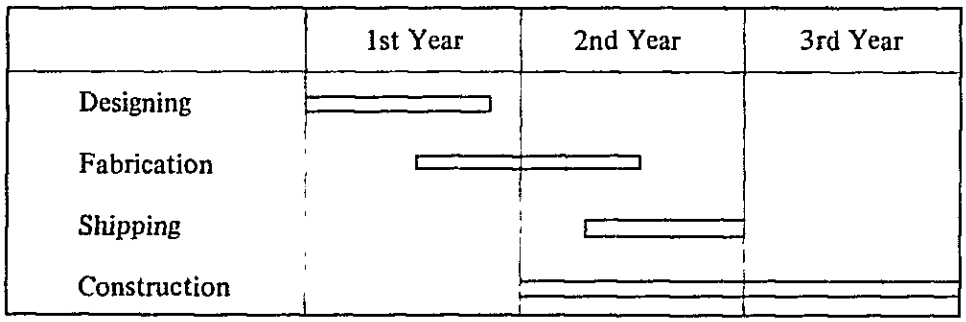
CHAPTER 9 CONSTRUCTION PLAN

The construction of the projected sinter plant requires basic and detailed designings, manufacture, inspection, transportation, erection and construction works of mechanical and electrical equipment, instruments, buildings and structures, and commissioning and test operation of the plant. The outline of the work schedule for the plant is as follows.

Table 9-1 Work Schedule



9.1 Scope of the Works

9.1.1 Works, Facilities and Structures Newly Performed or Installed

(1) Land grading

(2) Roads

(3) Limestone sizing equipment (Impeller breaker, limestone screen conveyors surrounding the breaker and screen)

(4) Blending yard and yard equipment

(5) Bin blending equipment

(6) Coke grinding equipment

(7) Mixing equipment

(8) Sintering equipment and sinter building, including a sample preparation room

(9) Main exhausting system and stack

(10) Cooling equipment

(11) Sinter screening system

(12) Belt conveyor system

(13) Dust collector

(14) Sinter yard and the yard equipment

(15) Sample preparation and laboratory equipment

(16) Equipment for the utilities

(17) Electrical equipment, electric room and laboratory

(18) Equipment, devices, etc. for the instrumentation

9.1.2 Existing Facilities to be used in common for the Sinter Plant

(1) Main office, warehouse and canteen

(2) Maintenance shop and machinery and equipment therein

(3) Sinter feed yard, coke breeze yard and conveyors – some conveyors will be modified

(4) No. 1 limestone crushing plant, silo, limestone sizing house (scrubbing and cobbing building) and limestone bin (waste truck bin)

(5) Pier, ship loader and pier conveyor

9.2 Design and Manufacture

The basic and detailed designs of the machinery, equipment and structures are made according to the basic plan described in Chapter 6. And when such design works are going to be implemented, the standards and criteria to which such designs shall conform should be confirmed and the properties and characteristics of the soil of the plant site should be precisely investigated. And moreover, special attention should be paid to the connection points between the existing installations and structures and those to be newly installed or constructed as well as to the modifications of the existing facilities.

The manufacture is implemented by applying various different processes, such as plate cutting and forming, casting, forging, machining, etc., which should be elaborately performed and minutely controlled with great care. And special machinery and equipment should be particularly inspected and tested when assembled by the manufacturers Some of the machinery, equipment and structures will be fabricated and/or assembled on the plant site, whereas most of the modifications of the existing facilities may be performed on the site.

9.3 Procurement of the Materials, Machinery, Equipment, etc.

The machinery, equipment, instruments and steel structures are imported from foreign countries, while the materials for the construction works, such as cement, gravel, sand, reinforcing steel bars, oxygen, acethylene, etc. are procured in Peru. However, some of the machinery and equipment may be procured in

Peru, but such selection should be made when the detailed designing is implemented. The approximate quantities of the materials, machinery, equipment, etc. required for the construction of the plant are presumed as follows.

(1) Machinery, equipment and apparatuses

Machinery and equipment in the blending yard	500 tons
Bin blending, coke grinding, and mixing equipment	350
Sintering equipment	1,600
Main exhausting equipment, including the main exhaust dust collector	1,300
Cooling equipment, including the cooler dust collector	800
Sinter screening equipment, including the room dust collector	1,300
Belt conveyors with accessories	2,800
Sinter yard equipment	800
Equipment for the utilities	500
Electrical equipment (Motors are included in each of the above items.)	700
Equipment, devices, etc. for the instrumentation	250
Others	100
Total	11,000

(2) Buildings and structures

	Steel Weight
Sinter building	2,000 tons
Blending bin	1,400
Blending yard bin	350

	Rails and others	350
	Total	4,100
(3)	Concrete	27,300 m^3

9.4 Transportation of the Machinery, Equipment and Materials

The machinery, equipment and prefabricated steel materials delivered by means of marine transportation are unloaded at the San Nicolas Pier. The weight and dimensions of one packing are made in principle less than 10 tons and smaller than 3 m x 3 m x 10 m to facilitate the marine transportation and unloading, but if such bulky items as mixer drum, etc. are divided in small parts, the assembling on the site become difficult, and therefore, one packing of these items will weigh about 30 tons.

Although the materials, machinery and equipment are delivered by several shipments, taking the progress of the works on the site into consideration, a space of about 80,000 m^2 is required to store them temporarily on the site.

9.5 Works on the Site

The works on the site are executed by constructors in Peru under the supervision of the engineers delegated from a foreign country.

(1) Schedule for the works on the site

As shown in Table 9-2, approximately two years are required after the land grading is commenced until the test operation is performed.

(2) Workers

The estimated manpower required for the works on the site is as indicated

on Table 9-3, and approximately 1,500 workers are needed on the peak of the works. The number of the staff members of the constructors and the engineers from a foreign country at the peak are estimated at about 80 and 60 respectively.

(3) Temporary facilities

The existing lodgings are used for the workers, but since they are capable of accommodating only 1,300 of 1,500 workers, new lodgings should be provided for the balance of 200 workers. The lodgings for 80 staff members of the constructors and 60 engineers from a foreign country also should newly be installed. The electric power and water required for the works on the site are supplied by Hierro-Peru at the take-over points nearby on the site. The electric power necessary for the works will be about 500 kw.

(4) Heavy equipment for the works on the site

The heavy equipment can be procured in Peru, excepting a 100-ton class truck crane which will have to be imported from a foreign country as it is hardly available in Peru. Such heavy equipment as truck cranes, dump trucks, bulldozers, etc. which will be required for the works are listed up in Table 9-4.

Table 9 - 2 Construction Schedule

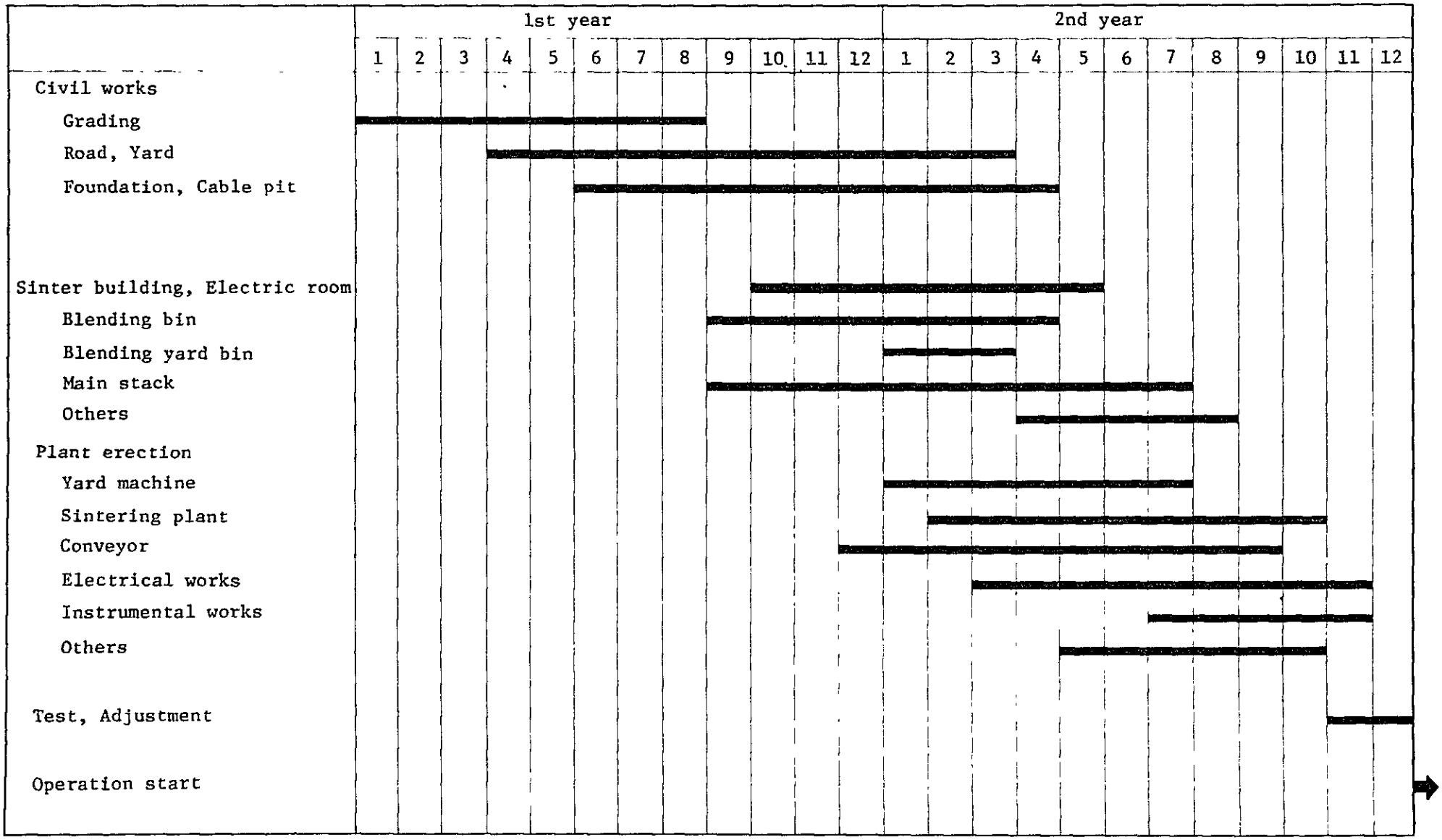


Table 9 - 3 Man-Power Schedule for Construction

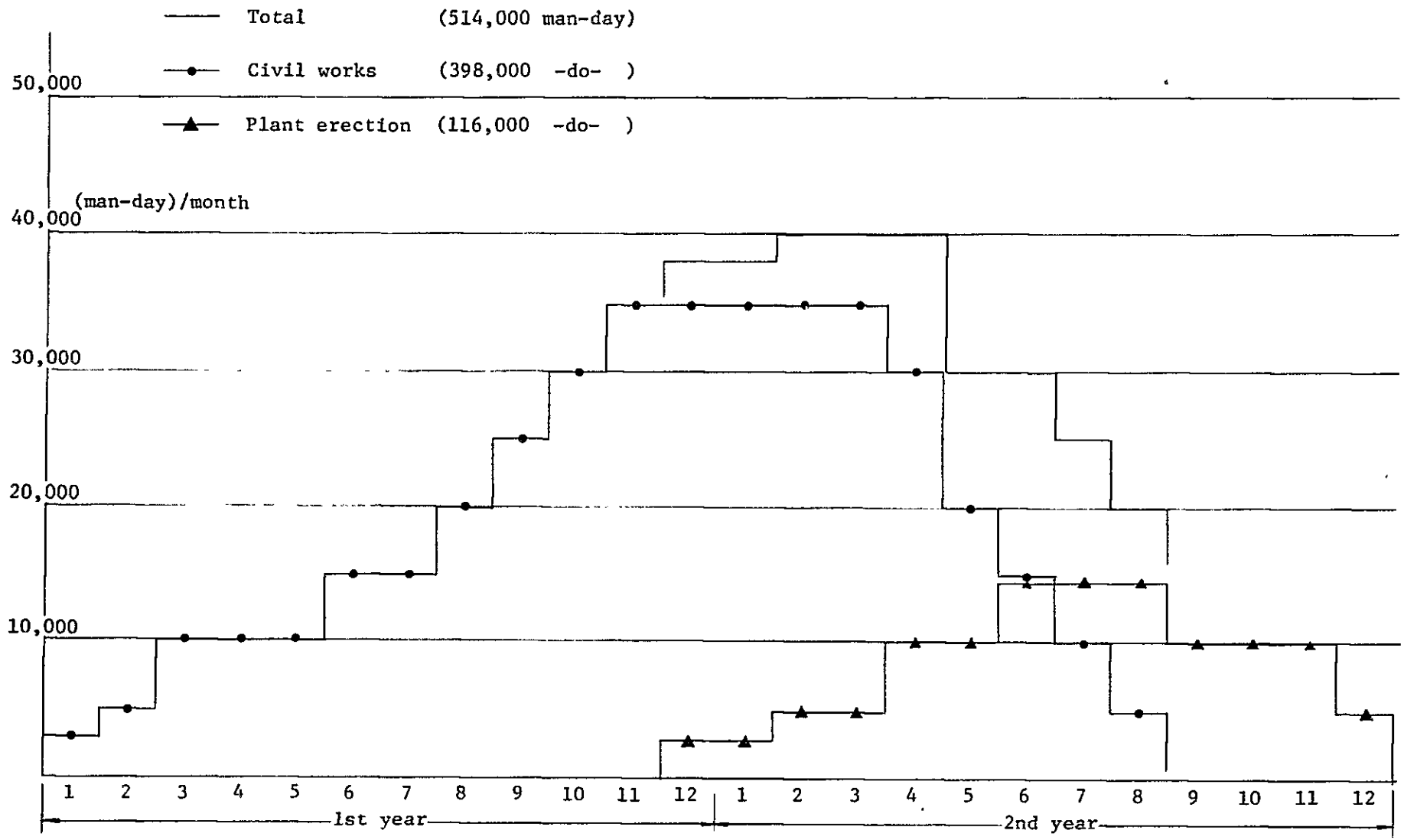


Table 9 - 4 Heavy Equipment Schedule for Construction

(1/2)

	1st year												2nd year											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Truck crane 100t						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
" " 60t		for hauling				1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2			
" " 35t									2	2	2	2	2	2	2	2	2	2	2	2	1	1		
" " 25t									2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	
" " 10t					1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Trailer 40t						1	1	1	1	1	1	1	1	1	1	1	1	1	1					
Truck 15t						2	2	2	2	2	3	3	4	4	4	4	4	4	4	3	3	3	1	1
" 5t						1	1	1	2	2	3	3	4	4	4	4	4	4	4	3	3	3	2	2
Dump truck 11t	20	24	24	24	24	24	20	20	20	10	10	10	5	5	5	5								
Bulldozer D-9 class	2	3	3	3	3	2	1	1	1	1	1													
" D-8 class	1	2	2	2	2	2	2	2	2	1	1	1	1	1										
" D-7 class	2	3	3	3	3	2	2	2	2	1	1	1	1	1										

Heavy Equipment Schedule for Construction (2/2)

	1st year												2nd year											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Shovel loader 1.8^{m3}	7	8	8	8	8	8	6	4	4	3	3	3	2	2	2									
Macadam roller 10^{t}							2	2	2	2	2	2	2	2	2									
Motor grader		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
Back hoe 1.6^{m3}						1	1	2	2	2	2	2	2	2	1	1								
" " 0.7^{m3}						1	2	2	2	2	2	2	2	2	2	1								
Agitator truck 3^{m3}							2	4	4	4	4	4	4	4	3	2								

CHAPTER 10

ORGANIZATION AND LABORER EMPLOYMENT

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10.1 Present Organization of Hierro-Peru

Hierro-Peru headquartering in Lima locates its operating division consisting of the mines, beneficiation plant and relevant facilities at Marcona, San Nicolas and San Juan districts of Nazca County of Ica Province.

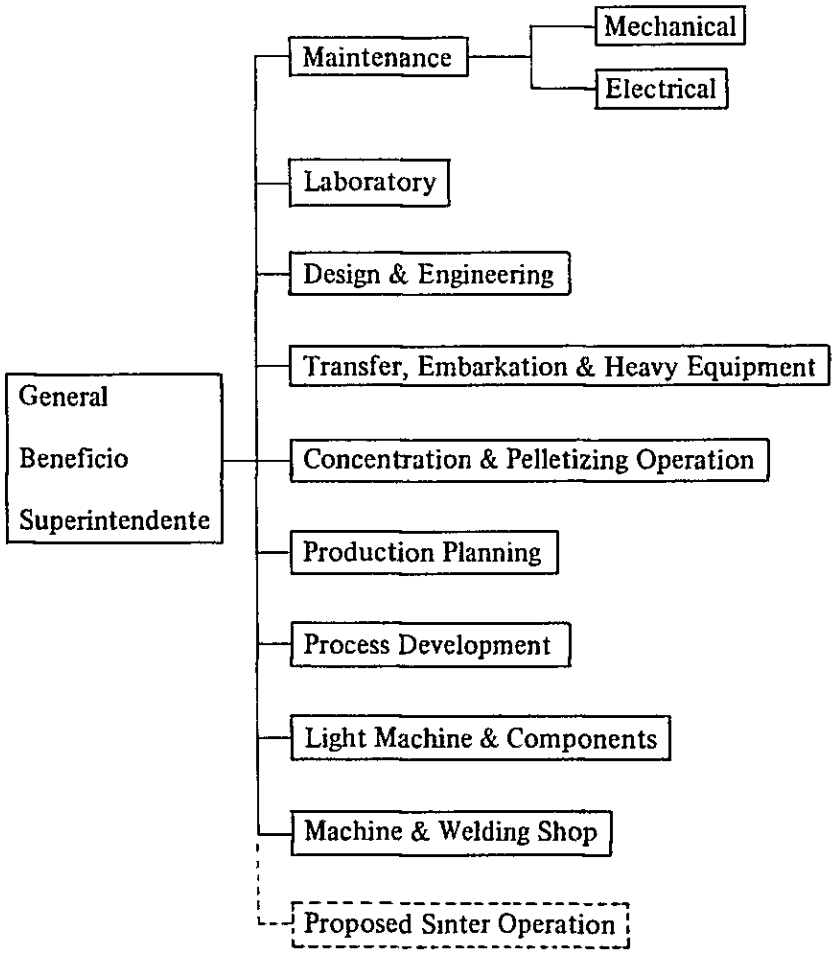
A part of the plant control functions in addition to the head office functions such as general affaires, legal, finance, personnel, labor relations, engineering and procurement are centralized in the Lima Head Office. Thereby the Hierro-Peru organization is highly centralized.

The following departments and office, in total eight, are under the Gerente De Operaciones.

- Mining
- Beneficiation
- Maritime Operation
- Inventory Control
- Safety
- Administration
- Industrial Relations
- San Juan Office

The Beneficiation Department to which the projected sinter plant is to belong is operated and managed by the following organization.

Table 10-1 Organization



The numbers of the employees as of January, 1980 by divisions and ranks are as follows.

Table 10-2 Number of Employees

	Lima Head Office	Mines	Beneficiation (Pellet inclusive)	Total
Staff[1] *	130	64	65 (4)	259
Empleodos[2] *	142	122	264 (40)	528
Obreros[3] *	0	841	1,072 (128)	1,913
Total	272	1,027	1,401 (172)	2,700

Note = 1* Annual Salary

2* Monthly Salary

3* Daily Wage

10.2 Plan for the Employment

The personnel required for the new sinter plant and auxiliary facilities thereof will be a part of those organizations of Hierro-Peru, and Hierro-Peru will utilize as many of those personnel as possible work for the new sinter plant. No new organization will be formed for the personnel who will work for the yard operation, limestone crushing, analyzation, and repair and maintenance; these principle belong to the existing organization.

The coke breeze is unloaded by ships' derricks and the buckets and transported by dump trucks, and therefore, the unloading is to be consigned to stevedore and transportation companies and the personnel who belong to the existing organization which handle the transportation are to supervise such unloading and transportation. Since the dump trucks are required for the said purpose only once a month or so, the existing dump trucks and the drivers already employed are commonly used for these works. Consequently, any number of personnel for the unloading and transportation of the coke breeze is not considered in the plan for the employment.

The program for the training of the new employees is to be considered in the timing of the recruitment. Namely, a minimum number of personnel including those who are required for the control and management of the erection and construction works is to be recruited while the plant is being installed, and most of the personnel required for the plant operation are to be employed before the test operation is commences, taking the time for training into consideration.

Table 10-3 Plan for the Employment

Department	Manager	Engineer	Foreman	Workers	Work	Remark
Sinter (30)	1	2	1 x 3	3 x 3 2 x 3 3 x 3 (8x3=24)	Operation control Raw materials Product	Including control in the sinter plant Including coke crushing Including stacking
Yard (34)		1	1 x 3	2 x 3 2 x 3 2 x 3 2 x 3 2 x 3 (10x3=30)	Operation control Limestone crushing Raw material yard Ore bed Product yard	 Including BC Including tripper above blending bin Including stacker, reclaimer, BC Including reclaimer, BC
Analysis (25)		1	1 x 3	4 x 3 2 x 3 3 (6x3+3=21)	Sampling VXQ, wet analysis RDI, etc.	Sizing, shatter test, sample preparation VXQ, FeO RDI before shipment
Maintenance (50)		2 2	3 3	18 12 10 (40)	Mechanical Electrical, instrument Periodical maintenance, etc.	
Total	1	8	15	115		139

Table 10-4 Plan for the Timing of Employment

Time	Manager	Section chief	Foreman	Worker	Total
1st year of plant construction	1	3	5	10	19
2nd year of plant construction		5	5	10	20
Trial operation			5	95	100
Total	1	8	15	115	139

10.3 Plan for the Training

The training is performed in two ways, one outside Peru and the other on the site. The chief engineers in charge of the respective works and some of the foremen and workers are delegated to a foreign country, they mainly acquire the knowledge required for the sinter plant operation, maintenance and control, and also have practical training through the respective actual works. And after returning to Peru, they are engaged in the training of the workers. Although the above is the main part of the plan for the training, in order to supplement this, supervisors are invited to the plant from a foreign country when the trial operation is commenced to have them supervise the workers.

Table 10-5 Training Outside Peru

Objective of Training	No. of Trainees	Training Period
Sintering	3	2 Months
Yard Operation	2	2
Analyzation	2	2
Maintenance (Mechanical)	2	2
Maintenance (Electrical and Instrument)	3	3
Total	12	

Table 10-6 Supervision on the Plant Site by Technical Personnel Invited from Abroad

Objective of Supervision	No. of Supervisors	Supervising Period
Sintering	2	3 Months
Yard Operation	2	3
Analyzation	2	3
Maintenance (Mechanical)	1	3
Maintenance (Electrical and Instrument)	2	3
Total	9	

CHAPTER 11

TRANSPORTATION OF RAW MATERIALS AND PRODUCTS

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11.1 Raw Materials and Sub-materials

11.1.1 Sinter Feed

Refractory ore and transition ore, which are fine ores for sinter feed, are to be processed and sized at the existing beneficiation plant of Hierro-Peru. They will be mixed in the ratio of 60 to 40 and will be fed to the sinter feed yard at the sinter plant. The transportation of the above will be carried out using the existing equipment. Therefore, this subject will not be dealt with in this study.

11.1.2 Limestone

(1) Transportation by Trucks

Regarding limestone, some ore deposits exist near the Marcona mine site. For transportation from the initial N-14 mine site to the crushing plant, a distance of about 10 km, transportation using trucks is considered to be most economical.

At present, Hierro-Peru possesses 65-ton, 100-ton, and 120-ton trucks. According to Hierro-Peru, the 65-ton trucks will be replaced by 100-ton and 120-ton trucks in the near future. These 65-ton trucks will be used since they are not expected to be used for any other purposes.

Necessary quantity of limestone to be transported	· approximately 372,500 tons/year
Necessary number of 65-ton trucks	· 3 (one spare included)
Transportation cost (direct cost)	· US$1.03/ton of limestone

(2) Transportation by Belt Conveyors

Details for transportation of limestone from the ore deposit (N-14) to the existing crushing plant using belt conveyors as an alternative to the above mentioned trucks are indicated in the Appendix F-1. Use of a belt conveyor will require the installation of a crusher for coarse crushing at the N-14 mine site.

The proven minable reserves of limestone in the N-14 mine site are presently approximately one million tons. There is a strong possibility that a necessity to move on to another ore deposit may arise after four years of operation. The outcome of research on the ore reserve of the area which will be carried out by Hierro-Peru as well as reserch on such limestone deposits as 15, 7, and Nazca, will clarify the probability of a need for crushers and additional installment of belt conveyors along with other equipment.

More detailed studies will be required to carry out the alternatives in the future, since it is not realistic at this time.

Construction cost of belt conveyor and crusher	:	US$17,433,000
Operating cost	:	US$0.51/ton of limestone
Depreciation and interest	:	US$6.26/ton of limestone

11.1.3 Silicastone

Silicastone is now transported from the mine site to the pelletizing plants of Hierro-peru, and silicastone for sintering is tranpported in the same way. Thefrefore, this study will not deal with its transportation.

11.1.4 Coke Breeze

(1) Unloading by Derrick

As there is little domestic coke breeze available, importation from Central, South, and North America will be considered as stated in 5.4.1. Mexico, Argentina, Chile, and the United States would probably be the main suppliers. Since the details of specification of coke breeze are unclear, bulk carriers of 20,000 DWT ~ 30,000 DWT with derricks or cranes are generally assumed to be suitable as the transport vessel for the purposes of this study.

For unloading, the use of the derricks or cranes of the vessel is believed appropriate. This will make it necessary for Hierro-Peru to provide buckets. Based on the assumption that the general capacity of the derricks or cranes of a 20,000 DWT ~ 30,000 DWT bulk carrier is a minimum 10 tons, the capacity of the buckets would be 5.6 m^3. As for the pier side, direct loading from buckets to trucks will be used.

65-ton trucks will be used for the time being. Since the bed of the tracks is large, a hopper for loading is regarded as unnecessary. However, anti-deflection devices will be installed with the buckets as a safety precaution.

To accept the vessel, the east side of the San Nicholas pier will be used. Since the distance between the vessel side and the pier is approximately 2.1 m, vessel should be selected with the necessary derricks or cranes out reach. The

unloading capacity is presumed to be a maximum 350 ton/h (average 210 ton/h) for a vessel with four derricks or cranes.

Regarding costs, the following is a comparison of cost of the above mentioned unloading method and the unloading method using an unloader (mentioned in the following section (2))

Unloading quantity of required coke breeze	: 125,000 ton/year
Purchase cost of buckets and accessories	. US$116,700 (5 units)
Operating cost (stevedore charge)	: US$2.23/ton of coke breeze
Number of 65-ton trucks required	: 8 (4 trucks x 2)
Transportation cost using trucks (direct cost)	: US$1.50/ton of coke breeze
Depreciation and interest	: US$0.12/ton of coke breeze

(2) Unloading with an Unloader

As an alternative unlaoding system to a vessel with derricks, an unloader and belt conveyors were studied. The specifications are shown in the Appendix F.2 (nominal 300 ton/h, actual unloading capacity 210 ton/h).

The results of this study proved that the additional installment of an unloader and belt conveyors would be uneconomical if the annual unloading quantity were 125,000 tons.

Unloader and belt conveyor	
Construction cost	: US$3,755,000
Operating cost	: US$0.38/ton of coke breeze
Depreciation and interest	: US$4.02/ton of coke breeze

11.2 Sintered Ore

11.2.1 Slide Chute

Sintered ore, being generally brittle, is easily degraded. This is one of the reasons why steel mills traditionally have their sinter factories within their integrated steel plants to reduce handling as much as possible.

As sintered ore, including that for domestic sales, will require marine transportation, to minimize degradation in order to maintain the commercial value of the sintered ore will be a major point.

Kawasaki Steel Coporation carried out repeated sintered ore transportation tests, including some under bad weather conditions, to clarify the causes of degradation. It was concluded that the maximum degradation was generated when sintered ore was loaded into the vessels. Measures to prevent this were worked out in cooperation with Mitsui Engineering & Shipbuilding Co. When exporting sintered ore, it is indispensable to use a vessel of 100,000 DWT ~ 150,000 DWT in order to keep the ocean freight as low as possible. However, in the case of a large vessel, there is more than 20 meters from the hatch opening to the bottom of the hold, and direct loading generates much degradation. In order to minimize this, Kawasaki Steel Corporation, after two years of study, developed a slide chute in cooperation with Mitsui Engineering & Shipbuilding Co.

The development of this slide chute, has enabled Kawasaki Steel to construct the first overseas sinter plant in the world and at present two large sized vessels with slide chutes run between the Philippines and Japan.

In order to decrease the impact of the drop from the loader to the bottom

of the hold it is important to lower the sintered ore into the hold by rolling or sliding it The chute is so designed that the sintered ore itself will make the angle of repose and serve as a cusion. A perspective drawing is found in Fig. 11-1.

The slide chute has already been patented in Japan and in Peru (patent No. 0942, July 13, 1978), and in the Philippines a patent is hereby applied for and is expected to be granted in the near future.

11.2.2 Loading Method Using a Slide Chute

The slide chute loading method is illustrated in the Appendix B with the M.S. "Amanda", currently being used by Kawasaki Steel Corporation. The initial stage of loading is carried out by a slide chute being installed at the side of the hold. Once the angle of repose is made in the chute, the sintered ore is rolled down, gradually transfering the ship loader towards the center of the hold. The operation of the ship loader does not require much specialized skill, and only slight modifications in the traditional loading method is sufficient. However, there is a difference in the levels of the tip of the ship loader and the opening of the slide chute. In order to decrease the impact of this fall, it is necessary to lower the boom of the ship loader as much as possible and to install a trimming chute on the end of the ship loader.

11.2.3 Suitable Vessel for Slide Chute Installation

The volume of the holds in an ore bulk carrier, which is best suited for a slide chute, are calculated using the bulk density of iron ore ($2.4g/cm^3$). Because the bulk density of sintered ore is slightly less ($1.6g/cm^3$), the shipping quantity may decrease to a certain extent. Nevertheless, the holds are rather

long, running the length of the vessel and the number of holds are small, making the use of the slide chute more effective and thus providing favorable conditions for prevention of degradation.

A bulk carrier on the other hand, has more holds and tends to be less effective than an ore bulk carrier in spite of the sufficient capacity. Moreover, as the hatches are small, the slide chute obstructs the unloading and makes it time consuming.

Therefore, desired conditions for a vessel would be few and elongated holds, running the length of the vessel.

11.2.4 Problems for the Future

With regards to marine transportation, installment of a slide chute is highly recommended for its effectiveness in preventing degradation. The vessel with a slide chute may be used for loading other goods as traditional ore carriers or bulk carriers.

Because the slide chutes must be attached to the vessel itself, the future problem will be who the owner of the ship is and by whom they should be installed. Hierro-Peru's study of transport methods, in relation to sales, for instance installment in an ore carrier owned by a purchaser under a long-term contract or installment in a Peruvian owned vessel is recommended.

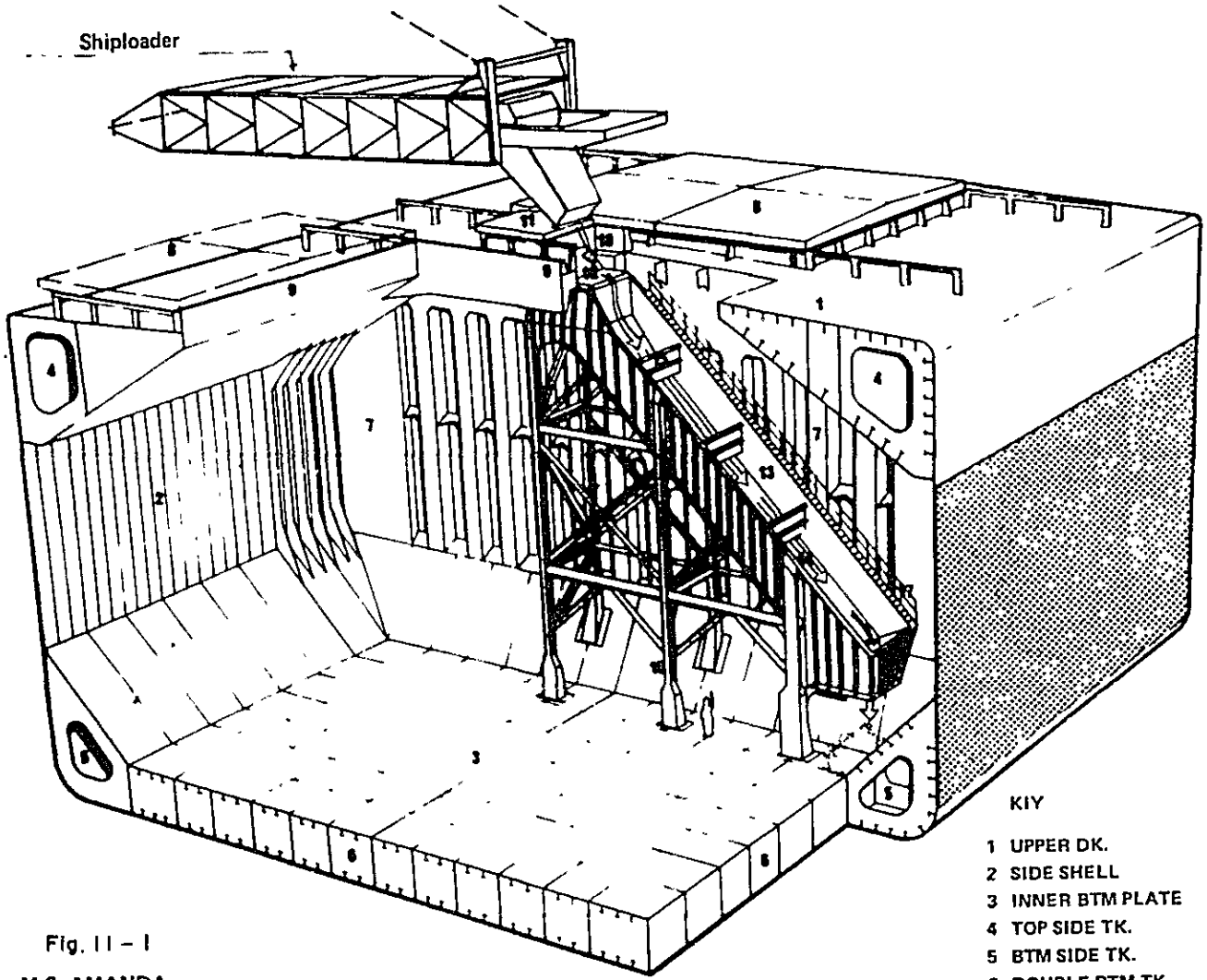


Fig. 11 – 1

M.S. AMANDA

DW 130 000 T SINTERED ORE CARRIER

PERSPECTIVE DRAWING OF 6 000 T/H SLIDE CHUTE

KIY

1	UPPER DK.	10	SMALL HATCH
2	SIDE SHELL	11	SMALL HATCH COVER
3	INNER BTM PLATE	12	SLANT PLATE
4	TOP SIDE TK.	13	SIDE PLATE
5	BTM SIDE TK.	14	BTM PLAT
6	DOUBLE BTM TK.	15	DAM PLATE
7	TRANS BHD.	16	PILLER
8	HATCH COVER	17	ACCESS LADDER
9	HTACH COAMING	18	

11.3 Berth Occupance Rate

11.3.1 Loading Cargo

According to the information presented by Hierro-Peru the loading record of iron ore and pellet from January 1977 to November 1979 is as follows:

	No. of ships	Quantity	Actual loading hours
Jan.–Dec., 1977	115	6,664,493 tons	3,491 hr.
Jan.–Dec., 1978	78	5,117,887	2,844
Jan.–Nov. 1979	93	5,556,387	2,960

Details on a monthly basis are shown in the Appendix E.

