6-4-3. Rolling mill plant

(1) Outline

1) Basic concept

a) Production

Production by Bar mill is to be same as that in the 1st stage (425,000 T/Y) and production by Rod mill to be about double that in the 1st stage (320,000 T/Y). As a result, the total production is to increase from 745,000 T/Y to 1,120,000 T/Y.

b) Expansion of facilities

b-1) Rod mill to have two strand rolling lines

Rolling line of Rod mill to be expanded from one strand (1st stage) to two strands (the expansion)
Bar mill facilities not to be expanded

b-2) Expansion of billet yard

In line with production increase, the site area of billet yard to be expanded 1.5 times that in 1st stage

b-3) Expansion of coil storage yard

In line with production increase at Rod mill, site area of coil storage yard to be expanded twice that in 1st stage

b-4) Layout

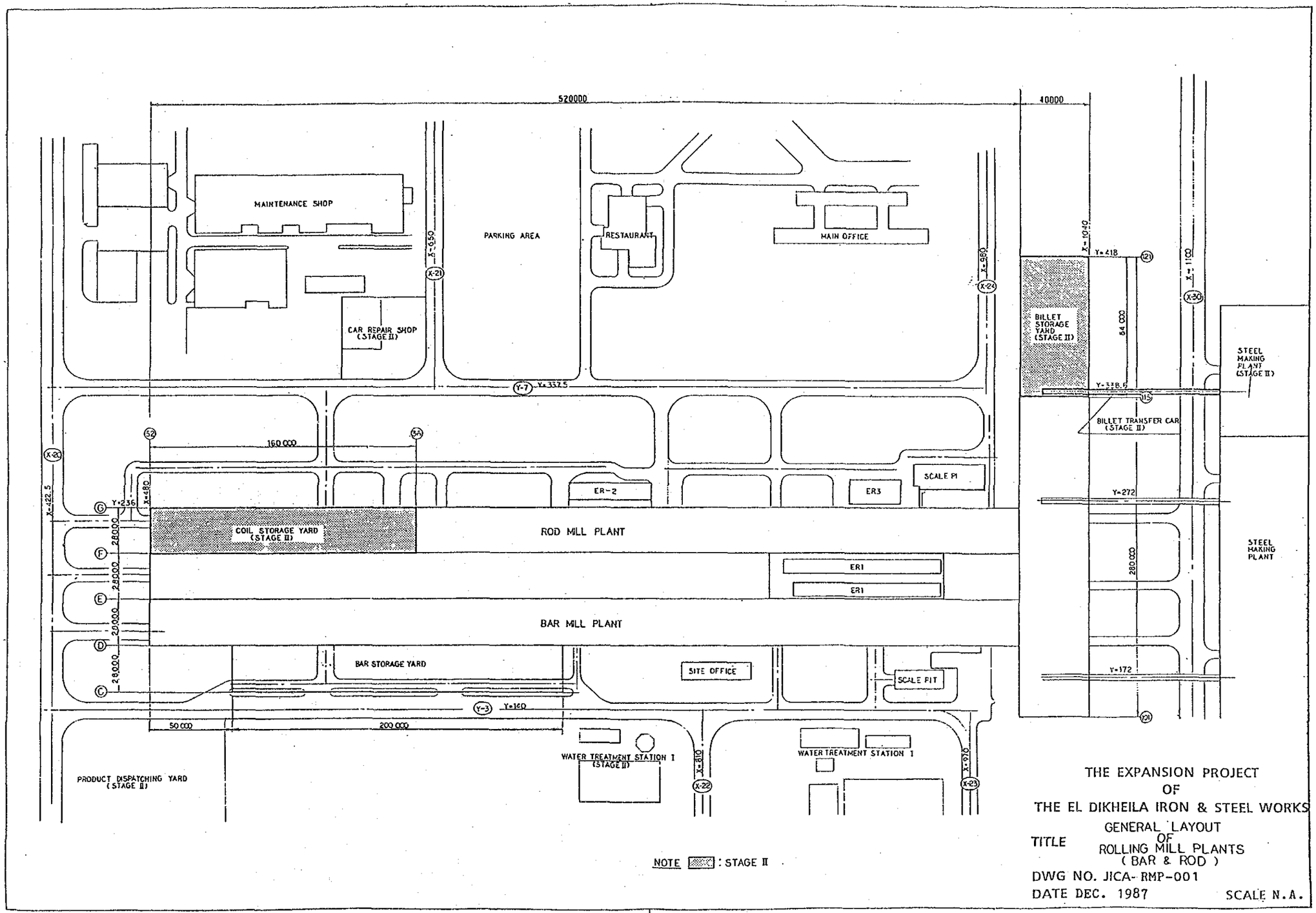
Drawing JICA RMP-001 and 002 show the layout of after expansion. RMP-001 shows the relation between Steelmaking plant and Rolling mill plant. RMP-002 shows the detail of rod mill layout.

2) Production

Production quantity is to increase from 745,000 T/Y (1st stage) to 1,120,000 T/Y (the expansion).

3) Kind of product

Product produced in the 2nd stage is to be rebar as in the 1st stage. Demand for rebars is expected brisk in future and there will be shortage even with production of 1,120,000 T/Y by ANSDK.



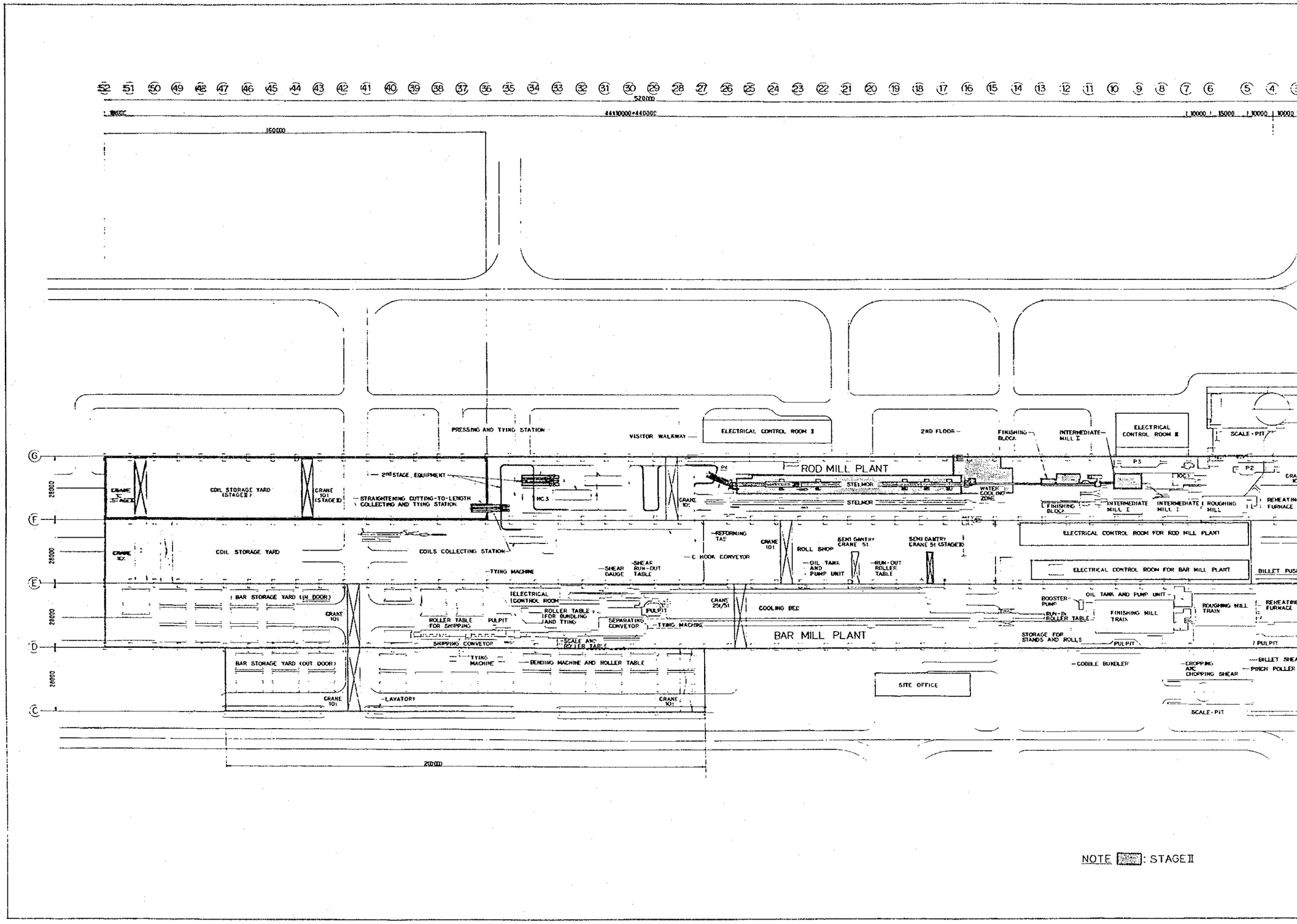
NOTE ▨ : STAGE II

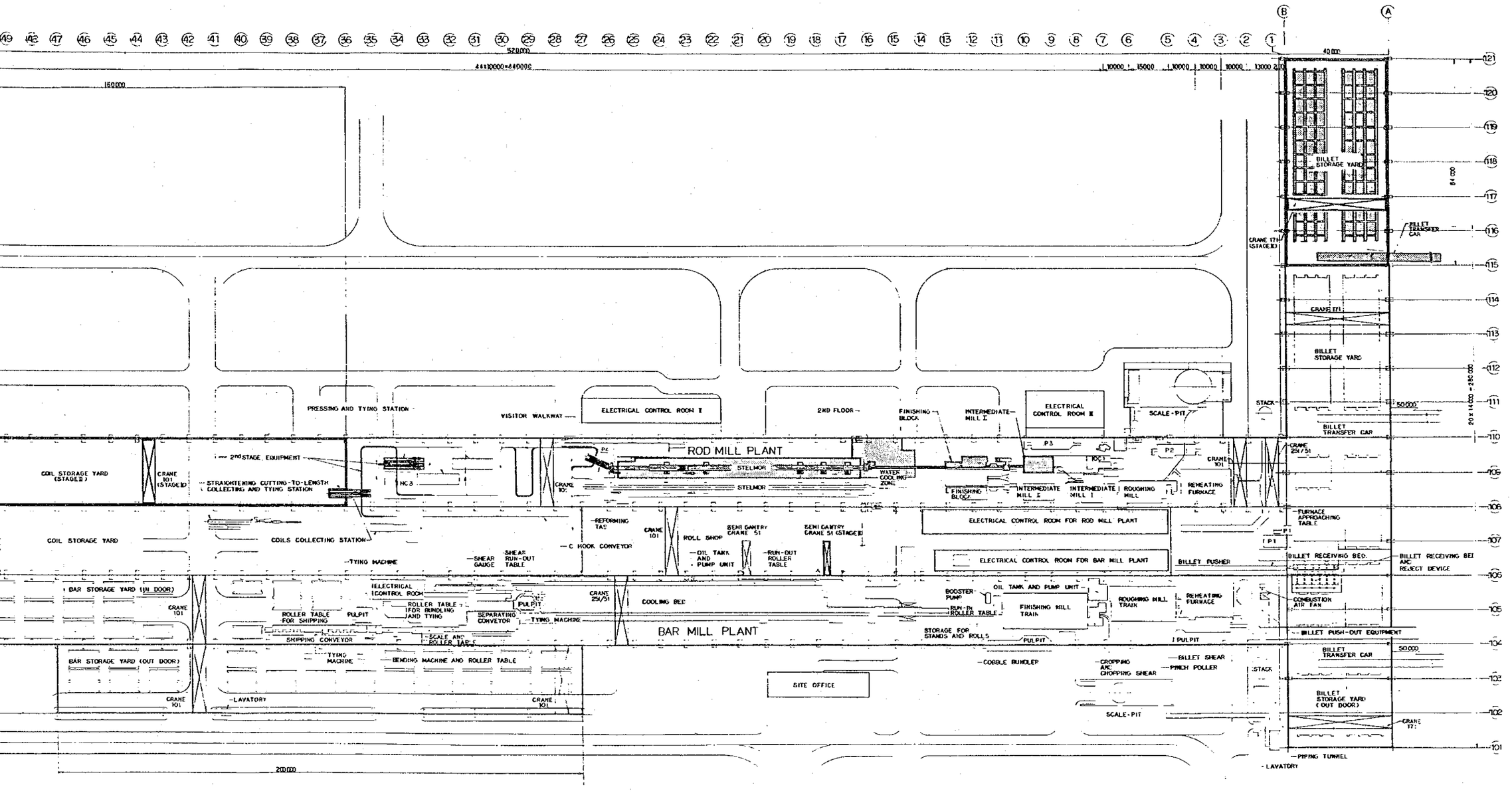
THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL WORKS

TITLE GENERAL LAYOUT OF ROLLING MILL PLANTS (BAR & ROD)

DWG NO. JICA- RMP-001

DATE DEC. 1987 SCALE N.A.


520000
150000
PRESSING AND TYING STATION
VISITOR WALKWAY
ELECTRICAL CONTROL ROOM II
2ND FLOOR
FINISHING BLOCK
INTERMEDIATE MILL I
ELECTRICAL CONTROL ROOM II
SCALE-PIT
ROD MILL PLANT
STELMOR
WATER COOLING ZONE
INTERMEDIATE MILL I
INTERMEDIATE MILL II
ROUGHING MILL
REHEATING FURNACE
ELECTRICAL CONTROL ROOM FOR ROD MILL PLANT
ELECTRICAL CONTROL ROOM FOR BAR MILL PLANT
BILLET PUSHER
COIL STORAGE YARD (STAGE II)
CRANE 101 (STAGE II)
2ND STAGE EQUIPMENT
STRAIGHTENING CUTTING-TO-LENGTH COLLECTING AND TYING STATION
MC3
CRANE 101 (STAGE I)
COIL STORAGE YARD
COILS COLLECTING STATION
REFORMING TAB
C HOOK CONVEYOR
CRANE 101
ROLL SHOP
SEMI GANTRY CRANE 51
OIL TANK AND PUMP UNIT
RUN-OUT ROLLER TABLE
SEMI GANTRY CRANE 51 (STAGE II)
TYING MACHINE
SHEAR GAUGE
SHEAR RUN-OUT TABLE
BAR STORAGE YARD (IN DOOR)
ELECTRICAL CONTROL ROOM
ROLLER TABLE FOR BUNDLING AND TYING
PULPIT
CRANE 25/51
COOLING BED
BAR MILL PLANT
BOOSTER PUMP
OIL TANK AND PUMP UNIT
RUN-IN ROLLER TABLE
FINISHING MILL TRAIN
ROUGHING MILL TRAIN
ROLLER TABLE FOR SHIPPING
SHIPPING CONVEYOR
SEPARATING CONVEYOR
SCALE AND ROLLER TABLE
STORAGE FOR STANDS AND ROLLS
BAR STORAGE YARD (OUT DOOR)
TYING MACHINE
BENDING MACHINE AND ROLLER TABLE
COBBLE BUNDLER
CROPPING AND CHOPPING SHEAR
BILLET SHEAR
PINCH POLLER
LAVATORY
SITE OFFICE
SCALE-PIT
20000
28000
NOTE : STAGE II



NOTE ▨: STAGE II

THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL WORKS
ROD MILL PLANT
TITLE GENERAL ARRANGEMENT OF EQUIPMENT

DWG NO. JICA- RMP-002
DATE DEC. 1987 SCALE N.A.

4) Major facilities

Comparison of major facilities in 1st and 2nd stages is shown in Table 6.4.3-1.

5) Basic design

a) Reheating furnace at Rod mill
Heating capacity of reheating furnace of Rod mill is to be doubled by increasing the number of burners. That of Bar mill is to be kept as it is.

b) Rod mill strand
The number of strand of Rod mill is to be increased to two strands. For this, mill stands of No. 2 intermediate mill and thereafter are to be installed. Roughing mill and No1 intermediate mill are to install roll-groove only

c) Coil straightener
As in the 1st stage, Rod mill produces products of 6,8,10 & 12 mm dia.
But new coil straightener is not to be installed because imported coils are being used by customers as they are. (Table 6.4.3-3 and Table 6.4.3-5)

(2) Production plan

1) Product mix (the expansion)

Table 6.4.3-2 shows product mix (the expansion). To arrive at the figures, calculation was made on the premises of 2), 3) and 4) below.

2) Size composition

Table 6.4.3-3 shows details of imported Re-bars (1986) prepared by ANSDK Sales Dept. By the production in the expansion, it is assumed that imported Re-bars are to be substituted by Re-bars produced by ANSDK. Therefore, size composition of the imported Re-bars is applied to that of ANSDK production.

3) Annual rolling hours

Table 6.4.3-4 shows "Effective rolling hours (Annual)"

4) Rolling efficiency

a) Bar mill

10 mm = 60 T/h

12 mm = 76.7 T/h {(13 mm = 90 T/h)x(12x12)÷(13x13)}

14-32 mm = 101.2 T/h {110 BT-T/hx92%(yield)}

b) Rod mill

6 mm = 123.4 T/h {61.7 T/h·STR x 2 STR}

8-12 mm = 142.5 T/h {150 BT-T/h x 95%(yield)}

5) Ratio of 10 mm bars and coils

In the size of 10 mm and 12 mm, both bars and coils are imported.
Rolling efficiency of 10 mm on Bar mill is low and so, minimum production of this size is desirable, but from sales policy, 10% is alloted to this size on Bar mill.

6) Ratio of plain bar (37 kg/mm^2) and deformed bar (52 kg/mm^2)
Table 6.4.3-5 shows "Imported plain bar and deformed bar (January and February, 1987)" prepared by ANSDK Sales Dept. On the average of the total, plain bar accounts for 90% and deformed bar 10%, and it is reasonable to assume the ratio in the expansion of ANSDK to be the same. Incidentally rolling efficiency is same for plain bar and deformed bar.

7) Yield and by-product

Yield and by-product is assumed to be same as those given in Table 5.2.3-2 The figures of yield and by-product are based on actual data in January-March, 1987.

8) Base consumption units

Table 6.4.3-6 shows base consumption units at Rolling mill plant.

9) Material flow in Rolling mill plant.

Fig. 6.4.3-7 shows material flow in Rolling mill plant. The figures shown in this flow sheet integrate those in 1), 7) and 8) above.

10) Consumable

Consumable is assumed to be same as those given in Table 5.2.5-4.

11) Start up plan (Learning Curve)

Table 6.4.3-8 shows the start up plan (Learning Curve). Rod mill needs 8 (eight) months as the start up time, and it gets full production at 9 (nine) month after start up. Start up time and full production time of whole plant including DRP, SMP are shown as below.

1st month --- Rod mill start up
3rd month --- SMP mill start up
4th month --- DRP mill start up
9th month --- All plant full production.

(3) Personnel

1) Rolling mill plant personnel

Table 6.4.3-9 shows summary of Rolling mill plant personnel.

2) Bar mill personnel

Table 6.4.3-10 shows details of Bar mill personnel.

3) Rod mill personnel

Table 6.4.3-11 shows details of Rod mill personnel.

(4) Equipment list and their details

1) Equipment list of Rod mill

Table 6.4.3-12 gives equipment list of Rod mill.

2) Equipment details of Rod mill

Table 6.4.3-13 shows euipment details of Rod mill.

3) Equipment details of Bar mill (For reference)

Expansion of the bar mill is not planned. But only for reference, equipment details of the bar mill are given in Table 6.4.3-14.

In addition, in line with increased production at Rod mill, billet yard building is extended (14,000 mm x 6 spans = 84,000 mm) and coil yard building also extended (10,000 mm x 16 spans = 160,000 mm).

Table 6.4.3-1 Major facilities in 1st and the expansion.

Mill	Item	1st stage	Expansion
Bar	No of furnace	1	ditto
	No of stand	16	ditto
	No of strand	1	ditto
	Shape of product	Straight only	ditto
Rod	No of furnace	1	ditto
	No of stand	25	ditto
	No of strand	1	2
	Shape of product	Coil only	ditto

Table 6.4.3-2 Product Mix (the expansion)

Dia	Quantity & ratio	Bar mill			Rod mill		
		Quantity	Rolling rate	Hour	Quantity	Rolling rate	Hour
mm	10^3 x t/y (%)	10^3t/y (%)	t/h	h/y	10^3t/y (%)	t/h	h/y
6	81 (7.2)				81	123.4	656
8	87 (7.8)				87	142.5	610
10	370(33.0)	112 (10.0)	60.0	1,867	258 (23.0)	142.5	1,810
12	432(38.6)	165 (14.7)	76.7	2,162	267 (23.9)	142.5	1,873
16	116(10.4)	116	101.2	1,146			
19	16 (1.4)	16	101.2	158			
22	5 (0.4)	5	101.2	49			
25	9 (0.8)	9	101.2	89			
28	1 (0.1)	1	101.2	10			
32	3 (0.3)	3	101.2	30			
Total	1,120 (100.0)	427		5,511	693		4,949

Notes: 1. Size composition: Same as Table 6-2-1-1.

