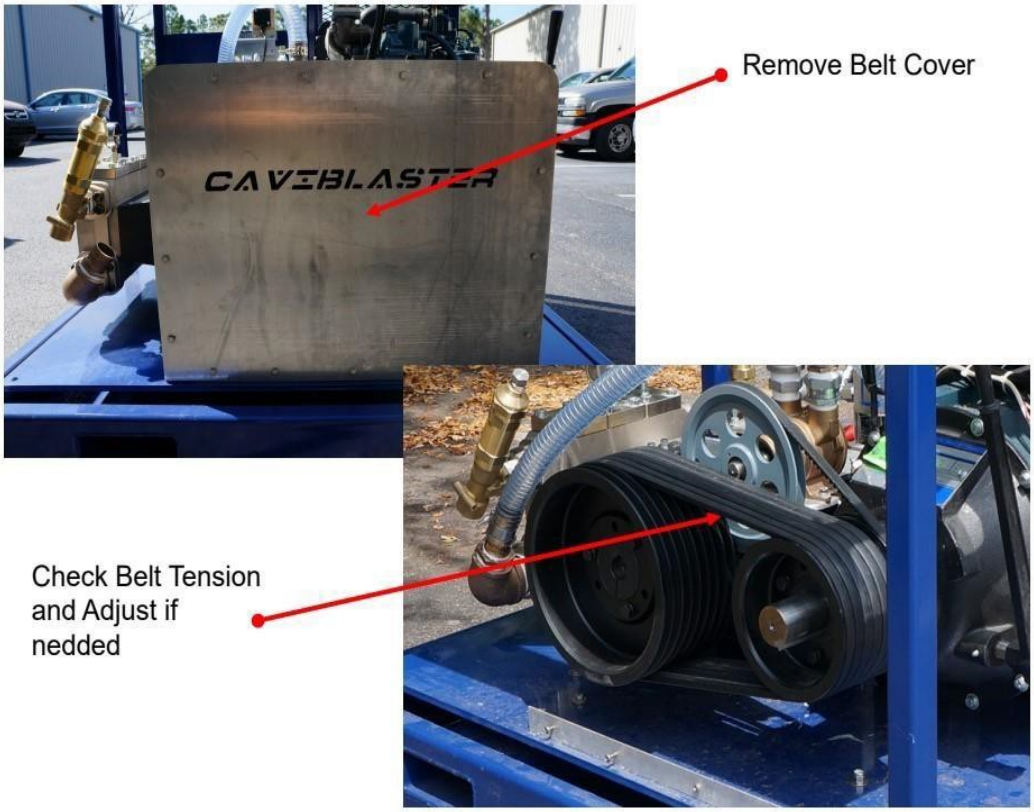


Figure 6.2 – Belt Inspection / Tension

Inspection / Maintenance of the Zero-Thrust Gun:

To minimize potential problems with the Zero-Thrust Gun it is recommended that the gun be treated 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 super swivel from the gun handle 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 and minimize the possibility of corrosion or mineral crystals forming that would freeze the pin or valve cone.

Figure 6.3 – Zero-Thrust Diver Gun

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 4030-D Power Unit:

1. Fill a 5 gallon or larger tank with appropriate antifreeze solution.
2. Insert the suction hose 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.

Troubleshooting:

ENGINE DOES NOT TURN OVER

- Verify that the Emergency Engine Shut-Down knob is released
- Verify that air is flowing to the starter (Offshore Models)
- Verify battery connections are clean and secure (Electric Start Models)

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

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 (Offshore Models)

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

- Verify inlet water supply is functioning and the system is fully primed.
- 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 airlock in the water inlet lines
- Verify that the feed pump is delivering water Pump mechanical failure
- Drive belt failure
- Check that pressure pump inlet and discharge valves are not stuck open (common problem if not flushed with fresh water after use with sea water)
- Check for water going out of the bypass – pressure regulator failure

WATER IN CRANK CASE

- Check the pump seals for damage (feeding water at greater than 70-PSI (4.8 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

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

- Replace the mechanical trigger valve assembly in the gun handle

GUN IS NOT CLEANING PROPERLY

- Verify that the system is operating at the correct pressure (4,000-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

Replacement Parts:

CaviBlaster 4030-D Power Unit Replacement Parts			
Recommended Order Qty.:	**Recommended Order Qty.:**	**Recommended Order Qty.:**	**Recommended Order Qty.:**
1	1	Inlet Strainer – Banjo	LS250
1	1	Inlet Filter Housing	L44121.50NB415
1	1	Inlet Filter Housing O-Ring Viton	FKM
1	1	Inlet Filter Basket - Stainless Steel	L44 BT-4-SR-9/64
1	1	Inlet Filter Bag – Multifilament Nylon	KO100K4S
1	1	Engine Air Filter	P828889
2	1	Engine Oil Filter	HH1C0-32430
1	1	Engine Fuel Filter	16631-42560
1	1	Engine Fan Belt	17112-97010
2	1	Pressure Pump Drive Belt - Banded	6/B59 Banded
2	1	Feed Pump Drive Belt	BP46
1	1	Pump Seal Kit	5019.0211.00
1	1	Pump Valve Kit	5025.0044.00
1	1	Valve Seal Kit	5019.0139.00
1	1	Pressure Regulating Unloader	8116.2543.00
1	1	Pressure Regulating Unloader Repair Kit	TBA
1	1	Relief/Safety Valve	8116.2538.00
1	1	Trigger Valve Repair Kit	20 3600 490