- Tests/inspections; certification
- Measuring/testing instrument calibration/maintenance

For each of the above items, the manual should prescribe:

- Designation of relevant document
- Form No.
- By whom drafted
- By whom checked
- By whom approved
- To whom distributed
- Original document under custody of whom

The mode of controlling each item should be clearly prescribed, in reference to the six factors of "who", "what", "where", "when", "why" and "how", in so far as applicable.

All the prescriptions of the manual must be practically enforceable. The manual must be subject to a working system for updating, whereby the substance is periodically reviewed to maintain its operability under current circumstances, and adequacy to meet current needs.

(3) Statistical data

There currently exist no adequate statistical data such as to permit tracing the progress of data on quality control activities at JFC. it needs to be recognized that the present level of product quality and the technical capability supporting this capability represent the accumulated fruit of the efforts laboriously contributed by precedessors through the years. Whether successful and unsuccessful, the records of such endeavors constitute valuable data to serve in considering the next step to be adopted for improving the quality control system, and for this reason, form a precious heritage of technological achievement.

Such being the case, the Quality Control Group should make a point of assembling the records enumerated below, and to make effective use of the filed information.

a) Defect data by kind of product

(a) Monthly data, by kind of defect, and by data: The current practice of recording daily numbers (weights) of defective products generated, and data on the nature of defects detected, should be extended by compiling a "List of Defects Detected", containing sketches indicating the positions of defect, defect sizes and characteristics.

(b) Monthly statistics on defect generation: This should be regularly compiled.

(c) Graphic representation: The tabulated data should additionally be represented graphically in chart form, and plotted every day, for comparing with the target defect rate accumulation line inscribed in advance in the chart.

(d) If the plots come to indicate an inordinately high defect rate, the measure adopted to prevent recurrence should be noted in the chart.

(e) Every month, a Pareto diagram should be drawn, relating the kinds of defect to their rate of generation.

b) Monthly statistics on defect generation

(a) Monthly defect generation rate should be recorded by kind of defect, in terms of both aggregate weight and number of pieces.

(b) Every month, plot the defect generation rate, for comparison with the target defect rate line inscribed in advance in the chart.

(c) Every month pareto diagram should be drawn, Relating the kinds of products to their rate of generation.

(d) Every month, a Pareto diagram should be drawn relating the kind of defect of their rate of generation.

(e) Also one relating kind of defect to rate of defect generation.

Clear pointout for countermeasures for inordinately high defect rate.

c) Annual statistics and other data

The monthly records derived above should be further compiled into annual records indicating the progress from month to month, to provide a macroscopic picture of the quality control status and progress, and to serve in planning improvement measures.

Other ad hoc defect statistics should also be compiled as necessary.

Upon implementation of an improvement measure, or other quality control activity, a report should be made, containing details of the measure adopted, as described in the ensuing Section.

(4) Activities for improving quality control

Meetings for discussing quality control are not actively held in current practice at JFC. Quality study meetings should be held at prescribed intervals, and further supplemented with ad hoc meetings to examine particular cases.

a) Weekly quality study meetings

Weekly meetings should be held to study the defects generated during the past week. For these meetings, it is essential that:

(a) They should never adjourn without determining who should do what and how by when.

(b) Minutes of the meeting should be drawn up, and confirmed at the ensuing meeting.

In other words,

(a) The quality study meetings must never degenerate into a talking party.

(b) The discussions must never deviate from observed facts and be allowed to digress into conjectures. For this, one measure is to have the defective product brought before the meeting as evidence, or to have the participants visit the relevant shop before start of the meeting.

b) Monthly quality study meetings

A written report should be prepared beforehand, reviewing the progress of quality data in relation to quality control activities, the quality control activities undertaken in collaboration with the relevant departments, and other results noted in quality control activity, all based on factual data. This report must serve as basis for pinpointing major outstanding problems and for discussing pertinent countermeasures.

The Factory Manager should preside at the monthly meetings.

c) Annual quality study meetings

Based on a written report prepared for the occasion, annual quality study meetings should review the progress of quality data covering the past year, to pinpoint outstanding problems, an to discuss pertinent counter-measures, to serve in establishing the targets for the ensuing year.

d) Customer relations; meetings with customers

In the event of a delivered product proving to be defective, a member of the Quality Control Group should lose no time in contacting the customer, to attentively gather the substance of the customer's claim, and to examine the actual defect. The measure to be adopted to cope with the situation should be speedily determined, and a report submitted to the customer.

With particularly important customers, regular quality study meetings should be held every 1 to 3 months, or other pertinent action should be taken to manifest the positive approach adopted at JFC on matters of quality assurance.

e) Records of quality control activities

Meeting minutes should always be drawn up covering each of the meetings described in the preceding Sections. The meeting minutes should be filed by the Quality Control Group for ready reference, together with the reports prepared for the monthly and annual meetings, and those submitted to customers.

Other reports recording the quality control activities should include those on the quality obtained on trially manufactured products.

f) Quality specifications

Previous agreement with customer on the level of quality to be assured on the product to be delivered will not only provide the Production Department with necessary information on the requirements governing manufacture but also serve to prevent eventual dispute with customer concerning product quality.

The quality specifications should cover, for instance:-

- Material
- Chemical composition
- Mechanical properties (tensile/bending strength, elongation, hardness, impact value)
- Metallographic structure
- Dimensional tolerances, machining allowance tolerances, eccentricity tolerance
- Unconformity acceptance criteria
- Remedial measures to be adopted for minor unconformities

- Mode of test piece sampling and test piece size
- Heat treatment.

Such specification — even if not prescribed by customer in accordance with their standards — should be established in agreement with the customer, and the quality specifications thus established should be made known to relevant departments in JFC.

(5) Quality standards

In-house quality standards should indispensably be established to serve as criteria for judging the quality of workpieces/products processed.

a) Universal standards

Standards applicable in principle to all products should govern:

(a) Dimensional tolerances of cast products

(b) Surface defects

(c) Internal defects

(d) Mechanical properties

(e) Chemical composition

(f) Microstructure.

b) Particular standards

Where applicable, special specifications governing individual products call for the establishment of particular standards, to ensure conformity with the relevant specifications.

c) Standards governing manipulation/calibration/maintenance of testing/inspection equipment

(6) Testing/inspection equipment; their location

The existing equipment for testing/inspection should suffice for the time being, with certain additions as indicated in the ensuing Section. For adequately performing the requisite testing/inspection operations, however, the most effective and efficient use must be made of the available equipment.

a) Additional equipment requiring to be acquired

- Inspection surface plate:

  1 of 1.5m x 2.0m

- Square for holding pieces and determing their verticality:

  1 of 500 mm x 1,000 mm

  1 of 300 mm x 600 mm

- Scribing block for marking at given height:

  1 of 600 mm

  1 of 300 mm

- Height gauge with shrinkage scale:

  1 of 1,000 mm.

The above list of equipment is specified envisaging the manufacture of castings measuring up to 1,500 mm x 1,500 mm.

b) Location of facility for scribing and inspection

The product inspection facility is currently located inconveniently, in the building No. 2 outside the line of flow of products emerging from the foundry. For more efficient operation, the facility should be moved to a location directly downstream of the final processing station, i.e. shot blasting and grinding. The facility

need not be under cover — as in the current location — but should be conveniently located/arranged for product manipulation by crane.

(7) Customer relations

As pointed out elsewhere in this report, customer reputation for the quality of JFC products is not favorable. This is ascribable not only to inadequate mastery of production techniques but also to insufficient quality control activity. The practice requires urgently to be established of correctly grasping the substance of customer claims and complaints concerning product quality, and seriously endeavoring to solve the problems encountered. Extending the market for JFC products can only be ensured by first recovering customer reputation, through immediate grasp of customer claims, followed by timely adoption of effective counter-measures, to ensure avoidance of recurring defects, and thus coming to deliver satisfactory products that do not fail to satisfy the customer.

Prime priority should be accorded by the Quality Control Group to its function of correctly understanding customer requirements related to product quality, followed by correctly sounding customer satisfaction for the delivered products, to assess the effectiveness of the quality control measures applied, and analyze the cause of any customer dissatisfaction in order to devise appropriate counter-measures.

Customer requirements generally concern quality, price and/or delivery period. In particular respect of quality, the Quality Control Group should make a point of opportunely visiting customers to sound their views on the quality of products delivered, and if a complaint is heard, to react with appropriate counter-measures applied in subsequent production, or else meetings should be held with customers at regular intervals to discuss quality problems, as already mentioned, to ensure proper follow-up, monitoring, and reporting to customer. The ultimate objective is to gain customer reliance on product quality.

(8) Quality control that should govern each stage of manufacture

The classic approach to quality assurance was to apply quality control as a means of diminishing the rate of defect generation. This is a passive approach and will never serve to reach the root of the quality control problem. The advanced active approach to quality control is to eliminate the causes of defect generation, through analysis of the mechanism of defect generation, through diagnosis of manufacturing process, and through application of defect-preventive measures to the early stages of engineering and design. Prescriptions governing quality should be applied through every stage of manufacturing, from receipt of customer drawings/specifications and molding design, through pattern-making, molding, melting, as well as the purchase of raw materials and sand/additives, sand mixing, furnace tapping, pouring, shaking-out, shot-blasting, inspection of product/material by sampling/100% inspection, and shipment. The quality prescriptions should specify:-

- Items to be checked
- Acceptance criteria (level of quality requiring to be satisfied),

and a system should be firmly established to ensure that all workpieces emerging from every stage of manufacturing present quality characteristics falling within the prescribed range of acceptance.

To summarize, the essential points of quality control are:

a) Determine the conditions of processing, based on quality considerations, and strive to minimize fluctuations in the quality of workpieces emerging from each stage of manufacturing.

b) Let the principle of "quality first" pervade throughout the production line; assess the beneficial effect of quality control activities by their impact on the overall production cost.

c) Bear in view that the ultimate aim of quality improvement is to cultivate customer satisfaction and reliance.

The basic principle should be to minimize quality fluctuations within the prescribed range of acceptance, with the end view of reducing defect generation to zero. The prescribed acceptance range should, however, be of a practically attainable level in day-to-day operation, or else it will only obstruct the flow of production. Quality can be enhanced only by constantly reviewing the current practices and processes with the aim held in mind of improving workpiece quality, and by gradually raising the acceptance standards in keeping with improvements gained in the technical capability of the production line.

3) Cost accounting system

The system adopted for cost accounting must be matched to the mode or condition under which the production is effected. The different systems practiced for cost accounting are cited in Table 6.2.1-4, together with the mode of production to which they are suited. The modes of production are listed from left to right with gradually increasing tendency from mass production to order-made individual manufacture. Foundry work will fall within a certain range of production modes indicated in Table 6.2.1-4 by the symbols "b" and "c". The ensuing description will therefore cover the corresponding accounting systems "2", "3" and "4".

(1) Process cost accounting (systems "2", "3", "4" in Table 6.2.1-4)

a) Simple process cost accounting (System "2")

In the simple process cost accounting system, all the expenditures incurred during an accounting period are totalized, to the result of which is added the value of work in progress at beginning of period, which aggregate is separated into work completed and work in progress at end of period, to derive the integrated cost of work completed, which cost is then divided equally among units of products manufactured to yield the unit product cost. This system calls for assessing individually the degree of

completion of work in progress at end of period, the resulting factors then being applied to the number of pieces presenting the relevant degree of completion to derive the equivalent number of pieces completed. Correct performance of this assessment may not be an easily performed operation: One expedient to avoid this difficulty is to estimated the degree of completion represented by products at the different stages of processing — in consideration for instance of the amounts of direct materials and labor expended up to that stage — and to consider all workpieces at a given stage of processing to commonly represent the relevant degree of completion. If no significant variations in the value of work in progress prove to be marked from period to period, the work in progress could well be excluded from consideration. This simplification is also resorted to when the assessment of work in progress at end of period proves to be excessively onerous.

The characteristic features of the simple process accounting system can be presented in the following tabulated form.

	INPUT	=		OUTPUT
A:	Work in progress at beginning of period		C:	Integrated cost of products through period
B:	Manufacturing expenses during period		D:	Work in progress at end of period

$$A + B = C + D$$

(Integrated cost of products through period)

/(Total quantity of products completed during period)

= Prime unit cost of products

If, for instance,

- Work in progress at beginning of period (A) ¥2,000,000
- Manufacturing expneses during period (B) ¥42,200,000
- Work in progress at end of period (D) ¥3,000,000
- Integrated cost of products through period (C=A+B-D) ¥41,200,000

Further, if:

- Quantity of products produced during period 220 tons,

then, unit manufacturing cost

= ¥41,200,000 + 220 tons = ¥187,272 per ton.

b) Class cost system (System "3")

Class cost system is a variant of the system "2" described above, the difference being that the unit product value is graded by product quality, through assignment to each grade of product a coefficient representing the product quality. This grade coefficient is determined by collaboration between the cost accounting and the technical departments, for different grades classified by appropriate factors such as weight, size, purity, hardness, heat consumed in production, based on standard manufacturing cost derived from standard quantities of material/labor expended, or else from statistical data.

The grade coefficient for each grade of product thus determined are applied to the actual quantities manufactured during the period, to derive the equivalent quantities produced, converted to uniform quality.

For instance, if 4 grades of product "A" to "D" are assigned grade coefficients 0.6, 0.8, 1.2 and 1.0 (standard grade), respectively, of which 30, 50, 40 and 100 tons were actually manufactured during the period, then:

Grade	Quantities actually manufactured (tons)	Grade coefficient	Equivalent production quantities converted to uniform grade (Equivalent tons)
A	30	0.6	30 x 0.6 = 18
B	50	0.8	50 x 0.8 = 40
C	40	1.2	40 x 1.2 = 48
D	100	1.0	100 x 1.0 = 100
	220		206

The unit manufacturing cost for equivalent ton of product is derived by the same procedure as for system "2" derived in the preceding section, assuming differences in unit material cost not to affect significantly the unit manufacturing cost (which assumption is applicable to the present instance, where iron castings are envisaged to represent a predominant portion of the products)*.

Taking the same values as assumed in the preceding Section,

Unit manufacturing cost of equivalent ton of product

= (¥41,200,000) ÷ (206 tons) = ¥200,000 per equivalent ton of product

The real unit production cost of the different grades of product are as follows.

Product	Equivalent quantity produced (x tons)	Equivalent unit manufacturing cost (y=¥/t)	Annual total production cost (x.y ¥)	Annual quantity manufactured (z tons)	Real unit Production cost ($\frac{x.y}{z}$ ¥/t)
A	18	200,000	3,6000,000	30	120,000
B	40	200,000	8,000,000	50	160,000
C	48	200,000	9,600,000	40	240,000
D	100	200,000	20,000,000	100	200,000
Total	206		41,200,000		

*) In a case where differences in unit material cost affect the unit manufacturing cost significantly, the manufacturing cost requires to be obtained from calculations made omitting this factor.

c) Lot cost system (System "4")

Lot cost system is a system whereby the direct manufacturing expenses are allocated to the relevant lots, while indirect expenses are distributed over the lots applying an appropriate rate similarly to the individualized system.

The total production costs for the individual lots produced during the period are divided by the quantities produced during the period to derive the unit product costs of the individual lots.

(2) Advice concerning cost accounting system

The Renovation Project for the Jakarta Foundry Center envisages a basic product mix of mass production in limited variety, but of iron castings alone in terms of material.

The most suitable accounting system for such a product mix is considered to be described in the preceding Section 6.2.1 (1), on the grounds that:-

- It permits simple and effective comparisons of (a) elementary costs, (b) departmental cost, and (c) unit product manufacturing cost.
- It will effect savings in computer time, data handling work and accounting cost, compared with the individualized system.

Among the three accounting systems "2", "3", and "4" discussed in the preceding section 6.2.1 (1), the simplest system "2" could effectively be adopted as basis, with consideration given to the system "3" if and when the necessity should arise.

In respect of assessing the value of work in progress at the juncture between periods, it can be considered that, in the present instance, the fluctuations from one period to the next should not be very significant, while in practice, attending to reliably accurate assessment of the work in progress should impose on the shop floor foremen a considerable additional burden of work such as could not be justified by the expected merit gained by such operation: The assessment might be undertaken say once every year for verification.

The system advised to be adopted is therefore a further simple process cost accounting system not taking account of fluctuations of work in progress from period to period.

The shortcomings of the simple process cost accounting system are:-

- Not providing an indication of fluctuation in product cost between the same kind of products which produced on the same line.
- Cost of rejected and defective products normally absorbed into that of accepted products.

To cover these shortcomings and to enhance the effectiveness of cost control, the following measures (budget control, estimated unit production cost and production cost and performance control) require to be taken.

Budget control: A budget control system already exists at the Jakarta Foundry Center. For reaping fuller benefit from this system, and in consideration of the

foregoing circumstances, a review will be presented below on the significance and essential points of budget control.

Budget control is a technique of management through figures, consisting of drawing up the budget for the period ahead along scientific lines and reflecting corporate strategy, by a management that takes due account of views and suggestions emanating from the frontline production floor, which budget is then implemented through coordination and control of the activities of the relevant departments.

What is of prime importance is to "take due account of the views and suggestions emanating from frontline". What can lead those in the frontline to believe that management is assessing the budget in arbitrary and mandatory manner will undermine any feeling of willingness on the part of the frontline personnel to abide by the budget allocation, and to realize the underlying corporate strategy and objectives.

The second point of importance in budget control is that the budget must clearly reflect the policy and strategy upheld by top management, considering that controlling the purse strings is the most straight forward means of directing activities along an envisaged line of action.

The last most important point is effective control of actual disbursements in line with the budget. As already mentioned, the front-line people must be brought to feel a live interest in holding expenditures within the budget, by running their own account books to keep watch on the amounts left spendable on the budget, and taking measures to check excessive outflow in good time. The head office and those charged with accounting should on their part keep track of expenditures in reference to allocated budget, and alert in good time any department or section that shows signs of spending too fast.

Estimated unit production cost: The establishment of estimated unit production cost serves not only to yield data necessary for budget control and thereby contribute to effective cost control, but also provides the basis for inventory valuation on work in progress, and for providing a true reference for sales price determination.

Estimation of unit production cost is already practiced at the Jakarta Foundry Center, and standard costs have been established for different materials and grades of products. Since the Renovation Project envisages concentration of products on iron castings, and the variety of products requiring establishment and updating of unit cost estimates will be reduced, a few points of importance in establishment of estimated unit production cost are mentioned below.

Estimated unit production cost comprises standard values for:-

- Quantities of direct materials
- Prices of ditto
- Manhours of direct labor
- Cost of ditto
- Indirect costs

This implies that estimating unit production cost is not for the head office or accounting department to undertake on their own. It requires thorough discussion with those directly charged with production. A committee for unit production cost estimation should be established under the Branch Manager, to enlist the contribution of all concerned in the whole foundry to take part in the establishment of estimated unit production cost.

Once established, estimated unit production cost must be constantly kept under examination and review through comparisons made with corresponding values of other foundries, and through incessant effort at improvement of production method with view to lowering unit production cost.

Production cost and performance control: Upon implementation of the Renovation Project, production at the Jakarta Foundry Center will concentrate on iron castings, in relatively large lots of limited variety. It is therefore advised to make out every month the production cost and performance indexes described below to monitor the production operations. A procedure must be established to regularly follow up the

monthly records, and upon detection of an anomalous situation, to immediately proceed with analysis of cause and identification of the origin of anomaly, to eliminate the cause and restore normal operating condition.

PRODUCTION COST INDEXES

Item of cost		Of which	
		Variable cost	Fixed cost
Per unit product weight	Melting (Rp/kg product)		
	Molding (ditto)		
	Finishinig (ditto)		
Per unit man-hour spent	Melting (Rp/manhour)		
	Molding (ditto)		
	Finishing (ditto)		
Per unit product weight	Total unit production cost (Rp/kg product)		
$\frac{\text{Molding and finishing cost}}{\text{Manhours spent in molding}}$	=Molding and finishing cost per molding manhours		
$\frac{\text{Pattern-making cost}}{\text{Manhours spent in pattern-making}}$	=Pattern-making cost per pattern-making manhours		

Product performance indexes

- Melting yield (weight tapped/weight charged)
- Power consumed for melting (kWh/tons melted)
- Furnace repair cost (Rp/tons melted between repairs)
- Quantity melted between repairs (tons melted/repairs)
- Pouring yield (weight of product/weight poured)
- Sand used for molding (weight of molded sand/weight of product)
- Shot grit used for finishing (kg shot/tons of product)
- Additive used for molding (kg of additive/tons of sand)
- Reject rate, by time of rejection (before/after shipment), by type of defect, by type of product
- Labor productivity (tons product/man-months)
- Severity of delivery delays (tons of product involved in delayed delivery/total tonnage delivered)
- Attendance rate
- Unit labor expenditure (manhours spent/tons of product), by department
- Annealing furnace fuel consumption (heavy oil/tons of product)
- Molding machine capacity utilization (hours worked/working hours)

The cost accounting system described above is schematized in the form of flow sheet in Fig. 6.2.1-2.