2. Ratio of 10 mm bar and coil:
   10 mm bar to be 10% for sales activities

3. Annual operating hours: See Table 6-4-3-4.

Table 6.4.3-3 Imported Re-bar (TON/1986)
prepared by ANSDK Sales DEPT

(1) Bar or Coil

Dia	Bar		Coil		Total	
mm	t/y	(%)	t/y	(%)	t/y	(%)
6			127,924		127,924	7.2
8			139,628		139,628	7.8
10	239,555	(13.4)	350,324	(19.6)	589,879	33.0
12 } (12)	393,745	(22.2)	293,501	(16.4)	687,246	} 38.6
14 }	3,135				3,135	
16	185,944				185,944	10.4
18 }	11,949				11,949	}
19 } (19)	500				500	} 1.4
20 }	12,425				12,415	}
22	6,575				6,575	0.4
25	13,506				13,506	0.8
28	993				993	0.1
32	5,551				5,551	0.3
40	802				802	0
Total	874,680		911,377		1,786,057	100.0

(2) Customer (t/y, %)

Customer	Bar	Coil	Total	%
Private sector	671,522	702,613	1,374,135	77
Public sector	203,158	208,764	411,922	23
Total	874,680	911,377	1,786,057	100

Table 6.4.3-4 Effective rolling hours (Annual)

No.	Item		Bar mill		Rod mill	
①	Calender time	h/y	*8,760	24x365		
②	Annual maintenance	h/y	* 336	24x 14		
③	Weekly maintenance	h/y	* 800	16x 50		
④	Lunch time	h/y	0			
⑤	Non-working time for shift	h/y	* 400	8x 50		
⑥	Scheduled downtime	h/y	*1,536	②+③+④+⑤		
⑦	Working hours	h/y	*7,224	①-⑥	*7,224	
⑧	Working hours	h/W	* 144		* 144	
⑨	Downtime hours	h/w	* 34.2		* 45.4	
⑩	Downtime hours ratio	%	23.7	⑨÷⑧	* 31.5	
⑪	Rolling hours ratio	%	76.3	100- ⑩	68.5	100- ⑩
⑫	Effective rolling hours	h/y	5,511	⑦x ⑪	4,949	⑦x ⑪

* are contract base data prepared by ANSDK.

Bar mill: Volume IIA, Technical specification, P5-4 ~ 5-7.

Rod mill: Volume IIB-1/2, Technical schedules, P1260 ~ 1262.

Table 6.4.3-5 Imported Plain bar, Deformed bar
(Jan + Feb/1987)

Size	Bar		Coil		Total			
	P	D	P	D	P		D	
mm	t	t	t	t	t	%	t	%
6			18,824	151	18,824	99.2	151	0.8
8			7,107	101	7,107	98.6	101	1.4
10	15,684	1,444	59,615	1,668	75,299	96.0	3,112	4.0
12	30,490	1,603	44,421	0	74,911	97.9	1,603	2.1
14	0	131			0	--	131	--
16	17,452	4,368			17,452	80,0	4,368	20.0
18	1,213	547			1,213	69.0	547	31.0
20	0	4,004			0	0	4,004	100
22	495	750			495	40.0	750	60.0
25	173	4,067			173	4.0	4,067	96.0
28	0	488			0	0	488	100
32	0	581			0	0	581	100
40	0	383			0	0	383	100
Total	65,507	18,366	129,967	1,920	195,474	90.6 (90)	20,286	9.4 (10)
	83,873t (39%)		131,887t (61%)		215,760t (100%)			

Remarks:

1) Data for private sector only
(Public sector = excl. for Ministry of Housing)

2) P = Plain bar
D = Deformed bar

Table 6.4.3-6 Unit consumption

Mill	Item	Unit Consumption ①		Qt'y ②		Consumption per year ③=①x②	Consumption per day ③÷301
Bar	Natural gas	$27x10^4$	kcal/BT-t	449,500	BT-t		
		28.3	Nm^3/BT-t	449,500	BT-t		
		29.3	Nm^3/Bar-t	427,000	Bar-t	$12.7x10^6$ Nm^3	$42.2x10^3$
	Electric power	87	kwH/Bar-t	427,000	Bar-t	$37.2x10^6$ kwH	$123.6x10^3$
	Direct water	6.9	m^3/Bar-t	427,000	Bar-t	$2.9x10^6$ m^3	$9.7x10^3$
	Indirect water	8.4	m^3/Bar-t	427,000	Bar-t	$3.6x10^6$ m^3	$12.0x10^3$
	Compressed air	19.5	Nm^3/Bar-t	427,000	Bar-t	$8.3x10^6$ Nm^3	$27.6x10^3$
Rod	Natural gas	$29x10^4$	kcal/BT-t				
		30.4	Nm^3/BT-t	714,400	BT-t		
		31.3	Nm^3/Coil-t	693,000	Coil-t	$21.7x10^6$ Nm^3	$72.1x10^3$
	Electric power	131	kwH/Coil-t	693,000	Coil-t	$90.8x10^6$ kwh	$301.7x10^3$
	Direct water	8.8	m^3/Coil-t	693,000	Coil-t	$6.1x10^6$ m^3	$20.3x10^3$
	Indirect water	8.8	m^3/Coil-t	693,000	Coil-t	$6.1x10^6$ m^3	$20.3x10^3$
	Compressed air	25.0	Nm^3/Coil-t	693,000	Coil-t	$17.3x10^6$ Nm^3	$57.5x10^3$

o 301 d/y = 365 d/y - 50 d/y - 14 d/y

o Natural gas 9540 kcal/Nm^3

Table 6.4.3-7 Material flow in Rolling mill plant (the expansion)

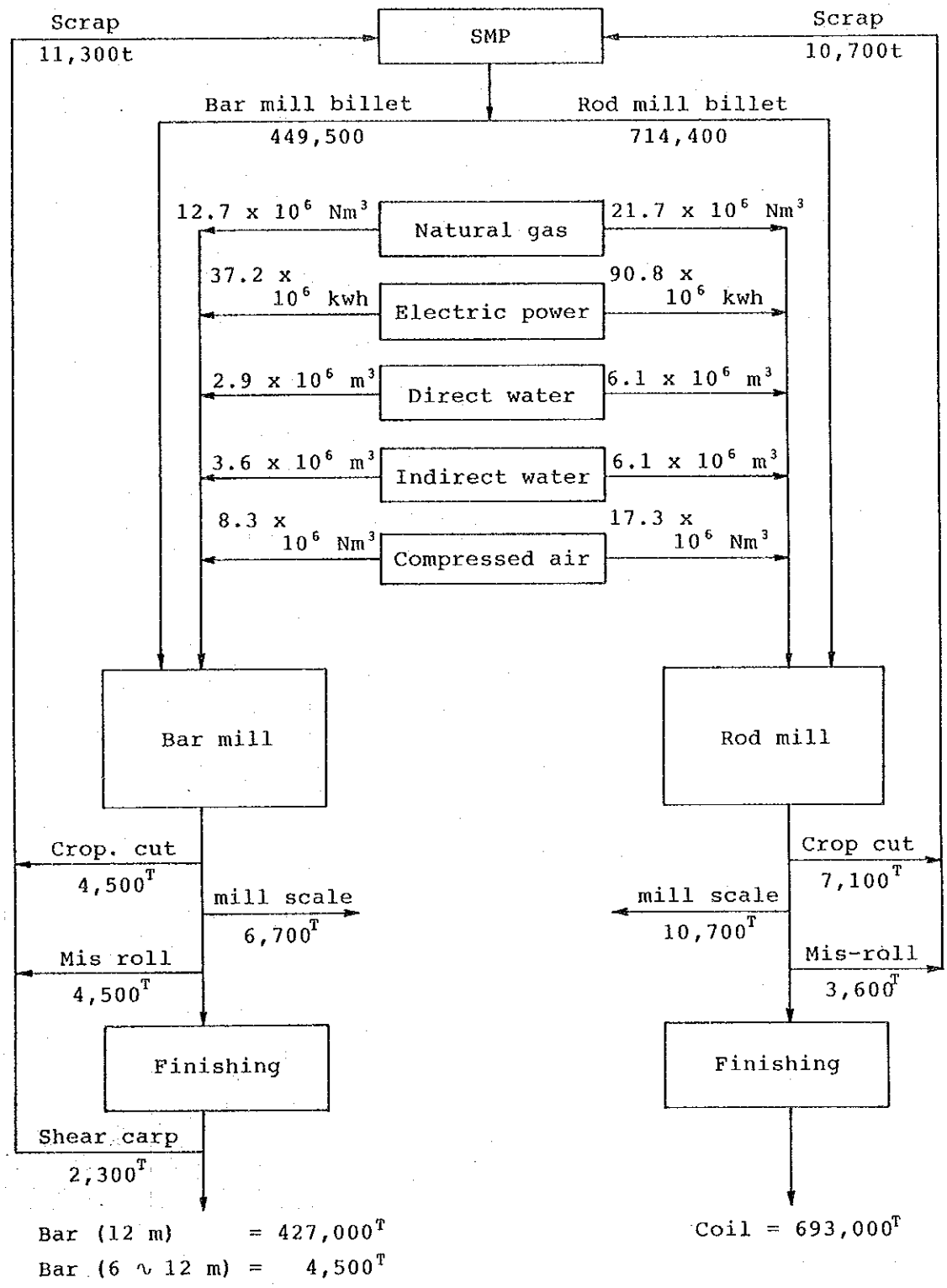


Table 6.4.3-8 Start up plan

Project month	Bar	Rod			Total	Shift
		No.1 Strand	No.2 Strand	Sub-total		
1	35,580	28,880	1,320	30,200	65,780	1 Shift
2	"	"	4,820	33,700	69,280	"
3	"	"	8,320	37,200	72,780	2 Shift
4	"	"	11,820	40,700	76,280	"
5	"	"	15,320	44,200	79,780	3 Shift
6	"	"	18,820	47,700	83,280	"
7	"	"	22,320	51,200	86,780	"
8	"	"	25,820	54,700	90,280	"
9	"	"	28,880	57,760	93,340	"
10	"	"	"	"	"	"
11	"	"	"	"	"	"
12	"	"	"	"	"	"
1st year	427,000	346,500	224,300	570,800	997,800	
2nd year	427,000	346,500	346,500	693,000	1,120,000	3 Shift

Table 6.4.3-9 Summary of Rolling mill plant

Job group	Ist stage ①					Expansion ②					②-①
	FM	AFM	Worker		Total	FM	AFM	Worker		Total	
			Net	R				Net	R		
(1) Bar mill											
• Reheating f'ce	1x1	2x3	5x3	3	25		ditto			25	0
• Rolling	1x3	2x3	9x3	3	39		ditto			39	0
• Finishing	1x3	3x3	21x3	6	81		ditto			81	0
• Crane	1x1	2x3	9x3	6	40	1x1	2x3	13x3	6	48	12
Total	8	27	132	18	185	8	27	144	18	197	12
(2) Rod mill											
• Reheating f'ce	1x1	2x3	4x3	2(3)	21(22)	1x1	2x3	5x3	3	25	3
• Rolling	1x3	2x3	7x3	2(3)	32(33)	1x3	2x3	8x3	3	36	3
• Finishing	1x3	3x3	10x3	2(3)	44(45)	1x3	2x3	14x3	3	57	12
• Roll shop	1x3	2x3	11x3	2(3)	47(48)	1x3	2x3	15x3	3	60	12
Total	11	29	96	8(12)	144(148)	11	29	126	12	178	30
Grand total	19	56	228	26(30)	329(333)	19	56	270	30	375	46(42)

FM = Foreman

AFM = Assistant foreman

R = Relief

No of Relief in each job group of Rod mill is 2, but in near future this is expected to change from 2 to 3.

Table 6.4.3-10 Details of Bar mill personnel

Job group & Job unit	Ist stage ①					Expansion ②					②-①
	FM	AFM	Worker		Total	FM	AFM	Worker		Total	
			Net	R				Net	R		
(1) Bar Reheating furnace						ditto					
· Foreman	1x1										
· A-Foreman		2x3									
· Billet receiving			2x3								
· Charging to f'ce			1x3								
· Discharging from f'ce			1x3								
· For meal			1x3								
· Relief				3							
Total	1x1	2x3	5x3	3	25	ditto				25	0
(2) Bar rolling mill						ditto					
· Foreman	1x3										
· A-foreman		2x3									
· Pulpit			1x3								
· Oil cellar			1x3								
· Roughing mill			1x3								
· Intermediate mill			1x3								
· Sample measuring etc			1x3								
· Finishing mill			1x3								
· Cooling bed			1x3								
· For meal			2x3								
· Relief				3							
Total	1x3	2x3	9x3	3	39	ditto				39	0

FM = Foreman,

AFM = Assistant foreman

R = Relief

Job group & Job unit	Ist stage ①					Expansion ②					②-①
	FM	AFM	Worker Net	Worker R	Total	FM	AFM	Worker Net	Worker R	Total	
(3) Bar finishing						ditto					
• Foreman	1x3										
• A-foreman		3x3									
• Cooling bed			1x3								
• Cold shear			1x3								
• Short bundle			3x3								
• Controlling bar rolling process			1x3								
• Bending machine			3x3								
• Hooking/hanging			8x3								
• For meal			4x3								
• Relief				6							
Total	1x3	3x3	21 x3	6	81	ditto				81	0
(4) Crane											
• Foreman	1x1					1x1					
• A-foreman		2x3					2x3				
• Billet yard			1x3					2x3			+3
• Bar mill yard			1x3					1x3			
• Rod mill yard			1x3					1x3			
• Bar finishing yard			2x3					2x3			
• Rod finishing yard			2x3					4x3			+6
• For meal			2x3					3x3			+3
• Relief				6					6		
Total	1x1	2x3	9x3	6	40	1x1	2x3	13 x3	6	52	+12
Bar mill total	8	27	132	18	185	8	27	144	18	197	+12

Table 6.4.3-11 *Details of Rod mill personnel*

FM = Foreman, AFM = Assistant foreman, R = Relief

Job group & Job unit	Ist stage ①					Expansion ②					②-①
	FM	AFM	Worker		Total	FM	AFM	Worker		Total	
			Net	R				Net	R		
(1) Rod reheating furnace											
· Foreman	1x1					1x1					
· A-foreman		2x3					2x3				
· Billet receiving			1x3					2x3			+3
· Charging to f'ce			1x3					1x3			
· Discharging from f'ce			1x3					1x3			
· For meal			1x3					1x3			
· Relief --- Nov, 87 (Relief --- Future)				2 (3)					3		
Total ---- Nov, 87 (Total ---- Future)	1x1	2x3	4x3	2 (3)	21 (22)	1x2	2x3	5x3	3	25	+4 (+3)
(2) Rod rolling mill											
· Foreman	1x3					1x3					
· A-foreman		2x3					2x3				
· Pulpit			1x3					1x3			
· Oil cellar			1x3					1x3			
· Roughing mill			1x3					1x3			
· Intermediate mill			1x3					1x3			
· Finishing mill			1x3					2x3			+3
· For meal			2x3					2x3			
· Relief --- Nov, 87 (Relief --- Future)				2 (3)					3		
Total ---- Nov, 87 (Total ---- Future)	1x3	2x3	7x3	2 (3)	32 (33)	1x3	2x3	8x3	3	36	+4 (+3)

Job group & Job unit	Ist stage ①					Expansion ②					②-①
	FM	AFM	Worker		Total	FM	AFM	Worker		Total	
			Net	R				Net	R		
(3) Coil finishing											
· Foreman	1x3					1x3					
· A-foreman		3x3					3x3				
· Coil arranging			1x3					2x3			+3
· Compacting/labeling			2x3					2x3			
· Hooking/rejection			1x3					1x3			
· Receiving/delivering			1x3					2x3			+3
· Hooking/straightening			3x3					4x3			+3
· For meal			2x3					3x3			+3
· Relief --- Nov, 87 (Relief --- Future)				2 (3)					3		
Total ---- Nov, 87 (Total ---- Future)	1x3	3x3	10x3	2 (3)	44 (45)	1x3	3x3	14x3	3	57	+13 (+12)
(4) Roll shops											
· Foreman	1x3 1x1					1x3 1x1					
· A-foreman		2x3 2x1					2x3 2x1				
· Roll turning lathe			1x3					1x3			
· Sintered roll grinder			1x3					2x3			+3
· Roll grooving			1x3					1x3			
· Roll assembling (A)			2x3					3x3			+3
· Roll assembling (B)			5x3					6x3			+3
· Spare parts			1x3					2x3			+3
· Fore meal			0					0			
· Relief --- Nov, 87 (Relief --- Future)				2 (3)					3		
Total ---- Nov, 87 (Total ---- Future)	1x3 1x1	2x3 2x1	11x3	2 (3)	47 (48)	1x3 1x1	2x3 2x1	15x3	3	60	+13 (+12)
Rod mill total --- Nov, 87 (Rod mill total -- Future)	11	29	96	8 (12)	144 (148)	11	29	126	12	178	+34 (+30)

No of relief in each job group of Rod mill is 2, but in near future this is expected to change from 2 to 3.

Table 6.4.3-12 Equipment List of Rod Mill

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
	REHEATING FURNACE		
RMP-001	Combustion Equipment	1 set	Type : Natural gas burner Capacity : 150 t/h Remarks : 1st stage = 88 t/h
RMP-002	Automatic Combustion Control Equipment	1 set	Type : Automatic combustion control system for 150 t/h
	MILL MECHANICAL EQUIPMENT		
RMP-101	Switch plate	1 set	Type : Automatic hydraulic switching device.
RMP-102	1st Cropping and Chopping Shear	1 set	Consist of: Shear, crop chute, crop buckets
RMP-103	2nd Intermediate Stands	4 Stands	Type : Horizontal/vertical cantilever stands Consist of: Stands, entry guides, delivery guides, changing equipment
RMP-104	2nd Cropping and Chopping shear	1 set	Consist of: Pinch roll units shear, crop chute, crop buckets
RMP-105	Finishing Stands	1 set	Type : Ten-stand twist-free finishing blocks Consist of: Roll stand units, entry guides, delivery guides, cobble guards
RMP-106	Driving Shafts	2 sets	Type : Common shaft for 2nd intermediate stands common shaft for finishing stands.
RMP-107	Reduction Gear	2 sets	For above stands
RMP-108	Snap Shears	1 set	

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
RMP-109	Troughs and Loopers	1 set	Consist of: Troughs and loopers between stands
RMP-110	Rolls	14 sets	Consist of: 4 sets for 2nd intermediate stands and 10 sets for finishing stands.
RMP-111	Cobble Bundler	1 set	
	COOLING FACILITIES		
RMP-201	Water Cooling Zone	1 set	Type : Controlled cooling with high pressure water Consist of: Water cooling boxes, supports, water supply line, controlled valves and electrical equipment
RMP-202	Laying Cone	1 set	Type : Horizontal type Consist of: Pinch roll units, laying cone, laying pipe, laying head balancing device
RMP-203	Cooling Conveyor	1 set	Type : Controlled cooling conveyor Consist of: Structure, roller conveyor, fans, ducting, walkways
RMP-204	Reforming Tub	1 set	Consist of: Reforming tub, coil downender, hook loader
	FINISHING FACILITIES		
RMP-301	Coil Transportation System	1 set	Type : 'C' hook type (power free) Automatic trucking system (Coil No. Reader) shall be facilitated for all hooks. Consist of: Hooks, drives, beam
RMP-302	Coil Compacting and Binding Machine	1 set	Type : Automatic 4 wire binding Consist of: Binding press, binder head, 4 wire-red coil re-

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
RMP-302	(Cont'd)		ceivers and feed facilities hydraulic and electrical equipment
RMP-303	Label Stamping Machine	1 set	Type : Lot numbers and weight stamp C.P.U. connected
RMP-304	Coil Unloader	1 set	Type : Walking beam system
	SERVICE SYSTEMS		
RMP-401	Centralized Oil Lubrication System	1 set	Consist of: Units including centrifugal machine
RMP-402	Centralized Grease Lubrication System	1 set	
RMP-403	Hydraulic System	1 set	
RMP-404	Pipe for Above Facilities	1 set	
RMP-405	Pipe for Utilities	1 set	Consist of: Direct water, indirect water, natural gas, air, nitrogen
RMP-406	Draining Pumps	1 set	
RMP-407	Booster Pumps	2 sets	For finishing stands, water cooling zone
	AUXILIARY FACILITIES		
RMP-501	Carbide Disc Roll Grinding Machine	2 sets	
RMP-502	Guide Assembling Equipment	1 set	Consist of: Work benches with vise, washing tanks
RMP-503	Roll Racks	1 set	
RMP-504	Instruments	1 set	Consist of: Various measuring instruments, like scales micro meters, welding transfor-

