5.2.8. Power receiving and substation facilities (PW)

1) Outline

El Dikheila Iron and Steel Works is a mini-mill plant consisting of DR furnace, EAFs, CCMs, Bar mill and Rod mill, and compared with an integrated steel mill based on BF-BOF process, it is characterized by very high consumption of electric power per ton of steel product. Namely, unit consumption of power in the BF based integrated steel mill is generally 400-500 kWh/t, but this Works requires 700 kWh/t for EAFs alone and more than 900 kWh for the entire Works.

This means that stable supply of power is critical for efficient operation of El Dikheila Works. Features of power load can be illustrated by wide-fluctuation large power load as EAF and load for which momentary power failure cannot be permitted as DR furnace. To ensure steady and stable supply of power, the power system inside and outside the Works has the following characteristics.

Power is received by two circuits of 220 kV system connected to EEA's El Dikheila substation in the vicinity of the Works. Each circuit has capacity to satisfy the load of the entire Works after the expansion. El Dikheila Works is connected by 220 kV line with Ameria substation which belongs to 220 kV trunk lines in Egypt. Therefore, the Works depends on the reliability of such 220 kV trunk line network.

Power distribution in the Works begins with branch lines from 220 kV bus, and after step-down to 33 kV and 6.6 kV by 4 units of 220/33 kV transformers and

units of 33/6.6 kV transformers, the power is distributed to each plant.

Each plant receives power through one or two circuits. Plants receiving power through one circuit have link lines with other plants using the same voltage to prepare against repair or trouble of their power lines.

Needless to say, failure of 220 kV receiving lines will force production stoppage at all plants. Even in such case, however, monitoring facilities, furnace facilities, sewage treatment facilities, etc. require power for the purpose of protection of facilities and men. To ensure power for those loads, 2 units of emergency generators are installed. Separate from the above ordinary power system, 6.6 kV emergency power lines with the 2 generators as power source are installed and essential power is distributed to each plant. And after occurrence of trouble, each plant, upon start of the generators, is to switch power from the ordinary source to this emergency source.

2) Equipment list

Table 5.2.8-1 shows a summary of equipment of the substation.

Table 5.2.8-1 Outline of Substation (S/S) in ANSDK

No.	System	Principal Equipment and Capacity	Remarks
1.	220 kV System	∘ GIS (Gas Insulated Switchgear) : 2 x Incoming, 1 x Bustie, 4 x Outgoing feeders using GCB (Gas Circuit Breaker) of 245 kV 1250 A & interrupting capacity 40 kA. Enclosed SF6 gas (6 or 4 bar) provides high insulation and interrupting ability. ∘ Main TR (Transformer) : 4 x 80/110 MVA (Natural/forced cooling) 220/33 kV with on load tap changer. ∘ Fire Fighting Equipment for Main TR : Tank capacity 50 m^3 for water storage 30 m^3 and compressed air (12.5-14 bar) 20 m^3	∘ Maximum reliability, safety and simple maintenance with completely enclosed construction. ∘ Cooling fans run automatically according to loads. ∘ Automatic water spray system
2.	33 kV System	∘ MCS (Matal-clad Switchgear) : 4 x Incoming VCB (Vacuum CB) 36 kV, 2,400A, 25 kA,/4 x Bustie VCB d.o./ 10 x Outgoing VCB 36 kV, 1,250A 25 kA and 5 x Outgoing GCB d.o. ∘ TR : 2 x 15/18 MVA (Natural/Forced cooling), 33/6.9 kV	
3.	6.6 kV System	∘ MCS : 2 x Incoming and 1 x Bustie VCB, 7.2 kV 2,000 A, 40 kA/15 x Outgoing VCB, 7.2 kV 1,250 A, 40 kA.	
4.	Common System	∘ Supervisory and Control Panel : 1 set to control all equipment. ∘ Battery and Charger : 1 set 250 AH ∘ Air Conditioning System : 1 set for GIS, MCS and Control room.	∘ Coupled with Protective Releay Panel ∘ To control the temperature in the dustproof rooms.
5.	Diesel Generators	∘ Diesel Engine : 2 sets x 2,870 PS, V-type, 4 cycle, 1,000 rpm ∘ Generator : 2 sets x 2,500 kVA Brushless excitation, 6.6 KV 6 poles	
6.	Power Distribution Cables	∘ 33 kV XLPE : 1 Core 630 mm^2 x 4,400m, 1c. 300 mm^2 x 9,000 m ∘ 6.6 kV XLPE : 7,300 m	∘ XLPE = Cross Linked Polyethyrene Insulation Cable

5.2.9. Maintenance facilities (MS)

1) Outline

In the iron and steel making industry that is a typical one using a lot of facilities, the importance of plant maintenance has been rising more and more to maintain automatic, continuous and high speed functions of facilities. These functions aim for stable operation, increase in production, high quality and cost reduction.

A modernized maintenance system has been introduced to El Dikheila Iron and Steel Works considering the importance of plant maintenance since the planning stage of the Works.

The mainstream of maintenance method is a time-based maintenance (TBM) which is carried out by periodic changes of spare parts and repairs, and another effective and economical maintenance method, condition-based maintenance (CBM) which is done according to the deterioration of equipment, is introduced. At the same time of introducing those modernized maintenance methods, ANSDK has been promoting standardization of maintenance works, and aiming for a further advanced maintenance system.

2) Basic policy

Maintenance has been performed based on the maintenance schedules (maintenance standards) set up by ANSDK. One thousand ninety three standards are established by maintenance sections. (See Table 5.2.9-1.)

Maintenance works are carried out according to the maintenance schedule as mentioned above, and preventive maintenance (time-based maintenance)- periodic inspections, exchange of parts, and repairs, including routine inspection and repair of equipment- is applied. Breakdown maintenance, which maintains equipment after trouble, is applied to some of the equipment such as those not to cause production decrease or those having stand-by facilities like utility plant. Also, expanded application of predictive maintenance is being promoted by using diagnostic technology of vibration and oil analysis.

a) Maintenance method for main plants

(1) Direct reduction plant

TBM is applied to almost facilities in DRP, and CBM is applied to high tenshion motors, compressors, pumps etc.

(2) Steelmaking plant

TBM is applied to facilities except motors of fume extraction system which are maintained by CBM.

(3) Rolling mill plant
CBM is applied to non-twist block mill, laying head and hydraulic unit of walking beam, and TBM to others.

b) Maintenance and repair of equipment

Maintenance and repairs are performed based on the schedule. However, in the case of maintenance

required not on schedule, coordination section in MUD arranges the production schedule with personnel in production section, and decides the day to do maintenance and the way.

As to periodic maintenance and repair carried out weekly or monthly, the schedules are planned in the monthly production plan and executed.

Regarding major repairs requiring several days once a year, the schedule is planned in the yearly production plan or a half year production plan.

Table 5.2.9-1 Maintenance standards set up by MUD

Mechanical	No. of standards	Electrical	No. of standards
D R P	---	D R P	54
S M P	123	S M P	136
R M P	41	R M P	181
Repair	16	Repair	50
		Power	350
Utility	52	Instrument	82
Coodination	8		

3) Maintenance shop

There are two buildings for maintenance work: one houses machining shop, assembly shop, electric and instrument repair shop including air conditioning and tele-communication repair, while the other is a fabricating shop.

A list of loading time of equipment, and a list of

major equipment of Maintenance Shop is given in Table 5.2.9-2 and Table 5.2.9-3.

4) Control of spares, materials and equipment

Control of spares and materials required for peridic maintenance and repair of troubles is one of the important works of the Maintenance Dept.

The department formulates pruchasing plan by taking into consideration the repair plan of the following fiscal year and requests from each plant.

Full study is made particularly for the items which are purchased overseas as to quality, delivery and price. However, optimum inventory control tends to be difficult due to long lead time. It often takes from 1 to 1.5 years because orders are made by various spare parts collectively and international bidding is applied to the orders.

Table 5.2.9-2 Loading Time of Equipment for Maint. Shop

Code	Equipment Name	h/day/unit	h/ month	No. of units
1101	Boring Machine (M/C)	16		1
1102	Lathe 5 m	10		1
1103	Lathe 2.5 m	16		1
1104 1121	Lathe 1 m	16		2
1105	Face Lathe	8		1
1106	Milling M/C	16		2
1107	Slotting M/C	16		1
1108	Shaping M/C	8		1
1109	Planer		60	1
1110	Hobbing M/C		100	1
1111	Cylindrical grinding M/C		60	1
1112	Surface Grinding M/C		80	1
1113	Radial Drilling M/C	16		1
	Upright Drill	8		1
1114	Band Saw	10		1
	Hack Saw	5		1
1120	Lathe 2 m	16		1
1204	Motor Driven Winches		10	3
1208	Test Stand for Hydraulic	4		1
1210	Dynamic Balance M/C		30	1
1301	Guillotine Shear	5		1
1302	HYD. Side Frame Press		50	1
1302	Bending Roller M/C		50	1
1304	Metal Coating Spray Gun		5	1
1305	TIG Welding M/C		5	2
1306	MIG Welding M/C	6		4
1307	Movable Pipe Threading M/C	4		1
1308	HYD. Pipe Bender		40	1
1309	Heating Furnace		80	1
1310	Pneumatic Forging Hammer		15	1
1311	Forklift		30	1
1312	Facility for H. Treatment		30	1

