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Final Report

to

United Nations Industrial Development Organization

for the project

Energy Conservation and GHG Emissions Reduction in Chinese TVEs Phase II

Project No: EG/CPR/99/G31

subcontract

Technical Renovation for Energy Efficiency at Dalian Jinmei Cast Pipe Co. Ltd

Submitted By:

Wafangdian Hualong Fiberglass Factory

July 2006

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INTRODUCTION

This document is the final report submits to Project Management Office (PMO) and the United Nations Industrial Development Organization (UNIDO), prepared by Wafangdian Hualong Fiberglass Factory (WHFF), related to the project of "Energy Conservation and GHG Emissions Reduction in Chinese TVEs-Phase II".

In this document the progress will be reported in the categories of WHFF's 7 Tasks in the subcontract *Technical Renovation for Energy Efficiency at Dalian Jinmei Cast Pipe Co. Ltd* which intended to improve energy efficiency of this pilot foundry by upgrading its production technology and product quality.

- Task 1: Devise a preliminary design for the proposed renovation and conduct a comprehensive feasibility study
- Task 2: Design a production process and its overall layout associated with the proposed renovation measures.
- Task 3: Devise an engineering design for the new production process and auxiliary systems in the workshop, including water supply, sewage, and power and compressed air distribution systems.
- Task 4: Devise a construction design for the new facilities, the basement of the new equipments, special structures, and a general layout of the Foundry.
- Task 5: Devise an engineering design of fiberglass epoxy patterns for the production of castings of common pipe fittings sizing from ø80mm- ø 1,600mm
- Task 6: Invite the Foundry and its designated experts to review and evaluate the feasibility study, design and drawings, and make necessary adjustments.
- Task 7: Provide relevant training of the operators and devise a production management and an energy management system for the Foundry.

SUMMARY OF PROGRESS

Task 1. Devise a preliminary design for the proposed renovation and conduct a comprehensive feasibility study

Activity 1: Briefing and Kickoff Meeting

The kickoff meeting was held in Feb 28. Mr. Wang Qing He and team members discussed with PMO on working measures and plans together with DJCP, and finalized the project details. This meeting is extremely important for subcontractor to clarify duties, deliveries, approaches and timetable.

Activity 2: Survey and Interview

Based on working plan finalized in the kickoff meeting, the subcontractor held a 5-day investigation to collect information for preliminary design and the feasibility study mainly focus on following aspects:

- Climate, geologic and hydrologic information of the site of DJCP
- Original planning and designing of existing process lines
- Energy supply and storage
- Production techniques
- Products inventory of energy and metal consumption
- Energy consumption inventory of equipments and facilities
- Process loss inventory
- Energy management system
- Domestic and oversea outstanding figures of similar foundries
- Future products and potential market information

Activity 3: Preliminary design

Based on the information collected by Activity 2 and several discussions between experts and the management of DJCP, a vision of future DJCP raised up. During the second week, the preliminary designing was made according to the local conditions. The preliminary design includes the planning of whole renovation, production techniques, equipments and facilities that related to energy conservation. DJCP was fully agreed with this preliminary designing.

Activity 4: Feasibility study

The feasibility study done was drafted in the fourth week based on the preliminary design and

information collected in Activity 2 including:

1. **A comprehensive energy-efficient technical renovation plan and description of the production process**

   In order to guarantee the validity of the renovation plan we considered the all respects completely, and carefully design the production process to achieve energy-efficient goal.

2. **Selection of main equipments**

   According to the ability of the fund and technological force we select Shanghai Aikesi electronic equipment company' medium-frequency induction furnace and mix sand machine from Qingdao cast equipment Co., Ltd, 5t digital automobile platform scale from Dalian Huayi Weighing apparatus Co., Ltd. These companies all introduces Germany's advanced technology, have good prestige in their production.

3. **Personnel and staffing requirements (including number and technical ability of operators for each post**

   After implementing the new production process DJCP need to adjust personnel to adapt to the new procedure. Two new post will be set up one is melting process worker another is for recover used foundry sand.

4. **Measures to meet relevant environmental standards and requirements**

   As we all know casting factory produce heavy pollution. Some concrete measure to achieve relevant environmental standards is, adopt praying device inside the workshop and sack type dust removal device outside the workshop at the same time, through the high-power dust removal device, can reducing dust emission more than 40%.

5. **Measures for energy conservation and rational utilization of resources**

   Use the sand mix machine made in Qingdao casting company, new sand consumption can be reduced by 50%.

6. **An engineering plan and assessment of safety and industrial hygiene issues**

7. **Project implementation schedule**

8. **Investment estimates and economic and financial analysis for each of the renovation measures**

9. **Detailed estimates of energy savings.**

   Total energy savings associated with the proposed renovation measures are expected to reach 152.94 tce/y, and CO2 emissions reduction will be about 381.27 tons/y.

Task 2: Design a production process and its overall layout associated with the proposed renovation measures.

Activity 1: Design the fiberglass epoxy patterning process

Because the Foundry will use fiberglass epoxy to replace the old patterning process, it needs to design new patterning process and rules of operation. The new process and rules fully consider the good malleability and the accuracy of the mould.

The old molding process is done by hands with a piece of stickling board which leads to a poor accurate of sand moulds. As a result, the overweight rate of casting is as high as over 15% thus leading to 450 tons of casting overweight annually. It is proposed to replace the process with fiberglass epoxy patterning process in the production of those common pipe fittings sizing from ø80mm- ø1,600mm thereby effectively lowering overweight rate and improving the mould accurate.

By replacing the current patterning process with fiberglass epoxy patterning process, it will exterminate the casting overweight rate which is as high as 15%. The total coke consumption in the melting process for ductile iron casting will reduce from 816 tons in 2003 to 710 tons, a coke saving of 106 tons or 103 tce.

Process: pattern checking→filling sand→surface filling→shaping→correcting the shape→ making air holes→brushing alcohol and lead powder (twice) →making core→making box→ setting core→pouring

Detailed guides and requirements are in Annex 2. Process of new fiberglass epoxy patterning

Activity 2: Design new melting process

The old melting process used cold blast cupolas with low energy efficiency. Due to the poor quality and low temperature of molten iron, it can not meet the requirement for casting nodular cast iron pipe fittings, and also leads to cinder inclusion and cold flows in castings which are the main causes of a high reject rate, as high as 15%.

The old melting process is replaced with duplex melting system consisting of 5T cupola and a 5T electric furnace, i.e. to have the iron melted in the cupola to a temperature of 1350℃ firstly, and then turn into an electric furnace till the temperature reaches to 1500℃ (tapping temperature). Comparing with the old melting process, the duplex process will improve significantly the melting rate and rise the molten iron temperature (the economically utmost melting temperature of a cupola is under 1450℃, which causes a low quality of molten iron) thereby reducing significantly cold flows and inclusions in castings. As a result, the scrap rate will lower from 15% to 5%.

Annex 3. Installation of 5T Electronic Furnace

Activity 3: Design new process recover used foundry sand.

As a prevalent phenomenon in Chinese TVEs, a mass of used foundry sand was not been recovered but thrown out. This is not only a big waste of resources, but also increases the cost of production, occupies land resource and causes environmental pollutions. The used foundry sand in Jinmei is over 30,000 tons a year.

The used foundry sand can be mostly recovered after the following new treatment:
Used sand crushing→screening→washing (to remove water glass coating from the sand) → drying (in open air) →collecting and stacking (by a front loader). This will reduce the waste and pollution.

By undertaking the new treatment, foundry sand consumption can be decreased by 50%, i.e. 6,300 tons annually, thereby reducing production cost and environmental pollution significantly.

Activity 4: Overall layout

According to the new process and technical standard, a new layout of Jinmei Foundry is designed and attached as Annex 4 Overall Layout.

Task 3: Devise an engineering design for the new production process and auxiliary systems in the workshop, including water supply, sewage, and power and compressed air distribution systems.

Activity 1: Design new power system

The new designed workshop adopted two sets power transformer and connected the system in parallel. When production is in unsaturated state, the electric power system is in the single transformer operation state automatically, reduce transformer unloaded loss reduce 3% of energy consumption.

Activity 2: Design a sewage disposal pool

The new melting process can produce more wastewater. So DJCP built a sewage disposal pool.

Through precipitate and filter wastewater turn into the neutral water can use Irrigate fields or spray the dust in casting workshop. This pool is 16m x 6m x 3m.

Task 4: Devise a construction design for the new facilities, the basement of the new equipments, special structures, and a general layout of the Foundry.

Activity 1: Enlargement of workshop

To use new melting process with a duplex melting system consisting of a cupola and an electric furnace, the workshop was enlarged to put new electric furnace and other equipment.

Area for blasting, cutting, grinding, and heat treatment: 2720m^2
Water press testing area: 54 x12=648m^2
Oven room: 12 x 8=96m^2

Activity 2: Design a coke storage room
It was planned to construct a 100m^2 coke storage room to protect coke from being damaged. However, as the real output of the company required a larger one, we build a 300 m^2 (300m x 100m) coke storage room at the west part of the foundry, and in this way it economize the water as well as improved the energy utilization ratio.

By using the store, coke damage will be reduced by 15%, or 144 tons of coke, or 140 tce, will be saved (to be calculated based on the annual consumption of 960 tons of coke).

Please find it in Annex 5 *Site Plan*.

Activity 3: Devise a construction design of the new equipments
According to the above equipments, the devise should abide to the Guideline of Chinese building standard and design criteria.

Please find the construction design in Annex 6 Construction Design.

Activity 4: Draw general layout of the Foundry.
Some new equipment are purchased and installed to meet the new requirements of the renovated production system:

1. 5T medium frequency electric furnace
2. mixer of foundry sand
3. electronic scale for raw materials, coke, and etc.

Please find the general layout and position of new equipment in Annex 4 and Annex 5

Task 5: Devise an engineering design of fiberglass epoxy patterns for the production of castings of common pipe fittings sizing from ø80mm- ø 1,600mm

Devise an engineering design of fiberglass epoxy patterns for the production of castings of common pipe fittings sizing from ø80mm- ø 1,600mm
A series of fiberglass epoxy patterns are designed to produce castings of common pipe fittings sizing from ø80mm- ø 1,600mm. the following table is a list of main patterns with drawings attached in Annex 7 Drawings of fiberglass epoxy patterns.

Task 6: Invite the Foundry and its designated experts to review and evaluate the feasibility study, design and drawings, and make necessary adjustments.

Activity 1.Hold a Seminar
A small seminar about the technical renovation was organized in October18-21, 2005. The project team invited the foundry staff, and designated experts (Professor Lin from Tsinghua

University, and the project foundry expert Mr. Staf Henderieckx) to review and evaluate the feasibility study, design and drawings. Some technical suggestions were adopted in the renovation.

Task 7: Provide relevant training of the operators and devise a production management and an energy management system for the Foundry.

Trainings were organized during the technical renovation from July 2005 to February 2006. Forms of training include training classes, lectures, and on-site operation practice. The training covered a wide range as below:

- Melting and pouring
- Molding sand
- Different operations between copula and electronic furnace
- Causes of defects
- Process control
- Environmental problems in foundries

RESULTS OF THE PROJECT

1. Energy savings and GHG emissions reduction after the technical renovation

Comparing with the current practice, technical renovation measures and expected results will include the following:

1.1 Renovation of molding processes

By replacing the current patterning process with fiberglass epoxy patterning process, the casting overweight rate was reduced. Therefore, the coke consumption per ton of castings reduced from 320 kg in 2003 to 278 kg, or say 42 kg coke per ton was saved for qualified castings. To calculate based on the total annual output of 3,500 tons of castings, it saved 147 tons of coke, or 140 tce, and reduce CO_2 emissions by 350 tons.

1.1 Renovation of melting processes

For the old melting process, the thermal efficiency of a cupola dropped sharply to about 7% after its inside temperature reaches 1350℃. In this case, to rise the temperature of molten iron from 1350℃ to 1450℃ will consume 80 kg of coke per ton of iron equivalent to 77.68 kg of coal equivalent; While with an electric furnace which has a thermal efficiency of as high as 60%, it consumes only 60 kWh or 22.98 kg of coal equivalent. In this connection, 54.7 kg of coal equivalent per ton of molten iron was saved by using a duplex system.

In addition, the improvement of the quality of molten iron reduces the scrap rate from 15% to 5% thereby reducing coke consumption. To calculate based on the total output of 3,500 tons of qualified castings, it can save 525 tons of molten iron, or 84 tons of coke or 80 tce, and reduce CO_2 emissions by 200 tons.

In the meantime, the improvement of thermal efficiency at the high temperature stage by using the duplex melting system was, to be calculated based on producing 3,500 tons of qualified castings needs about 5,500 tons molten iron, reduce about 300 tce and 750 tons of CO_2 emissions.

1.2 Construction of a coke store

By using the store, coke damage was reduced by 15%, or 144 tons of coke, or 140 tce (calculation is based on the annual consumption of 960 tons of coke).

As a result, the total energy conservation of the renovation project was 660 tce while the reduction of CO_2 emissions was 1,600 tons.

2. Economic development

By the projected technical renovation, there is 467.7 tons energy savings and 1169.25 tons of CO_2 emissions reduction.

- After the calculation and analysis, we have the following data in 2005:
- Annual output of castings 3,000 tons;
- Business income RMB￥24,000,000;
- Average annual profit RMB￥2,818,000;
- Investment recovery period 5.3 years (including construction period);
- FIRR 19.2% and FNPV RMB￥ 2,430,000.