The above includes loading in slurry carriers exclusively for loading pellet feed, about one carrier every three months, requiring a maximum of 30 hours for loading.

The present loading time for each typical carrier is as follows:

Name of carrier	DWT	Loading hours (Actual record)
"Mythic"	71,806	19 hr
"Japan Magnolia"	94,465	20 hr
"Fukuyama Maru"	100,277	26 hr
"London Team"	107,663	34 hr
"Oceania Maru"	140,858	56 hr

11.3.2 Unloading Cargo

According to Hierro-Peru, the following cargo is unloaded at the pier at San Nicholas.

(1) General Cargo

A 12,000 DWT ~ 17,000 DWT vessel arrives every two months with such cargoes as 1,500 tons of ammonium nitrate, 200 ~ 300 tons of aluminum powder, heavy machinery such as drills, parts for conveyors, etc. The handling time varies according to the cargo from 2 hours to 1 week. For example, a ammonium nitrate takes approximately 2 days, with the average unloading speed being 35 t/hr.

(2) Petroleum

A 35,000 tonner arrives once in every three months and the average handling time is approximately 50 hours.

11.3.3 Sintered Ore Production and Port Condition

The increase in the number of entering and exiting vessels and their relation to the production of sintered ore is as follows:

(1) Loading Cargo

Sintered ore	:	2,500,000 tons/year
Type of vessel	:	80,000 DWT to 150,000 DWT
Number of vessels	:	80,000 DWT x 17 150,000 DWT x 8
Loading hours	:	1,025 hr/year (average loading capacity approx. 2,500 t/hr)

(2) Unloading Cargo

Coke breeze	:	125,000 tons/year
Type of vessel	:	25,000 DWT
Number of vessels	:	5
Unloading hours	:	595 hr/year (average unloading capacity approx. 210 t/hr)

11.3.4 Berth Occupancy Rate

The average loading record of iron ore and pellet in the past three years in 98 ships, 5,947,964 tons and 3,188 loading hours per year.

For general cargo the average loading time is 2 days/vessel with 10 vessels per year and for petroleum, 50 hours for loading time per vessel with 4 vessels per year.

From the above the hours of berth occupancy calculated are as follows:

(1) Ore and pellet	:	3,200 hours/year
(2) General cargo	:	480 hours/year
(3) Petroleum	:	200 hours/year
(4) Sintered ore	:	1,025 hours/year
(5) Coke breeze	:	595 hours/year
Total	:	5,500 hours/year

Berth occupancy hours total 5,500 hours/year corresponds to a berth occupancy rate of 62.8%. However, the east side of the pier will be used for general cargo and coke breeze, which will permit a simultaneous loading when the west side of the pier is used for iron ore, pellet and sintered ore. Therefore, the existing port capacity is considered sufficient to handle this operation and for the time being expansion of the port is considered unnecessary.

CHAPTER 12

FINANCE

CHAPTER 12 FINANCE

CHAPTER 12 FINANCE

12.1 Estimation of Construction Cost

12.1.1 Basic Assumptions For Estimate

(1) Coverage

Construction Costs cover procurement of machinery, equipment and materials, transportation, construction works at site, contingency, engineering, education, training and operation guidance, preoperating expenses, and interests on borrowings during construction period.

(2) Procurement

- Machinery and Equipment ..... Foreign
- Steel Materials for Buildings ..... Foreign
- Other Construction Materials ..... Domestic
- Construction Works ..... Domestic

Priority was given to Domestic Procurement over Foreign Procurement in deciding suppliers and contractors. Steel Materials for Buildings were, however, decided to depend on Foreign for their procurement since the Study Team could

not have enough assurance of Domestic procument in terms of quality and delivery during our field survey of limited time. In execution of the proposed project, it is necessary to reexamine this matter and convert to Domestic Procurement as much as possible by using whatever obtainable in Peru.

(3) Calculation Base

· Price Reference.	The market prices prevailing in January of 1980
· Currency:	U.S. Dollar
· Currency Conversion Rates:	US$1 = ¥240
	US$1 = S 255
	¥ 1 = S 1.0625

The main purpose of this financial projections is to evaluate the profitability of the proposed sinter project under the relative balance between costs and earnings prevailing at the time of estimation. The probable price fluctuation after the reference time will not be considered in this study to avoid unnecessary complexity and vagueness resulting from incorporation of price fluctuation.

In execution of the proposed sinter project, therefore, it is necessary to make full review of the construction cost estimate hereof and to reexamine it under the prevailing prices.

(4) Tax and Duty

Despite the fact that Hierro-Peru, the performer of this project is a governmental corporation wholly owned by the Peruvian Government, it is not granted

any special beneficial treatment in taxation for construction of a new project. Accordingly it was assumed that Hierro-Peru was subject to the ordinary import duties and other charges on its importations.

The following are the current import duties and other charges stipulated in the Peruvian Arancel and related Decreto Ley.

Machinery & Equipment	Steel Materials for Buildings
· CIF Amount x 27.2%	· CIF Amount x 96.4%
· Freight Cost x 10%	· Freight Cost x 10%
· Consulate Charge	· Consulate Charge
· Port Charge	· Port Charge

There is no possibility of exemption or deduction from the import duties and other charges. There has, however, been a case where other similar mining project was allowed to defer payment of duties and charges for five years after operation start without no interest charges. The effect of this deferred payment of duties and charges will be taken up later as an **Alternative Simulation Case (II)** in 12.5.2 (3).

12.1.2 Estimated Construction Cost

(1) Direct Construction Cost

Table 12-1 shows the Direct Construction Cost by major construction cost factors after classifying the proposed sinter plant into thirteen facility units. The Contingency was estimated at 5% of the sum excluding import duties and charges.

Table 12-1 Details of Direct Construction Cost

[$1,000]

Facilities	Civil Works	Buildings				Machinery & Equipment				Contingency	Grand Total
		CIF	Import Duty	Site Works	Sub-total	CIF	Import Duty	Site Works	Sub-total		
Raw Material Handling	279					2,057	595	996	3,648	167	4,094
Blending Bin	279					5,201	1,505	3,339	10,045	441	10,765
Sintering Machine	560	3,170	3,119	3,045	9,334	6,083	1,760	2,976	10,819	792	21,505
Cooling	279					3,065	887	1,652	5,604	250	6,133
Main Blower	279			1,056	1,056	4,702	1,360	1,651	7,713	384	9,432
Screening	279					4,046	1,171	1,262	6,479	279	7,037
Sinter Handling	279					4,441	1,285	1,637	7,363	318	7,960
Utilities						1,161	336	466	1,963	81	2,044
Laboratory		8	7	35	50	1,061	307	156	1,524	63	1,637
Sinter Yard	1,676					6,061	1,753	2,163	9,977	495	12,148
Ore Blending Yard	1,676					4,483	1,297	2,426	8,206	429	10,311
Electric						10,283	2,975	2,111	15,369	620	15,989
Instrumentation						3,114	901	440	4,455	178	4,633
Total	5,586	3,178	3,126	4,136	10,440	55,758	16,132	21,275	93,165	4,497	113,688

It is expected for the proposed sinter plant to utilize the existing facilities of Hierro-Peru beneficiation plant as much as possible because the proposed sinter plant is planned to locate adjacent to it, as explained in CHAPTER 9.

In consequence of this advantage, the Required Direct Construction cost will amount to $113,688,000 in total or $45.48 per sinter ton (the quotient of the total Direct Construction Cost divided by the normal annual sinter production of 2,500,000 MT), which, can be said, is a favorable figure compared to a sinter plant at a new location.

(2) Other Construction Costs

- Engineering Fee

  It was estimated at 4% of the total Direct Construction Cost excluding import duties and other charges.

- Education and Training Cost and Operation Guidance Fee

  It was estimated by calculating the required costs for education and training of Hierro-Peru personnel overseas as well as on site, and for inviting foreign instructors and supervisors at the start-up operation, based on the education and training plan described in CHAPTER 10.

- Preoperating Expenses

  These are the expenses incurred indirectly by the construction at the Administration Office, which mainly consist of man power costs because of the full utilization of existing facilities.

- Interest during Construction Period

  As explained later, the total Construction Requirements will be financed with Equity Contribution and the two types of the Long-Term Borrowings.

  The interest accrued from the said Borrowings during Construction Period will be incorporated into the acquisition cost of the Fixed Assets, in cost accounting, due to the fact of pre-commercial operations.

  Cash flow wise, the said interest will be paid out in cash on each due date without being capitalized into the principal of borrowings.

  The aggregate amount of the above items will form the total Construction Cost, which is shown in Table 12-2.

Table 12-2 Total Required Construction Cost

[$1,000]

Items	Procurement Segmentation			Per Sinter Ton
	Domestic	Foreign	Total	($1)
Direct Construction Cost	$52,325	$61,363	$113,688	$45.48
Engineering Fee		3,776	3,776	1.51
Education and Training Cost and Operation Guidance Fee	294	139	433	.17
Preoperating Expenses	505		505	.20
Interest during Construction Period		8,244	8,244	3.30
Total	$53,124	$73,522	$126,646	$50.66
(Component Percentage)	(42%)	(58%)	(100%)	

12.1.3 Asset Classification of Construction Cost

The construction cost estimated in the previous sections will be classified into the following assets for sake of financial forecast.

The Direct Construction Cost, the Engineering Fee and the Interest during Construction Cost will contsitute the Tangible Fixed Asset, which will be classified into the two categories, i.e. "Building and Other Structures" and "Machinery and Equipment" according to useful life of assets.

The remaining items of the Education and Training Cost and Operation Guidance Fee, and the Preoperating Expenses will constitute "Deferred Assets".

Table 12-3 indicates the acquisition cost of each asset.

Table 12-3 Asset Classification

[$1,000]

Asset	Acquisition Cost
Tangible Fixed Assets	
Building and Other Structure	$ 18,487
Machinery & Equipment	107,221
Sub-Total	125,708
Deferred assets	938
Total	$126,646

12.2 Estimation of Production Cost

12.2.1 Basic Assumptions for Estimate

(1) Coverage

The proposed sinter plant will be functionally and inseparably related to the existing operations of Hierro-Peru.

In forecasting production cost in this study, however, the proposed sinter operation will be segregated from the existings and be assumed to bear such costs as raw materials, utilities and services provided by the existing operations, in accordance with their consumption and utilization, and the allocation standards. It will be out of scope of this study to evaluate the advantageous and disadvantageous effects on the production costs of the existing operations brought about by the establishment of the proposed sinter plant, and then to reflect these effects on the sinter production cost.

(2) Calculation Base

· Price Reference:	The market prices prevailing in January of 1980
· Currency:	U.S. Dollar
· Currency Conversion Rates.	US$1 = ¥ 240
	US$1 = S 255
	¥ 1 = S 1.0625
· Measure:	Dry Metric Ton

As mentioned in the previous section, the probable price fluctuations after the above reference time will not be under consideration in this study to preclude unnecessary uncertainty from our forecasts.

(3) Plant Operation

Different from other steel-making facilities, a sinter plant could reach the normal stage operation relatively early.

Consequently, the unit consumptions of various cost elements could be assumed to show a relatively stable trend except for start-up operation.

In this forecast, it was assumed that the unit consumptions of part of cost elements would be affected adversely by the lower operating rate of 66% in the first year caused by the rating-up effects and the market limitation explained later.

In the second year and thereafter the unit consumption figures were assumed to be normal and constant.

12.2.2 Assumptions for Cost Estimate

The following descriptions are the assumptions for the unit consumptions and unit prices of the various cost elements which are decided based upon the expertise and experience of our study team and through a series of discussions with Hierro-Peru.

(1) Raw Materials

Raw Materials required for the production of sinter are fine iron ore, carbon material, limestone and silicastone.

- Fine Iron Ore

  As main raw material, supplied is the sinter feed which is processed from refractory ore (R.O.) and transition ore (T.O.) at the adjacent Hierro-Peru beneficiation plant.

  It is estimated to cost $8.10 per ton in accordance with Hierro-Peru calculation.

- Carbon Materials

  As carbon material, imported coke breeze will be used.

  Coke breeze will be unloaded and conveyed by trucks to the coke breeze storage yard.

  The unit price is estimated at $75.347 per ton including the purchase price, the import duty and other charges, and the unloading and conveying costs.

- Limestone and Silicastone

  Limestone and silicastone will be used as CaO source and SiO_2 source, respectively. The both will be carried by trucks from the mining site within Hierro-Peru concession to the crushing plant, and then carried by the existing down-hill conveyor to the limestone-silicastone yard. The unit prices are estimated at $3.20 and $3.64 per ton, respectively in accordance with Hierro-Peru calculations.

- Unit Consumption

  Table 12-4 indicates the above raw materials consumptions per one ton sinter production, which were forecasted based on the results of Pot Test explained in CHAPTER 5 and experience and expertise of the study team.

Table 12-4 Unit Consumption of Raw Materials

[kg]

Items	Unit Consumption	
	1st year	2nd year & after
Sinter Feed		
Refractory Ore	539 kg	536 kg
Transition Ore	360	357
Sub-total	899	893
Coke Breeze	56	50
Limestone	151	149
Silicastone	22	21

(2) Man Power Cost

Table 12-5 shows the Man Power Cost which was figured out by applying the Hierro-Peru payroll rates to the personnel requirements by job classification for sinter operations under the manning plan in CHAPTER 10. Since the manning plan suggested no new personnel requirements at the Plant Administration Sector, this Man Power Cost will constitute the total of Direct Labor Cost.

Table 12-5 Man Power Cost

[$1]

Job Class	Personnel	Annual Wage Rate			Annual Cost
		Basic Pay	Fringe Benefit	Total	
Staff (Annual)	9	——	——	$7,480	$ 67,320
Maestro (Daily)	15	1,701	3,764	5,465	81,975
Operador (Daily)	115	1,672	3,700	5,372	617,780
	—	—	—	—	—
Total	139				$767,075

(3) Utility

The following are the assumptions for cost estimate with regard to utility requirements for sinter operations, explained in detail in CHAPTERs 5 and 7.

- Electricity

  The two power sources are available.

  The purchased price from Electro-Peru is $43.838/MWH, while the power generated from existing Hierro-Peru plant costs $53.913/MWH.

  The power cost in this study was estimated at $48.8755/MWH, the simple average of the above two sources, on the assumption that the sinter plant will tap its power supply equally from the two sources.

- Fuel Oil

  Petro-Peru Industrial No. 6 (equivalent to Bunker C) will be consumed as fuel oil for the ignition furnace.

  Based on its purchased price, the cost of fuel oil is estimated at $.093 per litter.

- Steam

  The existing Hierro-Peru plant will supply steam, which is required for atomizing at the ignition furnace.

  Based on the Hierro-Peru calculations, the cost of steam is estimated at $12 per ton.

- Water

  The deep wells at Jahuay and the desalination plant in Hierro-Peru com-

pound are now under study to fulfil the fresh water requirements, which are mainly for use as mixture in blending raw materials. The cost of fresh water is estimated at $1.52/m^3$ in accordance with the production cost of the existing desalination plant.

Sea water to be required for cooling the sinter equipment will be provided from the existing sea water tank. Its cost is estimated at $.034 per ton in accordance with Hierro-Peru figures.

- L.P.G.

  L.P.G. will be used as a pilot burner at the ignition furnace.

  It is estimated to cost $.151 per kg.

- Unit Consumptions of Utilities

  Table 12-6 indicates the unit consumptions of the above utilities, which are figured out in accordance with the results of Pot Test of sample ore and the experience and expertise of our study team.

Table 12-6 Unit Consumption of Utility

Items	Unit Consumption	
	1st year	2nd year & after
Electricity	39 KWH	35 KWH
Fuel Oil	2.6 ℓ	2 ℓ
Water		
Fresh Water	.05 m^3	.05 m^3
Sea Water	2.0 m^3	2.0 m^3
Steam	3.2 kg	3.2 kg
L.P.G.	.01 kg	.01 kg

(4) Maintenance Materials

In view of the characteristics of sinter plant, the required maintenance materials are considered to depend mainly on operation circumstances and the chemical nature of the raw materials to be used.

Taking account of the long-time performance of the existing Hierro-Peru pelletizing plant, the annual requirements for maintenance materials are estimated at 2.87% of the direct construction cost of machinery and equipment.

(5) Depreciation

In accordance with the accounting practice in Peru, the Depreciation Costs are calculated under a straight-line method without residual value over the useful life of 10 years for machinery and equipment and of 30 years for building and structure.

Table 12-7 indicates the Depreciation Cost calculated by applying the above method to the Asset Classification explained in the previous section.

Table 12-7 Depreciation

[$1,000]

Asset	Acquisition Cost	Useful Life	Annual Depreciation Cost
Building and Structure	$ 18,487	30 years	$ 616
Machinery & Equipment	107,221	10 years	10,722
Total	$125,708		$11,338

(6) Factory Overhead and Others

The plant administrative work will be handled by the existing Hierro-Peru Administrative Department without staff increase. Based on the Hierro-Peru calculations, the plant administration cost charged to the sinter operation is estimated at $1.5452 per one ton of sinter produced.

(7) Tax, Duty and Charges

The property tax and royalties which are usually counted in the operating costs will be exempted due to the Government ownership of Hierro-Peru. In this calculations, the import duty and other charges on imported coke breeze are included in the costs.

12.2.3 Estimated Production Cost

Table 12-8 shows the estimated Production Cost of sinter calculated based on the previous assumptions.

In the initial year when the operating rate is as low as 66%, the unit production cost is projected to be $25.10 per ton, which is $3.87 higher than that in the third year and thereafter when the normal operation is established. The high unit cost in the first year can be attributed to the aggravated unit consumption figures in part of cost elements and the heavier burden of fixed cost per ton.

Table 12-8 Production Cost

[Amount; $1,000
Unit Cost; $1]

Items	1st Year		2nd Year		3rd Year and After	
	Amount	Unit Cost	Amount	Unit Cost	Amount	Unit Cost
Production Volume	1,650,000 MT		2,000,000 MT		2,500,000 MT	
Raw Material						
Sinter Feed	12,015	7.28	14,467	7.23	18,083	7.23
Coke Breeze	6,962	4.22	7,535	3.77	9,418	3.77
Limestone	805	.49	963	.48	1,203	.48
Silicastone	132	.08	153	.08	191	.08
Sub-total	19,914	12.07	23,118	11.56	28,895	11.56
Operating Cost						
Man Power	767	.46	767	.38	767	.31
Maintenance Materials	2,911	1.76	2,911	1.46	2,911	1.16
Utility	3,846	2.33	4,161	2.08	5,202	2.08
Electricity	3,145	1.91	3,421	1.71	4,277	1.71
Fuel Oil	399	.24	372	.19	465	.19
Fresh Water	125	.07	152	.07	190	.07
Sea Water	112	.07	136	.07	170	.07
Steam	63	.04	77	.04	96	.04
L.P.G.	2	–	3	–	4	–
Depreciation	11,338	6.87	11,338	5.67	11,338	4.54
Amortization	94	.06	94	.05	94	.04
Factory Overhead	2,550	1.55	3,091	1.54	3,863	1.54
Sub-total	21,506	13.03	22,362	11.18	24,175	9.67
Total	41,420	25.10	45,480	22.74	53,070	21.23

12.2.4 Analysis of Production Cost

To analyze its structure, the production cost in the normal year, i.e. the third year and thereafter was focused attention on. Fig. 12.1 "Production Cost Structure" illustrates the component ratio of each cost element and ratio of variable costs to fixed costs.

It is noticeable that the raw material costs account for a share of 54.4%, followed by the Depreciation & Amortization costs of 21.6% and the Utility Cost of 9.8%, while the Man Power costs account for a small share of 1.4%. This fact confirms our notion that the sinter operation has capital-intensive and raw material-intensive character, similar to the other steel-making plants.

The variable costs outnumber the fixed costs by 64.2% to 35.8%.

The costs of tax, duty and charges accounts for 1.7%.

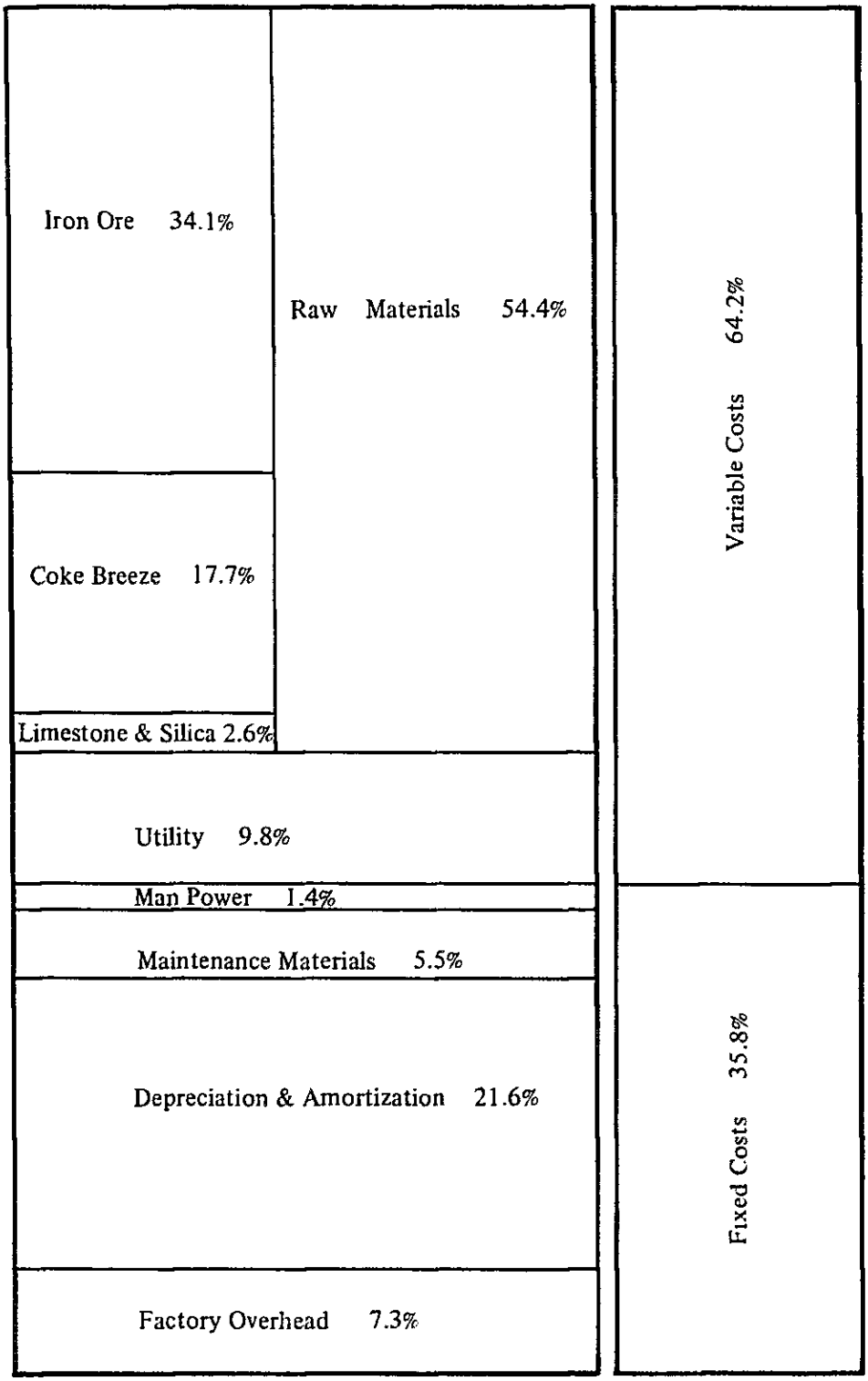


Fig. 12-1 Production Cost Structure

12.3 Financing Plan

12.3.1 During Construction Period

(1) Funds required

The total required capital investment for a sinter plant was explained in the previous section.

The funds for Raw Materials Inventory Buildup and Cash on hand preparatory to the start-up operation must be counted in the Total Fund Requirements during construction period in addition to the above Capital Investment Requirements such as Direct Construction Cost, Preoperating Expenses and Interest during construction.

The payment schedule of the above items was projected based on each work schedule of engineering, manufacturing of machinery and equipment, transportation, construction work, education and training, and start-up operation.

(2) Fund Raising Plan

The above total funds requirements during construction period will be met by the following fund raising plan.

- Equity Contribution

  The 25% of the total funds requirements will be relied on the Equity Contribution by Peruvian Government, that is, paid-in capital increase of Hierro-Peru, which amounts to $32 million.

  The ratio of equity financing rises to approximately 27%, if Interest during construction and Initial Working Capital are subtracted from the total requirements.

- Export Credit

  The 90% of the import prices of Machinery and Equipment, and Steel Materials for Buildings will be financed by institutional Export Credits granted by exporting countries, which amount to $53,042,000.

- U.S. Dollar Loan

  U.S. Dollar Loan amounting to $44,338,000 will finance the remaining balance of the total funds requirements which will not be covered by the above Equity Contribution and Export Credit, specifically speaking, part or whole of Construction Work at Site, Interest during construction, Education and Training Costs, Preoperating Expenses and Initial Working Capital.

- Terms and Conditions of Borrowings

  The terms and conditions of the two loans could be diversified depending on lenders and the climate of international financial market. This forecast assumed the following terms and conditions for borrowings, which were considered as adequate level for international borrowings.

Effective Interest Rate:		9% p.a.
Repayment:		
	Export Credit;	Equal semi-annual installments over 10 years after operation start
	U.S.Dollar Loan;	Equal semi-annual installments over 7 years with grace period of 3 years after operation start
	Security;	Guarantee by Peruvian Government

Table 12-10 shows the Cash Flow Projection during 3 years construction period, which compiles semi-annually the payment schedule and the fund raising schedule explained above.

Its summarized version is shown below as Table 12-9 "Cash Balance during Construction Period".

Table 12-9 Cash Balance during Construction

[$1,000]

	Item	Amount
Funds Required	Building & Structure	$ 17,173
	Machinery & Equipment	100,291
	Interest during Construction	8,244
	Preoperating Expenses	938
	Raw Material Inventory Buildup	1,845
	Total	$128,491
Funds Raised	Equity Contribution	$ 32,000
	Long-Term Borrowings	
	Export Credit	53,042
	U.S. Dollar Loan	44,338
	Sub-Total	97,380
	Total	$129,380
	Cash Balance	$ 889

TABLE 12 - 10 ** PROJECTED CASH FLOW STATEMENTS (CONSTRUCTION) **

(UNIT: $1000)

	-3RD YEAR		-2ND YEAR		-1ST YEAR		
	1ST HALF	2ND HALF	1ST HALF	2ND HALF	1ST HALF	2ND HALF	TOTAL
** CASH BALANCE, BEGINNING	0	307	54	207	448	360	0
** CASH PROVIDED BY **							
CAPITAL STOCK	3,500	0	7,000	21,500	0	0	32,000
LONG TERM DEBTS	5,304		2,917	32,762	37,541	18,857	97,380
SUPPLIER S CREDIT	5,304		2,917	30,765	14,056	0	53,042
U.S. DOLLAR LOAN	0	0	0	1,997	23,485	18,857	44,338
TAX PAYABLE	0	0	0	0	0	0	
INTEREST ON TEMPORARY INVESTMENT	0	0	0	0	0	0	0
(TOTAL)	8,804	0	9,917	54,262	37,541	18,857	129,380
** CASH APPLIED TO **							
FIXED ASSETS ACQUISITION COST	8,362	0	9,404	52,882	34,884	11,932	117,465
BUILDING AND STRUCTURE	656	0	5,167	7,025	4,009	317	17,173
MACHINERY AND EQUIPMENT	7,706	0	4,237	45,857	30,875	11,616	100,291
INTEREST DURING CONSTRUCTION	119	239	304	1,083	2,630	3,871	8,246
SUPPLIER S CREDIT	119	239	304	1,062	2,071	2,387	6,182
U.S. DOLLAR LOAN	0	0	0	21	559	1,484	2,063
PRE-OPERATIONAL EXPENSES	15	15	55	56	115	682	938
INVENTORY BUILDUP	0	0	0	0	0	1,843	1,843
(TOTAL)	8,497	254	9,763	54,021	37,629	18,328	128,491
** NET CASH INCREASE/DECREASE	307	-254	154	241	-88	529	889
** CASH BALANCE, END	307	54	207	448	360	889	889

12.3.2 After Operation Start

Any fund shortage caused after operation start will practically be filled up by the Finance Department of Hierro-Peru.

In this forecast, however, such fund shortage is assumed to be covered with Short-term Loan in U.S. dollar with the effective borrowing cost of 12% p.a., to maintain the independence of culculation.

On the other hand, along with this assumption, the fund surplus to be generated from operation is assumed to be invested in financial market at the yield of same 12% p.a., keeping the minimum required cash on hand.

The treatment of fund surplus will be discussed later in 12.5.2 Alternative Simulation.

12.4 Financial Forecast

12.4.1 Assumptions for Forecasting

(1) Coverage

The financial forecast in this Study will cover the 10 years subsequent to the construction period.

The 10 years coverage is in accordance with the practice at Hierro-Peru and consistent with the useful life of 10 years for the depreciation of Machinery & Equipment which is relatively shorter than usual.

Estimation for Construction Cost and Production Cost, and Financing Plan will establish the basis of financial forecast.

Moreover, the following assumptions were required for making forecast.

(2) Production · Sales · Inventory Plan

The normal operation stage of sinter could be attained relatively easily with short rating-up period.

Technically speaking, there will not be hard restriction on production.

In view of the lead time for market penetration, however, it is assumed that the possible sales volume in the first year and the second year will be 1,500,000 MT and 2,000,000 MT, respectively, and that in the third year will reach 2,500,000 MT of the full rated capacity.

Sinter inventory will be maintained at the level of 150,000 MT, equivalent to the capacity of average ore-carrier.

The foregoing assumptions result in the following Table 12-11.

Table 12-11 Production · Inventory · Sales Plan

[1,000 ton]

Year	Production Volume	Inventory Increase	Sales Volume
1st Year	1,650	150	1,500
2nd Year	2,000	–	2,000
3rd Year & After	2,500	–	2,500

(3) Sales Price

To fix a sales price is one of the most vital and sensitive assumptions for our financial forecast.

Through the discussion and exchange of data amd information between Hierro-Peru staff and our study team, agreed is the basic concept that the sales price of sinter is equivalent to the market price of self-fluxing pellet in 1980 in terms of the price per Fe unit.

Although it might be still arguable, this concept is deemed less of error and justifiably conservative, as a basis of financial calculations.

In this study the sales price of sinter (FOB at San Nicols port) was estimated at $27.4/DMT by starting with the market price of pellet per Fe unit prevailing for 1980 and taking account of the difference in degradation ratios between pellet and sinter and freight cost.

(4) Taxation and Incentives

As explained in the previous section, Hierro-Peru has, in principle, not been given special favorable tax treatment by the Government compared to a private company.

Due to its government ownership and being a mining industry, however, Hierro-Peru has been exempted from some part of taxes.

In this study Hierro-Peru was assumed to be subject to the following taxes.

- Value-Added Tax

  2% of FOB value of sinter under the Decreto Ley No. 21497

- Income Tax

  Corporate income tax rates in Peru are progressive. The following is the outline of income tax system applied to a mining industry.

If taxable income is not more than S 100 million

(Taxable Income Bracket)	(Rate %)
Up to S 0.1 million	20%
Over S 0.1 million to S 0.5 million	30%
Over S 0.5 million to S 50 million	35%
Over S 50 million to S 100 million	40%

Consequently, tax payable amounts to S 37,465,000 if taxable income is exactly S 100 million.

If taxable income is more than S 100 million

In addition to the above S 37,465,000, the progressive rates from 24% to 55% stipulated for the 23 tax brackets which are classified based upon the ratio of (Taxable Income + Depreciation + Interest)/(95% of Fixed Assets Amount) are applied to the excess over S 100 million.

Against the gross income tax, granted are tax credits for reinvestment and comunidad.

Strictly to follow the above taxation formula, it will be necessary to make considerably arbitrary assumptions with regard to the future financial performance of the existing Hierro-Peru operations, and with regard to the conversion rate between U.S. dollar and Soles, which has been adjusted daily under the Mini Devaluation method. To preclude difficulty about these assumptions, this study dared to assume, simplifying the tax calculations, that a Corporate Income Tax was levied at a straight rate of 40% of Net Income before tax.

In accordance with the Peruvian tax practice it is assumed that Net Operating Loss incurred in any year can be carried over for the following three years and dedutible from taxable income.

The follwing taxes will be exempted under the Mining Law, related Decreto Ley and Decreto Supremo.

- Property Tax
- Royalties

} To be exempted owing to the government ownership.

- Export Tax

  To be exempted because sinter is deemed not to fall into the category of traditional exports, on which a tax of 17.5% of FOB value is levied.

- Withholding Tax on interest payment on foreign loans

  To be exempted from a 10% withholding tax on interest payment on the Export Credit and the U.S. Dollar Loan, under the Decreto Supremo No. 049-69-HA.

(5) Assumptions regarding Income Statement items

- General and Administrative Expenses at Head Office

  Based on the Hierro-Peru calculations, $.7832 per metric ton of sinter will be distributed to the Sinter Operation as General and Administrative Expenses at Lima Head Office.

- Shipping Cost

  Based on the actual costs of the Hierro-Peru existing operation, the cost of conveying from sinter yard and loading into vessel was estimated at $.1319 per sinter ton shipped.

- Minpeco Commission

  As a sales commission, the 2% of FOB Price will be paid to Minero Peru Comercial (MINPECO) which is a state mineral marketing company dealing with all the Hierro-Peru products.

- Amortization of Deferred Assets

  The Deferred Assets consisting of Education and training Cost and Operation Guidance Fee, and Preoperating Expenses during construction period will be amortized over a period of 10 years.

(6) Assumptions for Balance Sheet items

- Cash on hand and Bank Deposit

  Cash on hand and Bank Deposit was estimated to be maintained at the level of 3% of the sum of cash items in production cost, based on the practice at Hierro-Peru.

- Inventories

  Sinter : 150,000 MT, equivalent to the capacity of average ore-carrier

  Raw Materials For keeping the sinter operation smooth,

Sinter Feed;	87,000 MT
Coke Breeze;	15,000 MT
Limestone;	2,000 MT
Silicastone;	500 MT

- Account Receivable

  In view of the business practice in Peru, it was estimated that one month is required to receive the proceeeds after shipment (by L/C).

- Account Payable

  In the light of payment conditions of materials, man power cost, utilities and others in Peru, Coke Breeze and Cash Items of Operating Cost were assumed to be payable in half a month.

