4.6 What the proposed renovation project should be ideally:

As already referred to in Preceding Section 4.5, the JFC Renovation Plan has the meaning that it offers an opportune chance for JFC to look back over its own history for a period of fifteen years after starting its operations and to search for the course along which JFC is to move from now on.

It is no exaggeration to say that whether or not the good chance could be effectively taken is entirely dependent upon what is contained in the proposed Renovation Project and upon how it is implemented. Especially when JFC is going to newly expand its activities, based on its own capabilities under the present circumstances, even a little gap between technical capability and actual production level might expand the managerial risk of a foundry, which is a typical skill-incentive industry. If so, the proposed Renovation Project will be eventually castle in the air with high probability.

Apart from the JICA Renovation Project, moreover, the JFC's own plan is now under way. It will be one of the crucial problems to consolidate them into a consistent program, though dependent upon how JFC's own proposal is related with JICA's proposal. therefore, the JICA renovation plan will be prepared independently of the JFC's own renovation plan now in progress, although the latter is taken into account as well.

An overlook of the JFC's situations in the past and at present would permit a summary into the three major comments below as typically represented by the customers' evaluation of JFC discovered through the latest our JICA survey.

(1) Many problems have taken place in terms of quality. For instances, some proposals have contained poor accuracy in surface roughness, locally high hardness and existence of blow holes.

(2) Prices are higher by 20 thru 30 percent than those offered by the private sector. Castings in the private sector, for instance, are at a market price level of 900 rupiah per kilogram. JFC, on the other hand, has been rating a price level of 1,100 thru 1,200 rupiahs.

(3) In terms of delivery periods, JFC has not established reliability among customers. As seen in delivering the beds for machine tools, for example, many defective products have been found so that 40% only has been achieved in effecting deliveries within a contractual delivery period in some worst cases.

To improve three items, i.e. quality, price and delivery as referred to above, it is important to renovate facilities. Nevertheless, it is more urgently important to build up the management/technology, that is, to arrange in order quality standards, technical manuals and operation standards and to establish a system to perfectly implement a production process, based on such standards, etc. From the viewpoint of skill, moreover, many problems have arisen from pattern making and from molding processes. In this field, therefore, it is necessary for labors to be intensively trained.

To heighten the levels of production engineering and working skill as mentioned above while implanting the technology will be the main subject in the JFC Renovation Plan. A recent new participation of the private foundries could be typically represented by enticing key persons from JFC. Such chronic labor insufficiency situations will never diminish but are likely to extend more and more according as the Indonesian economy is being advancedly developed. Enticing skilled personnel from JFC as mentioned above, therefore, should not be taken negatively but JFC should continue on cultivating the manpower mainly through skill training so as to positively perform its role as a government-owned enterprise leading the industry. While discharging part of the manpower to the private sector, JFC should constructively tackle with an expansion of the casting industry which supports the basis for a development of the Indonesian economy.

For those conditions which may restrict the proposed Renovation Project from the viewpoint of a production system, it is necessary to:

- Select quantities and types of products
- Define types of materials
- Limit input product sizes and unit weights
- Introduce the principle of collaborative competition on an orderly market
- Set an upward target in productivity
- Set a competitive price target
- Set a target of annual production size
- Map out man power allocation and training plans

Details involved are omitted herefrom, because they are described in detail in 6.1, 6.2 and 6.3 of Chapter 6 by way of Chapter 5 "Survey of the Center".

Nevertheless, "Cost Minimum and Maximum Performance" should be normally taken into account as the fundamental to the way of thinking in every aspect mentioned above.

4.7 Roles and functions of the project

The roles and functions of the proposed Renovation Project are to embody in the future those roles and functions of JFC which have been reviewed on a current basis as referred to in 4.5. What has been so far discussed could be summarized to enumerate the roles and functions of the proposed Renovation Project as follows:

1) To implant a production system capable of competing internationally,
2) To establish a system in which manpower may be fostered and transferred to the private sector,
3) To adjust and maintain the consistency of the existing JFC's own renovation plan with the project,
4) To attach importance to the management/technology in the project,
5) To clarify the significance of the project, with consideration given to a plan to foster the Indonesian casting industry as a whole and
6) To work out a packaged technology transfer plan, based on new ideas.

It may be said that the roles and functions as itemized above have been assigned to the project.

CHAPTER 5

SURVEY ON ACTUAL SITUATION OF JAKARTA FOUNDRY CENTER

CHAPTER 5 SURVEY ON ACTUAL SITUATION OF JAKARTA FOUNDRY CENTER

5.1 Outline of Jakarta Foundry Center (JFC)

1) Site Condition

Jakarta Foundry Center (JFC) is situated in the industrial park of Pulogadung 21 km to the east of the "Tower of Love", Meron Kashi, at JL.M.H.THAMRIN, the center street of Jakarta. This industrial park, a plan is shown in Fig. 5.1-1, extends about 3,800m from north to south and about 2,000m from east to west and includes around 250 large and small companies in it.

JFC is situated at the north end of the park forming a part of P.T. BARATA, its upper organization. Its site area is about 30,000m, and the building area is about 4,000m. P.T. BARATA is a large national enterprise manufacturing various kinds of heavy machinery such as mining machine, cement plant machinery, sugar refining machine and civil engineering & construction machinery, and in addition to JFC, it has some foundries in Bandung, Surabaya, Gresik as well.

2) Production

The foundry demand in Indonesia amounts up to 86,800 tons in 1978, and among them, it is said that 31,800 tons were domestically produced and all the test (55,000 tons) imported. Major customers were tin mines, cement, sugar refineries, rubber and palm oil industries. In recent years, foundry demand has increased more and more reflecting demand increase of construction machinery, agricultural machinery/equipment and transporting equipment.

A fair amount of imported castings are used in the field of these industries, thus it is considerably important for Indonesia to promote the sound production of castings. It is expected that the foundry industry of this country, considering such movement in the industrial world, to meet the demand as soon as possible. JFC judging from its function and role should naturally have the ability to cope with the situation.

It does not seem that JFC has sufficiently performed, up to now, its function and role JFC's planned output was 4,000 tons per year in 1970, when the factory was planned. However, actual output results from1977 to 1979 could not exceed 500 tons per year, as shown in Table 5.1-1.

When looking at recent results, numerous troubles related to pump case, impeller, counter weight for forklift, etc. can be pointed out, and it does not seem that JFC could sufficiently comply with buyer's demand. This is probably one of factors why the production plan could not be realized and the management of the company could not be successfully conducted.

Table 5.1-1 Output by JFC

Unit: Ton

Demand Sector	1977	1978	1979
Public Project	347.2	248.8	80.1
Agriculture	155.0	43.5	85.1
Mining	-	90.3	66.3
Industry	5.6	80.9	73.2
Transportation	2.4	6.8	30.8
Others	-	51.0	70.0
Total	510.2	521.3	405.5

At the time of our survey, the total number of JFC's employees were 190 and the planned output was around 800 tons per year. Out of the 190 employees, about 60% were engaging in production and about 40% were staff. This proportion varies depending on the scale of enterprises and production items, and in advanced industrial countries, the standard proportion is 85:15. Therefore, JFC should endeavor to improve the present situation as soon as possible.

3) Technology

We can easily find at the workshop, the problem of workmanship of workers. Despite of certain defects of products lacking the compliance with customer's specifications, it seems that the work is proceeded without any solution. If workers lack the ability to solve problems, their immediate supervisors should set up some measures to improve the situation.

After the survey on causes of defects following each working process, the worker's skill was found to be the first one pointed out.

Workers are always working roughly and carelessly, as a result, the lack of exactitude in dimension and thickness, mismatch and the like considerably occur. Some of these defects are due to defective patterns and flasks, however, most of them can be considered to be principly caused by the lack of worker's fundamental skill. Therefore, the acquisition and the improvement of the basic skill shall be considered as the most important subject.

Although the melting and the sand preparation among working processes are kept at a certain level of technique, there are problems in the casting plan and the sand reclaiming method.

With the existing reclaiming method, cement sand and CO_2 sand are contamined into the reclaimed sand degrading the property of green sand. To avoid the degradation, new silica sand is mixed in green sand at 70% of proportion. However, this method is extraordinary when judged from the technical point of view, and it is one of the causes increasing the prime cost.

Table 5.1.2-2 Mixture of Green Sand (Facing Sand)

Unit: Weight %

Country / Item	JFC	Japan
New Silica Sand	70 %	5 %
Reclaimed Silica Sand	30	95
Bentonite	8	1 - 1.5
Dextrine	0.5	0.5 - 1.0
Sea Coal	1.0	0.3 - 0.5

Note: Data are presented by JFC, and those of Japan are reference values.

4) Equipment

Two induction furnaces of 5 tons and 2 tons are installed as melting equipments, and a series of sand reclaiming system are adopted as well. This is innovative and can be recognized. In general, nevertheless, due to the lack of sufficient maintenance of machines and tools, there are some equipments not fully functioning or out of service. For example, the wear and tear on cooling tower for induction furnaces or dust collectors for the reclaiming sand plant and troubles on overhead cranes can be seen. These are factors which largely influence the quality of products and product efficiency and in consequence, the effective management of equipment is expected.

5) Production Environment

JFC, situated in an industrial park, has excellent surroundings.

Inside the factory, many things, considered unnecessary lie scattered and the floor space is not well arranged. Thus, the small working place becomes narrower obstructing the quickness of operation. Employees shall be trained to keep the floor always in order.

6) Education/Training

Every problem occurred at workshop shall be treated urgently and effectively by personnel concerned. But so far as we know at present, it is not done in many aspects.

Therefore it is necessary to give all the personnel concerned further ability to solve problems. Consequently, the trainings, for managers to develop the ability to discover and solve problems and for skilled workers to manufacture nondefective products, are urgently required.

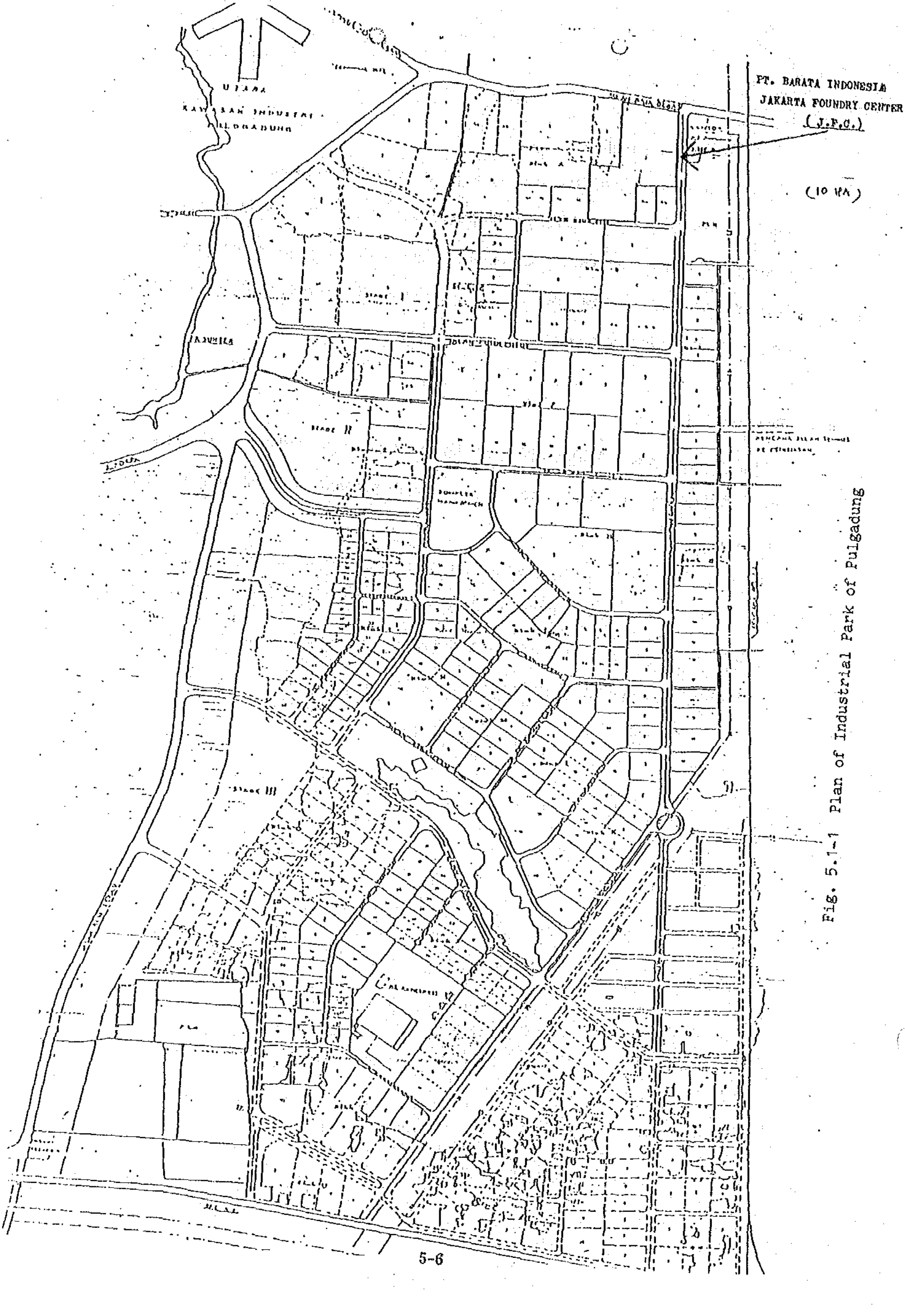


Fig. 5.1-1 Plan of Industrial Park of Pulgadung

5.2 Management and control

As it will be discussed in detail in Chapter 7, the Jakarta Foundry Center's business performance has been very far from satisfactory, having not once recorded operating profit ever since its establishment. To uncover all the factors that have led to this deplorable situation should call for much time and for voluminous background information and documentation, but the cursory survey conducted in the present Study has indicated the principal factors to be low productivity and poor quality control in the foundry operations.

In respect of productivity, operating records reveal the work force of 190 to be currently producing 70 to 80 tons of product per month, which is equivalent to a productivity of 0.37 to 0.42 tons/month per employee. This is an appallingly low figure compared with the corresponding level of 7 ton/month per employee that is current in Japanese foundries. (in 1984) As for quality control, the current defect rate level of 17% is not commendable. It reflects the poor control of quality maintained through the successive stages of production.

The two factors of low productivity and poor quality control are not unrelated, and combine to result in high product price and delayed deliveries, as well as unstable product quality. The consequence is customer dissatisfaction, and in the worst case loss of clients. Such circumstances lead us to note the strong need for the Foundry Center executives to devote determined efforts toward improving the business management and production techniques.

Instances of serious deficiencies requiring urgent remedial measures range from problems in personnel organization (e.g. inordinately large indirect relative to direct labor force, ambiguous demarkation between the activities of personnel in line and in staff functions) and in accounting (e.g. unpractically complex systme of cost accounting) to those in production control techniques (e.g. unsystematic mode of inputting workload into the production program). The notably high defect rate is another problem calling for urgent attention, and this is a matter of "quality-mindedness" requiring to be instilled in all personnel down to the last worker.

All the foregoing problems must indispensably be taken up by the topmost executives of the Foundry Center, whose readiness to squarely face the serious situation of the their enterprise is the essential factor for successful accomplishment of the Renovation Project.

The following Sections present the results of the present Survey in respect of management and contorl.

5.2.1 Operation

1) Current production

Production records of castings covering the period from 1981 to May 1985 are as shown in Table 5.2.1-1; Table 5.2.1-2 gives, for the period January to May 1985, the monthly figures for pouring, accepted product and rejected scrap weights, together with the reject rate. These tables evidence extremely low production being actually realized in reference to the quantities envisaged at the time of foundry establishment (3,000, 4,000 and 5,000 tons, respectively, for the 1st, 2nd and ensuing years after establishment, as cited in the Preliminary Survey Report). The sharp rise of production from December 1984 is due to the manufacture of manhole covers and sewer grating for the new Jakarta Airport, and completion of this order has resulted in resumption of the previous low level of production, with 2-shift operation reverted to day work only.

In the initial period after establishment, steel castings constituted a large percentage of products, but they have been largely replaced by iron castings since November 1984, consisting of such articles as counterweights for forklift trucks, impellers for mine pumps, lathe components, flywheels for agricultural diesel engines, metallic dies for automotive industry presses, and water supply pipe fittings.

In respect of product quality, Table 5.2.1-2 reveals the reject rate to have been quite high even during the period when manhole covers and gratings occupied a large percentage of the products; since April 1985, when these products no longer were manufactured, the reject rate has become much higher.

Manhole covers and grating are articles that can be product with relatively little technological capability and worker skill, and the high reject rate recorded even when such easily manufactured articles were being product indicates that the primordial question requiring to be tackled is enhancement of the quality of production operations.

2) Current level of workable manhours

The number of manhours that can be worked in productive activity, taking as example the representative operations of molding and product finishing, are as indicated below.

(1) Molding

The current work force engaged in molding and pouring, represented by the number of employees in the Hand Molding and Machine Molding Sections, not counting the Section Chiefs, is as follows.

- Number of workers:

  (31 in hand molding, 20 in machine molding) = 51 ①

  This number includes those engaged in sand preparation and shaking out: Assuming say 6 to be charged with these operations,

- Work force directly engaged in molding and pouring:

  51 - 6 = 45 ②

- Hours worked per worker per month (not counting overtime):

  (40 hours per workers/week ÷ 6 days/week) x 25 days/month

  = 167 hours per worker/month ③

- Rate of presence : 98% ④

  Note: The foregoing figures are based on average values recorded in the period February - May 1985 for the two Sections in question.

- From Eqs. ②, ③ and ④, the total manhours that can be worked in molding by the two Sections:

  (45 workers x 167 hours per worker/month) x 0.98

  = 7,365 manhours/month ⑤

(2) Product finishing

The monthly hours workable in product finishing, derived in similar manner are:

(40 hours per workers/week ÷ 6 days/week) x 25 days/month

x 23 workers x 0.98 = 3,765 manhours/month ⑥

(3) Observations

The foregoing calculations reveal a relatively high value of workable hours, both in the Molding and Product Finishing Sections. Supposing their number of manhours to be fully worked, and assuming a productivity of 14 kg/man-hour in molding and a reject rate of 18% -for the case, for instance, of the counterweights, pump impellers and diesel engine flywheels currently being produced,

14 kgs/man-hour x 7,365 man-hours/month x 0.82
= approx. 85 tons/month

of acceptable finished product should be manufactured.

The workable manhours in product finishing amounting to apprximative half the corresponding manhours in molding should amply suffice to cover the above-cited volume of monthly production. Yet, the production figures actually being recorded today are the very significantly poorer values seen in Table 5.2.1-2. This can only be attributed to insufficient orders being received by the Foundry Center. Enhancement of the rate of reception of orders for castings can only be ensured by diligently striving to stabilize the quality of products delivered, and thereby to build up customer reliance.

Table 5.2.1-1 Production records of castings

(Unit: ton)

Year Month	1981	1982	1983	1984	1985
January	43.0	24.4	64.0	87.5	179.0
Feburary	22.2	50.5	58.1	89.1	105.0
March	20.6	73.9	66.1	57.2	110.5
April	18.2	81.3	64.8	54.3	28.0
May	26.8	78.7	45.8	45.2	37.4
June	28.3	86.6	68.6	48.6	
July	30.9	73.3	42.9	33.5	
August	31.3	92.7	64.0	63.1	
September	41.4	85.3	64.2	41.9	
October	36.3	78.3	65.0	41.0	
November	36.3	83.7	45.0	59.1	
December	36.2	50.4	42.0	137.1	
Total	371.5	859.1	690.5	757.6	

Table 5.2.1-2 Pouring, accepted product, rejected scrap weights and reject rate in 1985

Month	Pouring Weight (ton)		Accepted Product Weight (ton)		Rejected scrap Weight (ton)		Reject Rate (%)
	FC	SC	FC	SC	FC	SC	
Jan.	295	0	179	0	47	0	20.8
Feb.	187	0	105	0	32	0	23.4
Mar.	170	0	110.5	0	18.5	0	14.3
Apr.	81	0	28	0	23	0	45.1
May	65	1.8	36.4	0.97	9.6	0	20.9

5.2.2 Quality control

1) Organization

In the current organization, the Technical Department has under its control the sections of:-

- Quality control
- Laboratories
- Casting design,

thus incorporating within the Department the function of administering quality control. The Quality Control Group is staffed by the Supervisor and inspectors assigned, one each, to the different sections of the shop floor:

1 Supervisor	One person
1 inspector for pattern control	One person
1 inspector for shake-out control	One person
1 inspector for fettling control	One person
1 inspector for cast product control.	One person

The principal duties entrusted to the inspectors is to distinguish between acceptable and unacceptable workpieces processed on the shop floor, and to report on the results. This would indicate that not enough weight is attached in the work of this Section to the functions of planning, statistics, and activities aimed at diminishing the reject rate.

2) System of quality assurance

According to the established chart of work organization, the flow of work follows the sequence: Customer - sales - engineering - production - machining -quality control. As described in what follows, however, the quality control function is not operating effectively.

There has yet to be established a basic quality control manual setting forth the setup and procedure that should permit the Foundry Center to assure its customers of product quality.

3) Statistical records on product quality

The data currently generated through the quality control activities comprise:

(1) Daily routine data from operations by the molding, shake-out, fettling and cast product inspectors.

(2) Monthly records on reject rate, by material (cast iron/steel), compiled by the Quality Control Group in the Production Control Section.

(3) Daily reports on rejects, by type of product and of defect, compiled monthly into statistical data on defect frequency, by type of defect and of product. The data by type of defect can be further processed in the form of Pareto chart.

But it could be pointed out of the current practice:

(a) The daily report from shop floor inspectios do not have inspection records attached, giving the description and the positions on the workpieces of individual defects that have been found.

(b) The monthly reports do not give integrated data indicating the overall picture of defect generation by type of defect. This denies the benefit of judging the trends of occurrence of specific types of defect in the foundry as a whole.

(c) No chronological chart is drawn up indicative of the trend of defect generation through the year,and from year to year.

(d) No definite target is established concerning the ultimate level of quality to be attained.

(e) No records or reports are made of action taken for improving product quality.

To summarize, data on rejects (number, weight) are taken as part of routine statistical work of product amount, but insufficient attention and action is directed toward the essential function of quality control: i.e. of improving quality to reduce the reject rate, through assembly and analysis of pertinent data to this purpose.

4) Activities for improving quality

(1) Quality examination meetings

In current practice, meetings are called ad hoc upon occurrence of trouble related to product quality, but not on regular periodical basis. The ad hoc meetings have been called during 1984 at an average interval of about 1 month. This would reflect insufficient importance attached to measures for quality improvement, in consideration of the inordinately high defect rate of 18% (1984). No minutes being made to record the discussions at these meetings, there is nothing to prevent these discussions from falling into a talking party that leaves no positive action to follow up the results. Nor are there periodical reports — weekly, monthly, annually — to record the progress of quality control activities.

