

AOKPI

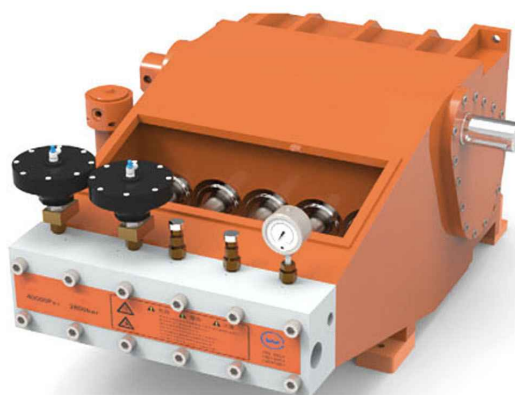


ISO 9001
ISO14001
ISO45001

>>Ultra-high pressure
waterjet pump unit
——Diesel engine set

Operating Manual

AOKPI INDUSTRY



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1、 Warranty description

Limited warranty:

Aokpi Industry CO., LTD. provides a 12-month or 1000-hour material and process defect warranty for each water jet equipment, high-pressure pump or hydraulic end it manufactures (under normal use and in accordance with all Under the premise of operating instructions). If sold to an end user, the applicable warranty period starts from the date of delivery to the end user. If it is used for leasing, the applicable warranty period starts from the day when the equipment is delivered to the hireable party. During the warranty period, the limited warranty can be renewed by any subsequent assignee. This limited warranty is the only exclusive warranty provided by Aokpi Industry CO., LTD.

maintenance proposal:

If products such as water jet equipment, high-pressure pumps or hydraulic ends fail during the warranty period and are confirmed to be defective in materials or original production process by Aokpi Company, the parts shall be repaired or replaced by Aokpi Company. Repair or replacement shall be carried out at Aokpi Company, the customer's location or other locations approved by Aokpi Company. The above maintenance plan should be the only dedicated maintenance plan when either party submits a valid warranty application.

Aokpi's limited warranty does not apply (and Aokpi is not responsible for the following conditions):

1. Main components and commercial accessories that are independent of the original manufacturer's warranty, such as engines, couplings, pressure gauges, high-pressure hoses, etc.
2. Daily maintenance and maintenance services performed by the end user.
3. Normal wear parts, such as: coupling, belt, packing, etc.
4. Failure caused by the use of non-Aokpi company suggestions or man-made damage.
5. Repair, alteration or transformation without the written permission of Aokpi Company. According to the judgment of Aokpi, the above actions have caused adverse effects on the stability, operation or reliability of the equipment designed and manufactured by the original factory.
6. Misuse of parts, operating negligence, accidents or improper equipment maintenance, etc.

* Note *

Using any part of the product that is not within the scope of Aokpi's approval may also invalidate the warranty. Aokpi reserves the right to determine whether the warranty is valid due to the use of non-approved parts.

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For the parts not listed in this warranty, Aokpi is not responsible for any loss, injury or any type of damage caused by any defect or malfunction of the equipment to any other organization.

The warranty clause replaces all other express or implied warranties, including but not limited to the marketability of the equipment (the feature that the equipment can be sold at a reasonable price in a short period of time), or the suitability for a particular purpose.

For the avoidance of doubt, Aokpi is not responsible for any indirect, special, incidental or subsequent damages, including but not limited to losses caused by use or lost profits. Except for the written materials, catalogs or specifications of Aokpi company attached to the equipment, Aokpi company has not declared that the equipment has any other performance. Aokpi Company did not authorize any personnel or company representatives to change the terms of the warranty, nor did it give any other warranty. At the same time, it did not authorize other companies to act on behalf of Aokpi Company to undertake the sales and any other responsibilities related to service or repair. If such behavior is discovered, the company will take corresponding legal actions within 18 months of the occurrence of the event or fact. Aokpi company reserves the right to change the design scheme or improve the product, but this does not mean that Aokpi company is responsible for making changes or improvements to the previously produced products.

2. Water jet safety

2.1 Identify safety information



This is a safety warning symbol. When you see this symbol in your equipment or this manual, be alert to the possibility of personal injury. Follow recommended precautions and safe operating practices.

Understand the logo vocabulary



"Danger" is used to indicate the existence of the said danger. If the warning is ignored, it will cause serious personal injury or death.



"Warning" is used to indicate the existence of the hazard. If the warning is ignored, it may cause serious personal injury or death.

NOTICE

"Caution" is used to indicate that there may be danger. If the warning is ignored, it may cause minor personal injury.

Tips

"Tips" indicate that installation, operation and maintenance information is important, but does not involve hazards.

2.2 Safety Training

Only trained personnel can set up, operate and maintain the equipment. The water jet operator should be aware that the water jet discharged from the nozzle may cause serious personal injury.

Safety specification for high-pressure water jet cleaning operation

It is recommended to implement the national standard safety code "Safety Code for High Pressure Water Jet Cleaning Operation". When using and maintaining high pressure water jet equipment, the safety code provides various guidelines and instructions for maintenance in a safe working environment. (Website: National Technical Standard Resource Service Platform. Website: <http://www.gb688.cn/> This website can be retrieved to view this specification.)

In order to ensure a safe working environment, please ensure that all operators and maintenance personnel have read and understood the contents of this manual.

Check the pressure level

Check the condition of all components. Please do not use any suspected defective parts. If you are not sure about the parts, seek help from your supervisor or maintenance personnel. Only use parts marked with recommended working pressure. The working pressure should not exceed the working pressure of the parts marked with the lowest pressure in the system.

All components in the system must correctly meet the rated operating pressure. Please refer to the safety manual for details of pressure ratings.

Check the high voltage connection

Before assembling any high-pressure connector, check the condition of the connecting thread. The outer pipe thread (NPT thread) is sealed with polytetrafluoroethylene (raw tape) tape. Do not let the raw material tape overlap at the threaded end of the outer pipe, because the tape fragments may enter the water flow of the system and block the nozzle orifice. On the connection where the internal and external threads are both stainless steel, a layer of anti-sticking agent should be coated on the Teflon sealant to prevent the threads from "sticking" or seizing.

Tighten the connector

Tighten all high-pressure connections appropriately. When connecting the assembly pipe (NPT), it should be tightened by hand first, and then tightened one and a half to two turns with a wrench. Do not turn the wrench more than two turns to tighten the NPT thread. All NPT connections must have at least four threads engaged.



When using a pipe wrench, avoid leaving a deep wrench mark to avoid damage to the components.

Guarantee two operators

There must be at least two operators in the water jet operation; the gun operator (operator 1) must always maintain control of the high-pressure water outlet pressure. The high-pressure pump operator (operator 2) must maintain a safe distance of 3.7 meters from the gun operator (operator 1). In addition, the gun operator should be within the sight of the high-pressure pump operator, and other effective communication methods must be established if they cannot be within the sight.

Purge the high-pressure pipeline

Before connecting the nozzle to the spray gun or pipe to clean the spray rod, the high-pressure pump should be operated at low speed to blow off the dirt and debris in the high-pressure pipeline. Dirt and debris can block the nozzle holes and cause excessive system pressure.

Test system

After installing the nozzle, operate the high-pressure pump at low speed (low pressure) for testing. If necessary, the system can be revised and adjusted, but the high-pressure pump should be stopped and all pressure should be released before the corresponding operation.

Tighten the connector

When visually inspecting at 1000 psi (69 bar), check all joints for leaks, and then pressurize again to bring the system to full pressure. Do not use your hands to look for leaks. If it leaks, it is obvious. Turn off the system and release the pressure. Remove the leaking joints for inspection and cleaning. If the connector looks intact, reinstall the connector. If the leak persists, the

connector must be replaced. Leaking joints can cause joint damage and very dangerous spray damage.

Let the system operate normally, slowly increase the pump speed until the demand is reached, adjust the operating pressure, and be sure to adjust the pressure slowly.



(Figure 2.1.1) Pressure gauge

Use the specified maximum system pressure

Do not use pressures that exceed the lowest rated pressure components in the system. Try to avoid using components with lower pressure ratings in the system. If you cannot maintain vigilance, components with lower rated pressures in the system will be ignored or burst.

All equipment pressure ratings and warning labels should be kept intact.

Stay safe at all times

If it is suspected that the equipment is malfunctioning or not functioning properly, the cleaning work should be stopped immediately and the pressure in the system should be released before repairing. Be sure to follow the manufacturer's repair instructions.

Perform maintenance or repair

Due to the hazards involved in high-pressure water jets, equipment maintenance or repairs can only be completed by properly trained maintenance personnel. You can get in touch with Kejet. During repair or maintenance, the equipment should be operated under lower pressure when testing. The pressure should be adjusted slowly during operation.

Freezing and cold working environment

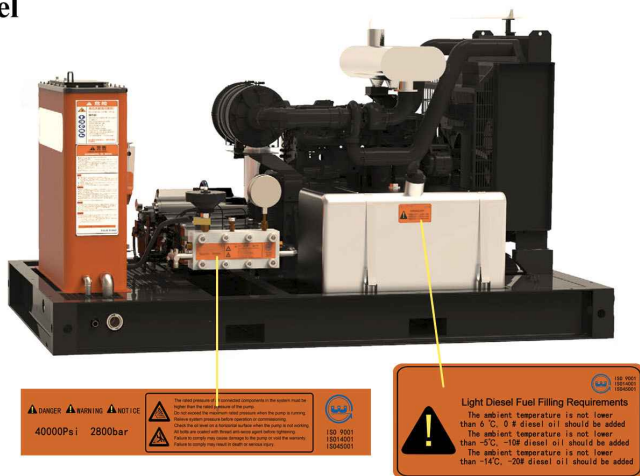
When shutting down in a cold working environment, even if it is a short-term shutdown, all components must be drained of water. Before operation, you must carefully check the operation of all equipment components to ensure that the components are not frozen and can be operated.

Please refer to Chapter 7.6 of this book for detailed information on "Equipment Antifreeze".

Properly store spare parts

When not in use, it should be protected to avoid damage. Ensure that safety warning labels and markings are intact and undamaged.

2.3 Warning label



(Figure 2.3.1) Front side of equipment operation



(Figure 2.3.2) Rear side of equipment operation

2.4 Maintenance work safety

2.4.1 personal protection

1. Wear protective goggles, safety shoes and helmets when working.
2. Do not wear loose clothing or torn clothing. Take off all jewelry while working.

2.4.2 Environmental site

1. Remove any loose objects, such as trash and oily rags, from the work area.
2. Do not participate in or tolerate frolicking in the work area.
3. Make sure that all tools, parts and wipes are removed from any rotating parts after

completing the maintenance work of the equipment.