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION		
RMP-504	Instruments (Cont'd)		mer, gas cutting & welding set, portable electric drills & grinder, hand grease pump		
	CRANES AND HOISTS		Type	Net Capacity	Building Span
RMP-601	Billet Yard (Outdoor)	1 set	Double girder EOT with lifting magnets	17 T	40 M
RMP-602	Coil Storage Yard (Indoor)	2	Double girder EOT with double C hook	10 T	28 M
	SPARES, SPECIAL TOOLS & MISCELLANEOUS ITEMS				
RMP-701	Capital Spares	1 set	For 1 year		
RMP-702	Changing Spares	1 set	For housings chocks, rolls, shear blades		
RMP-703	Wearing Spares	1 set	For 1 year		
RMP-704	Consumable Spares	1 set	For 6 months		
RMP-705	Special Tools	1 set			
RMP-706	Miscellaneous Items	1 set	Consist of: Platforms, walkways, cross-overs, railings cover plate, anchoring materials, base plates shims & wedges, supports for pipe & ducts		
	ELECTRICAL EQUIPMENT				
RMP-801	DC Main Mill Drive Motors and Controls	1 set	Consist of: Main drive motors Motor ventilation equipment Converter transformers Thyristor converters		

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
RMP-801	(Cont'd)		Control desks and posts Metering panel Detectors (H.M.D., H.M.P.D.)
RMP-802	Auxiliary Motors and Controls	1 set	Consist of: DC auxiliary motors Thyristor converters AC auxiliary motors AC auxiliary motor controls Control desks and posts Detectors Limit switches (roller, rotary cam, proximity type) cold metal detectors (C.M.D.)
RMP-803	Computer System	1 set	
RMP-804	Power Distribution	1 set	Consist of: 30 KV load disconnection switchboard 6 KV high tension boards Power transformers Power factor compensation equipment Distribution boards Battery & charge panel Earthing system Lightning protection system
RMP-805	Lighting and Small Power System	1 set	Consist of: Lighting power distribution board Sodium vapour lamps for high-bay Incandescent lamps for oil cellar Fluorescent lamps for low-bay Emergency lamps Mercury vapour lamp for outdoor Aviation obstruction lights Crane power and cooler power distribution board

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
RMP-805	(Cont'd)		Miscellanesou equipments power distribution board Socket outlets system
RMP-806	Intercommunication	1 set	Consist of: Wireless paging system Telephone communication system Indication system Selectional wire paging system Siren system Public address system Wire paging system ITV system
RMP-807	Fire Protection System	1 set	Consist of: Receiving panel Fire alarming supervisory panel Smoke detectors Control boxes Fire extinguisher Halogen type Powder type
RMP-808	Ventilation	1 set	
RMP-809	Spares, Special Tools & Miscellaneous	1 set	

Table 6.4.3-13 Equipment list of rod mill

Rod-1

Item	Equipment	Ist stage	Expansion
Reheating furnace	Type of furnace capacity (max)	Walking beam 88 T/H	Walking beam 150 T/H
	Furnace dimension		
	Effective	15.0m(L)x16.0m(W)	15.0m(L)x16.0m(W)
	Over-all	19.0m(L)x18.1m(W)	19.0m(L)x18.1m(W)
	No of burner		
	Top preheat zone	0	2x8x750x10³kcal/h
	Top heat zone	2x10x1000x10³kcal/h	2x10x1000x10³kcal/h
	Top soak zone	2x10x400x10³kcal/h	2x10x400x10³kcal/h
	Bottom soak zone	10x1,100x10³kcal/h	10x1,100x10³kcal/h
	Bottom heat zone	0	4x3,250x10³kcal/h
	Combustion air blower		
	No	2	2
	Max air flow	38,000 Nm³/h	
	No of walking beam		
	Walking beam	6 beams	6 beams
	Stationary	7 beams	7 beams
	Recuperator type	Metalic tubler	Metalic tubler
	Combustion air volume	51,000 Nm³/h (at 150 T/h)	51,000 Nm³/h (at 150 T/h)
	Waste gas volume	54,000 Nm³/h (at 150 T/h)	54,000 Nm³/h (at 150 T/h)
	Air temperature	20°C/480°C	20°C/480°C
	Waste gas temperature	700°C/360°C	700°C/360°C
	Stack (Individual from bar furnace)		
	Draft type	Natural draft	Natural draft
	Height	GL + 60m	GL + 60m
	BT receiving bed		
	Loading capacity	80 T	80 T

Item	Equipment	Ist stage	Expansion
Reheating furnace	BT charging pusher	Un-necessary	Un-necessary
	BT discharging Type of Bt discharge	Side discharging	Side discharging
Rolling Mill Roughing Mill	No of strand	1	2 (Roll groove install only)
	No of stand	7	7
	Type of housing	2-High closed type	2-High closed type
	Roll changing	Chock with roll	Chock with roll
	Groove changing	Stand shift	Stand shift
	Switch plate	Fixed device	Automatic hydraulic switching device.
No.1 inter-mediate mill	No of strand	1	2 (Roll groove install only)
	No of stand	4	4
	Type of housing	2 High closed type	2 High closed type
	Roll changing	Stand with used roll and stand-by with new roll	Stand with used roll and stand-by with new roll
	Groove changing	Shaft shift	Shaft shift
No.2 inter-mediate mill	No of strand	1	2 (New strand mill install necessary)
	No of stand	4	8
	Type of housing	Cantilever type	Cantilever type
	Roll changing	Roll only	Roll only
	Groove changing	Roll only	Roll only
Finishing block mill	No of strand	1	2 (New strand mill install necessary)
	No of stand	10	20
	Type of housing	Cantilever type	Cantilever type
	Roll changing	Roll only	Roll only
	Groove changing	Roll only	Roll only
	Product dia meter	6 mm ~ 12 mm	6 mm ~ 12 mm

Item	Equipment	Ist stage	Expansion
Crop shear	Crop shear	After No.7 stand	After No.7 stand
	Crop shear	Befqre No.16 stand	More new one
Snap shear	Snap shear	Before No.12 stand Before No.16 stand	More new one
Looper	Side looper	Before No.12 stand	More new one
	Up looper	Between No.12-No.15	More new one set
	Side looper	Before No.16 stand	More new one
Water cooling zone	Total length	38 m	More new one
	No of zone	3	More new one
Laying head	Pinch roll dia x length	182mm(D)x74(L)x2	More new one
	Laying cone	One set	More new one
	Ring dia of rod	1,050mm approx	1,050mm approx
	Max revolution	1,820 r.p.m.	1,820 r.p.m.
Cooling conveyer	Total length	98 m	More new one
	No of cooling fan	5	More new one
Reforming tub	Type	Double mandrel type with tub shear	More new one
Coil trans-portation	Type	Power & free type C-hook conveyor	Power & free type C-hook conveyor
	No of C-hook	40	+20 (Total 60)
Coil compactor	Type	Horizontal	Horizontal
	No of compactor	2	+1 (Total 3)
	Tying wire dia	6.0 mmϕ	6.0 mmϕ
	No of tying wire	4	4
Coil scale	Type	Load cell	Load cell
	Weighing range	Up to 2.5T	Up to 2.5T
	No of coil scale	1	1

Item	Equipment	Ist stage	Expansion
Coil off-loading	Type	Load cell	Load cell
	No of equipment	1	+1 (Total 2)
Coil straight	Type & function	de-coiling, straitenning cutting, collecting	de-coiling straitenning cutting, collecting
	No of straightner	1	1
Label stamping machine	Type	Automatic	Automatic
	No of machine	1	1
	Metal tag	Alminium or steel 110x55x0.3mm	Alminium or steel 110x55x0.3mm
Roll shop	Roll turning lathe		
	Type	Numerical control	Numerical control
	No of Lathe	2(Bar)+1(Rod)=3	2(Bar)+1(Rod)=3
	Roll ribbing machine		
	No of machine	1(Bar)+1(Rod)=2	1(Bar)+1(Rod)=2
	Sintered hard roll grinders	2 (Rod)	+2 (Total 4)
	Roll & bearing assembly equipment		More new one
	Transfer car	One car (Bar & Rod common)	One car (Bar & Rod common)
	Roll racks & cabinets		More new one
Crane	BT yard (Bar & Rod)	2 x 17T	+1 (Total 3)
	Mill yard	1 x (25T, 5T)	1 x (25T , 5T)
	Coil yard	2 x 10T	+2 (Total 4)
	Furnace yard	1 x 10T	1 x 10T
	Roll shop	1 x 10T	1 x 10T
		1 x 5T (Semi-gantry)	1 x 5T (Semi-gantry)
	Mill scale pit yard	1 x 3T	1 x 3T

Item	Equipment	Ist stage	Expansion
Lubri-cation system	No.1 centralized oil lubrication system	1 set	1 set
	No.2 centralized oil lubrication system	1 set	1 set
	No.3 centralized oil lubrication system	1 set	1 set
	No.1 air-oil lubrication system	1 set	1 set
	No.2 air-oil lubrication system	1 set	1 set
	No.1 Cnetralized grease lubrication system	1 set	1 set
	No.2 Centralized grease lubrication system	1 set	1 set
	No.3 Centralized grease lubrication system	1 set	1 set
	No.4 Centralized grease lubrication system	1 set	1 set
	No.5 Centralized grease lubrication system	1 set	1 set
	No.6 Centralized grease lubrication system	1 set	1 set

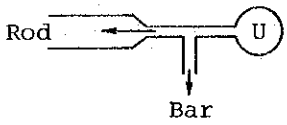
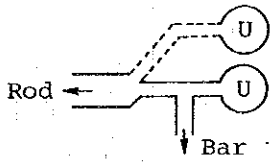
Item	Equipment	Ist stage	Expansion
Hydraulic system	No.1 hydraulic system	1 set	1 set
	No.2 hydraulic system	1 set	1 set
	No.3 hydraulic system	1 set	1 set
	No.4 hydraulic system	1 set	1 set
	No.5 hydraulic system	1 set	1 set
Fire protection	Halogen fire extinguisher	1 set	1 set
	Dry-chemical fire extinguisher	1 set	1 set
Inter-Communication system		One system	One system
Utilities Electric power	Power source	AC33kv 3-phase 3 wire 50Hz	AC33kv 3-phase 3 wire 50Hz
	Emergency source	AC6.6kv 3-phase 3 wire 50Hz	AC6.6kv 3-phase 3 wire 50Hz
Natural gas	Piping dia Gas comsumption max.	 3,200 Nm³/h	 5,900 Nm³/h
Compressed air		1,500 Nm³/h	2,200 Nm³/h
Water system	Indirect water	726 m³/h	1,452 m³/h
	Direct water	1,145 m³/h	2,160 m³/h
	Flushing water	100 m³/h	200 m³/h

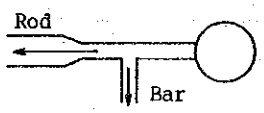
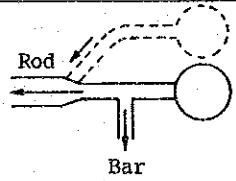
Table 6.4.15-14 Equipment detail of Bar mill

Bar-1

Item	Equipment	Ist stage	Expansion
BT Yard Bar, Rod Common	Building area	40,000mm x 196,000mm	"
	No of crane	2	"
	No of BT transfer car	2	"
	BT storage tons ◦ For bar ◦ For rod	18,900 T	"
	BT size	130mm x 130 x 16,000	"
	BT weight	2,000 kg	"
Bar Reheating Furnace	Type of furnace	Walking beam	"
	Capacity (Max)	120 t/h	"
	Furnace dimension		
	Effective	13.0m(L) x 16.8m(W)	"
	Over-all	15.0m(L) x 18.1m(W)	"
	No of burner		
	Upper left zone	6 sets x 97.5 Nm^3/h	"
	Upper right zone	6 sets x 97.5 Nm^3/h	"
	Lower left zone	6 sets x 97.5 Nm^3/h	"
	Lower right zone	6 sets x 97.5 Nm^3/h	"
	Combustion air blower		
	No	1 set	"
	Max air flow	45,000 Nm^3/h	"
	No of walking beam		
	Walking beam	6 beams	"
	Stationary beam	7 beams	"
	Recuperator		
	Type	Metalic tublar	"
	Combustion air volume	36,000 Nm^3/h	"
	Waste gas volume	40,000 Nm^3/h	"
	Air temperature	20°C/430°C	"
	Waste gas temperature	640°C/260°C	"

Item	Equipment	Ist stage	Expansion
Bar Reheating Furnace	Stack (Individual from rod furnace)		
	Draft type	Natural draft	"
	Height	GL + 55m	"
	BT receiving bed Loading capacity	51 ton	"
	Furnace approaching table Type of drive	Individual	"
	Billet charging Type of BT charging	Pusher	"
	Billet discharging Type of BT discharging	Side discharge	"
Bar Rolling Mill Roughing Mill	No of strand	1	"
	No of stand	8	"
	Type of housing	2-High closed	"
	Roll changing	Roll with chock only	"
	Groove changing	Stand shift	"
Inter-mediate Mill	No of strand	1	"
	No of stand	4	"
	Type of housing	2-High closed	"
	Roll changing	Stand with used roll and stand-by stand with new roll	
	Broove changing	Stand shift	"
Finishing Mill	No of strand	1	"
	No fo stand	4	"
	Type of housing	2-High closed	"
	Roll changing	Stand with used roll and stand-by stand with new roll	"
	Groove changing	Stand shift	"

Item	Equipment	Ist stage	Expansion
Finishing Mill	Slit rolling stand Slit rolling size Product diameter	Stand No = 14 ~ 16 10mm ~ 16mm 10mm ~ 28mm	" " 10mm ~ 32mm
Crop Shear		After No.8 stand	"
Snap Shear		After No.12 stand	"
Diving Shear		After No.16 stand	"
Looper	Side looper (single) Up looper Side looper (double arrangement for slit rolling)	Between No.12 and No.13 stands Between No.13 and No.14 stands Between No.14 and No.15, and between No.15 and No.16 stands	" " "
Cooling bed	Effective bar length	120 m	"
Cold shear	Cutting force Shape of Knife blade	400 T Plain knife	"
Shear Gauge	Gauge length	6.0 ~ 12.5 m	"
Tying	Type	Automatical wire tying	"
Scale	Type Product weight	Load cell Max 2.5 tons	" "
Bending Machine	Type	Hydraulically driven	"
Roll Shop	See rod mill section		
Crane	Quantity & capacity BT yard (Bar and rod common)	2 x 17 T	"

Item	Equipment	Ist stage	Expansion
Crane	Mill yard	1 x (25T, 5T)	"
	Bar storage yard	1 x 10T indoor	"
		2 x 10T outdoor	"
	Furnace yard	1 x 5T	"
	Roll shop	1 x 10T 1 x 5T (semi-gantry)	"
	Mill scale pit yard	1 x 5T	"
Lubrication System	No.1 centralized oil lubrication system	1 set	"
	No.2 centralized oil lubrication system	1 set	"
	Centralized grease lubrication system	4 sets	"
	Other lubrication system		"
Hydraulic System	No.1 hydraulic system	1 set	"
	No.2 hydraulic system	1 set	"
	No.3 hydraulic system	1 set	"
	No.4 hydraulic system	3 sets	"
Fire Protection System		One system	"
Inter communication system		One system	"
Utilities Electric Power	Power source	AC 33KV 3 phase	"
		3 wire 50 Hz	"
	Emergency	AC 6KV 3 phase	"
		3 wire 50 Hz	"
Natural Gas	Piping dia		
	Mas gas volume	4,000 Nm^3/hr	"

Item	Equipment	Ist stage	Expansion
Compressed Air		Max 1,923 Nm^3/h	"
Water System	Indirect water	Max 916 m^3/h	"
	Direct water	Max 600 m^3/h	"
Scale Pit	Water flow rate	600 m^3/hr	"

6-4-4. Utilities

In making a plan for facilities of utility plants, as shown in Table 6.4.4-1, requirement of utilities such as water, gas, air, etc. after the expansion was calculated by estimating utilities used at full operation of each of existing production plants and those required for expanded facilities and compared with designed capacity of the existing utility plants.

A study for expansion plan for the utility plants was made based on the table with a view of making use of surplus capacity of the existing plants as much as possible, and it was decided not to increase capacity of, or remodel, the following plants.

1) Raw water treatment & receiving station
2) Water treatment station - III
3) Sewage treatment station
4) Drainage pumping station
5) Air compression station
6) Natural gas station
7) Outdoor fire hydrant system

On the other hand, it is necessary to expand the following facilities and the equipment lists of those plants are given in Table 6.4.4-2. However, at the time when the expansion plan is implemented, surplus capacity of the existing facilities should be rechecked for better utilization of those facilities.

(1) Water treatment station - I

In order to recycle 1,300 m^3/hour of direct cooling water for Rod mill plant and Steelmaking plant, facilities consisting of sedimentation basin, pressure filters, cooling tower, cold well, pumps, etc. will be constructed.

For dehydration of scale, the existing dehydration system will be used as it has surplus capacity.

In addition, facilities consisting of cooling tower, cold well, pumps, etc. will be installed to recycle 750 m^3/hour of indirect cooling water for Rod mill plant.

Those treatment facilities are to be installed on the west of the existing water treatment station.

Flow sheet of this system is shown in DWG JICA-UT-005 and general layout is shown in DWG JICA-UT-006.

(2) Water treatment station - II

In order to recycle 4,600 m^3/hour of indirect cooling water for SMP, facilities consisting of cooling tower, cold well, pumps, etc. will be constructed on the north of SMP.

Incidentally, the new facilities include full closed cooling water system with plate heat exchangerto supply high quality cooling water to electro-magnetic stirrer which is installed for the first time.

Flow sheet of this system is shown in DWG-JICA-UT-005 and general layout is shown in DWG JICA-UT-007.

(3) Oxygen shop

The facilities at present have capacity to produce 400 Nm^3/hour of oxygen gas and 550 Nm^3/hour of nitrogen gas and are equipped with gas holder to cope with fluctuation of load.

After the expansion project, requirements of oxygen gas and nitrogen gas on the hourly average are 350 Nm^3/hour and 550 Nm^3/hour, respectively, and capacity increase of existing facilities is not necessary.

However, should the load fluctuation of those gases be bigger than at present, it is necessary to study in detail whether the existing gas holder has adequate capacity.

In addition, as a result of construction of new DR plant, a large amount of nitrogen gas is required in short time when the plant is shut down, and one gas holder of about 120 m^3 capacity is to be constructed.

(4) Yard piping

In order to supply utilities to the facilities and buildings newly constructed in line with the expansion, yard piping is laid for the following.

1) Potable water
2) Make-up water
3) Direct cooling water
4) Indirect cooling water
5) Emergency water
6) Sewage water
7) Oxygen gas
8) Nitrogen gas
9) Compressed air
10) Natural gas

(5) Personnel requirement for the expansion facilities 10 personnel (2 x 4 groups, maintenance 1, staff 1).

(6) It will be required to consider in detail the utilization of excess capacity of the existing facilities at the time of implementation of expansion.