The defect rate records covering the first 3 years is presented in Table 5.2.2-1. It is revealed that the defect rate, far from showing improvement, has actually deteriorated during the period covered.

(2) Quality specifications

Any product — including castings — requires to be manufactured to satisfy a prescribed quality level, which therefore requires to be prescribed, together with the specifications that should ensure satisfaction of the prescribed quality level for the product.

The foregoing quality level prescription and specification should properly speaking be established at the time of receipt of order, but the practice is not well established at JFC. For certain products, mention is made in the contract specifications of the chemical composition, material, mechanical properties, microstructure etc., but such cases are an exception rather than the rule.

If these specifications were definitely set at the time of planning job order execution, the key quality criteria could then be defined for the workpieces produced at each stage of the manufacturing process, to contribute to reducing the defect rate, and to provide a logical basis for detecting defective products before uselessly processing them to final form.

Table 5.2.2-1 Monthly Defect Rates Recorded during Past 3 Years

	1982			1983			1984		
	FC	SC	Total	FC	SC	Total	FC	SC	Total
Jan.	57.8%	57.5%	57.7%	6.9%	12.2%	9.8%	13.8%	0%	13.7%
Feb.	9.3%	30.0%	16.6%	5.7%	4.4%	4.8%	15.8%	6.4%	15.2%
Mar.	8.2%	8.4%	8.2%	6.4%	0.3%	1.4%	29.2%	0.3%	23.5%
Apr.	11.4%	9.5%	10.9%	4.4%	7.8%	10.3%	8.2%	0%	8.0%
May	5.5%	1.5%	4.6%	25.1%	0.4%	16.2%	16.5%	0%	14.2%
Jun.	7.1%	3.9%	7.0%	4.7%	5.1%	4.7%	11.5%	0%	11.1%
Jul.	3.7%	9.7%	4.6%	22%	36.4%	22.4%	18.6%	0%	16.5%
Aug.	91.2%	0.6%	10.4%	8%	9.9%	8.0%	22.7%	0%	22.4%
Sep.	10.3%	6.5%	9.8%	15.1%	15.8%	15.2%	15.0%	-	15.0%
Oct.	5.6%	4.1%	5.3%	8%	6.4%	8.0%	16.5%	0%	16.4%
Nov.	5.0%	13.9%	6.6%	19.4%	3.9%	17.9%	61.7%	0%	57.9%
Dec.	11.2%	4.2%	8.6%	18.9%	23.7%	19.3%	27.0%	0%	26.8%
Total	9.8%	9.1%	9.6%	11.7%	6.0%	10.8%	19.0%	1.1%	18.1%

5) Quality control standards

At JFC, there are established neither general standards commonly applicable to all products nor particular standards governing individual job orders. As stopgap expedient, prescriptions given in technical Literature cited or found in JIS are applied to meet circumstances.

what required to be established as in-house standards are those governing:

(1) Dimensional tolerances

(2) Surface defects

(3) Internal defects

(4) Mechanical properties

(5) Chemical composition

(6) Microstructure.

All products should be manufactured in conformity with such standards, except in special cases where particular prescriptions may be applied for particular reasons.

6) Utilization of inspection equipment

(1) Dimensional inspection

Normally, only visual inspection is applied at JFC, and the products are not measured for dimensional conformity except for certain products such as grating, flywheels and dies.

(2) Dye penetrant inspection

Only 1 set of dye penetrant spray is available, and which is hardly ever used. Surface defect inspection relies almost exclusively on visual inspection.

(3) Nondestructive testing

No radiographic, magnetic particle or ultrasonic testing is practiced. The ultrasonic equipment has been left out of order for the last 7 years.

(4) Mechanical testing

It was affirmed that about half of the customers demand mechanical testing on samples of product they receive, but the fraction of products so tested, in terms of quantity of product, is almost insignificant.

Mechanical testing on a certain ratio for the casting material should be carried out at the foundry on its own initiative, whether or not demanded by the customer, as a measure for monitoring the level of technical capability and for assuring product quality.

(5) Microstructure observation

For ductile iron castings, microphotographs are taken occasionally to ascertain the generation of spheroidal graphite.

The practice should be extended to iron castings, to serve in monitoring the level and fluctuations in product quality.

7) Currently available inspection equipment

The inspection equipment currently available are listed in Table 5.2.2-2

(1) Dye penetrant inspection

Dye penetrant inspection is a recommendably simple technique for detecting surface defects, but is hardly being utilized at JFC. The sole equipment possessed is a set of 1 spray. Such sets are marketed domestically, and should be utilized more regularly.

(2) Ultrasonic equipment

The existing ultrasonic equipment has remained in unusable condition since 1978. This inspection technique is effective on steel castings, but not applicable to iron and ductile iron material. If occasion should arise in the future to make use of this technique, the equipment should more advantageously be renewed rather than repaired.

(3) Magnetic particle equipment

No magnetic particle equipment is installed, but the technique is effective more particularly on steel castings. It is not widely used on iron or ductile iron products, so that the equipment could well be dispensed with, so long as steel castings are not regularly produced.

(4) Radiographic equipment

No radiographic equipment is installed. This technique also is used mainly on steel castings, but it is also applicable for iron castings and ductile castings.

(5) Mechanical testing equipment

A minimum necessary range of mechanical testing equipment is available, comprising:-

- Tension testing machine of 30 ton capacity
- Brinell, Shore and Rockwell hardness testers.
- Rockwell hardness tester
- Shore hardness tester

(6) Chemical analysis equipment

An optical emission spectro meter (Quant recorder) is in service since March 1985, replacing the wet analysis practiced previously.

(7) Metallography

The existing metallurgical microscope requires to have its source of light for field illumination replaced, and the instrument overhauled and cleaned, to improve the present inconveniently dark field.

A modern metallurgical microscope is expected to be made available as part of a technical assistance program concluded with a Japanese firm. To make good use of this microscope, additional equipment should be acquired to the account of JFC, including a magnification scale to permit correct indication of the actual size of the specimen represented in printed photograph. A photo-enlargement equipment and suitably equipped dark room should also be indispensable.

(8) Dimensional measurement equipment

Scribing tables: One each for pattern-making and for finished product inspection is available, but should be found too small when larger castings come to be produced that will measure close to 1,500 mm x 1,500 mm.

Height gauge: The existing 600 mm gauge is insufficient: One of at least 1,000 mm capacity should be acquired.

Angle plate: A square of suitable size requires to be acquired, to replace the hoist and mini-jack currently used for scribing vertical lines on product.

L-scale: Existing scale of 500 mm x 200 mm is too flimsy, and should be replaced by a thicker and more solid instrument.

Table 5.2.2-2 Inspection Equipment Currently Available

Inspection	Equipment	Particulars	Q'ty	Condition
1. Surface defect detection	Liquid penetrant tester	Spray-can (USA)	1 set	Good
2. Surface defect detection	Magnetic particle detector	-	-	-
3. Nondestructive testing	Ultrasonic detector	SUF-1/109058 (Shimadzu)	1	Out of order since 1978
4. Nondestructive testing	Radiograph examination device	-	-	-
5. Mechanical testing	Tension tester	RAF-30 (30T)	1	Good
	Rockwell H.T	RH3V	1	Good
	Brinell H.T	BH3CF	1	Good
	Shore H.T	SHNOD (All of Tokyo Koki make)	1	Good
6. Chemical analysis	Wet type analysis		1 set	Good
	Quant recorder	6VM-1000S (Shimadzu)	1 set	Good (Since March 1985)
7. Microstructure observation	Micro scope	MG (Olympus)	1	Unusable
8. Dimensional measurement	Height gauge	600 mm	1	Good
	Vernier caliper	350	2	Good (*1)
	Vernier caliper (dial G)	300	1	Good (*1)
	Vernier caliper	150	1	Good (*1)
	Vernier caliper	300	1	Good (*2)
	Vernier caliper	200	2	Good (*2)
	Surface plate	1m x 2m	1	Good ((*1)
	Surface plate	1m x 2m	1	Good (*2)
	Micro meter	25 mm - 50 mm	1	Good
	Micro meter	50 - 75	1	Good
	Micro meter	100 - 200	1	Good
	Pass (large)	500	1	Good
	Pass (medium)	250	1	Good
	Pass (small)	200	2	Good
	Depth gauge	600	1	Good
	Block gauge		1 set	Good

Table 5.2.2-2 Inspection Equipment Currently Available (continued)

Inspection	Equipment	Particulars	Q'ty	Condition
8. Dimensional measurement (continued)	Compass	300 m	1	Good
	Compass	200	1	Good
	Caliper pass	100	1	Good
	Dial gauge (inside Dia)	100 - 160	1 set	Good
	Square	500 x 200	1	Unusable
	Scale (Rolled)	3M	1	Good
	Mini jack	80 - 100	3	Good
	Punch	100	1	Good
	V-block	200 x 200	2	Good

*1 For cast products
*2 For patterns

8) Activity of quality control to customer

The current quality of products delivered by JFC is unfortunately not very highly appreciated by customers. A number of them who were contacted by the survey team have pointed out in common such defects as:-

- Irregular and rough surface; locally excessive wall thickness
- Locally excessive surface hardness, which are difficult to machine
- Large deviations from drawing specification, on both positive and negative sides, to the extent of making it difficult to scribe for machining
- Blowholes, pinholes, shrinkage and other porosity defects frequently found.

Despite the same or similar defects being repeatedly pointed out by many customers, no remedial action appears to have been regularly taken so far. No sign is seen of active contact being made with customers to find out what is wrong with the products, and seeking measures to eliminate the more frequently generated defects.

An important function of the Quality Control Group should be to take the initiative in joining forces with the production and sales departments, to prevent recurring customer claims.

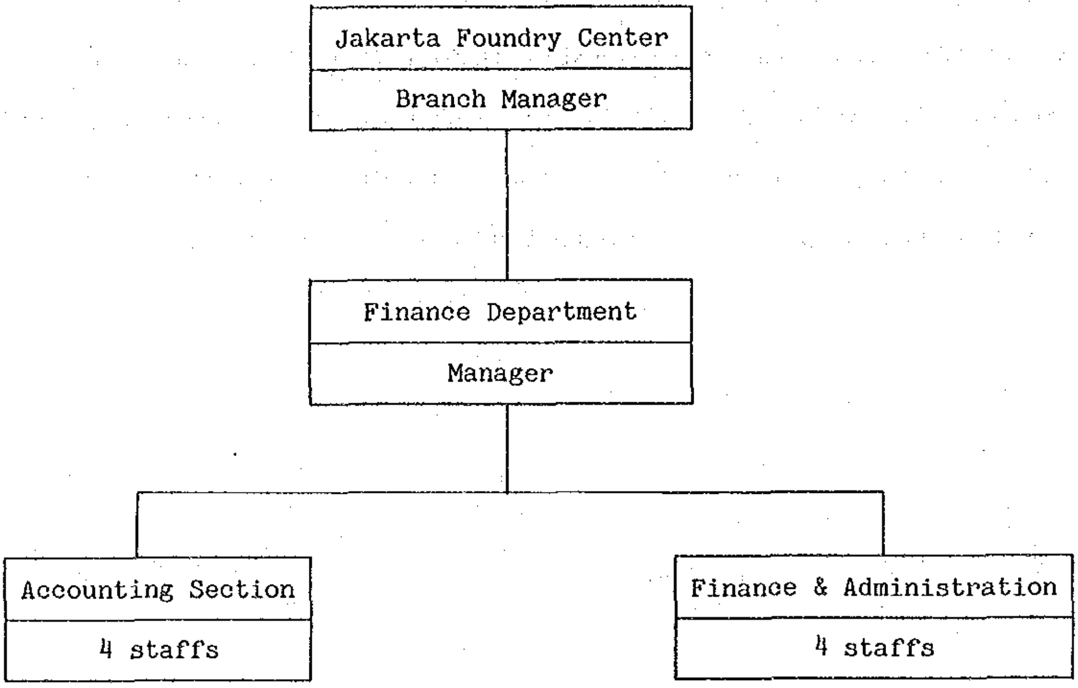
9) Quality control in the manufacturing process

Considerable waste can be avoided by corrective action being taken on the workpieces before it reaches the process of finished product, only to be rejected as defective. Quality must be built into a product through every process of manufacture. For this, measurable acceptance criteria require to be established for each process of each product during manufacture, and the workpieces must be examined for conformity before they are passed onto their next process of manufacture. No such system currently exists, and requires to be immediately established, in joint action between the Quality Control Group and Production Department.

5.2.3 Cost accounting system

5.2.3.1 Organization for cost accounting

The organization for cost accounting is as reproduced below.



The Finance Department, under the Branch Manager, is staffed in charge of accounting, and in charge of finance/administration, totaling 9 including the Department Manager.

The accounting group undertakes accounting and cost calculations. Profit and loss statements as well as balance sheets, previously prepared by this group (as shown in Tables 5.2.3-1 and -2), are today made out monthly by computer at the Barata Head Office, so that the work of this group in this connection has been reduced to preparing the raw data to be communicated to the Head Office for preparing the balance sheet.

Other duties of the accounting group include cost accounting and control, through the preparation of budgets, assembly of actual expenditure figures, comparison of actually spent with budgeted amounts. The comparisons are made every year, every quarter and every month. The resulting data are reported to the Branch Manager, to Head Office, and to the department managers concerned. A Report of Operational Income is also submitted every month to the Head Office for information on sales records.

The finance/administration group prepares the cash flow tables every month, for submission to the Branch manager and Head Office. The group also draws up a Report of Administration (buying and sales) based on the record of the group's function of controlling payments and receipts. Annual disbursements (salary/wage payments, tax arrangement/payment, ...) and receipts are also undertaken by the group, together with the financing operations of depositing and borrowing.

The documents sent to Head Office include:-

- Receipt/payment slips
- Material transfer slips
- Inter-Barata transfer slips
- Statement of payments received, by job order
- List of machine time and manhours expended, by job order

5.2.3.2 Procedure currently adopted for cost accounting

For cost accounting, the manual of procedure issued by Barata Head Office is followed. This manual postulates accounting by "Electric Data Processing System", and covers the following subjects:-

- Description of code system
- Description of individual codes (for balance sheet, profit and loss statement, ...)

- Procedure of cost accounting (materials, direct/indirect costs), general administrative and selling expenses
- Income accounting procedure (down payments, progress sales, after-finished-order sales)

The job order cost accounting system adopted at the Foundry Center follows the outline presented in Fig. 5.2.3-1. The prime cost is itemized into material (main, auxiliary, ...), labor (salary, fringe benefits, ...), miscellaneous expenses (depreciation, insurance, ...), with the organization divided roughly following the actual organization of the Foundry Center.

The job order cost accounting is made out for the different departments as follows:-

- Melting Department

Material cost			x
Machine cost	Machine-hour	x Tariff rate	y
Labor cost	Man-hour	x Tariff rate	z

Total (1 month) V (x + y + z)

Volume of pouring (1 month total) W

Unit cost per pouring V/W

Job order A Melting cost = V/W x Pouring weight A

Job order B Melting cost = V/W x Pouring weight B

Job order C Melting cost = V/W x Pouring weight C

- Molding Department

Job order A Molding cost = Job order A man-hours x Tariff
+ Job order A machine-hours x Tariff

Job order B Molding cost = Job order B man-hours x Tariff
+ Job order B machine-hours x Tariff

- Pattern Department

Job order A pattern cost = Job order A man-hours x Tariff
+ Job order A machine-hours x Tariff

Job order B pattern cost = Job order B man-hours x Tariff
+ Job order B machine-hours x Tariff

- Finishing Department

Job order A finishing cost = Job order A man-hours x Tariff
+ Job order A machine-hours x Tariff

Job order B finishing cost = Job order B man-hours x Tariff
+ Job order B machine-hours x Tariff

5.2.3.3 Standard cost and budget

The standard cost list is drawn up by the Branch Manager for purposes of cost control.

<table>
<tr><td rowspan="2"></td><td colspan="6">Type of Machine Molding Box
A B</td></tr>
<tr><td colspan="3">Weight (kg/mold)</td><td colspan="3">Weight (kg/mold)</td></tr>
<tr><td>Iron castings (FC)</td><td colspan="6">Cost of product (casting/kg)</td></tr>
<tr><td>Ductile iron castings (DFC)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Steel castings (SC)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

In respect of pattern cost, apart from distinguishing between different casting materials, separate standard costs are set to accord with the complexity of pattern configuration.

For raw materials and auxiliary materials, the normal practice is followed of establishing standard consumption figures per ton of product. Labor and machine costs are derived by multiplying the required hours per ton of product by the tariff calculated from the program of operation and allocated budget.

For determining the budget, that for individual job orders is derived with the Estimate Section of the Sales Department undertaking preliminary calculations. The overall annual budget is drawn up at the Head Office based on information and data submitted by the Jakarta Foundry Center. The annual budget contains programs of:-

- Expected orders, by product material, in weight and in value
- Expected sales, by ditto in ditto
- Planned production, by ditto in ditto
- Planned material movement — initial inventory, purchases during period, consumption during same, end inventory
- Planned manning/manhour consumption, by department, by product
- Planned overtime to be worked, by ditto
- Planned machine utilization/time consumption, by ditto
- Planned indirect costs
- Planned salary/wage payments, by department, separately for direct and indirect labor, and for administration
- Planned exploitation expenditure
- Budgets, by department
- Planned general administrative and selling expenses/manufacturing cost rates

- Tariffs, by department, separately for labor and machine costs
- Planned rehabilitation and capital investments
- Planned cash flow
- Planned profit/loss

The foregoing programs are followed up by comparisons with actual expenditures, by the Branch Manager and at Head Office.

5.2.3.4 Prime cost composition

The composition of the prime cost annually incurred at the Foundry Center is compared in Table 5.2.3-3 with corresponding figures for Japanese foundries.

It is revealed that the portion spent in direct materials is much the same as in Japan. On the other hand, direct labor accounts for only about half of what is paid in Japan. What corresponds to the "indirect costs" in Japan (machine/miscellaneous/ indirect production costs) adds up to 38% of the total prime cost, compared with 28% for the Japanese foundries, which would appear to constitute an important factor that undermines profit in the case of the Foundry Center. The sales/administration cost not counting interest and discount expenses is 14% for the Foundry Center, which does not differ appreciably from the 13% for the Japanese foundries, but what differs strikingly is the weight presented by interest/discount expenses, which is 1.6% in the case of the Japanese foundries operating soundly, and 4.3% even in the case of foundries in deficit, but which accounts for as much as 14% with the Foundry Center, to constitute a critical drain on profits.

5.2.3.5 Remarks

The accounting system is incorporated into the Electric Data Processing System of the Head Office, and thus completely modernized.

Adoption of the job order system of cost accounting, however, might be unduly complicating the accounting operations, and it should be worth considering simplification of this system (for instance, adopting process cost accounting system), after which to establish guidelines for cost control.

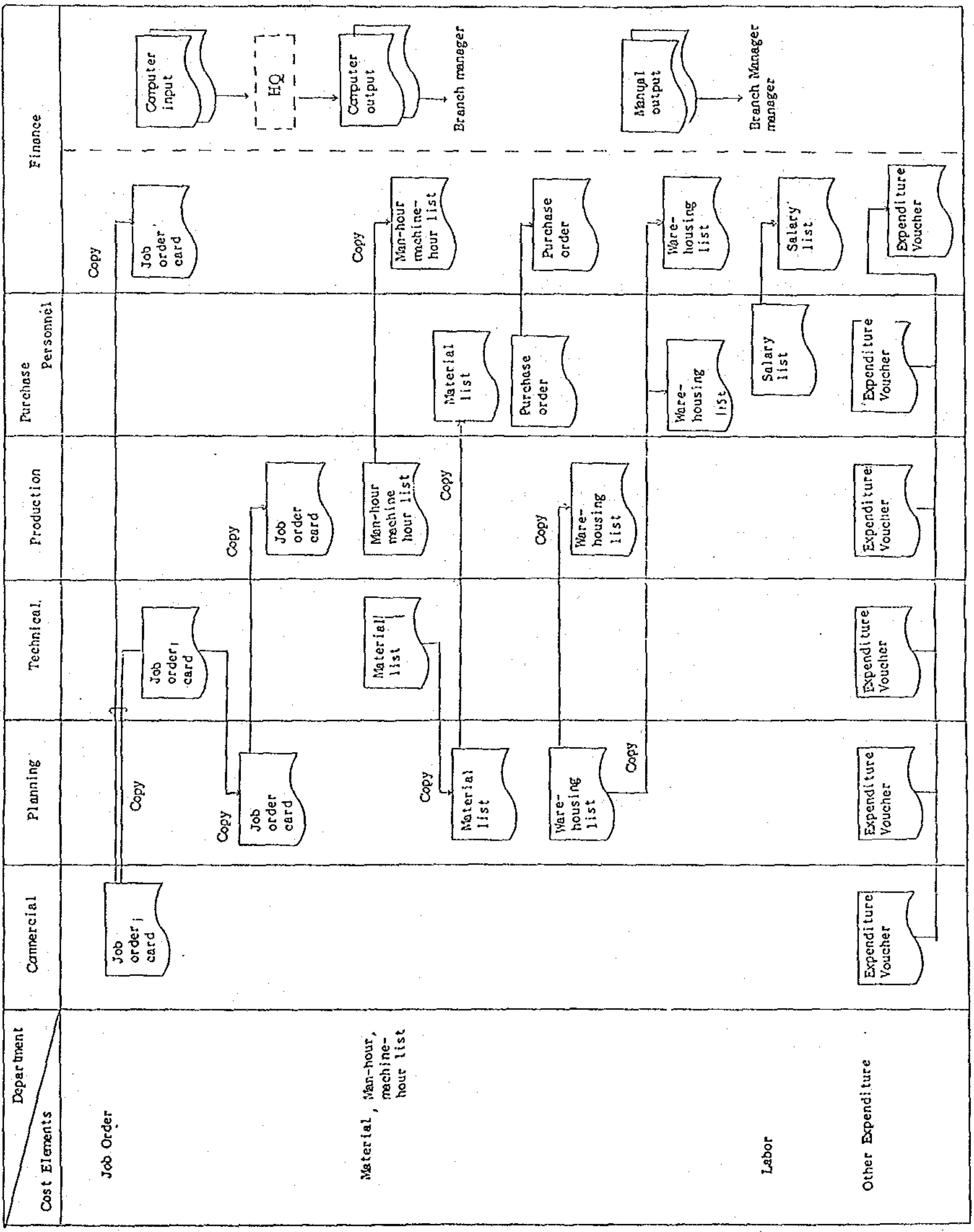


Fig. 5.2.3-1 Flow Chart of Cost Accounting

Table 5.2.3-1 Jakarta Foundry Center Profit & Loss Statement

Profit & Loss Sales

Gross sales
- Order from Outside
- Order from Barata Branch
- Ready Stock

Manufacturing Cost
- Order from Outside
- Order from Barata Branch
- Ready Stock

Profit & Loss on Sales

Profit & Loss Difference on Efficiency
- Standard Cost
- Realization Cost

Profit Difference on Efficiency

Profit & Loss Difference on Calculation

Difference on fabrication of Foundry

Difference on Stock/Material

Difference on Calculation Work-in-Process

Profit Difference on Calculation

General Expenses

Administration Cost

Sales Cost

Total General Expenses
- Interest

Operating Profit

Other Profit & Loss

Other Income

Other Expenses

Profit before tax

Table 5.2.3-2 Balance Sheet

P.T. BARATA INDONESIA
CABANG COR JAKARTA

ASSETS

A. CURRENT ASSETS

1. Liquidity
   - Cash
   - Bank

2. Receivables
   - Trade Receivables
   - Tax over charge
   - Miscellaneous
   - Transitories
   - Other Receivables

3. Inventories
   - Finished/Finished Goods
   - Work in process
   - Materials

Total Current Assets

B. OTHER ASSETS
- Head office
- Miscellaneous
- Incurrent Assets
- Bad debts

C. FIXED ASSETS
- Fixed assets
- Depreciation
- Intangibel assets

LIABILITIES

A. Current liabilities
- Bank loans
- Trade loans
- Advance payment
- Transitoeries
- Other liabilities

Total current liabilities

B. Other liabilities
- N. Miscellaneous Debts
- Debts Head Office
- Allowance for Bad debts

Long Term Loans

C. Profit : Loss

Total Liabilities

Table 5.2.3-3 Breakdown of Prime Cost Compared between Jakarta Foundry Center and Japanese Foundries