2.4.3 Maintenance preparation

1. Maintenance personnel must pay attention to all safety signs pasted on the high-pressure water jet device.
2. Review all safety information related to the job you will be doing.
3. Safety starts with you. Before starting work, make sure that all equipment has been completed and turned off.
4. Always use tools in good condition. Make sure you understand how to use these tools before performing any preventive maintenance work.
5. Prepare a suitable container to collect the stored liquid and the disassembled parts.
6. Check repeatedly to ensure that all pressure in the system is released before starting repair work.
7. If the equipment must be operated to confirm the expected maintenance work, make sure you know how to stop the equipment.

2.4.4 Safety warning

Stay alert

1. To avoid burns, be alert to hot parts of components that have just been turned off.
2. Before removing or unplugging any pipelines, parts or related items, release all high pressure. When removing any equipment from a system that uses high pressure, be alert to possible pressure.
3. Do not work on anything that is only supported by a jack or crane. Before carrying out any work, you must use blocks or suitable brackets to support the product.
4. Avoid personal injury. When lifting components over 25 kg, use a chain crane or ask for help. Ensure that all the equipment (chains, hooks or hoists) in it is in good condition and the load-bearing weight is correct. Make sure that the hook is placed in the correct position. Always use struts when necessary. The crane hook should not be loaded from one side.
5. When the equipment is running, do not try to perform any maintenance or cleaning around the equipment.

2.4.5 Operating guidelines

1. Do not make any unauthorized changes to the equipment or components. Only use genuine spare parts produced by Kejet.
2. All electronic components connected to this system should be maintained in accordance with approved practices. Never jumper wires across fuses, fuse holders or circuit

breakers.

3. Insist on preventive maintenance intervals to ensure the correct operation of high-pressure water jet equipment.

2.4.6 High pressure operation

1. After turning off the high-pressure water source, the high-pressure water will stay in the device for a long time. Make sure to drain all water from the device before performing maintenance on any part of the device.
2. Some accessories, attachments or spare parts have drain holes. Do not touch these drain holes with bare hands or try to block these holes to prevent water from flowing out.
3. When disconnecting any high-pressure connections, slowly loosen the fastening nut to release any stored pressure from the drain hole of the accessory.
4. Do not move the high-pressure pipe guard plate. If the protective plate is moved for maintenance, make sure to put the protective plate back in its place before starting the device.
5. Do not stand or lean on high-pressure water pipes. You may break the connection and cause water leakage.

3. Equipment operation

3.1 Steps

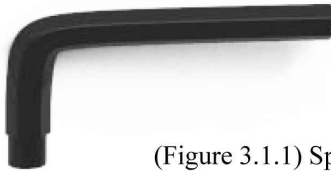
3.1.1 Equipment preparation

Remove all transportation protection

1. During transportation, the engine exhaust pipes of some equipment are equipped with rain caps. After receiving the goods, please remove the cable tie and label from the engine exhaust pipe.

NOTICE

2. **Remove all shipping packaging.**
3. Check the equipment, if there is any damage, please contact the after-sales personnel in time.
4. Take out the pump wrench from the attached accessories (Figure 3.1.1).



(Figure 3.1.1) Special wrench for high pressure pump

Tips

Considering transportation safety, there is little or no oil in the equipment when transporting the equipment. Please add oil etc. before starting the equipment.

Warning

Operating without any of the above safety components is unsafe and will cause damage to the equipment.

Tips

The use of quick couplings is an important way to avoid wear of the pump head high-pressure hose connections. If the internal thread of the pump head is worn or damaged, the cost is far greater than replacing the quick connector. The pump head may need to be shipped back to the factory for repair or replacement.

3.1.2 Hose and water supply requirements

The inner diameter of the water supply hose must be large enough to meet the water supply flow requirement of 150% of the maximum flow of the equipment.

The inner diameter of the high-pressure discharge hose will be determined by the necessary length of the high-pressure hose and the flow rate through the high-pressure hose. Please contact the sales representative of Kejet Company to select the appropriate high-pressure pipe size.

The water supply pressure should not exceed 100 pounds (6.9 bar). If the water supply pressure exceeds 100 pounds (6.9 bar), a valve needs to be installed at the water inlet to adjust the pressure to meet the flow demand.

3.1.3 Start preparation

1. Place the device on a hard, flat surface.

2. Check the oil level of the engine crankcase lubricating oil. Please refer to the engine manual for more information.
3. Check the oil level of the oil storage tank.
4. Check the oil level of the lubricating oil at the power end of the high-pressure pump. Please refer to 5.1.3.1 "Checking the power end lubricating oil level".
5. Check whether the filter bag and filter element need to be replaced.
6. Check the tightness of the gland nut of each high-pressure cylinder.
7. Check all equipment. Ensure that the rated pressure of each component in the pressure circuit is greater than that of the circuit, and replace any components with incorrectly calibrated rated pressure.
8. Connect the water supply hose and make sure the drain valve is closed.
9. Open the water supply valve and fill the water tank. All valves between the water supply valve and the pump must be opened until cooling water flows out from the back of the stuffing box.
10. Connect the high-pressure pipe to the joint on the pump head, and install the hose safety lock sleeve at the same time.



When the equipment is ready for operation, the piping system must be flushed. When the high-pressure hose is connected to the equipment for the first time or an additional high-pressure hose is added, the hose must be flushed with high-pressure water to remove all dust and debris. Do not connect any overflow spray gun or tools to the high-pressure hose before flushing all dust and debris with high-pressure water. If the debris in the hose is not completely removed, it may cause the cleaning nozzle to be blocked and the system to overpressure.

3.1.4 Operating the high-pressure pump

3.1.4.1 Device boot

1. Visually inspect the surrounding conditions of the cleaning site, and there should be no debris on the site, so as to avoid splashing and hurting people; because on-site cleaning is noisy, it needs to be confirmed before cleaning. The necessary hand language is at least startup and shutdown.
2. Turn on the power switch and check that the equipment meets the conditions. (Refer to the cleaning equipment list)
3. Open the pneumatic valve by turning the knob counterclockwise until the O-ring is visible (when the knob enters the valve body) or turn counterclockwise four full turns from the closed position. At this time, it is allowed to start the engine without the load of

the pump.

4. Click the start button (if the engine does not start successfully within 15 seconds, also need to release the button, and then repeat this)
5. Observe the engine data displayed on the control panel and increase the speed to the working speed.
6. Exhaust the air in the dual element filter.
7. Use the pressure regulating valve to adjust the pressure to the pressure required for the work.

3.1.4.2 Flushing equipment waterway

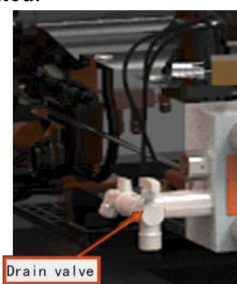
When the engine is idling and warming up to operating temperature, this time is used to flush all debris in the system. The flushing system prevents debris from clogging the cleaning nozzles and valves, which will cause overpressure in the system. All nozzles must be removed during equipment flushing.

1. First open the exhaust valve to empty the air from the dual element filter. Once the water continues to pass through the dual element filter, immediately close the valve.



(Figure 3.1.2) Double element filter exhaust valve

2. Flush the pump head. Open the drain valve on the pump head and let the water flow out of the pump head drain valve for about 5-10 seconds. If there is no replacement or installation of any parts in the water circuit of the equipment in daily operations, this step can be omitted.



(Figure 3.1.3) Flushing the pump head



Two operators are required to flush the equipment and high-pressure pipes. One operator must be beside the equipment and the other at the drain end.

3. Fix the high-pressure pipe (fixed with a safety lock).

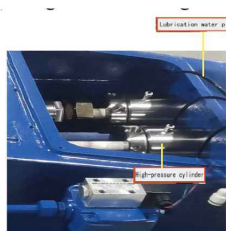
4. After the pump head is flushed with debris, the engine reaches normal operating temperature. Due to differences in the parameters of different types of engines, please refer to the engine manual for specific temperature values.
5. Connect the high-pressure hose and turn the pneumatic valve clockwise until enough water flows out through the high-pressure hose. Allow the hose to flush for about 30 seconds.
6. Reduce the flow of water from the high-pressure hose by fully opening the pneumatic valve (counterclockwise).
7. After confirming that the high-pressure hose is normal, turn off the engine.
8. Connect the control gun (or other equipment being used) to the discharge high-pressure hose.
9. Another operator controls the safety of the equipment and high-pressure pipes.
10. Turn the pneumatic valve clockwise to increase the output flow of the high-pressure pipe, allowing the control gun to flush for about 30 seconds.
11. Reduce the discharge water flow by fully opening the pneumatic valve.
12. After confirming that the high-pressure hose is normal, reduce the engine speed to the idle state and turn off the engine.
13. The nozzle can now be installed on the discharge device.
14. Before cleaning, check the water lubrication system. Please refer to 3.1.4.3 "Checking Water Lubrication System".

3.1.4.3 Check the water lubrication system

1. Look through the plexiglass cover to view the water lubrication system.

Warning Be very careful with the moving parts inside the cabinet, as it may cause serious personal injury during the movement. When the pump is running, make sure that all tools are outside the box.

2. Observe the inside of the rod box and verify that the lubricating water flows in from the plunger opening of the stuffing box (Figure 3.1.4) and flows down to the back cover of



(Figure 3.1.4) Check water lubrication

3. Next, please put your fingertips on top of the stuffing box to check the temperature of the

stuffing box. The temperature should be from cool to warm, but still cool enough, you can keep your fingers on it for 10 seconds.

If there is no water flowing, or the temperature is too high, or water vapor can be seen, then the needle valve needs to be adjusted.

4. Adjust the needle valve (Figure 3.1.5) to increase the flow of water. Turning the needle valve counterclockwise will increase the water flow. Until a small stream of water (more than one drop) is visible, instead of splashing from the baffle.



(Figure 3.1.5) Needle valve adjustment

5. Once properly adjusted in place, the system pressure can be instantly increased for cleaning.

3.1.4.4 Increase system pressure

Warning The pressure can only be established after confirming that all parts of the high-pressure system are installed properly. Otherwise, death or serious injury may result. When high-pressure water is shot from the overflow barrel and then hits the steel pipe, it will produce a huge reverse thrust (very large flow and pressure).

The end of the hose must be fixed, and the spray must be in a closed space to ensure that no one will be injured. Safety locks must be installed at all high-pressure pipe connections.

Warning Do not use damaged high-pressure hoses at any time. Once a leak is found in the high-pressure system, it must be shut down and repaired.


NOTICE When working in cold temperatures, give the high-pressure pump plenty of time to warm up the pump oil before increasing the system pressure.

Tips If a new plunger seal assembly is installed, or if the high-pressure pump is operated for the first time, the pump plunger packing must be properly opened. Please refer to 3.1.4.5 "Disassembling the new plunger seal assembly".

