



SMALL HOLE EDM OPERATION MANUAL

SUZHOU KINGRED

NOTES IN OPERATION

Please read this manual carefully before actual operation

In order to keep machine working in best suitable, please follow below.

NOTES OF SAFETY

1. Connect ground cable well
2. Do not touch electrode and workpiece during machining
3. Please operate machine while all doors of machine closed.

INSTALLATION AND OPERATION NOTES

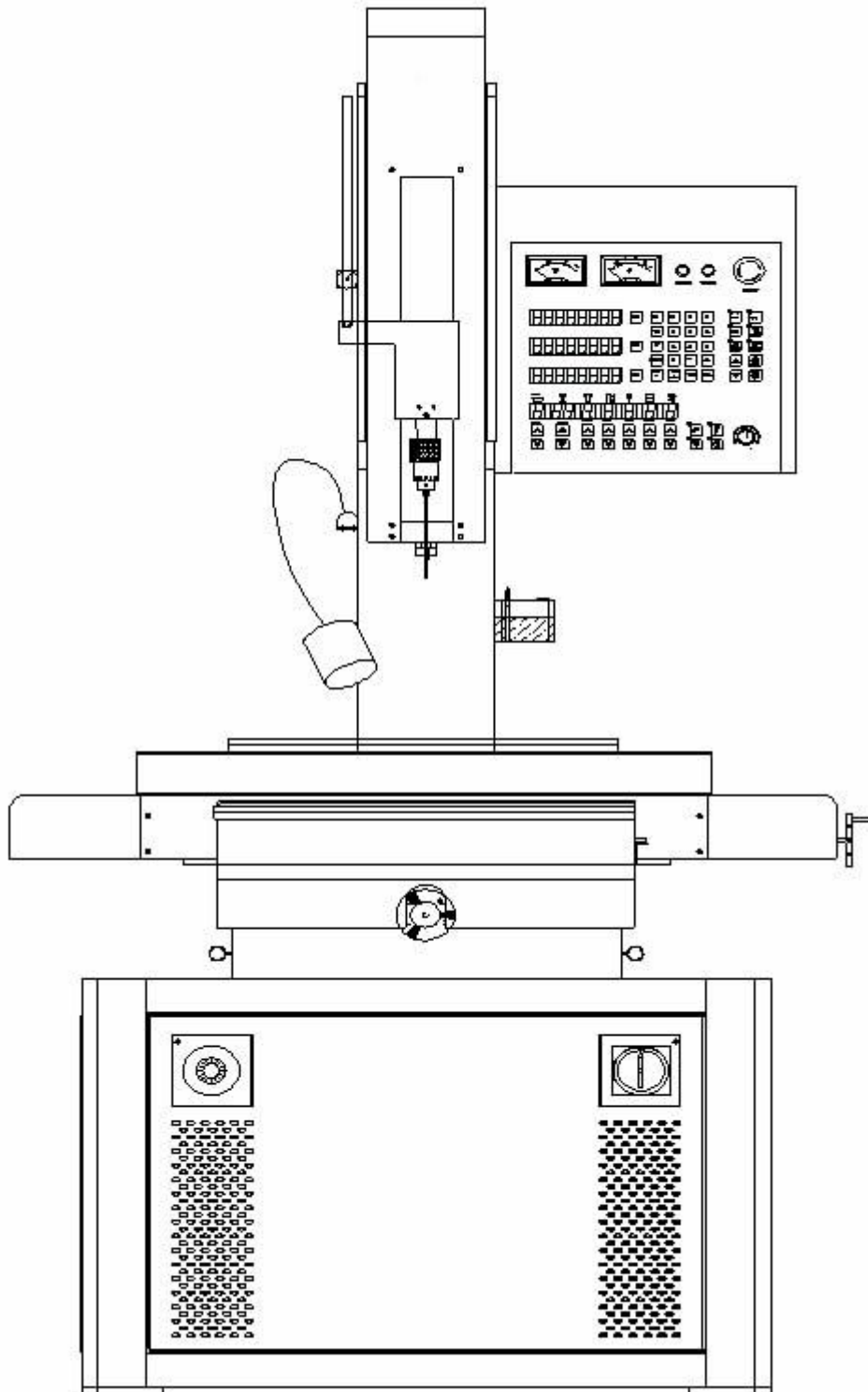
1. Please set machine on flat plane,
2. Don't set machine in below environment
 - Exposed in sunshine with rapid temperature change
 - Keep machine far away from vibration source such as punching machine.
 - Keep machine away from dust and garbage
3. Don't put items on machine body and operation box
4. Don't put other items except workpiece
5. Clean machine after work for next time machining
6. Necessary maintenance is required periodically.
7. After machining, separate electrode and workpiece and shut down power(there would be malfunction when power up machine with electrode touching workpiece)

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1. SUMMARY

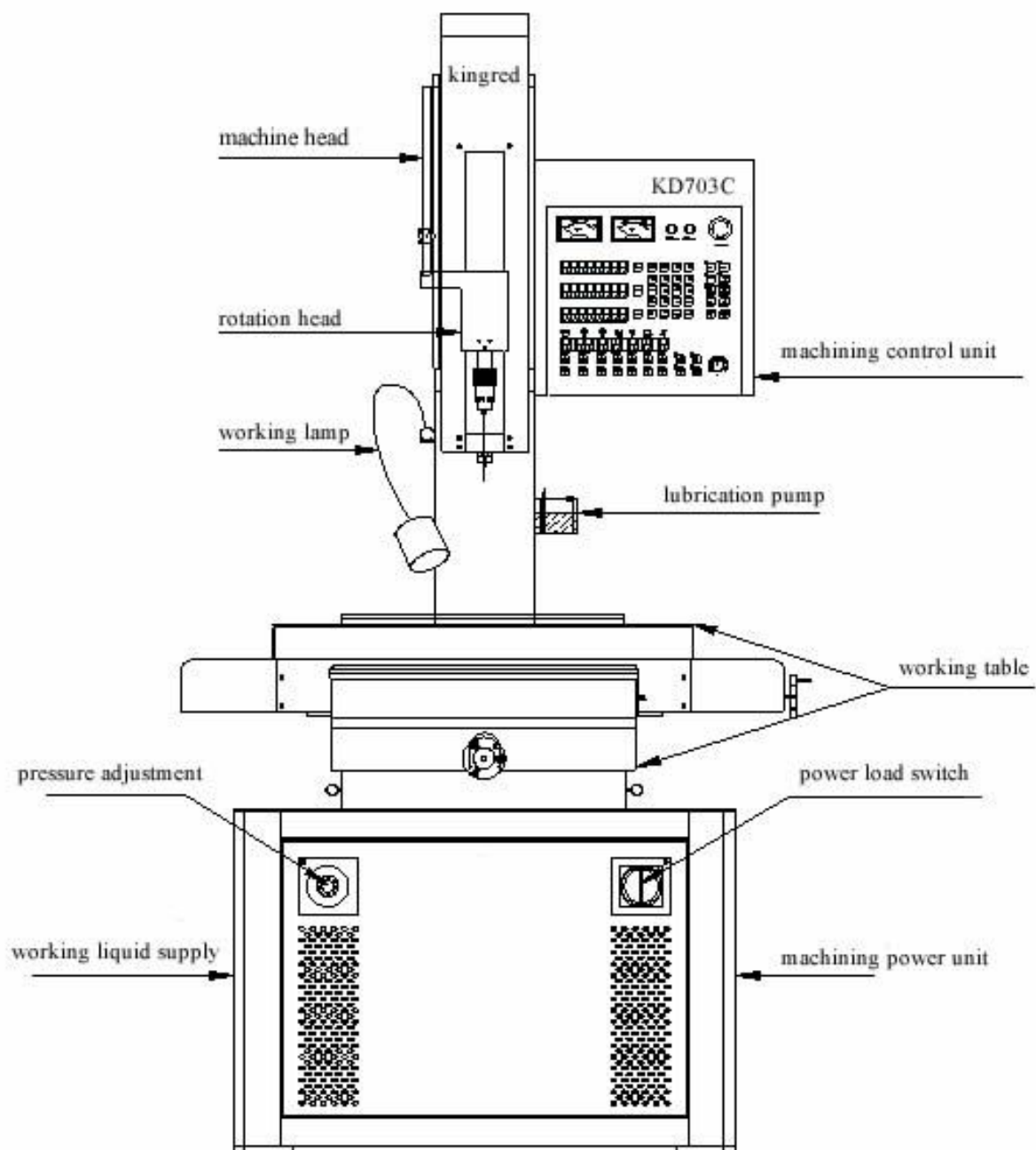
Kingred's small hole EDM machine DK703C uses electrode from $\Phi 0.2 \sim 3.0\text{MM}$, its working principle is to utilize brass or copper tube as an electrode with spark to erode metal with continuous up and down movement.



The manual includes all information of whole operation and maintenance

2.STRUCTURE

Machine includes six parts: machine head, tank body, working table system, working liquid system, machining power system, machining control system.

