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UNITED NATIONS INDUSTRIAL DEVELOPMENT
ORGANIZATION

18457

FINAL REPORT

Proposals for the improvement
in quality and technology
of the products
of
CHINESE FOUNDRY MACHINERY INDUSTRY

DP / CPR / 89 / 016



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TABLE OF CONTENTS

	Page
1. Scope of work	3
2. Performance	4
3. Actual situation of foundry machinery industry in the P.R. of China	5
3.1 Baoding foundry machine works	7
3.1.1 Production program, shops for production and assembling	7
3.1.2 Drawing offices	7
3.1.3 Laboratories, testing facilities, quality control	8
3.1.4 Material flow	8
3.1.5 Production planning, organization and control	8
3.1.6 Training facilities for the technical staff	9
3.1.7 Procurement of auxiliary components and parts	10
3.2 Suzhou foundry machine works	10
3.2.1 -	
3.2.7 same chapters as 3.1.1 - 3.1.7	10 - 12
3.3 Shanghai diecasting machine works	13
3.3.1 -	
3.3.7 same chapters as 3.2.1 - 3.2.7	13 - 14
3.4 Qingdao foundry machine works	15
3.4.1 -	
3.4.7 same chapters as 3.3.1 - 3.3.7	15 - 16
3.5 Luohe- , Chongqing foundry machine works	17
3.6 Remarks about the time of delivery for equipment	17

	Page	
3.7	Foundries attached to the foundry machine works	18
3.8	Jinan foundry and metalforming machinery research institute	18
3.8.1	Testing activities and equipment	18
3.8.2	Design activities and facilities	19
3.8.3	Other laboratories	20
4.	Summary of the impressions received during field observations	21
5.	Remarks about foundry machinery equipment seen in various foundries	23
6.	Proposals for improvement of the actual situation of the foundry machinery industry	25
7.	Catalogue of measures	34
8.	Conclusions	37

1. **SCOPE OF WORK**

The contractor will evaluate the existing capacity both human and material of the principal machinery manufacturers and the JFMMRI and will propose courses of action for the industry and the Institute in order to initiate a program of improvement in accordance with modern technology and processes.

The study will take into account the present and expected future technological tendencies and requirements of the world foundry industry as well as those of its equipment suppliers.

2. **PERFORMANCE**

During their stay in China the two experts visited 4 foundry machinery works and 3 foundries where equipments of these factories are installed and partly operated.

Total time consumed were 9 days from which 3 days had to be used for travelling. The remaining 6 days included also the time for discussions apart from the visits to workshops.

This rather tight time schedule had repercussions on the profoundness of the present evaluation.

Beside these activities the complete project document was reviewed in cooperation with Chinese counterparts during the final stay in the Jinan Foundry and Metalforming Machinery Research Institute (JFMMRI).

3. **ACTUAL SITUATION OF FOUNDRY MACHINERY INDUSTRY
IN THE P.R. OF CHINA**

In this chapter the actual situation of the above mentioned industry will be described by going into different aspects. The aim is to create a rather complete picture of the establishments. Various data and figures stated by the management of the companies will be combined with findings and observations the experts made.

According to written information China's foundry machinery industry disposes of 50 specialized foundry machinery works with 22,000 employees including 1500 persons belonging to the technical staff. In total, 3000 sets (e.g. lathes, milling machines, shaping machines, drilling machines) of metal cutting machine tools are installed and 249 types of foundry machinery in a wide variety are produced.

In 1988 these establishments produced 8500 sets of foundry machinery with an output value of 220 million RMB Yüan.

From 1985 until 1986 China has imported 300 various sets of foundry equipments from 62 foreign companies. It is supposed that in the next five years foundries will require about 100 different moulding lines. In 1985 and 86, 31 different complete moulding lines have been imported. A similar situation can be found in other fields of foundry equipment, too.

The actual situation of the foundry machinery industry is described in the following, listing up each factory.

