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Project No.: EG/CPR/99/G31

Agresso No.: 16000781

Contract No.: 05/004

**Final Report for Energy Conservation Renovation for Xi'an  
Liucun Hollow Brick Plant**

*to*

The United Nations Industrial Development Organization (UNIDO)

*for the Project Entitled*

UNDP/GEF Energy Conservation and Greenhouse Gas Emissions Reduction in  
Chinese TVEs—Phase II

*Submitted by*

Xi'an Research and Design Institute of Wall & Roof Materials of China Building  
Material

On June, 2006

**UNDP/GEF Energy Conservation and GHG Emissions**

**Reduction in Chinese TVEs—Phase II**

**Energy Conservation Renovation  
for Xi'an Liucun Hollow Brick Plant**

**Final Report**

Project No.: EG/CPR/99/G31

Agresso No.: 16000781

Contract No.: 05/004

Team leader: Xiao Hui (professor)

Team member: Meng Yongli, senior engineer  
Tang Baoquan, senior engineer  
Cheng Xiangwei, engineer

**Xi'an Research and Design Institute of Wall & Roof Materials**

June, 2006

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Brick

## 1 Preface and Thanks

### 1.1 Preface

This document is the Final Report of energy conservation renovation for Xi'an Liucun Hollow Brick Plant submitted to Project Management Office (PMO) and the United Nations Industrial Development Organization (UNIDO), prepared by Xi'an Research and Design Institute of Wall & Roof Materials, related to the project of "Energy Conservation and GHG Emissions Reduction in Chinese TVEs-Phase II". This report covers the work and achievement completed during the beginning of March and the middle of June 2005.

Project title: Energy Conservation and GHG Emissions Reduction in Chinese TVEs (Phase II)  
–Energy Conservation Renovation for Xi'an Liucun Hollow Brick Plant

Project No.: EG/CPR/99/G31, P.O.No. 16000781

Contract No.: 05/004

The contract of this project was signed on the beginning of March. Our Institute completed seven tasks stipulated in the contract through nine activities.

This report includes the following parts.

- a) Summary of achievements
- b) Final accounts
- c) Summary of progress

### 1.2 Thanks

We greatly appreciate the help from the following personnel. Without their support and guide, we can't complete this project smoothly.

Mrs. Wang Guiling, Deputy Director of PMO

Dr. Zhang Zhihong, Chief Technical Adviser of UNIDO

Mr. Song Dongfeng, Contract Officer of PMO

Other personnel of Beijing Hongyuan Environment and Energy Technology Company

Mrs. Mounira Latrech, Contract Officer of UNIDO

Dr. Enver Khan and other working personnel

## 2. Summary of the project and result of technical renovation and proposal

### 2.1 Achievements of this project

After the technical renovation, the output of Xi'an Liucun Hollow Brick Plant (hereinafter

referred to as "the Plant") is increased from 30 million bricks (common brick equivalent) to 50 million bricks yearly, and the number of workers from 156 to 260, the output value from 3 million RMB to 5 million RMB, as well as the profit rate from 10~12% to 15~18%.

Coal consumption is reduced from 1.25 tons/10,000 bricks (common brick equivalent) to 1.00 tons/10,000 bricks (common brick equivalent) after building new energy saving Hoffmann kiln and renovating the old Hoffmann kiln by using sealing and heat preservation material. Electricity is saved 10 kW.h/10,000 bricks (common brick equivalent) by using non-power compensator, as well as electricity can be saved about 15% by adding frequency converter to blower. And energy can be saved 8% on the buildings with rectangular perforated brick.

Gas emission of CO<sub>2</sub> is reduced 3210.95 tons/year and the consumption of coal is saved 1287.99 tons of coal equivalent (tce)/year through technical renovation for the pilot project of Liucun plant. Scheduled working task and aim of this project is completed.

Through renewing old equipments and adoption of advanced and practical equipment, repairing old Hoffmann kiln and constructing a new Hoffmann kiln, and improving and perfecting production process and management system to make arrangement of the existing production line (See 4.3.2 (2) of the report) reasonable, the renovated production line is the best in Xi'an brick and tile enterprises.

The details are as follows.

(1) To reduce energy consumption greatly by usage of energy saving Hoffmann kiln.