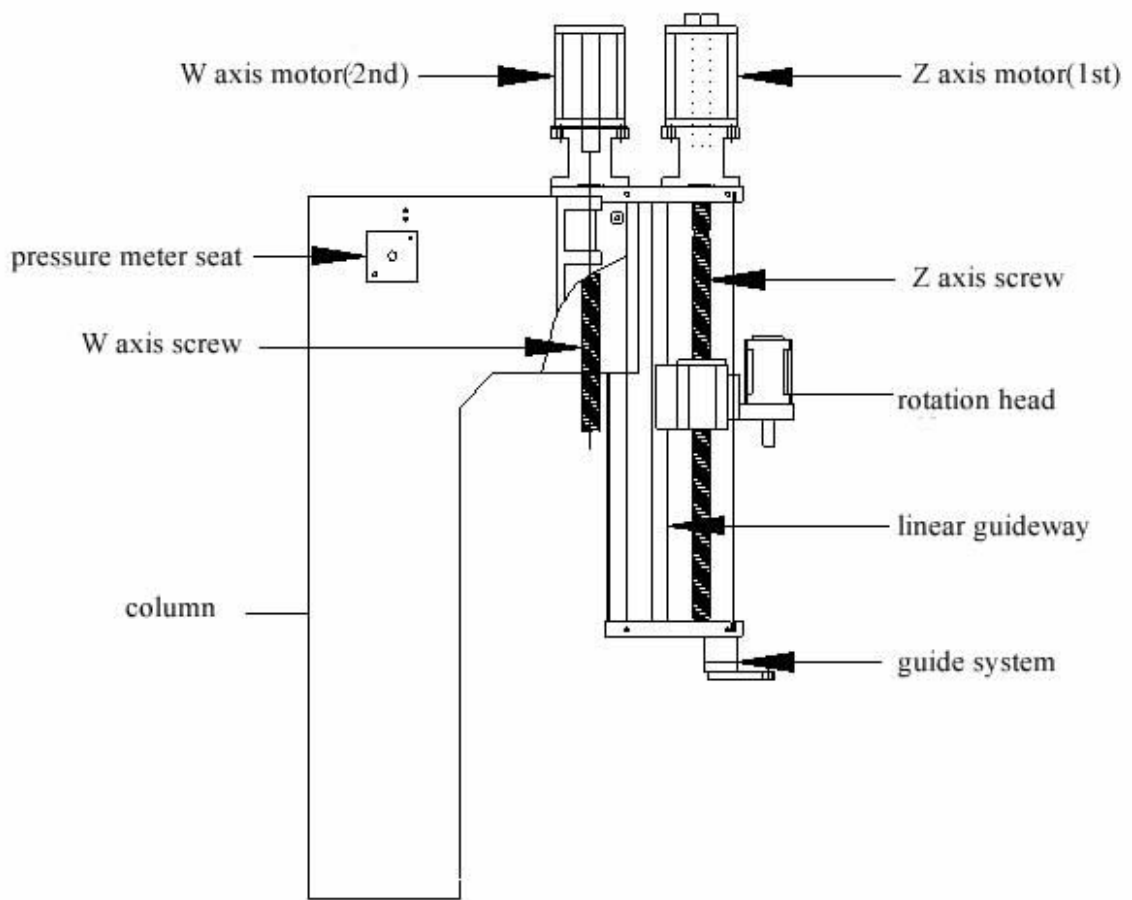


Appearance of machine

1. MACHINE HEAD

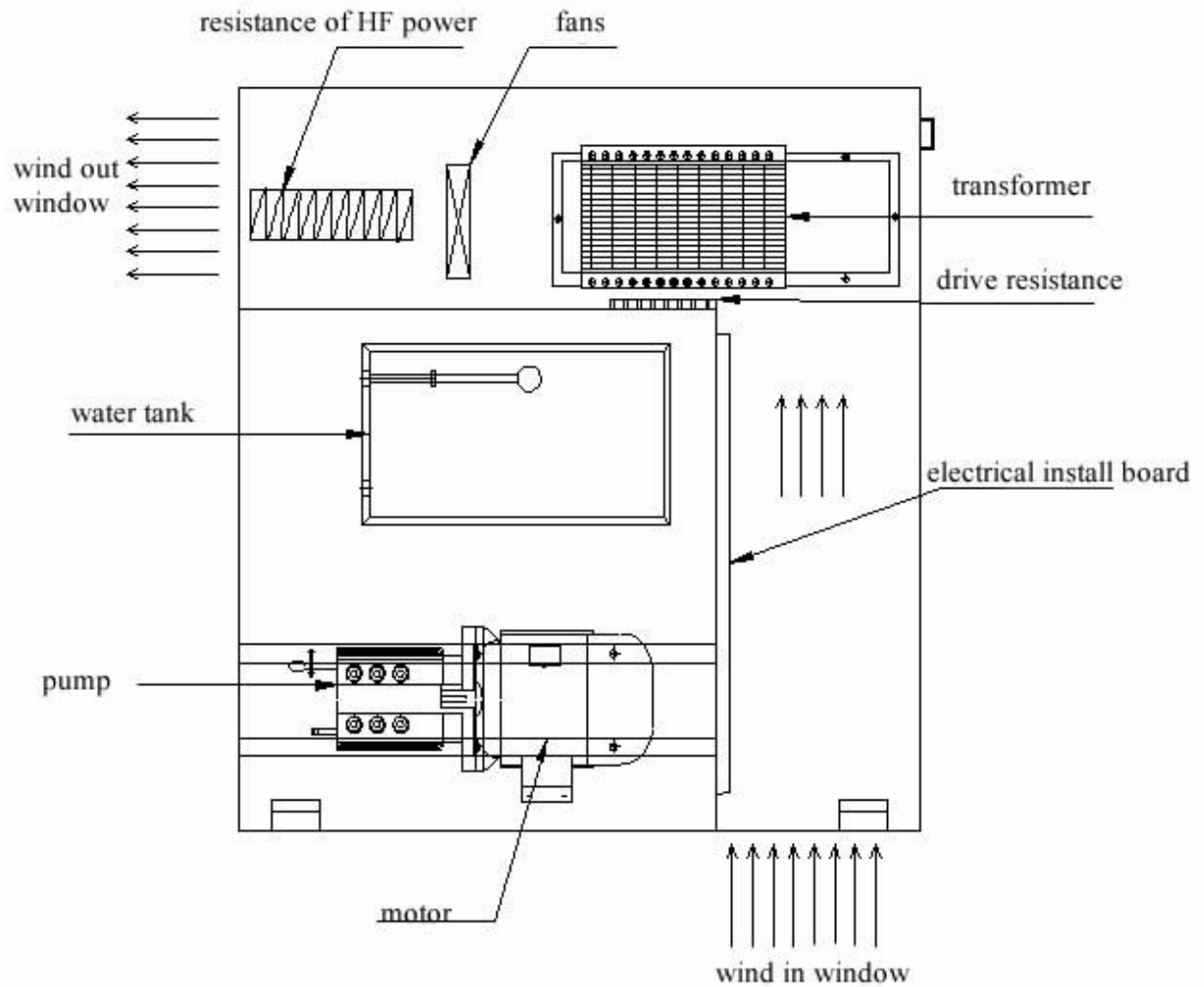
Machine head is installed on column, and consist of spindle system, 2nd travel of Z axis(W axis), rotation head and etc.

Spindle systems perform servo feed of machining..



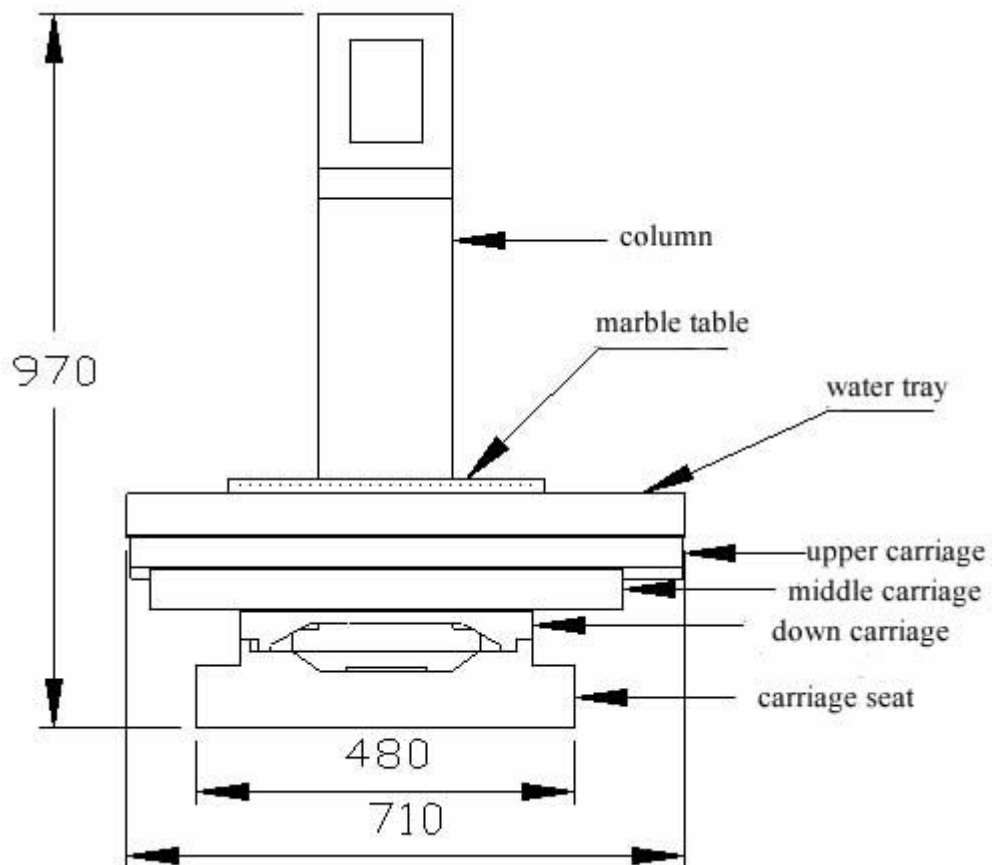
2.Box body

Box body includes working liquid supply system and machining power unit, separate in two space of box body, this structure is easy for maintenance, installation, and cooling.

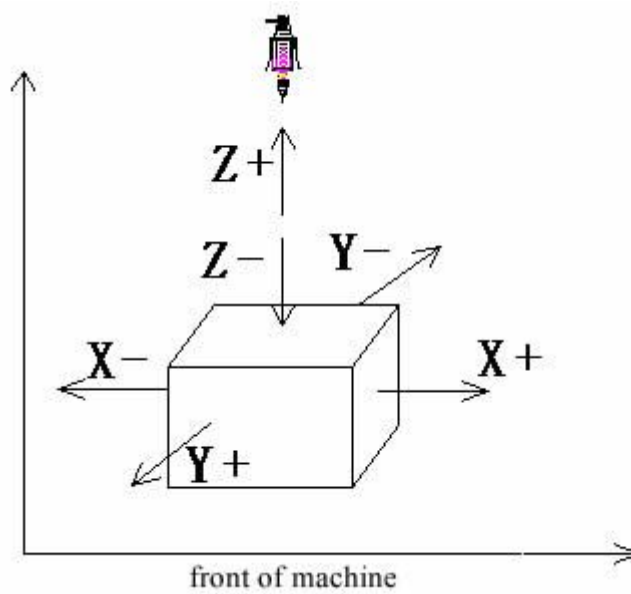


Basic assembly diagram of box body

3. Working table



Working table



Feed coordinate of transmission

3. Parameters of machine

3.1 machine specification

| | | |
|--|------|----------------|
| Overall dimension(L*W*H) | (mm) | 1000*1000*1900 |
| Weight | (KG) | 800 |
| Working table | (mm) | 440*320 |
| Min read unit | (mm) | 0.02 |
| Left and right travel(Y axis) | (mm) | 400 |
| Front and back travel(X axis) | (mm) | 300 |
| Max. load of table | (KG) | 300 |
| Travel of machine head | (mm) | 280 |
| Spindle(Z axis) servo travel | (mm) | 380 |
| Max distance between guide and working table | (mm) | 320 |

3.2 main technical parameters

| | | |
|---|----------|-----------------|
| Electrode range(mm) | (mm) | Φ0.2~Φ3.0 |
| Spindle(Z axis) Max feed speed | (mm/min) | 2200 |
| Rotate speed of spindle head(C 轴) | r/pm | 0~500adjustable |
| Max. input power | KVA | 4.0 |
| Input power | V/HZ | 3*AC380/50 |
| Max machining current | A | 30 |
| 2 nd travel of machine head(W 轴) | | Motorized |
| DROs | | 3 axes |
| Working liquid supply | | Pneumatic pump |
| Max working pressure | Mpa | 10 |

4. Installation

4.1 transportation

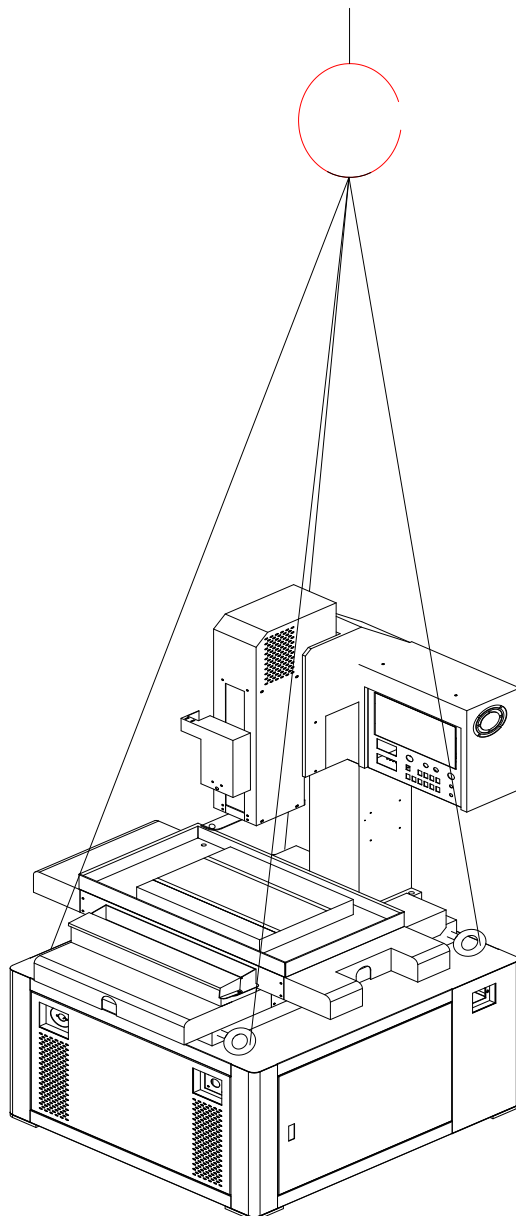
(1). While lifting machine, please use lifting ring bots at two-side of machine base.

There is direct touch between machine and lifting rope, please use wood make sure no direct touching.

