



**CNC Universal Surface Water-Cutting Machine**

# **Operating Manual**



Shanghai Jinjian Waterjet Equipment Manufacturing Co., Ltd.

Shanghai Jinjian Automation Equipment Scientific & Technical Co., Ltd

## Introduction

Prior to installation and operation, the operating manual should be read carefully. It will make a detailed explanation about installation, commissioning, operation, maintenance and trouble-shooting.

If you encounter any insolvable problem in course of operation, please let us know and we shall solve it certainly.

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## Outline

There are kinds of cutting equipment for processing different materials with different requirements in course of production in an enterprise. Water-cutting equipment is a kind of cold cutting machinery completely different from conventional cutting equipment, which has appeared in pace with science and technology ever-developing and can be suited for cutting a wide range of materials from metals, nonmetals to composite materials and make the difficult machining problems solve easily.

A series of water-cutting equipment made by Shanghai Jinjian Waterjet Equipment Manufacturing Co., Ltd can boost the ordinary water pressure up to 300 MPa or more, even 420 MPa working pressure to the utmost extent and cut various materials by means of special cutting heads. CNC Universal Surface Water-Cutting Machine is developed independently by our company, which is a kind of new generation cutting equipment with international advanced level and has products series with 300MPa、320MPa、380MPa、420MPa working pressure.

The system consists of high pressure generator, CNC or PC two dimensional semi-numeric control systems and CAD/CAM computer aided system. This machine is suited in surface cutting any patterns on various materials such as steel sheet, glass, composite materials, ceramics and etc.

The users of the CNC Universal Surface Water-Cutting Machine should follow the requirements listed below:

1. The operator must be familiar with the properties of the machine; unqualified workers are prohibited from operating the machine.
2. Protection goggle, work footwear and clothes should be put on during operation. It is strictly forbidden to touch the water column with your body. Keep away from the cutting head for safety.
3. In case of failures, the machine must be stopped for inspection and repair. In case of leakage, it is strictly forbidden to block up the leakage by hand or other substances.
4. The high pressure hydraulic system should be depressurized before any inspection or repair. It is strictly prohibited to inspect and repair the system under pressure. Furthermore, it is also strictly prohibited to inspect and repair the electric, water and air circuits when electric power, water or compressed air is supplied.
5. After the inspection and repair, the personnel should leave the dangerous zone and put the machine into test operation under normal working pressure for 3-5 minutes. The machine can be put into normal operation only if the test proves that the machine runs all right.
6. It is strictly forbidden to impact the high pressure water pipe.
7. As for the matters which are not mentioned in this manual, the relevant industry standards and national regulations should be complied with.



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# Chapter I Installation

## Section 1 Preparations Prior to Installation

Prior to installation, the user should carry out the following preparations:

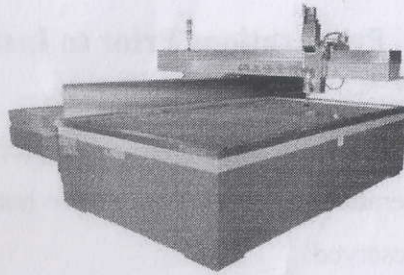
1. Environment: Room temperature 10°C~38°C; Relative humidity 30%~80%; sufficient working space should be reserved.
2. List of materials to be prepared by the user:

No.	Description	Specs	Qt.	Remarks
1	3-phase power supply	AC380V/50HZ, 30KW above		With power supply isolation device Earth leakage protection
2	Water supply	>2kg/cm <sup>2</sup> (0.2MPa)		3 pcs of 1/2" taps, connected with water supply
3	Power cable	4-core (3*10mm <sup>2</sup> + 1*6mm <sup>2</sup> )	1 pcs	The length should fit the distance from the power socket to the electric cabinet of the booster system
4	Water pipe	ID: Φ15	3 pcs	The length of each should fit the distance from the water supply to the booster system (proof pressure 0.6MPa)
5	Compressed air Supply	Discharging pressure 8Kg/cm <sup>2</sup> ; volume flow 0.1~0.3m <sup>3</sup> /min		Or an air supply with a discharging pressure ≥ 6kg/m <sup>2</sup> should be offered
6	Wear resistant hydraulic oil	YB-N46	250 KG	
7	Garnet sand	60~80μm	Several tons	
8	Ordinary hardware & tools	Monkey wrench (450*55) Allen key Normal screw drivers and pliers	2 pcs 1 set each 1 pcs	Metric system, British system
9	Electric tool	Multimeter	1	
10	Earth wire		1 pcs	
11	Hoisting equipment	3-ton fork lift or crane		For unloading and installing the machine





## Section 2 Installation of Type JJ-I Machine (Cantilever Type)



1. Select a place for installing the machine based on the type and specs you choose. For the floor space and layout of the machine, please refer to the Layout Plan in Chapter XV.
2. Get everything ready as per the "List of materials to be prepared by the user" in Section 1, Chapter I.
3. Lift the Y-axis bed with a fork lift and move it into position. Before placing it on the ground, steel shims of 5 – 10 mm (supplied together with the machine) should be put under the M24 anchor bolts. Dismantle the Y-axis protection cover. Measure the horizontal and vertical levelness by a leveler, taking the linear guide as the basis. Adjust the M24 anchor bolts for leveling, and then the footing of the bed should be firmly fixed.
4. Lift the X-axis beam and move it onto the saddle on the Y-axis bed. Hit in taper pins and tighten bolts.
5. Lift the water tank with the fork lift. Put the water tank in position with reference to the position and dimensions marked on the front side of the Y-axis bed when the machine left the factory. Use a  $\Phi 8$  transparent hose with a length of 5 - 6 m (supplied together with the machine), fill it with water and measure the levelness on the four corners of the tank with the same height (within 2 mm) and then put shims under the corners of the tank.
6. Put the HP generator in the proper place (refer to Section 1, Chapter II for details).
7. Put the sand barrel in the proper place.
8. Put the operation desk in the proper place.
9. Install the external frame of the HP generator,  $3/8 \times 1300$  high pressure pipe (from the T-connector on the sensor to the reducer on the external frame) and  $1/4 \times 7000$  high pressure pipe (reducer to the straight connector on the Z-axis frame) (refer to Section 1, Chapter II).
10. Connect the water pipes (service water, cooling water inlet, cooling water outlet) as per the label plates (refer to Section 1, Chapter II for details).
11. Connect the compressed air supply to the sand barrel. Connect the sand feeding tube to the outlet on the bottom of the barrel and fasten it.
12. Connect respectively the operating cables, cables for motors of X axis and Y axis into the junction box of the machine and the operation cabinet. Pay attention to the labels on the connectors and on the cabinet. Fasten the connectors.
13. Install the cutting head, and check L plate for verticalness. Check if the air pipes of the solenoid valve above Z axis are securely inserted.
14. Connect the main power cord. Check if the circuits are connected in the correct way. Then switch on the machine, and check if the main motor rotates in the right direction.
15. Jog the machine along the X axis and Y axis. If Ok, install the working platform Use a small square with a thickness of 10 – 20 mm, or measure the four corners of platform with the same height, until all the adjustment of platform are finished (flatness  $\leq 1$  mm).
16. Now the installation of machine is completed.



### Section 3 Installation of Type JJ-II Machine (Gantry -Type)



1. Select a place for installing the machine based on the type and specs you choose. For the floor space and layout of the machines, please refer to the Layout Plan in Chapter XV.
2. Get everything ready as per the "List of materials to be prepared by the user" in Section 1 Chapter I.
3. Put the water tank in position with a fork lift or a hydraulic cart. Adjust the 8 adjusting footings around the tank, taking the fixed footing at the center of the tank as the reference (the tank is so big that the footing in the center cannot be adjusted. Therefore, it is used as the reference to adjust the other 8 footings). The adjusting steps are as follows:
  - A. Lift up each side of the tank respectively, and place steel shims (supplied together with the machine) under the adjusting bolts for getting levelness.
  - B. Use a  $\Phi 8$  transparent hose with a length of 10 m (a hose is supplied together with the machine, which could be used for adjusting levelness), fill it with water and measure the levelness on the four corners of the tank with the same height (within 2 mm).
  - C. Check the 8 anchors around the tank and ensure that they are adjusted to the right position.
4. Place the left part and right part of the Y-axis bed to both sides of the tank respectively with a hydraulic cart while roughly determine the distances between the bed parts and the tank. Place 4 adjusting steel shims under the corners of the Y-axis bed (4 shims each bed, supplied together with the machine), and then screw the central adjusting footing (M24 bolt) into the lower bottom plate from bottom.
5. Get the two straining beams ready. Verify which the front beam is and which the back beam is (there are marks both on the beds and the beams). Install the beams and Y-axis bed. Align the taper pins and connect bolts (adjust the steel shims and move the bed appropriately, so that the taper pins may be aligned).
6. Move the 2 Y-axis beds as a whole, and ensure an appropriate gap between the two beds and the water tank (the nominal size of the gap is marked on the bed as the ex-factory size).
7. Dismantle the two protection covers for the Y-axis beds. Measure and adjust the vertical levelness of the left bed by a leveler, taking the linear guide as the basis. Measure and adjust the horizontal levelness of the saddle by a leveler; Take a  $\Phi 8$  transparent hose, fill it with water and roughly measure and adjust the levelness of the right bed (the same height as the left bed), taking the heights of both ends of the guide rail of the left bed as reference; turn the lead screws of the left and right beds by the handles (turning by 2 people, taking care of



synchronization) to move the saddle to one side, put an optical collimator onto the left saddle and align the marks of the mirror, and then move the mirror shelf to the right saddle for measuring and adjusting the levelness and height of the right bed. Move the saddle forward and backward with the handle during measuring and adjusting, so as to ensure that both beds are in the same level with a deviation of  $< 0.10$  (Note: the left bed should be regarded as the reference and should not be adjusted; only the right bed is adjustable).

8. Install the X beam onto the saddles of the left and right Y-axis bed, align the positioning taper holes, push in taper pins and tighten the bolts.
9. Install the working platform for the water tank.
10. Put the HP generator in its proper position (refer to Section 1, Chapter II for details).
11. Put the sand feeding device in its proper position.
12. Put the operation table in its proper position.
13. Install the external frame for the HP generator. Install the 3/8\*1300 HP pipes (from the T-connector on the sensor to the reducer on the external frame) and 1/4\*7000 high pressure pipe (reducer to the straight connector on the Z-axis frame) (refer to Section 1, Chapter II for details).
14. Connect the water pipes as per the indications on the labels (refer to Section 1, Chapter II for details).
15. Connect the compressed air supply to the sand barrel. Connect the sand feeding tube to the outlet on the bottom of the barrel and fasten it.
16. Connect respectively the operating cables, cables for X axis and Y axis into the junction box of the machine and the operation cabinet. Pay attention to the labels on the connectors and on the cabinet. Fasten the connectors.
17. Connect the main power cable. Check if the circuits are connected in the correct way. Then switch on the machine, and check if the main motor rotates in the right direction.
18. Jog the machine along the X axis and Y axis to see if it works properly. Place a 600 mm angle square onto the working platform. Attach a dial indicator on the carriage on Z axis, and travel slowly along Y axis, while at the same time adjust the square so as to parallel it with the Y axis (deviation  $\leq 0.03$  mm). The square should not be shifted any more once it is well adjusted. Then make the tip of dial indicator against the side of the square parallel with the X axis and move it slowly along the X axis, so as to measure if the square parallels with the X axis. Adjust one of the two lead screws manually based on the unparallel degree until the square parallels with the X axis (deviation  $\leq 0.04$  mm).

#### **Special Note!**

**\*At this point it is not allowed to turn either of Y-axis lead screws by hand, otherwise the precision of the machine will get lost.**

19. Install the cutting head. Check if the air pipes of the solenoid valve above Z axis are securely inserted, and check the L plate for verticalness.
20. Install the protection covers for left and right parts of Y axis.
21. Adjust the working platform. Use a small square (or a piece of glass) with a thickness of 10 – 20 mm to measure the four corners of each platform and adjust them to the same height, until all the adjustment of platform are finished (flatness  $\leq 1$  mm).
22. Now the installation of machine is completed.

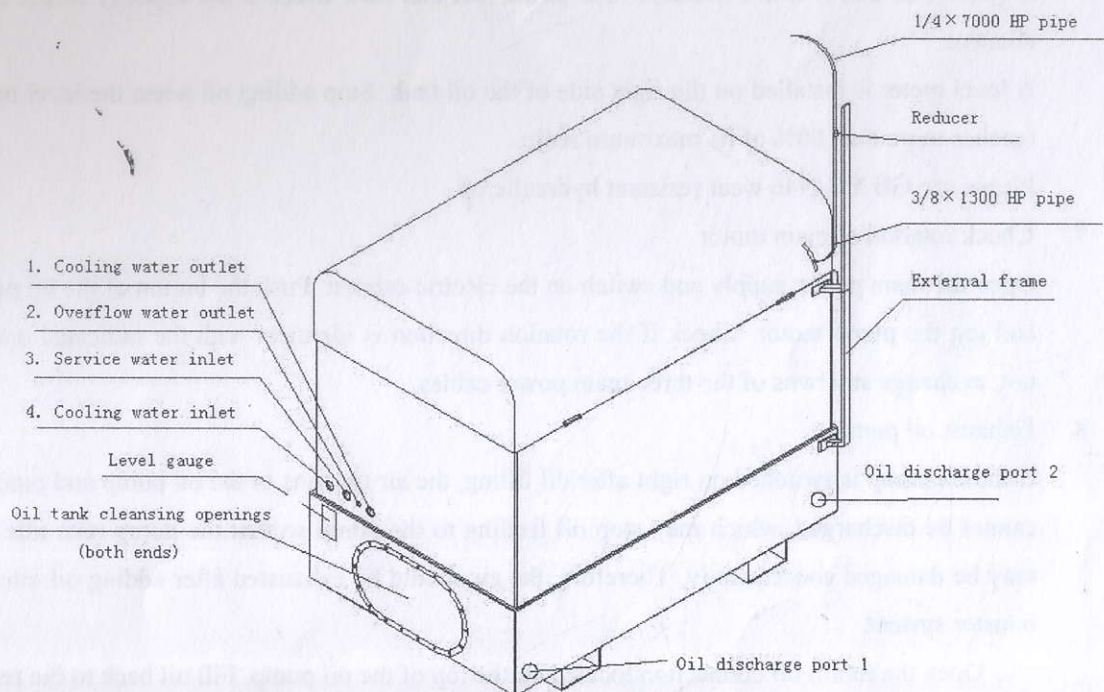




## Chapter II HP Generator System

### Section 1 Installation of HP Generator

1. Put the HP generator system into designated position and have it stand firmly against any shaking.
2. Install the external frame.



3. Install 3/8\*1300 HP pipe and 1/4\*7000 HP pipe (this pipe is long, so support rings are used in the middle part of the pipe for hanging it up).
4. Connect water pipe

Specs of water pipe: material: reinforced plastics; inner diameter:  $\Phi 15$ ; length: with reference to the distance between the water supply to the HP generator. The Connector 3 should be used as the inlet of service water supply. The water supply should deliver a pressure of 0.2-0.4MPa. When the pressure from the water supply exceeds 0.2MPa, the self-priming inline pump should stop working; when the pressure is less than 0.2MPa, the pump should switch on automatically. If the pump cannot stop when the local pressure is larger than 0.2MPa, please open the plastic cover of the pump and turn the adjusting screw in "+" or "-" directions, so as to have the pump stop working when the pressure is  $\geq 0.2$ MPa (pump operation for a long time is more likely to lead to damage itself).

Connector 2 serves the function that if there is water on the flat plate of the booster, water will go out from this outlet. A  $\Phi 8$  transparent plastic hose should be connected while its length depends on the situation (the distance from Connector 2 to the drainage).

Connectors 1 and 4 serve for the flowing water supply (recyclable) of which the function is to cool down temperature of the oil in the hydraulic system by means of internal water cooling.



Concerning natural water source, please use cooling tower for cycling use of water if applicable.

5. Wiring

Connect a 4-core cable of  $3 \times 10\text{mm}^2 + 1 \times 6\text{mm}^2$  to the terminal studs in the electric cabinet

6. Fill in oil

Open the rear door of the HP generator, and screw off the cover of air filter. Oil should be filled in gently, so that it won't overflow due to the fact that flow exceeds the capacity of the filter element.

A level meter is installed on the right side of the oil tank. Stop adding oil when the level meter reaches more than 80% of its maximum scale.

Please use GB YB-N46 wear resistant hydraulic oil.

7. Check rotation of main motor

Open the main power supply and switch on the electric cabinet. Push the button of the oil pump and jog the pump motor. Check if the rotation direction is identical with the indicated one. If not, exchange any twos of the three main power cables.

8. Exhaust oil pump

If the oil pump is switched on right after oil filling, the air remains in the oil pump and pipeline cannot be discharged, which may stop oil feeding to the pump so that the pump runs idle and may be damaged consequently. Therefore, the air should be exhausted after adding oil into the booster system.

