USER MANUAL

AX-ZL3+ Induction Casting Machine (Water Cooling)

Description

The AX-ZL3+ Water Cooling Induction Casting Machine is a high-end equipment for dental laboratories. It is upgraded from the high frequency casting machines. It features small size, light weight, easy operations, no radiation, less electricity consumption and the machine can be used on electric outlets in general homes.

Specifications:

| Power supply voltage | AC 220V±10% 50HZ |
|------------------------------|--|
| Power | 2.5KW |
| Maximum amount of alloy | 50g (cr-co alloy) |
| Melting duration | 30g (cr-co)≤60s (standard) |
| Casting radius | 210mm |
| Centrifugal rotational speed | 500rpm |
| Casting method | Horizontal centrifugal melting and casting |
| Motor power | 0.37KW |
| Cooling method | Water cooling |
| Water pump | 220V / 50Hz 30W 10L/Min |
| Dimensions | 68x53x90 (cm) |
| Weight | 120kg |

Circuit Diagram:

The medium-frequency casting machine has an all-transistor circuitry, the circuit diagram is below.



It consists of the following elements in the return circuit: transformer, voltage selector, rectifier filter, amplifying of medium frequency fluctuating power, over-heat protection, operation indications.

The process includes the following procedures: single phase power supply goes through a transformer and a voltage-selector, choose the suitable voltage according to the material and weight of the alloy. The amplified medium frequency which is applied to the work coil melts the alloy. There is a temperature measurement device which can prevent over-heating by operating the return circuit. And by operating the return circuit, it can also control the melting and casting process.

Packing List

| User manual | 1pcs |
|-------------------------------|----------|
| Casting rings | 3pcs/set |
| Tongs | 1pcs |
| Crucible | 5pcs |
| brush | 1pcs |
| fuse (32A) | 2pcs |
| fuse (20A) | 2pcs |
| fuse (10A) (small glass tube) | 1pcs |
| resistance (100R) | 1pcs |
| Capacitor (474/630V) | 1pcs |
| Rectifier (5010) | 1pcs |
| Rectifier (3510) | 1pcs |
| V-bracket | 3pcs |

Installation

1. Power

Single phase power should be used, the capacity should be ≥ 2.5 KVA, voltage AC220V±5%, 50Hz. If voltage is exceeds this range, a voltage regulator should be used. The capacity of the voltage regulator should be ≥ 3 KVA.

- The conductor cross-section used for separate electrical power distribution should be ≥ 2.5mm² copper, ampere of more than 20A, voltage endurance of 400V, single-phase breaker (for example D20 circuit breaker).
- 3. The resistance of the grounding device should be $\leq 4\Omega$, the grounding wire of the casting machine should be safely connected to the grounding device to ensure the safety of the operator.
- 4. This casting machine cannot be connected to a power leakage protector, otherwise power will be tripped regularly.

Instructions:

Read the instructions carefully before operating. Please operate strictly according to the operation instructions to assure the safety of the operator.

Before operating this machine, make sure there is enough water in the water tank. Check water level and water temperature regularly during operations.

Standard Operations

- 1. Turn on the power, the fan and the water pump should start working. Choose the right voltage (readings on the AC voltmeter) on the Voltage Selector according to the material and its weight. Choose Voltage 3 (about 180V) for melting 30g of alloy, and choose Voltage 2 if the weight is 40g. The voltage should be between 175-195V and should NOT exceed 200V.
- 2. Rotate the frame until the crucible is right above the coil, make sure when the coil goes up the crucible is at the center of the coil.
- 3. Choose the correct V-bracket according to the size of the casting ring. Adjust the height of the casting ring to make outlet of the crucible pointing to the sprue. Put alloy in the crucible.
- 4. Put the pre-heated casting ring on the V-bracket, loosen the fixing screw in the middle of the frame and adjust the position of the weight to make the frame balanced, then tighten the middle screw. Adjust the position of the frame, close the lid, and the door indicator light and the position indicator light should be on.
- 5. Press Melt button, the coil goes up and start heating. The ampere should be around 10A, it should not exceed 15A. If the ampere exceeds 15A, the machine should be shut down to avoid accidents.
- 6. Observe the state of alloy from the observation window. When the alloy is completely melted, press Cast button, the coil goes down, press Stop button after the centrifugal motor rotates for about 3-5 seconds and then wait for the frame to stop rotating completely.
- 7. After the frame stops completely, open the lid and take out the casting ring.