Table 5.2.9-3 Major Equipment of Maintenance Shop

1. Equipment for Machining

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
MS 1101	Horizontal Boring and Milling Machine	1	Boring spindle dia. : 110 mm Column travel : 4,000 mm Main motor : 15 kW Overall dimension (approx.) : 7,300L x 5,500W x 5,050H mm	32 ton
MS 1102	Lathe (850 x 5,000)	1	Swing over bed : 850 mm Center distance : 5,500 mm Main motor : 15 kW Overall dimension (approx.) : 7,590L x 1,660W x 1,455H mm	9.3 ton
MS 1103	Lathe (600 x 2,500)	1	Swing over bed : 600 mm Center distance : 2,500 mm Main motor : 7.5 kW Overall dimension (approx.) : 4,215L x 1,333W x 1,340H mm	4 ton
MS 1104	Lathe (460 x 1,000)	1	Swing over bed : 460 mm Center distance : 1,000 mm Main motor : 3.7 kW Overall dimension (approx.) : 2,468L x 1,203W x 1,285H mm	2 ton
MS 1105	Heavy Duty Face Lathe	1	Swing over bed : 1,300 mm Center distance : 1,500 mm Main motor : 22 kW Overall dimension (approx.) : 5,000L x 2,500W x 1,980H mm	12.5 ton
MS 1106	Universal Milling Machine	1	Table working surface : 1,550 x 300 mm Main motor : 5.5 kW Overall dimension (approx.) : 2,070L x 2,417W x 2,105H mm	3.5 ton
MS 1107	Slotting Machine	1	Ram stroke : 310 mm Main motor : 3.7 kW Overall dimension (approx.) : 1,690L x 2,770W x 2,915H mm	3.8 ton
MS 1108	Shaping Machine	1	Ram stroke : 800 mm Main motor : 5.5 kW Overall dimension (approx.) : 2,715L x 1,382W x 1,882H mm	4.2 ton
MS 1109	Double Housing Planning Machine	1	Cutting capacity : 3,000L x 1,500W x 1,300H mm Generator drive motor: 30 kW Overall dimension (approx.) : 10,800L x 4,300W x 3,700H mm	19.3 ton

1. Equipment for Machining (continued)

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
MS 1110	Gear Hobbing Machine	1	Max. work size : MP8 x 500ϕ mm Main motor : 5.5 kW Overall dimension (approx.) : 2,215L x 1,380W x 2,315H mm	5.2 ton
MS 1111	Surface Grinder	1	Max. work size : 1,200 x 500W mm Main motor : 7.5 kW Overall dimension (approx.) : 4,600L x 2,460W x 2,200H mm	9.3 ton
MS 1102	Cylindrical Roll Grinder	1	Max. work size : 600ϕ x 2,500L mm Main motor : 11 kW Overall dimension (approx.) : 8,000L x 2,720W x 2,100H mm	15.7 ton
MS 1113	Radial Drilling Machine	1	Drilling capacity (steel) : 80ϕ mm Main motor : 7.5 kW Overall dimension (approx.) : 3,050L x 1,400W x 3,120H mm	7.1 ton
MS 1114	Horizontal Band Sawing Machine	1	Cutting capacity : 360ϕ mm Main motor : 3.7 kW Overall dimension (approx.) : 2,220L x 1,010W x 1,220H mm	1.6 ton
MS 1115	Universal Tool and Cutter Grinder	1	Table size : 1,060L x 200W mm Main motor : 0.75 kW Overall dimension (approx.) : 1,300L x 1,300W x 1,520H mm	1.0 ton
MS 1116	Carbide Tool Grinder	1	Max. work size : 40 x 40 mm Main motor : 0.2 kW Overall dimension (approx.) : 670L x 920W x 1,110H mm	0.17 ton
MS 1117	Drill Grinder	1	Drill diameter : 12-80 mm Main motor : 0.75 kW Overall dimension (approx.) : 600L x 525W x 1,230H mm	0.4 ton
MS 1118	Layout Surface Plate	1	Surface plate size : 2,000 x 2,000 x 250 mm	2.3 ton
MS 1119	Clamping Tool	26		0.1 ton
MS 1120	Lathe 2M (SPANISH)	1	L-3/155 C.D.=2.225 m	
MS 1121	Lathe 1M (EGYPT)	1	1M x 450 mm	
MS 1122	Universal Milling M/C	1	Fu3 1,700 x 40	
MS 1123	Lathe 2M (CHINESE)	1	2M x 450	

2. Equipment for Assembling

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
MS 1201	Horizontal Hydraulic Press.	1	Max. capacity : 200 ton Main motor : 11 kW Overall dimension (approx.) : 6,050L x 2,000W x 2,000H mm	9 ton
MS 1202	Upright Drilling Machine	1	Drilling capacity (steel) : 40ϕ mm Main motor : 1.5 kW Overall dimension (approx.) : 550L x 900W x 2,143H mm	0.75 ton x 2
MS 1203	Portable Drilling Machine with Magnet Base	1	Drilling capacity (steel) : 25 mm Rated power : 1.3 kW	---
MS 1204	Motor Driven Winch	1	Capacity : 2 ton Main motor : 2.5 kW Overall dimension (approx.) : 1,700L x 630W x 765H mm	0.66 ton
MS 1205	Motor Driven Winch (Small)	3	Capacity : 1 ton Main motor : 2.5 kW Overall dimension (approx.) : 1,210L x 2,470W x 652H mm	0.35 ton x 3 pcs
MS 1206	Safety Scaffold	1	Main frame size : 1,524H x 1,219W mm Overall dimension (approx.) : 10L x 1.2W x 16.7H mm	3.6 ton
MS 1207	Submergible Water Pump	2	Volume : 60 m3/h	0.1 ton x 2 pcs
MS 1208	Surface Plate (box type)	2	3,000L x 1,500W x 250H mm	2.7 ton x 2 pcs
MS 1209	Test Stand for Hydraulic Oil Unit	1	Oil capacity : 400 lit. Main motor : 15 kW Overall dimension (approx.) : 1,610L x 1,425W x 1,400H mm	1.4 ton
MS 1210	Dynamic Balance Machine	1	Work size : 1,600ϕ x 2,000L mm Main motor : 7.5 kW Overall dimension (approx.) : 3,100L x 1,000W x 1,590H mm	1.6 ton
MS 1211	Transit	1	Magnification : x 30	---
MS 1212	Level	1	Magnification : x 32	---

3. Equipment for Fabricating

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
MS 1301	Horizontal Hydraulic Press.	1	Cutting capacity : 16t x 3,050w mm Main motor : 37 kW Overall dimension (approx.) : 4,270L x 2,950W x 2,460H mm	18.23 ton
MS 1302	Hydraulic Side Frame Press	1	Capacity : 300 ton Main motor : 22 kW Overall dimension (approx.) : 3,200L x 1,500W x 4,080H mm	18 ton
MS 1303	Bending Roller Machine	1	Bending capacity : 16t x 2,000w mm Main motor : 7.5 kW Overall dimension (approx.) : 4,200L x 1,720W x 1,600H mm	7 ton
MS 1304	Metal-Coating Spray Gun (Metallizing)	1	Max. work size : 600ϕ x 2,500L mm Main motor : 15 kW Overall dimension (approx.) : 5,400L x 1,300W x 1,370H mm	8 ton
MS 1305	Tig Welding Machine	1	Capacity : 300 ton Rated power : 28 kVA Overall dimension (approx.) : 430L x 510W x 1,345H mm	0.2 ton
MS 1306	Mig Welding Machine	1	Capacity : 350 ton Rated power : 18.1 kVA Overall dimension (approx.) : 350L x 680W x 690H mm	0.2 ton
MS 1307	Movable Pipe Threading Machine	1	Threading capacity : 1/4 - 4" Motor power : 0.75 kW Overall dimension (approx.) : 1,049L x 660W x 1,057H mm	0.23 ton
MS 1308	Movable Hydraulic Pipe Bender	1	Bending capacity : 3.8t x 60.5ϕ mm Motor power : 0.75 kW Overall dimension : 800L x 700W x 500H mm	0.1 ton
MS 1309	Heating Furnace	1	Inside dimension : 1,200L x 1,400W x 1,000H mm Motor power : 3.7 kW (Blower)	22.5 ton

3. Equipment for Fabricating

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
MS 1310	Pneumatic Forging Hammer	1	Capacity : 1 ton Motor power : 75 kW Overall dimension (approx.) : 4,700L x 1,950W x 4,850H mm	45 ton
MS 1311	Forklift with Rotating Clamp for Forging Operation	1	Handling capacity : 500 kg Overall dimension (approx.) : 4,700L x 1,330W x 2,200H mm	6 ton
MS 1312	Facility of Heat Treatment	1	Inside dimension : 3,000L x 1,650W x 1,200H mm Motor power : 41 kW (total)	24.5 ton
MS 1313	Surface Plate (Hole Type)	1	3,000L x 2,000W x 250H mm	3.7 ton
MS 1314	Surface Plate (Hole Type)	5	1,200L x 900W x 125H mm	0.5 ton

4. Equipment for Carpentry

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
MS 1401	Circular Saw	1	Table size : 840L x 700W mm Motor power : 3.7 kW (total) Overall dimension (approx.) : 1,015L x 810W x 875H mm	0.3 ton
MS 1402	Hand Feeding Single Side Surface Planner	1	Table size : 2,000L x 300W mm Motor power : 4.4 kW (total) Overall dimension (approx.) : 2,000L x 700W x 970H mm	0.7 ton
MS 1403	Automatic Feeding Single Side Surface Planner	1	Max. Width of planer : 450 mm Motor power : 5.9 kW (total) Overall dimension (approx.) : 1,075L x 990W x 1,200H mm	0.78 ton
MS 1404	Band Saw	1	Table size : 825L x 800W mm Motor power : 5.9 kW (total) Overall dimension (approx.) : 1,345L x 1,580W x 2,150H mm	0.75 ton
MS 1405	Wood Lathe	1	Swing over bed : 250 mm Center distance : 1,040 mm Motor power :.0.75 kW Overall dimension (approx.) : 1,980L x 655W x 1,255H mm	0.5 ton
MS 1406	Radial Arm Drill Press	1	Drilling capacity (wood) : 36ϕ mm Motor power : 0.4 kW Overall dimension (approx.) : 1,100L x 280W x 800H mm	0.13 ton

5. Equipment for Electrical Repair

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
MS 1501	Vacuum Dryer	1	Inside dimension : 2,500L x 1,500W x 1,500H mm Electric power : 83.7kW (total) Overall dimension (approx.) : 11,250L x 3,500W x 3,360H mm	5 ton
MS 1502	Automatic Layer Winder	1	Max. work size: 750ϕ x 870L mm Motor power : 0.75 kW Overall dimension (approx.) : 1,650L x 720W x 1,200H mm	0.45 ton
MS 1503	Winding Machine	1	Max. work size : 1,900ϕ x 1,700L mm Motor power : 3.7 kW Overall dimension (approx.) : 2,930L x 790W x 1,470H mm	1.3 ton
MS 1504	Coil Winding and Spreading Machine	1	Max. work size: 750L x 350W	0.1 ton
MS 1505	Impregnation and Saturation Machine	1	Capacity : 170 lit. Motor power : 0.25 kW Overall dimension (approx.) : 1,500ϕ x 850H mm	0.2 ton
MS 1506	Hydraulic Coil Press	1	Pressing force Horixontal : 7.718 kg Vertical : 3,632 kg Electric power : 8.3 kW (total) Overall dimension (approx.) : 1,092L x 1,056W x 1,570H mm	0.9 ton
MS 1507	Shear	1	Cutting capacity : 4.5t x 1,280W mm Motor power : 2.2 kW Overall dimension (approx.) : 2,450L x 1,800W x 1,350H mm	2.1 ton
MS 1508	Treadle Shear	1	Cutting capacity : 2.0t x 1,000W mm	0.4 ton
MS 1509	Insulation Cutter	1	Cutting capacity : 2t x 1,000W mm Overall dimension (approx.) : 900L x 1,500W x 900H mm	0.12 ton