A new energy saving Hoffmann kiln was built in the renovation for The Plant. Heat preservation hollow block was chosen to masonry side wall and roof of the kiln. And cinder was used as sealing layer of arch roof, not only can the construction cost be reduced, but also can the heat preservation property of the Hoffmann kiln be perfected greatly. Surplus heat can be extracted from up smoker passage to dry adobe.

The usage efficiency of coal is increased and the coal consumption is reduced 20% in use of surplus heat and by sealing kiln after technical renovation. The new Hoffmann kiln gives a good demonstration to village and town brick and tile enterprises and has good popularizing value.

(2) To reduce energy consumption greatly by installation of electricity saving compensator.

The principle of electricity saving compensator is to perfect power rate and to reduce electricity loss of supply line to reach the aim of electricity saving.

The power rate is kept above 0.95 and the non-power loss of motor is reduced greatly by

adding electricity saving compensator to extruder of The Plant. And the electricity consumption is saved 10kW.h/10,000 bricks (common brick equivalent). This technology can realize saving electricity 50 thousand kW.h yearly calculating on the output of 50 million common bricks of this Plant after renovation,.

- (3) Saving electricity about 15% by installing frequency converter to blower.

The electricity is saved and the equipments are protected in use of frequency converter technology to change gas flowing amount. Frequency converter was installed to 3 sets blower. Average electricity saving of 3 sets blower is 150kW.h everyday, about 15%.

- (4) Saving energy 8% on the buildings with rectangular holes perforated brick.

Only can this Plant produce circular holes perforated brick before renovation. After renovation the Plant develop rectangular holes perforated brick to realize saving energy 8% on the buildings. At the same time, strong abrasion-resistant ceramic core can prolong the usage life of core and increasing perforation rate of rectangular can save raw material.

- (5) Helping the enterprise improving production efficiency by perfecting management regulation.

During implementation of the project, we developed staff training for manager and key post worker of the enterprise, helped the Plant setting up system of energy management, post rules of operation and product quality testing regulation, perfected system of quota responsibility, rewards and penalties, and consumption index monitoring, to make every working procedure to be carried on relevant regulation. Furthermore the personnel is conscious that output, product quality and factual institution of energy saving is related to their working closely. So the production efficiency and rate of qualified product is improved and energy consumption is reduced.

Implementation of the technical renovation measure mentioned above brings good economic and society benefit for the Plant.

## 2.2 Demonstrative effect of the pilot enterprise

- (1) The Plant plays a good demonstration to the village and town brick and tile enterprises in Xi'an along with the plant all over China because the Plant saves energy and lowers cost greatly through technical renovation. At present, there are more than 160 brick plants to have visited the Plant. Persons in charge of the brick plants including Chongqing, Zhejiang Province and Hunan Province are ready to develop renovation in their enterprise to energetically popularize energy saving technology such as energy-saving Hoffmann kiln, frequency converter and rectangular hole perforated brick after visiting.

The persons in charge of the foreign enterprises including Bangladesh and Guinea visited the Plant several times, and they prepared to take the Plant as an example to build brick plant.

- (2) The successful implementation of technical renovation for the Plant leads rapid development of local building material market. In 2003, Xi'an Wall and Roof Material Industry Association provided a plan to Xi'an Municipality Government to build three building material localities in Changan County, Gaoling County and sloping fields in Baqiao district in order to solve the problem of land destroying resulted from firing brick and to meet the brick demand of Xi'an construction. But all kinds of reason hindered the smooth implementation of the plan. Accompany with the project, Xi'an Business and Trade Association and Baqiao District Business and Trade Bureau supported Xi'an Wall and Roof Material Industry Association to accelerate the establishment of three building material locality. The successful implementation of technical renovation for the Plant led rapid development of the brick enterprises and market around and provided a good basis for the establishment of building material locality in Baqiao district. At present, building material locality in Baqiao District had become the best one of the three and had been developing promptly.
- (3) The total output of clay brick in China is about 500 billion bricks (common brick equivalent) and coal consumption is about 6.25 million tons of coal equivalent yearly. Even the coal consumption of individual brick plant attains 2.5 tce/10,000 bricks (common brick equivalent). If the energy saving technical measure of the Plant is popularized, the coal consumption will be saved 1.25 million tce annually, which is calculated that coal consumption is reduced from 1.25 tce/10,000 bricks (common brick equivalent) to 1.00 tces/10,000 bricks (common brick equivalent).