A. Open the return oil connection located on the top of the oil pump. Fill oil back to the return oil opening with an oil cup till the oil overflows;

B. Adjust the flow of the oil pump to Scale 8;

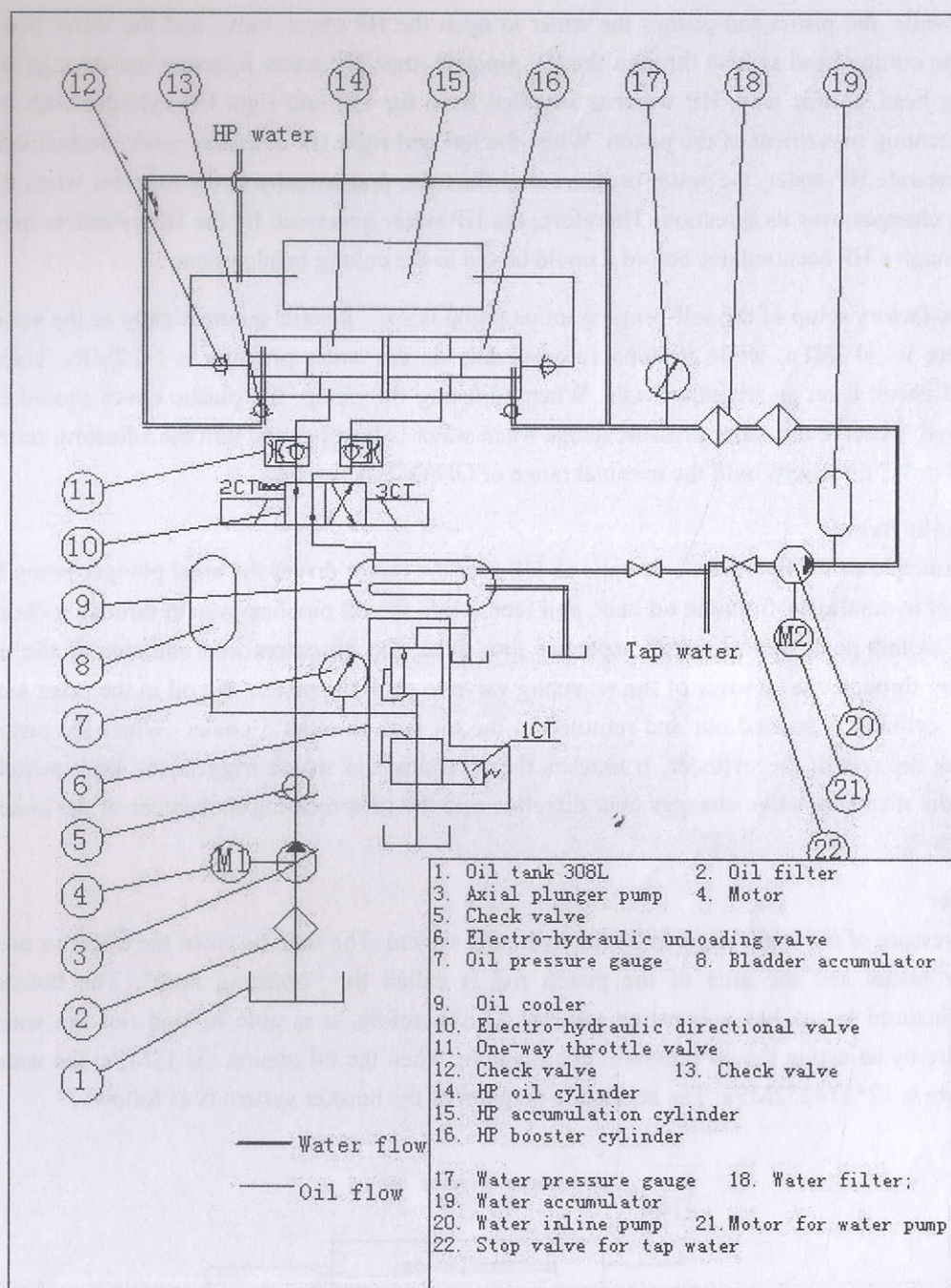
C. Jog ON and OFF buttons of the oil pump in turn. Generally, most of the air in the oil pump and oil pipeline will be discharged after 20 times of jogging;

D. Adjust the flow of the oil pump back to Scale 4~5, tighten the nut. If it is necessary to make another adjustment in future, the main power supply must be switched off.

## Section 2 Working Principle of HP Generator

HP generator consists of hydraulic system, booster system, HP & LP pipelines, etc.

### 1. Schematic Diagram of Hydraulic System





## 2. Water Supply System

The tap water is pressurized by the “self-priming inline pump” (of which the ex-factory setup is that it switches on when the water pressure  $\leq 0.2\text{MPa}$ ) and filtered with three filters ( $5\mu\text{m}$ ,  $1\mu\text{m}$ ,  $0.45\mu\text{m}$ ). When the piston in the oil cylinder moves to one side, the LP check valve on the other side is opened by the pressure of the water and the water goes into the HP cylinder; while when the piston goes back, the LP check valve is closed by the pressure from the HP water. Meanwhile, the piston rod pushes the water to open the HP check valve and the water flows into the cutting head system through the HP pipeline, thus HP water injecting out through the cutting head. In this way, HP water is supplied from the left and right HP cylinder with the reciprocating movement of the piston. When the left and right HP cylinders work alternatively and generate HP water, the water pressure will fluctuate dramatically at the moment when the piston changes over its direction. Therefore, the HP water generated by the HP cylinders must go through a HP accumulator before it could be fed to the cutting head system.

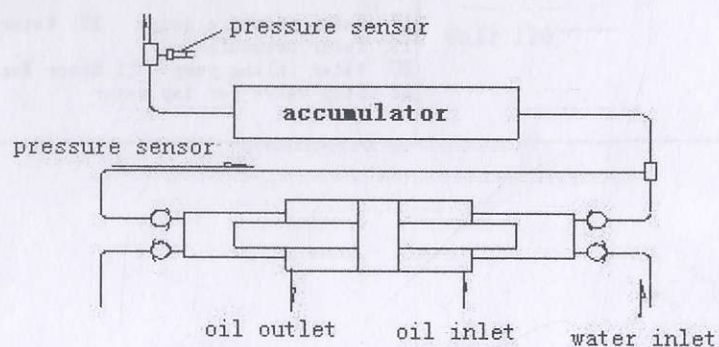
The ex-factory setup of the self-priming inline pump is so: it starts automatically as the water pressure is  $\leq 0.2\text{MPa}$ , while it stops automatically as the water pressure is  $> 0.2\text{MPa}$ . Users should check it on an irregular basis. When adjusting the pump, the plastic cover should be removed. Observe the water pressure gauge when water is feeding, and turn the adjusting screw in “+” or “-” directions until the nominal range of ON/OFF is reached.

## 3. Hydraulic System

The principle of the hydraulic system is as follows: the motor drives the axial plunger pump to take out hydraulic oil from the oil tank, and feed it into the oil pipeline system through a check valve; at this point the oil circuit separates into three: the oil enters into one side of the oil cylinder through change-over of the reversing valve to push the piston, the oil in the other side of the cylinder is pushed out and returned to the oil tank through a cooler. When the piston reaches the end of the cylinder, it touches the reversing rod which triggers the limit switch. Thus the reversing valve changes over direction and the reciprocating movement of the piston realizes.

## 4. Booster

The pressure of the water is given by the hydraulic system. The ratio between the effective area of the piston and the area of the piston rod is called the “boosting ratio”. The booster manufactured by us has a boosting ratio of 21. Therefore, it is able to find out the water pressure by adjusting the oil pressure. For example, when the oil pressure is  $12\text{MPa}$ , the water pressure is  $12 \times 21 = 252\text{MPa}$ . The schematic diagram of the booster system is as follows:





### Section 3 Safety Device

The safety protection function of “auto unloading” is provided in the water cutting machine. The safety protection device is designed specially for ensuring safety of personnel and equipment in case the pressure rises up suddenly during operation.

A relief valve is installed in the hydraulic system. When the system pressure reaches the preset value, the relief valve unloads automatically; at the same time, there is another system for ensuring the function of auto unloading: when the system pressure reaches or goes over the preset value, the pressure sensor will generate a signal to the pressure indicator which will pass on the signal to the unloading valve, then the unloading valve breaks off and the oil discharges from it.

Among all the components of the booster, some of them contain small holes called “inspection hole”. If relevant components or seals parts are damaged, working media will go out from these holes. It is strictly forbidden to block these holes with hand or other substances.

#### 3-Color Lamp Operational Status Indication

There is a 3-color lamp located on the beam of the machine with the following meanings:

- Green: HP water available for cutting
- Yellow: pause, HP water closed
- Red: malfunction of machine (limit switch triggered, emergency stop)



## Section 4 Dismantlement and Maintenance of 300MPa & 320MPa Booster System

### 1. Water Filtering and Maintenance of Water Pump

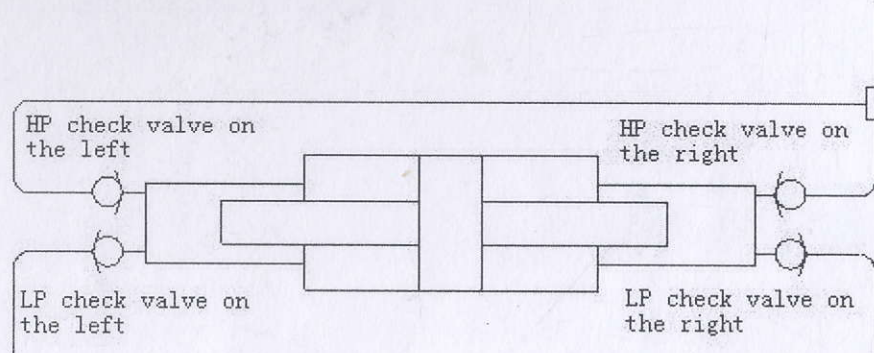
The water cutting machine has higher demands on water. The properties of water, including water quality, pressure, have some impact on cutting and the HP components. If the machine loses the water pressure during operation, and if it is found out that there is no fault other than the water circuit, the problem is probably due to shortage of water. The method of examination and determination is as follows:

- A. Check if there is any water supply from the tap. If so, check the pressure of tap water. When the pressure is very low, check if the water pump is running. Take off the plastic cover of the water pump, turn the adjusting screw in “+” or “-” directions with a screw driver, so as to see if the pump is functional. If the pump doesn’t work, it means there is something wrong with the pump. If the pump works, adjust it until it stop running automatically when the water pressure  $\geq 0.2\text{MPa}$ .
- B. If the above steps are carried out while the system pressure is still lost, take off the elements of the 3 water filters (make sure no wrong installation; the elements is  $5\mu\text{m}$ ,  $1\mu\text{m}$ ,  $0.45\mu\text{m}$  respectively) and check if the elements are clean. If they are too dirty, replace them respectively with new ones of the same specs. After that and before feeding in water, loosen the small screws on top of the covers of filter elements to exhaust the filters, then retighten them.

The ex-factory setup of the pump is that it starts automatically when the water pressure  $\leq 0.2\text{MPa}$ , and stops automatically when the pressure  $> 0.2\text{MPa}$ . Users should check it on an irregular basis. When adjusting the pump, the plastic cover should be removed. Observe the water pressure gauge as water is feeding, and turn the adjusting screw in “+” or “-” directions until the nominal range of ON/OFF is reached. If the adjustment goes too far towards the higher limit, the pump will run continuously, which might damage the pump; while if the adjustment goes too far towards the lower limit, the pump won’t start even if the water pressure is low, which will result in a low pressure condition and the pressure of service water is unstable.

The quality of water may be different in different geopotential areas. Please check the elements of the water filters regularly and timely; if necessary, replace them.

### 2. Maintenance of HP and LP Check Valves



The above mentioned method is for examining and repairing of pressure losing fault during



operation due to insufficient water supply or malfunction in water circuit system. Now we begin to explain the way to examine and repair the second possible reason for losing pressure: bad seals of check valves:

- A. Start booster system, switch on HP and run the machine.
- B. There is a proximity switch on each side of the oil cylinder in booster system. When the piston changes its moving direction, observe the red light signal of the proximity switches and how the pressure fluctuates on the pressure indicator. If the red lamp lights up on the left proximity switch on pressure dropping, it means that there is something wrong with the LP check valve on the right or the HP check valve on the left. The reason is: when the red lamp of the left proximity switch is on, the piston has finished a stroke from the right to left and begins a stroke from left to right. At this time, the LP check valve on the right and the HP check valve on the left are closed. If there is a pressure drop, it means either the LP check valve on the right or the HP check valve on the left loses tightness to water, i.e. water returns in the inlet of HP cylinder on the right or in the HP check valve on the left. If it is the other way round, it means that the LP check valve on the left or the HP check valve on the right have some problems.

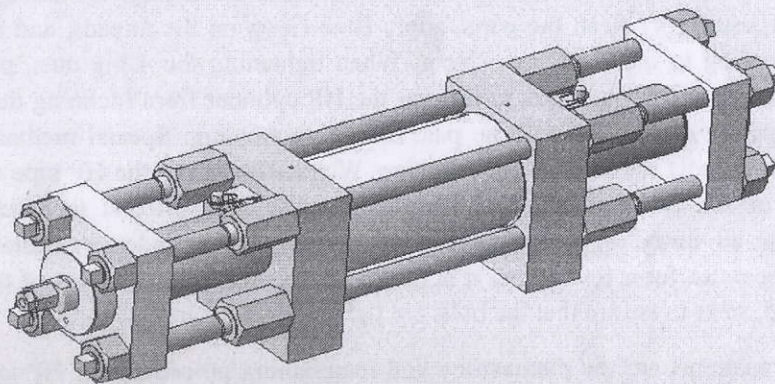


Fig 2 - Appearance of Booster Assembly

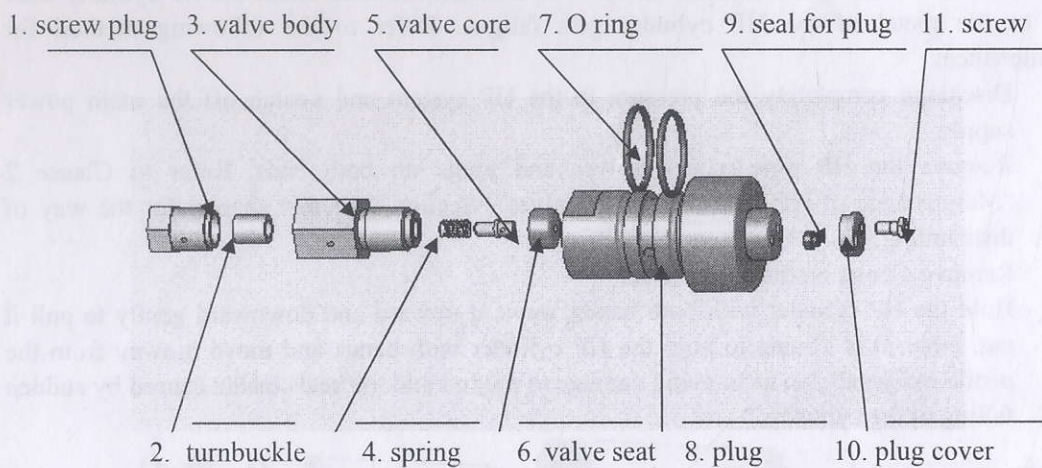


Fig. 3 - Exploded Diagram of Components of Check Valve

- C. After finding out the faulty HP check valve with the above-mentioned method, dismantle it



with reference to the following procedure: first, relief completely the pressure in the HP pipeline; disconnect the HP pipe to the check valve (take off Part 1 while disconnect the other end of HP pipe at the same time), and then remove Parts 3, 4, 5 and 6 in order; hold Part 6 (valve seat) on a small bench drill with the right side facing downwards (as per the direction indicated in Fig 3); place a flat plate (or a piece of glass) with the same height onto the working platform of the bench drill with a mesh #600 metallopatternic abrasive paper on the top; run the drill to lap the valve seat surface to be smooth; lap the surface of Part 6 (valve seat) to be smooth following a path of "8" shape with a mesh #600 metallopatternic abrasive paper; clean the parts, apply Blue Goop on the threads, and assemble the valve according to the sequence. At the point, the inspection and repair of a HP check valve is fully carried out and the valve could be put into trial operation (pay attention that after starting up the machine, the HP pipe connected to one side of the check valve should be loosened a little bit and then retighten after discharging the air away). If the pressure is OK after start-up, it means the problem is solved. If not, it means the problem lies in the LP check valve. After finding out the faulty LP check valve, dismantle it with reference to the following procedure: 1) follow the procedure of HP check valve dismantling; 2) loosen the 4 nuts connecting the HP cylinder, take off the end covers, shake Part 8 (plug body) so as to take it out; loosen Part 11 (screw), take away Part 9 (plug seal); lap the surfaces of Parts 8 and 9 manually with the same method mentioned above until the surfaces of both parts are smooth; 3) check if the O-rings are damaged. Replace them if necessary; 4) clean the parts, apply Blue Goop on the threads, and assemble the valve according to the sequence. {Note: When tightening the 4 big nuts, please evenly tighten the nuts crosswise so as to prevent the HP cylinder from inclining due to its own weight. Special attention should be paid during assembling. Special methods and skills shall be mastered!}; 5) start up the machine. When starting up, the HP pipe connected to one side of the check valve should be loosened a little bit and then retighten after discharging air away; 6) After the big bolts of the HP cylinder are installed and the machine operates for a few hours, it is necessary to check the tightness of the nuts once dismantled, so as to ensure that the bolts are tightened with the same torque.

The above parapatterns are the dismantling and maintaining procedures of HP and LP check valves.

### 3. Maintenance of HP Cylinder and Seals

If serious water leakage is discovered at the inspection holes of the end covers of the HP cylinder or on the lateral sides of the end covers, it means the seals inside the HP cylinder wear out or the metal of the HP cylinder gets fatigue. Refer to the following method for maintenance:

- 1) Discharge completely the pressure in the HP system and switch off the main power supply;
- 2) Remove the HP pipe, check valves and plugs on both ends. Refer to Clause 2 "Maintenance of HP and LP Check Valves", Section 4 of this chapter for the way of dismantling;
- 3) Remove 4 bolts on the HP cylinder;
- 4) Hold the HP cylinder with both hands, move it upward and downward gently to pull it out. Note: it is a must to hold the HP cylinder with hands and move it away from the piston rod gently, so as to avoid damage to the rod and the seals inside caused by sudden falling of the cylinder;

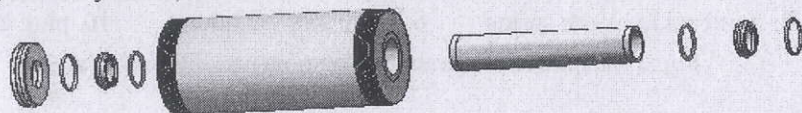


Fig. 4 - Exploded Diagram of Components of HP Cylinder



- 5) The same measure should be followed when dismantling the other set of HP cylinder;
- 6) Place the dismantled components on the working platform in turn. Clean the piston rod with soft cloth, and check if it is damaged (scratches, rough surface, breaches, etc.). The surface of the piston rod must be bright and clean (roughness  $0.2 \mu - 0.4 \mu$ ). Replace the piston rod in case it is damaged (refer to Clause 4, Section 4 of this chapter).