5. Equipment for Electrical Repair (continued)

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
MS 1510	Surface Plate (Rail Type)	15	Overall dimension of one rail : 5,000L x 200W x 300H mm	1 ton x 15 pcs
MS 1511	Double Belt Sander	1	Belt width : 100 mm Motor power : 0.75 kW	0.1 ton
MS 1512	Mica Undercutter	1	Motor power : 0.5 kW	0.05 ton
MS 1513	Steam Cleaner	1	Steam volume : 320 - 640 lit./h Electric power : 0.31 kW	0.2 ton
MS 1514	Transfer Car	1	Car size : 1,500W x 2,000L mm	0.5 ton

6F.1 Electrical, Pneumatic and Hand Tools for Maintenance Shop

6F.1 Electrical and pneumatic tools (Item No. MS 9001)

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
1)	Electric floor grinder	1	Wheel dimension: 255ϕ x 25W mm Electric power : 1.15 kW	103 kg x 3 pcs
2)	Double head bench grinder	16	Wheel dimension: 205ϕ x 19W mm Electric power : 590 W	24 kg x 16pcs
3)	Bench drilling machine	16	Capacity (steel): 13 mm Electric power : 200 W	53 kg x 16pcs
4)	Bench drilling machine	5	Capacity (steel): 23 mm Electric power : 400 W	145 kg x 5 pcs
5)	Portable electric drill	5	Capacity (steel): 6.5 mm Electric power : 250 W	1.6 kg x 5 pcs
6)	Portable electric drill	15	Capacity (steel): 13 mm Electric power : 620 W	4.4 kg x 15pcs
7)	Portable electric disc sander (angle type)	11	Wheel size : 100ϕ mm Electric power : 480 W	1.8 kg x 11pcs
8)	Portable electric disc grinder (angle type)	2	Wheel size : 205ϕ mm Electric power : 1.35 kW	6.8 kg x 2 pcs
9)	Electric hand grinder	4	Wheel size : 32ϕ mm Electric power : 240 W	1.9 kg x 4 pcs
10)	Portable electric disc sander	3	Wheel size : 180ϕ mm Electric power : 820 W	5.0 kg
11)	Electric hand grinder	3	Wheel size : 125ϕ mm Electric power : 590 W	5.5 kg x 2 pcs
12)	Portable electric jig saw	3	Capacity (steel): 6t mm Electric power : 380 W	2.1 kg x 2 pcs
13)	Portable electric polisher	5	Wheel size : 125ϕ mm Electric power : 230 W	2.5 kg x 5 pcs
14)	Hot air generator	1	Capacity : 300 lit./min x 480°C Electric power : 1 kW	1.0 kg

6F.1 Electrical and pneumatic tools (continued)

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
15)	Hammer drill	4	Drill : 25 mm Electric power : 1.05 kW	7.0 kg x 4 pcs
16)	Portable circular saw with brake	1	Blade dia. : 185 mm Electric power : 950 kW	3.9 kg
17)	Electric plane	1	Capacity Width : 156 mm Depth : 0-3 mm Electric power : 1.14 kW	7.6 kg
18)	Movable abrasive cut-off machine	11	Capacity : 60ϕ mm Electric power : 3.7 kW	70 kg x 11pcs
19)	Movable electric vacuum cleaner	8	Capacity : 8.0 m^3/min Electric power : 3.4 kW	35 kg x 8 pcs
20)	Industrial cooling fan for workers	20	Capacity : 340 m^3/min Electric power : 800 W	15.5 kg x 20pcs
21)	Portable electric blower	8	Capacity : 2.3 m^3/min Electric power : 335 W	1.8 kg x 8 pcs
22)	Alternating current arc welder kit	29	Capacity : 300 A Electric power : 13.0 kW	100 kg x 29pcs
23)	Pneumatic needle scaler (air jet chisel)	3	Needle dia. : 3 mm	2.2 kg x 3 pcs
24)	High speed air grinder	3	Wheel size : 65ϕ mm	1.3 kg x 3 pcs
25)	Pneumatic angle grinder	3	Wheel size : 150ϕ mm	2.8 kg x 3 pcs
26)	Air drill	2	Capacity (steel) : 10 mm	1.4 kg x 2 pcs

6F.1 Electrical and pneumatic tools (continued)

Item No.	Name of equipment	Q'TY	Short Spec	Weight (approx.)
27)	Pneumatic riveting hammer	2	Capacity (steel) : 4.8 mm	1.4 kg x 2 pcs
28)	Concrete breaker	1	Piston dia. : 57.15 mm	30 kg
29)	Coal pick hammer (Pneumatic)	1	No. of striking : 1,250/min	9.0 kg
30)	Portable exhaust fan (propeller fan)	3	Capacity : 70m3/min Electric power : 200 W	10.0 kg x 3 pcs
31)	Electric chain hoist with electric trolley	1	Capacity : 2 ton Lift : 4 m	160 kg (without I-beam)

5.2.10. In-works transportation facilities (TR)

1) Outline

Transportation in the compound of the Works includes transport and storing of raw materials, products, by-products and others required for production and sale of about 1,035,000 t/y of rebar and also maintenance of transportation equipment and is classified and controlled as given below.

a) Trasportation and purchasing department in charge of :

(1) Storing, handling and delivery of raw materials and sub-materials

(2) Control, storing and delivery of materials and spares

(3) Handling and disposal of wastes

(4) Control and operation of weighing stations

(5) Inspection and repair of vehicles

b) Production and technical coodination department

(1) Transportation of products from plants to yards and control of products at yards and delivery to users

2) Material transportation flow

Main routes of material transportation flow and amount of handling in the El Dikheila Works are as shown in Table 5.2.10-1.

Table 5.2.10-1 Material to be Transported

(result in 1992)

Material	Route	Amount t/y
Purchased scrap	O.S.Y. ~ SMP - S.Y.	240,035
Limestone	Storage yard ~ LCP hopper	66,648
Sub-material	Warehouse (WH/3) ~ SMP	21,085
SMP refractories	Warehouse (WH/1) ~ SMP	23,499
Electrode	Warehouse (WH/1) ~ SMP	4,718
Products (bars)	BMP ~ Products yard	514,200
Products (rods)	RMP ~ Products yard	520,800
Home scrap CC	CC ~ SMP - S.Y.	7,600
(SLAG)	Cutting area ~ SMP - S.Y.	15,029
BMP	BMP ~ SMP - S.Y.	6,012
RMP	RMP ~ SMP - S.Y.	10,293
Slag yard	Slag yard ~ treatment area	25,628
Mill scale CC	CC ~ Stock yard	5,489
RMP	RMP ~ Stock yard	13,949
By-products:		
Oxide fine	DRP ~ Stock yard	2,779
Limestone fine	LCP ~ Stock yard	6,607
Briquet	DRP ~ SMP - S.Y.	21,753
Wastes:		
Slag	SMP ~ Slag yard ~ Disposal area	234,274
DRP dust	DRP ~ Disposal area	60,919
SMP	SMP ~ Disposal area	42,799

*O.S.Y. = Open Scrap Yard
SMP-S.Y. = SMP scrap yard

3) Major equipment

a) In-works transportation vehicles

(1) Transportation section

Forklift	6 units
Wheel loader	9 units
Crawler shovel	5 units
Hydraulic breaker	2 units
Bulldozer	2 units
Self-loading dump truck	6 units
Dump truck	34 units
Flat deck truck	8 units
Semi-trailer/Tractor	One unit each
Crawler mounted crane with lif-mag	8 units
Others	

(2) Other sections

Forklift	16 units
Charging machine	3 units
Semi-trailer & Tractor	5 units
Truck crane	12 units
Bulldozer	3 units
Double cabine truck	3 units
Single cabine truck	35 units
Private car	17 units
Ambulance	1 unit
Fire truck	1 unit
Others	

b) Warehouse

for brick	8,700m^2

	for spare parts	3,100m^2 + 600m^2
	for additives	2,300m^2
c)	Slag yard	110m x 2
d)	Car repair shop	1 set
e)	Products dispatch yard	97,100m^2 + temporary stock yard

5.2.11. Analysis and inspection facilities (AI)

1) Outline

ANSDK's analysis and inspection facilities were supplied by Shimazu Co. A contract was signed in December 1984 and analysis work was begun in May 1986. Modern analysis equipment has been installed rationally in a two-storied building of 35 m x 14.5 m.

The analysis and inspection facilities include sample preparation section, chemical analysis section, metallurgical section and supporting facilities such as waste disposal and electric measuring instruments.

2) Description of sections

The sample preparation section consists of cutting tools, grinding tools, saws, crushers, etc. and prepares samples before analysis and testing at the chemical analysis section and the metallurgical section. Samples of the steelmaking plant are sent by pneumatic tube very fast to this sample preparation section. This section prepares samples and at the same time keeps samples.

The chemical analysis section consists of such facilities as fluorescent X-ray analyzer, optical emission spectrometer, carbon & sulfur determinator, and automatic absorption & flame emission spectrometer, and performs chemical analysis of raw meterials and products of production facilities such as DR, LC SMP, and RMP, chemical analysis for water treatment facilities, and chemical analysis of natural gas, waste gas, oil, and others. Among others, rapidly

analyzing samples from EAFs and CCMs and feeding back the result immediately and correctly is the most important task of this section. For the purpose, data transmission system is established between the computers in addition to the above pneumatic tube.

The metallurgical section consists of tension and compression tester, hardness tester, and impact tester, and mainly performs mechanical tests of final rolled steel products and also sampling tests of semi-finished products.