3. Social impacts

a) After the project started in Jinmei Company, its performance attracts more attention from local government. In 2005, the Company was identified by Jinzhou government of Dalian as the key supporting enterprise and displaying its technical renovation in a national demonstration seminar of marine accessories. Early 2006, a workshop of technical demonstration on advanced technologies was held in the company by the local government. For the previous consecutive three years, this company acquired the honor of key supporting enterprise for its technical advance both by Dalian Government and Jinzhou district government.

b) Working environment of the company was improved through the technical renovation. All the outdoor activities (fettling, blasting, coating, painting and so on) was moved to newly build workshops.

c) Due to the improved working environment, the company increased its female employees. Among the 38 new employees, 22 are female.

d) During the project period, the company also did donation in charity for the local people. Each year the company sent a bag of flour and a birthday cake to every non-salary senior citizens. On the anniversary of the Communist Party's foundation each year, the Company sponsor for a visit for the Party members.

Annex 1

Energy Conservation and GHG Emissions Reduction in Chinese TVEs – Phase II

Feasibility Study Report

For the Technical Renovation on the Steel Casting Production Line in Dalian Jinmei Cast Pipe Co. Ltd

Submitted by:

Wafangdian Fiber Reinforced Plastic Factory

April 2005

This report is written by:

Editor in chief: Xia Fengmin

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Editor: Han Yuzhen Registered consultant(investment)Engineer

Gong Guosheng Engineer

Xue Xinguo Accountant

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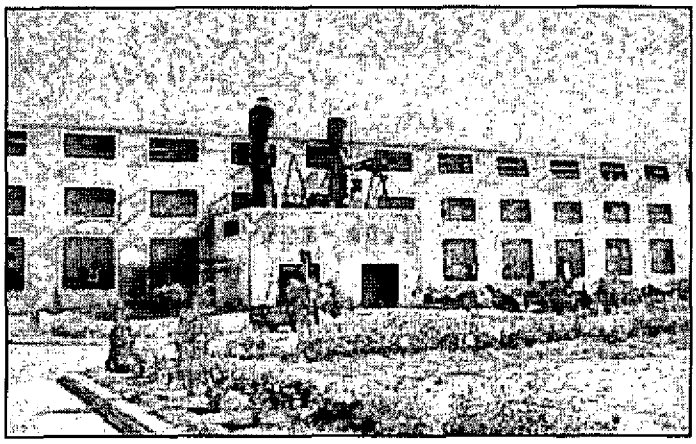
CHAPRTER ONE INTRODUCTION

1 PROJECT BACKGROUND

1.1 PROJECT NAME

This project is named Technical Renovation for Energy Efficiency at Dalian Jinmei Cast Pipe Co. Ltd in Energy Conservation and Greenhouse Gas Emissions Reduction in Chinese Township and Village Enterprises – Phase II.

1.2 GENERAL SITUATION OF THE FOUNDRY



Located at Huajia Town, Jinzhou District, Dalian, the Foundry has registered capital of ¥ 3 million Yuan and total assets of ¥ 34 million Yuan, one of the large-scaled cast pipe producers in China. It has approved by SGS ISO9001 international quality system certificate in 1998. There are three workshops, of which, one is for metal casting, and the others are for tooling and precision casting respectively. Main foundry equipments of the Foundry include two sets of 5-ton cold blast cupola, one set of 500-kg medium frequency electric induction holding furnaces, shot blasters with capacities of 3 tons and 2 tons one each, 2 bridge cranes with capacities of 10 tons and 16 tons one each, 5 pressure testing equipments for various types of valves and pipe fittings and more than 20 sets of various types of tooling machines.

The Foundry produces various categories of nodular iron pipe fittings and valves, weighing from 5 kg -10 kg and sizing from ø50mm—ø2000mm, and stainless steel precision castings registering an annual output of 3,500 tons of castings valuing over ¥30 million Yuan, exported to over 40 countries including USA., Germany, and Japan.

1.3 BASIS AND REFERENCES OF THE FEASIBILITY STUDY REPORT

1.3.1 *Guide on Feasibility Study in Investment Projects*

1.3.2 Notice on Publishing of *Guide on Feasibility Study in Investment Projects* from National Development and Reform Committee

1.3.3 *Guide on Writing of Feasibility Study Report for Industrial Projects*

1.3.4 Materials provided by the foundry

1.3.5 Contract signed with UNIDO

1.4 PROJECT BACKGROUND

Township and village enterprises (TVEs) constitute a significant share of the Chinese economy. China has 22 million TVEs, which employ 130 million people and produce 30% of China's gross domestic product. More than 6.7 million of these TVEs are engaged in industrial activities and cover almost all industrial sectors. Nearly half of China's industrial output is derived from TVEs.

During the past 20 years, TVEs in the cement, brick, metal casting and coking sectors have made significant contribution to China's economic growth. However, due to the outdated, inefficient technologies typically used by TVEs, they have also caused serious resource waste and environmental pollution. TVEs in these four sectors alone account for a staggering one sixth of China's total emissions of CO2.

The project entitled "Energy Conservation and GHG Emissions Reduction in Chinese TVEs" is funded by the Global Environment Facility (GEF) and implemented by the United Nations Development Programme (UNDP). The project is executed by the United Nations Industrial Development Organization (UNIDO) and the Chinese Ministry of Agriculture (MOA). During project Phase I (1998-99), surveys of TVEs in these four sectors were carried out, and the findings were incorporated in the design of project Phase II. Approved by the GEF at the end of 2000, Phase II was formally launched in February 2001 and is scheduled to last for four years.

Eight pilot plants have been selected for technology demonstration. In the metal casting sector, the Dalian Jinmei Cast Pipe Co. Ltd (hereafter the Foundry) has been selected as one of the pilot enterprises. This subcontract is intended to upgrade the technologies for energy efficiency improvement at this pilot foundry.

2. GENERAL SITUATION

2.1 PROJECT SITE

This project is to be carried out in Dalian Jinmei Cast Pipe Co. Ltd at Huajia Town, Jinzhou District, Dalian.

2.2 OBJECTIVE OF TECHNICAL RENOVATION

The project intends to improve productivity and product quality thereby reducing energy consumption and GHG emissions. In the meantime, it aims to establish barrier-removal mechanisms at all levels and smooth channels for commercial financing.

2.3 PROJECT BUDGET AND FINANCIAL RESOURCES

Total investment of this project is RMB 5.3 million, among which RMB 5.3 million from UNIDO (equivalent to $US 6), ¥RMB 3.80 million from loans, and ¥RMB 100 million from the foundry's self-financing.

2.4 MAIN TECHNICAL & ECONOMIC INDICATORS

It is expected, after the technical renovation, to save energy about 467.7 tce and reduce 1169.25 tons of CO2 emissions. The economic indicators include:

1 Internal rate of return—19.2%;

2 Financial Net Present Value—RMB2,430,000;

3 Investment recovery period (including construction period)—5.3 years;

4 Loan maturity period (including construction period)—2.98 years

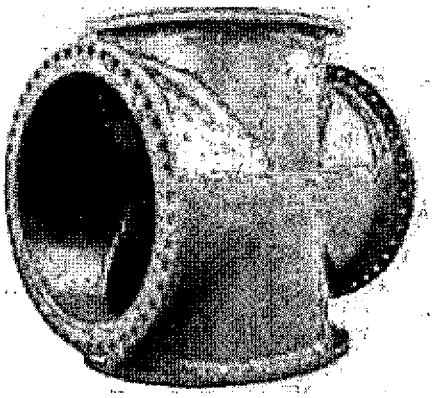
5 Rate of return on investment: 53%;

6 Annual profit: ¥RMB2,818,000

These data indicate decent ecological and economic results.

CHAPTER TWO PRODUCTS AND MARKET ANALYSIS

1. PRODUCTS



Ductile iron products include ductile iron pipes, flanges pipes and ductile iron pipe fittings. There are over 30 varieties of pipe fittings such as tee joints, elbow joints and couplers with more than 1,500 standards. Among them the largest caliber is DN2000mm and the heaviest one weighs about 10 tons.

2. PRIDICTION OF PRODUCT SUPPLY

2.1 SUPPLIES OF DUCTILE CAST PIPES IN WORLD MARKET

In the developed countries, gray cast iron pipes were replaced by ductile iron pipes in 1960's. By now, more than twenty countries are producing nodular iron pipes with an annual capacity from 6.5-7 million tons, sizing from DN50～2900mm. Larger producers are mainly in France, the USA, Germany, Japan, Australia, as well as in the developed countries in China, India, and Brazil. The annual output of the USA is 1.5 -1.8 million tons, of Japan 0.9 million tons, of France 0.6 -0.8 million tons, of Germany 0.4 million tons, and of UK 0.2 million tons. Pipelines in the USA installed for water and sewage is 230,000 km, in which ductile iron pipes account for 47.7%.

There are 16 enterprises that have annual capacity of cast pipes over 100,000 tons, owning nearly 40 factories that totally account for 85% of the world annual output. Among them, Saint-Gobain Pipelines Co., Ltd with its annual output of 1.3 million tons of ductile iron pipes ranks the number one, and Kubota Corporation ranks the second with 0.8 million tons, and Xinxing Ductile Iron Pipes Co. in China ranks the third with 0.55 million-ton-output.

Nodular iron pipe is one of the most often used pipes in water and sewage network. Currently, the annual output of nodular iron pipe is about 7 million tons and is increasing by 3%.

2.2 SUPPLIES OF DUCTILE CAST PIPES IN CHINESE MARKET

Imported dragging processing method (Laguang Fa) from the former Soviet Union in 1958, China begun using it in producing cast pipes prevalently, due to its simple production process, unsophisticated equipments, low investment. Products made by this mehod still account for 50% of the total output of cast pipes.

In 1985, China started to adopt Metal mode spun cast pipe machine of walter-cooling from Germany and the USA, and in the meantime developed methods of metal mode water-cooling casting, heat membrane coating and resin padding cloth spun casting. In 1996, there was more than 100 foundries in China producing various pipes with an annual output around 1-2 million tons.

In these years, China has a rapid development in production of ductile iron pipes. In 2000, the national annual output of ductile iron pipes is around 800,000 tons; in 2002, it increased to 1,300,000 tons; in 2003, it is 1,500,000 tons. The annual output is till increasing, which could cover all the domestic demands, but also contribute to export amount.

Currently, there are 15 foundries producing centrifugal shperulitic iron pipes over 1 million tons per year with 43 sets of centrifugal machines of three types.

3. PREDICTION OF PRODUCT DEMANDS

3.1 DEMANDS OF DUCTILE CAST PIPES IN WORLD MARKET

Given its characters of high intensity, toughness, corrosion resistance and easy-installation, ductile iron pipes are replacing the traditional pipes and are popularly used in transportation of oil, water and gases. In China's water supply networks, ductile iron pipe has taken the role of gray cast iron pipe and account for over 80% of pipes in use. Therefore, ductile iron pipes will be the mainstream product that will be used in world economic construction.

Output of castings is stable in these years, which is around 70-75 tons. Products of ductile iron castings and aluminum alloy castings are greatly increasing, while castings of gray iron, malleable iron and molded steel decrease. Limited by the labor cost and environment, the developed industrial countries cut down their castings production, and shift to import them from the developed countries with export to these countries the castings with high added values.

3.2 DEMANDS OF DUCTILE CAST PIPES IN CHINESE MARKET

China is generally lack of water: 80% of the large- and medium-sized cities do not have a sufficient water supply and their facility for water and oil supplies are asking for improvement. Besides, there are millions of people in China are not having water supply. Therefore, the demand for ductile iron pipes will greatly increase in these years.

Showing in the statistics, China has an annual demand of 1.5-2 million tons cast pipes, among which the demand for centrifugal spherulitic iron pipes are 1.2-1.5 million tons per year. A rapid increase of the demands is also obvious presented.

In the recent 5 to 10 years, centrifugal spherulitic iron pipe will account for a larger percentage, and will basically complete the "two changes". As the international standards do not accept the dragging processing method (Laguang Fa), the centrifugal processing method will has a faster development.

Because the nodular iron pipe is 1/3 times more expensive than gray cast iron pipe, the later one will occupy a certain market for some time due to it lower price, and is still competitive in the medium- and small-sized castings in many cases. Given the ductile iron's traits of high intensity, toughness, corrosion resistance, easy-installation, and innocuity, but high price, it is mainly used in important civil projects in big cities and developed areas. To enlarge market share of ductile iron products, technical enhancement and lower production costs are strongly required.

4. MARKETING NETWORK

Affiliated to Dalian Jinmei Industry Co., Ltd., Dalian Jinmei Casting Pipes Co, Ltd. and Dalian Jinmei Valves Co., Ltd. are coordinated enterprises of China Shipping Industry General Inc(pointed relative enterprises). The products are sold to domestic markets and over ten foreign countries and areas such as Japan, France, Vietnam, Germany, Canada, Egypt, Singapore, Malaysia, Hong Kong, Belgium, Pakistan, Norway, Switzerland, and Argentina etc. Since 1990, we have successively established the supplying relationship with every national large-scale boatyards, American Sigma Corporation, American PCI Corporation, British Ford Corporation and Indian Electric Steel Corporation etc.