Table 6.4.4-1 Utility Requirement

Station/Shop	Design capacity for the first stage	Quantity		
		Estimation in full operation at the first stage	Requirement for expansion	Total
1. Raw Water Treatment & Receiving Station				
1) Raw Water	930 m^3/hr	560	330	890 m^3/hr
2) Make-up Water	890 m^3/hr	500	320	820 m^3/hr
3) Potable Water	30 m^3/hr	20	5	25 m^3/hr
2. Water Treatment Station - I				
1) Direct Cooling Water	3,190 m^3/hr	2,940	1,300	4,240 m^3/hr
2) Indirect Cooling Water	2,000 m^3/hr	1,900	750	2,650 m^3/hr
3. Water Treatment Station - II				
1) Indirect Cooling Water	7,150 m^3/hr	7,040	4,600	11,640 m^3/hr
4. Water Treatment Station - III				
1) Indirect Cooling Water	284 m^3/hr	245	40	285 m^3/hr
5. Sewage Treatment Station				
1) Sewage	500 m^3/d	380	80	460 m^3/hr
6. Drainage Pumping Station				
1) Drainage	1,950 m^3/hr	1,750	100	1,850 m^3/hr
7. Oxygen Shop				
1) Oxygen Gas	400 Nm^3/hr	Ave.200	Ave.150	Ave.350 Nm^3/hr
2) Nitrogen Gas	550 Nm^3/hr	Ave.350	Ave.200	Ave.550 Nm^3/hr
8. Air Compression Station				
1) Compressed Air	12,800 Nm^3/hr	8,000	2,300	10,300 Nm^3/hr
9. Natural Gas Station				
1) Natural Gas	50,000 Nm^3/hr	30,000	28,000	58,000 Nm^3/hr
10. Outdoor Fire Hydrant System				
1) Fire Water	240 m^3/hr	240	0	240 m^3/hr

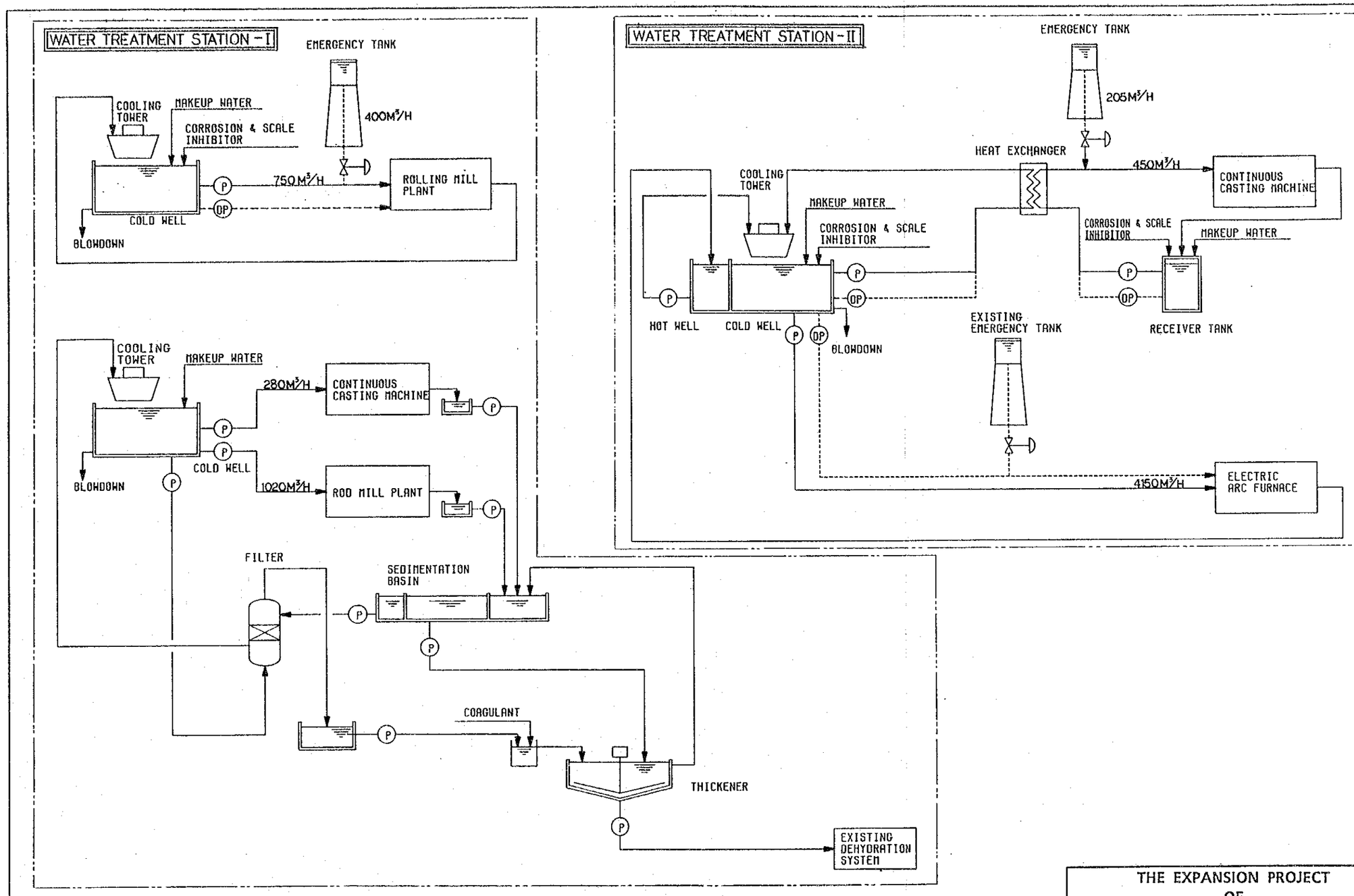
Table 6.4.4-2 Equipment List

PLANT: UTILITY SYSTEM

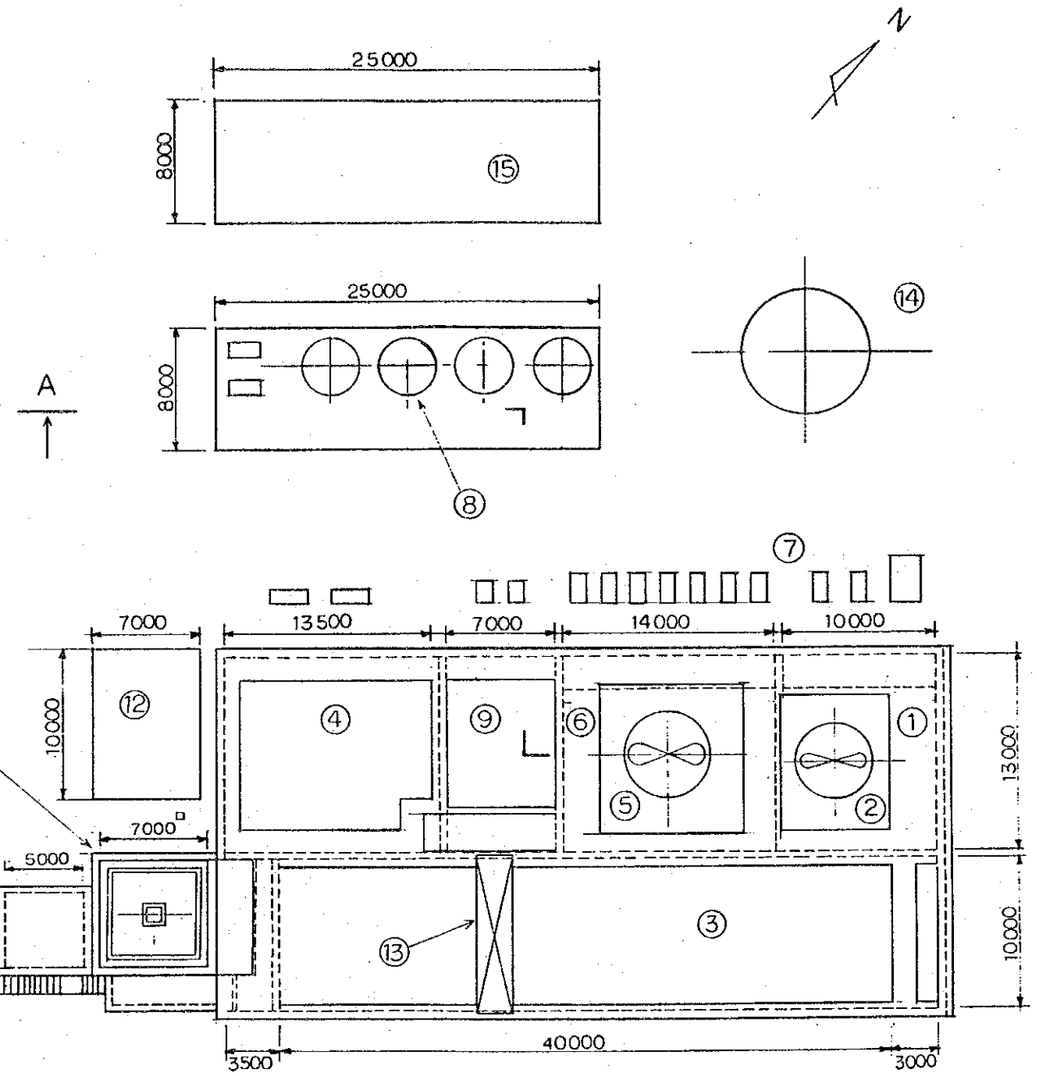
NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
UT-100	WATER TREATMENT STATION-I		
UT-110	Indirect Cooling Water System		
UT-111	Cooling tower	1	Type : Cross flow type Capacity : 750 m^3/h
UT-112	Cold well	1	Capacity : 400 m^3/h Material : Reinforced concrete
UT-113	Pumps	1 lot	
UT-114	Emergency tank		Capacity : 100 m^3 Material : Reinforced concrete
UT-120	Direct Cooling Water System		
UT-121	Cooling tower	1	Type : Cross flow type Capacity : 1300 m^3/h
UT-122	Cold well	1	Capacity : 550 m^3/h Material : Reinforced concrete
UT-123	Pumps	1 lot	
UT-124	Sedimentation basin	1	Capacity : 1,400 m^3/h Material : Reinforced concrete
UT-125	Filters	1 set	Type : Dual media type
UT-126	Thickener	1	Capacity : 100 m^3
UT-130	Auxiliary System		
UT-131	Piping with accessories	1 lot	
UT-132	Instrumentation	1 lot	
UT-133	Electrical equipment	1 lot	

EQUIPMENT LIST — PLANT: UTILITY SYSTEM (Cont'd)

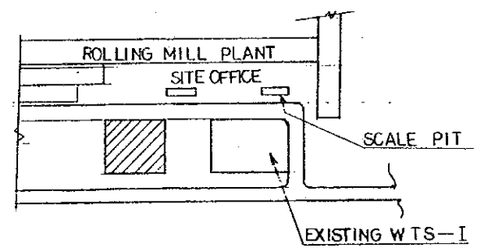
NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
UT-200	WATER TREATMENT STATION-II		
UT-210	Indirect Cooling Water System		
UT-211	Cooling tower	1	Type : Cross flow type Capacity : 4,600 m^3/h
UT-212	Heat Exchanger	1	Type : Plate type Capacity : 450 m^3/h
UT-213	Cold well	1	Capacity : 2,000 m^3 Material : Reinforced concrete
UT-214	Pumps	1 lot	
UT-215	Emergency tank	1	Capacity : 80 m^3 Material : Carbon steel
UT-216	Receiver tank	1	Capacity : 250 m^3 Material : Reinforced concrete
UT-220	Auxiliary System		
UT-221	Piping with accessories	1 lot	
	Instrumentation	1 lot	
	Electrical equipment	1 lot	
UT-300	OXYGEN SHOP		
UT-301	Nitrogen gas holder	1	Type : Cylindrical Capacity : 120 m^3
UT-400	YARD PIPING		
UT-401	Piping with accessories	1 lot	
UT-402	Racks and stanchions	1 lot	



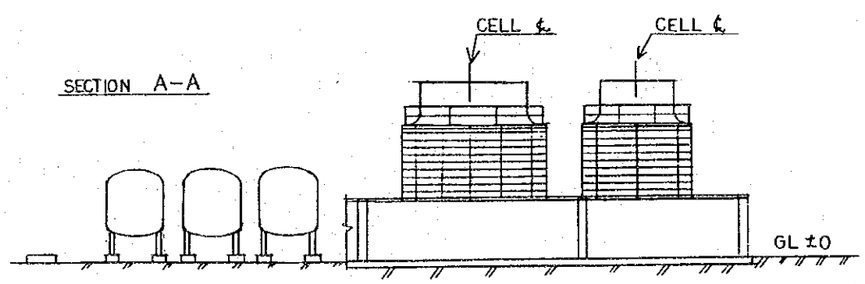
THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	UTILITY PLANT FLOWSHEET OF WATER TREATMENT SYSTEM
DWG NO. JICA-UT-005	
DATE	JUNE 19, 1987 SCALE



① COLD WELL FOR INDIRECT WATER
② COOLING TOWER FOR INDIRECT WATER
③ SEDIMENTATION BASIN
④ SEDIMENTATION TREATED WATER BASIN
⑤ COOLING TOWER FOR DIRECT WATER
⑥ COLD WELL FOR DIRECT WATER
⑦ PUMPS
⑧ PRESSURE FILTER
⑨ BACKWASH WATER BASIN
⑩ THICKNER
⑪ SLUDGE STORAGE BASIN
⑫ CHEMICAL HOUSE
⑬ SLUDGE REMOVER
⑭ EMERGENCY TANK
⑮ ELECTRIC ROOM

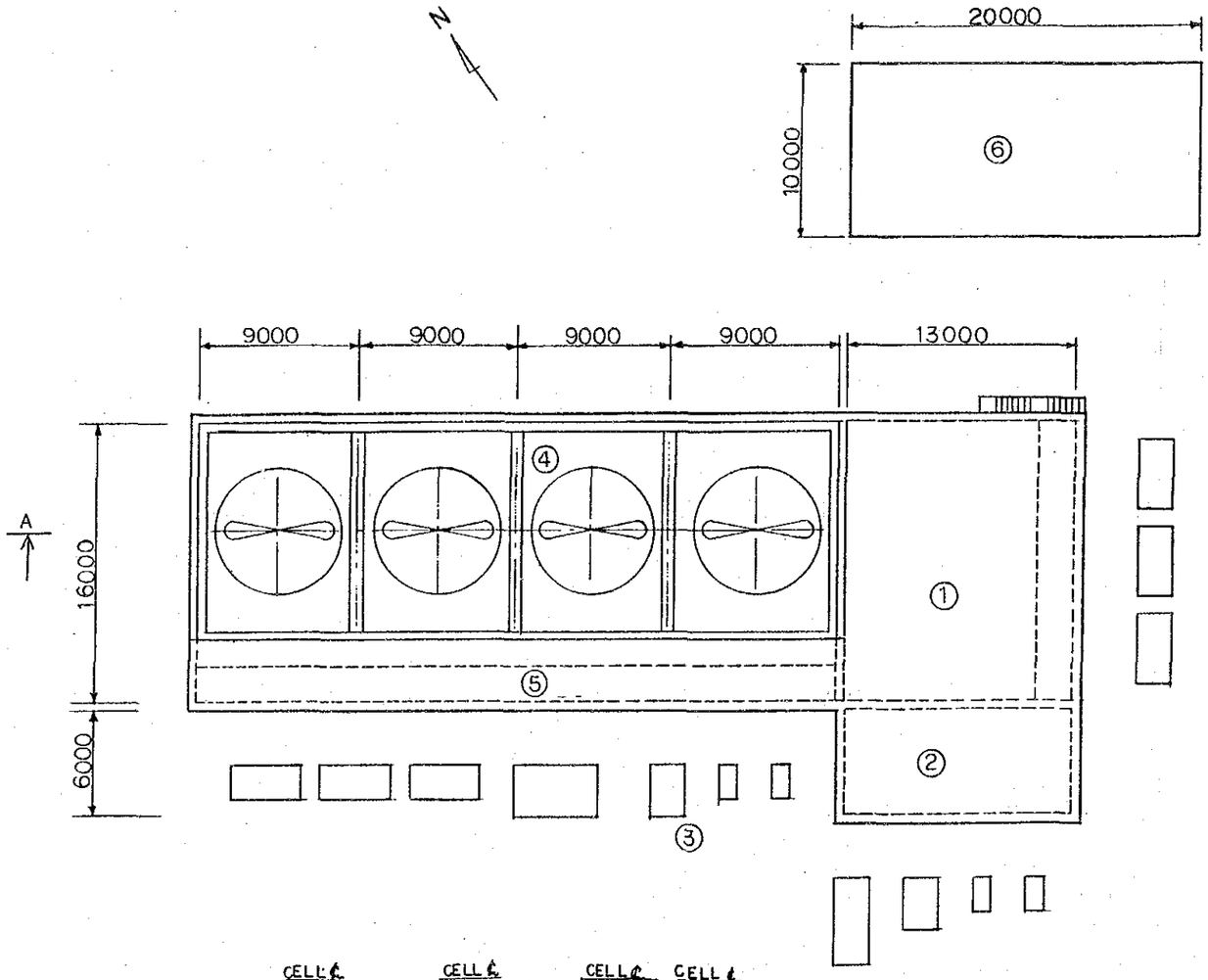


PLOT PLAN



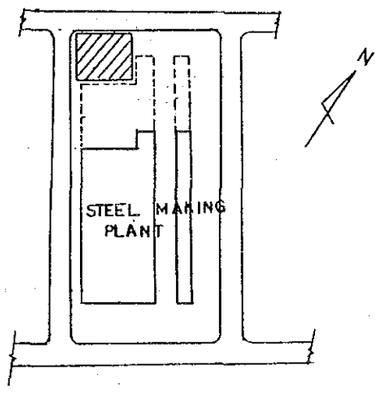
SECTION A–A

THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	UTILITY PLANT GENERAL LAYOUT OF WATER TREATMENT STATION — I
DWG NO. JICA-UT-006	
DATE JULY.8. 1987.	SCALE 1/250



SECTION A—A

① HOT WELL
② E.M.S. WELL
③ PUMPS
④ COOLING TOWER
⑤ COLD WELL
⑥ ELECTRIC ROOM



PLOT PLAN

THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	UTILITY PLANT GENERAL LAYOUT OF WATER TREATMENT STATION — II
DWG NO. JICA-UT-007	
DATE JULY, 8. 1987	SCALE 1/200

6-4-5 Power receiving and substation facilities

(1) Outline

This section covers expansion plan for the scope of substation facilities which refer to the following items.

Power Distribution
* 220 kv Receiving system
* 220 kv/33 kv Step-down transformers
  33 kv Distribution system
* 33 kv/6.6 kv Step-down transformers
  6.6 kv Distribution system
  Emergency power system

Communication system
Load lighting
Ancillary facilities

Out of expansion items of the works the following are taken up as major factors to determine expansion plan for the substation scope.

1) Construction of new DRI plant with the same production rate as No.1 DRI plant (650,000 t/y)
2) Construction of new SMP consisting of 2-70 ton EAFs (Electric Arc Furnace), 1-70 ton LF (ladle furnace) and 1-CCM (Continuous Casting Machine)
3) Addition of one strand in Rod Mill plant.
4) Construction of new Water Treatment Station I (WT-TRMNT 1) for SMP and Rod, and new Water Treatment Station II (WT-TRMNT II) for SMP.
5) Expansion of Warehouse and Product Dispaching Yard.

Most of the existing facilities in the substation scope have been designed, provided and installed in anticipation of their expansion relating to the abovementined plant expansions.

The substation items marked * above do not need any expansion, being capable of feeding additional loads.

Some minor expansion and modification, however, will be necessary for the rest of the substation items as

foreseen in the previous project.

(2) Distribution Scheme

1) Power Demand for Production

Table 6.4.5-1 indicates estimated power demand for each plant and works after the Expansion.

The power demand requires the present network of distribution to be expanded as shown in dotted line on single line diagram DWG-PW-002.

The expansion plan featurs:

- 6 new 33kv lines for new DRP, No.5 EAF, No.6 EAF, Ladle Furnace, SMP Auxiliary, and Rod Mill (One line per each load)
- Addition of 2 33kv feeders for 26 MVA flicker compensator bank (1 for Hi, impedance transformer, 1 for static condensor)
- DRI plant and Rolling mill (referring to the combination of Bar Mill and Rod Mill) will be equipped with an additional 33kv/6.6kv receiving transformer respectively. This third transformer is considered one for back-up purpose in case one of two 33kv/6.6kv working transformers gets out of order.
- 4 new 6.6kv lines for new WT-TRMNT I and new WT-TRMNT II (dual lines per station).

2) Emergency Power

Expansion results in increase of emergency loads as well as normal production loads. Estimate of additional emergency power is shown in Table 6.4.5-2. Total of required emergency power for the portion of expansion amounts to about 2000kw, which is equivalent to the unit output of the present emergency generators. Single line diagram DWG-PW-002 shows a third generator having the same capacity as the present generators will be employed to meet the load increase.

The new generator will be designed to connect to the same 6.6kv emergency bus for the present two generators

so that all three generators can work in paralell to achieve higher reliability in power supply operation.

(3) Design Basis

The design for the Expansioh should be done on the same design basis as that for the existing facilities in respect of standards, requirements, and arrangement of equipment. This idea is of importance to allow operators and maintenance men to handle both existing and new facilities in the same understanding.

Fandamental requirements include:

1) Power Distribution

- Receiving voltage conditions

i Receiving voltage: 220KV, 2 phase, 50Hz directly grounded

ii Fluctuation : 220KV ±10%
50Hz ±2% normally

iii Short circuit capacity of 220KV system
max. 15,000MVA (40KA at 220KV)
min. 4,000MVA (10KA at 220KV)

- Distribution design data

System Volt.	Phase/ wire	Grounding	*Short circuit capacity
AC 33KV	3/3	100A resistance	25KA at 36KV
AC 6.6KV	3/3	10A resistance	40KA at 7.2KV
AC 380V	3/3	direct grounded	----
AC 220V	3/4	direct grounded	----

* Each equipment to be capable of withstanding interrupting current for minimum one sec.

- Insulation level

System	BIL	Low frequency
AC 33KV	170KV	70KV (1 minute)
AC 6.6KV	60KV	20KV (1 minute)
Less than AC600V	---	2KV

- Ambient temperature
  40°C for indoor equipment (except diesel generator)
  45°C for outdoor equipment

- Circumstances

	Frequency
Sand storm	2.2 days/year
Cloud of dust	7.2 days/year
Salty wind from seashore	3 km distant from site most of all the year

2) Communication system
- Intra-works telephone
  Hand sets of a given type to be used
- Public address
  Speakers of a given type to be used
- Power telephone
  Subscriber stations of a given type to be used
- Fire alarm
  Modification of indication board
- Clock distribution
  Clock of a given type to be used

Note: Given type refers to that for the existing equipment

3) Load lighting
- Area to be illuminated
  Main load passing the area in the scope of works' expansion, and some part of perimeter loads of new plants.
- Lighting arrangement
  Lighting fixtures to be located at every 50m along one side of the load.

4) Ancillary facillities
- Scope
  Warehouse and product dispatching yard
- Power supply
  Lightings, power tools, cranes to be fed through 380V or 220V system.