(Unit: $)

Foundries/mode of breakdown Categories/items of cost				Breakdown of cost				
				Average of 28 Japanese foundries operating soundly			38 in deficit	Jakarta Foundry center
				Breakdown of total prime cost	Breakdown of manufacturing cost	Breakdown of A/S expenses	Breakdown of total prime cost	Breakdown of total prime cost
Total prime cost	Manufacturing cost	Direct	Direct materials	24.1	28.4		22.3	26.0
			Purchased components	0.8	1.0		1.3	
			Subcontracted work	13.9	16.4		12.6	
			Direct labor	15.5	18.3		17.0	8.0
			Other direct costs	2.6	3.0		0.9	
			Subtotal	56.9	67.1		54.1	34.0
		Indirect	Indirect materials	6.0	7.0		5.7	Machine cost
			Indirect labor	3.1	3.7		2.9	21.0
			Fringe benefits/board	3.6	4.3		2.4	Miscellaneous
			Depreciation	4.2	4.9		3.4	8.0
			Rental	0.7	0.8		0.4	
			Insurance	0.3	0.3		0.2	Indirect production cost
			Repair/maintenance	1.4	1.7		2.0	
			Electricity	4.6	5.4		5.6	9.0
			Gas	0.1	0.1		0.7	
			Water	0.0	0.1		0.1	
			Fuel	0.7	0.9		1.8	
			Other indirect costs	3.2	3.7		3.6	
			Subtotal	27.9	32.9		28.8	38.0
			Total	84.8	100.0		82.9	72.0
	Administration/selling expenses	Selling	Sales staff salaries	0.8		5.4	0.6	
			Travel	0.3		2.2	0.4	
			Communication	0.2		1.1	0.2	
			Shipping	1.5		8.9	0.9	
			Packing	0.0		0.0	0.1	
			Consumables	0.1		0.9	0.2	
			Advertising	0.1		0.8	0.1	
			Entertainment	0.3		2.1	0.5	
			Other sales expenses	0.6		4.1	0.2	
			Subtotal	3.9		25.5	3.2	6.0
		Administration	Officers' salaries/allowances	2.9		19.0	3.6	
			Clerical staff salaries/allowances	2.4		15.9	2.7	A
			Board	0.0		0.1	0.0	
			Fringe benefits	0.5		3.2	0.7	
			Interest/discount expenses	1.6		10.7	4.3	14.0
			Depreciation	0.2		1.6	0.3	A + B
			Taxes	1.0		6.5	0.6	B = 8.0
			Other business expenses	2.7		17.5	1.7	
			Subtotal	11.3		74.5	13.9	22.0
			Total	15.2		100.0	17.1	28.0
			Grand total	100.0			100.0	100.0

Source: For Japan: "Guidelines for Medium/Small Enterprises", 1984
For Jakarta Foundry Center: Budget data for 1984 made available by Center

5.2.4 Production control

In this section, the production control of this foundry is mainly stated.

1) Production control department and its personnel disposition

Fig. 5.2.4-1 shows the position and the personnel disposition of production control department in the functional organization of the foundry.

This department, as well as the production department, is directly connected to the factory manager and is composed of 13 persons including 1 manage and 3 chiefs of section.

The roles of each section ar shown in Table 5.2.4-1.

2) Production plan

Table 5.2.4-2 shows the annual production plan in 1985. As shown in the table, the plan includes 10 items and 900 tons per year of products covering iron castings and steel castings, and the amount of manhours for the whole production process including pattern making, melting, molding and finishing is estimated at 252,146 manhours per year.

Moreover, the annual plan covering the operating time for production machines and equipment such as melting furnaces, molding machines, etc. is also prepared.

In regard to the production control after the acceptance of an order, production planning & control department (hereinafter referred to as PPC) prepares Job Tickets based on order cards (order commitment) issued by the commercial department.

These tickets, which may be also called weekly production schedules, are made out each week in 2 types, one for molding operation and another for finishing operation according to the order number, and are sent to theproduction department.

In these tickets, daily production items, name of castings, material, desired quantity of products and desired manhours are specified for a certain week, and after the week in question has passed, tickets are returned to PPC being filled with the actual quantity and manhours.

As to reporting, Job Tickets for molding operation are returned directly to PPC, and those for finishing operation are returned, after the operation is over, accompanied with inspector's sign of approval subsequent to product inspection by an inspector from Q.C. department and the recording of the accepted product quantities. For actual manhours involved for the finishing operation, all manhours including those which were spent for rejected products are entered.

The flow chart of production instructions and reports, which are mentioned above, is shown in Fig. 5.2.4-2.

3) Schedule control

PPC repairs weekly progress reports based mainly on data on returned Job Tickets and send them to production department together with Job Tickets for the next week.

In this report, order number, order quantity classified by product and quantity of castings which are poured, being finished, rejected after their delivery to customers are recorded.

This report is sent not only to the production department but also to the branch manager, commercial and finance department. THe schedule control (delivery control) is conducted by PPC through meetings with production department once a week depending mainly on the above mentioned progress reports.

4) Material control

a) Procurement plan of materials which have never been used.

According to results, it can be said that about 90% of all orders received are the same kind of product items as those manufactured in the past and the rest is non-experienced ones. Therefore, the new type of materials are rarely purchased.

When an order of non-experienced product item is received, PPC gives technical department charged of study on its manufacturing process and the kind and quantity of required new materials, then based on its result, it charges Purchasing section of Commercial department with purchasing of materials.

b) Procurement plan of materials being used from the past

Concerning materials being used from the past, warehouse section of PPC makes out the procurement plan based on the minimum quantity control principle.

c) Control of the amount of materials used

In the control of the amount of materials used, the control of the amount linked with the production rate, in other words, the budget-result control is required.

At this foundry, warehouse section is charged in preparing periodical reports on the amount of materials used, then sending to relatd sections, however, it does not seem that the said budget-result control utilizing these report is perfectly carried out.

Following the production plan mentioned in section 2, the material plan is to be made up. Accordingly, production department shall exercise by itself the budget-result control on the material use utilizing this material plan and periodical reports on the amount of materials used.

5) Manhour Control

In columns for manhours and machine/equipment hours in Job Tickets, each planned value for each casting by PPC is specified. Production department shall record the real values and return tickets to PPC.

PPC, based on these values, totalizes executed manhours and machine/equipment hours classified by operation processes for each casting to prepare daily, weekly and monthly reports. it also draws up reports calculating each annual value of executed manhours and machine/equipment hours for each operation process. Thus, JFC's manhours and machine/equipment hours may be appreciated because executed manhours and machine/equipment hours are sufficiently seized. Nevertheless, for materials to be studied, it is unsatisfactory that planned manhours or machine/equipment hours are not entered in any totalization. Results of these totalizations will be more effective, if these are used from now on, together with planned manhours or machine/equipment hours, to study the difference between planned values and real ones as well as to control the amount of materials used.

And we recommend, to make the manhour control perfect, that all departments concerned should endeavor to reduce the said difference through serious study on it.

Table 5.2.4-1 Role of Each Section of Production Planning & Control Department

Section	Role of Each Section
Production Planning	Preparation of production plan and production schedule, Arrangement of raw materials
Production Control	Manhour control, Machine hour control, Delivery control, Stock control of materials and pre-calculationof production cost
Warehosue	Storing of raw materials, spare parts and production tools. Control of minimum quantity of materials, Drawing up of report on material consumption

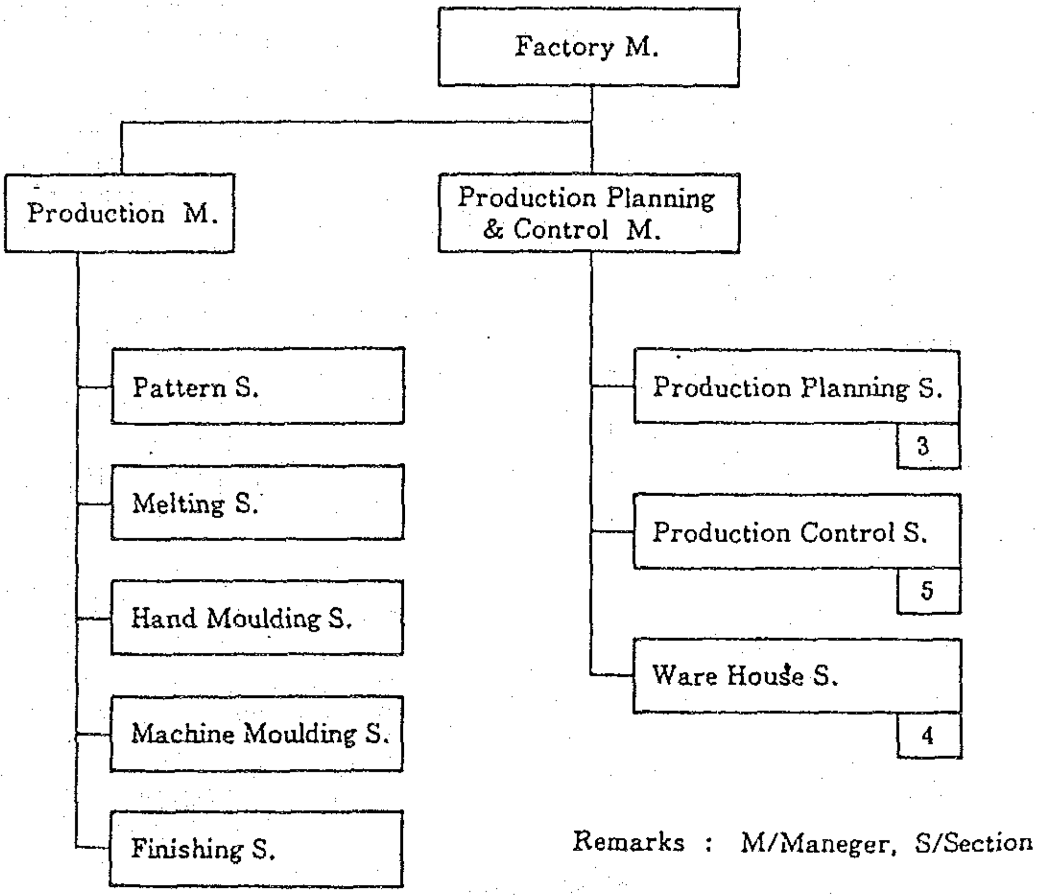
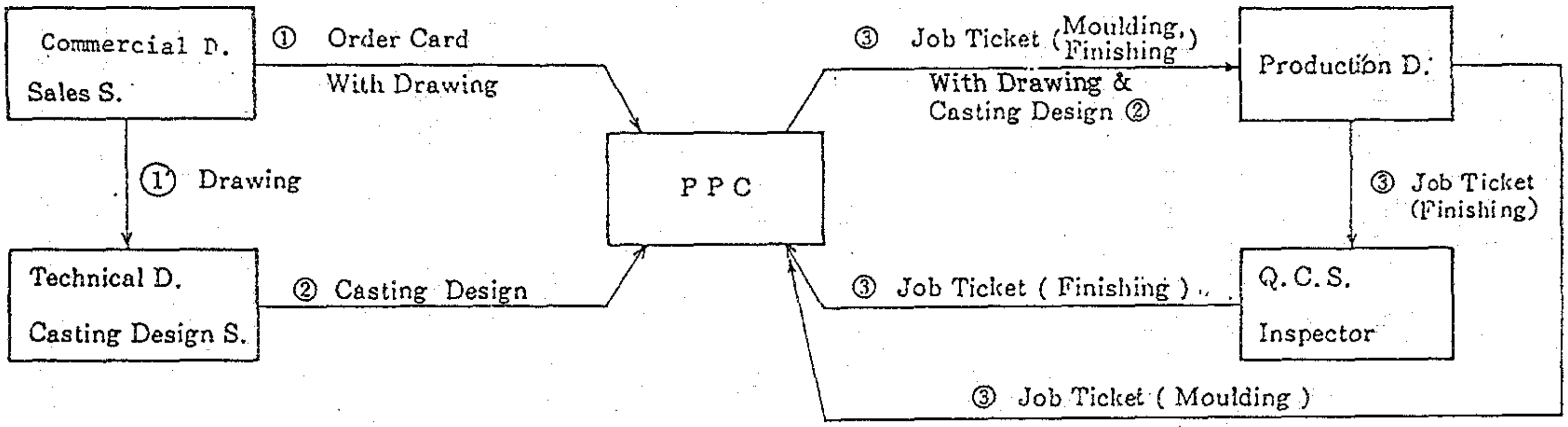


Fig. 5.2.4-1 Position and Personnel Disposition of Production Control Department

Table 5.2.4-2 Production Plan in 1986

Products	Manhour					Total
	Weight (ton)	Pattern making (man/ hour)	Melting (man/ hour)	Molding (man/ hour)	Finish-ing (man/ hour)	(man/ hour)
A. Steel castings for dockyard	50	1,282	1,417	7,310	4,000	14,009
A. Steel castings Anchor, Bush	50	1,282	1,417	7,310	4,000	14,009
A. Iron castings Pump	200	5,126	5,666	29,240	16,000	56,032
A. Iron castings Counter weight	200	5,126	5,666	29,240	16,000	56,032
A. Iron castings Flywheel	100	2,563	2,833	14,620	8,000	28,016
A. Iron castings Shoulder	50	1,282	1,417	7,310	4,000	14,009
A. Iron castings Manhole cover	100	2,563	2,833	14,620	8,000	28,016
A. Iron castings Metal die	100	2,563	2,833	14,620	8,000	28,016
B. Steel castings Casting for public use	10	256	283	1,462	800	2,801
B. Steel castings Road-roller parts	40	1,025	1,133	5,848	3,200	11,206
Total	900	23,068	23,498	131,580	72,000	252,146
Numberof Persons	-	9	10	42	24	85

Note: A ... External order
B ... Internal order from BARATA



Remarks : D/ Department, S/Section

Fig. 5.2.4-2 Flow Chart of Production Instruction and reports

5.3 Technical capability

5.3.1 Technical capability

For appraising the level of technical capability, the survey covered the following 4 items;

- Establishment and application of quality, technical and work standards
- Engineering capability in such aspects as casting designing
- Pattern-making capability
- Product quality

The results of the survey are summarized below.

1) Establishment and application of quality, technical and work standards

All foundry work should of necessity be performed within the framework of one or the other of the foregoing standards, and the instruction and training of operators should begin with inculcation in the applicable governing standards.

The survey revealed, however, that the only standard established so far was a manual for standard melting operations. What was claimed to be a work standard for the model FD-4 molding machine proved to be constituted largely of the operating instructions issued by the machine manufacturer: No apposite instructions are given in this document on the sequence of molding work, on the essential points and practical hints in going about the work, and the document thus lacks the essence of a work standard.

There is urgent need for drawing up indispensable standards to govern foundry operations, and to have them properly followed by the relevant workers.

2) Engineering capability in such aspects as casting designing.

The capability of casting designing, based on the plan to be followed in the casting operation, is a valid measure for assessing the engineering capability of a foundry. Upon survey, such capability appeared to have been acquired to a certain extent through instruction furnished by the JICA expert. An example of casting design is shown in Fig. 5.3.1-1.

It was revealed that the casting designs are modeled on Japanese reference literature in the case of iron and on European for steel castings.

Establishment of an internal standard to guide and govern casting design should contribute appreciably to enhancing the technological level of the Foundry Center.

3) Pattern-making capability

The capability of efficiently making patterns of complex forms and structures is an accomplishment that is not always accorded due weight. Yet it is a basic knowhow and technique without which the other capabilities cited above will be of no avail in enhancing the quality and quantity of the castings produced.

The survey revealed that the pattern-making capability sufficed to a certain degree for castings of simple form - like sewer grating and manhole covers - only requiring simple cores, if at all. Advance into the production of more complex castings involving the use of multiple cores should, however, call for assimilation of much higher skills and knowhow, for which the technical assistance of experts should be urgently considered. A similar advice is contained in the JICA report on their technical assistance program.

4) Product quality

Product quality represents the result of integrated application of all the capabilities cited under the foregoing headings.

The survey proved the castings produced by JFC to present no particular problem in the case of simple products like sewer grating, but the high rejection rates recorded on castings of some degree of complexity, and the extravagant amount of remedial work applied to correct surface defects betokens the urgency of necessity to improve the basic foundry techniques.

It is concluded from the foregoing observations that, to advance from simple castings to the manufacture at adequate rate of products presenting some complexity, the current level of technological capability requires to be enhanced through instruction and training. The aim should be set at properly acquiring the most basic and essential accomplishment of being able to correctly make accurate molds.

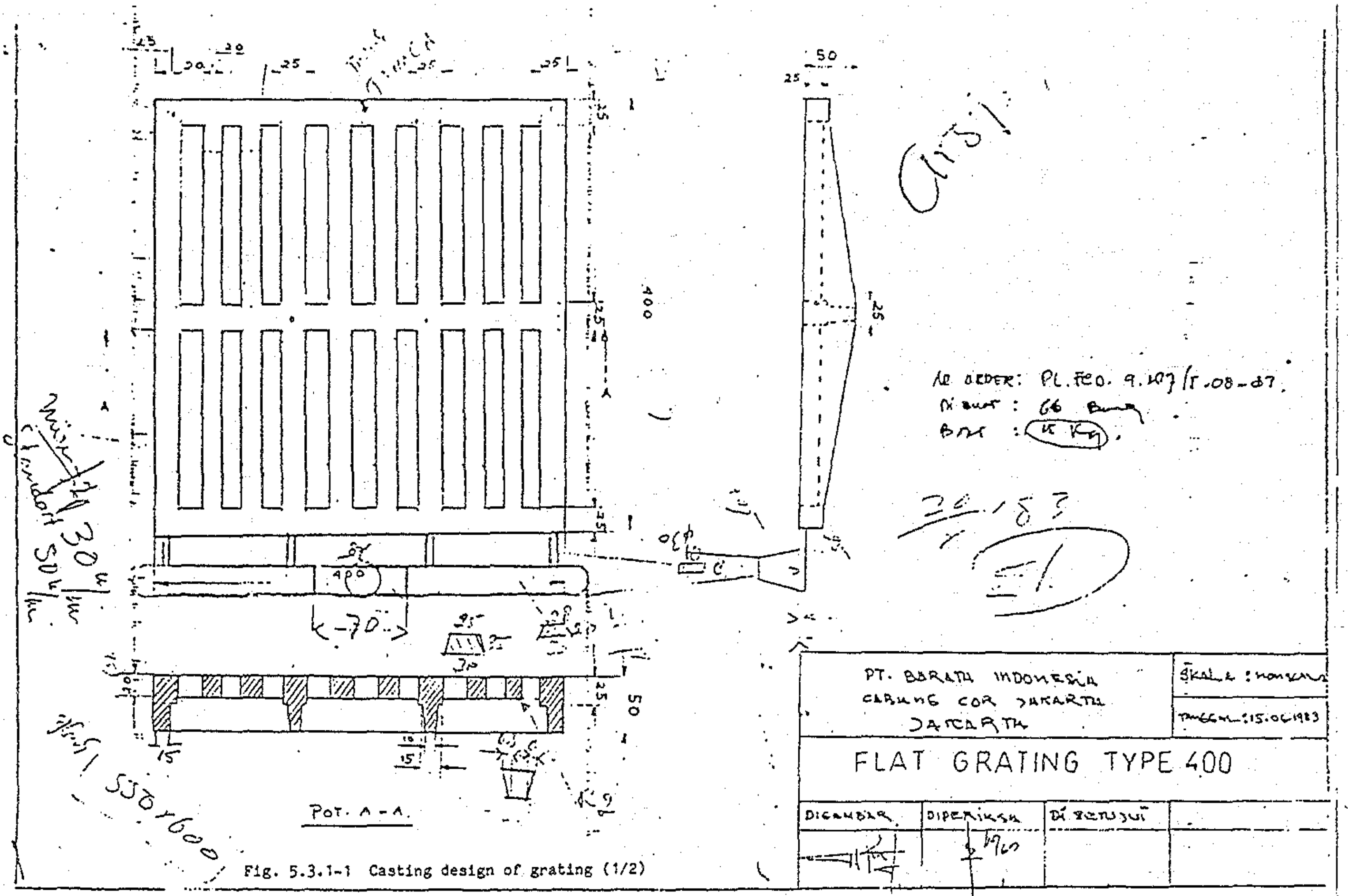


Fig. 5.3.1-1 Casting design of grating (1/2)

RENCANA - PENGECORAN

Tanggal : ...

NO. ORDER : 91. KCD. [illegible]

PEMESAN : Cipy tuang

NAMA BARANG : ? [illegible]

B A H A N : FC 20

Rangka Kotak	L u a s	Tinggi	Isi Pasir	B e r a t
550/600		120/170		

Jml.Dibuat : 66 Bh.

Berat/buah : 15 Kg.

Berat total : 1590 Kg.

D A F T A R   K E R J A

P o l a	Cetak & tuang	Penyelesaian	Perlakuan panas an; nor; temp; quenc	Tek. Mesin	Perakitan	Pemerik.Kualitas	Pengerahan
[illegible]	[illegible]	[illegible]				[illegible]	E [illegible]

Berat benda : 15 Kg.