1. Adjust the engine to the best speed. (Please note that the inlet pressure of the high-pressure pump is 1.8bar~7bar)
2. Slowly turn the pneumatic valve clockwise to gradually build up the pressure from the start position to the closed position.

Tips When the engine is idling or warming up to operating temperature, this time is used to flush out the debris in the system. The flushing system can prevent any debris from clogging the

cleaning nozzles and valves, which will cause overpressure in the system. All equipment is always cleaned with the pneumatic valve fully closed to ensure that all water is used for the most efficient operation. If only a small amount of water is needed, please control the flow by reducing the engine speed, because a large amount of overflow water will not only cause the pneumatic valve core and pneumatic valve buffer to wear quickly, shorten the service life of these components, and at the same time overflow Water is also a waste of water, fuel, and work.

 **When the engine speed is lower than the optimal speed, do not let the pump work with load. This will cause excessive engine vibration, resulting in engine damage and bracket cracking, and damage to protective devices and accessories.**

3.1.4.5 Disassemble the new plunger seal assembly

Tips This step is only suitable for 15K and 20K molded packing seals. The new packing installation should adjust 3 to 4 pressure sections to run-in within 5 minutes to ensure the best performance.

1. Adjust the engine speed to 1400r/min.
2. Slowly close the pneumatic valve and adjust the discharge pressure to 3000 PSI (200 bar) (all dump valves are closed).
3. Increase the engine speed to the maximum speed to ensure that the temperature of the plunger cooling water (lubricating water) does not exceed 50°C.
4. Continue to operate the pump in three stages and adjust the discharge pressure to reach the operating pressure. Each step lasts for 1 minute during operation. Check the lubricating water and carefully feel the temperature of the stuffing box. When the pump is running at the rated working pressure, the stuffing box and gland nuts should only be slightly warm to the touch. Overheating of the stuffing box and compression nut may be caused by insufficient water lubrication or an over-tight packing seal. If the lubrication is insufficient, the water flow cannot be corrected by adjusting the needle valve. At this time, the pump needs to be stopped and the problem corrected.

3.1.5 Check for leaks

A drain hole is designed in the pump head. When the seal is damaged, water will drain from the drain hole. If the seal is damaged, water will leak from its associated drain hole. There are two types of drain holes. The high-pressure end seal drain hole is a rectangular groove (Figure 3.1.6), and the low-pressure one-way combination valve seal drain hole is round. Each type of drain has three manifolds leading to the top.



(Figure 3.1.6) Leak hole

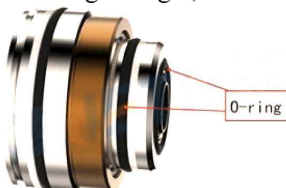


(Figure 3.1.7) Combination valve and packing seal

If water leaks from one of the rectangular drain holes, the seal between the one-way combination valve and the high-pressure cylinder is damaged or the seal of the corresponding joint is damaged. For 15K and 20K pump heads, the O-ring on the valve (Figure 3.1.7) seals it. On the 40K pump head, there is no O-ring on the combined valve to seal. The high-pressure cylinder contains a packing seal to seal the connection.

Tips In the 20K pump head, the rectangular drain hole is also connected to the upper pressure port. If water is observed in the rectangular drain hole, first check the corresponding 20K pressure port connection. The seal at the 20K interface may need to be repositioned or replaced. If water flows out from the circular drain hole (Figure 3.1.6), the seal on the outer O-ring (Figure 3.1.8) on the outside of the combined valve is damaged.

Note: If the O-ring is larger, water will leak from the rectangular leak hole.



(Figure 3.1.8) Outer O-ring

During operation, pay attention to check the pump head leakage. If a leak occurs, immediately replace all seals of the leaking valve.

Warning If the leakage continues, the combination valve or pump head may be severely damaged. Check the valve seat when replacing the sealing components of the combined valve, and grind the combined valve if necessary.

Please refer to the description of 5.1.2.7.5 "Combination Valve Grinding".

3.1.6 Shut down equipment

1. Open the pneumatic valve and turn it counterclockwise four full turns to release the system pressure. Observe the pressure gauge to ensure that the system pressure is zero.
2. Reduce the engine speed to idle speed.
3. Let the engine run for another 4-5 minutes and then shut down the engine. This allows the engine's turbocharger to dissipate heat normally. When the temperature displayed on the control panel drops to about 80°C, the engine can be safely shut down.

4. Press the stop key. Turn off the engine and cut off the power supply.
5. Wipe off the water and dirt on the nozzles, guns, valves and other parts, and spray anti-rust oil to prepare for next use.
6. Wrap all exposed threads with raw tape before storing.

3.2 2800 bar operation

3.2.1 Filter element replacement

1. Close the water tank valve and drain the water. The water in the filter will bring dirty water to the pump. Release the shell pressure through the exhaust valve, and then loosen the four eye nuts on the filter cover (Figure 3.2.1).



(Figure 3.2.1) Filter cover

2. Slowly open the cover and take out the spring and spring retainer.
3. Take out the filter element.
4. Install the new filter element on the guide rod. Make sure that the guide rod is properly seated to the bottom of the housing.
5. Check the O-ring and install a new one if necessary.
6. Install the spring retainer and spring on the edge of the filter element.
7. Close the filter cover and tighten the eye nut. Open the tank valve and the filter drain valve, and then flush the dirty water from the filter through the drain valve with water.
8. Prepare the pump to run and start the machine. Start the cleaning operation, and record the engine speed and the pressure of the dual filter element filter pressure gauge.
9. Save the record and observe the status of the dual element filter. The filter bag (filter element) must be replaced when the pressure difference of the pressure gauge on the filter drops to about 0.3 bar (the same rotation speed recorded before when the equipment is working).

3.2.2 Switch adjustment

When the pressure of the filter drops to about 0.3 bar, the differential pressure switch will shut off the device.

3.2.3 Life of one-way combination valve

The valve seat of the one-way combination valve will be damaged by the passing dirty water. The filter bag (filter element) needs to be replaced regularly to improve the performance of the pump, which is very effective in extending the service life of the combined valve (the nozzle and

the bypass valve spool are also affected by dirty water).

Regular inspection (it is recommended to check once every 300-500 hours, if the water quality is poor, the inspection time will be shortened) one-way combined valve seat, monitor the condition, and grind the valve seat if necessary. Please refer to the description of 5.1.2.7.5 "Combination Valve Grinding".

3.2.4 Pressure conversion

The high-pressure cleaner has three pressure ranges, and the operator can switch to different working pressure ranges by replacing the corresponding accessories when necessary.

And are usually called 15K, 20K and 40K. These abbreviations indicate the maximum operating pressure.

It can operate up to 15000 PSI (1034 bar) at the 15K hydraulic end.

It can operate up to 20000 PSI (1379 bar) at the 20K hydraulic end.

It can operate up to 40,000 PSI (2758 bar) at the 40K hydraulic end.

When switching a hydraulic end with a different pressure, the high-pressure cylinder, pump head and appropriate components must be replaced.

Warning When switching to a higher operating pressure, all equipment must meet the correct pressure rating.

3.2.5 Pump conversion

1. Release the pressure from the pump and turn off the engine.
2. Turn off the water supply and drain pipes of the water tank.
3. Remove the high-pressure sensor (Figure 3.2.2) and the drain valve on the pump head.
4. Disconnect the bypass drain hose and water supply assembly from the pump head.
5. Open the glass cover (Figure 3.2.3), and disconnect the lubrication line on the high-pressure cylinder pipe.



(Figure 3.2.2) High pressure sensor



(Figure 3.2.3) Remove the lubricating water pipe

6. Remove the bolts on the pump head (Figure 3.2.4), and remove the top pump head bolts from each corner in turn.



(Figure 3.2.4)



(Figure 3.2.5)

Tips The pump head bolts can be removed by hitting the pump wrench with a hammer.

7. In the two holes in the upper left corner and the upper right corner, install the pump head installation tooling to make it easier to install the new pump head.
8. Continue to remove the remaining pump head bolts.
9. Once all the bolts have been removed, two people are required to lift the pump head away from the pump body, as shown in the figure (Figure 3.2.6). The weight of the pump head is approximately: 100 kg.



(Figure 3.2.6) Pump head removal

10. Remove the water lubrication joints on all the high-pressure cylinders (Figure 3.2.7).



(Figure 3.2.7)



(Figure 3.2.8)

11. Take out the high-pressure cylinders from the pump housing (Figure 3.2.8)
12. Thoroughly clean the cavity of the high-pressure cylinder and apply petroleum jelly or anti-seize agent to the cavity.

Tips When installing the high-pressure cylinder, use petroleum jelly or anti-seize agent to prevent corrosion and prolong the service life of the pump.

13. Install a new high-pressure cylinder to the pump housing. Pay attention to the installation direction.
14. Wrap raw material tape around the threads of the water lubrication harness connector (Figure 3.2.9). Install the connector to the high-pressure cylinder.



(Figure 3.2.9)



(Figure 3.2.10)

15. Apply a layer of petroleum jelly or anti-seize compound to the mounting surface of the power end. This will effectively reduce the accumulation of corrosion.
16. Lift up the new pump head and install it on the pump housing.
17. Adjust the fluid end to be flush with the power end, and install the trunnion bolt under the pump head (Figure 3.2.10). If the bolts cannot be installed, it is because they are not aligned, and the pump head needs to be adjusted appropriately to make it aligned.



(Figure 3.2.11)

18. Install the pump head bolt (Figure 3.2.11) in the opening and tighten it by hand.
19. Remove the pump head mounting bolts and install the remaining two bolts. Start the installation in a crisscross sequence, starting from the middle bolt, and tighten all the bolts, as shown in Figure 3.2.12. The torque is 350 foot-pounds (470 N.m).

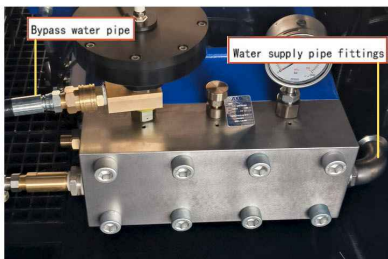


(Figure 3.2.12) Bolt tightening sequence

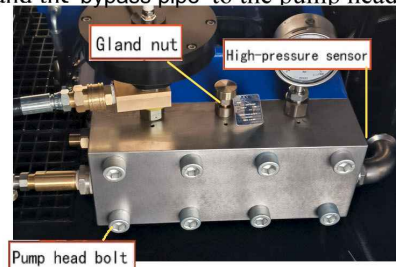


(Figure 3.2.13)

20. Push out the plunger in each high-pressure cylinder until it contacts the opposing cross-head piston rod.
21. Ensure that the gland nuts are tight. Hit with a pump wrench and a 5-pound (2 kg) hammer, and tighten the gland nut (approximately 250 ft-lb 338 N.m).
22. Connect the water lubrication line (Figure 3.2.13) connected to the high-pressure cylinder to the joint. Install the cover.
23. Connect the water supply pipe (Figure 3.2.14) and the bypass pipe to the pump head.