12.4.2 Financial Forecast

The results of financial projection on the basis of the foregoing assumptions are shown in;

Table 12-12	Projected Income Statements
Table 12-13	Detail of Cost of Goods Manufactured and Sold
Table 12-14	Projected Balance Sheets
Table 12-15	Projected Cash Flow statements (operation period)

(1) Income Statement Projection

The Operation will fall into the red respectively in the first and second year when the annual sales volume will be far below the full rated capacity. In the third year when the normal operation is established, however, the operation will go into the black for fiscal year proper and in the sixth year even for cumulative basis. Thereafter, Net Income will increase steadily year after year. That is attributable to the interest cost burden decreased proportionately to the declining outstanding balance of the Long-term Borrowings, and the rise in the temporary investment earnings of surplus funds.

(2) Cash Flow Projection

In the first year when the production and sales volume is much lower than the rated capacity, the sinter operation will experience, due to Net Operating Loss, funds shortage which will be covered by the short-term borrowing.

The sinter operation, however, will generate the funds surplus of $1.6 million in the second year and of $7.8 million in the third year, which are more than enough to repay the above short-term borrowing fully.

Even after the repayment of U.S. Dollar Loan is started in the fourth year, the surplus funds will continue to be generated constantly and their outstanding balance will amount to as sizable as $47.6 million at the end of the tenth year. This is due to the fact that the sum of annual Depreciation and Amortization ($11.4 million), the funds sources for repayment will well exceed the annual average requirements for repayment ($9.7 million), because of shorter depreciation periods.

(3) Balance Sheet Projection

The total assets of sinter operation will be decreased continuously to $70.6 million at the end of the tenth year, which is only 45% of the peak amount of $129.4 million in the beginning balance, by depreciation and amortization of assets and repayment of borrowings.

Equity/Debt ratio starting at 24.7% in the beginning balance will decline to 18.9% and 17.3% at the end of the first and second year, respectively, owing to the cumulative Net Operating Loss, but will turn upward in the third year, recover the initial level in the fourth year and thereafter increase sharply to 90.6% at the end of the tenth year. The current ratio exceeding one from the beginning will jump up to 8.8 times at the last year end.

TABLE 12 - 12 (1) ** PROJECTED INCOME STATEMENTS ** (UNIT: $1000)

	1	2	3	4	5	6	7	8
SALES AMOUNT	41,100	54,800	68,500	68,500	68,500	68,500	68,500	68,500
VOLUME (1000 TON)	1,500	2,000	2,500	2,500	2,500	2,500	2,500	2,500
AVERAGE OF UNIT PRICE ($/TON)	27.40	27.40	27.40	27.40	27.40	27.40	27.40	27.40
COST OF GOODS SOLD	37,654	45,809	53,308	53,084	53,071	53,070	53,070	53,070
SELLING, GEN. & ADM.	3,017	4,022	5,028	5,028	5,028	5,028	5,028	5,028
ADMINISTRATIVE	1,175	1,566	1,958	1,958	1,958	1,958	1,958	1,958
VALUE ADDED TAX	822	1,096	1,370	1,370	1,370	1,370	1,370	1,370
MINPECO COMMISSION	822	1,096	1,370	1,370	1,370	1,370	1,370	1,370
SHIPPING COST	198	264	330	330	330	330	330	330
INCOME FROM OPERATION	429	4,968	10,165	10,388	10,401	10,402	10,402	10,402
INTEREST	8,761	8,724	8,143	7,070	6,023	4,975	3,928	2,880
SUPPLIER S CREDIT	(4,654)	(4,177)	(3,700)	(3,222)	(2,745)	(2,268)	(1,790)	(1,313)
U.S. DOLLAR LOAN	(3,990)	(3,990)	(3,990)	(3,848)	(3,278)	(2,708)	(2,138)	(1,568)
SHORT TERM LOAN	(116)	(557)	(453)	(0)	(0)	(0)	(0)	(0)
INTEREST ON TEMPORARY INVESTMENT	0	0	402	767	1,265	1,904	2,569	3,268
NET INCOME BEFORE TAX	-8,332	-3,756	2,423	4,085	5,644	7,331	9,043	10,790
(PRE-YEAR LOSS CARRY OVER)	(0)	(8,332)	(12,088)	(9,664)	(3,756)	(0)	(0)	(0)
(TAXABLE INCOME)	(0)	(0)	(0)	(0)	(1,888)	(7,331)	(9,043)	(10,790)
INCOME TAX	0	0	0	0	755	2,932	3,617	4,316
NET INCOME AFTER TAX	-8,332	-3,756	2,423	4,085	4,889	4,398	5,426	6,474
RETAIND EARNINGS	-8,332	-12,088	-9,664	-5,579	-691	3,708	9,134	15,607

TABLE 12 - 12 (2) ** PROJECTED INCOME STATEMENTS ** (UNIT: $1000)

	9	10	TOTAL
SALES AMOUNT	68,500	68,500	643,900
VOLUME (1000 TON)	2,500	2,500	23,500
AVERAGE OF UNIT PRICE ($/TON)	27.40	27.40	27.40
COST OF GOODS SOLD	53,070	53,070	508,278
SELLING, GEN. & ADM.	5,028	5,028	47,261
ADMINISTRATIVE	1,958	1,958	18,405
VALUE ADDED TAX	1,370	1,370	12,878
MINPECO COMMISSION	1,370	1,370	12,878
SHIPPING COST	330	330	3,100
INCOME FROM OPERATION	10,402	10,402	88,361
INTEREST	1,833	786	53,124
SUPPLIER S CREDIT	(835)	(358)	(25,062)
U.S. DOLLAR LOAN	(998)	(428)	(26,936)
SHORT TERM LOAN	(0)	(0)	(1,126)
INTEREST ON TEMPORARY INVESTMENT	4,094	5,057	19,327
NET INCOME BEFORE TAX	12,663	14,673	54,564
(PRE-YEAR LOSS CARRY OVER)	(0)	(0)	(0)
(TAXABLE INCOME)	(12,663)	(14,673)	(0)
INCOME TAX	5,065	5,869	22,555
NET INCOME AFTER TAX	7,598	8,804	32,009
RETAIND EARNINGS	23,205	32,009	32,009

TABLE 12 - 13 (1) ** DETAIL OF COST GOODS MANUFACTURED AND SOLD **

(UNIT: $1000)

	1	2	3	4	5	6	7	8
(PRODUCTION VOLUME :1000 TON)	1,650	2,000	2,500	2,500	2,500	2,500	2,500	2,500
RAW MATERIALS	19,914	23,118	28,895	28,895	28,895	28,895	28,895	28,895
OPERATING COST	21,506	22,362	24,175	24,175	24,175	24,175	24,175	24,175
MAN POWER	767	767	767	767	767	767	767	767
MAINTENANCE MATERIAL	2,911	2,911	2,911	2,911	2,911	2,911	2,911	2,911
UTILITY	3,846	4,161	5,202	5,202	5,202	5,202	5,202	5,202
FACTORY OVERHEAD	2,550	3,090	3,863	3,863	3,863	3,863	3,863	3,863
DEPRECIATION	11,339	11,339	11,339	11,339	11,339	11,339	11,339	11,339
AMORTIZATION	94	94	94	94	94	94	94	94
COST OF GOODS MANUFACTURED	41,420	45,480	53,070	53,070	53,070	53,070	53,070	53,070
INVENTRY								
BEGINNING		3,765	3,436	3,198	3,185	3,184	3,184	3,184
END	3,765	3,436	3,198	3,185	3,184	3,184	3,184	3,184
COST OF GOODS SOLD	37,654	45,809	53,308	53,084	53,071	53,070	53,070	53,070

TABLE 12 - 13 (2)** DETAIL OF COST GOODS MANUFACTURED AND SOLD **

(UNIT: $1000)

	9	10	TOTAL
(PRODUCTION VOLUME (1000 TON)	2,500	2,500	23,650
RAW MATERIALS	28,895	28,895	274,192
OPERATING COST	24,175	24,175	237,271
MAN POWER	767	767	7,670
MAINTENANCE MATERIAL	2,911	2,911	29,110
UTILITY	5,202	5,202	49,623
FACTORY OVERHEAD	3,863	3,863	36,544
DEPRECIATION	11,339	11,339	113,386
AMORTIZATION	94	94	938
COST OF GOODS MANUFACTURED	53,070	53,070	511,462
INVENTRY			
BEGINNING	3,184	3,184	29,506
END	3,184	3,184	32,690
COST OF GOODS SOLD	53,070	53,070	508,278

TABLE 12 - 14 (1)** PROJECTED BALANCE SHEET **

(UNIT: $1000)

	-3RD YEAR		-2ND YEAR		-1ST YEAR			
	1ST HALF	2ND HALF	1ST HALF	2ND HALF	1ST HALF	2ND HALF	1	2
** ASSETS **								
CURRENT ASSETS	307	54	207	448	360	2,732	10,067	11,096
CASH ON HAND AND DEPOSIT	307	53	206	448	360	889	1,033	1,250
TEMPORARY INVESTMENT	0	1	1	0	0	0	0	0
ACCOUNTS RECEIVABLE							3,425	4,567
INVENTORIES						1,843	5,608	5,279
FINISHED PRODUCTS	( )	( )	( )	( )	( )	( )	(3,765)	(3,436)
MATERIALS	( )	( )	( )	( )	( )	(1,843)	(1,843)	(1,843)
FIXED ASSETS	8,482	8,720	18,429	72,394	109,907	125,710	114,372	103,033
BUILDING AND STRUCTURE							17,871	17,255
MACHINERY AND EQUIPMENT							96,501	85,779
CONSTRUCTION IN PROGRESS	8,482	8,720	18,429	72,394	109,907	125,710	0	0
DEFERRED ASSETS	15	30	85	141	256	938	844	750
(TOTAL ASSETS)	8,804	8,804	18,721	72,983	110,523	129,380	125,283	114,879
** LIABILITIES **								
CURRENT LIABILITIES	0	0	0	0	0	0	9,538	8,195
ACCOUNT PAYABLE							577	641
SHORT TERM LOAN							8,961	7,555
INCOME TAX PAYABLE							0	0
IMPORT TAX PAYABLE								
LONG TERM DEBTS	5,304	5,304	8,221	40,983	78,523	97,380	92,076	86,772
SUPPLIER S CREDIT	5,304	5,304	8,221	38,986	53,042	53,042	47,738	42,434
U.S. DOLLAR LOAN				1,997	25,481	44,338	44,338	44,338
(TOTAL LIABILITIES)	5,304	5,304	8,221	40,983	78,523	97,380	101,615	94,967
** EQUITY **								
CAPITAL STOCK	3,500	3,500	10,500	32,000	32,000	32,000	32,000	32,000
ALLOWANCE OF DIVIDEND							0	0
RETAINED EARNINGS	0	0	0	0	0	0	-8,332	-12,088
(TOTAL EQUITY)	3,500	3,500	10,500	32,000	32,000	32,000	23,668	19,912
(TOTAL LIABILITIES AND EQUITY)	8,804	8,804	18,721	72,983	110,523	129,380	125,283	114,879

TABLE 12 - 14 (2) ** PROJECTED BALANCE SHEET ** (UNIT: $1000)

	3	4	5	6	7	8	9	10
** ASSETS **								
CURRENT ASSETS	12,214	16,094	21,531	27,901	33,806	40,773	48,913	58,316
CASH ON HAND AND DEPOSIT	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249
TEMPORARY INVESTMENT	216	4,108	9,547	15,916	21,822	28,788	36,929	46,331
ACCOUNTS RECEIVABLE	5,708	5,708	5,708	5,708	5,708	5,708	5,708	5,708
INVENTORIES	5,041	5,028	5,027	5,027	5,027	5,027	5,027	5,027
FINISHED PRODUCTS	(3,198)	(3,185)	(3,184)	(3,184)	(3,184)	(3,184)	(3,184)	(3,184)
MATERIALS	(1,843)	(1,843)	(1,843)	(1,843)	(1,843)	(1,843)	(1,843)	(1,843)
FIXED ASSETS	91,695	80,356	69,018	57,679	46,340	35,002	23,663	12,325
BUILDING AND STRUCTURE	16,638	16,022	15,406	14,790	14,173	13,557	12,941	12,325
MACHINERY AND EQUIPMENT	75,056	64,334	53,612	42,889	32,167	21,445	10,722	0
CONSTRUCTION IN PROGRESS	0	0	0	0	0	0	0	0
DEFERRED ASSETS	657	563	469	375	281	188	94	0
(TOTAL ASSETS)	104,566	97,013	91,018	85,955	80,428	75,962	72,671	70,641
** LIABILITIES **								
CURRENT LIABILITIES	762	762	1,517	3,695	4,380	5,078	5,827	6,632
ACCOUNT PAYABLE	762	762	762	762	762	762	762	762
SHORT TERM LOAN	0	0	0	0	0	0	0	0
INCOME TAX PAYABLE	0	0	755	2,932	3,617	4,316	5,065	5,869
IMPORT TAX PAYABLE								
LONG TERM DEBTS	81,468	69,829	58,191	46,553	34,915	23,276	11,638	0
SUPPLIER S CREDIT	37,129	31,825	26,521	21,217	15,913	10,608	5,304	0
U.S. DOLLAR LOAN	44,338	38,004	31,670	25,336	19,002	12,668	6,334	0
(TOTAL LIABILITIES)	82,230	70,592	59,709	50,248	39,294	28,355	17,466	6,632
** EQUITY **								
CAPITAL STOCK	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
ALLOWANCE OF DIVIDEND	0	0	0	0	0	0	0	0
RETAINED EARNINGS	-9,664	-5,579	-691	3,708	9,134	15,607	23,205	32,009
(TOTAL EQUITY)	22,336	26,421	31,309	35,708	41,134	47,607	55,205	64,009
(TOTAL LIABILITIES AND EQUITY)	104,566	97,013	91,018	85,955	80,428	75,962	72,671	70,641

TABLE 12 - 15 (1) ** PROJECTED CASH FLOW STATEMENTS (OPERATING PERIOD) ** (UNIT: $1000)

	1	2	3	4	5	6	7	8
** CASH BALANCE, BEGINNING	889	1,033	1,250	1,465	5,357	10,796	17,166	23,071
** CASH PROVIDED BY **								
CASH SALES	37,675	50,233	62,792	62,792	62,792	62,792	62,792	62,792
SALES AMOUNT	(41,100)	(54,800)	(68,500)	(68,500)	(68,500)	(68,500)	(68,500)(	68,500)
ACCOUNTS RECEIVABLE	(-3,425)	(-4,567)	(-5,708)	(-5,708)	(-5,708)	(-5,708)	(-5,708)(	-5,708)
COLLECTION OF RECEIVABLES		3,425	4,567	5,708	5,708	5,708	5,708	5,708
INTEREST ON TEMPORARY INVESTMENT	0	0	402	767	1,265	1,904	2,569	3,268
INCREASE,,ACCOUNT PAYABLE	577	63	122	0	0	0	0	0
SHORT TERM LOAN	8,961	0	0	0	0	0	0	0
LONG TERM DEBTS	0	0	0					
SUPPLIER S CREDIT	( )	( )	( )	( )	( )	( )	( )	( )
U.S. DOLLAR LOAN	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
CAPITAL STOCK	0	0	0	0	0	0	0	0
DEPRECIATION & AMORTIZATION	11,432	11,432	11,432	11,432	11,432	11,432	11,432	11,432
(TOTAL)	58,646	65,154	79,315	80,699	81,198	81,836	82,502	83,201
** CASH APPLIED TO **								
COST OF GOODS SOLD	37,654	45,809	53,308	53,084	53,071	53,070	53,070	53,070
SELLING, GEN, & ADM,	3,017	4,022	5,028	5,028	5,028	5,028	5,028	5,028
INCOME TAX		0	0	0	0	755	2,932	3,617
PAYMENT OF TAX PAYABLE	0	0	0	0	0	0	0	0
REPAYMENT OF DEBTS	5,304	6,711	12,859	11,638	11,638	11,638	11,638	11,638
SUPPLIER S CREDIT	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)
U.S. DOLLAR LOAN	(0)	(0)	(0)	(6,334)	(6,334)	(6,334)	(6,334)	(6,334)
SHORT TERM LOAN	(0)	(1,407)	(7,555)	(0)	(0)	(0)	(0)	(0)
INTEREST	8,761	8,724	8,143	7,070	6,023	4,975	3,928	2,880
SUPPLIER S CREDIT	(4,654)	(4,177)	(3,700)	(3,222)	(2,745)	(2,268)	(1,790)	(1,313)
U.S. DOLLAR LOAN	(3,990)	(3,990)	(3,990)	(3,848)	(3,278)	(2,708)	(2,138)	(1,568)
SHORT TERM LOAN	(116)	(557)	(453)	(0)	(0)	(0)	(0)	(0)
INCREASE,,FIXED ASSET	0	0	0	0	0	0	0	0
INCREASE,,INVENTORIES	3,765	-330	-237	-13	-1	0	0	0
(TOTAL)	58,501	64,937	79,100	76,807	75,759	75,467	76,596	76,234
** NET CASH INCREASE/DECREASE	144	217	214	3,893	5,439	6,370	5,905	6,966
** CASH BALANCE, END	1,033	1,250	1,465	5,357	10,796	17,166	23,071	30,037

TABLE 12 - 15 (2) ** PROJECTED CASH FLOW STATEMENTS (OPERATING PERIOD) ** (UNIT: $1000)

	9	10	TOTAL
** CASH BALANCE, BEGINNING	30,037	38,178	889
** CASH PROVIDED BY **			
CASH SALES	62,792	62,792	590,242
SALES AMOUNT	(68,500)	(68,500)	(643,900)
ACCOUNTS RECEIVABLE	(-5,708)	(-5,708)	(-53,658)
COLLECTION OF RECEIVABLES	5,708	5,708	47,950
INTEREST ON TEMPORARY INVESTMENT	4,094	5,057	19,327
INCREASE,,ACCOUNT PAYABLE	0	0	762
SHORT TERM LOAN	0	0	8,961
LONG TERM DEBTS			0
SUPPLIER S CREDIT	( )	( )	(0)
U.S. DOLLAR LOAN	(0)	(0)	(0)
CAPITAL STOCK	0	0	0
DEPRECIATION & AMORTIZATION	11,432	11,432	114,324
(TOTAL)	84,026	84,989	781,565
** CASH APPLIED TO **			
COST OF GOODS SOLD	53,070	53,070	508,278
SELLING, GEN, & ADM,	5,028	5,028	47,261
INCOME TAX	4,316	5,065	16,685
PAYMENT OF TAX PAYABLE	0	0	
REPAYMENT OF DEBTS	11,638	11,638	106,342
SUPPLIER S CREDIT	(5,304)	(5,304)	(53,042)
U.S. DOLLAR LOAN	(6,334)	(6,334)	(44,338)
SHORT TERM LOAN	(0)	(0)	(8,961)
INTEREST	1,833	786	53,124
SUPPLIER S CREDIT	(835)	(358)	(25,062)
U.S. DOLLAR LOAN	(998)	(428)	(26,936)
SHORT TERM LOAN	(0)	(0)	(1,126)
INCREASE,,FIXED ASSET	0	0	0
INCREASE,,INVENTORIES	0	0	3,184
(TOTAL)	75,885	75,587	734,874
** NET CASH INCREASE/DECREASE	8,141	9,402	46,691
** CASH BALANCE, END	38,178	47,580	47,580

12.5 Financial Analysis

12.5.1 Basic Case

The profitability of the proposed sinter project is evaluated by the Discounted Cash Flow Method, based upon the above financial forecast.

As indicated in **Table 12-16, "Internal Rate of Return Calculation"**;

- ROI (Discounted Cash Flow Rate of Return on Investment) will be 7.2%.
- ROE (Discounted Cash Flow Rate of Return on Equity) will be 5.7%.
- The Average Return on Sales will be 5.0%.

TABLE 12 - 16 ** INTERNAL RATE OF RETURN CALCULATION ** (UNIT: $1000) ROE= 5.72% ROI= 7.22%

		-3RD YEAR 1ST HALF	-3RD YEAR 2ND HALF	-2ND YEAR 1ST HALF	-2ND YEAR 2ND HALF	-1ST YEAR 1ST HALF	-1ST YEAR 2ND HALF	1	2
** CASH PROVIDED **									
CAPITAL STOCK	(A)	3,500	0	7,000	21,500	0	0	0	0
LONG TERM DEBTS	(B)	5,304		2,917	32,762	37,541	18,857	0	0
SUPPLIER S CREDIT		(5,304)	( )	(2,917)	(30,765)	(14,056)	(0)	( )	( )
U.S. DOLLAR LOAN		(0)	(0)	(0)	(1,997)	(23,485)	(18,857)	(0)	(0)
(TOTAL)		8,804	0	9,917	54,262	37,541	18,857	0	0
** CASH GENERATED **									
NET INCOME	(C)							-8,332	-3,756
DEPRICIATION AND AMOTIZATION	(D)							11,432	11,432
INTEREST OF LONG TERM DEBTS	(E)							8,645	8,168
SUPPLIER S CREDIT		( )	( )	( )	( )	( )	( )	(4,654)	(4,177)
U.S. DOLLAR LOAN		( )	( )	( )	( )	( )	( )	(3,990)	(3,990)
(TOTAL)		0	0	0	0	0	0	11,746	15,844
REPAYMENT OF LONG TERM DEBTS	(F)	0	0	0	0	0	0	5,304	5,304
SUPPLIER S CREDIT		(0)	(0)	(0)	(0)	(0)	(0)	(5,304)	(5,304)
U.S. DOLLAR LOAN		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
** RETURN ON INVESTMENT **									
NET BALANCE	(C+D-F)-(A)	-3,500	0	-7,000	-21,500	0	0	-2,204	2,372
CUMULATIVE		-3,500	-3,500	-10,500	-32,000	-32,000	-32,000	-34,204	-31,832
DISCOUNT RATE		1.00000	.97256	.94588	.91992	.89468	.87013	.83457	.78940
PRESENT VALUE		-3,500	0	-6,621	-19,778	0	0	-1,839	1,872
** RETURN ON INVESTMENT AND LOAN **									
NET BALANCE	(C+D+E)-(A+B)	-8,804	0	-9,917	-54,262	-37,541	-18,857	11,746	15,844
CUMULATIVE		-8,804	-8,804	-18,721	-72,983	-110,523	-129,380	-117,635	-101,791
DISCOUNT RATE		1.00000	.96574	.93264	.90069	.86983	.84002	.79722	.74352
PRESENT VALUE		-8,804	0	-9,249	-48,873	-32,654	-15,840	9,364	11,780

		3	4	5	6	7	8	9	10
** CASH PROVIDED **									
CAPITAL STOCK	(A)	0	0	0	0	0	0	0	0
LONG TERM DEBTS	(B)	0							
SUPPLIER S CREDIT		( )	( )	( )	( )	( )	( )	( )	( )
U.S. DOLLAR LOAN		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
(TOTAL)		0	0	0	0	0	0	0	0
** CASH GENERATED **									
NET INCOME	(C)	2,423	4,085	4,889	4,398	5,426	6,474	7,598	8,804
DEPRICIATION AND AMOTIZATION	(D)	11,432	11,432	11,432	11,432	11,432	11,432	11,432	11,432
INTEREST OF LONG TERM DEBTS	(E)	7,690	7,070	6,023	4,975	3,928	2,880	1,833	786
SUPPLIER S CREDIT		(3,700)	(3,222)	(2,745)	(2,268)	(1,790)	(1,313)	(835)	(358)
U.S. DOLLAR LOAN		(3,990)	(3,848)	(3,278)	(2,708)	(2,138)	(1,568)	(998)	(428)
(TOTAL)		21,546	22,588	22,344	20,806	20,786	20,787	20,863	21,022
REPAYMENT OF LONG TERM DEBTS	(F)	5,304	11,638	11,638	11,638	11,638	11,638	11,638	11,638
SUPPLIER S CREDIT		(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)	(5,304)
U.S. DOLLAR LOAN		(0)	(6,334)	(6,334)	(6,334)	(6,334)	(6,334)	(6,334)	(6,334)
** RETURN ON INVESTMENT **									
NET BALANCE	(C+D-F)-(A)	8,552	3,879	4,683	4,192	5,220	6,268	7,392	8,598
CUMULATIVE		-23,280	-19,401	-14,718	-10,526	-5,305	962	8,354	16,952
DISCOUNT RATE		.74667	.70626	.66804	.63188	.59768	.56533	.53473	.50579
PRESENT VALUE		6,385	2,740	3,128	2,649	3,120	3,543	3,953	4,349
** RETURN ON INVESTMENT AND LOAN **									
NET BALANCE	(C+D+E)-(A+B)	21,546	22,588	22,344	20,806	20,786	20,787	20,863	21,022
CUMULATIVE		-80,245	-57,658	-35,314	-14,508	6,279	27,065	47,928	68,950
DISCOUNT RATE		.69344	.64673	.60317	.56255	.52466	.48932	.45636	.42562
PRESENT VALUE		14,941	14,608	13,477	11,704	10,906	10,171	9,521	8,947

12.5.2 Alternative Simulation

As alternatives to the basic case, the computor program simulation is operated for the following three cases.

(1) To compute the Sales Price of sinter which will allow for ROI=10%.

(2) In case of the deferred payment of the import duty and other charges on imported machinery and material over a period of five years after the operation start without any interest charges. and

(3) In case of no yield on temporary investment of surplus funds.

(1) Case I

In conducting the financial analysis for a specific project, the level of profitability as an acceptance criterion might depend upon the profitability of other investment opportunities, the financial position of an investor (more concretely, Cost-of-Capital Rate) and the strategical significance of a specific project for an investor.

In this analysis, to respect the intention of Hierro-Peru, the sales price ensuring ROI = 10% will be computed by a simulation. In other words, this is to solve the simulation that the sales price is an unknown factor and ROI is a variable of 10% under the other conditions unchanged.

As the result of the simulation, it will be found that the required level of sales price is $28.87, higher than the basic case by $1.47. In this case ROE will rise to 14.0% and Average Return on Sales to 9.3%.

Profit and Loss situation wise, although the first and second year will incur the Net Operating Loss for fiscal year base, that is the same as in the basic case, the third year will turn to the black for cumulative base, that is 3 years ahead of the basic case.

Cash Flow wise, the funds shortage will be caused only in the first year. The required short-term borrowing will remain as low as $6.9 million, which can be fully repayed in the second year, one year earlier than in the basic case.

(2) Case II

The basic case assumed that the import duties and other charges on the imported machineries and materials were paid to the customs office in cash at the time of customs clearance, and the required funds were financed properly.

Although there is no possibility of being granted total or partial exemption, there has been a case where other similar mining projects were allowed to defer the payment of the above import duties and other charges over the five years after the commercial operation (no interest).

Case II will aim at evaluating the financial effect of this deferred payment of the import duties and other charges.

Deferring the above tax payment will give, on the Credit side of the beginning Balance Sheet, the effects that U.S. Dollar Loan is decreased by the amount of $19,258,000 equivalent to the relevant import duties and charges and a new item, i.e. Long-Term Debt-"Tax Payable" is established in the amount of $19,258,000.

The effects on the Debit side of the beginning Balance Sheet will be the deduction of the Acquisition Cost of Fixed Assets because the required amount of U.S. Dollar Loan is decreased and consequently the Interest charges during construction period are reduced proportionately.

As the result of the simulation, ROE will go up to 12.8%, ROI to 9.7% and Average Return on Sales to 6.1%, all of which are improved relative to those in the basic case.

Profit and Loss situation wise, the same as in the basic case, the Net Operating Loss will be incurred in the first and second years for fiscal year base. The year when the sinter operation goes into the black for cumulative base will be advanced by two years to the fourth year.

Cash Flow wise, the required Short-term Borrowing will reach as high as $11.7 million and be fully paid in the fifth year, since the deferred payment is repayable over a period of five years while U.S. Dollar Loan is repayable over a period of ten years with three years grace period.

(3) Case III

The basic case assumed that the surplus funds were invested in money market at the yield of 12% p.a., leaving the minimum cash requirements on hand.

Practically, however, it is more natural to consider that the surplus funds generated from operation will be absorbed by the Financial Department at Lima Head Office and will be paid out as dividend or appropriated for capital investment under Hierro-Peru financial policy.

In view of this possibility and for the purpose of eliminating the distortion caused by the yield from the surplus funds investment, Case III Simulation will be conducted under the assumption that the yield on temporary investment is Zero.

As the results of the simulation, ROE will decline to 1.9%, ROI to 6.2% and Average Return on Sales to 3.1%, all of which are deteriorated relative to the basic case.

There will be no noticeable changes in the years when the operation turns to the profit for fiscal year and cumulative base, and in the required amount of the Short-term Borrowing to fill up the funds shortage, except for one year delay in full repayment of this Borrowing. That is owing to the relatively weak effect of earnings from temporary investment in the first four years and the rapidly growing effect in the later years.

Table 12-17 indicates the comparison among the basic case and the three alternative simulation cases. (refer to Appendix "Alternative Simulation Case (I), (II) & (III)")

Table 12-17 Alternative Simulation

Items	Basic Case	Case I [Sales Price allowing for ROI= 10%]	Case II [Deferred Payment of Import Duty over 5 years]	Case III [Yields of Surplus Funds; 0%]
Sales Price	$27.40	$28.87	$27.40	$27.40
ROE	5.7%	14.0%	12.8%	1.9%
ROI	7.2%	10.0%	9.7%	6.2%
Average Return on Sales (10 years)	5.0%	9.3%	6.1%	3.1%
Years incurring Net Loss	1st & 2nd	1st & 2nd	1st & 2nd	1st & 2nd
Year turning to Net Profit on cumulative base	6th	3rd	4th	6th
Years incurring Funds Shortage	1st	1st	1st & 2nd	1st & 2nd
Short-term borrowings				
Outstanding balance at peak time	$9.0 million	$6.9 million	$11.7 million	$9.0 million
Year of full repayment	3rd	3rd	5th	4th

12.5.3 Sensitivity Analysis

Sensitivity Analysis is to analyze and evaluate the effect and influence on the three profitability indexes, i.e. ROE, ROI, Average Return on Sales, by varying one main assumption under the other assumptions unchanged.

By Sensitivity Analysis, understanding of the financial characteristics of a project will be upgraded.

The Sensitivity Analysis items in this study are as follows,

- Construction Cost – 10% up
- Construction Cost – 10% down
- Raw Material Cost – 10% up
- Raw Material Cost – 10% down
- Interest Rate of Long-term Loan – increase by 2% to 11% p.a.
- Sales Price – 10% up
- Sales Price – 10% down

Table 12-18 shows the results of the Sensitivity Analysis.