Check if there is any obvious bulge on both end cover of the HP cylinder. If so, it means the cylinder is damaged and must be replaced;

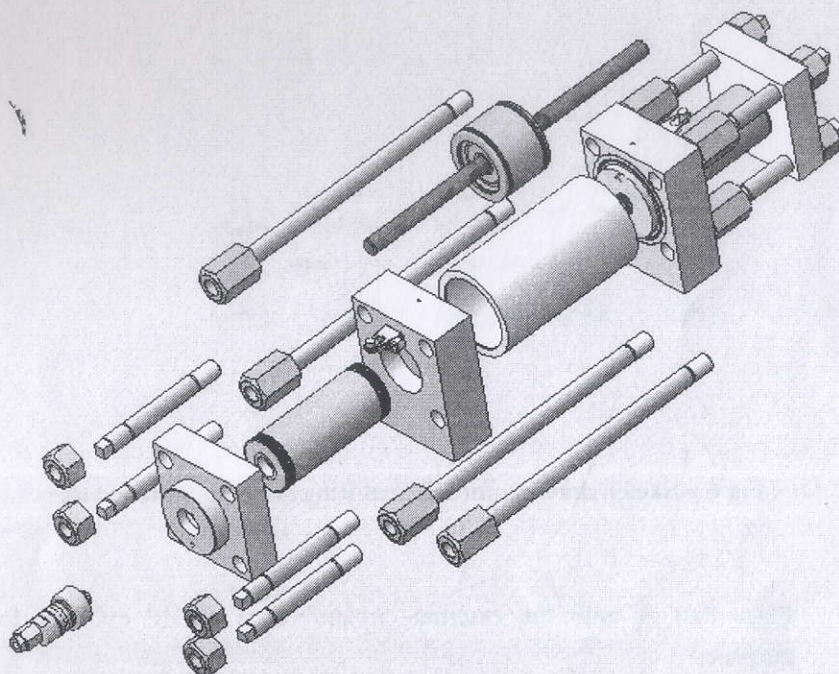


Fig. 5 - Exploded Diagram of Components of Booster Assembly

- 7) Check if the seals inside both ends of the HP cylinder are damaged, and if the end faces of the copper ring are unsmooth or with obvious impression (refer to Fig. 4 - Exploded Diagram of Components of HP Cylinder). The seal ring consists of 3 parts: HP seal ring, O-ring and back ring.
- 8) Lap both end faces of copper ring. It is possible to use firstly a metallographic abrasive paper of lower than mesh #600 for lapping, and then a mesh #600 metallographic abrasive paper for final lapping. A path of "8" shape should be followed in lapping;
- 9) Special tools should be used for assembly purpose when replacing seal rings (supplied together with the spare parts attached with the machine). Take out the special tools from the Spare Parts Container and carry out assembly with the tool which contains 5 parts (A, B, C, D, E) indicated in Fig 6.



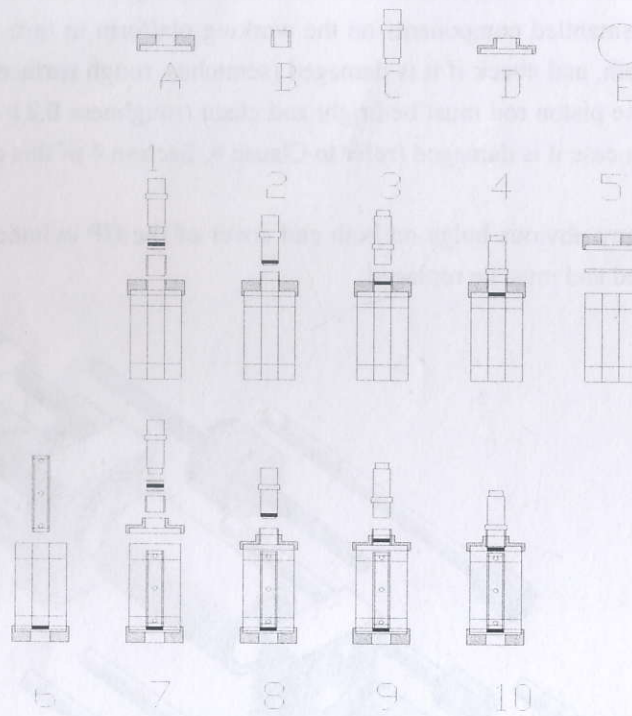


Fig 6 – Sketch drawing for HP Seal Ring Assembly Procedure

- i) Place Part A onto the external circumference of HP cylinder for positioning purpose;
  - ii) Place Part B into the hole of Part A and attach it firmly on the end face of the HP cylinder (Note: Part B has a taper hole and the larger diameter should face top). Place the seal ring on Part C (Don't confuse the installation orientation );
  - iii) Place Part C into the middle of the Part B's hole, and then take out Part B;
  - iv) Turn Part C upside down so that the larger diameter faces the ground. Hold Part A & B and press down Part C to push the seal ring into the HP cylinder;
  - v) Take out Part A, B & C. Place E onto the end faces of HP cylinder. Then place Part A onto the external circumference of the cylinder for positioning purpose. Hold Part A by hand, turn the cylinder around and place it onto the platform;
  - vi) Put the inner cover into the inner hole of the HP cylinder;
  - vii) Put Part E onto the external ring of the cylinder for positioning purpose;
  - viii) The same as Fig 2;
  - ix) The same as Fig 3;
  - x) The same as Fig 4.
- 10) Don't let dirt or impurity stick on the components when cleansing them;



- 11) Lubricate the piston rod and the inner hole of seal rings inside the HP cylinder. Apply Blue Goop on the threads of check valves and plugs;
- 12) Put the copper ring onto the piston rod. Put it until it reaches firmly to the end face of the large end cover. Place gently the HP cylinder through the piston rod and move it slowly to the large end cover. After that, assemble the plug and place it gently into the inner hole of the cylinder until the requirements is fulfilled (refer to Fig. 5 - Explored Diagram of Components of Booster Assembly);
- 13). Install the end cover and tighten the 4 bolts. Note: When tightening the nuts, it is a must to hold the HP cylinder and the external end cover with your hands and evenly tighten the nuts crosswise. Special attention should be paid! The same method should be used for the assembly of the other side;
- 14) Install check valve sets and HP pipeline with the same measure mentioned in Clause 2, Section 4 of this chapter;
- 15) The above parapatterns are the method for disassembling HP cylinder and replacing HP seal rings. Now the assembly of HP seals is finished and the cylinder could be put into trial operation. Pay attention that the air remaining in the HP cylinder must be removed (the same methods explained in item 5), Clause 2, Section 4 of this chapter) before the water is supplied and trial operation starts. If leakage is still found on the ends of the HP cylinder during trial operation, and bulges are found on both sides of the cylinder or there is leakage in the cylinder itself, it means the metal material of the cylinder gets fatigued and the cylinder is damaged. The above-said process should be followed for replacing a new HP cylinder

#### 4. Maintenance and Replacement of LP Seals and Piston Rod

LP seals refer to the sealing for the oil cylinder and piston. They serve the function of preventing oil leakage or intrusion, and keep a stable pressure in LP system, so that proper operation of HP system is guaranteed.

If oil leakage is found on the inspection holes of the cylinder cover, it means the seal ring in the cover wore out and needs to be replaced. Otherwise, the water in the HP cylinder might go into the oil cylinder and the oil in the oil tank might mix with water.

If the seal ring of the piston rod is damaged, the HP system will have the following faults: the machine runs properly and the pressure is stable when switched on; after running for a period of time, the pressure drops gradually and cannot be raised up again.

These two problems are the foundation for judging possible reasons of the faults. Normally, if a seal ring is dismantled, it should be replaced no matter if it is damaged or not. So the recommendation is that the seal rings should be replaced no matter if they are damaged or not.



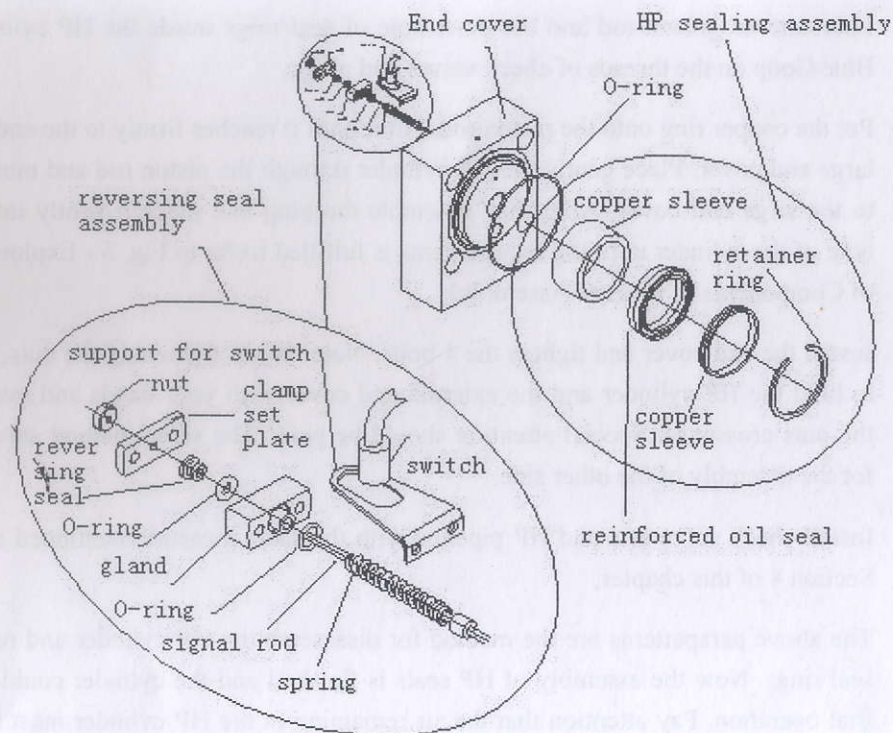


Fig 7 - Exploded Diagram of End Cover Seal and Reversing System of Oil Cylinder

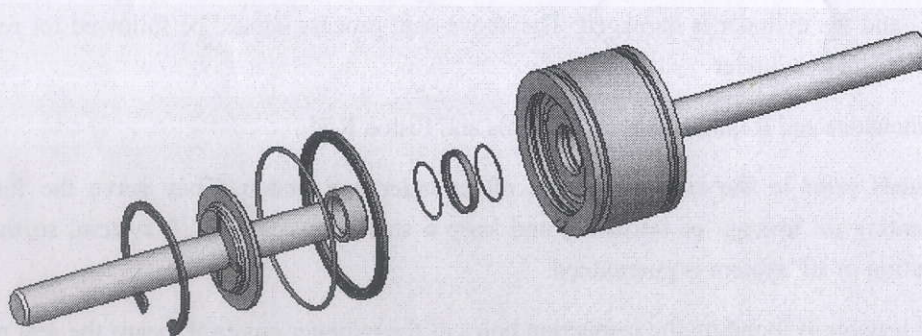


Fig 8 - Exploded Diagram of Components of Piston and Piston Rod

- 1) Dismantle the HP pipe and check valve on the left and right connection. For the steps of dismantling, please refer to Clause 2, Section 4 of this chapter (Maintenance of HP and LP Check Valves);
- 2) Dismantle the HP cylinders on both ends. For the steps of dismantling, please refer to Clause 3, Section 4 of this chapter (Maintenance of HP Cylinder and Seals);
- 3) Loosen the nuts on the 2 end cover at both ends of the oil cylinder (8 pcs in total);
- 4) Loosen the 4 bolts on the bottom of two end covers with an Allen key;
- 5) Hold the cylinder and pull out the end covers from the piston rod gently;
- 6) Pull piston and piston rod out of the cylinder;



- 7) Check: any scratch or rough on the piston rod; any scratch inside the cylinder; damage to the Y-shaped seal ring on the piston;
- 8) A caliper is used for taking out upper retainer ring on end covers and upper retainer ring on piston respectively. Take out the sealing parts on the end covers and piston and check if there is any damage;
- 9) Judgment could be got with the examination results.

We recommend replacing all the seal rings no matter if they are damaged or not. There are a bag of spare seals attached with the each cylinder when the machine leaves the factory. If they are used up, please order from us in advance (Oil Seal Maintenance Kit M10641).

As for the problems of the piston, piston rod and oil cylinder, they should be replaced promptly.

Please assemble the piston and piston rod as per the requirements. Remember the positions of the parts. Refer to Fig. 8 for exploded diagram. After the piston rod is assembled, grease the inner chamber of the oil cylinder. Install a Y-shaped seal ring on one side of the external circumference of the piston and install the piston into the cylinder. Push the piston into the other side until the external slot of the piston exposes. Then install a Y seal on the other side, and push the piston into the cylinder (special care shall be placed not to install in a wrong way). As for the assembly procedure of other parts, please follow the sequence and positions of disassembly, and refer to the dismantling measure of HP pipe and check valves listed in Section 4 of this chapter, as well as Fig 7 and Fig 8.

#### 5. Replacing Reversing Seal

Reversing systems locate at both sides of the cylinder end covers (Fig 7).

When the reversing seal is damaged, oil will leak out at the end faces of the gland. When this happens, the seal should be replaced in time. If the reversing spring loses its function, the signal rod could not be fully return and thus the phenomena of unstable reversing or no reversing happens.

Method and procedure of replacement:

Cut off the power supply. Dismantle the inductive switches on both ends. Dismantle the switches and supports;

Screw off the nuts, and remove 2 screws on each side by an Allen key;

Take out the components. Check if the reversing seal and O-rings are damaged and the spring is bent or shortened.

Replace the seals and spring, and then reassemble the parts (refer to Fig 7 - Exploded Diagram of Reversing System).

Install the switch support and inductive switch.

Trial operation: when the machine is started up or running, it is possible that the reversing system doesn't work. If so, please adjust the distance and height of the 2 inductive switches. If



the distance isn't right (generally the axial distance between the inductive switches and the nuts shall be set at 8 mm), the two switches may be induced at the same time, thus the oil cylinder won't work; and if it is too high, the induction won't take place and the cylinder won't work, too. Tighten the inductive switches after adjustment so that they won't move due to the operation of the machine and consequently stop functioning.

6. Cleaning and Maintenance of Filter in Oil Tank

The filter in the oil tank should be cleaned on a regular basis. The oil circuit may be blocked if it hasn't been cleaned for a long time. The filter locates under a semicircle cover of the oil tank. Dismantle the oil pipe at first, then loosen the 8 bolts by an Allen key and take out the filter. Screw it off and water it with gasoline. Replace it with a new one if the filter mesh is damaged.

7. Changing Hydraulic Oil

Long-term operation of machine may deteriorate the quality and cleanness of hydraulic oil, so it is required that the oil should be changed once every year by the following method:

On the both sides of the rear part of the oil tank, it is marked "Left Oil Tank Outlet" and "Left Oil Tank Drainage". Remove the 2 screw covers under the labels and drain oil into a barrel. After that, remove the bolts fixing the covers of the tank on lateral sides with an Allen key, take off the covers and clean the bottom of the oil tank with gasoline (no water or other impurities should remain inside the dried tank).

Reinstall the lateral covers, screw in the left and right drainage plugs, connect oil pipes, open the covers of air filters and then fill in fresh oil. As for oil filling and the following steps, please refer to Clause 6 & 8 of Section 1, Chapter II.



## Section 5 Two Stage Booster System

The two stage booster system (optional) is designed specially for cutting glass with purpose of punching under low pressure and cutting under high pressure, so as to avoid breaking the glass due to the high pressure during punching.

The pressure for the first stage is preset to be below 200MPa in the factory, while the user may not change it. This pressure changes together with the changing setup of cutting pressure. But the first stage pressure will not exceed 200MPa under the maximum working pressure allowed by the machine.

Setup of punching time: the setup of punching time depends on the thickness of the glass. It is set up by the operator based on the pressure of the machine and the thickness of the glass. It is controlled by the punching time relay which locates at the outer flank of Y-axis and near the operation desk for convenient adjustment purpose.

Operational principle of two-stage booster system: it consists of solenoid reversing valve and time relay. When the time relay is set to 5 seconds, the solenoid reversing valve is under "power on delay" mode in these 5 seconds after the machine starts up. At the point, some hydraulic oil overflows the solenoid reversing valve and returns to the oil tank, so that the pressure is reduced. After the 5 seconds. The solenoid valve is switched off and overflow is stopped in the system, while the machine starts to run in high pressure mode.

The solenoid reversing valve for two-stage boosting locates under the valve plate in the front of the hydraulic cabinet. If no two-stage boosting is needed, you may either turn the time relay to "Zero" or disconnect the plug of the solenoid reversing valve.





## Section 6      **Assembly, Disassembly & Maintenance of 420MPa & 380MPa Booster Systems**

The inner structures of these two boosters are identical with the 320MPa booster described in Section 4. They share the same major components and HP and LP seals. The differences lie in the components and seals of the reversing systems. In 420MPa & 380MPa booster systems, the components of HP cylinders are connected by threaded connections, while the HP cylinders of 320MPa series are connected by bolts. Therefore, the HP cylinders and end covers of 420MPa & 380MPa booster systems are of threaded connection structure.