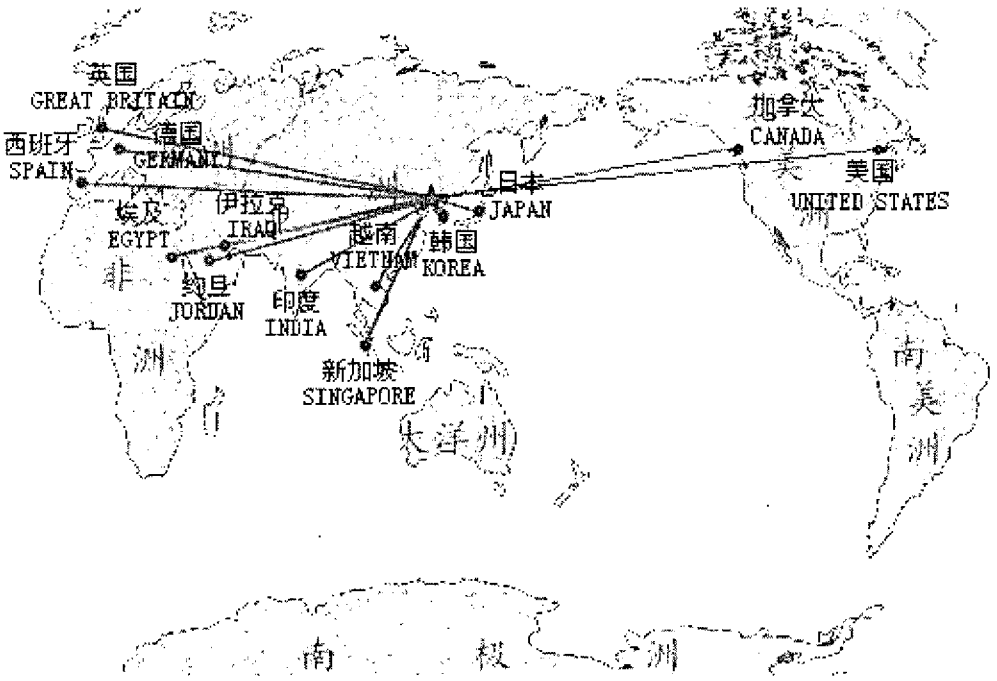


Figure 2-1 Marketing Network

CHAPTER THREE TECHNICAL RENOVATION AND THE EXPECTED RESULTS

1. TECHNICAL RENOVATION

In order to improve productivity and product quality thereby reducing energy consumption, Jinmei Cast Pipe Co. Ltd intends to renovate comprehensively its currently applied production processes while modifying its production line as the following:

1.1 RENOVATION OF THE MOLDING PROCESSES TO REDUCE OVERWEIGHT OF PIPE FITTINGS MADE OF NODULAR CAST IRON

The current applied molding process is done by hands with a piece of stickling board which leads to a poor accurate of sand moulds. As a result, the overweight rate of castings is as high as over 15% thus leading to 450 tons of casting overweight annually. It is proposed to replace the process with fiberglass epoxy patterning process in the production of those common pipe fittings sizing from ø 80 mm – 1,600 mm thereby effectively lowering overweight rate and improving the mould accurate.

1.2 RENOVATION OF MELTING PROCESS: TO REPLACE THE SOLE CUPOLAS MELTING PROCESS WITH A DUPLEX MELTING SYSTEM CONSISTING OF A CUPOLA AND A MEDIUM FREQUENCY INDUCTION FURNACE

The currently adopted melting process is to use cold blast cupolas with low energy efficiency. Due to the poor quality and low temperature of molten iron, it can not meet the requirement for casting nodular cast iron pipe fittings, and also leads to cinder inclusion and cold shuts in castings which are the main causes of a high reject rate, as high as 15%.

It is planned to replace the process with a duplex melting system consisting of a cupola and an electric furnace, i.e. to have the iron melted in the cupola to a temperature of 1350℃ firstly, and then turn into an electric furnace till the

temperature reaches to 1500℃ (tapping temperature). Comparing with the old melting process, the duplex process will improve significantly the melting rate and rise the molten iron temperature (the economically utmost melting temperature of a cupola is under 1450℃, which causes a low quality of molten iron) thereby reducing significantly cold shuts and cinder inclusions in castings. As a result, the scrap rate will lower from 15% to 5%.

1.3 RECOVERY OF USED FOUNDRY SAND

As a prevalent phenomenon in Chinese TVEs, a mass of used foundry sand was not been recovered but thrown out. This is not only a heavy waste of resources, but also increases the cost of production, occupies land resource and causes environmental pollutions.

The Foundry intends to take renovation measures to recover and reuse the used foundry sand.

The recovery process includes:

Used sand crushing → screening →washing (to remove water glass coating from the sand) → drying (natural airing) → collecting and stacking (by a front loader)

By doing so, the new sand consumption can be reduced by 50%, i.e. 6,300 tons per annual thereby reducing production cost and environmental pollution significantly. In addition, the success of the renovation will certainly generate good pilot effects in local foundries.

1.4 CONSTRUCTION OF A COKE STORE

A coke store covering an area of 100 m^2 will be constructed to protect coke from weathering.

2. RESULTS EXPECTED AFTER THE RENOVATION

Comparing with the current practice, technical renovation measures and expected results will include the following:

2.1 CONSTRUCTION OF A COKE STORE

By using the store, coke damage will be reduced by 15%, or 144 tons of coke, or 140 tce, will be saved (to be calculated based on the annual consumption of 960 tons

of coke).

2.2 RENOVATION OF MOLDING PROCESSES

By replacing the current patterning process with fiberglass epoxy patterning process, it will exterminate the casting overweight rate which is as high as 15%. The total coke consumption in the melting process for ductile iron casting will reduce from 816 ton in 2003 to 710 ton, a coke saving of 106 ton or 103 tce.

2.2 RENOVATION OF MELTING PROCESSES

With the current applied melting process, the thermal efficiency of a cupola will drop sharply to about 7% after its inside temperature reaches 1350℃. In this case, to rise the temperature of molten iron from 1350℃ to 1450℃ will consume 80 kg of coke per ton of iron equivalent to 77.7 kg of coal equivalent; While with an electric furnace which has a thermal efficiency of as high as 60% in a duplex system, it will consume only 90 kWh or 34.5 kg of coal equivalent. In this connection, 43.2 kg of coal equivalent per ton of molten iron will be saved comparing with a cupola.

In addition, the improvement of the quality of molten iron can reduce the scrap rate from 15% to 5% thereby reducing coke consumption. To calculate based on the total output of 3,000 tons of qualified castings, it can save 224.7 tce.

Through the above three measures, it is expected to save 467.7 tce and have 1169.25 ton of CO_2 emissions reduction.

2.3 CONSTRUCTION OF A COKE STORE

By using the store, coke damage will be reduce by 15%, or 146 tons of coke, or 142 tce, will be saved (to be calculated based on the annual consumption of 960 tons of coke).

As a result, the total energy conservation of the renovation project will be 667 tce while the reduction of CO_2 emissions will be 1,668 tons.

3. PRODUCTION PROCESS

See Figure 3.

CHAPTER FOUR MAIN EQUIPMENTS

According to the requirements of this technical renovation, a 5-ton cupola will be upgraded; a recovery system of used foundry sand will be built; one set of 5-ton medium frequency electric induction holding furnace and some patterns will be purchased. There is a list of the main equipment in need:

Main Equipment

No.	Name	Unit	Quantity
1	5-ton medium frequency electric induction holding furnace	set	1
2	5-ton cupola	set	1
3	recovery system of used foundry sand	set	1
4	Modeling process, patterns and etc.	set	761
	Total		764

CHAPTER FIVE SUPPLY OF MAJOR RAW MATERIALS AND FEULS

1. SUPPLY OF MAJOR RAW MATERIALS

Raw materials and supplement materials in this project are pig iron, industrial silicon, pure iron, Chrome with low carbon, manganese, and etc. These materials with their annual consumption, resources, and transportation are listed in the following table.

Major Materials

No.	Material	Unit	Annual Demand	Source	Transportation
1	pig iron	ton	4000	Dalian	Automobile
2	industrial silicon	ton	1	Dalian	Automobile
3	pure iron	ton	50	Dalian	Automobile
4	Chrome with low carbon	ton	30	Dalian	Automobile
5	manganese	ton	10	Dalian	Automobile
6	Chrome	ton	30	Dalian	Automobile
7	manganese	ton	10	Dalian	Automobile

2. SUPPLY OF FUEL

After completion of the technical renovation, energy used as power in the foundry is electric power, coke, diesel oil, which has reliable supplies.

Power Supply

No.	Name	Unit	Annual Consuption (Newly Added)	Sources
1	electric power	10k degree	70	Jinzhou
2	coke	ton	344	Dalian
3	diesel oil	ton	50	Dalian

3. PRICES OF RAW MATEIALS AND FUELS

Prices for the major raw materials and fuels are as the following:

PRICES FOR THE MAJOR RAW MATERIALS AND FUELS

No.	Name	Price（RMB￥）
1	pig iron	3150
2	Industrial silicon	122000
3	pure iron	4800
4	chrome with low carbon	15000
5	manganese	15600
6	electric	0. 635
7	coke	1800
8	diesel oil	4530

CHAPTER SIX GENERAL LAYOUT

1. GENERAL LAYOUT OF THE FOUNDRY

Project location is at the site of Dalian Jinmei Cast Pipe Co. Ltd at Shengli Village, Huajia Town, Jinzhou District, Dalian.

Layout of the foundry can be found in Figure 2 General Layout.

2. PUBLIC AUXILIARY SYSTEMS

2.1 ELECTRIC POWER SUPPLY

Transformer substation of the foundry is in its north part, with a 10KV circuitry from 66KV in Huajia Town, which is sufficient for the project construction.

2.2 WATER SUPPLY

The daily life usage water is from the urban water supply network.

2.3 SEWAGE SYSTEM

The water diverging system is adopted to devide industrial usage water and daily-life usage water, in which the sewage will be lead to the foundrys sewage system.

CHAPTER SEVEN ASSESSMENT ON ENVRIONMENTAL IMPACTS

1. ENVRIONMENT OF THE FOUNDRY

The construction site of the project is in a spare area in the foundry. Location of the foundry, Shengli Village, Huajiatun Town, Jinzhou District in the city of Dalian, enjoys a decent environment with no severe industry pollution, no physical, chemical and radioactive pollution sources. Its ambient air quality reaches the National Ambient Air Quality Standards-II （GB3095-1996）, and has sufficient surface water with National Surface Water Quality Standard-III（GHZB1-1999） and adequate Subterranean water—the fourth hole underground water for both living and industry use. The environmental noise reaches the Standard I for Environmental Noise in City （GB3095-1993）.

2. IMPACTS OF PROJECT CONSTRUCTION AND PRODUCTION TO THE ENVIRONMENT

2.1 ENVRIONMENTAL IMPACTS FROM PROJECT CONSTRUCTION

Equipments in this project do not have the problems of "Three pollutions". Noise pollution is not a problem due to its high-standard equipment; and volume of dust emission is below the national standard and do not have bad effects to workers.

2.2 ENVRIONMENTAL IMPACTS FROM PROJECT POLLUTANTS

Environmental impacts from the pollutants of the project after construction are:

2.2.1. Dust pollution in production

Dust caused in production will cause air pollution.

2.2.2 Noise pollution

Heating and processing equipments used in the production will cause noises and noise pollution.

2.2.3 Scraps

Steel scrap, leftover materials, and oil paint not for use in the production can be sold and decrease their pollution to the environment.

3. MEASURES FOR ENVRIONMENTAL PROTECTION

3.1 STANDARDS TAKEN FOR DESIGN AND MONITORING OF THE ENVIRONMENTAL PROTECTION IN THE FOUNDRY:

- Sewage Discharging Integrated Standards(GB8978-88);
- Ambient Air Quality Standards(GB3095-1996)
- Emission Standards of Air Pollutants(GB16297-1996)
- Standards for Noise Pollutions in Cities(GB3096-82)

3.2 MEASURES TO POLLUTANTS

- Use dust collectors to reduce dust below the national standards described in Emission Standards of Air Pollutants(GB16297-1996)
- Measures of screening, shock absorption, sound insulation, sound absorption and so on use to reduce noise pollution and reach requirements in Standards for Noise Pollutions in Cities(GB3096-82)
- Reclaim and reuse the solid wastes for Zero Emissions and non-contamination.

4. ASSESSMENTS TO ENVIRONMENTAL IMPACTS

According to the analysis to the project geological situations, foundry's layout, equipments, as well as generation, emissions and treatments of wastes, we draw the following conclusion to the project's environmental impacts:

The location of this project is decent, and measures taken to protect environment during production are proper. Therefore, from the aspect of environment, this project is workable.

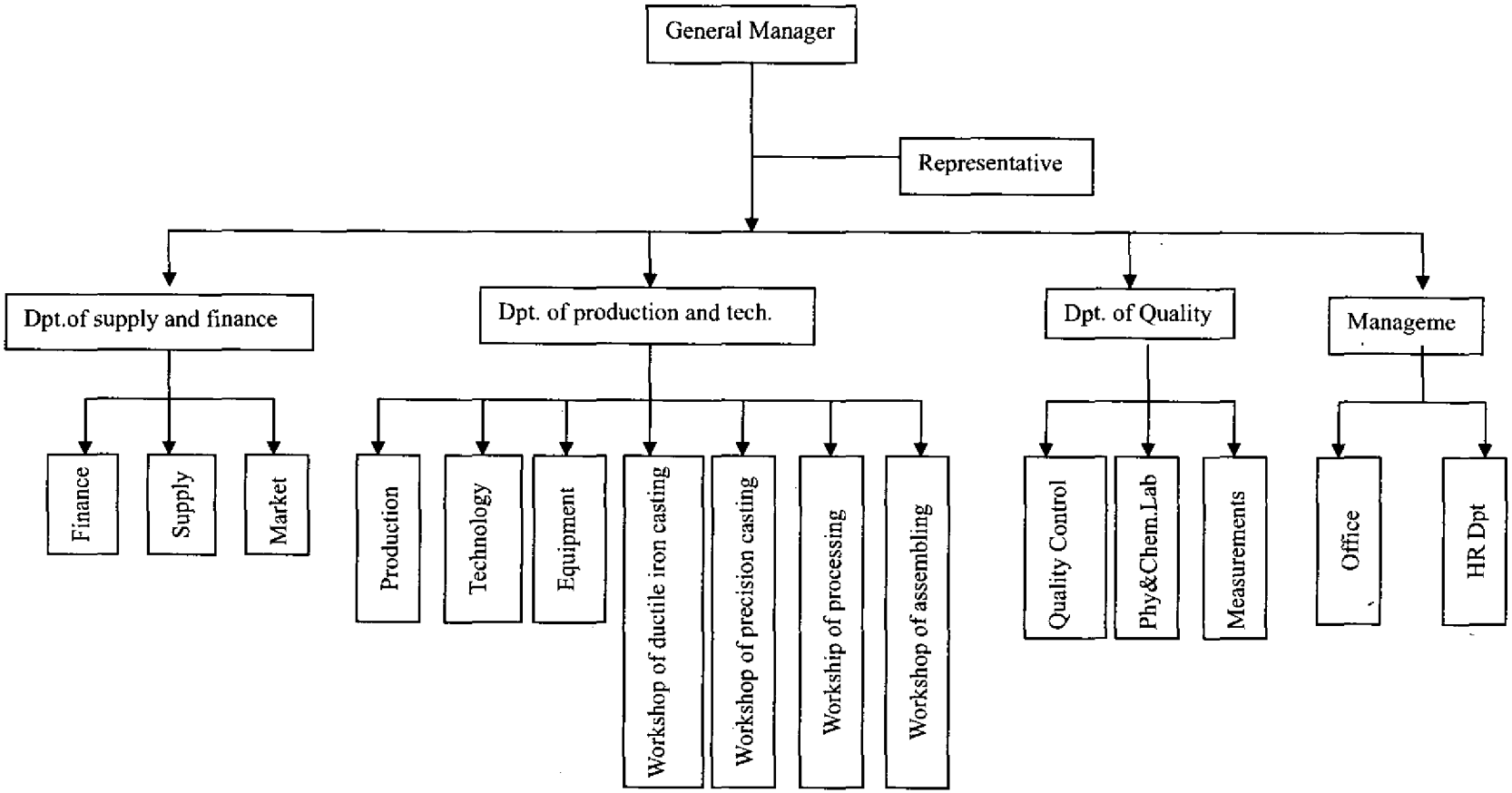
CHAPTER EIGHT STRUCTURE OF MANAGEMENT AND HR SETTINGS

1. STRUCTURE OF MANAGEMENT

1.1 LEGAL PERSON RESPONSIBILITY SYSTEM

The management after the project will take the legal person/ general manager responsibility system. Yu Deyan is the legal person.