Items of chemical analysis and physical tests are shown in Table 5.2.11-1 and Table 5.2.11-2, respectively.

A list of analysis samples and their frequency at ANSDK is shown in Table 5.2.11-3.

The present operation rate of the main equipment is shown in Table 5.2.11-4 and Table 5.2.11-5.

Table 5.2.11-1 Samples and Chemical Analysis Items

	SAMPLES	PURPOSE OF ANALYSIS	ACTIONS ACCORDING TO ANALYSIS RESULTS	ANALYSIS ITEMS	ANALYZER
1	Sample in EAF	Analysis of elements in molten steel	Control of EAF refining condition	C,S	C & S determinator Optical emission spectrometer
				O_2, N_2	N & O determinator
				Si, Mn, P, Ni, Cr, Mo, Al, V, Cu, Sn, S, Pb, Sb, As, Ti	Fluorescent X-ray analyzer Optical emission spectrometer Wet chemical analysis
2	Sample in ladle	Representative chemical composition of the charge	Acceptance of judgment according to the specified steel grade Steel grade decision	C, S	C & S determinator Optical emission spectrometer
				O_2, N_2	N & O determinator
				Si, Mn, P, Ni, Cr, Mo, Al, V, Cu, Sn, S, Pb, Sb, As, Ti	Fluorescent X-ray analyzer Optical emission spectrometer Wet chemical analysis
3	Sponge iron	Analysis of reduction ratio	Control of DR refining condition	T-Fe, SiO_2, CaO, MgO, Al_2O_3, TiO_2, V_2O_5, P	Fluorescent X-ray analyzer Wet chemical analysis Saturation magnetic analyzer
				M-Fe, T-Fe	Wet chemical analysis
				C, S	C & S determinator
4	Oxide pellets & lump ore	Analysis of samples per delivery	Evaluation and judgment according to the requirement	T-Fe, SiO_2, CaO, MgO, Al_2O_3, TiO_2, V_2O_5, P	Fluorescent X-ray analyzer Wet chemical analysis
				S	C & S determinator
				FeO, T-Fe	Wet chemical analysis

	SAMPLES	PURPOSE OF ANALYSIS	ACTIONS ACCORDING TO ANALYSIS RESULTS	ANALYSIS ITEMS	ANALYZER
5	Burnt lime	Analysis of burning ratio	Control of calcining lime	Rest CO_2, S	C & S determinator
				SiO_2, CaO, Al_2O_3, Fe_2O_3, MgO, K_2O, Na_2O, P	Fluorescent X-ray analyzer Wet chemical analysis
		Reactivity		Coarse grain titration	
6	Limestone	Analysis of samples per delivery	Evaluation and judgment according to the requirement	SiO_2, CaO, Al_2O_3, Fe_2O_3, MgO, K_2O, P, loss of ignition (LOI)	Fluorescent X-ray analyzer Wet chemical analysis
				S	C & S determinator
7	EAF slag	Analysis of basicity and FeO content	Control of basicity and chemical composition in molten steel	T-Fe, SiO_2, CaO, MnO, Al_2O_3, MgO, V_2O_5, S, TiO_2, P_2O_5	Fluorescent X-ray analyzer Wet chemical analysis
				FeO, T-Fe	Wet chemical analysis
8	Natural gas	Monitor of H_2S and CO_2 Contents in natural gas Investigation data		H_2S, CH_4, CmHn, N_2, CO_2, CO, O_2	Gas chromatograph
				CO_2, CO, O_2, H_2	Orsat gas analyzing apparatus

	SAMPLES	PURPOSE OF ANALYSIS	ACTIONS ACCORDING TO ANALYSIS RESULTS	ANALYSIS ITEMS	ANALYZER
9	Industrial water	Checking the quality of water	Control of water characteristics	pH, conductivity	Water testing meter
				Cl, Ca, Mg, SiO_2, SO_4, alkalinity	Wet chemial analysis
				NH_4	Nessler analysis
				Suspended solid	Filtration
				Inhibitor	Spectrophotometer Wet chemical analysis
				Absorbed O_2	Water testing meter
				Turbidity	Wet chemical analysis
10	Liquid oxygen	Checking the C2H2 content, and protection against explosion	Control of C2H2 content	C_2H_2	Gas chromatograph
11	Oil and lubricant	Checking the quality of oil and lubricant	Evaluation and judgement according to the requirement	Heavy metals (Ti, V, Ca, Ni, Zn, Cr)	Fluorescent X-ray analyzer Wet chemical analysis
12	Refractory	Checking the quality of refractory	Evaluation and judgement according to the requirement	SiO_2, Al_2O_3, Fe_2O_3, TiO_2. CaO, MgO, Cr_2O_3	Fluorescent X-ray analyzer Wet chemical analysis

Table 5.2.11-2 Samples and Physical Testing Items

	SAMPLES	PHYSICAL TESTING ITEMS
1	Bar & rod	Tensile strength Bending test Hardness test Impact test Re-bend test
2	Sponge iron, oxide pellet & lump ore	Specific gravity Cold crushing strength Screen analysis Tumbler test Bulk density Drop test Porosity Moisture content
3	Limestone and burnt lime	Specific gravity Abrasion Porosity Cold crushing strength
4	Natural gas	Calorific value
5	Oil and lubricant	Kinematic viscosity Cloud and pour point Water content Precipitation value Saponification value Interfacial tension Consistency Dropping point Evaporation
6	Refractory	Refractoriness Refractoriness under load Cold crushing strength Thermal expansion Thermal conductivity Residual linear expansion Modulus of rupture Slag corrosion Apparent porosity Water absorption Specific gravity Gas permeability
7	Briquette (DRI)	Drop test Screen analysis Cold crushing strength Moisture content
8	Briquette (Lime)	Drop test Screen analysis Cold crushing strength Moisture content

Table 5.2.11-3 Samples and Receiving Frequency

	SAMPLES	RECEIVING FREQUENCY	RECEIVING CONDITION	RECEIVING ROOM
1	EAF sample	4-6 times/heat	Temp. : Below 700°C Size : ϕ 35/30 x 70	Sending station of sample trans. system in EAF
2	Ladle sample	Once/heat	Temp. : Below 700°C Size : ϕ 35/30 x 70	Sending station of sample trans. system in CCM
3	EAF slag	Once/heat	Temp. : Below 100°C Size : ϕ 35/30 x 70	Sending station of sample trans. system in EAF
4	Bar & rod sample*	3 samples/ charge	300 mml/size and charge-wise	Universal testing machine room
5	Sponge iron sample	Once/ 4 hours	Weight : 5 kg Size : <50 mm	Sample preparation room (Non-metal)
6	Oxide pellet sample	Once/week	Weight : 5 kg Size : <50 mm	-Ditto-
7	Limestone	Once/week	Weight : 5 kg Size : 20-50 mm	-Ditto-
8	Burnt lime sample	Once/ 4 hours	Weight : 5 kg Size : <40 mm	-Ditto-
9	Natural gas sample	Once/week	Gas collecting tube or gas sampling bubbler	Gas analysis room

*Quantity depends on the Egyptian Standard No. ES262-1974.

	SAMPLES	RECEIVING FREQUENCY	RECEIVING CONDITION	RECEIVING ROOM
10	Industrial water sample · DR circular-tion water · Raw water · Make-up water · WTS No.1 · WTS No.2	Twice/week Once/week 3 times/week Once/day	4 liters/each sample water,using sampling bottle	Analysis room (Liquid)
11	Oil and lubricant	300 samples/ year	2 liters or 2 kg	Analysis room (Oil)
12	Refractory	Twice/ month	5 standard size bricks and 5 kg of castable	Preparation room (Non-metal)
13	Liquid oxygen	Once/week	Al container	Gas analysis room

Table 5.2.11-4 Operation Rate (Chemical Analysis Section)

	EQUIPMENT	OPERATION RATE
1	Optical emission spectrometer	50%
2	X-ray fluorescent analyzer	25%
3	Carbon and sulphur determinator	20%
4	Wet chemical lab with: A : Atomic absorption spectrophotometer B : U.V. spectrophotometer	A : 30% (per 8 h) B : 40% (per 8 h)
5	Sample transportation system	50%
6	Oil & grease testing facilities	50% (per 8 h)
7	Gas chromatograph	65% (per 8 h)
8	Abrasive cut-off machine	50%
9	Double head pedestal belt grinding machine	50%
10	Disc vibration mill	20%

Table 5.2.11-5 Operation Rate (Metallurgical Section)

	EQUIPMENT	OPERATION RATE
1	Universal testing machine	88% (per 8 h) 12% (per 8 h)
2	Compression testing machine	55% (per 8 h)
3	Charpy impact tester	10% (per 8 h)
4	Refractoriness tester	Occasionally
5	Refractoriness under load tester	Occasionally
6	Thermal conductivity tester	Occasionally
7	Thermal expansion tester	Occasionally
8	Hardness tester	Occasionally
9	Universal projector	Occasionally
10	Optical metallographic microscope	Occasionally
11	Horizontal band-saw cutting machine	25% (per 8 h)

5.2.12. Administration facilities

Administration facilities of El Dikheila Works include administrative buildings, roads and sewage facilities in the Works and employees housing.

1) Administrative building

Table 5.2.12-1 List of Administrative Buildings

Name	Building Area	Floor Area	Construction
Main office	2,386 m^2	4,193 m^2	RC
Restaurant	797	826	RC
SMP site office	468	936	RC
RMP site office	432	864	RC
T.R. site office	300	300	RC
M.T. site office	585	585	RC
Guard office	220	220	RC
Fire station	431.6	431.6	SS
Gate, No.1-No.5	82	82	RC
Watch room, No.1-No.12	19.5	19.5	RC

Note: In Addition, there is a site offce of DR control room with area of 129 m^2 and accommodating 68 persons.

2) Roads and sewage facilities in the Works

Width of roads, all paved, in the Works is 13 m for the trunk line, 9 m for branch line and 6 m for others and the roads are finished to ensure smooth transportation of raw materials and products.

Alexandria area is under the influence of the Mediter-

ranean climate and annual rainfall is about 200 mm, but in the rainy season (Nov. - Mar.), rain often falls somewhat heavily in a short time. Sewage system is that of combined rainwater and plant effluent and installed throughout the Works.

All sewer pipings gather at the pump station installed at the last downstream, from which sewage is discharged by pumping into the Mediterranean Sea. The effluent conforms to the water quality standard of Egypt and adequate attention is paid to measures against pollution of the open sea and water quality.

