



Hand book for Alloy heater heated ceramic kettle

Security Guide

Examples and diagrams in this book are just for illustration. Any installation has the particular factors and changes, so Tianjin Gongda Galvanizing Equipment Co., Ltd does not take responsibility for any practical application according to them.

Tianjin Gongda Galvanizing Equipment Co., Ltd does not take patent responsibility for information, circuit, equipment and software mentioned in this book.

We use notes throughout this manual to alert the users.



Notes: refer to circumstance that may cause personal injury or death, property damage and economic loss, and important information that users should pay attention.

Notes can help users:

- identify hazards
- Avoid hazards
- Understand the consequences of hazards



Shock hazard mark : Attached to electrical equipment, to alert people dangerous
People should pay attention to safety

To obtain detailed technical information, please contact us.

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Preface Summary

Instruction

Immersion heated ceramic zinc kettle is developed by our company, with the character of high strength and corrosion resistance. The alloy heater, corollary equipment of zinc kettle, is our patented product, having long efficiency and long life. They have been successfully and widely used in hot-dip galvanizing industry at home and abroad. At the same time, based on our immersion heated ceramic zinc kettle, we design Galfan alloy galvanizing line, steel wire hot-dip galvanizing line, fastener hot-dip galvanizing line, malleable cast iron product hot-dip galvanizing line, large tower hot-dip galvanizing line, etc.

Applications

Immersion heated ceramic zinc kettle is widely used in hot-dip galvanizing industry of steel plate, steel wire, steel mesh, nails, malleable iron fittings, fasteners, structural parts, electrical fittings. The working temperature of the molten zinc can be up to 550°C

Features

1. The kettle is made of ceramic kettle body, corrosion-resistant alloy heater, and temperature control system. The inner layer consists of high-strength corrosion-resistant ceramic coating, high temperature ceramic fiber, and high thermal insulation layer. The outer layer consists of welded high-strength steel plate and decorative plate.
2. The heaters are set evenly along the kettle inner side to ensure the uniform temperature of molten zinc, easy operation and maintenance.
3. The kettle is measured by thermocouple , which is made of corrosion-resistant alloy material, with the character of high accuracy and long life.
4. The kettle body is welded by high quality steel plate which surface is treated through a special anti-corrosion treatment. Thus having beautiful appearance and long service life.
5. The kettle is easily operated. After commissioning, the kettle is controlled automatically by temperature controller and cut off automatically when electrical fault happens.

Parameter

1. kettle size: length(according to customer's require)×width(0.8-2.5m)×depth(0.8-1.5m);
2. temperature controlling range: 420--550°C;
3. temperature controlling precision: ±0.5°C;
4. kettle body working life : guarantee period -10years;

5. guarantee period for alloy heaters: Corrosion-resistant part against liquid zinc corrosion resistant-one year (normal use, not artificial damage)

Parameters of heaters

1. Type: PJ95-920-10-1
2. Standard: Q/12QT4007-2002
3. Max power: 10KW
4. Single-phase current: 10A

Bill of materials:

