MODEL: AT-TAQ2436-20A

FLAT/BEND GLASS TEMPERING FURNACE

EQUIPMENT DATA

1. Brief Introduction

Machine structure and working principle

This machine is consisted of Loading section, Heating section, Flat Tempering section, Unloading section, Blower System and Control System. The glass sheet enters into heating oven from loading table, and tempered & cooled in flat quench & cooling section after heating. It goes to unloading table to finish process.

1.1 Loading section

Loading section is consisted of compound steel structure frame, transmission system, photo-electric switch and universal ball elevating table etc..

Drive motor of loading section is drove by inverter, transporting the fixed glass sheet to the photoelectric sensor of front door of the heating section and ready for enter the furnace.

When glass is entering the furnace, rollers in loading section are ran in high speed through motor driven by inverter, transporting the fixed glass to the heating furnace for heating. Encoder will exactly measure and record the total length of the glass. Moving distance of loaded glass sheets can be changeable through man-computer interface according to glass size.

Universal ball frame with pneumatic actuator will be manual controlled elevating, which is suitable for bigger size glass sheets loading.

1.2 Heating section

The heating section includes the roof lifting mechanism, heating system, fast cooling system, thermal balance system, ceramic rollers, the length measuring and temperature measuring devices.

The heating furnace is divided into upper and lower parts. The upper part can freely move up and down by the roof lifting mechanism for easy maintenance. Latest heat-insulation material is chosen for heating oven body, the connection of which is also specially handled for further better heat preservation.

The fast cooling system is for fast cooling when the heating oven is needed to reduce temperature.

The heating structure is lattice type. Upper and lower parts of the furnace are heated independently in each heating zone. Upper heating area and lower heating area will be divided into several small areas according to furnace size. Each heating zone has its thermocouple forming independent control loop. The heater is good quality alloy material to service more years.

Ceramic rollers are driven by round-shape belt. Adjustable speed by inverter can ensure simultaneous and stable running.

When glass is entering into the furnace, front oven-door opens. rollers in loading section and heating section move simultaneously and transport the glass to the heating furnace. During heating in oven, glass makes reciprocating movement, which can be heated evenly.

When heating is finished, the quench section will move at same speed with the heating section conveying the glass to the tempering sections for tempering and cooling.

1.3 Flat tempering and cooling section

The cooling section includes steel-structure frame, transmission system, quenches, quenches open/close mechanism, upper-quench elevating frame and soft air pipes… Quenches are upper and lower two parts, which are connected separately with air distribution center.

Proximity switch of quench open/close mechanism can adjust electrically air-blowing distance between upper and lower quenches. Upper quench elevating frame will solely adjust high of upper quench, which is more convenient to adjust glass flatness during operation.

Upper and lower quenches will close automatically when heated glass is ready to exit from oven,. Rollers will run at same speed with ceramic rollers in heating oven to carry heated glass to flat tempering and cooling section. During cooling, glass acts reciprocating movement to get symmetrical cooling of glass. For different thickness glass, the computer will auto-regulate inverter of blower to supply proper

air-pressure and air-quantity accordingly.

1.4 Unloading section

It's primarily the same as the loading section. Since of manufacturability, there is equipped photo-electric switch at end part. Rollers will stop running when the glass touches photo-electric switch, and people unload glass by hands. Bigger size of glass sheets can be unloaded at universal balls elevating table trough side-rollers.

1.5 Blower system

The fan system includes the blowers, inverter, air-door control unit, air distribution center, and air adjusting devices for upper quench and lower quench.

Blower is integral type structure, convenient to be installed.

Air distribution center ensures coherence of upper and lower quenches. Blower will be adjusted speed by inverter. Air volume and air pressure can be adjusted according to different production need since of different thickness glass, to get perfect tempered glass quality.

1.6 Control system

The control system consists of temperature control system, transmission control system, air route control system and alarm system during urgent trouble.

It can accurately control temperature in heating oven and show work-state through industrial control computer, and also regulate process data according to process requirement. PLC program controls logic action of machine different section. In addition, we use far-terminal temperature module to change simulate-signal which is collected by temperature detector at spot to digital signal for computer collection, which greatly improves steady of temperature collection system, maximum reduces interference by

heaters to temperature control system. Meanwhile, to keep temperature balance, temperature control system has two working mode for choice. One is hand-control start/stop of heating balance system, the other is auto-start/stop heating balance system by computer according to spot temperature data.