Special tools are necessary for dismantling the HP cylinders and end covers of 420MPa & 380MPa booster systems. There are two kinds of special tools: one for dismantling end covers and the other for HP cylinders. These tools are provided together with the machine.

Despite the different special dismantling tools and reversing system, the dismantling and maintaining methods and procedures described in Section 4 of this chapter shall be regarded as the reference for dismantling and maintaining 420MPa & 380MPa booster systems.

Sketch drawing for 420MPa booster system: Fig 9, Fig 12 attached.

Sketch drawing for 380MPa booster system: Fig 10, Fig 11, Fig 12, Fig 13 attached.

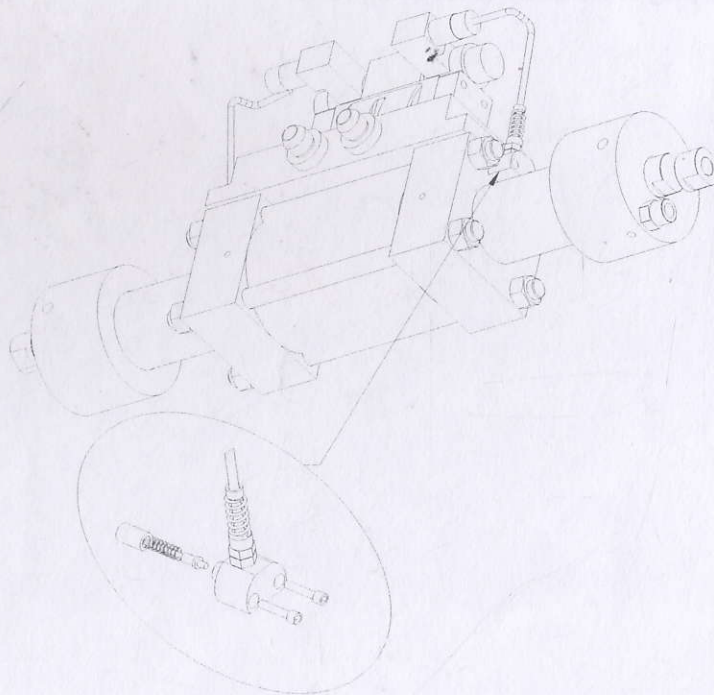


Fig 9 – Appearance of 420MPa Booster Assembly



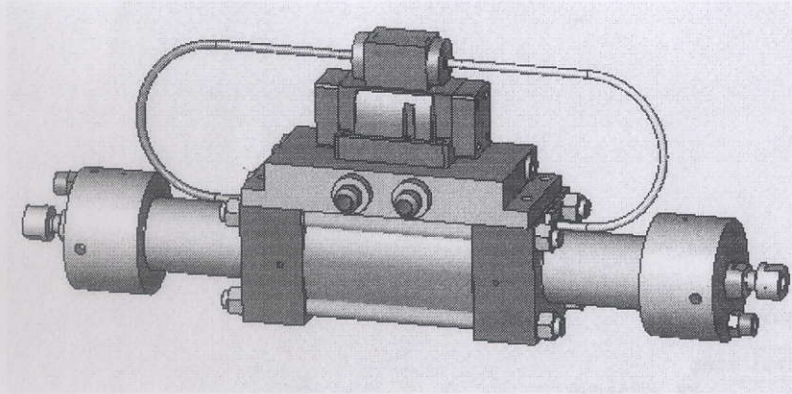


Fig 10 – Appearance of 380MPa Booster Assembly

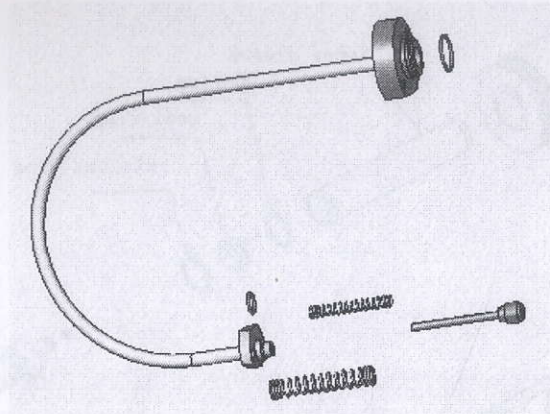


Fig 11 –Explored Diagram of 380MPa Booster and Its Reversing System

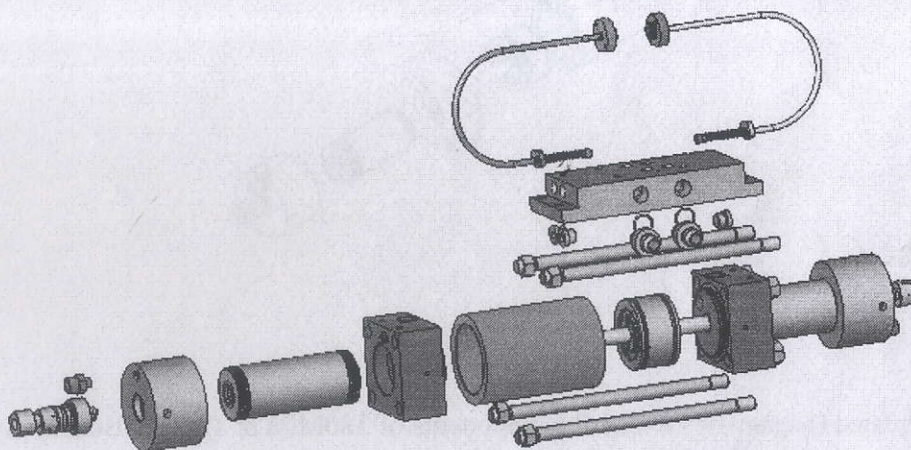


Fig 12 –Explored Diagram of HP & LP Components of 380MPa & 420MPa Booster System



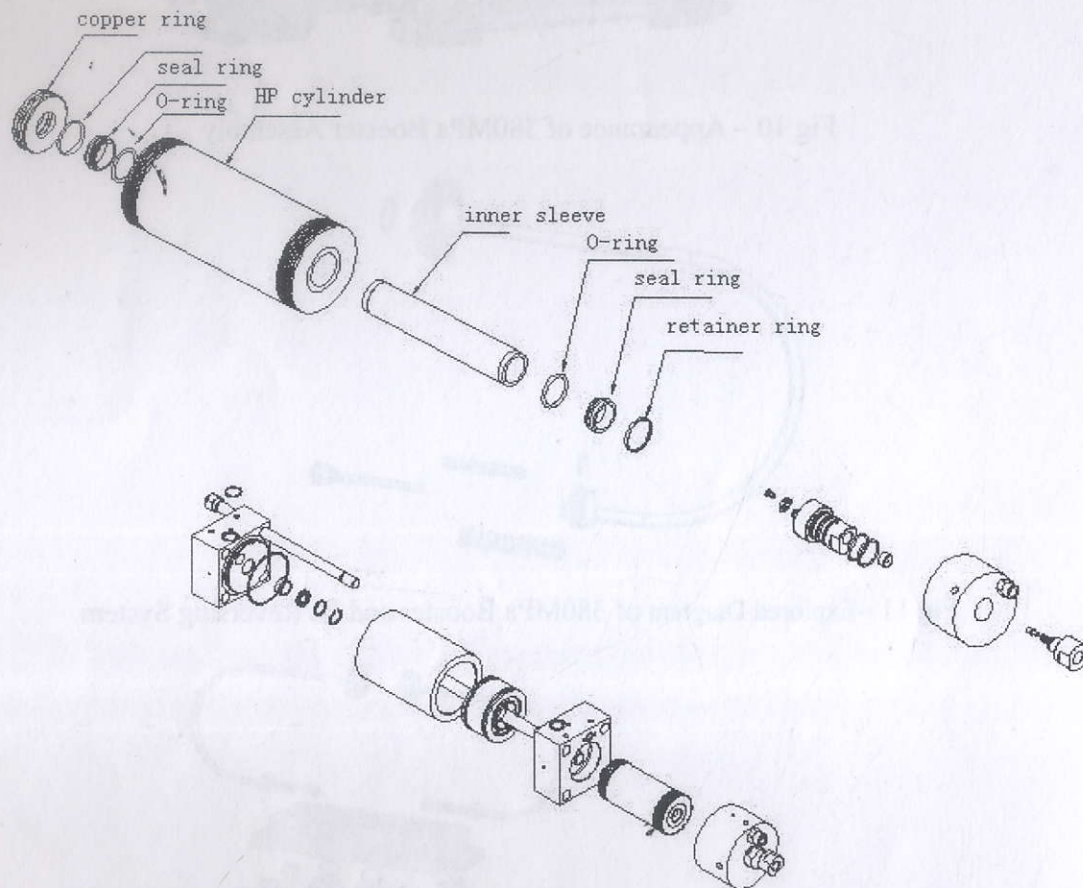


Fig 13 - Exploded Diagram of HP & LP Components of 380MPa & 420MPa Booster System



## Chapter III Working Platform System

The working platform system is the major moving part of the machine. The flexibility and accuracy of its movement have a direct impact on the processing accuracy of work pieces. Therefore, it is a must to frequently check and maintain the working conditions of the movable parts of machine for proper operation.

### Section 1 Check and Adjustment on Accuracy of Ball Screw

#### 1. Check and Adjustment of Accuracy and Torque of Lead Screw

Lead screw is a major part of the machine, having a direct impact on processing precision. On checking it, the first step is to put a dial indicator against one side of the screw. Move the carriage to see if there is any axial run-out. The normal run-out shall be within 0.01-0.03 mm. If axial run-out is larger, tighten the slotted nut inside the bearing bracket until it could be turned gently.

#### 2. Check and Adjustment of Nut Block

Nut block is a bridge connecting the lead screw and the carriage. It features a very precision matching accuracy. If the cleanness and lubrication of the lead screw could not be guaranteed, gap will appear between the nut block and the screw, thus resulting in the screw transmission getting loose, which will have a negative impact on the cutting accuracy. If there is severe wearing and loosening, the lead screw should be replaced.

#### 3. Check and Adjustment of Bearing Bracket and Supporting Bracket

Bearing and supporting brackets serve the functions of supporting, positioning and rotating the lead screw. It shall be installed in such a position that the lead screw could be parallel with the guide rail. Any deviation such as in height, parallel or central position may lead to uneven rotation or vibrating of the screw. When checking the screw, it is able to measure the lead screw, taking the guide rail as reference, and adjust the centre and height of the bearing bracket and support bracket of the screw while at the same time guarantee that the horizontal position of the bearing bracket is vertical to the guide rails.

#### 4. Error Adjusting for Y axis synchro-system of Brige Type Machine

Y axis double screw mandrel synchro-system, the allowable error which set by computer for synchro system should  $<0.40\text{mm}$ , when the error of synchro-system  $\geq 0.4\text{mm}$ , the right and left Y axis will stop work. If this problem happen, please adjust it according following steps:

Turn off the driver, turn the left or the right Y axis a bit, meanwhile, please note to observe the error value which be shown on the computer, till adjusting the value to the zero position or





<0.1mm. Then turn on the Diver.

When need to reset the Uprightness of the X axis and Y axis, please ajust according following steps:

- ① Turn off the Driver and open the shields of left and right Y Axis;
- ② Please turn off the Mini High-breaking Capacity Breaker RL10 and turn off the Mini High-breaking Capacity Breaker RL11, both located inside the Y axis.
- ③ Ask two worker turn the left Y axis and right Y axis at the clockwise direction by a hand shank till the slider bump against the orientation block which located at the end of linear guide;
- ④ Turn on the Diver, after the Y axis move about 300mm(out of the location limit at the positive direction, then stop it, turn off RL10, turn off RL11;
- ⑤ Install on the shield;

## Section 2 Guide Rail

The guide rails are the paths for machine movements. They shall be linear and parallel to each other. The carriage moves along the guide rail by the rotation of many steel balls inside it. If the rails are corroded or contaminated by foreign substance or dust so that the rails aren't well lubricated as usual, the steel balls inside the carriage may drop out and the carriage has to be discarded as useless. This phenomena are: uneven speed of the machine, unable to cut a round circle. If these phenomena are found, a prompt examination and maintenance should be carried out. And the rails or carriage should be replaced in case of severe damage.



### Section 3 Lubrication System

A greaser is equipped with the machine for lubrication purpose. Push its handle and the oil is pressured through a distributor and into the carriage. The nuts, lead screws and guide rails should be kept clean and well lubricated to ensure proper running and a long service life.

In order to guarantee good lubrication of the guide rails and the lead screw, the manual oil pumps on X-beam and Y-beam should be pressed 3 – 4 times before every shift starts. Better results will be achieved if the oil is added when the machine runs along X axis and Y axis without cutting.

N32 machine oil could be chosen for lubrication.



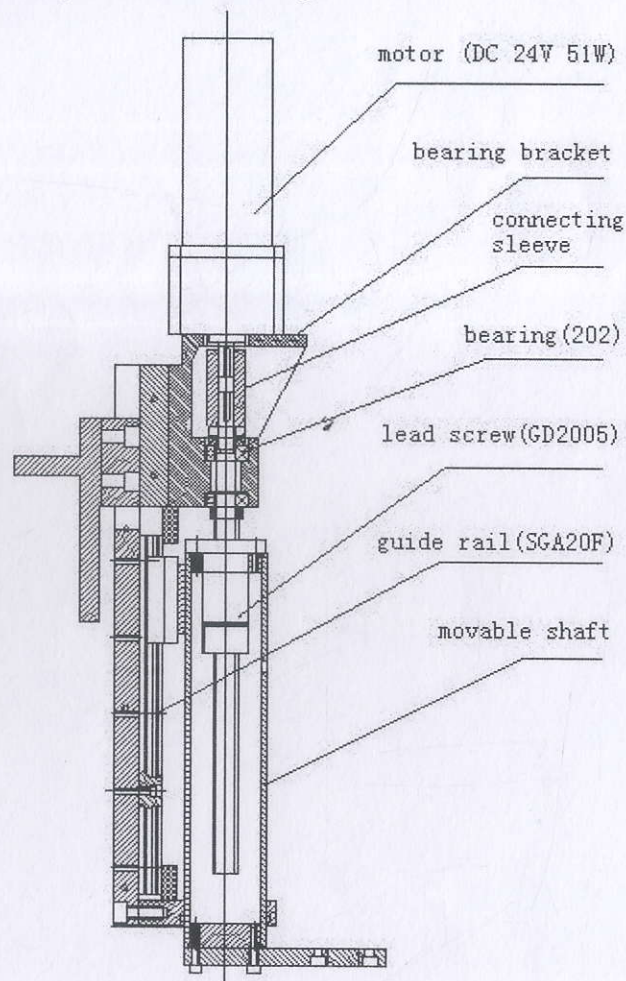


## Chapter IV Z-Axis System

1. The function of Z axis in the machine is to hold the tool tip and make it so up and down that the tool tip may keep an optimal cutting distance with the work piece. The principal is as follows: the control button starts up the LV miniature motor; the rotation of the motor is passed on to the gearbox which lowers the rotation speed and drives the lead screw; the lead screw moves together with the carriage fixed on the guide rails and with the nut on the screw, so that the upward and downward movements are realized. Based on the operating range, a limit device is installed at each end of Z-axis. When the carriage travels to the terminal positions on one end, the limit device will alarm and stop the machine automatically, so as to prevent bumping.

2. In case that malfunction occurs and the system needs to be disassembled for repair purpose, please pay attention to the following: if the motor is running, the gearbox is blocked, the lead screw is bent, the bearing is corroded, the guide rail and the carriage are movable or they get loose due to wearing; the limit devices are working. In case of any of the above faults, repair the corresponding faults and replace parts if necessary.

3. The stainless steel housing of the Z-axis system should be opened every 3 month for cleaning and lubricating the lead screw, guide rails and bearings.



Schematic Diagram of Z-axis System



## Chapter V Cutting head set

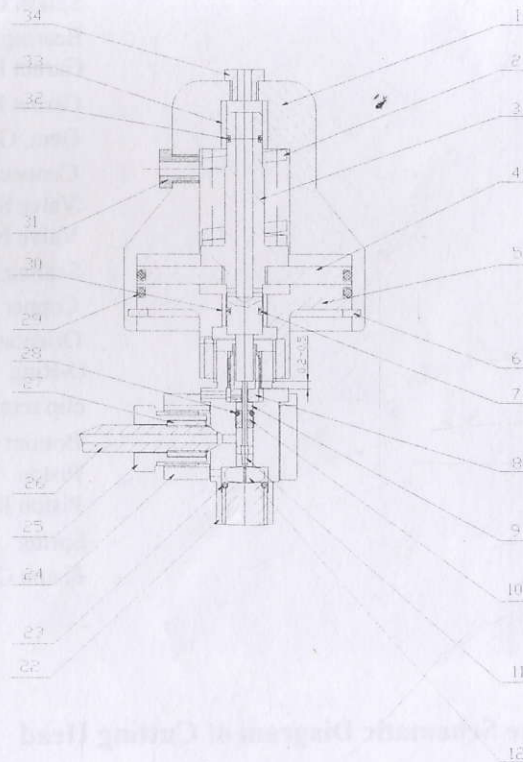
### Section 1 Working Principle of HP Water Switch

The HP water switch serves the function to turn on and close up the high pressure water. Turn on the high pressure water——compress the air into the Cylinder, under the effect of compressed air, the Cylinder Spring be compressed and push up the Valve Needle, then the high pressure water come into the cutting head; Close up the high pressure water——close up the compressed air, the Cylinder spring will restoration. By the action of the Spring, the Valve contact with the conical surface of inner orifice for the Valve seat, the high pressure water be closed.