Adoption of this system will affect also the accounting system of the Barata head office and the Electric Data Processing System adopted for accounting. It is advised to proceed with introducing the reform after a lapse of 1 or 2 years of

preparatory period, during which to work out details of the system to be introduced and the relevant changes requiring to be brought to the Electric Data Processing System.

Under the existing cost accounting system, it will be also useful for JFC Management to organize the movement or campaign for the cost reduction which involve in from the top management of JFC to worker.

Table 6.2.1-4 Modes of Production & Cost Accounting Systems Adapted to Each Mode

MODE OF PRODUCTION				
A Mass production in a broad sense			B Job order production in a broad sense	
a. Mass-production of byproducts/associated products	b. Mass-production of single variety	c. Production in lots	d. Individual production in series	e. Strictly individual production
COST ACCOUNTING SYSTEM ADAPTED TO THE PRODUCTION MODE				
I LINKED TO PERIOD			II LINKED TO JOB ORDER	
1 Apportioned prime cost accounting by equivalence coefficient reflecting variations in earnings	2 Simple process cost accounting (pure form of apportioned prime cost accounting)	3 Class cost system (Apportioned prime cost accounting by equivalence coefficient reflecting differences in unit production cost)	4 Lot cost system	Job order costing 5 Imputed prime cost accounting involving further derivation of quotation based on result of calculation 6 Pure form of imputed prime cost accounting

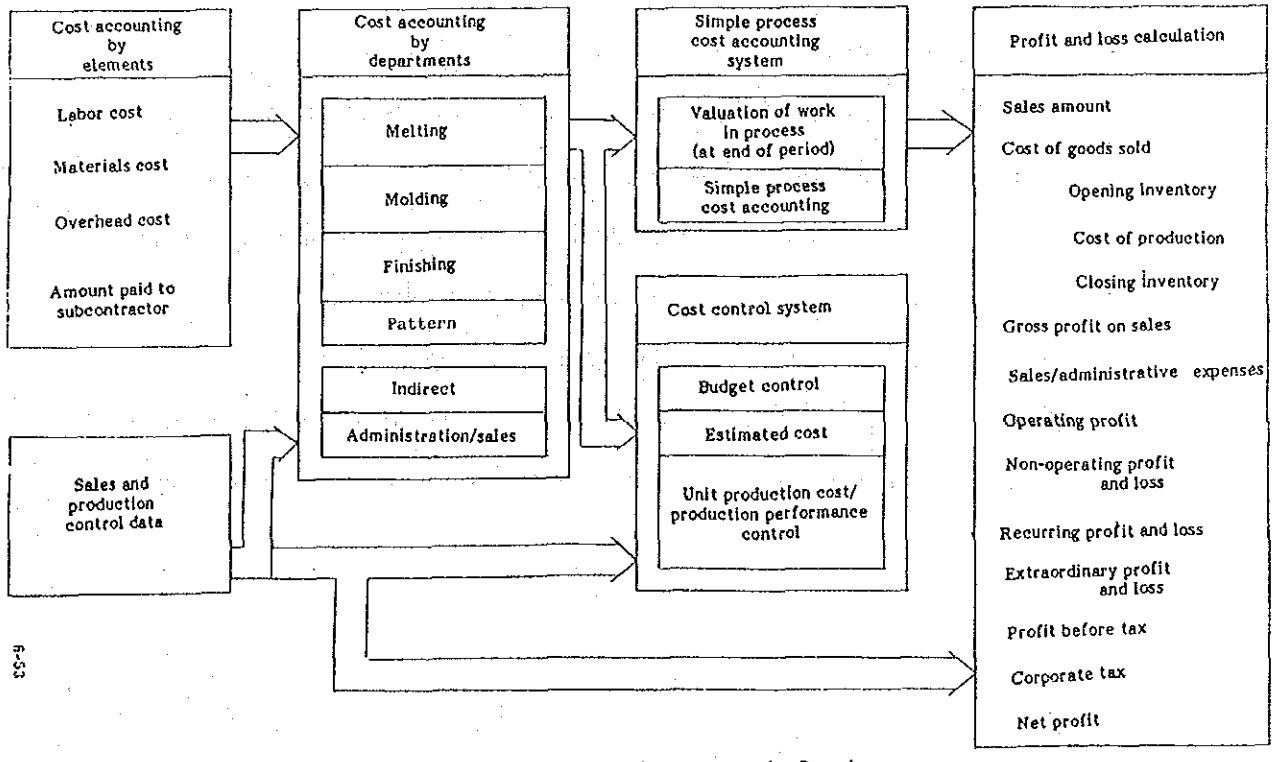


Fig.6.2.1-2 Flow Chart of Cost Accounting Procedure

4) Production control

In accordance with the results of diagnosis described in 5.2.4, a few suggestions regarding to the production control shall be forwarded herewith.

(1) Department charging production control and its manpower distribution

The situation and manpower distribution for the production control department in the functional organization for this foundry are as described in 5.2.4. It is considered suitable and sufficient for the situation and manpower distribution even in the future when an increase of the amount of production is expected.

(2) Constitution of production control

It is considered that the existing constitution of production control including the system of production order and its repetition described in 5.2.4 has almost completed and will be able to cope with the difficulties even if the future when an increase of the amount of production is expected.

(3) Production control

As is described in 5.2.1, the present shortage of the total amount of works ordered are caused finally by the poor quality of the products. Therefore the level-up of the quality of products in near future shall have an effect on the increase of the total amount of works ordered and further the amount of production is expected to increase. So it is considered that some suitable production control methods are required to be established to meet the above situation. To this end, the following suggestions are given.

a) Preparation of cumulative schedule

The purpose of the cumulative planning for man-hour and machine-hour is to grasp the amount of works for whole shop and/or each kind of works. In accordance with this planning, neck points in each kind of works (procedure) and/or machines are catched at early time and countermeasures for each can be studied more easily. Further recognizing more or less amount of works for each kind of works, it becomes possible to adjust them beforehand.

Usually as the amount of the works was rather little and even in such short period as the amount of the works became much more than the capability of the shop - in such the case, most of the works were rather simple such as the gratings for new international air-port - it is considered that the necessity of cumulative schedule has not been reviewed. However from now on, in accordance with the increase of the amount of production, the necessity of preparing cumulative schedule shall become really higher and shall be indispensable.

In order to prepare cumulative plan, it is essential to grasp the capability man-hours for each works and capability machine-hours for each machine. At the same time, it is necessary to decide the standard man-hours for molding and product finishing for each product. These standard man-hours should depend upon the foremer results.

Cumulative schedule shall be prepared monthly (weekly, if required) from capability man-hours and standard man-hours for molding and product finishing based upon each delivery time of products.

After the completion of cumulative schedule, constant checking shall be required by means of comparing cumulated man-hours with the capability man-hours. And for the excess and less man-hours, suitable countermeasures are required to be established. These checking actions can be said a real control for the amount of works.

b) Control for planned value and its result

As mentioned in 5.2.4 item 4) and 5), it is considered one of an excellent existing practices that the results of molding man-hour, product finishing man-hour and machine-hour for each machine and facility are recorded and summarized faithfully into a report. However it is very regretful that the comparison with planned value and further studies seems not to be done.

It is strongly recommended to implement the comparison, and in case the difference between the planned value and its result is large, a trial of finding out the causes and further studies to clear out the problems should be implemented, it is important to assign the each responsible person who carried out the cause analysis, study for countermeasures and its implementation.

Although the above responsible persons are considered to be assigned from the production department, a strong back-up by PPC such as the supply of various data for the responsible persons are considered indispensable.

All the above recommended actions are also recommended to be applied similarly to the daily production control as well as delivery date control.

6.2.2 Technical capability

1) Technical capability

Although result of diagnosis concerning technical capability is described in 5.3.1, as a result following items are pointed out as a problem.

a) Since standards (quality control standard, technical standard and work standard) which form the base for reference and levelling up of technology and technique are not maintained, it is required to prepare them urgently.

b) Since manufacturing technology and technique of more complex product compared with current product is deemed to be insufficient, it is required to improve this technology and technique.

c) Sinice mainly fundamental technique in moulding is deemed to be insufficient, it is required to improve this technique.

Although above-mentioned standards can be prepared by the middle management, engineer and staff who receive the education and improvement of pattern making and moulding technique can be achieved by the worker who receives the training, the planning for this education and training will be described in 6.2.2 3) Training and here content of production engineering and technique which requires levelling up in the future, target of levelling up and target date are described.

(1) Technlogy

Table 6.2.2-1 indicates the content, minimum required target and target date of production engineering which can be attained by the middle management, engineer and technical staff who receive production and the target indicates that a plan can be made and that standards can be prepared. It is considered that production of product shown in 6.1.3

Production plan is possible when technology shown in this table is surely obtained.

Incidentally, although melting technology is not included in this table, the work standard is already established for melting and operation work is considered to be enough when it is carried out based on this standard.

(2) Technique

Technique is intended to be improved when worker and inspector receives the training mainly consisting of on the job training based on each work standard and Tabel 6.2.2-2 indicates the content, target and target date of technique which should be obtained by worker and inspector who receive the training and the target is such that each pattern can be produced concerning pattern production technique and that each work can be completed concerning other techniques.

Table 6.2.2-1 Categories, levels to be achieved and time limits of technological improvements

Time limit / Category	First year of short term of Renovation Project	Second year of intermediate term of Renovation Project	Intermediate term of Renovation Project
Technology of casting design	1) Drawing up standards for casting design (shrinkage rule, finishing allowance, risers, chills, gating system, pouring temperature, pouring time, venting) 2) Drawing up casting designs for shoulder castings, lathe/milling machine coponents, bubble cap castings	1) Drawing up casting designs for cylinder liners, heads and blocks of general-use diesel engines 2) Drawing up casting designs for cylinder blocks of agriculture-use diesel engines	Drawing up casting desinges for cylinder liners, heads and pistons of generator-use diesel engines
Technology of pattern making	1) Drawing up standards for pattern making for furnace sand molds (draft, core priint dimensions, draw pin number/position) 2) Drawing up metal patterns for sheel molding sand cores for bubble cap castings	1) Drawing up metal patterns for shell molding sand cores for cylinder heads and blocks of general-use diesel engines 2) Drawing up metal patterns for shell molding sand cors for cylinder blocks of agriculture-use diesel engines	Drawing up pattern designs for cylinder liners, heads and pistons of generator-use diesel engines
Technology of furan sand preparation	Drawing up standards for furan sand preparation (blending, mixing sequence/time, bench time, sand testing)		
Technology of sand molding	1) Drawing up standards for green sand machine molding (sequence, procedure and practical hints) 2) Drawing up standards for furan sand molding and pouring (sequence, procedure and practical hints) 3) Drawing up stnadards for shell molding (sequence, procedure and practical hints)		

Time limit / Category	First year of short term of Renovation Project	Second year of intermediate term of Renovation Project	Intermediate term of Renovation Project
Technology of shaking out	1) Drawing up standards for shaking out of furan sand molds (sequence, procedure and practical hints) 2) Drawing up stnadards for shaking out the thin and small type items (timing, sequence, procedure and practical hints)	1) Drawing up standards for shaking out cylinder heads and blocks of general-use diesel engines (timing/procedue) 2) Drawing up stnadards for shaking out cylinder blocks of agriculture-use diesel engines (timing/procedure)	
Inspection technology	1) Drawing up standards for visual inspection on fly wheels, shoulder castings, metal dies for press, counter weights, lathe/milling machine components, pump components, bubble cap castings, pipe fittings 2) Drawing up standards for dimensional/thickness inspection on the above 3) Drawing up standards for hardness test 4) Drawing up standards for micro structure inspection 5) Drawing up standards for dye penetrant examination 6) Drawing up standards for magnetic particle examination	1) Drawing up standards for inspection on cylinder liners, heads and blocks of general-use diesel engines 2) Drawing up standards for inspection on cylinder blocks of agriculture-use diesel engines	Drawing up standards for inspection on cylinder liners, heads and pistons of generator-use diesel engines

Time limit / Category	First year of short term of Renovation Project	Second year of intermediate term of Renovation Project	Intermediate term of Renovation Project
Quality control technique	1) Compiling manual on quality assurance 2) Acquisition of basic principles of quality contorl 3) Compiling manual on quality control		

Table 6.2.2-2 Categories, levels to be achieved and time limits of technical improvements

Time limit / Category	First year of short term of Renovation Project	Second year of intermediate term of Renovation Project	Intermediate term of Renovation Project
Skill of melting operation	1) Exact melting operation in accordance with standards for melting operation 2) Complete writing out melting records		
Skill of pattern making	Pattern making for lathe/milling machine components	1) Pattern making for cylinder blocks of agriculture-use diesel engines (material: hand wood or plastic) 2) Pattern making for clinder heads and blocks of general-use diesel engines (material: hard wood or plastic)	Pattern and core box making for cylinder heads of generator-use diesel engines
Skill of molding	1) Exact green sand machine molding and core setting in accordance with standards for green sand machine molding and core setting 2) Exact furan sand molding and core setting in accordance with standards for furan sand molding and core setting 3) Exact shell molding in accordance with to standards for shell molding	1) Molding and pouring for 1)cylinder blocks of agriculture-use diesel engines 2) Molding and pouring for cylinder heads and blocks of general-use diesel engines	Molding and pouring for cylinder liners, heads and pistons of generator-use diesel engines

Time limit Category	First year of short term of Renovation Project	Second year of intermediate term of Renovation Project	Intermediate term of Renovation Project
Skill of shaking out	1) Exact shaking out furan sand molds in accordance with standards for shaking out furan sand molds 2) Exact shaking out the thin and small type items in accordance with standards for shaking out thin and small type items		
Inspection technique	1) Exact visual inspection on fly wheels, shoulder castings, metal dies for press, counter weights, lathe/milling machine components, pump components, bubble cap castings, pipe fittings in accordance with standards for visual inspection 2) Exact dimensional/thickness inspection on above castings in accordance with standards for same. 3) Exact dye penetrant examination in accordance with standards for same 4) Exact magnetic particle examination in accordance with standards for same	1) Exact visual, dimentional/thickness inspection, dye penetrant and magnetic particle examination on cyulinder blocks of agriculure-use diesel engines in accordance with standards for same 2) Exact visual, dimentional/thickness inspection, dye penetrant and magnetic particle examination on cylinder heads and blocks of genral-use diesel engines in accordance with standards for same	Exact visual, dimentional/thickness inspection, dye penetrant and magnetic particle examination on cylinder liners, heads and pistons of generator-use diesel engiens in accordance with standard for same
Quality control	Understanding of basic principle of quality control	Starting of QC small circle activity	

2) Material

The current status and problems of material for producing casting are described in Section 5.3.2. Hence, the coverage of the present Section will be limited mainly to the countermeasures for the problems raised, and to notes on the use of furan sand, which is to be introduced with the Renovation Project.

a) Measures for improving product quality with greensand molding

It has already been mentioned that the principal problem in the current practice of green sand molding in the mixture of cement sand in the process of sand reclaiming due to the use of a common sand reclaiming unit for both green sand and cement sand. The solution to this problem would be to avoid in so far as possible the adoption of both kinds of sand in one mold.

When cement sand is used for molding, both mold and core should be of cement sand, or else cement sand for mold and CO_2 sand for core. After pouring the mold should be discarded and not reclaimed.

In special cases where both kinds of sand have unavoidably to be used in one mold, the mold should be transferred to an area reserved for the purpose, shaken out, and the cement sand removed by hand before reclaiming the greensand.

b) Improvement of sand depository

Raw material sand (new sand) to be used for preparing cement sand and CO_2 sand is currently dried by a primitive dryer as shown in Fig. 6.6.2-1.

To prevent mingling of undried sand with sand that has already been dried, a partition should be provided in the sand depository, as shown in Fig. 6.2.2-2, to permit proper separation of the dried from undried sand, while maximizing effective utilization of the available area.

Fig. 6.6.2-1 Simple dryer currently used

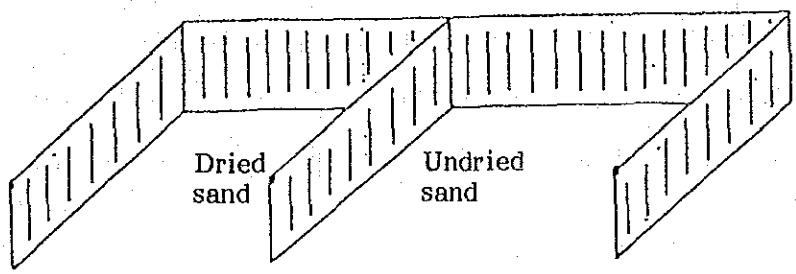


Fig. 6.6.2-2 Partitioned sand depository

c) Melting material

(a) As it may be seen from Fig. 6.2.2.-3, the present melting material depository is in confusion, with materials of different kinds heaped indiscriminately. To permit proper management of melting material, which is an essential condition of sound foundry operation, and which once disturbed will upset the entire melting process, the melting material depository should be partitioned as shown in Fig. 6.2.2-4, to permit storage of different materials properly classified and separated from each other.

(b) The principal problem associatd with the use of automobile press trimmings for steel scrap is, as discussed in Section 5.3.2, its large bulk and oparsity, on account of its being in the form of loose thin sheets. To solve this problem, a scrap press should be installed, for compressing the scrap into blocks of 50 to 100 kg. Such blocks will be far easier to handle and will contribute to shortening the furace feeding time and to maintaining proper order in the depository.

d) Silica sand for furan molding

Silica sand for furan molding must be free of moisture, or else it will require excessive time to harden after ramming, and moreover the resulting mold will lack strength.

To properly dry the silica sand used for this molding method, a silica sand dryer of 1 ton/hour capacity is to be newly installed under the Renovation Plan.

This dryer is primarily intended for drying furan mold sand, but it should serve equal well also for treating greensand molding material.

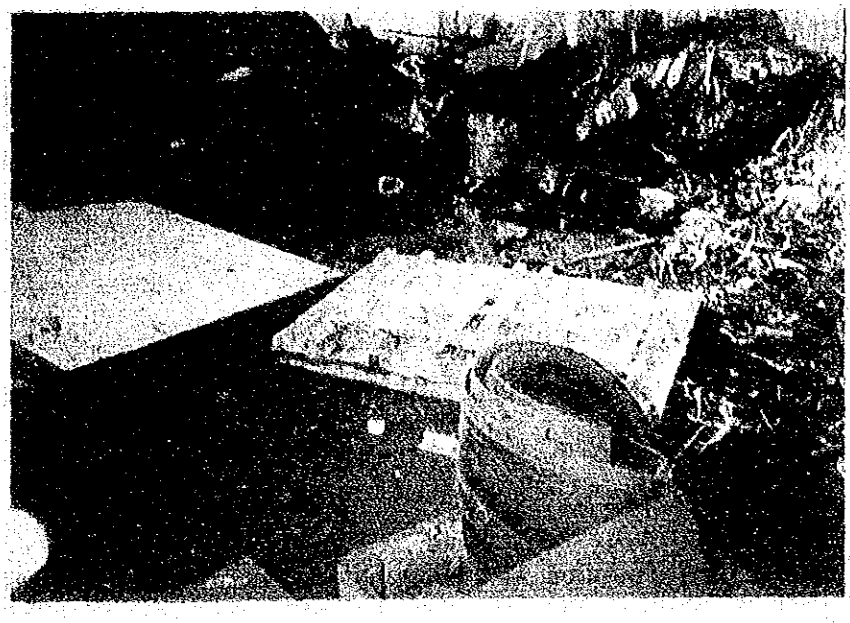


Fig. 6.2.2-3 Present melting material depository

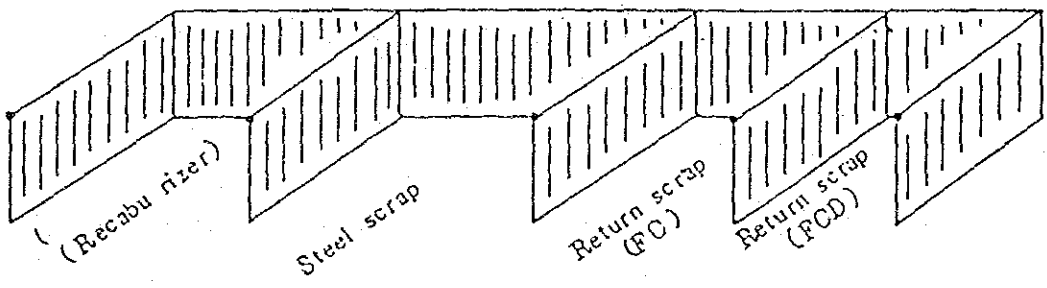


Fig. 6.2.2-4 Partitioned melting material depository

3) Education/Training

Having already explained (in 6.2.2-1) the contents, levels to be achieved and time limits of technical/technological improvements for JFC, we would like to outline the education/training program necessary for this purpose.