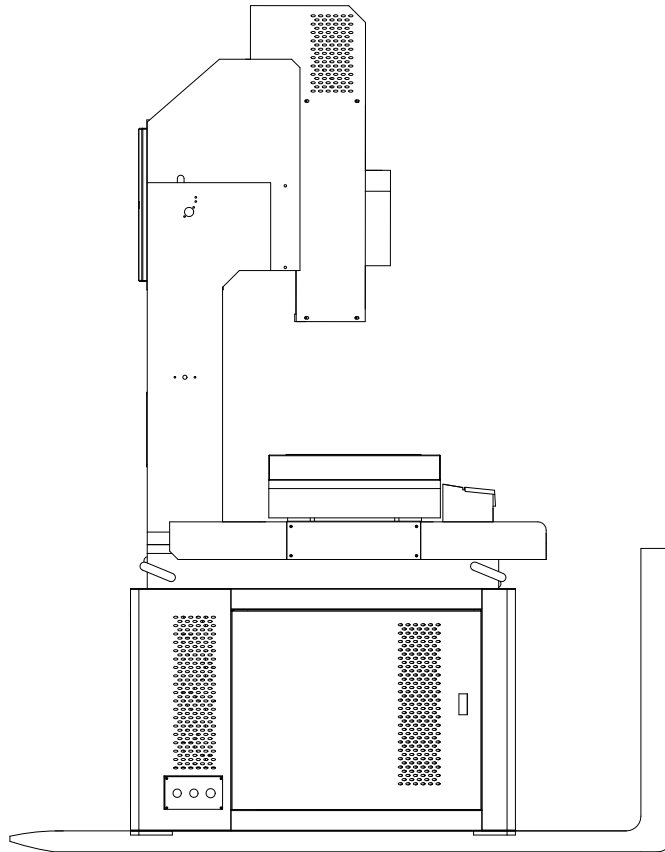
2). While moving machine, please move machine head to lowest position, and then use a wood to support machine had, don't touch stainless guide plate.

(3). Be cautious while moving machine, especially protect spindle head, guide plate and working table, and etc.Keep distance between small hole EDM from other objects.

(4). Lifting indication as below diagram



(5). Transportation by forklift



(6). After arrive destination position, remove fix wood and in stall foot bloc, adjust level.

4.2 setting environment and adjustment

(1). Ground of setting

Please set machine on the ground with enough weight loading capacity.

(2). Vibration

Keep machine away from vibration source.

(3). Setting environment

Place machine in the environment without much effect of machining accuracy, i.e. small temperature change, less moisture, less dust and away from direct sunshine.

(4). Level adjustment

Put gradienter at the center of working table, adjust level through four foot bolts of machine. Please adjust level of working table to less than 0.04mm/m. After adjustment, fasten nuts of foot screw, and make sure all foot screws touch group in good condition.

(5). Temperature management

Try best to keep machine in environment of less temperature change, this is important for drilling performance.

(6). Power voltage

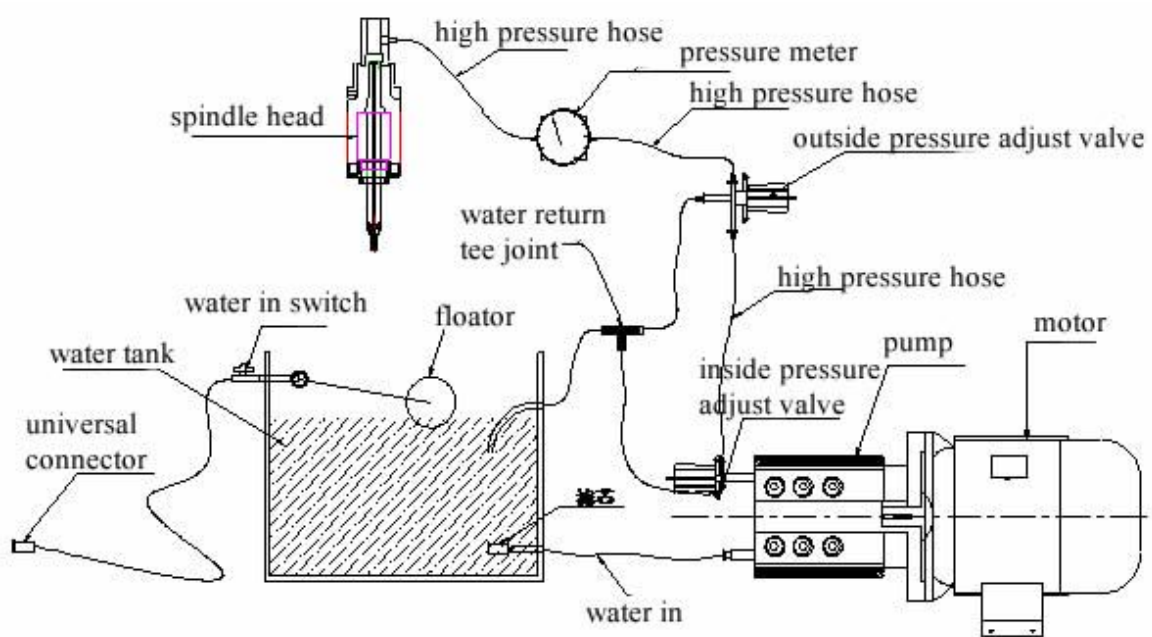
AC380V±7%,50HZ

(7). Ground connection

Ground cable must be connected well.

4.3 Working liquid recycle system

(1).



recycle system of motor drive pump

(2) pump

It's a high pressure, light, small and high speed three cylinder ceramic plunger pump. Water temperature 0~40°C.

Main technical parameters

| | |
|---------------------------|--------------------------------|
| plunger diameter * travel | Φ18x4.5MM |
| Rated rotating speed | 1390r/min |
| Theoretical Throw | 4.88L/min |
| Rated pressure | 7Mpa |
| Matched motor | 750W |
| Lubrication oil | N68-N150 machine oil GB3142-82 |

| | |
|-------------------------------|----------------|
| Plunger material | ceramic |
| Outer dimension | 200x190x115 |
| Seat dimension | 80x80-M6 screw |
| Weight | About 4.8Kg |
| connectors | PC10-3 |
| Thread of water out connector | M12x1.25 |
| Water suck inner diameter | Φ10 |
| Water out inner diameter | Φ6 |

Working principle: Powered by crank, crank's rotary motion into reciprocating motion of the plunger when the plunger back, due to the vacuum suction, water valve open water valve close, water is drawn into the cylinder in the piston forward, due to elevated pressure within the pump, the intake valve closes, water valve open, high pressure water from the water valve to the pressure pipe.

Pump pressure depends on the size of pump outlet dampers, damping pressure is high, whereas low pressure.

Backwater structures within the pump, when the brass plug or pressure gauge when there is no water pressure, the running time of the pump must not exceed 2min.

Seals pump operation there are drops of oil or oil spills, but drop weight not to exceed 1ml/min is a natural phenomenon.

New pump after working 20 hours, you should replace the oil, change oil after every 100 hours.

Oil change:

Open the fuel cover, place the oil container, open the oil drain bolt, releasing the old oil, old oil drain screw oil drain bolt, injected from the refueling Cap require brand new lubricating oil, half the oil level should be between the oil standard, screw cover good cheer.

After pump in around 500 hours of work, it should conduct a comprehensive inspection, check the pump body screw is loose, there is no leakage, leakage phenomenon, decided whether to replace bad parts.

Do not disassemble or open the crankcase cylinder head, if have questions , do not hesitate to contact my company, replacement parts use original parts.

(3) motor

Motor parameters refer to the motor nameplate.

Motor directly connected to the motor and pump Assembly together, which the motor's direction of rotation

to be content with being an unlimited reverse rotation of the pump performance.

★The motor must be securely grounded.

(4) pressure meter

It shows pressure value of working fluid .

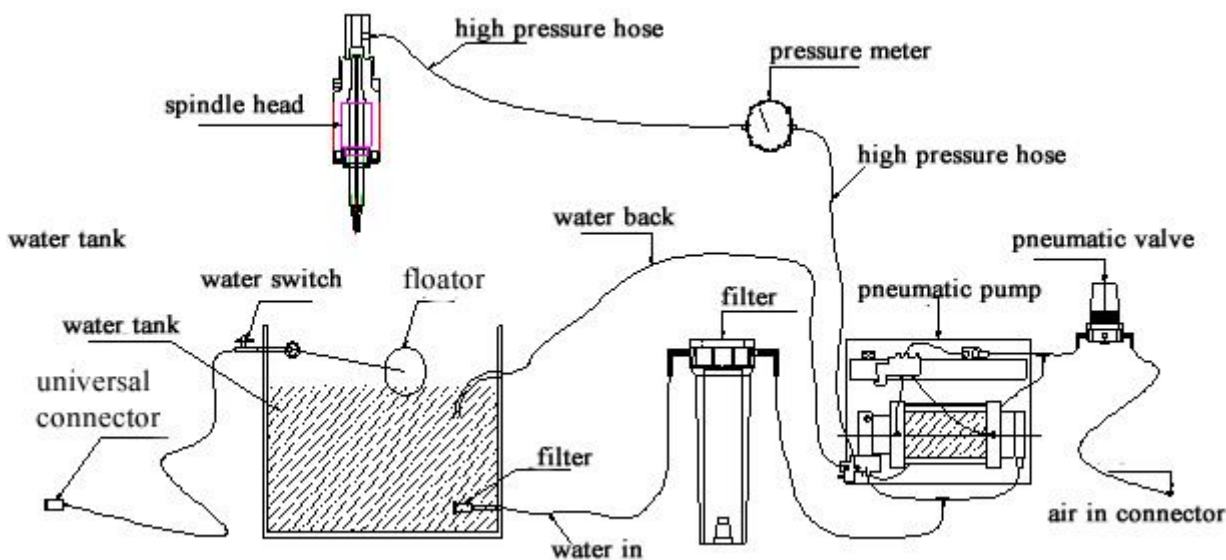
(5) pressure adjustment valve

Use pressure adjust valve to change working pressure, when open pump, observe reading of pressure meter. Clockwise rotate to increase pressure; and counterclockwise to decrease pressure. Regular pressure 5~7Mpa. There are inner and outer pressure adjust valve. Inner one is on pump body, it's purpose is to avoid b pressure is too big to impact piping system and motor, then cause leakage, it's pre-set before leaving factory. When it needs to adjust it again, please clockwise turn outer pressure adjust valve to it's end, counterclockwise turn inner pressure adjust valve to it's end, then open pump, watching pressure meter while adjusting inner pressure valve until pressure to 8Mpa. Outer pressure adjuster is located at left top of machine body, which is convenient to operate and observe.

(6) Filter

Filter is installed at bottom of water tank and near water in hose to avoid water pump suck in unclean. Please clean it once a month at least. During machining, filter should be submerged beneath water level.

(7) Pneumatic type water recycle system



pneumatic type water recycle system

4.4 power connection and commissioning

(1). Connect power

Connect three phase industrial power and keep machine has separated power supply cables. Make sure there is enough power consumption for the machine.

★power cable requirement $\geq 2.5\text{MM}^2$ (standard copper cable)

★ connect power cable firmly and ground must be connected(yellow-green cable)

(2) check all connection

a. visual inspection

a.1: check there is movement of transformer, pump motor after long distance transportation.

a.2: check if all cables connect well and electrical boards are loose or not.

a.3:check if there is damage of sheet metal which affect wiring connections..

b. instrument check

b.1 Check the main loop

Use Ohm range of multimeter to check pump motor and second travel motor of Z axis, if U,V,W has same resistance value.

Use Ohm range of multimeter to check spindle motor and rotation motor A1 A2 and B1 B2, if resistance value is same.

Use Ohm range of multimeter to check if there is grounded phenomena.

Use Ohm range of multimeter to check if there is short circuit of main electrical loop.

b.2 check control loop

Use Ohm range of multimeter to check if there is short circuit of AC circuit and DC circuits

Use Ohm range of multimeter to check if there is tandem connection of AC circuits and DC circuits

Use Ohm range of multimeter to check situation of ground of AC circuits and DC circuits.

c. Check if there is any connection pins loose during transportation, if so, connect then well.