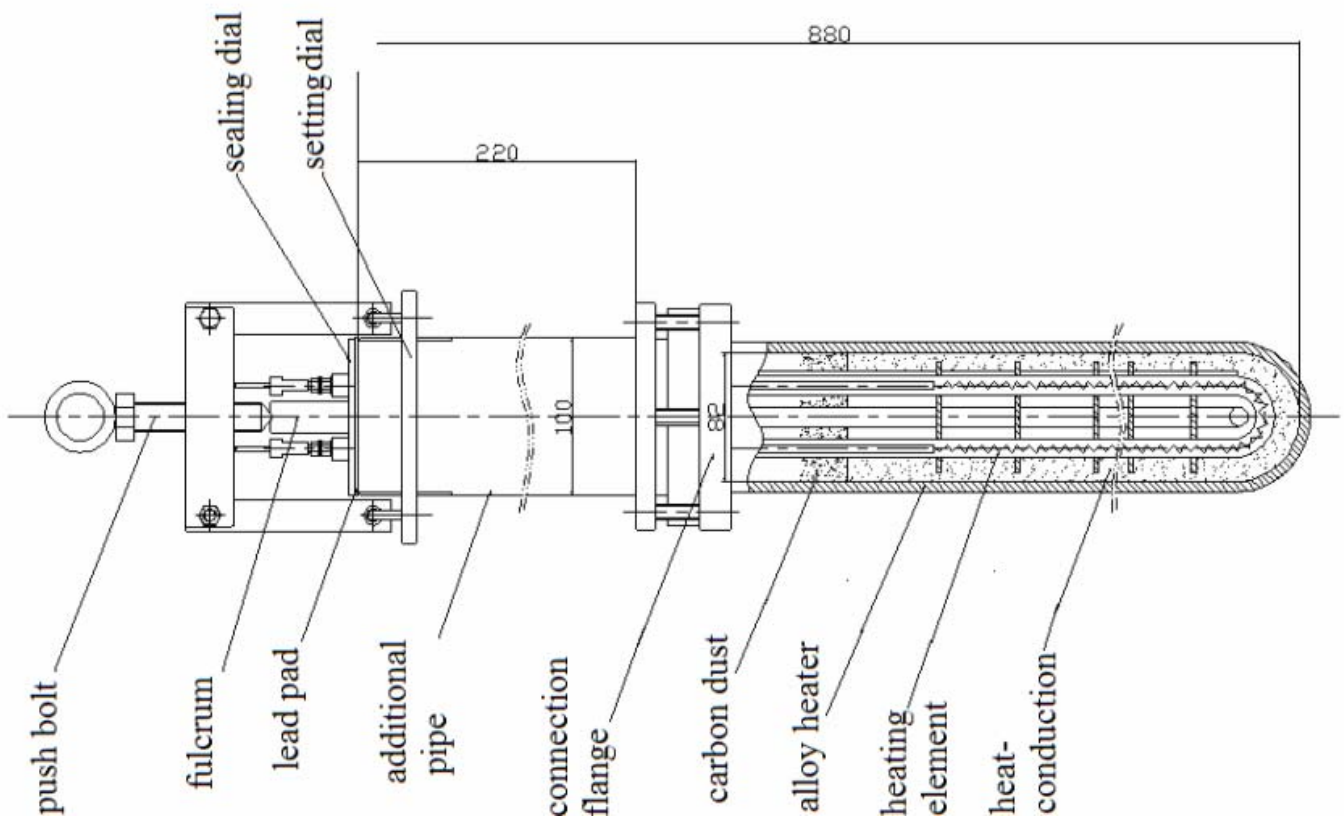
name	specification	quantity	notes
alloy sheath		1	
fulcrum	GD-605-2	1	
jbscrew	GD-605-1-1	1	

beam	GD-605-1-3	1	
fastener for beam	M8	2	
hanging scaffold	GD-605-1-2	1	
heating element	10KW	1	

ceramic bead		1 袋 (100g)	
wiring terminal		8	
lead pad		1	
fastener for live wire	M6*10-Q	4	

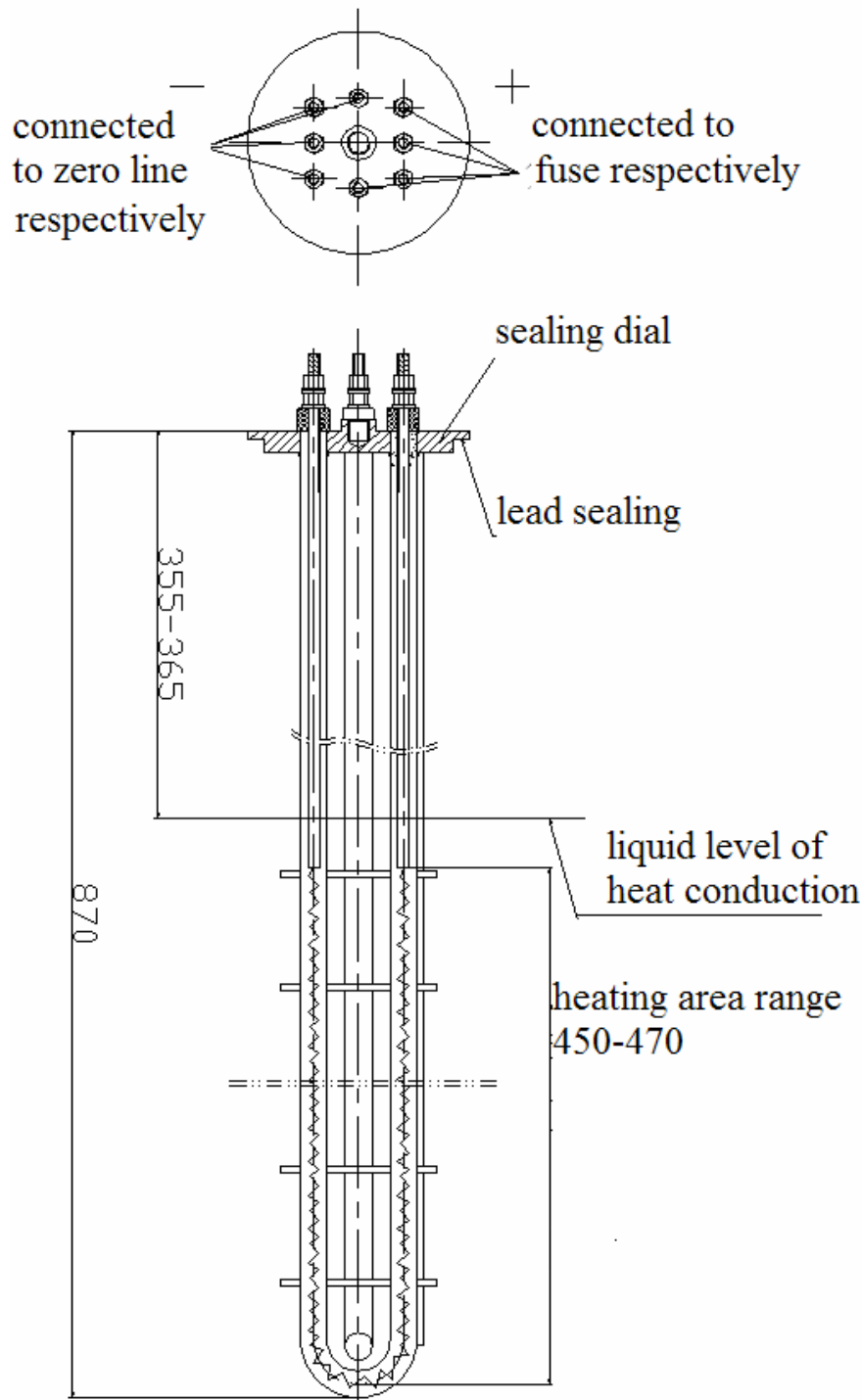
<p>fastener for zero line</p>	<p>M6*18-Q</p>	<p>2</p>	
<p>heat-conductor alloy</p>		<p>约 22kg</p>	
<p>carbon dust</p>		<p>1 袋 (400g)</p>	
<p>wax duct</p>	<p>Φ 12*2+Φ 16*1</p>	<p>3</p>	