Brief Information concerning 20 Foundry Machinery Works in China

No.	Unit Name	Personnel	Technical personnel	Output(set) per year	Main Products
1	Baoding FFW	2200	182	572	Large & medium type jolt squeeze moulding machine (line); (400x500mm & 600x150mm); Resin coated sand complete set of equipment (5-10 T/h).
2	Qingdao FFW	2600	204	692	Jolt squeeze moulding machine (line); Sand preparation equipment; Shot blasting equipment; Shot blasting chamber.
3	Suzhou FFW	750	71	371	Air impact moulding machine (line); Multiple-head high pressure moulding machine (line); Horizontal parting flaskless moulding machine (line); Hot box core making machine
4	Chongqing FFW	1013	86	134	Shell mold (core) machine; Cold (hot) box core making machine (22 kg and 0.5-12 kg); Resin coated sand complete set of equipment (0.5-10t/h); Jolt squeeze machine; Low pressure casting machine.
5	Luohu FFW	978	53	561	Shot blasting machine; Sand preparation machine; Resin coated complete set of equipment; Air impact moulding machine (line); Shot blasting shake-out device; Cooling shake-out drum (1-12t/h).
6	Shanghai DCFW	500	29	94	Medium and small size horizontal cold chamber die casting machine (125-400t); Hot chamber die casting machine (100t).
7	Chengde FFW	456	23	129	Medium and small size horizontal cold chamber die casting machine (125t); Muller; Coating material mixer.
8	Botou FFW	300	6	61	Shake-out machine (7.5T, 12T); Shot blasting machine
9	Tangshan FFW	404	20	253	Complete set of sand preparation equipment; Shake-out device (15T).
10	Xiongyue FFW	840	16	298	Sand mixer; Muller; Sand reclamation plant; Magnetic selecting device.
11	Shenyang FFW	595	16	300	Sand mixer; Sand screening machine.
12	Yanshou FFW	285	24	60	Mould/core drier. Sand mixer; Sand screening machine; Magnetic selecting plant.
13	Babu FFW	662	40	149	Shot blowing/blasting cleaning equipment; Sand screening machine; Mixing cooling machine; Cooling elevator machine.
14	Qingdao No. 2 FFW	1129		299	Sand mixer; Shot blasting machine; Small size moulding machine; Squeezing table.
15	Qingdao No. 3 FFW	408	17	416	Shot blasting cleaning drum; Mold conveyor; Belt conveyor, etc.
16	Weifang No. 2 FFW	350	16	63	'Lost wax' equipment; Sand mixer; Small size moulding machine; Sand screening machine.
17	Beze FFW	289	21	144	Medium and small size moulding machine; Pneumatic conveying device.
18	Linhai FFW	200	15	60	Medium and small size jolt/squeezing moulding machine; Squeeze table; Shake-out machine.
19	Tianshui FFW	396	8	105	Low pressure casting machine; Centrifugal casting machine; Sand mixer; Magnetic separation plant.
20	Suzhou FFW	741	70	54	Sand mixer; Muller; Sand screening machine; Medium and small size moulding machine.

3.1 Baoding foundry machine works

- Basic data according to company's information

Total employees:	2,200
Technical staff (inc.):	182
Total factory area:	290,000 m ²
Total built up area:	70,000 m ²
Machine workshop area:	10,800 m ²
Foundry workshop area:	12,200 m ²

3.1.1 Production program, shops for production and assembly

Production program: jolt squeeze pin lifting moulding machines, tumbling machines, moulding lines

Production shops show a wide range of all kinds of machine tools suitable to fulfill the requirements of foundry machinery. A forging shop (floor space of about 4,800 m² and a heat treatment shop, floor space 550 m²) were shown. Work was carried out in all shops and the machining of single foundry machinery parts was observed.

In the assembling shop a big sized jolt squeeze moulding equipment and conventional jolt squeeze moulding machines could be seen. A flaskless moulding unit including some conveyor systems and shake-out was under test (since 1983). Furthermore, a sand slinger was set up in the assembly hall.

3.1.2 Drawing offices

Drawing offices are equipped with conventional drawing boards, partly with drafting machines.

3.1.3 Laboratories, testing facilities, quality control

The company possesses a fully equipped conventional chemical and physical laboratory (300 m²). Consultants were informed that all incoming raw material had to be checked because of material quality deviations.

Furthermore, the company owns a measuring laboratory which is sufficiently equipped for this kind of machine factory (150 m²) and also a small moulding sand testing laboratory is available for simple tests which seem to meet the demands of the existing foundry. Taking into account all these facilities a certain level of quality control can be kept during the manufacturing process.

3.1.4 Material flow

As the visit in the company was very short and working activities low, the material flow could not be investigated thoroughly.

3.1.5 Production planning, organisation and control

One of the management departments is the production control department (called "processing department") whose activities are to register and enter into forms the single production steps for every machine part. By these means the production department has for certain the assistance it needs to produce the different machine parts on the basis of the drawings. However, these forms do not contain the timing for the different production steps and there is no feedback from the floor to the production control department. As a result, production control and organization is insufficient.

3.1.6 Training facilities for the technical staff

Above mentioned facilities were not shown to the experts.

3.1.7 Procurement of auxiliary components and parts

It was pointed out by the management during the discussions that procurement of such components as e.g. hydraulic or pneumatic valves or cylinders is problematic as these items do not comply with the foundry requirements in many cases (dust, heat etc.) and are not available within a reasonable time.

3.2 Suzhou foundry machine works

- Basic data according to company's information

Total employees:	750
Technical staff (incl.):	125
Total factory area:	56,300 m ²
Total built-up area:	28,000 m ²
Total work shop area:	15,700 m ²
Machine workshop area:	9,000 m ²
Foundry shop:	3,500 m ²

3.2.1 Production program, shops for production and assembly

Production program: Single jolt squeeze pin lifting moulding machines, heavy jolt squeeze moulding machines and lines, core shooters, 12-100 kg core weight, air impact moulding machines.