(1) Education/training on foundry technology

The technological education/training covers middle management, engineers and technical staff. Table 6.2.2-3 shows who take part in what types of training session.

In regard to its method, at the beginning the best way may be to engage the services of foreign engineers from the appropriate type of foundry in an industrialized country.

By the end of that training, the trainees shall be able to make up technical/work standards by themselves.

In addition, it is preferable to have one member of the design section trained at the appropriate foundry abroad in 1986 and 1987 respectively. The period of this O.J.T. will be three months.

(2) Technical

This training covers workers and inspectors and intends to improve their skills.

In regard to its method, at the beginning the best way may be to engage the services of foreman-class technicians from an industrialized country mainly for O.J.T. In addition, it is preferable to have foreman-class workers in the molding section trained at the appropriate foundry abroad. This O.J.T. will be conducted for three months once a year from 1986 to 1990 (one trainee for each year) and centered on molding/pouring technique.

The workers trained abroad will be in charge of training other workers in the future.

(3) Education/training program

Table 6.2.2-3 shows the program for the above-mentioned education/training - its contents, trainees, period, cost, instructors, etc. All figures in the Table are kept down to the minimum.

The foregoing is our suggestion on the education/training. In conclusion JFC's management should place full confidence in instructors from advanced foundries abroad and realize that these instructors are acting on their behalf. Moreover, it is essential for the trainees to be strongly motivated to improve themselves.

Table 6.2.2-3 Training Program

CATEGORY	PERSONNEL ENVISAGED	SUBSTANCE OF INSTRUCTION/ TRAINING	PERIOD 1986	1987	1988	INSTRUCTOR
Instruction in foundry technology	Technical Manager; Chief of quality Control Section	1) Basic principles and elementary techniques of quality control 2) Practical guidance in compiling manual on quality control 3) Aims and techniques of visual inspection; practical guidance in drawing up standards for same 4) Techniques of dimensional/thickness measurements; practical guidance in drawing up standards for same 5) Aims and techniques of dye penetration test; practical guidance in drawing up standards for same 6) Aims and techniques of magnetic practicle test; practical guidance in drawing up standards for same	→	→		One engineer (from foundry abroad)
	Technical Manager; Chief of Casting Design Section, staff of casting Design Section	1) Principles of casting design (shrinkage rule, finishing allowance, risers, chills, gating system, venting, pouring temperature/time) 2) Practical guidance in drawing up standards for same	→	→		Two JFC staffs Charged with Casting design (three months/ one staff, dispatch to foundry abroad)

CATEGORY	PERSONNEL ENVISAGED	SUBSTANCE OF INSTRUCTION/ TRAINING	PERIOD			INSTRUCTOR
			1986	1987	1988	
	Technical Manager; Chief of Laboratory Section	1) Principles of furan sand blending, mixing sequence/time, bench time sand testing 2) Practical guidance in drawing up standards for same				
	Production Manager; Chief of Pattern-Making Section	Practical guidance in drawing up standards for wood pattern making for furan sand molds (draft, core print dimensions, draw pin number/ position)				
	Production Manager, Chief of Hand Molding Section	Principles governing furan sand molding (Sequence, procedure and practical hints) Practical guidance in drawing up Standards for same				
	Production Manager; Chief of Machine Molding Section	1) Principles governing furan sand molding (sequence, procedure and practical hints) Practical guidance in drawing up standards for same 2) Principles governing shell molding (sequence, procedure and practical hints) Practical guidance in drawing up standards for same				

CATEGORY	PERSONNEL ENVISAGED	SUBSTANCE OF INSTRUCTION/ TRAINING	PERIOD			INSTRUCTOR
			1986	1987	1988	
	Production Manager; Chief of Finishing Section	1) Principles governing the shaking out of furan sand molds (sequence, procedure and practical hints) Practical guidance in drawing up standards for same 2) Practical guidance in drawing up standards for shaking out the thin and small type items.				
Training in foundry skills	Workers in Melting Section	1) Sequence, procedure and practical hints on:- a) Melting furnace inspection/ maintenance b) Poking down unmolten pieces during melt down c) Timing/procedure of temperature measurements during melt down d) Ladle lining e) Wedge test, carbon equivalent measurements and other shop floor tests 2) Writing out melting records	→			One technician (from foundry abroad)

CATEGORY	PERSONNEL ENVISAGED	SUBSTANCE OF INSTRUCTION/ TRAINING	PERIOD 1986	PERIOD 1987	PERIOD 1988	INSTRUCTOR
	Workers in Pattern-Making Section	Sequence, procedure and practical hints on:- - Pattern-making for lathe/milling machine components - Cylinder head/block of agricultura-use diesel engines - Cylinder block of general-use diesel engines	→			One technician (from foundry abroad)
	Workers in Hand-Molding Section	1) Sequence, procedure and practical hints on:- a) Placiing the pattern on molding table b) Ramming c) Venting d) Tally marking e) Pattern drawing f) Touching up g) Coating h) Setting the core i) Placing the cope j) Clamping cope to drag k) Pouring 2) Timing/procedure shaking out furan sand molds	→	→	→	One technician (from foundry abroad) Five JFC foremen engaged in hand molding (three months per one foreman, dispatch to foundry abroad from 1986 to 1990)

CATEGORY	PERSONNEL ENVISAGED	SUBSTANCE OF INSTRUCTION/ TRAINING	PERIOD			INSTRUCTOR
			1986	1987	1988	
	Workers in Machine Molding Section	1) Sequence, procedure and practical hints in green sand machine molding, covering such operation as:- a) Inspecting the pattern/flask b) Charging the sand c) Jolting/squeezing d) Drawing the pattern e) Touching up the mold f) Venting g) Coating h) Setting the core i) Palcing the cope j) Clamping cope to drag k) Pouring 2) Sequence, procedure and practical hints in shell molding covering such operations as:- a) Setting the metal pattern on machine b) Cleaning the pattern c) Preheating the pattern d) Spraying the parting compound e) Baking the mold f) Drawing the pattern g) Touching up the mold h) Coating i) Storing the finished mold 3) Training of the shaking out of the thin and small type casting items based on the shaking out work standard				

CATEGORY	PERSONNEL ENVISAGED	SUBSTANCE OF INSTRUCTION/ TRAINING	PERIOD			INSTRUCTOR
			1986	1987	1988	
	Inspectors in Quality Control Section	Sequence, procedure and practical hints on such operation as:- 1) Visual inspection 2) Dimensional/thickness measurements 3) Dye penetration testing 4) Magnetic particle tetsting				

4) Maintenance

As seen in 5.3.4, the present maintenance work in JFC is not satisfactory. Although they carry out the maintenance based on daily, monthly and annual schedules, one can still find a great deal of faults such as inferior precision of pins and bushes in casting flask, wear and tear of dust collectors and cooling towers.

Maintenance work is one of the decisive factors in the Renovation Plan. To carry out maintenance work successfully, the following matters should be thoroughly reviewed and enforced.

* Preparation of maintenance standards and its scrupulous application
* Follow-up of the maintenance work
* Control of spare parts

(1) Preparation and revision of maintenance standards and their strict application

a. Preparation of maintenance standards

1) Judgment on priority of equipment and apparatus for establishment of maintenance standards

The pieces of equipment currently in use should be ranked according to priority, and the maintenance standards should be established in that order. The criteria for priority is:

* The amount of production loss in case of stoppage
* Deterioration of quality and the loss of production materials/capacity in case of stoppage (e.g. melting capacity-kwh/t, molding sand/castings)
* The cost of repair & maintenance
* Possibility of serious damage

2) Items of maintenance standards

Maintenance standards should contain the following items for each piece of equipment.

* Places to be checked
* Frequency (Daily, weekly, monthly, regular)
* Method (Visual, touching, audial, use of measuring devices)
* Measuring device (Test hammer, calipers, rod for audial check, thickness gauge)
* Criteria (Assessment criteria, vibration, temperature, seal, dimension, precision)
* Person in charge of checking (worker, group leader, foreman, person in charge of maintenance, maintenance supervisor)
* Report form (Daily check list, weekly report, monthly report, regular check report)

b. Scrupulous application of maintenance standards

Established standards should be applied scrupulously through the maintenance organization.

* Through foremen, the established standards should be made known thoroughly to those who are concerned with operation of equipment and machines.
* Through a supervisor, the established standards should be made known thoroughly to the maintenance staff

(2) Follow-up of the maintenance work

To increase maintenance efficiency, follow-up review should be carried out for the executed maintenance work. The outline of follow-up is stated below:

a. Confirmation should be made that the maintenance has been executed as planned, and the problems should be pointed out with their countermeasures.

The factory manager will hold an assessment meeting once a month in order to give appropriate instructions.

b. Confirmation should be made that the maintenance is carried out for each part of equipment in accordance with the prescribed method, and problems should be pointed out with their countermeasures.

The maintenance manager will discuss the problems with person in charge of equipment concerned in order to take preventive measures and review the standards.

(3) Control of spare parts

Sophisticated machine parts would take considerable time from ordering to receiving, and moreover, they are tend to be used for important equipment. Thus, the production loss would be large if they were not received or repaired in time. To prevent this situation occurring, parts of equipment should be listed up and stocked in advance.

In making a spare part list, it would be better to distinguish domestically procurable parts from those that should be imported, and have clear grasp of necessary time from ordering to receiving for each of them.

For the storing of spare parts, at least the following matters should be taken into consideration.

* The life of machine parts is judged from the present state of use and maintenance.
* Parts, whose service life are less than 1 year, should be always in stock.
* The storing of spare parts should be based on the life and maintenance results of the products concerned.
* The distinction between standardized parts and special order parts should be made clear.

6.2.3 Personnel organization

As stated in 5.4, the biggest problem of JFC is delivery delay which seems to deter new orders and thus cause the shortage of demand.

The studies show that the main reason of delivery delay lies in product flaws. The improvement of product quality is, therefore, urgently needed.

To achieve this, the concept of quality control has to be learned by all personnel concerned. The necessary measures in this aspect being already mentioned in 6.2.2-3) "Education/Training", hereafter, we would like to confine ourselves to discuss the functional organization for improving product quality, and then the arrangement of personnel to cope with the increased demand which would be expected once the product quality has been improved.

1) Functional organization

Fig. 6.2.3-1 is the revised functional organization chart (plan). The difference between the current organization and the revised one concerns the position of the technical department. At present it is directly under the branch manager, but in the revised organization it would be under the factory manager.

Since one of the main functions of the technical department is to support the production department in order to achieve proper quality control, both of them should work in harmony. That is why it is preferable for both departments to be under same supervision of factory manager.

Furthermore, in such fields as testing, product inspection and casting design which make up another main functions of the technical department, both departments have close relations. The functions of the laboratory section of the technical department is, as explained in 6.2.1-2), to evaluate and control product quality. Hence, it would be better to integrate it into the quality control section.

As for other departments and sections, no alteration seems to be necessary.

2) Arrangement of personnel

As explained in 6.1.2 "Basic conditions" and 6.2.1-1) "Production", the increase of production amount is planned in the future.

New employment of personnel, however, will be kept to a minimum level, because:

a) quality improvement (i.e. decrease of unsalable products)

b) rise of productivity

could sufficiently cope with planned production increase.

Table 6.2.3-1 shows the planned placement of personnel. Addition of one clerk in the quality control section in 1986 is aimed to enhance quality control activities of JFC as a whole. Increase of personnel is also planned in the hand molding section after 1989, the purpose of which is to deal with production increase. The streamlining in melting process and maintenance work will provide necessary personnel for this.

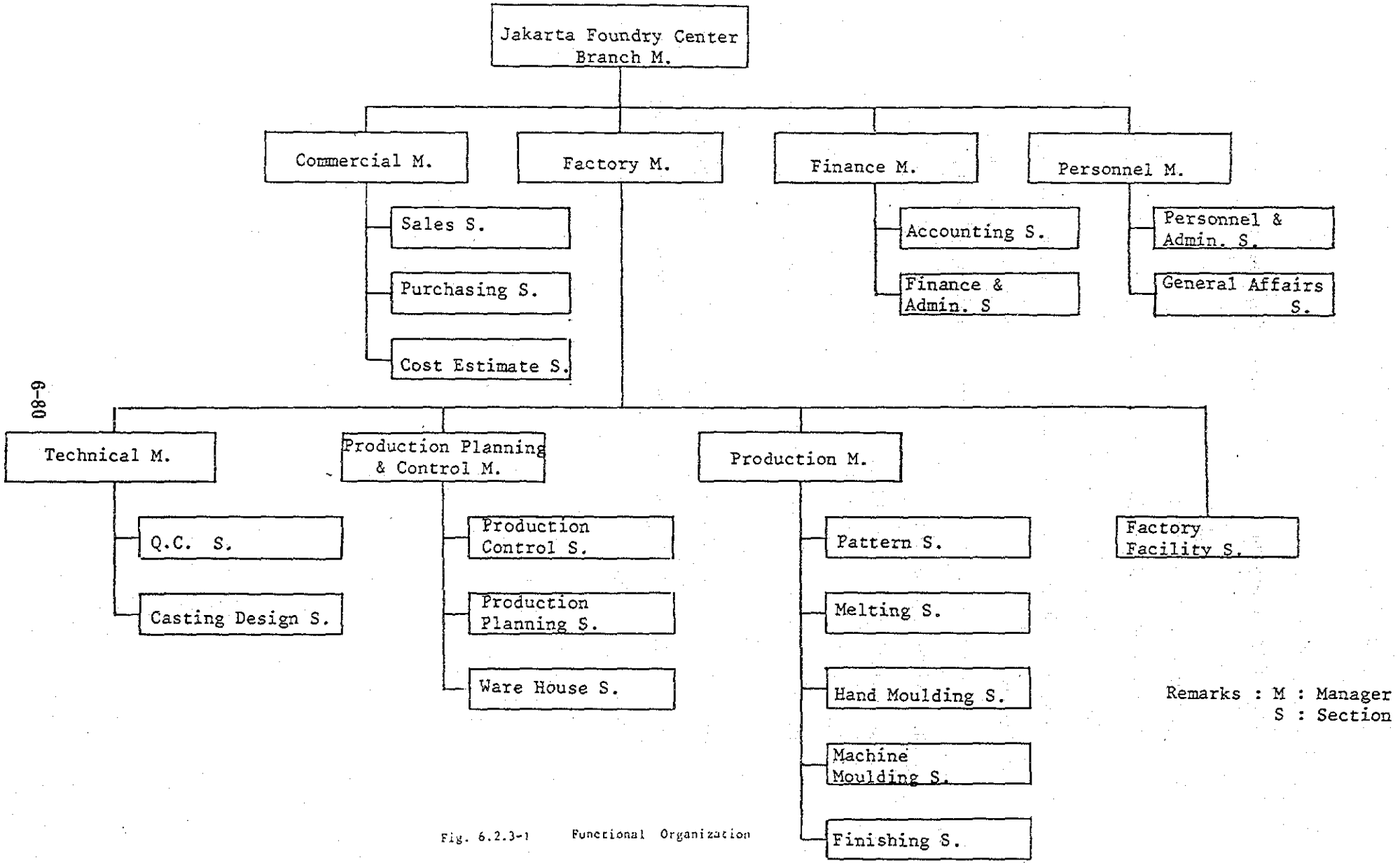


Fig. 6.2.3-1 Functional Organization

Table 6.2.3-1 Personnel Organization Plan

Branch, Factory & Department	Section	1985				1986 - 1988				1989 -			
		Manager	Chief of Sec. or Supervisor	Clerk	Worker	Manager	Chief of Sec. or Supervisor	Clerk	Worker	Manager	Chief of Sec. or Supervisor	Clerk	Worker
Branch		1				1				1			
Commercial (D)	Sales	1	1	4		1	1	4		1	1	4	
	Purchasing		1	1			1	1			1	1	
	Cost Estimate		1	1			1	1			1	1	
Personnel (D)	Personnel & Administration	1	1	10		1	1	10		1	1	10	
	General Affairs		1	15			1	15			1	15	
Finance (D)	Accounting	1	1	3		1	1	3		1	1	3	
	Finance & Administration		1	3			1	3			1	3	
Technical (D)	Quality Control	1	1	5		1	1	10		1	1	10	
	Laboracory		1	3			integrating into Q.C.S.	integrating into Q.C.S.					
	Casting Design		1	2			1	2			1	2	
Factory		1				1				1			
Production Planning & Control (D)	Production Control	1	1	4		1	1	4		1	1	4	
	Production Planning		1	2			1	2			1	2	
	Ware Rause		1	3			1	3			1	3	
Production (D)	Pattern	1	1		8	1	1		8	1	1		8
	Melting		1		11		1		11		1		9
	Hand Moulding		1		31		1		31		1		34
	Machine Moulding		1		20		1		20		1		20
	Finishing		1		23		1		23		1		23
	Factory Facility		1		14		1		14		1		13
Total		8	19	56	107	8	18	58	107	8	18	58	107
		190				191				191			

6.2.4 Packaged Technology Transfer Plan

Technologies are basically transferred from person to person as a transfer medium. A variety of methods, however, are available as a system to accelerate and implant the transfer of technologies from person to person. Described herein is a packaged technology transfer plan to more positively and efficiently promote the achievement of targets to be aimed at in implementing the proposed Renovation Project.

1) Reflection of Technology Transfer in the Past

Heretofore, technologies have been transferred in a variety of forms, i.e. technology transfer from the exterior of JFC, technology transfer inside JFC, etc. Whatever the form, the basic pattern strictly followed was imparting or knowledge and skills from person to person. As a result, technology acquired by a key person in JFC has sometimes been entirely lost, when this key person left JFC to work for another foundry. This is the consequence of assimilated technology not being accumulated one by one in lasting form, such as written standards and instruction manuals.

In future, while the basic pattern of person-to-person transfer will not change, it should be complemented by efforts to permanently implant the acquired technology in the JFC organization, with the aim of ensuring more effective, continuing, self-actuated transfer of technological capability within JFC and dissemination to outside foundries.

The levels of technology acquired have tended to overemphasize the higher engineering capabilities, and insufficient weight has been accorded to assimilation of the lower levels represented by foundry skills and practices. This unbalance of importance attached to the different levels of technological

assimilation appears to have been at the root of many difficulties encountered at JFC.

The future plan for assimilating technical capabilities requires to be drawn up in consideration of the foregoing shortcomings of the current situation.

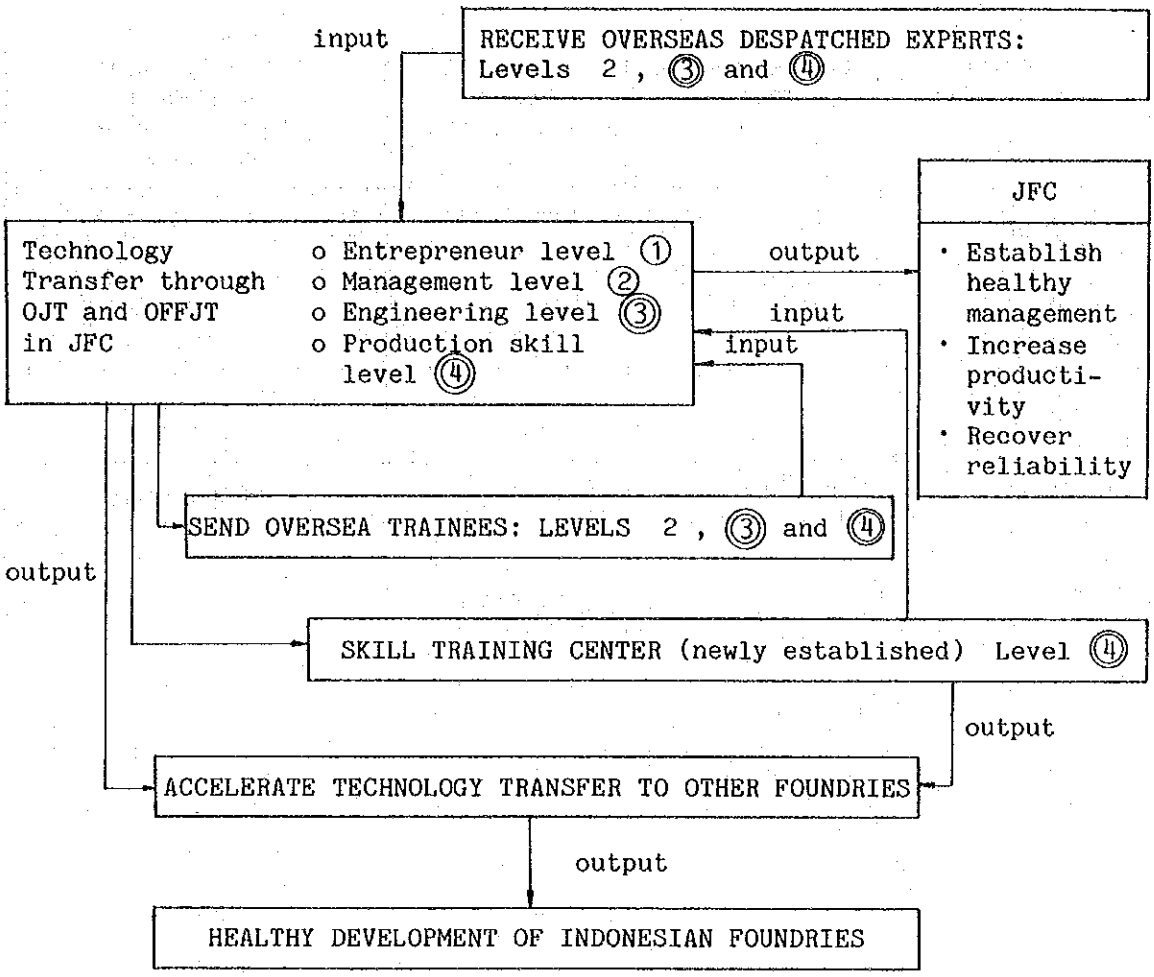
2) Future Technology Transfer Plan

The packaged total scheme of a technology transfer plan could be roughly divided into experts sent from overseas, JFC personnel despatched overseas for training, technology transfer and implantation within JFC and promotion of technology transfer from JFC to Indonesian other foundries. To attain the promptest effectiveness in enhancing JFC, a policy should be taken to heighten the overall technological capabilities of JFC through systematic instruction and training, linking together and integrating the relevant activities undertaken inside and outside JFC. Primary emphasis should be accorded to the instruction/training of engineers and technicians, and of the middle management to be charged with supervising the technicians. The subjects to be assimilated should primarily include the know-how to be acquired by those to specialize in drafting quality/engineering/work standards to govern casting design, pattern-making, melting, mold engineering.