(Figure 3.2.14)



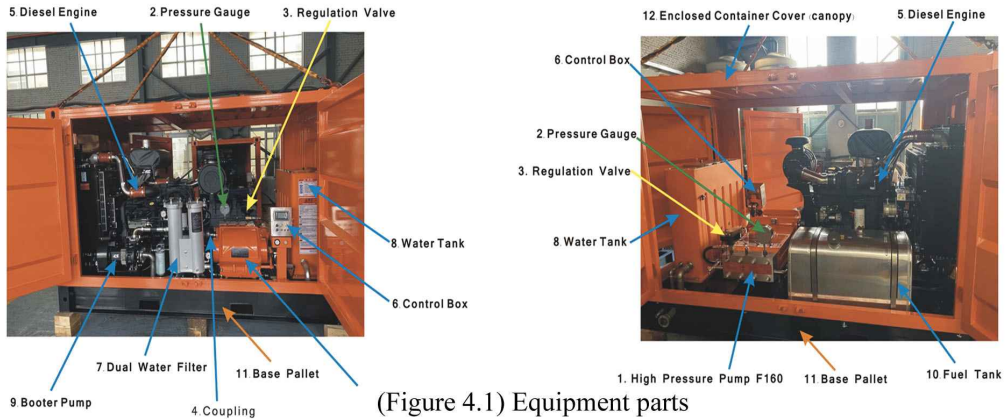
(Figure 3.2.15)

24. Install a new high-pressure sensor corresponding to the pressure (Figure 3.2.15), pay attention to the value in the operating system and adjust accordingly.
25. Check all connections, and ensure that the gland nuts and pump head bolts are tight.
26. Ensure that the water lubrication system is properly adjusted before cleaning. Please refer to 3.1.4.3 "Checked Water Lubrication System" instructions.
27. If a new plunger seal assembly is installed, follow 3.1.4.5 "Disassembly of the new seal assembly" to generalize the disassembly of the assembly.

4. General component maintenance

4.1 Part identification

Before operating the pump, you must fully understand each component and its function. The following is a brief description of the main components that make up the device.



(Figure 4.1) Equipment parts

4.2 Power System

4.2.1 Engine

Diesel engine is the source of power to drive the pump.

4.2.2 Coupling

Couplings provide a way to connect engine power to the high-pressure pump.

4.2.3 tank

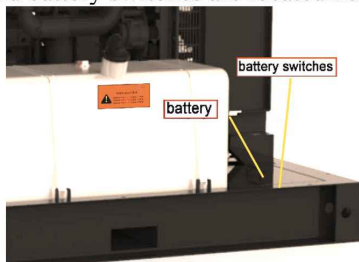
The fuel tank is located on the rear side of the engine (Figure 4.2.1). The fuel tank level is transmitted to the control panel through a fuel level sensor to inform the operator of the remaining fuel in the fuel tank.



(Figure 4.2.1)

4.2.4 Battery and switch

Two 12V maintenance-free starting batteries are connected in parallel. Its main function is to provide the current needed when the engine starts and to provide electricity for the control cabinet. The battery and battery switches are located next to the fuel tank.



(Figure 4.2.2)

4.3 Low pressure waterway

4.3.1 Water tank

4.3.1.1 Introduction to Water Tank

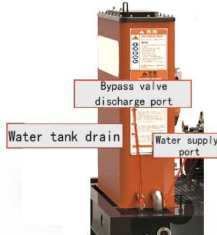
The water tank is connected to the water supply end through an elbow on the side of the tank. The water tank contains a float valve to maintain the proper water level. A level switch installed on the side of the tank will stop the engine once the water tank runs at a low water level (the control panel displays "low water level").

The overflow port (elbow joint) is located on the other side of the water tank, slightly higher than the inlet elbow. As a vent, this connector must always be kept open to the atmosphere. Do not block the opening or vertically upward.

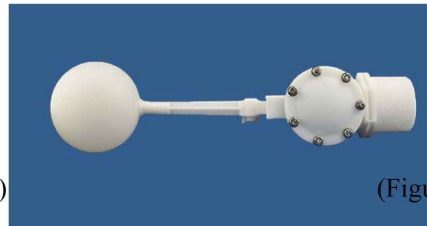
When the water supply is stopped externally, the full water tank can only maintain the water jet operation for a few minutes.

4.3.1.2 Water inlet

The water supply inlet is used for the water supply connection of the water jet (Figure 4.3.1).



(Figure4.3.1)



(Figure4.3.2)

4.3.1.3 Float valve

When the water tank is full, the float valve automatically shuts off the water supply. This component can fine-tune the height of the water storage level by adjusting the installation position of the float. Daily attention should be paid to the cleaning of the filter inside the valve to prevent clogging.

Plastic float valve has many advantages such as high fluidity, compact structure, slow closing to reduce water hammer, simple maintenance and use.

4.3.1.4 Water quality requirements

The quality of the water supply has a direct impact on the performance of your high-pressure pump. Using water with a PH value exceeding the standard will cause premature failure of pump components and related accessories (such as cracking).

As part of the pump installation and use process, the water quality must be tested. If the water you use is found to exceed the allowable measurement range value in the chart below, please consult Water Purification.

Recommended water quality level:

substance	Maximum allowable value(mg/L)	substance	Maximum allowable value(mg/L)
SiO	1.0	chloride	5.0
Ca	0.5	SO	25.0
Mg	0.5	Nitrate	25.0
Fe	0.1	CO2	0
Mn	0.1	Total dissolved solids	50.0
pH	6.8-7.5	Conductivity	50μΩ/cm

Note: Boiler water additives and ammonia or amines are not allowed to be used.

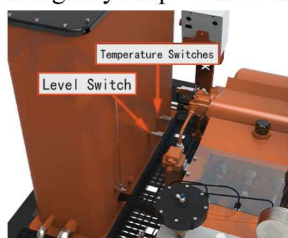
NOTICE The use of treated reverse osmosis water or deionized water will damage the plunger and support ring and other parts. It is known that water and dissolved solids with a TDS reading of less than 0.5 PPM can damage the carbide part.

4.3.1.5 Water tank and filter

The overflow port (elbow fitting) is located at the top of the water tank, and water will overflow from it when the float valve fails.

Warning Do not block this port. This port serves as a vent and must be kept open.

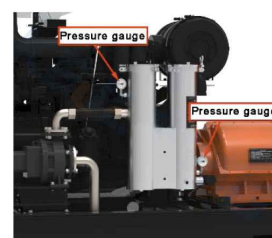
The liquid level switch (Figure 4.3.3) is installed on the side of the water tank. When the water tank is running at a low water level, it will shut down the engine. If this happens, "Emergency Stop" will be displayed on the control panel.



(Figure 4.3.3)



(Figure 4.3.4)



(Figure 4.3.5)

4.3.2 filtering system

4.3.2.1 Filter check

1. Loosen the bolts on the filter cover (Figure 4.3.4) and lift the cover.
2. Take out the filter fixing plate.
3. Take the filter bag or filter element out of the filter and check for debris, and replace it if necessary.

Tips The filter bags are not washable. Cleaning or rinsing the filter bag may damage the filter bag. This will cause debris to enter, causing damage to the valve.

4.3.2.2 Double element filter

Observe the pressure gauge of the double element filter (Figure 4.3.5): In normal operation, the pressure gauge should be within the range of 40 to 50 PSI (2.75 to 3.45 bar). When the pressure difference in the filter housing between the clean side and the dirty side rises to 0.3 bar, the engine will be turned off by the differential pressure switch connected to the filter housing to protect the equipment from damage. If this happens, replace the dirty filter element.

Warning Dirty filter work for a long time will cause filter failure, and debris will cause damage to the valve.

The condition of the filter element is very important. In order to monitor the condition of the filter, standard equipment is equipped with a pressure gauge on the filter. When the filter is replaced, pay special attention to the pump inlet pressure on the filter.

The double element filter is used to filter impurities in the water, and a pair of pressure gauges are installed on the filter to monitor the pressure in the filter. The differential pressure switch is installed on the housing of the secondary filter to monitor whether the flow through the filter is normal. If the filter is blocked, when the pressure difference between the front and back ends of the filter bag is large, this switch will give a signal to turn off the engine, and the control panel will display "filter blocked". The exhaust valve is located on the filter cover. When starting the equipment, the operator opens this valve to empty the air in the filter.

4.3.3 Booster pump

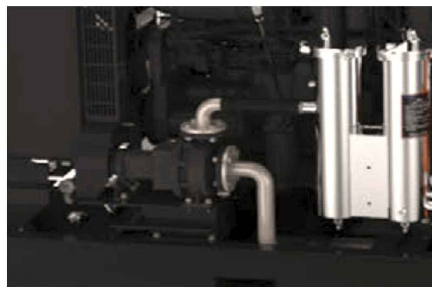
4.3.3.1 Introduction to booster pumps

The booster pump is driven by a belt and driven by a diesel engine. The booster pump pressurizes the water and then passes through the double element filter (Figure 4.3.6).

NOTICE Do not operate the pump when there is no water in the system to avoid damage to the pump.



(Figure 4.3.6)



(Figure 4.3.7)

4.3.3.2 Remove

1. Empty the water tank.
2. Remove the protective cover used to fix the pulley. (Figure 4.3.7)
3. Remove the fixing nut of the tension wheel, and the belt can be loosened by rotating the tension wheel.
4. Remove the water outlet hose and water inlet hose of the booster pump.
5. Remove the six nuts holding the booster pump and remove the booster pump.

4.3.3.3 Install

1. Install the booster pump on the base, and the booster pump pulley is parallel to the pulley on the main shaft of the diesel engine.
2. Install the booster pump drive belt.
3. Install the booster pump fixing bolts.
4. Adjust the angle of the tensioner to make the belt in a proper position.
5. Install the pulley guard.
6. Connect the water supply hose and the water outlet hose to the booster pump.

4.3.4 Pneumatic valve drain

During the operation of the pump, the water discharged by the bypass will flow out from this valve (if opened). Please refer to 5.2.3 "Pneumatic Pressure Regulator Introduction" for explanation. Either vertically downwards or return the water to the water tank (if needed). The water tank has been reserved for the return water interface (has been blocked with a blind plate). If it can be confirmed that the inlet water temperature of the high-pressure pump does not exceed 50°C during operation, the overflow water can be recycled.

If a bypass drain hose is used, the hose must be equipped with the correct size to prevent excessive back pressure, which can cause vibration and pulsation in the system and damage the system components.