Heater structure



Alloy heater drawing

Heating element consists of four U-shaped heating pipes, with total power of 10 kw. The negative pole of each heating pipe is connected to zero line. And the positive pole is connected to power through fuse.



Heating element drawing

Heat conductor is made up by our company. It's very important to the heater. The height has to be controlled strictly.

Heater features:

- 1) High thermal efficiency- up to 95%
- 2) Heating up fast
- 3) Having the character of good corrosion resistance, long life and no dross
- 4) Easily maintenance, replace the heater without stopping production

- 5) Easily installation

Chapter one Zinc kettle

1. Preparation work

Unpacking

1). Large lifting equipment is needed to move the zinc kettle to the installation location. During transport, fastener may loose or the kettle surface may be damaged. Please check the kettle body and contact us in needed when the kettle arrives.

2). remove the package and place the control cabinet to easy control room or control board.

3). Heaters are packed by wooded box. Each heater contains sheath and parts, which have the same serial number. Do not open the packaging and mix them before installation until our engineer come and instruct.

Kettle installation

1). Before installation the basic horizon plane needs to be measured to insure molten zinc keep at level condition. Customers can decide the distance from upper edge of zinc kettle to the ground depending on the requirement of process. Generally the distance is 500-600mm.

2). Wiring must depending on circuit diagram.

3). in order to insure safety use when installing the zinc kettle we must install a thing to connect the ground (when installation of zinc kettle, our company will have technicians to instruct on site. Uses should operate depending on requirement)

Circuit plan

1. Customer should connect control cabinet to factory power..

2. About the power line position which connect the heaters to zinc kettle, we recommend embedding method. Customer can dig cement tanks or wear the line through tubes. Bending is to be avoided possibly. Wire casing should be anti-acid, waterproof and protected from heavy pressure.

3. The power laying and operation should be done by electrical engineer.

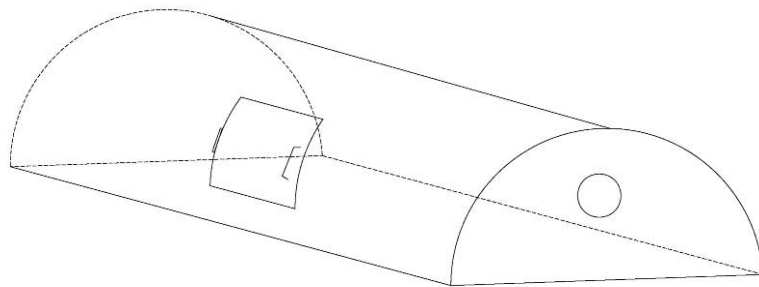
Auxiliary heat source

The kettle has to be baked thoroughly before the fist use, to avoid that moisture coming from the inner layer of the kettle oxidizes the liquid zinc. So the auxiliary heat source is needed to bake the kettle after the kettle is installed. There are several sources: electric heating pipe, oil burner, gas burner and so on.