The combination between high pressure water and cutting head, can turn on and close up the high pressure water instantly, so it can save the time of postpone before the start of cutting and the time of decompression after cutting be finished, meanwhile, it can avoid the phenomena of water back into the cutting head.

### Section 2 The Installation and adjusting of high pressure water switch

Before the installation and use of high pressure water switch, firstly, you should lock up the Valve sleeve (22) and the connection rod (13), then adjusting the Orientation Threaded Sleeve (8). The method of adjusting: Push the Valve Needle to the bottom and touch with the conical surface of the Valve Seat. (till can't move on), Now adjust the Orientation Threaded Sleeve (8) till the upper extremity surface of Valve needle 0.2-0.5mm higher than the inner orifice plane of the Orientation Nut (8). Lock up the Cylinder (1) and Valve set (22).

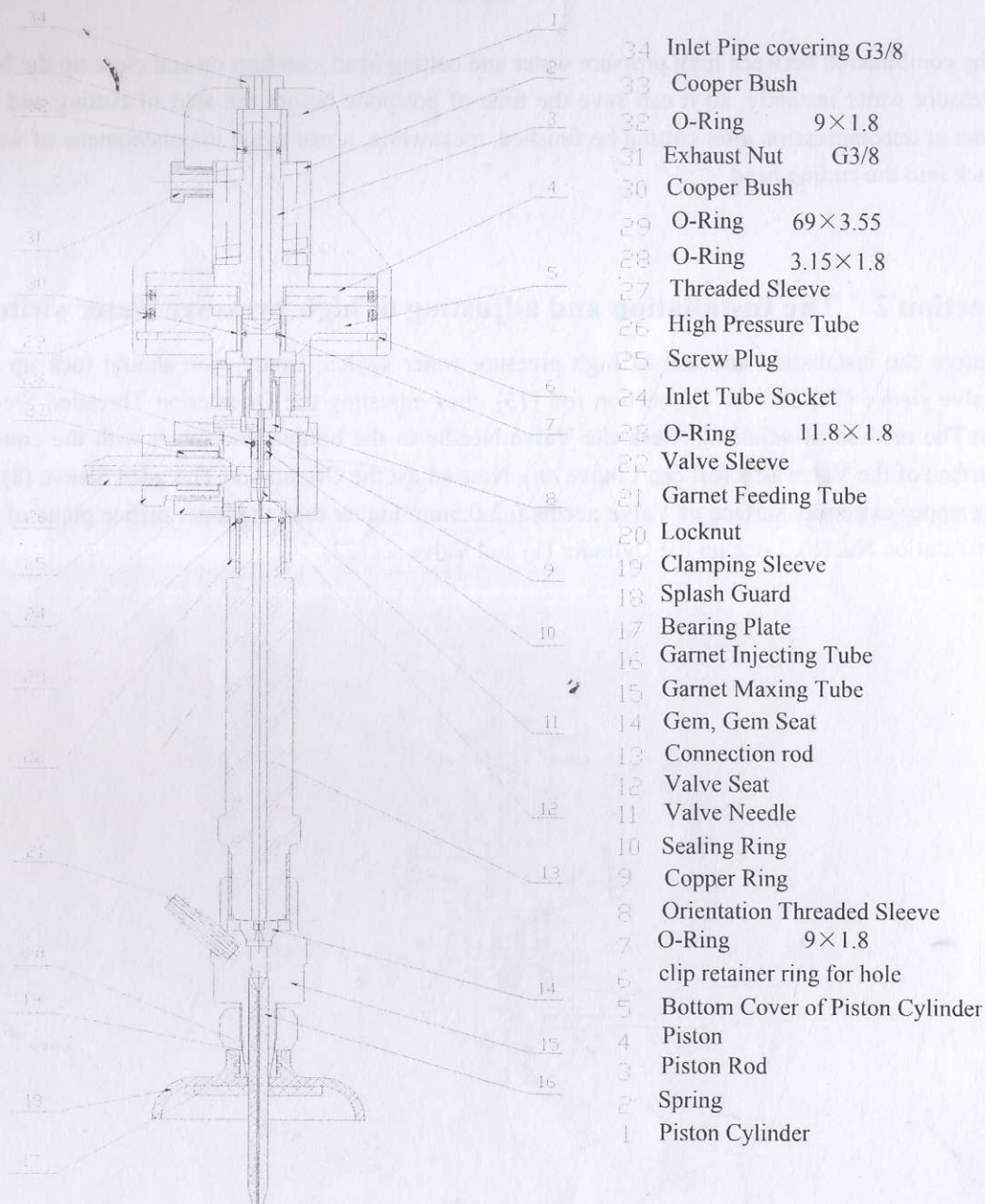


The Schematic Diagram of High Pressure Water Switch



### Section 3 Working Principle of Cutting Head

The high pressure water pass through the Water Switch, then enter into the Cutting Head. The High pressure water pass through the orifice, then form the high speed current, by the effect of the high speed water current, form the negative pressure, the garnet be absorbed into the water current and mixing together, then enter into the mixing tube, jetting out together at high speed.



The Schematic Diagram of Cutting Head

## Section 4 The installation of Cutting Head

1. Put the Nozzle (14) into the Garnet Mixing Chamber (15), screw into the HP Blade rod and tighten it;
2. Install on the Mixing Tube (46). Push the mixing tube up till it can't move on (touch with the Garnet Mixing Chamber);
3. Install on the Clamp Housing (19) and Locknut, only need screw them down by hand, can't use other tools screw down forcibly.

## Section 5 Installation and Use Notication

1. After a certain length of operation time, it's necessary to adjusting the Orientation Threaded Sleeve (8) frequently to ensure the normal working and useful life;
2. Before be installed, the each Screw thread joint should be coated by blue goop to prevent from seizure;
3. The Seal hoop (10) , O-ring (7), (23), (28), (29) are all the exhaustion parts. Before be installed, they should be coated by lubricant( White goop) to prevent from damage;
4. The high pressure water must be filtered and reach the standard, the dirty water will affect the useful life or damage the switch.
5. The air pressure should be  $\geq 0.6\text{Mpa}$ , no air pressure or deficient air pressure will lead the high pressure water can't be turned on .
6. Strictly prohibit collision, otherwise the cutting head will lose the precision, and affect the useful life.



## Chapter V Sand Feeding System

### 1. Working Principle

Sand feeding system consists of sand barrel, air pressure regulating valve, sand feeding tube, sand cup, sand control valve and air control valve. During operation, the air is supplied by an external air supply. The air pressure regulating valve controls the pressure to around 0.2MPa and feed air into the sand barrel. With the pressure, the small Pneumatic Cylinder pulls the spool of the sand control valve, so that sand is fed out. If the sand valve close button is pushed, the system goes back to original status in a reverse sequence.

### 2. Method of Use

When using the system, firstly fill the sand barrel with sand, tighten the cover of it and open the air relief valve; then adjust the air pressure to around 0.2MPa, open the valve at the bottom of the sand barrel, so that sand flows into the sand cup. There is a tunable nut on the rear side of the sand valve for adjusting the sand flow which should be adjusted according to the material and thickness of the work piece.

### 3. Cautions

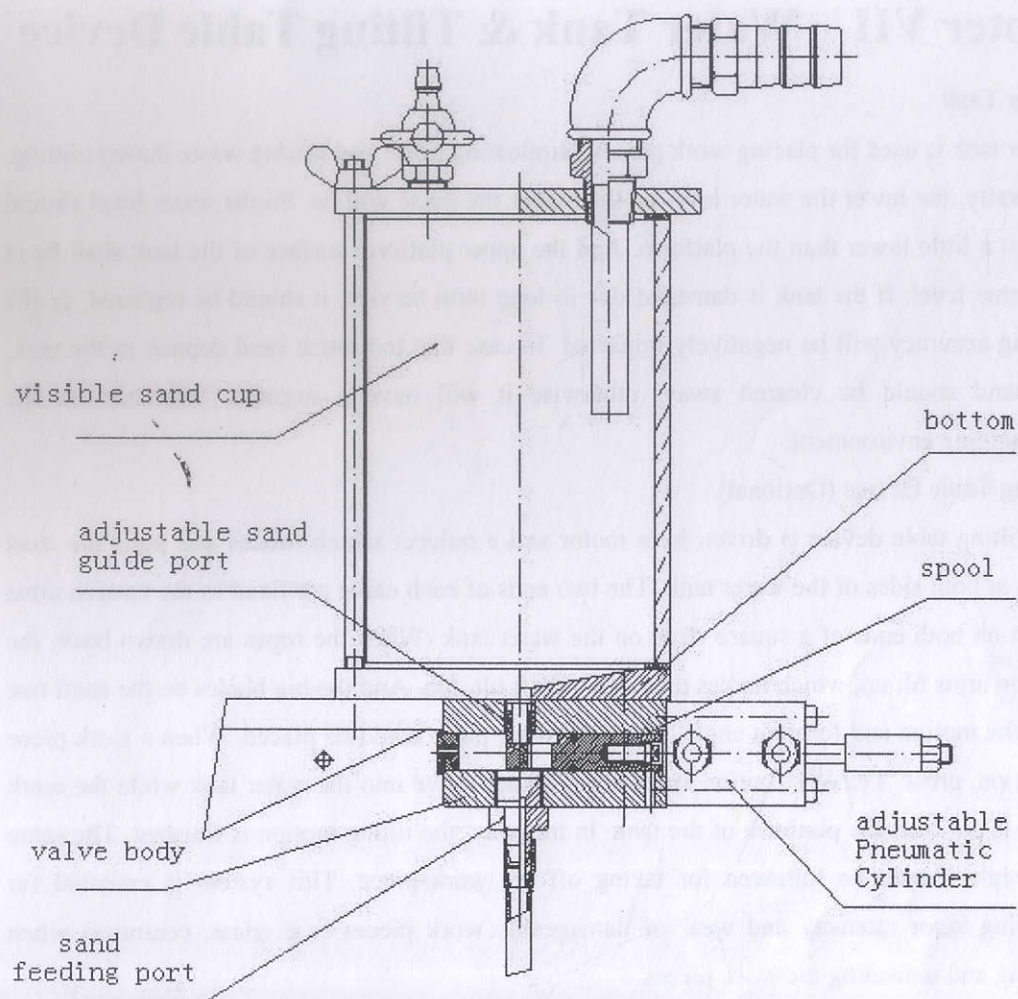
Principally, the sand shall be screened and kept dry before being added into the sand barrel. The air pressure in the barrel shouldn't be too high and the air vent on the sand cup should be open. If sand is blown out from the air vent, use a light cloth to close it and wait until the sand flowed in the sand pipe becomes higher than the sand inlet. Note: Never let the sand barrel be empty before adding sand, or the sand pipe will be full of air and sand will be blown out afterwards.

### 4. Method of Dismantling

After a certain period of time, the spool hole in the sand valve is worn out and need to be replaced. When dismantling it, firstly dismantle the screws fixing the sand valve, then dismantle the screws on the small Pneumatic Cylinder, take out the spool and the shaft of the small cylinder at the same time, and push out the spool; place a new spool into it, retighten it. When installing the small cylinder, pay attention that a flat surface on the spool shall be against an adjusting screw on the valve body. The adjusting screw should not be tightened too much. It should be able to pull the shaft of the Pneumatic Cylinder. Finally, install the valve body and then the procedure finishes. This method is also suitable to the disassembly and assembly process in case if any water goes into the valve body.

Special cautions: When adding sand into the sand barrel or maintaining the barrel, the screw plug of the sand barrel should not be opened until the compressed air in the barrel is discharged completely, otherwise it may cause personal injury.

Assembly drawing of sand cup and sand valve attached:



**Assembly Drawing of Sand Cup & Sand Valve**



## Chapter VII Water Tank & Tilting Table Device

### 1. Water Tank

Water tank is used for placing work pieces, eliminating noise and storing waste during cutting. Generally, the lower the water level is, the higher the noise will be. So the water level should be just a little lower than the platform. And the upper platform surface of the tank shall be at the same level. If the tank is damaged due to long term service, it should be replaced, or the cutting accuracy will be negatively impacted. In case that too much sand deposit in the tank, the sand should be cleared away, otherwise it will have a negative influence on the surrounding environment.

### 2. Tilting Table Device (Optional)

The tilting table device is driven by a motor and a reducer which rotates and pulls the steel ropes at both sides of the water tank. The two ends of each cable are fixed to the tension arms fixing on both ends of a square shaft on the water tank. When the ropes are drawn back, the tension arms tilt up, which makes the square shaft tilt, too. And the big blades on the shaft rise with the motion and form an angle. Thus, the work piece could be placed. When a work piece is put on, press "DOWN" button and the big blades move into the water tank while the work piece is put onto the platform of the tank. In this way, the tilting motion is finished. The same procedure should be followed for taking off the work piece. This system is essential for reducing labor intensity and wear of damageable work pieces (e.g. glass, ceramics) when loading and unloading the work pieces.

### 3. Cautions

The tilting device shall not be overloaded, otherwise the motor might be burned out, the steel ropes might break and/or other parts might deform and get damaged. The maximum load of this system is 150 kg. The seal between the square shaft and the water tank might be worn out and water leakage thus be found. If so, the reinforced sealing should be replaced.

If the functions of rising and lowering tilting table fails, the EMERGENCY STOP button shall be pressed down, and then check if the electric circuit, limit devices, steel ropes, tension device, pulleys are all right.

Stop the machine immediately whenever any abnormal noise is heard. Check if the pulleys rotate or the steel ropes are in the pulley groove. Repair the pulleys if they don't rotate, and keep the steel ropes in the pulley groove.

## Chapter VIII Operation System And Computer Aid Design

There are two types of operation systems: PC control system and embedded control system. Now we use the 320W system developed by Nanjing Huaxin Co. as the embedded control system. The PC control system could be divided into two kinds based on the motion control card and control software used in the system: one is domestic made motion control card and GNC control software ("PC1"), the other is US-made motion control card and JETAREAM control software ("PC2").

### Section 1 Functions and Principle of Operation Systems

#### 1. Functions of Operation System

The operation system controls the overall operation of the machine. It serves a similar function like a brain of a human being. When the program is running, it gives commands to the driver and all kinds of switches, quickly analyzes feedback information and compares it with the command it has given for any difference, and promptly gives further commands. This keeps happening until the program stops. When the program stops, the system will give a command to stop the tool tip at a designated position.

#### 2. Principle of Operation Systems

- A. PC1 system, which is designed for running under WINDOWS XP environment, is a G-CODE programming software built up on the basis of CAD and with reference to the characteristics of CAD. It could be directly loaded into CAD for operation, while the drawings made by CAD could be transferred into codes directly. GNC's control software will give commands through the motion control card based on the codes.
- B. PC2 system, which is designed for running under WINDOWS XP environment, is a JETSTREAM programming software built up on the basis of BOBCAD and with reference to the characteristics of BOBCAD. It could turn BOBCAD into codes and send them out through the motion control card, while at the same time monitor real-time feedback and make adjustments whenever it is necessary.

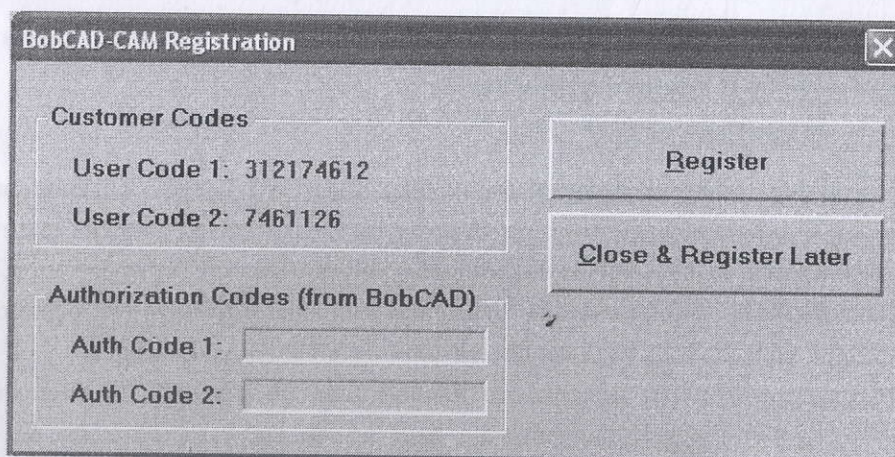




## Section 2 Installation & Operation of PC-based System

### 2a. Install and Setup BobCad/CAM for use with Jetstream Waterjet

1. Install BobCad/Cam v21 or higher on the PC by inserting the disk and double clicking on the Setup.exe icon. When prompted select "Full Installation". If you do not have a BobCad/CAM v21 installation disk, the program can be downloaded at their website, [www.bobcad.com](http://www.bobcad.com).
2. Run BobCad/CAM by going to the Start Menu > All Programs > BobCad-CAM v21 > BobCad-CAM v21 or by double clicking on the Desktop Shortcut.
3. When first run, the BCL License status screen will appear. The top right hand side of this dialog contains 2 command buttons; "Run Demo" will appear until the Application has been installed for more than 30 days, after that period it will change to "Close". The other command button is "Register". Click on "Register"
4. Another dialog will appear containing a frame titled "Customer Codes". This Frame contains User Code 1 and User Code 2. Send these codes as well as the customer information (Customer Name, Address, Contact details) to [mds\\_digitizer@hotmail.com](mailto:mds_digitizer@hotmail.com). Authorization codes will be sent back within 1 working day.

