
H.E.R.O - Tunnel Kiln for Heavy Clay & Masonry Blocks & Bricks

Introduction – Clay Brick making

RHO Group of companies takes traditional production systems and applies the most innovative materials, the most recent technology and the most sophisticated process controls so as to ensure outstanding quality and maximum energy savings.

“A good start is half the battle”: that’s why RHO Group of companies carries out careful, accurate analysis and research on raw materials to identify the most efficient solution for each specific project.

Body preparation and forming

RHO Group of companies has an internal laboratory fully equipped with all the instrumentation needed to analyze and characterize raw materials and bodies.

Depending on the technological results of the laboratory tests, RHO Group of companies provides wet or dry-method body preprocessing systems and an extensive range of forming solutions, each designed on a case by case basis to meet the specific needs of the individual customer.

RHO Group of companies supplies every single machine on the production line .

Drying

RHO Group of companies offers its customers technical solutions that optimise energy consumption while providing outstanding production flexibility.

RHO Group of companies-designed drying systems are conceived to allow plenty of scope when it comes to adjusting primary and recirculation flows, the goal being to optimise cycles according to product type and car load layout.

The key feature of the RHO Group of companies drier is the forwards-backwards load movement with deflector cone; fully designed and built by the Group’s production facilities, its purpose is to maximise reliability and minimise maintenance.

Firing

Firing temperatures vary considerably between different clay types and are often quite critical.

During firing, bricks undergo a physical change. Clay particles and impurities are fused together to produce a hard durable and weather resistant product.

This is called vitrification. This is usually accompanied by further shrinkage and a colour change.

Temperatures vary greatly depending on clay type but are generally in the range of 900 – 1200degrees centigrade.

Obviously bricks cannot suddenly be subjected to these temperatures so firing is in three stages.

1. Pre heating – this ensures total dryness of the brick and utilizes combustion oils in the kiln to raise the brick temperature. (Where wet setting has taken place great care needs to be take at this stage)
2. Firing - A fuel, usually natural oil, LPG, oil or coal is used to raise and maintain the temperature to the required level over a few hours.
3. Cooling – Cold air is drawn into the kiln to cool the bricks slowly ready for sorting and packing.

This air becomes hot and can be drawn off and recycled for use in the drying process.

The range of kilns designed and built by RHO Group of companies consists of refractory brick-built tunnel kilns (FTO) or prefabricated structure (FPO) tunnel kilns; both feature combustion systems with burners installed on the walls or in the roof and a combustion space between one pack and the next.

RHO Group of companies kilns are designed and built according to the customer's specific plant engineering requirements and feature all the apparatus and instrumentation needed to ensure optimisation of consumption and compliance with product-specific process requirements.

RHO Group of companies designs and produces all the burner types installed on its kilns, thus ensuring comprehensive process control.

Loading/unloading and packaging automation

RHO Group of companies designs and produces cutting-edge plant engineering solutions for each product handling stage, using both conventional Cartesian and robotized systems that adapt perfectly to the specificity of the individual product or plant.

Making the difference...

RHO Group of companies' substantial R&D capacity is guaranteed by three internal in-plant labs, all fully equipped for the analysis and development of numerous applications in the heavy clay world.

Through these internal facilities RHO Group of companies meets and fully satisfies all the needs and requirements advanced directly by customers. And thanks to smooth synergies with Group companies, RHO Group of companies provides complete turnkey plants for the heavy clay brick industry that cover everything from body preparation to palletization.

Anytime, anywhere, customers can always count on RHO Group of companies's outstanding heavy clay know-how.