### 2.3 Proposal

- (1) We propose to choose several plants as pilot in one district to popularize Liucun pilot production line and to hold site meeting for studying. And successful experience and energy saving technology of renovation in pilot enterprise is introduced by holding training class in the district with high price of coal, for example, Chong Qing, Jiang Su and Zhe Jiang.
- (2) Gas emission of CO<sub>2</sub> is reduced 3210.95 tons/year and coal is saved 1287.99 tce/year through technical renovation for the pilot plant. The working task and scheduled aim is completed. But the project only gains part achievement at present. Though little part of emission of the green house gas is reduced, a large amount of CO<sub>2</sub> and SO<sub>3</sub> is emitted to the air. So the next stage work is to reduce gas emission of CO<sub>2</sub> and SO<sub>3</sub> through modern



technology to make the work of energy saving and green house gas emission step up to a new stage.

## 2.4 Comparison of technical index between before and after renovation

The Plant can produce rectangular perforated brick after technical renovation. Strength of the product is grade MU15. The product has no efflorescence, no lime blowing, no defect on frost and perforation is 31% with rectangular core arranged orderly. The product quality meets the first class in Chinese National Standard *GB13544-2000 Fired perforated brick* (The quality see appendix *Testing report*). The Plant gas emission of CO<sub>2</sub> is reduced 3210.95 tons and coal is saved 1287.99 tce yearly.

Comparison of technical index between before and after renovation see table 1.

**Table 1 Comparison of Technical Index**

Item		Unit	Index	
			Before	After
Output (yearly)		(Common brick equivalent) 10,000 bricks/year	3,400	5,000
Qualified rate		%	80	90
Perforation	Fired perforated brick	%	26	33
Coal consumption		kg ce/10,000 bricks (Common brick equivalent)	1,250	1,000
Electricity consumption		kW.h/10,000 bricks (Common brick equivalent)	165	145

## 3 Final accounts of the project

Budget allocation in the Feasibility is US\$ 301,584.00 and final accounts of total investment is US\$ 301,584.00. The subsidy fund of UNIDO is US\$ 60,000.00, of which US\$ 38,980.00 is used for constructing a new energy conservation Hoffmann kiln and purchasing an energy saving blower for the Plant, while US\$ 21,020.00 is paid for technical service for the contractor. Co-finance of the beneficiary plant is US\$241,584.00. The co-finance to the UNIDO subsidy fund is 4:1. Final accounts sees table 2.

**Table 2 Final accounts**

No.	Item		Expense (US\$)	Remark
1	An early cost		1,700.00	Co-finance
2	Technical consultation and services	Technical consultation	15,020.00	UNIDO subsidy fund
		Design	6,000.00	
3	Hoffmann kiln and drainage system renovation	Constructing a new energy saving Hoffmann kiln	38,254.00	Co-finance
4		Repairing the roofs, fire holes, internal and external wall, kiln-door and air dampers for the two original Hoffmann kilns	60,459.00	
5		Repairing drainage in the drying yard; using hollow brick as hack and increasing the hack height	5,837.00	

No.	Item	Expense (US\$)	Remark
6	2 loaders	31,439.00	Co-finance
7	2 box feeders	12,092.00	
8	High speed fine rolls	14,510.00	
9	Double shaft mixer	10,883.00	
10	Two-stage vacuum extruder	36,276.00	
11	2 dies (core bridge and core heads)	960.00	
12	Vertical column cutter	1,450.00	
13	3 frequency converter controlling system of blower	1,350.00	
14	Non-power compensator	1,814.00	
15	Belt conveyor	16,926.00	
16	3 energy saving blower	2,178.00	One is purchased by UNIDO subsidy fund.
17	Equipment installation	10,332.00	Co-finance
18	Staff training	13,059.00	
19	Studying the feasibility of the project; examination and evaluation of the technology renovation	15,000.00	
20	Landscaping and treating the environment	6,045.00	
Total		301,584.00	

## 4 Summary of specific working

### 4.1 Project task

According to the contract and TOR, our Institute had undertaken 7 tasks.