5.3. Present Status of Infrastructure

5.3.1. Natural gas supply

The natural gas used in ANSDK is supplied by pipeline from Webco plant (Abu Qir) and Bader El-dine plant of EGPC; 65 % from Webco and 35 % from Bader plant.

The supply capacity of this pipeline and the receiving capacity of EGPC stationed in ANSDK is both 92,000 Nm^3/h, which is sufficient for the expansion project.

The actual receiving quantity is 33,000 Nm^3/h and the design receiving capacity is 50,000 Nm^3/h.

The supply of the gas has been assured up to the year 2002 by the agreement between ANSDK and EGPC.

The present supply conditions of the natural gas are as follows:

· Supply capacity	:	92,000 Nm^3/h
· Pipeline to ANSDK	:	450 A
· Receiving capacity of EGPC stationed in ANSDK	:	92,000 Nm^3/h
· Receiving capacity of ANSDK		
- Design	:	50,000 Nm^3/h
- Actual	:	33,000 Nm^3/h
· Net calorific value	:	9,062 kcal/Nm^3

(Data in July 1991)

The quality of the gas is shown in Table 5.3.1-1.
As for this natural gas quality, especially DR plant has been suffering from its heavy hydrocarbon, such as C5+, C4

and C3 due to mixing of Webco plant and Bader El-dine plant since October 1990. Since the heavy hydrocarbon is cracked and creates/deposits carbon around catalyst inside reformer tube, carbon removal operation, so-called carbon burn-out operation, should be executed by stopping DRI production, which affects DRI production plan.
Therefore,it is important to study how to eliminate such heavy hydrocarbon from natural gas through the discussion between ANSDK and EGPC.

Table 5.3.1-1 Natural Gas Quality in ANSDK

(Data in July 1991)

ITEM	REQUIREMENT	ACTUAL
CH4 (%)	≧94.00	91.25
CO2 (%)	-	1.91
C2H6 (%)	<4.00	4.47
C3H8 (%)	<1.50	1.65
I-C4H10 (%)	<0.40	0.27
N-C4H10 (%)		0.27
I-C5H12 (%)	<0.10	0.08
N-C5H12 (%)		0.05
N-C6H14 (%)		0.04
N2 (%)		-
Sulfur (ppm)	≦5	-
Gross calorific value (kcal/Nm3)	-	10,038
Net calorific value (kcal/Nm3)	-	9,062

5.3.2. Industrial water

Industrial water and potable water used in ANSDK are supplied by waterworks of Alexandria Water Authority. Water quality is shown in Table 5.3.2-1. As seen from the table, total hardness is high and the water is used afer softening treatment with ion exchange resin and used as potable water after chlorination. There is no big problem in particular in the supply of industrial water except that water pressure drop occurs rather frequently (1 kg/cm2 as against rated pressure of 3 kg/cm2).

Present conditions are as follows.

- Supply capacity : 2,000 m^3/h
- Pipeline to ANSDK : 700 mmϕ, 1-3 kg/cm2G
- Receiving capacity : 930 m^3/h
- Receiving piping : 450 mmϕ, 1-3 kg/cm2G
- Consumption : 550 m^3/h (March 1993)
  630 m^3/h
  (Estimated, at full operation)

Table 5.3.2-1 Raw Water Quality in ANSDK

ITEM	ACTUAL
Turbidity	2.6-3.0 NTU
Smell	Normal
Taste	Normal
Color	Normal
pH	7.0-8.1
CL	30.2-88.00 ppm
CL_2 (Free)	0.1-0.6 ppm
Total alkalinity as CaCO3	129.2-174.0 ppm
Total hardness as CaCO3	137.5-205.0 ppm (Av. 159.6 ppm)
Free NH_3	0.082-0.42 ppm
Albuminoid NH_3	0.041-0.190 ppm
Absorbed O_2 (during 3 hours at 37°C)	0.87-1.20 ppm
Total Fe	Less than 0.05 ppm
Ca	19.70-46.40 ppm
Mg	12.30-19.74 ppm
Na+K (as Na)	38.83-86.00 ppm
Carbonate	75.48-104.40 ppm
Sulfate	34.44-52.90 ppm
Nitrate	1.90-4.80 ppm
Silica	7.00-18.80 ppm
Dissolved solids (110°C)	192.00-432.00 ppm
Electric conductivity	350-560 μ Mho/cm
Maximum temperature	30°C
Minimum pressure	2 kgf/cm2G
Total flow rate	930 m^3/h (max.)

5.3.3 Electric power

At present, ANSDK receives electric power through two circuit, 405-mm sq. power transmission lines via Ameria sub-station and El Dikheila substation from Kafr Dawar Power Station of Egyptian Electricity Authority (EEA).

At the time of the start-up, ANSDK was affected by the problems of the power supply shortage. However, the power supply situation in Egypt has been improved since. And ANSDK has enjoyed the production increase without the restriction of the power supply, in addition to ANSDK's own efforts.

1) Present power supply condition

a) Power supply in the entire Egypt

(1) Max. power generating capacity	12,415 MW (Mar. '93)
(2) Av. power demand	4,914 MW (Mar. '93)
(3) Max. power demand	7,560 MW (Mar. '93)

b) Power supply in the Alexandria area

(1) Max. power generating capacity	1,213 MW (Mar. '93)
(2) Av. power demand	682 MW (Mar. '93)
(3) Max. power demand	1,050 MW (Mar. '93)

c) Power supply to ANSDK

(1) Contracted power with EEA

15 minute demand	187 MW
Instant	228 MW

(2) Actual power consumption

15 minute demand	173 MW (1992)

(3) Estimated consumption at full operation

	4 EAFs
15 minute demand	168.5 MW
Momentary demand	218.5 MW

(4) Transmission line to ANSDK

Ameria line: From Ameria substation to Dikheila substation

Voltage	220 kV
Cable size	405 mm^2
Distance	5.8 km
No. of lines	2 circuits

Abu Qir line: Abu Qir power station to Dikheila sub-station (under construction & completion scheduled by the end of '87)

Voltage	220 kV
Cable size	405 mm^2
Distance	46 km
No. of lines	2 circuits

(5) Short-circuit capacity at the receiving point

EEA indication: 4,500 MVA
(Ameria substation)

Actual value: Normally 4,000 MVA
(ANSDK receiving point)
Minimum 3,000-3,700 MVA (-"-)

(6) Power factor

Permissible av. Value: Contracted value 90% min.
Actual value 99%

(7) Flicker regulation

At receiving point of ANSDK
$\triangle V_{10}$ --- 0.45 (V/100V)

5.3.4. Raw material receiving facilities

The raw material berths, storage yard and transporting facilities were constructed by Industrial Mining Complexes (IMC) and completed at the end of 1986. At present, these facilities are under control of the Port Authority, but the operation and maintenance are conducted by ANSDK.

As the main raw material, pellets are imported from Samarco (Brazil), CVRD (Brazil) and LKAB (Sweden) by ships of 100,000 to 150,000 deadweight tonnage. About 1.2 million tons of pellets are received into or delivered from this yard annually.

In addition, the stock yard has been newly expanded to handle coals since 1992 by utilizing the same unloader cranes, stacker cranes, reclaimer cranes, etc. This coal stock yard is located at the south of the existing pellet yard and its capacity is 80,000 tons.

At present, the raw materials (pellets, coals) supplied to ANSDK (pellets) or to the other customers (coals) are (1) unloaded by unloader cranes from a raw material vessel at the raw material berth, (2) transported by belt conveyors to the storage yard, (3) piled by stacker crane at the yard, (4) reclaimed by reclaimer crane from a pile, and (5) transported by conveyors.

In addition to the above, depending upon the production plan, HBI and DRI are imported. These materials are unloaded by unloading cranes, then trasported directly to ANSDK by trucks.

Main specifications of the mineral jetty and stockyard are as follows:

1) Raw material berth

- Total length : 650 m
- Water depth : 14-20 m
- Vessel size : 200,000 DWT max

2) Unloader crane

- No. of units : 2
- Unloading capacity : 1,000 t/h x 2
- Lifting capacity : 30 t (bucket + raw material)
- Arm length
  (from seaside rail) : 37 m
- Rail span : 20 m
- Bucket traversing distance : 65 m
- Lift
  - Above seaside rail : 22 m
  - Below seaside rail : 18 m
- Speed
  - Lifting : 120 m/min
  - Bucket traverse : 220 m/min
  - Crane travel : 20 m/min

3) Stacker crane

- No. of units : 2
- Capacity : 2,000 t/h x 2
- Length of boom : 35 m
- Inclination of boom : 12° max
- Total traveling distance : 630 m
- Rail span : 12 m

4) Reclaimer crane

- No. of units : 2
- Capacity : 800 t/h x 2
- Length of boom : 40 m
- Inclination of boom : 12° max
- Total traveling distance : 630 m
- Rail span : 10 m

5) Conveyor

- Capacity : 700-1,000 t/h
- Belt width : 800-1,200 mm
- Speed : 2.5-2.7 m/min

6) Stockyard

- Oxide pellet
  - Area : Approx 30,000 m^2
  - Capacity : Approx 300,000 t
- Coal
  - Area : Approx 20,000 m^2
  - Capacity : Approx 80,000 t

At present, there are no serious problems appeared even after receiving of coals by careful operation of ANSDK.

CHAPTER 6. EXPANSION PLAN

6.1. Basic Policy of Expansion Plan

6.1.1. Product mix and production

In the F/S conducted by JICA from 1987 to 1988, increase of steel grades in addition to the production of rebars was studied considering the market conditions in Egypt, economic point of view, layout of El Dikheila Iron and Steel Works, operational conditions of the Works, etc.
After all the study, the expansion of rebar production was recommended.
In this F/S, the same subjects as the above have been investigated and studied for updating. The results are as follows:

As stated in CHAPTER 3, the consumption of steel products in Egypt has increased year by year, and will reach 6.3 million t/y in 2002. Especially, the consumption of bar products will reach 4.6 million t/y. On the other hand, the production of bars in Egypt is now about 1.9 million t/y and will be 2.0 million t/y in 2002. The discrepancy between consumption and supply of bar products has been very large historically in Egypt in spite of the expansion of the production capacity in Egyptian steel mills. Though the imbalance between consumption and supply of steel products has been compensated by imported products, this imbalance will further increase.