1.2 STRUCTURE OF MANAGEMENT


General Manager
Representative
Dpt.of supply and finance
Dpt. of production and tech.
Dpt. of Quality
Manageme
Finance
Supply
Market
Production
Technology
Equipment
Workshop of ductile iron casting
Workshop of precision casting
Workship of processing
Workshop of assembling
Quality Control
Phy&Chem.Lab
Measurements
Office
HR Dpt

1.3 MANAGEMENT SYSTEM

The foundry is introducing a modern management system to replace its traditional way, by referring to the advanced management models,and establishing scientific and active management methods. This management system emphasizes carefull marketing research, market-oriented sales, well arranged production, clear financial management and HR system.

During the project implementation, management of the foundry will be strenghtened through: consuminating the legal person responsibility system; introducing the updated management methods and skills; and improving the marketing system.

2. HR SETTINGS

Presently, the foundry has 120 employers which is sufficient to this project.

CHAPTER NINE PROJECT IMPLEMENTATION PROCESS

1. TIME LIMIT FOR PROJECT CONSTRUCTION

Prepared from Oct. 2004, the project is to be completed in June 2005, through the implementation steps of preparation, design and plan, and equipment purchase, installation, testing and commissioning.

2. SCHEDULE FOR PROJECT IMPLEMENTATION

To ensure the timing of the project implementation, as well as its quality, the schedule is below and will be strictly followed.

Jan-Feb. 2005 preparation, design and plan of the project

Jan-May 2005 bidding for equipment purchase; testing and commissioning

June 2005 test-run; formal operation

SCHEDULE FOR PROJECT IMPLEMENTATION:

2004			2005					
10	11	12	1	2	3	4	5	6
Preparation, design and plan of the project								
			Bidding for equipment purchase; testing and commissioning					
								test-run; formal operation

CHAPTER TEN INVESTMENT ESTIMATE AND FINANCING

1. INVESTMENT ESTIMATE

1.1 INVESTMENT ESTIMATE

1.1.1 EXPENSES OF CONSTRUCTION

Expense of construction is estimated by units. Construction cost per unit is RMB ￥750/m3, and this project is going to build a coke storeroom of 100m3. therefore, the total cost of construction is RMB￥75,000.

1.1.2 EXPENSES OF TECHNICAL RENOVATION AND EQUIPMENT PRUCHACE & INSTALLTION

This project is intended to undertake renovation on a 5-ton cupola, recovery system of used foundry sand, the molding processes and patterns, and a duplex melting system consisting of the 5-ton cupola and a newly purchased 5-ton medium frequency induction furnace. the total expense is RMB￥ 4,740,000, details as the following:

ESTIMATED EXPENSES ON TECHNICAL RENOVATION AND EQUIPMENT PURCHASE

Table 10-1 unit: RMB￥1,000,000

No.	Equipment	Type	Unit	Quantity	Unit price	Total price
1	5-ton medium frequency induction furnace		set	1	1	1
2	5-ton cupola		set	1	0.8	0.8
3	recovery system of used foundry sand		set	1	0.8	0.8
4	molding processes and patterns		set	1	2.14	2.14

	total					4. 74

Installation fees are supposed to be 5% of the estimated expenses on technical renovation and equipment purchase, therefore, the total investment is RMB ￥237,000.

1.1.3 ESTIMATED RESERVED-FUND

Given the unexpected circumstance arise or prices get higher during the project implementation, a reserved fund is estimated. According to national rules on reserved funds in large and medium-sized projects, inflation is not taken into consideration as the prices are stable for these years.

The reserved fund is 3% of the total project expense of construction, purchase, and installation, which is RMB￥142,000.

1.1.4 INTERESTS

This project applied a loan of RMB￥3.8 million from bank with the interests of 5.58%. Calculated by its project duration, the total cost for bank interests is RMB ￥106,000.

1.2 TOTAL INVESTMENT

Total investment=construction fee+ equipment purchase+ interests

=RMB￥5.3 million

2. FINANCING

Investment of this project is from three parts: RMB￥500，000 financial support from GEF，RMB￥3.8 million bank loan, and RMB￥1 million self-financing by the foundry.

CHAPTER ELEVEN ANALYSIS OF ECONOMICS EFFECTS

1. SELECTION OF BASIC DATA AND PARAMETERS IN FINANCIAL EVALUATION

1.1 BASIS AND REFERENCES OF FINANCIAL EVALUATION

Based on *the National Guidelines for the Project Investment Feasibility Study* and it relative regulations, as well as materials provided by project parties.

1.2 SELECTION OF BASIC DATA AND PARAMETERS

1.1.1 DURATION AND PRODUCTION LOAD

Duration of this project is supposed to be eleven years, including a production period of ten years. From the second year, the designed production load will be reached.

1.1.2 RATE OF PROFIT

Based on the current interests of national debts and risk factors, a basic rate of profit is set as sum of the above both. Considering the 4.03% interests of 30-year national debts (pre-tax); and 33% income tax rate, and relating risk factors, the basic rate of profit is 10%.

1.1.3 OTHER PARAMETERS

The baseline of investment recovery period is 10 years, and average rate of investment return is 12%.

2. ESTIMATE OF INCOMES AND TAXATION

2.1 BUSINESS INCOME

Upon the completion of project construction, earnings by selling products of 3,000 ton will be RMB￥4,200. Details are in the following table.

Estimate of Business Income

Table 11-1 Monetary Unit: RMB￥10,000

No.	Products	Sale（T）	Unit Price（RMB10,000/t）	Income
1	Ductile iron castings	3000	0.8	2400
2	Total	3000		2400

2.2 VALUE-ADDED TAX, TAX OF SALES, AND OTHERS

Value-added tax-17%; Civil construction tax（7%）; Added tax on Education（3%）

Value-added tax =Output tax- Input tax=(Business income-purchase of raw and supplementary materials and fuels and power)/(1+17%)x17%

3 ESTIMATE OF THE COSTS

3.1 COSTS OF MATERIALS

3.1.1 MAIN RAW MATERILS

It is estimated that main materials cost each year will be RMB￥1,356.8. Details can be found in table 11-2.

ESTIMATE OF THE COSTS OF MAIN RAW MATERILS

TABLE 11-2 Monetary Unit: RMB￥10,000

No.	Name	Unit	Annual consumption (t)	Unit price	Cost
1	Pig iron	ton	4000	0.315	1260
2	Industrial silicon	ton	1	12.2	12.2
3	Pure iron	ton	50	0.48	24
4	Chrome with low carbon	ton	30	1.5	45
5	manganese	ton	10	1.56	15.6
	total		4091		1356.8

3.2 COSTS OF FUELS

It is estimated that the cost of fuels, including electric, coke, diesel oil, and etc, each year will be RMB￥239.9. Details can be found in table 11-3..

Estimate of Fuel and Power Cost

TABLE 11-3 Monetary Unit: RMB￥10,000

No.	Name	Unit	Annual consumption (t)	Unit price	Cost
1	Electric	10,000 degree	70	0.635	44.5
2	Coke	ton	344	1800	61.9
3	diesel oil	ton	50	4530	22.7
4	Total				129.9

3.3 SALARY AND BENEFITS

There are 120 employees in the foundry, with an average annual salary and benefits RMB￥12,000. Therefore, the total cost on salary and benefits is RMB1,440,000.

3.4 DEPRECIATION

The original fixed asset is RMB￥5.3 million, including RMB￥75,000 of construction and building, and RMB￥5.225 million equipment (purchase price). Depreciation duration for buildings and construction is 20 years, and for equipment 10 years, so the depreciation rate sets to be 5%.

3.5 LABOR COST

8% of the cost on raw material is calculated as the labor cost, which is RMB ￥1.085 million.

3.6 ACCOUNTING COST

Loans in construction period bring interests in operation, which is regarded as accounting cost. Details about accounting cost could be found in Table 4: Estimate of the Total Costs.

3.7 OTHER EXPENSES

Other expenses means the sum of production cost, management cost, and accounting cost minus salary and benefits of employees, depreciation, labor cost, and interests expenses. According to the real situation, the other expenses set to be 10% of the above mentioned sum as RMB￥1.788 million.

3.8 TOTAL COSTS

The total cost is supposed to be RMB￥19.912 million. Details are in Table 4: Estimate of the Total Costs.

3.9 MANAGEMENT COST

Management cost= total cost-depreciation-amortization-accounting cost

Annual management cost is estimated to be RMB￥19.194 million.

4. PROFIT AND PROFIT ALLOCATION

4.1 ESTIMATE OF THE TOTAL PROFIT

Profit= business income-total cost-sales tax

Details could be found in table 5 Profit and Profit Sharing.

4.1.1 During the whole business period, the total business income is RMB28.18 million, and the annual business income on average is RMB2.818 million.

4.1.2 to deduct the income tax, which is 33%, the total after tax profit is RMB18.88 million, which in on average RMB1.888 million per year.

4.2 PROFIT ALLOCATION

15% of after-tax profit is surplus reserve and public welfare funds, and the other is profit for allocation. Except the surplus reserve and public welfare funds, the accumulated unallocated profit is RMB￥16.04 million, and the average annual unallocated profit is RMB￥1.604 million.

5. FINANCIAL EFFECTS ANALYSIS

5.1 CASH FLOW ANALYSIS

The estimated indicators according to the foundry's cash flow are:

Table 14-4:

Indicator	FIRR（%）	FNPV RMB￥10,000	Pt (investment recovery period)
After-tax income	19.2%	243	5.3 year (including construction period)

The financial internal rate of return (FIRR) is higher than basic discount rate 10%, and the financial net present value (FNPV) is much more than zero. Also considering the PT including construction period is 5.3 years, this project has a good profit potential.

5.2 INVESTMENT PROFIT RATE, INVESTMENT PROFIT RATE

Investment profit rate: 53%

Investment profit rate: 35.6%

5.3 SOLVENCY

There are RMB¥3.8 million bank loans which will be payback by depreciation, amortization, and the unallocated profit. Calculated as table 7 Plan for Payback of Loans, the shortest loan maturity period is 2.98 years, including construction period.

CHAPTER TWELVE SOCIAL EFFECT ANALYSIS

1. This project is intended to reduce CO2 emission. Currently, China is the second largest CO2 emission country in the world. Besides, emissions of CH_4 and N_2O are also notable. From 1990-2001, China's CO2 emissions have an increase of 823,000,000 tons, and account for 27% of the world increase. it is expected that the CO2 emissions in 2020 will be 1.32 times of that in 2000, and probablely exceed USA's emission and rank the No.1. Due to the relatively backward technology and huge energy consumption in China, its CO2 emission/GDP is quite high, also. The technical renovation will greatly reduce CO2 emissions of the foundry, and play important role to "control the GHG within the level not harmful to human beings".

2. This project is helpful to resolve energy problems. Coal is a major energy sources in China that account for 70% of the total unrecovered energy. this also make China one of the most soot-polluted countries, as well as a big CO2-emission country. Restricted by the energy resources structure, to use energy like oil and gas with less pollution is a problem, while to improve energy efficiency is limited by technical and financial support.

3. This project is helpful in solving the huge pressure in China's economic development. GHG emissions and energy demands are increasing with China's economic development. by reducing GHG emissions and resolve energy problems, this project reduce the pressure that China is facing.

CHAPTER THIRTEEN SUMMARY AND SUGGESTIONS

1. SUMMARY OF THE FEASIBILITY STUDY

This project is to improve energy efficiency and reduce GHG emissions by adopting advanced technology and to remove key policy, market, technology, and financial barriers for TVEs.

By the projected technical renovation, there will be 467.7 tons energy savings and 1169.25 tons of CO_2 emissions reduction. After the calculation and analysis, we have the following data: annual output of castings 3,000 tons, business income RMB ￥24,000,000, average annual profit RMB￥2,818,000; investment recovery period 5.3 years (including construction period); FIRR 19.2%, FNPV RMB￥ 2,430,000. These data are all better than the baseline data, and indicate good economic and environmental effects.