It's time for a H.E.R.O Tunnel kiln (High Efficiency Resource Optimizer)



Introduction of H.E.R.O Tunnel kiln

RHO Group of companies introduced Red brick production machines to produce International stranded Red brick used for building construction, H.E.R.O automatic Tunnel kiln and Red brick production machine group is designed on German technology, and we fully reform the design of the equipment with most up to date international 3 dimension design software (pro ENGINEER), and the design of the automatic production line is in accordance with the national design criteria of the People's Republic of China. In a tunnel kiln, which is a horizontal moving ware kiln, bricks to be fired are passed on cars through a long horizontal tunnel. The firing zone remains stationary near the centre of the tunnel, while the bricks and air move in counter-current paths. Cold air is drawn from the car exit end of the kiln, cooling the fired bricks. The combustion oils travel towards the car entrance, transferring part of their heat to the incoming green bricks. The cars can be pushed either continuously or intermittently at fixed time intervals. The tunnel kilns have provisions for air extraction and supply at several points along the length of the kiln.

H.E.R.O - Tunnel kiln design criteria and Energy Saving

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H.E.R.O: Advantages

German technology
PID temperature control
High fuel efficiency
Fast firing cycle higher out put
Eco friendly and low carbon emission.
Lower operational cost,
Lower product temperature at exit
Make use of all the residual heat.

H.E.R.O - Tunnel Kiln Technical Parameters

Item	Specification - Coal fired
Tunnel kiln for Red brick burning 1 set	L60m×W2.9m×1.35m
Preheating section	L20m
Firing section	L25m
Cooling section	L20m
Inside Width	W-2.9m
Inside Height	H-1.35m
Daily output	175 tone, 50000 piece
Kiln car	L2.84m*W2.84m
Quantity of the kiln car	Inner kiln 23sets; outside 23sets
Kiln car loading weight	8316KG, 2376piece
Firing cycle	24 hours
Kiln car into the kiln speed	68minute/car
Firing temperature	900℃-1000℃
fuel	Coal
Atmosphere during firing	Negative pressure, Neutral
Fuel value	6500Kcal
Quantity of Gun	10set
Temperature control point	20
High temperature control precision	±20℃(The high temperature burn area)
Control mode	Manual control
Hydraulic pusher	Hydraulic automatic into the car
Transfer car	2set

Cart machine	2set
Kiln pressure checkpoint	1 point
Kiln temperature checkpoint	8 point
Finished product rate	95%
Rail, 12kg	Inside 3/set, Outside 1 set, Converting kiln car rail 2set
preheating section L30m	wall thickness 480mm
Firing section L50m	wall thickness 600mm
Cooling section L50m	wall thickness 480mm
Flat ceiling	Refractory material
Fume exhausting blower	11kw, 1set
Combustion supporting blower	7.5kw, 1set
Smoke extraction blower	30kw, 2set
Emergency cooling blower	3.5kw, 2set
Heat suction blower	18.5kw, 2set
Combustion supporting air pipe	Ø175mm, 2 set
Fume exhaust wind pipe	Ø480mm, 1 batch
Heat suction wind pipe	Ø480mm, 1 batch
Temperature controller	1set
Electrical controller	1set
Kiln pressure control system	1set
Coal supply system	1set

Description of Kiln Structure

1. The kiln is steel frame structure. That is the rectangular steel pipe column for post. There are steel sheet installed between different sections.
2. Configuration of tunnel kiln zones: a: Preheating zone is 30m(30%), b: firing zone is 40m(40%), c: cooling zone is 30m(30%)



3. Requirements for brick structure: it designed as flat roof .Different refractory materials are used at different temp zone. That is to say, Clay bricks are used at pre-heating zone and cooling zone. Light high aluminum refractory material and high quality alumina silicate fiber are used for heat-preservation. Cordierite plates are used at the roof, and the alumina silicate fiber can resist the moisture and without clinkers. Poly light mullite bricks (JM26, ratio0.8~0.9) and light high aluminum bricks are used at firing zone. Light heat preservation materials and fiber are used as heat preservation.



4. Requirements for foundation :12T / m². The kiln body are built on the concrete foundation, and the level of foundation should be $\pm 0.000\text{m}$.
5. There are baffles at the entrance of kiln to prevent cooling air enter into kiln.
6. The moisture exhaust zone designed at the 16m with mixing air to mix airflow inside, to keep each product in same atmosphere and speed to exhaust the moisture at the ducts, which provide suitable atmosphere for fast firing.
7. Group of moisture exhaust ducts at the moisture exhaust zone for extra moisture exhaust exhausting.