The prices of bar products are now at considerable levels and this situation will continue mainly due to shortage of steel products in Egypt.

El Dikheila Iron and Steel Works produces mainly rebar of about 1.0 million tons/year with high productivity and excellent operational technology and delivers steel

products to the domestic market and partially foreign markets.

Considering all the above, increase of production of rebar is recommended to El Dikheila Iron and Steel Works as the core of the expansion plan.

In the meantime, consumption of quality steel is seen in Egypt and the demand will increase in accordance with the development of the mechanical, electrical, and car industries. However, the increase in the consumption of quality steel is expected to be small.

As seen in the previous F/S, El Dikheila Iron and Steel Works has some possibility of producing the quality steels. However, considering the production quantity, investment cost, limitation due to process, development of operational technology, etc., production of quality steel will not be beneficial to ANSDK now. Therefore, expansion of the facilities for increase of rebar production is preferable.

With regard to the production capacity of bar and wire rod after the expansion, the target should be 1.5 million tons per year, considering the investment cost, full utilization of the existing facilities, layout, etc., instead of 1.1 to 1.2 million tons per year in the previous F/S because the present production is more than 1.0 million tons per year of rolled products.

6.1.2. Expansion of production facilities

In the previous F/S, expansion of the production facilities consisted of one direct reduction plant, two electric arc furnaces, one continuous billet caster, and one strand of wire rod mill to be added to the existing

mill, and those specifications of the equipment were the same as those of the existing equipment.

Based on the investigation conducted this time, an economic analysis has been performed to reexamine the feasibility of the expansion plan using the planned expansion of production facilities. The obtained ROI is as low as 7.48%. The detailed data and results of the economic analysis are shown in APPENDIX 2.

Therefore, review of the production process for the expansion plan is required to improve the ROI by reduction of the investment cost for the main production facilities consisting of the direct reduction plant, electric arc furnaces and billet caster, and wire rod mill.

Installation of the direct reduction plant was planned to secure iron resources under the unstable market conditions of scrap at the time of previous F/S, and to obtain less contaminated raw material. Presently, scrap can be easily procured from abroad in terms of quality and quantity. Also, HBI can be utilized.

Considering the above, the direct reduction plant is deleted from the expansion plan for production of rebar of some 0.4 million t/y.

In the steelmaking plant, the addition of two electric arc furnaces was planned in the previous F/S. However, the production of molten steel is now reaching about 1.2 million t/y using the existing four electric arc furnaces. If ladle furnaces are installed in the steelmaking plant, the production capacity of molten steel in El Dikheila Iron and Steel Works will increase by more than 0.4 million t/y. This ladle furnace process is now widely used in many steel mills in order to increase the production capacity through reduction of the tap-to-tap

time of electric arc furnace and also the investment cost of ladle furnaces is lower than that of the electric arc furnaces.

Therefore, adoption of ladle furnaces is preferable to the installation of new electric arc furnaces from the viewpoint of investment cost.

The production of billets by the existing three continuous casters in El Dikheila is now about 1.1 million t/y. If the operation ratio of the casters is increased, the billet production will reach about 1.5 million t/y, and this is attainable under the present operation in El Dikheila. Therefore, installation of the new caster is deleted.

In the rolling mill plant, the production of bar and wire rod exceeds the designed capacity and there remains no room to further expand the production capacity.
Therefore, the additional facilities are required to increase the production capacity by about 0.4 million t/y. Addition of one strand in the wire rod mill as planned in the previous F/S is advantageous and recommendable.

The expansion plan has been reviewed in order to increase the production of rebar by 0.4 million t/y with full utilization of the existing plant and the investment cost as low as possible.

The aim of the expansion is to increase the production of rebar from the present 1.1 million tons per year to 1.5 million tons per year through maximum use of the existing equipment, maximization of scrap as raw material, and minimum investment. Based on this basic concept, the following production facilities are required.

1) Steelmaking plant

Two ladle furnaces will be installed to reduce the tap-to-tap time of the existing electric arc furnaces together with application of oxygen lancing to accelerate scrap melting.

2) Rolling mill plant

In the wire rod mill, a one-strand line consisting of intermediate and finishing mill stands, and one coil cooling and handling line will be installed. The existing reheating furnace will be modified to increase the heating capacity.

3) Other facilities

In accordance with the installation and modification of the production facilities, the plant support facilities like water treatment facilities, oxygen gas generation facilities, compressed air generation facilities, transportation facilities, maintenance facilities, and analysis and inspection facilities will be modified as needed.

6.1.3. Further expansion

Advance into new fields

Any enterprise desires to expand its business in consideration of successive advance. To survive, it is important for steel producers to advance into new fields by incorporation of new technologies and by expansion of product mix through sufficient survey of the steel market.

In the case of ANSDK in terms of expansion, the project of 1.0 million t/y rebar production is under successful execution as Stage-1. Then, the expansion plan of additional 0.5 million t/y of steel products, mainly

rebars, will lead to the steel complex specialized in long products with the production capacity of 1.5 million t/y.

After completion of this expansion project, the further expansion project, mainly in terms of technologies, will focus on the high value added product such as strip and/or long products.

1) Advance of mini-mills into the production of flat products

Recently, many projects that allow mini-mills to move up to the production of flat products are successively under execution worldwide. In U.S.A., NUCOR constructed the world-first mini-mill plant for production of strip products in Crawfordsville in 1989. Since its start-up, NUCOR has solved problems one after another to be successful in the American market. Furthermore, NUCOR is active in setting forth new plants, which is a stimulus to the steel producers in the world.

Today, regardless of blast-furnace-integrated steel mills or mini-mills, the production of flat products from electric arc furnace steel is a common topic not only in America and Europe but also in other countries. As a matter of fact, several projects have been announced in various areas in the world for production of flat products by mini-mills using electric arc furnace steel. Some of these projects have been completed to start production, while some others are toward completion.

This situation is explained by the fact that the applicable range of flat products produced from electric arc furnace steel has been extended by the recent improvement and development of steelmaking

technologies and that the investment cost, less than that of blast furnace integrated process, is for about 1.0 million t/y of production capacity with utilization of advantage of mini-mills. Also, the recent stability of scrap price contributes to sufficiently high competitiveness thanks to the superior productivity of labor in mini-mills.
To be successful in the steel market, it is of course important to meet surrounding conditions such as the market demand.

Conceptional plan for strip mill is as follows:

A direct reduction (DR) plant can be installed next to the existing DR plant on the premises of El Dikheila Iron and Steel Works.
A steelmaking plant, a strip rolling mill, and related facilities will be installed in the green field in the south of the Works.
The direct reduced iron produced by the new DR plant will be transferred to the new steelmaking plant by a new belt conveyor.
The flat products will be hot rolled coils of 1,250 mm in width, 2.0 to 6.0 mm in thickness, and about 20 tons in coil weight. The steel grade will be carbon steel for general use.
The facilities to produce flat products will consist of one 600-module DR plant, two 100- to 150-ton electric arc furnaces, and one 100- to 150-ton secondary metallurgy equipment. The capacity and type of these facilities should be decided through detailed study in consideration of the required quality of products.
The hot rolling mill will be a finishing mill of five to six stands directly connected to a thin slab caster or a semi-continuous hot strip mill with a coil box.

At any rate, the equipment should be selected considering the quality, quantity, and others of flat products to be produced through detailed study.

In the analysis of further expansion plan, study of the demand-supply conditions in Egypt plays a major role.
Concerning the flat products in general, the gap between demand and supply is on the increase and is expected to reach about 0.7 million tons in the year 2002. Though detailed market research including indirect export will be required, successful advance of ANSDK into the production and sales of flat products in future will have a possibility thanks to its advantageous standing of a mini-mill.

2) Expansion for production of long products

Even after completion of the expansion project analyzed in this F/S, supply of long products is expected to run short because of the active demand.

Facilities for additional production of long products in ANSDK will be as follow:

For additional production capacity of long products of 0.3 to 0.5 million t/y utilizing the existing area of El Dikheila Iron and Steel Works, new facilities will consist of one 600-module DR plant, one 70-ton electric arc furnace, three ladle furnaces, a continuous caster, a new rolling facility, for example a merchant bar mill, and ancillary facilities.
The detail of technical conditions and financial analysis is included in APPENDIX -5.

The steel grade will mainly be carbon steel. The steel grade and kind of products, however, should be

decided in consideration of future demand.
As a matter of course, both cases for future expansion should be studied through research of market characteristics and economy as well as feasibility.

6.2. Production Plan

6.2.1. Size composition and production of products

Composition of rebars by size and annual production plan is shown in Table 6.2-1. Size composition varies according to demand structure, but in this F/S it is assumed that imported products are to be substituted by domestic products and the size composition was discussed and decided between ANSDK and the JICA's Study Mission.

6.2.2. Material balance sheet

Material balance sheet used as the basic model in this F/S is shown in Fig. 6.2-1. Unit consumption and yield of raw materials, auxiliary raw materials and semi-products at each plant were established based on the actual results of El Dikheila Iron and Steel Works.