- (1) Devise a general plan for the Plant and conducted a comprehensive feasibility study.
- (2) Invite the Plant and its designated experts to review and evaluate the feasibility study, design and drawings, and make necessary adjustments.
- (3) Design an energy-efficient kiln, undertake the construction, and use thermal insulation in the new kiln.
- (4) Supply an energy-efficient blower for the kiln according to the proposed technical specification and assist in the installation and testing of the blower.
- (5) Provide on-site personnel with relevant expertise as and when required by the Plant.

(6) Ensure the approval of the renovation project by the local environmental and other relevant authorities.

(7) Provide relevant training of the operators and set up a production management and an energy management system for the Plant.

## 4.2 Activities

Our Institute had completed 7 tasks mentioned above through the following nine activities.

Activity 1: Earlier work

Activity 2: Devise a general plan for technical renovation

Activity 3: Process design

Activity 4: Kiln design and construction

Activity 5: Evaluation

Activity 6: Equipments purchasing, installation and commissioning

Activity 7: Appraising of equipment running

Activity 8: Perfect management system of enterprise

Activity 9: Staff training

## 4.3 Summary of progress

To ensure the project implementing smoothly, we organized working team for the project. The team has 4 members. They are efficient and high-level technical professors with rich experience in brick plant design, energy efficiency renovation and production management.

The leader of this team and UNIDO liaison man is Mr.Xiao Hui, the president of Xi'an Research & Design Institute of Wall and Roof Materials.

Members: Meng Yongli, Tang Baoquan, and Cheng Xiangwei.

At the earlier stage of the project, members of working team exchanged view with GEF project management office of China Agriculture Bureau established by UNIDO and working staff of Beijing Hongyuan Environment and Energy Technical Company fully to discuss and confirm plan and working schedule of the project.

### 4.3.1 Summary of progress

From March 8, 2005 to March 13, 2005, working team investigated the Plant and proposed technical plan and measure.

From March 14, 2005 to April 1, 2005, working team completed Feasibility Report according

to the technical plan and measure. The feasibility report was accepted by the Plant after approval of PMO, and it was submitted to UNIDO and PMO on July.

From April 4, 2005 to April 15, 2005, working team completed working drawing of process renovation and working drawing of new energy saving Hoffmann kiln. The relevant expert revised and evaluated the drawings and approved it. Then the drawings and list of newly added equipments were submitted to UNIDO and PMO and the Plant.

From April 18, 2005 to May 20, 2005, working team completed constructing new energy saving Hoffmann kiln and repairing the 2 original Hoffmann kilns. By May 27, 2005, test running of the 3 Hoffmann kilns were completed.

At the same time of construction of Hoffmann kiln, equipments were ordered according to the list of newly added equipments.

From April 18, 2005 to April 24, 2005, new equipments were ordered, including two-stage vacuum extruder, high-speed fine rolls and energy saving blower, etc. (See table 3). From April 25, 2005 to May 6, 2005, the new equipments were transported to the Plant and begun installing, then to be commissioned. Firstly single equipment was tested running, and then production line was commissioned. At the same time of installation and commissioning, working experts helped the Plant set up operation rules and explained it to the technical personnel and the operating worker when training on site.

From May 7, 2005 to June 3, 2005, new process equipments and new kiln and its auxiliary facilities were test running. Equipments and new kiln ran normally during the period of commissioning. Daily output of the new kiln is 50 thousand common bricks to 60 thousand common bricks.

From June 6, 2005 to June 10, 2005, working team helped the Plant completing management system construction and developed staff training for key post (See 4.3.2(7) in this report).

At present, the production line runs normally and reaches the designed output. And coal and electricity saving reach anticipated aim. The proportion of the product is increased. Quality of the product meets the demand of first-degree of national standard through testing and inspecting of National Building Material Industry Monitoring and Testing Center of Wall and Roof Materials. (Details see 2.3)

#### **4.3.2 Summary of completing institution of the project task**

By the middle of June 2005, of the completed task is summarized as following.

- (1) Task 1: Devise a general plan for the Plant and conducted a comprehensive feasibility study.

Working team completed following works.

① Investigating enterprise

Working team investigated the Plant and conversed with management personnel and key post worker of the Plant to know the production process, raw material, energy efficiency, ownership, management system, fixed assets, loans and other financial institution.

In the Plant, the production process and equipments were rudely and efficient rate of raw material treatment of the Plant was low. Life of the kiln exceeded the limit. Energy consumption was high because the kiln ran out seriously.