NOTE: Before casting, please balance and fix the frame, otherwise the machine may be damaged.

Elevation of the crucible

- 1. During melting process or Test Mode, the coil must be on top, the coil should wrap the crucible. During centrifugal process the coil must be below, the coil is separated from the crucible.
- 2. Two elevation methods

a) automatic. During standard operations, when Melt is pressed the coil goes up, when Cast is pressed the coil goes down.

b) Manual. Press UP button to raise the coil, press DOWN button to lower the coil.

c) Hybrid. For example, adjust the position of the frame, and then press UP button to raise the coil, after that put in crucible, and the crucible should be in the center of the coil, the crucible should not touch the coil. After this, proceed with standard melting process.

d) NOTE: Before raising the coil, adjust the position of the frame, make sure the crucible does not touch the coil.

e) NOTE: When the coil is raised, make sure the frame and crucible does not hit the coil when the frame rotates.

PARTS



1. Power switch: ON means power is on, OFF means power is off.

2. Voltage Switch:

Voltage Switch: it has 6 voltages, the power decreases from the voltage 1 to voltage 6. Voltage 2 and 3 are used for melting high-melting point metals like cr-co alloys. Voltage 4 and 5 are used for melting medium-melting point alloys. Voltage 6 is used for Test Mode. Choose the right voltage on the Voltage Switch, for example, for melting high-melting metals, voltage 3 is normally used, but if the voltage is too high or too low, adjust the voltage switch to make the voltage within the range of 180V-185V.

- 3. Door indicator light: indicates whether the lid is closed. When the lid is closed, the indicator light is on, users can operate the machine.
- 4. Position indicator light: this light is on only when the frame is adjusted to the right position. After the lid is closed, the position indicator should turn on.
- 5. AC voltage: indicates the AC voltage for melting.
- 6. DC voltage: indicates the DC voltage for melting.
- 7. DC current: indicates the DC current for melting.
- 8. Observation Window: observing the state of the melting and casting
- 9. Melt button: after pressing this button, the medium-frequency vibrating circuit is activated, and the machine starts to melt.
- 10. Cast button: after pressing this button, the centrifugal system is activated, and the melted alloy is cast into the casting ring.
- 11. Stop button: press this button to stop melting or centrifugal.

There are two buttons inside the front panels for adjusting the position of the coil during maintenance.

- 1. UP button for coil. Press this button for raise the coil. The button can be pressed intermittently or continuously.
- 2. DOWN button for coil. Press this button for lower the coil. The button can be pressed intermittently or continuously.

When pressing these two buttons, do NOT press Melt or Cast button. After maintenance, the coil must be adjusted to the bottom position.

NOTE

- 1. Before the machine's first use after transportation or storage, the Test Mode is recommended to ensure the safety of the operator.
- 2. Balance and fix the frame to avoid vibration during casting process. If the frame is not balanced and fixed, the machine may be damaged.
- 3. Do NOT open the lid in the melting or casting process.
- 4. Do not adjust the Voltage switch (XK) during melting process, otherwise the circuit board may be damaged.
- 5. Observe the current display after pressing the Melt button, if the current exceeds 15A, the machine should be stopped immediately. Identify and solve the problem (the condition of the alloy, inappropriate voltage selected etc.) and operate the machine after the problems are solved.
- 6. Observe the state of the alloy carefully during melting process, avoid melting with extreme high temperatures, otherwise the crucible base may be broken, or the alloys being oxidized.
- 7. Press Stop button immediately if there is anything wrong, and then examine the machine.
- 8. In the melting process, observe the state of metal carefully, different alloys may have different melting times. After the melting process is done, the casting process should be started immediately.
- 9. The process of melting and casting: after the heating starts, the color of the alloy changes from yellow to red and then to white. Casting should start immediately when the surface softens, the surface starts to overflow. If heating continues, the alloy will reach its boiling point, which indicates over-melting. If there is alloy hanging in the middle of the crucible, open the observation window and poke the alloy with a non-metal stick to make it fall down, close the lid, continue the melting process.
- 10. Notes on crucibles: do not use crucibles with cracks, keep the inside clean, wipe off the sand and dust with a clean cloth before using, keep the outside clean from dirt.
- The Test Mode is for examine if the melting device is working properly, users must run this test after repair or transportation.
 Running the Test Mode: turn on the power, do not put in crucible, select Voltage 0 on the Voltage Switch (lowest voltage), and the AC voltage should indicate 120V. Press the Melt button, and the AC ammeter should indicate 4.0A, the AC voltmeter 140V, which indicates the device is normal. Press Stop button after the test.