Berat tuang : 16,6 Kg.

Temperatur tuang : OP

Waktu tuang : detik

Alur turun Ø : 20 Jumlah : Bh.

Penampang : 314 mm2 Bh.

T o t a l : 314 mm2

Berat 0,6 kg

CARA MENCETAK :

a. F₂A d. SS

[✓ b.] FD₄ e. [illegible]

c. VJ₂

CARA PENUANGAN :

a. Tegak

[✓ b.] Mendatar

Pengalir :

Penampang : 576 mm2

T o t a l : 576 mm2

Berat 1 kg

PASIR CETAK :

[✓ a.] Green d. CO₂

b. Self hard e. ...

c. Dry

PELAPIS : ...

Saluran masuk : 4 Bh.

Penampang : a. △ ; ▭ 80 mm2/Bh

T o t a l : 320 mm2

Berat 0,25 kg

I N T I :

a. Cg; Banyaknya Bag. : macam

b. Self hard T o t a l : Bh.

c. Oil sand Pelapis :

d.

P O L A :

a. Pelat pasangan

b. Pelat pola kup & Dreg.

c. Pola pejal

Bahan : [illegible]

Banyak : Bh/cetak

Cawan tuang : Bh.

Ukuran : a. Besar [✓ b.] Kecil

Tambahan : Bh.

J u m l a h :

Jumlah penutup : Bh.

Berat penutup : Kg.

Berat Cetakan : Kg.

K E T E R A N G A N

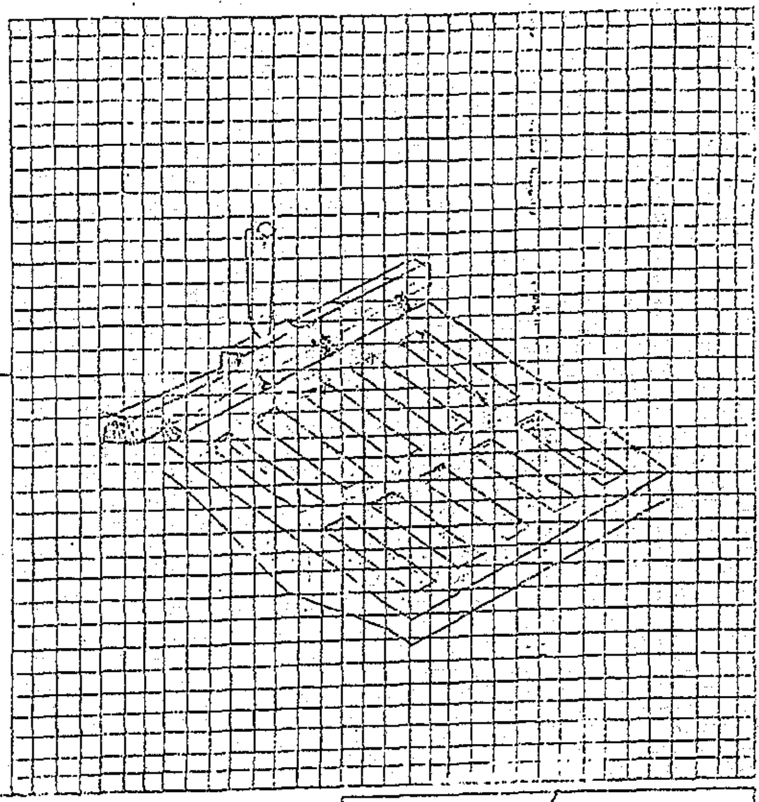


Fig. 5.3.1-1 Casting design of grating (2/2)

5.3.2 Material

Regarding materials, we have surveyed under following four items.

- Kind of materials which are used.
- Distinction between domestic materials and imported ones.
- Country of origin of mateirals.
- Mixing ratio and price by mateirals.

Most materials for pattern making and molding are domestic, however, those for melting and finishing are imported from Japan and Australia.

Summary of the survey result are as follows;

1. Kind of materials for each process

a) Pattern making materials

As shown in Table 5.3.2-1, most of pattern making materials are domestic. When the quantity of castings to be manufactured is small, polystyrene foam is sometimes used instead of wood, and when wood is adopted, plywood is often used as material. We consider that there is no problem concerning, in particular, pattern making materials.

b) Sand preparation and molding materials

1) As shown in Table 5.3.2-2, domestic materials such as silica sand, bentonite, cement,water glass and CO_2 gas, are used for molding.

2) Silica sand gathered at Banka Island is purchased in undryed state, and a part of it is used for cement sand and CO_2 sand after dryed in a simple dryer. Since sand is not clearly separated into dryed one and undryed one, it is necessary to provide a divider.

3) Green sand deteriorates in quality due to the contamination of cement sand and CO_2 sand.

Molds for hand molding are now made of two types of sand of which binder are different, i.e. master mold = green sand, core = cement sand and master mold = green sand, core = CO_2 sand, and after pouring, these molds are recovered with the same sand reclaiming equipment. This causes the contamination of cement sand and CO_2 sand into green sand resulting the degradation of the latter.

c) Melting Materials

Materials as shown in Table 5.3.2-3 are used for melting.

1) Steel scraps, automobile press trimmings are used for the main material for melting.

This material, without any rusts or oils adhered on, is stable in its component and good in quality, however there are some inconveniences as mentioned below, when used as it is, because pressed scraps are different in shape, thin and bulky.

- * Because of large spaces between scraps in a furnace, the heat efficiency is reduced causing the long melting time.
- * Bridging is liable to occur during the melting operation.
- * Additional material charging are required many times, and it lowers workability.
- * As they are bulky, large storing spaces are necessary.

From these points of view, it is recommended to use this type of steel scraps in masses of 50 kg to 100 kg.

2) For melting in induction furnaces, the management of melting materials is the most important item. In the present condition of the materials management system, materials are not stored according to their types. It is necessary to install dividers to store them separately.

3) Starting blocks for induction furnaces of 5 tons are made at each foundry, being poured into sand molds, however, they shall be used after removing the sand adhered on the surface to avoid the acceleration of the wear of furnace walls.

4) Finishing materials

As shown in Table 5.3.2-4, shot grits and grinding-stones imported from Japan are used as finishing materials.

2. Mixing Ratio and Prices of Materials for Each Process

a) Mixing ratio and prices of molding sands are shown in Table 5.3.2-5.

b) Mixing ratio and prices of melting materials are shown in Table 5.3.2-6.

Table 5.3.2-1 Pattern Materials

Classification	No.	Items	Specification	Purchased Price (RP)	Country of origin Imported
Pattern	1.	Square Timber		1,200,000/m^3	Indonesia
	2.	Veneer Plywood	1200 x 1500 x 15	12,000/sheet	Indonesia
	3.	dhesive AGent		1,500/kg	Indonesia
	4.	Lacquer		3,000/kg	Indonesia
	5.	Paint		3,000/kg	Indonesia

Table 5.3.2-2 Molding Materials

Classification	No.	Items	Specification	Purchased Price (RP)	Country of origin Imported
Molding	1.	Natural Sand	SiO_2 95%	32,500/m^3	Indonesia
	2.	Bentonite		200/kg	Indonesia
	3.	Water Glass		175/kg	Indonesia
	4.	Coating Agent		1,250/kg	Indonesia
	5.	Alcohol		630/lit.	Inodnesia
	6.	Methanol		320/lit.	Indonesia
	7.	Cement	White-Cement	210/kg	Indonesia

Table 5.3.2-3 Melting Materials

Classification	No.	Items	Specification	Purchased Price (RP)	Country of origin Imported
Melting	1.	Steel Scrap		120/kg	Indonesia
	2.	Return Scrap		200/kg	Indonesia
	3.	Starting-block		200/kg	Indonesia
	4.	Recarburizer		175/kg	Indonesia
	5.	Ferro-Silicon	Silicon 75%	1,350/kg	Japan
	6.	Ferro-manganese	Manganese 75%	800/kg	Japan
	7.	Ferro-chromium		2,500/kg	Japan
	8.	Cupper-scrap		1,400/kg	Indonesia
	9.	Nodular-agent	Toyo Denka	4,125/kg	Japan
	10.	Refractory brick		850/PC	Indonesia
	11.	Magnesia Clinder		775/kg	Australila
	12.	Material for furnacewall		775/kg	Australia

Table 5.3.2-4 Finishing and other Materials

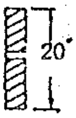
Classification	No.	Items	Specification	Purchased Price (RP)	Country of origin Imported
Cleaning	1.	Shot grit		1,000/kg	Japan
Inspection	2.	Grinding-stone	A_1 = 	A_1 1,300/PC	Japan
			B_1 = 	B_1 3,000/PC	Japan
			C = 	C_1 100,000/PC	Japan
	3.	Welding rod	(SC)	785/kg	Indonesia
	4.	Propane gas		333/kg	Indonesia
	5.	Gasoline		400/lit.	
	6.	Water		200/m^3	Indonesia

Table 5.3.2-5 Mixing Ratio and Prices of Foundry Sand (cost/ton)

	Mixing material	Mixing ratio (%)	Mixing weight (kg)	Price (RP/kg)	Total price (RP)
CO_2 Sand	New Sand	100	1,000	25	25,000
	Water Glass	7	70	175	12,250
	CO_2-Gas	2. Btl/T	2. Btl	15,500/Bttl	31,000
	Total				68,250
Cement Sand	New Sand	100	1,000	25	25,000
	Molasess	6	60	85	5,100
	Cment	9	90	209	18,810
	Total				48,910
Green Sand	New Sand	70	700	New 25	17,500
	Used Sand	30	300	2.5	750
	Bentonite	8	80	200	16,000
	Dextrin	0.5	5	600	3,000
	Sea Coal	1.0	10	350	3,500
	Total				40,750
Green Sand Bentonite	Used Sand	100	1,000	2.5	2,500
		0.5	5	200	1,000
	Total				3,500
Furan Sand	New Sand	100	1,000	25	25,000
	Furan Solution	1.0	10	4,800	48,000
	Hardening Agent	0.5	5	3,600	18,000
	Total				91,000

Table 5.3.2-6 Compounding Ratio and Price by Product

	Changing ingot metal	Mixing ratio (%)	Compoundig weight (kg)	Price (RP/kg)	Total price (RP)
Iron casting	Steel-scrap	30	300	120	36,000
	Return-scrap	70	700	200	140,000
	Recarburizer	3	30	175	5,250
	Ferro-manganese	0.3	3	800	2,400
	Ferro-silicon	0.9	9	1,350	12,150
	Inoculant	0.15	1.5	1,350	2,025
	Total	104.35	1,043.5		197,825
Ductile iron	Steel-scrap	50	500	120	60,000
	Return-scrap	50	500	200	100,000
	Recarburizer	4	40	175	7,000
	Ferro-silicon	0.9	9	1,350	12,150
	Inoculant	0.5	5	1,350	6,750
	Mg-Alloy	0.7	7	4,150	29,050
	Total	106.1	1,061		214,950
Cast steel	Steel-scrap	100	1,000	120	120,000
	Ferro-manganese	0.5	5	800	4,000
	Ferro-silicon	0.5	5	1,350	6,750
	Aluminium	0.1	1	1,000	1,000
	Total	101.1	1,011		131,750

5.3.3 Education/Training

According to the general report prepared by the experts from JICA, plenty of teaching and training have been given to the managers, staff and workers to acquire necessary production technique and skills.

Moreover, JICA provided 5 managers and members of staff with training at the JICA Training Center.

Certainly it is through this series of training/education that JFC has reached present level of technical capability.

Nonetheless, as explained in 5.3.1 and 5.4, the study of JFC foundry shows that the biggest problem lies in high rate of defetive products (unusable products). Even usable products need extravagant amount of remedial work applied to correct surface defects such as penetration.

According to the study, the main cause of these defective products is the lack of basic skills of workers.

Education/training is divided into two categories. One is production technique education for managers/engineers and members of staff, and the other is technical training for workers. In the present state of JFC, both of them are needed.

Although both types of training have been done at JFC, the stress seems to have placed on production technique education.

In the future, technical training for workers should be emphasized as well as education of managers for technical control and supervisory ability.

In our opinion, JFC should engage services of engineers and technicians from advanced countries for education/training.

5.3.4 Maintenance

With regard to maintenance, the following points were studied.

- Organization, personnel and activities of the maintenance department.
- Standards for maintenance
- Equipment for maintenance
- Maintenance schedule and its implementation.

1) Organization, personnel and activities of the maintenance department.

The present situation of the maintenance department is shown in Fig. 5.3.4-1 and Table 5.3.4-1.

a) Personnel

The maintenance department has 16 members including a manager.

The assignment of personnel is as follows:

* Electrical maintenance group	4
* Mechanical maintenance group ...	4
* General maintenance group	2
* Material handling group	4
* Staff	1

b) The activities of the maintenance department

* Duties of machine operators	Machine cleaning and lubrication.
* Duties of maintenance dept	Repair work and replacement of machine parts.

2) Standards for maintenance

Standards have not yet beenestablished for maintenance. The check items listed in the various manuals of equipment are being used as guidance. Those check items can not be proper standards, and it is necessary for JFC to establish its own standards.

3) Equipment for maintenance

The machine tools used for maintenance are:

* Lathe	1 unit
* Bench drill	1 unit

4) Maintenance schedule and its implementation

a) The maintenance schedule is established by the staff and equipment checking is carried out accordingly.

Table 5.3.4-2 shows the annual schedule.

b) Classification of check items and frequency of checking

Check items are divided into three fields, i.e. machinery, electricity and oil change. According to frequency, there are three types of checking - daily, monthly and annual checking.

c) Implementation of maintenance

Examples of check list for maintenance is given in Tables 5.3.4-3, -4 and -5.

Table 5.3.4-3 is the check lilst of power receiving equipment.

Table 5.3.4-4 is the check list of induction furnace.

Table 5.3.4-5 is the check list of a molding machine.

In spite of the fact that the maintenance work is being implemented in accordance with the schedule, the following faults in maintenance have been noticed.

(a) The pin and bush of the casting flask for molding machine.

The pins and bushes of the flask used for FD-4 molding machine, which are repaired outside JFC, are not satisfactory in precision.

(b) Dust collector for the green sand mixer

The dust collector used for the green sand mixer is not working properly because of corrosion.

(c) Cooling tower for 2 tons and 5 tons induction furnaces

The cooling towers used for 2 tons and 5 tons induction furnaces have been so worn out that their water-cooling capacity is decreasing.

These examples indicate that the execution of maintenance is not satisfactory. It is, therefore, necessary to review the schedule, implementation and confirmation method of maintenance closely.

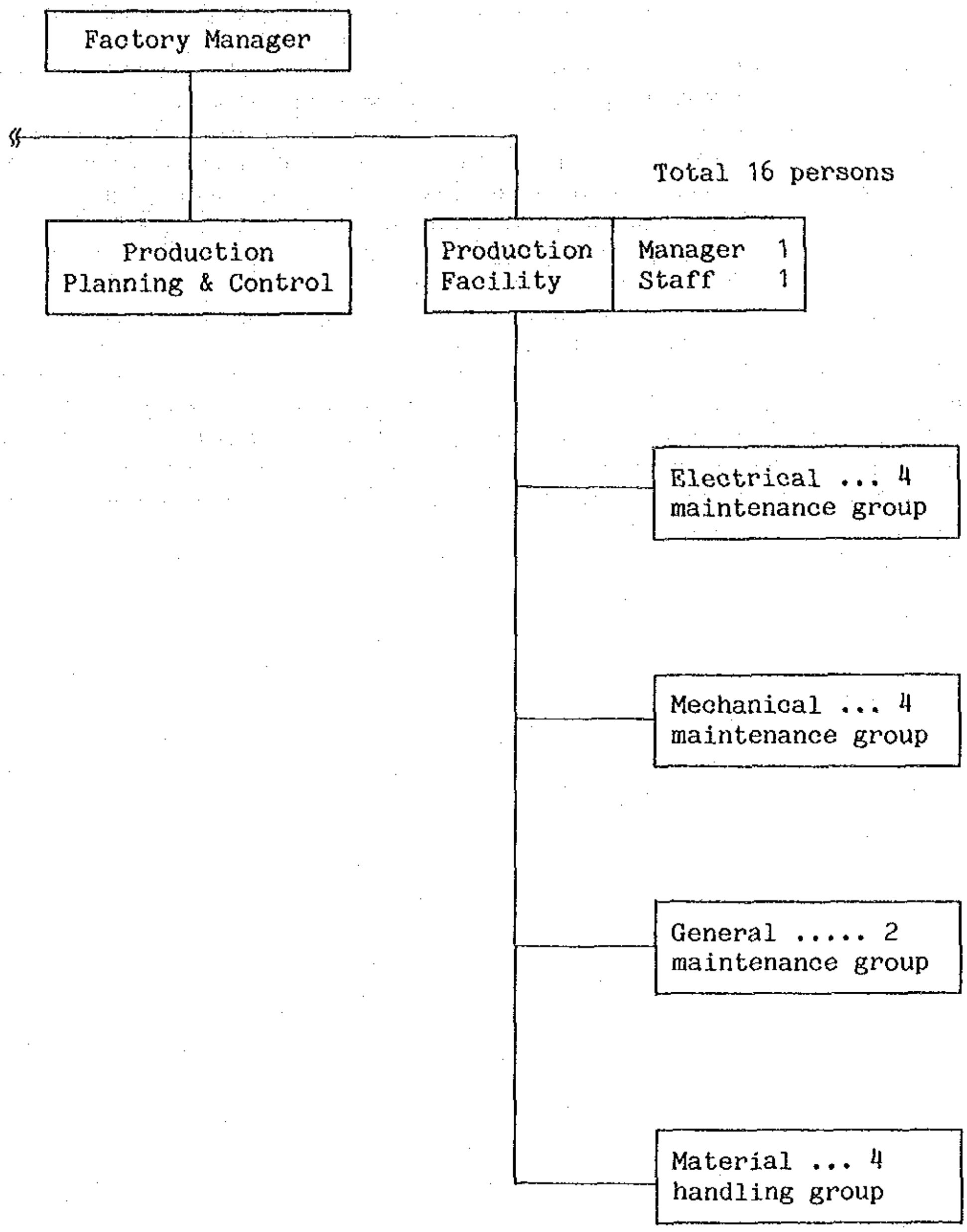


Fig. 5.3.4-1 The Organization Chart of the Maintenance Dept.

Table 5.3.4-1 The Activities of the Maintenance Dept.

Group		Activities
1	Staff	Preparation of maintenance schedule.
2	Electrical maintenance group	Check, repair and parts replacement of electric equipment (power receiving equipment, low frequency induction furnaces, etc.) in accordance with the check list.
3	Mechanical maintenance group	Check, repair and parts replacement in accordance with the check list.
4	General maintenance group	Repair work of factory buildings, check and judgement of the accuracy of manufacturing tools.
5	Material handling group	Operation and check of overhead traveling cranes and forklifts.

BANG :

Fig. 5.3.4-2 Annual Maintenance Schedule

½ No :

MESIN.		BULAN. MINGGU		
KODE	JENIS	H.	M	B
D.56	Lathe Machine	●	●	
D.56 - 1	Crosscut Sawing Mach.	●	●	
D.56 - 3	Band Sawing Machine		●	
D.56 - 4	Tilting Arbor Saw	●	●	
D.56 - 5	Wood Shaping Machine	●	●	
D.56 - 6	Pattern Milling Mach.	●	●	
D.56 - 7	Lathe Machine	●	●	
D.56 - 8	Band Sawing Machine		●	
D.56 - 9	Circular Saw Shaperne		●	
D.56 -10	Knife Grinder		●	
D.53 - 1	Double Head Grinder		●	
D.53 - 2	Swing Grinder		●	
D.53 - 3	Abrassive Cutter		●	
D.3	Universal Crane	●	●	
D. 4	Universal Crane	●	●	
D.6	Monornil Hoist	●	●	
D.8	Monorell Hoist	●	●	
D.7	Jib Crane		●	
D.9	Over Head Crane	●	●	
D.85	Over Head Crane	●	●	
D.32	[illegible] Belt Mach.	●	●	
D.15	Roller Conveyor		●	
D.16	Roller Conveyor		●	
D.17	Doub.Row Roller Conv.		●	
D.34	Screw Conveyor	●	●	●
D.33	Air Conveyor FLO 3		●	
D.10	Moulding Mach. (3x)	●	●	●
D.11	Striper Moulding(2x)	●	●	●
D.42	Dust Collector		●	
D.43	Speed Mulling Mach.	●	●	
D.44	Shot Blasting		●	
D.45	Drum Type Shot Blst		●	
D.35	Belt Conveyor	●	●	●
D.54	Air Compressor.	●	●	
D.38	Sand Bin		●	
D.75	Anilling Furnace		●	
D.60	O v e n		●	
D.1 - 1	Induction Furnace dan peralatannya	●	●	●
D.1 - 2	Induction Furnace peralatannya	●	●	●
D.22	Oscilating Conveyor		●	●
D.23	Oscilating Conveyor		●	●
D.40	Over Head Conveyor	●	●	●
D.25	Bucket Elevator	●	●	●
D.39	Over Head Conveyor	●	●	●
D.20	Oscilating Conveyor		●	●
D.21	Oscilating Conveyor		●	●
D.71	Blower Control	●	●	
D.2	Graphit Crucible		●	
D.14	Roller Conveyor		●	
D.18	Shake Out Machine	●	●	●
D.19	Shake Out Machine	●	●	●
D.30	Bucket Elevator	●	●	●
D.24	Belt Conveyor	●	●	●
D.13	Sand Slinger	●	●	●