(refer to Appendix "Sensitivity Analysis Case, Case (1), (2), (3), (4), (5) (6) & (7)")

Table 12-18 Sensitivity Analysis

Items	ROE	ROI	Average Return on Sales
Basic Case	5.7%	7.2%	5.0%
Construction Cost			
10% up	Negative	5.3%	1.8%
10% down	11.2%	9.0%	7.3%
Raw Material			
10% up	Negative	3.9%	Negative
10% down	13.0%	9.6%	9.1%
Interest Rate of Long-term Loans			
2% added	Negative	6.4%	1.7%
Sales Price			
10% up	19.4%	12.0%	12.6%
10% down	Negative	Negative	Negative

APPENDIX

APPENDIX

APPENDIX - A

Specification of Equipments and Drawings

APPENDIX - A Specification of Equipments and Drawings

Contents

(1) Limestone Sizing Equipment

(a) Impeller Breaker

Quantity: 1 (one) set

Description:

material to be crushed: limestone

feed size: -10 mm

product size: -3 mm approx. 60%

capacity: 172 t/h (new feed 100 t/h)

peripheral speed of rotor: 50 m/sec. (5.95 r.p.m)

driving method: V-Belt

motor: 220 kW x 8P

(b) Limestone Screen

Quantity: 1 (one) set

Description:

type: horizontally floor setting type vibrating screen

dimension: 2400 mm width x 6000 mm length

capacity: 172 t/h

screen net: 3 mm (wier dia. 1.6 mm)

plain woven hard steel wire cloth

number of vibration: 1000 c.p.m

type of motion: elliptical motion

driving method: center - drive type

(motor → timing belt → gear box → rubber coupling)

motor: 37 kW x 6P

(2) Yard Equipment

(a) Stacker

Quantity: 1 (one) set

Description:

capacity: 317 t/h

boom conveyor reach: 29 m

(i) Travelling device

rail gauge: 6 m

wheel base: 7 m

travelling distance: abt. 310 m

travelling speed: 20 m/min

motor: 11 kW x 6P x 3 sets

(ii) Luffing device

driving system: wire rope and winch system

luffing speed: approx. 5 m/min (at tip of boom)

motor: 11 kW x 6P

(iii) Boom conveyor

belt width: 750 mm

belt speed: 120 m/min

motor: 22 kW x 4P

(iv) Tripper

belt width: 750 mm

belt speed: 90 m/min

(v) Operating method: manual operation and automatic operation after setting of buttons in operator's cabin

(vi) Power supply: AC 3 PH, 6 HZ, 4,160 V

(b) Reclaimer

Quantity: 1 (one) set

Description:

capacity: 3000 t/h

(i) Travelling device

rail gauge: 8 m

wheel base: 9 m

travelling distance: abt. 375 m

travelling speed: 30/7.5 m/min (two-speeds)

motor: 22/5.5 kW x 4/16 P x 6 sets

(ii) Slewing device

type: roller path

radius of slewing: 45 m

driving system: hydraulic power system

slewing speed: 0 ~ 36 °/min (variable)

slewing angle: 90°

motor: 30 kW x 4P (main)

3.7 kW x 6P (sub)

(iii) Luffing device

driving system: wire rope and winch system

luffing speed: approx. 4 m/min (at wheel center)

motor: 30 kW x 6P

(iv) bucket wheel device

type: rotary bucket wheel

driving system: motor drive

wheel revolution: 6.5 r.p.m

wheel diameter: 7 m

No. of bucket: 8

motor: 132 kW x 6P

(v) Boom conveyor

belt width: 1600 mm

belt speed: 150 m/min

motor: 90 kW x 4P x 2 sets

(vi) Tripper

belt width: 1400 mm

belt speed: 150 m/min

(vii) Operating method: manual

(viii) Power supply: AC 3 PH, 60 Hz, 4,160 V

(c) Blending Yard Bin

Quantity: 2 (two) sets

Description:

type: welded steel plate construction

effective volume: abt. 600 m^3

size: upper opening - 9.5 m dia. x total height 18 m

accessary: tilt type level switch

: vibrater for choke prevention

(d) Constant Feed Weigher

Quantity: 2 (two) sets

Description:

type: load cell type

capacity: 600 - 120 t/h

belt feeder:

belt width: 1400 mm

belt troughing: flat

pulley center distance: 1,750 mm

weighing belt conveyor

belt width: 1600 mm

belt troughing: flat

pulley center distance: 4000 mm

(e) Blending Stacker

Quantity: 1 (one) set

Description:

capacity: 500 t/h

(i) Travelling device

rail gauge: 6 m

wheel base: 6 m

travelling distance: abt. 135 m

travelling speed: 30/20 m/min (two-speeds)

motor: 15/11 kW x 6P x 2 sets

(ii) Slewing device

type: roller path

radius of slewing: 23 m

slewing speed: 36 °/min

slewing angle: ±90° (total 180°)

motor: 5.5 kW x 8P

(iii) Luffing device

driving method: wire rope and winch system

luffing speed: approx. 6 m/min (at tip of boom)

motor: 15 kW x 8P

(iv) Boom conveyor

belt width: 750 mm

belt speed: 140 m/min

motor: 30 kW x 4P

(v) Tripper

belt width: 750 mm

belt speed: 120 m/min

(vi) Operating method: manual operation and automatic operation after setting of buttons in operator's cabin

(vii) Power supply: AC 3 PH, 60 HZ, 440 V

(f) Blending Reclaimer

Quantity: 1 (one) set

Description:

capacity: 700 t/h

(i) Travelling device

rail gauge: 32 m

wheel base: 6 m

travelling distance: abt. 150 m

travelling speed: 30/2 m/min (two-speeds)

motor: 7.5 kW x 4P x 4 sets (for high speed)

1.5 kW x 6P x 4 sets (for low speed)

(ii) Traversing device

type: wire rope and winch system

traversing speed: 7 m/min

motor: 22 kW x 6P

(iii) Bucket wheel device

type: rotary bucket wheel

driving system: motor drive

wheel revolution: 5 r.p.m

wheel diameter: 6 m

No. of wheel: 2 sets

motor: 30 kW x 4P x 2 sets

(iv) Harrow luffing device

type: wire rope and winch system

luffing speed: slow

No. of harrow: 2 sets

motor: 0.75 kW x 6P x 2 sets

(v) Relay conveyor

belt width: 750 mm

belt speed: 120 m/min

motor: 11 kW x 4P

(vi) Operating method: manual operation and automatic operation after setting of buttons in operator's cabin

(vii) Power supply: AC 3 PH, 60 HZ, 440 V

(g) Transfer Car

Quantity: 1 (one) set

Description:

rail gauge: 9 m

wheel base: 32 m

travelling distance: abt. 50 m

travelling speed: 12/3 m/min (two-speeds)

motor: 7.5/2.2 kW x 4/16 P x 2 sets

operating method: manual

power supply: AC 3 PH, 60 HZ, 440 V

(3) Bin Blending Equipment

(a) Blending Bin

(i) Return Fines Bin

Quantity: 1 (one) set

Description:

type : welded steel plate construction, stone-box

effective volume : abt. 600 m^3

size: upper opening - 8.3 m dia. x total height - 17 m

(cylindrical - 14 m + conical - 3 m)

supports: 2 - load cells and 2 - dummy blocks

(ii) Iron Ore Bin

Quantity: 3 (three) sets

Description:

type : welded steel plate construction

effective volume: abt. 600 m^3

size: upper opening - 9.5 m dia. x total height

- 18 m (cylindrical - 7.5 m + conical - 10.5 m)

(iii) Silicastone Bin

Quantity: 1 (one)

Description:

type : welded steel plate construction

effective volume: abt. 600 m^3

size : upper opening - 9.5 m dia. x total height

- 18 m (cylindrical 7.5 m + conical - 10.5 m)

(iv) Limestone Bin

Quantity: 1 (one) set

Description:

type: welded steel plate construction

effective volume: abt. 600 m^3

size: upper opening - 9.5 m dia. x total height - 18 m (cylindrical - 7.5 m + conical - 10.5 m)

(v) Anthracite Bin or spare

Quantity: 1 (one) set

Description:

type: welded steel plate construction

effective volume: abt. 600 m^3

size: upper opening - 9.5 m dia. x total height - 18 m (cylindrical - 7.5 m + conical - 10.5 m)

(vi) Coke Breeze Bin

Quantity: 1 (one) set

Description:

type: welded steel plate construction

effective volume: abt. 600 m^3

size: upper opening - 9.5 m dia. x total height - 18 m (cylindrical - 7.5 m + conical - 10.5 m)

(vii) Coke Breeze (ground) Bin

Quantity: 1 (one) set

Description:

type: welded steel plate construction

effective volume: abt. 600 m^3

size: upper opening - 9.5 m dia. x total height

- 18 m (cylindrical - 7.5 m + conical - 10.5 m)

(b) Constant Feed Weigher

(i) Constant Feed Weigher for Return Fines

Quantity: 1 (one) set

Description:

type: load cell

capacity: 175 - 35 t/h

belt feeder:

belt width: 1,050 mm

belt troughing: flat

pulley centers: 1,750 mm

weighing belt conveyor:

belt width: 1,200 mm

belt troughing: flat

pulley centers: 4,000 mm

(ii) Constant Feed Weigher for Iron Ore

Quantity: 3 (three) sets

Description:

type: load cell

capacity: 175 - 35 t/h

belt feeder:

belt width: 1,050 mm

belt troughing: flat

pulley centers: 1,750 mm

weighing belt conveyor:

belt width: 1,200 mm

bet troughing: flat

pulley centers: 4,000 mm

(iii) Constant Feed Weigher for Silicastone

Quantity: 1 (one) set

Description:

type: load cell

capacity: 10 - 2 t/h

belt feeder:

belt width: 900 mm

belt troughing: flat

pulley centers: 1,750 mm

weighing belt conveyor:

belt width: 1,050 mm

belt troughing: flat

pulley centers: 4,000 mm

(iv) Constant Feed Weigher for Limestone

Quantity: 1 (one) set

Description:

type: load cell

capacity: 75 - 15 t/h

belt feeder:

belt width: 900 mm

belt troughing: flat

pulley centers: 1,750 mm

weighing belt conveyor:

belt width: 1,050 mm

belt troughing: flat

pulley centers: 4,000 mm

(v) Constant Feed Weigher for Anthracite or spare

Quantity: 1 (one) set

Description:

type: load cell

capacity: 35 - 7 t/h

belt feeder:

belt width: 900 mm

belt troughing: flat

pulley centers: 1,750 mm

weighing belt conveyor:

belt width: 1,050 mm

belt troughing: flat

pulley centers: 8,300 mm

(vi) Constant Feed Weigher for Coke Breeze

Quantity: 1 (one) set

Description:

type: load cell

capacity: 35 - 7 t/h

belt feeder:

belt width: 900 mm

belt troughing: flat

pulley centers: 1,750 mm

weighing belt conveyor:

belt width: 1,050 mm

belt troughing: flat

pulley centers: 8,300 mm

(vii) Constant Feed Weigher for Coke Breeze (ground)

Quantity: 1 (one) set

Description:

type: load cell

capacity: 25 - 5 t/h

belt feeder:

belt width: 900 mm

belt troughing: flat

pulley centers: 1,750 mm

weighing belt conveyor

belt width: 1,050 mm

belt troughing: flat

pulley centers: 4,000 mm

(4) Coke Grinding Equipment

(a) Rod Mill

Quantity: 1 (one) set

Description:

type: end-peripheral discharge, dry

capacity: 29.5 t/h with abt. 10 pct. moisture

size: dia. - abt. 2.4 m x length - abt. 4.2 m

mill speed: abt. 17 rpm

main accessories: . screw feeder

. rod charging device

. inching device

. forced lubrication unit

(motor: abt. 280 kW)

(5) Mixing Equipment

(a) Mixer

(i) Mixer proper

Quantity: 1 (one) set

Description:

type: rotary drum

capacity: 506 t/h with abt. 5.5 pct. moisture
(drum-outlet)

size: dia. - 3.8 m x length - 19 m

drum speed: 6 rpm

inclination: 3/100

with 2 - forged steel tyres integrated with drum-shell
and 1 - cast steel girth gear bolted to drum-shell.

accessories: . lifters for mixing section of drum

. water spray pipe with additive water control valve and orifice

(ii) Supporting Roller

Quantity: 1 (one) set

Description:

type: smoothed-surface, cast steel roller,
consisting of 4 - supporting rollers and 2 - thrust rollers,
mounted on base frames.

accessories: . centralized grease supply unit

(iii) Driving Gear

Quantity: 1 (one) set

Description:

type: pinion/girth-gear drive

consisting of main motor, gear-box, pinion and inching motor, mounted on base frame.

type: forced lubrication, parallel shaft

ratio: abt. 1/27

accessories: · flexible couplings for output and input shafts, claw clutch for inching

(motor: 450 kW for drum)

(6) Sintering Equipment

(A) Sintering Machine Charging System

(a) Sinter Mix Hopper

Quantity: 1 (one) set

Description:

type: welded steel plate construction

effective volume: abt. 27 m^3

size: upper opening - 4.5 m x 1.8 m

rectangle x total height - 5.8 m

(rectangular - 2 m + pyramidal - 3.8 m)

supports: 4 - load cells

accessories: . hydraulic operated damper, adjustable flap

(b) Drum Feeder

Quantity: 1 (one) set

Description:

type: rotary drum

capacity: 506 t/h (wet)

size: dia. - 1,318 mm x length - 3,090 mm

drum speed: abt. 10 - 3.3 rpm

gearbox

type: oil bath cyclo

ratio: 1/87

(motor: DC 7.5 kW)

(c) Sinter Mix Chute

Quantity: 1 (one) set

Description:

type: deflector plate, with cut-off plate and auto-cleaner

chute: manually movable

deflector plate: hydraulic operated, angle-changeable (50° - 60°)

cut-off plate: hydraulic operated, depth-adjustable (200mm)

auto-cleaner: · motor-driven, up and down on deflector plate surface.

(d) Hearth Layer Hopper

Quantity: 1 (one) set

Description:

type: welded steel plate construction

effective volume: abt. 30 m^3

size: upper opening - 4 m x 3.4 m rectangle x total height
- abt. 6.7 m
(rectangular - 1.5 m + pyramidal - abt. 5.2 m
including upper-and lower-parts)

supports: 2 - load cells

accessories: · manually operated damper

(e) Hearth Layer Chute

Quantity: 1 (one) set

Description:

type: pendulum type

adjustable depth: 40 - 20 mm

accessories: . manually adjustable gate
. balance weight

(B) Ignition Equipment

(a) Ignition and Heat-holding Hood

(i) Ignition Furnace

Quantity: 1 (one) set

Description:

type: Bunker-C oil burning, box, roof burner type

ignition surface: width-abt. 3.1 m x length - abt. 6.3 m

furnace volume: abt. 19.5 m^3

combustion capacity: max. abt. 12 x 10^6 kcal/h

furnace pressure: abt. 0 - -2 mmH_2O

furnace temperature: abt. 1,100 - 1,300 °C

furnace frame:

type: shape steel bolted construction

refractory:

hot face: high alumina plastic except high alumina castable for front wall and partition wall water lintels

accessories: . water lintels for front and partition wall
. heat protecting water box before front-wall

(ii) Heat-holding Hood

Quantity: 1 (one) set

Description:

heat-holding surface: width - abt. 3.1 m x length - 3.5 m

hood frame:

type: shape steel bolted construction

refractory:

hot face: fire-clay castable

(b) Combustion Equipment

(i) Ignition Furnace Burner

Quantity: 27 (twenty-seven) pcs.

Description:

type: high pressure nozzle mix

fuel: Bunker - C

low calorific value

- abt. 9,700 kcal/kg

arrangement: 9 x 3 rows = 27pcs.

combustion capacity:

max. abt 45 l/h/burner x 27 = abt. 1,200 l/h

= abt. 12 x 10^6 kcal/h

excess air ratio = max. 50 pct.

accessories: . oil regulating cock

. oil filter

. steam regulating cock

. air butterfly valve

. oil shut-off valve

(ii) Pilot Burner

Quantity: 27 (twenty-seven) pcs.

Description:

type: nozzle mix

fuel: propane gas

low calorific value - abt. 20,000 kcal/m^3 (0°C, 1 atm)

arrangement: fixed to each ignition furnace burner

combustion capacity: abt. 5,000 kcal/h/burner

accessories: . ignition plug

(c) Fuel Oil Supply System

(i) Fuel Oil Supply Pump

Quantity: 2 (two) sets

(one for operation and one for stand-by)

Description:

type: rotary screw

capacity: abt. 3,600 l/h

pressure: abt. 7 kg/cm^2 (gauge)

operating temp.: max. 130°C

(ii) Fuel Oil Piping

Quantity: 1 (one) lot

Description: complete fuel oil piping from fuel oil day tank to each ignition furnace burner.

including:
- . oil strainer
- . oil heater
- . oil pressure regulating valve
- . oil flow regulating valve
- . oil flow-meter

(d) Propane Gas Supply System

Quantity: 1 (one) lot

Description:

complete propane gas piping from gas cylinder to each pilot burner

including:
- gas vaporizer
- gas pressure regulating valve
- gas shut-off valve

(e) Steam Supply System

Quantity: 1 (one) lot

Description:

complete steam piping for oil atmizing, oil heating and steam-tracing

including:
- steam pressure regulating valve
- steam flow reguratıng valve

(f) Combustion Air Supply System

(i) Combustion Air Fan for Ignition Furnace

Quantity: 1 (one) set

Description:

type: single suction, turbo

capacity: 350 m^3/min

pressure: 650 mmH_2O

(motor: abt. 55 kW)

(ii) Combustion Air Piping

Quantity: 1 (one) lot

Description:

complete combustion air piping from air fan to each igntion furnace burner and pilot burner.

including:

. air flow control valve

. orifice

(C) Sintering Machine

(a) Sintering Machine

(i) Sintering Machine proper

Quantity: 1 (one) set

Description:

type: Dwight-Lloyd

effective grate area: 249 m^2

grate width: 3 m

effective grate length: 83 m

sprocket centers: 92.245 m

pallet speed: abt. 5.4 - 1.8 m/min

machine supporting frame

type: slide frame, shape steel bolted construction.

pallet track:

consisting of two line upper tracks, two line lower tracks and each two curved tracks at lifting-and lowering-ends.

pallet-body:

quantity: 194 sets

type: with-insulation pieces, spring loaded air seal

size: width-3 m x length - 1 m

material: nodular cast iron

side wall:

quantity: 388 sets

type: tripartite

total height: 595 mm

effective height: 500 mm

material: nodular cast iron

(ii) Driving Gear

Quantity: 1 (one) set

Description:

type: Bogi -flex/sprocket

consisting of DC-motor, gearbox, lifting or driving sprocket wheel with torsion-drum, lowering or driven sprocket wheel.

sprocket:

p.c.d: abt. 3.1 m

material: induction-hardened alloy steel casting

gearbox:

type: oil bath, Bogi -flex

ratio: abt. 1/1,670

accessories: . safety coupling for input shaft

. universal coupling

(motor: DC 30 kW)

(iii) Spillage Chute inside Sintering Machine

Quantity: 3 (three) sets

Description:

type: welded steel plate construction

arranged at feeding - and discharge - ends.

(iv) Miscellaneous Equipment and Accessories

Quantity: 1 (one) lot

Description:

including:

- driving sprocket wheel-bearing position adjusting device
- grease take-off device
- balance weight for discharge-end slide frame
- spillage collecting plates on the surface of lifting sprocket wheel torsion drum
- manual oil jack at discharge-end
- manual grease pump for Bogi -flex type gearbox
- grate bar cleaner

(b) Windbox

Quantity: 21 (twenty-one) sets

Description:

type: single-suction, welded steel plate construction

size and quantity: width - 3 m x length - 3 m - 1 set

width - 3 m x length - 4.0 m - 20 sets

accessories: . two-line slide beds for air-seal

. two balance-weight type air seal devices for feeding and discharging end windboxes

(c) Dust Chute underneath Sintering Machine

Quantity: 12 (twelve) sets

Description:

type: welded steel plate construction

size and quantity:

upper opening - abt. 4.5m x 9.5m - 1 set

" - abt. 4.5m x 7 m - 1 set

" - abt. 4.5m x 8 m - 9 sets

upper opening - abt. 6 m x 6 m - 1 set

accessories: . grid-net of abt. 100 mm square-mesh for total opening

(d) Centralized Grease Supply System

(i) Grease Supply Equipment

Quantity: 1 (one) set

Description:

consisting of 1 - transfer pump and 2 - grease pumps

(one for stand-by)

transfer pump:

type: barrel, motor-driven

capacity: 1.4 l/min

pressure: max. 28 kg/cm^2 (gauge)

grease pump:

type: Farval, motor-driven

capacity: 700 cm^3/min

pressure: 100 kg/cm^2 (gauge)

grease consistency: NLGI No. 0 or 1

grease tank: abt. 90 l

(ii) Grease Piping

Quantity: 1 (one) lot

Description:

type: loop

grease supply points:
- slide bed for air seal
- sintering machine driving gear (sprocket wheels)
- drum feeder
- hot sinter crusher

accessories: . distributing valves.

(D) Hot Sinter Crusher

(a) Crusher proper

Quantity: 1 (one) set

Description:

type: single spiked roll

capacity: 463 t/h

crushed sinter size: abt. below 200 mm

cutter:

shape: three blade

size: dia. - 1.6 m x thickness - abt. 80 mm

quantity of cutter: 12 pcs.

cutter speed: 7.5 rpm

(b) Driving Gear

Quantity: 1 (one) set

Description:

type: pinion/gear - drive

consisting of motor, gearbox, pinion, gear and base-frame.

gearbox:

type: oil-bath, parallel shaft

ratio: abt. 1/40

accessories: safety coupling for input shaft and flexible coupling for output shaft

(motor: 55 kW)

(c) Breaker Bar

Quantity: 1 (one) set

Description:

type: movable wagon - mounted

size and quantity: thickness - abt. 80 mm x 13 pcs.

bar pitch: 250 mm

accessories: . movable wagon with winch

(d) Crushing Guide

Quantity: 1 (one) set

Description:

type: stone-box, welded construction

(e) Crusher Casing

Quantity: 1 (one) set

Description:

type: box, bolted construction.

(7) Cooling Equipment

(A) Cooling Equipment

(a) Cooler Charge Chute

(combined with Hot Sinter Crusher Chute)

Quantity: 1 (one) set

Description:

type: stone-box, welded steel plate construction

(b) Cooler

(i) Cooler proper

Quantity: 1 (one) set

Description:

type: pressure circular (annular dip-rail)

capacity: 463 t/h

effective cooling area: 210 m^2

trough width: 3.5 m

cooler mean dia.: 24 m

trough speed: abt. 1.2 - 0.4 rph

cooling time: abt. 60 min.

trough:

quantity: 36 sets

size: width - 3.5 m x depth - 1.6 m

accessories: · trough rotating circular frame with side rollers and friction plate

(ii) Driving Gear

Quantity: 2 (two) sets

Description:

type: suspended

consisting of DC-motor, gearbox, friction rollers and suspended base frame

gearbox:

type: forced lubrication, parallel shaft

ratio: abt. 1/1830

accessories: . safety coupling for input shaft and flexible coupling for output shaft

(motor: 2 - DC 3.7 kW)

(iii) Air Chamber

Quantity: 1 (one) set

Description:

type: mainly reinforced concrete construction and integrated with cooler supporting structure

accessories: . 4 - double cone damper for spillage discharge only for steel-made air chamber

(iv) Hood and Stack

Quantity: 1 (one) set

Description:

only for high temperature waste air area and with supporting structure

(v) Cooler Discharge Chute

Quantity: 1 (one) set

Description

type: stonebox, welded steel plate construction

supports: 2-load cells

accessories: . dip-rails

. trough supporting rollers

(c) Cooler Supporting Structure

Quantity: 1 (one) set

Description:

type: mainly reinforced concrete construction

size: mean dia. - 24 m x height - 4 m

accessories: . trough running tracks

. guide-rail for side roller

(d) Discharge Vibrating Feeder

Quantity: 1 (one) set

Description:

type: variable feedrate, movable

capacity: abt. 600 - 200 t/h

size: width - 1.5 m x length - 1.8 m

accessories: . manually movable supporting frame

(e) Cooling Air Fan

Quantity: 3 (three) sets

Description:

type: double suction, turbo

capacity: 6,500 m^3/min

pressure: 400 mmH_2O at 20°C

accessories: . motor driven delivery damper

. suction silencer

. delivery side connecting duct to air chamber

(motor: abt. 630 kW)

(B) Cooler Dust Collecting System

(a) Dedusting Duct

Quantity: 1 (one) lot

Description:

including;

. duct between cooler-hood and cyclone

. duct between cyclone and exhaust fan

. duct between exhaust fan and stack

. expansion joints

(b) Cyclone

(i) Cyclone proper

Quantity: 2 (two) sets

Description:

type: dry

total capacity: 3,000 m^3/min

size: dia. - 3.5 m x total height - abt. 14 m

accessories: . double cone damper

. inlet and outlet header ducts

(ii) Supporting Structure

Quantity: 1 (one) set

Description:

type: shape steel bolted truss

size: sectional span - abt. 8.1 m x longitudinal span - abt. 12.8 m x total height - abt. 10.5 m

(iii) Exhaust Fan

Quantity: 1 (one) set

Description:

type: double suction, turbo

capacity: 3,000 m^3/min

pressure: 200 mmH_2O at 300°C

accessories: . motor driven suction damper

(motor: abt. 280 kW)

(iv) Stack

Quantity: 1 (one) set

Description:

type: self-standing, welded steel plate construction

size: dia. - 2 m x height - 20 m

(8) Main Exhausting System

(A) Down Comer (Wind Leg)

Quantity: 21 (twenty-one) sets

Description:

type: single way suction, welded steel plate construction

size and quantity: dia. 1,000 mm ..... 21 sets

accessories: . asbestos expansion joint

. damper actuators:

manual actuators ..... 19 sets

motorized actuators .... 2 sets

(B) Waste Gas Main Duct

(a) Duct inside Sintering Machine Building

Quantity: 1 (one) set

Description:

type: stepped, welded steel plate construction

section: circular

size: dia. - 2.8 m x length - abt. 19 m
+ dia. - 3.4 m x length - abt. 20 m
+ dia. - 4.0 m x length - abt. 20 m
+ dia. - 4.6 m x length - abt. 35 m

total length - abt. 94 m

expansion joint: asbestos

accessories: . supporting rollers

(b) Duct between Sintering Machine Building and Main Dust Collector Header-Duct.

Quantity: 1 (one) set

Description:

type: welded steel plate construction

section: circular → rectangular

size: dia. 4.6 m → abt. 4 m x abt. 4.8 m

expansion joint: asbestos

(c) Duct between Main Dust Collector and Main Exhaust Blower

Quantity: 1 (one) set

Description:

type: welded steel plate construction

section: circular → rectangular

size: dia. - abt. 4.5 m → abt. 2.9 m x abt. 4.1 m

expansion joint: asbestos

(d) Duct between Main Exhaust Blower and Main Stack

Quantity: 1 (one) set

Description:

type. welded steel plate construction

section: rectangular

size: abt. 2.9 m x abt. 4.1 m →

abt. 2.9 m x abt. 6 m

(e) Dust Chamber

Quantity: 19 (nineteen) sets

Description:

type: welded steel plate construction

shape: pyramidal

(f) Double Cone Damper

Quantity: 19 (nineteen) sets

Description:

type: pneumatic

size: height — abt. 1.3 m

accessories: . 2-air cylinders and solenoid valves

(C) Main Dust Collector

(a) Cyclone proper

Quantity: 10 (ten) sets

Description:

type: dry

total capacity: 18,000 m^3/min

size: dia. - 3.5 m x total height - abt. 14 m

accessories: . double cone damper

. inlet and outlet header duct

(b) Supporting Structure

Quantity: 1 (one) set

Description:

type: shape steel bolted truss

size: sectional span - abt. 14.7 m x

longitudinal span - abt. 29.7 m x

total height - abt. 11.7 m

(D) Main Exhaust Blower

Quantity: 1 (one) set

Description:

type: double suction, turbo

capacity: 18,000 m^3/min at 150°C, - 1,600 mmH_2O

pressure: 1,650 mmH_2O at 150°C

accessories: . motor driven suction damper

. forced lubrication unit

. bearing vibration monitor

. bearing thermometer

. expansion joints at suction and delivery sides

. delivery silencer

(motor: 6,500 kW)

(E) Main Stack

Quantity: 1 (one) set

Description:

type: reinforced concrete construction

size: top dia. - 3.6 m x height - 100 m

accessories: inside refractory lining

(9) Sinter Screening System

(A) 1st Screening Station

(a) 1st Cold Screen

Quantity: 1 (one) set

Description:

type: floor mounted, stationary grizzly

capacity: 463 t/h

size: width - abt. 2.5 m x length - abt. 6 m

inclination: abt. 37°

screen deck

type: wear resisting cast steel

opening size: 100 mm slit

(b) 1st Cold Screen Oversize Chute

Quantity: 1 (one) set

Description:

type: stone box, welded steel plate construction

(c) 1st Cold Screen Undersize Chute

Quantity: 1 (one) set

Description:

type: stone box, welded steel plate construction

(d) Cold Sinter Crusher

Quantity: 1 (one) set

Description:

type: double spiked roll

capacity: 110 t/h

crushed sinter size: abt. below 100 mm

roll-size: dia. - 750 mm x length - 1,200 mm

roll-speed: 60/50 rpm

roll clearance: 50 - 100 mm (adjustable)

drive-set: motor + V-belt + gearbox + (high speed roll)
+ chain + (low speed roll)

gearbox:

type: oil bath, parallel shaft

ratio: abt. 1/6

accessories: flexible coupling for output shaft

accessories: . manual centralized grease
supply unit

(motor: 55 kW)

(e) Crusher Chute underneath Cold Sinter Crusher

Quantity: 1 (one) set

Description:

type: stone-box, welded steel plate construction

(f) Steel Structure

Quantity: 1 (one) set

Description:

type: shape steel bolted structure

size: sectional span - abt. 10 m x longitudinal span - abt. 13 m x total height - abt. 14 m

accessories: . monorail for hoist

(B) 2nd and 3rd Screening Station

(a) 2nd Cold Screen

Quantity: 1 (one) set

Description:

type: floor mounted, double deck, ripl-flo

capacity: 463 t/h

size: width - abt. 2.7 m x length - abt. 7.2 m

inclination: abt. 20°

screen deck:

type: wear resisting cast steel

opening size: . upper deck - 20 mm

. lower deck - 10 mm

(motor: 2 - 45 kW)

(b) 2nd Cold Screen Oversize Chute

Quantity: 1 (one) set

Description:

type: stone box, welded steel plate construction

(c) 2nd Cold Screen Undersize Chute

Quantity: 1 (one) set

Description:

type: stone-box, welded steel plate construction

(d) 3rd Cold Screen

Quantity: 1 (one) set

Description:

type: floor mounted, single deck, ripl-flo

capacity: 230 t/h

size width: - abt. 3 m x length - abt. 7.2 m

inclination: abt. 20°

screen deck:

type: perforated high tensile steel plate

opening size: 6 mm

(motor: 2 - 37 kW)

(e) 3rd Cold Screen Oversize Chute

Quantity: 1 (one) set

Description:

type: stone-box, welded steel plate construction

(f) 3rd Cold Screen Undersize Chute

Quantity: 1 (one) set

Description

type: stone-box, welded steel plate construction

(g) Steel Structure

Quantity: 1 (one)

Description:

type: shape steel bolted structure

size: sectional span - abt. 12 m x longitudinal span - abt. 25 m x total height - abt. 18.5 m

accessories: . monorail for hoist

(C) Room Dust Collecting System

(a) Dedusting Duct

Quantity: 1 (one) lot

Description:

including;

. ducts and pipings between various suction points and cyclone

. hoods and dampers for suction points

. duct between cyclone and exhaust fan

. duct between exhaust fan and stack

. expansion joints

. stanchions and supports

(b) Cyclone

(i) Cyclone proper

Quantity: 40 (forty) sets

Description:

type: dry

total capacity: 6,500 m^3/min

size: dia. - 1 m x total height - abt. 5.3 m

arrangement: 10 x 4 rows

accessories: · inlet and outlet header ducts

(ii) Dust Discharging Equipment

Quantity: 4 (four)

Description:

type: flow conveyor

size: length - abt. 16.5 m

accessories: . double cone damper

(iii) Supporting Structure

Quantity: 1 (one) set

Description:

type: shape steel bolted truss

size: sectional span - abt. 11.8 m x longitudinal span - abt. 22 m x total height - abt. 7 m

(c) Exhaust Fan

Quantity: 1 (one) set

Description:

type: double suction, plate

capacity: 6,500 m^3/min

pressure: 350 mm H_2O at 75°C

accessories: . motor driven suction damper

(motor: abt. 800 kW)

(d) Stack

Quantity: 1 (one) set

Description:

type: self-standing, welded steel plate construction

size: dia. - 2.8 m x height - 20 m

(10) Transportation Equipment

Belt Conveyor

B.C NO.	Transported material	Capacity (t/h)	Belt width (mm)	Belt speed (m/min)	Horizontal length (m)	Lift (m)	Motor (kW)	Remarks
-	limestone	100	600	120	15	4	3.7	10 sets for limestone sizing plant
63-137	limestone	100	600	120	86	11.4	18.5	head end modification
L-1	limestone	750	750	150	128.5	-3.3	15	
B-1	sinter feed	500	600	120	77.9	5.2	22	
B-2	sinter feed	1000	750	150	279.5	12	110	63-605 BC modification
	coke breeze	250						
	limestone	750						
B-3	do	do	750	150	181	9	55	
B-4	do	do	750	150	92.5	17	75	with belt weigher
B-5R	do	do	750	150	50.5	13.8	75	reversible conveyor
D-1R	sinter feed	1000	750	150	9	0	11	reversible conveyor
D-2	sinter feed	500	750	150	200	8.5	55	connecting with blending stacker
D-3	sinter feed	700	750	150	192.5	5	55	
D-4	sinter feed	700	750	150	192.5	3	37	

B.C NO.	Transported material	Capacity (t/h)	Belt width (mm)	Belt speed (m/min)	Horizontal length (m)	Lift (m)	Motor (kW)	Remarks
D-5	sinter feed	700	750	150	56.5	3.5	22	with belt weigher
B-6	sinter feed	700	750	150	196.5	26	150	with tripper
	cobe breeze	250						
	limestone	750						
C-1	coke breeze	29.5	600	90	100	7	5.5	
C-2	coke breeze	29.5	600	90	77	23.5	7.5	with metal detector and metal remover
M-1	sinter mix	496	900	120	163	9.5	55	
M-2	sinter mix	506	750	120	16	3.5	18.5	
M-3	sinter mix	506	750	120	106	26.5	90	
M-4	sinter mix	506	750	120	49.5	5	30	
M-5S	sinter mix	506	1200	60	7	0	7.5	shuttle conveyor
S-1	spillage	-	600	65	113.5	0	7.5	
S-2	sintered ore	463	900	90	36	3.5	18.5	
S-3	sintered ore	463	900	90	72	19	55	with metal detector and metal remover
S-4	sintered ore	463	900	90	75	18.5	55	
S-5	sintered ore	163	600	90	8	0	3.7	
S-6R	sintered ore	70	600	90	8	0	3.7	reversible conveyor

B.C NO.	Transported material	Capacity (t/h)	Belt width (mm)	Belt speed (m/min)	Horizontal length (m)	Lift (m)	Motor (kW)	Remarks
S-7	sintered ore	230	750	90	10.5	2.5	11	
S-8	sintered ore	103	600	90	8	0	3.7	
S-9	sintered ore	317	750	90	68	5.5	18.5	with belt weigher
S-10	sintered ore	317	750	90	393	13	75	connecting with stacker
S-11	sintered ore	3000	1400	120	975	-35.3	132x2	with metal detector and metal remover
H-1	hearth layer	70	600	90	170	21	22	
H-2	hearth layer	70	600	90	55	3.5	7.5	with belt weigher
R-1	return fines	127	600	90	40.5	2.5	7.5	
R-2	return fines	127	600	90	173	26	45	with belt weigher
R-3	return fines	127	600	90	7.5	0	3.7	
E-1	dust	-	600	65	25	0	3.7	
E-2	dust	-	600	65	27	0	3.7	
E-3	dust	-	600	65	7	2	2.2	
E-4	dust	-	600	65	7	2	2.2	
E-5	dust	-	600	65	25	0	3.7	
E-6	spillage	-	600	65	13	3	2.2	
E-7	dust	-	600	65	28.5	2	3.7	

Remark: A belt weigher for limestone is installed on an existing 63-14 BC.

(11) Lifting Equipment

(a) Crane for Sintering Machine Building

Quantity: 1 (one) set

Description:

type: electric overhead travelling crane with crab

capacity: 15 ton

lift: abt. 23 m

rail span: abt. 9.5 m

travelling distance: abt. 97.5

operating method: push-buttons (pendant)

(b) Hoist

(i) Hoist for Sintering Machine Feeding-end

Quantity: 1 (one) set

Description:

type: electric, mono-rail

capacity: 2 ton

lift: abt. 33 m

travelling distance: abt. 20 m

operating method: push-buttons (pendant)

(ii) Hoist for Cooler Trough

Quantity: 1 (one) set

Description:

type: electric mono-rail

capacity: 5 ton

lift: abt. 9 m

travelling distance: abt. 25 m

operating method: push-buttons (pendant)

(iii) Hoist for 1st Cold Screen and Cold Sinter Crusher

Quantity: 1 (one) set

Description:

type: electric, mono-rail

capacity: 5 ton

lift: abt. 17.5 m

travelling distance: abt. 15.5 m

operating method: push-buttons (pendant)

(iv) Hoist for 2nd Cold Screen

Quantity: 1 (one) set

Description:

type: electric, mono-rail

capacity: 3 ton

lift: abt. 14.5 m

travelling distance: abt. 14.5 m

operating method: push buttons (pendant)

(v) Hoist for 3rd Cold Screen

Quantity: 1 (one) set

Description:

type: electric, mono-rail

capacity: 3 ton

lift: abt. 13 m

travelling distance: abt. 14.5 m

operating method: push buttons (pendant)

(vi) Hoist for Blending Bin Building

Quantity: 1 (one)

Description:

type: electric, mono-rail

capacity: 2 ton

lift: abt. 31.5 m

travelling distance: abt. 93 m

operating method: push-buttons (pendant)

(12) Utilities Equipment

(A) Fuel Oil Receiving System

(a) Fuel Oil Transfer Pump

Quantity: 2 (two) sets

(one for operation and one for stand-by)

Description:

type: rotary screw

capacity: abt. 30 m^3/h

pressure: abt. 5 kg/cm^2 (gauge)

(motor: abt. 15 kW)

(b) Fuel Oil Piping

Quantity: 1 (one) lot

Description:

complete fuel oil piping from existing fuel oil tank to fuel oil day tank in sintering plant.

including:

. oil strainer

(c) Day Tank

Quantity: 1 (one) set

Description:

type: welded steel plate construction

capacity: abt. 30 m^3

size: dia. - abt. 2.85m x height - abt. 5.0 m

accessories: . bottom heater

. level gauge

(B) Fresh Water System

(a) Additive Water System

(i) Additive Water Piping

Quantity: 1 (one) lot

Description:

complete additive water piping from fresh water take-over point (existing sea water tank) to water spray pipe of mixer, including necessary valves etc.