(3) power up machine

a. Use voltage range of multimeter if power in is correct.

b. Make sure there is no problem of missing phase.

c. switch on air breaker switch and load switch, and measure if input power is correct, make sure no problem of missing phase.

d. Release the emergency stop switch, the system is power up.

After power up, DRO shows original coordinate and indicator lights of control panel are on.

★ If there is abnormal sound or smell inside of machine, please shut down machine and check reason..

(3). Power phase sequence check

After power up, first of all, check the motor of 2nd travel of Z axis(W axis) rotate direction, jog UP button, if W axis moves up, it's correct; if W axis goes down, please exchange any two of three phase cable. Make sure UP and DW and relative direction of W axis correct.

★ Why can't press UP for long time at the beginning?

In order to avoid W axis slide down during transport, a wood is set under W axis for protection, so if direction is not correct, W axis can't go down and motor will burn.

★ Why power phase sequence check is necessary.

As the motor of 2nd travel (W axis) is 3 phase 380V low-speed permanent magnet synchronous motor, motor drive screw to perform up and down motion, at top and down of it's stroke, there is position limit switch, when it stroke touches up or down limit switch, W axis will stop. But if power phase sequence is not correct, motor will keep rotating, then it will cause damage of W axis motor.

If W axis stuck due to wrong phase sequence, please exchange any two of three phase cable, no matter at up or down limit position.

Don't keep pushing UP or DW when W axis stuck.

(4). Removing locking fixtures.

a. after power up, move W axis upward, and remove wood that support W axis.

b. remove anti-deformation paper of rotation head.

c. X axis locking plate

Use inner hexagon spanner to remove sheet metal of X axis' left end, then there is X axis locking plate, remove this plate and install cover sheet metal back.

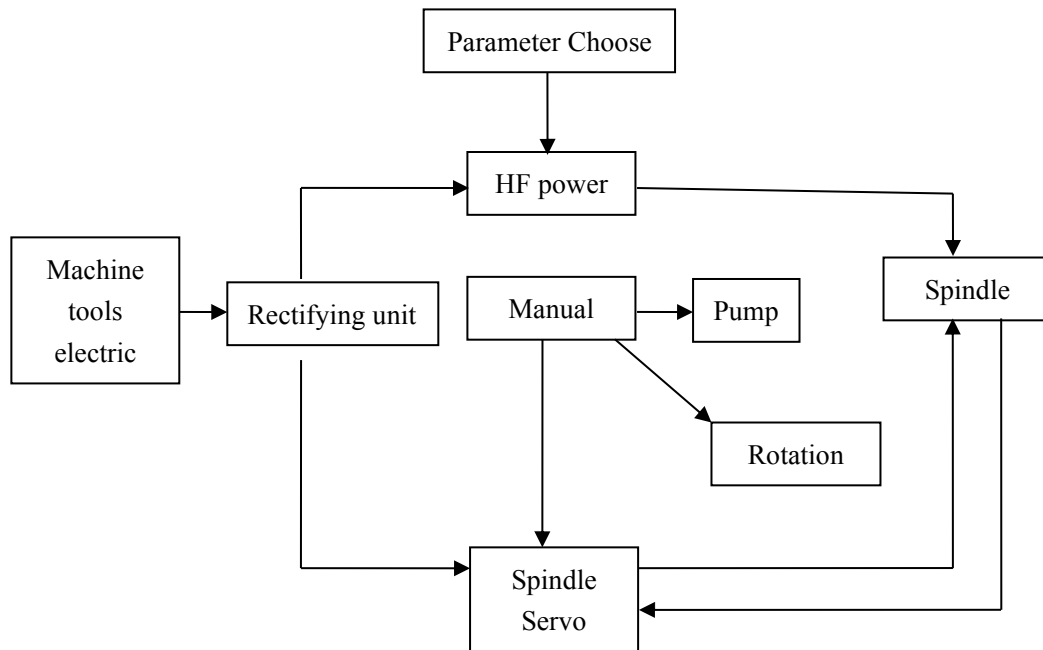
d. Y axis locking plate

Same as X axis

5. NAME OF EACH PART AND FUNCTION

5.1 electrical control system

The electrical control system of this machine includes: impulse power(HF power), spindle servo control system, spindle rotation device, rectifying unit.



(1) Impulse power(HF power)

Choose by operator by changing different impulse parameters or data base on control panel, choose suitable parameters is very important to burning efficiency and wear of electrode. According to received parameters, large scale integrated circuit automatically generates relative high frequency width and high frequency interval as machining pulse, at the same time, decides how many power tubes are needed, to make sure impulse parameter and machining current are suitable for preseted parameters.

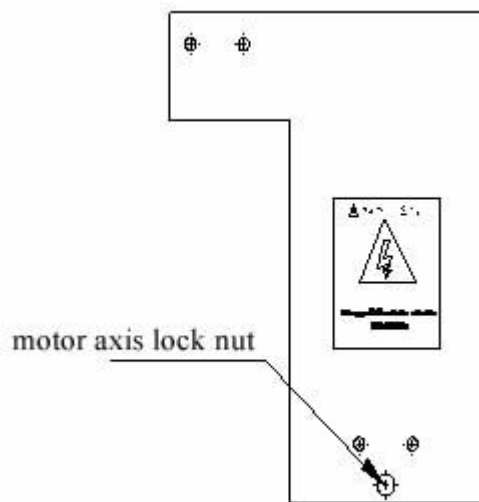
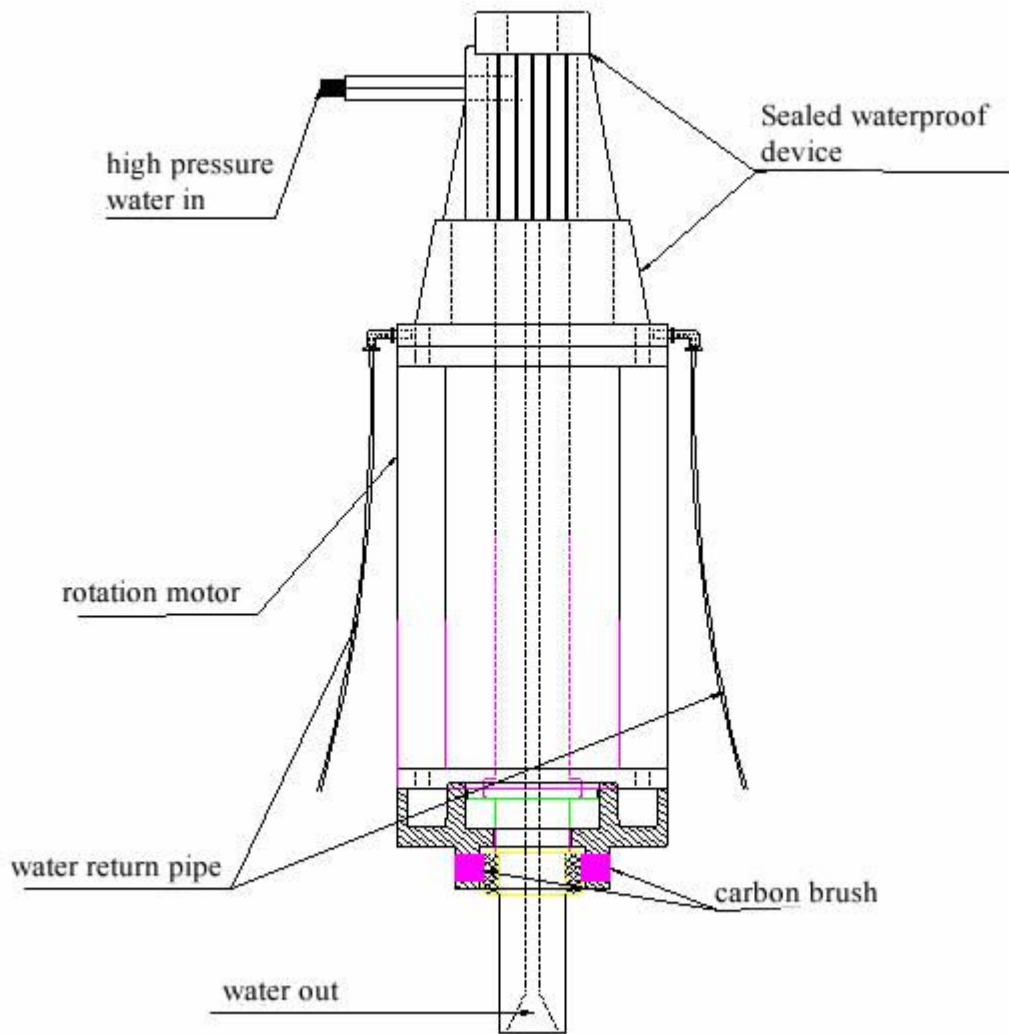
(2) Spindle servo system

Spindle servo system is composed by control power drive unit, feedback signal processing unit, and motor.

5.2 Rotation head

Rotation head is installed on slide block of spindle, it realize function of clamping electrode, rotation, conductive contact and working liquid going through while rotating. The rotation head is integrated design, rotation of electrode is directly driven by motor, no any kind transmission, larger torque and lower malfunction. The high pressure working liquid go in through central hole of motor. The structure and leakage resistance is more reasonable and reliable.

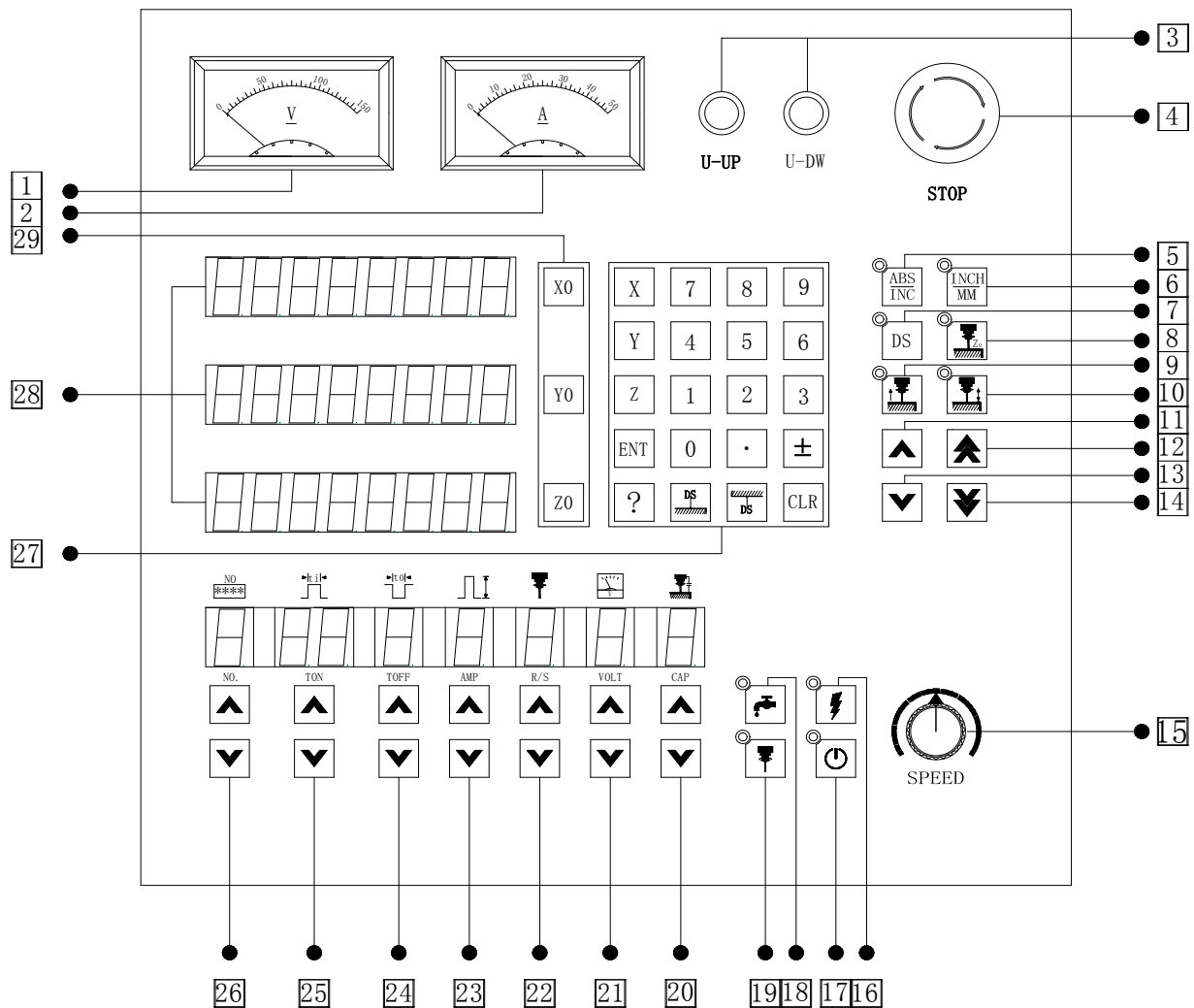
★Patented design, copy is forbidden.