5) Data logging system

This system will be introduced aimed at the following advantages in connection with fault and operation records of the distribution system and reports for energy and electricity balances.

1. To relieve operators of trouble of gathering readings on meters and other data.
2. To quickly obtain accurate data.

(4) Location and Cabling Plan

Spaces for the installation of new equipment and cabling route will be provided as follows.

- Feeding switchgear (see layout drawing DWG-PW-001)
  - 33KV Feeders for 33KV lines of DRI No.3, ROD No.2, No.2 SMP, No.5 EAF, No.6 EAF, Ladle Furnace, No.2 Hi Impedance Tr, and No.2 Static Condensor.
    Existing 33KV metal-clad switchgear panel will be extended over the future space.
  - 6.6KV Feeders for 6.6KV lines of new WT TRMNT-I 1 and 2, and new WT TRMNT-II 1 and 2.
    Existing 6.6KV metal-clad switchgear panel will be extended over the future space.
  - Emergency 6.6KV Feeders for 6.6KV lines of new SMP, new WT TRMNT-I and new WT TRMNT-II.
    Existing 6.6KV emergency switchgear panel will be extended in relation with expansion of the diesel generator room described below.
- Diesel engine room
  The present room including electrical room to be extended toward the south to house No.3 Diesel engine system.
- Flicker yard
  Future space next to the existing flicker yard to be used for the new flicker equipment

- Cabling route:

  • DRI No.3 33KV line

    to be burried through same route for the existing two lines.

  • ROD No.2 33KV line

    to run in parallel with ROD No.1 33KV line through the existing cable tunnel

  • No.2 SMP, No.5 EAF, No.6 EAF, and Ladle Furnace 33KV lines

    The existing cable tunnels under the existing SMP shop will be extended to new SMP shop for the new 33KV lines to reach their terminal rooms. Therefore these line will pass through existing cable tunnel up to the existing SMP from the substation then lead through new tunnels to their destnations.

  • New WT TRMNT-II 1 and 2 6.6KV lines and emergency line

    Net WT TRMNT-II station will be located in north vicinity of the new SMP. Therefore the new lines will come to the new SMP from the substation through the abovementioned 33KV cable tunnels. Then they will travel a burried route between the new SMP and the new WT TRMNT-I.

  • New WT TRMNT-I 1 and 2 6.6KV lines and emergency line

    New WT TRMNT-I will be situated about 100 meters west of the present WT TRMNT-I station. They will be taken through the same route for the existing cables for the existing station up to there. Then they will be passed through a burried route up to the new station.

(5) Equipment List

Table 6.4.5-3 shows the equipment required for the expansion in the substation scope in accordance with the above descriptions items (1) to (4).

Table 6.4.5-1 Electricity Balance after Expansion

Plant	Unit cons. KWH/T	Production x 10^3T/Y	Operating Hr H/Y	Average Power KW	Load Factor	Demand Power KW
DRI	110	1,432	7,680	20,500	0.9	22,800
Lime Calcining	60	50	7,920	400	0.9	440
SMP (EAF)	710	1,260	7,680	116,500	0.6	191,000
SMP (Aux)	40	1,260	7,680	6,600	0.9	7,330
Bar	87	455	7,220	5,500	0.7	7,860
Rod	144	695	7,220	13,900	0.7	19,860
Sani. WT TRTMNT	7	1,150	7,920	1,000	0.9	1,100
UT WT TRTMNT	38	1,150	8,760	5,000	0.95	5,300
Air Separation	10	1,150	7,200	1,600	0.9	1,800
Comp. Air	14	1,150	7,200	2,200	0.9	2,400
Maint. Shop	4	1,150	7,200	600	0.6	1,000
Others	20	1,150	7,200	3,200	0.8	4,000
Total				177,000		264,890

Given the diversity factor of total load to demand factor is 1.1, and works overall demand is

$$\frac{264,890\ KW}{1,1} = 240,000KW$$

Table 6.4.5-2 Emergency Load Increase

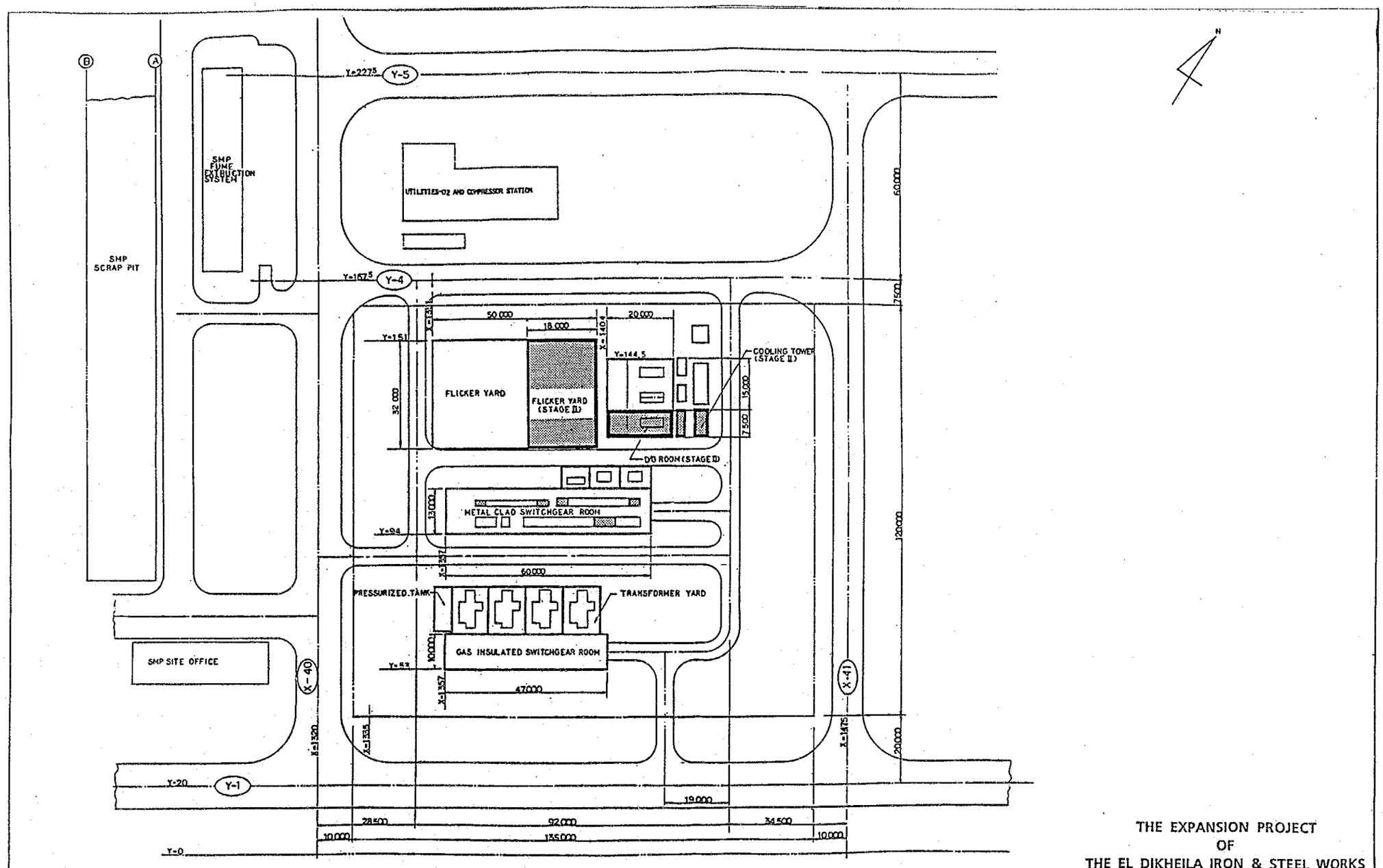
Plant	Max. motor KW	Other motor KW	Lighting, etc. KW	Total KW
Direct reduction	150	619	81	850
Steelmaking	110	303	110	523
Continuous casting	37	107.4	10	154.4
Water treatment	135	30	10	175
Rolling mill	110	124.4	10	244.4
Others	---	---	100	100
Total	542	1183.8	321	2046.8

Table 6.4.5-3 Equipment list of substation

EQUIPMENT LIST			PLANT: Substation (1)	
No.	EQUIPMENT	Q'ty	MAIN SPECIFICATION	REMARKS
1	33KV Equipment			
	Feeder Panel	8	Metal clad switchgear Indoor type CB-36KV, 1250A, 25KA (1 sec.) 8 Feeders: 33KV No.1 Bus: -DRP No.3; -ROD No.2 33KV No.2 Bus: -New SMP 33KV No.3 Bus: -No.2 Hi, Z, Tr; -No.2 SC; -No.5 EAF; -No.6 EAF; -Ladle Furnace	
2	6.6KV Equipment			
	Feeder Panel	4	Metal clad switchgear Indoor type CB-7.2KV, 1250A, 40KV 4 Feeders: 6.6KV No.1 Bus: -New Water treatment I-1; -New Water treatment II-1 6.6KV No.2 Bus: -New Water treatment I-2; -New Water treatment II-2	

EQUIPMENT LIST		PLANT: Substation (1)		
No.	EQUIPMENT	Qt'y	MAIN SPECIFICATION	REMARKS
3	Diesel Generator Set			
	Diesel Engine	1	V-type, trunk piston type Output: 2870 Ps 1000 rpm	
	Generator	1	6.6KV 2500KVA	
	Auxiliary transformer	1	Oil immersed outdoor type 150KVA 3 phase 50Hz 6.6KV/0.4KV	
	Control panel	1	Self standing indoor use control and supervision	
	Distribution Panel	1	Self-standing indoor use 6.6KV switchgear Main receiving CB x 1 Feeding CB x 3	
	Starter	1	Compressed air type	
	Cooling system	1	Water cooled type	
	Fuel system	1	Fuel supply system including oil tank	
	Accessory	1	Necessary accessory for operation and maintenance.	
4	Cable & Materials			
	Power Cable	1	33KV, 6.6KV, 400V Including: Cable head material and supporting material	

EQUIPMENT LIST		PLANT: Substation (1)		
No.	EQUIPMENT	Qt'y	MAIN SPECIFICATION	REMARKS
	Control Cable	1		
	Grounding Wire and Material	1		
	Steel and Other Material	1		
5	Communication Systems			
	Intra-works Telephone	1	Addition of terminal stations	less than 10% to 15%
	Public Address	1	- do -	- do -
	Power Telephone	1	- do -	- do -
	Fire Alarm	1	- do -	- do -
	Clock Distribution	1 Addition		
6	Load Lighting			
	Lighting apparatus and wiring	1	For part of expansion	
7	Axcillary Facilities			
	Electrical Equipment for Warehouse II	1	Including: Distribution, lighting, crane power feeding and fire alarm system.	
8	Spare Parts	1	Covering items 1 to 6 above.	

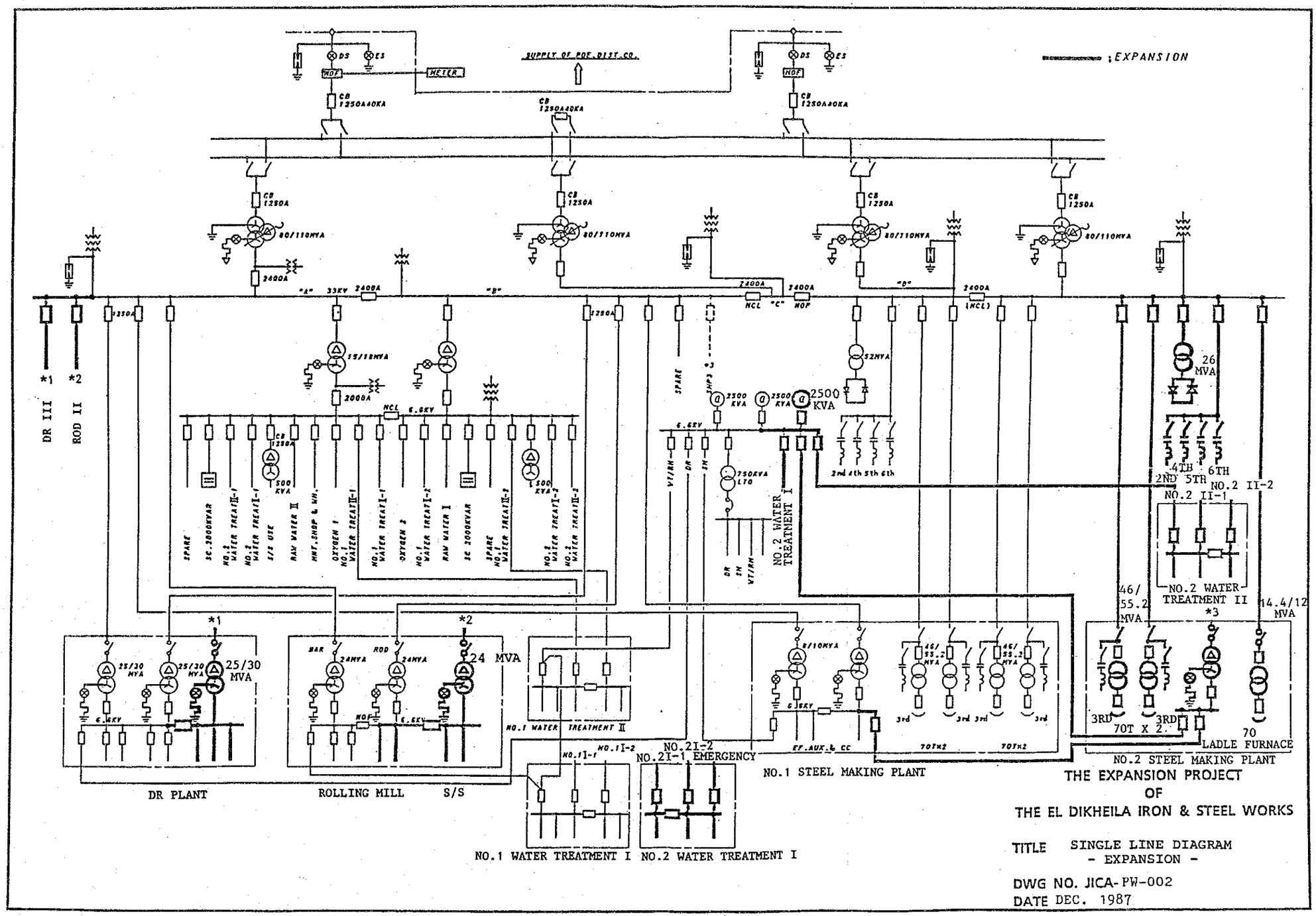


NOTE: ▒▒ STAGE II

THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL WORKS

TITLE LAYOUT OF SUBSTATION

DWG NO. JICA-PW-001
DATE DEC. 1987 SCALE N.A.


; EXPANSION
SUPPLY OF PDE. DIST. CO.
METER
DS
ES
MOF
CB 1250A40KA
CB 1250A
80/110MVA
2400A
"A" 33KV 2400A
"B"
"C"
"D"
NCL
(NCL)
1250A
*1
*2
DR III
ROD II
15/18MVA
2000A
6.6KV
SPARE
SC. 3800KVAR
NO.1 WATER TREATMENT-I
NO.2 WATER TREATMENT-I
ELE USE
RAW WATER II
HMT.SHOP & WH.
OXYGEN 1
NO.1 WATER TREATMENT-II
SC 2000KVAR
RAW WATER I
OXYGEN 2
NO.2 WATER TREATMENT-II
1500 KVA
SPARE
2500 KVA
52MVA
2nd 4th 5th 6th
750KVA LTO
VT/RH
DR
IN
NO.2 WATER TREATMENT I
26 MVA
4TH 6TH
2ND 5TH
NO.2 II-2
NO.2 II-1
NO.2 WATER TREATMENT II
*3
46/55.2 MVA
14.4/12 MVA
3RD
70T X 2
70
LADLE FURNACE
NO.2 STEEL MAKING PLANT
25/30 MVA
DR PLANT
BAR
ROD
24MVA
24 MVA
ROLLING MILL S/S
NO.1 WATER TREATMENT II
8/10MVA
6.6KV
EF.AUX.& CC
70TH2
NO.1 STEEL MAKING PLANT
NO.1-1
NO.1-2
NO.2-1
NO.2-2
EMERGENCY
NO.1 WATER TREATMENT I
NO.2 WATER TREATMENT I
THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL WORKS
TITLE SINGLE LINE DIAGRAM
- EXPANSION -
DWG NO. JICA-PW-002
DATE DEC. 1987

6-4-6. Maintenance facilities

(1) Facilities

In Chapter 5, facilities of maintenance plants of EL DIKHEILA Works and its maintenance system were discussed, and by utilizing those facilities and system in full, maintenance work required after the expansion can be performed. Therefore the expansion project will not include expansion of any particular facilities for maintenance.

(2) Personnel plan

The expansion project under study consists mainly of new construction of one DR plant, two EAFs and one CCM in SMP and one strand for Rod mill in RMP and utility plants required in relation with those new facilities. Increase of maintenance personnel was planned by taking those plans into consideration as shown in Table 6.4.6-1.

Table 6.4.6-1 Required personnel after expansion

Section/Branch Work Group	After expansion				
	ASM	E	F	AF	W
Coordination					
Planning	2	7	-	1	3
Mechanical					
DRP	1	2	2	8	24
SMP	1	2	2	6	33
RMP	1	2	2	5	17
Repair	2	6	4	15	106
Electrical					
DRP	1	3	2	7	26
SMP	1	3	2	7	35
RMP	1	4	2	7	30
PW	1	2	1	4	17
Instrum.	1	5	2	5	16
Repair	1	4	3	7	43

6-4-7. In-plant transportation facilities

(1) Outline

1) Basic concept of the expansion project

a) Scope of in-plant transport jobs

Materials to be handled and transported within the Works vary greatly in kinds as well as in shape and volume. With so many kinds of materials and fluctuation in volume, it is necessary to have some surplus capacity in the in-plant transport facilities. After the expansion, production of bars and rods will increase to about 1,120,000 T/Y, and after review of base consumption units and yields of various materials in the present operation condition, a new material distribution and flow plan was prepared. Based on this plan, facilities and vehicles required for operation after the expansion were studied to cover any possible shortage in capacity of existing facilities.

b) Volume of materials to be handled

Volume of main materials as raw materials, auxiliary raw materials, materials, finished products, semi-finished products and wastes to be handled in in-plant transport calculated according to the material flow for expansion is shown in Table 6.4.7-1.
For calculation of the volume of materials, base consumption units after their review were used. Therefore the volume of some of the materials showed decrease as compared those in the 1st stage though production increases after the expansion. "Rate" in the Table shows the ratio of the volume after the expansion to the volume in the 1st stage which had been used in deciding the number of existing transport equipment.

Table 6.4.7-1 Materials to be Handled and Transported

Materials	1st Phase (t/y)	After Expansion (t/y)	Rate (t/y)	Remarks
1. Purchased scrap	165,400	105,200	0.64	SMP
2. Fluorspar	1,680	2,520	1.50	"
3. Fe-Mn	8,910	17,640	1.98	"
4. Fe-Si	4,370	6,050	1.34	"
5. Coke breeze	3,360	1,650	0.49	"
6. Al	360	130	0.36	"
7. Furnace brick	3,450	3,150	0.91	"
8. Ladle brick	5,380	3,780	0.70	"
9. Tundish brick	3,990	3,690	0.93	"
10. Gunning material	12,020	31,500	2.62	"
11. Electrode	5,040	5,040	1.0	"
12. Hot Slag	161,040	252,000	1.57	"
13. Furnace waste brick	2,270	4,030	0.68	"
14. Ladle waste brick	2,690			
15. Dust (EAF)	12,610	15,120	1.19	"
16. Dust (Conveyor)	120			
17. Scrap (CC)	33,600	14,170	0.42	"
18. Tundish waste brick	2,000	1,850	0.93	"
19. Tundish slag	3,900	Including Hot slag	---	"
20. Scale (CC)	4,200	2,460	0.57	"
21. Scrap	14,430	6,030	0.42	"
22. Cold slag	146,610	245,970	1.68	"
23. Oxide fines	42,400	64,400	1.52	DR
24. Sludge cake	39,600	24,100	0.61	"
25. Classifier sludge	7,500	4,600	0.61	"
26. Sulfur	100	---	---	"
27. Briquette	28,000	76,800	2.75	"
28. Chunk size DRI	---	---	---	
29. Semi-product	Ocasionally	Ocasionally	---	"
30. DRI fines and dust	---	---	---	
31. Limestone fines	10,700	13,600	1.27	L/C
32. Un-burnt lime	Ocasionally	Ocasionally	---	"

Materials	1st Phase (t/y)	After Expansion (t/y)	Rate (t/y)	Remarks
33. Burnt lime fines	660	1,000	1.52	LC
34. Limestone	109,050	99,800	0.92	"
35. Sludge	1,825m³	240	0.13	UT
36. Sludge cake	3,650m³	4,560	1.25	"
37. Separated oil	240m³	300	1.25	"
38. Sludge	730m³	730	1.00	"
39. Sample scrap (SMP)	32	50	1.70	AI
40. Sample scrap (RMP)	24	40	1.67	"
41. D.R.I.	20	40	2.00	"
42. CaO	20	20	1.00	"
43. Product (Bar)	297,500	302,050	1.02	R.M.
44. Product (Rod)	224,000	485,000	2.17	"
45. Scrap (Bar)	23,100	22,000	0.61	"
46. Scrap (Rod)	13,470			
47. Scale (Bar)	5,020	6,700	1.34	"
48. Scale (Rod)	3,660	10,700	2.0	"
49. Scale (Bar before RF)	990			"
50. Scale (Rod before RF)	800			
51. Turning chips	10	15	1.50	"
52. Scrap	10	15	1.5	"
53. D.R.I. (Sale)	---	105,700		S.M.P.
54. Billet (Sale)	---	67,100		R.M.