auxiliary heat source	character
electric heating pipe	Simple operation, accurate temperature control, high cost
oil burner	Heating speed, simple operation, suitable for most area
gas burner	Heating speed, complex control, suitable for gas rich area

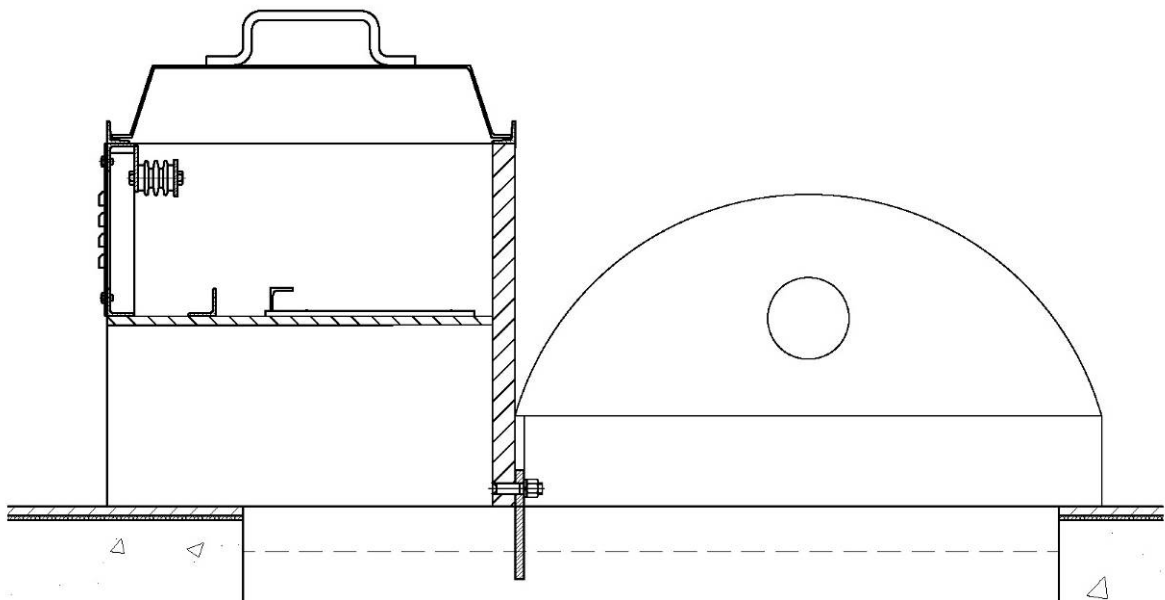
Insulation measures

During baking kettle and melting zinc ingot process, insulation cover is used to reduce the heat loss. Our company will supply this cover or customer make the cover according to the drawings our company supply.



insulation cover

Put the insulation cover in the kettle before baking, filling the gap and covering with ceramic wool.



Installing the cover

2. Baking

After preparation, we start baking work. We introduce baking process using diesel burner which is used commonly.

1) Install Burner

Put the burner in the kettle where has a hole for fire. Adjust burner crater slightly oblique down and surround the nozzle by ceramic fiber burner for protection.

Do not block the burner air inlet.

2) Baking technology

Set the temperature controller according to the baking technology curve(see appendix A). Bake the kettle slowly according to the curve, and adjust the holding time according to the practical situation to let the moisture go sufficiently. During baking, you can see a lot of water vapor go from the kettle cover gaps or side positions. Generally in the high-temperature stage, steam oven will basically disappear. When baking process ends, cut off power and oil source. Let the kettle cool to room temperature.

3. Melting zinc ingot

1. Installing

1) Installing zinc ingot must along the bottom of zinc kettle and put in “V” shape. and can't be put random and must be put on lay to the upper edge of zinc kettle. In the process of putting zinc pay attention not to collide the heaters.

2) Zinc cannot be placed any higher than the upper edge of the ceramic of the kettle. Once installing work finish, put insulation cover in the kettle.

2. Melting

Bake the kettle slowly according to the curve strictly. Shortening heat-up time is forbidden.

1) When the zinc kettle temperature reaches 420 °C, inspect the zinc. When the zinc is molten more zinc may be added.

2) Prior to adding zinc ingots to the molten zinc (to top up the bath to the operating level) the ingots should be pre-warmed on the top surface of the zinc kettle. The preheated zinc ingot should be carefully placed on the surface of the already molten zinc. Under no circumstances should the ingots be dropped into the molten zinc.

3) The surface level of liquid zinc should be controlled about 100mm below the upper edge of zinc kettle.