Cover of rotation head

★ Rotation motor axis lock device, press the nut, motor axis lock and tighten chuck of electrode head.

5.3 Control panel



layout of control panel

(1) Voltage meter

Show machining gap voltage.

(2) Ampere meter

Show machining current

(3) W axis up and down button

Press “UP”,W axis goes up; press “DW” ,W axis goes down.

(4) Emergency stop

Loosen it when power up machine, when there is emergency situation, press it to cut power off.

(5) ABS/INC coordinate

Functional keys of DRO , ABS shows absolute coordinate, the default status is light off. INS shows relative coordinate, the default status is light on. Operator can set Zero in ABS coordinate for record, and then

turn to INC coordinate to do machining operation, clear Zero at any position in INC coordinate will not affect position in ABS coordinate.

(6) INCH and METRIC mode

Indicate position in INCH or in METRIC. Light on is INCH, while light off is METRIC.

(7) Preseted depth function

Light on is activated status



Purpose of preseted depth burning: It's a method to burn blind hole, after finish machining, automatic return to surface of workpiece.

Machining setup:


(1) Set zero for Z axis(touch edge)

↓ Press touch edge button, light goes on, and do edge touching process. During the process, speed of spindle could be adjusted by potentiometer, when machine is buzzing, stop and set Z axis zero, and then move Z axis upward to 2~5mm above workpiece

(2) Sample machining

↓ Do drilling machining on the workpiece to needed then, turn off machining, and press  one time for recording. When press , reading value of Z axis will twinkle two times, For instance, if actual needed machining depth is 20mm, regularly wear ratio of electrode is 100%, then Z axis needs to go down to 40mm.

(3) Return

↓ Pull out electrode out of workpiece, keep suitable distance between surface of workpiece, normally 2~5mm, at this moment, press  (Z axis coordinate twinkle two times). At this moment, operator can measure actual machined depth according to DRO reading of Z axis, if depth is not in expectation, operator can adjust value again and do sample burning again for better accuracy.

(4) Machining

↓ Use handle wheel to move X and Y axis to position where need to drill hole.
↓ Press DS, light on, start to do preseted depth machining.


At the beginning of machining, Z axis will clear Zero once electrode touches workpiece and starts counting since touch.


(5) Machining finish

↓ After finish machining, press **DS**, light off, quit preset depth machining status.

Set up of no machining status sampling:



For example, according to regular wear ratio 100%, it needs to burn a hole with depth 20mm, first step clear

Zero for Z axis, and then manually move Z axis down 40mm and press , record down end of machining.

Then move Z axis up 22mm, press , record back upward surface. Open **DS**, then start sample machining.

Depth preset machining sample:

15mm blind hole machining

(1) Z axis clear Zero, manually move Z axis downward 30mm, press  to record down machining face, upward move Z axis 15mm, press  to record up face of machining, open **DS** depth preset function and start machining.

(2) After machining is done, pull out electrode out of workpiece, at the same time, record actual depth is 14mm.(operator can set Z axis Zero, move X and Y axis after electrode leave surface of workpiece, and then make electrode touch surface of workpiece)

(3) Actual wear ratio of electrode=(used length)÷(actual burned depth)×100

$$(30-14) \div 14 \times 100 = 114\%$$

(4) Actual used length in machining=actual machined depth×(1+wear ratio÷100)

$$15 \times (1 + 114 \div 100) = 32.1$$

(5) reset down face of machining as 32.1mm, up face is 17mm, start depth preset machining.

8 Automatic upward return function

After open automatic upward return function, after machining, electrode will go back to a certain position which had been set before machining.

For example: for Z axis read out coordinate, input or manual move 50mm, press **CLR** to record, the light of this function is on, every time, after machining, electrode will move backward 50mm distance.

9 Touch edge switch

Press down touch edge switch, adjust potentiometer knob. When Z axis move downward smoothly, counterclockwise turn knob, speed of Z axis going down and getting slower until stop; clockwise turn knob,

speed of Z axis going up and getting faster. When electrode touches workpiece, there is alarm of buzzer. Spindle move up and down slightly and there is spark appears.

Touch edge and find center should work with DRO.

★ In regular machining, please don't open touch edge function.

10 Electrode correction switch

When burning deep hole, sometimes, there is problem of carbon deposition which will affect machining status. Operator can use this function to correct head until machining is steady. Light off, function canceled

11 Up move switch-slow

Manually move Z axis up in low speed

12 Up move switch-fast

Manually move Z axis up in high speed, press the button for 3 seconds, Z axis will move up to top position automatically.

13 Down move switch-slow

Manually move Z axis down in low speed

14 Down move switch-fast

Manually move Z axis down in fast speed.

15 Potentiometer

- (1) During machining, it can adjust machining gap voltage and machining current. Clockwise turn it to reduce gap voltage to increase machining current; counterclockwise turn it to increase gap voltage to decrease machining current. Normally, use potentiometer according to chosen parameters, but should keep machining current steady, Normally machining voltage 20~25V。
- (2) Effective adjustable range of potentiometer is from the center to left and right 60°。
- (3) When do touching edge, adjust speed of Z axis, clockwise turn it, spindle goes down; counterclockwise turn it, spindle goes up.

16 HF power switch

Open HF power switch, impulse power is on, voltage meter shows machining voltage, electrode and workpiece are electrified, don't touch them.

17 One key machining

After set up machining parameters, press this key, machine will start to do machining

automatically.

18 Pump switch

Open pump, water comes out of electrode, check situation of water coming out of electrode.

19 Rotation head switch

Press it, rotation motor starts to run.

- ★ Motor rotates clockwise(from top view, already set up in factory)
- ★ If it is not easy to take seal out, operator can use pump switch on control panel to use high pressure water to flush it out.

20 Gap capacitance(0-4)

Parallel capacitance between negative and positive poles. It could speed high machining speed, the bigger value it is, the faster the cutting speed is, but it will lead to bigger wear of electrode, if not use gap capacitance, it would be very slow to burn metal with high hardness, so it is necessary to burn some material which is not easy to burn holes.

21 Machining voltage(1-3)

When machining tiny holes, it's better to choose low voltage, high voltage with big current will burn electrode and make wear ratio big, less than 0.5mm choose medium voltage, less than 0,3mm use low voltage.

| Diameter of electrode | Set value | Output voltage |
|-----------------------|-----------|----------------|
| » $\phi 0.5$ | 1 | 68V |
| » $\phi 0.3$ | 2 | 45V |
| » $\phi 0.2$ | 3 | 29V |

0- No voltage output

22 Rotation head speed adjustment(1-F)

When machining is not stable or there is strict requirement of diameter of machined hole, rotation head speed could be adjusted to make machining more stable and efficiently, but normally, no need to adjust it for regular machining.

23 power amplifier(1-8)

More AMP, larger machining current, higher efficiency, but wear of electrode is also big, so use it properly.

24 High frequency interval(0-F)

TOFF is relative to machining stability and chip removal, bigger TOFF, easier to move machined chips, but machining speed will be lower.

25 High frequency width (0-99)

TON is very important to surface finish of machined hole and wear ratio, bigger TON value, smaller

electrode wear ratio, faster burning speed, but surface finish is not good.

26 Segment number

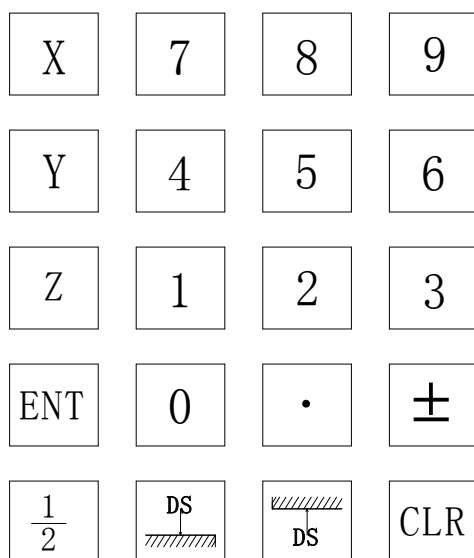
There are 16 segments of default setting in system, as below table shows:

Machining Parameters

| No, | Diameter | Material | TON | TOFF | AMP | R/S | VOLT | CAP |
|-----|----------|----------|-----|------|-----|-----|------|-----|
| 1 | | | | | | | | |
| 2 | Φ1.0 | - | 14 | B | 5 | F | 1 | 2 |
| 3 | Φ0.8 | - | 13 | B | 4 | F | 1 | 1 |
| 4 | Φ0.7 | - | 10 | B | 4 | F | 1 | 1 |
| 5 | Φ0.5 | - | 7 | A | 3 | F | 1 | 1 |
| 6 | Φ0.4 | - | 10 | A | 4 | F | 2 | 1 |
| 7 | Φ0.3 | - | 4 | 5 | 3 | F | 2 | 1 |
| 8 | Φ0.3 | - | 4 | 3 | 2 | F | 2 | 1 |
| 9 | Φ0.2 | - | 3 | 5 | 2 | F | 2 | 1 |
| A | Φ0.2 | - | 2 | 4 | 2 | F | 2 | 1 |
| B | Φ0.15 | - | 2 | 3 | 1 | F | 2 | 1 |
| C | Φ1.5 | - | 16 | A | 6 | F | 1 | 2 |
| D | Φ2.0 | - | 20 | A | 6 | F | 1 | 3 |
| E | Φ2.5 | - | 25 | A | 8 | F | 1 | 3 |
| F | Φ3.0 | - | 30 | A | 8 | F | 1 | 4 |

★ Segment No. 1 is for customer's use, in this segment, parameters could be amended at random.

27 DRO control area



For example: X axis, input coordinate “88”

First, press “X”, then input number “88”, then press “ENT” for confirmation.

Y axis input “-88”

First, input number “88”, then press “X”, and then press “±”, at last press “ENT” for confirmation.

28 Clear Zero of coordinate

29 Indication of coordinate

30 Machining speed

Side of control box:

穿透 高速 低速

Burn Through, High Speed, Low Speed

High speed: Usually use it when burn electrode $\geq \Phi 0.5\text{mm}$

Low speed: Usually use it when burn electrode $< \Phi 0.5$. When machine hard alloy, Aluminum, titanium and etc. When machining is not stable and electrode is shaking a lot, use it to stabilize machining.

Burn through: when use it, electrode will go through down face of workpiece.

6. Machining Sequence

6.1 Process before machining

1 Set up workpiece

Set workpiece in fixture on working table.



2 Installation of electrode

Install electrode in chuck and then install chuck into spindle.



3 Confirmation of working liquid

Open water pump to check if water coming out of electrode correctly.



4 Adjustment of machining position

Use hand wheel of X,Y axis to position where to burn the hole.



Adjust position of W axis to get distance from down guide to workpiece 3~5MM.

5 Set up of machining parameters

Choose parameters, set track and choose speed.