Production shops are clearly subdivided in sheet-metal shop, welding, heat treatment, forging and small and large part machining shop. In the machining departments, drawings for the part to be produced are available and measuring instruments are provided for each working place. All parts produced are stored on the floor in front of each working place. Intermediate checking is done and afterwards these parts - except from the big ones - are stored in a fenced area in the assembly hall. The parts are provided there with a number and designation. They are moved from there to be assembled.

In the assembling hall various kinds of core shooting machines in various stages of assembling could be seen, as well as moulding machines.

About 10 core shooters of different sizes were ready for shipping or already packed. Different parts for a moulding line were packed and ready for shipping (pallet cars, flasks etc.). The company also overhauls machines which have been supplied to customers years ago.

3.2.2 Drawing offices

Drawing offices are equipped with drawing boards which all have a drafting machine. Detailed designs could be observed during the consultants' visit.

3.2.3 Laboratories, testing facilities, quality control

All kinds of equipment mentioned under item 3.1.3 are available. The experts observed the tests and corrections of measuring gauges and registration of the values obtained in insufficiently heated rooms. Sand testing equipments is somewhat old fashioned and well maintained but has to be improved by adding more equipment.

3.2.4 Material flow

As described already under item 3.2.1 material flow was followed up but still needs some improvements on certain sectors. There is a basis for such improvements.

3.2.5 Production planning, organization and control

The system applied for the different activities on this sector is the same as described under item 3.1.5. Production control and organization is performed on the floor and is obviously sufficient to a certain degree. Unfortunately there is no feed back from the floor and the organizational means to purchase auxiliary equipment from sub-suppliers in proper time need to be improved.

3.2.6 Training facilities for the technical staff

Suzhou F.M.W. has established a training centre where 2 groups of apprentices are instructed practically and theoretically in a weekly alternating system for 3 years. Thus the company itself educates the future staff by using a system which is approved in industrialized countries.

3.2.7 Procurement of auxiliary components and parts

The same statements were made by the management as under item 3.1.7. The company produces some items like hydraulic cylinders on its own. The management knows that improvements here are urgently required and that the capacities for tests and development are minimal or not existing.

3.3 Shanghai diecasting machine works

- Basic data according to company's information:

Total employees	: 512
Technical staff (incl.):	42
Total factory area:	35,000 m ²
Workshop area:	14,800 m ²

- 3.3.1 Production program, shops for production and assembling
Production program: Pressure diecasting machines,
hot chamber: until 1000 KN locking force,
cold chamber: until 4000 KN locking force.

In the production shops all kinds of conventional machine tools are in operation. The machines seem to be well maintained. Grinding and general rehabilitation of cutting tools is performed in a separate area. All machines were working and the work pieces produced were stored on the floor and then transported to a high storage where they were put on stock together with the foreign parts (hydraulic valves etc.) In the assembling hall at least 10 pressure diecasting machines with diverse capacities could be seen in different stages of assembling. Three machines were under final test. At least 5 machines were ready for dispatch. Assembling was performed by groups of different workers, attending each job separately, e.g. general assembling, hydraulic assembling etc.

3.3.2 Drawing offices

Drawing offices are well equipped with all the necessary material. Development of ladle dosing system was in process and could be followed up.

3.3.3 Laboratories, testing facilities, quality control

Testing of measuring means is performed in air conditioned rooms. Quality control on the floor through measurements at intervals of the work pieces through the machine operators and temporary controllers. The basic drawing for the work pieces is fixed on each working place.

3.3.4 Material flow

Material flow could be observed due to strict separation of the different workshops. But it still has to be streamlined by introducing proper organizational and institutional methods.

3.3.5 Production planning, organization and control

It has to be referred here to chapter 3.2.5 The problem to obtain in due time auxiliary parts from outside is obviously avoided by storing such items in larger quantities.

3.3.6 Training facilities for the technical staff

The experts did not visit a training centre and details were not discussed. The staff seems to be well trained and educated in view of the production outcome.

3.3.7 Procurement of auxiliary components and parts

The company tries to procure a larger part of components and parts on the local market. Some items are produced in China on own development or under licence, some are imported from abroad. Due to the leading position on the pressure diecasting market the company stores rare parts in a quantity beyond the actual need.

3.4 Quindao foundry machine works

- Basic data according to company's information:

Total employees in 2 plants: 2,600

Technical staff (incl.): 212

Total factory areas,

approx. 2 x 70,000: 140,000 m²

Built up area in total: 100,000 m²

Built up area divided in:

Machining shops, sheet metal shop, assembling shop,
testing areas, foundry shop etc.

3.4.1 Production program, shops for production and assembling

Production program: Mixers for sand preparation plants, shot blasting machines (turntable-, tumbling- and hanger type) moulding machines of various sizes and types, complete moulding lines.