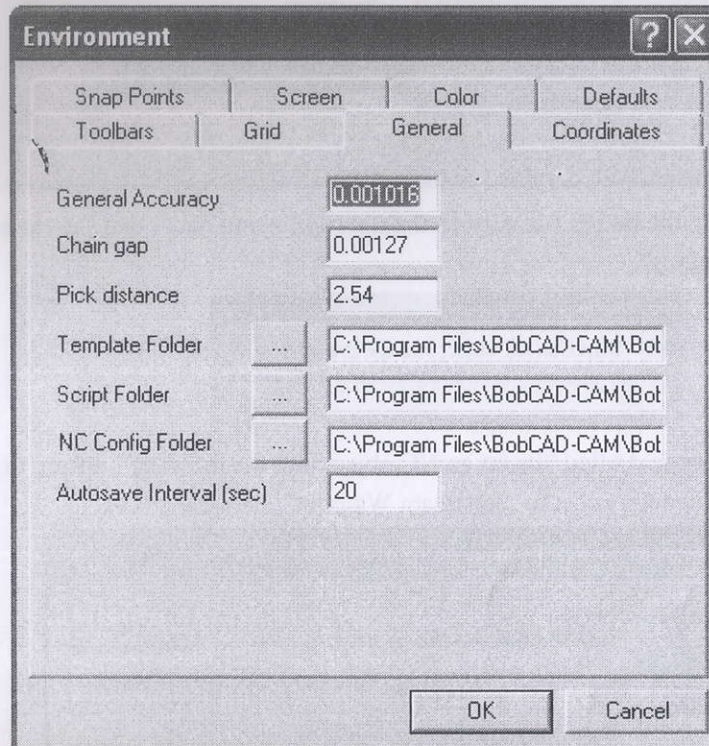


5. When Authorization codes are received, enter them in the 2 text boxes contained in the frame titled "Authorization Codes (From BobCAD)". Normally only 1 authorization code is used and therefore Auth Code 2 is left blank.
6. Click "Register". \*\*\*\*Important\*\*\*\* you must left mouse click on the "register" command button; do not press the "enter" key. The program will not register properly.
7. If the correct codes were entered, then a message box will appear letting you know that registration was completed successfully. If not check that you entered the codes correctly.
8. Using Windows Explorer navigate to "C:\Program Files\BobCAD-CAM\BobCAD-CAM V21\NC Config". Delete the contents of this folder. Copy and paste the file "Jetstream Waterjet.cfg" that is included with this manual.

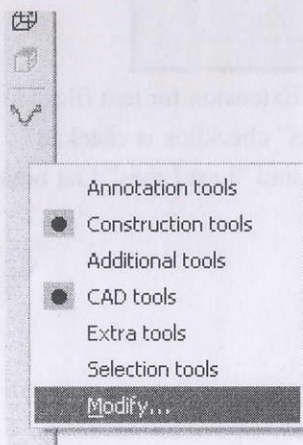




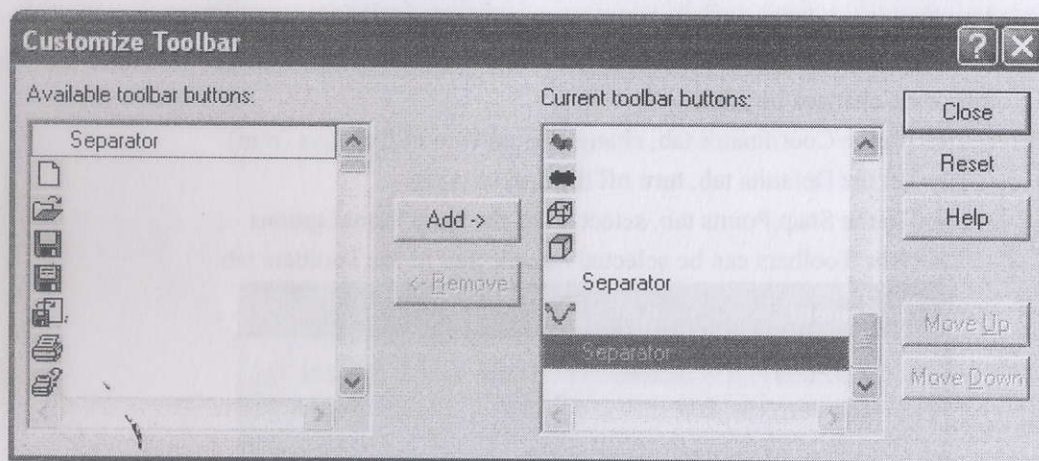
9. Now that BobCad/CAM has been successfully installed, run the program and start a new drawing.
10. To Setup the drawing environment, go to File > Environment. It is recommended that the following changes be made;
  - In the Coordinates tab, change the units to millimeters (mm)
  - In the Defaults tab, turn off the Screen Axis
  - In the Snap Points tab, select all of the Snap Point Options
  - The Toolbars can be selected / deselected in the Toolbars tab.



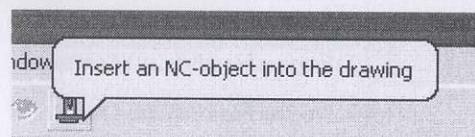
11. Toolbars can also be modified by right clicking on a toolbar. The context menu displayed sets which toolbars are displayed. You can select what items are displayed on a toolbar by selecting "Modify", the bottom member of the context menu.



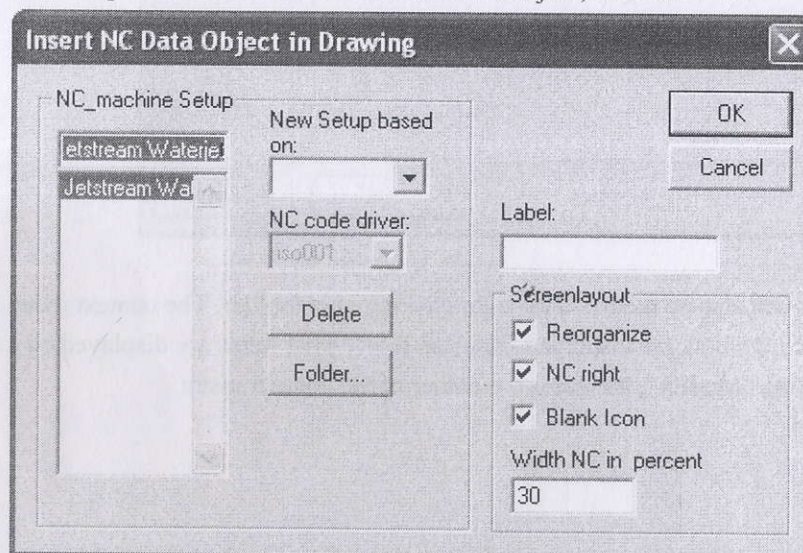




12. In BobCad click on the button (usually on the top right menu bar) titled "Insert an NC object into the drawing".

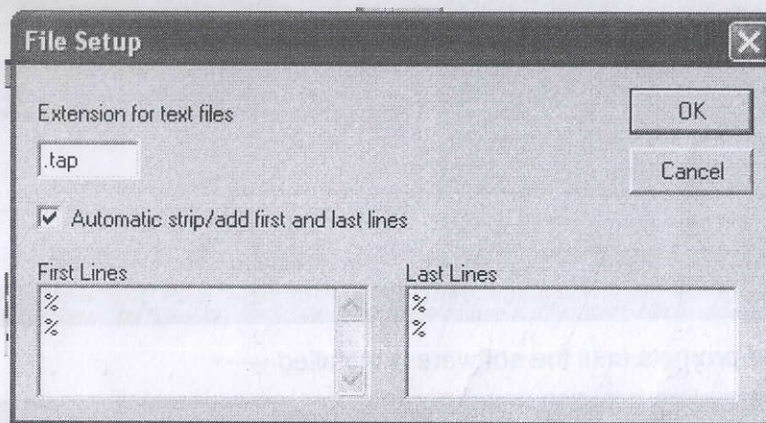
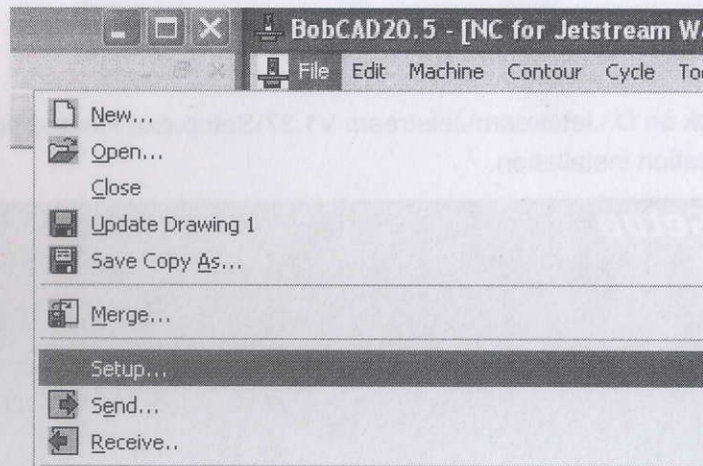


13. A dialog box will appear titled "Insert an NC object into the drawing", ensure that the NC Machine Setup Parameter is set to "Jetstream Waterjet", then click 'OK'



14. In the NC windows top menu bar go to File > Setup. Set the "Extension for text files" to ".tap". Ensure the "Automatically strip / add first and last lines" checkbox is checked. Place 2 "%" signs (one above each other) in the "First Lines" and "Last Lines" List boxes. Click "OK"





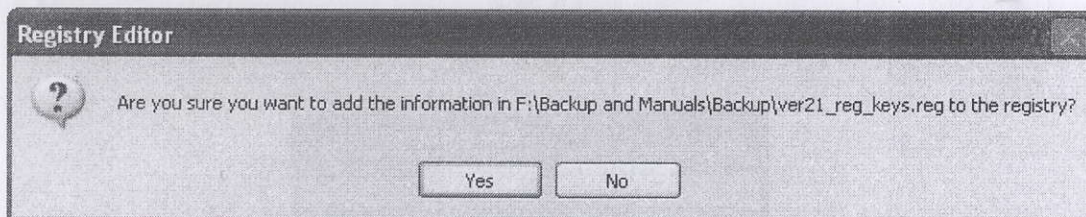
15. When drawing objects in BobCad, the “3D” option always should be off.

Notes:

- If BobCad should fail to open when launched from the desktop, re-install the registry keys included with this manual, by double clicking on the icon shown below.



A message box similar to this will ask you if you want to add the registry keys. Click “Yes”

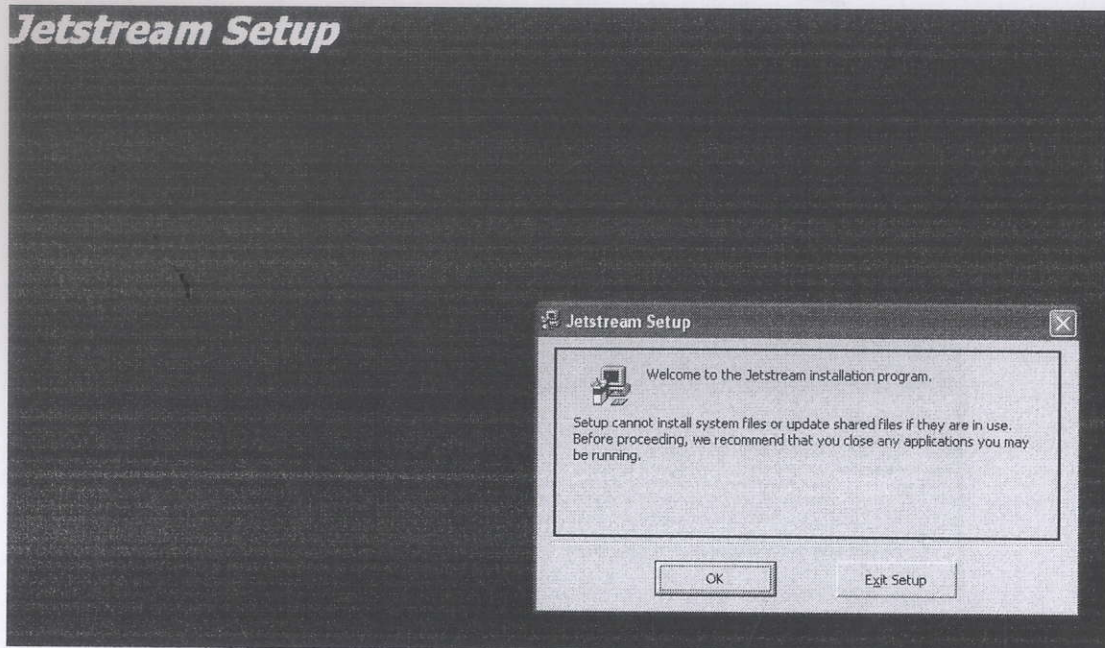


Repeat steps 9 – 14 to re-setup the program.

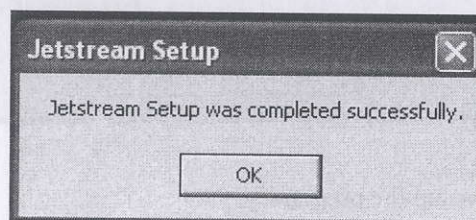
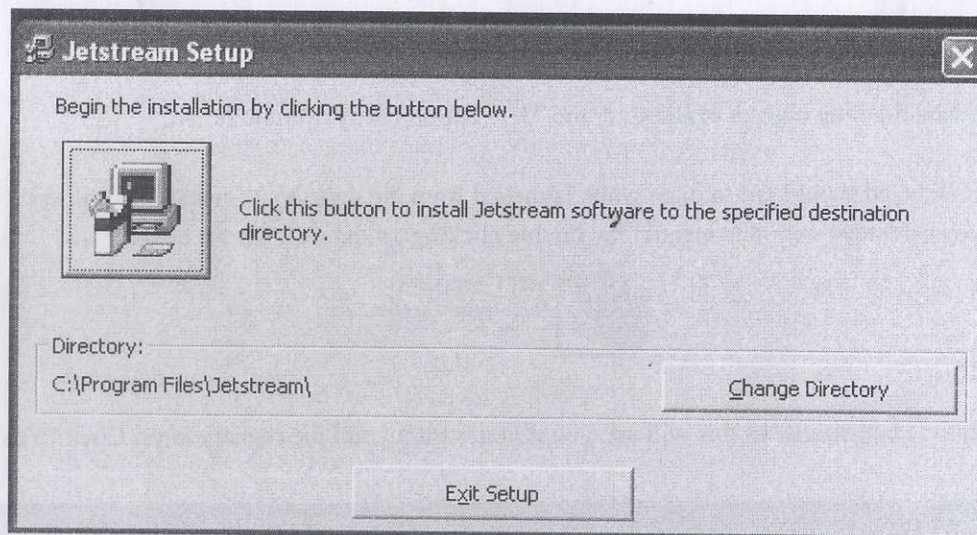


## 2b. Install and Setup Jetstream Application

1. Double click on D:\Jetstream\Jetstream V1.37\Setup.exe located on this CD to start application installation.

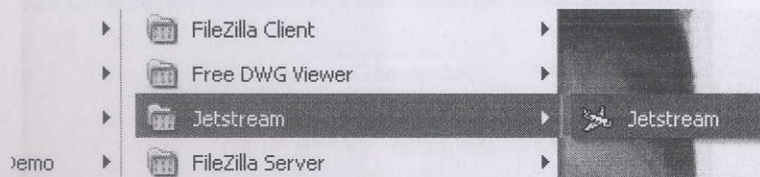


2. Follow the prompts until the software is installed





3. The Jetstream Application can be run from Start Menu > Jetstream > Jetstream.



The following dialog box will be displayed;

 A screenshot of a dialog box titled "Enter User Details". It contains two input fields: "User Name:" followed by a single text box, and "User Code:" followed by five separate character input boxes. At the bottom of the dialog, there are two buttons: "OK" and "Cancel".

If the User Name and User Codes are known, then enter it now and click "OK", if it is a new installation and no User Name and User Code has been created yet, and then click "Cancel". The following will describe how to create a new User Name and User Code;

- After Cancel has been clicked run the Jetstream License App Generator found in D:\Jetstream\Jetstream License Generator
- Enter the Name of the Company that you want to register and the size of the machine.

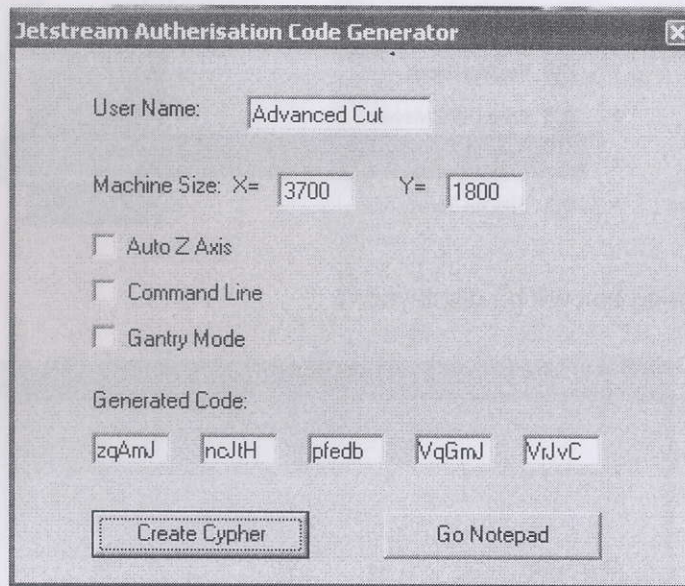
 A screenshot of a dialog box titled "Jetstream Authorisation Code Generator". It contains the following fields and options:
 

- "User Name:" followed by a text box containing the text "Advanced Cut".
- "Machine Size: X=" followed by a text box containing "3700", and "Y=" followed by a text box containing "1800".
- Three unchecked checkboxes: "Auto Z Axis", "Command Line", and "Gantry Mode".
- "Generated Code:" followed by five empty character input boxes.
- Two buttons at the bottom: "Create Cypher" and "Go Notepad".

If the machine is going to use the Auto Z axis option, the Command Line option or the Gantry Mode Option select the corresponding check box.