2. SUGGESTIONS

To ensure the smooth project implementation, it is better to shorten the construction period and guarantee the project capital.

After completion of the project, it is necessary to continuously improve production and management, so as to further enlarge the market and build the brand.

Annex 2 Process of Fiberglass Epoxy Patterning

玻璃钢模具生产工艺

1.0 主题内容与适用范围:

1.1 本规程规定了造型、制芯、合箱、浇注作业应遵循的准则，操作方法及质量要求。

1.2 本规程适用于我厂玻璃钢模具造型、制砂、合箱、浇铸作业的实施、检查与控制。

1.3 为确保造型、制芯、合箱、浇注质量达到规定要求，以便生产出合格的管件毛坯件，特制定本生产工艺规程。

2.0 引用文件:

2.1DJM 质量手册

3.0 职责:

3.1 本规程由技术生产部归口管理，并对执行情况进行监督控制。

3.2 质保部协助技术部门对工艺执行情况进行监督检查。

3.3 铸造车间负责本规程的组织与实施、督促检查。

4.0 工作内容

4.1 造型作业

4.1.1 工作前首先检查模型是否完整正确，如发现有损坏、错误之处（包括使用过程中），应立即送交模型修理、改正，模型不许带病使用。

4.1.2 填砂时，一次上砂不许过厚，手工冲型时，砂层厚为100mm-150mm,风动工具冲箱时砂层厚度为 150mm-200mm。

4.1.3 口径 500 以上的管件应在箱底及四周充填砂块。

4.1.4 在铸型表面填一层面砂，面砂厚度不小于 20-40 mm 捣实并达到要求尺寸形状，并通知调度铸字。

4.1.5 冲制上型时，直浇口四周应切实冲紧，无漏冲松散部位存在。

4.1.6 修型时，用力应均匀，作到形状规整，尺寸正确，修理不走形，以保证吊芯时准确定位。

4.1.7 芯座部位必须作到形状规整，尺寸正确，修理不走形，以保证吊芯时准确定位。

4.1.8 浇注系统的开设应符合工艺规定，作到形状尺寸正确，表面光滑、平整。

4.1.9 造型作业完成后，在铸型上用于通二氧化碳气的孔穴，扎孔穴应均匀，全面无死角，不许有硬化不良的软层存在。通气时采用小

流量，并严格用手摸的方法检查硬化强度，适度为止，不许过量充二氧化碳气，以防铸型强度不足而溃散。
4.1.10 充气硬化后，把孔全部填死，涂酒精涂料，第一遍应粘稠一些，点火燃着干燥后，把流痕及不平处擦平，再涂第二遍铅粉，二遍铅粉涂完后，做到光滑、平整、无流痕，并点燃干燥。
4.2 制芯:
4.2.1 芯合置备：在下半型表面均匀放一层砂，用针状物检查各处壁厚是否符合标准，如壁过厚和太薄，应用刮削及填面砂压实的办法调整，达到要求后充二氧化碳气硬化。
4.2.2 制芯时先在下半芯合表面放一层面砂厚度 30-50mm，铺平后填石灰石砂，放芯铁调好位置后，再填石灰石砂冲实到与箱口一平，大中管件（直径 400 以上）应在中心部位堆放就砂块，在填石灰石砂冲实。小型泥芯可直接天石灰石冲实，但中心必须放通气棒，（直径 50 以上）以便泥芯通气。
4.2.3 在上面再铺层厚度 30-50 mm 面砂捣实达到光滑、平整、无明显的凸凹不平。然后与在法兰承口对应各位置划条线，以便吊芯时找正位置。
4.2.4 扎通二氧化碳气用的通气孔，箱口处划条标记线，并吹二氧化碳硬化(具体要求与造型硬化要求相同)，硬化后把通气孔全部堵死，不许遗漏。
4.2.5 把硬化好的芯子吊起，放在支架上准备修整，芯子吊起后，检查表面有无硬化不良的部位，如果有应立即填充面砂，冲实修平，充二氧化碳气硬化。
4.2.6 检查芯合各处壁厚，达不到要求的部位对芯子相应部位进行修整。
4.2.7 芯子修整，除磨修壁厚达不到要求的部位外，重点与箱口对应的两侧的磨修，及凸凹不平处表面损坏部位的修补硬化与磨修。
4.2.8 对芯子按砂型相同的要求涂刷两遍酒精铅粉。
4.3 研箱:
4.3.1 造型制芯工作完成后，把上下箱合在一起研箱，调整和修整到不错箱为止，然后打箱，不许存在模棱两可的箱号。
4.3.2 研箱的同时，仔细检查直浇口质量有无松散部位存在，如有应刷铅粉（特别严重铸型应报废）同时把直浇口中的异物清除后研箱。
4.3.3 研箱合格后，作水口箱，冒口圈及出气口圈，水口箱应沿周捣实，直浇口周边 100mm 范围内制作平整，以便安放水口堵，使平面

间的密封良好。
4.4 合箱:
4.4.1 吊芯前，应把下半型中的散砂等异物清理干净，并把芯座沿半圆周打上泥封。
4.4.2 按制芯时划的与法兰或承口对应的记号，弯管按与箱口对应记号下芯，检查各部壁厚是否合格，是否均匀，并调整到正确位置，检查下型壁厚，并调到合格为止。
4.4.3.用压缩空气把芯子与下半型形成的腔中的散砂等异物切实吹净，并在箱口平面及上半芯头上打泥封，为扣上箱做准备。
4.4.4 盖上箱前，检查直浇口，出气冒口，冒口中是否干净，并用压缩空气全面吹一遍，切实吹净后，方可盖上箱，原则规定盖上箱前必须用泥条研箱，如壁厚达不到要求，应调整到合格再盖上箱。
4.4.5 管件盖上箱时，应有专人观察有无掉砂情况，（小型管件应箱口较低，不趴在地上难以看到，易被忽略，应格外注意）
4.4.6 盖完上箱时，用螺栓或箱卡子切实紧固砂型，并把大中型管件的芯铁两端切实顶牢。
4.4.7 把芯头及箱口全面无遗漏的用水玻璃砂塞严，并充二氧化碳硬化，尤其芯头端必须切实封严，大型管件因压头大，水口端应最好用长木板封严。
4.5 浇注:
4.5.1 浇注前把通道及砂箱周围清理干净，保证畅通。
4.5.2 浇注时先将包嘴切实对准水口箱及浇口杯，然后不断流地进行浇注，尽量避免浇一点铁水后断流，再大流浇注，防止产生冷豆性冷隔。
4.5.3 浇注过程中注意引气，并作好跑火堵漏的准备工作。
4.5.4 在出气冒口和冒口灭火的情况下，表明铁水即将浇满，应缓流浇注。防止因流大压头迅速上升而跑火。
4.5.5 为防止生产冷隔废品，壁厚薄的小型管件，尽量用包头铁水浇注，应尽量避免用包尾铁水浇注小型薄壁管件，温度过低的包尾铁水应倒掉，不浇注铸件。
4.5.6 浇注后应按工艺规定时间使铸件在型内降温，不许打箱过早，以免铸件裂纹或尺寸变化引起超差。
4.5.7 浇注完后，稍过一段时间，趁直浇口还没完全凝固时，把水口扒掉。

5t中频熔炼炉安装概要

（钢壳）

一、电器安装

（1）、变压器要求：

一套5吨熔炼炉配两台变压器（参见平面布置图）

	结构	容量	次级电压	备注
电力变压器	$\triangle/Y_0$—11	4000kVA	950V_{AC}	

（2）、进线铜排截面：≥800mm²，（由用户负责）

（3）、逆变输出铜排（电源装置柜与电容器柜之间的连接铜排）截面：≥1500mm²，由本公司提供8×200铜排10m。

二、电器柜（电源柜与电容器柜）水路安装（由用户负责）

（1）、进水水路流向：水泵从电气柜冷却水池中抽水进总水管，流向各电气柜，并分别安装阀门，便于调节各设备的进水压力和流量。

（2）、出水：电气柜各水冷器件的出水均流向漏斗水箱，便于观察各元件出水是否畅通，有无堵塞。各漏斗水箱汇总于总出水管再流回水池。

（3）、水路说明(参照图2)。

★水池容积：≥100吨

★水泵规格：功率≥10kW；扬程≥32米；流量≥50吨

★总进水管≥150mm；分进水管75mm；总回水管≥200mm

★进水压力：0.1MPa~0.2Mpa

★进水温度：电源柜，电容器柜≤35℃

★漏斗水箱安装高度一般高度为距地面1.5米，便于观察及处理。因此要求水池最高水位不高于地面0.5米，以防回水不畅，导致漏斗水箱溢流。

★各分水路均需安装1Mpa压力表，放在便于观察的位置

★水路安装的走向应尽量避免过多的弯头

三、熔炼炉水路安装（由用户负责）

（1）、进水水路流向：水泵从炉体冷却水池中抽水进总水管，流向熔炼炉及水冷电缆，每一路分水路均需安装阀门，便于调节各路进水压力和流量。

（2）、出水：各分路出水均流向总出水管再流回水池，各分路出水均安装温度计，高于设定温度均自动报警。

（3）、水路说明(参照图2)。

★水池容积：≥250吨

★水泵规格：功率≥20kW；扬程≥30米；流量≥100吨

★总进水管≥150mm；分进水管32mm；总回水管≥240mm

★进水压力：0.2MPa~0.3Mpa

★进水温度：熔炼炉≤40℃

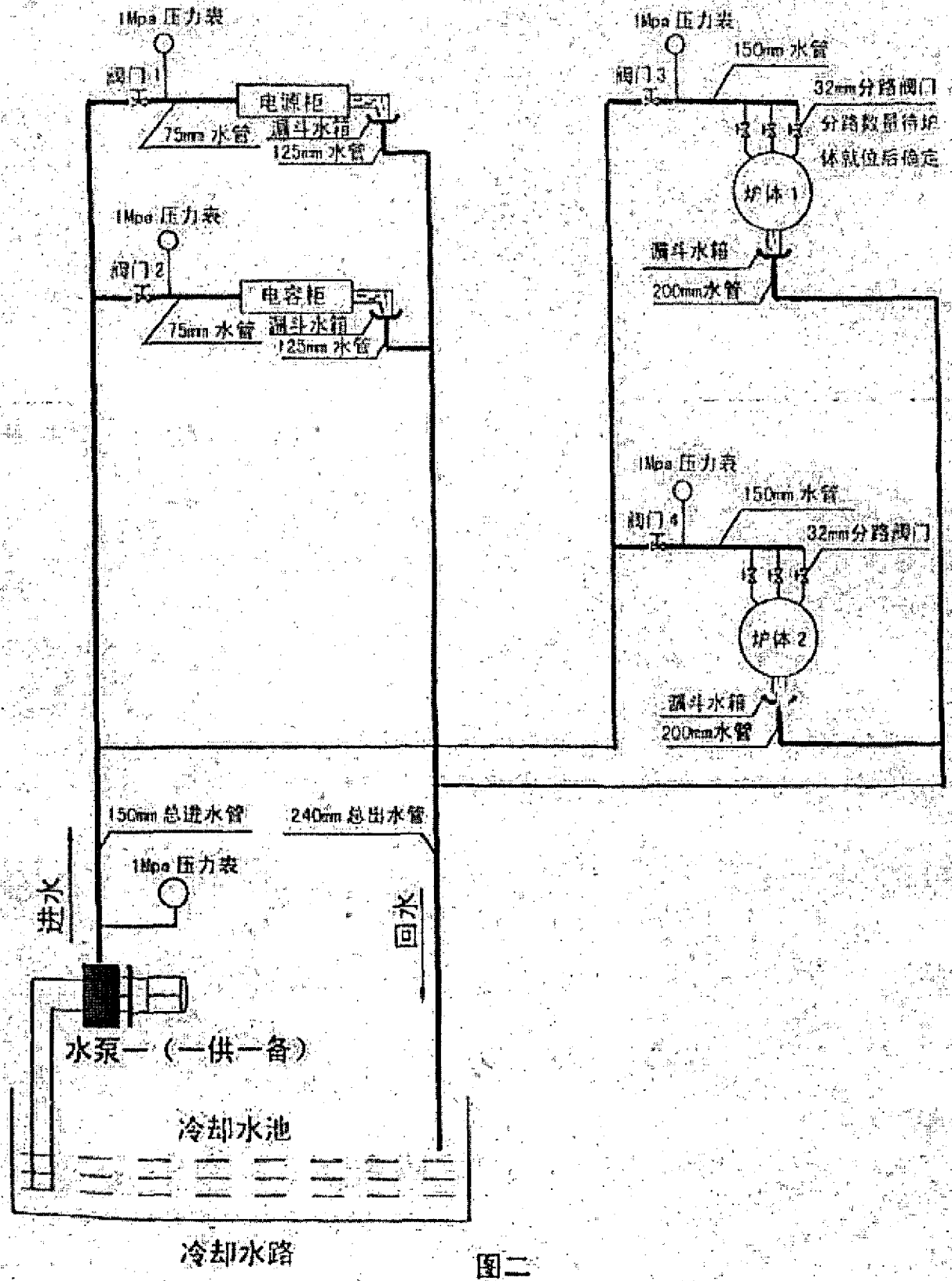
★漏斗水箱一般安装在炉台上，各分水路阀门也位于炉台上，便于炉工开关水路及观察处理水路问题