2. Technical characteristic

2.1 Heater arrangement

The heaters of tempering furnaces in our company are arranged by different ways since different oven size. Such arrangement makes simple heater structure, convenient installation and longer service life.

Heaters have single-point adjust-control function. Each heater has sole thermo-couple to measure temperature, and can be set temperature and power alone, which great possibly even temperature.

Heaters are from Beijing Shougang Electrics Company and service long time. Over-hung installation mode is easier to maintain. Each heater installation is independent, it will not affect others when to replace the trouble one.

The lower part is with our streamlined swing-shape radiant panel which can radiate the energy from lower heaters to oven hearth for effective heating result. There is no radiant panel in upper part, so the infra-red energy from upper heaters can radiate to upper surface of glass for fast heating absorption. Thus can reduce glass staying time in oven and improve glass surface quality, especially coated glass, which can avoid film-off phenomenon of glass surface. In addition, we add intelligent. When thicker glass comes to heating oven, operator can set power of glass entering and power gain speed.

It can set late-start heating when thicker glass comes to oven, namely, after glass finishes crisis time it start to heat, which can avoid glass breaking rate.

Reasonable radiant panels arrangement at lower part can effectively radiate energy and insulate broken glass.

2.2 Heat preservation structure

Full-enclosed heating oven adopts good quality heat insulation material, which has high performance

heat preservation, heat rising from 20℃-700℃ needs 4-8 hours. It is lower 10-15℃ than per hour for natural temperature-reduction. So the energy consumption is very low. At oven surface there is high-grade ceramic high-alumina plate, which is with lighter weight and high hardness and longer service life, can solve the problem of dregs-off once heat-insulation material pulverization.

2.3 Speed-control technology

Over-fast and/or over-early heating absorption at glass lower surface can cause over-long time glass up-bent, which can make “White mark” at glass lower surface. Forced convection can change such sate more, but the result at earlier time when comes into oven is not palpable. Since of this, we make some modification in control. 1. Speed-change technology. When the glass just comes into heating oven, we make its swing speed very slow, which can possibly reduce glass slippage on rollers. At this time glass is hard state, it is impossible to have roller mark. 2. After glass comes into oven the lower heaters stop working. The stop time can be set in computer. Thus can defer heating absorption speed of glass lower surface, shorten glass up-bent time, reduce glass up-bent rate. Because of very low speed of glass movement, the possibility of mark causing is very limit. So, this will have better result to delete “white mark” in glass.

2.4 position shift technology

Inherent principle of reciprocating type tempering furnaces determines some defects inevitable which will be caused during glass heating. For example, glass pause when direction-change. This kind of pause takes certain damage of glass quality. To reduce such damage, we adopt position-shift technology. We can’t delete glass pause when direction-change, but we set different pause position for glass, that is to say, the touch points of each glass pause with ceramic rollers will be different, which is intermittent cycle alternant. It will repeat once after more than ten times cycles. This will greatly reduce glass wave rate.

2.5 Convenient Maintenance

The heating oven is divided into top and bottom part, the top part could move up & down freely, which is very convenient for maintenance. The emergency cooling system on top of the furnace is used to cool down the oven quickly, which makes the maintenance more easy and convenient.

2.6 Electric Control Elements

The temperature collecting module adopts the A/D conversion module. There is one temperature-measuring control box at the side of oven, the thermocouple cables are connected into this box and connected with the temperature-measuring module, after conversion, it needs only one piece of two-core shielded wire which could transfer the digital temperature signal to the temperature control module. This design could avoid the interference to the temperature collecting from the site equipments, such as, inverters or other equipments with big power.

The temperature control module is a small computer, it could receive the temperature signals which collected by the temperature-collecting module, then it could control the heaters' on/off according to the control requirements (control requirements consist of temperature set value and power set value), the control accuracy is under 3℃.

The host computer adopts the industrial control computer and PLC is from Omron, Japan brand.