Tabe 6.2-1 Size Composition and Annual Production of Rebars

Mill	Dia.	Products		Rolling Productivity	Rolling hour	Available hour
		Ton	Ratio			
	(mm)	1,000t/y	%	t/y	h/y	h/y
ROD	5.5	46.9	5	99.8	470	
	6	131.3	14	124.2	1,058	
	6.5	28.1	3	147.0	192	
	7	18.7	2	147.0	127	
	7.5	18.7	2	147.0	127	
	8	145.5	15.5	147.0	990	
	9	18.7	2	147.0	127	
	10	310.0	33	147.0	2,109	
	12	215.8	23	147.0	1,468	
	13	4.7	0.5	147.0	32	
	Total	983.4	100		6,700	6,700
BAR	10	112.0	20	62.6	1,789	
	12	156.8	28	83.1	1,886	
	13	0	0	-	-	
	14	5.6	1	94.5	59	
	16	173.5	31	106.0	1,636	
	18	50.4	9	108.2	465	
	19	0	0	-	-	
	20	5.6	1	108.7	51	
	22	22.4	4	109.1	205	
	25	22.4	4	109.1	205	
	28	5.6	1	108.0	51	
	32	5.6	1	108.0	51	
	Total	559.9	100		6,398	6,398
ROD + BAR		1,498.3				

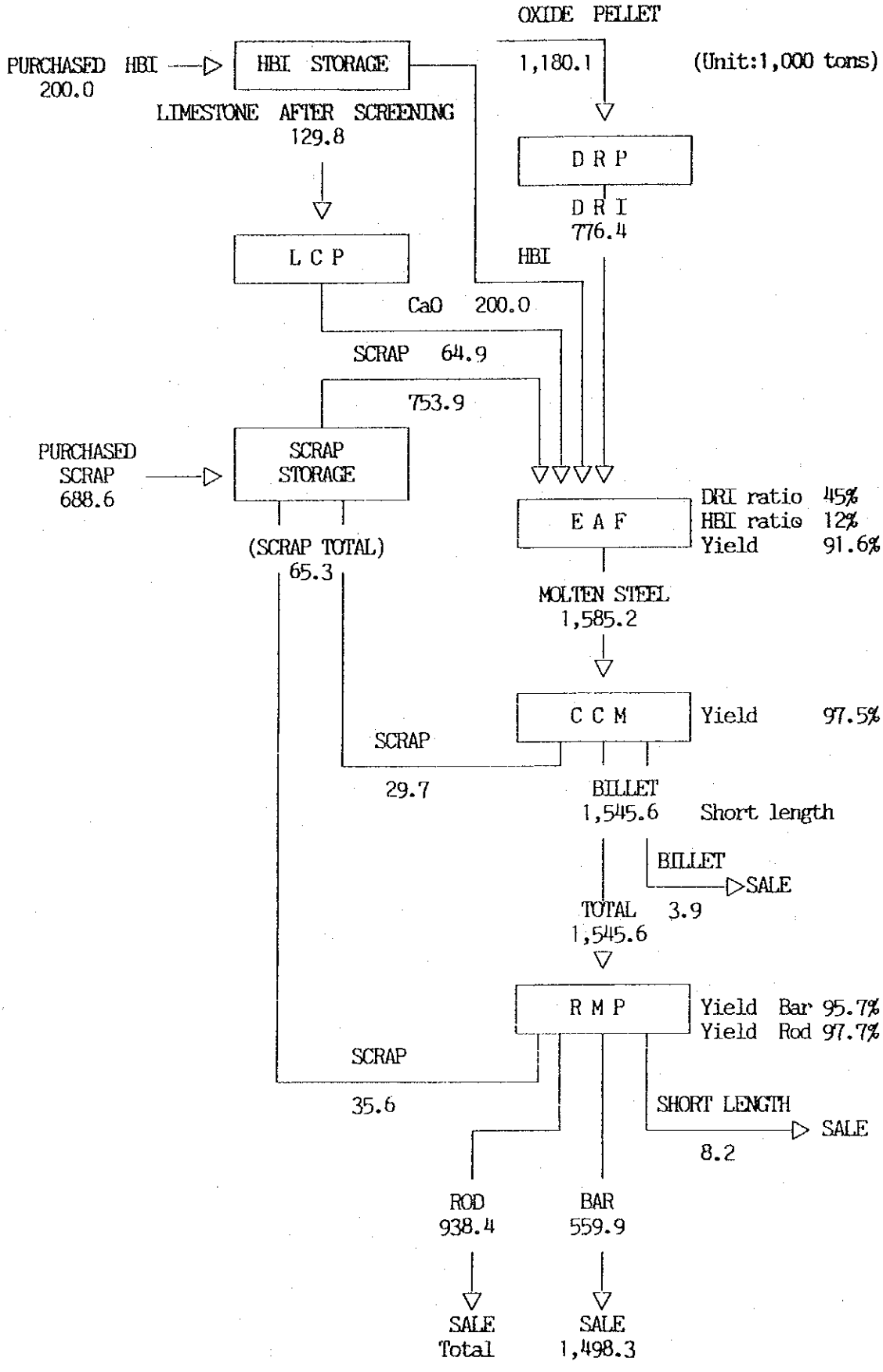


Fig. 6.2-1 Material Balance Sheet after Expansion

6.3. Facilities Plan

6.3.1. Facilities plan to be expanded

Plants/shops to be constructed or expanded in line with increase of productin are as follows:

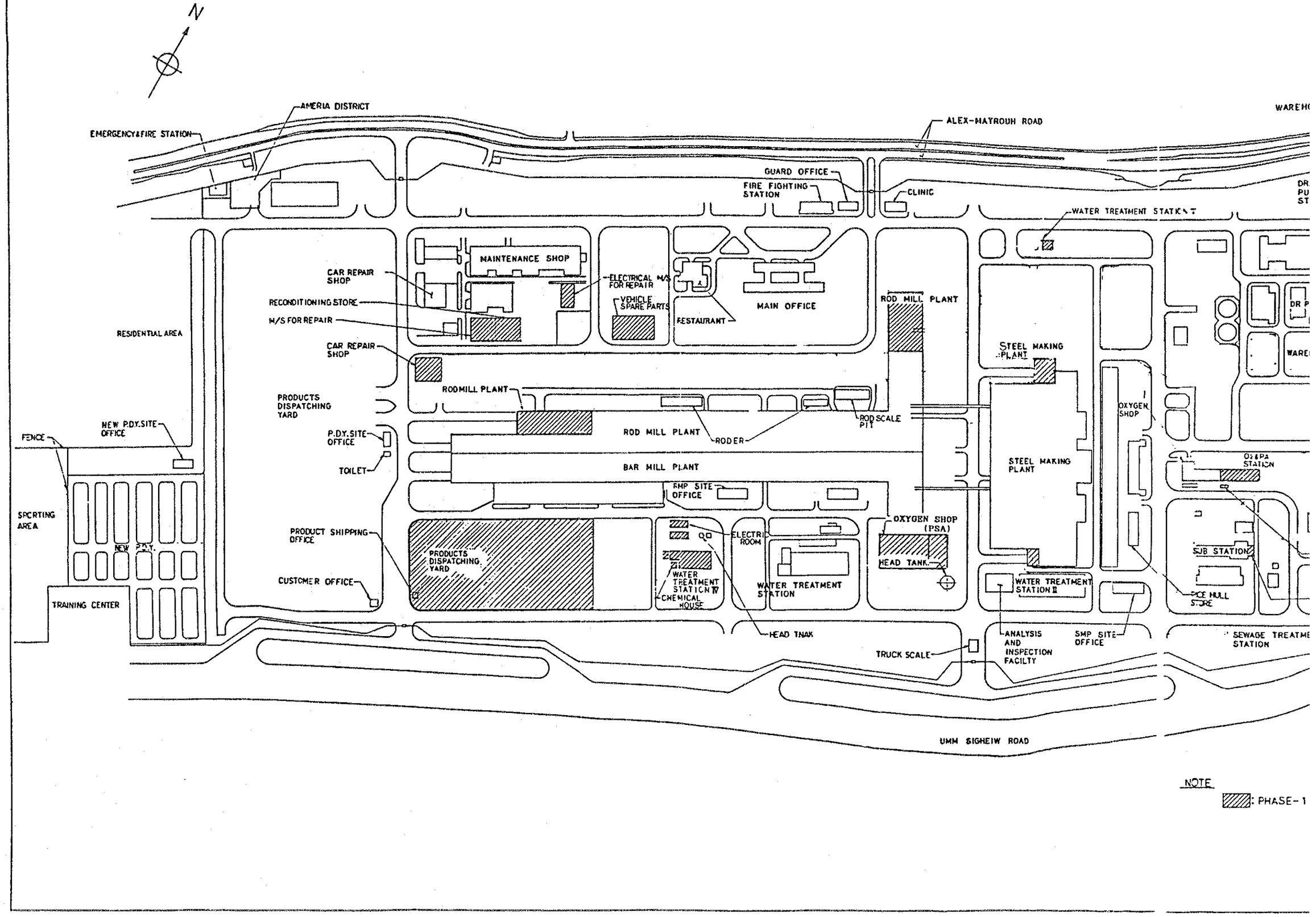
(1) Steelmaking Plant (SMP)
(2) Rod Mill Plant (ROD)
(3) Utilities (UT)
(4) Power Receiving and Distributing Facilities(PW)
(5) Maintenance Facilities (MS)
(6) In-Works Transportation Facilities (TR)
(7) Inspection and Analysis Facilities (AI)
(8) Others (Roads, Sewerage, etc.)

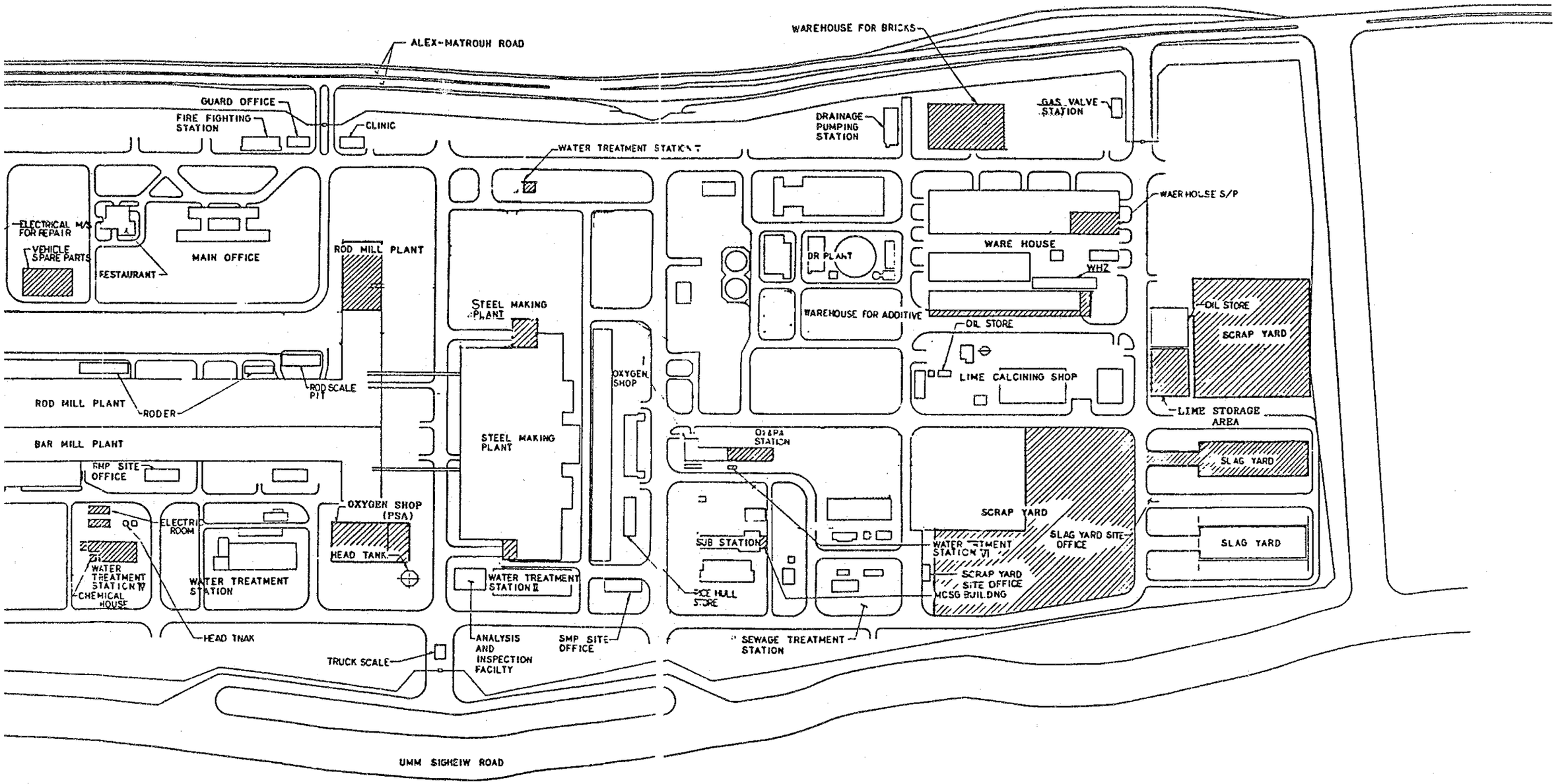
Necessity of expansion plan of each plant/shop and improvement of infrastructure are discussed in Sections 6.4 and 6.5.