According to the institution of the Plant, working team proposed the following technical renovation plan.

- a) Strengthen clay winning and weatherization
- b) Renew process equipments
- c) Repair green pit
- d) Build a new energy saving Hoffmann kiln and repair the roof of the other two original Hoffmann kilns.
- e) Adopt energy saving blower for Hoffmann kiln

② Compiling feasibility report

According to the technical renovation plan, demand of the project and advice of national and foreign experts, working team compiled the feasibility report of the project. The main content is as following.

- a) Reference and principle of the feasibility study
- b) Technical plan and detailed measure
- c) Occupational safety
- d) Detailed measure of energy saving and reasonable usage of resource to attain the environment standard and request.
- e) Staff and training
- f) Working schedule
- g) Budget allocation and economic evaluation
- h) Energy efficiency and environment evaluation

- (2) Task 2: Experts review and evaluate the feasibility study design and drawings, and make

necessary adjustments.

Working team completed following work.

① Completing process design and list of newly added equipments of process.

The original production line was renovated. The production line still adopted plastic extrusion, natural drying and firing in Hoffmann kiln. Layout of renovated production line is reasonable and production efficiency is improved through renewing and adding equipments. The detailed measure was as follows.

- a) Add 2 loaders to extract and transfer raw material.
- b) Add a set of rolls
- c) Renew a set of double shaft mixer
- d) Add a set of type JZK50/50-30 vacuum extruder
- e) Renew core and model
- f) Change original column cutter
- g) Add electricity saving compensator

The renovated production line is as follows.

Clay extracting (Loader)→Storing (Half a year)→Box feeder→Coarse rolls→Double shaft mixer→Fine rolls→Type JZK50/50-3.0 two stage vacuum extruder→Column and green cutter→Artificially transporting green brick to nature drying yard→Loading Hoffmann kiln by manual work→Firing with Hoffmann kiln (26 chambers energy saving Hoffmann kiln)→Unloading from the kiln by manual work→Stacking

Working drawing of the process and list of newly added equipments for the process production line was completed according to the process renovation plan.

② Completing design of building new energy saving Hoffmann kiln, renovation of 2 original Hoffmann kiln and green yard.

a) We designed a new energy saving Hoffmann kiln for the Plant and working drawing was completed.

b) Repairing schedule of the two original Hoffmann kilns was completed. The arch mode was made firstly before repairing the Hoffmann kilns because some bricks had fell down from the Hoffmann kiln arch due to high temperature firing for a long time. The coal feeding hole on the kiln roof, intake, outside and inside wall and kiln door were sealed with asbestos cord, refractory wool and other refractory materials.

c) Repairing schedule of drainage system of green yard was completed. Hollow brick produced in the Plant was used to masonry the green platform and height of hack

was increased to reduce the loss of adobe when rainy season and heavy rain suddenly.

Construction drawing and newly added equipments of kiln was submitted.

③ Expertise

Manager of the Plant and related experts revised and evaluated the technical renovation plan, construction drawing of process and working drawing of kiln. And the experts proposed that the construction of the new kiln should adapt to local condition and make use of local resource first to ensure that the heat efficiency of the kiln is perfect and the cost of the kiln is low.

According to the advice of the experts, working team revised working drawing and technical renovation plan and decided to adopt local excellent quality hollow brick to masonry new Hoffmann kiln.

(3) Task 3: Design and construction of energy saving Hoffmann kiln and construction of relevant technical renovation

Working team completed following work.

① Ordering new equipments

Working team proposed advice of technical parameter and manufacturer to help the enterprise ordering new equipments.

② Process production line renovation

When the equipments were transported to the Plant, the construction group installed the equipments according to installation drawing and process working drawing strictly under the guide of experts of working team. Then each single machine was test-running first, and then it was debugged on-line. Meanwhile, operation rules for equipments were set up.

③ Construction of energy saving Hoffmann kiln.

New energy saving Hoffmann kiln was built according to the construction drawing. Then the Hoffmann kiln was tested running.

Technical parameters of the energy conservation Hoffmann kiln are as following.

a) In this Hoffman kiln, ignition is carried out in two different places. Green bricks are fired by internal fuel, synchronously coal is added by manual to supply and adjust fuel. Means of firing in this kiln is the same as the normal kiln. This kiln is designed with surplus heat usage system in the cooling area.

b) Specification and dimension of the Hoffmann kiln are as follows.