Preheating module without roof air

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Labyrinth

- Chamotte
- JM 23

Wall

- JM 23
- Blok 800
- Rockwool

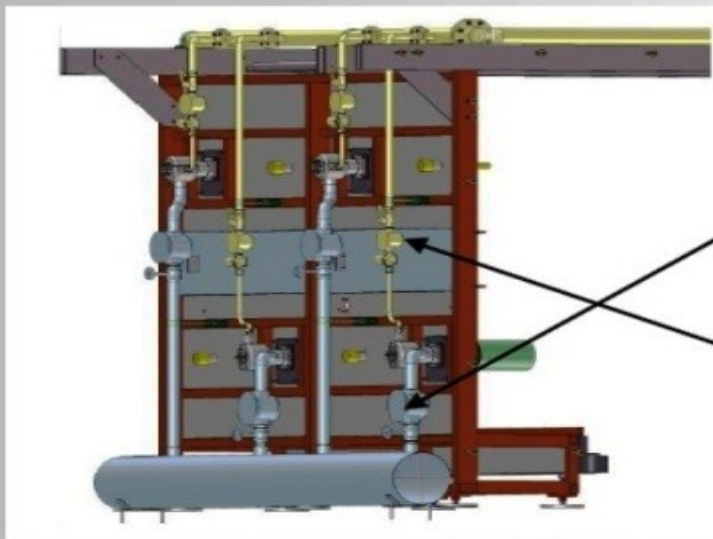
Roof

- JM 26 suspended blocks
- Fibre blanket
- Concrete

8. At the preheating zone, there are ducts with dampers for moisture discharge and can adjust the temp curve effectively in preheating.

Firing system – combustion air and gas

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Combustion air

- Fixed flow
- Modulation of central flow depending of main gas flow **or modulated**
- Piping stainless steel
- **Air filter in front of each burner optional**
- Fan with filter
- **Silencer optional**
- **Standby fan optional**

Gas

- Modulated
- Piping carbon steel
- Gas filter in front of each burner optional
- Main gas station single line
- **Gas counter optional**

9. There are total 100sets of high speed burner installed crisscross at the two sides of kiln wall. The product in each car divided into 2parts, heating happed at center of flame path to burner the temperature range and distribute heat all over products uniformly.
10. Intermittent feeding of the kiln car, rapidly move forward to keep the burner focus the flame path.
11. There are thermo couples on the roof of the kiln to control set temperature all over pre heating zone, firing zone and cooling zone exactly.

Rapid cooling module

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Labyrinth

- Chamotte
- JM 23

Wall

- JM 26 or JM 28
- JM 23
- Blok 1100
- Rockwool

Roof

- JM 26 or JM 28 suspended bricks
- Fibre blanket
- Concrete

- Instant cooling system is installed at cooling zone, which provide strong cooling air with slow airflow to cool the products.
- Direct and indirect cooling equipments can adjust cooling speed and make sure to cool evenly from top to bottom.
- Longer cooling section reasonable which can keep cooling evenly with fast speed.
- Cooling ducts and heat withdrawing equipments at the cooling zone combined to control cooling and make sure the hot air withdrew to the dryer house

Rapid cooling system

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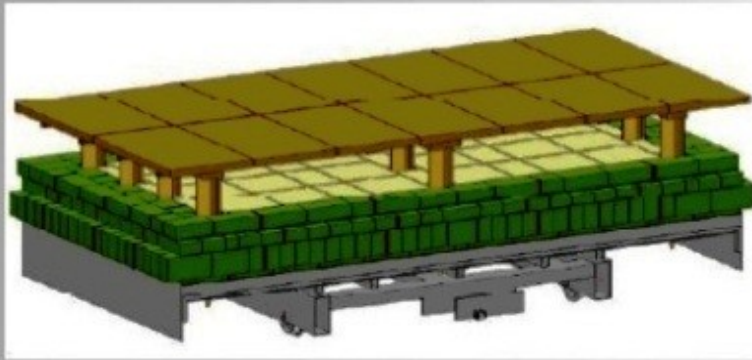
- Rapid cooling with automatic temperature control
- 6 cold air injections each side at the top per 3 m
- 6 cold air injections each side at the bottom per 3 m
- All injections with ceramic nozzle and individually adjustable
- Piping stainless steel