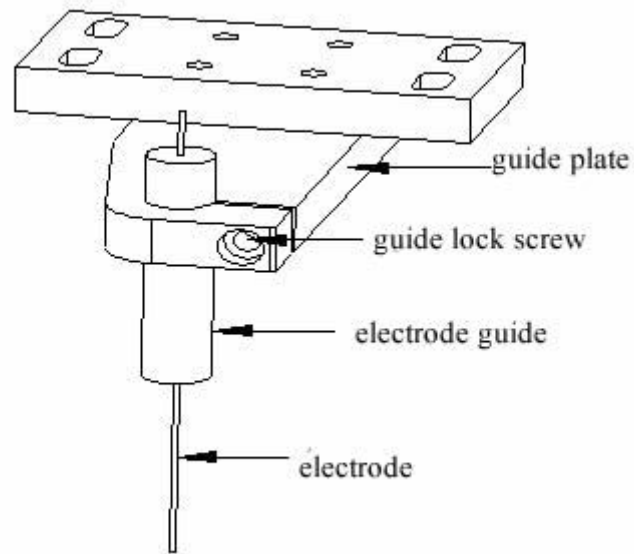


6 Machining start

Press one key machining to start burning hole.



6.2 set up electrode guide



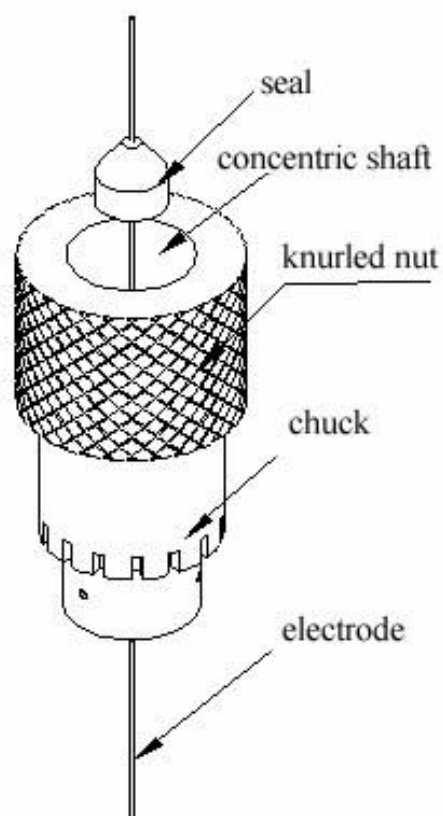
Size of electrode guide should matches diameter of electrode, and clamp guide steady.

6.3 Installation of electrode

(1). Electrode check

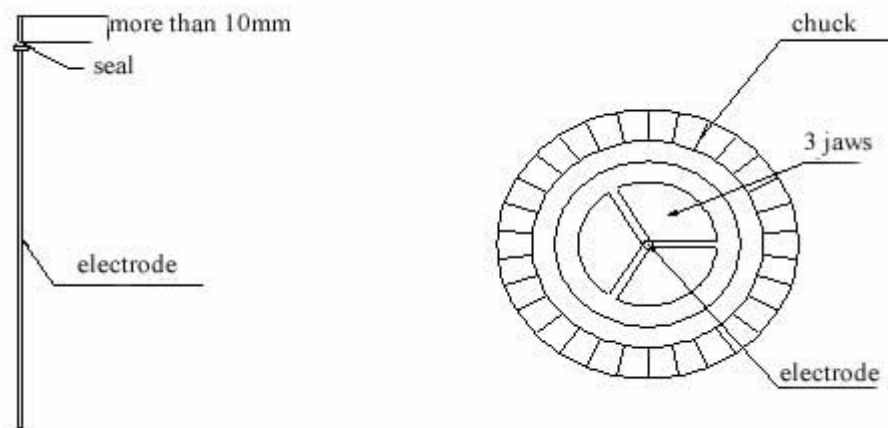
- a. Choose good quality electrode, not too bend.
- b. Make sure electrode hole is not stuck. (especially for the diameter less than $\Phi 0.5\text{MM}$)

(2). How to install electrode



According to above graph, install seal to electrode, and then use chuck to get through electrode from upper end.

- ★ Diameter of seal should match diameter of electrode
- ★ Don't bend electrode during operation.
- ★ Taper head of seal point up to match inner taper of motor shaft.



Upper end of electrode should exceed at least 10mm.

As chuck has three jaws, so please make sure electrode is installed in the center of chuck.

- ★ For electrode less than $\Phi 0.5\text{MM}$, in order not to damage electrode, please don't use spanner of chuck with too much strength, or if electrode will bend and water can't come out of electrode, and it will affect machining performance.

(3) How to install electrode chuck

- a. Open machining switch and adjust potentiometer, and get spindle move up to top position at fastest speed.
- b. Left hand hold knurled nut and approach it to bottom of motor shaft(with inner taper thread), right hand open rotation switch, knurled nut move upward and lock itself(when knurled nut rotates together with motor shaft, release left hand). For electrode larger than 1.0mm, it needs to press lock nut above chuck.
- c. Use special spanner of electrode chuck to tighten 3 jaws.
- d. Keep electrode rotating, press manual up and down switch, to make spindle move downward and observe if end of electrode can go through guide successfully, after electrode get through guide, stop movement. During process, be aware of not bending electrode.

6.4 Installation of workpiece.

- (1) Put workpiece on stainless steel fixture on working table.
- (2) Leveling and aligning workpiece with dial indicator, fasten workpiece.

6.5 Method to locate machining position.

- (1) Open touch edge switch, rotation head switch, and machining switch. Adjust potentiometer to move spindle down until down end of electrode exceed guide 20~30MM 。
- (2) Move X and Y axis to get Z axis approach workpiece slowly, touch side of electrode to side of workpiece(clean workpiece to make sure positioning more accurate)
- (3) Once electrode touches workpiece, machine will keep buzzing, stop move X or Y axis.
 - ★ If electrode touch workpiece too much, electrode will bend. So move X or Y axis slowly and look closely and carefully.
- (4) Once side position is decided, move electrode upward away from workpiece. Then move X and Y axis according to DRO reading to location where to make hole.

★ Note: Radius of electrode should be took into consideration, compensate radius is necessary.

6.6 Setting of machining parameters

According to different diameter of electrode, material of electrode and workpiece, surface finish requirement, machining efficiency, choose suitable parameters.

Machining parameter reference list(could be different in different environment, just for reference)

| Material | Thickness (mm) | Electrode (mm) | TON | TOFF | AMP | R/S (r/m) | VOLT | CAP | Time |
|----------------|----------------|----------------|-----|------|-----|-----------|------|-----|-------|
| SS | 6 | Φ0.15 | 2 | 3 | 1 | F | 2 | 1 | 1'20" |
| CR12 | 10 | Φ0.15 | 4 | 3 | 1 | F | 2 | 1 | 4'30" |
| SS | 6 | Φ0.2 | 3 | 7 | 3 | F | 2 | 1 | 15" |
| tungsten | 10 | Φ0.2 | 3 | 6 | 3 | F | 2 | 1 | 6' |
| tungsten | 35 | Φ0.2 | 4 | 3 | 2 | F | 2 | 1 | 35' |
| tungsten | 8 | Φ0.2 | 4 | 3 | 2 | F | 2 | 1 | 7' |
| tungsten | 18 | Φ0.2 | 4 | 3 | 2 | F | 2 | 1 | 18' |
| AL | 31 | Φ0.2 | 2 | 4 | 2 | F | 2 | 4 | 20' |
| bearing steels | 5.5 | Φ0.2 | 2 | 3 | 3 | F | 2 | 1 | 55" |
| AK80 | 22 | Φ0.2 | 4 | 3 | 1 | F | 2 | 1 | 4'55" |
| 45# | 7 | Φ0.2 | 3 | 3 | 1 | F | 2 | 1 | 1'30" |
| tungsten | 30 | Φ0.3 | 4 | 7 | 4 | F | 2 | 1 | 9' |
| tungsten | 15 | Φ0.3 | 4 | 4 | 3 | F | 2 | 1 | 4'05" |

| | | | | | | | | | |
|-----------------|-----|------|----|----|---|---|---|---|--------|
| tungsten | 50 | Φ0.3 | 4 | 7 | 4 | F | 2 | 1 | 16' |
| SS | 40 | Φ0.3 | 4 | 3 | 3 | F | 2 | 1 | 1'50" |
| SKD11 | 30 | Φ0.3 | 4 | 3 | 2 | F | 2 | 1 | 2'30" |
| AL | 70 | Φ0.3 | 3 | 4 | 2 | F | 2 | 3 | 13' |
| CR12 | 20 | Φ0.3 | 4 | 3 | 2 | F | 2 | 1 | 1'30" |
| AL | 70 | Φ0.5 | 8 | 8 | 3 | F | 2 | 1 | 2'05" |
| SS | 40 | Φ0.5 | 8 | 8 | 4 | F | 2 | 1 | 2'18" |
| 45# | 30 | Φ0.5 | 7 | 8 | 2 | F | 1 | 1 | 1'30" |
| tungsten | 50 | Φ0.5 | 6 | 10 | 3 | F | 1 | 1 | 12' |
| tungsten | 50 | Φ0.7 | 7 | 10 | 4 | F | 1 | 2 | 11'30" |
| AK80 | 50 | Φ0.7 | 8 | 7 | 3 | F | 1 | 1 | 2'15" |
| SKD11 | 40 | Φ1.0 | 15 | 9 | 6 | F | 1 | 1 | 1'07" |
| tungsten | 100 | Φ1.0 | 20 | 13 | 5 | F | 1 | 1 | 38' |
| tungsten K44 | 50 | Φ1.0 | 8 | 12 | 4 | D | 1 | 1 | 10'30" |
| SS | 150 | Φ1.0 | 13 | 12 | 5 | F | 1 | 1 | 8'45" |
| 45# | 40 | Φ1.5 | 20 | 11 | 6 | F | 1 | 2 | 1'58" |
| 45# | 40 | Φ2.0 | 25 | 11 | 7 | F | 1 | 3 | 2'10" |
| 45# | 40 | Φ3.0 | 30 | 11 | 8 | F | 1 | 3 | 3'35" |

6.7 Machining

- (1) Make sure machine is not status of depth preset function or automatic upward
- (2) Watch if water coming out of electrode in good condition, if there is enough working pressure, and then press one key machining switch, start machining.
- (3) Watching discharging condition and adjust potentiometer slowly until working condition is stable.
- (4) After drill through, there is spark at down side of workpiece, and water comes out, finish machining.

If put a metal under workpiece, there would be a nice hole made.

- (5). Continue to make holes, move X and Y axis to next position for machining.
- (6). After machining is done, keep rotation head rotating while moving spindle head up, pull out electrode out of guide, keep machine clean if not use machine.

★ When move workpiece, make sure electrode is already out of workpiece.

★ Clean guide frequently, and check if it's situation.

7. Attention of unusual machining situation

7.1 Electrode guide

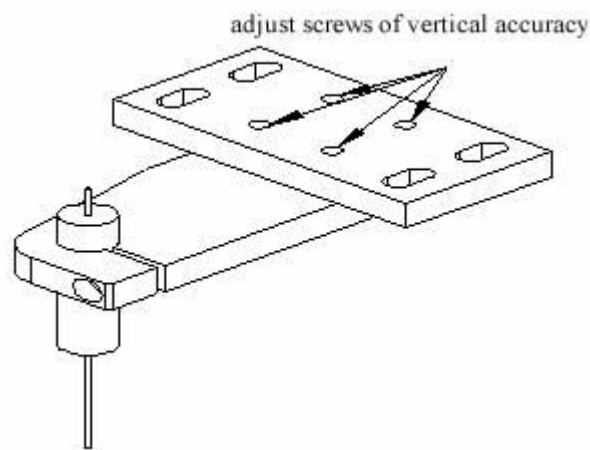
(1) Regular check of guide

- a. Check if there is crack or notch of guide.
- b. Check if guide is stuck or not.

(2) Fixation of electrode guide

Electrode is fastened by stainless steel screw, don't fasten screw with too much strength, too much strength of long time will cause bad accuracy of it, and get worse vertical accuracy of drilled hole.

(3) Adjustment of vertical accuracy of guide



- a. Get electrode extend out of guide about 40~50mm(it's better to choose electrode diameter $\geq\Phi 1.5\text{mm}$) Or set a outer diameter $\Phi 12\text{mm}$ round bar in the position of guide.
- b. Use right angle ruler, right angle block or 90 degree block approach extended electrode or round bar, adjust 4 screws in X and Y direction, to get extended electrode or round bar parallel to right angle ruler.
- c. At last, tighten all four screws.