The production operates all kinds of conventional standard machine tools. During the experts' visit about one third of the machines were in operation. Finished pieces covered a remarkable part of the shop area. Due to the production program, sheet metal work constitutes an important part of the manufacturing process and therefore this shop covers a large part of the built factory area. All necessary equipment is provided.

Assembling and finishing shops are next to each other and about 30 sand mixers were under finishing operation. One completely assembled mixer could be seen in the hall however no shotblasting equipment. The experts saw also 2 completed heavy jolt squeeze moulding machines.

3.4.2 Drawing offices

Drawing offices are equipped with standard equipment and can fulfill all requirements of design work.

3.4.3 Laboratories, testing facilities, quality control

Various pieces of equipment as mentioned under item 3.1.3 are available in this company, too. Testing and correction of measurement means can be performed with the existing instruments.

3.4.4 Material flow

Course of a material flow could not be detected in the plant due to the fact that various pieces had to be transported from one factory to the other.

3.4.5 Production planning, organization and control

Here, the statement given under item 3.1.5. is valid.

3.4.6 Training facilities for the technical staff

The company informed the consultant about an existing technical school. Due to lack of time more details could not be followed up.

3.4.7 Procurement of auxiliary components and parts

The statement given under item 3.2.7 is also valid for this company.

3.5 Luohu foundry machinery works, Chongqing foundry machinery works

These two companies have not been visited during the study tour due to a lack of time. During the visit of Jinan's automobile works foundry, however, a hanger type shot blasting machine was seen. Apart from the very good impression of this machine and the functioning itself, the general appearance alone makes this machine competitive even under European conditions. Therefore, should any further investigations about foundry machinery works be executed, this company and others have to be visited in order to complete the knowledge of the establishments belonging to this sector.

3.6 Remarks about the delay of delivery for equipment

Some companies have been in the process of developing foundry machines for 7 years without a final result. In China, the time of delivery for a single component machine is between 8 to 12 months depending on the kind, type and size. The time of delivery for moulding lines, for example, is 3 to 5 years. In Europe the time of delivery for simple machines is in general 6 to 8 months, complete, fully automatic moulding lines 12 months and lines of a simpler standard only 8 months. This is one of the reasons why Chinese foundries with an ambitious production program prefer to import these equipments.

3.7 Foundries attached to the foundry machine works

All these foundries do give the impression of a poor equipment and their exploitation degree is lower than 30%. Necessary investments are not justified under such conditions and the suppliers of machines should attempt in future to buy their castings from sub-suppliers.

3.8 Jinan Foundry and Metalforming Machinery Research Institute (J.F.M.M.R.I.)

- Basic data according to the institute's information:

Total employees:	948
Technical personnel:	542
Technical personnel engaged in foundry machinery development:	270
Total institute area:	46,500 m ²
Total built up area:	33,170 m ²
Total office space:	9,270 m ²
Total laboratories space:	7,380 m ²
Total foundry lab.(incl.):	2,600 m ²
Pilot plant:	4,540 m ²
Extension since 1987:	25,700 m ²
Foundry lab. area incl. extension:	7,000 m ²

3.8.1 Testing activities and equipment

During a briefing the consultants were introduced to the institute's activities. They are as follows in the foundry technology department:

- Sand mould department:
Testing of moulding conditions on an impact moulding machine

- Special casting department:
Testing of pressure diecasting machines on reliability of the parts concerned with the movement of the mould halves
- Pneumatic and hydraulic technology department:
Testing various designs of pneumatic valves on realibility and function
- Electric/electronic technology department:
Development and testing of electric, electronic circuits and control equipment
- Information department:
Library and periodical presentations from allover the world; edition of the periodical "CHINA FOUNDRY MACHINERY"

Main equipment and laboratories:

- Sand mixer and impact moulding machine
- Shot blasting table type equipment
- Low pressure diecasting unit
- High pressure diecasting machine (2 No.)
- Pneumatic and hydraulic valve testing unit
- Electric, electronical laboratory with various equipment for testing and assembly.

3.8.2 Design activities and facilities

- Planning and design department

Designing of general layouts for foundry equipment (e.g. moulding lines) including general hydraulic and electrical plans for such equipment.

- Main equipment in this division:

- Standard drawing boards
- Complete CAD equipment

3.8.3 Other laboratories

The foundry technology department includes:

- Standard wet chemical laboratory
- standard physical laboratory
- standard moulding sand testing laboratory
(to be completed).

During the short visits in the various laboratories a reliability test on pressure diecasting machines and a performance test on the air impact machine was observed. The design department and the electrical department were fully working on development and drawing tasks.