4. Installing heaters

- 1) After melting work, we start install heaters. Put the heating tube and the corresponding heat conductor on the kettle edge according to the serial number. Let the mounting parts outwards. Use the kettle heat to bake. Cover the tube with ceramic fiber to reduce the heat loss. Baking time should not be less than 24 hours. Heating elements and carbon dust also should be baked in advance to remove moisture contained.
- 2) The heat conductor can be put into the corresponding tube before baking. And the left heat conductor can be added after the tube is put into the kettle and the inside heat conductor melts.
- 3) Install hanging scaffold, jackscrew and beam.
- 4) After the zinc ingot melt totally, adjust the surface level of liquid zinc about 100mm below the upper edge of zinc kettle.
- 5) When the surface temperature of the heating tube reaches above 150 °C, move the tube to the heater support by crane or worker, vertical float, slow decline, controlling the rate of decline at 100mm per minute. Prohibited quickly insert heaters into liquid zinc during descent. The heaters can not crack the kettle during descent.
- 6) When the heater is put into the kettle, the heat conductor will melt because of the heating. To avoid darting, the tube nozzle can be covered by ceramic fiber. Do no let the ceramic fiber fall into the tube.
- 7) Install the tubes according to the serial number and adjust the tube spacing.
- 8) Check whether all the heat conductor have been added to the corresponding tube and make sure no heat conductor left.
- 9) When all the heat conductor melt, start to install the heating element. Insert the heating element (with a sealed lead-pad) into the tube slowly and later take out a little. Check whether the heat conductor surface level is suitable. The level should be about 50mm above the top disk.
- 10) Raise up the heating element about 100mm, add carbon rust to the tube evenly and clean the tube nozzle. Adjust the heating element position(if the heating element can not move, just wait for a moment) to let the zero line and the live line separately stay in the beam side. Press the heating element and the fulcrum, tighten jackscrew.
- 11) connect the heaters to power.

5. Try galvanizing

- 1) Strat the kettle
- 2) Take the zinc ash away from the liquid zinc surface
- 3) Regulate zinc liquid ingredients
- 4) Observe liquid zinc temperature fluctuations
- 5) When the temperature is stable, put the pre-treated work piece into the kettle and start galvanizing

Chapter two alloy heater

Installation

1. Put the tube on the kettle edge and bake. Cover the tube during baking to reduce heat loss.
2. Pre-heat the heating elements and the heat conductor.
3. Making simple mounting bracket for heating tube assembly.



Number of heat conductor



number of tube



Install the hanging scaffold



install the beam and the jackscrew



Fix the beam



lay the pad

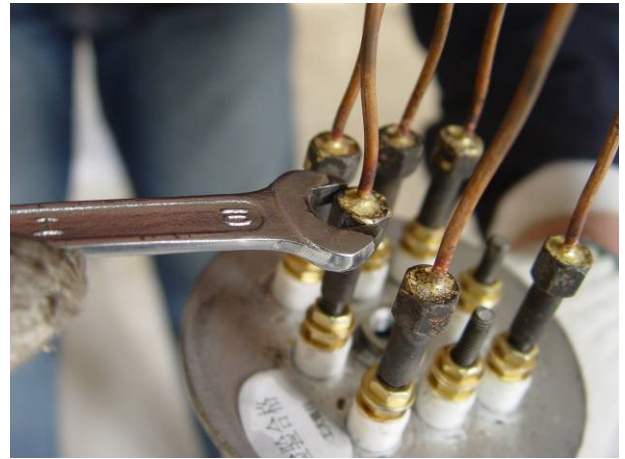


Adjust the hanging scaffold position to make sure the nether flange is 20mm away from the liquid zinc surface.

4. Install heating element



Put the wiring terminal



tighten the wiring terminal



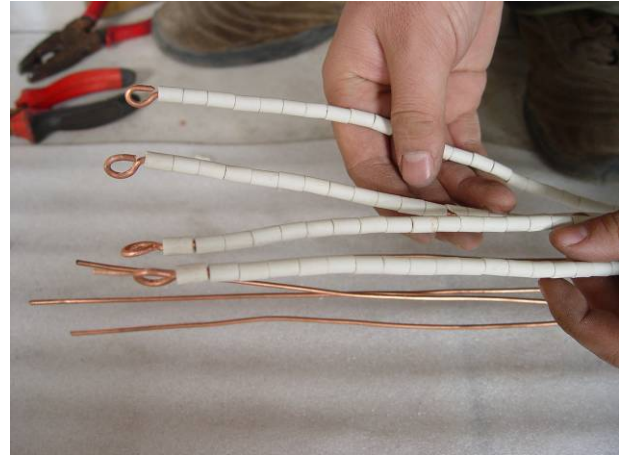
identify two-phase of the four heating cores