2.7 Control program

The control program is researched and developed by ourselves. Since we have the deep research on the glass tempering processes, when we make the program, we could make it give a better service for the operation process. We divided the parameters into two kinds: operator's parameters and engineer's parameters. Operator's parameters refer to the ones which the operators adjust usually, engineer's parameters refer to the ones which affects the glass position and moving speed, etc. also, there are some high-grade parameters which is set by the manufacturers and we called them as "administrator parameters". For the "administrator parameters", we could hand them over to the user's administrator for

the maintenance.

Features:

2.7.1 The operating interface is connected to the glass tempering machine closely. With the control interface, it is very convenient to monitor the running situation of each section.

2.7.2 Easy parameters-adjustment interface which makes the operation easily.

2.7.3 The temperature control module is a small computer, and there is the temperature-control program inside it. If the host computer transfer the temperature set value and power set value of each heater to this module, this small computer could control the temperature of the whole oven. At that time, even the host computer stop working or damaged, if only there is power, this kind of glass could be tempered continuously, in other words, the host computer only has the function for parameters setting and monitoring, it is out of control, which could improve the safety greatly.

2.7.4 The program has the reliable stability and friendly man-machine interface, and has much warning function for abnormal situation (such as joints of encoder loose, parameter setting wrong, etc) and has warning note for maintenance man checking.

2.7.5 Mass memory for parameters-saving, since the program adopts “ACCESS” abase software from Microsoft Office, the data could be deleted and called out at will..

3. Main parts：

Mechanical parts

No.	Description	Supplier
01	Ceramic roller	Sinoma or Kamrola
02	Ceramic roller drive belt	Taiwan
03	Insulating material (high aluminum insulating board)	Shandong , Luoyang
04	Fiber rope	France or U.S.A.
05	Blower	Wendeng

06	Cycloid reducer	Guotai
07	Turbine worm reducer	Zhujiang
08	Pneumatic element	Sazn , Airtac
09	Bearing	Harbin, Luoyang , Wafang dian
10	Type steel	Wuhan Iron& Steel plant
11	Heaters	Capital Iron& Steel plant
12	Rubber roller	Sandong
13	Chain	Zhejiang

Electric parts:

No.	Description	**Supplier**
1	PLC	Siemens
2	40point expander	Siemens
3	20point expander	Siemens
8	Analog output block	Siemens
9	Encoder	Bonner/U.S.A.
10	Photoelectric switch	OMRON/Japan
11	Approach switch	OMRON/Japan
12	Industrial control computer	Siemens
13	Temperature measurement module	Siemens
14	Soleplate of temperature measurement module	Siemens
15	data output module	Siemens
16	CPU of data output module	Siemens

17	Monitor	SAMSUNG
18	Inverter	Schneider
19	Thermo couple	Chuanyi
20	S.S.R	Wuxi
21	Blower inverter	Innovance

4. Technical data

Specification of flat glass：

Item	Data	Remark
Glass thickness	4-19mm	
Max. size	2440*1830mm-4mm 2440x3660—5-19mm	
Min. size	100x300mm	
Finished product rate	≥97%	
Glass quality	International standard	Flatness ≤0.2%
Power consumption	≤4℃/㎡——5mm	
Output	18-20L/H——4mm 15-17L/H——5mm 12-14L/H——6mm 9-11L/H——8mm 7-9L/H——10mm 6-7L/H——12mm 5-6L/H——15mm 3-4L/H——19mm	The output will be more or less because of the different size, origin and color of the glass. Bigger output with smaller glass size , deep color
Request of raw glass sheet	High quality float glass without bladder , sundries ; glass is after chamfering , edging ,washing and drying	

Specification of bend glass：

Item	Bend Glass
Glass thickness	5-19mm
Maximum glass bending size	2440x⌒2000mm
Minimum glass bending size	400x⌒400mm
Minimum radius	5, 6, 8, 10, 12mm---R≥1200 15mm--------R≥2000 19mm--------R≥2500
Finished product rate	≥95%
Glass quality	Goodness of fit 2.5mm

Total power

Item	Data	Remark
Heating power	518KW	
Blower power	250KW	
Convection blower	4kWx3	
Other	23KW	
Ceramic roller quantity	Φ85x44	
Transformer	630kWA	Customer-owned
Air compressor	7kg/cm2，1m3/min	Customer-owned