OPTION

- SiSiC-cooling tubes across the kiln for more intensive cooling (passage holes in the side wall already foreseen)

- Optimization of sealing structure, curve structure is designed between kiln car and kiln wall, as well as in each car. The sealing results seems even better in firing zone, which can prevent flame up and down and reduce temperature under the kiln car, with efficient energy saving.

Kiln car



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Car chassis

- profile frame
- Ceramic sealing at both ends

Wheels

- Wheels Ø 200 mm, GG25
- Bearings with maximum temperature 270°C without greasing

Car insulation

- Expanded clay block (Liapor)
- Fibre core, **optional covered**
- Fibre biosoluble
- Car enclosure JM 26

OPTION

- **Car enclosure with extruded hollow blocks optional**

17. The cooling system under kiln the kiln car can control the temperature of the lower car , protect frame of kiln car and keep the kiln car in good order.
18. The kiln cars are made of heavy refractory materials (with slight shrinkage, heat resistant and anti-scouring)top and curve sealing places, other parts are all made of light heat insulation and refractoriness. It means the structure of kiln car should be compact and there shouldn't be any impact between refractory materials. With all the above the kiln car will has good thermal shock resistance and heat preservation.
19. The kiln car wheels made of casting steel, which make sure the wheel is durable. The high quality high temp bearing can avoid problem of kiln car.

H.E.R.O -Tunnel kiln Fuel Oil Supplying System, Air Supplying and Discharging System

1. According to the function of blower pipes, it can be recognized as smoke discharge system, moisture discharge system, combustion system, fast cooling system, residual heat system and instant cooling system. There are 10sets of blowers, that is ,2 sets of smoke exhaust blower(1set stand-by), 2 sets of combustion air blower (1set stand-by), 2 sets of secondary air blower(1set stand-by), 2set of rapid cooling blower (1set stand-by),, and 2 set of hot air suction blower (1set stand-by),

Discharge channel

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- Located in rapid cooling module
- To extract the hot air from rapid cooling
- In first module 1, then 2 hot air offtakes per side
- All offtakes individually adjustable
- Natural draught to release pressure
- Steel channel with inside insulation

2. The materials of pipe system are designed according to technical requirements. The main pipes are all made of A₃ rolling pipe. There are valves at the pass-by pipe, which can achieve related adjust.

Final cooling system

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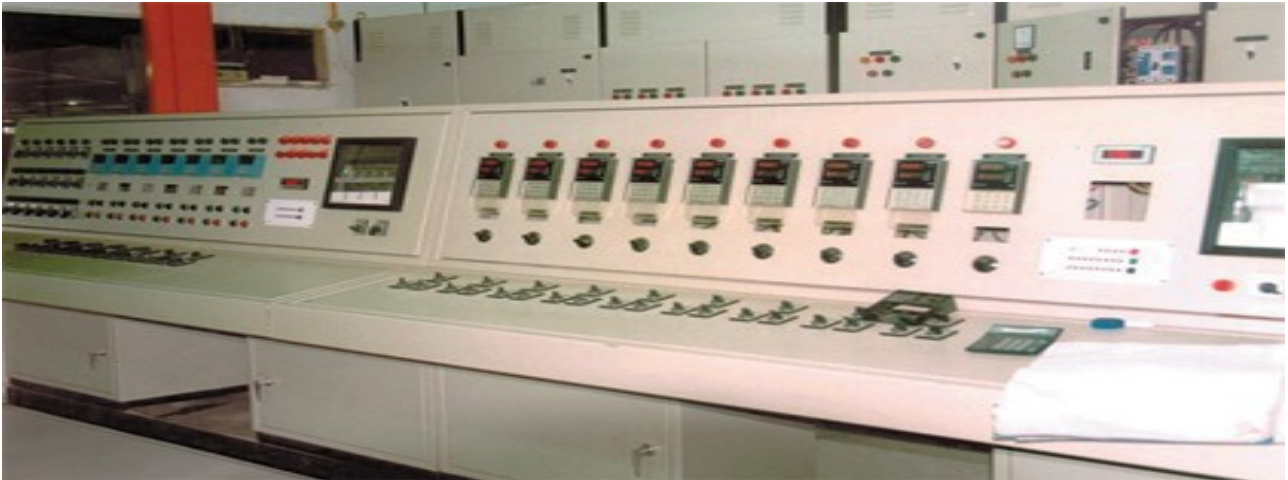
- Cold air injection to cool down product
- 2 injections each side at the top per module
- 5 injections each side at the bottom per module
- All injections with ceramic nozzle and individually adjustable