Number of chambers: 26

Internal width of kiln: 3800mm

Internal height of kiln: 2800mm

External total length of kiln: 75740mm

External width of kiln: 17400mm

External height of kiln: 4000mm

Distance between door of chamber: 5000mm

Internal section area of kiln: 8.47m<sup>2</sup>

c) Daily output of each ignition: 50~60 thousand common bricks.

d) External partition of the kiln is built with hollow blocks for heat preservation.

At present, the new Hoffmann kiln runs normally.

④ Repairing 2 original Hoffmann kiln and green yard.

2 original Hoffmann kilns were repaired and drainage system of green yard was renovated according to renovation plan.

(4) Task 4: Supply an energy-efficient blower for the kiln according to the proposed technical specification and assist in the installation and testing of the blower.

Our Institute supplied a new set of energy conservation blower for the Plant. The parameters of the blower are as follows.

Model: Type ZFJ-8

Capacity: 46000m<sup>3</sup>/h

Wind pressure: 330Pa

Power: 5.5KW

At present, this blower runs normally and all its performances reached the designed.

(5) Task 5: Provide on-site personnel with relevant expertise as and when required by the Plant.

During the process of construction of new Hoffmann kiln, renovation of 2 original Hoffmann kilns and drainage system of green yard, and equipments installing and commissioning, experts of the working team provided technical guide on site to solve the problem in time to ensure the engineer be completed smoothly.

(6) Ensure the approval of the renovation project by the local environmental and other relevant



authorities.

At the earlier stage of the project, our Institute connected with Xi'an Wall Material Reform Office and environmental authority and other relevant authorities fully. The authorities thought that the renovation in the Plant would play a good demonstration for popularizing technology of energy conservation in Xi'an and western area in China as this Plant was the typical brick and tile enterprise. Xi'an Wall Material Reform Office and relevant authorities supported the technical renovation in Liucun Plant energetically.

- (7) Provide relevant training of the operators and set up a production management and an energy management system for the Plant.

① Staff training

A) Training aim

Let worker in key position, technical and management personnel understand the production line, have the knowledge of safety production, and grasp technology of excellent quality and high output of product and saving energy, and know the relation between self-post responsibility and the production line in order to ensure that production process run normally.

B) Training content

Training period is one week.

Participant: All members of the working team.

Two types of staff were trained.

a) For operator at the post

Training site: The Plant

Training time: During the services for the Plant by training specialist.

Training specialist: Tang Baoquan, Meng Yongli, Cheng Xiangwei.

The training contents are as follows:

- ◇ Operation rules and routine maintenance for machinery equipment.
- ◇ How to establish and control firing system of Hoffmann kiln.
- ◇ Emergency measures about firing process for Hoffmann kiln.
- ◇ How to utilize new technology, process and equipment to save energy and reduce consumption.

b) For technician, administrator and staff at key post

Training site: The Plant

Training time: June 6 ~ 10, 2005.

Training specialist: Tang Baoquan, Meng Yongli, Cheng Xiangwei.

The training contents are as follows:

- ◇ Present condition of brick-making enterprises in China and development trends of new technology domestic and abroad.
- ◇ State document and preferential policy for wall materials reform.
- ◇ Ways and means of production management.
- ◇ The trade standard of brick and tile.
- ◇ The method of improving product quality.
- ◇ Establishment of modern enterprise management system.

c) The manager of The Plant was invited to attend the training class held by Xi'an Research and Design Institute of Wall & Roof Materials in Tangyu Holiday Village, Mei County, Shaanxi during July 25, 2005 to July 28, 2005.

## ② Management system construction

On the basis of investigation and assessment of enterprise's institution and according to its factual institution, experts of the working team helped the Plant constructing new management system or renewing original management system, setting up purchasing and using regulation of coal and electricity, post operation system and quality testing system of the product, and perfecting system of quota responsibility, rewards and penalties, and consumption index monitoring in order to strengthen production management, energy management and quality inspect and improve management production level. The main contents includes following aspects.