7.2 Machining is not stable

- (1) Check of cutting parameters are suitable
- (2) Check if working liquid comes out correctly.
- (3) Make sure electrode is not bent.
- (4) If workpiece is fastened well.
- (5) Installation of electrode is correct or not, especially chuck.
- (6) Check if there is unusual wear of electrode
- (7) Check verticality of installed electrode.

7.3 Electrode is bending a lot

- (1) Check machining parameters
- (2) Check if there is insulation material between electrode and workpiece
- (3) Please check power output cable to electrode and workpiece(connect to stainless steel fixtures)
- (4) Please check if too much distance between electrode and workpiece.
- (5) Check if electrode is stuck.

7.4 Abnormal discharging

- (1) Check machining parameters
- (2) If there is water coming out of electrode

7.5 Spindle lifting frequently

- (1) Check machining parameters
- (2) If electrode is bent
- (3) If there is unusual wear of electrode

★ When use electrode to do machining again, if there is black burnt mark(normally<10mm) or deformation. Please use shear to cut off black burnt or deformed part(it's better to open water pump before cutting).

7.6 Low machining speed

- (1) Check machining parameters
- (2) If working liquid flushing out well
- (3) Electrode extend out of chuck too much
- (4) Electrode and chuck are not at same center core position
- (5) Verticality of guide is not good

7.7 W axis can't move up and down

- (1) Check if 3 phase motor missing phase
- (2) Phase sequence is not correct

- (3) If manual up and down buttons connect well or damaged
- (4) If up or down limit switch is damaged or stuck
- (5) Check if middle relay works in good condition.

8. Regular check and maintenance

8.1 Lubricate components are below table:

| Lubrication position | Lubrication oil | Quantity | Explanation |
|--------------------------------|-----------------|-------------|--|
| Guide of X, Y axis | Guide oil | Appropriate | Hand pump automatic inject(1time/100hours) |
| Screw and nuts of X Y axis | Guide oil | Appropriate | Hand pump automatic inject(1time/100hours) |
| Z axis guideway, screw and nut | Guide oil | Appropriate | Hand pump automatic inject(1time/100hours) |
| 2 nd screw and nut | Guide oil | Appropriate | Hand pump automatic inject(1time/100hours) |

8.2 Check if any connection parts of machine loose or not

Every 3~6 months, check all electrical connection pins, devices, water recycle system, board slot, make sure they are not loose.

8.3 Check fans of control panel

Every 1~3 months, check if fans are all working good, and keep inner temperature of control box down.

8.4 Working liquid

- (1) Tap water could be used directly as working liquid, but it can't be hard water
- (2) Check tank of working liquid every week, keep it clean.
- (3) Check and clean filtering net every week.
- (4) The processing of waste liquid

Environment friendly treatment of water liquid is recommended.

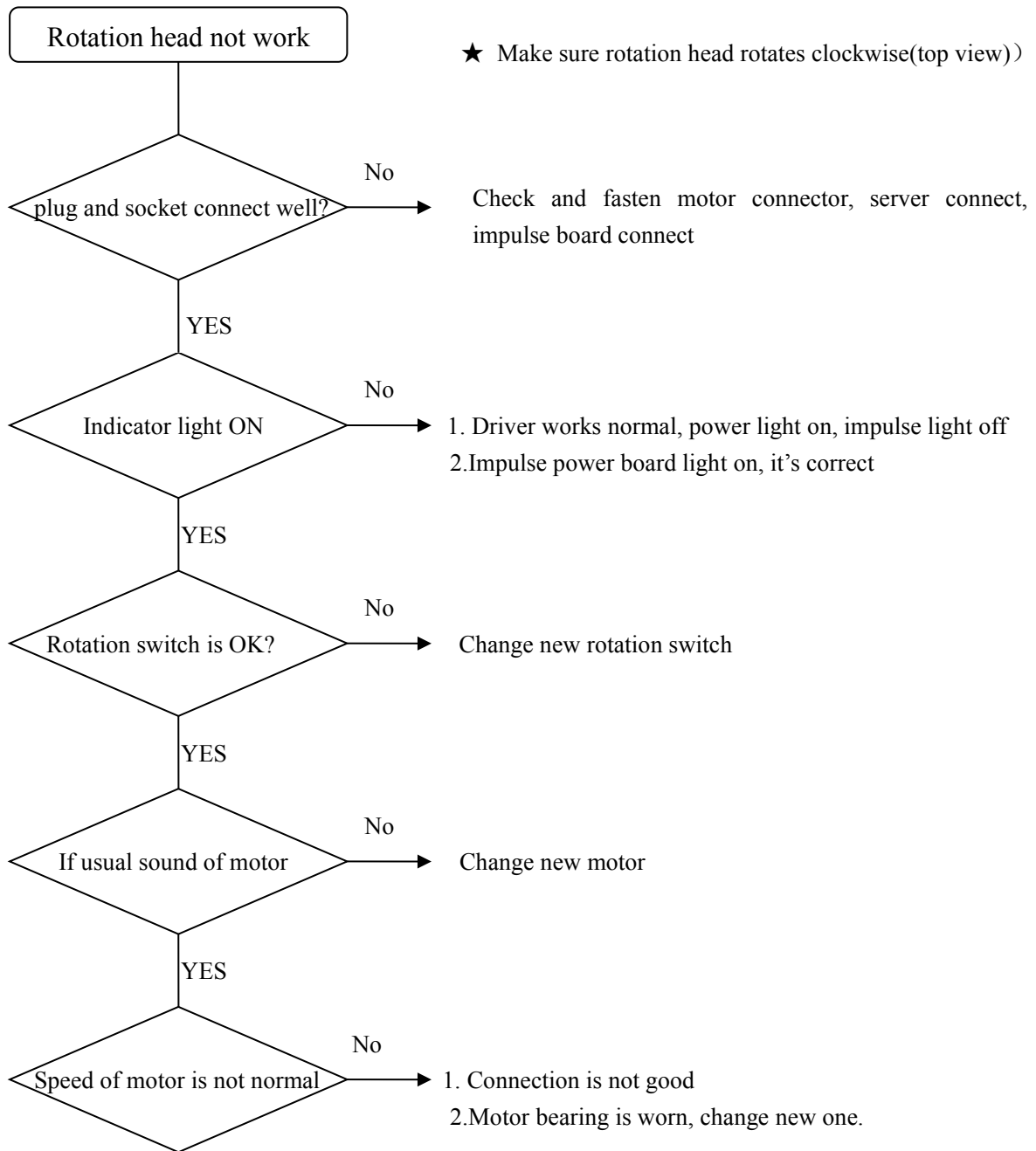
8.5 Clean every part of machine

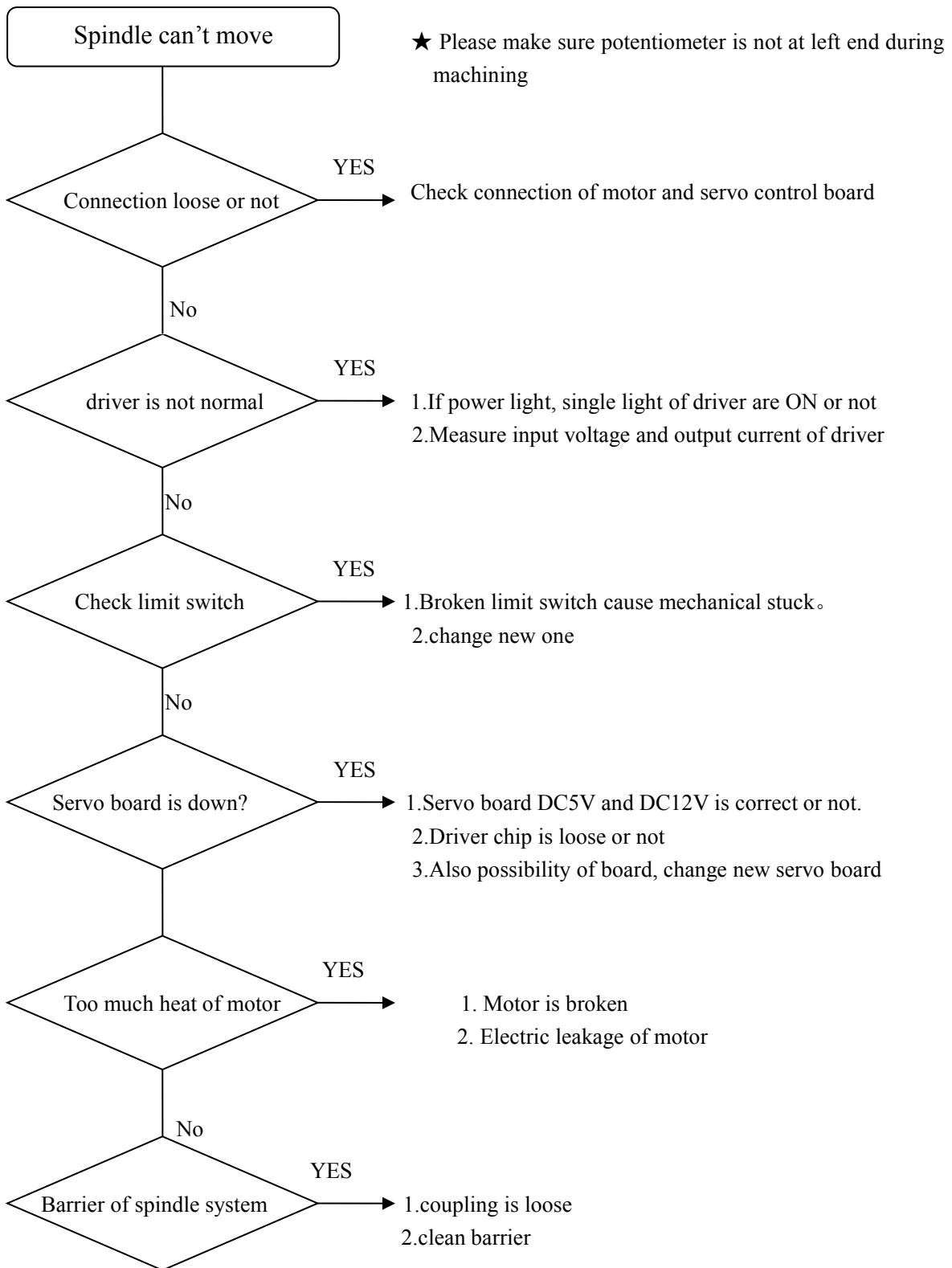
For working table and water tray, they are easy to get dirty, clean them every day after work.