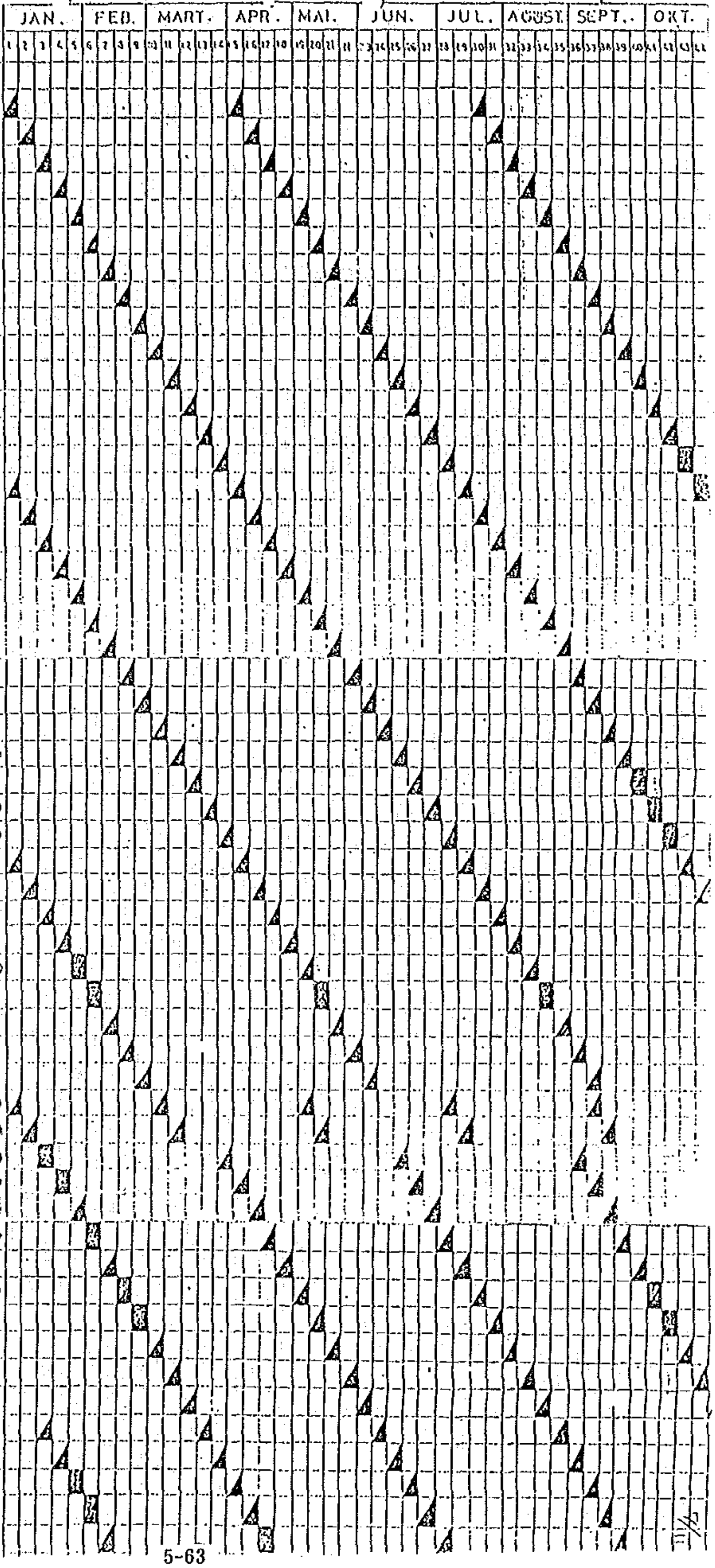
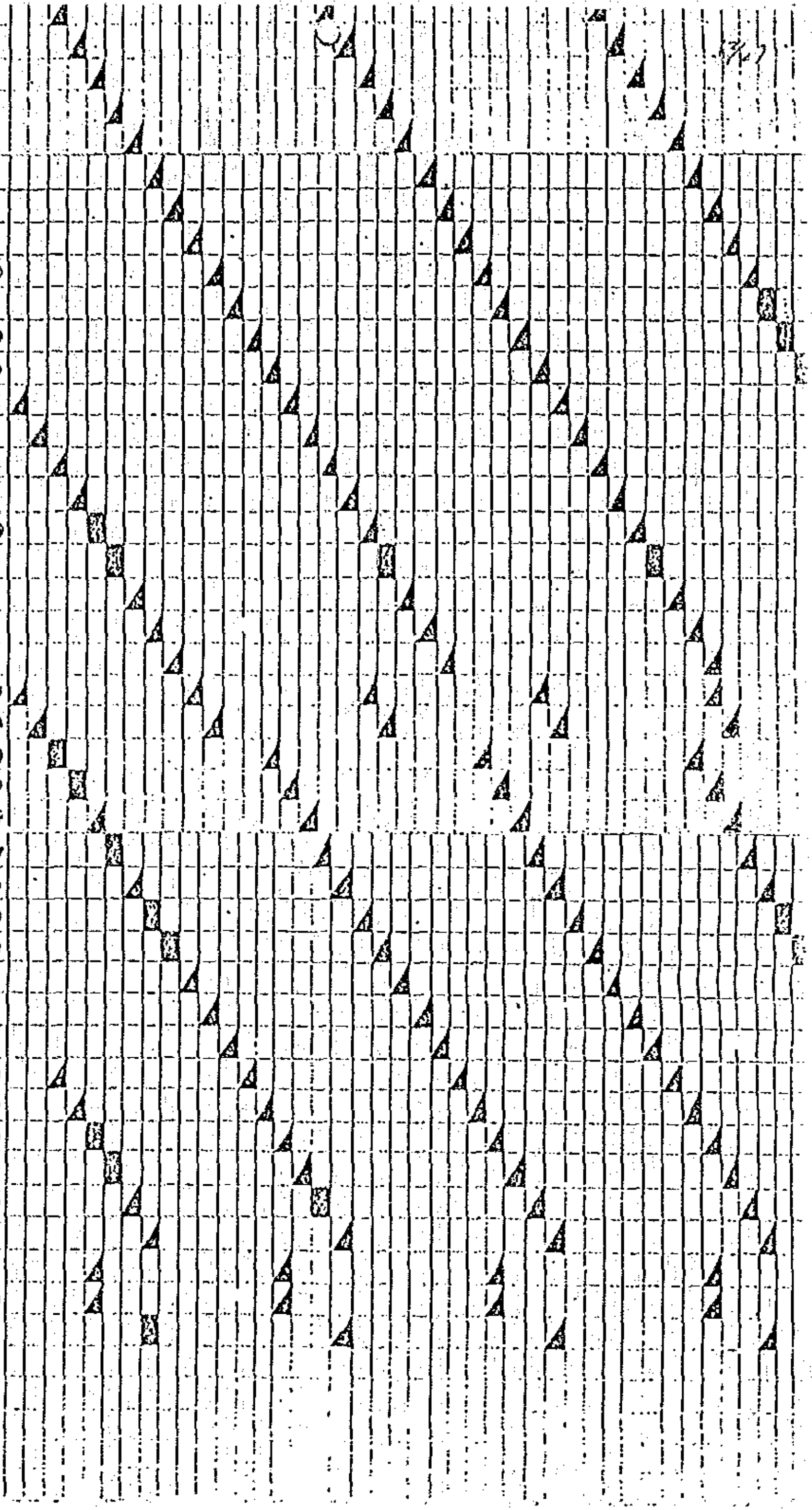


Fig. 5.3.4-2 Annual Maintenance Schedule (Continued)

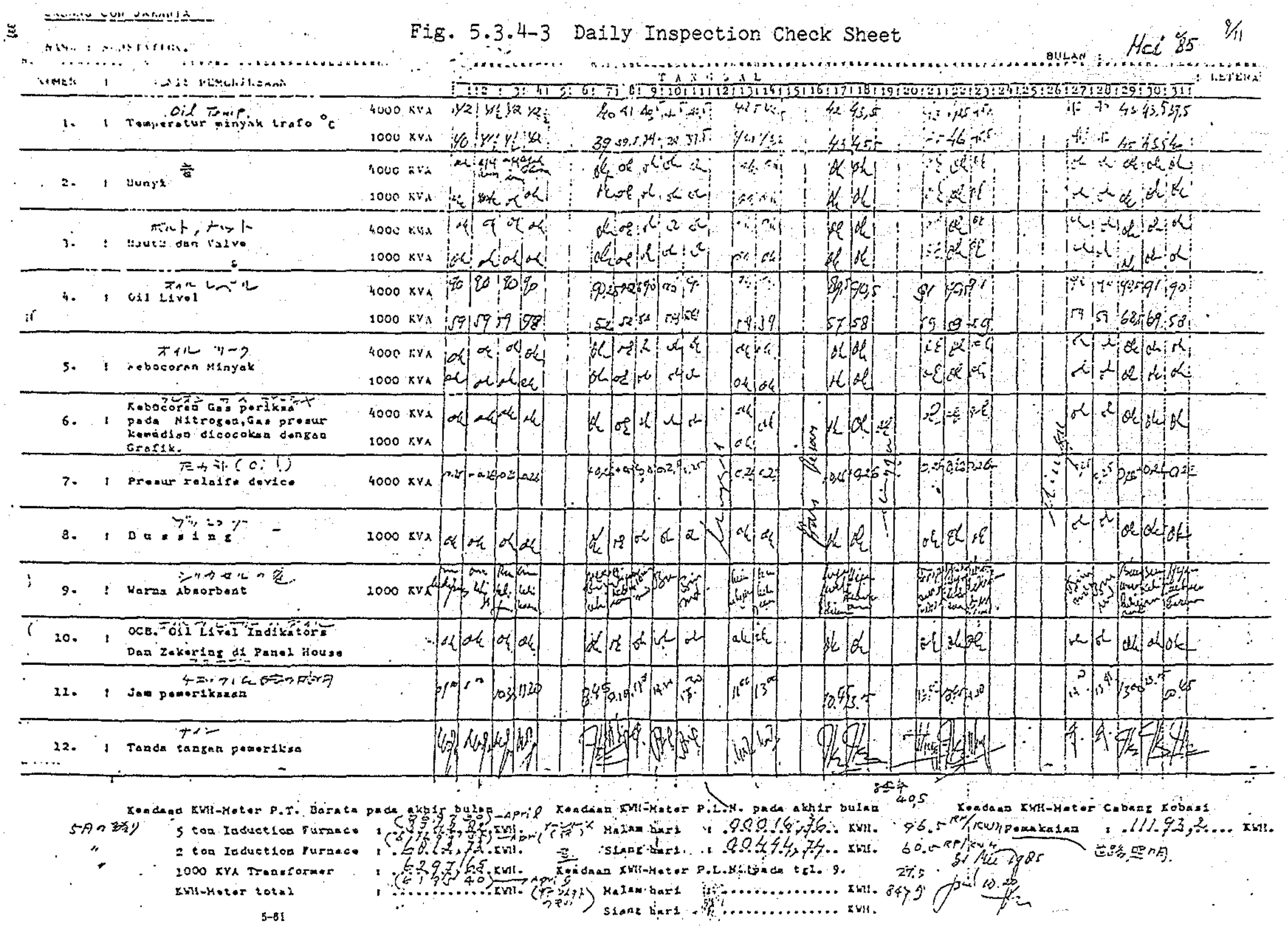
7.	D.8	Monorail Hoist	[illegible]	[illegible]	
18.	D.7	Jib Crane			
19.	D.9	Over Head Crane	[illegible]	[illegible]	
0.	D.85	Over Head Crane	[illegible]	[illegible]	
1.	D.12	Shockless Jolt Mach.	[illegible]	[illegible]	
2.	D.15	Roller Conveyor		[illegible]	
3.	D.16	Roller Conveyor		[illegible]	
4.	D.17	Doub.Row Roller Conv.		[illegible]	
5.	D.34	Screw Conveyor	[illegible]	[illegible]	[illegible]
6.	D.33	Air Conveyor FLO 3		[illegible]	
7.	D.10	Moulding Mach. (3x)	[illegible]	[illegible]	[illegible]
8.	D.11	Striper Moulding(2x)	[illegible]	[illegible]	[illegible]
9.	D.42	Dust Collector		[illegible]	
30.	D.43	Speed Mulling Mach.	[illegible]	[illegible]	
31.	D.44	Shot Blasting		[illegible]	
12.	D.45	Drum Type Shot Blst		[illegible]	
33.	D.35	Belt Conveyor	[illegible]	[illegible]	[illegible]
34.	D.54	Air Compressor	[illegible]	[illegible]	
35.	D.38	Sand Bin		[illegible]	
36.	D.75	Anilling Furnace		[illegible]	
37.	D.60	O v e n		[illegible]	
38.	D.1 − 1	Induction Furnace	[illegible]	[illegible]	[illegible]
39.	D.1 − 2	Induction Furnace	[illegible]	[illegible]	[illegible]
0.	D.22	Oscilating Conveyor		[illegible]	[illegible]
11.	D.23	Oscilating Conveyor		[illegible]	[illegible]
2.	D.40	Over Head Conveyor	[illegible]	[illegible]	[illegible]
3.	D.25	Bucket Elevator	[illegible]	[illegible]	[illegible]
4.	D.39	Over Head Conveyor	[illegible]	[illegible]	[illegible]
5.	D.20	Oscilating Conveyor		[illegible]	[illegible]
6.	D.21	Oscilating Conveyor		[illegible]	[illegible]
7.	D.71	Blower Control	[illegible]	[illegible]	
8.	D.2	Graphit Crusible		[illegible]	
9.	D.14	Roller Conveyor		[illegible]	
0.	D.18	Shake Out Machine	[illegible]	[illegible]	[illegible]
1.	D.19	Shake Out Machine	[illegible]	[illegible]	[illegible]
52.	D.30	Bucket Elevator	[illegible]	[illegible]	[illegible]
53.	D.24	Belt Conveyor	[illegible]	[illegible]	[illegible]
54.	D.13	Sand Slinger	[illegible]	[illegible]	[illegible]
55.	D.27	Sand Storage		[illegible]	
56.	D.31	Automatic Sand Mixer	[illegible]	[illegible]	
57.	D.36	Over Head Conveyor	[illegible]	[illegible]	[illegible]
58.	D.26	Breaker Screen	[illegible]	[illegible]	[illegible]
		2週間(ベアリング)			



Ⓢ [illegible]
定期・給油.
Ⓟ [illegible]
部分 チェック

▲ [illegible]
(オイル, 電気)
▨ [illegible]
オイル交換 (ギヤー ボックス

Fig. 5.3.4-3 Daily Inspection Check Sheet



BULAN : Mei '85 9/11

TANGGAL

NOMER	JENIS PEMERIKSAAN		KETERANGAN
1.	Oil Temp. Temperatur minyak trafo °C	4000 KVA 1000 KVA	
2.	音 Bunyi	4000 KVA 1000 KVA	
3.	ボルト，ナット Mautz dan Valve	4000 KVA 1000 KVA	
4.	オイル レベル Oil Livel	4000 KVA 1000 KVA	
5.	オイル リーク Kebocoran Minyak	4000 KVA 1000 KVA	
6.	Kebocoran Gas perikss pada Nitrogen,Gas presur kemedian dicocokan dengan Grafik.	4000 KVA 1000 KVA	
7.	圧力計（ ） Presur relaife device	4000 KVA	
8.	ブッシング B u s s i n g	1000 KVA	
9.	シリカゲルの色 Warna Absorbent	1000 KVA	
10.	OCB. Oil Livel Indikators Dan Zekering di Panel House		
11.	点検時間 Jam pemeriksaan		
12.	サイン Tanda tangan pemeriksa		

Keadaan KWH-Meter P.T. Barata pada akhir bulan — April

5月の残り 5 ton Induction Furnace : (8997,30) 8979,82 KWH. — April

" 2 ton Induction Furnace : 6812,72 KWH.

1000 KVA Transformer : 6297,65 KWH. (6173,40) — April 9

KWH-Meter total : ....KWH.

Keadaan KWH-Meter P.L.N. pada akhir bulan

Malam hari : 90016,76 KWH.

Siang hari : 90444,74 KWH.

Keadaan KWH-Meter P.L.N. pada tgl. 9.

Malam hari : .... KWH.

Siang hari : .... KWH.

405

96.5 Rp/KWH

60.0 Rp/KWH

27.5

8479

Keadaan KWH-Meter Cabang Kobasi

Pemakaian : 111.93,2... KWH.

31 Mei 1985

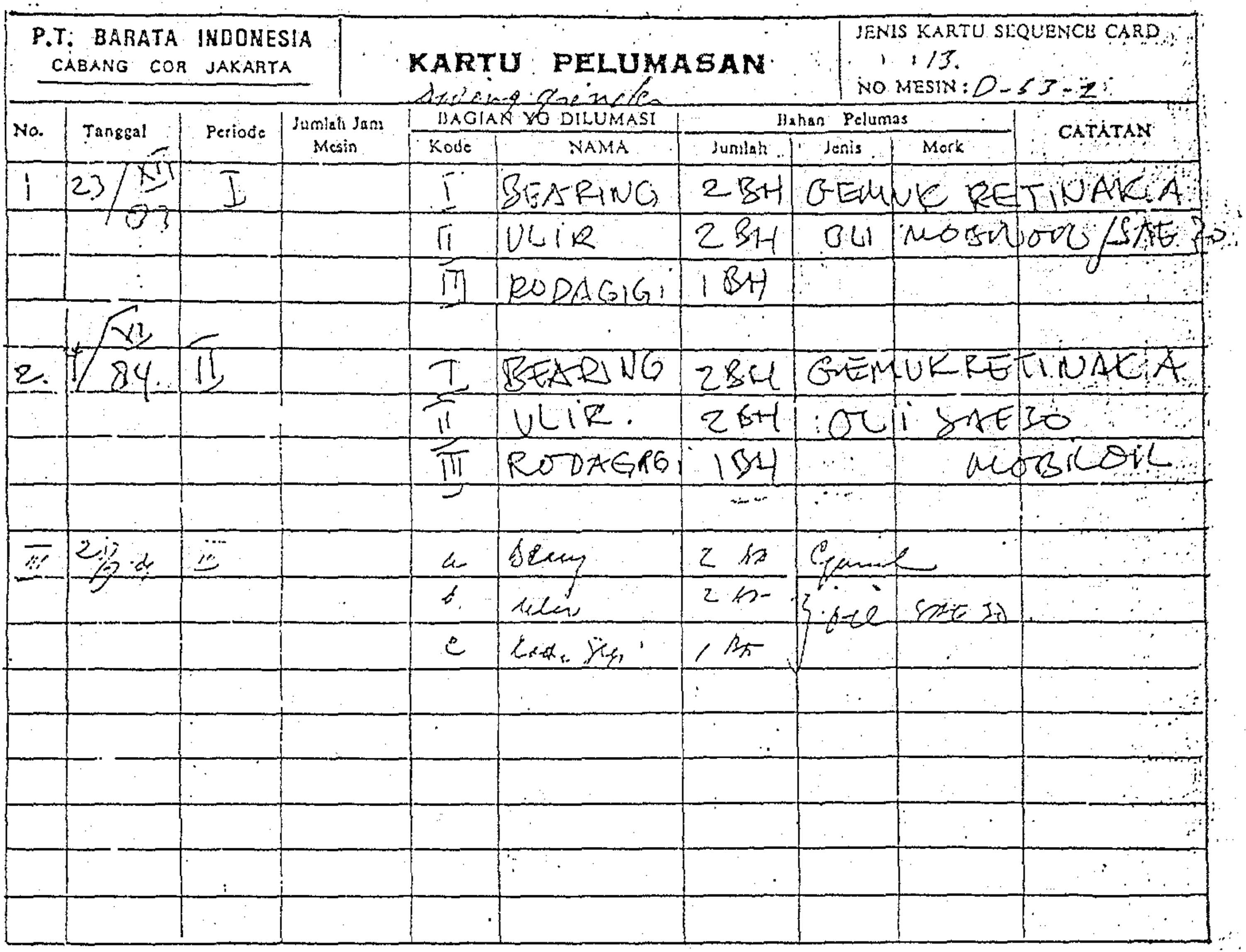
Juli 10.85

5-61

Fig. 5.3.4-4 CHeck Items for 5 Ton Furnace

BULAN : Nopember

NOMOR	NOMOR	JENIS PEMERIKSAAN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	29	30	31	KETER
	1.	インシュレイション コイル ISOLASI COIL DAPUR 目視	5 TON	ok	ok				ok	ok	[illegible]	[illegible]			ok	ok	ok	ok	ok	ok				ok		ok	ok	ok	ok	ok	ok	ok	ok			
			2 TON	ok	ok				ok	ok	[illegible]	[illegible]			ok	ok	ok	ok	ok	ok				ok		ok	ok	ok	ok	ok	ok	ok	ok			
	2.	水の圧力 TEKANAN AIR MASUK MAX. 4 Kg/CM^2	5 TON	2	2,5	[illegible]	[illegible]		2	2	2	[illegible]			4,5	4.	4,1	4,1	2	2				4,2		4,5	2	3,9	3,9	4.	4,1	4,1	2,8			
			2 TON	4	4.→ Operator				4	4,1	4.	[illegible]			4,1	2.	2	2	4,2	4,1				2		0,4	4,2	4,0	1,8	2.	2.	2	4,3			
	3.	水の使用量 200ℓ/分 DEBET AIR DARI COIL MAX. 12 - 15 H/H.	5TTON	6	6,5				5	6,5	5	[illegible]			6,5	4.	6,5	13	6,5	5				13,5		13,5	6,5	13	12,5	10	12,5	12,5	10			Tgl 17/11-84
			2TTON	9	9,5				7,5	9,5	10	[illegible]			8,5	5.	7.	6	9,5	10				13,5		10	3,5	4	4	6.	4,5	4,5	8,5			
	4.	水もれ (ホース等) KEBOCORAN AIR DARI SLANG, NEPEL & PIPA	5 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok	ok				ok		ok	ok	ok	ok	ok	baik	baik	baik			
			2 TON	[illegible]	baik				ok	baik	baik	[illegible]			baik	baik	baik	baik	baik	baik				baik		baik	baik	baik	baik	ok	ok	ok	ok			
	5.	ボルト, ナット 止 (コイル) BAUT SAMBUNGAN BUSHBAR DAN PENGIKAT COIL	5 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok	ok				ok		ok	ok	ok	ok	ok	ok	ok	ok			
			2 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok	ok				ok		ok	ok	ok	ok	ok	ok	ok	ok			
	6.	作動油 レベル (オイル) OIL LIVEL HIDROLIC	5 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok					ok		ok	ok		ok	ok	ok	ok	ok			
			2 TON	ok	baik				baik	baik	baik	[illegible]			baik	baik	ok	ok	baik	baik				baik		baik	baik		baik	ok	baik	baik	baik			
	7.	運転前 コントロールパネル CONTROL PANEL PERIKSA SEBELUM OPERASI	5 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok	ok	Minggu			ok		ok	ok	MINGGU	ok	ok	ok	ok	ok			
			2 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok	ok				ok		ok	ok		ok	ok	ok	ok	ok			
	8.	ヒューズ タイプ PEMASANGAN FUSE DAN MEMBUKA, COTROL KABEL^{2}NYA	5 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok	ok				ok		ok	ok		ok	ok	ok	ok	ok			
			2 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok	ok				ok		ok	ok		ok	ok	ok	ok	ok			
	9.	インプット電圧 VOLTAGE MASUK 3,3 KV	5 TON	1'	–			[illegible]	–	–	–	3'			–	~~ok~~	ok	3,3	3,20	ok				3,20		3,22	3,20	~~3,22~~	3,22	ok	3,22	3,24	–			
			2 TON	3,1	3,14				3,4	5,4	3,2	3,5			3,0	ok	3,3	3,4	3,3	3,3				3,5		~~3,20~~	3,15	3,15	3,15	ok	3,12	3,15	3,15			
	10.	水温 TEMPERATUR AIR SETELAH OPERASI MAX. 70°C	5 TON	40	30	–	–	[illegible]	–	50	30	30			40	37	40	42	30	30				40		50	10			40	52	52	30			
			2 TON	40	44		[illegible]		45	42	40	50		[illegible]	44	30	3	40	44	40				30		50	44		30	30	30	30	49			
	11.	油もれ (シリンダー) KEBOCORAN MINYAK DAN LIMIT STOP TAPING	5 TON	ok	ok		[illegible]		ok	ok	ok	ok		[illegible]	ok	ok	ok	ok	ok	ok				ok	ok	ok	ok		ok	ok	ok	ok	ok			
			2 TON	ok	ok				ok	ok	ok	ok			ok	ok	ok	ok	ok	ok				ok	ok	ok	ok		ok	ok	ok	ok	ok			



P.T. BARATA INDONESIA
CABANG COR JAKARTA

KARTU PELUMASAN
swing grinda

JENIS KARTU SEQUENCE CARD
1/13.
NO MESIN : D-53-2

No.	Tanggal	Periode	Jumlah Jam Mesin	BAGIAN YG DILUMASI		Bahan Pelumas			CATATAN
				Kode	NAMA	Jumlah	Jenis	Mork	
1	23/XII/83	I		I	BEARING	2 BH	GEMUK	RETINAK A	
				II	ULIR	2 BH	OLI	MOBILOIL/SAE 20	
				III	RODAGIGI	1 BH			
2.	1/XI/84.	II		I	BEARING	2 BH	GEMUK	RETINAK A	
				II	ULIR.	2 BH	OLI	SAE 30	
				III	RODAGIGI	1 BH		MOBILOIL	
III	[illegible]	III		a	Bearing	2 bh	Gemuk		
				b.	ulir	2 bh	oli	SAE 30	
				c	Roda gigi	1 bh			

Fig. 5.3.4-5 Check Items for Moulding Machine

5.4 Personnel organization

The present personnel organization and staffing are as presented in Fig. 5.4-1, which reveals the Foundry Center to be staffed by 190 including the Branch Manager. Table 5.4-1 gives the numbers of personnel staffing the Technical, Production Planning and Control, and the Production Departments. Operation in 2 shifts has today been replaced by day-work only, on account of insufficient work volume. Details of Production Department staff, by different trades, are given in Table 5.4-2.