3. The fuel pipe beside the burner has double valve, one for starting, one for adjusting.
4. The entire blowers are all controlled by frequency and cooling system for hot blower. The chimney is installed above the roof for 2m.

H.E.R.O -Tunnel kiln fuel oil, temperature and pressure automatic control system

I Configuration of automatic fuel oil system

There are ten groups of fuel oil burners arranged interlaced each other. In order to reach high precision temperature burner, one temperature measuring thermocouple and one PID micro-computer controlled check meter is equipped for each group of fuel oil burner.



II. Operation safety

1. Each fuel oil burner group is equipped with a solenoid valve, air-fuel oil proportioning valve, manual regulating switch. The main oil duct is provided with a solenoid valve, which is interlocked with combustion-supporting fan. In case that the combustion-supporting fan stops running for power failure or fault, the solenoid valve of main oil duct will cut off coal oil supply to ensure the safety of application.



2. Each fuel oil burner is attached with a ultraviolet flame detector. When there is flame, the detector will start working; otherwise the solenoid valve before fuel oil burner will cut off the oil supply and send out alarm through the signal lamp on the main control cabinet.

III. The working principle of temperature automatic control

1. The automatic control system of tunnel kiln adopts proportional combustion control form, namely, the combustion-supporting air and fuel oil are automatically controlled by proportioning valve.

2. In order to ensure the precise temperature there are 10 PID controller for each group of fuel oil burner and one temperature measuring thermocouple.

3. Operation methods

A. Firstly set temperature rise curve in PID main control meter, with more than six different firing temperature curves available for setting. Each temperature rise curve is divided into 8 sections and temperature and time can be input and stored in the PID temperature meter.

B. Before firing of production, start combustion-supporting fan and smoke exhausting fan, then press automatic button to start the automatic control system. First, blow air for three minutes, make automatic ignition and close kiln door when each burner succeeds in automatic ignition. The entire temperature rise and firing process is under automatic control of PID microcomputer automatic temperature control meter. After the completion of firing, all the fuel oil supply pipes and burners are automatically closed up, but combustion-supporting fan and smoke exhausting fan still work on and they will be closed up by operators when temperature drops completely.

4. How to make automatic control to fuel oil burner

PID temperature control meter sends out commands of temperature rise continuously in

accordance with temperature rise curves. Each burner will make automatic control of fire via proportioning valve and electric executor air valve based on the temperature measured by thermocouple. When the temperature is relatively low, increase the fire while the temperature confirms to standard, the fire power will be decrease. Besides, heat preservation for several hours is needed for uniform temperature (switchover between manual control and automatic control is available).

5. Automatic control system for kiln pressure

During the process of product firing, pressure control in the kiln is a crucial factor of normal firing. The kiln has a pressure checking point. You can choose to set positive or negative pressure for firing via kiln pressure control meter. Positive pressure is for reduction atmosphere firing while negative pressure is for oxidation atmosphere firing. The kiln pressure sensor, pressure control meter, transducer and smoke-exhausting fan constitute a set of interlocking automatic and manual control system. The transducer can constantly change the smoke exhausting volume of the fan based on the kiln pressure measured so as to ensure stable kiln pressure during the whole process of product firing and achieve optimal result.