put the ceramic bead to the live line



No ceramic bead in the zero line



make circle in the top part



Check whether there is short or open circuit in each heating core



connect the heating core to control cabinet



Protect the live line with \varnothing 12 wax duct



Protect the live line joint with \varnothing 16 wax duct

5. install heaters



Put two pieces of heat conductor together into tube



push the alloy to the bottom



Make sure no conductor left



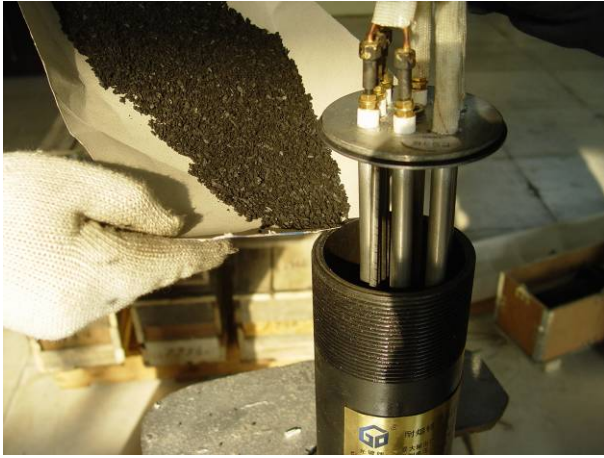
insert the heating element to the tube when all conductor melt



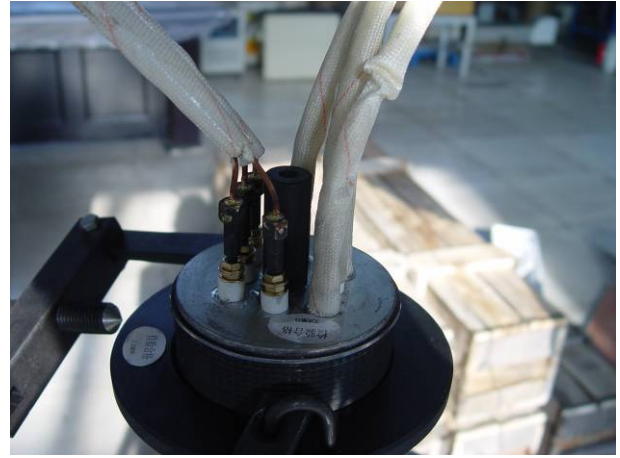
Pre-heat the heating element in the tube for a moment



pull up the element a little and add carbon



Carbon should be added around the element even



push the element to the tube bottom
and place the fulcrum



Fix the beam and the jackscrew



tighten jackscrew

Chapter three maintenance

Preparations:

Material list for maintenance

name	specification	quantity	application
carbon	Diameter 2mm	400g/each heater	Spare and added to prevent over-consumption
spanner	M10	2	Removing wire connecting bolt
spanner	M12	2	Removing beams

note:

1. maintenance every month by skilled worker.
2. move the bolt, add about 400g ϕ 2mm carbon, and then seal the heating element. If the lead pad is damaged during this process, use a new one for well sealing.



If carbon do not be added regularly and conductor is oxidized, our company do not warranty this heater when the heater breaks down.

3. Please appoint special persons to check, repair and change the heater periodically. Our company will give technically training when assembling heater at the first time.

4. The joint of heater's current source has high temperature, this will cause electric source to oxidize and virtual connecting. When check the heater, please check that protector is all right or not. Cut out current source, measure electric resistance of the heating pipe (the electric resistance of single heating pipe is about 18Ω). If the electric resistance is in a proper condition, please change the protector or find out the virtual joint to repair. If not, the heating core is proved to be broken.

5. Treating: If only one heating pipe in the heating core is broken, not effecting production in addition, you may not treat it. If not, please change it.

6. Suggest clean the zinc ash that around the heaters and the zinc dross (to avoid crash heaters) by every shift, and maintain heater monthly, add heat conductot and carbon rust timely.

1) Controlling of liquid zinc level:

a. Using for normal production: The distance between liquid level and connection flange bottom should be 30mm;

b. When stopping production for cleaning zinc dross: The distance between liquid level and connection flange bottom should be 20-35mm. After cleaning the zinc dross, please fill in zinc ingot immediately.

c. Please strictly control the liquid zinc surface level, or else heaters may be damaged or working life will be reduced.

d. If the ring flange is not in one level, the maintenance man should adjust the height of heater in time.

2. Please avoid crash heater when producing and cleaning zinc dross.

3. The periodic cleaning work: Clean the liquid zinc surface in heating zone by every shift, so as to keep the region around heating zone clean. Clean the zinc dross timely. If the bottom of the heater is buried in the zinc dross, it is likely to cause the heater tilt, corrosion, or damage resulted from local overheating.

4. During the normal producing, the maintenance staff should measure and record three-phase current , please pay attention to changes about it.If changes happen, please doing some checks and maintenances in time to avoid bad effects on production.