As thus seen on above Fig. 5.4-1 the organization and staffing of JFC appears to be appropriate and balanced: This raises the question of why the production rate has dropped to the current extremely low figures, particularly since April 1985.

The results of survey would point toward delays in product deliveries to constitute a large factor in the present low production records. It appears that such delays in filling orders received are preventing the receipt of further orders to serve a market for castings that is far from being saturated.

Consequently, enhancement of production would be premised upon improvement of production capability, so as to lower the reject rate and hours lost in remedying defective intermediate products.

Such improvement of production capability should be realized through basic training in the fundamentals of working procedures for the shop-floor operators; what is even more important, however, is to inculcate in the foremen and middle management the principle that "quality must be built in at each stage of production". For this, the Production Department must be entrusted also with ensuring the requisite quality in their routine production operations and in the resulting intermediate products through all the stages of manufacture; the Technical Department should then be charged with assisting the Production Department with technical counsel and advice.

In view of the foregoing considerations, the Technical Department might more appropriately be transferred to a position of staff unit attached to the Factory Manager. In respect of staffing, more engineers - other than department managers - should be assigned to the various departments. This applies particularly to the Technical Department, to be charged with studying and planning measures for enhancing the quality of production operations, in order to assist the Production Department in enhancing the technical level of their operations and consequently the quality of their finished products.

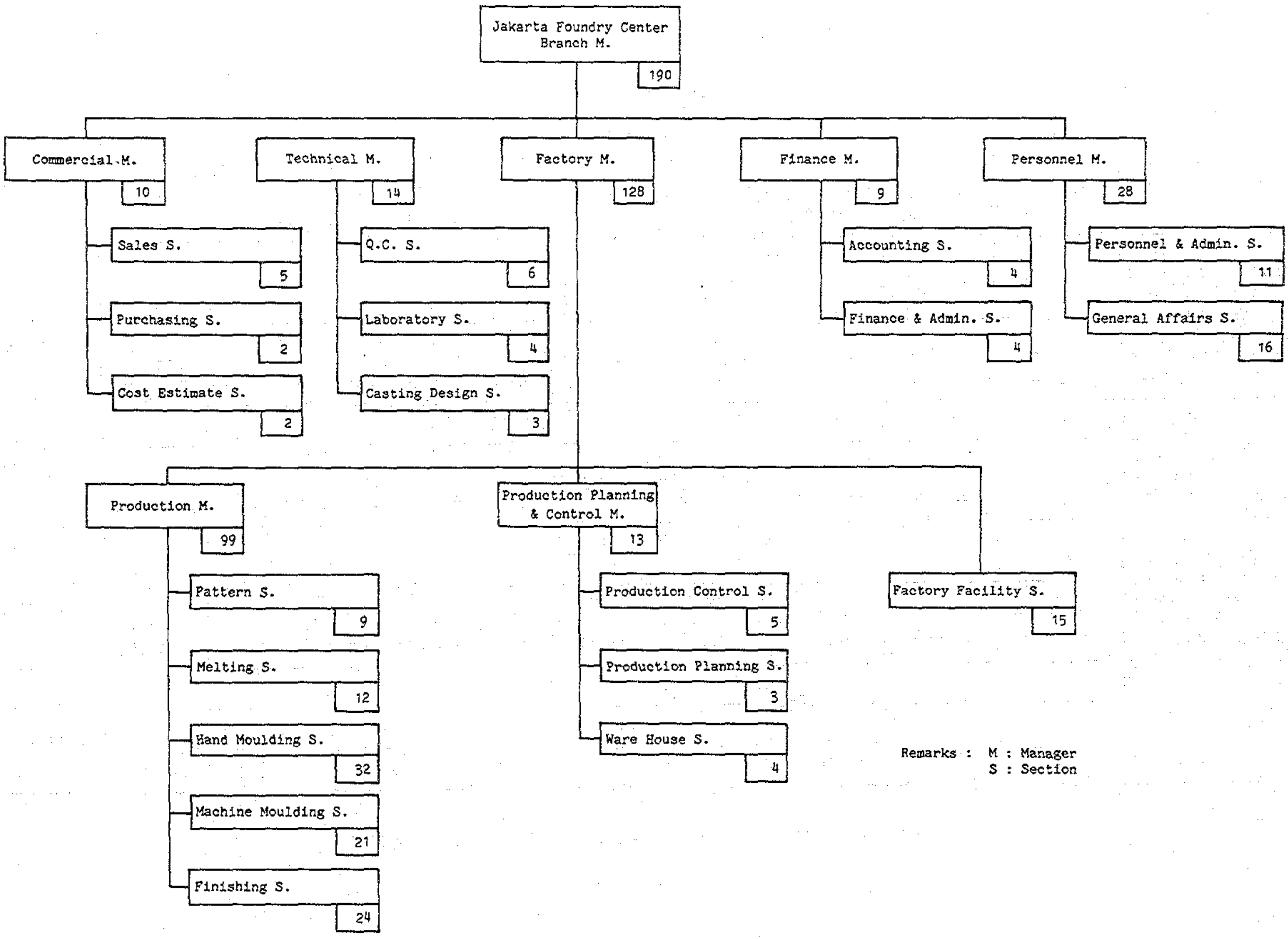
Table 5.4-1 The numbers of personnel staffing the Technical, Production Planning and Control, and the Production Department

Department	Section	Chief of Section	Engineer	Staff or Clerk	Direct Worker	Indirect Worker	Total
Technical	Q.C.	1	0	5	0	0	6
	Laboratory	1	0	3	0	0	4
	Casting Design	1	0	2	0	0	3
Production Planning & Control	Production Control	1	0	4	0	0	5
	Production Planning	1	0	2	0	0	3
	Ware House	1	0	3	0	0	4
Production	Pattern	1	0	0	8	0	9
	Melting	1	0	0	11	0	12
	Hand Moulding	1	0	0	31	0	32
	Machine Moulding	1	0	0	20	0	21
	Finishing	1	0	0	23	0	24
	Factory Facility	2	0	0	9	4	15

Remarks : Chief of section is superisor. Chiefs of Factory Facility Section are consist of 2 supervisors, one is mechanical, another one is electrical.
Factory Facility's indirect workers are crane and forklift operatior.

Table 5.4-2 Personnel distribution of Production Department

Pattern Section	Chief Section	Enginner	Staff or Clerk	Pattern Making	Pattern Inspection	Material Preparation	Pattern Strage	Others	Total	
	1	0	0	8	0	0	0	0	9	
Melting Section	Chief of Section	Engineer	Staff or Clerk	Melting	Laddle Preparation	Scrap Preparation	Pouring	Others	Total	Melting: including scrap preparation, Ladle preparation: including pouring
	1	0	0	6	5	0	0	0	12	
Hand Moulding Section	Chief of Section	Engineer	Staff or Clerk	Moulding	Core Making	Sand Preparation	Pouring	Others	Total	Moulding: including sand preparation, pouring and shaking out
	1	0	0	31	0	0	0	0	32	
Machine Moulding Section	Chief of Section	Engineer	Staff or Clerk	Mouling	Core Making	Sand Preparation	Pouring	Others	Total	Moulding: including pouring and shaking out, Core Making: including core making for hand mould
	1	0	0	11	6	3	0	0	21	
Finishing Section	Chief of Section	Engieer	Staff or Clerk	Shake out	Gas Cutting	Grinding	Repair Welding	Heat Treatment	Total	—
	1	0	0	0	3	15	3	2	24	



Remarks : M : Manager
S : Section

Fig. 5.4-1 Personnel Organization and Staffing

5.5 Production line, machine and equipment

Survey of the current production line, machinery and equipment of JFC has yielded the following results:

5.5.1 Production line

Viewed mainly from the aspect of molding, the production line consists of the following two major lines:

- o Small product line (machine molding)
- o Medium and large product line (hand molding)

The small product line consists of two FD-4 and three F-2A molding machines, served by a series of sand mixers feeding greensand to the molding machines, and a sand reclaiming unit

For molding medium and large products by hand, cement sand is used for facing sand and greensand for backing sand, with ramming provided by sand slinger.

Cement sand is supplied from a sand mill serving exclusively for the purpose, and backing sand is supplied from the green sand mixer and preparation unit referred to above, serving both machine and hand molding lines.

Cores for these two molding lines are molding made of CO_2 sand, molded.

Molten metal for pouring into the molds thus made is supplied from a low-frequency, 5-ton and medium-frequency 2-ton induction furnace, all pouring operations being carried out using overhead traveling crane.

After pouring, all molds are shaken out by machine, and the casting after shaking is transfered to finishing shop.

The product is them cleaned on either table or drum type shot blast machine, and further finished by swing or table grinder.

Patterns are supplied to the molding line from a pattern shop located close to the molding shop.

The layout of the foundry is shown in Fig. 5.5.1-1.

A problem inherent in the current system of production is the arrangement for processing of the molds made in the two-molding lines by one sand reclaiming unit. This results in green sand molds mingling with cement sand from to impair the room-temperature properties of green sand.

Measures for solving this problem are presented in Section 6.3.

Other problems observed on individual foundry equipment are discussed in the ensuring Section 5.5.2.

5.5.2 Machine and equipment

Table 5.5.2-1 lists the equipment which is discussed in what follows under the headings of equipment for:-

- Pattern-making
- Sand preparation
- Molding
- Melting
- Finishing
- Material handling
- Inspectin and testing

1) Pattern-making

Major equipment comprises cross cut, band and circular saws, woodwork lathe, universal pattern miller, grinder, surface plate for inspection.

Among these items, the woodwork lathe and universal pattern miller generate a large amount of wood dust in operation, to impair the work environment. No dust collecting device is currently provided, and requires to be installed.

Cutting work of wood which generate noize and dusts, and assemble work of wooden pattern are performed in the same floor. The two shops should be separated from each other, to improve the working environment, and enhance work efficiency. Moreover, the pattern shop is poorly lighted, and calls for, consideration in respect of illumination.

2) Sand preparation

Sand preparation equipment comprises, mainly a greensand mixing and reclaiming unit, a sand mill for mixing cement sand, and a primitive raw silica sand drier.

a) Green sand mixing and sand reclaiming unit

Green sand is mixed in a Simpson sand mill, equipped with wet-type dust collector.

This dust collector has badly damaged ducting, and a fan that is generating vibration, to the extent that continued operation will affect the dust collecting performance and consequently lower the quality of green sand.

The dust collecting system calls for immediate renewal.

The sand reclaiming unit has been discussed in Section 5.5.1. Measures for improving this unit will be presented in Section 6.3.

b) Raw sand drying

Raw sand is received undried, and is dried by a primitive device, which is incapable of properly drying the sand.

3) Molding

Apart from major molding facilities described in Section 5.3.1, there is a shockless molding machine for medium size castings, but which is currently not in use. The two FD-4 molding machines for small castings are effectively operating with their ancillary roller conveyor and traverser. The three F-2A machines, on the other hand, are currently stopped with their ancillary equipment dismantled.

The FD-4 machines have the pins and bushes on their flasks worn out, to frequently cause mismatch defects on the product castings.

The pins and bushes have been sent out for repair, but the firm is incapable of doing a satisfactory job. The measures urgently needed to deal with this difficulty will be discussed in Section 6.3.

Some of the flasks for hand-molding medium and large castings are worn, and require renewal. The molding plate used for hand-molding medium and large castings is insufficiently rigid, and deforms under the weight of flask and sand, to impair the levelness of parting plate. The surface plate needs to be strenghtened, or else replaced by one of adequate strength.

4) Melting

As mentioned in Section 5.5.1, the major melting equipment comprises 2 induction furnaces (5-ton low-frequency and 2-ton medium-frequency), and a crubcible furnace for nonferrous alloy.

The lifting magnet provided for charging the furnace, as well as for transfer of steel scrap, is out of order and unusable. It calls for urgent repair or else renewal if anrepairable.

For steel scrap, automobile press trimmings are used. This scrap has the disadvantage of being loose and bulky, and its large specific volume greatly impairs efficiency in handling and in charging. It also wastes power consumed in melting down. A scrap press requires to be installed for compacting the scrap into blocks.

The fan of cooling tower which supply cooled water for furnace coil has already broken. The cooling tower itself is badly leaking from corrosion.

Such a condition of cooling system is likely to lead to overheating and burn out of the coils. The cooling tower calls for urgent renewal.

5) Finishing

The major finishing equipment comprises one table type and one drum type shot blast machine, together with an annealing furnace and swing grinder. Also, several table grinders are installed.

6) Material handling

Two overhead traveling cranes both of 10 ton capacity, are available for molding and pouring work, and for handling product castings. For transportation, forklift trucks are used.

7) Inspection and testing

The inspection and testing equipment comprises those for testing mechanical tests on castings, for chemical analysis, for dimensional measurement on castings, and for determining the composition and temperature of molten metal.

The itmes of equipment are as follows:

- For sand testing: Sand rammer for forming sand test pieces, low-tap sieves, sand washing unit, moisture content measuring device, permiability tester; compression tester.

- For mechanical testing of castings: Universal tension tester, Brinell and Shore hardness testers, metallurgical microscope

For chemical analysis: Emission spectro meter.
For dimensional measurement of castings: Surface plate for marking-off, dial gauges, cylinder gauge, vernier calipers

For determining composition/temperature of molten metal: CE meter, optical pyrometer.

8) Environmental protection

A dust collecting system is provided on the greensand mixer and on the shot blast machine as measures for preventing atmospheric pollution.

Further measuers should have to be provided in the future, when regulatory restrictions on environmental pollution come to be strengthened with further progress of industrialization.

5.5.3 Utility

Compressed air is supplied from 2 compressors to the molding machiens, sand processing units and finishing grinder. The cooling tower for the compressor cooling water is out of order and not providing adequate cooling.

The tower is seriously dilapidated, and calls for renewal.

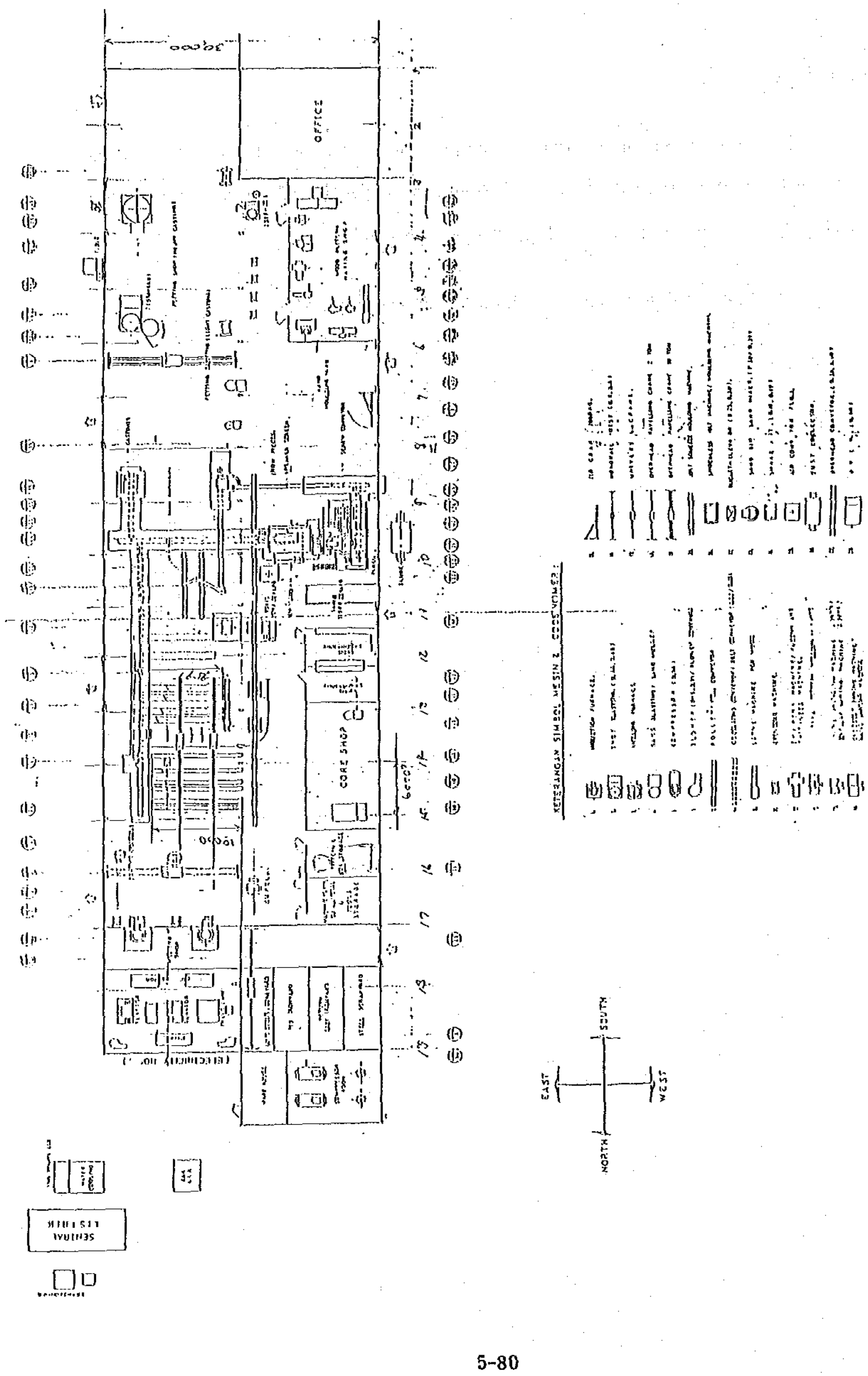


Fig. 5.5-1 Foundry Layout

Table 5.5.2-1

SPECIFICATION OF EQUIPMENT

P.T. BARATA METALWORKS & ENGINEERING JAKARTA FOUNDRY CENTER

Item No.	Description	Quantity
D. 1-1	Triple Frequency Crucible Induction Melting Furnace Manufacture: Fuji Electric Co., Ltd. Normal Capacity: 2,000 kgs Connected Load of Furnace: 1,400 kVA	1 set
D. 1-2	Main Frequency Crucible Induction Melting Furnace Manufacture: Fuji Electric Co., Ltd. Normal Capacity: 5,000 kgs Connected Load of Furnace: 1,450 kVA	1 set
D. 2	350 Kilograms Heavy Oil Fires, Crucible Furnace Manufacture: Nippon Kanetsu Kogyo Co., Ltd. Melting Capacity: 350 kgs (copper) per Batch Melting Hour: One hour (Continualy)	1 set
D.3	Universal Crane Manufacture: Kuwana Sangyo K.K.	1 set
D. 7	Jib Crane for Shockless Jolt Machine Manufacture: Kuwana Sangyo K.K. Capacity: 2 ton	1 set
D.9	10-Ton Capacity Cabin type Overhead Travelling Hoist Manufacture: Ito Industry Ltd. Type: Double rail, open cub type	2 sets
D. 10	Jolt Squeeze Moulding Machine Manufacture: Sintokogio Ltd. Model: F-2A Jolt Capacity: 300 kgs	3 sets
D. 11	Jolt Squeeze Stripper Moulding Machine Manufacture: Sintokogio Ltd. Model: FD-4 Jolt Capacity: 1,000 kgs	2 sets
D. 12	Shockless Jolt Machine Manufacture: Sintokogio Ltd. Model: VJ-3A Jolt Capacity: 3,000 kgs	1 set
D. 13	Hydraulic Stationary Sand Slinger Manufacture: Sintokogio Ltd. Model: DBS-25D Ramming Capacity: 0.25 m^3/min	1 set

Item No.	Description	Quantity
D. 14	Roller Conveyor for Jolt Machine Manufacture: Sintokogio Ltd. Model: RC-806	1 set
D. 15	Traverser Manufacture: Sintokogio Ltd. Model: TRA-217	1 set
D. 18	Shakeout Machine Manufacture: Sintokogio Ltd. Model: SHO-5 Max. Charging Capacity: 1,500 kgs	1 set
D. 19	Shakeout Machine Manufacture: Sintokogio Ltd. Model: SHO-10AZ Max. Charging Capacity: 4,500 kgs	1 set
D. 20	Oscillating Conveyor Manufacture: Sintokogio Ltd. Model: OC-5-6	1 set
D. 21	Oscillating Conveyor Manufacture: Sintokogio Ltd. Model: OC-5-9	2 sets
D. 22	Oscillating Conveyor Manufacture: Sintokogio Ltd. Model: OC-5-9	1 set
D. 23	Oscillating Conveyor Manufacture: Sintokogio Ltd. Model: OC-5-9	1 set
D. 24	Belt Conveyor Manufacture: Sintokogio Ltd. Model: BC-63-15	1 set
D. 25	Bucket Elevator Manufacture: Sintokogio Ltd. Model: BE-40A-12 Capacity: 40 Ton/H.	1 set
D. 26	Rotary Breaker Screen Manufacture: Sintokogio Ltd. Model: RCS-10A Treating Capacity: 40 m^3/hour	1 set