(b) Cooling Water System

(i) Water Tank

Quantity: 1 (one) set

Description:

type: welded steel plate construction

capacity: abt. 10 m^3

size: dia. - abt. 2.3 m x height - abt. 2.7 m

(ii) Cooling Water Pump

Quantity: 2 (two) sets

(one for operation and one for standby)

Description

type: centrifugal

capacity: abt. 280 m^3/h

pressure: abt. 5 kg/cm^2 (gauge)

(motor: abt. 75 kW)

(iii) Water Cooler

Quantity: 1 (one) set

Description:

type: shell and tube

cooling area: abt. 400 m^2

(iv) Cooling Water Piping

Quantity: 1 (one) lot

Description:

complete cooling water piping from additive water piping to water tank for make-up, and from water tank to respective equipment, and from respective equipment to water tank for circulation, including necessary valves, open funnels or flow sights etc.

(C) Sea Water System

(a) Sea Water Piping

Quantity: 1 (one) lot

Description:

complete sea water piping from take-over point (existing seawater tank or pipe-line) to water cooler, and from water cooler to sintering plant "Battery Limit", including necessary valves etc.

(D) Compressed Air System

(a) Plant Air Compressor

Quantity: 2 (two) sets

(one for operation and one for standby)

Description:

type: water cooled, reciprocating

capacity: abt. 8 m^3/min. (free air)

pressure: abt. 7 kg/cm^2 (gauge)

air tank: abt. 1 m^3 (one for two compressors)

accessories: . suction filter

. after cooler

. drain separator

(motor: abt. 55 kW)

(b) Compressed Air Piping

Quantity: 1 (one) lot

Description:

complete compressed air piping from compressors to respective equipment and general use points, including necessary oiler, filters, valves etc.

(E) Steam System

(a) Steam Piping

Quantity: 1 (one) lot

Description:

complete steam piping from take-over point (existing steam pipe line) to steam supply system of ignition equipment and fuel oil receiving system, including necessary valves, steam-traps etc.

(13) Sample Preparation Equipment

(A) Sampler

(a) for S-9 BC
Quantity : 1 (one) set

Description :

type : cutter

installed on sinter product belt conveyor S-9 head chute

(b) for S-11 BC

Quantity : 1 (one) set

Description :

type : rotary bottom damp sampler

installed on sinter product belt conveyor S-11 head chute

(B) Preparation Equipment

(a) Jaw Crusher

Quantity : 3 (three) sets

(b) Roll Mill

Quantity : 2 (two) sets

(c) Grinder

Quantity : 3 (three) sets

(d) Drying Oven

Quantity : 2 (one) set

(e) Sieve Shaker

Quantity : 1 (one) set

(f) Reducibility Measuring Apparatus

Quantity : 1 (one) set

(g) Shatter Tester

Quantity : 1 (one) set

(h) Screen

Quantity : 1 (one) set

Type : triple deck

(14) Laboratory Equipment

(a) Fluorescence X-ray Spectrometer

Quantity : 1 (one) set

Type : VXQ-150 or similar, with computer

(b) Sample Fusion (Glass Bead) Device

Quantity : 1 (one) set

Type : AUTO-BEAD-1000M or similar

(c) Atomic Absorption/Flame Spectrophotometer

Quantity : 1 (one) set

Type : AA-640-12 or similar

(d) Double-Beam Spectrophotometer

Quantity : 1 (one) set

Type : UV-150-01 or similar

(e) C.S. Sincro-Quantitative Apparatus

Quantity : 1 (one) set

Type : TR or similar

(f) Karl Fischer Mositure Measuring Apparatus

Quantity : 1 (one) set

Type : MK-AII or similar, with furnace

(g) Chemical Balance

Electronic Reading Balance

Quantity : 2 (two) sets

Direct Reading Balance

Quantity : 2 (two) sets

(h) Electric Furnace

Quantity : 1 (one) set

Type : Model AMF-6

(i) Automatic pure water Apparatus

Quantity : 1 (one) set

Type : Model WA-550

(15) Electrical Equipment

(A) General Design Condition

Nominal System Voltage

(a) 13.8 kV 3-Phase 60 Hz for incoming and Main Exhaust Blower motor circuit, Rupturring capacity 750 MVA symmetrical value

(b) 4.16 kV 3-Phase 60 Hz for high tension motor circuit, Rupturring capacity 250 MVA symmetrical value

(c) 460V 3-Phase 60 Hz for low tension motor circuit

(d) 230 V single-phase 60 Hz for sequence control and lighting circuit

(e) DC 220 V for DC motor and switchgear control circuit

(B) Sintering Plant

(a)	13.8 kV Switchgear	1 (one) lot
(b)	4.16 kV Switchgear and fused combination starter	〃
(c)	460 V Switchgear and switchboard	〃
(d)	230 V Distribution panel	〃
(e)	Transformer	〃
(f)	Control equipment (L.T motor control center, Master control device, Thyristor Leonard control device,Scherbius control device, Supervisory panel, Operation desk, Local operation switch)	〃
(g)	Motor	〃
(h)	Air conditioning equipment	〃
(i)	Lighting equipment	〃
(j)	Tele-Paging equipment	〃
(k)	Wiring material	〃

(C)	Raw Material and Sinter Yards	1 (one) lot
(a)	4.16 kV Fused combination starter for high tension feeder	〃
(b)	460 V Switchgear and switchboard for low tension feeder	〃
(c)	230 V Distribution panel for lighting feeder	〃
(d)	Transformer for low tension power and lighting	〃
(e)	Control equipment	〃
(f)	Motor	〃
(g)	Lighting equipment	〃
(h)	Wiring material	〃

(D) Blending Yard

(a) 460 V Switchboard	1 (one) lot
(b) Control equipment	〃
(c) Motor	〃
(d) Wiring material	〃

(E) Description

(a) 13.8 kV Switchgear

(i) Metal-clad type, indoor use

(ii) Draw-out type circuit breaker, protection relay and instrument will be equipped.

(b) 4.16 kV Switchgear

(i) Metal-clad type, indoor use

(ii) Draw-out type circuit breaker, protection relay and instrument will be equipped.

(c) 4.16 kV Fused Combination Starter

(i) Metal-clad type, indoor use

(ii) Draw-out type current limit fuse, magnetic contactor, protection relay and instrument will be equipped.

(d) 460 V Switchgear and Switchboard

(i) Metal-enclosed type, indoor use

(ii) Draw-out type low tension air circuit breaker for incoming, molded case circuit breaker for feeder and instrument will be equipped.

(e) 230 V Distribution Panel

(i) Metal enclosed type, indoor use

(ii) Molded case circuit breaker and instrument will be equipped.

(f) Transformer

(i) Oil immersed natural cooling type, outdoor installed

(ii) Rating : For high tension feeding 13.8 kV/4.16 kV, 3-phase, 60 Hz, delta-star connection, neutral grounding via resistor.
For low tension feeding 4.16 kV/460 V, 3-phase, 60 Hz, delta-star connection, neutral solid grounding.

(g) Control Equipment

(i) Metal-enclosed type, indoor use

(ii) Mainly consist of:

- Low tension motor control center
- Thyristor Leonard control panel
- Master control device
- Supervisory panel
- Operation desk
- Local operation switch box
- Scherbius control panel

(n) Motor

(i) Totally enclosed fan-cooling

(Main exhaust blower motor: water cooled heat exchanger)

3-phase induction motor, D.C motor

(ii) Rating : 13.8 kV for Main Exhaust Blower motor

4.16 kV for high tension motor

(Rated output 300 kW and over)

440 V for low tension motor

(Rated output less than 300 kW)

D.C. 220 V for D.C motor.

B-class insulation for high tension and

D.C motors.

E-class insulation for low tension motor.

Full voltage starting and continuous rating

in principle

(i) Air-conditioning Equipment

(i) Packaged type, water cooled

(ii) Used for electric room and control room

(j) Lighting Equipment

(i) Mercury, fluorescent lamp with lighting fixture

(ii) Rated voltage : AC 220 V 60 Hz

(k) Wiring Material

(i) The incoming power cable will be extended by a bare aerial wire up to a point near the Crude Ore Yard and an isolated aerial wire up to the electirc room of this plant.

(ii) In principle, main cable route will be of open pit system with steel plate cover and equipped with ladder type cable tray.

(iii) The cable will be laid in the cable tray and/or steel conduit pipe in principle.

(iv) The cable and wire will be constructed with stranded copper conductor and single/multi-core type.

(16) Instrumentation Equipment

(A) General Design Condition

(a) Instruments will generally be of the electric D.C. (4-20 mA) transmission type.

(b) Local mounted transmitters will be installed in the metallic enclosure suitable for dust proof.

(c) In general, electronic instrument will be solid state type.

(d) Electrical power available in both local and control room are nominal 115V, 60 Hz, A.C.

(e) Instrument air supply will be 5 ~ 6 kg/cm^2 gauge.

(f) Unit of measurements

The measuring unit of instruments will be as follows:

(i) Flow ..... m^3/h, Nm^3/h, Nm^3/min, t/h

(ii) Level ..... %, mm

(iii) Pressure ..... kg/cm^2, mmH_2O

(iv) Temperature ..... °C

(v) Revolution ..... rpm, rph

(vi) Speed ..... m/min

(B)	Sintering Plant	
(a)	Instrument	1 (one) lot
(b)	Instrument Panel	〃
(c)	Instrumentation Compressed Air System	〃
(d)	Testing Instrument and Tool	〃
(e)	Materials for Instrumentation Erection Work	〃
(C)	Raw Material and Sinter Product Yards	
(a)	Instrument	1 (one) lot
(b)	Instrument Panel	〃
(c)	Materials for Instrumentation Erection Work	〃
(D)	Blending Yard	
(a)	Instrument	1 (one) lot
(b)	Instrument Panel	〃
(c)	Materials for Instrumentation Erection Work	〃

(E) Instrument List

(a) Instrument list for Sintering Plant

(a-1) 8 - Blending Bin level alarm (LA-1 ~ 8)

Detector : Tilt switch type

(a-2) 1 - Return Fines Bin level indicator with alarm (LIA-9)

Detector : Loadcell

(a-3) 1 - Mixer additive water flow indicating controller and recorder (FIC-1, FR-1)

Detector : Orifice

Control : Globe valve

(a-4) 1 - Mixer additive water shut-off valve (SV-1)

(a-5) 1 - Sinter Mix Hopper level indicator with alarm and recorder (LIA-10, LR-10)

Detector : Loadcell

(a-6) 1 - Hearth Layer Hopper level indicator with alarm (LICA-11)

Detector : Loadcell

Control : Reversible Belt Conveyor S-6.R

(a-7) 1 - Ignition Furnace temperature indicating controller and recorder (TIC-1, TR-1)

Detector : PR thermocouple

(a-8) 3 - Ignition Furnace fuel oil flow indicating controller (FIC-2 ~ 4)

Detector : Oval flowmeter

Control : Fuel oil/Steam

(a-9) 3 - Ignition Furnace combustion air flow indicating controller (FrIC-5 ~ 7)

Detector : Orifice

Control : Butterfly valve

(a-10) 1 - Ignition Furnace oil flow indicator and integrator (FIQ-8)

Detector : Oval flowmeter

(a-11) 1 - Propane gas pressure gauge with alarm (PIA-8)

(a-12) 1 - Fuel oil pressure gauge with alarm (PIA-9)

(a-13) 1 - Atomizing steam pressure gauge with alarm (PIA-10)

(a-14) 1 - Combustion air pressure gauge with alarm (PIA-11)

(a-15) 1 - Cooling water pressure gauge with alarm (PIA-12)

(a-16) 1 - Mixer additive water pressure gauge with alarm (PIA-13)

(a-17) 1 - Instrument compressed air pressure gauge with alarm (PIA-14)

(a-18) 1 - Plant compressed air pressure gauge with alarm (PIA-15)

(a-19) 6 - Windbox temperature indicator and recorder (TI-2 ~ 7, TR-6)

Detector : Thermocouple

(a-20) 2 - Windbox pressure indicator (PI-1, 2)

Detector : Pressure transmitter

(a-21) 1 - Pallet speed indicator and recorder (SI-1, SR-1)

Detector : Tacho generator

(a-22) 1 - Drum Feeder speed indicator (SI-2)

Detector : Tacho generator

(a-23) 1 - Cut-off Plate depth controller (HC-1)

Control : Cut-off plate hydraulic unit

(a-24) 1 - Sinter Mix charging layer indicator (XI-1)

Detector : Electrode type

(a-25) 1 - Sinter Mix bed height indicator (XI-2)

Detector : Cut-off plate position transmitter

(a-26) 1 - Cooler speed indicator (SI-3)

Detector : Tacho generator

(a-27) 1 - Cooler Discharge Chute level alarm (LA-12)

Detector : Loadcell

(a-28) 1 - Cooler waste air temperature indicator (TI-8)

Detector : Thermocouple

(a-29) 3 - Cooling Air Fan pressure indicator (PI-4 ~ 6)

Detector : D/P transmitter

(a-30) 1 - Main waste gas flow recorder with alarm (FRA-9)

Detector : Annubar flow element

(a-31) 1 - Main waste gas pressure recorder with alarm (PRA-7)

Detector : Pressure transmitter.

(a-32) 1 - Main waste gas temperature indicator with alarm (TIA-9)

Detector : Thermocouple

(a-33) 1 - Cooler dedusting air temperature indicator with alarm (TIA-10)

Detector : Thermocouple

(a-34) 1 - Room dedusting air temperature indicator with alarm (TIA-11)

Detector : Thermocouple

(a-35) 1 - Fuel Oil Day Tank level indicator with alarm (LIA-13)

Detector : D/P transmitter

(a-36) 1 - Fuel Oil Day Tank level gauge with alarm (LC-14)

Detector : Float type level gauge

Control : Oil transfer pump

(a-37) 1 - Fuel Oil temperature indicator with alarm (TIA-12)

Detector : Resistance Bulb.

(a-38) 1 - Water Tank level alarm (LA-15)

Detector : Electrode type

Control : Make up water

(a-39) 1 - Cooling water temperature indicator with alarm (TIA-13)

Detector : Resistance bulb

(a-40) 1 - Tripper position indicator (XI-3)

Detector : Position transmitter

(a-41) 1 - Total flow rate setter (WIC-1)

(a-42) 1 - Trend recorder (UR-1)

4-pens recorder with 20-points jack borad

(a-43) Constant Feed Weigher (refer to A-(3)-(b))

1 - Constant Feed Weigher for Coke Breeze (Ground) (WICQ-1)

1 - Constant Feed Weigher for Coke Breeze (WICQ-2)

1 - Constant Feed Weigher for Anthracite or Spare (WICQ-3)

1 - Constant Feed Weigher for Limestone (WICQ-4)

1 - Constant Feed Weigher for Silicastone (WICQ-5)

3 - Constant Feed Weigher for Iron Ore (WICQ-6 ~ 8)

1 - Constant Feed Weigher for Return Fines (WICQ-9)

(a-44) Belt Weigher

1 - Belt Weigher for Hearth Layer (WIQ-1)

1 - Belt Weigher for Return Fines (WIQ-2)

1 - Belt Weigher for Sinter Product (WIQ-3)

(b) Instrument list for Raw Material and Sinter Product Yards

(i) 1 - Existing Waste Truck Bin level alarm

Detector : Capacitance type

(ii) Belt Weigher

1 - Belt Weigher for Fine Ore, Limestone, Coke Breeze

1 - Belt Weigher for Limestone

(c) Instrument list for Blending Yard

(i) 2 - Blending Yard Bin level alarm

Detector : Capacitance type

(ii) Constant Feed Weigher (refer to A-(2)-(d))

(a) 2 - Constant Feed Weigher for Fine Ore

(iii) Belt Weigher

(a) 1 - Belt Weigher for Fine Ore

Drawing List

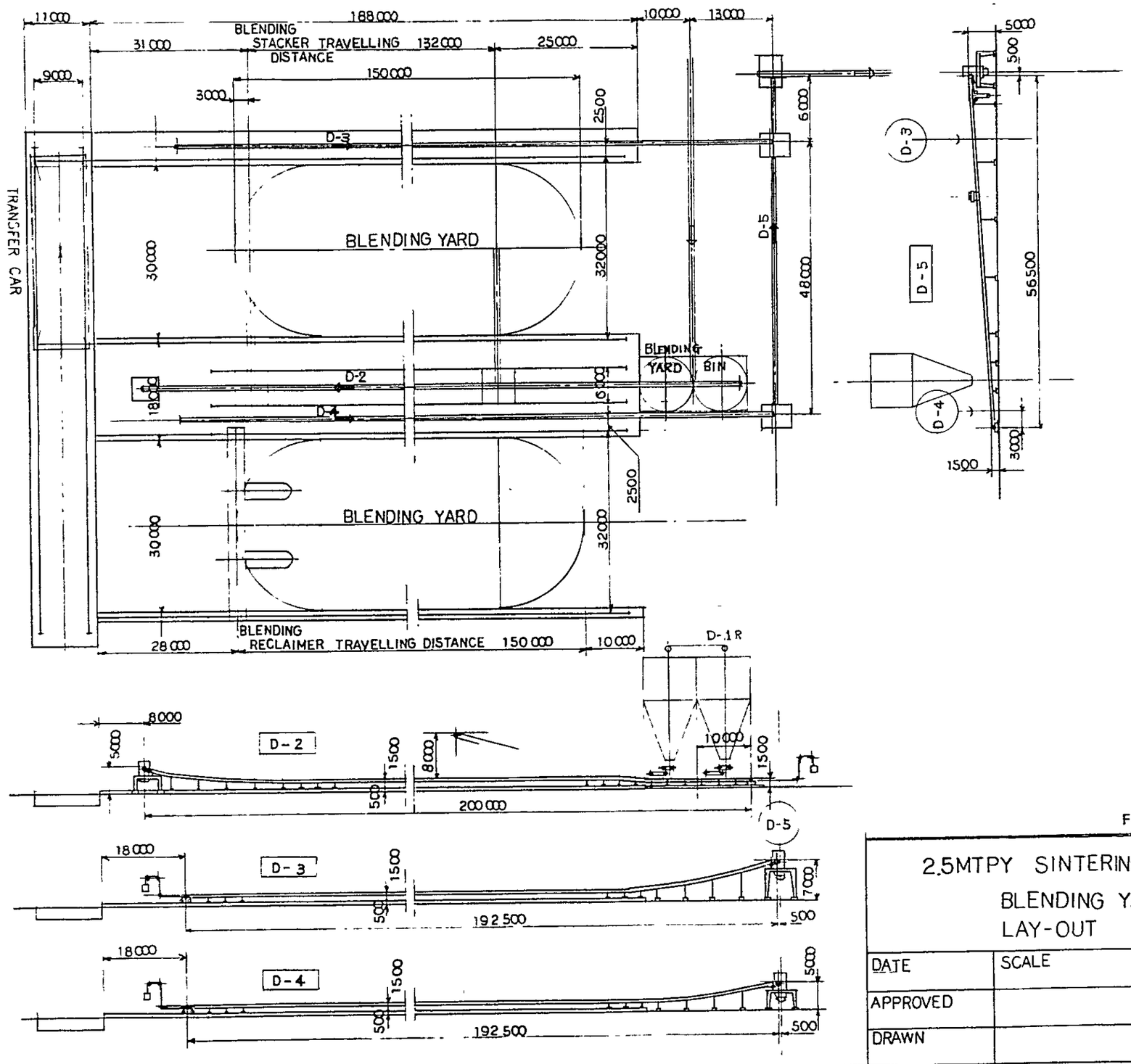
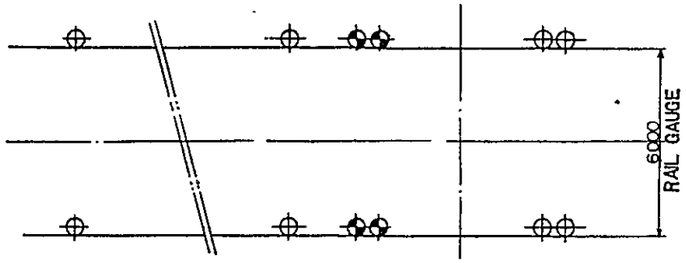


FIG. A - 1

2.5MTPY SINTERING PLANT BLENDING YARD LAY-OUT		
DATE	SCALE	
APPROVED		DWG NO.
DRAWN		

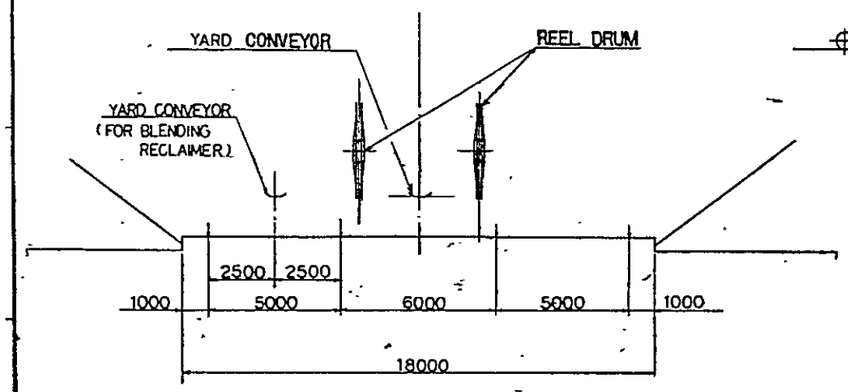
MAJOR SPECIFICATION	
MATERIAL HANDLED	BLENDED ORE
HANDLING CAPACITY (ton/hr)	500(MAX 700)(r.2.3t/m³)
TRAVELLING SPEED (m/min.)	30/20 (2 SPEEDS)
SLEWING RADIUS (m)	23(AT TIP OF BOOM)
SLEWING ANGLE (deg.)	180
SLEWING SPEED (deg/min.)	36
LUFFING SPEED (m/min.) AT TIP OF BOOM	APPROX 6
BOOM CONVEYOR BELT WIDTH mm x SPEED (m/min.)	750 x 140
TRIPPER BELT WIDTH (mm) x SPEED (m/min.)	750 x 120
RAIL GAUGE (m)	6



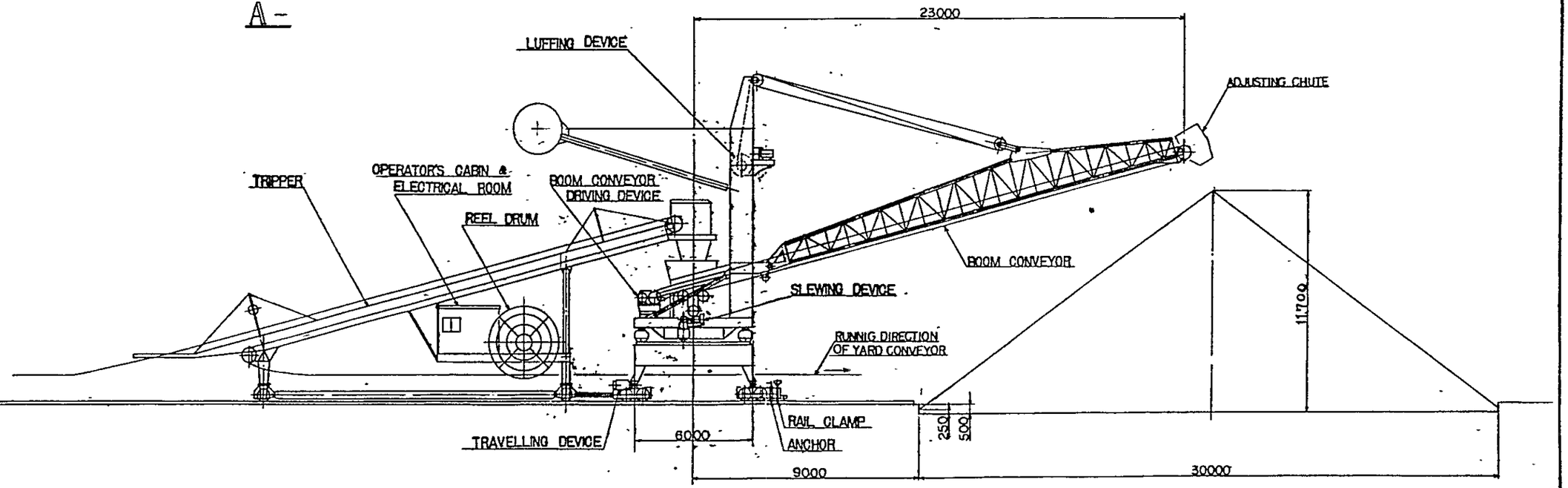
ARRANGMENT OF TRAVELLING WHEELS

NOTE : ⊕ : DRIVE WHEEL, ⊕ : TRAILED WHEEL

WHEEL LOAD ON TRACK	
MAX LOAD/WHEEL	CONDITIONS
20 ton	IN WORKING
24 ton	IN STORMY



A –

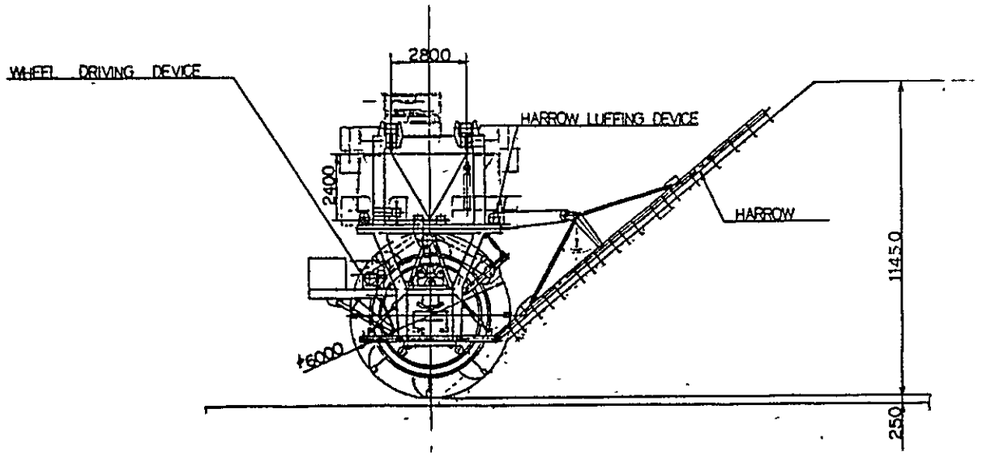


A

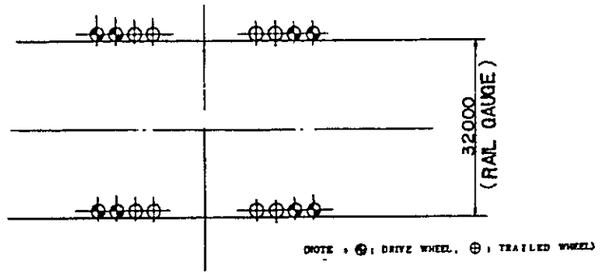
FIG. A-2

2.5 MTPY SINTERING PLANT 500 T/H BLENDING STACKER		
DATE		SCALE
APPROVED		DWG. NO.
DRAWN		

MAJOR SPECIFICATION	
MATERIAL HANDLED	BLENDED ORE
HANDLING CAPACITY (t/h)	MAX 700 (r=2.3 t/m³)
TRAVELLING SPEED (m/min.)	30/2
TRAVERSING SPEED (m/min.)	7
BUCKET WHEEL SPEED (r.p.m)	5
RELAY CONVEYOR BELT WIDTH (mm) x SPEED (m/min.)	750 x 120
RAIL GAUGE (m)	32



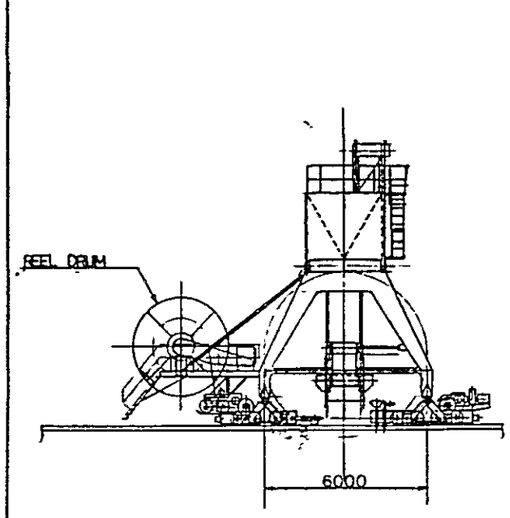
C–



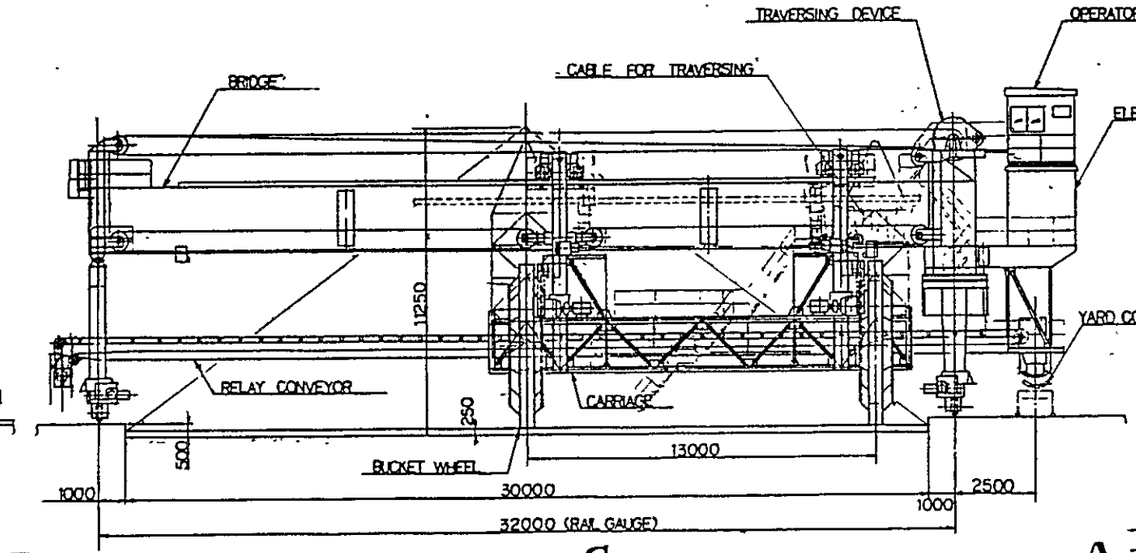
NOTE : ⊕ : DRIVE WHEEL, ⊕ : TRAILED WHEEL

ARRANGMENT OF TRAVELLING WHEELS

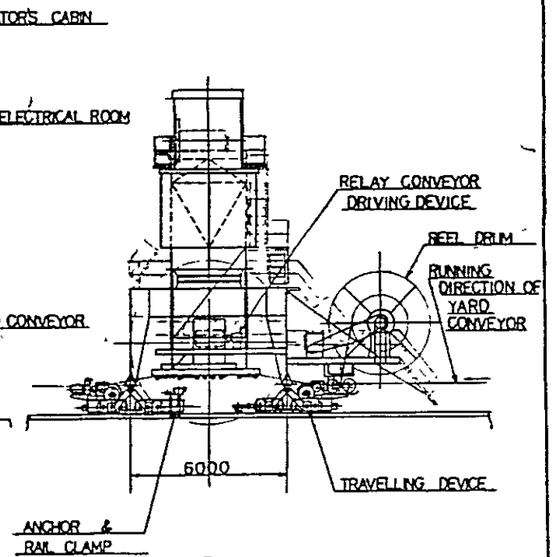
WHEEL LOAD ON TRACK	
MAX. LOAD/WHEEL	CONDITIONS
20 ton	IN WORKING
24 ton	IN STORMY



B–



B C A

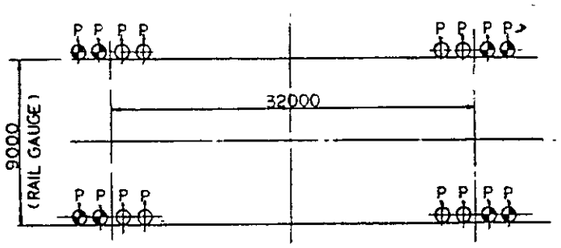


A–

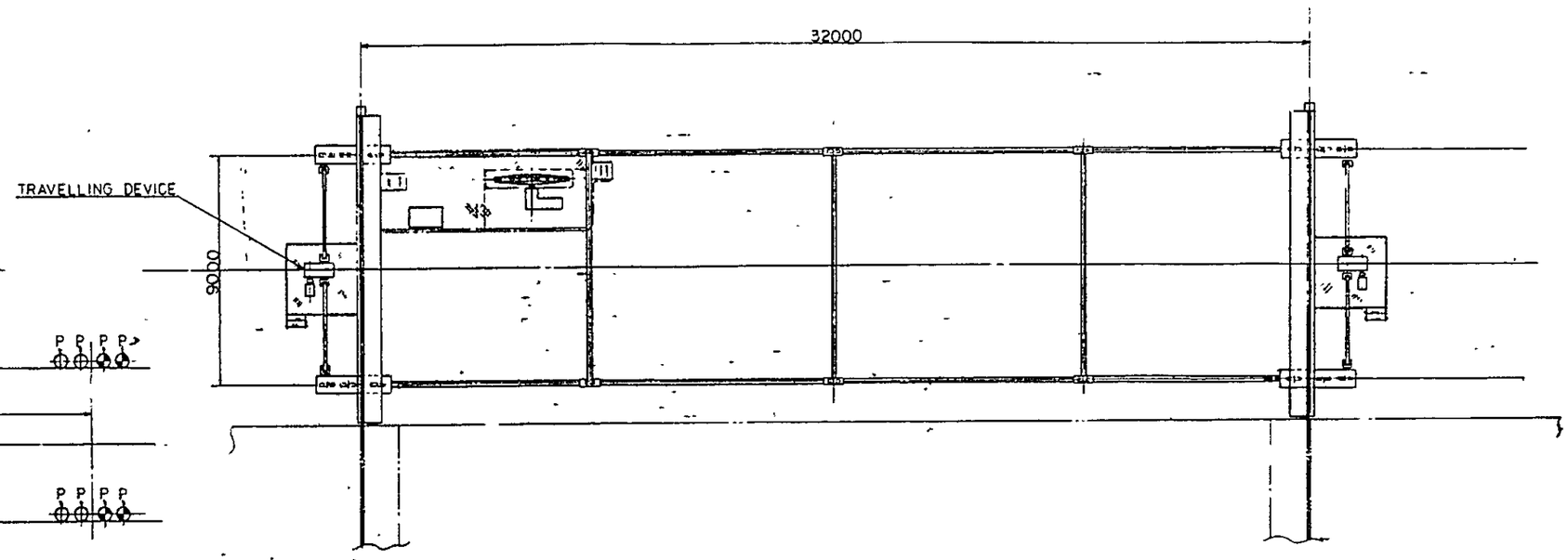
FIG. A-3

2.5 MTPY SINTERING PLANT 700 t/H BLENDING RECLAIMER		
DATE		SCALE
APPROVED		DWG. NO.
DRAWN		-

SPEC.
TRAVELLING SPEED 12/3 M/MIN
(2 SPEEDS)