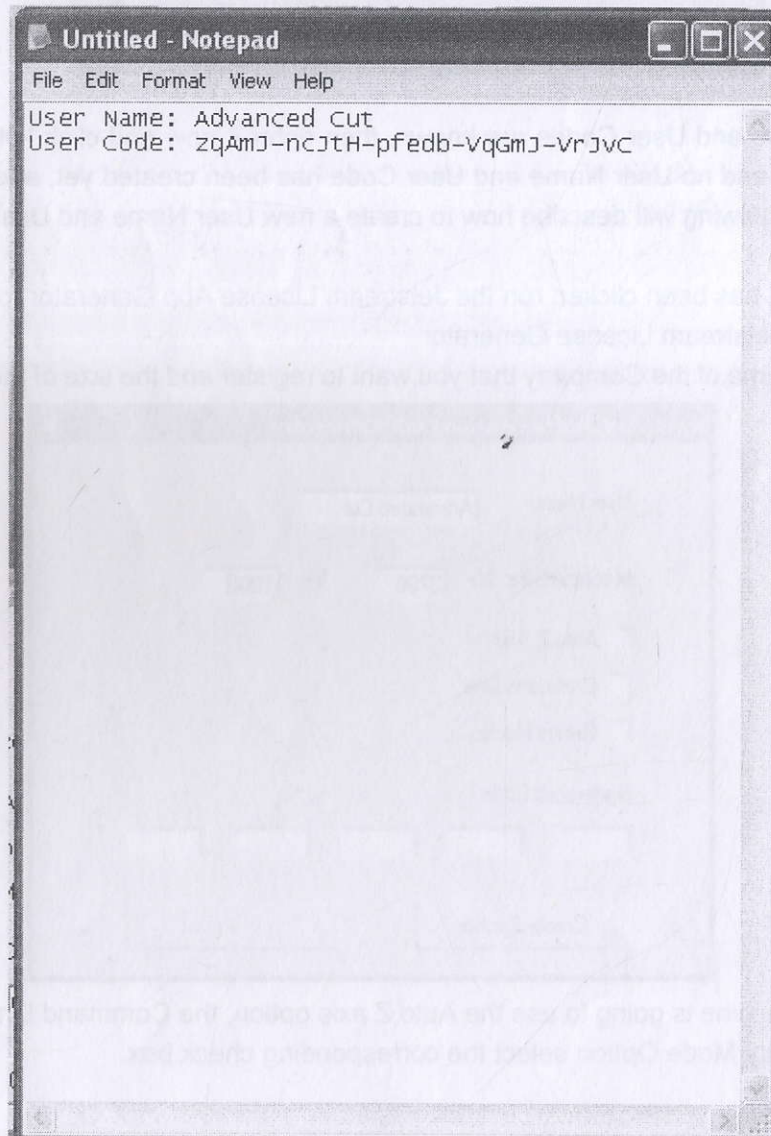
- Click "Create Cypher"



The dialog box is titled "Jetstream Authorisation Code Generator". It contains the following fields and options:

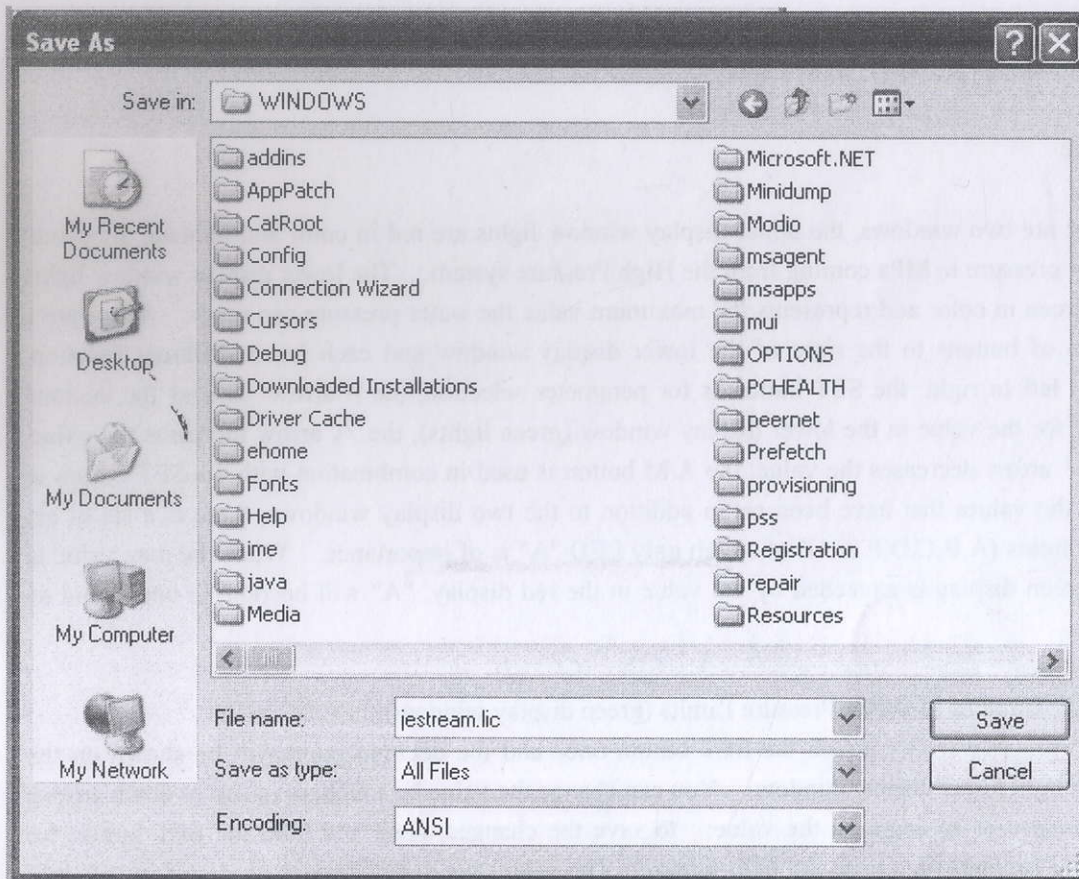
- User Name:
- Machine Size: X=  Y=
- ☐ Auto Z Axis
- ☐ Command Line
- ☐ Gantry Mode
- Generated Code:
- 

- Now click "Go Notepad" and Notepad.exe will be launched as shown.





- In Notepad.exe go to File > Save As



File Name: Jetstream.lic

Location: C:\WINDOWS

Save as type: All Files

Encoding: ANSI

- Now close down the License file and the License File Generator. The Jetstream Application should now be able to be run.
4. The first time the Jetstream Application is run, values must be entered in each of the Settings forms. These can be found on the main screen of the application under the menu item "Settings". For all 3 members of this Menu Item (Cutting Settings, Autorun Settings and Machine Settings), values must be entered.

Note:

Make sure that "Save as type" is set to "All Files". If it is left as a .txt document then the license file will be saved as Jetstream.lic.txt and will not work.

The Jetstream License Generator Application is for OEM use only and not for re-distribution.



## Section 3 Pressure Indicator and Its Setup

### 1. Features of the XMT 3000 display

#### Usage

There are two windows, the upper display window lights are red in color and indicate the actual water pressure in MPa coming from the High Pressure system. The lower display window lights are green in color and represents the maximum value the water pressure can reach. There are a series of buttons to the right of the lower display window and each has a different function. From left to right: the SET button is for parameter selection, the > arrow moves the decimal point for the value in the lower display window (green lights), the ^ arrow increases the value, the v arrow decreases the value, the A/M button is used in combination with the SET button to save the values that have been set. In addition to the two display windows, there is a set of six LED lights (A,B,C,D,E & G) of which only LED "A" is of importance. When the max value in the green display is exceeded by the value in the red display, "A" will become lit and sound an alarm.

#### 1a. Adjustments of Water Pressure Limits (green display window)

After you power ON, touch the SET button once and the decimal point will be shown on the green light lower display window. You can change the value by touching the up or down arrows to increase or to decrease the value; to save the changes, push and hold the SET button for about 3 seconds then push the A/M button. The values set in this display are listed in the chart below for each machine class.

#### 2. Adjustments of Measured Values

When adjusting the value in the upper display window (red lights) one must take into consideration the size of the machine in use - 320, 380 or 420 MPa. Below is a chart of the recommended values for each. Also, one must become familiar with two gages located on the front (right side) of the High Pressure Generator. The upper gage (the largest of the two) indicates the oil pressure, with a range from 0-40 MPa. The smaller gage is the water pressure indicator, with a range from 0-1.0 MPa. To convert the metric value MPa to PSI, take the figure on the indicator and multiply it by 14.3.

When calculating the measured value in the red display, the simple formula is applied: multiply the value found on the oil pressure gage by 21. In practice, a 320 MPa machine cutting glass will normally have oil pressure of around 10MPa, thus, a measured value of around 210 MPa (see chart below). When adjusting measured values, one will need the password, which has been set in the factory at "486". The following case will walk one through the steps necessary to change a red display value from "165" to "210".

#### 2a. Procedure for password

- 1) power on the unit (push the Emergency button off then on again)
- 2) in about 5 seconds, a 3-digit number will appear in the green display
- 3) to change it to 486, press SET once then A/M once until SEL appears in the red display screen
- 4) use the up or down arrows to change the value to 486





5) to save it, press SET then release, again and again (should be 6 times) until "LUP" appears in the red display, then press SET and hold it for about 3 seconds then press A/M

Note: If this procedure was successful, the values that appears in the green display will be the limit you set for your machine (e.g. 340 for a 320 MPa machine) in the first step and the red display will have a new value which may or may not be correct.

#### 2b. Procedure for changing measured value

After saving the password in Step 5, a value will appear in the red display - e.g. 165; the value we need in this display should be 210; the factory has set a base value of 2000 that will be used in calculating what the measured value should be; since the difference between the current measured value (165) and the desired measured value (210) is 45, we must multiply this number by 8 and add the result to 2000 to obtain a new base value; e.g.  $(45 * 8) + 2000 = 2360$ ;

6) using the arrow keys, set the value of 2360 in the green box; to save it. Press and hold SET for about 3 seconds then press A/M once; the value in the red display should be 210.

Note: you may see some fluctuation in the values by one or two which is normal; e.g. the value will go from 210 to 212 then back.

Recommended Adjusted Values Chart

MPa	Maximum limit water pressure	Measured Value for water pressure
320	340	210
380	400	
420	440	378



## Chapter IX Preservation, Maintenance and Safety

1. Under normal working conditions, the guides and ball lead screws must be guaranteed with good lubrication. Prior to each shift, pull the lubricating bar for oiling. It's better to oil on no-load operation. Lubricating oil is N32.
2. Every three months, open dust proof cover to clean the guides and ball lead screws and inspect if the ball lead screws have axial run-out, the guides get rust and the supplied oil flow smooth.
3. In order to ensure oil clean and smooth, it is necessary to dismantle and clean the oil filters every three months (The screens can be cleaned by an old tooth brush), and clean the oil tank every six months.
4. Cartridges of water filters must be cleaned and replaced timely, if necessary, so as to guarantee HP water clean and smooth.
5. Every six months test the gas pressure of accumulator(300MPa~340MPa Machine, 10MPa; 380MPa~420MPa Machine, 12MPa) .
6. After working each day, it is needed to clean and clear up the outer surfaces and surrounding environment so as to decrease impact of sand and water on machine.
7. Inspect the electric devices and circuits at regular intervals, check if the connection gets loose, electric cables is damaged, dust gets removed so as to guarantee safe operation of electric circuits and normal operation of electric devices.
8. In cold weather or during the long outage, it is necessary to drain off water in the water filters in order to avoid frost cracking or rust.
9. **It is prohibited to operate the machine beyond the rated Max pressure so as to prevent from incidents occurring.**
10. During operation there is possibility of burst for HP pipes, please keep proper distance away from the machine.
11. Precision elements are installed in the driving motors of machine, so it is prohibited to knock and impact the machine.





## Chapter X Troubleshooting & Remedies

### Section 1 Common Mechanical Faults

Faults	Possible Causes	Remedies
Unstable pressure, large oscillation of indicator of oil pressure gauge with abnormal noise	Low pressure, insufficient water supply	Increase water supply pressure; check if the booster pump operates.
	Dirt blocks up the cartridge of water filter.	Dismantle and clean the filter, replace it if necessary.
	Bad seal in a plug or a check valve	Dismantle and lap the plug and seal or check valve seat and spool, if necessary, replace them.
	Booster cylinder, plug, HP pipe or accumulator bursts up.	Check if they have spray-like leakage. If so, replace them.
	Insufficient oil supply or oil pump damage	Slightly increase the flow of oil pump or pressure of unloading valve. If the pump is damaged, replace it.
	Insufficient nitrogen pressure in accumulator	Check the gas pressure of accumulator. If the bladder is damaged, replace it.
The direction can't be switched over, HP water can't be supplied, but the oil pump is rotating.	Blockage of gem nozzle or sand-injecting tube	Dismantle nozzle body, get rid of gem and remove blocking thing.
	Proximity switch is slackened, thus resulting in one side not being induced.	Move the switch so as to be induced by signals, but it is allowed to make two sides induced at the same time.
	Damage of signal rod or bending of switching-over spring	Dismantlement and check. In general, the cause is deformation of switching-over spring and it needs to be replaced.
	Water switch jams or center ball drops off.	Turn up the cylinder of water switch a bit or replace the center.
	The spool of check valve jams.	Clean the spool. If the circlip is broken, replace it.
	Relays KA10, KA11 or KA12 damaged	Check them one by one. Replace failed one.
	One proximity switch failed at least.	Use a metal piece to induce the switch in turn, observe whether the lamps on the switch and check valve light up by turns. If the switch is induced without lighting or not induced with lighting, it is damaged and needs to be replaced.
	Foreign matters in the hydraulic circuit.	Dismantle the oil pipe for inspection and take out foreign matters.
Leakage of water from inspection hole of end cover	Y seal or framework oil seal, HP seal wore off	Dismantle HP cylinder, fetch out and replace seals.
	If water leakage often occurs, inspect the piston rod.	If the piston rod is damaged, replace it.
Leakage of oil from inspection hole of end cover	Oil seal wore off.	Dismantle HP cylinder, fetch out and replace seals.
	The piston rod is damaged and scratched.	Replace the piston rod.
Non-ideal cutting effects and slow speed drop	Hole diameter of gem nozzle got enlarged and pressure became lower.	Replace gem nozzle.
	ID of sand-injecting tube became bigger or ellipse.	Replace the sand-injecting tube.
	Bad concentricity between gem and sand-injecting tube	Align the gem to the sand-injecting tube. If concentricity can't be reached, replace the spraying head body.
	Problem of sand quality or improper sand flow	80# imported sand is the best and adjust sand flow.
Water switch	Insufficient gas pressure	Gas pressure is generally about 3kg.



can't seal water.	The contact surface between the center and the seat is not tight.	Replace seat.
Leakage of water from inspection hole over water switch	Seal of water switch or center damaged	Replace seal of water switch or center.
Leakage of water from inspection hole under water switch	HP outer pipe isn't tightened or the seat has problem.	Retighten HP outer pipe. If it doesn't work, replace the seat and copper washer.
Sudden interruption of sand supply	Sand feeding tube or sand control valve blocked	Dismantle the feeding tube or sand control valve, fetch out foreign matters and purge them clean.
	Breakage of sand feeding tube without suction force	Replace plastic sand feeding tube.
	Debris in sand	It is necessary to check if there is debris in the sand cup or tube and to guarantee the purity of sand.
As soon as the oil pump starts running, high pressure turns on automatically.	Jamming of unloading valve makes it open.	Dismantle the unloading valve, clean the spool and make it move free and smooth.
	Damage of relay KA3	Replace it.
HP can't be on	Driving doesn't switch on.	Press the button on the NC panel.
	Damage of relays KA1 or KA3	Check them one by one and replace the failed one.
	Jamming of unloading valve makes it close	Dismantle the unloading valve, clean the spool and make it move free and smooth.
Sand valve can't open up or close up.	The spool of sand valve jams and doesn't move.	Dismantle and check the spool, check if the air valve functions free.
	Damage of relays KA3, KA4 or KA5	Check them one by one and replace the failed one.
Cutting dimensions and accuracy are beyond tolerance, the cut circle shows zigzag or ellipse pattern.	X or Y axes lead screws occur axial run-out.	Check the bearings at both sides of X and Y axial lead screws; if looseness occurs, retighten the nut.
	X or Y axes lead screws appear wear problem.	Adjust the gap between lead screw and nut. In case of serious wear, it is needed to replace the lead screw.
	Damage of guides or slide blocks at X or Y axis	Adjustment is impossible and they should be replaced.
	There are perpendicularity errors in X and Y axes.	Adjust the angle between beams X and Y to 90° With a square and a dial gauge.
	Problems in driver parameters or system	Maybe the parameters can be adjusted at first. If it doesn't work, we need to repair the host or system hardware.
Red indicator lights up and the machine can't run.	Emergency button gets pressed down.	Turn the emergency switch clockwise and relieve emergency stop.
	Limit alarming	Check if over stroke exists in positive and negative directions of X, Y, Z axes. If so, movement should be made in the negative direction.
	Errors** appear in systematic alarm.	Click Cancel key to eliminate errors or operate according 《Programming & Operation.》, P58-P59.
	The driver alarms and the display blinks ERROR	Refer to 《Installation and Operation Manual of AC Servo System》, P25—P27, troubleshoot in accordance with alarm codes or contact us.