To foster the young force who will support JFC and Indonesian foundries in the future, moreover, it is essentially necessary to provide skill-training centers so as to drastically dissolve the insufficient manpower supply problem for a well balanced development of the Indonesian economy. With these skill training centers effectively utilized, all strata inside JFC should be repeatedly and continuously educated throughout their life, based on the job training capability development program.

What should not be forgotten, in particular, is to multilaterally evaluate every change in participants' reaction, knowledge and skill, in their attitude and/or work done by them and in results or achievements as an organ without neglecting the measurement of technology transfer and educational training effects. To further improve the packaged technology transfer plan, moreover, it is also essentially necessary to review the educational training and technology transfer plans.

A concept of the above might be simplified and illustrated as follows:



A Conceptual Framework of Packaged Technology Transfer Plan

P.S.: ◎ Higher Priority

Table 6.2.4-1 A Summary of Packaged Technology Transfer Plan

Technology Transfer Level	Entrepreneur/ Management Level	Engineering Level (specialist)	Level of Skill (foreman) (skilled worker) (apprentice)
Technology transferred		See Table	given in 3) of 6.2.2.
Experts received		24 persons/ month	48 persons/ month
Trainees sent		6 persons/ month	15 persons/ month
OJT/OFFJT	conducted	conducted	conducted
Skill training center			conducted

3) Newly Establishment and Operation of a Foundry Skill Training Center

Establishing a skill training center has been referred to in the preceding section and its facilities will be described later. (See Section 6.6.) To avoid redundancy herein, therefore, the objective of newly establishing the center and its necessity in managerial and functional aspects will be discussed below.

(1) Objective of establishing and reason therefor

While Indonesia is being advancedly industrialized, the development of the Indonesian casting industry is an important sector as one of the key industries which support the understructure of industrialization. This industrial sector is skill-incentive and a lot of able engineers and capable skilled workers are required to foster the industrial sector. Since its establishment, JFC has been bringing up a lot of manpower through OJT and OFFJT. For recent years, however, private foundries have been established one after another. The manpower brought up by JFC has often moved to those private companies. Now, four persons only could be counted as the personnel who have continued to serve JFC since its establishment. Such situation, however, is liable to take place more or less in the country which has continued on developing national economy. Nevertheless, Indonesia does not own any manpower cultivating organization that may meet the vigorous demand for manpower, with emphasis placed on OJT. The MIDC (Metal Industry Development Center) located in Bandung has a casting section, which is, however, mainly engaged in such activities as R&D and extension services. There has not been still the education/training organization directly related with practical engineering and skill development.

Such organization cannot allow the most efficient technology transfer without being managed as an in-house organ. Judging from its position as a government-owned company and from its historical precedents, JFC should most naturally manage the center as its ancillary organ. For these various reasons, it is hereby strongly proposed that the center be newly established within JFC.

(2) Management and functions

The skill training center should be put under the direct control of the Department of Machinery and Basic Metal, Ministry of Industry, and should be managed in the form of being entrusted to JFC. This is because of the center's nature that its establishment is strongly intended to build up the human resources in high social need. In other words, it is beneficial to achieve the objective to the benefit of both by making effective use of the center's functions without thwarting the management of JFC. In terms of facilities & equipment, therefore, the skill training center is utilize to maximum extent possible the existing facilities owned by JFC to reduce the equipment required for the center on a cost minimum basis. (See 6.6.)

For a group of trainers, those men of excellent ability should be selected out of the managerial personnel, supervisor foreman and the like. In addition, experts sent from overseas and external local experts are to support the activities of the skill training center so as to fill up the entirety of its curriculum. With the year of 1986 taken for the period during which preparations are to be made for the establishment of the center, it is scheduled to be opened in 1987.

The curriculumn may be outlined as a one-year course.

For the time being, two courses are to be opened, pattern making and molding, for which needs are very high. For the first year after opening the center, a total of ten traineers are to be trained: three for pattern and seven for molding. From the second year and on, traineers are to be increased to approximately 20 persons, though dependent upon the results for the first year.

For the initial one month, an orientation is conducted, with lectures on castings in general given mainly. For the subsequent one month, traineers are divided into pattern making and molding courses to receive specialized lectures. For the remaining ten months, they are to enter in working sites to receive the education and training mainly on an OJT basis practically. In the meantime, lectures are to be given approximately once a week while striving to match knowledge with practices well.

The center will be also used to re-educate the personnel of JFC by level, taking the opportunity on which the center is unoccupied.

6.2.5 Casting technique training plan

Since objective of establishment, management and function of casting technique training center is described in 6.2.4 and its equipment and facility are described in 6.7, organization, personnel allocation, training content and method are described here.

1) Organization and personnel allocation of training center

Organization and personnel allocation of training center are shown in Table 6.2.5-1.

a) Organization

- o Organization consists of control department and instruction department.
- o Control department executes affairs concerning management of training center.
- o Instruction department executes affaiirs concerning instruction of trainee.

b) Personnel allocation

All members of training center are 15 and consist of the general manager, 3 members of control department and 11 members of instruction department.

2) Content and method of training

a) Lesson

(a) Common general knowledge

- o General knowledge concerning casting
- o Fundamental casting plan

- o General knowledge of pattern production
- o Reading of drawing

(b) Mould special coarse

- o Casting plan
- o Molding sand
- o Molding method
- o Melting method
- o Casting finish method
- o Quality control

(c) Pattern special course

- o Reading of drawing
- o Drafting method
- o Pattern making method
- o Drafting of full size drawing
- o Preparation of wood material for pattern
- o Inspection
- o Quality control

Lecture is made by using a text and audiovidual materials concerning above-mentioned items.

b) Practical skill

The following practical skills are instructed and trained by utilizing the training center and JFC's production plant.

(a) Mould

- o Hand molding

- o Machine molding
- o Pouring work
- o Finishing work
- o Inspection work

(b) Pattern making

- o Handling of pattern making machine
- o Drafting of full size drawing
- o Preparation of wood material for pattern
- o Wood pattern assembly method
- o Wood pattern inspection method

3) Trainee to be covered and term of training

a) Trainee to be covered

In the first year of establishment, 3 trainees for pattern and 7 trainees for casting, a total of 10 are planned.

For subsequent years, number of trainee shall be about 20.

b) Term of training (Table 6.2.5-2 indicates casting technique training program)

The term shall be one year. The content is as follows:

Initial one month	:	Orientation is executed mainly in general education concerning casting
Next one month	:	Special lecture is rendered by classifying into pattern and casting
Remaining ten months	:	Practical skill training putting stress on OJT is executed

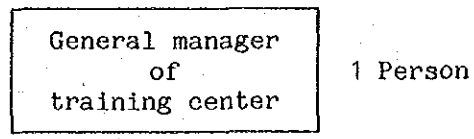
During this period, special lecture of two hours is rendered per week.

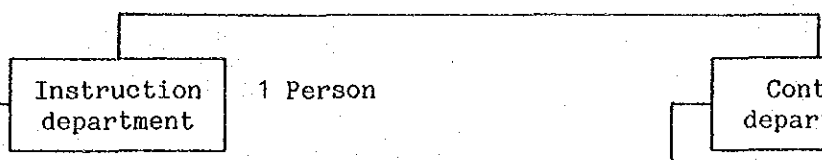
4) Certificate

A certificate is awarded after completion of predetermined course of training center.

The training center aims to have a function of public authority for certification in the future.

Table 6.2.5-1 Organization and personnel allocation of training center





Inst-ructor	Assistant instructor	Content
1	1	Plan (casting, pattern)
1	1	Mould Sand preparation
1	1	Melting Material
1	1	Casting finish Inspection
1	1	Analysis test Material test

Control member	Content
1	Budgeting general affairs (Work and safety)
1	Control and manage-ment of training center

Table 6..2.5-2 Casting technique training program

Classification		Content	(Month) 1 2 3 4 5 6 7 8 9 10 11 12
1. Lesson (General)		General education concerning casting	→
2. Lesson (Special)	Wood pattern	· Kind of wood pattern · Reading of drawing · Drafting of full size drawing · General knowledge of wood pattern making · Material for wood pattern wood working machine	→
	Casting (FC)	· Fundamental plan of casting · Mould material · Kind of mould work method and moulding method · Pouring method · Machine for moulding	→
3. Practical skill	Wood pattern	· Reading of drawing · Drafting method · Wood pattern making method · Drafting at full size drawing · Preparation at wood material for pattern	← A lecture of two hours per week is rendered during this period →
	Casting (FC)	· Moulding work · Pouring work · Casting finish work · Product inspection	← A lecture of two hours per week is rendered during this period →

6.3 Facilities/equipment renovation plan

In this plan the introduction or replacement of facilities/equipment is limited to the minimum level, i.e. it will occur only if it is necessary for the furan process. Under this basic policy, the outline of facilities/equipment renovation plan is given as follows:

The outline of a plan drafted under the above-mentioned fundamental policy is as follow in terms of hardware.

6.3.1 Production line

Production line of molding consists of the following two major lines - the same as the current status.

- o Machine molding line for smalle-sized products
- o Hand molding line for medium- and large-sized products.

Fundamental small sized product machine molding line consists of two FD-4 type molding machines, three F-2A type molding machines, a series of sand mixer which supplies green sand and sand reclaiming equipment as they are currently.

Although three F-2A type molding machines are currently out of use, operation will be restored by attaching roller conveyor.

However, when production amount is increased thereafter, this molding machine is removed and two FD-4 type molding machines which are larger will be installed.

Start of operation of added FD-4 type molding machine will be 1991. Incidentally, new roller conveyor, traverser, etc. will be equipped as the accessary facilities at that time, Medium- and large sized product hand molding machine line will have a major chance from the current line. Namely, this line should be adjusted to furan molding which uses furan sand.

Therefore, current sand slinger is removed and instead two furan sand continuous mixer of which one has 3 ton/h capacity and another has 10 ton/h capacity are introduced.

A mixer with 10 ton/h capacity is used for major molding and mixer with 3 ton/h capacity is used for core molding and also for major molding of medium-sized products. Sand reclaiming equipment is introduced to supply sand to the above-mentioned continuous mixer.

Furan sand mold to which molten metal is poured is shaked down at shake down pit for medium- and large-sized product hand molding line and furan sand is transferred to reclaiming equipment through an exclusive exit.

Therefore, mixing of different kind of sand with green sand, which occurs now, is completely prevented.

To deal with the increase of production amount, enlargement of molding shop area is intended and a separate building adjacent to the current factory is constructed for finishing work.

In addition, a new office building and pattern making plant are constructed outside the plant to replace present ones.

The site of finishing shop, office and pattern making shop is utilized as molding shop in the future and a part of building of current office is strengthened to install an overhead travelling crane (capacity: 3 ton). The section under this crane is used as both core molding shop and medium size product major molding shop.

To improve productivity of core molding of small size castings and rationalize the finishing work, shell mold process is introduced.

For this purpose, two shell molding machines are installed on the site of present office.

The foregoing is the outline of major molding line. Concerning other melting and finishing work although each facility is strengthened, most of production line is the same as the current status.

Products after being shaked down are transferred to the finishing shop in a separate building by using hand push car.

Above is the essential part of production line and Fig. 6.3.1-1 shows plant layout based on this plan.

6.3.2 Machine and equipment

Table 6.3.2-1 is a list of machines and equipment based on this plan and these machines and out line of equipment is shown as follows according to the types of work process.

- o Pattern making equipment
- o Sand preparing equipment
- o Molding equipment
- o Melting equipment
- o Finishing equipment
- o Test and inspection equipment

Based upon the above-mentioned categories, the outline of machines and equipments are described below.

1) Pattern making equipment

A new pattern making plant is constructed outside the current plant and the existing pattern making equipment is re-installed as well as a wood lathe, bobbin sander and dust collector.

In a new plant, a wood making shop and pattern assembly shop are separated with each other and the above-mentioned dust collector is installed in the wood working shop.

2) Sand preparing equipment

A set of furan sand reclaiming equipment and raw material silica sand drying equipment are newly installed for sand preparation. Although the above-mentioned raw material silica sand drying equipment is used to dry raw material -silica sand - for furan sand, it is also used to dry raw material - silica sand - or green sand.

Besides the above-mentioned new equipment and dust collector for sand reclaiming equipment are renewed.

3) Molding equipment

The outline of molding machines is already described in 6.3.1. In addition to the machines and equipment described these casting flasks for FD-4 type and F-2A type molding machines and those for hand molding machines are renewed.

4) Melting equipment

The following equipment is newly installed for melting.

Press machine for pressing steel scrap	:	One unit
Ladle for pouring molten metal	:	8
Coil for induction furnace	:	For 2 ton induction furance and for 5 ton induction furnace, each one unit

A press machine is intended to shorten melting time and save power consumption by pressing the scrap from automobile factories and charging it into melting furnace in a lump.

A ladle is to pour molten metal into small size casting molds produced by FD-4 type and F-2A type molding machine, and medium size casting molds produced by hand molding and is newly installed to deal with the increase of production amount.

Once coil for induction furnace is broken, it would require a lot of time from ordering to receiving. Therefore it should be always kept in stock.

Other than above-mentioned introduction of machine and equipment, a lifting magnet for transportation and charging of melting materials into a melting and a cooling tower for cooling water of induction furnace coil are renewed. The lifting magnet is renewed because at present the degree of failure is significant and cooling tower is renewed because it is already fairly deteriorated.

5) Finishing equipment

The finishing shop is to be transferred to a separate building which is newly constructed adjacent to the existing plant, and all existing machines and equipment are to be reinstalled there. Also, a 5 ton overhead travelling crane, four grinders for product grinding (one type grinder and three bench grinders) and a hand push car for product transportation swing are newly equipped.

The above-mentioned overhead travelling crane is for transportation of products and the grinders are for dealing with the increase of production amount.

Hand push car is for transfering shaked out products to the finishing shop in the newly constructed separate building newly constructed.

6) Test and inspection equipment

As test and inspection equipment, one large surface plate for marking-off, one metallurgical microscope and two hardness tester (one Vicker's hardness tester and one shore hardness tester) are newly equipped.

Large surface plate for marking-off is for dimensional inspection of large size castings. Although a small surface plate is currently used, a large one is yet to be equipped.

Besides large surface plate, one set of jig and tools for large size marking-off is newly equipped.

A metallurigical microscope is for the examination of metallurigical organization of castings and hardness tester for the measurement of hardness of castings. There is no such instruments at present.

6.3.3 Building

The outline of plan concerning building is already described in 6.3.1 — "Production line", its details being described below.

1) Office

A new office is constructed outside the present plant. The new office is one-story and its floor area is 312 M^2 (12M x 26M). The present office site is to be used as core molding shop.

2) Pattern making factory

A new pattern making factory is constructed outside the present plant. This factory is one-story and its floor area is 225 M^2 (= 15M x 15M).

3) Finishing shop

A separate building for finishing work is constructed adjacent to current plant. Its floor area is 504 M^2 (12M x 42M).

4) Steel scrap pressing shop

A new steel scrap pressing shop is constructed beside the melting work shop and steel scrap press machine is installed. The floor area of this shop is 65 M^2 (13M x 5M).

In order to transfer pressed steel scrap to melting work shop, 2 ton overhead travelling crane is provided.

5) Warehouse for raw material silica sand and products

A new warehouse for raw material silica sand and products is constructed outside the present plant. The total floor area of warehouse is 350 M^2 (10M x 35M) and full length 35M is divided into 15M and 20M. 15M is used for storage of raw material silica sand and 20M is used for storage of product.

6) Reinforcement of the present office building

Since a part of the present office is to be changed into a molding shop with a 3 ton overhead travelling crane, its colums should be reinforced.

6.3.4 Utility

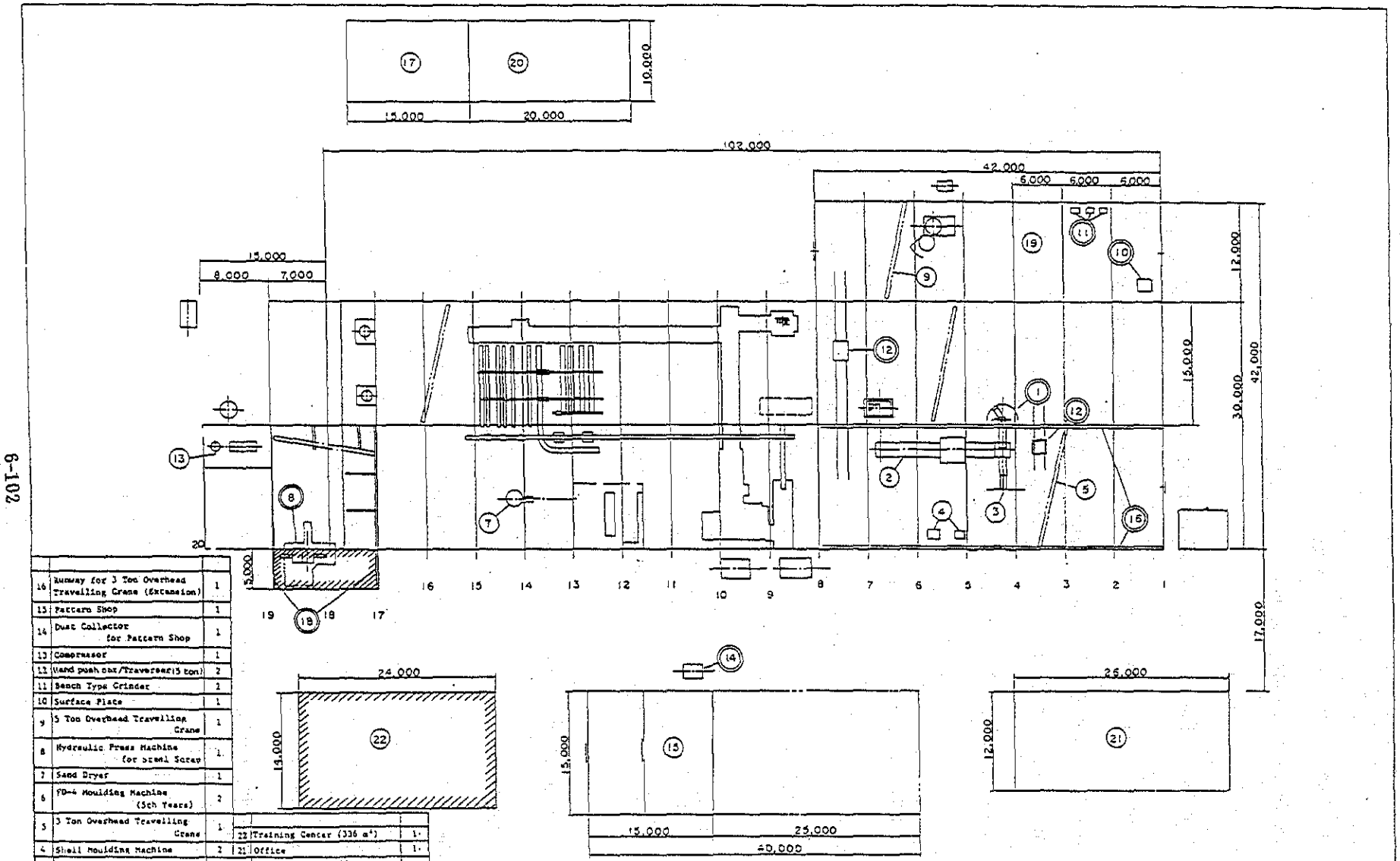
Outline of utility-related equipment is as follows:

1) Addition of compressor for plant air

Although two compressors are currently in use, new one is added because machines and equipment which use plant air are increased.