- ◇ Develop modern enterprise management knowledge training for the manager.
- ◇ Help the enterprise perfect the original management system.
- ◇ Draw worker regulations for the factory.
- ◇ Set up inspective and controlling management system for consumption of coal and electricity.
- ◇ Draw workshop management system.
- ◇ Draw equipment management system.
- ◇ Draw product quality inspecting and management system.
- ◇ Set up and perfect financial, staff and salary management system.
- ◇ Set up worker operation manual.

## (8) Catalogue of drawing and list of newly added equipments

### A) Catalogue of drawing

#### ① Catalogue of drawing of process construction

No.	Name of drawing
01	Process layout drawing
02	Installation drawing of box feeder
03	Installation drawing of fine rolls
04	Installation drawing of double shaft mixer
05	Installation drawing of vacuum extruder

② Catalogue of drawing of construction of Hoffmann kiln

- No. Name of drawing  
 01 Design specification  
 02 Construction specification  
 03 General layout drawing of Hoffmann kiln 1  
 04 General layout drawing of Hoffmann kiln 1  
 05 Foundation drawing  
 06 No.1-1 section drawing  
 07 No.2-2 section drawing  
 08 No.3-3 section drawing  
 09 No.4-4 section drawing  
 10 Flue cover  
 11 Concrete foundation for exhaust blower  
 12 Prefabricated member for fire hole  
 13 Flue damper  
 14 Holder and cover of fire hole  
 15 A framework for flue damper

B) List of newly added equipments see table 3.

**Table 3 List of newly added equipments**

No.	Name	Type	Unit	Quantity	Remark
1	New energy saving Hoffmann kiln	26 chambers	Set	1	UNIDO subsidy
2	Energy saving blower	ZFJ-8	Set	1	
3	Repair roof, fire hole, intake, internal and external wall and kiln doors of the original Hoffmann kiln	26 chambers	Set	2	Co-finance
4	Repair drainage system of green pit, use hollow brick for hack and increase height of hack	/	m <sup>2</sup>	35000	
5	Loader	ZL40	Set	2	
6	Box feeder	XG800	Set	2	
7	High speed fine rolls	800×600	Set	1	
8	Double shaft mixer	SJ240-42	Set	1	
9	Two-stage vacuum extruder	JZK50/50-30	Set	1	
10	Die (Frame and core)	JZK50/50-30	Set	2	
11	Vertical column cutter	QT107	Set	1	
12	Energy conservation blower	ZFJ-8	Set	2	
13	Frequency converter controlling system of blower	SSL-10	Set	3	
14	Non-power compensator	WMJ	Set	1	
15	Belt conveyer	B500	Set	6	

Appendix: Testing report of the fired perforated brick of Xi'an Liucun Hollow Brick

The following copy is the testing report of the fired perforated brick of Xi'an Liucun Hollow Brick Plant.

The fired perforated brick of Xi'an Liucun Hollow Brick Plant is sampled and tested by State Wall and Roof Materials Quality Monitoring and Testing Center of Building Material Industry on September 3, 2005. The quality of the fired perforated brick meets the first class in Chinese National Standard *GB13544-2000 Fired perforated brick*. Strength of the product is grade MU15. The product has no efflorescence, no lime blowing and no defect on frost. The perforation is 31% with thirty-three rectangular cores arranged orderly. And appearance quality and size deviation of the product meets the standard.



(2004) 认(国)字(R0117)号



No.L1438



(2004) 建材质监认字(04)号

# 检 验 报 告

## (Test Report)

NO. (2005) 质检字第 5597 号

受检单位(Client) 西安市刘村空心砖厂

产品名称(Name of product) 烧结多孔砖

规格型号(Type/Model) 240×115×90 (mm)

产品标记(Mark) Z4

检验类别(Testing category) 重点企业抽查

国家建筑材料工业墙体屋面材料质量监督检验测试中心

Building Materials Industry of the State Wall and Roof Materials Quality Monitoring and Testing Center

# 国家建筑材料工业墙体屋面材料质量监督检验测试中心

Building Materials Industry of the State Wall and Roof Materials Quality Monitoring and Testing Center

## 检 验 报 告

(Test Report)