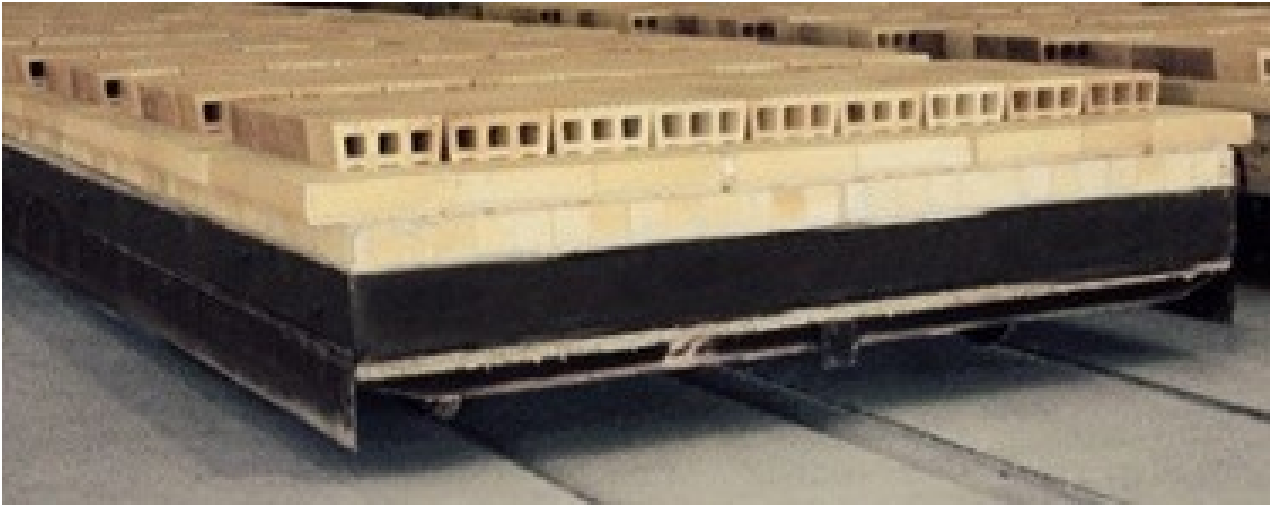
6. Function of stainless steel heat exchanger

All the shuttle kilns with firing temperature more than 1650C shall be equipped with combustion supporting air heat exchanger since the air blown into the kiln is cool.

As the kiln temperature rises slowly, especially difficult to rise as high as 1650°C . The combustion supporting air heat exchanger can increase the temperature of combustion supporting by 300-400°C, which will improve the firing effect of fuel oil burner, accelerate temperature rise speed remarkably so as to save fuel and ensure stable firing quality.

1. The blowers controlled by frequency, the start and breakdowns will be concatenate controlled, that is, start smoke discharge blower firstly, then start combustion blower, then for start the fuel supply system. Once problems come to smoke discharge blower or combustion blower or power off, it will automatically cut off oil supply to keep safe operating.

Kiln Car &. Tracks



1. According to the processing requirements, kiln car tracks are installed both in the kiln and dryer, and 2 sets of tracks for loading and unloading operation, 3 sets of tracks for trolley as well.
2. Hydraulic pusher: the pusher which is installed under ground for better operating.

Details of refractory materials used in H.E.R.O Tunnel kiln



Mullite insulation brick: temperature 1400°C, $Al_2O_3 \geq 56\%$, $Fe_2O_3 \leq 0.7\%$, bulk density 0.9g/cm³, Cold crushing strength $\geq 40\text{kgf/cm}^2$, thermal conductivity W/(m.k), average temperature (350±25°C) ≤ 0.33 , Re sintering shrinkage $\leq 0.6\%$

High aluminum insulation brick: Brand LG-0.8, $Al_2O_3 \geq 48\%$, $Fe_2O_3 \leq 2\%$, bulk density 0.8g/cm³, cold crushing strength $\geq 40\text{kgf/cm}^2$, Refractoriness under load $\geq 1160^\circ\text{C}$, Re sintering shrinkage $\leq 0.5\%$.