WHEEL LOAD ON TRACK



WHEEL LOAD ON TRACK	
MAX LOAD/WHEEL	CONDITION
20ton	IN WORKING

NOTE : ⊕ DRIVE WHEEL ⊖ TRAILED WHEEL

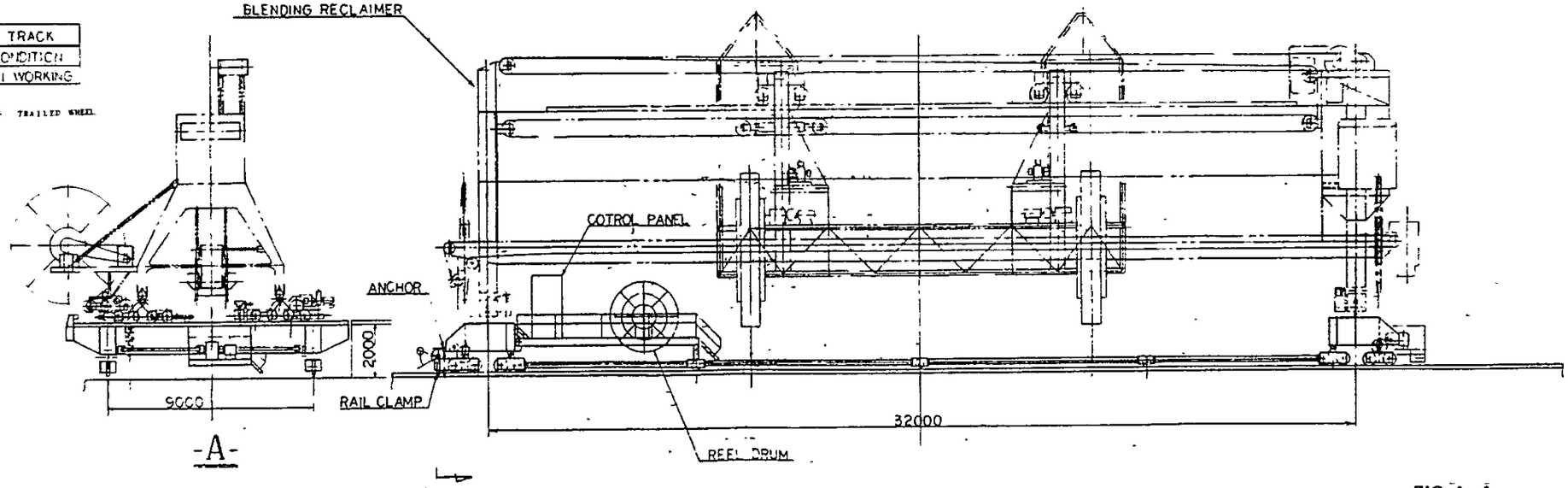


FIG. A - 4

2.5 MTPY SINTERING PLANT TRANSFER CAR		
DATE		SCALE
APPROVED		DWG. NO
DRAWN		

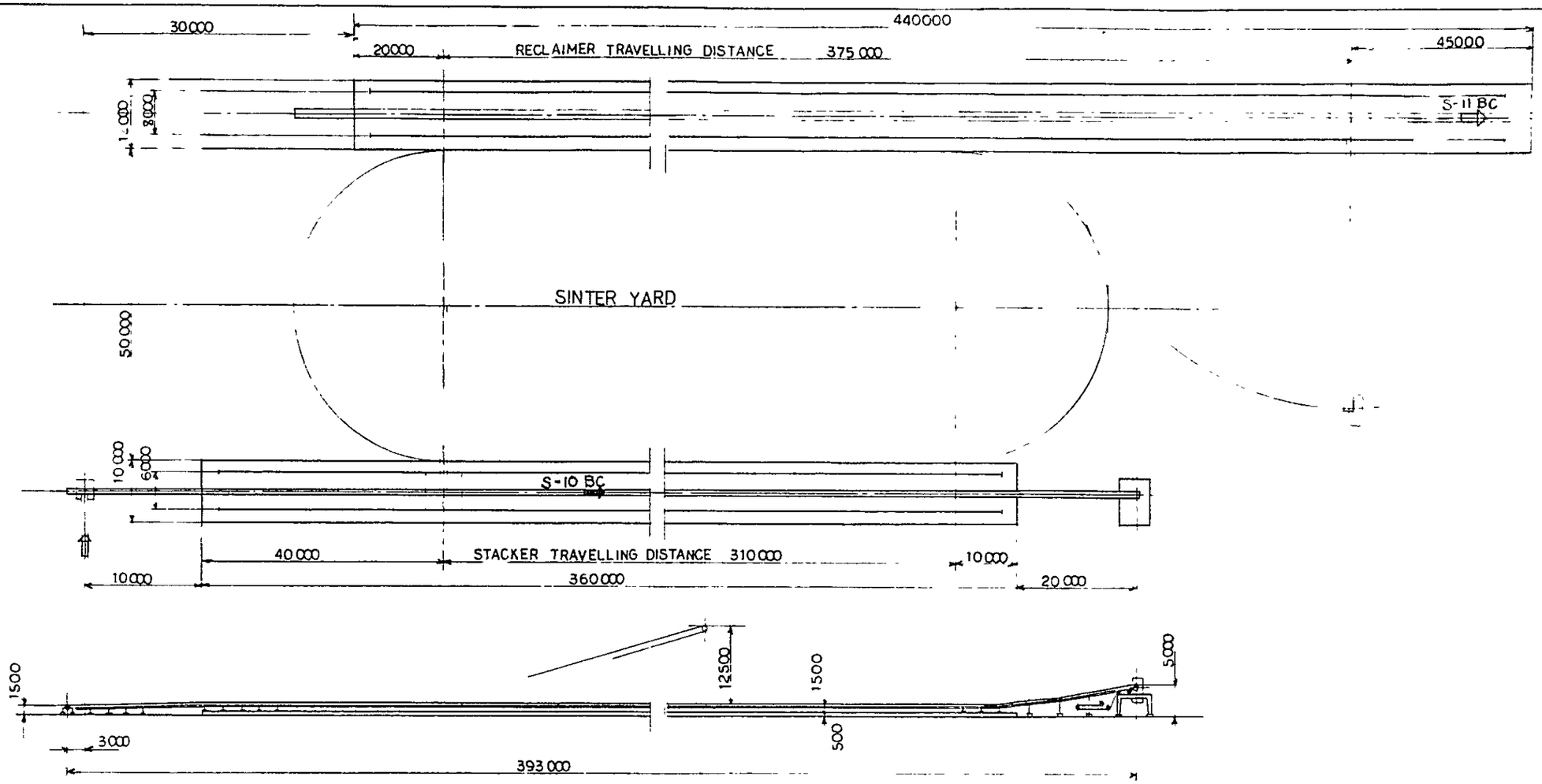
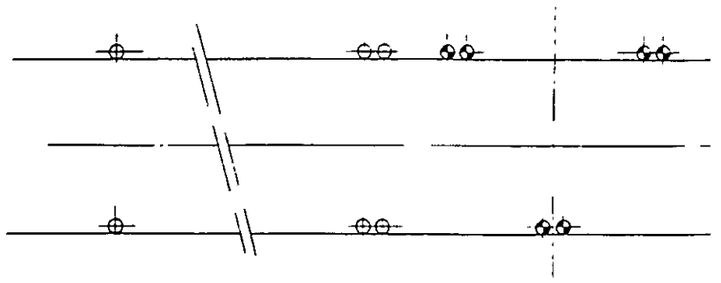


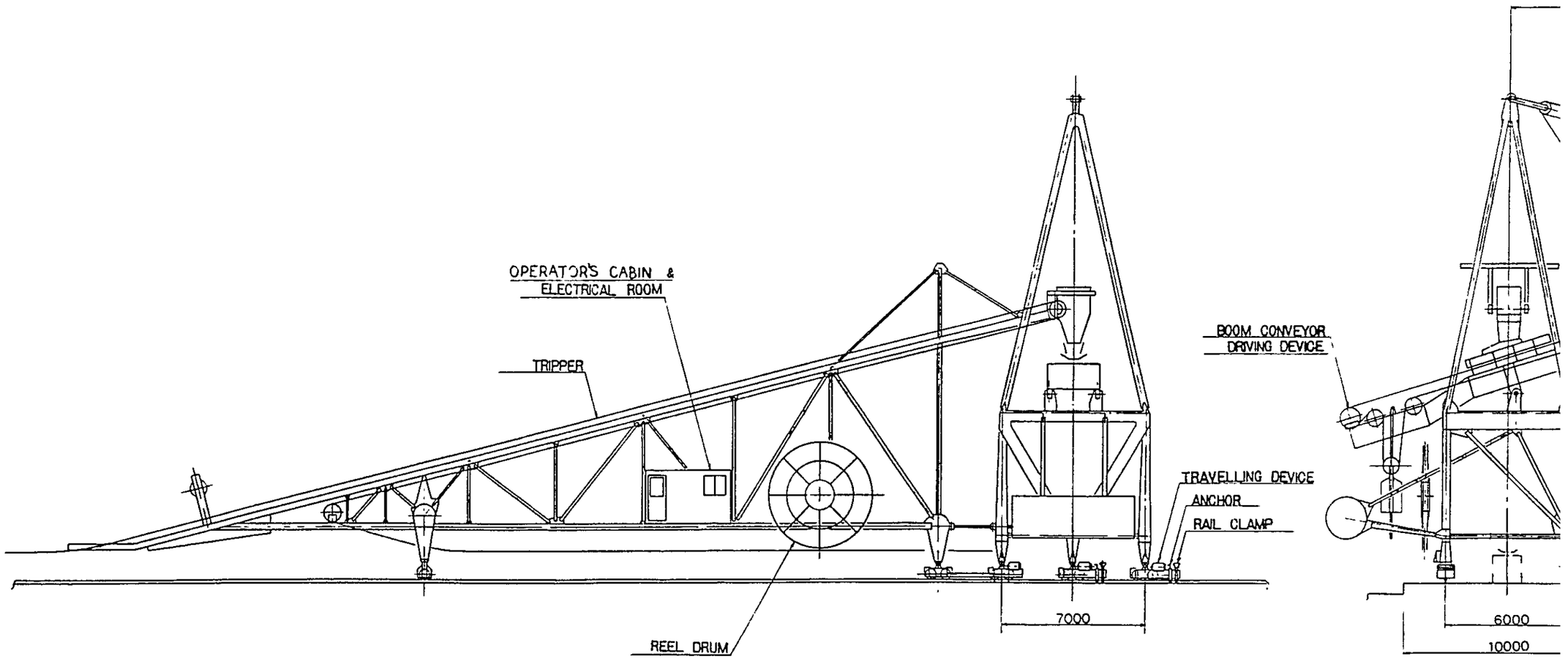
FIG. A - 5

2.5 MTPY SINTERING PLANT
SINTER YARD
LAY-OUT

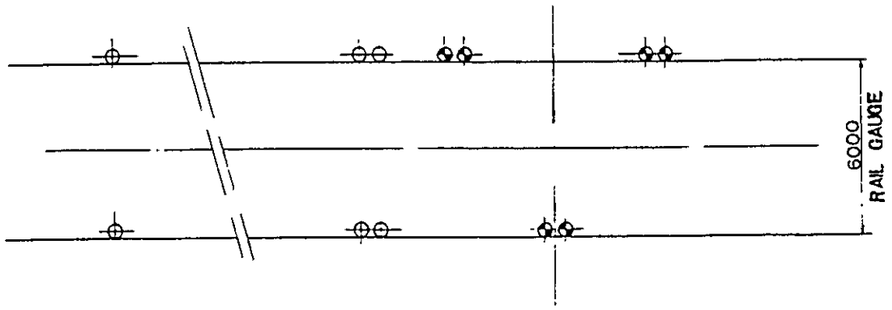
DATE	SCALE	
APPROVED		DWG NO.
DRAWN		



ARRNGMENT OF TRAVELLING WHEELS



MAJOR SPECIFICATION	
MATERIAL HANDLED	SINTER
HANDLING CAPACITY (ton/hr)	[illegible]
TRAVELLING SPEED (m/min.)	20
LUFFING SPEED (m/min.) (AT TIP OF BOOM)	APPROX 5
BOOM CONVEYOR BELT WIDTH (mm) x SPEED (m/min.)	750 x 120
TRIPPER BELT WIDTH (mm) x SPEED (m/min.)	750 x 110
RAIL GAUGE (m)	6



ARRNGMENT OF TRAVELLING WHEELS

WHEEL LOAD ON TRACK	
MAX. LOAD/WHEEL	CONDITIONS
20 ton	IN WORKING
24 ton	IN STORMY

(NOTE : ⊕ : DRIVE WHEEL, ⊕ : TRAILED WHEEL)

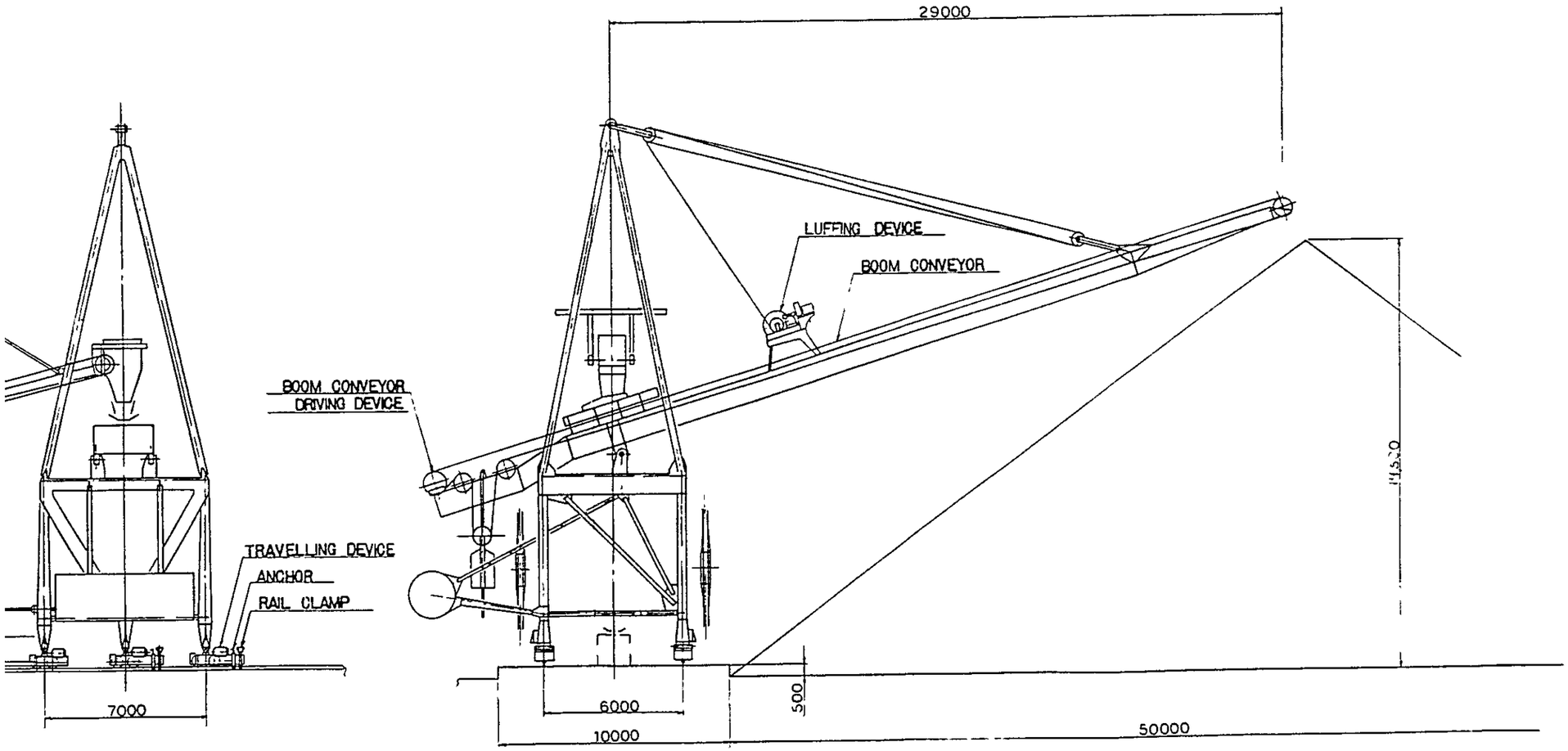


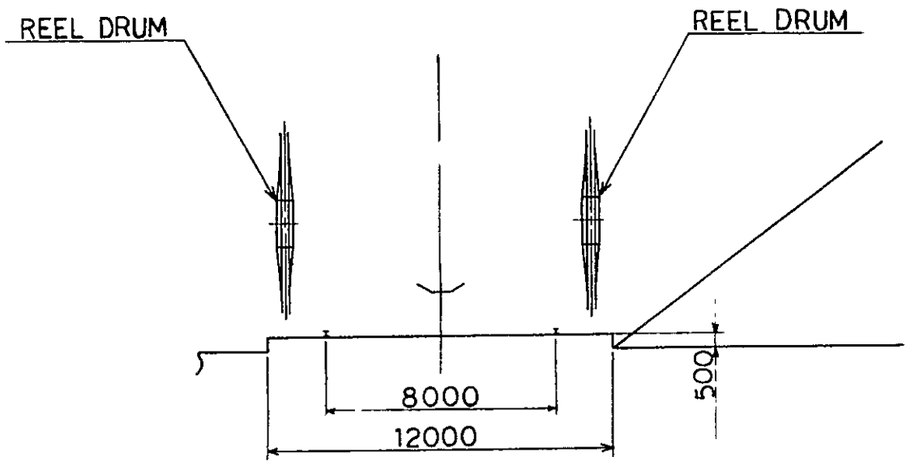
FIG. A - 6

25 MTPY SINTERING PLANT [illegible] T/H STACKER		
DATE		SCALE
APPROVED		DWG NO
DRAWN		

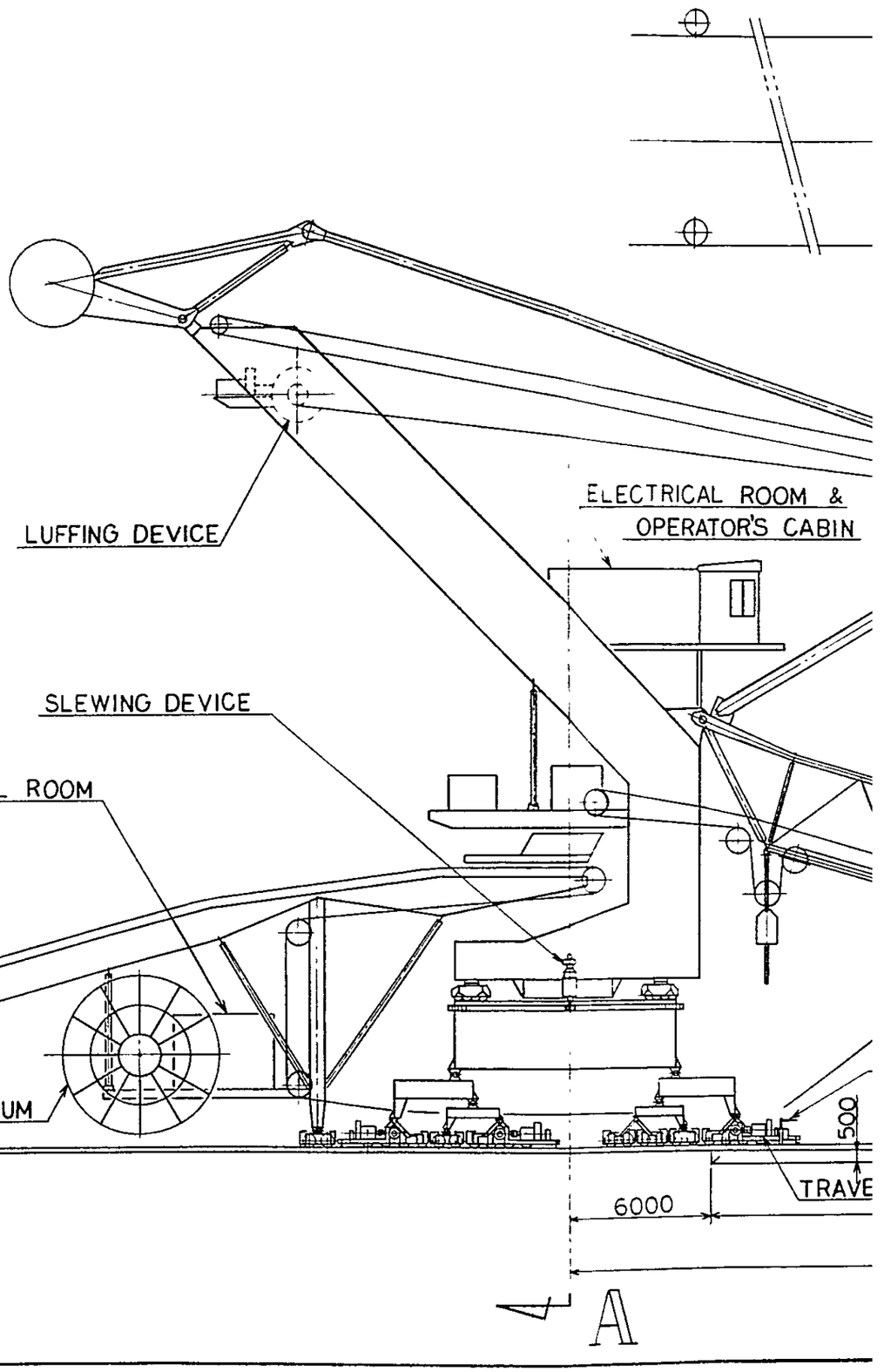
A B C D E

8 7 6 5

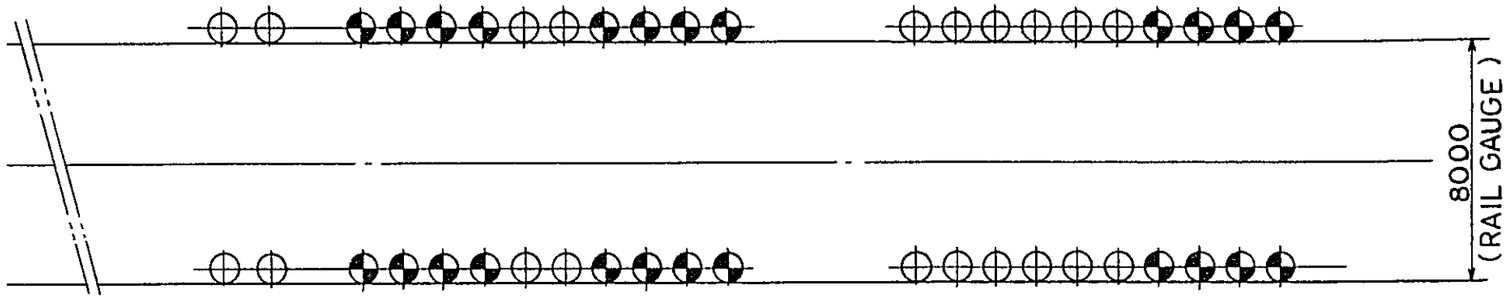
KEEP NO.



A–



A



(NOTE : ⊕ ; DRIVE WHEEL, ⊕ ; TRAILED WHEEL)

ARRANGEMENT OF TRAVELLING WHEELS

MAJOR SPECIFICATION	
MATERIAL HANDLED	SINTER
HANDLING CAPACITY (ton/hr)	3000
TRAVELLING SPEED (m/min.)	30/7.5 (2SPEEDS)
SLEWING RADIUS (m)	45
SLEWING ANGLE (deg.)	90° (1YARD)
SLEWING SPEED (deg./min.)	0~36
LUFFING SPEED (m/min.) (AT CENTER OF WHEEL)	APPROX. 4
BUCKET WHEEL SPEED (r.p.m)	6.5
BOOM CONVEYOR BELT WIDTH (mm) x SPEED (m/min)	1600 X 150
RAIL GAUGE (m)	8

WHEEL LOAD ON TRACK		
MAX. LOAD/WHEEL		CONDITIONS
20	ton	IN WORKING
24	ton	IN STORMY

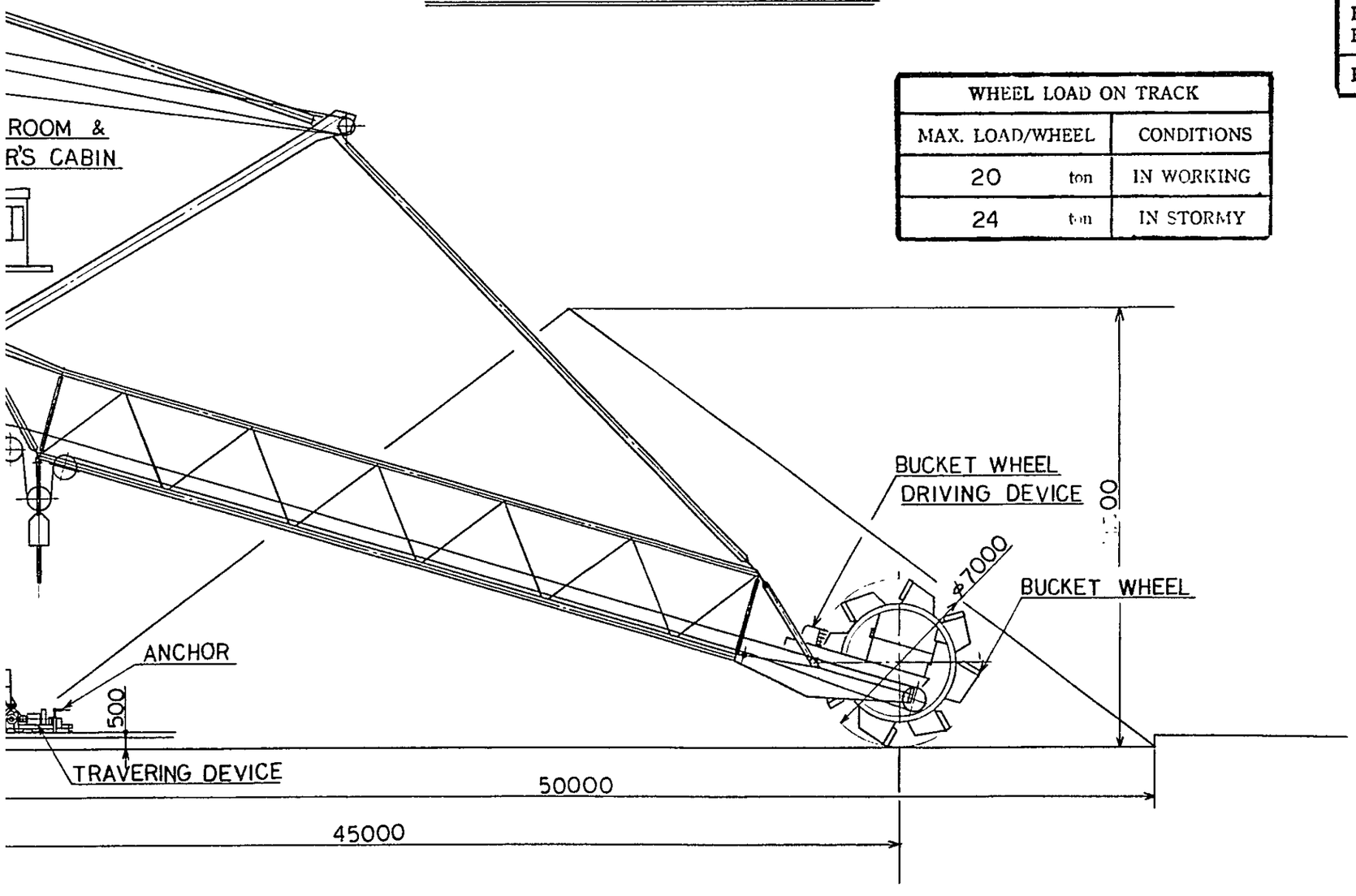
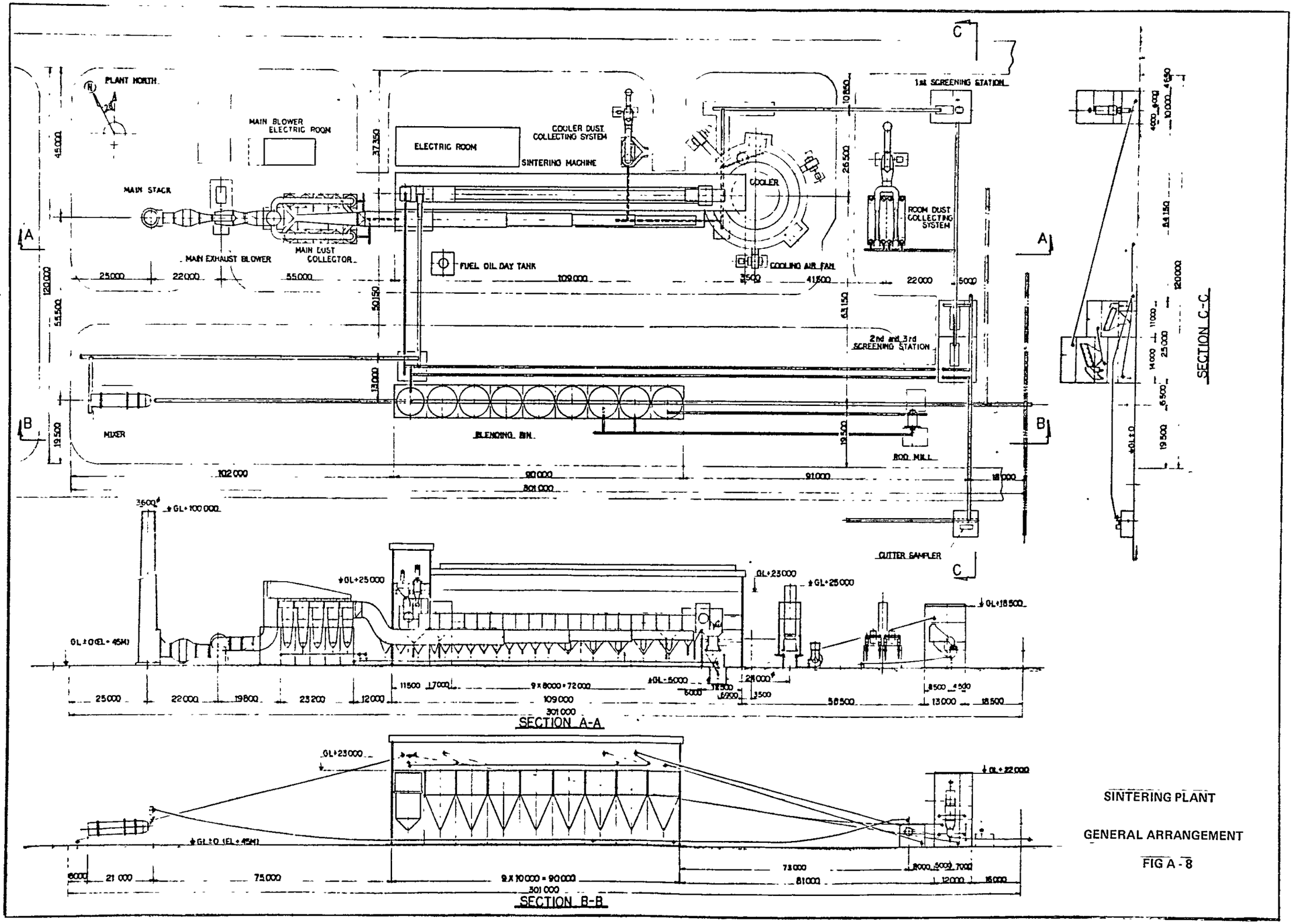