Warning: the Empty Test should only be run under the lowest voltage.

Troubleshooting:

- 1. Return circuit operating failure.
- a) Connector broken, needs to be replaced.
- b) The Door and Position indicator lights do not turn on. Repair the machine according to the AX-ZL3+ circuit diagram.

2. Melting system failure:

If there is problem with the melting system, use the Test Mode should be used to examine and identify the problem. Repair the machine until the machine tested normal. Use the AX-ZL3+ circuit diagram as a reference.

- a) If the power indicator does not light up after connected to the power, check fuse RD1, 2 (32A), replace if necessary. Check the indicator lights, replace if necessary. If the fuse is blown again after replacing, check for short circuit on the circuit board. The casing of the machine needs to be opened.
- b) Press power button DK, AC voltage is 0V, check fuse RD3 (20A), replace if necessary.

| Problems | | Ca | uses | Solu | utions |
|------------------|---------------|----|-----------------------------------|-------|--|
| 1. Connect the | Fan does | 1. | RD1 and RD2 (32A) melted. | 1. T | The fuse still blows after being replaced, which |
| power switch | not work | 2. | There is open circuit in the DK | indic | cates that there is short circuit in the return circuit. |
| DK, AC | | | and JC operating return circuit, | Cau | ses and solutions: |
| voltage is 0V, | | | or JC is damaged and JC is | 1) | There is short circuit in the filtering box caused by the |
| RD is not | | | open. | | breakdown of the capacitor. Open the filtering box \ensuremath{LB} |
| melted. | | | | | and replace the capacitor. |
| | | | | 2) | Wire 3, 4, 5, 6 are loose, touching each other or |
| | | | | | touching the case of the machine, find out the wire |
| | | | | | and connect them properly. |
| | | | | 3) | The main transformer B1 is damaged or there is |
| | | | | | problem in secondary winding contacts. |
| | | | | 2. Fi | ind the open circuit on the DK, JC connecting return |
| | | | | circu | uit and the damaged parts. |
| | Fan works | 1. | The AC voltmeter is damaged | 1 | Replace the voltmeter, find out the open-circuit |
| | normally. | | or there is a connection problem. | | locations and make repairs. |
| | | 2. | There is open circuit in the | 2 | Check the connection of the input and output of the |
| | | | connections of the main | | transformer and find the open circuit point. |
| | | | transformer B1. | | |
| | | | | | |
| 2. Connect the | e DK power | 1. | There is short circuit in the C2 | 1. | Measure C2, C11 using a multi-meter while the |
| switch, AC volta | ige is 0V, RD | | capacitor (connected parallel to | | power is off, find out and replace the breakdown |
| is melted. | | | the AC voltmeter) or the C11 | | capacitors. |
| | | | capacitor (installed on the JCR | 2. | Method to examine the rectifier bridge G11: (G11 and |
| | | | contactor). | | C13 shunts are fixed on the cooling plate) loose the |
| | | 2. | The rectifier bridge G11 is | | screws on the shunt, separate the wires, measure |
| | | | damaged (50A, 1000V). | | the rectifier bridge with a multi-meter. |