4. **SUMMARY OF THE IMPRESSIONS RECEIVED DURING
FIELD OBSERVATIONS**

After having visited 4 foundry machinery companies and 3 foundries (their customers) and the Institute, the following statements can be made:

- 4.1 Generally the existing machinery capacities are very large and are far from being utilized. A slightly better situation can be found with Shanghai Diecasting M/C WORKS and SUZHOU F.M.W.
- 4.2 Most of the machines are standard machines and their specifications fulfill the requirements of the customer also with regard to the required tolerances of the single work pieces.
- 4.3 Quality control on the floor is very poor. Supervision of the different steps of work processes is not done intensively enough. Efforts to improve the rather poor quality control systems could not be observed.
- 4.4 Production planning, organization and control exists only in form of a planning department (called "processing department"). Organization is very limited indeed and there is no control. Planning does not include a time plan for work processes. There is no data feedback from the floor to the "processing department" (production control department). This is one of the main reasons for the extremely long time of delivery for machines and equipment.

- 4.5 The companies' design departments do not have much experience with the planning and designing of complete foundry process or sub-process lines or complete foundries. This kind of work is partly done by the Institute but the connections to the machine suppliers are obviously not close enough and the design capacity in the Institute seems to be somewhat restricted.
- 4.6 The equipment the experts saw in the foundries is functioning and also achieves the designed capacity. But some details reveal that designers' reflections are basically over complex. This leads to excessively complicated solutions on the mechanic sector which again has repercussions on the reliability and the possibility of maintenance at reasonable cost.
- 4.7 Many reclamations from the foundries about "bad" and "backward" equipment only cover the fact that maintenance in the same foundry is very poor or not existing.
- 4.8 The Institute's efforts are not strong enough to provide the suppliers and the foundries with the adequate guidelines. It is not the supposed or expected connection link between the different partners which would be very necessary.
- 4.9 Working conditions
- The working conditions for staff and workers in the different shops are found difficult as in winter insufficient or no heating at all is provided. A motivation of the personnel or efficiency at work cannot be expected under such circumstances which again results in the quality of the products.

5. **REMARKS ABOUT FOUNDRY MACHINERY EQUIPMENT
 SEEN IN VARIOUS FOUNDRIES**

In order to complete as much as possible the impressions obtained during the visits to the various foundry machinery supplying companies, the experts visited 3 foundries.

5.1 **Shanghai No. 1 Automobile Accessory factory**

This factory was visited to inspect a pressure die-casting machine of Shanghai Diecasting Works operating under foundry conditions. Operation of the machine itself was perfect with the mould which was fitted at the time of the visit.

5.2 **Jinan First Machine Tool Works**

In its green sand moulding plant this foundry operates a sand preparation plant supplied by Qingdao foundry machine works. The plant is utilized on a very low basis today due to the shifting of the main moulding process from green sand to furan resin sand. The equipment is still in working conditions but not well maintained, probably because of the afore mentioned reason.

5.3 **Jinan Automobile Works Foundry**

This foundry has installed 2 new moulding lines and a sand preparation plant including a new core making department and a cupola melting department.

Moulding lines (one from Suzhou F.M.W. and one from Qingyidai F.M.W.) are being constructed since one year and nearly completed. The bigger moulding line (flask size 1200 x 800 x 300/300 mm, output 60 moulds per hour) and the smaller line (flask size 800 x 600 x 200/200 mm, output 100 moulds per hour) give the impression that they will achieve their target.

The sand preparation plant (4 mixers from Qingdao F.M.W., total capacity 160 t/h) is being constructed and possibly 60% are completed. The plant, as it is today, will not satisfy its customers' needs because its machines were produced in an extremely bad workmanship and their setting up was insufficient, too. The same plant operates a hanger type shot blasting machine. See item 3.5 about its performance.

5.4 Environment conditions

Efforts in view of environmental protection are made in several factories. However, very often the old establishments do not make minimum efforts. As China is only at the beginning to turn into an industrialized country it should attempt to avoid the errors of the industrialized countries and introduce environmental protection at the design stage for all processes and installations.

6. **PROPOSALS FOR IMPROVEMENTS OF THE ACTUAL SITUATION OF THE FOUNDRY MACHINERY INDUSTRY**

Four foundry machinery works out of 50 specialized companies have been visited in a very restricted time. Therefore, the proposals made hereunder refer to these companies and cannot be extended to the other factories. The visits just allowed a glimpse into the extensive Chinese foundry machinery production and suggestions apply definitely to a limited number.

The main activities to be performed in order to reinforce the capabilities of the Chinese foundry machinery industry are shown in the following tables naming also the parties involved, the proposed actions of the parties and the results that will be obtained.

After carrying out all activities the following principal objectives can be reached:

- 6.1 The supply time for foundry machinery equipment will be shortened and may reach the time span which is common in industrialized countries.
- 6.2 Quality and durability of equipment will be improved.
- 6.3 Equipment technology will be improved and simplified for the profit of the foundries.