Item No.	Description	Quantity
D. 27	Sand Storage Manufacture: Sintokogio Ltd. Model: SS-35AJ Capacity: For Collected Sand: 30 m^3 For New Sand : 5 m^3	1 set
D. 30	Bucket Elevator Manufacture: Sintokogio Ltd. Model: BE-40A-13 Conveying Capacity: 40 ton/H.	1 set
D. 31	Automatic Sand Mixer Manufacture: Sintokogio Ltd. Model: MSF 1/2F (G)-C Capacity per Batch: 1,350 kgs	1 set
D. 33	Bond Conveying Device Manufacture: Sintokogio Ltd. Model: PLO-3A Tank Capacity: 0.3 m^3	1 set
D. 35	Belt Conveyor Manufacture: Sintokogio Ltd. Model: BC-5A Conveying Capacity: 30 ton/H.	2 sets
D. 36	Overhead Conveyor Manufacture: Sintokogio Ltd. Model: BCH-4D-15 Conveying Capacity: 30 ton/H.	1 set
D. 38	Sand Bin Manufacture: Sintokogio Ltd. Model: Bin-3 Tank Capacity: 3 m^3	1 set
D. 39	Belt Conveyor Manufacture: Sintokogio Ltd. Model: BCH-4B-14	1 set
D. 40	Overhead Conveyor Manufacture: Sintokogio Ltd. Model: BCH-4D-40 Conveying Capacity: 30 ton/H.	1 set
D. 42	Dust Collector Manufacture: Sintokogio Ltd. Model: BDC-40SH Capacity of Water Tank: 4,600 lt.	1 set

Item No.	Description	Quantity
D. 43	Junior Speedy Mulling Machine Manufacture: Nagoya Kiko Co., Ltd. Model: MSU-3C Capacity: 800 - 2,000 kg/h	2 sets
D. 44	Super Core Knockout Type Shot Blast Manufacture: Sintokogio Ltd. Model: STA-8KB Shot Tank Capacity: 4 tons	1 set
D. 45	Drum Type Shot Blast Manufacture: Sintokogio Ltd. Model: STB-2C	1 set
D. 53-1	Double Head Grinder Model: NHC-20VF Manufacture: Noritake Co., Ltd.	4 sets
D. 53-2	Swing Grinder Model: NSG-20 Manufacture: Noritake Co., Ltd. Grinding Wheel: 510 mm x 50 mm thickness	1 set
D. 53-4	Pneumatic Chisel & Grinder Manufacture: Nippon Pneumatic Kogio Ltd. Model: Chisel: AA-4 Grinder: NHG-200A	5 sets
D. 53-3	Abrasive Cutter Manufacture: Noritake Co., Ltd. Grinding Wheel: 455 mm x 3.5 mm thickness	1 set
D. 54	Air Compressor Manufacture: Hitachi Ltd. Model: I3-W-75 kW Stroke Capacity: 15.84 m^3/min	2 sets
D. 56-1	Cross cut Saw Manufacture: Kikukawa Iron Works, Inc.	1 set
D. 56-3	28" Band Saw Manufacture: Shimohira Manufacturing Co., Ltd. Model: JB-S70	1 set
D. 56-4	Tilting Arbor Variety Saw Manufacture: Tokai Works Co., Ltd.	1 set

Item No.	Description	Quantity
D. 56-5	Facing & Thickness Machine Manufacture: Kikukawa Iron Works Inc. Type: PW-12A	1 set
D. 56-6	Universal Pattern Miller Manufacture: Kikukawa Iron Works Inc. Type: NH	1 set
D. 56-7	Wood Lathe Manufacture: Hattori Iron Mfg. Co., Ltd. Model: HRL-6	1 set
D. 56-8	Band Saw Sharpener Manufacture: Tokai Netsushori Co., Ltd.	1 set
D. 56-9	Circular Saw Sharpener Manufacture: Tokai Netsushori Co., Ltd.	1 set
D. 56-10	Knife Grinder Manufacture: Takekawa Iron Works Co., Ltd.	1 set
D. 71	Cupola Blower & Starter Manufacture: Hitachi, Ltd. & Others Type: - Cupola Blower - Starter	1 set
D. 75	Multi Purpose Heat Treatment Furnace Manufacture: Nippon Kanetsu Kogio Co., Ltd.	1 set
D. 78	Mixer for Self Hardening Manufacture: Nagoya Kiko Co., Ltd. Model: MSU-3C	1 set
D. 80	Burnars for Oven Manufacture: Nippon Kanetsu Kogyo Co. Model: PLP-1	2 sets
D. 85	Lifting Magnet Manufacture: Hitachi Mfg. Ltd. Model: DA-B7	1 set

Jakarta, October 4, 1979

CHAPTER 6

RENOVATION PROGRAM

CHAPTER 6 RENOVATION PROGRAM

6.1 Basic Plan of Renovation

The market research shows that there is plenty of demand for the products of JFC. On this supposition, the production amount is planned to be 1,000 tons a year for the 1st year of the Plan, 1,800 tons a year for the 3rd year, 2,400 tons a year for the 6th year and 2,650 tons a year for the final year. As the technical capacity increases, high-grade products with greater added value will be produced. Here we would like to explain the outline of the basic plan to achieve these goals.

In the basic plan, emphasis is put on the management and technology aspects rather than facilities and equipment. First of all, engineers and workers shall acquire basic technique and skils to improve and stabilize product quality. And then high-grade products with greater added value shall be aimed at.

For this purpose, engineers and technians will be invited from abroad, and the furan process will be employed for foundry.

Introduction, renovation or replacement of equipment will be kept to a minimum level, i.e. only when they are needed for the furan process.

The basic plan has led to the more detailed plan concerning technology and equipment, which will be explained in 6.1.1 and hereafter. The relation between JFC's renovation plan and JICA's plan will be explained in 6.5.

6.1.1 Envisaged market

Castings are used, to larger or smaller extent, in almost all branches of industry, but as envisaged market for the renovated JFC, a selection was made of the most promising customer industries. The industries thus selected are those associated with:

(1) Sugar Industry
(2) Cement Industry
(3) Agriculture-based Machine and Equipment
(4) Paper Machine
(5) Steelmaking
(6) Transportation
(7) Electrical Equipment
(8) Civil Construction
(9) Machining Industry
(10) Mining and Energy

These ten branches of industry were further grouped into three categories in order of priority, as described in detail in Chapter 3, in consideration of (a) the policy of the Ministry of Industry, (b) the intentions of the JFC itself concerning the Renovation Project, (c) past performance of JFC, (d) its strong and weak points in organization and operation, (e) the role expected to be played as Government enterprise, (f) the Government program for promoting the use of domestically-manufactured components in industry, and as well as (g) the report of a previous survey by the Japan International Cooperation Agency.

The three groups in order of priority are:

Priority A -

- Agriculture-based Machine and Equipment
- Transportation
- Civil Construction
- Machining Industry
- Mining and Energy

Priority B -

- Steelmaking
- Electrical Equipment

Priority C -

- Sugar Industry
- Cement Industry
- Paper Industry.

The cast components of interest relevant to these branches of industry are:

Priority A branches -

- Agriculture-based Machine and Equipment: Diesel engine components. Flywheels are already being produced at JFC; other components that can be expected to be demanded include =

  = cylinder blocks

  = cylinder liners

  = gear boxes.

- Transportation: Dies for automotive factory press are already being produced at JFC; other cast products of promise include =
    - = railroad track shoulders
    - = general-purpose diesel engine components.

- Civil Construction: Counterweights for forklift trucks are already produced; other promising products include =
    - = other components for bulldozers, forklift trucks and other construction equipment.

- Machining Industry: This is a branch accorded the utmost priority in REPELITA IV, and a rapidly rising demand for cast components can be expected in this domain.

- Mining and Energy: Components for mine pumps are already produced. While a large demand for other cast products cannot be expected to arise in this domain, the current orders for pump components should be retained to provide a stable workload for JFC. Of possible interest in the petroleum-oriented sector are =
    - = bubble caps (currently imported).

<u>Priority B branches</u> -

- Steelmaking: Chilled rolls present a challengingly important demand, but the technical level required for their production would make it advisable to shelve plans for this product pending a future opportunity.

- Electrical Equipment: Counterweights for elevators present possibilities, but might be shelved in this instance.

Priority C branches -

- Sugar Industry
- Cement Industry
- Paper Industry.

These branches are accorded lowest priority in this instance, not for their being of small interest, but in consideration of the preventions as purveyor to these branches that should rightly be claimed by the Gresik and Surabaya Foundry Center.

Estimation of the expected demand for the cast components in the Priority A branches selected above proved that orders from these branches alone could well keep JFC in full operation.

What should be of concern for JFC is not the size of the market but how to secure the requisite share of this market, by gaining the reliance of customers through delivery of conformable quality products in good time at acceptable price.

The estimated demand for cast components of interest in the different Priority A branches is given in Table 6.1.1-1.

Table 6.1.1-1 Estimated Demand for Cast Components in the Priority "A" Branches of Industry

(Unit: Tons/year)

	Branch of Industry	Cast Components of Interest	Estimated Total Demand	Estimated Share for Jakarta Foundry Center
1.	Agriculture-based Machine/ equipment	Flywheels	260 - 814	50 - 100
		Cylinder blocks	455 - 1432	35 - 150
2.	Transportation	Shoulders	250	100 - 125
		Press dies	26 - 80	13 - 40
		General-use diesel engine components	382 - 2256	10 - 570
		Generator-drive diesel engine components	346 - 519	60 - 215
3.	Civil and Construction	Counterweights	1640 - 4100	300 - 800
4.	Machinery Industry	Lathe components	2133 - 5950	100 - 600
		Milling machine components	551 - 1000	50 - 180
5.	Mining and Energy	Pump components	300 - 420	150 - 200
		Bubble cap	300 - 600	100 - 250
6.	Public Works	Pipe fittings (manhole covers)	200	200

NOTE: The estimated annual demand values given above represent averages for the 10 years envisaged for the Renovation Project.

6.1.2 Basic principles for determining the product mix

For determining the product mix best suited to the renovated JFC, the basic principles to govern the kinds and quantities of the products to be envisaged manufacture require to take into account:-

- The scale of operation and production facilities of the present JFC
- The role expected to be played by JFC as Government-operated enterprise
- Obtaining the maximum effectiveness with minimum investment in equipment renovation.

1) Kinds/quantities of products to be manufactured

The current practice of producing in most part a wide range of castings in small lots is not conductive to efficient production, and to enhancement of technological capability, production efficiency and product quality. Appreciable improvement in these aspects should be ensurable by narrowing down the variety of products, and seeking to secure orders for castings in larger lots. This should consequently lead to significant reduction of production cost.

2) Product materials

The current wide range of castings in steel, iron, ductile iron and copper alloy should to advantage be rationally shared with the Gresik and Surabaya Foundry Center:

Jakarta	:	Iron and ductile iron castings
Gresik	:	Steel castings
Surabaya	:	Iron and non-ferrous castings

Considering the existing equipment and available ground at JFC, it is advisable to discontinue the production of both steel and iron castings, which call for operation of distinctly different kinds of equipment.

3) Product sizes

The current practice of indiscriminately producing castings of all sizes is occasioning such anomalies as molding press dies in a 3m x 3m flask.

Greensand mold castings should be limited to sizes suitable to molding with the FD-4 machine, i.e. pattern accommodatable within a 600 mm x 650 mm flask.

For castings by hand molding, the 1,500 mm x 1,500 mm flask should set the limit in size, premised on the use of furan sand.

Orders should not be accepted for products that impair efficient operation of JFC.

4) Product weights

Limitation of product size, as advised under the preceding heading 3) should automatically limit also the maximum unit weight of product. While depending to some extent on product wall thickness, a reasonable limit for unit product weight might be 3 tons.

5) Productivity

The foregoing measures for narrowing down the kinds, materials, sizes and weights of the products — to be processed in larger lots — should contribute appreciably to enhancing productivity. The time and effort spared from coping with the current bewildering variety of castings should be directed toward enhancing and stabilizing the level of production techniques, to improve the current disreputably low productivity level of 0.37 tons/man-month (70 tons/190 men-month) to at least 0.79

tons/man-month (150 tons/191 men-month), in say 3 years. This should only mark the first step in improving the productivity, which should be steadily raised through incessant effort, with ultimate target set at 1.15 tons/man-month (220 tons/191 men-month) at the end of the 10 year period envisaged for the Renovation Project.

6) Market

A tendency is discerned of hesitation on the part of JFC to market products being manufactured by private foundries, a case in point being flywheels for agricultural machinery. Such consideration for equitably sharing the market with private industry should not, however, prevent JFC from operating at an efficient rate of production. The Government-operated enterprise should consider itself bound to present a model also of sound business, as well as of technical capability. It is based on this principle that the share of the renovated JFC in the market has been envisaged in Table 6.1.1-2.

Table 6.1.2-1 Basic Principles to Govern the Product Mix in the Renovated JFC .

	Item	Current Practice	After Renovation
1	Kinds/quantities of products	Wide range in small lots	Narrow variety in large (or medium) lots
2	Product materials	Steel/iron/ductile iron/copper alloy castings	Iron/ductile iron castings
3	Product sizes	No limitation	Greensand mold castings: Moldable with FD-4 machine (600 mm x 560 mm flask max.) Hand molded (furan sand) castings: (1,500 mm x 1,500 mm flask max.)
4	Product weights	Ditto	3 tons/casting max.
5	Productivity	0.37 tons/man-month (70 tons/190 men-month)	0.79 tons/man-month (150 tons/191 men-month) in 3 years. 1.15 tons/man-month (220 tons/191 men-month) in 10 years.

6.1.3 Scheme of production

The scheme of production governing the 10 years envisaged for the Renovation Project is presented in Table 6.1.3-1, which has been drawn up taking into account the envisaged market and the basic principles to govern the product mix, set forth in the preceding chapters.

This scheme should be revised toward mid-Project (say in 1992) to follow any eventual changes or deviation from foreseen progress in the economic and technical circumstances and conditions.

The present scheme is founded on the following concept.

1) Production quantity

The envisaged progress of production quantity is presented graphically in Fig. 6.1.3-1.

(1) Initial phase (1986 - 1988, 1st to third year of renovation)

The total annual production is set at 1,000 tons for the first year of Renovation (1986). The underlying concept for the first phase of Renovation is to accord weight to establishing the basic production techniques, rather than to raising the quantity of castings produced — i.e. of firmly setting up the practice of delivering good castings in good time, which should not fail to contribute to subsequent increase of orders received, through enhanced reliance placed on JFC by the customers.

For the second half of the 1st phase (1988, 3rd year of Renovation), the target production is set at 1,800 tons/year, which is twice the current level, and which is considered attainable provided the concerted effort of all concerned in firmly rooting and improving the basic production techniques, and in reforming the business and production management organization and practice.

(2) Intermediate phase (1989 - 1991, 4th to 6th year of renovation)

The target production for 1991, 6th year of Renovation, is set at 2,400 tons/year. During this intermediate phase, the pace of production increase from one year to the next is relaxed to some extent, to permit devoting additional effort to acquiring new production techniques, to undertake the manufacture of products calling for more advanced production engineering and practice.

(3) Final phase (1992 - 1995, 7th to 10th year of renovation)

During this final phase, production is envisaged to level off at 2,600 - 2,650 tons/year, but continuing efforts are to be directed toward mastering the capability of manufacturing products requiring ever higher techniques. The changes to be brought to the quality of products — as opposed to quantity discussed above — are taken up under the ensuing heading 6.1.3.1.

2) Product mix

In consideration of the basic principle set forth under the heading 6.1.2 to narrow down the variety of products in determining the product mix of the Renovated JFC, the components of interest in the "Priority A" branches of industry given under the heading 6.1.1 (cf. Table 6.1.1-1) were further sifted for each of the successive phases.

(1) Initial phase (1st - 3rd years)

The 1st year should be spent in properly mastering the basic production engineering and practices, for which only the minimum variety of products should be taken in hand, with the aim set at steadily and stably ensuring the requisite quality on the products through all the stages of their manufacture.

The components advised to be manufactured during this 1st year of Renovation are:-

- Counterweights
- Pump components
- Lathe components
- Rail shoulders
- Bubble caps
- Pipe fittings.

Further, slack periods — when work on orders received would not suffice to keep the Foundry fully operating — should be utilized in producing stock articles such as manhole covers.

(2) Intermediate phase (4th - 6th years)

During the intermediate phase, the manufacture of general-use diesel engine components should be taken in hand, with the firm intention of playing a leading role in initiating the domestic manufacture of these components. This implies conversely that products already well mastered and whose production might appropriately be passed on to the private sector should be relinquished to private foundries. Products to be considered in this light should include, for instance, small flywheels and rail shoulders, followed by counterweights, whose production should be gradually reduced during this phase.

The new products of higher grade to be newly taken in hand should be centered around components for the BB1 general-use diesel engine. In readiness for this pioneer domestic production, necessary drawings should be obtained in advance for undertaking the requisite studies and preparations.

The components to be manufactured should be narrowed down to the principal parts of:-

- Cylinder liner
- Cylinder head
- Cylinder block (crank case).

(3) Final phase (7th to 10th years)

During the final phase, the manufacture of general-purpose diesle engine components should be set on firm footing, and that of generator-drive diesel engine components taken in hand. For the latter undertaking, the components to be taken up should again be limited to those that are most adapted for manufacture at JFC, such as:-

- Cylinder liner
- Cylinder head
- Piston
- Large flywheel.

Other large castings like crank case and oil pan should more appropriately be undertaken at JFC, where the facilities are more suited to the manufacture of castings of such size.

The main products of JFC at the end of the 10-year period would be:-

- Diesel engine components
- Machine tool components.

Effective mastery of all the technical aspects of manufacture of these components should contribute greatly to enhancing the level of technical capability of JFC, and the principle set forth above of relinquishing to private foundries the manufacture of products already fully familiarized at JFC should permit it to fulfill its expected function of disseminating foundry techniques and practice to the private sector.

3) JFC's share of the market

There could be plenty of demand for the products of JFC. As a leading state corporation, however, JFC is supposed to be reasoable in sharing the market. Thus JFC's share is set at below 50%.

As private enterprises grow, JFC should gradually hand over its market share and take to pioneer activities. Int this way JFC can keep the leadership in the industry.

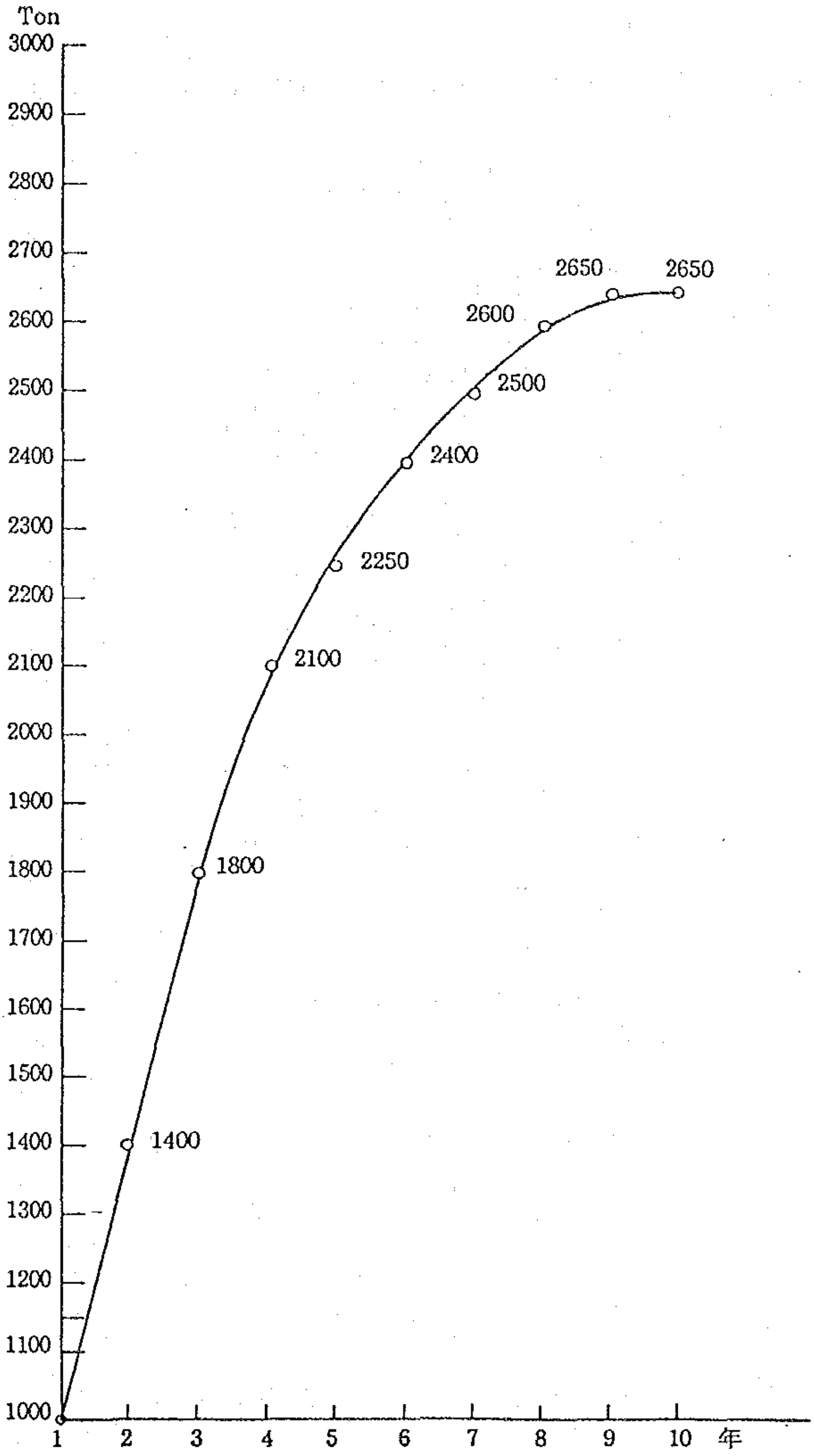
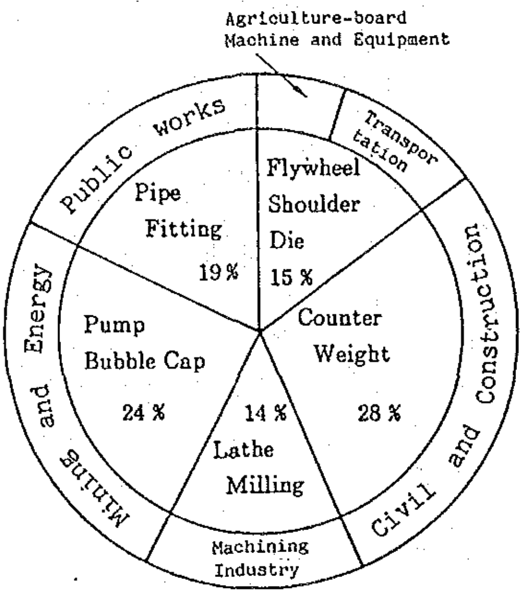


Fig. 6.1.3-1 Progress of Production Quantity Envisaged for Renovated Jakarta Foundry Center

1. Year of renovation

1st year of Renovation (total production: 1,000 tons/year)



2. Ending year of Renovation (total production: 2,650 tons/year)

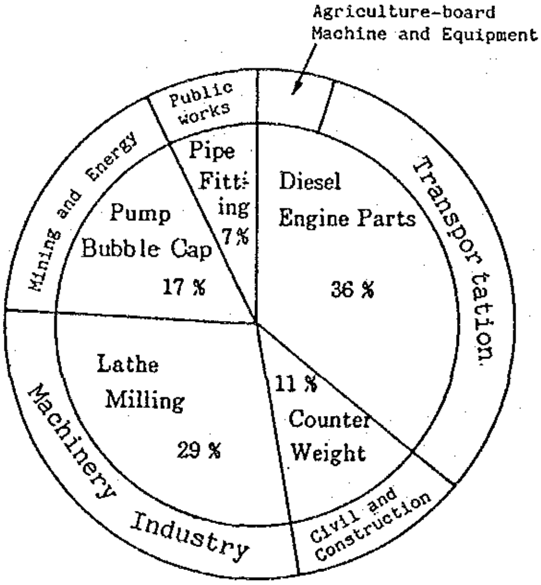


Fig. 6.1.3-2 Product Mixes at Initial and Ending Phases of Renovation Project

4) Types of castings to be produced

As already explained, the types of castings should be confined to FC and FCD. In addition, only certain grades of FC and FCD are to be produced.