| | T | | |
|---------------------------------|--|---|--|
| | 3. The electrolytic capacitor C13 | 3. While measuring the rectifier bridge, also measure | |
| | (six parallel connected, 470µ) is | the C13 with the multi-meter to check if there is short | |
| | breakdown. | circuit. If there is short circuit, measure the capacitor | |
| | 4. The chosen voltage is too high | separately to find out the breakdown capacitor. | |
| | (>200V) which causes strong | 4. Lower the voltage to a normal range. | |
| | current. | 5. Decrease the amount of alloy melted or lower the | |
| | 5. Too much metal melted or the | selected voltage. | |
| | current is too strong caused by | | |
| | the change of alloy. | | |
| 3. After melting is activated, | 1. This problem is caused by the | 1. Find out the return circuit connections of the melt | |
| the readings of the DC | opening of the melting contactor | operation and tighten them. | |
| voltmeter and DC ammeter | JCR, and the poor contact of the | 2. Find out and replace the damaged parts. | |
| are 0, RD3 is not melted. | connecting point of the return | 3. Run the Operation Test first, if it tests normal, find | |
| (the door indicator and the | circuit in the melting operation. | and replace JCR or JR. If the test result is not | |
| position indicator are | 2. Damage of the device in the melt | normal, the parts on the MB panel are broken, to | |
| normal) | button AN1, contactor, JCR, JC | solve the problem, replace the MB panel. | |
| | or MB. | | |
| 4. After activating the melting | RD4 is not melted, under normal | Run the vibrator test. The procedures are: Disconnect the | |
| function, there is reading on | circumstances the vibrator is normal. | output wires of the high frequency transformer, one of the | |
| the DC voltmeter, there is no | If the vibrator is normal, the problem | output wires in the JD12 terminal (two orange terminals on | |
| reading on the DC ammeter. | might be caused by the following | the upper left corner of the cooling board). Select the | |
| RD4 (20A) is not melted. | reasons: | lowest voltage, the AC voltage is about 120V, press the | |
| (installed in the upper part of | 1. Poor contacts caused by the | Melt button. If the reading on the AC voltmeter is around | |
| the printing panel of the | loosening of the screws on the | 170V, the AC current is 1A, the vibrator is normal. The | |
| vibrator). | electrodes. | problem parts are between JD12 terminal and the working | |
| | 2. Poor contacts between the | coil. | |
| | electrodes and the conducting | 1. Tighten the loose screws. | |
| | board (the force on the spring is | 2. Remove one side of the spring, tighten it and put it | |
| | too little or there is a layer of | back to increase its power. Polish the electrodes and | |
| | oxide). | the oxide laver of the conducting board with a piece | |
| | 3. The copper cooling plates on the | | |
| | 11 01 | of fine sandpaper (insert the sandpaper into the | |
| | working coil touch each other. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the | |
| | working coil touch each other.The capacitor case is breakdown | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame).3. Watch the copper cooling plates of the working coil | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame).3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame).3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). 3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. 4. Disconnect one of the wires between the capacitor. | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). 3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. 4. Disconnect one of the wires between the capacitor case and the working coil rotate the centrifugal | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). 3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. 4. Disconnect one of the wires between the capacitor case and the working coil, rotate the centrifugal frame to the position where melting does not occur. | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). 3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. 4. Disconnect one of the wires between the capacitor case and the working coil, rotate the centrifugal frame to the position where melting does not occur, measure the resistance of the two conducting chins | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). 3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. 4. Disconnect one of the wires between the capacitor case and the working coil, rotate the centrifugal frame to the position where melting does not occur, measure the resistance of the two conducting chips of the capacitor case (*10K) with a multi-meter | |
| | working coil touch each other.4. The capacitor case is breakdown and short circuited. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). 3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. 4. Disconnect one of the wires between the capacitor case and the working coil, rotate the centrifugal frame to the position where melting does not occur, measure the resistance of the two conducting chips of the capacitor case (*10K) with a multi-meter, replace them if there is short circuit | |
| 5. After press the Melt | working coil touch each other. 4. The capacitor case is breakdown and short circuited. 1. The power transistor or the reverse. | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). 3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. 4. Disconnect one of the wires between the capacitor case and the working coil, rotate the centrifugal frame to the position where melting does not occur, measure the resistance of the two conducting chips of the capacitor case (*10K) with a multi-meter, replace them if there is short circuit. 1. The RD4 is melted make replacement of the func. | |
| 5. After press the Melt | working coil touch each other. 4. The capacitor case is breakdown and short circuited. 1. The power transistor or the reverse diode is damaged | of fine sandpaper (insert the sandpaper into the electrode and the conducting board and turn the centrifugal frame). 3. Watch the copper cooling plates of the working coil and see if there is touching among them, separate them if they contact. 4. Disconnect one of the wires between the capacitor case and the working coil, rotate the centrifugal frame to the position where melting does not occur, measure the resistance of the two conducting chips of the capacitor case (*10K) with a multi-meter, replace them if there is short circuit. 1. The RD4 is melted, make replacement of the fuse and run the Empty test only when there is no short | |