	Pressure indicator breaks down.	If removal of Line 47# can relieve alarm, maybe the indicator breaks down and needs to be replaced.
Loud noise of oil pump. The noise intensifies after HP switches on.	Polluted oil filter and high suction resistance	Dismantle the oil filter and clean the screen.
	Unsealed suction line causes air invasion	Check if the air enters the inlet line. If so, eliminate it.
	Water enters oil or oil is too dirty.	If oil is too dirty or mixes with water, replace it.
	The mating surface between the distributing disk and cylinder body wears off seriously.	Dismantle and check the disk. For light wear, it can be lapped. In case of grave wear, it needs to be replaced.
	The guide wears off or damages.	Dismantle and check it. For light wear, it can be lapped. In case of grave wear, it needs to be replaced.
High temperature of the hydraulic cylinder of booster and rapid rise of oil temperature	Insufficient flow of cooling water	Increase cooling water flow and check if the water pipe line is free and unblocked.
	Improper effects of cooler	Dirt deposits in the cooler and should be cleaned.
	Large flow of oil pump causes overflow too much.	Adjust the flow of oil pump in proper and relief valve as well.
	High ambient temperature	In case of high temperature a fan can be used to strengthen cooling.
	The hydraulic cylinder or its seal in it wears off.	If the cylinder gets scratched, it is necessary to replace the cylinder together with seal.
Injection of sand at the air outlet of sand cup	Air exists in the sand feeding tube.	Use a piece of thin cloth to cover the air outlet and make sand flow in the feeding tube to the full.
	Due to deformation of sand feeding tube, sand can't flow off.	Check if the feeding tube bends up. If so, straighten it.
	Sand has lumped because of humidity and doesn't flow.	The compressor for air supply often needs to drain, sand in the barrel and air should be kept dry.
On cutting, tool tips sometimes have water returned to the sand-injecting tube.	Clogging of sand-injecting tube	No water drained means clogging of sand-injecting tube. Dismantle the feeding tube, assemble it in the opposite direction and flush it.
	Damaged delay relay or long time delay or short time delay	Check the delay relay for switching off HP. In general, time delay is 5-6 sec.
	Water switch can't seal water.	Refer to water switch in the previous page.
Water leakage at one or both sides of accumulator	Plug seal of accumulator damaged	Replace the seal or O ring of accumulator.
	The liner of accumulator bursts up.	Replace it.
On operation the machine bed vibrates.	Improper setup of machine driver parameters	Set up parameters again.
	Failure of driving motor	Send it back for repair or replacement.
	Movement of lead screw or guide is not even and deviation exists in precision.	Check lead screw or guide. On turning the lead screw by hand, the mating status between lead screw and nut appears kind of even tightness without axial run-out.
	The position of lead screw bracket is too high or too low or not concentric with the lead screw.	Adjust the position of lead screw bracket to a proper level.
Tool tips can't move up and down.	Breakdown of Z axis connection	Check the circuit and replace the broken cable.
	The controlling relay is in failure.	Replace it.\
	The Z axis motor burns out or the gearbox blocks up.	If the motor burnt out, replace it; if the gearbox blocked up, clean the gearbox.



## Section 2 Common Electric Faults

### 1. Huaxin CNC Part

Huaxin CNC Part: In case of faults, firstly check whether the emergency button is pressed, the drivers are turned on or power supply is failed..		
Faults	Possible Causes	Remedies
Common system faults: Driver 41 alarms, X and Y axes can't move.	The driver is not switched on and alarms.	Switch on the driver. If alarm occurs, look over the alarm codes and contact us.
Driver 8 alarms	Damage of driver	Dismantle it and return it to the manufacturer for maintenance or replacement.
Common system faults: the system can't read out the content of U disk.	Failure of U disk	Formatting of U disk. Replace U disk..
Common system faults: the program in U disk can't be copied in the system or to the full.	The memory of system is filled at full.	Cancel programs in the system that are not used temporarily.
Z axis can't move up and down.	Blocking motor; tripped relay RL 6, limit switch failure, broken circuit, failed power switch	Press Up/Down button to see whether kA10/kA11 acts in the NC cabinet. If so, failure will occur in the motor circuit of Z axis; if not, the breaker trips. It is due to limit switch failure only if pressing Reset button.
Z axis can move up but not down/ can move down but not up.	Failures of button, circuit or KA10/KA11.	Replace button, check circuit, replace relay
Oil pump can't work.	Signal-off.; failure of relays on miniature relay panel; failure of time relay in booster cabinet; failure of contactor; failure of auxiliary connection of contactor.	Check wiring, replace control relay, and inspect time relay, contactor and auxiliary connection.
HP can't be switched on; the green one of three segmental lamps on the small beam doesn't light up.	Signal-off, relay failure	Check wiring and replace control relays.
Switch on HP but no HP water supply; booster doesn't change over; lamp of unloading valve and the green one of three segmental lamps on the small beam doesn't light up.	Mechanical failure, failures of relays in the booster cabinet and proximity switch	Replace relays. Check proximity switch: under normal operational conditions, the lamp lights up on approaching iron things; if not approaching iron things but the lamp often lights up, it means that the switch is damaged and needs to be replaced.



## 2. Huaxin PC Part

PC Computer: In case of faults, firstly check whether the emergency button is pressed, the drivers are turned on or power supply is failed..		
Faults	Possible Causes	Remedies
Z axis can't move up and down.	Blocking motor; tripped relay RL7, limit switch failure, broken circuit, failed power switch	Press Up/Down button to see whether kA10/kA11 acts in the NC cabinet. If so, the failure will occur in the motor circuit of Z axis; if not, the breaker trips. It is due to the limit switch failure only if pressing Reset button.
Z axis can move up but not down/ can move down but not up.	Failures of button, circuit or KA5/KA6.	Replace button, check circuit, replace relay.
The driver can't be switched on.	Failures of button, limit switch or circuit	Check whether the movements along X/Y axes go beyond the stroke limits and touch the limit switches. Replace Driving button and check if the circuits broke down.
Switch on HP but no HP water supply; booster doesn't change over; lamp of unloading valve and the green one of three segmental lamps on the small beam doesn't light up.	Mechanical failure, failures of relays in the booster cabinet and proximity switch	Replace relays. Check proximity switch: under normal operational conditions, the lamp lights up on approaching iron things; if not approaching iron things but the lamp often lights up, it means that the switch is damaged and needs to be replaced.
The operation software can't be opened and the error tips occur on opening.	Failures of software, control card or computer system due to virus infection.	Reinstall control software and reinsert control card. Destroy virus. Upon turning on PC, click F11 key, resume the system and then replace the control card.
Oil pump can't work.	I/P signal-off.; failure of relays, time relay in booster cabinet, contactor or auxiliary connection of contactor.	Check broken I/P card at the back of PC. Replace control relay, and inspect time relay, contactor and auxiliary connection.
HP can't be switched on; the green one of three segmental lamps on the small beam doesn't light up.	I/P signal-off.; failures of relays, control card or circuit.	Check broken I/P card at the back of PC. Replace control relay and control card.
During operation, numbers of software change, and X and Y axes don't move.	Power failure.	Power failure causes driver alarming. Check power supply and switch it on again.
During operation, numbers of software change, either of X and Y axes don't move.	Driver alarms. Control signal off. Movement control card fails.	Look over alarm codes. Check circuit. Replace control card.
Either of X/Y axes movement occurs in one direction only.	Control signal off. Movement control card fails.	Check the signal line connected with the control card. Change control card.

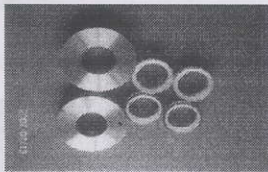


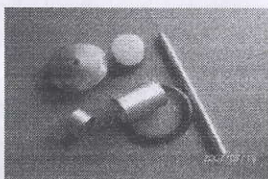
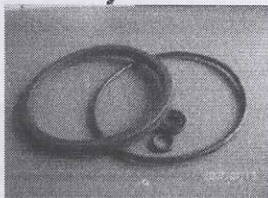
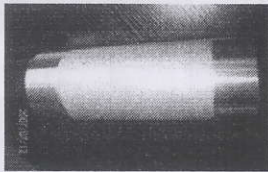
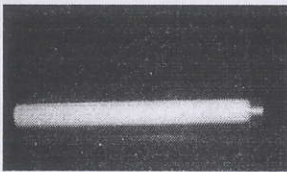


### Section 3 Other Points for Attention in Operation

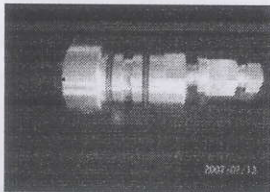








- i. The operators who are not trained or skilled should operate the machine under the guidance of a specialized technician.
- ii. Prior to starting-up, check the working conditions of water, electricity, air and sand, put the machine into operation for a few minutes and then process material.
- iii. On cutting, sand and water spatter. It is necessary to prevent them as much as possible from spattering in electric control devices.
- iv. It is not allowed to make the machine run beyond Max working pressure so as to prevent accidents from happening.
- v. On cutting, pay attention to lifting and lowering of tool tips. Jagged surface to be processed may damage tool tips.
- vi. In case of processing glass or other fragile materials, pay attention to flatness of working platform so as to avoid breakdown of work pieces.
- vii. During the machine is running, the operator can't leave away and should take note of observation at any time.
- viii. As soon as the failure of machine is discover, stop the machine running and turn off HP. It is prohibited to make it run by force or repair it under pressure.
- ix. It is necessary to master the right method for inspection, dismantlement and assembly, otherwise the components may be damaged.
- x. Sufficient cooling water is very important to operation of machine. Please turn on cooling water supply prior to starting up the machine.
- xi. After a certain length of operation time, light leakage on seals is the normal phenomenon and they can still be used under the circumstances that can't impact cutting.
- xii. If HP pipes burst up and there is no relevant stock, repair the pipes with argon arc welding for emergent use.



## Chapter XII Photos of Spare Parts

No.	Description	Code	Sample	Spec	Remarks
1	HP water seal repair kit	M01198			USA
2	Check valve repair kit	M01586			USA
3	Hydraulic seals repair kit	M10641			USA
4	HP water switch repair kit	M00005			USA
5	Pneumatic cylinder repair kit	M00004			USA
6	HP cylinder	M0703832			USA
7	Ceramic piston rod	M1025332			USA

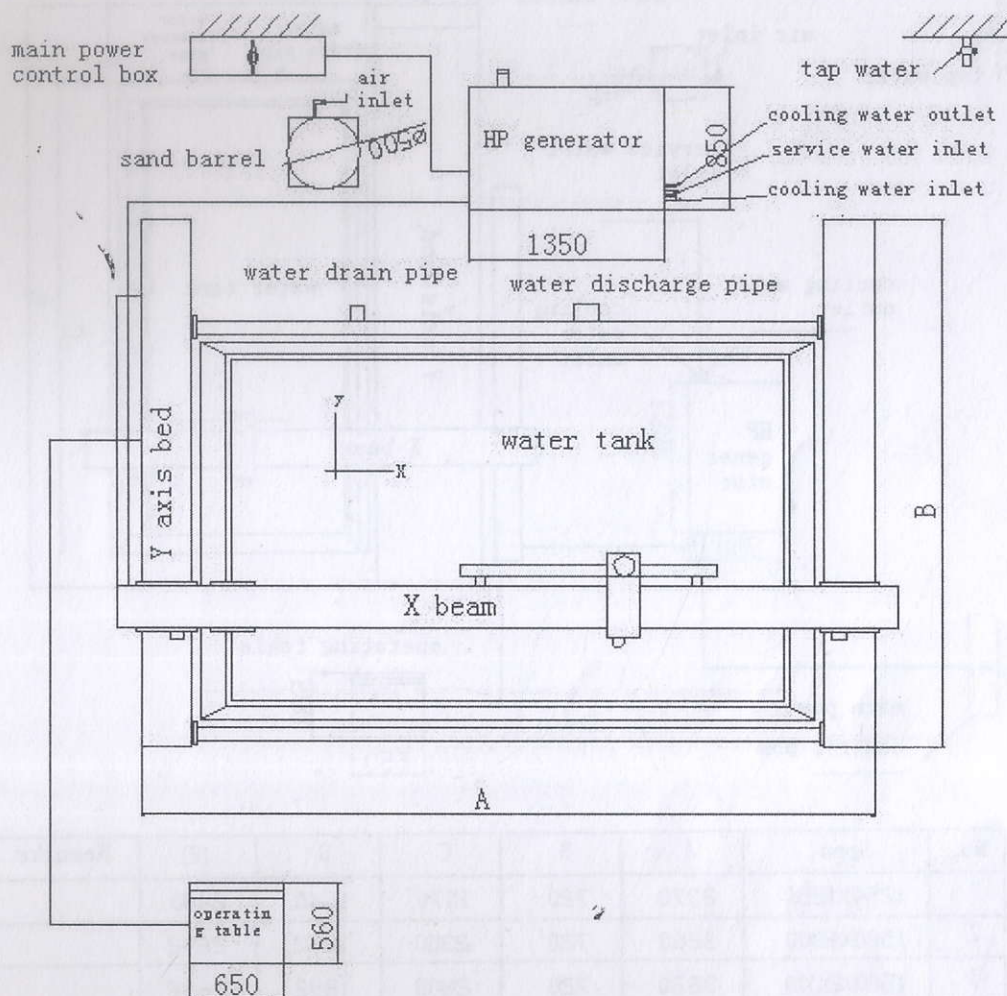


8	HP plug	M04383			USA
9	Check valve body				USA
10	Anti-blocking Blue Goop			2 ounces	USA
11	Switching-over repair tool				
12	Accumulator plug				
13	Dismantling too for 420 booster				
14	Cutting tool tips set				USA
15	HP seals fixture (320Mpa)				
16	HP seals fixture (420Mpa)				



## Chapter XIII Layout Plan of Machine

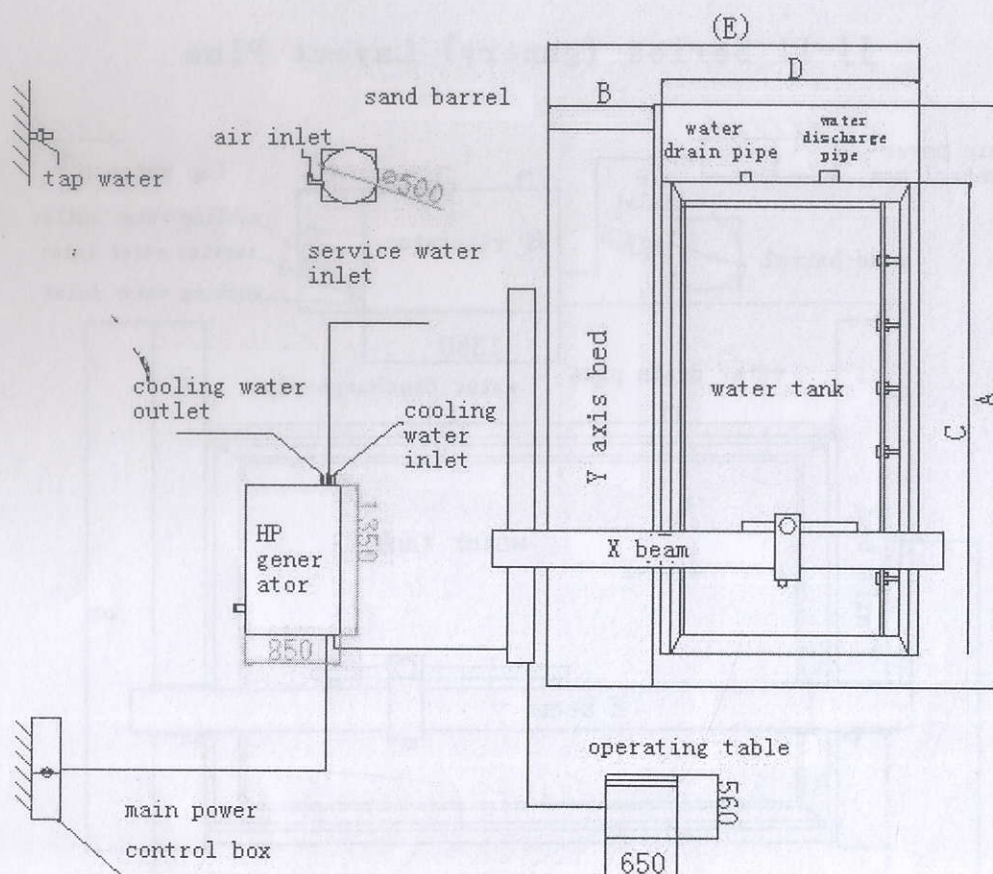
### JJ-II Series (gantry) Layout Plan



No.	Spec	A	B	Remarks
1	3300X2300	4560	3770	
2	3700X2140	4960	3610	
3	3700X2440	4960	3910	



# JJ-I Series (cantilever) Layout Plan



No.	Spec	A	B	C	D	(E)	Remarks
1	1250X1250	2370	720	1570	1640	2400	
2	1500X2000	3260	720	2300	1892	2692	
3	1500X2500	3830	720	2800	1892	2692	
4	1500X3000	4330	720	3300	1892	2692	
5	1500X3700	5030	720	4000	1892	2692	
6	1800X3700	5030	970	4000	2192	3242	
7	1800X4000	5030	970	4292	2192	3242	
8	1840X3700	5030	970	4250	2312	3362	with tilting table



## Chapter XIV Schematic Drawings of Electric Devices & Circuits

Refer to appendices.



## Editorial Notes

After reading over this manual carefully, you may have an overall knowledge of water-cutting machines made by our company. However, from familiar with the machine to skilled operation of it, there is a cumulative process, which requires that you have a high degree of responsibility, strong dedication and serious operation, meticulous maintenance, carefully accumulated work experience. In course of your application, if you have any doubt, please contact the After Service Dept of our company and we will provide you with warm and considerate service.

Our Water Cutting Machine products are in continuous improvement. We hope to hear your voice. If you have any suggestions or comments, please let us know. Adaption to the market and meeting our customers' demands is our relentless pursuit

Because of limited technical level of our writers, there may be insufficiencies in the manual. We hope that the users will point out the shortcomings for our improvement in the next edition.