报告编号(No. of Report): (2005) 质检字第 5597 号

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产品名称 Name of product	烧结多孔砖	规格型号 Type/Model	240×115×90(mm)
		产品标记 Mark	<b>ZA</b>
受检单位 Client	西安市刘村空心砖厂	检验类别 Testing category	重点企业抽查
	企业电话: 029-83576073	样品等级 Grade	一 等 品
生产单位 Manufacturer	西安市刘村空心砖厂	原编号或 生产日期 Batch NO/ Production date	2005 年 09 月
	企业电话: 029-83576073		
抽样地点 Sampling site	企业成品堆场	抽 样 者 Sampling by	周 炫、王保财
抽样基数 Sampling base	70000 块	抽 样 日 期 Sampling date	2005 年 09 月 03 日
样品数量 Sample quantity	50 块	检 验 完 成 日 期 Finishing date	2005 年 09 月 25 日
样品状态 Sampling state	自然干燥状态, 块状, 33 个矩形孔	检 验 项 目 Testing item	全 项
检验依据 Testing reference	GB13544-2000		
检 验 结 论 Conclusion	抽样产品经检验符合 GB13544-2000《烧结多孔砖》标准一等品要求  抽 样 产 品 合 格  签发日期(Signing date)		
备 注 Remarks			

批准(Approval):

*周炫*

审核(Verification):

*林*

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*王保财*

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# 国家建筑材料工业墙体屋面材料质量监督检验测试中心

Building Materials Industry of the State Wall and Roof Materials Quality Monitoring and Testing Center

## 检 验 报 告

(Test Report)

报告编号(No. of Report): (2005) 质检字第 5597 号

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检验结果(Result)			一等品标准值 (First grade standard value)	检测值 (Test Result)	单项结论 (Conclusion)
检验项目(Item)					
强度等级	抗压强度 MPa	平均值 $\bar{f}$	$\geq 15.0$	19.7	MU 15 合格
		变异系数 $\delta$	$\leq 0.21$	0.10	
		标准值 $f_t$	$\geq 10.0$	15.9	
		变异系数 $\delta$	$> 0.21$	/	
		最小值 $f_{min}$	$\geq 12.0$	/	
泛 霜			不允许出现中等泛霜	无泛霜	合格
石灰爆裂			1. 最大破坏尺寸 $> 2\text{mm}$ 且 $\leq 10\text{mm}$ 的爆裂区域, 每组砖样不得多于 15 处。 2. 不允许出现最大破坏尺寸 $> 10\text{mm}$ 的爆裂区域。	无爆裂	合格
抗风化性能	5h 煮沸吸水率 %	平均值	$\leq 21$	/	合格
		最大值	$\leq 23$	/	
	饱和系数	平均值	$\leq 0.85$	/	
		最大值	$\leq 0.87$	/	
	冻 融		冻融试验后, 每块砖样不允许出现裂纹、分层、掉皮、缺棱、掉角等冻坏现象	无冻坏	
孔型孔洞率及孔洞排列		孔 型	矩形条孔或矩形孔	矩形孔	合格
		孔洞率 %	$\geq 25$	31	
		孔洞排列	交错排列, 有序	交错排列, 有序	
尺寸偏差	样 本 平均偏差 mm	长	$\pm 2.5$	- 0.1	合格
		宽	$\pm 2.0$	+ 0.3	
		高	$\pm 1.7$	+ 0.1	
	样本极差 mm	长	$\leq 7$	1	
宽		$\leq 6$	3		
高		$\leq 5$	3		
外观质量		块	一次抽样允许不合格数 $\leq 7$	3	合格
			欠火砖、酥砖和螺旋纹砖不合格数为 0	0	

## 注 意 事 项 (NOTICE)

1. 检验报告首页及骑缝未加盖“检验报告专用章”或检验单位公章无效。(Test Report is invalid without the "Specialized stamp " or that of test department on it)
2. 复制报告首页及骑缝未重新加盖“检验报告专用章”或检验单位公章无效。(Duplication of test report is invalid without the "Specialized stamp of test report" or that of test department re-stamped on it.)
3. 检验报告首页及骑缝无编写、审核、批准人签字无效。(Test Report is invalid without the signatures of writer, verification and approval.)
4. 检验报告涂改无效。(Test report is invalid if altered.)
5. 对检验报告若有异议, 应于收到报告之日起 15 天内向检验单位提出, 逾期不予受理。(Different opinions about test report should be reported to the test department within 15 days from the date of receiving the test report, otherwise we will not accept it.)
6. 一般情况, 委托检验仅对来样负责。(In general, for entrusted tests the responsibilities are undertaken for the delivered samples only.)

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