ACTIVITIES, THEIR CONTROL AND RESULTS

S.No.	Activities to be implemented	Acting parties	Control of activities and acting parties	Experts or own activities	Results
1.	<p>PRELIMINARY PLANNING consisting of:</p> <p>1.1 Local investigation</p> <p>1.2 Engineering, e.g. general layout, specifications etc.</p> <p>1.3 Timing of the project</p> <p>1.4 Performance guarantees</p>	<p>Design and planning office of JFMWRl</p>	<p>Customer (foundry) as direct partner</p>	<p>EXPERTS TO IMPROVE THE CAPACITY OF THE RELEVANT JFMWRl DEPARTMENT</p>	<p>The first important step is handled by one party (JFMWRl) together with customer (foundry)</p>
2.	<p>OBLIGATIONS OF CUSTOMER (FOUNDRY)</p> <p>2.1 Supply of patterns for equipment tests</p> <p>2.2 Supply of all raw and auxiliary materials</p> <p>2.3 Energy supply</p> <p>2.4 Available staff to operate and maintain the equipment</p>	<p>Customer (foundry) with the duty to prepare all of the tasks mentioned under 2.1 - 2.4 JFMWRl as consultant</p>	<p>and as controlling party for customer (foundry)</p>	<p>Same expert as above</p>	<p>Clear division of the responsibilities and follow up as to completeness and time schedule</p>
3.	<p>OBLIGATIONS OF FOUNDRY MACHINE SUPPLIER</p> <p>DETAILED PLANNING:</p> <p>3.1 Detail engineering of equipment</p> <p>3.2 Guarantees for material quality and capacity of the plant</p> <p>3.3 Keeping to a time schedule which has been planned in advance and which is accepted from all parties</p>	<p>Foundry machine supplier</p> <p>Foundry machine supplier</p> <p>Foundry machine supplier and customer (foundry)</p>	<p>through JFMWRl</p> <p>through JFMWRl</p>	<p>Only own activities</p>	<p>Complete control and follow up of the project at every stage</p>

ACTIVITIES, THEIR CONTROL AND RESULTS

TABLE 1/2 page 27

S.No.	Activities to be implemented	Acting parties	Control of activities and acting parties	Experts or own activities	Results
3.4 3.5 3.6	Planning of erection Commissioning Planning of foundations and related civil works	Foundry machine supplier Foundry machine supplier and customer (foundry) Customer (foundry)	through JFMWRI through JFMWRI through JFMWRI	-- -- --	Complete control of all activities through one Institution (JFMWRI) in cooperation with supplier + customer
3.7	Training of operational personnel	Foundry machine suppliers			
4.	ACTIVITIES IN THE PLANT OF FOUNDRY MACHINE SUPPLIER				
4.1	Detail drawing and designing of the plant	Drawing office of foundry machine supplier	JFMWRI in so far as standards are concerned	TRAINING ABROAD OF CHINESE ENGINEERS EXPERTS FROM ABROAD Organizational methods in the companies to be improved	Acquire knowledge of detail designing Activities accomplished according to a set time schedule
4.2	Machining of all parts	Machining shop	Strict supervision of all actions through medium and low level management	Own activities only	Keeping up with time schedule + qual. standard
4.3	Purchase of auxiliary components and parts from sub-supplier	Process- and purchasing dept. of supplier	Support through JFMWRI	Own activities only	Observing time schedule quality + function control
4.4	Assembling of the plant including cold test	Foundry machine supplier	Follow up and documentation of test results through JFMWRI	Own activities only	Time schedule proof of preliminary functioning
4.5	Production planning organization and control ("Process plan")	Process planning department of machine supplier	Control through management of the machine supplier Control of system and time	TRAINING ABROAD, AFTERWARDS WITH EXPERTS IN CHINA	Development + installation of a production planning + control system in order to control all production activities
4.5.1	Planning of the complete plant's requirements according to drawings, specifications, parts lists and capacity data of the workshop	as above	as above	as above	as above