2) Renewal of cooling water tower for cooling water and pump

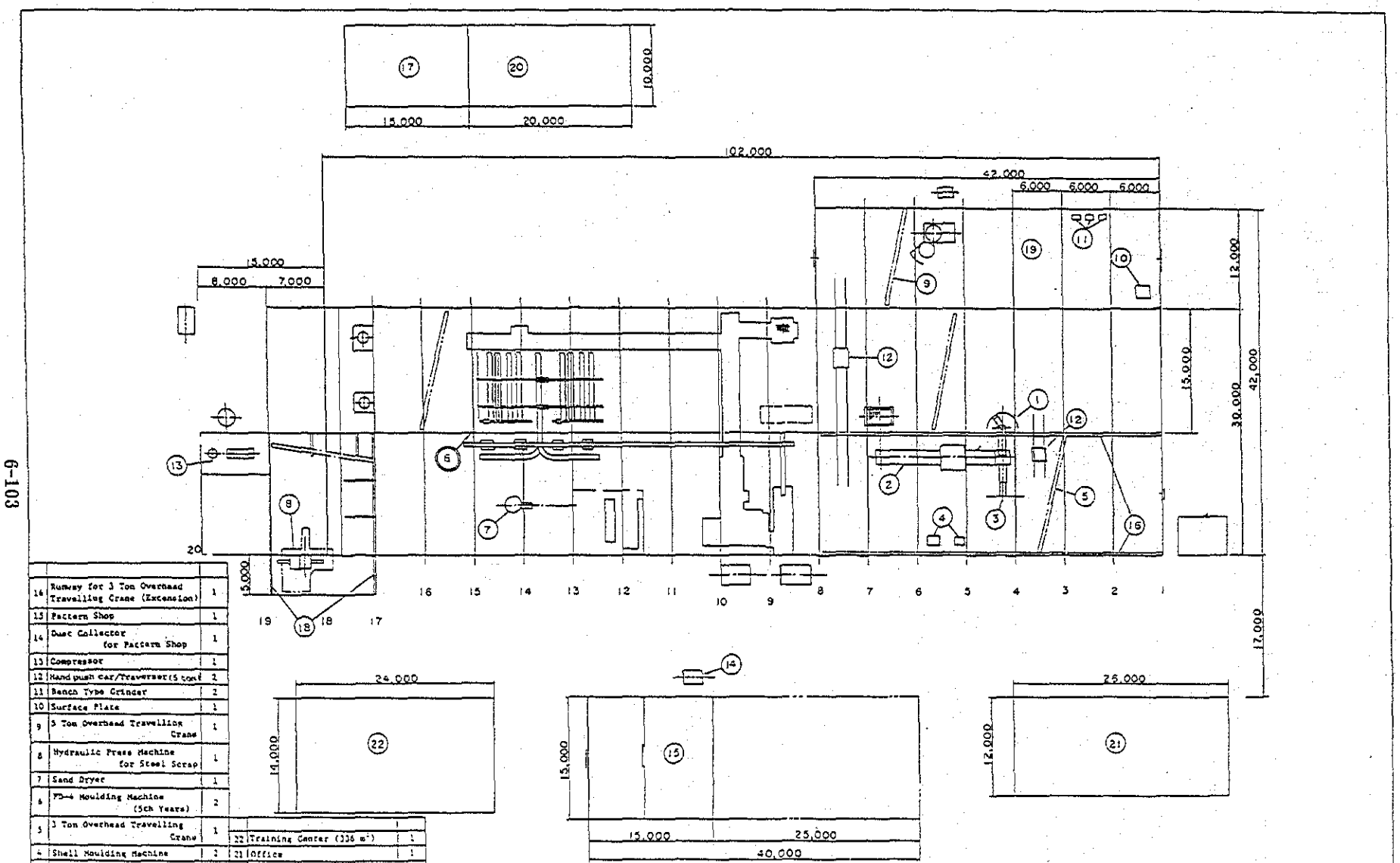
One unit of cooling tower and pump should be newly installed in order to cool the air compressors, since present ones are considerably deteriorated.



No.	Name of Facility	Q'ty
16	Runway for 3 Ton Overhead Travelling Crane (Extension)	1
15	Pattern Shop	1
14	Dust Collector for Pattern Shop	1
13	Compressor	1
12	Hand push car/Traverser(5 ton)	2
11	Bench Type Grinder	1
10	Surface Plate	1
9	5 Ton Overhead Travelling Crane	1
8	Hydraulic Press Machine for Sand Scrap	1
7	Sand Dryer	1
6	FD-4 Moulding Machine (5th Years)	2
5	3 Ton Overhead Travelling Crane	1
4	Shell Moulding Machine	2
3	Furan Sand Mixing Equipment for Core	1
2	Furan Sand Reclaiming Equipment	1
1	Furan Sand Mixing Equipment	1

No.	Name of Facility	Q'ty
22	Training Center (336 m²)	1
21	Office	1
20	Warehouse for Delivery	1
19	Fitting Shop	1
18	Runway for 2 Ton Overhead Travelling Crane	1
17	Sand Storage	1

Fig. 6.3.1-1 Factory Layout (1) S 1/300



No.	Name of Facility	Q'ty
16	Runway for 3 Ton Overhead Travelling Crane (Extension)	1
15	Pattern Shop	1
14	Dust Collector for Pattern Shop	1
13	Compressor	1
12	Hand push car/Traverser(5 ton)	2
11	Bench Type Grinder	2
10	Surface Plate	1
9	3 Ton Overhead Travelling Crane	1
8	Hydraulic Press Machine for Steel Scrap	1
7	Sand Dryer	1
6	FD-4 Moulding Machine (5th Years)	2
5	3 Ton Overhead Travelling Crane	1
4	Shell Moulding Machine	2
3	Furan Sand Mixing Equipment for Core	1
2	Furan Sand Reclaiming Equipment	1
1	Furan Sand Mixing Equipment	1

No.	Name of Facility	Q'ty
22	Training Center (336 m²)	1
21	Office	1
20	Warehouse for Delivery	1
19	Fitting Shop	1
18	Runway for 2 Ton Overhead Travelling Crane	1
17	Sand Storage	1

Fig. 6.3.1-1 Factory Layout (2) S 1/300

Table 6.3.2-1 List of facility and building

New construction facility

	Name of facility	Specification	Q'ty	Remark
(1)	Pattern facility			
	Wood working lathe	Max. dia. 1,000	1	
	Bobbin sander	Disc ø760	1	
	Dust collector	Bobbin ø90 length 240 mm	1	
(2)	Sand arrangement facility			
	Furan sand reclaiming device		1 set	
	Sand dryer	1 Ton/Hr	1 set	
	Furan sand mixer	10 Ton/Hr	1	
	Furan sand mixer (core)	3 Ton/Hr	1	
(3)	Moulding facility			
	Shell moulding machine		2	
	Overhead travelling crane	3 Ton	1	
	Moulding flask	1500 x 1500 x 400/400	15 sets	
	FD-4 type moulding machine and accessories	Flask dimension 600 x 560 x 200/200	2	
	Greensand hardness tester		3	
	Roller conveyor (for F-2A)		1 set	
	Hoist (for FD-4)	500 kg	2	
	Traverser		1	
(4)	Melting facility			
	Hydraulic press machine		1	
	Ladle	1 Ton	2	
	Ladle	300 kg	2	
	Ladle	500 kg	2	
	Ladle	1,000 kg (Tea pot type)	2	
	Lifting magnet for monorail (2 Ton)	500 kg	1	

New construction facility (continued)

	Name of facility	Specification	Q'ty	Remark
(5)	Finishing facility			
	Overhead travelling crane	5 Ton	1	
	Swing grinder	Grind wheel diameter ø500	1	
	Fixed grinder	Grind wheel diameter ø250	3	
	Cyclone type dust collector	Air flow 200 M^3/min Air pressure 320 mmAq	1	
	Hand push car		1	
	Compressor	Type 75 kW x S-W No. of cylinder	1	
		Maximum pressure 7 kg/cm^2		
	Jib crane	2 ton	1	
(6)	Inspection facility			
	Brinell hardness tester	BH 100 to 500	1	
	Vickers' hardness tester	Max. load 50 kgf Min. load 1 kgf	1	
	Metallurgical microscope (with camera)	10 to 2000X	1	
	Drilling machine		1	
	Inspection surface plate	1,500 x 2,000 mm	1	
	Measuring device for above		1	

Machine facility (Renewal, repair)

	Name of facility	Specification	Q'ty	Remark
(1)	Pattern facility			
	Band saw blade	76 x 4,750 mm	6	
	Cutter for universal milling machine	ø50 to ø70 mm	1 set	
(2)	Sand preparation facility			
	Greensand dust collector	UDC 816 PR	1	Renewal
	Belt conveyor	Belt width 500 mm Distance between centers 42,000 mm Transfer capability 40 Ton/Hr	1	
(3)	Molding facility			
	Molding flask for F-2A type moulding machine	300 x 400 x 120/120 mm	15 sets	Renewal
	Molding flask for FD-4 type moulding machine	600 x 560 x 200/200 mm	60 sets	Renewal
(4)	Melting facility			
	Cooling tower for 2 Ton and 5 Ton induction furnace	Cooling water flow 30 Ton/Hr Inlet temperature 50°C Outlet temperature 30°C	1	 Renewal Renewal
	Pump for above	18 M^3/Hr Total lift 12M Motor 5.5 kW 380V	2	Renewal
	Coil for 2 Ton induction furnace	TFT Ge 2,000/900	1 set	Renewal
	Coil for 5 Ton induction furnace	NET Ge 5,000/1,200	1 set	Renewal
	Vacuum switch for 2 Ton and 5 Ton induction furnace		6	
	Contactor	SR 200B	5	
(5)	Finishing facility			
	Cooling tower for compressor	Cooling water flow 190 ltr/min Inlet temperature 40°C Outlet temperature 30°C	1	Renewal

Building

	Name of facility	Specification	Q'ty	Remark
(1)	Pattern			
	Pattern shop	15M x 15M = 225 M^2	1	New construction
(2)	Molding			
	Installation of rail for 3T overhead travelling crane and strengthening of columns	New installment of rail 42M x 2 = 84		Improvement
(3)	Sand arrangement			
	Sand depository	10M x 15M = 150 M^2	1	New construction
(4)	Melting			
	Extension of rail for 2T overhead travelling crane and improvement of building	Rail extension 5M x 2 = 10M 5M x 13M = 65 M^2	1	Improvement
(5)	Finishing			
	Relocation of finishing shop	12M x 42M = 504 M^2	1	New construction
	Product site	10M x 20M = 200 M^2	1	
(6)	Office			
	New construction of office	12M x 26M = 312 M^2	1	New construction

6.4 Present on-going renovation plan by JFC, Barata

P.T. Barata is in the planning renovation of Jakarta Foundry Center and Gresik.

Although all aspect of this plan could not be known accurately because the person in charge was on a business trip abroad during our visit, the outline of renovation plan described below is clarified from available data, various situations in the plant and conversation with the JFC top management.

Table 6.4.1 indicates the renovation list.

1) Outline of renovation plan at JFC

On-going renovation plan by JFC is as follows:

a) Start of production of centrifugal casting steel pipe and chilled roll by introduction of centrifugal casting machine (Table 6.4-1: 7.11).

b) Start of production of large size casting (Example: press metal mold for automobile) by introduction of the following large size of flask.

3000 x 3000 x 400/400	20 sets (7.39, 7.40)
2000 x 2000 x 400/400	20 sets
2000 x 2000 x 300/300	20 sets

c) Strengthening of production line (Greensand molding line) by introduction of full automatic molding machine (7.69) and renewal of 60 sets of casting flask of FD-4 molding (7.38).

d) Strengthening of cement sand molding line by introduction of Simpson mill (Cap. 1350 kg/time) (7.16).

e) Stabilization of quality and improvement of productivity by introduction of organic chemical binder system (7.31).

f) Improvement of efficiency of core making by introduction of shell molding machine (7.50).

g) Rationalization of melting work by introduction of 2 Ton monorail crane (7.1) and 150 Ton scrap press (8 x .4)

h) Renewal renovation of deteriorated cooling tower (for air compressor and 2T and 5T induction furnaces) and dust collector for green sand production facilities.

i) Strengthening of quality control by introduction of equipment to check property of casting (hardness tester and microscope).

j) Strengthening of quality control and expansion of sales by introduction of machine tool.

k) Improvement of production work environment by enlargement of shop area.

Although above-mentioned renovation plan by JFC is according to the demand forecast of JFC indicated in Table 3-6-1 in Chapter 3, it is anticipated that some confusions will occur when this plan is implemented.

These are described below.

2) Problems of JFC renovation plan

a) Type of product

The type of product by this plan is divided into two major categories which are small size product using molding machine and medium and large size products by hand molding. Large-sized products range from 10 to 15 tons/piece, and are beyond the production capacity (from the viewpoint of both technology and facilities) of JFC.

In addition, concurrent production of small size product and such huge product makes production control of this foundry difficult. As a result, management becomes difficult by bringing about high cost. It is considered that production of large size product should be restudied.

b) Equipment

A 3 T/H mixer is planned for no bake sand core and there is a sand reclaiming equipment (7.31) for molding. One continuous screw mixer 10 Ton/H should be added for master mold molding.

There is a total of 40 sets of flask of 2,000 x 2,000 x 400/400, 3,000 x 3,000 x 400/400, etc.. Since dimension of each flask is large and the quantity is large, storage requires a large space, and when piled up, they become unstable and dangerous. Judging from width of plant and effective height of crane (7m), turning over such large molding flask is risky and there are many technical problems. Although production of chilled roll is planned by centrifugal casting method, production of this product requires high level technology and acquisition of the technology requires long time. Therefore, production of this product is considered for restudy after improvement of technical capability of this foundry is attained.

Besides these, many machine tools (automatic turning lathe 7.51, universal lathe 7.64, surface grinding machine 7.65, copy milling machine 7.68) and equipment (ladle capacity 4 Ton, bottom pouring ladle 2 sets, Simpson mixer 7.16, full automatic molding machine 7.69) are listed up depending on its necessity and these equipment are considered to be introduced after improvement of technical capability of JFC is attained.

c) Management of system sand

The Renovation Project provides for molding sand in 5 different systems - green sand, cement sand, CO_2 sand, shell molding sand, and no-bake sand - flowing simultaneously through the Foundry, and this calls for measures to prevent the different sands from mutual immixture.

Even at present, the green sand is found adulterated by cement and CO_2 sand through the use of a common sand reclaiming system. Currently, the quality of facing sand is being maintained by dint of adding as much as 70% of new sand (Section 5.3.2-2), when in normal practice the proportion of new sand is only 5 to 20%.

This concludes the outline of the Renovation Project and the difficulties foreseen in its implementation.

Table 6.4-1 Facilities and Equipment in JFC Renovation Plan

		Description	Q'ty	Tender-No.
Pattern shop	1	Wood Working Turning Lathe machine	1	7.13
	2	Bobbin sander	1	7.14
	3	Copy Milling Machine	1	7.68
	4	Band Saw Blade	6	8.15
	5	Cutter for Wood U. Milling M.	1 set	8.16
Sand Treatment	6	Sand Drying Unit	1	7.19
	7	Continuous Mixer (3 Ton)	1	7.15
	8	Sand Reclaiming Unit	1 set	7.31
	9	Simpson Mix Muller	1	7.16
	10	Whirl Mixer	1	7.71
	11	Rubber Belt for Conveyor	1 set	8.17
Moulding Shop	12	Centrifugal Casting Machine	1	7.11
	13	Shell Core Blowing Machine	2	7.50
	14	Moulding Box for F-2A	15 sets	7.37
	15	Moulding Box for FD-4	60 sets	7.39
	16	Moulding Box for Hand. M.	each	7.40
		(2M x 2M & 3M x 3M)	20 sets	7.40
	17	Green sand Hardness Tester	3	7.23
	18	Full Automatic Moulding M.	2	7.69
Melting Shop	19	Stopper Pouring Ladle	2	7.5
	20	Teapot Pouring Ladle	2	7.6
	21	Ladle for Ductile Iron	each 2	7.58
		(1 Ton, 0.5T, 0.3T)		
	22	Hydraulic Press. Machine	1	8X.4
	23	Cooling Tower	1	8X.2
	24	Water Pump for Furnace	2	8.6
	26	Mono Rail for Furnace (2T)	1	7.1
	27	Coil for 2T-furnace	1	8.13
	28	Coil for 5T-furnace	1	8.14
	29	Vacuum Switch (2T/5T)	each 3	8.5
	30	Contactor	5	8X.5
	31	Burner for Crucible Furance	3	8.3
	32	Blowre for Crucible Furnace	1	8.4
Fettling	33	Overhead Crane (5T)	1	7.18
	34	Jib Crane (2T)	1	7.43
	35	Swing Grinder	3	7.46
	36	Cyclone Type Dust Collector	1	7.49
	37	Compressor	1	8X.1
	38	Cooling Tower for Compressor	1	8X.2

		Description	Q'ty	Tender-No.
Inspec-tion	39	Digital Metal Hardness Tester (Brinel Hardness Tester)	1	7.48
	40	Vickers Hardness Tester	1	7.62
	41	Micro Scope and Camera	1 set	7.67
	42	Boring Machine (Drilling machine)	1	8X.4
Machine Tool	43	Shaping Machine	1	7.12
	44	Automatic Turning Lathe	2	7.51
	45	Surface Grinding Machine	1	7.65
	46	Universal Lathe Machine	1	7.64

6.5 Consistency of present JFC, Barata renovation plan with JICA Plan

Jakarta Foundry Center (JFC) is demanded by its customers to realize supply of quality products, cost reduction and strict observance of delivery date. JFC should, considering its role, manufacture "quality products" without fail. Therefore, we would like to put emphasis on improvements in such fields as management, finance, production, technology, facility, material and quality as well as the development of efficient manpower through education/training. Judging from the present situation where a great deal of time is spent to solve various problems, the personnel training is the first priority to be implemented urgently.

Major troubles in work places include dimensional defects, insufficient thickness, sand inclusions, and blow holes of castings.

Although some of these defects are caused by the inferiority of mold flask, molding sand and so on; main blame is to be placed on the worker's skills.

It is essential to train engineers/managers who will be able to handle such problems.

Renovation proposal to JFC by JICA team is mainly management/technology oriented one intending to realize the stabilization and improvement of quality, and the consideration is paid to the equipment so that their function sufficiently also in future production scale.

Tentative Proposel on the Renovations Plan to JFC Based on Site Survey" (July, 1985, JICA) submitted to JFC at the time of the survey is annexed at the end of this volume.

Basic plan on the renovations by JICA is stated in 6.1, and its renovation plan for equipment in 6.3. JFC's own plan is described in 6.4.

Consistency of both plans by each process is described below.

1) Pattern

In order to maintain dimensional precision of castings, it is required to make further endeavor to improve the pattern making skill utilizing fully the existing equipment. For this purpose, it may be required to receive the aid of engineers from an industrialized country. Introduction of copying machine shall be considered after a certain improvement of the pattern making skill.

Since the work environment of pattern making shop is worsened due to wood chips, a dust collector shall be introduced.

2) Molding and sand

(1) Green sand mold

In green sand production line, since flasks for F-2A molding machine and FD-4 molding machine is outworn, 15 sets and 60 sets shall be respectively introduced for replacement.

There are some flasks, among existing ones, which can be used in future when pin and bush are repaired. It is necessary to maintain them systematically.

The molding plates for F-2A and FD-4 molding machines are so worn-out that they need to be replaced with new ones.

To cope with the increase of green sand mold production of small-sized castings, 2 units of FD-4 molding machine will be added 5 years later, instead of existing F-2A.

Full-automatic molding machines will not be installed, because the present shop floor is not spacious enough for them to be run efficiently.

Currently JFC mix 70% of new sand in order to keep the quality of facing sand in green sand molding. This is not only wasteful but causes decrease of strength of green sand through mixture of cement and CO_2 sand with green sand. Therefore at the time of shake out, cement and CO_2 sand should be removed and only green sand should be reclaimed.

(2) Cement sand and CO_2 sand

Since the use of cement and CO_2 sand is likely to cause such defects as sand penetration, sand inclusion and blow hole, it is advisable to stop using them.

CO_2 sand and shell mold sand, however, may be used for the core of green sand mold.

(3) Shell mold sand

Shell mold sand machines will be effective to provide the cores of mass-produced castings of small size.