5. Maintenance of high voltage components

5.1 High pressure pump installation and commissioning

Aokpi UHP pump is suitable for various engines and various pressure water jets. The versatility of Aokpi's high-pressure water jet equipment enables the operator to switch the pump head to different working pressure ranges when necessary. There are usually three basic pressure ranges, usually called 15K, 20K and 40K. These abbreviations indicate the maximum operating pressure.

15K pumps can operate up to 15000 psi (1035 bar)

The 20K pump can run up to 20000 psi (1380 bar)

40K pumps can operate up to 40,000 psi (2760 bar)

The conversion of the three pressure ranges is achieved by changing part of the pump components (hydraulic end, high-pressure cylinder, plunger, etc.). Each pressure range has its own pump head, high pressure cylinder and plunger. Different pressure ranges use different materials and structures. Different plunger diameters control the flow rate. Usually a high-pressure cylinder is matched with a plunger, but there are some ranges that use the same plunger size, so it is important to keep the same. For details of pressure conversion, please refer to 3.2.4 "Pressure Conversion". If you have any questions, please call Kejet to contact customer service.

5.1.1 High-pressure pump

5.1.1.1 Introduction to high-pressure pumps

The high-pressure pump uses the power of an electric motor to pressurize the normal-pressure water to form a high-pressure water output. The high-pressure pump is divided into two parts, the power end and the hydraulic end. With the deflector as the boundary, the rear part is the power end, and the front part is the hydraulic end.

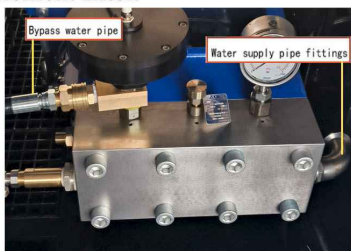
The power end contains the components that drive the pump. It is also called the "crank end" because it contains a crankshaft.

The hydraulic end contains components that determine the output pressure of the high-pressure pump. The operator can change the output pressure and flow rate of the pump by replacing the components in the hydraulic end.

5.1.1.2 High pressure pump removal

1. Empty the water tank.
2. Remove the pneumatic valve overflow water pipe and water supply pipe (Figure 5.1.1).

If the water supply pipe is connected to a dual element filter, disconnect it from the dual element filter.



(Figure 5.1.1) Preparation for pump removal



(Figure 5.1.2) Lifting the high-pressure pump

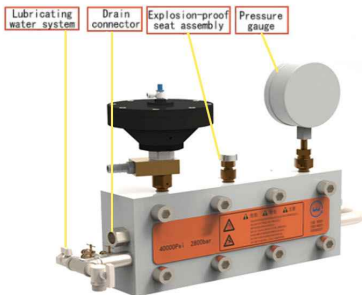
3. Remove the high-pressure sensor and disconnect the switch.
4. Remove the coupling bolts.

5. In order to facilitate the re-installation, use a marker pen to mark the position of the pump foot.
6. Remove the four outer hexagonal bolts and nuts that secure the pump.
7. Connect the hoist or lifting device to the pump. As shown in the figure (Figure 5.1.2).
8. Lift the pump from the equipment and place it in a suitable location for easy maintenance.
9. If there is a gasket under the pump, make sure that the pump and gasket are placed together, paying attention to their correct position.

5.1.1.3 Install

1. If the gasket is under the pump, place the gasket in a suitable location.
2. Apply butter or petroleum jelly (anti-rust, lubrication) to the four installation slots of the pump.
3. Connect the hoist or lifting device to the pump. As shown in the figure (Figure 5.1.2)
4. Place the pump near the position of the pump foot marked on the base seat surface during the disassembly process, adjust the position, and remove the lifting device after positioning.
5. Loosen the spreader on which the pump is installed.
6. Install the coupling to the flywheel of the diesel engine.
7. Install four external hexagonal bolts and nuts to fix the pump.
8. Install the coupling guard.
9. Install the high-pressure sensor on the valve plate.
10. Install the pneumatic valve water pipe and water supply hose.

5.1.2 Liquid end



(Figure 5.1.3) High-pressure pump components

5.1.2.1 Introduction to pump head body

The pump head body (also known as the valve plate) includes a combination valve that composes the hydraulic end of the pump. Three combination valves, each containing a suction valve and a discharge valve, are combined into one component. The combination valve converts low-pressure water into high-pressure water.

All the liquid end pump heads are affixed with a nameplate (Figure 5.1.4). The nameplate is printed with the fluid end model number. In addition, the nameplate is also printed with output pressure and flow. Refer to this nameplate before operating the pump.



(Figure 5.1.4)

5.1.2.2 Introduction to pump head drain valve

The pump head drain valve provides a way to drain water from the pump head. Before the pump is used, the contaminants in the pump head are flushed by draining. It can also be used to discharge air during the start-up operation.

5.1.2.3 Introduction to Water Lubrication System

The water lubrication system provides cooling water for the high-pressure cylinder in the pump. Water lubricates and cools the pump to make it run well. The system includes a manifold and three water lines. The needle valve on the manifold is used for flow adjustment. The needle valve controls the flow of each high-pressure cylinder, and proper adjustments must be made during operation. There is no pressure delivery in the manifold, only a fixed flow rate. Please refer to 4.3.3 "Booster Pump" for details, Manifold Pressure Delivery.

5.1.2.4 High voltage output connector

A high-pressure pipe is connected to the high-pressure connector. The high-pressure water flows out of the pipe fitting. It is recommended to use a quick connector on the 15K pump head to prevent damage to the pipe thread and cause wear of the pump head thread.

5.1.2.5 Liquid end maintenance

5.1.2.5.1 Check the pump head bolt torque

Check whether the head bolts are loose. Starting from the middle, check the bolt torque in a sequential staggered manner, as shown in the figure (Figure 5.1.5). Use a suitable torque of 350 ft-lbs (470 N·m), which can be achieved by hammering the pump wrench with a hammer.



(Figure 5.1.5) Bolt tightening sequence

5.1.2.5.2 Check the gland nut torque

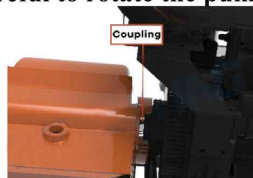
1. Open the front cover of the box.
2. Place the long end of the pump wrench in the gland nut hole.
3. Use a 5-pound (2 kg) hammer to hit the wrench and tighten the gland nut. Strike the wrench with three times the force. Provide enough torque to the nut.
4. Repeat tightening the remaining gland nuts.
5. Close the front cover of the box.

5.1.2.6 Replace the plunger seal kit

5.1.2.6.1 Remove

1. Relieve the pump pressure and turn off the engine.
2. Turn off the water supply and drain pipes of the water tank.
3. Open the front cover of the box.
4. Disconnect the water lubrication harness.
5. Remove the plunger for repair. Move the plunger to bottom dead center (the piston rod is fully retracted toward the crankshaft). As shown in Figure 5.1.6

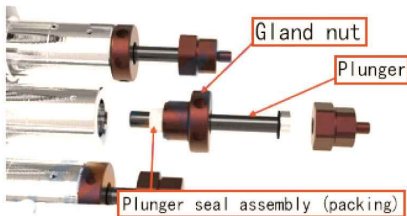
NOTICE Be careful to rotate the pump, as this may cause a pinching hazard.



(Figure 5.1.6)

Operating Manual

6. Insert the round end of the pump wrench into one of the compression nut holes, press the top of the wrench and knock it loose with a heavy hammer. Then unscrew the gland nut of the high-pressure cylinder by hand.
7. Remove the gland nut and plunger from the other side of the high-pressure cylinder. It may be necessary to swing the packing by moving the plunger up, down, left, and right.



(Figure 5.1.7)



(Figure 5.1.8)

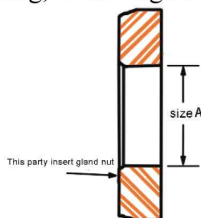
8. Remove the plunger seal assembly (packing) (Figure 5.1.7).
9. Remove the plunger and guide ring from the gland nut (Figure 5.1.8) and check. The guide ring may be stuck and requires some force to remove it. Use the incision tool to press out the bushing. Be careful to avoid damaging the gland nuts.

NOTICE At the 40K hydraulic end, the guide ring in the high-pressure cylinder (Figure 5.1.8) does not need to be replaced unless there are obvious traces of friction sleeve on the plunger.

10. Remove the O-ring from the gland nut (Figure 5.1.8).
11. If the plunger seal assembly needs to be replaced, repeat the previous steps to remove the remaining high-pressure cylinder.

5.1.2.6.2 inspection

1. Check the plunger for scratches or nicks. Discard the damaged plunger.
2. For 40K equipment, measure the diameter of the guide ring. Refer to the dimension of diameter A in (Figure 5.1.9). If the diameter exceeds the specifications listed in the diameter A table, please replace the guide ring. If there are nicks on the surface of the guide ring, or the edge is chipped, the guide ring needs to be replaced.



(Figure 5.1.9)

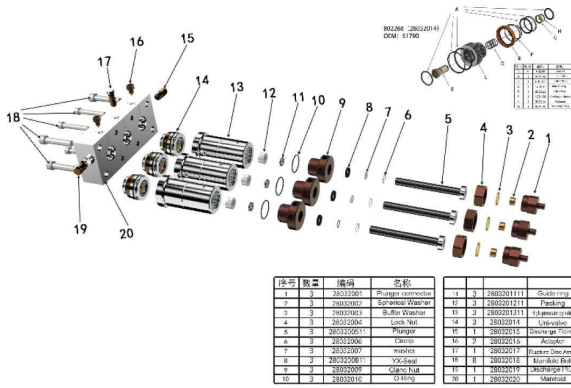


(Figure 5.1.10)

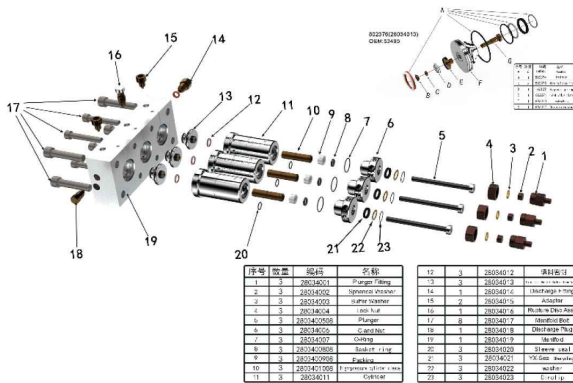
5.1.2.6.3 installation

1. Install a new O-ring on the gland nut (figure 5.1.10), the dimensions refer to dimension A in the above table (figure 5.1.9).
2. Install the guide sleeve (Figure 5.1.10) and plunger in the gland nut.
3. Install the new plunger seal assembly (packing) and guide sleeve on the plunger, and the orientation is shown in the figure (Figure 5.1.11), the packing is 15K/20K and (Figure 5.1.12) is 40K.