5. In the event of loss of electrical power, the kettle must be covered at once to retain heat and prevent freezing of the liquid zinc. As soon as the electrical supply is restored, the heaters should be turned on to avoid freezing of the zinc. If the liquid zinc has become solid, operating according to the melting technology curve. Quick heating-up operation is forbidden.

products	notes
Control cabinet	<p>1. The temperature control equipment (PID) must be used according to the hank book.</p> <p>2. The kettle works best when the automatic temperature control system is used. The manual system should only be used when the automatic system cannot function. When manual system works, the temperature can not be controlled automatically, workers have to get the temperaturwert from meter and control the temperature.</p> <p>3. when welding is to take place on the kettle, the temperature control equipment (PID) must be turned off.</p> <p>4. During the normal producing, the maintenance staff should measure and record three-phase current , please pay attention to changes about it. If changes happen, please doing some checks and maintenances in time to avoid bad effects on production.</p>
Zinc kettle	<p>1. The surface of the molten zinc which is non-work area should be covered with insulation to reduce heat loss.</p> <p>2. The molten zinc surface level is not allowed to exceed the maximum sated level. Or else liquid zinc overflowing could cause electrical short circuit</p> <p>3. The molten zinc surface and space between adjacent heaters shall be cleaned</p>

at least one time by every shift to make sure the liquid zinc flow freely everywhere..

4. Galvanizing speed should be balanced to give full play to temperature control function of PID, improve product quality, and reduce energy consumption.

5. In the event of loss of electrical power, the kettle must be covered at once to reduce heat loss. As soon as the electrical supply is restored, heat up the kettle immediately to avoid freezing of the liquid zinc.

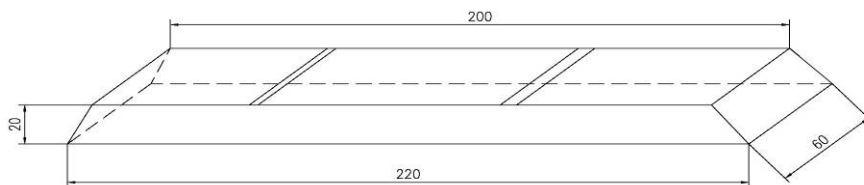
Chapter four stop production and freeze liquid zinc

Please reduce times of zinc freezing and zinc melting, to increase the working life of ceramic zinc kettle and the heaters. We suggest keeping kettle temperature at 425°C when the time for stopping production is not more than two months. Please do zinc freezing operation according to the following technology for lone time non-production:

Preparation work

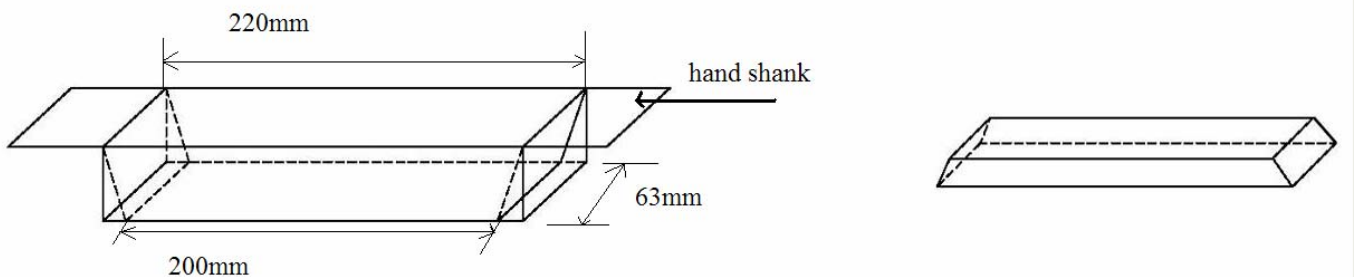
1. making alloy tank

All heat conductor alloy has to be removed totally from the tube before the alloy become solid, to prevent the tube splitting when the alloy melt again. Since the alloy can be recycled, make alloy tank for easy operation for re-use.



Standard alloy ingot size

Suggested tank : Material is steel plate. About the size, see following picture



Prepare 7-8 alloy tanks. After welding, remove rust and make sure the tank is dry when using.

2. Clean the zinc dross zinc ash thoroughly
3. Adjust the zinc surface level to working height.
4. Cover the liquid zinc surface with ceramic fiber or insulation cover to reduce heat loss.
5. Heat up the kettle temperature to 500°C.
6. Turn off the power.

Freezing process:

1. After turning off the power, loosen the Jbckscrew. Then take out the heating element quickly. Put the element in a safety place and store when cooling to room temperature.

2. Take out the tube and pour the liquid alloy to the alloy tanks. During this process, the temperature is high, be careful. Do not crash the tube. Place the tube on thermal insulation and store after cooling.