(4) Furan sand

Furan molding method, in which furan resin is used as binder, is very effective way of foundry production. In JFC plan, a mixer (3 tons/h) is intended to be installed for furan molding. In JICA plan, on the other hand, furan molding will become the main part of hand molding, so that another mixer (10 tons/h) is to be added.

(5) New sand dryer

When introducing furan casting process, it is an absolute requisite that sand to be used is dried. Since banker sand used by JFC contains moisture, sand dryer is installed for drying.

(6) Flask for hand molding

Although introduction of large flasks such as 2M x 2M, 3M x 3M, etc. is planned, it is not adopted in JICA plan because, as mentioned already in 6.4.2 "production of large size product", the use of such large flasks is considered to be beyond the technology and facilities of JFC.

Instead, introduction of flask of 1.5M x 1.5M is planned.

(7) Centrifugal casting machine

In JFC plan, the introduction of a centrifugal casting machine is planned. The production of chilled roll for rolling mill seems to be intended by introduction of this machine. Even in industrialized countries, extremely high and special technology is required for production of chilled roll with this machine.

In addition, if technical knowhow is offered by some companies in a industrialized country, realization of production would require considerable time. Therefore, it is considered that introduction of this machine should be considered again only when improvement of technological capability of JFC is attained. The JICA plan does not envisage the introduction of this machine.

3) Melting

It is considered that there is no major problem of melting technology of JFC judging results of tapping temperature (less than 1500^{o}C) and CE value measurements at the furnace front side. In order to make pressed block of sheet metal scrap for sheet metal scrap, a hydraulic scrap press machine shall be installed and the cooling tower system shall be renovated. Introduction of a scrap press

machine will contribute to lower melting costs, reduce manhours by simplifying handling and diminish melting loss, which are considerable advantages.

It should be better not to install burner and blower of tilting furnace for copper alloy melting from the viewpoint of simplification (production of FC, FCD only) of product range in the future.

The planned bottom pouring ladle, which is for SC product, will not be installed, because there is no SC product in future production plan.

Spare part of coil for induction furnace is included in the plan and this must be always provided.

4) Finishing

Planned three swing grinders are reduced to one in JICA Plan. It is expected that casting technology improvement will diminish casting fins in the future so that it is enough to execute works by adding one swing grinder.

Installation of three double head type grinder is foreseen in JICA plan and this corresponds to increased casting finishing volume of small size casting.

Moreover, installation of hand push car is planned and this is used for transportation of castings to finishing shop after shake out and of flasks.

5) Inspection

In JFC plan, introduction of hardness tester for hardness inspection of metal material and metallurgical microscope is planned. Since current metallurgical microscope is deteriorated, renewal is desirable.

These inspection equipments are fundamentally required for quality control and should be introduced.

On the other hand, in JICA plan, introduction of large surface plate for marking-off, marking-off jig and tool is foreseen because it is expected that large inspection surface plate are required for large size product manufacturing in the future.

6) Machine tool

In JFC plan, introduction of machine tools to work fly wheel, cylinder liner, pump case and impeller is provided. It is said that, as one of reasons of introduction of these machine tools, customers, require machined product but in fact it is considered that inferior precision of current casting will be a true major reason.

Therefore, first of all an establishment of techniques to produce casting with higher precision is urgently required. Casting manufacturers generally do not provide machine tool and do not deliver machined product.

If machine tools are installed, it requires long time to acquire high precision machining skills and it can not be attained in short period. In addition, the machine tools can not be in full operation and it may be a cause of cost increase.

Therefore, for the time being, it is necessary to make effort for producing casting with high precision, and installation of machine tools should be left for a next step. So, in JICA proposal, installation of machine tool is not foreseen.

7) Others

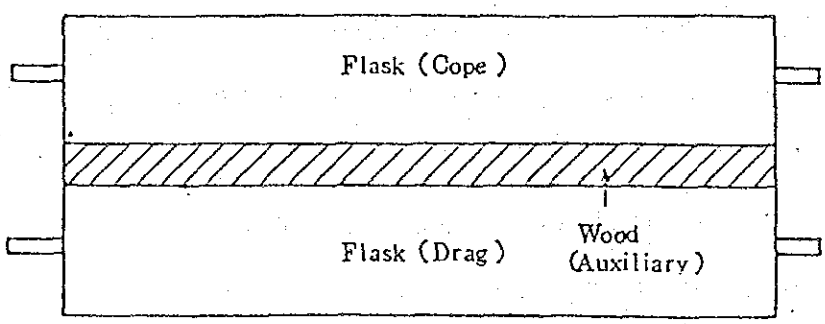
(1) Pattern plate for molding

Current pattern plate for molding is fragile and easily deformed when casting flask is charged on and molding is carried out. As a result of this reason, defect in dimension of casting product often occurs.

One example of standard drawing of pattern plate for molding is shown in Fig. 6.5-1 and Fig. 6.5-2. It is important to set precisely pins in these filling surface tables.

(2) Auxiliary wood flask

Although auxiliary wood flask is used between cope and drag to adjust the height of flasks, it may cause molten metal leakage so it should be made of steel plate.



Auxiliary wood flask

Table 6.5-1 Harmonization of JFC Plan and JICA plan

	Description			Q'ty		Remarks
Pattern shop	JICA	1	Dust collector	1	o	
	JFC	1	Wood Working Turning Lathe Machine	1	o	
		2	Bobbin Sander	1	o	
		3	Copy Milling Machine	1	x	
		4	Band Saw Blade	6	o	
		5	Cutter for Universal M.M.	1 set	o	
Sand Treat-ment	JICA	1	Continuous Mixer (10 T/H)	1	o	
		2	Dust Collector for Green Sand	1	o	Replace
	JFC	1	Sand Drying Unit	1	o	
		2	Continuous Mixer (3 T/H)	1	o	
		3	Sand Reclaiming Unit	1 set	o	
		4	Simpson Mix Muller	1	x	
		5	Whirl Mixer	1	x	
		6	Rubber Belt for Conveyor	1 set	o	
Molding shop	JICA	1	FD-4 molding machine/ accessories*	2	o	* Secondary plan 5-years later
		2	Overhead Hoist Crane (3T)	1	o	
		3	Molding Box for Hand Molding	15 set	o	1.5M x 1.5M
		4	Hoist for FD-4 (500 kg)	2	o	
		5	Roller Conveyor for F-2A line	1 set	o	
		6	Traverser	1	o	
	JFC	1	Shell Core Blowing Machine	2	o	
		2	Moulding Box for F-2A	15 sets	o	
		3	Moulding Box for FD-4	60 sets	o	
		4	Moulding Box for Hand Moulding	each 20 sets	x	2M x 2M ... 20 sets
		5	Green Sand Hardness Tester	3	o	3M x 3M
		6	Full Automatic Moulding M.	2	x	... 20 sets
		7	Centrifugal Castig Machine	1	x	
Melting shop	JICA	1	Hydraulic Press Machine	1	o	
	JFC	1	Stopper Pouring Ladle	2	x	
		2	Tea Pot Pouring Ladle	2	o	
		3	Ladle for Ductile Iron	each 2	o	(0.3T, 0.5T, 1T)
		4	Cooling Tower	1	o	
		5	Water Pump for Furnace	2	o	
		6	Mono Rail for Furnace (2T)	1	o	

Note: o installation
x cancellation

			Description	Q'ty		Remarks
Melting	JFC	8	Coil for 2T-furnace	1	o	
		9	Coil for 5T-furnace	1	o	
		10	Vacuum Switch (2T/5T)	each 3	o	
		11	Contactor	5	o	
		12	Burner for Crucible F	3	x	
		13	Blower for Crucible Furnace	1	x	
Fettl-ing	JICA	1	Grinder	3	o	
		2	Hand Push Car	1	o	
	JFC	1	Overhead Crane (5T)	1	o	
		2	Jib Crane (2T)	1	o	
		3	Swing Grinder	1	o	
				2	x	
		4	Cyclone Type Dust Collector	1	o	
		5	Compressor	1	o	
		6	Cooling Tower for Comp.	1	o	
Inspec-tion	JICA	1	Surface plate	1	o	
		2	Angle Plate	1	o	
		3	Height Gauge (1M)	1	o	
		4	Square	1	o	
	JFC	1	Digital Hardness Tester (Brinel)	1	o	
		2	Vickers Hardness tester	1	o	
		3	Micro Scope and Camera	1 set	o	
		4	Drilling Machine	1	o	
Machine Tool	JFC	1	Shaping Machine	1	x	
		2	Automatic Turning Lathe	2	x	
		3	Surface Grinding M	1	x	
		4	Universal Lathe M	1	x	

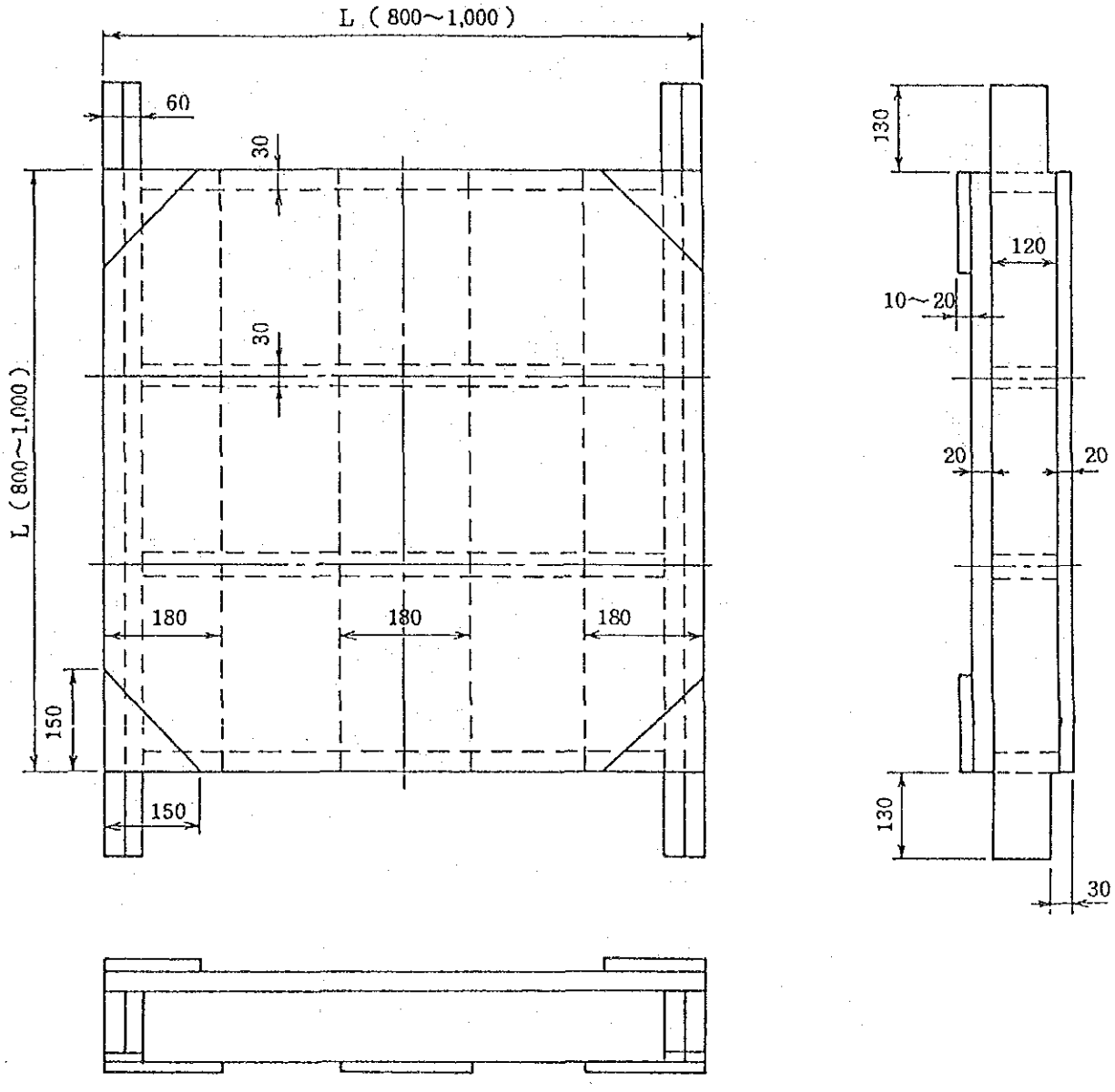


Fig. 6.5-1 Example of standard pattern plate for molding

L = outside dimension of flask + 60 mm

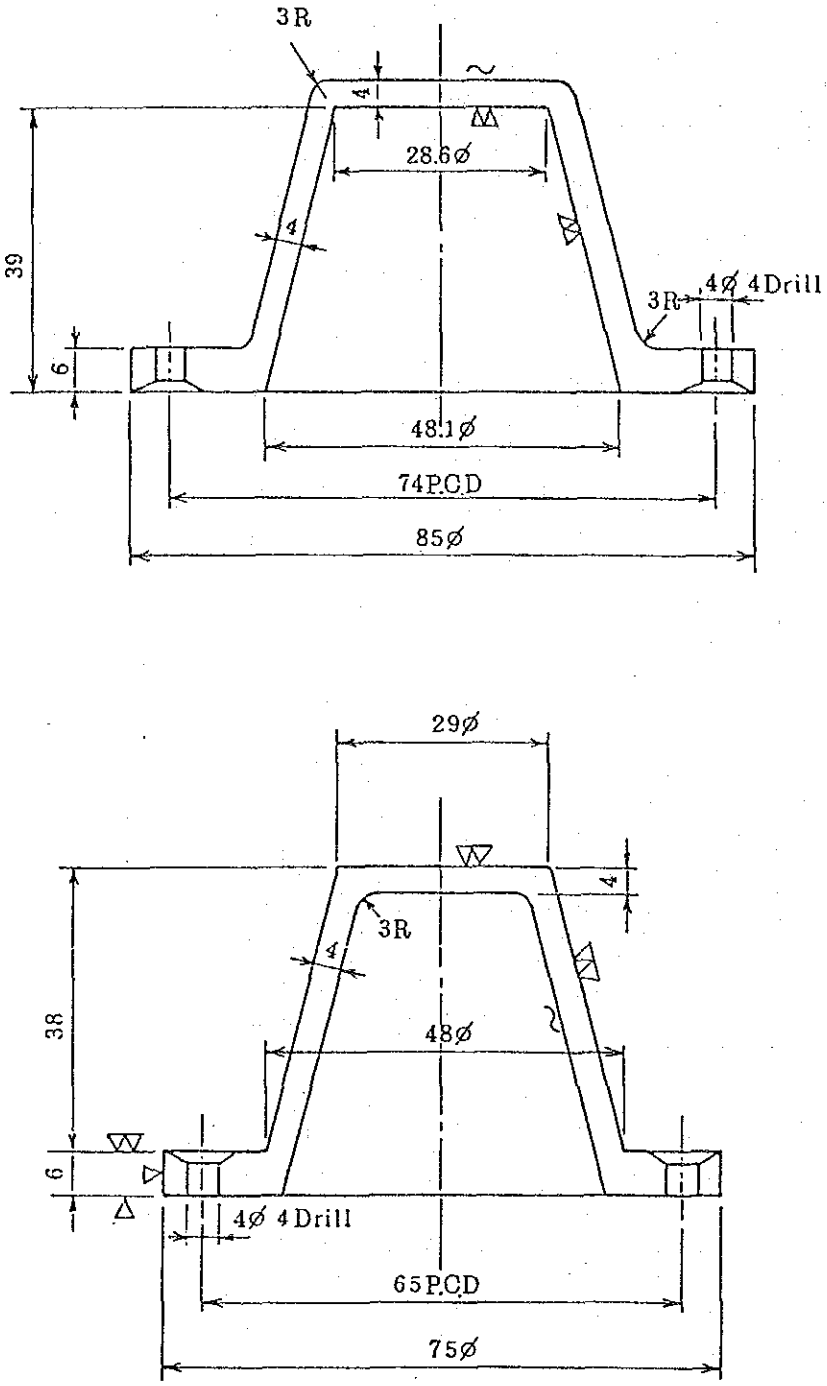


Fig. 6.5-2 Dowel pin on pattern plate for molding

Material AC3A

6.6 Facilities of the casting technique training center

The objectives of establishment, the management and functions of the casting technique training center have been set forth in Section 6.2.4, and the policy and method to be adopted presented in Section 6.2.5. The present Section will hence cover mainly the facilities to be provided in the training center.

The training center facilities will essentially comprise what is necessary for basic instruction/training in sand preparation, molding finishing and inspection work.

As for other facilities that may be required for training, use will be made of the production facilities at the Jakarta Foundry Center.

The following pages present the layout and outline of the facilities of the training center.

1) Layout

The layout of casting technique training center is shown in Fig. 6.6-1.

2) Equipment

The equipment of the training center is listed in Table 6.6-1.

Among them, the major items are the following:

a) Equipment

- o Greensand mixer
- o Mold flasks
- o Grinders
- o Inspection surface plate and measuring instruments/jigs
- o Audiovisual equipment

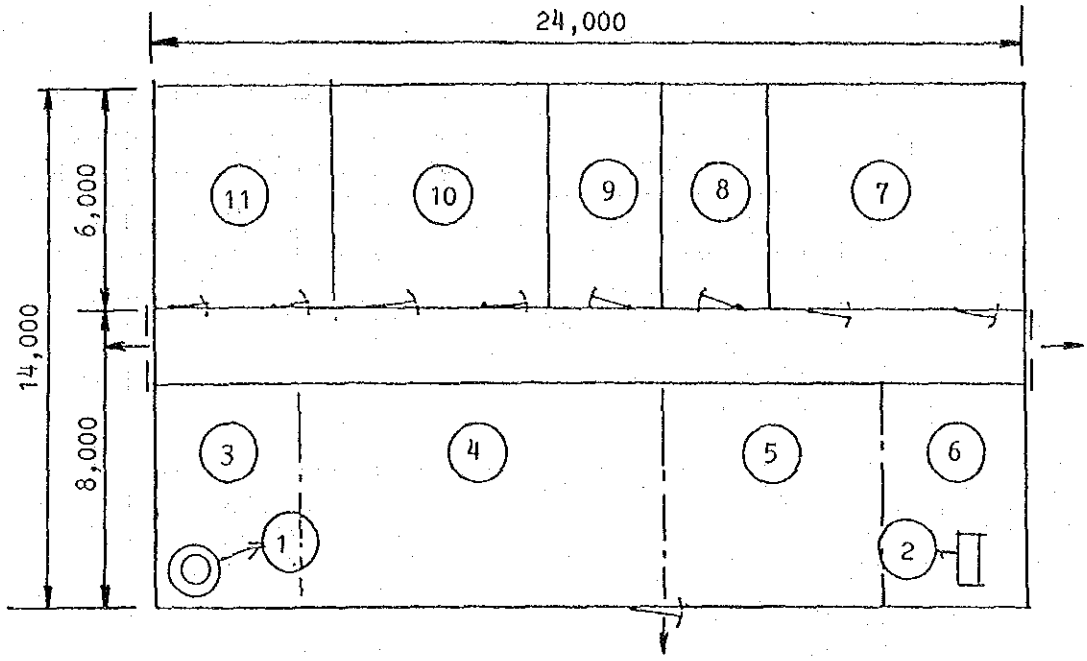
b) Building

The building will comprise of office, practice shop and class rooms.