Table 6.4.7-2 List of transport equipment

Equipment	Typical Specification	Q'ty			Remarks
		1st	2nd	Total	
Forklift	5.5 ton	-	5	5	Swing ram type or 6.0 ton
	3.5 ton	3	-	3	Products Storage Yard (Rod)
	3.5 ton	2	-	2	Raw materials
	2.5 ton	2	-	2	Warehouse (brick)
	2.5 ton	-	2	2	New warehouse
	1.5 ton	2	-	2	Container, Tools Parts
Wheel loader	1.5 m^3	7	2	9	Raw materials, wastes etc.
	0.3 m^3	1	-	1	Raw materials
Crawler shovel	2.5 m^3	5	-	5	Slag yard
Power breaker	1.2 m^3 class	2	1	3	Slag yard
Buldozer	16 ton	2	-	2	Disposal area
Slag Dump	45 ton	5	1	6	Hot slag
Dump truck	14 ton	11	-	11	Scrap
	14 ton	12	4	16	Slag
	14 ton	5	-	5	Silty wastes
	14 ton	4	2	6	Scale, Oxide
	5 ton	1	-	1	
Dump truck with crane	5 m^3 & 10 ton	1	-	1	
Flat deck truck	15 ton	7	1	7	Raw materials Bricks
	3.5 ton with crane	1	-	1	
Semi trailer	35 ton	5	3	8	Products
	35 ton	1	-	1	Car repair shop
Tractor	16 ton	5	3	8	Products
	16 ton	1	-	1	Car repair shop

Equipment	Typical Specification	Q'ty			Remarks
		1st	2nd	Total	
Truck crane	20 ton	1	-	1	Maintenance
	100 ton	-	1	1	Maintenance
	35 ton	11	4	15	Products
Crawler crane with lifting magnet	35 ton	5	-	5	Scrap
Vacuum dumper	5 ton	1	-	1	Silty wastes
Fire truck		1	-	1	
Water sprinkling car	15 ton tank	1	-	1	
Tank lorry	4 ton	1	-	1	Refueling
Ambulance		1	-	1	
Double-cab truck	6 persons	5	-	5	
Minibus	20 persons	2	-	2	
Road cleaner		-	1	1	

(2) Expansion plan

Considering the material flow after the expansion and the capacity of existing facilities, expansion of facilities was planned as given below.

a) Transport vehicles and construction equipment
The number of existing equipment and that of additional equipment required in the expansion are shown in Table 6.4.7-2.

b) Scrap yard
The existing facilities are adequate and not to be increased.

c) Indoor warehouse
A warehouse with space of 5,000 m^2 is to be built in line with increase of various material. The new warehouse will be equipped with a 10-T overhead travelling crane to improve yard efficiency. With respect to its operation, most efficient use of the warehouse including the existing one should be studied.
Although auxiliary raw materials will increase by about 9,000 tons, the existing warehouse for additive has adequate capacity.

d) Product yard
In line with increase of production, about 10,000 m^2 of outdoor product yard (Capacity about 13,000 tons) is to be constructed on the south side of Bar mill plant.

e) Slag yard
As increased quantity of slag is generated, a slag yard having the capacity same as the existing one is to be provided.

f) Truck weighing station
The existing equipment (50-T x 2, 50-T/100-T x 2) are adequate and no increase is planned.

g) Vehicle repair shop

In anticipation of the increase in the number of vehicles and also the fact that repair of existing vehicles will be more frequent as they get old, a new vehicle repair shop is to be constructed. The scale and contents of the shop is to be same as that of the existing one.

The equipment list is shown in Table 6.4.7-3.

Table 6.4.7-3 *Equipment list of vehicle repair shop*

Description	Number
Vehicle service	One complete unit
Engine service	-"-
Electric & battery service	-"-
Machine service	-"-
Lubricant service	-"-
Body and frame service	-"-
Painting service	-"-
Tire service	-"-
Crane (5 ton)	One unit
Other tools	One complete unit

(3) Personnel plan for in-plant transport

Personnel plan for in-plant transport work after the expansion is shown in Table 6.4.7-4.

Table 6.4.7-4 Personnel plan for in-plant transportation

Section/Branch Work Group	After expansion					
	SM	ASM	E	E	AF	W
Raw Materials	1	1	3	1	2	7
Machine & Supplies	1	1	2	1	2	10
Transportation	1					
Delivery		1	3	3	4	42
Collection		1	3	2	5	75
Products Shipping	1	2	4	5	15	119

6-4-8. Analysis and inspection facilities

As a backup for production facilities such as DR plant, SMP, RMP (Bar mill & Rod mill) and others, there are analysis and inspection facilities which perform analysis as shown in Table 6.4.8-1.

As various production facilities are expanded and production increases, frequency of analysis will increase so much that the existing analysis facilities cannot cope with the situation. It is considered necessary to add one each of carbon and sulphur determinator and optical emission spectrometer and one complete unit each of tools for preparation of samples.

One existing line of sample transportation system for transporting samples from SMP will be insufficient and one more system will be required.

At present, various titrations are performed by manual analysis and after the expansion, capacity of volumetric analysis by titration will be inadequate, and installation of automatic titrator is considered necessary.

The existing 100-ton compression tester is to be remodeled so that it can be used as a tension tester and used as a backup of existing 100-ton and 30-ton compression and tension testers.

In line with increased frequency of analyses, it is considered necessary to permit automatic feedback data communication between host computer at SMP and FEP at A&I Dept.

Equipment required for expansion and those remodelled are shown in Table 6.4.8-1.

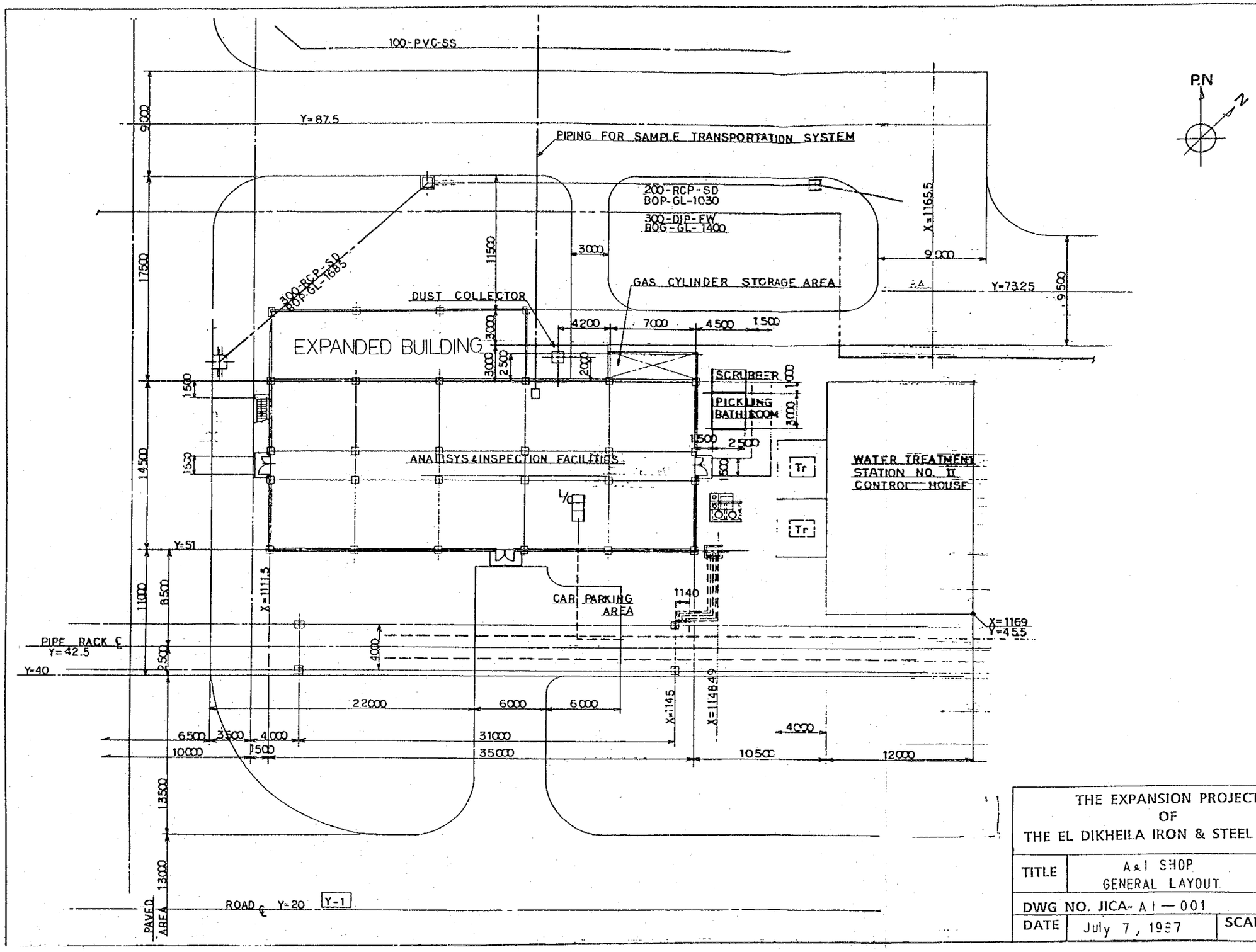
As a building for the above equipment for expansion, one-story concrete-block building (about 21 m x 6 m) is to be built on the north side of existing building as shown in DWG-JICA-A1-001.

Table 6.4.8-1 Equipment list for expansion

No.	Equipment	Q'ty	Specification
1	Optical Emission Spectrometer	1	Type : Vacuum Spectrometer Type Analytical elements : Si, Mn, P, Cu, Ni, Cr, Mo, Al, Ti, Ca, Fe, V, Sn, C, S, As, Pb, Sb Elements Analyzed Simultaneously : Up to 30 elements
2	Carbon and Sulphur Determinator	1	Type : Infrared Detection Type Accuracy : Standard Deviation ( ) Carbon : ±0.002 (>0.1%)/±0.0002% (<0.1%) Sulphur : ±0.001 (>0.01%)/±0.0003% (<0.01%) Co-efficient of Variation (CV) Carbon : ±1% Sulphur : ±3% (>0.01%) Actual Analysis Time : ≒ 30 sec.
3	Sample Transportation System	1	Type : One way reversible, plant air, reversible carrier type Sample size : 35/30 mm dia. x 70 mm No. of station : 1 - Laboratory 1 - EF Station 1 - CC Station

No.	Equipment	Q'ty	Specification
4	Automatic Titrator	1	Control and calculation : Microprocessor controlled titration, end point detection and concentration calculation Detection range : Potential difference : -2000 ∿ +2000 mV pH : 0 ∿ 14.00 pH Temp.: 0 ∿ 50°C Titration form : Full titration Auto-titration - stop at endpoint Titration stop at set-up potential Stat titration Buret : Auto-piston buret Auto-delivery / suction buret position Backlash elimination device Volume : 20 ml. Display : 0.000 ∿ 20.000 ml. Accuracy: ±0.002 ml. Reproducibility : ±0.01 ml. Discharging speed : 1.3 ∿ 200 sec./ml.
5	Abrasive Cut-off Machine	1	Type : Wet cutting type Cutting capacity : 75 mm dia. in steel rod Wheel diameter : 405 mm Wheel speed : 2,000 rpm

No.	Equipment	Q'ty	Specification
6	Vertical Drilling Machine	1	Drilling capacity : 19 mm in steel Vertical travel of spindle : 125 mm Table size : 280 x 280 mm Spindle speed : 250 - 1550 rpm Distance of Column to Spindle Axis : 205 mm
7	Double Head Pedestal Belt Grinding Machine	1	Type : Double head, endless belt, dry type Belt size : 915 mm x 100 mm width Belt speed : 520 m/min.
8	100T, Universal Testing Machine	1 lot	The existing AI1130 compression testing machine is modified to the 100T universal testing machine. Kind of tests : Tensile, compression, Transverse and bending test Capacity : Max. : 100 ton.f Auxiliary : 50, 20, 10, 5, 2 ton.f Display digits : 4 digits
9	Analytical Data Feedback System	1 lot	The existing AI5100 Analytical data feedback system is modified. 1. to receive the answerback of the SMP's computer. 2. to enable the system to treat the data of additional analyzers.
10	Power Receiving and Distribution Panel and Wiring Materials	1 lot	Indoor, metal closed type 380 V, 3 ϕ, 50 Hz.



THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	A & I SHOP GENERAL LAYOUT
DWG NO.	JICA-AI—001
DATE	July 7, 1987
SCALE	

6-4-9. Civil engineering and building work

List of civil engineering structure (foundation work, floor pavement, roads and sewerage) and buildings required in relation with construction and expansion of production facilities and ancillary facilities is shown in Table 6.4.9-1

Table 6.4.9-2 shows volume of major works of civil engineering and building work.

Table 6.4.9-1 building and foundation list

Building List for DIRECT REDUCTION PLANT

Name of the Building	No. of Building	No. of floors	1st Floor Level GL+(M)	Building Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Structure	Roofing	Siding	S/S (T)
- Hydraulic unit building	1	1	0.4	6.5	6.3x8.4	61	61	S	MS	MS	12.1
- Product screen building	1	1	2.5	15.5	12x12.5	150	162	S	MS	MS+RC	48.3
- Oxide. storage bin Building.	1	4	18.5	29.5	16x8	128	172	S+RC	MS	MS+RC	50
- Main control building	1	2	0.4	10.7	26x30+7.5x19 +6x14	1,007	1,607	RC+S	MS+RCS	MB	11.5
- Chemical dosing station building	1	2	0.4	6.7	10x5	50	100	RC	RCS	MB	0.6
- Dehydrator building	1	2	0.4	12.05	9x13	117	234	RC	RCS	MB	1.1
Total	6					1,513	2,336				

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Foundation List for DIRECT REDUCTION PLANT

Item	Description		Concrete Volume
Foundation for buildings	· Oxide storage building	128 m^2	1,415 m^3
	· Main control building	1,007 m^2	1,374 m^3
	· Chemical dosing station building	50 m^2	79 m^3
	· Dehydrator building	117 m^2	307 m^3
Foundation for machinery and equipment	· Semi product pile area		149 m^3
	· Hydraulic unit		32 m^3
	· Furnace	6.8 mϕ x 65 mH	740 m^3
	· Compressor area	481 m^2	866 m^3
	· Reformer 46m x 15m x 9m		842 m^3
	· Stack area		707 m^3
	· Briquetting system	17 T/HR	564 m^3
	· Product screen (3mm, 6mm)	270 T/HR	448 m^3
	· Product dust cyclone & collection		582 m^3
	· Product storage bin 2 sets 7200 T/each		5,666 m^3
	· Emergency discharge		166 m^3
	· Binder storage		34 m^3
	· Clarifier	4,400 m^3	1,371 m^3
	· Thickner		14 m^3
	· Cooling tower with pump foundation	2,700 m^3/H	715 m^3
Culverts and pits	· Cable Culvert 2.20 x 2.20	36 m	133 m^3
	· Cable pit 0.80 x 0.50	528 m	373 m^3

Item	Description		Concrete Volume
Floor Slabs	· Ground floor slab	1,340 m²	268 m³
	· Others		2,330 m³
Other Civil Work	- Road and paving		
	· Bituminous base course (5.0cm thick)	1,490 m²	
	· Asphalt curbs	53 m	
	- Pipe installation		
	· Sanitary sewage pipe P.V.C. ϕ150 mm	239 m	

Building List for STEEL MAKING PLANT (1)

Name of the Building	No. of Building	No. of floors	1st Floor Level GL+(M)	Building Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Structure	Roofing	Siding	S/S (T)
- Covered scrap Aisle	1	1	0.4	14.9	100.0x20.0	2,000.0	2,000.0	S	MS	MS	
- Main building	1										2850T
· Sponge iron storage Aisle	1	1	0.4	22.4	33.94x9.4	319.0	319.0	S	MS	MS	
· Furnace Aisle	1	2	0.4	26.7	120.0x24.0	2,880.0	4,320.0	S	MS	MS	
· Ladle Aisle	1	1	0.4	31.5	140.0x20.0	2,800.0	2,800.0	S	MS	MS	
· Casting Aisle	1	1	0.4	25.5	80.0x30.0	2,300.0	2,400.0	S	MS	MS	
· Billet Aisle	1	1	0.4	15.1	80.0x30.0	2,400.0	2,400.0	S	MS	MS	
Total	2					12,799.0	14,239.0				

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Building List for STEEL MAKING PLANT (2)

Name of the Building	No. of Building	No. of floors	1st Floor Level GL+(M)	Building Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Structure	Roofing	Siding	S/S (T)
- Ancillary buildings											
- EAF Electric Room	2	3	0.5	17.7	17.21x15.92	548	1,499	S	MS	RC	231
- RMP load center	1	2	1.9	11.2	16.32x11.62	190	379	S	MS	RC	59
- Lavatory	1	1	0.4	3.2	3.18x2.68	9	9	S	MS	MS	
- Scrap control room	1	1	1.4	5.05	4.22x5.22	22	22	S	MS	MS	3
- Ladle relining operator room	1	1	0.8	4.3	4.42x5.42	24	24	S	MS	MS	3
- Tundish relining operator room	1	1	0.43	3.93	5.42x4.42	24	24	S	MS	MS	3
- CCM Billet control room	1	1	1.4	4.9	5.42x6.42	35	35	S	MS	MS	11
- Lavatory (indoor)	1	1	10.15	---	2.0x0.75	1.5	1.5	S	MS	MS	
- Ladle furnace electric room	1	1	0.5	4.0	9.5x12.5	119	119	S	MS	MS	25
- Ladle furnace control room	1	1	0.5	4.0	7.5x6	45	45.0	S	MS	MS	5

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Building List for STEEL MAKING PLANT (3)

Name of the Building	No. of Building	No. of floors	1st Floor Level GL+(M)	Building Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Structure	Roofing	Siding	S/S (T)
- Slag transfer operator room	1	1	1.4	5.05	4.22x5.22	22	22	RC	RCS	RC	
- Fuel storage house	1	1	0.4	4.25	4.22x55.22	22	22	RC	MS	RC	
- Mould repairing operator room	1	1	0.43	3.93	4.42x5.42	24	24	S	MS	MS	3
- Fume Extraction electric room	1	1	0.4	4.4	6.61x5.27	35	35	RC	RCS	RC	
- Billet handling control room	1	1	1.4	4.9	5.42x6.42	35	35	S	MS	MS	4
- CCM Control room	1	1	8.56	12.18	8.42x4.42	37.5	37.5	S	MS	MS	5
Sub-total	17					1,193.0	2,283.0				

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Building List for STEEL MAKING PLANT (4)

Name of the Building	No. of Building	No. of floors	1st Floor Level GL+(M)	Building Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Structure	Roofing	Siding	S/S (T)
- Ladle valve operator room	1	1	0.5	5.2	4.4x5.1	22.5	22.5	S	MS	MS	
- CC. Electric room	1	1	0.4	5.2	27.95x11.8	330	330	S	MS	MS	
- CC. Electric room	1	1	0.4	5.2	14.4x11.8	170	170	S	MS	MS	
- CC.M. hydraulic room	1	1	0.4	5.2	11.8x9.3+10.68 x2.1	132	132	S	MS	MS	
- Storage room	1	1	0.4	5.2	11.8x7.1	84	84	S	MS	MS	
Sub-total	5					738.5	738.5				
Total	22					15,923.5	17,260.5				

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Foundation List for STEEL MAKING PLANT (1)

Item	Description		Concrete Volume
Foundation for buildings	· Spread foundation	53 sets	2,282 m³
	· Charging platform	350 m²	357 m³
	· Operation floor	800 m²	120 m³
Foundation for machinery and equipment	· Electric Arc Furnace 70t	2 sets	1,530 m³
	· Continuous Casting Machine 2.3m/min	1 set	2,935 m³
	· Conveyor pit	2 sets	204 m³
	· DRI/LIME Bunker (150m³x2, 100m³x2, 6m³x2)		318 m³
	· Scrap handling Facilities		
	· Scrap pit		455 m³
	· Scrap Bucket Transfer Car 50T	1 set	220 m³
	· Ladle Transfer Car 130T	2 sets	350 m³
	· Billet Transfer Car 70T	1 set	165 m³
	· Ladle Relining Area	200 m²	56 m³
	· Tundish Relining Area	450 m²	38 m³
	· Mould Repairing Area	900 m²	67 m³
	· Fume Extraction	7,300 Nm³/HR	235 m³
	· EAF Electrical Control Room	274 m² 2 sets	2,456 m³
	· CCM Electrical Control Room	170 m²	137 m³
	· CCM Hydraulic Room	133 m² 1 set	243 m³
	· CCM Storage Room	84 m²	48 m³
	· Load Center	190 m²	890 m³