Recommend crane or other lifting equipment to take out the tubes. If personal operation, it should be done by two people through leverage.



The tube should be taken out smoothly. Crash is forbidden. Operators should have physical protection to avoid damage due to tube break and liquid alloy flow out.

3. Pouring process should be smooth and prevent splashing.

4. The width of alloy ingot is about 20mm.

5. Waiting until the alloy become solid, overturn the tank by handle and let the alloy block falls out.

6. Do not take out all the tubes immediately after turn off the power. Because the heat conductor alloy will become solid in the tube, if do not pour out the alloy in time when the tube is taken out of the kettle.



If some tubes are still not taken out when the kettle temperature falls quickly, the kettle should be heated again. Before turn on the power, make sure all the wire lines, which the taken out heaters connect to, have been protected well to avoid short circuit and leakage.

Note: Freezing the heaters in the kettle is forbidden.

Since the control cabinet uses the three-phase-zero-crossing control system, we recommend three-phase average removing.

6. The alloy blocks should be packed and stored according to the corresponding serial number. Mixed packed is forbidden.

7. After take out all the heaters, cover the kettle with insulation cover or the ceramic fiber and let the kettle natural cool down. Warning signs should be established to prevent injury happens.

Chapter five restart the kettle

Operation for restarting the kettle is the same as the first time the kettle is used. If the inner part of the kettle is well protected and no pollution, customer can melting solid zinc directly, baking is not needed.



Pay attention to the distance between the liquid zinc surface and the connection flange during the melting process. Do not let the liquid zinc corrodes the flange.



Some ones should be in charge of the melting and freezing process. Be on duty and make notes for kettle changes and operation time 24 hours per day.

Note: During the warranty period, our company do not take responsibility for the heater broken resulted from wrong operation.

Telephone number:022-58859390

Appendix A:

Technological operation for baking kettle and melting zinc ingot for ceramic zinc kettle

No	Baking temperature (°C)	Baking time (hour)	note	No	Baking temperature (°C)	Baking time (hour)	note
1	30	1		32	485	1	
2	45	1		33	500	24	constant temperature
3	60	1		34	540	2	
4	75	1		35	550	24	constant temperature
5	90	1		36	40	24	Cooling down, workers start work
6	105	1		37	40	24	Place the zinc ingot in the kettle edge
7	120	1		38	65	1	Melting zinc ingot and heating up
8	135	1		39	90	1	
9	150	32	constant temperature	40	115	1	
10	165	1		41	140	1	
11	180	1		42	165	1	
12	195	1		43	190	1	
13	210	1		44	215	1	
14	225	1		45	240	1	
15	240	1		46	265	1	
16	250	24	constant temperature	47	290	1	
17	265	1		48	315	1	
18	280	1		49	340	1	
19	295	1		50	350	8	constant temperature
20	310	1		51	365	1	
21	325	1		52	380	1	
22	340	1		53	395	1	
23	350	24	constant	54	410	1	

			temperatur e				
24	365	1		55	425	1	Melting zinc ingot
25	380	1		56	440	1	
26	395	1		57	450	1	Add zinc ingot
27	410	1		58	465	1	
28	425	1		59	480	1	
29	440	1		60	500	6	Install heaters
30	455	1		61	530	2	Try galvanizing fasteners
31	470	1		61	450	2	Try galvanizing steel wire

Note; 1、 extend baking time at 250°C according to the moisture discharging situation.

Appendix B Information about ceramic zinc kettle

Item	Index	notes
Working environment	temperature	-20°C—50°C
	atmosphere	Control cabinet can not work within explosive gas, corrosive gas, vapor and dust. Simple control room is recommended.
	relative humidity,	0—95%, non-condensing
Control functions	PID	<p>Freely input, display accuracy-0.3grade</p> <p>Manual output, double setpoint</p> <p>two independent sets of PID parameters</p> <p>Sample / display cycle 4 times per second</p> <p>Expert PID algorithm, including SF overshoot suppression coefficient</p> <p>power-slow start between 0-100seconds</p> <p>Can set upper and lower absolute, upper and lower limit deviation value, deviation, internal / external alarm mode</p> <p>Analog transmitter (optional): measured value, set value deviation,</p> <p>Adjust the output transmitter for field recording data, multi-zone temperature control or cascade regulation.</p> <p>positive or negative off could be set as complement of PV measurement value.</p> <p>To avoid measurement interference field, you can set the digital filter time constant interference.</p>
	Power regulator	<p>Patented wide mouth centrifugal fan</p> <p>Blade radiator</p> <p>Operating current exceeds 1000A</p> <p>Low noise</p> <p>Automatically detection of the fan speed</p> <p>Automatically detection of the temperature of the radiator</p>