Total floor area	336 m^2
Office	91 m^2
Practice room	168 m^2
Class room	77 m^2

Apart from the foregoing, instruction and training will be provided using service equipment in JFC for:-

- Pattern making
- Melting
- Sand testing
- Material analysis
- Mechanical testing



1	Sand mixer	7	Office
2	Inspection surface plate	8	Lavatory
3	Sand preparation shop	9	Dressing room
4	Molding shop	10	Class room
5	Finishing shop	11	Class room
6	Inspection shop		

S: 1/200

Fig. 6.6-1 Layout of casting technique training center

Table 6.6-1 List of facilities of casting technique training center

Category		Name	Specification	Q'ty
1. Training center	1.	Training center building	336 m^2	1
	2.	Blackboards	900 x 1800	2
	3.	Desks and chairs (other than office)		5
	4.	Desks and chairs (office)		5 sets
	5.	Lockers		2
	6.	Slide projector and screen		1 set
		Films		2
2. Sand preparation	1.	Sand mixer	40 kg/batch	1
	2.	Platform scale	50 kg	1
	3.	Balance	12 kg	1
	4.	Sieves		10
	5.	Hand shovels		5
	6.	Water buckets		3
	7.	Tool rack		1
3. Molding	1.	Flasks (wooden flask)	400 x 200	25 sets
	2.	Mold surface hardness testers		10
	3.	Mold drying burners		3
	4.	Baume meters		20
	5.	Molding plates	600 mm square x 20 mm thick, of plywood	20
	6.	Wooden rules		5
	7.	Contraction scales		5
	8.	Tape measures		5
	9.	Inside calipers		10
	10.	Outside calipers		10
	11.	Buckets		10
	12.	Sand brushes		20
	13.	Spoon tools		20
	14.	Corner tools		20
	15.	Double enders		20
	16.	Hand hammers		20
	17.	Hand shovels		10
	18.	Rammers		20
	19.	Stamps		10
	20.	Vent wires		20
	21.	Cutting pliers		4
	22.	Chisels		5
	23.	Tool rack		1

Category		Name	Specification	Q'ty
4. Finishing	1.	Hand trolleys	1120 mm x 600 mm 400 kg capacity	2
	2.	Pneumatic grinders		5
	3.	Chipping hammers		3
	4.	Flat chisels		10
	5.	Round chisels		10
	6.	Hand hammers		5
	7.	Hand shovels		5
5. Inspection	1.	Inspection surface plate		1
	2.	Jacks		10
	3.	V blocks		10
	4.	Straight rule		3
	5.	Scribing gauges		3
	6.	Rule holders		2
	7.	Squares		3
	8.	Vernier calipers		5
	9.	Inside calipers		5
	10.	Outside calipers		5
	11.	Hand hammers		3
	12.	Test hammers		5
	13.	Grinding stones		30
	14.	Penetration test agent		10 bottles
	15.	Balance	50 kg	1
	16.	Tool box		1

6.7 Promotion organization running with implementation of renovation project

When promotion of this project is determined, JFC side must establish the project promotion organization and implement the following various works so that the promotion of this project may not be interfered and problems may not occur.

a) Design of improvement of layout of current plant, new construction and added construction and determination of machine and device procurement

b) Control and monitoring of construction process of civil engineering work, building work and installation work of machine and device

c) Preparation and promotion of instruction and training plan for manager, engineer and worker to improve technical capability

Fig. 6.7-1 indicates the promotion organization incorporating these contents. Incidentally, content of above-mentioned various works, supervising of work and instruction and training plan are as follows:

1) Content of work

(1) Work item

Work item is classified into the following practical affairs:

a) Civil engineering work

b) Building work

c) Procurement arrangement and installation of equipment, electric component, instrumentation and piping

d) Integration of whole project and detail design

e) Supervising of each above-mentioned item

(2) Content of work

Each item of above-mentioned (1) can be classified into domestic currency portion and foreign currency portion.

a) Work of domestic currency portion

Major works are supplying of labor, material which can be procured within Indonesia, domestic transportation and custom duty, a part of supervising and lease of construction equipment.

b) Work of foreign currency portion

Major works are procurement of equipment and facility, overseas transportation, arrangement for insurance, integration of whole project, detail design of each item and supervising.

2) Supervising of work

Work items requiring supervising are as follows:

(1) Civil engineering work
(2) Building work
(3) Installation work of equipment
(4) Installation work of electric instrumentation
(5) Piping work
(6) Operating instruction of major equipment

3) Instruction and training plan

Detail of instruction and training plan is as described in 6.2.2.3) Instruction and training.

4) Person in charge for promotion organization

This renovation project is considered to be very important and large-scale project for JFC. Therefore, not speaking of promotion organization but selection of each person in charge should be fully investigated.

In this line of thinking, it is considered to be favorable that the director in charge of casting division of P.T. Barata is assigned as project manager, the executive manager of JFC is assigned as general advisor and the branch manager of JFC is assigned as coordinator.

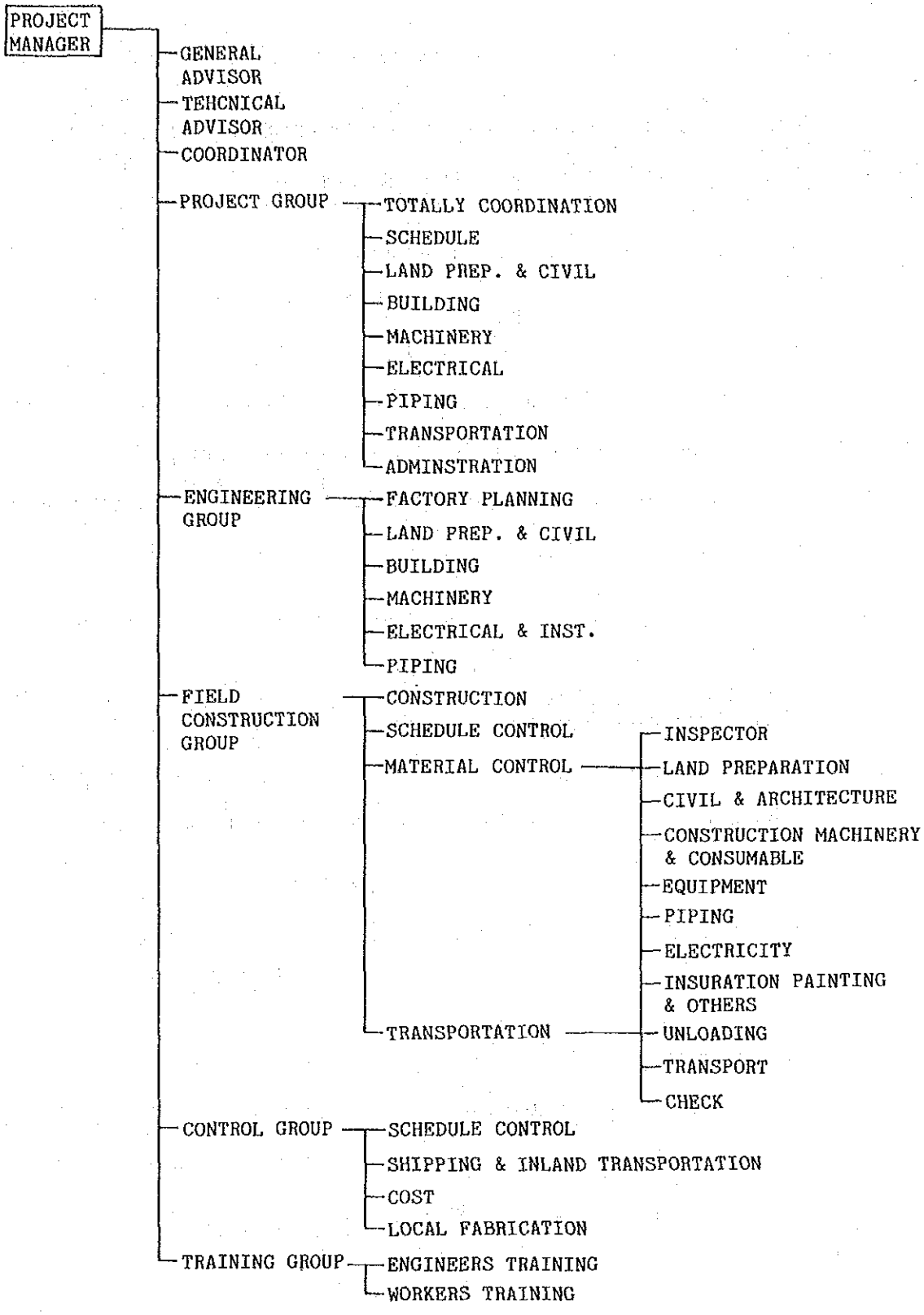


Fig. 6.7-1 Promotion organization of renovation project

6.8 Plan for implementing the Renovation Project

This Section covers the plan for implementing the Renovation Plan in both "facilities/equipment" and "management/technology" aspects.

6.8.1 Facilities/equipment aspect substance

1) Outline

As indicated in Table 6.1.3-1, implementation of the Renovation Plan is to result in production capacity amounting to 1,000 tons/year in the first year, to be raised in the final (10th) year to 2,650 tons/year. The Plan is to be implemented in successive phases, as follows:-

a) Initial phase (1st to 3rd year): To aim at assimilation, consolidation and stabilization of basic foundry techniques.

b) Intermediate phase (4th to 6th year): To serve in mastering the basic techniques and skills, and to further assimilate more advanced foundry techniques to enable undertaking the manufacture of higher grade castings

c) Final phase (7th to 10th year): To envisage the assimilation of further advanced techniques for producing still higher grade castings of medium/large sizes.

Production will proceed first with manufacture of simple castings — including those currently produced — and gradually extend to products of successively higher grade and complexity. The products envisaged to be undertaken will include, principally, components/parts for machine tools and diesel engines.

(1) Design conditions of renovated foundry

To follow the basic principle of striving for maximum effect with minimum capital investment, which latter is to principally cover replacements of existing equipment that has become dilapidated, together with a minimum range of new equipment indispensable for enhancing production and for improving product quality and accuracy.

a) Equipment to be newly installed: Selected to be in keeping with the production program; to be introduced in large part in the initial phase, and certain items in the intermediate phase. The equipment envisaged is given in Section 6.3.1-1 (newly installed facilities)

b) Replacement of dilapidated equipment: To be undertaken as soon as possible. The envisaged equipment is given in Section 6.3.1-1 (replacement, repair)

c) Rearrangement/new construction of premises

Foundry premises to be rearranged

a) To extend the hand molding shop

b) To newly install a steel scrap press.

c) Finishing shop to be moved to new extension of foundry premises.

d) Pattern shop to be newly constructed.

e) Material/product storehouse to be newly constructed.

f) Office building to newly constructed.

g) Foundry technique training facility to be newly constructed.

(2) Enhancement expected of productivity through facilities/equipment

The foundry productivity is expected to improve as a result of the facilities/equipment as given in the accompanying table.

	BEFORE RENOVATION	AFTER RENOVATION	
		3rd year	10th year
Productivity	4.25	9.42	13.87

(3) Foundry layout

The foundry layout has been presented in Fig. 6.3.1-1. The main equipment of the renovated foundry is as listed in Table 6.8.1-1.

Table 6.8.1-1 Hardware renovation

	CATEGORY	PARTICULARS	Ref. No. in Fig. 6.3.1-1
1	Pattern making	Pattern-making shop newly installed	15
2	Sand preparation		
	- Drying new sand	Dryer newly installed	7
	- Greensand mixing/ recovering line	Dust collector renewed	
	- Sand mixing for shell molding	Shell molding machine newly installed	4
	- CO_2 molding		
	- Furan sand mixing recovering	Mixing/recovering line newly installed	2
3	Melting		
	- Melting furnace	Cooling system renewed	
	- Ladle depository	Additionally provided for new ladles	

Table 6.8.1-1 Hardware renovation

	CATEGORY	PARTICULARS	Ref. No. in Fig. 6.3.1-1
	- Indoor material depository	Partitions newly installed	
	- Scrap steel press	Newly installed, together with scrap yard	8
4	Greensand molding line		
	- Initial phase	Furan sand molding line	3
	- Intermediate phase	Molding machine and line newly installed	7
5	Hand molding with furan sand	Molding shop extended to include area currently occupied by finishing shop	
6	Finishing shop		
	- Heat treatment	Move to foundry shop extension	
	- Shot blasting	Ditto	
	- Grinding	Suspended grinder newly installed	
7	Inspection	Remove to foundry shop extension	15
8	Packing/shipping	Facility newly installed in foundry shop extension	
9	Warehouse	Independent building newly constructed	20
10	Material depository	Newly established	17
11	Office	Office building newly constructed	21
12	Foundry technique training center	Newly established	22

2) Facilities/equipment aspect plan of implementation

Upon decision to proceed with the Renovation Project, the Jakarta Foundry Center is expected to undertake as its obligation in ensuring smooth Project implementation free from trouble:

a. Design of the new foundry facilities, and determination of the equipment to be procured

b. Management/supervision of the relevant civil work, building construction and equipment installation operations.

c. Training of requisite middle management personnel, technicians and workers to permit smooth start-up of the renovated foundry.

(1) Operating units

The units that operate for implementing the facilities/equipment aspect of the Renovation Project are as described below.

a) Executive body

The executive body, is to be a Project Implementation Department, to be organized within P.T. Barata. Project implementation will be premised upon the establishment of such an executive body.

This executive body will undertake:

1. Operations relevant to selection of the design/management consultant for carrying out the work
2. Instructions and assistance to the consultant to facilitate its function
3. Approval of plan for Project implementation
4. Operations relevant to selection of suppliers for equipment to be purchased

5. Ditto of local contractors
6. Management of suppliers/contractors
7. Coordination or work among suppliers/contractors
8. Operations relevant to selection of instructors to be entrusted with instruction/training
9. Instructions and assistance to instructors to facilitate their functions.

b) Design/work management consultant

To be selected and contracted by P.T. Barata for undertaking detail design and work management, based on the present Feasibility Study.

c) Equipment suppliers

To undertake supply of foundry and material handling equipment, structural steel members, electrical components and other requisite equipment/components/materials for Project implementation.

d) Local contractors

To undertake work on foundations, structural steel fabrication, building construction, and/or installation of utilities/production/material handling equipment.

e) Installation/operation supervisors

Supervisors selected and commissioned by P.T. Barata for instruction/guidona in installation/operation of the facilities/equipment.

(2) Substance of work

a) Items of work to be undertaken

- Civil work

- Building construction
- Procurement/installation of equipment/electrical installations/instrumentation/piping
- Detail design/management of overall Project
- Supervision of foregoing items
- Operational guidance for special equipment.

b) Division of work between local and foreign currency portions

The work enumerated above is divided into those performed with local and with foreign currencies.

(a) Local currency portion

Labor supply, procurement of equipment/components available on domestic market, inland transportation, taxes/duties, certain consultant services, renting of constructional equipment, etc.

(b) Foreign currency portion

Purchase of imported equipment/components, ocean transport/insurance, consultant services for overall work management, certain design and supervisory operations.

(3) Work supervision

Work calling for foreign supervision comprises:-

- Civil work
- Building construction
- Equipment installation
- Electrical/instrumentation installation

- Piping installation
- Start-up/operation of principal equipment.

(4) Schedule of implementation

Facilities/equipment renovation is to be implemented in several division:

- Rearrangement of existing foundry; new installation of scrap steel press
- Extension of finishing shop
- New construction of pattern-making shop
- Ditto of product/melting material storehouse
- Ditto of office building

The foregoing steps will constitute the owrk to be done during the initial phase of the Renovation Project. During the intermediate phase, additional introduction will be seen of FD-4 molding machines.

The schedule of work implementation is presented in Section 6.12. (Table 6.11-1 - 6.11-5)

6.8.2 Management/technology aspect substance

1) Outline

The objective of renovation will be to set on foot a sound and firm management system and practice, such as to permit the Jakarta Foundry Center to fulfil its mission of model enterprise for the Indonesian foundry industry.

The prerequisites for this are proper mastery of basic foundry techniques and enhancement of relevant engineering capability and technical skills.

The current situation is a tendency of the capability and skills to degenerate with outflow of foundry personnel, the acquired capability and skills failing to be transferred to successors and thus accumulated as technological heritage rooted in the foundry. Training of workers in foundry skills has also not been adequately conducted.

To remedy the foregoing shortcomings, the aim is to be set on establishing a system to ensure proper inheritance and further enhancement of the acquired technical abilities, and to satisfy outside demands for the supply of skilled technicians.

The program of renovation in this aspect is to cover:

(1) Acquisition of foundry engineering capability by training basic casting knowledge and technique

(2) Establishment of production/management standards; application in practice and updating of the established standards

(3) On-the -job training of technicians in basic foundry practice

(4) Training in foundry skills in Foundry Technique Training Center.

For implementing the instruction/training:

(a) Similar assignment is to be obtained of engineers for training engineers; key engineers are to be similarly assigned periods of training abroad.

(b) Assignment is to be obtained from industrialized country of experienced instructors of foreman grade for training technicians; key technicians are to be assigned periods of training abroad

(c) The Foundry Technique Training Center is to be staffed with capable engineers/foremen of the Foundry Center, with guidance obtained from the instructors referred to above, as well as with qualified experts and specialists invited from Indonesian educational, research and industrial institutions.

2) Management/technology — plan of implementation

(1) Operating units

The units that operate for implementing the management/technology aspect of the Renovation Project are as described below.

a) Executive body

The executive body is to be a Project Group to be established in P.T. Barata, charged with consolidating the acquired management/technology within the foundry.

b) Management/technology consultant

To be selected and contracted by P.T. Barata for undertaking detail planning and management of the instruction/training program, based on the present Feasibility Study.

c) Instruction/training equipment suppliers

To undertake supply of instruction/training equipment requisite for Project implementation.

d) Instruction/training instructors

Instructors selected and commissioned by P.T. Barata for undertaking instruction/training based on the present Feasibility Study:-

(a) Instructors to undertake on-the-job training on shop floor to enhance technical capabilities

(b) Instructors to engage in enhancing engineering capability.

(2) Substance of work

Items of work to be undertaken

a) On-the-job training in skills relevant to:-

- Pattern making
- Sand preparation
- Molding
- Melting
- Finishing
- Inspection.

b) Instruction in engineering capability for:-

- Drafting molding designs
- Drafting standards governing different stages of foundry work
- Quality control
- Maintenanc management.

c) Training at Foundry Technique Training Center in skills relevant to:-

- Pattern making
- Molding.

(3) Division of work between local and foreign currency portions

The work enumerated above is divided into those performed with local and with foreign currencies.

a) Local currency portion

Labor supply, procurement of equipment available on domestic market, inland transportation, taxes/duties, domestic instructors, etc.

b) Foreign currency portion

Purchase of imported equipment, ocean transport/insurance, consultant services for overall work management, certain design and supervisory operation.

(4) Schedule of implementation

Management/technology renovation is to be implemented as indicated in Tables 6.2.2-3 and 6.2.5-2.

6.9 Construction and installation work

The procedure of construction of building and installation and transfer of equipment of this plan is as follows:

Construction and installation works are implemented when the supervisor is dispatched.

Consideration such that construction and installation works give minimum effect to current production work is required.

1) Construction procedure of building

(1) Creation of land : Matched to current plant level

(2) Ground and pile : Dimension of pile is determined after nature of soil is examined.

(3) Building : Main body is steel structure and roof is slate.

- o Construction of pattern shop and office is carried out based on predetermined schedule so that it may not disturb the normal work.
- o Work of rail of overhead travelling crane and modification of building is carried out based on detailed schedule by considering to use holiday or night time so that the production may not be disturbed.

2) Installation and transfer of equipment

(1) Electric wiring work is carried out according to construction process of building.

Then, when roof work has been completed, overhead travelling crane is installed.

(2) When equipment is installed, difficulty of installation and scale of foundation work are considered and detailed work schedule is prepared and surely promote this schedule so that loss of work period may be avoided. Condition of delivery shall be after completion of test run subsequent to installation.

(3) In order to achieve the installation work schedule, it is required to grasp well the progress status of civil engineering work and construction work which are prior process at all times.

3) Dispatch of supervisor

Dispatch of supervisor and employment of local supervisor shall be considered for construction of building, installation of machine and test run.

Since dispatch of supervisor is required for the following various works, arrangement of supervisor must be made.

(1) Civil engineering work

(2) Building work (Building work except for product and sand warehouse)

* (3) Equipment installation work
(Furan sand mixer and reclamation device, shell mould machine)

(4) Electric wiring work

(5) Piping work within building

* (6) Operational instruction of major equipment
(Furan sand mixer and reclamation device, hydraulic press machine, shell mold machine)

- o Duty of supervisor terminates at the end of completion of work.
- o The supervisor is not dispatched for operation of imported item other than above-mentioned (6) and only instruction manual in English is attached.

* indicates a supervisor from abroad and others are local supervisor.

6.10 Scope of work

Works based on this renovation plan are largely categorized into facility work and design job.

1) Facility work

a. JFC side execution

- o Construction of building and accessory work
- o Machine foundation and pit work
- o Primary and secondary piping work and accessory work
- o Primary and secondary wiring work and accessory work
- o Local custom clearance
- o Local unloading work
- o Local transportation work
- o Procurement of local procurement equipment
- o Installation and test run work of local procuremnt equipment
- o Storage of equipment
- o Procurement of various materials for installation work
- o Control of work

b. Supplier side execution (Imported item)

- o Procurement of equipment (Delivered as CIF)
- o Procurement of jig and tool (Delivered as CIF)

  (Dispatch of installation instruction of equipment and test run and adjustment depending on facility)

2) Design job

a. JFC side execution (Entrusted to consultant)

- o Detail design
- o Preparation of detail specification
- o Preparation of detail layout

b. Supplier side execution (Imported item)

- o Fundamental layout

  (Example: Installation foundation drawing, Furan sand mixer and reclamation system)
- o Detail design

6.11 Work schedule

Works based on this renovation plan are largely categorized into the following five works. Each work schedule is as shown in Table 6.11-1 to Table 6.11-5.