Insulation clay brick: Brand LG-0.8, Al_2O_3 about 45%, Fe_2O_3 about 1.5%, bulk density 0.8g/cm³, thermal conductivity W/(m.k), average temperature (350±25°C) ≤ 0.26 , Re sintering shrinkage $\leq 0.5\%$, cold crushing strength $\geq 20\text{kgf/cm}^2$.

High aluminum blanket and felt percentage composition: Al_2O_3 about $\geq 52\%$, $Al_2O_3 + SiO_2$ about $\geq 99\%$, Fe_2O_3 about $< 0.2\%$, $K_2O + Na_2O$ about $< 0.5\%$, long time usage temperature 1200°C, heating shrinkage 1300°C*24h $< 3\%$, volume 128~220kg/m³.

H.E.R.O – Dryer



Clay brick drying principle

Before the bricks can be fired, as much moisture as possible must be removed or they will explode in the kilns. Drying involves the removal of water from the wet brick in such a way as to dry them out evenly from inside out. If the outer skin of the brick dries first it becomes impossible for the moisture inside to escape. In the kiln the extreme temperatures will force out this moisture and some cracking may occur.

To prevent this happening the dryers are kept at temperatures of about 80°C –120°C and the atmosphere is very humid keeping the exterior of the brick as moist as possible. This is monitored very closely to reduce surface cracking.

The bricks will shrink in the dryers as the clay particles come together and they become strong enough to be stacked, but at this stage they have no weather resistant qualities.

Drying schedules vary but between 18 to 40 hours is typical for an automated plant.

Special shapes and large units can take up to a week or more.

The dry bricks are then set onto kiln cars ready to be fired.

100m Tunnel dryer will be installed parallel to the tunnel kiln drying according to the firing technical requirements. The dryer car is the same as kiln car. The dryer will efficiently use the residual heat from the kiln to dry the green brick. It contains heating curing phase, constant speed heating phase, reducing speed heating, burner heating phase, etc. to prevent cracks at the center or outer surface of green brick, make sure uniform drying all over product.

1. The red bricks will installed at the inner wall of dryer with expansion joint. The interlay of roof are made of perforated hollow slab and cast-in-place concrete(civil engineering are freely provided by buyer)
2. Air supply and discharge system: for convenient temperature adjusting inside kiln and control the hot air supply, the individual air supply and discharge system will be adopted. The regulating valve equipped in the main and side hot air supply pipes, it's convenient to adjust the air supply. Both air supply and discharge system adopts calandria and increase the splitter to keep air feed evenly.

3. Moisture discharge system: moisture discharge holes and hot air branched passage are lay corresponding , based on the principle of smooth airflow and balancing supply or discharge , and make sure the heat are completely used without block.
4. The air pipe are welded by 2.0~2.5mm A3steel , the 20mm cotton blanket will wrap the air pipe, the surface of air pipe will be wrapped by aluminum sheet for heat preservation of the air pipe.
5. The dryer has 2sets of hydraulic pusher to push green brick cars continuously.
6. The blower of dryer will controlled by frequency, scientific layout of air pipe can discharge the moisture rapidly and efficiently. The local season and atmosphere has no influence to the dryer.

H.E.R.O – Tunnel dryer specification

H.E.R.O - Tunnel dryer -100/4.66/1.42/2D - Specification		
1	Dryer size	100 * 4.66 * 1.432 meter
2	Quantity of cars inside dryer	22 cars
3	Flat ceiling	RCC
4	Wall	Red brick - 360mm thickness
5	Moisture exhausting blower	35kw,2set - 1 set in use and 1 set stand by
6	Hot air supply	From tunnel kiln - waste heat / Booster burner
7	Rail,18kg	Inside 2/set, Outside 1 set, Converting kiln car rail 2set
8	Dryer car pusher - YDS-60 / 21602KC	2 set (two each for Tunnel kiln + Dryer)
9	Dryer transfer car - BDC-4.6 - Power - 2.2/1.1	1set
10	Return tractor - QYS-4 - Power - 5.5	8set
11	Exit tractor - LYS-40 - Power - 2.2	2set
12	Temperature check point	6 numbers
13	Steel pipe	1 set
14	Cables & others	1 set