★每分水路最近的总进水管均需安装1Mpa压力表，放在便于观察的位置

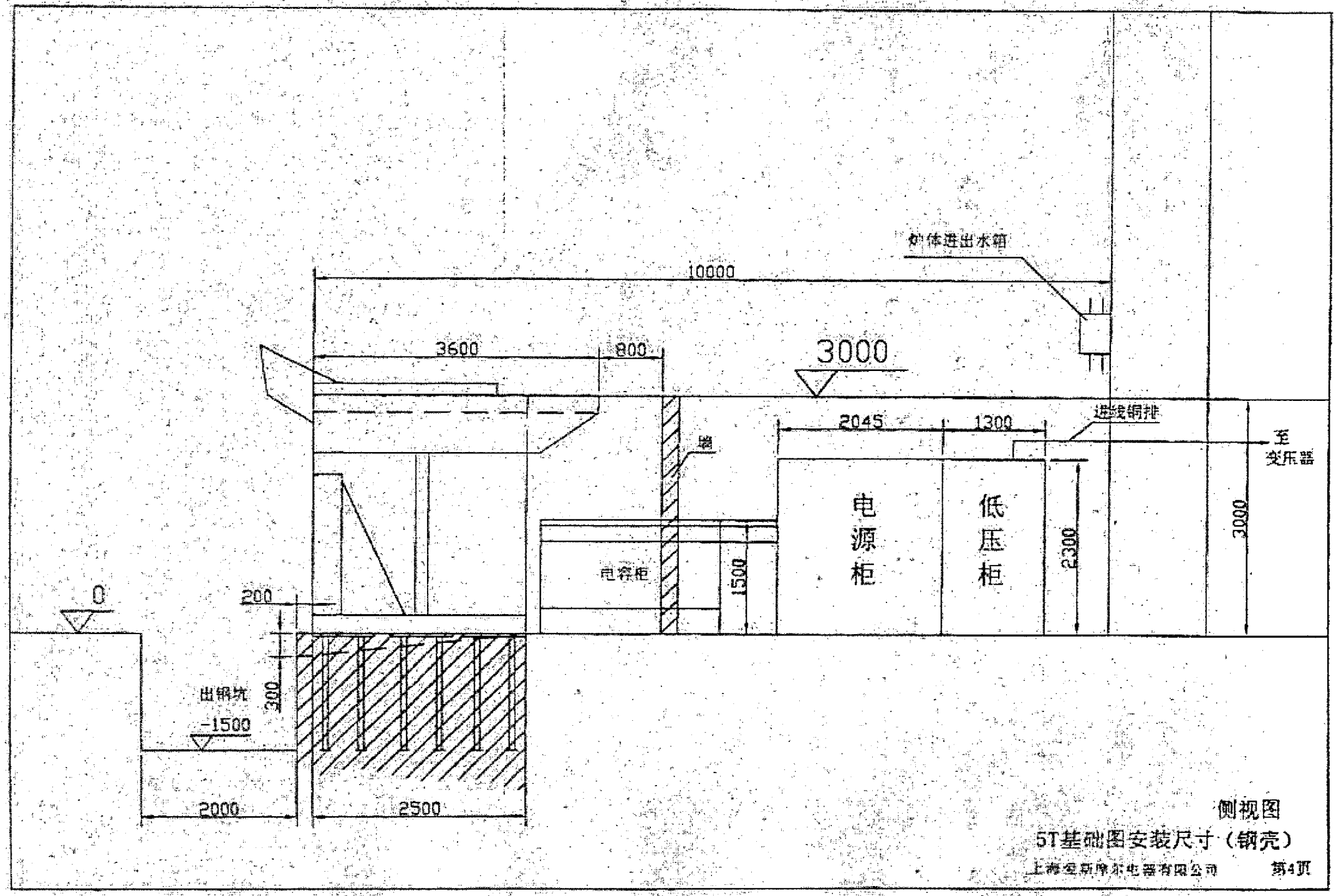
★水路安装的走向应尽量避免过多的弯头

（4）炉体支架及液压油缸转轴每周注射高温黄油。

说明：• 进线铜排（第(2)项）的安装连接由用户负责；
• 内部电气连接安装（第（3）（4）项）以用户为主，本公司派员指导安装；
• 水路安装由用户负责；
• 阀门1～阀门4 可调节各电气柜和炉体的进水压力至要求范围。