- o Modification of part of current plant and equipment installation work
- o Relocation work of finishing shop
- o New construction of pattern shop
- o New construction work of office
- o New construction work of product and sand warehouse

Table 6.11-1 Schedule for modification of part of current plant and equipment installation work

Item \ Month	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Fundamental design													
1) Facility fundamental concept	→	→											
2) Layout concept of facility			→	→									
2. Detail design													
1) Layout detail design					→	→							
2) Foundation detail design						→	→						
3. Foundation piping and wiring work							→	→	→	→			
4. Machine installation work								→	→	→	→	→	
5. Test run and adjustment												→	
6. Test run													→
7. Delivery													◇

Table 6.11-2 Schedule for relocation work of finishing shop

Item \ Month	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Fundamental design													
1) Fundamental concept of building	→	→	→										
2) Fundamental concept of facility arrangement	→	→	→										
2. Detail design													
1) Detail design of building			→	→	→	→							
2) Foundation design of facility			→	→	→	→							
3. Construction work of building						→	→	→	→				
4. Machine transfer work									→	→			
5. Test run and adjustment											→		

Table 6.11-3 Schedule for new construction work of pattern shop

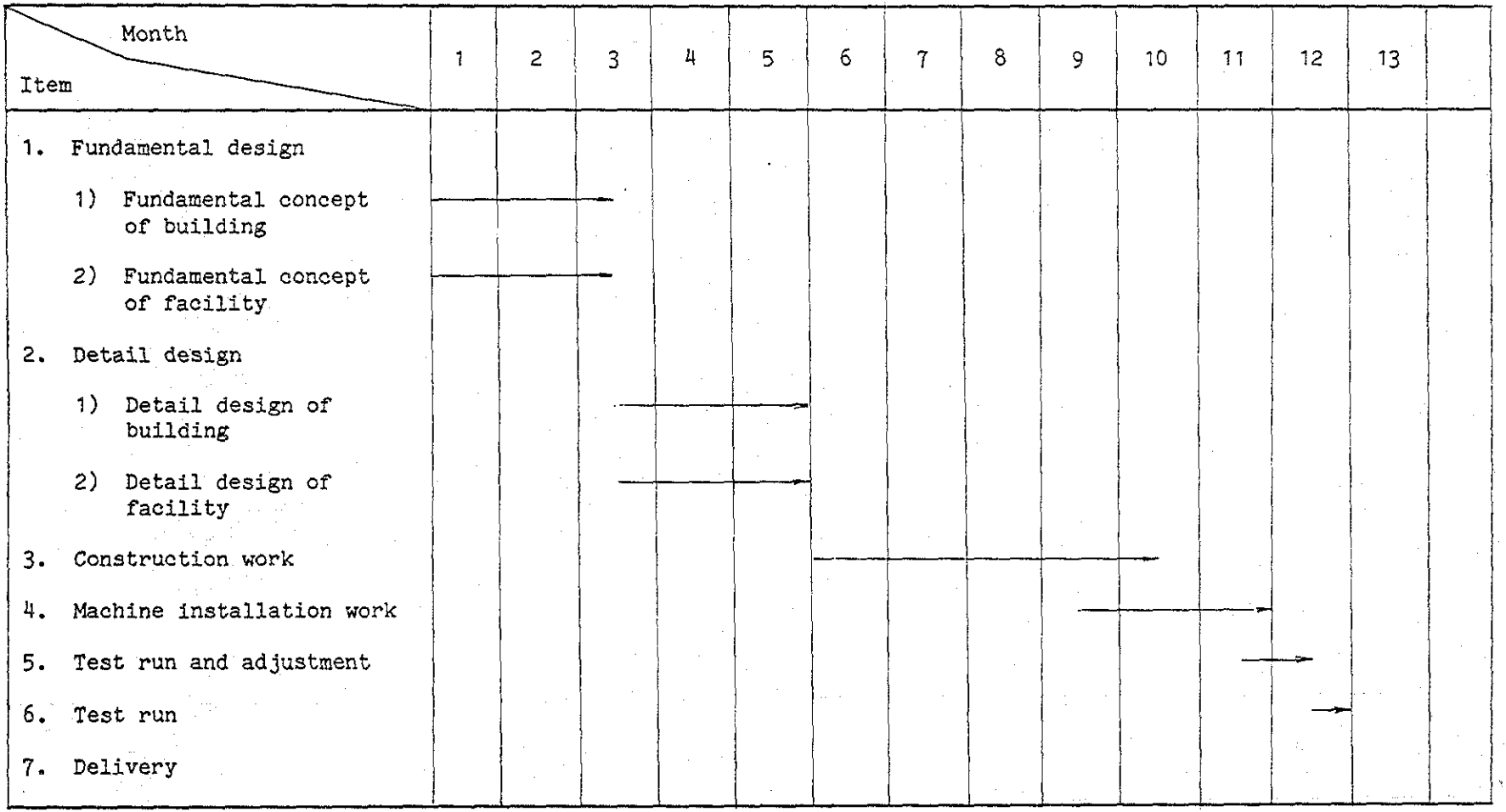
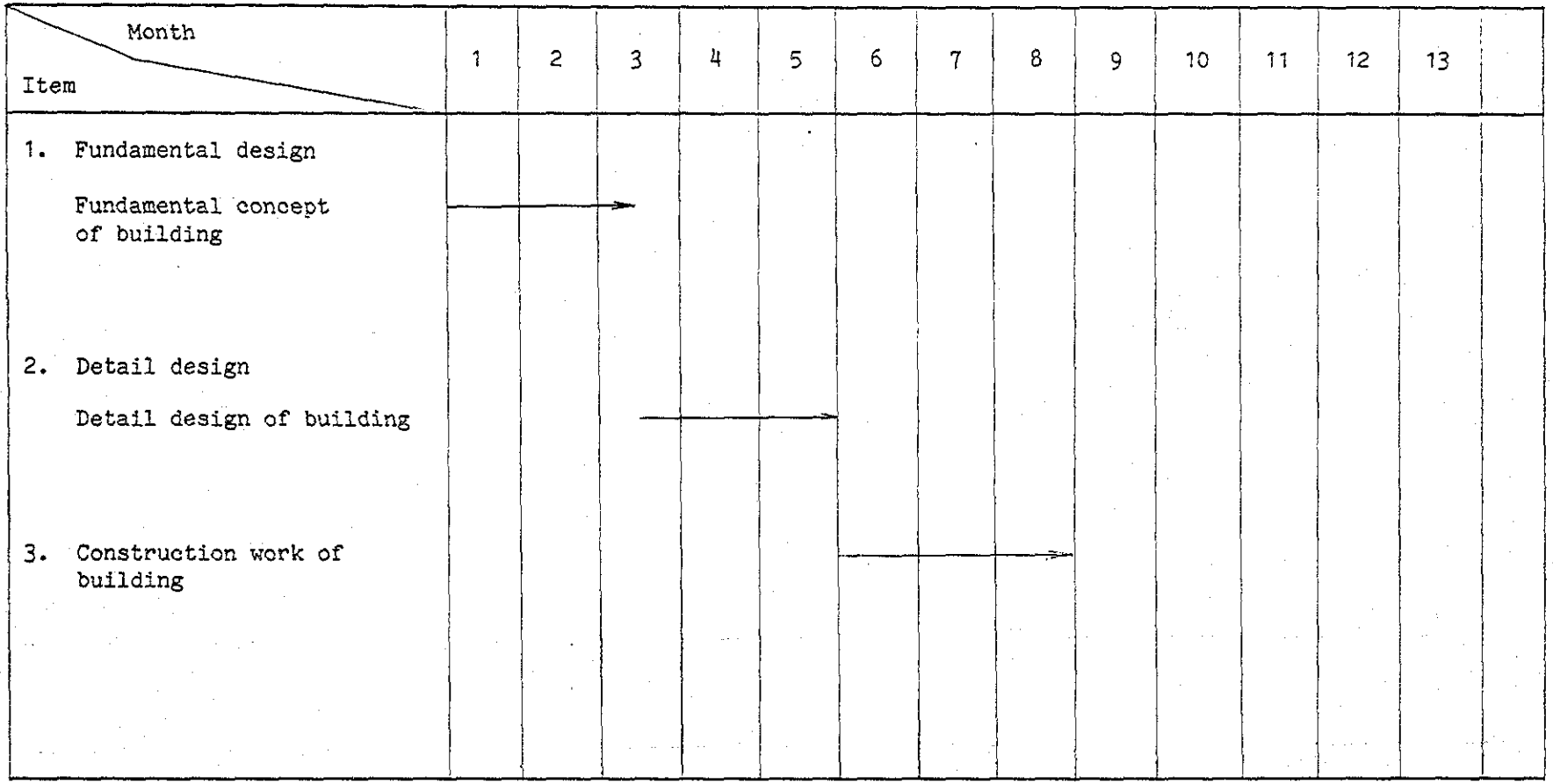


Table 6.11-4 Schedule for new construction work of office

Item \ Month	1	2	3	4	5	6	7	8	9	10	11	12	13	
1. Fundamental design Fundamental concept of building	→	→	→											
2. Detail design Detail design of building			→	→	→	→								
3. Construction work of building						→	→	→	→	→				

Table 6.11-5 Schedule for new construction work of product and sand warehouse



6.12 Required capital and finance plan

6.12.1 Basic condition

Major conditions to accumulate the capital required for this renovation plan are set as follows:

- o Exchange rate of currency

  US$ 1 = ¥250 = Rp. 1110 (1¥ = 4.44 Rp)

- o Tax

  Import duty is exempted but 10% of contract price is counted as added value tax.

- o Basis of price

  price as of 1985 is taken as basis.

- o Price escalation

Foreign currency	3%
Domestic currency	10%

  (Refer to table 6.12.1-1 and table 6.12.1-2.)

- o This is an estimate concerning case "A"

  (Renovation of the plant using the fran process)

Table 6.12.1-1 Commodity price index of Japan

Export commodity price index of Japan

(Average of 1980 = 100)

Item / Year	Total average	Metal and metal product	General precision equipment	Electric equipment
1982	105.1	109.3	101.6	98.7
1983	98.8	94.0	96.9	91.3
1984	99.4	96.2	96.3	90.1

Data: Survey and statistics bureau of Bank of Japan

Consumer commodity price index of Japan (1980 = 100)

Year / Item	1977	1978	1979	1980	1981	1982	1983	1984
Index	86.1	89.4	92.6	100	104.9	107.7	109.7	112.1

Data: Survey and statistics bureau of Bank of Japan

Table 6.12.1-2 Commodity price index of Indonesia

Consumer commodity price index
(1977/78 = 100)

( ) indicates change in 12 months.

Period		General (100)	
1979	March	121.8	(17.3)
	June	132.3	(26.5)
	September	139.8	(30.5)
	December	143.1	(27.8)
1980	March	147.1	(20.8)
	June	156.6	(18.4)
	September	160.8	(15.0)
	December	167.6	(17.1)
1981	March	172.1	(17.0)
	June	174.7	(11.6)
	September	177.4	(10.3)
	December	179.8	(10.1)
1982	March	189.6	(10.2)
	June	190.5	(9.0)
	September	193.4	(9.0)
	December	197.9	(10.1)
1983	January	206.9	(9.9)
	February	207.2	(9.5)
	March	206.0	(8.6)
	April	211.0	(11.3)
	May	212.8	(12.1)
	June	216.2	(13.5)
	July	217.9	(13.1)
	August	217.8	(13.6)
	September	219.8	(13.5)
	October	219.6	(12.2)
	November	220.2	(12.0)
	December	221.5	(12.0)
1984	January	229.1	(10.7)
	February	232.9	(12.4)
	March	233.4	(13.3)
	April	236.5	(12.1)
	May	238.0	(11.3)
	June	238.7	(10.4)
	July	239.6	(10.0)
	August	239.2	(99.8)
	September	239.0	(8.8)
	October	239.1	(8.6)
	November	239.1	(8.8)
	December	241.6	(9.1)
1985	January	242.8	(6.0)
	February	241.5	(3.7)
	March	242.1	(3.7)

Source: Central Bureau of Statistics

Whole sale price index
(1975 = 100)

( ) indicates change in 12 months.

Period		Agri-culture	Mining	Manufacturing	
1979	March	194	164	164	
	June	212	176	177	
	September	229	181	189	
	December	234	187	192	
1980	March	247	197	195	
	June	262	219	212	
	September	271	229	217	
	December	281	240	226	(17.7)
1981	March	292	250	231	
	June	302	268	234	
	September	308	276	237	
	December	316	281	239	(5.7)
1982	March	329	308	254	
	June	335	311	254	
	September	340	314	259	
	December	346	317	268	(12.1)
1983	January	352	322	285	
	February	355	324	287	
	March	356	328	287	
	April	373	340	297	
	May	380	342	299	
	June	389	343	302	
	July	392	342	304	
	August	390	343	306	
	September	392	345	309	
	October	392	346	311	
	November	398	346	312	
	December	409	349	315	(17.5)
1984	January	418	359	334	
	Febuary	422	364	336	
	March	423	367	336	
	April	427	369	337	
	May	431	370	338	
	June	437	372	340	
	July	435	373	341	
	August	428	373	341	
	September	433	374	341	
	October	437	374	342	
	November	438	380	343	
	December	444	381	346	(9.8)

6.12.2 Breakdown of estimate of project cost

Breakdown of estimate is as follows:

1) Equipment and facility

Price of machine and facility (CIF or domestic price) required for this project such as molding machine and sand treatment facility is counted.

2) Inland transportation

Transportation expense from the nearest port to JFC is counted.

3) Civil engineering and erection

Installation of various machines and facility foundation are estimated.

4) Building

Expense required for construction of plant building, namely, material and labor expenses are estimated.

5) Construction expense

Expense of temporary works for construction work is counted.

6) Engineering expense

Personal expense required for control of installation of machine and facility is counted.

7) Other expenses

Expense required for detail design is counted.

8) Technical instruction expense

Expense of instructor required for instruction and training of technical personnel is estimated and counted.

9) Contingency

Expense to provide for excess of required capital which may accrue due to change of design and unknown factor which can not be found by local examination is counted.

10) Tax

New tax system was executed starting from April of 1985 and value added tax was introduced. Rate of new value added tax is 10%. Import duty is also imposed on imported item. However, by considering an example where in several projects in Indonesia all taxes are exempted by intention of loan providing side, the following assumption is made with prerequisite that the tax does not become excessive in a reasonable range.

Import duty of imported equipment is exempted. Added value tax 10% is counted.

11) Operating capital

When an enterprise continues production activity, operating capital is necessary. In case of new construction project, initial operating capital is necessary. Since renovation of existing plant is covered by this plan, initial operating capital is not counted.

Operating capital for the continuous production is integrated into the financial statements by considering raw material, inventory, accounts receivable, etc.

Above-mentioned estimate of project cost is shown in Table 6.13.2-1.

Financial analysis and economic analysis are made by excluding revenue and expense of pattern shop and estimate of project cost excluding investment in pattern shop is shown in Table 6.13.2-2. Incidentally, as investment cost for training center, about 260 million Rp. is estimated.

Table 6.12.2-1 Total Capital Requirement

(Unit: 1,000 R.)

	1985			1986			1987			1990			Total		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
1. Machinery & Equipment (CIF)	868,840	129,827	998,667							97,544	14,575	112,119	966,384	144,402	1,110,786
2. Inland Trans-portation		39,946	39,946								4,485	4,485		44,431	44,431
3. Civil & Erection		215,713	215,713								24,219	24,219		239,932	239,932
4. Construction Expenses		63,915	63,915								7,176	7,176		71,091	71,091
5. Engineering Fee	159,787		159,787							17,940		17,940	177,727		177,727
6. Building		548,340	548,340											548,340	548,340
7. Others	140,612	35,153	175,765							15,787	3,947	19,734	156,399	39,100	195,499
Base Project Cost	1,169,239	1,032,894	2,202,133							131,271	54,402	185,673	1,300,510	1,087,296	2,387,806
8. Contingencies	77,656	66,152	143,808							11,415	4,730	16,145	89,071	70,882	159,953
Project Cost	1,246,895	1,099,046	2,345,941							142,686	59,132	201,818	1,389,581	1,158,178	2,547,759
9. Tax		234,591	234,591								20,182	20,182		254,773	254,773
Total Project Cost	1,246,895	1,333,637	2,580,532							142,686	79,314	222,000	1,389,581	1,412,951	2,802,532
10. Engineer Cost (Dispatched)				229,992	98,568	328,560	118,104	50,616	168,720				348,096	149,184	497,280
All Total Project Cost	1,246,895	1,333,637	2,580,532	229,992	98,568	328,560	118,104	50,616	168,720	142,686	79,314	222,000	1,737,677	1,562,135	3,299,812

Table 6.12.2-2 Total Capital Requirement
(for financial & economic analysis)

(Unit: 1,000 R.)

	1985			1986			1987			1990			Total		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
1. Machinery & Equipment (CIF)	835,230	124,805	960,035							97,544	14,575	112,119	932,774	139,380	1,072,154
2. Inland Trans-portation		38,401	38,401								4,485	4,485		42,886	42,886
3. Civil & Erection		207,368	207,368								24,219	24,219		231,587	231,587
4. Construction Expenses		61,442	61,442								7,176	7,176		68,618	68,618
5. Engineering Fee	153,606		153,606							17,940		17,940	171,546		171,546
6. Building		488,400	488,400											488,400	488,400
7. Others	135,173	33,793	168,966							15,787	3,947	19,734	150,960	37,740	188,700
Base Project Cost	1,124,009	954,209	2,078,218							131,271	54,402	185,673	1,255,280	1,008,611	2,263,891
8. Contingencies	74,770	63,475	138,245							11,415	4,730	16,145	86,185	68,205	154,390
Project Cost	1,198,779	1,017,684	2,216,463							142,686	59,132	201,818	1,341,465	1,076,816	2,418,281
9. Tax		221,643	221,643								20,182	20,182		241,825	241,825
Total Project Cost	1,198,779	1,239,327	2,438,106							142,686	79,314	222,000	1,341,465	1,318,641	2,660,106
10. Engineer Cost (Dispatched)				229,992	98,568	328,560	118,104	50,616	168,720				348,096	149,184	497,280
All Total Project Cost	1,198,779	1,239,327	2,438,106	229,992	98,568	328,560	118,104	50,616	168,720	142,686	79,314	222,000	1,689,561	1,467,825	3,157,386

6.12.3 Fund plan

In this report, it is assumed that 60% of all required fund is supplied by borrowed money and 40% is supplied by capital.

Finance condition of borrowed money is assumed as follows:

Interest	:	13%/year
Term of repayment	:	12 years
Grace period	:	3 years
Method of repayment	:	Equal installment

6.12.4 Investment schedule

Investment plan incorporating price escalation according to project schedule is shown in Table 6.12.4-1.

Table 6.12.4-1 Total Capital Requirement (Expenditure Base)

(Unit: 1,000 R.)

	1985			1986			1987			1990			Total		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
1. Machinery & Equipment (CIF)	868,840	129,827	998,667							113,083	23,473	136,556	981,923	153,300	1,135,223
2. Inland Trans-portation		39,946	39,946								7,223	7,223		47,169	47,169
3. Civil & Erection		215,713	215,713								39,005	39,005		254,718	254,718
4. Construction Expenses		63,915	63,915								11,557	11,557		75,472	76,472
5. Engineering Fee	159,787		159,787							20,798		20,798	180,585		180,585
6. Building		548,340	548,340											548,340	548,340
7. Others	140,612	35,153	175,765							18,302	6,356	24,658	158,914	41,509	200,423
Base Project Cost	1,169,239	1,032,894	2,202,133							152,183	87,614	239,797	1,321,422	1,120,508	2,441,930
8. Contingencies	77,656	66,152	143,808							13,233	7,618	20,851	90,889	73,770	164,659
Project Cost	1,246,895	1,099,046	2,345,941							165,416	95,232	260,648	1,412,311	1,194,278	2,606,589
9. Tax		234,591	234,591								32,503	32,503		267,094	267,094
Total Project Cost	1,246,895	1,333,637	2,580,532							165,416	127,735	293,151	1,412,311	1,461,372	2,873,683
10. Engineer Cost (Dispatched)				236,892	108,425	345,317	125,297	61,245	186,542				362,189	169,670	531,859
All Total Project Cost	1,246,895	1,333,637	2,580,532	236,892	108,425	345,317	125,297	61,245	186,542	165,416	127,735	293,151	1,774,500	1,631,042	3,405,542

CHAPTER 7

FINANCIAL ANALYSIS

CHAPTER 7 FINANCIAL ANALYSIS

The prices adopted in this financial analysis are all based on those of 1985.

7.1 Basic policy for financial analysis

In case the existing plant is renovated and its effect is judged, it is difficult to judge the effect of only new investment because it overlaps that of the old investment (including facilities/equipment and management/technology). Therefore, the following method has been adopted for the evaluation in this survey:

- o Estimation of the annual profit and loss of JFC when no renovation is made.
- o Calculation of the annual profit and loss of JFC when renovation is made. (In calculating the profit and loss, both the machining process and pattern-making process have been excluded.)
- o In order to clarify the effect of renovation, the difference of the annual profit and loss between the cases of renovation and of nonrenovation has been considered as the profit from the renovation and thus the internal rate of return was obtained. In this case, the investment made in the renovation has been regarded as the cost.