ACTIVITIES, THEIR CONTROL AND RESULTS

S.No.	Activities to be implemented	Acting parties	Control of activities and acting parties	Experts or own activities	Results
4.5.2	Time schedule of all activities	Process planning department of machine supplier	Control through management of machine supplier Control of system and time	TRAINING ABROAD, AFTERWARDS WITH EXPERTS IN CHINA	Development + installation of a production planning + control system in order to control all production activities
4.5.3	Production plan for every part to be produced	as above	as above	as above	as above
4.5.4	Determination of auxiliary components and parts, placing orders and follow up of supply	as above	as above	as above	as above
4.5.5	Quality plan and implementation of this plan on the floor	Working out of complete quality system with internal standards compiled in a handbook by machine supplier	JFMWR should cooperate with the machine supplier and should documentate and review	TRAINING ABROAD AND SHORT TERM EXPERT TO INITIATE THE SYSTEM	Complete quality control + improvement of the system through permanent examination
4.5.6	Control of every machined part as to number and measurement Performance of chemical or physical test whenever necessary	as above	as above	--	as above
5.	DEVELOPMENT OF NEW MACHINES; e.g. MACHINES OF BIGGER SIZE AND COMBINATIONS THEREOF (COMPL. PLANTS)				
5.1	Targets for new developments	Machine suppliers and JFMWR together with customers (foundries)	JFMWR and customer (foundries)	TRAINING ABROAD OF CHINESE ENGINEERS, EXPERTS TO PROVIDE BASIC SET-UP	Enhancement of the design capacity as to all sizes and variations of machine + complete equipment
5.2	Study of literature, books, patents etc.	JFMWR	Discussions about foreign developments in committee	Own activities	Better knowledge of technical standard in other countries.
5.3	Follow up, registration and evaluation of data	JFMWR	JFMWR in cooperation with customers (foundries)	Visit to foreign institutes Cooperation Own activities	Set-up of data basis for further machine development
5.4	Intermediate and final decision about results and further steps	Machine supplier, JFMWR and customers (foundries)	JFMWR together with customers (foundries)	Own activities	

ACTIVITIES, THEIR CONTROL AND RESULTS

TABLE 1/4 page 29

S.No.	Activities to be implemented	Acting parties	Control of activities and acting parties	Experts or own activities	Results
6.	TRAINING OF PERSONNEL				
6.1	Extended knowledge and education of foundry personnel e.g. engineers, foremen etc.	JFMRI as executing party together with customers (foundries)	Ministry of Education	TRAINING OF CHINESE EXPERTS ABROAD. FOREIGN EXPERTS TO ESTABLISH LECTURE PLANS	Extend the knowledge of technical employees. Increase of production output and better quality of castings
6.2	Training of maintenance personnel	JFMRI as active Institution together with machine suppliers and customer (foundry)	as above	as above Own activities: Purchase of training equipment for hydraulics, pneumatics etc.	Setting up a basis for the entire field of maintenance and its further development
5.3	Advisory services in foundry technology development Testing of raw and construction materials and castings. Development of gating and riser systems and development of special processes for special castings	JFMRI upon request from foundries and equipment suppliers	JFMRI taking the leading role in a close contact with machine suppliers, foundries and their customers	TRAINING OF CHINESE EXPERTS IN RELEVANT INSTITUTES ABROAD	Improvement of casting quality in foundries as well as foundry technology in general

- 6.4 The development of larger foundry machinery as well as the machinery of complete equipments will be reinforced.
- 6.5 Maintenance will become an important factor. In the future maintenance will be much more valuable than repair works after a breakdown of equipment or machinery.
- 6.6 Production processes will be accelerated due to positive changes in the organization. These processes refer to the foundry machinery industry during the production of machines and to foundries producing castings with a better equipment.

All these activities, however, which depend on the number of personnel trained, the experts which can be found to come to China for a certain period and the duration of training, will not immediately lead the Chinese foundry machinery to the standard of European foundry machinery. These measures can be considered only as the first step on a long way.

The JFMMRI will play a vital role in the realization of the diverse activities suggested and will be the important connection link between all parties concerned. These activities are listed in the tables 1/1 up to 1/4.

It should be made very clear at this point that the staff for these objectives has to be employed soon and sent for a training abroad. Training objectives have to be made clear in advance. Training time and number of trainees depend very much on their basic education. Training in a foreign country will be successful only if the trainees have a good basic knowledge of the language.

As a result of the experts' observations and the impression obtained during diverse discussions, 2 companies, namely Shanghai Diecasting Works and Suzhou F.M.W. are to be fully supported in their activities. With adequate measures these firms could develop to success. Baoding F.M.W. has to make many efforts and could have a good chance when concentrating on sand preparation plants and certain types of shotblasting equipment. Baoding has a very low level to start with. It is uncertain if Baoding can contribute to a support from outside.

Development to success means, with regard to Suzhou F.M.W. and Shanghai Diecasting works, that these companies will be in a position to fulfill the needs of the Chinese foundry industry after a certain time. They will be able to construct highly productive reliable equipment on the basis of a less complicated mechanical design and advanced control techniques. Foundry technology in detail has to be developed by the foundries themselves together with the JFMMRI.

For the improvement of the equipment and machines specified hereafter the activities mentioned before have to be performed.

- Development of complete sand preparation plants with large mixers and coolers consisting of:
 - Belt conveyors for transport of used sand
 - Magnetic separators
 - Used sand coolers
 - Bucket elevators
 - Polygonal sieves
 - Used sand storage bins
 - Discharge belt conveyors
 - Dosing and weighing equipment for all components like: used sand, quartz sand, bentonite, coal dust, water, various additives
 - Mixers
 - Belt conveyors for transport of the reconditioned sand to the moulding equipment
 - Sand areators
 - Storage bins for reconditioned sand at the moulding machine
 - Control equipment for moulding sand at the mixer
 - Electrical control equipment for the complete plant

- Development of complete coremaking equipment including core shooter, core sand conditioning including transport, consisting of:
 - Quartz sand storage bins
 - Core sand mixer with weighing and dosing equipment including control equipment
 - Core sand transport and supplying system
 - Core shooters of different sizes
 - Transport and dosing equipment for additives.