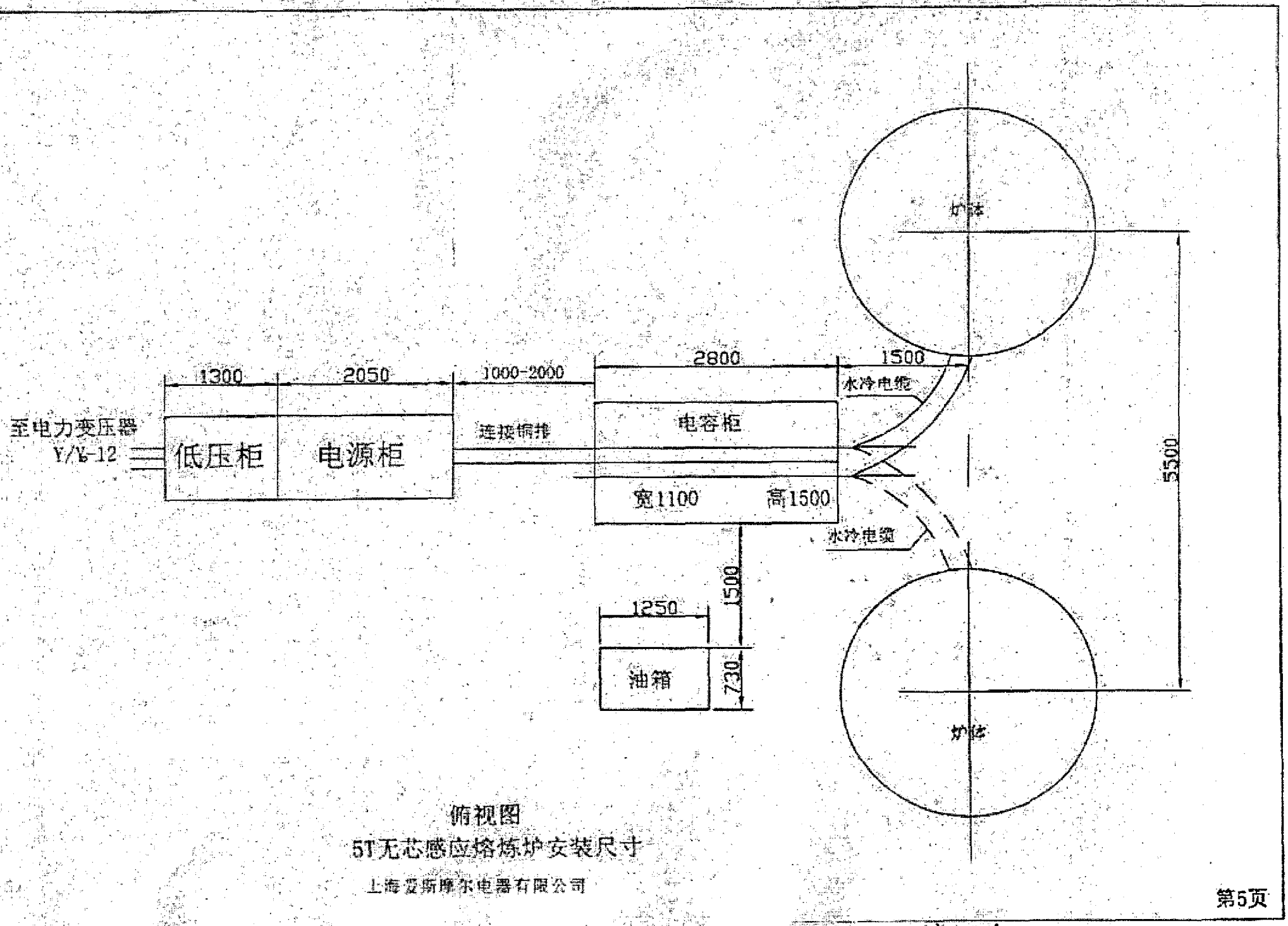


图二



侧视图

5T基础图安装尺寸（钢壳）

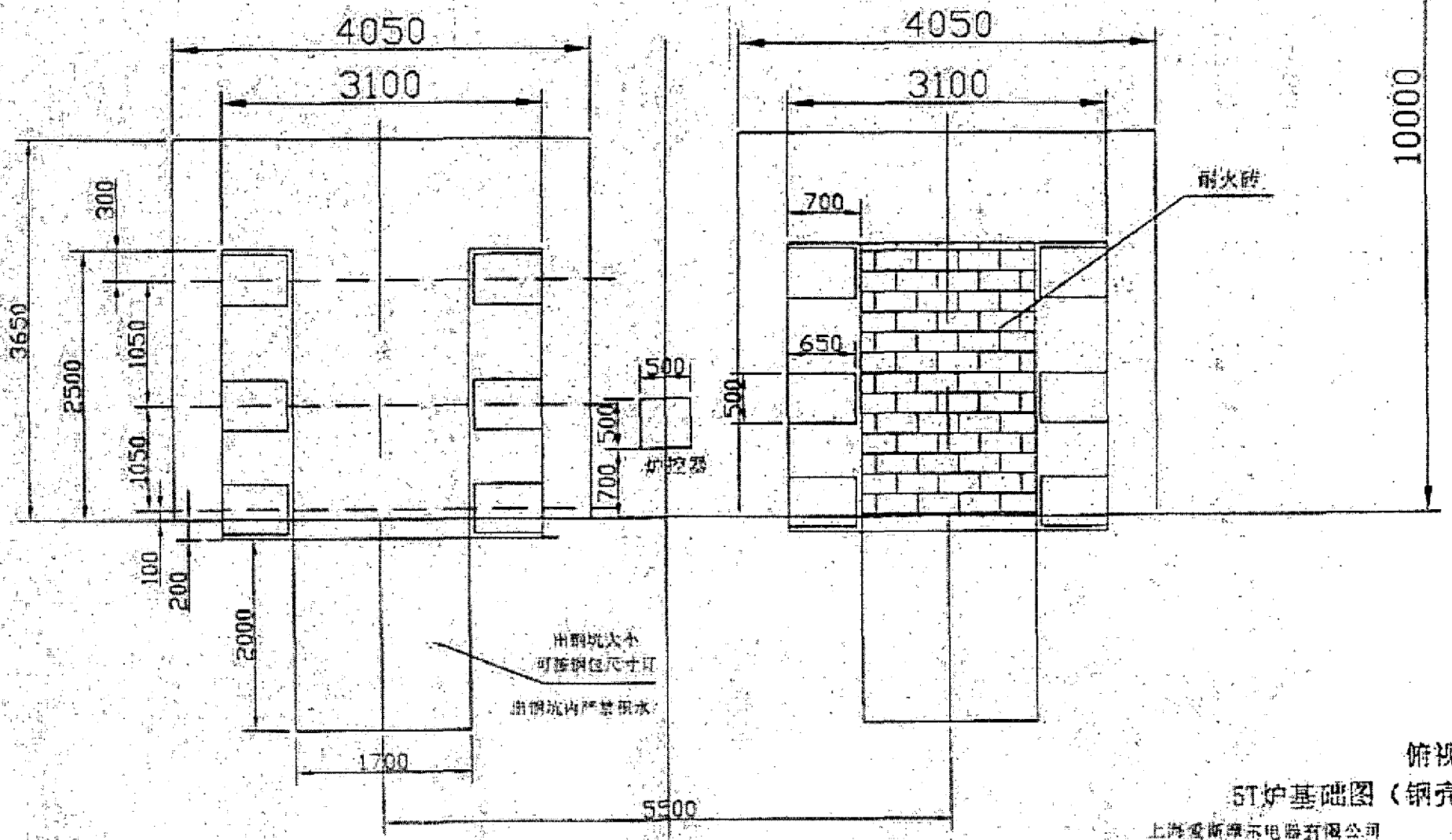


俯视图

5T无芯感应熔炼炉安装尺寸

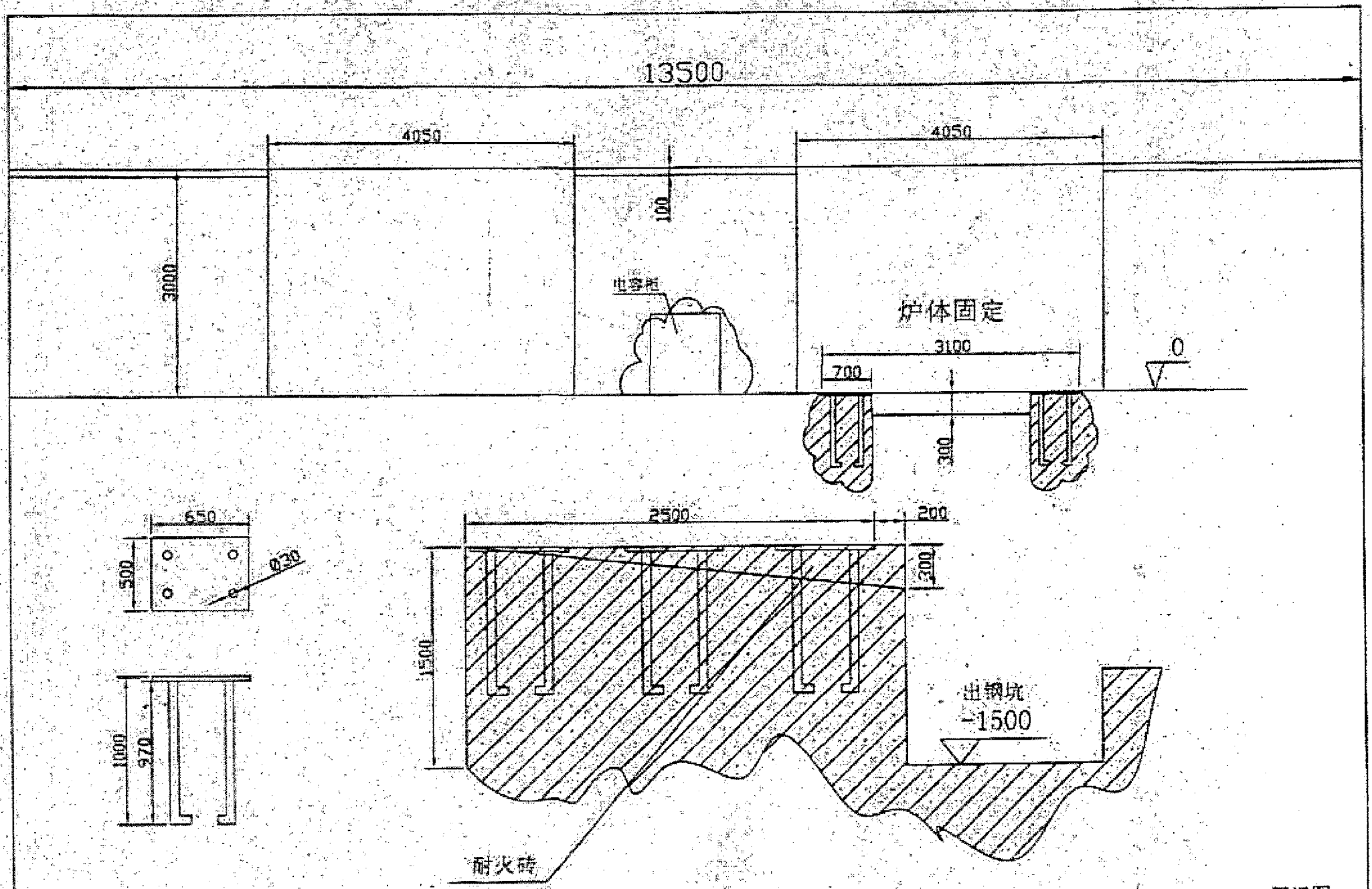
上海爱斯摩尔电器有限公司

炉体支架固定钢板
500X650X30 共12块



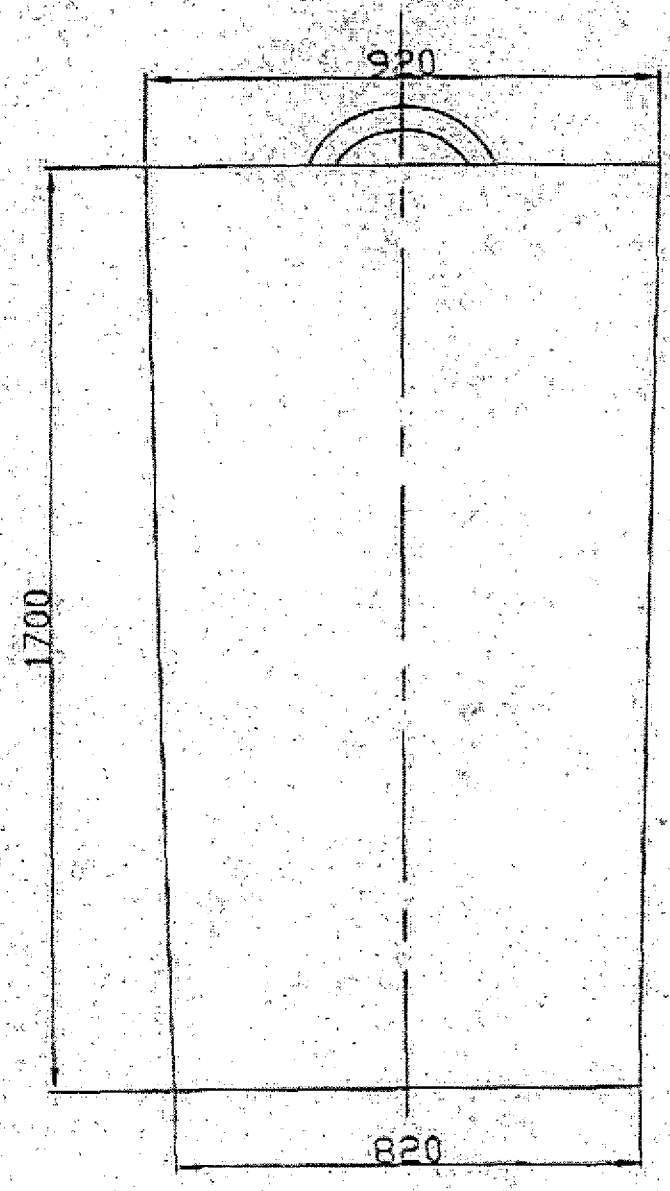
俯视图

5T炉基础图（钢壳）

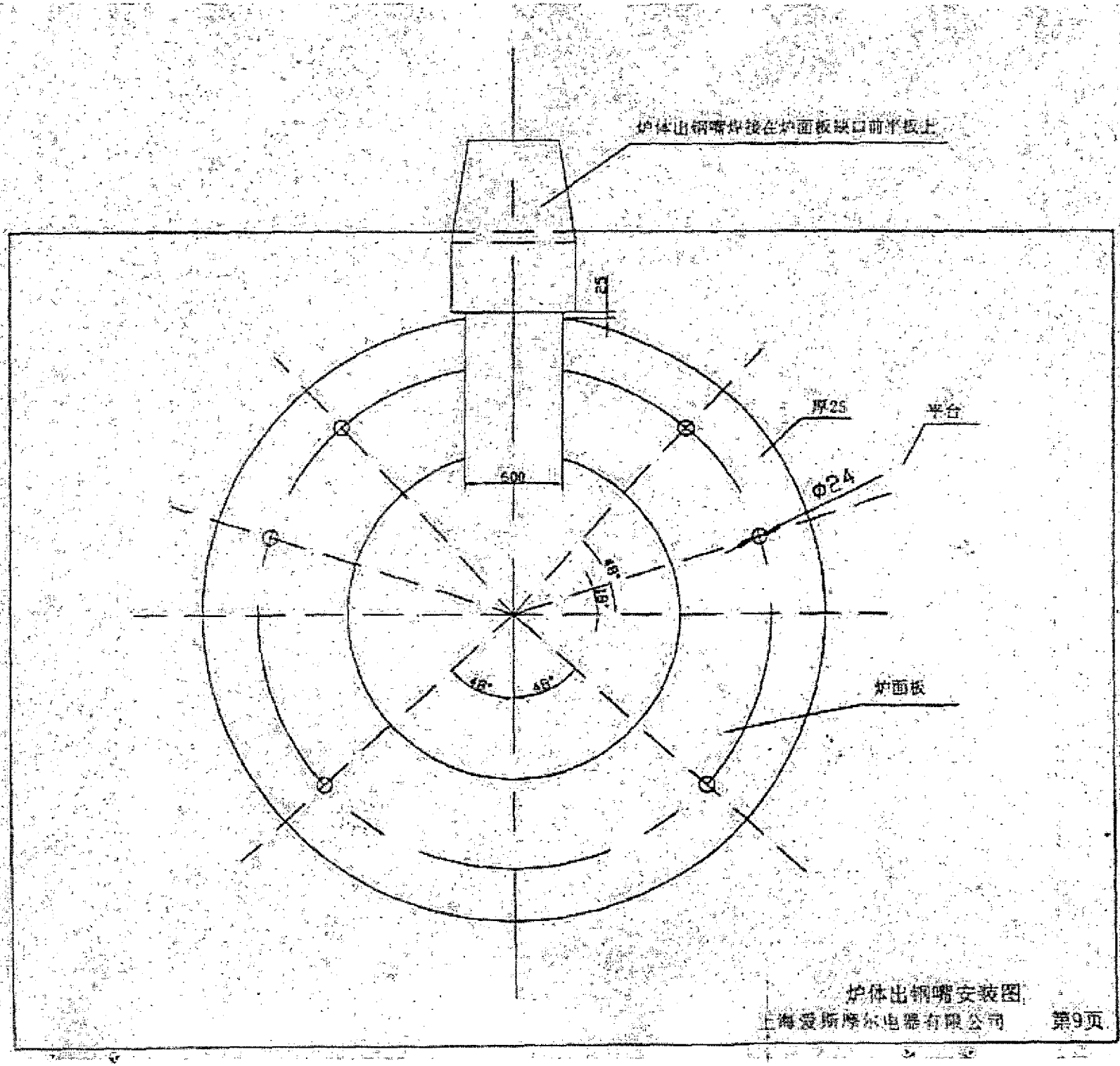


正视图

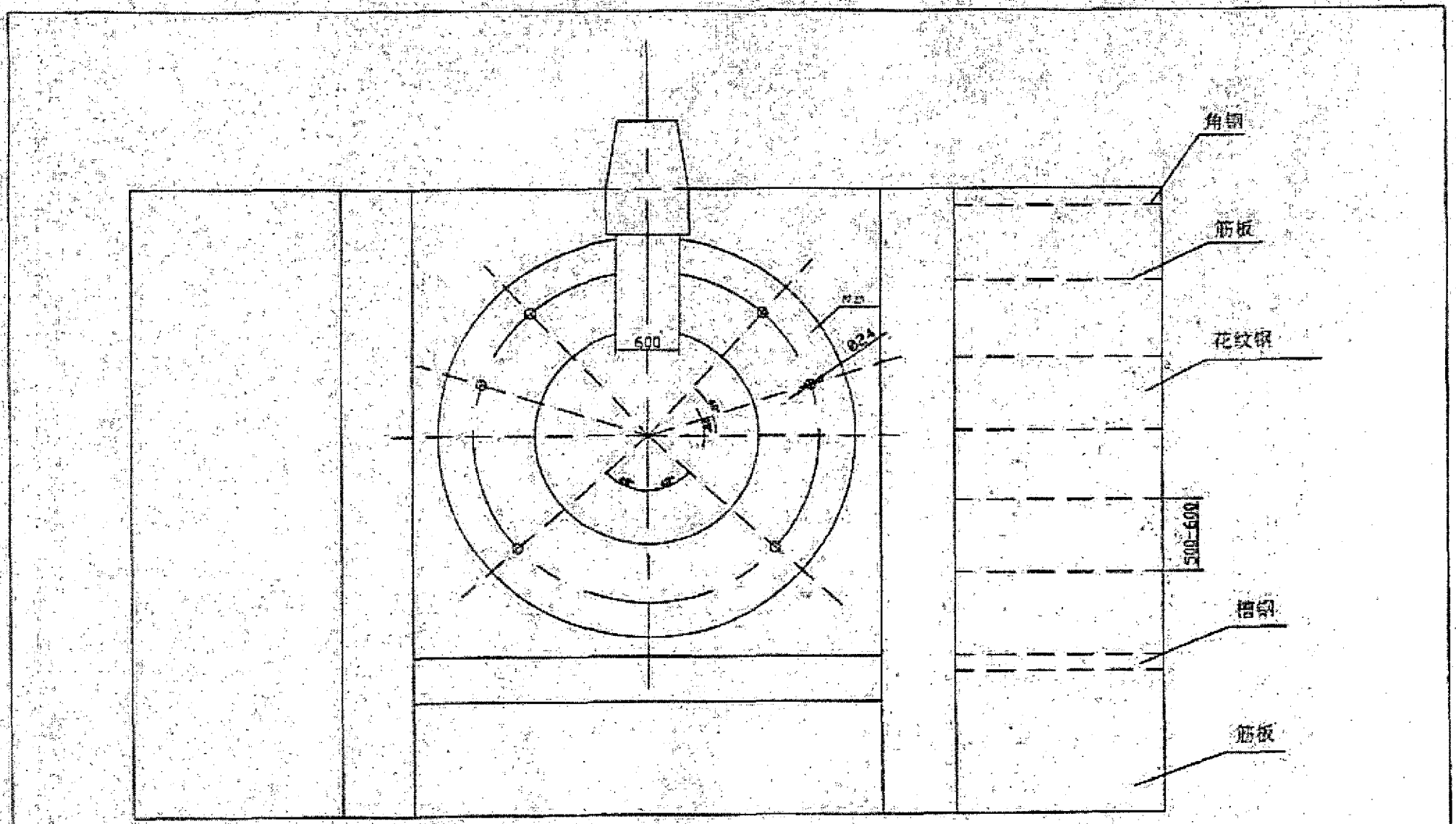
5T炉基础图（钢壳）



坩锅壁厚5mm