H.E.R.H.E.R.O Tunnel kiln car Specifications

H.E.R.O - Tunnel kiln Car - 4.66/4.35 / 1.432 - Specification		
1	Kiln car size	4.66 * 4.35 * 1.432 meters
2	Steel items	1.4 tones
3	Refractory brick - 1350°C	5 tones
4	Total	6.4 tones / car
5	Brick loading	3960 bricks / 17820 kgs/ 15840 kgs / car
6	Gross weight	24220kgs
7	Number of wheels	6

8	Masonry work	Total thickness of brick part – 480mm First layer Refractory brick, second layer red brick top layer refractory brick
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Respective obligation of buyer and seller

No.	Process name	A Work taken by seller	B Work taken by buyer
1	Kiln car	Supply materials , equipment, drawing, technical documents and technical guidance	Kiln car - Fabrication at site for refractory brick masonry work - should provide Brick masons, skilled and unskilled workers as required.
2	Heat engineering equipment (fan and burning system)	Supply equipment, drawing, technical documents and technical guidance	Assembly – Provide skilled and unskilled workers as required
3	Tunnel dryer	Supply equipment, technical documents and technical guidance	Supply construction material (as per list) and related construction tools and equipment, Brick masons, skilled and unskilled workers as required
4	Tunnel kiln	Supply equipment, materials, technical documents and technical guidance	Supply construction material (as per list) and related construction tools and equipment -Brick masons, skilled and unskilled workers as required.
5	Air pipeline	Supply materials, technical documents and technical guidance	Fabrication, installation, paint & painting and insulation
6	Track construction	Supply drawing, technical documents and technical guidance	Materials as per list foundation and installation
7	Floor construction in workshop	Technical documents and technical guidance	Material and construction
8	Debugging	Technical documents and technical guidance	Debugging labors, raw material and power supply

Work totally undertaken by the buyer

1. Detailed accurate relief map of plant;
2. Workshop construction project;
3. Drainage works in workshop;
4. Designing and construction for water feeding, drainage, lighting, road (trees, fire fighting, wall

etc.)

5. Main power supply to our electrical control panels.

6. Assembly & fabrication tools list

6.1. Fork lift 5 tones – 2 nos,

6.2. Crank – 25 tones – 1 no,

6.3. Hand pallet truck 3 tones – 3 nos.

6.4. Hydraulic jacks 5 tones, 10tones – 3 each,

6.5. Welding set – 5 nos,

6.6. Oxyacetylene oil cutter set – 3 nos,

6.7. Power distribution board – 10 nos

6.8. Assembly and construction tools – 5 sets (according to list)

6.9. Carpentry wooden frame work – 130 meter long X 5.5meter wide for RCC roof casting of dryers- 2 set.

6.10. Drilling machine, lath machine, grinders hand grinder, hammer drill with respective tools.

6.11. Others if any - will be notified as and when required.

7. Provide necessary communication and telephone facilities for the engineers and technicians from the buyer to communicate with our China office

10. Technical service provide

10.1: Visa to technicians, Work permit / licenses if applicable, Income/Local tax/charge if any at buyer country

10.2: Return flight ticket from China to buyer's site, and back to China.

10.3: Local transportation from hotel to work site and vice versa,

10.4: Insurance,

10.5: Lodging and boarding minimum 3 star hotel,

10.6: Landry

10.7: Technicians salary –@80US\$/man day

10.8: Supply 2-3 translators at construction site.

11. Red brick – 100000 nos

12. Cement concrete mix – 380 – 400CBM.

After-sale Service

1: Warranty time of main structure of kiln is one year. If there are any accessory problems, we will change or repair it free during the warranty period.

2: Professional engineer and technicians with 24-hour free of charge services.

3: Our principle of service: life long tracking service.