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(Figure 5.1.11) 15K/20K hydraulic end



(Figure 5.1.12) 40K hydraulic end

- Lubricate the gland nut with anti-seize agent, and apply anti-seize agent to the threads and the surface contacting the inside of the packing. Place the assembled high-pressure cylinder in the pump housing and tighten the gland nut by hand.
- Push the plunger (Figure 5.1.13) back to hit the crosshead piston rod. If the plunger seal assembly (packing) is too tight, move the plunger by hand, and move the piston rod by rotating the pump by hand to align the plunger. Connect the plunger in place and install the connecting bolt. Tighten the bolts to 20 ft-lbs (27 N.m).



(Figure 5.1.13) Plunger installation

- Use a pump wrench and a 5-pound (2 kg) hammer to tighten the gland nut to approximately 250 ft-lb (338 N.m). Use three times the strength to strike the wrench, which can give the nut enough torque.
- Repeat the previous steps for the remaining high-pressure cylinders.

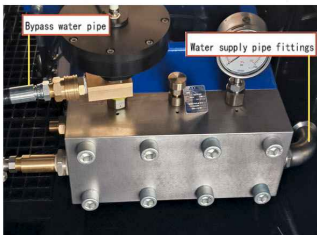
8. Connect the water lubrication line and close the box cover.
9. In order to ensure the best performance and proper sealing, it is necessary to disassemble the plunger seal assembly (packing). Please refer to "Disassembling the plunger seal assembly (packing)" on page 31 for the run-in process of the plunger seal assembly.

5.1.2.7 Valve group maintenance

5.1.2.7.1 Disassembly of the combination valve

5.1.2.7.1.1 Remove

1. Relieve the pump pressure and turn off the engine.
2. Turn off the water supply and drain pipes of the water tank.
3. Disconnect the bypass drain hose and disconnect the water supply pipe on the pump head.
4. Open the box cover (Figure 5.1.15) and disconnect the lubrication pipeline of the high-pressure cylinder pipe.



(Figure 5.1.14)



(Figure 5.1.15)

5. Remove the pump head bolts (Figure 5.1.16), make sure to install the trunnion bolts before removing all bolts (Figure 5.1.17).

Danger If the trunnion bolt is lost, the pump head may fall and cause serious personal injury.

NOTICE The pump head bolts can be removed by hitting with a hammer to remove the pump wrench.



(Figure 5.1.16)



(Figure 5.1.17)

6. Slowly swing the pump head down the pump head support. The weight of the pump head is approximately: 100 kg.
7. Use two small pry bars to pry out the combination valve from the valve seat of the pump head, as shown in the figure (Figure 5.1.17).
8. Remove the remaining combination valve. Refer to the disassembly and maintenance instructions for the repair of the combination valve at the back of this chapter.

Danger The combined valve must be regularly ground to minimize damage to the sealing end surface and maximize the service life of the combined valve. The maintenance cycle depends on the water quality, the maintenance of the filter and the number of hours of use.

Please refer to 5.1.2.7.5 "Combination Valve Grinding" instructions.

5.1.2.7.1.2 40K high pressure cylinder seal replacement

The 40K combination valve is a packing seal to seal the two surfaces. The replacement does the following:

1. Pull out the seal by gently pressing the back of the seal with your fingers.

Danger Do not use hard metal tools such as screwdrivers or chisels to remove the stuffing box seal. Doing so may damage the sealing surface and make it unusable.

2. Seal the fixed area and check.
3. O-ring lubricant to the entire area of the new seal.
4. The chamfered side of the stuffing box seal is close to the stuffing box. Press the new seal with your hand until it is in place.
5. Keep the seal in the correct position until the pump head is in place and tighten.

5.1.2.7.1.3 Install

1. Put the combination valve into the valve seat of the pump head, and then press the combination valve into the valve seat of the pump head with the palm of your hand, as shown in the figure (Figure 5.1.18).



(Figure5.1.18)

2. Install the remaining combination valves.
3. Flip up the pump head and install the pump head bolts.
4. Install the pump head bolts in a staggered manner. For example (Figure 5.1.19), starting from the center bolt, use an appropriate torque of 350 ft-lbs (470 N.m).

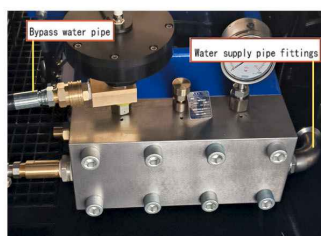


(Figure 5.1.19)



(Figure 5.1.20)

5. Connect the water lubrication harness to the stuffing box (Figure 5.1.20) and close the box cover.
6. Connect the water supply pipe (Figure 5.1.21) and the bypass water pipe to the pump head.



(Figure 5.1.21)Water pipe connection

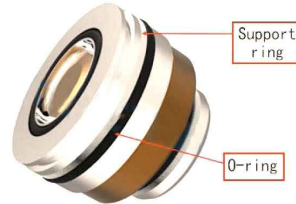
5.1.2.7.2 Combination valve repair

5.1.2.7.2.1 Disassemble

1. Remove the O-rings at both ends of the combination valve, and remove the O-rings as shown in (Figure 5.1.22).



(Figure 5.1.22)

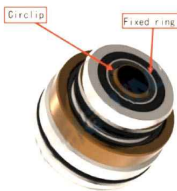


(Figure 5.1.23)

2. Find the two white seam support rings, carefully remove the support ring, and at the same time remove the accompanying O-ring, refer to (Figure 5.1.23), remove the O-ring and support ring.

NOTICE Pay attention to the direction of seal installation.

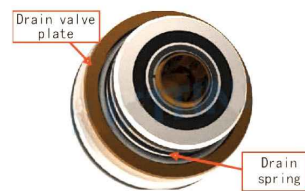
3. Use a small screwdriver to press down on the retaining ring. Use another screwdriver to remove the circlip. The blade is inserted into the slit and rotated to remove the spring from the slot. Use caution to prevent the spring from bending or twisting. (Figure 5.1.24).



(Figure 5.1.24)



(Figure 5.1.25)

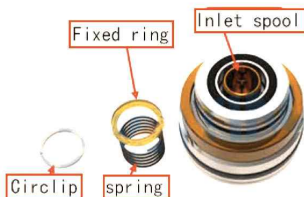


(Figure 5.1.26)

4. Remove the valve retaining ring and valve spring. Such as (Figure 5.1.25).
5. Take out the assembly from the side of the inlet spool and place it on the side of the inlet spool.
6. Insert a small screwdriver on the side of the drain spring (Figure 5.1.26). Slowly turn the screwdriver until the spring is released from the groove.
7. Remove the drain valve plate and drain spring.
8. Check the combination valve. Please refer to the inspection standard on 5.1.2.7.4 "Combined Valve Inspection".

5.1.2.7.2.2 Assembly

1. Install the drain valve plate to the valve body. The shiny metal surface faces the hole of the valve body. Insert the drain spring into the valve seat and fix the position.
2. Lock the spring and fix it in the groove. Method: Use a screwdriver to push the spring into place. Starting from the base of the spring, move in the direction of the coil to the top of the spring until the spring is locked in the retaining groove.
3. Put the inlet valve core into the valve body, as shown in (Figure 5.1.27).

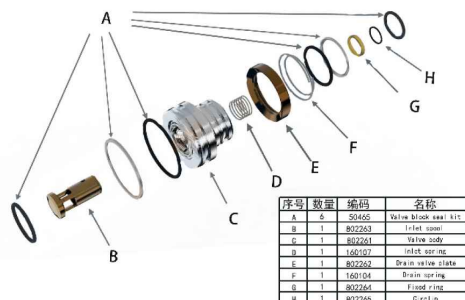


(Figure 5.1.27)



(Figure 5.1.28)

4. Install the spring and retaining ring into the valve body. Ensure that the flange circlip is fixed in the correct position, as shown in (Figure 5.1.28).
5. Keep the spring down and install the circlip on the inlet valve core.
6. Install the new O-ring and support ring to their respective positions. Refer to (Figure 5.1.29).



(Figure 5.1.29)

5.1.2.7.3 40K Combination valve repair

5.1.2.7.3.1 Disassemble

1. Use a small screwdriver to remove the two black O-rings from the combination valve. Refer to (Figure 5.1.30).
2. Use a screwdriver to remove the snap ring, insert the blade into the slit, and rotate the screwdriver around the fixing ring to remove the fixing ring, refer to (Figure 5.1.31). Note: Use the screwdriver carefully to prevent bending or twisting of the retaining ring and scratching the seal.



(Figure 5.1.30)



(Figure 5.1.31)

3. Use a screwdriver to remove the seal ring (Figure 5.1.32) and seal support ring.
4. Turn the valve over.



(Figure 5.1.32)



(Figure 5.1.33)



(Figure 5.1.34)

5. (Figure 5.1.33) Press down on the combined valve spring seat, and slide the cone half snap ring from the assembly to remove it.
6. Remove the combination valve spring and the combination valve spring seat.

7. As shown in the figure (Figure 5.1.34), remove the inlet valve plate and the drain valve stem.
8. Check the combination valve. Please refer to 5.1.2.7.4 "Combined Valve Inspection" inspection standard.

9.

5.1.2.7.3.2 Assembly

1. As shown in (Figure 5.1.35), install the discharge valve into the valve body.
2. Install the valve spring and valve spring seat into the suction valve in place. Press the spring down and insert the spring seat holder. (Figure 5.1.36)



(Figure 5.1.35)



(Figure 5.1.36)

3. Assemble the support ring (Figure 5.1.37). Note the groove on the inner diameter of the support ring. Ensure that the groove of the support ring faces the valve body and the flat surface of the support ring faces the cup seal.
4. Install two O-rings.



(Figure 5.1.37)



(Figure 5.1.38)

5.1.2.7.4 Combination valve inspection

1. Check all seals and replace unqualified seals.
2. Check the combination valve assembly. Discard parts that are excessively dented or damaged on the reverse side. Refer to (Figure 5.1.39).



(Figure 5.1.39)

3. If the combined valve is slightly worn or corroded, the combined valve can be

refurbished by grinding the combined valve.

5.1.2.7.5 Combination valve grinding

Grinding is to apply an abrasive on both surfaces, and then rub the two surfaces against each other. Regularly ensure that the combined valve is ground to ensure that the seal between the valve and the valve seat can be tightly matched. Regular grinding of the combined valve can also make the pump operate efficiently and help increase the service life of the combined valve.

NOTICE Use 220 mesh silicon carbide grinding paste.