Item	Description		Concrete Volume
	· Belt Conveyor	4 sets	41 m^3
	· Ladle Furnace	1 set	255 m^3
Culverts	· Piping Tunnel	247 m	1,708 m^3
	· Cable Culvert	305 m	
Floors slabs	· Ground Floor Slab	407 m^2	736 m^3
Other Civil Work	- Roads and Paving		
	· Bituminous base course (5.0 cm thick)	7,248 m^2	
	· Crushed stone paving	6,724 m^2	
	· Asphalt curbs	908 m^2	
	- Pipe Installation		
	· Sanitary sewage pipe P.V.C. ϕ150mm	39 m	

Building List for ROLLING MILL PLANTS (1)

Name of the Building	No. of Building	No. of floors	1st Floor Level GL+(M)	Building Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Structure	Roofing	Siding	S/S (T)
- Main Building	1										
· Billet storage yard		1	0.4	19.2	40 x 84	0	3,360.0	S	MS	MS	1,391 (ROD 2F 214)
· Coil storage yard		1	0.4	18.8	160 x 28	4,480.0	4,480.0	S	MS	MS	
Total	1					4,480.0	7,840.0				

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Foundation List for ROD MILL PLANT (1)

Item	Description			Concrete Volume
Foundation for buildings	Main building		30 sets	1,070 m³
	Intermediate column		18 sets	69 m³
	2nd floor		480 m²	213 m³
Foundation for machinery and equipment	- Billet Yard			
	Billet storage yard	33,000T (Common use of Bar Mill Plant)		769 m³
	Billet transfer car	70T	1 set	254 m³
	- Mill Yard			
	Interdediate Mill (2)		4 stands	628 m³
	Finishing Mill		10 stands	909 m³
	- Finishing Facilities			
	Water cooling zone		38 m	300 m³
	Laying head			111 m³
	Stelmor		98 m	564 m³
	Reforming tub & coil loading station			819 m³
	Coil compacting station		3 sets	185 m³
Colverts and pits	Cable culvert	2.0 x 2.5	100 m	537 m³
	Piping pit	1.0 x 1.2	30 m	18 m³
Floor Slabs	Ground Floors slabs		3,360 m²	672 m³
	Others			195 m³

Foundation List for ROD MILL PLANT (2)

Item	Description			Concrete Volume
Other Civil Work	- Roads and paving			
	· Bituminous base course (5.0cm thick)	3,726 m²		
	· Bituminous surface course (3.5cm thick)	605 m²		
	· Crushed stone paving	1,608 m²		
	· Asphalt curbs	617 m		
	- Pipe installation			
	· Drainage pipes concrete pipe	ϕ 200 mm	367 m	
		ϕ 300 mm	70 m	
		ϕ 400 mm	149 m	
	· Drainage pipes steel pipe	ϕ 200 mm	35 m	
		ϕ 300 mm	49 m	
	· Sanitary sewage pipe	ϕ 50 mm	30 m	
	Steel pipe	ϕ 100 mm	152 m	
	P.V.C.	ϕ 150 mm	305 m	

Building List for SUBSTATION

Name of the Building	No. of Build-ing	No. of floors	1st Floor Level GL+(M)	Build-ing Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Struc-ture	Roof-ing	Siding	S/S (T)
- D/G Building	1	1	0.4	8.15	7.6x20.15	153	153	RC & S	RCS	MB	

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Foundation List for SUBSTATION

Item	Description		Concrete Volume
Foundation for building	Diesel Generators	153 m^2	320 m^3
	Flicker Yard	576 m^2	192 m^3
Other Civil Work	Road and Paving		
	Bituminous base course (5.0cm thick)	100 m^2	
	Pipe installation		
	Casing pipes for cable P.V.C. ϕ150 mm	100 m	

Building List for UTILITIES

Name of the Building	No. of Build-ing	No. of floors	1st Floor Level GL+(M)	Build-ing Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Struc-ture	Roof-ing	Siding	S/S (T)
- W.T.S.I.E.E.R	1	1	0.4	4.4	8 x 25	200	200	RC	RCS	RC	
- W.T.S.I. Dehydrator building	1	1	0.4	11.8	7 x 10	70	70	RC+S	MS+	RC+MS	3T
- W.T.S.II.E.E.R.	1	1	0.4	4.4	10 x 20	200	200	RC	RCS	RC	
Total	3					470	470				

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Foundation List for UTILITIES (1)

Item	Description		Concrete Volume
Foundation for buildings	· Water treatment station No.1		
	· Electrical equipment room	200 m²	238 m³
	· Dehydrator building	70 m²	60 m³
	· Water treatment station No.2		
	· Electrical equipment room	200 m²	180 m³
	· Water treatment station No.1 50 x 23 x 4.5		3,098 m³
	· Water treatment station No.2 50 x 16 x 4.2 + 8 x 13 x 4.2		1,141 m³
	· Head tank	286 m³	716 m³
	· Sewage pumping station	1 set	50 m³
	· Yard piping	52 sets	762 m³
	· Others		50 m³
Other Civil Work	Roads and Paving		
	· Bituminous base course (5.0cm thick)	2,269 m²	
	· Asphalt curbs	683 m	
	Pipe installation	736 m	

Building List for TRANSPORTATION FACILITIES

Name of the Building	No. of Building	No. of floors	1st Floor Level GL+(M)	Building Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Structure	Roofing	Siding	S/S (T)
- Warehouse	2	1	0.4	11.9	25x100	5,000.0	5,000.0	S	MS	MS	
- Car repair shop											
· Car repair shop	1	2	0.4	10.4	37.06x28.545	1,058.0	1,300.0	S	MS	MS	
· Tire hut	1	1	0.2	4.00	4x15			S	MS	MS	
· Oil storage	1	1	0.4	3.9	4.315x6.315	27	27	S	MS	MB	
Total	5					6,151.0	6,393.0				

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Foundation List for TRANSPORTATION FACILITIES

Item	Description		Concrete Volume
Foundations for buildings	Wavehouse	5,000 m²	2,249 m²
	Car repair shop	1,151 m²	590 m³
Foundation for machinery and equipment	Slag Yard		290 m³
	Others		303 m³ 100 m³
Roads and Paving	· Product dispatching yard	10,000 m²	
	Bituminous base course (5.0cm thick)	4,500 m²	
	Crushed stone paving	5,500 m²	
	· Wavehouse		
	Bituminous base course (5.0cm thick)	10,000 m²	
	· Car repair shop		
	Bituminous base course (5.0cm thick)	3,300 m²	
	· Slag yard		
	Sub base course	4,350 m²	
	Crushud stone paving	11,250 m²	

Building List for ANALYSIS AND INSPECTION FACILITIES

Name of the Building	No. of Building	No. of floors	1st Floor Level GL+(M)	Building Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Structure	Roofing	Siding	S/S (T)
- Laboratory	1	2	0.4	8.1	6 x 21	126	126	RC	RCS	MB	

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Foundation List for ANALYSIS AND INSPECTION FACILITIES

Item	Description		Concrete Volume
Foundation for buildings and machinery and equipment	Laboratory	126 m^2	112 m^3

Building List for ADMINISTRATIVE FACILITIES

Name of the Building	No. of Build-ing	No. of floors	1st Floor Level GL+(M)	Build-ing Height GL+(M)	Dimension (M) x (M)	Building Area (SQ.M)	Total Floor Area (SQ.M)	Struc-ture	Roof-ing	Siding	S/S (T)
- Main office	1	2	0.4	7.77	15 x 30	450	900	RC	RCS	MB	

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

Table 6.4.9-2 Number of major works of civil engineering and building works

ITEM / FACILITY	Excavation (m^3)	Concrete (m^3)	Re-Bar (t)	Embedded Steel (t)	Structural Steel (t)	Roofing (m^2)	Terrazzo Tile Floor (m^2)	Pipe Installation (m)	Bituminouse Base Course (m^2)	Remarks
DRP	6,418	16,194	1,696	25.9	191	979	754	239	1,490	
SMP	40,286	20,536	2,172	112.3	3,177	15,958	749	766	7,248	
RMP	14,370	7,219	600	166	1,391	7,538	---	586	3,726	
UT	13,322	5,094	560	29.1	23	291	25	736	2,269	
PW	2,864	512	45	3.2	16	153	---	100	100	
TR	4,472	3,229	281	83.3	418	6,416	48	850	8,866	
AI	119	112	11	0.1	---	70	51	50	50	
ADM	1,350	900	90	5	3	450	900	100	600	
TOTAL	83,201	53,796	5,455	424.9	5,219	31,855	2,527	3,427	24,349	

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced concrete slab, MB: Masonry brick

6-5. Infrastructure

6-5-1. Supply of natural gas

1) Consumption

Consumption of natural gas required in the operation of the new added facilities is estimated to be 28,000 Nm^3/h, of which 27,000 Nm^3/h is consumed by DR plant. The entire consumption after the expansion, therefore, is 58,000 Nm^3/h including 30,000 Nm^3/h consumed by the existing facilities.

2) Supply source of natural gas for the expansion project

The present contract between ANSDK and EGPC assures the supply up to 2002. In addition, there is a plan to connect with gas fields at the Red Sea area to form a network in 1988. Therefore, it can be expected that natural gas required for the expansion project is stably available in future as well.

3) Facilities for supplying natural gas

The natural gas pipeline to ANSDK has capacity to supply 92,000 Nm^3/h, which is sufficient.

Receiving capacity of ANSDK is designed to be 50,000 Nm^3/h, but can be raised to 60,000 Nm^3/h by increasing gas velocity. Therefore, the consumption is 58,000 Nm^3/h while the receiving capacity is 60,000 Nm^3/h, and no expansion of pipeline, receiving station, etc. except natural gas meter of max 50,000 Nm^3/h is necessary.

6-5-2. Industrial water supply

Industrial water required for operation of the new facilities is recirculated as that of the existing facilities, and it is estimated that 330 m^3/h of make-up water may be

required. It means that together with 560 m^3/h required for the existing facilities, the total of 890 m^3/h of raw water is required. For this, the present capacity to receive the water is 930 m^3/h and so it is unnecessary to expand the water receiving facilities for the expansion project.

The rated water pressure is 3 kg/cm^2 at present. But pressure drop (3 kg/cm^2 to 1 kg/cm^2) occurs frequently and it may be necessary to expand the pumping capacity on the part of water supplier, Alexandria Water Authority.

6-5-3. Power supply

(1) Forecasted power demand in Alexandria area (1991-1995)

The present power generating capacity in Alexandria area is only 620 MW. On the other hand, the Alexandria office of Egyptian Electricity Authority expects future power demand as follows:

Year	MW
1991	980.1
1992	1,069.1
1993	1,164.9
1994	1,268.3
1995	1,379.5

(2) Construction plan of power station in Alexandria area

As against the forecasted power demand as above, there are no concrete plans of construction or expansion of power station in Alexandria under the present 5-year plan.

As known from the construction of Abu Qîr power station (it took 6 years to complete No.1 generator and 8 years for No.4 generator), the construction of power station takes years.

Even at present, power supply is short and it is obvious that power demand will increase further in line with industrial development in future and the power supply capacity will be extremely short. Without available power, no industrial development can be expected and such power shortage will pose a big problem for the Government of Egypt in pursuing industrial development in Alexandria area.

Under such condition, there is a plan, though not fixed yet, to construct a power station at the location of "Central Security Troops" in the neighborhood of ANSDK. Though the construction of a power station takes more than 5 years, it is necessary for the Government of Egypt to materialize this power station construction plan in an earliest date by all means so as to ensure industrial development in Alexandria area.

Also, though much increase of power supply cannot be expected, reopening of operation of No.4 generator now under repair at Abu Qîr power station is awaited with expectations.

(3) Idea on power supply for the expansion project at ANSDK

In addition to the 166 MW (Instant 207 MW) at 15-minute demand under the present contract between ANSDK and EEA, it is expected that 74 MW at 15-minute demand will be required for the expansion project of ANSDK. Regarding this increase of power demand with respect to the expansion project, EEA wrote in the letter dated May 6, 1987, to the JICA mission that power required for the project should be taken care of by ANSDK itself.

However, it is extremely difficult for an enterprise to construct even power generating facilities while it has various problems including shortage of foreign exchange.

Therefore, the Government of Egypt should actively promote construction of power stations to enable industrial development of the nation including the ANSDK expansion project. However, as it takes years to construct power stations, any new power capacity may not be available by the time of the ANSDK expansion and it is essential that EEA directs the power of No.4 generator of Abu Qir power station, when operation resumed, to the ANSDK expansion project preferentially.

Consequently, the idea concerning power supply to the expansion project is to be as follows:

1) Power supply

Increase of power demand, 74 MW, in connection with the expansion project is to be supplied by EEA.

2) Short circuit capacity at PCC

Short circuit capacity has an effect on flicker compensator. At present, short circuit capacity of 220 kV line from Ameria substation given by EEA is 4,500 MVA, but the capacity for the existing facilities of ANSDK is designed to be 4,000 MVA. Besides, the actual value at present is a little lower than that. Forecasting of increase of future short circuit capacity at this time is uncertain. Therefore, planned capacity for the expansion project of 4,000 MVA, same as the desinged one for the existing facilities, is to be used. Namly, the flicker compensator will be at the same level as at present and the number increased in proportion to the percentage increase of the facilities. In other words, as two more EAFs are installed in addition to the 4 units at present, the scale of flicker compensator will be 50% up.

6-5-4. Mineral jetty and stockyard

As discussed in Section 5-3-4, the capacities of Mineral jetty, unloader crane, stacker crane, reclaimer crane and various transfer conveyors are sufficient.

However, as regards stockyard, it is necessary to expand it for the expansion project. At present, the requirements of pellet and ore for one unit DR plant is about 1,200,000 t/y (100,000 t/m) and required stock of pellet and ore is about 3-month's use, or 300,000 tons. The present stockyard area is 30,000 m^2 and has reasonable capacity with 90,000 tons of ore yard and 70,000 tons x 3 of pellet yards.

As one more DR plant will be installed under the expansion project, it is necessary to have another ore yard of 300,000 tons. Fortunately, the present stockyard has layout which permits expansion in future. Therefore, by addition of another ore stockyard with the same capacity as the existing one (300,000 tons) and by extension of the stacker crane (from 310 m to 620 m) by Industrial Mining Complex-IMC, the ore stockyard capacity will be 600,000 tons and can meet the requirements of the expanded facilities of ANSDK.

Refer to DWG No. JICA-G-002 for the general layout.

6-6. Organization and personnel plan after the expansion

1) Organization

The expansion plan is based on increased production of re-bar and the expanded facilities are of same scale and contents as the existing facilities.

Therefore, there cannot be any necessity to change the organization and the existing organization is to be followed.

2) Personnel

Personnel plan after the expansion project is shown in Table 6.6-1.

Table 6.6-1 Staffing plan for the company

Department	Dept. Manager	Section Manager	Assistant S.M.	Specialist Clerk Engineer	Assist Engineer	Foremen Assist.F Workers	Total
Top Management Affairs		1	1	2			4
External Relation	1	1	2			2	6
Administration	1	4	9	37		46	97
Finance	1	3	5	17			26
Purchasing & Transportation	1	3	5	12		154	175
Sales	1	2	4	18			25
Production	1	3	8	25	8	1,139	1,184
Maintenance & Utilities	1	4	16	40		479	540
Production & Technical Control	1	3	9	20		201	234
Construction	1	1	2	11			15
Total	9	25	61	182	8	2,021	2,306

Chapter VII. CONSTRUCTION SCHEDULE

7. Construction Schedule

7-1. Organization for execution of construction work

7-1-1. Basic policy

Construction period of a steel works is very long, and in general it takes 30 to 40 months from supply contract of equipment entered to start-up of the works. If the time required for basic design, and bidding is added, 50-60 months are required from the decision to implement the project to the commencement of production of products.

A project can never be repeated under the same condition and besides the process under which the project is executed is not always free for control. In order to carry out the project, keeping predetermined budget and schedule, under uncertain and changeable conditions, a strong organization which can exercise powerful driving force and solve problems efficiently is indispensable. This role should be played by the enterprise of the project and consultant engineers.

Since the present project is to expand the existing Works in accordance with a plan made in advance, economic and financial effect of execution of the project is very high and it is hoped that the project is completed as soon as possible.

7-1-2. Consultant engineering

As consultant engineers, companies which have experience and actual record of planning and constructing modern steel works and can provide plant operation guidance after the completion is desirable. At present, Japanese staffs and Egyptian staffs are jointly engaged in plant management at EL DIKHEILA Works. But the management agreement expires in 1991 and at the time the expansion project is completed, the Japanese staffs will be none. It is considered that by the

time, technical transfer will be completed and no external management staffs necessary, but to cope with troubles early in the start-up, a part of management jobs provided so far is to be included in the scope of engineering. The scope of work of consultant engineering in this project is to be as follows:

(1) Basic design
(2) Supply contracts
(3) Preparation of design drawings (Civil engineering and building structures)
(4) Construction works management
(5) Operation guidance (Immediately after start-up)

7-1-3. Preparatory stage

Though this project is to expand EL DIKHEILA Works of ANSDK in private sector, it is executed to supplement shortage of rebars in Egypt. In view of its contribution towards Egyptian economy through its ripple effects such as saving foreign currency, enhancement of employment opportunity and development of peripheral industries in Egypt, the project should be given encouragement as one of national projects. In particular, at its preparatory stage when it is going to be executed, a strong support and assistance from the Egyptian Government, its agency and public sector is necessary. Matters which must be decided at the stage include the following.

- Introduction of construction fund from the Government or public sector
- Approval and guarantee by the governmental agency on financing from international financing institutions
- Allocation of foreign exchange for repayment of loans and purchase of raw materials and materials
- Agreements for supply and price of power, natural gas and industrial water
- Exemption or reduction of customs duties on imported materials and equipment for construction and operation

For the purpose of solving these problems early and realizing the project, it is proposed that EL DIKHEILA Expansion Project Steering Committee be established by those concerned. ANSDK will chair and manage the meeting as the enterprise of the project.

7-1-4. Execution of basic engineering

Another important matter to be carried out in preparatory stage is execusion of basic engineering. The object is to develop and materialize the feasibility study and it makes detailed study on alternative plans proposed in the F/S and conditions assumed in the F/S and endorses a concrete plan. Therefore, the basic engineering should cover every field; follow-up of market research, determination of production process, planning of practicable, detailed processes, up-dating of construction expenses and operation cost and financial and economic analyses.

The result of basic engineering is expected to play a decisive role in obtaining the final approval on execution of this expansion project from the Egyptian Government, investors or overseas official financial institutions such as the World Bank, OECF, EXIM Bank and others.

7-1-5. Preparation for tender

If the project is executed with financing from official organizations (e.g. World Bank and OECF), supply contract of the equipment and works for the project is applied rules of those financial institutions. Major items controlled by those rules include public notice of tender, pre-qualification of bidders participating in the tender, tender documents, and obtaining of approval of successful bidders. This is another important job which shall be done following the basic engineering.

7-2. Construction schedule

7-2-1. Basic policy

(1) Start-up of main plants

Start-up of main plants such as DR plant, SMP and RMP, is determined as below by taking into consideration the learning period until full operation and the material balance.

Start-up of RMP is to be project first month.
SMP is to be started up project third month.
DR plant is to be started up project fourth month.

Other ancillary facilities are to be started up in timing not to cause inconvenience of start-up of the main plants.

(2) Construction period

The period required from CIF contract to start-up is set to be 30 months for DR plant, 32 months for SMP and 28 months for RMP. In the expansion project, SMP constitutes critical work.

(3) Tender period

All contracts for this project are to be made through international tender, and it is assumed that issue of invitation for international bidding to signing contract takes 8 months.

(4) Preparatory period

The period required for decision to undertake the project (7-1-3), basic engineering (7-1-4) and tender preparation (7-1-5) was assumed to be 16 months after the completion of F/S.