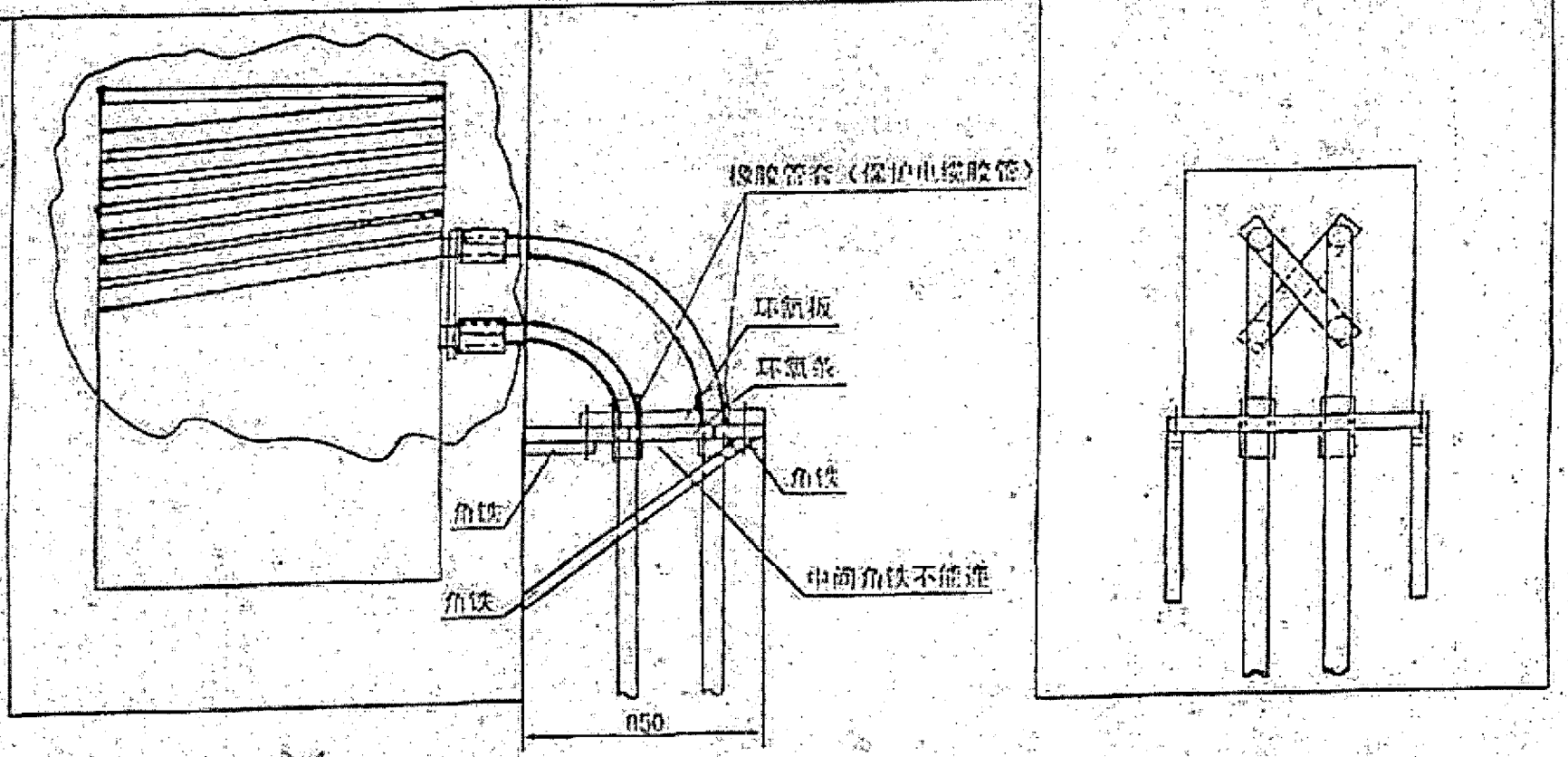
炉体出钢嘴安装图



1）每套炉角钢4条
2）筋板24条
3）槽钢4条
4）花纹钢板8mm 4块

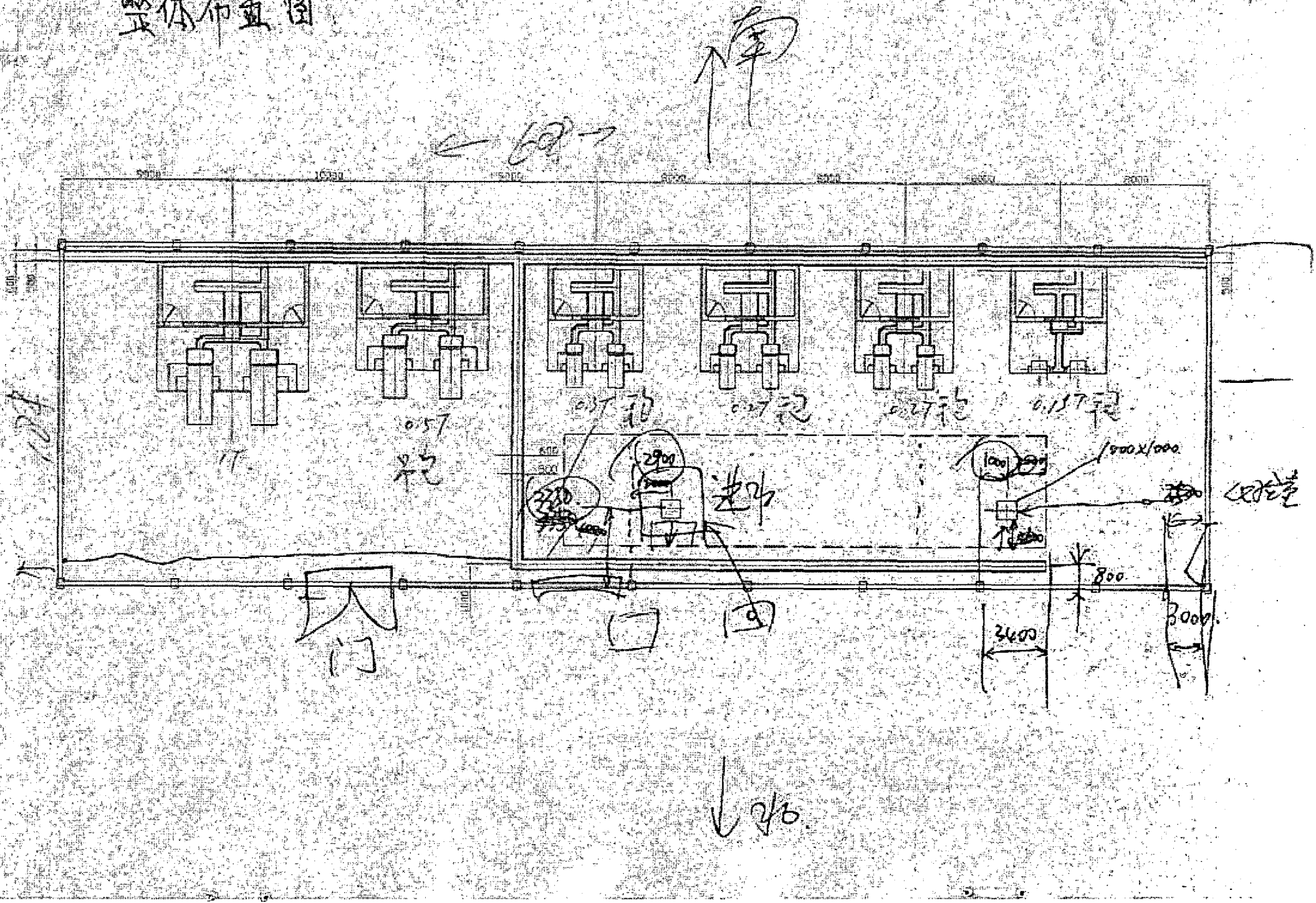
炉体平台安装图

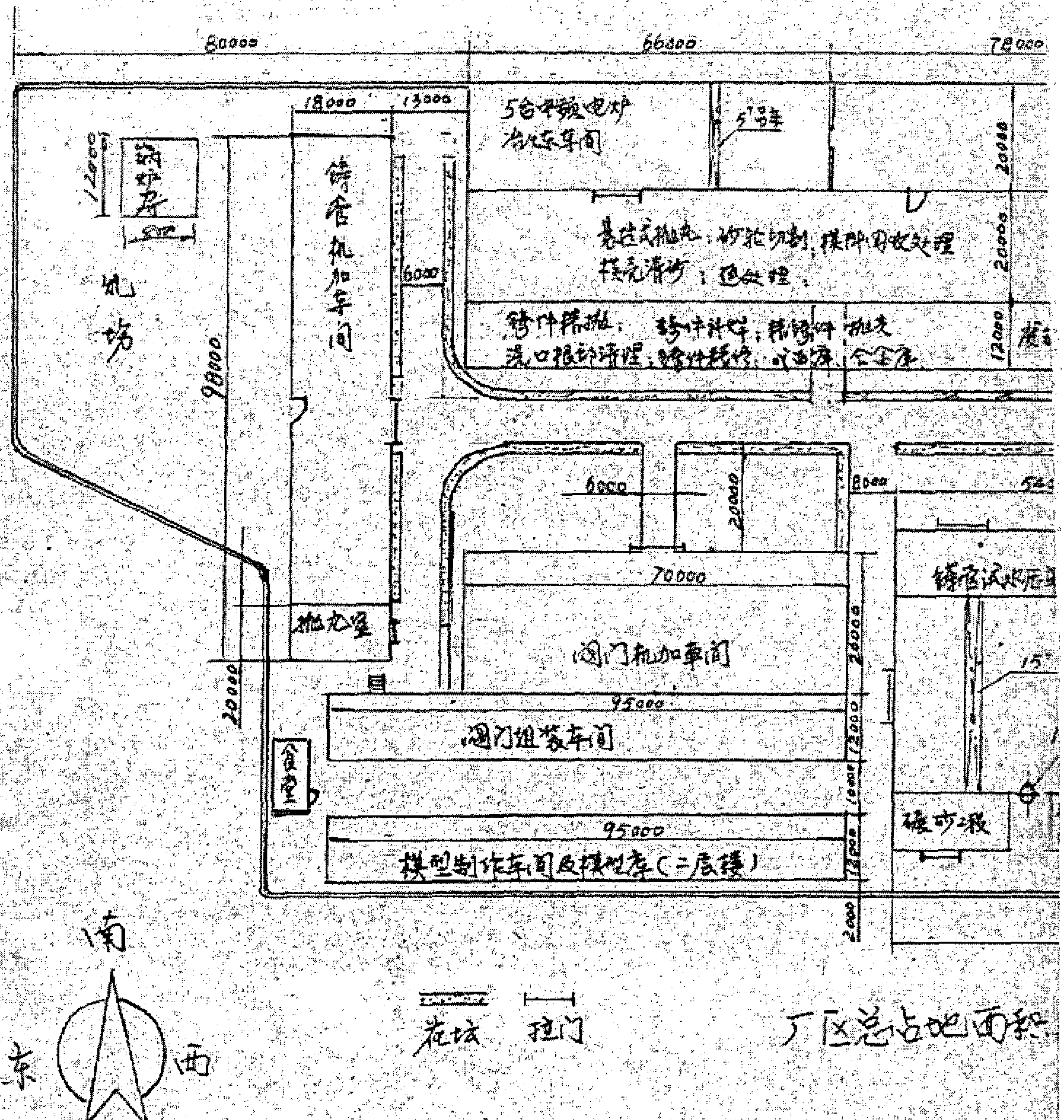
上海亚斯普尔电器有限公司



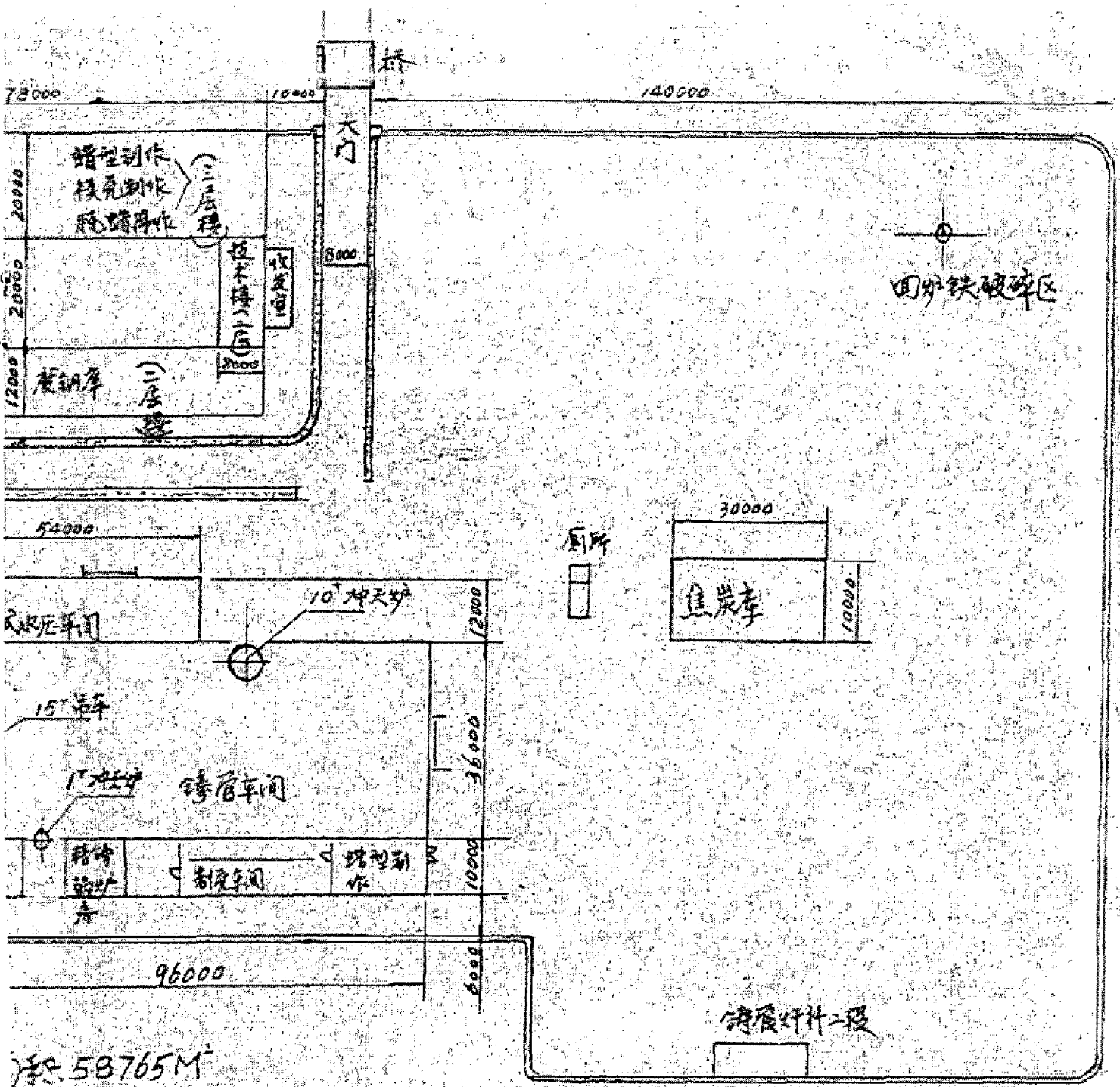
电缆固定架安装图

整体布置图




80000
66000
78000
18000
13000
5台中频电炉
冶炼车间
铸管机加车间
抛丸室
98000
6000
70000
阀门机加车间
95000
阀门组装车间
模型制作车间及模型库(二层楼)
食堂
南
东
西
北
花坛
拉门
厂区总占地面积

大连金煤铸管有限公司



约58765M²

二00五、六、二十二