1. Disassemble the valve.
2. Place the abrasive on the mating surface of the suction valve. Refer to (Figure 5.1.40) for a typical example of abrasive compound application.

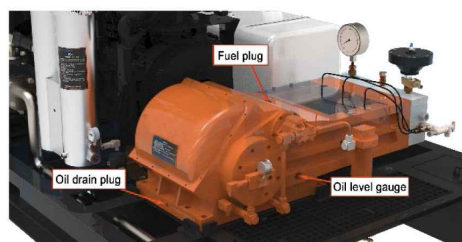


(Figure 5.1.40)

3. Insert the valve into the valve body in place. With slight pressure, rotate the valve and valve body in the opposite direction for about 30 seconds.
4. Pause the grinding and release the surface, then rotate the part about 90° in the opposite direction. Repeat the grinding process several times. This will ensure that the abrasive compound will not remain locally and will be evenly distributed along the valve-seat interface. Repeat for about 2-5 minutes, until you can see a dark gray ring without any remaining pits or surface defects.
5. Wipe with a clean dry cloth to remove excess abrasive. Check the contact surface, there is a uniform, dark gray sealing ring, as shown in (Figure 5.1.41).



(Figure 5.1.41)



(Figure 5.1.42)

6. Continue the grinding process until the desired sealing surface is reached.
7. Repeat the grinding process for the drain valve.
8. After completion, all metal parts are immersed in mineral oil for cleaning. After being immersed in the solution for a few minutes, take it out and dry it thoroughly with compressed air. Make sure that no compound or solution remains in the lateral holes.

5.1.3 Power end maintenance

5.1.3.1 Check the power end lubricating oil level

The most accurate method is to check the lubricating oil level when the equipment is not

turned on when it is on flat ground, rather than looking at the oil level after the equipment has been used for 5-8 hours.

NOTICE Due to various factors, such as temperature, the lubricating oil in the pump will completely settle after 30 minutes.

1. Place the equipment on a level ground and find the oil level gauge on the side box of the power end (Figure 5.1.42). When the pump stops running (about 30 minutes), the oil level should be visible in the oil level gauge.
2. The oil pressure switch is installed on the side of the power end. If the crankcase lubricating oil level is too low, the engine will be shut down. If this happens, the control panel will display "Emergency Stop".

Danger In any case, no matter what method is used to check the oil level, if there is no oil visible in the oil level gauge, the pump should be stopped immediately.

5.1.3.2 Replace the power end lubricating oil

1. When the motor is turned off, remove the oil drain plug from the oil drain valve on the back of the power end housing (must be done in the state of just stopping).
2. Place a large enough container under the drain valve. Please refer to the lubricant capacity list listed below.
3. If necessary, install the extension hose over the frame.
4. Drain the lubricating oil.
5. When the lubricating oil has drained from the pump housing, install the drain plug.
6. Remove the rear cover and check the metal chips on the magnet on the bottom of the pump. If there are metal chips, clean the magnet. Check the crankshaft journal bearing.
7. Install the rear cover.
8. Add 80W/90GL (15W/40 Mobil) lubricant through the filler plug, crankcase volume: 4 gallons (18 liters).
9. After adding lubricating oil, install the filling plug.

The oil is changed for 50 hours when the equipment is used for the first time, and every 200 hours of work thereafter (you can also observe the degree of oil use).

5.2 High voltage accessories

5.2.1 Introduction to rupture disks

Rupture disks are used for system overpressure protection. If the system pressure exceeds the rated pressure of the rupture disk calibration, the rupture disk will burst. If the rupture disk bursts, water will flow out through the explosion-proof seat, which will protect other parts of the system from overpressure. Before operating the pump, check the rupture disk and ensure that there is a spare rupture disk. If the rupture disk suddenly bursts, it needs to be replaced with a new rupture disk, otherwise the system cannot build pressure.

Inspection of rupture disk

1. Use an adjustable wrench to remove the assembly cap of the explosion-proof seat.
2. Remove the rupture disc from the base and inspect.
3. Verify that the rupture disk is installed correctly and whether it is damaged, and replace it if necessary.

After confirming normal operation, mark the position of the gland nut. Permanent markers can be used to mark the entire compression nut and the top of the stuffing box with a dashed line

to facilitate visual confirmation of the correct torque position of the compression nut.

4. Install the upper shell to complete the assembly.
5. Repeat check the remaining rupture discs.

5.2.2 Introduction to pressure gauges

The operator controls the pump and monitors the pressure of the system through a pressure gauge filled with liquid.

5.2.3 Introduction to Pneumatic Pressure Regulator

5.2.3.1 Introduction to Pneumatic Pressure Regulator

The air pressure of the pneumatic valve is adjusted by the precision pressure regulating valve. When the air pressure is zero, the overflow water valve port is opened. At this time, most of the high-pressure water outlet overflows from the overflow port of the pressure regulating valve. After the equipment is stabilized, the air pressure is gradually increased. At this time, the overflow valve is gradually closed, and the high-pressure water flow increases, so that the pressure of the equipment increases. When the valve ports are all closed, the equipment pressure reaches its maximum.

5.2.3.2 Working principle of pneumatic pressure regulator

The air source enters the pressure regulating valve cylinder through the one-way throttle valve and pushes the piston forward. The piston pushes the valve stem to move forward and finally contacts and closes with the stationary valve seat. The pressure regulation is controlled by controlling the pressure regulating valve body. The overflow is achieved, and the overflow is determined by the degree of closure (closed gap) of the valve stem and the valve seat. When the thrust of the piston acting on the valve stem is balanced with the reaction force of the high-pressure water in the valve body on the valve stem, the valve stem remains stationary. Once the system water pressure or piston thrust changes, the degree of closure between the valve stem and the valve seat There will also be changes, resulting in changes in overflow.

6. Control System

6.1 High pressure sensor (if any)

When the operator stops the gun, the operating system senses a sharp rise in the pressure in the pump through the high-pressure sensor, and sends a signal to turn the engine to idle. Please refer to 6.2 "Hydroelectric Throttle Switch".

6.2 Hydroelectric throttle switch (if any)

The hydroelectric throttle switch (also called the overflow gun mode) is not a separate switch part. It is a function, which consists of three parts consisting of a high-pressure gun (overflow gun, pneumatic gun, and electric control gun), high-pressure sensor, and PLC. It has the advantages of saving fuel consumption, reducing labor intensity, and improving safety.

When the engine is idling or warming up to operating temperature, the high-pressure sensor can be used to control the cycle between the pressure relief of the overflow gun (or other device) and the normal engine speed, allowing the operator to set the operating speed of the engine. During the cycle, this prevents the pump operator from manually adjusting the engine speed. Cycle the engine from a low idle speed to the speed set by the pump pressure.

Set the hydroelectric throttle switch

1. Start and switch to manual position.
2. Increase the engine speed to the speed required for work, and then switch the switch to the "auto position". The control panel will record this speed into the memory. Because the output pressure of the high-pressure pipeline will circulate between working pressure and pressure relief (zero pressure), the control panel will control the engine to cycle between idle speed and the set optimal working speed. If the switch is switched to "manual", the operator must reset the threshold.

6.3 Control System

6.3.1 control panel

The control panel is installed on the engine, close to the crankcase. The control panel is used to control engine start or stop, control engine speed, and view engine parameters, such as coolant temperature and engine speed. (Figure 6.3.1)

The control panel is used to start and control the engine speed.

This panel displays engine parameters to monitor engine operating conditions.



(Figure 6.3.1)

6.3.2 Warning lights and warning lights

First turn on the main battery switch, then turn on the power switch, the equipment will automatically detect after power on, press the start button, the diesel engine will start, adjust the diesel engine speed to between 1300-1500 rpm, turn the [Remote/Local] knob to local, press Pneumatic valve start button, and then adjust to the appropriate working pressure through the



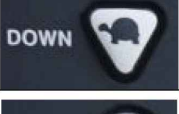


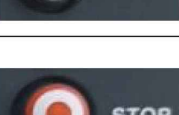


pneumatic pressure regulating valve, (if the air pressure reaches 4 kg, the required working pressure cannot be reached) increase the pressure by increasing the speed of the diesel engine, and finally reach the rated pressure, the maximum speed of the diesel engine does not exceed 2000 rpm.

Stop sequence: Reset the pneumatic control valve to zero and press the stop button of the pneumatic valve. Then reduce the diesel engine speed to idle speed, let the diesel engine run for 1 minute without load, then press the stop button, turn off the power switch, and turn off the battery switch.

6.3.3 Button function description



(Figure 6.3.2)

	MENU	Enter/exit menu.
	UP	1. Scroll the screen; 2. Move the cursor up in the setting and increase the number where the cursor is located. 3. The normal interface adjusts the diesel engine speed to increase.
	DOWN	1. Turn the screen; 2. Move the cursor down in the setting and reduce the number of the cursor. 3. The normal interface adjusts the diesel engine speed to drop.
	ENTER	1. Press this key to enter the operation help; 2. Press this key for more than 3 seconds to enter the parameter configuration menu; 3. Confirm the setting information in the setting.
	START	In manual mode or manual test mode, press this key to start the stationary water pump unit.
	AUTO	Press this key to put the controller in automatic mode.
	STOP	In the manual/automatic state, the running unit can be stopped. In the stop mode, the alarm can be reset. Press this key for more than 3 seconds to test whether the panel indicator is normal (test light). During the shutdown process, press this button again to quickly shutdown.
	SOOT	Comply with Tier 4 emission standards for mandatory regeneration/cancellation of regeneration.

7. Machine maintenance

7.1 daily

1. Check the equipment for leaks-repair all leaks found on the equipment.
2. Check the engine oil level-add oil if necessary.
3. Check the coolant level-add coolant if necessary.
4. Check the power end oil level-add lubricating oil if necessary. Please refer to 5.1.3.1 "Checking the power end lubricating oil level" instructions.
5. Check the gland nut torque-make sure the gland nut is tightened correctly during operation. Please refer to the description of 5.1.2.5.2 "Checking the gland nut torque".
6. Adjust the water lubrication system-by adjusting the needle valve to ensure that the right amount of water pressure is sent to the pump head. Please refer to 3.1.4.3 "Checking Water Lubrication System".
7. Check the rupture disk-make sure that the installed rupture disk has not burst, and check for damage. Please refer to 5.2.1 "Introduction to Rupture Disk" to ensure that there is a replaceable rupture disk in hand when the rupture disk bursts.
8. Double element filter-check the pressure of the double element filter pressure gauge. During operation, the pressure of the filter must be observed at any time to determine the state of the filter. Please refer to 3.2 "2800 bar operation" and 3.2.1 "Filter element replacement" for more information.