7-2-2. Overall construction schedule

(1) Construction schedule

Table 7-1 shows the overall schedule for the expansion project based on the above premises. Start-up date of main plants is assumed as follows:

RMP	May 1, 1992
SMP	July 1, 1992
DR Plant	August 1, 1992

EL DIKHEILA IRON & STEEL WORKS –EXPANSION PROJECT–

IMPLEMENTATION SCHEDULE

REMARKS ;
ITB : Invitation to Bid LI : Letter of Intent
BC : Bid Close CONT, Signing of Contract

DATE DEC, '87
PREPARED BY JICA

CALENDAR / PROJECT MONTH / ITEMS	1987												1988												1989												1990												1991												1992											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	-64	-63	-62	-61	-60	-59	-58	-57	-56	-55	-54	-53	-52	-51	-50	-49	-48	-47	-46	-45	-44	-43	-42	-41	-40	-39	-38	-37	-36	-35	-34	-33	-32	-31	-30	-29	-28	-27	-26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8

PROJECT AS A WHOLE
F/S — PROJECT ESTABLISHMENT — BASIC ENG. — BID PREP — BIDDING STAGE — CONSTRUCTION STAGE

D.R PLANT
C.I.F CONTRACT — DESIGN, MANUFACTURING, SHIPPING — INSTALLATION — START-UP

S,M,P
C.I.F CONTRACT — DESIGN, MANUFACTURING, SHIPPING — INSTALLATION — START-UP

ROD MILL PLANT
C.I.F CONTRACT — DESIGN, MANUFACTURING, SHIPPING — INSTALLATION — START-UP

UTILITIES
C.I.F CONTRACT — DESIGN, MANUFACTURING, SHIPPING — INSTALLATION — START-UP

OTHER FACILITIES
SUB-STATION
C.I.F CONTRACT — DESIGN, MANUFACTURING, SHIPPING — INSTALLATION — START-UP
WAREHOUSE

C/B WORKS
I.T.B
CONTRACT — MOBILIZATION — CIVIL & BUILDING WORKS

Chapter VIII. CALCULATION OF CONSTRUCTION EXPENSES

8. Calculation of Construction Expenses

8-1. Division of supply contracts and method of supply

All the equipment and works required for execution of the project are supplied, in principle, by supply contracts entered through international competitive bidding, and the scope of work covered by each division of supply contracts is set as given below.

(1) Supply of equipment

Supply of equipment & their appurtenances, materials such as steel frame stand, brick, cable, piping, consumables for 6 months after start-up and spares for one year after start-up, CIF Alexandria port
Supervision for installation works

(2) Inland transportation of equipment

Customs clearance of equipment, transportation of the equipment from Alexandria port to the site, and their unloading and deposit in bonded area in the site
Their transportation and delivery from the bonded area to respective construction sites

(3) Installation works of equipment

Assembly and installation works of equipment, and wiring and piping works
Supporting service for trial run of the equipment

(4) Civil engineering and building works

Foundation works, plant building, offices, warehouses and roads and sewerage works

8-2. Calculation of capital costs

8-2-1. Supply of equipment

Capital costs were assumed to be on international price level as of 1987. For the escalation case, however fluctuation of price during the period from 1987 through the time of construction has been taken into account.

At the time of tenders for the 1st stage construction, Japan and EC countries participated and it may be considered that prices tendered represented the level of international prices at that time. For the present F/S, the construction expenses were calculated, with reference to the above prices tendered, by taking into consideration change in price factors in those past years, mainly rise in wages and prices of industrial goods and change in exchange rate of currency, and in addition, in the light of reference estimates obtained from several makers and contractors.

Notes:

(1) Suppliers of equipment and contractors
At the time of the 1st stage project, invitation to the project was sent to numbers of countries through the World Bank, but the countries that perticipated in the tender were limited to a few countries including Japan and EC members. Therefore it was assumed for the 2nd stage that countries that might participate in the project would be about the same as in the 1st stage.

(2) Price level applied in this F/S
Price level expected by considering fluctuation of exchange rate and price increase is assumed to be in the range of 1.7 to 2 times that in 1983. As discussed above, in this F/S, price is estimated on the basis of the tender amount in the 1st stage and converted into US dollars using the

present exchange rate.

8-2-2. Field work

As regards inland transportation of equipment, their installation work, and civil engineering and building work, unit price of each item was set considering the result of field survey and the result of the 1st stage construction, and the total construction expenses were added up according to BQ method.

Heavy construction equipment and materials for temporary structures are found available in Egypt, but considering the timing of construction and tight schedule, those equipment and materials with a few exception are to be imported. The cost of the equipment and materials was added up accordingly.

8-2-3. Contingency

As against the capital costs of this project, the following reserve fund is provided as contingency.

(1) Import duties

The rate of customs duties levied on imported equipment was assumed to be 5% of the CIF price in compliance with Law No. 186/1986. Import duties on materials used permanently in civil engineering work were calculated in accordance with the Customs Tariff, Arab Republic of Egypt, Sept. 1986. The rates of tariff on major materials are shown below. The amount of tariffs was assumed to be calculated by converting the CIF price into Egyptian pounds by the official exchange rate (in the report, it is calculated on the assumption of US$ = 2LE.)

Rolled steels:	Sections	20%
	Steel plate	15%
	Seamless pipe	15%

	Other steel pipe	30%
	Steel frame and processed rolled steels	50%
	Bolts and nuts	20%
Glass :	3 mm or thinner wire glass	20%
	3-5 mm	30%
	5 mm or thicker	50%
Wood :	Lumber	50%
Sanitary ceramics :		60%
Building flooring :		60%
Paint :		15%

Note: No import duties were assumed to be charged on the construction equipment and materials for temporary structure as they were to be re-exported.

(2) Price increase

For the escalation case, the construction were costs calculated by taking account of the price increase in 1987 and subsequent years. The rate of price increase was assumed to be 3% per annum relative to the international price level. While the domestic level within Egypt is considered to occur, this increase will be deemed to be null in dollers by assuming the fluctuation of dollar exchange rate against Egyptial pound to be balanced with the price change.

(3) Other reserve funds

To complement accuracy in calculation of construction expenses, contingency is also provided in the amount 5% each for the price of equipment, inland transportation and erection work of the equipment and civil engineering work.

8-3. Summary Sheet of Construction Expenses

The construction expenses of the expansion project calculated based on the above premises are shown in Table 8-2. All are indicated in US dollars. Incidentally conversion rate from Egyptian pound to US dollars in US$ = LE2.

As shown in Tables 8.3-1 and 8.3-2, the construction cost of this project is about US$310 million when escalation is not considered and about US$340 million when escalation is taken into account.

Considering the outstanding balance of foreign debts related to the initial construction project and the trend of Egyptian pound to depreciate in exchange rate as agaist US dollars, it is one of key points for realization of the expansion project to increase local procurement as much as possible and decrease foreign purchases. For example, local portion of civil engineering and building projects is assumed to be about 20%, but if all the steel structure for buildings can be fabricated locally, the percentage can be raised to about 50%.

Similarly regarding purchase of equipment, there is a possibility to obtain steel frame stand and simple equipment locally.

However, quality assurance and secure delivery time are the most important factors in implementing this project and any increase of local procurement must be decided only after full deliberation of the above. At the basic engineering stage, it is desirable to make a detailed study in this respect.

Table 8.3-1 Summary of Capital Cost Estimate (Without Escalation Case)

UNIT: 1000 USD

	Equipment & Spares (CIF)			Installation of Equipment			Civil & Buildings			Total		
	FOREIGN	LOCAL	TOTAL	FOREIGN	LOCAL	TOTAL	FOREIGN	LOCAL	TOTAL	FOREIGN	LOCAL	TOTAL
D.R.P.	76,100	—	76,100	7,021	1,999	9,020	4,753	2,334	7,087	87,874	4,333	92,207
S.M.P.	80,767	—	80,767	4,267	1,234	5,501	16,034	3,720	19,754	101,068	4,954	106,022
R.M.P.	21,847	—	21,847	2,166	607	2,773	6,995	1,274	8,269	31,008	1,881	32,889
U.T.	8,067	—	8,067	1,699	464	2,163	2,118	896	3,014	11,884	1,360	13,244
S.S.	2,655	—	2,655	655	174	839	436	324	760	3,756	498	4,254
Trp. F	6,883	—	6,883	390	100	490	3,082	869	3,951	10,355	969	11,324
A/I	1,534	—	1,534	65	15	80	88	75	163	1,687	90	1,777
Adm. F	—	—	—	—	—	—	445	365	810	445	365	810
Total	197,853	—	197,853	16,273	4,593	20,866	33,951	9,857	43,808	248,077	14,450	262,527
Eng. Fees	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	22,603	350	22,953
Contingency:												
Price C.	—	—	—	—	—	—	—	—	—	—	—	—
Physical C.	10,056	—	10,056	826	233	1,059	1,709	495	2,204	12,591	728	13,319
Imp. Tax	—	9,892	9,892	—	—	—	—	2,500	2,500	—	12,392	12,392
Total	10,056	9,892	19,948	826	233	1,059	1,709	2,995	4,704	35,194	13,470	48,664
Grand Total	207,909	9,892	217,801	17,099	4,826	21,925	35,660	12,852	48,512	283,271	27,290	311,191

Table 8.3-2 Summary of Capital Cost Estimate (With Escalation Case)

UNIT: 1000 USD

	Equipment & Spare (CIF)			Installation of Equipment			Civil & Buildings			Total		
	FOREIGN	LOCAL	TOTAL	FOREIGN	LOCAL	TOTAL	FOREIGN	LOCAL	TOTAL	FOREIGN	LOCAL	TOTAL
D.R.P.	76,100	—	76,100	7,021	1,999	9,020	4,753	2,334	7,087	87,874	4,333	92,207
S.M.P.	80,767	—	80,767	4,267	1,234	5,501	16,034	3,720	19,754	101,068	4,954	106,022
R.M.P.	21,847	—	21,847	2,166	607	2,773	6,995	1,274	8,269	31,008	1,881	32,889
U.T.	8,067	—	8,067	1,699	464	2,163	2,118	896	3,014	11,884	1,360	13,244
S.S.	2,655	—	2,655	655	174	839	436	324	760	3,756	498	4,254
Trp. F	6,883	—	6,883	390	100	490	3,082	869	3,951	10,355	969	11,324
A/I	1,534	—	1,534	65	15	80	88	75	163	1,687	90	1,777
Adm. F	—	—	—	—	—	—	445	365	810	445	365	810
Total	197,853	—	197,853	16,273	4,593	20,866	33,951	9,857	43,808	248,077	14,450	262,527
Eng. Fees	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	22,603	350	22,953
Contingency:												
Price C.	25,140	—	25,140	2,070	—	2,070	4,272	—	4,272	31,482	—	31,482
Physical C.	10,056	—	10,056	826	233	1,059	1,709	495	2,204	12,591	728	13,319
Imp. Tax	—	9,892	9,892	—	—	—	—	2,500	2,500	—	12,392	12,392
Total	35,196	9,892	45,088	2,896	233	3,129	5,981	2,995	8,976	66,676	13,470	80,146
Grand Total	233,049	9,892	242,941	19,169	4,826	23,995	39,932	12,852	52,784	314,753	27,920	342,673

Chapter IX. COSTS AND FINANCIAL ANALYSIS

9. Costs and Financial Analysis

9-1. Calculation of manufacturing costs

9-1-1. Assumptions for costing.

(1) Costing method:

a) Process cost accounting:
Process cost accounting was adopted by setting the direct reduction process (DRP), the lime calcining process (LCP), the steelmaking process (SMP), the bar mill process (BMP) and the rod mill process (RMP) as the production processes, and electric power, natural gases, compressed air, oxygen and nitrogen, water, in-works transportation, analysis and inspection, maintenance shop, process control, and car maintenance as the auxiliary processes.

b) Distribution of auxiliary process costs:
The criteria for distributing the auxiliary process costs are shown in Table 9-1. No mutual distribution among utility processes was assumed.

Table 9-1 Criteria for distributing auxiliary process costs

Process	Criterion
Power	A
Natural gases	A
Compressed air	A
Oxygen, Nitrogen	A
Water	A
Maintenance shop	B
In-works transportation	C
Analysis, inspection	C
Process control	C
Car maintenance	D

In this table:

A: distributed in proportion to the quantity of services;

B: distributed in proportion to the acuisition cost of fixed assets by process;

C: equally distributed among the five manufacturing processes;

D: total amount distributed to in-works transportation.

c) Distinction between variable and fixed costs:
Variable and fixed costs are discriminated as shown in Table 9-2.

Table 9-2 Distinction between variable and fixed costs

Variable costs	Raw materials, operating materials such as refractories, by-product, utility
Fixed costs	Labor cost, depreciations, special repair, repair, in-works transportation, process control

(2) Exchange rate:

a) In calculating the acquisition costs of the existing Phase-1 plants as of December 31, 1986, a rate of US$ = LE1.35 was employed.

b) For the period subsequent to January 1, 1987, a rate of US$ = LE2 = ¥150 was used.

(3) Price level

Price level used in cost accounting was set considering the result of the field survey, discussion with counterparts and the global trends.

a) Without Escalation Case

This is the case where no escalation is considered and cost accounting and financial analysis are to be made by using the price level at the time of field survey in March 1987.

b) With Escalation Case

This is the case where cost accounting and financial analysis are made using the price level at the time of field survey as the base and taking account of inflation at the rates indicated in Table 9-3 for the first 5 years to 1992 when the expansion plants commence operation.

Table 9-3 Escalation Rate (Annual rate)

	Case IV	Case V	Case VI
Domestic expenses	0%	0%	0%
Imported goods	3%	3%	3%
Product sales price	0%	1.5%	3%

Concerning domestic expenses, escalation rate is to be 0% on US dollar base as it is considered that in view of the past trend and the circumstances at home and abroad, the inflation rate in Egypt and the rate of depreciation of Egyptian pound in exchange rate against US dollar are almost same.

Prices of imported goods are expected to rise 3% in view of price rise in the past in Japan, W. Germany, U.S., Italy and U.K.

Concerning product sales price, three escalation rates, 0%, 1.5% and 3%, are adopted.

(4) Raw material prices

Raw material prices were in principle set based on the data obtained during the field survey such as ANSDK's budget for the 1987 F.Y., but are specifically as shown in Table 9-4.

Table 9-4 List of raw materials prices

	Import/ domestic	Unit	Price
Pellet	Import	ton	34.165 US$
Lump Iron Ore	Import	ton	32.295 US$
Limestone	Domestic	ton	12 US$
Scrap	Domestic	ton	57.855 US$
Scrap	Import	ton	113.43 US$
Fluorspar	Import	ton	205.9 US$
Fe-Mn	Import	ton	357.36 US$
Fe-Si	Domestic	ton	518.805 US$
Aluminum	Domestic	ton	766.5 US$
Coke Breeze	Domestic	ton	97.125 US$
Electrode	Import	ton	2,045.82 US$
Fettling Materials	Import	ton	427 US$
Furnace Brick	Import	ton	1,207 US$
Ladle Brick	Import	ton	747 US$
Tundish Brick	Import	ton	713 US$

(5) By-products:

a) The price of return scrap recovered from the steel-making plant, the bar mill plant and the rod mill plant was assumed to be equal to the local price of domestic scrap produced in Egypt.

b) For the sale of scale and lime fine, the transfer and disposal costs were assumed to balance with the sales price.

(6) Labor costs:

The labor costs such as wages, salaries, bonuses and welfare costs were estimated as shown in Table 9-5 in accordance with the result of field survey. The amount of bonus was assumed to be equal to four months of basic wages, and the corporate social security contribution was taken into consideration for each year.

Table 9-5 Labor cost by class (US$/person·year)

Department manager	7,800
Section manager	6,030
Assistant section manager	4,290
Specialist, clerk, Engineer	3,010
Foreman, Assistant foreman, Worker	1,760

(7) Depreciations:

a) the fixed assets were classified into seven categories comprising manufacturing plants, auxiliary plants, plant buildings, tools and appliances, vehicles, office buildings and company housing, and land.

b) The fixed installment method was adopted for depreciation.

c) Acquisition costs and period for depreciation were estimated as shown in Tables 9-6 (Existing facilities), 9-7 (Expansion facilities: without escalation case) and 9-8 (Expansion facilities: with escalation case).

d) For tools and appliances and vehicles, a period for depreciation of four years was assumed, with however a re-investment every four years.

e) As regards fully depreciated fixed assets, special depreciation for replacement is to be used in accordance with the Egyptian accounting standards. The rate of such depreciation is 50% of ordinary depreciation expense.

Table 9-6 Fixed assets (Existing facilities)

(Unit: US$1,000)

	Depreciation period (years)	Acquisition price	Annual depreciation expense
Manufacturing plant	15	330,787	22,052
Auxiliary plant	10	55,074	5,507
Plant building	33	44,473	1,348
Tools & appliances	4	6,020	1,505
Vehicles	4	12,111	3,028
Office building & company housing	50	75,324	1,506
Land		29,589	
Total		553,378	34,946

Table 9-7 Fixed assets (Expansion facilities: without escalation case)

(Unit: US$1,000)

	Depreciation period (years)	Acquisition price	Annual depreciation expense
Manufacturing plant	15	252,751	16,850
Auxiliary plant	10	30,623	3,062
Plant building	33	26,726	810
Office building & company housing	50	1,091	22
Total		311,191	20,744

Table 9-8 Fixed assets (Expansion facilities: with escalation case)

(Unit: US$1,000)

	Depreciation period (years)	Acquisition price	Annual depreciation expense
Manufacturing plant	15	278,491	18,566
Auxiliary plant	10	33,571	3,357
Plant building	33	29,423	892
Office building & company housing	50	1,188	24
Total		342,673	22,839

(8) Repair costs:

The repair cost for each process consists of repairing materials cost, labor cost and other costs, and 3% of the equipment price of each process were assumed to be the annual required repair cost.
Regarding the facilities that are in use for 20 years since start-up, repair expanse is to be 6% of the equipment price of each process.

(9) Utility:

Unit prices are as shown in Table 9-9. Calculating methods are as follows:

a) Electric power:
The purchase price of electric power was assumed to be US$0.016/kWH in accordance with the result of site survey, and the unit price of electric power was calculated by adding depreciation, repairing and labor costs for the substations.

b) Natural gases:

Natural gas price contracted between ANSDK and Egyptian General Petroleum Corporation is US$2.3/Mil.BTU (though the payment is made in Egyptian pounds at exchange rate at the time of payment) and is calculated to be US$0.08707/$Nm^3$. And so this price is to be used, and the price before furnace is arrived at by adding depreciation expense, repair expense and labor expense etc of the related facilities. However, considering

- that the price of natural gas supplied to domestic industry in oil producing countries is about US$0.3 - 1.0/Mil.BTU in general, and
- that the export price of the gas to other countries through pipeline is about US$1.0/Mil. BTU in general,

calculation using US$1.5/Mil.BTU (US$0.05775/Nm^3 on LE basis before shift to the floating exchange rate system) and also US$1.0/Mil.BTU (US$0.03786/Nm^3) was made.

c) Water:

The purchase price of water was assumed to be US$0.075/$m^3$ in accordance with the result of site survey, and the unit price of water was calculated by adding depreciation, repairing and labor costs for the water treatment facilities.

d) Oxygen and nitrogen:

The unit price was calculated by taking account of the total cost required for the oxygen plant and the quantities of produced oxygen and nitrogen. Oxygen and nitrogen were assumed to have the same price because it was difficult to discriminate the cost for secondarily produced nitrogen from that for oxygen.

e) Compressed air:

The unit price was calculated by taking account of the total cost associated with the compressor plant and the quantity of produced compressed air.

Table 9-9 Unit price of utility (Without escalation case)

	1992			1993		
	Purchased price	Equipment cost and labour cost etc	Total	Purchased price	Equipment cost and labour cost etc	Total
Electricity (US$/KWH)	0.0160	0.0039	0.0199	0.0160	0.0034	0.0194
Natural Gas (US$/Nm^3)	0.08707	0.00043	0.0875	0.08707	0.00043	0.0875
	0.05775	0.00045	0.0582	0.05775	0.00035	0.0581
	0.03786	0.00044	0.0383	0.03786	0.00034	0.0382
Make-up Water (US$/m^3)	0.0750	0.8707	0.9457	0.0750	0.7541	0.8291
O^2/N^2 (US$/Nm^3)		0.1131	0.1131		0.0985	0.0985
Compressed Air (US$/Nm^3)		0.0167	0.0167		0.0153	0.0153

Note: Of the cost of make-up water, if recycled water is included, equipment cost and labor cost will be US$0.0396/Nm^3 and US$0.0343/Nm^3 instead of US$0.8707/Nm^3 and US$0.7541/Nm^3, respectively.

(10) Costs for other auxiliary processes:

The costs for the other auxiliary processes were estimated from data made available by the field survey including labor, depreciation and repairing costs.

9-1-2. Production plan

(1) Establishment of fiscal year:

The startup of the expansion rod mill plant is assumed to be in May 1992. In this analysis, therefore, a fiscal year was set to cover a period from May every year through April next year so that the startup of the expansion rod mill plant may become the start of the 1992 fiscal year. The fiscal 1987 was deemed to cover a period of 16 months from January 1987 through April 1988, since ANSDK's financial situation as of the end of December 1986 was to be used as the starting balance for the fiscal 1987.

(2) Without espansion case:

The production plan for the without expansion case was estimated as shown in Table 9-10.

Table 9-10 Production plan (without expansion)

(Unit: 1,000 tons)

	1987	1988	1989	1990 onwards
DRI	845	716	716	716
Burnt Lime	37	33	34	34
Billet	892	798	821	821
Bar	446	418	425	425
Rod	178	293	319	320