| but no DC current, RD4 is | 2. The load current is too high. | circuit in the oscillating board. Test method: remove |
|-------------------------------|--|--|
| melted. | | the RD4, set the multi-meter to the *100 mode, |
| | | connect the multi-meter to the electrolytic capacitor |
| | | (negative electrode, black wire) and the left frame of |
| | | the RD4 fuse, if the resistance is less than 100Ω , it |
| | | indicates that there is broken parts on the oscillating |
| | | board. Contact the company for repairs. |
| | | 2. The load current is too high, the reason is that the |
| | | selected voltage is too high (>200V), or the melted |
| | | metal is too much, or the melted metal is titanium. |
| 6. During the melting | The load is too heavy, or the | 1. Reduce the amount of allov melted. |
| process, the DC current | temperature of the power component | 2 Lower one level of voltage. |
| suddenly turns to 0, there is | is too high, which cause the vibrator to | 3 Increase the interval between two working |
| DC voltage. The Empty Test | stop vibrating | process |
| is normal under the lowest | | |
| voltage | | |
| 7 Press melt button there is | This indicates that after pressing the | 1 Measure the discharge resistance R1 (1000, 10w) if |
| DC voltage but no DC | Stop button the Capacitor C13 has po | the resistance is >1000 it means that it is broken |
| current press Step button | fast discharging roturn circuit the | and should be replaced. P1 should be installed on |
| current, press Stop button | | the controlling relay beard KID, remove one and |
| again, DC voitage drops | 1 The discharge registered D1 | while measuring |
| Slowly. | 1. The discharge resistance RT | While measuring. |
| | $(100\Omega, 1000)$ is melted. | 2. Find out the open circuit point on the discharge |
| | 2. There is open circuit in the C13 | return circuit of C13 according to the diagram (or the |
| | discharging return circuit | connection diagram), and connect it. |
| | connections. | wire NO.25 wire NO.22 |
| | | $\downarrow \downarrow$ |
| | | $C13(+) \rightarrow \text{shunt} \rightarrow \text{JD11} \rightarrow \text{JCR} \rightarrow \text{R1} \rightarrow \text{JD11} \rightarrow \text{C13(-)}$ |
| 8. Over-heating protection: | 1. There is something wrong with | 1. Replace the fan, and clean the air-inlet frequently. |
| When the temperature of the | the fan, or the air-inlet is jammed | 2. Increase the intervals between two working |
| cooling device is above | which cause insufficient air flow. | processes. |
| 65°C, the temperature relay | 2. Working continuously in | 3. Measure the two output wires of T11 with a |
| T11 is activated, the melting | high-temperature environment. | multi-meter, if there is open circuit (R>0), it is |
| contactor releases. When | 3. Temperature relay T11 is broken | damaged and should be replaced. |
| the temperature of the | (the contact points touching each | |
| cooling device drops: | other under low temperatures). | |
| melting contactor JCR | | |
| restarts. | | |