FIG. A - 7

2.5 MTPY SINTERING PLANT
3000 T/H RECLAIMER

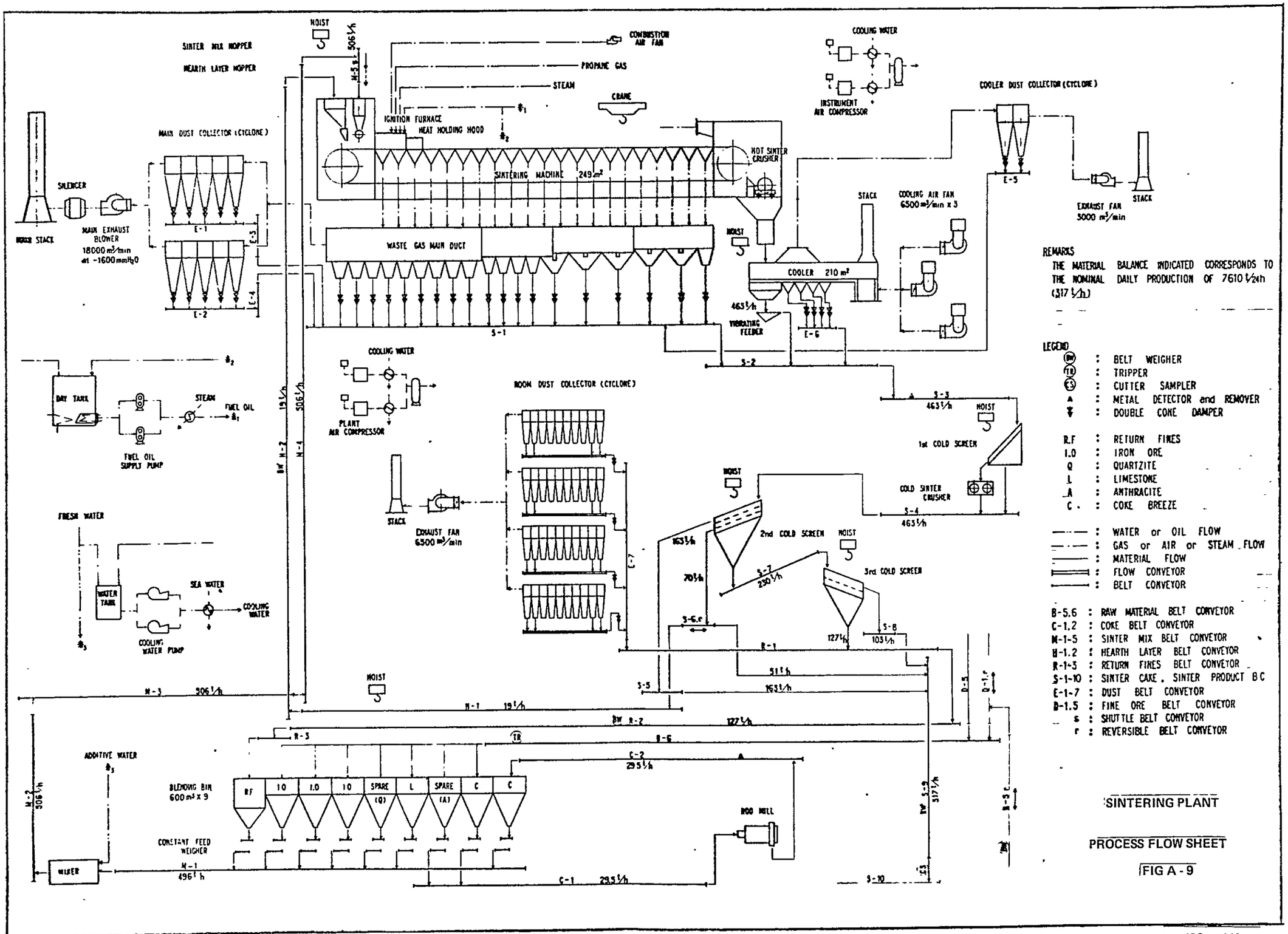
DATE		SCALE
APPROVED		DWG. NO.
DRAWN		

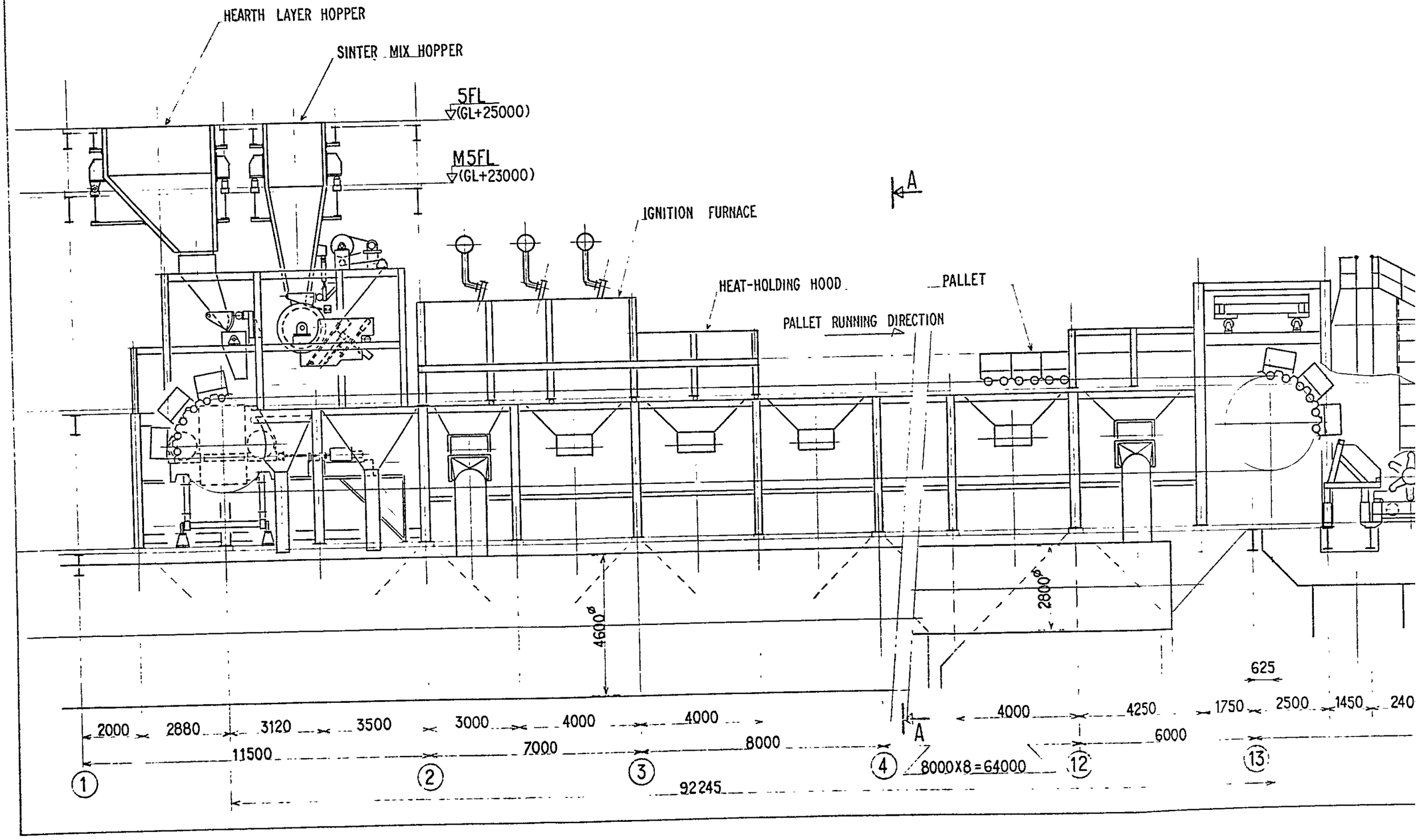


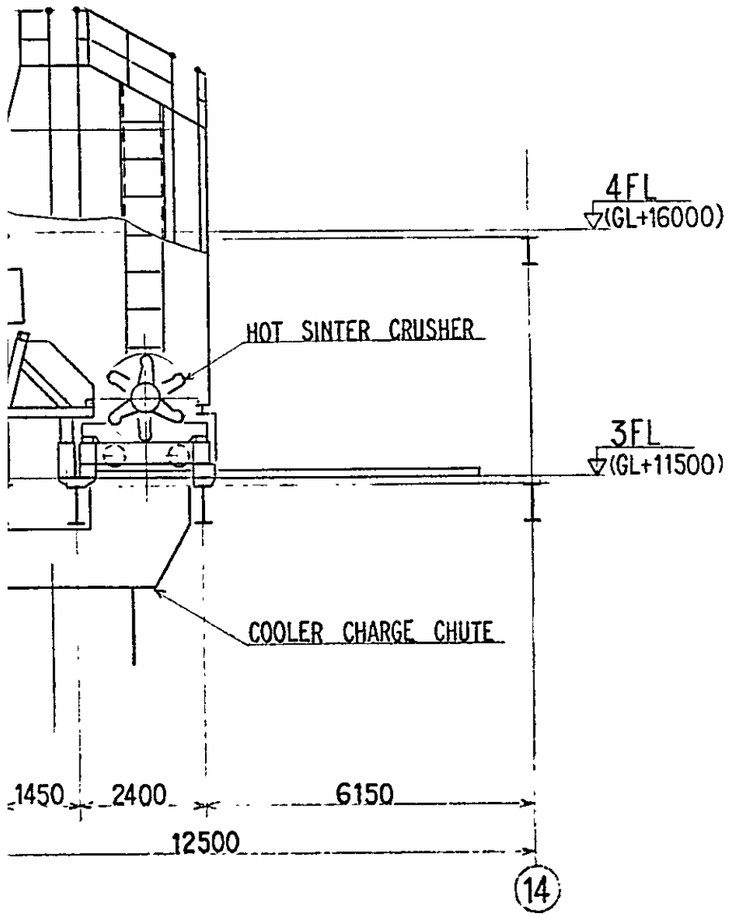
SINTERING PLANT

GENERAL ARRANGEMENT

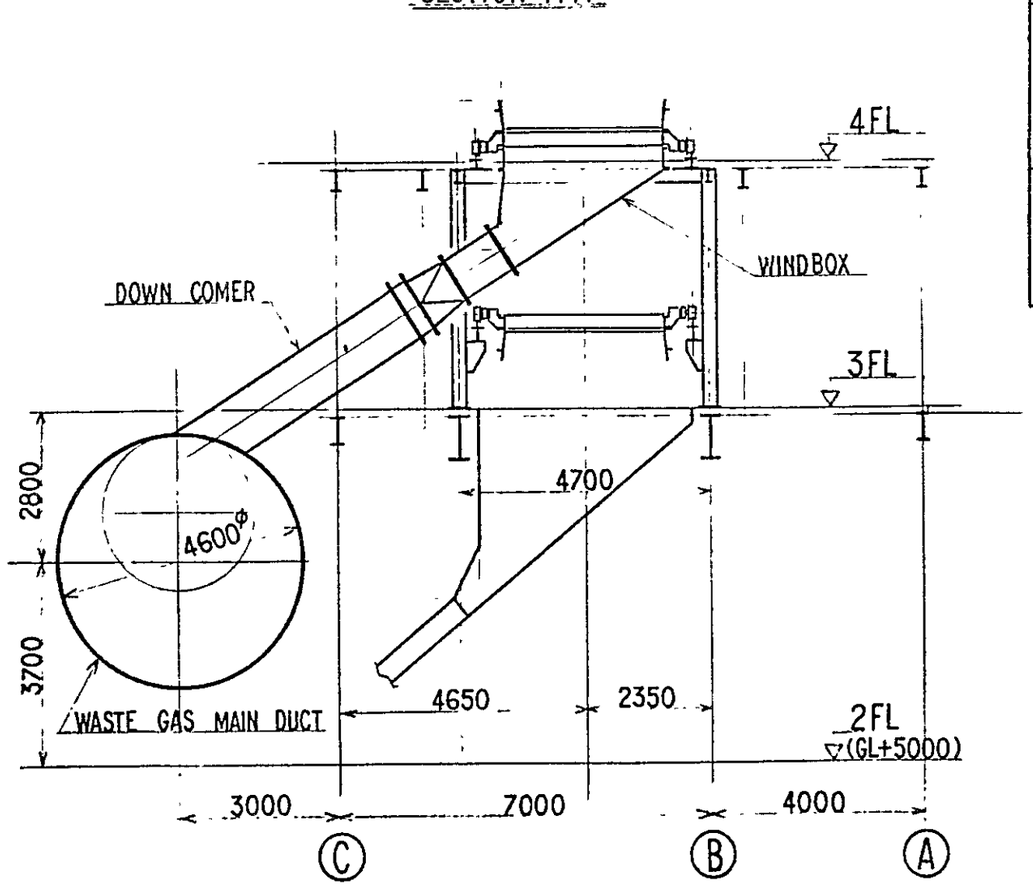
FIG A - 8


SINTER MIX HOPPER
HEARTH LAYER HOPPER
HOIST
506 t/h
M-5
COMBUSTION AIR FAN
PROPANE GAS
STEAM
CRANE
IGNITION FURNACE
HEAT HOLDING HOOD
SINTERING MACHINE 249 m²
HOT SINTER CRUSHER
WASTE GAS MAIN DUCT
S-1
COOLING WATER
INSTRUMENT AIR COMPRESSOR
COOLER DUST COLLECTOR (CYCLONE)
E-5
EXHAUST FAN 3000 m³/min
STACK
COOLING AIR FAN 6500 m³/min x 3
COOLER 210 m²
E-6
463 t/h
VIBRATING FEEDER
S-2
S-3
463 t/h
HOIST
1st COLD SCREEN
COLD SINTER CRUSHER
S-4
463 t/h
2nd COLD SCREEN
463 t/h
70 t/h
S-7
250 t/h
3rd COLD SCREEN
127 t/h
S-6
103 t/h
R-1
511 t/h
S-5
463 t/h
D-5
D-1.r
MAIN DUST COLLECTOR (CYCLONE)
SILENCER
MAIN EXHAUST BLOWER
18000 m³/min
at -1600 mmH₂O
E-1
E-2
E-3
E-4
ROOM DUST COLLECTOR (CYCLONE)
E-7
STACK
EXHAUST FAN 6500 m³/min
COOLING WATER
PLANT AIR COMPRESSOR
DAY TANK
STEAM
FUEL OIL
FUEL OIL SUPPLY PUMP
FRESH WATER
WATER TANK
SEA WATER
COOLING WATER
COOLING WATER PUMP
M-3 306 t/h
M-1 19 t/h
BW M-2 506 t/h
M-4 506 t/h
BW R-2 127 t/h
R-3
TR
B-6
C-2 295 t/h
ADDITIVE WATER
M-2 506 t/h
BLENDING BIN 600 m³ x 9
RF
I.O
I.O
I.O
SPARE (Q)
L
SPARE (A)
C
C
CONSTANT FEED WEIGHER
M-1 496 t/h
MIXER
ROD MILL
C-1 295 t/h
BW S-9 317 t/h
S-10
R-3.r
REMARKS
THE MATERIAL BALANCE INDICATED CORRESPONDS TO THE NOMINAL DAILY PRODUCTION OF 7610 t/24h (317 t/h)
LEGEND
BW : BELT WEIGHER
TR : TRIPPER
CS : CUTTER SAMPLER
▲ : METAL DETECTOR and REMOVER
DOUBLE CONE DAMPER
R.F : RETURN FINES
I.O : IRON ORE
Q : QUARTZITE
L : LIMESTONE
A : ANTHRACITE
C : COKE BREEZE
WATER or OIL FLOW
GAS or AIR or STEAM FLOW
MATERIAL FLOW
FLOW CONVEYOR
BELT CONVEYOR
B-5.6 : RAW MATERIAL BELT CONVEYOR
C-1.2 : COKE BELT CONVEYOR
M-1-5 : SINTER MIX BELT CONVEYOR
H-1.2 : HEARTH LAYER BELT CONVEYOR
R-1-3 : RETURN FINES BELT CONVEYOR
S-1-10 : SINTER CAKE, SINTER PRODUCT B C
E-1-7 : DUST BELT CONVEYOR
B-1.5 : FINE ORE BELT CONVEYOR
s : SHUTTLE BELT CONVEYOR
r : REVERSIBLE BELT CONVEYOR
SINTERING PLANT
PROCESS FLOW SHEET
FIG A - 9


HEARTH LAYER HOPPER
SINTER MIX HOPPER
5FL
(GL+25000)
M5FL
(GL+23000)
A
IGNITION FURNACE
HEAT-HOLDING HOOD
PALLET
PALLET RUNNING DIRECTION
4600ø
2800ø
625
2000
2880
3120
3500
3000
4000
4000
4000
4250
1750
2500
1450
240
11500
7000
8000
6000
8000X8=64000
92245
1
2
3
4
12
13



SECTION A A

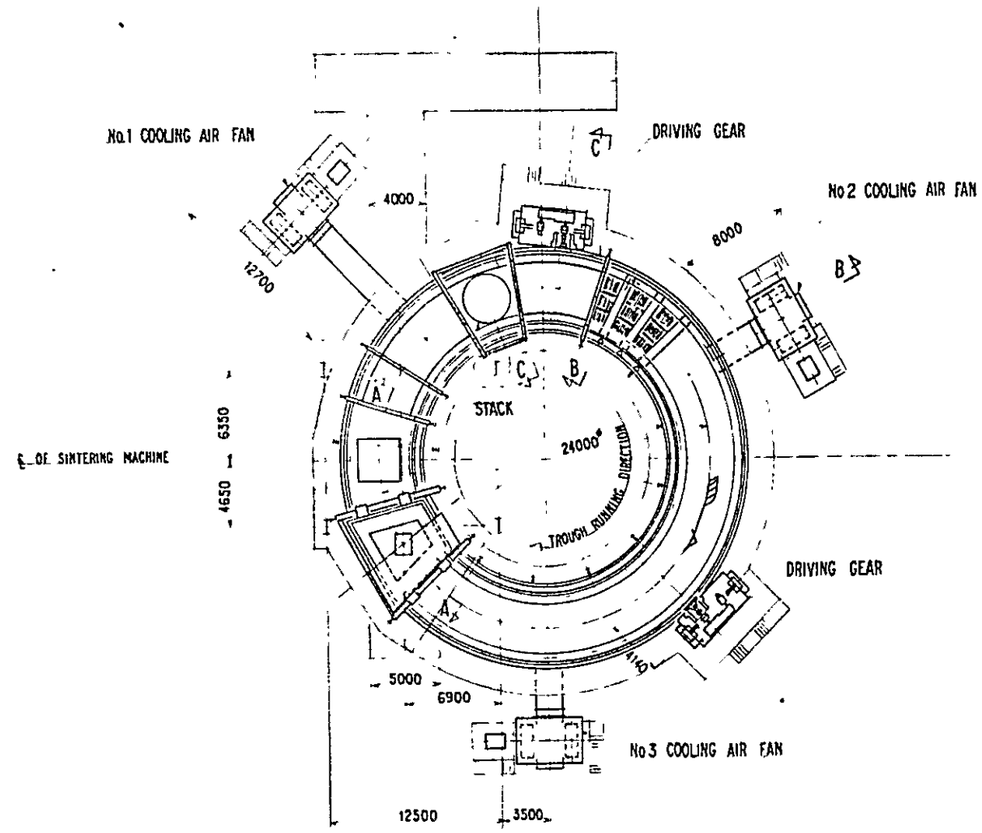


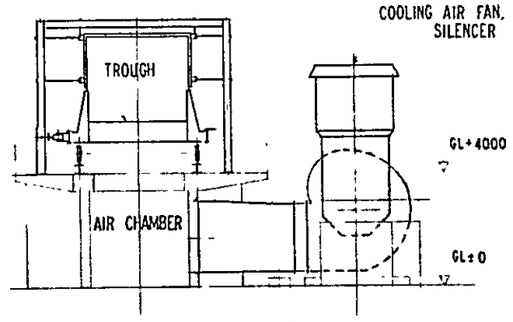
SINTERING MACHINE	
TYPE	DWIGHT-LLOYD
EFFECTIVE GRATE AREA	249 m^2
SPROCKET CENTERS	92 245 mm
PALLET SIZE	3 m^W x 1 m^l
PALLET SPEED	abt. 5.4 - 1.8 m/min
MOTOR	DC 30 kw
CHARGING SYSTEM	
SINTER MIX HOPPER	
EFFECTIVE VOLUME	abt. 27 m^3
SIZE	UPPER OPENING - 4.5 m x 1.8 m x TOTAL HEIGHT - 5.8 m
DRUM FEEDER	
CAPACITY	506 t/h (wet)
SIZE	1318 mm^ϕ x 3090 mm^l
MOTOR	DC 7.5 kw
HEARTH LAYER HOPPER	
EFFECTIVE VOLUME	abt. 30 m^3
SIZE	UPPER OPENING - 4 m x 3.4 m x TOTAL HEIGHT - abt. 6.7 m
IGNITION EQUIPMENT	
IGNITION FURNACE	
IGNITION SURFACE	abt. 3.1 m^W x abt. 6.3 m^l
COMBUSTION CAPACITY	max. abt. 12×10^6 kcal/h
HEAT-HOLDING HOOD	
HEAT-HOLDING SURFACE	abt. 3.1 m^W x 3.5 m^l
HOT SINTER CRUSHER	
TYPE	SINGLE SPIKED ROLL
CAPACITY	463 t/h
CUTTER SPEED	7.5 rpm
MOTOR	55 kw

SINTERING PLANT

SINTERING MACHINE - ASSEMBLY Dwg -

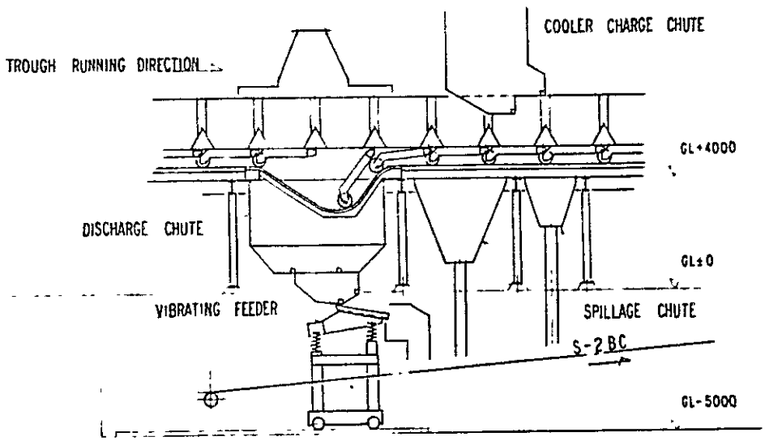
FIG A - 10



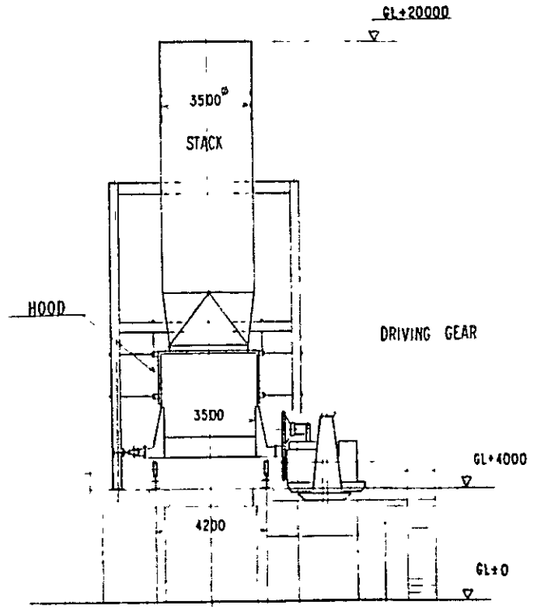


SECTION B B

COOLER SPECIFICATION		
TYPE	PRESSURE CIRCULAR	
CAPACITY	463 t/h	
COOLING AREA	210 m²	
TROUGH	SPEED (abt.)	12-0.4 r p h
	WIDTH	3 5 m
	DEPTH	1.6 m
COOLING AIR FAN	CAPACITY	6500m³/min (at 20°c 400mmH₂O)
	QUANTITY	3 sets