- Development of moulding machines and complete moulding lines.
 - Semi- or fully automatic moulding machines
 - Pattern change systems
 - Moulding flasks and mould conveying equipment (pallet car or roller conveyor system)
 - Mould separating and dosing units
 - Sprue and vent hole drilling unit
 - Pallet car and flask cleaning unit
 - Weight setting device
 - Mould push out device
 - Mould cooling conveyor
 - Knock-out grid

- Development of cold chamber pressure diecasting machine above 4000 KN locking force incl. various auxiliary devices
 - Pressure diecasting machine
 - Metal dosing unit
 - Casting unloading unit
 - Mould spraying unit
 - Mould heating and cooling unit
 - Electrical control unit incl. record of pressure, travel and velocity, programmable control and light display.

- Development of centrifugal shot blasting machines of various types, e.g.
 - Overhead conveyor blast machines
 - Barrel or apron type machines, continuous or batch type
 - Intensive shot blasting machines
 - Shot peening machines.

All machines with shot cleaning system and dust collector.

7. CATALOGUE OF MEASURES

The program of measures contains the following activities. Some of them can be performed parallel:

7.1 Working out terms of references and detailed scope of work for a detailed sector study according to the project documents. Performance of this detailed study and establishing the consultation report about the technical reform of the foundry machinery industry and an investigation of its market.

Main activities are shown in the time schedule on page 36.

7.2 Elaboration of training plans and job descriptions for Chinese trainees to be sent abroad

- Minimum duration of stay : 3 months/trainee.

- Main fields: a) designing of mechanics,
hydraulics, pneumatics,
electric/electronics

b) servicing of equipment

c) erection and commissioning.

Intensity of training according to the requirements of the equipment.

7.3 Elaboration of terms of reference and job descriptions for experts working in China

- Minimum duration of stay: 1,5 month/expert

- Main fields: a) designing of mechanics,
hydraulics, pneumatics,
electric/electronics.

7.4 Motivation of suppliers of above mentioned equipment in industrialized countries to cooperate with Chinese companies in form of joint ventures licence- or Know-how agreements

7.5 Elaboration of job descriptions for Chinese trainees of JFMMRI to be sent abroad to relevant institutes in industrialized countries

Minimum duration of stay: 3 months/trainee

Main fields: Development of engineering capabilities for foundry equipment or complete foundries, foundry technology, maintenance, planning and implementation

7.6 Elaboration of job descriptions for various foreign experts to work in the JFMMRI in the sectors shown under item 7.5

Some of the experts will be short term experts who will give lectures on specific subjects. One expert should be a long term expert, familiar with one or two subjects mentioned before and involved in the performance control of various activities. He will come to China several times over a longer period.

Activities	Time Month Week	1		2		3		4		5		6		7		8		9		10		11		12	
		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44		
Prepare questionnaire for revision and approval by DMTT and UNIDO	1	A																							
Completion of questionnaire by FMMs	2		B,C																						
Send copies of completed questionnaires to Contractor and UNIDO	3									B,D															
Evaluation of questionnaires	4									A,D															
Briefing of Contractor's team at UNIDO	5									A,D															
Fielding of Contractor's team to CPR and to visit Foundries and FMMs to hold discussions with JFMMRI	6																								
Discussions with DMTT, CICETE and JFMMRI and preparation of draft report	7																								
Assistance in the organization of a study tour by Chinese experts. (The cost of the study tour will be met outside the contract)	8																								
Discussions at Contractor's home office with study tour participants, to agree on final form of the strategy paper (to be attended by UNIDO)	9																								
Organization of a seminar with decision-makers and foundry and foundry machinery industry	10																								
Delivery of final report to UNIDO	11																								

Responsibilities:

A: Contractor B: DMTT C: JFMMRI D: UNIDO

8. CONCLUSIONS

The report gives a brief summary of the actual situation of 4 foundry machinery works in China and an impression of the equipment they produce and deliver to a number of foundries.

On the basis of these observations recommendations have been formulated in context with the cooperation of foundry machinery works, the Institute and the foundries. The objectives to be reached as well as the activities to be performed by different parties have been made visible.

In order to establish this cooperation and make it safe the necessary activities have to be made.

In order to deepen the knowledge of Chinese foundry machinery works and to extend the proposals for an improvement of the companies on various fields a detailed sector study should be made with a strategy plan for further development of the foundry machinery sector. A time schedule for the performance of the study is attached.

Parallel to the performance of the study, training projects with exactly defined subjects should be performed with companies which have a sound technical basis.

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