7.2 50 hours

1. Check the one-way combination valve-check whether the seal is damaged, whether the valve seat has debris, spray marks or other damage. Please refer to 5.1.2.7.4 "Inspection of Combination Valve".
2. Check the pump vent plug-remove the vent plug and check for dust and debris. Clean or replace as needed.
3. Initial power-end lubricating oil replacement-a new equipment should be replaced with power-end lubricating oil after the first 50 hours of operation. Please refer to 5.1.3.2 "Replace Power End Lubricant".

7.3 100 hours

1. Check the battery-check the battery to ensure that the terminals are tightened and protected with petroleum jelly. Clean the top of each battery.
2. Initial engine oil replacement-refer to the engine manual.

7.4 200 hours

1. Regular replacement of power end lubricating oil-replace the power end lubricating oil. Please refer to 5.1.3.2 "Replace Power End Lubricant".
2. Belt inspection-check the belt for cracks, breakage, glaze or any other defects, and replace if necessary. Please replace the belts by group and adjust the new belts.

7.5 Diesel engine maintenance

Refer to "Diesel Engine Maintenance Manual"

7.6 Equipment antifreeze

If the cleaning equipment is not well protected in cold conditions, it may cause serious damage. There is water in the stuffing box, which can cause damage to the stuffing box, one-way

combination valve, plunger and pump head due to freezing. In order to prevent freezing, all hoses, booster pumps, heat exchangers and water tanks need to be emptied and added with antifreeze.

If the equipment is left unused overnight or longer, the pump or pipeline will be frozen. The following liquid end antifreeze measures are recommended.

1. Drain the remaining water in the water tank.
2. Disconnect the water supply hose and the high-pressure discharge hose.
3. Turn on the high-pressure pump and close the drain valve after emptying the stuffing box and pump head.
4. Assemble the pipe fittings into the funnel assembly.
5. Install the above components on the suction side of the pump head.
6. Pour the glycol-based antifreeze solution into the funnel, at least 0.5 gallons (2L) of antifreeze.
7. Turn the jump switch to the ON position, skip the low water level and turn off the alarm.
8. Before starting the engine, check the path area of the pump head drain pipe. Make sure that the area is visible. During this process, the antifreeze will be discharged from the discharge pipe.
9. Start the engine.
10. After starting the engine, run the engine at idling speed, and slowly close the clutch handle to the half-clutch state of the clutch. Watch the plunger move slowly back and forth until the antifreeze is discharged from the discharge port of the pump head.
11. When the antifreeze is discharged from the discharge port of the pump head, immediately disconnect the clutch and turn off the engine.
12. Remove the suction funnel assembly of the pump head and reconnect the water inlet pipe.
13. Disconnect the water lubrication tube bundle of the stuffing box and drain the water in the tube bundle.
14. Disconnect the water inlet pipe of the booster pump to drain the water from the hose and reconnect it.
15. Flush the antifreeze completely from the equipment.
16. Ensure that the water supply piping system is protected from freezing.

7.6 Troubleshooting

problem	Possible Causes	Corrective Action
Engine problem		Refer to engine manual
Discharge pressure is too high	Nozzle is too small	Replace nozzle
	Engine speed is too high	Turn the throttle control knob clockwise
	Hose or spray gun blocked	Remove the nozzle and test the hose/spray gun
	Inaccurate pressure gauge	Replace the pressure gauge
Discharge pressure is too low	Nozzle is too large	Replace nozzle
	Nozzle wear	Replace nozzle
	Engine speed is too low	Turn the throttle control knob counterclockwise
	Insufficient water tank level	Fill the water tank
	Inaccurate pressure gauge	Replace the pressure gauge

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	The filter is clogged or dirty	Clean the filter
	Leaking or clogged pump valve	Repair or replace valve
	Pump plunger packing wear	Replace packing
	Leaking spray gun	Repair spray gun
	Dirty filter bag	Replace filter bag
Excessive fluctuation of pump displacement	Low water tank level	Fill the water tank
	The filter is clogged or dirty	Clean the filter
	Leaking pump valve	Repair or replace valve
	Broken pump valve spring	Replace the spring
	Pump plunger packing wear	Replace packing
Equipment vibration	Dirty filter bag	Replace filter bag
	Excessive pump fluctuation	See excessive volatility above
Pump packing gland temperature is high	Engine vibration	See engine manual
	Insufficient amount of filler lubricant	Increase lubricant hose pressure
		Clean the guide bush hole
Replace the water tank inlet check valve		
Pump noise	Low lubricant level	Charge
	Pump cavitation	See excessive volatility above
	Plunger clamp loose	Tighten the plunger clamp
	Bearing wear	Replace the bearing
	Cross head wear	Replace the cross head/repair the inner hole of the cross head
	Crankshaft end clearance is too large	Adjust the end gap
Leaking in the leaking hole of the pump manifold	Damaged valve seal	Replace the seal
Hydraulic throttling to control leakage	Damaged piston seal	Replace the seal
The engine does not return to idle when the spray gun is overturned	Hose back pressure is too high	Shorten the length of the hose line
	Throttle control piston jam	Repair throttling control device
	Throttle control cable jam	Lubricate, adjust or replace cables
The engine speed does not increase when the spray gun is closed for the first time	Engine idle speed is too low	Increase idle speed
	Big gun mouth	Reduce nozzle size
	Throttle control or cable jam	Repair or replace the cable
The safety valve is not open	Set pressure is too high	Recalibrate the safety valve at the manufacturer
Safety valve leak	Pump supply pressure is high	See above discharge pressure is too high
	Damaged ball/seat body	Repair or replace
	Set pressure is too low	Recalibrate the safety valve at the manufacturer
Not enough water to lubricate	Needle valve adjustment is incorrect	Adjust the needle valve
	There is air in the system	Open the pump head to empty the water
	Blocked water lubrication pipe	Remove impurities in the water pipe

8、 appendix

8.1 Cleaning equipment checklist

Serial number	name	Check analysis	qualified	Unqualified	Remark
1	Equipment condition	Check whether the fixing screws of the device are loose.			
2	Diesel engine water tank	The water level is 1 inch down from the top.			
3	Diesel engine oil	The oil level is between full and insufficient. Whether to change every 300 hours.			
4	Engine start condition	The engine starts without abnormal noise, and the speed is stable.			
5	Engine instrument	The display is normal and accurate.			
6	Engine Throttle	There is no abnormal noise when speeding up and down, and the speed is stable.			
7	Vibration-resistant high-pressure pressure gauge	After the high-pressure pump is pressurized, keep the pressure to see if there is any fluctuation. If there is any fluctuation, check whether the combined valve is damaged.			
8	Equipment protection	Test whether the water temperature, water pressure, and water level protection conditions are effective.			
9	Engine stop	Check whether the normal stop and emergency stop devices can work normally.			
10	Rupture Disk	Check whether the anti-riot device is installed correctly.			
11	Battery	Check the battery to ensure that the terminals are tightened and protected with petroleum jelly.			
12	Diesel engine oil filter	Whether the oil filter element is working normally, it is generally replaced every 300 hours.			
13	Primary and secondary water filters	Check whether the installation condition of the filter can meet the requirements.			
14	Ground wire	The equipment must be installed with a grounding wire, and check whether it is installed correctly.			
15	Diesel filter	Whether the diesel filter element is working normally, it is generally replaced every 300 hours.			

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16	Crankcase lubricating oil	Check the lubricating oil level in the crankcase, whether it is emulsified, and whether it is replaced every 200 hours.			
17	High pressure connector of pump set	All high-pressure connections must be made of stainless steel.			
18	Leaking pump set	After pressurizing, check each leakage port for leaks.			
19	Pressure regulating valve	Check whether the spool of the pressure regulating valve is stuck and whether the spool is worn.			
20	Pump head screw	Check whether it is loose, it is recommended to check before each cleaning.			
21	Packing gland	Check whether it is loose, it is recommended to check before each cleaning.			
22	Plunger	Check the plunger surface for scratches.			
23	Diesel antifreeze liquid level	The liquid level should be 1 inch down from the top.			
other:					

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8.2 Unit conversion table

Measurement Standard Conversion Table

unit of measurement	Conversion formula	Example
length	1 in. = 25.4 mm	12 in. × 25.4 = 304.8 mm
	1 in. = .0254 m	12 in. × .0254 = 3.05 m
	1 ft. = .3048 m	12 ft. × .3048 = 3.68 m
	1 mm = .03937 in.	100 mm × .03937 = 3.94 in
	1 m = 39.37 in	10 m × 39.37 = 393.7 in
	1 m = 3.281 ft.	10 m × 3.281 = 32.81 ft
weight	1 lb. = .454 kg	10 lb. × .454 = 4.54 kg
	1 kg. = 2.205 lb.	10 kg × 2.205 = 22.05 lb.
pressure	1 psi. = .069 bar	20000 psi × .069 = 1380 bar
	1 bar = 14.5 psi	1000 bar × 14.5 = 14500 psi
flow	1 gpm = 3.785 lpm	30 gpm × 3.785 = 113.55 lpm
	1 lpm = .264 gpm	100 lpm × .264 = 26.4 gpm
strength	1 lb. (f) = 4.44 N	100 lb. (f) × 4.44 = 444 N
	1 N = .2248 lb. (f)	900 N × .2248 = 202.32 lb. (f)
power	1 hp = .7457 KW	50 hp × .7457 = 37.29 KW
	1 KW = 1.341 hp	50 KW × 1.341 = 67.05 hp
Air flow	1 cfm = .47195 l/s	10 cfm × .47195 = 4.72 l/s
	1 l/s = 2.1189 cfm	10 l/s × 2.1189 = 21.2 cfm

Pressure quick conversion table

American standard	International standard	International standard approximation
40000 psi	2760 bar	2800 bar
36000 psi	2484 bar	2500 bar
30000 psi	2070 bar	2070 bar
20000 psi	1380 bar	1400 bar
15000 psi	1035 bar	1035 bar
13000 psi	897 bar	900 bar
10000 psi	690 bar	700 bar
5000 psi	345 bar	345 bar
3000 psi	207 bar	210 bar
1000 psi	69 bar	70 bar

Note:

pressure	flow	distance	weight	power
psi= Pounds per inch	gpm= Gallons per minute	in. = inch	lb. = lb.	KW= kilowatt
bar= Kilogram	lpm= Liters per minute	ft= foot	kg= kilogram	hp= horsepower
	l/s= Liters per second	mm= Mm	N= Newton	
	cfm= Cubic feet per minute	m= Meter		

Power calculation formula *

$$Hp = gpm \times psi / 1550$$

$$Kw = lpm \times bar / 540$$

* The formula assumes 90% mechanical power

Recoil calculation formula

$$Lb(f) = .052 \times gpm \times \sqrt{psi}$$

$$N = .2357 \times lpm \times \sqrt{bar}$$



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