SECTION A A



SECTION C C

SINTERING PLANT

COOLER - ASSEMBLY Dwg -

FIG A - 11

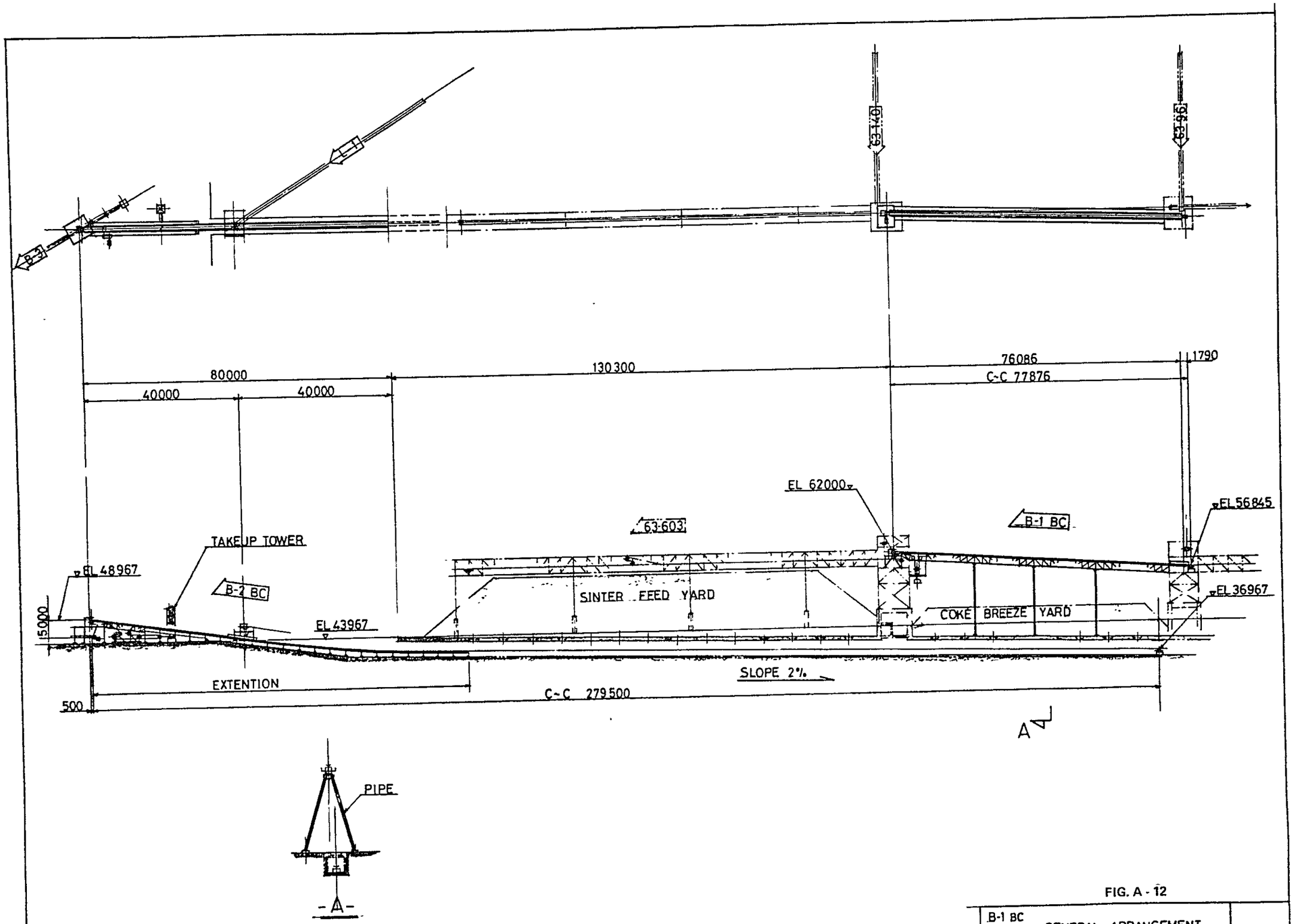


FIG. A - 12

B-1 BC
B-2 BC GENERAL ARRANGEMENT

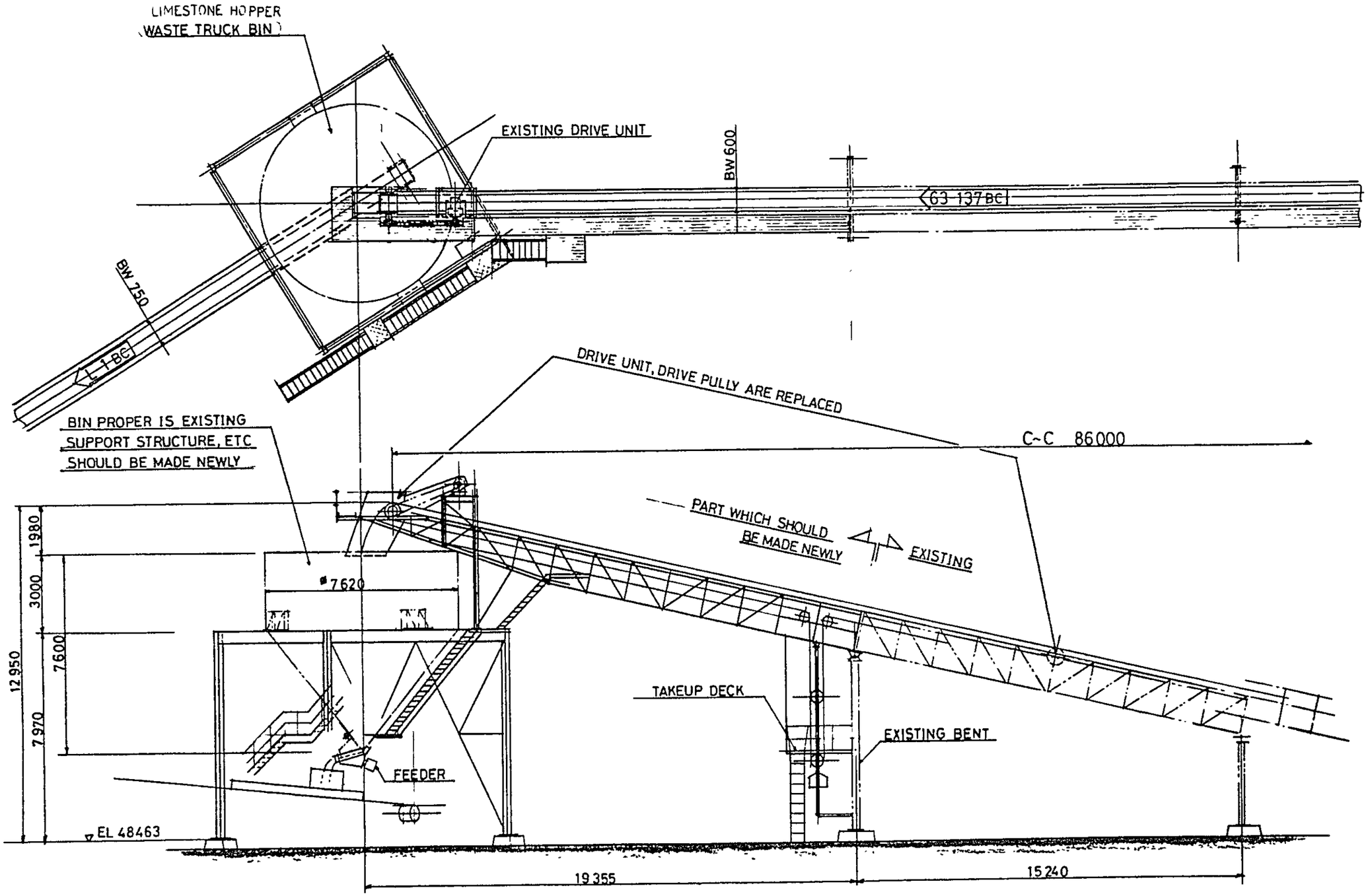


FIG. A - 13

63-137BC MODIFICATION

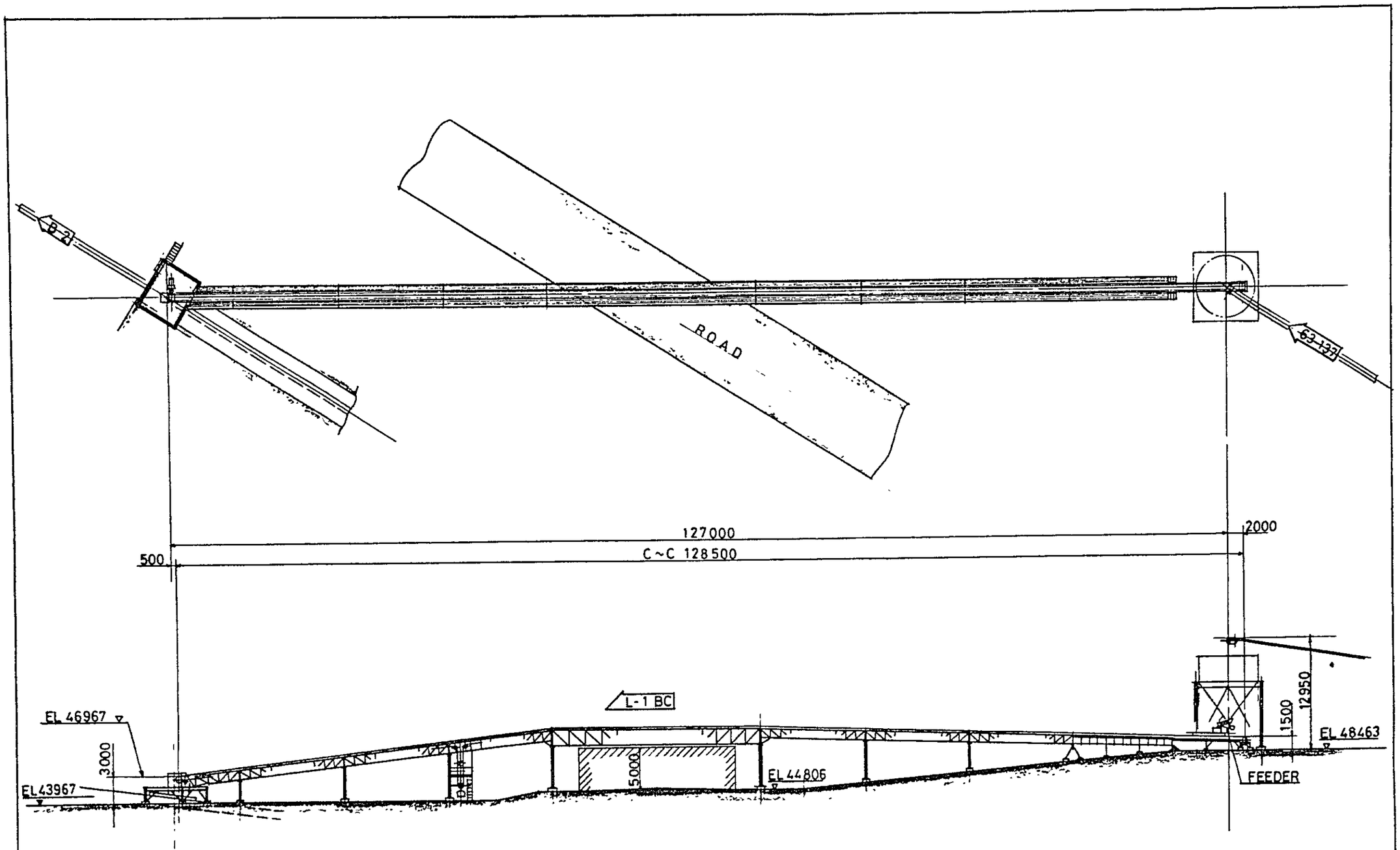


FIG. A - 14

L-1 BC GENERAL ARRANGEMENT		

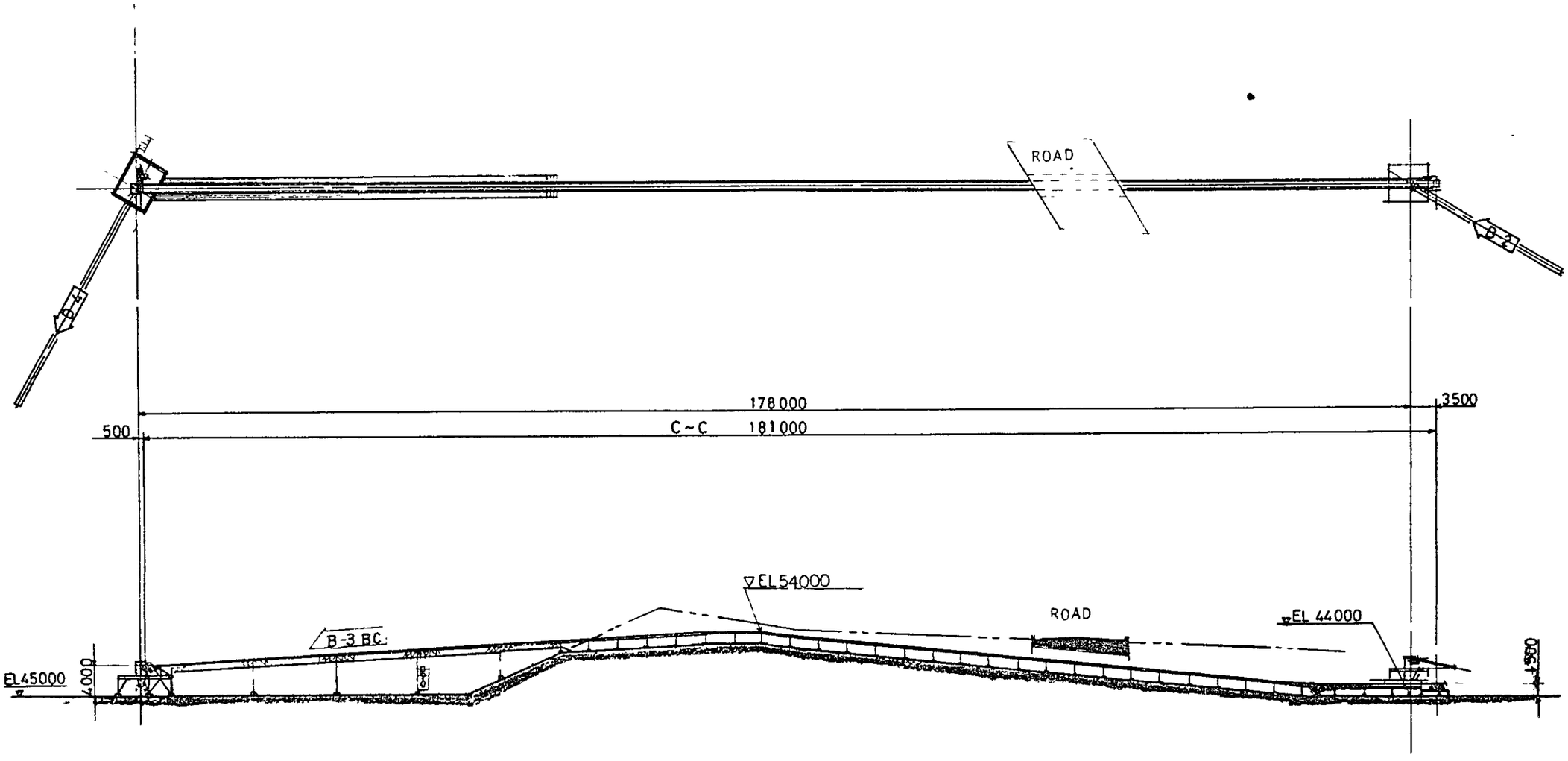


FIG. A - 15

B-3BC GENERAL ARRANGEMENT

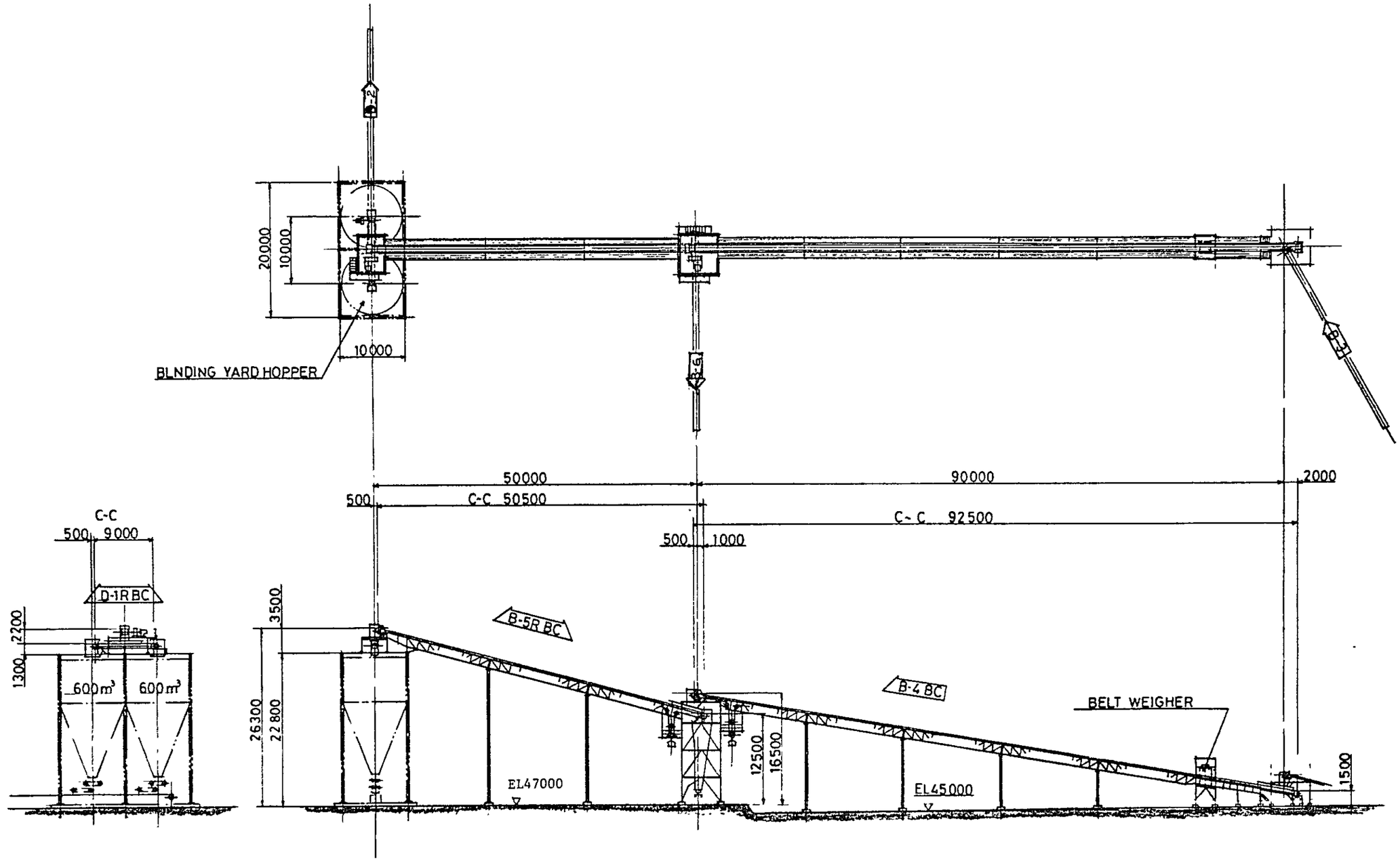


FIG. A - 16

B-4 BC, D-1RBC
B-5RBC GENERAL ARRANGEMENT

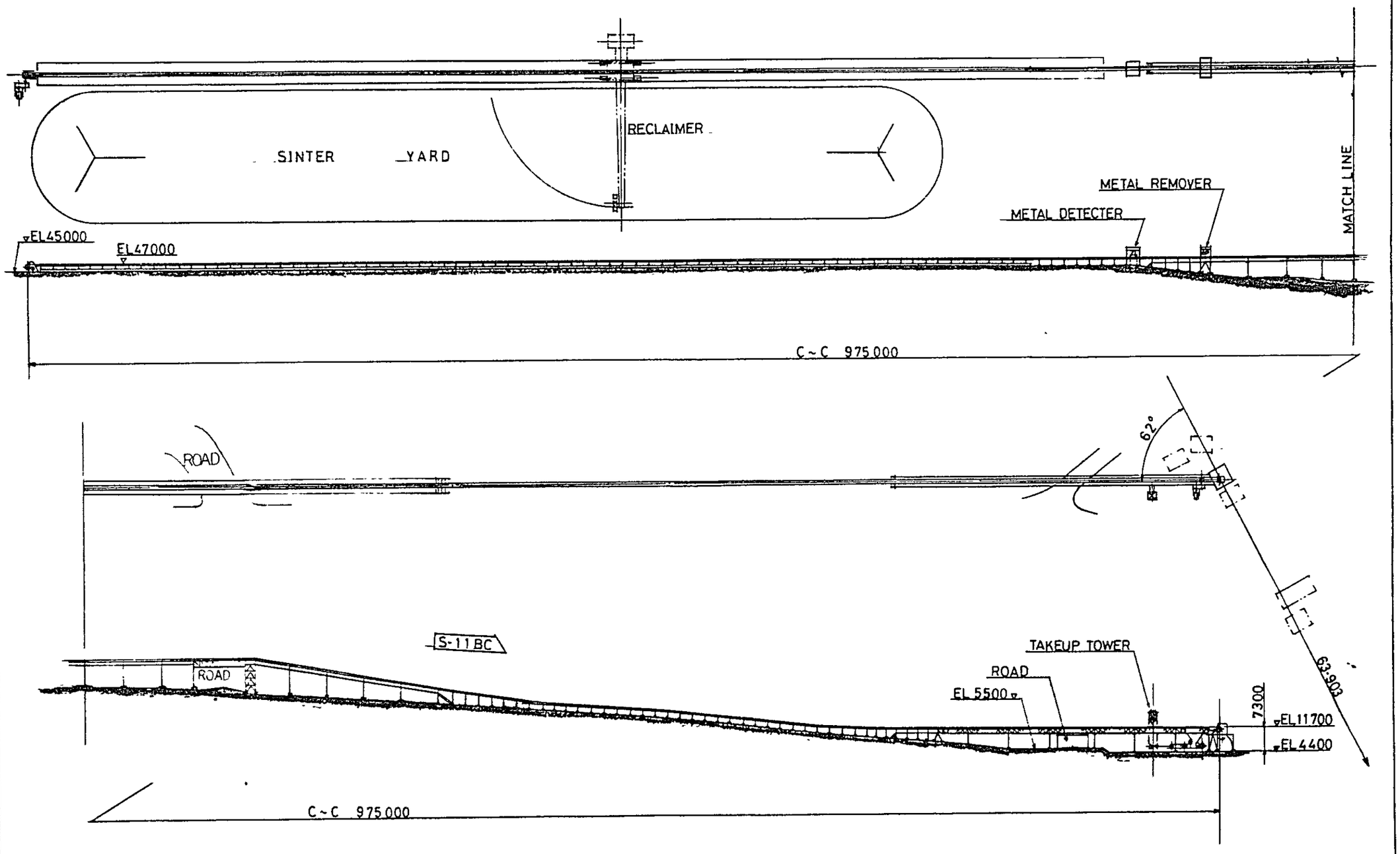


FIG. A - 17

S-11BC GENERAL ARRANGEMENT

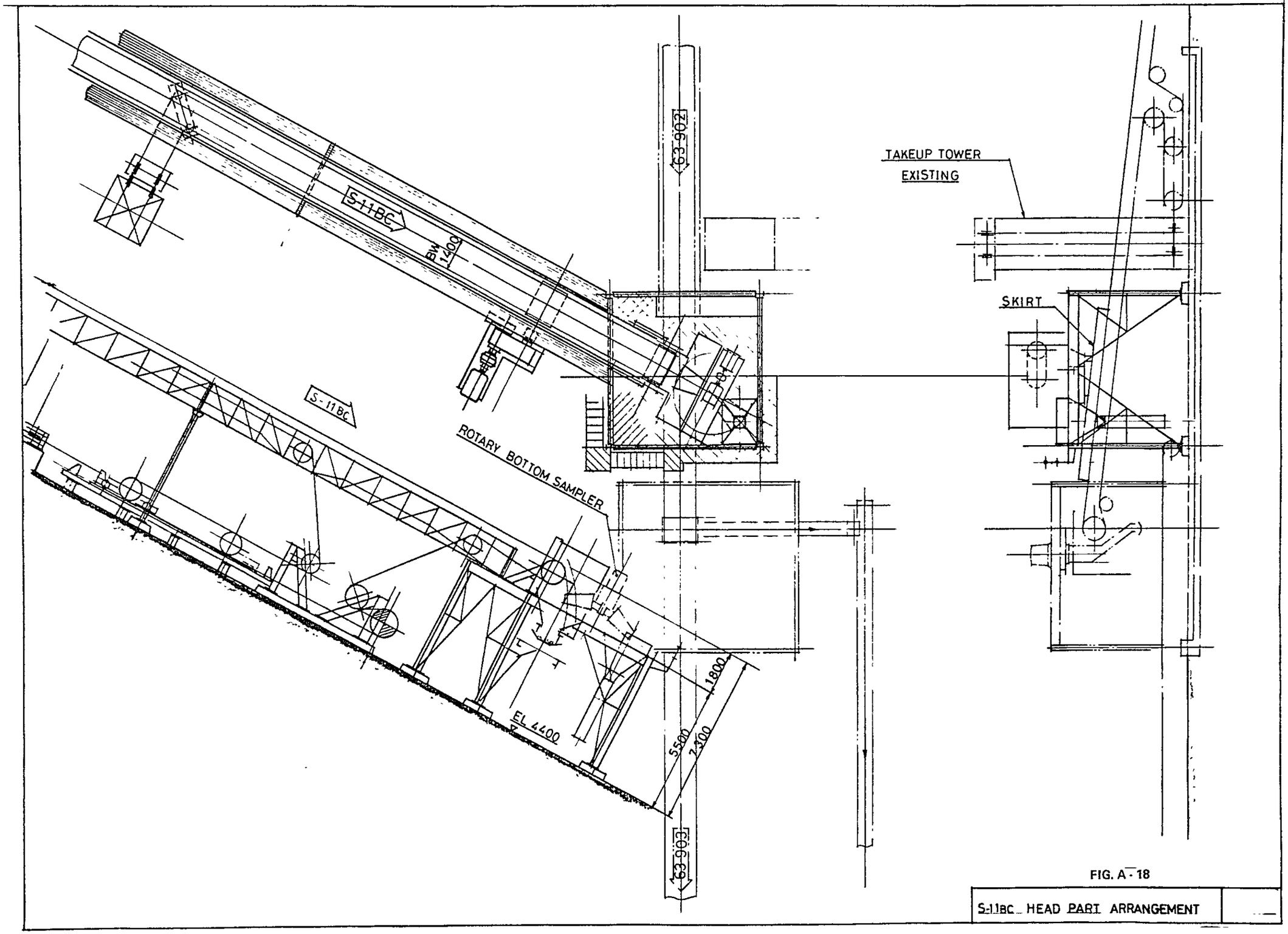
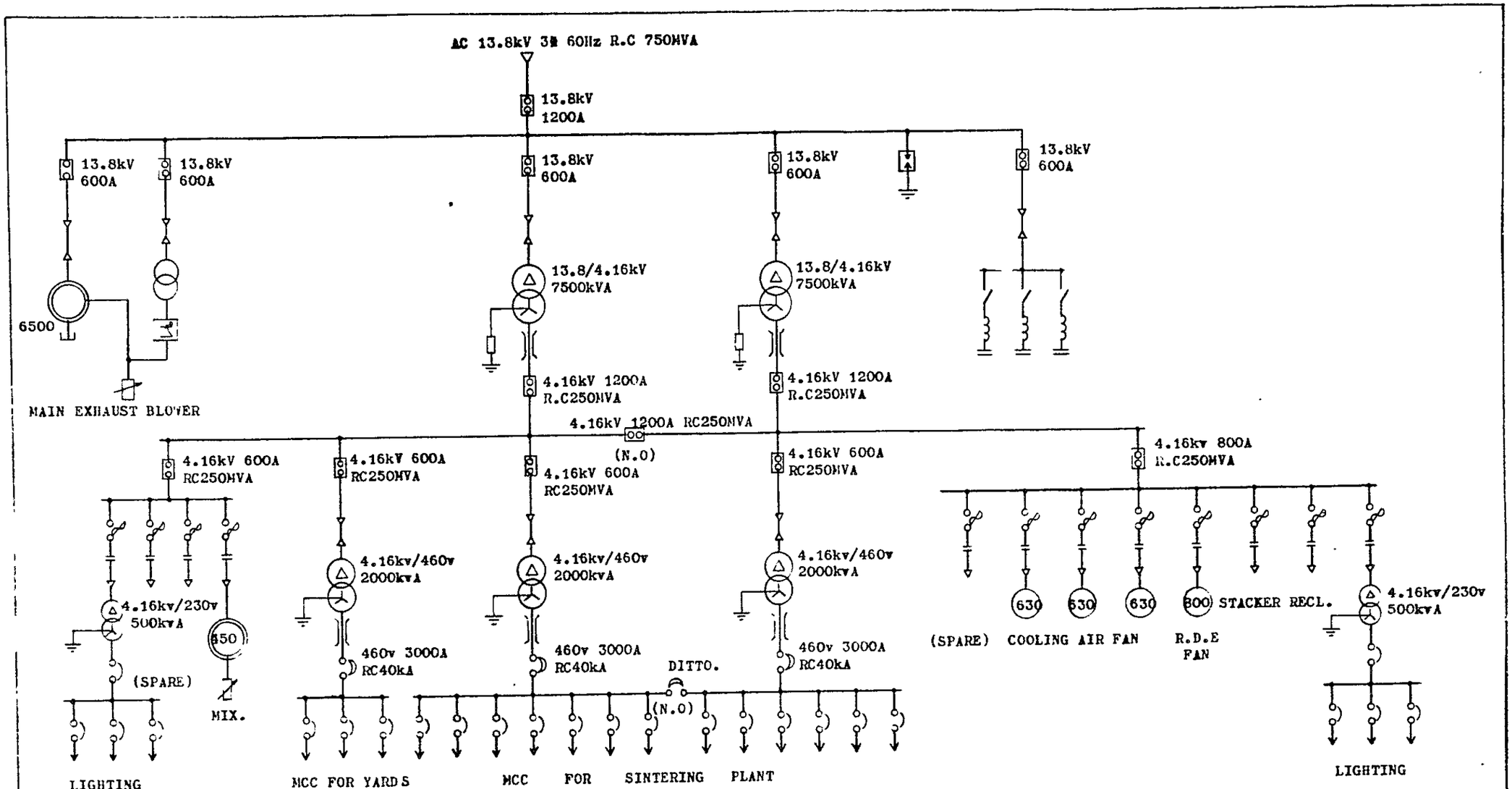


FIG. A-18

S-11BC HEAD PART ARRANGEMENT



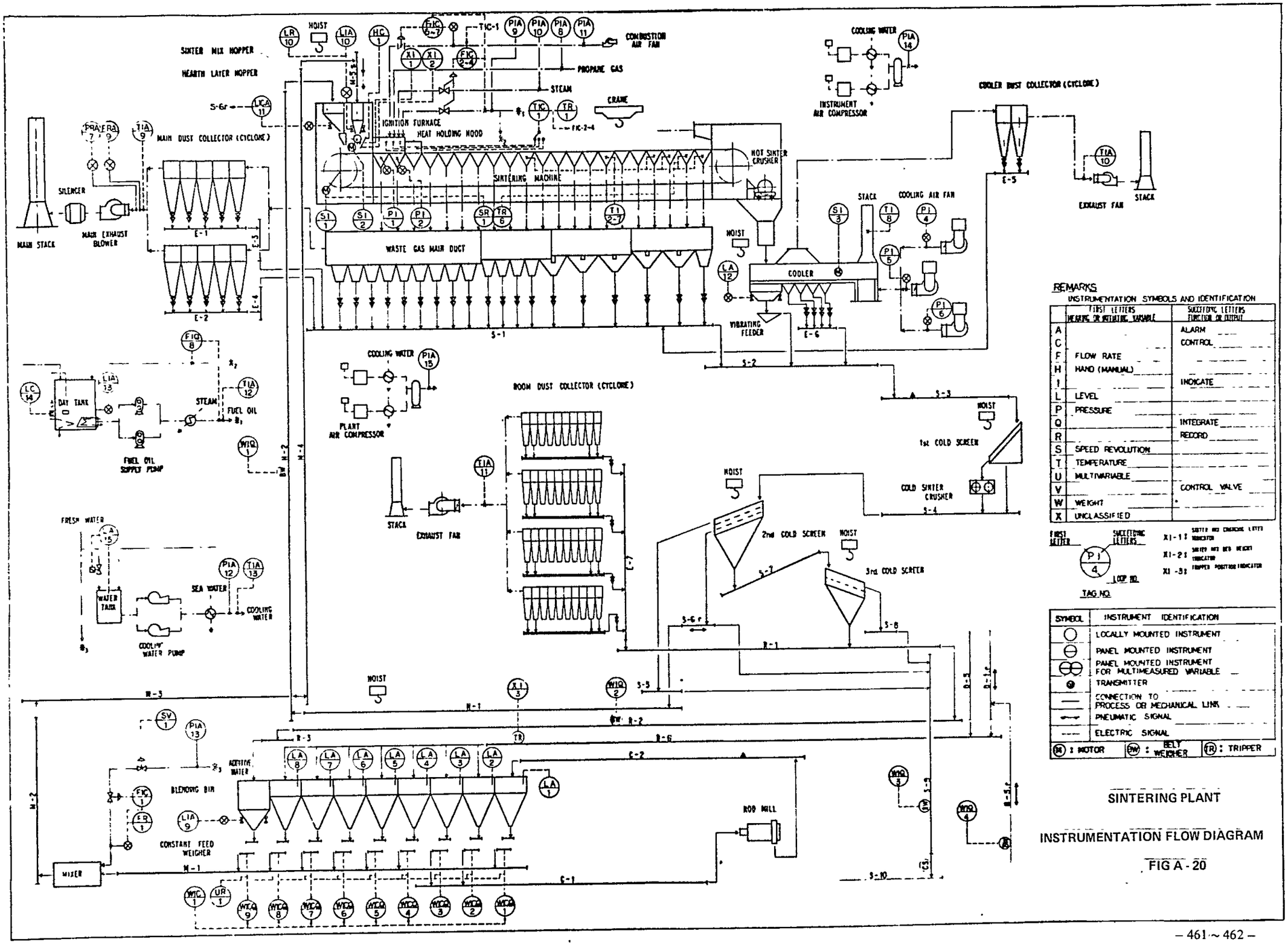
SYMBOL EXPLANATION

CIRCUIT BREAKER	STATIC CONDENSER	WOUND ROTOR INDUCTION MOTOR (KW)
LIGHTNING ARRESTOR	H.T. CURRENT LIMIT FUSE	SQUIRREL CAGE INDUCTION MOTOR (KW)
TRANSFORMER	H.T. MAGNETIC CONTACTOR	STATER (LIQ.RH)
BUS DUCT	L.T. AIR CIRCUIT BREAKER	
LOAD SWITCH	MOLDED CASE CIRCUIT BREAKER	
DISCHARGE RESISTOR	SHERBIUS CONTROL UNIT	

SINTERING PLANT

ELECTRIC SINGLE LINE DIAGRAM

FIG A - 19



REMARKS

INSTRUMENTATION SYMBOLS AND IDENTIFICATION

	FIRST LETTERS MEASURE OR INITIATING VARIABLE	SUCCEEDING LETTERS FUNCTION OR OUTPUT
A		ALARM
C		CONTROL
F	FLOW RATE	
H	HAND (MANUAL)	
I		INDICATE
L	LEVEL	
P	PRESSURE	
Q		INTEGRATE
R		RECORD
S	SPEED REVOLUTION	
T	TEMPERATURE	
U	MULTIVARIABLE	
V		CONTROL VALVE
W	WEIGHT	
X	UNCLASSIFIED	

FIRST LETTER — SUCCEEDING LETTERS — LOOP NO.

P I 4

TAG NO.

X1-1 F SINTER MIX CHARGING LEVEL INDICATOR

X1-2 F SINTER MIX BED HEIGHT INDICATOR

X1-3 F TRIPPER POSITION INDICATOR

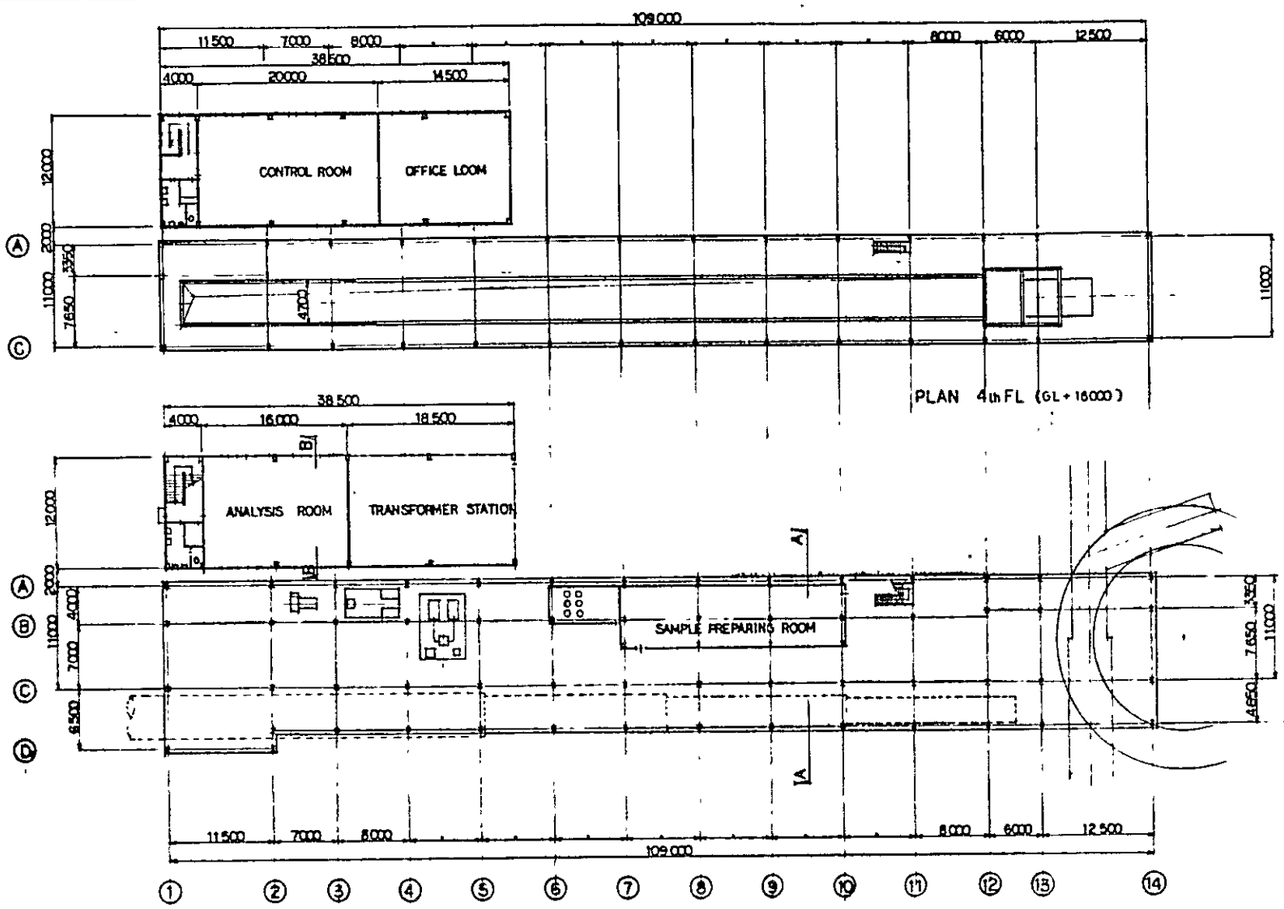
SYMBOL	INSTRUMENT IDENTIFICATION
○	LOCALLY MOUNTED INSTRUMENT
⊖	PANEL MOUNTED INSTRUMENT
⊖⊖	PANEL MOUNTED INSTRUMENT FOR MULTIMEASURED VARIABLE
◉	TRANSMITTER
—	CONNECTION TO PROCESS OR MECHANICAL LINK
⟷	PNEUMATIC SIGNAL
- - -	ELECTRIC SIGNAL

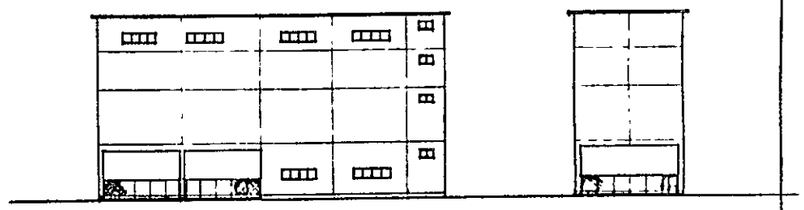
M : MOTOR — BW : BELT WEIGHER — TR : TRIPPER

SINTERING PLANT

INSTRUMENTATION FLOW DIAGRAM

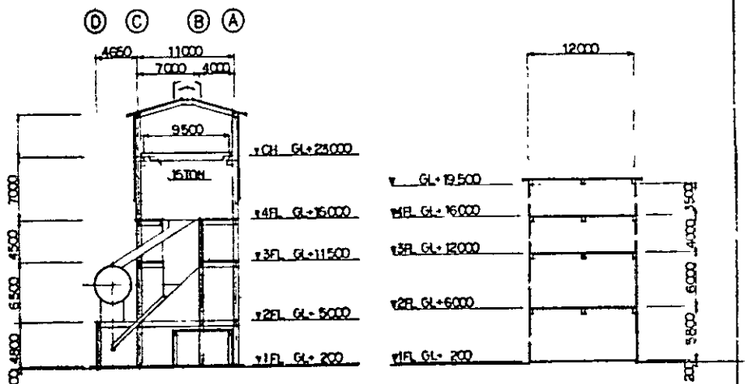
FIG A - 20

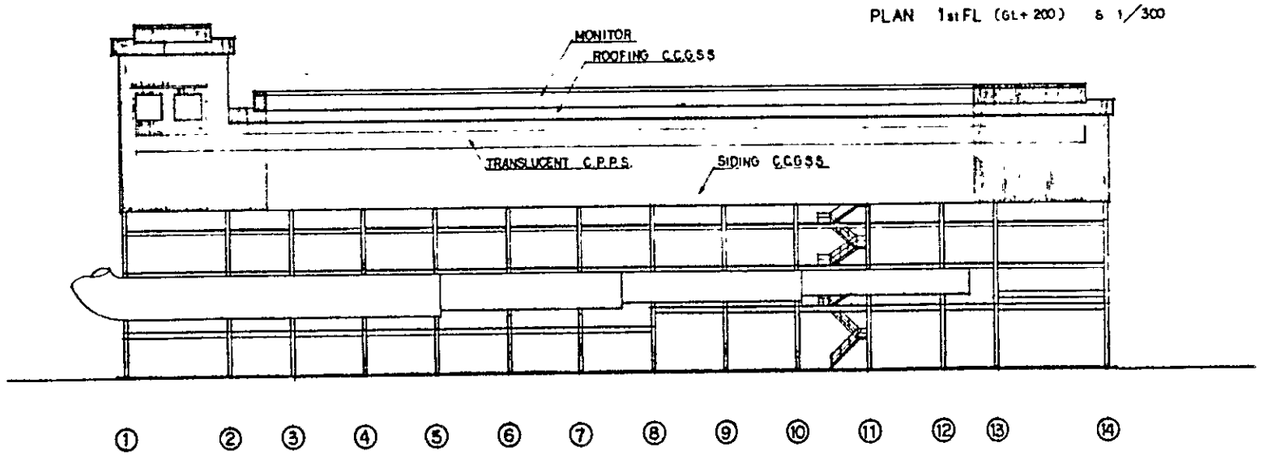


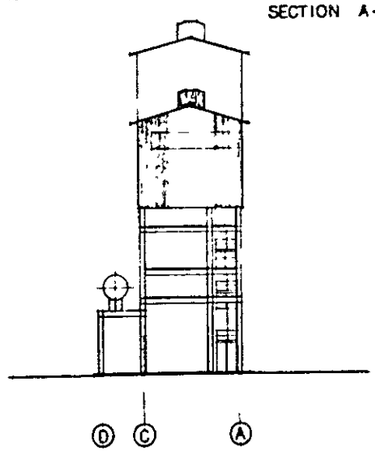


ELEVATION S 1/300

ELEVATION



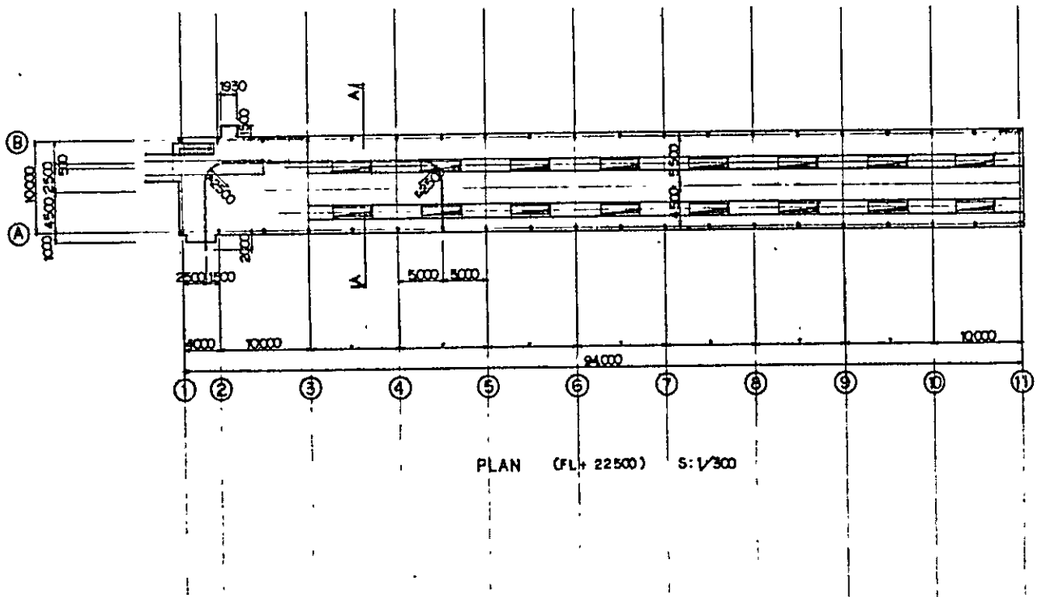




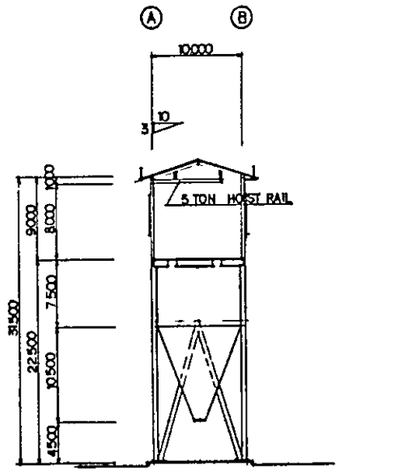
ELEVATION S 1/300

NOTE 1. ABBREVIATION
C P P S : CORRUGATED POLYESTER PLASTIC SHEET

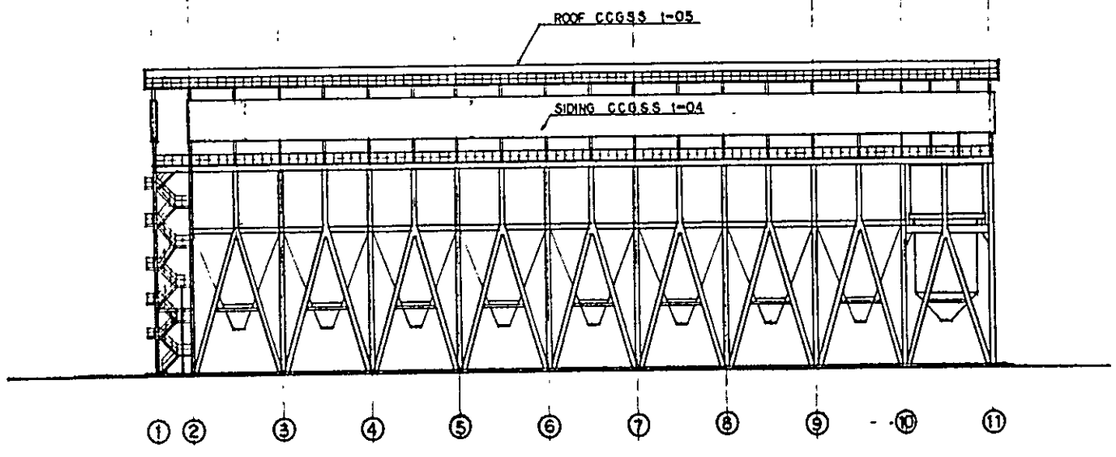
Fig. A - 21 SINTER BUILDING



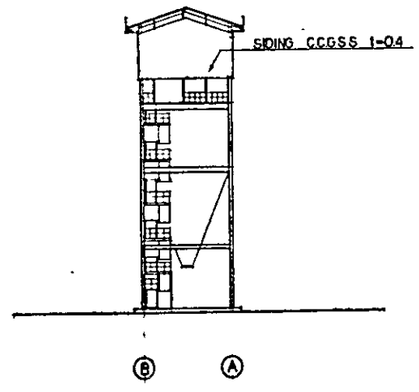
PLAN (FL+ 22500) S: 1/300



SECTION A – A S 1/300



ELEVATION S 1/300



ELEVATION S 1/300

NOTE. 1. ABBREVIATION
C.C.G.S.S : COLOURED CORRUGATED GALVANIZED STEEL SHEET.

Fig. A - 22 BLENDING BIN