(1) FC

In principle, FC 20 -30 is to be produce.

If, as is the case currently, a wide range of grades (FC 10 to 35) are supplied, it is difficult to keep the constant quality. In particular, putting FC10 - 15 into diesel engine or machine parts could result in difficulties in scrap and metal composition control. In other words, a great deal f trouble could be caused by the difference in structures, graphite shapes, sizes, etc.

Therefore, it is important to narow down the grade to correspond to the castings of the machine parts.

(2) FCD

The grades of FCD (spheroidal graphite cast iron) should be also limitted to 40 - 60, instead of taking all of the grades specified by JIS or DIN. For higher grades, alloy addition or heat treatment will be needed and quality stability is difficult to attain when the demand is small.

ALthough the production of high grade FCD could become possible with the increase of demand, at present it would be better to concentrate on above suggestion.

Table 6.1.3-1 Proposed Scheme of Production for Renovated Jakarta Foundry Center

Target Industry	Target products	Total demand (T/Y)	Unit weight	Pieces/ year	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
1. Agro-based machine and equipments	1) Flywheel	260 - 814	20 kg/piece		50T (19%)	70T (21%)	90T (23%)	100T (22%)	100T (20%)	80T (14%)	-	-	-	-
	2) Cylinder block	455 - 1432	35 kg/p							35T (4%)	70T (6%)	100T (8%)	150T (11%)	150T (10%)
2. Trans-portation	1) Shoulder	250	1 kg/p		100T (40%)	125T (50%)	125T (50%)	125T (50%)	125T (50%)					
	2) Press die	26 - 80	1 T - 3T		13T (50%)	13T (50%)	13T (50%)	40T (50%)	40T (50%)	40T (50%)	40T (50%)	40T (50%)	40T (50%)	40T (50%)
	3) Fly wheel	20 - 120	20 kg				10T (24%)	20T (38%)	30T (47%)	40T (53%)	-	-	-	-
	4) Cylinder liner	16 - 96	4 kg							10T (16%)	20T (29%)	30T (38%)	40T (46%)	50T (52%)
	5) Cylinder head	40 - 240	10 kg							30T (20%)	50T (29%)	80T (41%)	100T (46%)	120T (50%)
	6) Cylinder block	300 - 1,800	300 kg							50T (4%)	100T (8%)	200T (14%)	300T (18%)	400T (22%)
	7) Fly wheel	160 - 240	800 kg						60T (33%)	70T (36%)	80T (39%)	90T (41%)	100T (43%)	120T (50%)
	8) Cylinder liner	60 - 90	50 kg									10T (12%)	20T (23%)	30T (33%)
	9) Cylinder head	96 - 144	80 kg									15T (12%)	30T (22%)	50T (35%)
	10) Piston	30 - 45	25 kg									5T (12%)	10T (23%)	15T (33%)
3. Civil and construc-tion	1) Counter-weight	1640 - 4100	1.6 ton		300T (18%)	450T (24%)	650T (30%)	750T (30%)	800T (29%)	800T (27%)	800T (24%)	700T (20%)	500T (13%)	300T (7%)
4. Machining industry	1) Lathe parts	2133 - 5950	1 ton		100T (10%)	200T (18%)	300T (25%)	400T (30%)	400T (28%)	500T (32%)	550T (33%)	550T (31%)	550T (29%)	600T (30%)
	2) Milling machine	551 - 1000	1 ton		50T (10%)	70T (14%)	100T (19%)	150T (28%)	160T (29%)	170T (31%)	170T (30%)	170T (29%)	180T (31%)	180T (30%)
5. Mining and energy	1) Pump	300 - 420	1 ton		150T (50%)	150T (48%)	150T (46%)	170T (50%)	170T (48%)	180T (49%)	190T (50%)	200T (51%)	200T (49%)	200T (48%)
	2) Bubble cap	300 - 600	3 kg		100T (33%)	150T (45%)	180T (49%)	200T (50%)	200T (46%)	230T (50%)	250T (50%)	250T (47%)	250T (44%)	250T (42%)
6. Public	1) Pipe fitting	200	60 kg		200T (100%)	200T (100%)	200T (100%)	200T (100%)	200T (100%)	200T (100%)	200T (100%)	200T (100%)	200T (100%)	200T (100%)
	2) Manhole cover		200	50 kg		-	-	-	-	-	-	-	-	-
				Total	1063T	1428T	1818T	2155T	2285T	2435T	2520T	2640T	2670T	2705T
				Scheme of pro-duction	1000T	1400T	1800T	2100T	2250T	2400T	2500T	2600T	2650T	2650T

6.2 Management/technology renovation plan

6.2.1 Management and control

As repeatedly mentioed elsewhere in the present Report, management of the Jakarta Foundry Center is in a situation that calls for urgent remedial measures. The remedy is to rationalize all the operations of the Center — sales, production, shipment — so as to better fulfill the functions and role expected to be played by the Foundry Center as a model national foundry.

To succesfully implement the requisite remedial measures, the Foundry Center executives are called upon to devote every effort toward improving the situation, by enhancing their capabilities for administration and leadership, to exercise strict and equitable contorl over the plans and operations, as well as critical examination of results obtained, in the respective operating units.

1) Operation

As observed in Section 5.4, the current rate of production at JFC is extremely low, but with improvement of product quality realized upon renovation, increasing orders can be expected to be received, to call for enhancing the rate of production.

While the current production rate is far from approaching the ceiling of production capacity, and while the rate of production of salable products will rise appreciably through reduction of reject rate upon establishment of more effective quality control through all the stages of production, there are other measures that should contribute to further raising production, including enhancement of productivity in the molding and finishing stages.

Of primary importance for improving productivity is instruction/training of personnel to enhance the engineering capability and technical skills, which aspect is discussed in detail in Sctions 6.2.2.1) and 6.2.2.3).

In what follows, therefore, the discussion will be limited to the relation between product quality and production/productivity.

(1) Enhancement of product quality

Table 6.2.1-1 lists the principal measures envisaged for enhancing product quality, and the diminution of reject rate is terms of weight that can be expected to result from the measures.

Although not mentioned in the Table as measure directly aimed at improving product quality,the envisaged change of hand-molding process from the current cement sand process to furan sand process should contribute not only to raising productivity in the modling and finishing stages, but also at the same time reduce the generation of blowholes, pinholes, dimensional irregularities, burn-on and other casting defects, to consequently improve product quality.

As indicated in Table 6.2.1-1, the envisaged measures should reduce the reject rate from 18% in 1986 (assumed to remain unchanged from the actual figure for 1984) to 12% in 1987 and to 8% in 1988.

(2) Enhancement of productivity

The manhours actually spent at JFC in 1984 for the different stages of production are listed in Table 6.2.1-2. In the same year,, records indicate that 757.6 tons of finished castings were produced at JFC. The reject rate having been 18% for that year, it implies that, to produce the 757.6 tons of salable castings,molds to cover 757.6 ÷ (1 - 0.18) = 924 tons of castings had to be prepared. The molding Section of JFC is reported to have worked 64,571 manhours during the same year 1984, so that the molding productivity will have been

924 (tons) ÷ 64,571 manhours = 14.3 kg/manhour

This molding productivity of 14.3 kg/manhour has been taken as starting level for the envisaged progress of productivity given in Table 6.2.1-3, which lists the measures envisaged for enhancing productivity in molding. For 1986, a slightly lower figure than for 1984 has been estimated, for the reason that, as mentioned in Sections 6.1.2 and 6.1.3, there will be a change in the product mix upon initiation of the Renovation Project, so that a drop in productivity was considered unavoidable in the transition period before the personnel become familiarized with the modified operations.

As indicated in Table 6.2.1-3, productivity enhancement in molding will begin with the assignment of an expert instructor for guidance in basic operator skills, with change introduced at about the same time in molding process from cement to furan sand molding process. Another factor given in the same Table is the diminution of idle time with the increasing workload that should be expected from additional orders placed by clients finding JFC products to have been improved in quality. These factors are envisaged to raise the molding productivity to 18.0 kg/manhour already in 1987. With familiarization of the personnel with furan sand molding process, productivity is envisaged to further rise to 23.7 kg/manhour in 1989.

(3) Annual production

With lowered reject rate and other improvements brought to enhance the molding productivity, the annual production of JFC is envisaged to progress as shown in Fig. 6.2.1-1.

As given in Section 5.2.1, the number of workable manhours in molding is currently 7,365 manhours/month. Applying the same figure to 1986, the maximum quantity of castings producible would become

13.8 kg/manhour x 7,365 manhours/month x 12 months x 0.82

= 1,000 tons/year

By 1989, when 3 additional workers are envisaged to join the Molding Section from other trades (as described in Section 6.2.3), the workable manhours would attain 7,856 manhours/month, and combined with the enhancement of productivity, the annual production can be expected to attain about 2,100 tons.

Table 6.2.1-1 Envisaged Measures for Quality Enahncement and Expectable Consequent Diminution of Reject Rate

Year	Principal measures for quality enhancement	Reject rate by weight (%)
1986	———	18.0
'87	1) Assignment of expert engineer for instruction in establishment of technical and work standards 2) Assignment of expert technician for guidance in basic operator skills 3) Replacement of machine molding flask with resulting elimination of mismatch defects	12.0
'88	1) Enhancement of basic operator skills 2) Permeation among workers of "quality-mindedness".	8.0
'89	Enhanced quality control activity	6.0
'90	Ditto	5.0
'91	Ditto	4.5
'92	Ditto	4.0
'93	———	4.0
'94	———	4.0
'95	———	4.0

Table 6.2.1-2 Manhours Actually Spent at Jakarta Foundry Center during 1984 in Different Stages of Production

(Unit: man-hour)

Month	Pattern-making	Moulding	Melting	Finishing	Total
Jan.	1,392	6,960	1,392	2,784	12,528
Feb.	1,336	6,680	1,336	2,672	12,024
Mar.	1,432	3,759	1,074	2,327	8,592
Apr.	930	5,115	1,240	3,100	10,385
May	1,002	5,511	1,336	3,340	11,189
Jun.	918	5,049	1,224	3,060	10,251
Jul.	960	5,280	1,280	3,200	10,720
Aug.	1,008	5,544	1,344	3,360	11,256
Sep.	912	5,016	1,216	3,040	10,184
Oct.	1,086	5,973	1,448	3,620	12,127
Nov.	1,038	5,709	1,384	3,460	11,591
Dec.	954	3,975	1,113	2,226	8,268
Total	12,968	64,571	15,387	36,189	129,115

Table 6.2.1-3 Envisaged Measures for Productivity Enhancement, and Expectable Consequent Progress of Productivity

Year	Principal measures for molding productivity enhancement	Molding productivity (kg/manhour)
1986	————————	13.8
'87	1) Assignment of expert technician for guidance in basic operator skills 2) Rationalization of molding/finishing stages resulting from adoption of furan sand molding process 3) Diminution of idle time, through increased orders received, and consequently enhanced workload	18.0
'88	1) Enhanced worker skills 2) Diminution of idle time, through increased orders received, and consequently enhanced workload	22.1
'89	Familiarization with furan sand molding, resulting in rationalized operation in molding/finishing stages	23.7
'90	Ditto	25.1
'91	Additional installation of model FD-4 molding machines	26.7
'92	——	27.6
'93	——	28.7
'94	——	29.3
'95	——	29.3

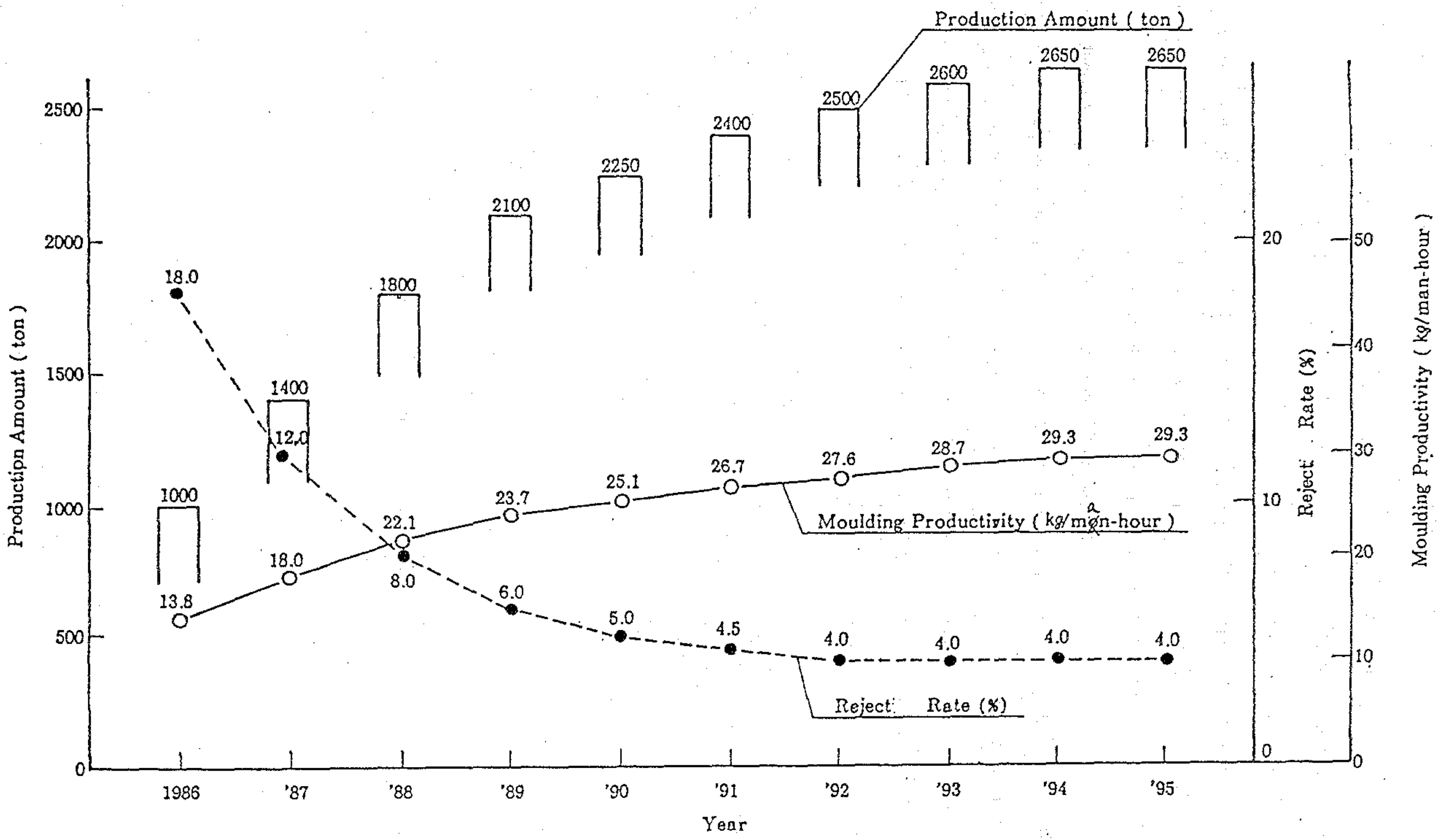


Fig. 6.2.1-1 Production Amount, Reject Rate & Moulding Productivity Plan

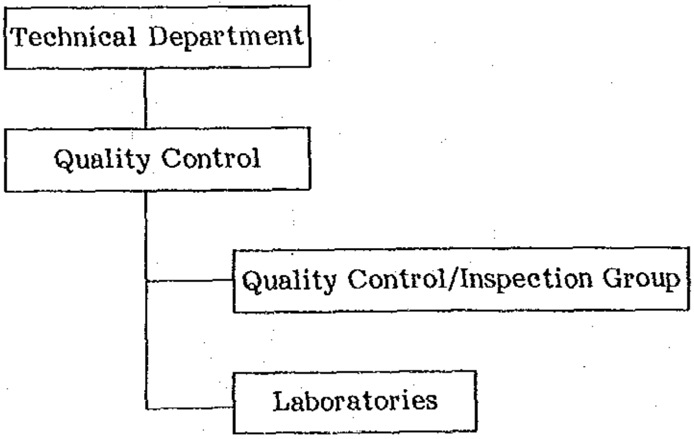
2) Quality control

(1) Organization

As observed under Section 5.2.2, quality control is currently organized at JFC largely on the principle of final product assessment, which is not conducive to positive and constructive quality control in its true modern concept.

The quality control organization requires to be adequately staffed to perform all the functions associated with advanced quality control and assurance functions, such as planning, checking, supervision,statistical treatment, planning/implementing system improvement, and customer relations. The Laboratories should also come under quality control, to constitute indispensable facilities for assessing the quality of products in all stages of manufacture.

a) Organization



b) Functions and staffing of the Quality Control Group

- Functions =
  - = Planning (drafting) product/workpiece quality specifications
  - = Planning (drafting) inspection standards
  - = Promoting the implementation of measures for improving workpiece/product quality
  - = Relations with customers concerning product quality
  - = Other functions conducive to enhancement of quality control techniques
  - = Timely assembly/processing of quality control records, to generate statistical data for use in quality assessment and in planning improvements.

- Staffing

A staff of 1 member should be assigned to perform the functions set forth above.

(2) Quality assurance system

There exists at JFC a flow chart indicating how the flow of work on quality assurance should proceed, which, if properly followed, should ensure quite well-organized quality assurance. Unfortunately, this does not appear to be the case, and the chart would not seem to be serving very much more than as an ornament. The current ineffectiveness of the quality assurance system can only be remedied by a firm and capable manager at the helm, who is determined to see the quality assurance system set properly on foot.

The requisite functions of an advanced quality control system are as set forth below.

a) Function of quality control

(a) At initial stage of engineering/design

- Properly grasp the requirements of the customer in respect of product quality; draw up specifications governing final product quality; check conformity of workpiece/product qualities with prescribed specifications.
- In collaboration with the Product Engineering Department, establish the quality level to be attained by workpieces issuing from each stage of manufacture
- To ensure attainment of the above quality levels, draw up standards for the acceptance of each kind of workpiece emerging from each stage of manufacture, and also for remedial measures that are authorized to be applied to minor unconformities.
- Before permitting production to start, make known the foregoing specifications, standards and other pertinent information — including problems encountered in previous jobs of similar nature — to all relevant departments (particularly those charged with manufacturing and engineering).

(b) During manufacture

- Inspect workpieces emerging from each stage, for conformity with prescribed standards; report results; decide disposition
- Compare prescribed and actually attained levels of workpiece quality at each stage of manufacture; report results; demand improvement measures as necessary.
- Inform in good time relevant departments (manufacturing, technical, production engineering, sales) of any inordinate generation of unconformities or other notable occurrences related to quality control
- Promote, in good time, measures for improvement, in collaboration with manufacturing and technical departments; follow up by ascertaining effective implementation of measures agreed to be applied.

(c) Final product

- Correctly grasp the situation of defect generation, and promote measures for improvement. Never depend on imagination in examining defects in products; for this, make a point of always recording in detail all circumstances of defect generation.
- In collaboration with relevant departments, devise concrete measures for preventing recurrence of specific defects; follow up by ascertaining effective implementation of the measures devised and adopted; see that the results gained from implementation of these measures are turned to profit in subsequent jobs.

(d) Customer relations; in-house promotion of quality control

- Represent JFC to customers on all matters relevant to quality assurance: Serve as channel through which the customer's quality requirements are transmitted to all relevant departments in JFC; serve also as monitor commissioned to see that the customer requirements are satisfied; make this mission of the Quality Control Group known to all departments concerned.
- Promote measures for preventing recurrence of defects: Encourage/assist the Production Department in taking the initiative to this end; follow up the measures by verifying the ensuing results.

(e) Statistical data compilation

Assemble/arrange/process in good time the accumulated quality control records, to compile statistical data useful for keeping track of the prevailing level of workpiece/product quality; compile data also to serve in devising measures for improvement.

The foregoing list enumerates the minimum basic functions requiring to be fulfilled by the Quality Control Group. Whether or not these functions will come to be properly performed will largely depend on the personal capability of the manager charged with directing this Group.

The establishment of strict quality inspection procedures and criteria will not automatically improve product quality. All personnel engaged in a productive activity should come to understand that quality is something that each must take part in building into the product by directly following the drawing indications and relevant instructions. When a defect is generated, the problem is to pinpoint "what went wrong", and "what measure could prevent its recurrence". The answer should be sought through untrammeled constructive discussions among all concerned. Quality is enhanced, not by strict inspection, but by awakening all personnel concerned to their mission of contributing toward a better quality product, by each bringing his ingenuity to bear on how the job assigned to him might done in a better manner. One effective practice conducive to such motivation is the "suggestion box" system, with awards conferred to suggestions that have proved upon implementation to have been effective.

b) Quality control manual

Selection of the items to be controlled by the quality control system is an important operation that can profoundly affect the quality assurance capability.

As a first step, the following items might appropriately be taken up at JFC, for incorporation in the quality control manual that requires to be established.

- Quality control organization
- Inquiries/orders received, technical measures for meeting product quality requirements
- Documentation
- Remedial welding
- Heat treatment