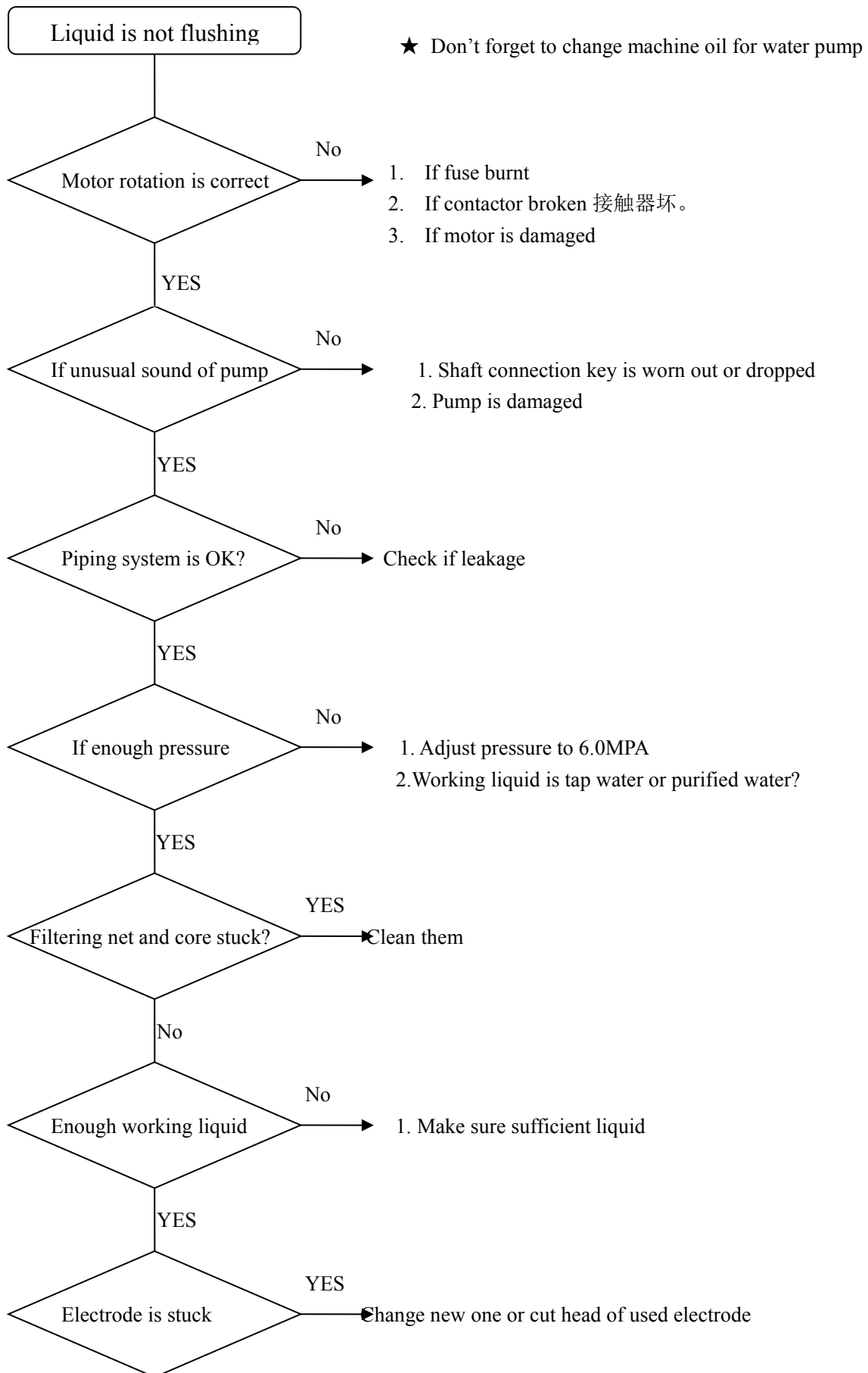
Please don't forget to clean these parts:

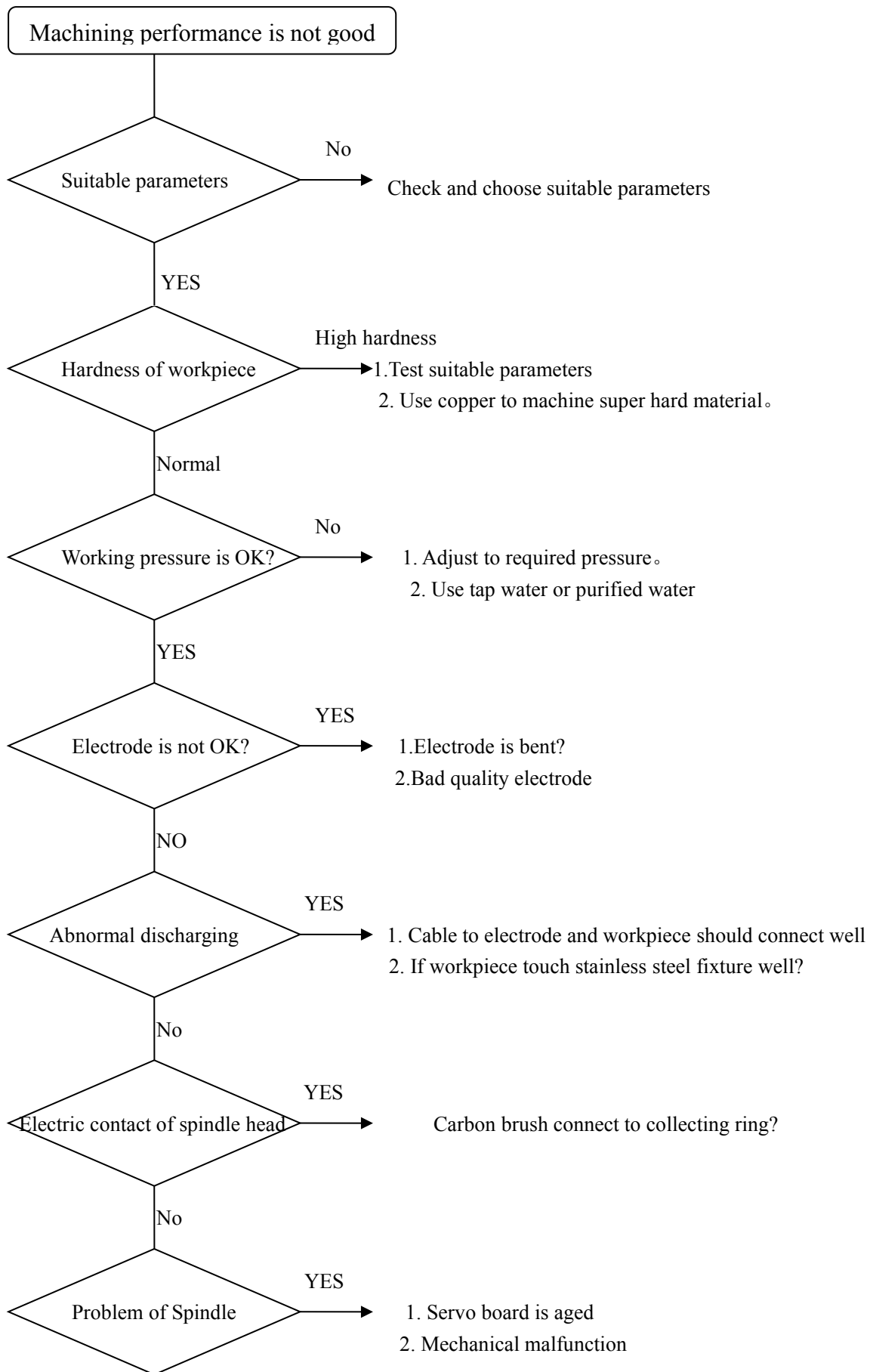
- (1) As electrode chuck is easy to get rusty in water, so it's better to clean and dry it, if don't use machine for long time, better disassemble it and keep with oil.
- (2) Base of working table, move Y axis away from column, clean this area.
- (3) In order to keep sufficient lubrication for 2nd travel screw, there is oil store pipe under screw, clean it every month and add new machine oil.
- (4) Clean rotation head and guide plate

9.Malfunction judgment

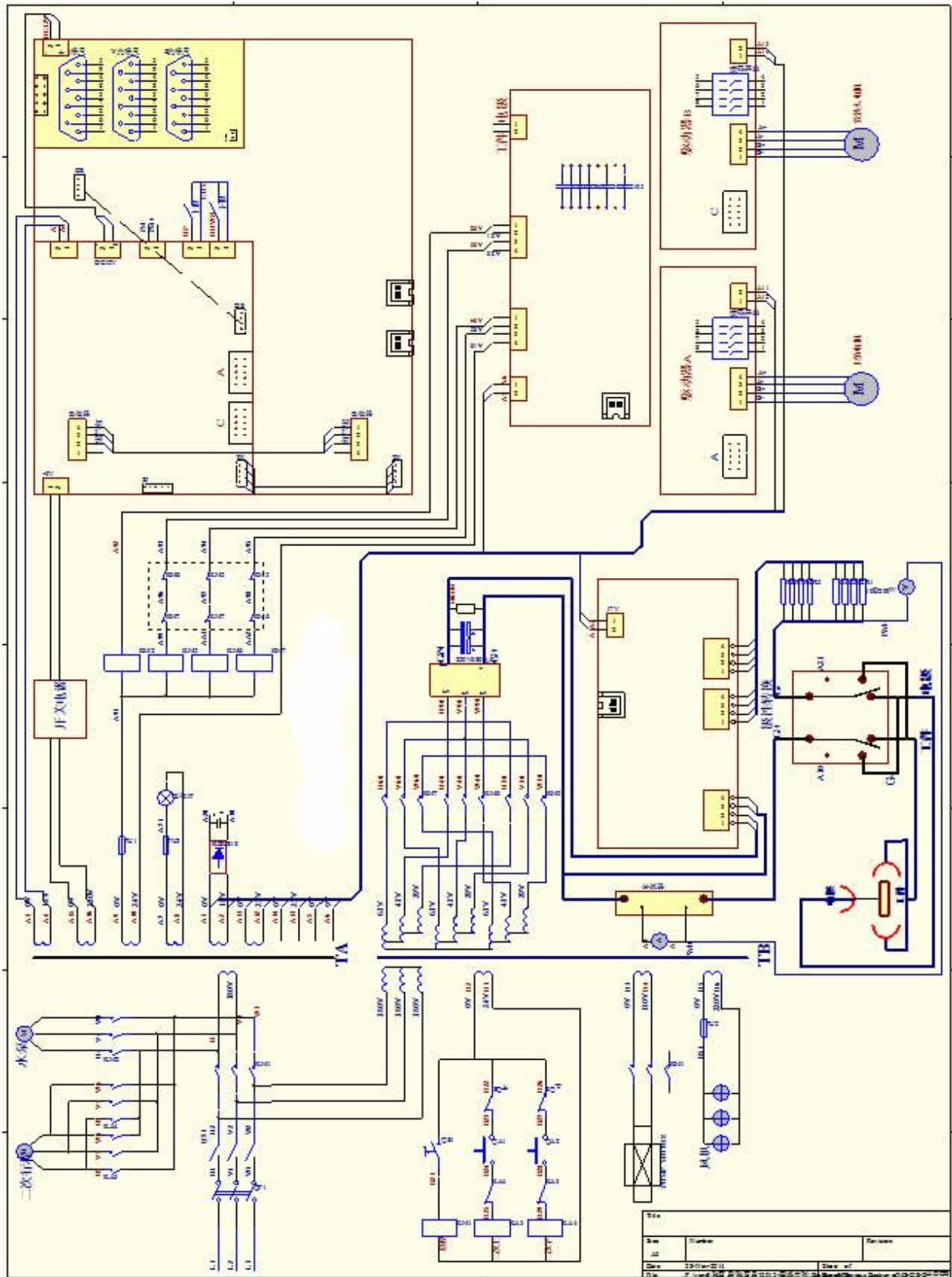








10. Electrical diagram



Electrical diagram

11. Qualification Report

QUALIFICATION REPORT

Model: KD703C

Table travel: 300 × 400 mm

Serial Number: _____

**The machine is qualified, granted to
leave factory**

Production manager: _____

Inspection manager: _____

Date: _____

12. Packing list

Packing list

| No. | Item name | Specification | Quantify | Remark |
|-----|-------------------------|----------------|--------------|--------|
| 1 | Inner hexagon spanner | M3 M4 M5 M6 M8 | 1 piece each | |
| 2 | Double-head screwdriver | | 1 piece | |
| 3 | Shear for electrode | | 1 piece | |
| 4 | Guide | Φ0.5mm | 1 piece | |
| 5 | Guide | Φ1.0mm | 1 piece | |
| 6 | Electrode | Φ0.5mm | 100 pieces | |
| 7 | Electrode | Φ1.0mm | 100 pieces | |
| 8 | Electrode seal | | 10 pieces | |
| 9 | Chuck | | 1 set | |
| 10 | Filter of pump | | 1 piece | |
| 11 | Tap connector | | 1 piece | |
| 12 | Foot block | M16 | 4 pieces | |
| 13 | Water tank | | 1 piece | |
| 14 | Water barrel | | 1 piece | |
| 15 | Water cover | | 1 set | |
| 16 | Manual | | 1 set | |
| 17 | Packing list | | 1 set | |

Note: above accessories for machine is standard configuration, subject to change without notice.