6.3.2. Plant layout

As mentioned in CHAPTER 5, the existing facilities were constructed in a layout to permit their expansion in future and there is adequate site for installing expanded facilities. As the newly constructed facilities can be installed next to the existing ones, raw materials handling and transport are easy and the facilities can be constructed at minimum cost by utilizing the existing facilities partly.

Overall plant layout after the expansion is shown in Drawing JICA G-003.


N
AMERIA DISTRICT
EMERGENCY&FIRE STATION
ALEX-MATROUH ROAD
GUARD OFFICE
FIRE FIGHTING STATION
CLINIC
WATER TREATMENT STATION I
MAINTENANCE SHOP
CAR REPAIR SHOP
RECONDITIONING STORE
M/S FOR REPAIR
ELECTRICAL M/S FOR REPAIR
VEHICLE SPARE PARTS
RESTAURANT
MAIN OFFICE
ROD MILL PLANT
RESIDENTIAL AREA
CAR REPAIR SHOP
STEEL MAKING PLANT
ROD MILL PLANT
PRODUCTS DISPATCHING YARD
ROD SCALE PIT
OXYGEN SHOP
NEW P.D.Y. SITE OFFICE
FENCE
P.D.Y. SITE OFFICE
ROD MILL PLANT
RODER
TOILET
BAR MILL PLANT
AMP SITE OFFICE
STEEL MAKING PLANT
O2&Pa STATION
SPORTING AREA
PRODUCT SHIPPING OFFICE
OXYGEN SHOP (PSA)
SUB STATION
PRODUCTS DISPATCHING YARD
ELECTRIC ROOM
WATER TREATMENT STATION IV
CHEMICAL HOUSE
WATER TREATMENT STATION
HEAD TANK
WATER TREATMENT STATION II
ICE HULL STORE
CUSTOMER OFFICE
TRAINING CENTER
HEAD TNAK
ANALYSIS AND INSPECTION FACILTY
SMP SITE OFFICE
TRUCK SCALE
SEWAGE TREATME STATION
UMM SIGHEIW ROAD
NOTE
: PHASE-1



NOTE

▨: PHASE-1

THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL WORKS

TITLE GENERAL LAYOUT

DWG NO. JICA-G-003
DATE JUNE 1993 SCALE N.A.

6.4. Details of Facilities Plan

6.4.1. DR plant

As described in Section 6.1.2, installation of a new DR plant is not planned in this expansion project.

6.4.2. Steelmaking Plant

1) Outline

a) Basic concept of the expansion project

(1) Production

Production of molten steel at the steelmaking plant (SMP) will be 1,585,000 t/y, up 35% from 1,180,000 t/y at present.

(2) Expansion of facilities

In order to attain the above production target, the following will be expanded or modified.

(a) Building of ladle yard to be expanded to the north of present building

(b) Oxy-lancing & carbon injection technology to be introduced to electric arc furnace (EAF) operation

(c) Two units of ladle furnace (LF) to be installed and EAFs to be modified from spout type to EBT type

(d) Capacity of fume extraction system to be increased

(e) Cranes, material handling facilities, molten steel handling facilities, ladle repair shop, electric facilities and other related facilities to be expanded

b) Production

Production of molten steel at SMP after the expansion project will be 1,585,000 t/y, which will be produced by 4 EAFs and 2 LFs, and cast to billets by 3 CCM. Annual production of billets will be 1,546,000 t/y.

c) Products

Products will be medium & low carbon steel for rebar and size of billets will be 130 mm square x 16 m long.

d) Main facilities

Major production facilities of SMP will be as follows:

Item	Existing	New	Total
EAF:			
Number	4	modified	4
Capacity	70t/ht	79t/ht	
Capacity of transformer	46MVA	same as left	
LF:			
Number	-	2	2
Capacity	-	79t/ht	
Capacity of transformer	-	12MVA	
CCM:			
Number	3	-	3
Number of strands	4	-	12

e) Basic design

(1) EAF

Main raw materials used in EAF will consist of DRI 45%, HBI 12% and scrap 43%.

Oxy-lancing & carbon injection will be adopted during melting. SMP will be operated on the basis of effective working days of 320 days per year and three shifts.

(2) LF

Molten steel tapped by EAF will be refined in the ladle in 40 min to obtain the adequate composition and temperature.

(3) CCM

In principle, CCMs will employ 8-heats sequence casting.

(4) Specification, capacity and operation

Specification, capacity and operation will be almost the same as the present ones with the exception of adopting LF and oxy-lancing.

2) Production plan

a) Production

Production plan of SMP is shown in Table 6.4.2-1.

Table 6.4.2-1. Production Plan of SMP

	Molten Steel	Billets	No. of Heats
Yearly production	1,585,000 t	1,546,000 t	20,100
Monthly production	132,000 t	129,000 t	1,700
Daily production	5,000 t	4,8000 t	63

b) Operating hours

Based on 365 calendar days a year and non-operating hours due to repair, shutdown and others, effective operating days of SMP will be 320 days a year as shown in Table 6.4.2-2.

Table 6.4.2-2 Effective Operating Days in SMP

Item	Days per Year
Calendar days	365
Scheduled repair	23.0
Downtime (6%)	21.9
Operating days	320.1

c) Steelmaking capacity of EAFs

With blending ratio of DRI 45%, HBI 12%, and scrap 43%, heat size of 79t/ht considering ladle crane's capacity, time required for melting charged materials is 72 minutes and tap-to-tap time is 92 minutes and the number of heats is 15.7 a day.

Charging time 5 min

Melting time	72	*
Refining time	7	
Tapping time	2	
Fettling time	6	
Tap-to-Tap	92	

*Note : Melting time

$$\frac{79 \times 500}{46{,}000 \times 1.2 \times 0.68 \times 0.93 \times 0.95}$$

= 1.19 hr = 72 min

where

79 : t/ht, molten steel

500 : kWh/t-MS, electric power required for melting one ton of molten steel

46,000 : kVA, transformer capacity

1.2 : Overload of transformer

0.68 : Power factor

0.93 : Power input efficiency

0.95 : Voltage drop factor

Therefore, steelmaking capacity of EAFs will be 1,585,000 t/y.

79 t/ht x 15.7 ht/d.f'ce x 4 f'ce x 320 d/y
= 1,585,000 t/y

d) Casting capacity of CCMs

When 3 CCMs adopt 8-heats sequence casting with matching of 4 EAFs and 2 LFs, the casting cycle wil be as shown in Fig. 6.4.2-1, and with operating rate of 94%, the CCMs can meet the steelmaking capacity of EAFs.

e) Unit consumption

Unit consumption of raw materials, auxiliary raw materials, refractories, electrodes, electric power and utilities of SMP are as shown in Table 6.4.2-3.

f) Material flow

Material flow at SMP is shown in Fig. 6.4.2-2.

3) Outline of major facilities

a) Scrap handling facilities

As the scrap usage will increase by about 2.3 times, charging bucket, scrap crane with lifting magnet, scrap transfer car and weigh bridge will be additionally installed.

b) DRI and burnt lime handling facilities

In the expansion, consumption of burnt lime will increase by 45 t/d but that of DRI is as it is, and the existing facilities have enough capacity of handling.

c) Additive handling facilities

Sand (for EBT) storage hopper will be installed and chute for ladle modified.

d) EAFs

Tapping spout will be modified into EBT system.

e) Steel handling facilities

At the existing facilities, ladle bubbling stirrer with nitrogen gas was installed to ensure uniform temperature and composition of molten steel in a ladle, but in the expansion two units of LFs will be installed, which permits not only ensuring uniform molten steel but also heating molten steel with nitrogen gas bubbling through porous plug set at bottom of the ladle.

In addition, four units of ladle transfer cars with weigher will be installed, ladles and the existing ladle transfer cars will be modified.

f) Computer control system

In the expansion, the following configuration will be adopted. One Factory Automation Type personal computer system is applied to LF common processing, No. 1 LF and No. 2 LF. Including EAF computer, four FA computers are linked with the existing EAF computer. Thus, EAF data and CCM data detected/gathered by the EAF computer is sent to each LF computer through the LF common processing computer.

g) CCM

The existing facilities are not modified.

h) Cranes

Two more units cranes will be installed at covered scrap yard, and one more each will be installed at EAF yard, ladle yard and billet yard. Those cranes

will be of the same specification as the existing ones.

4) Organization and personnel

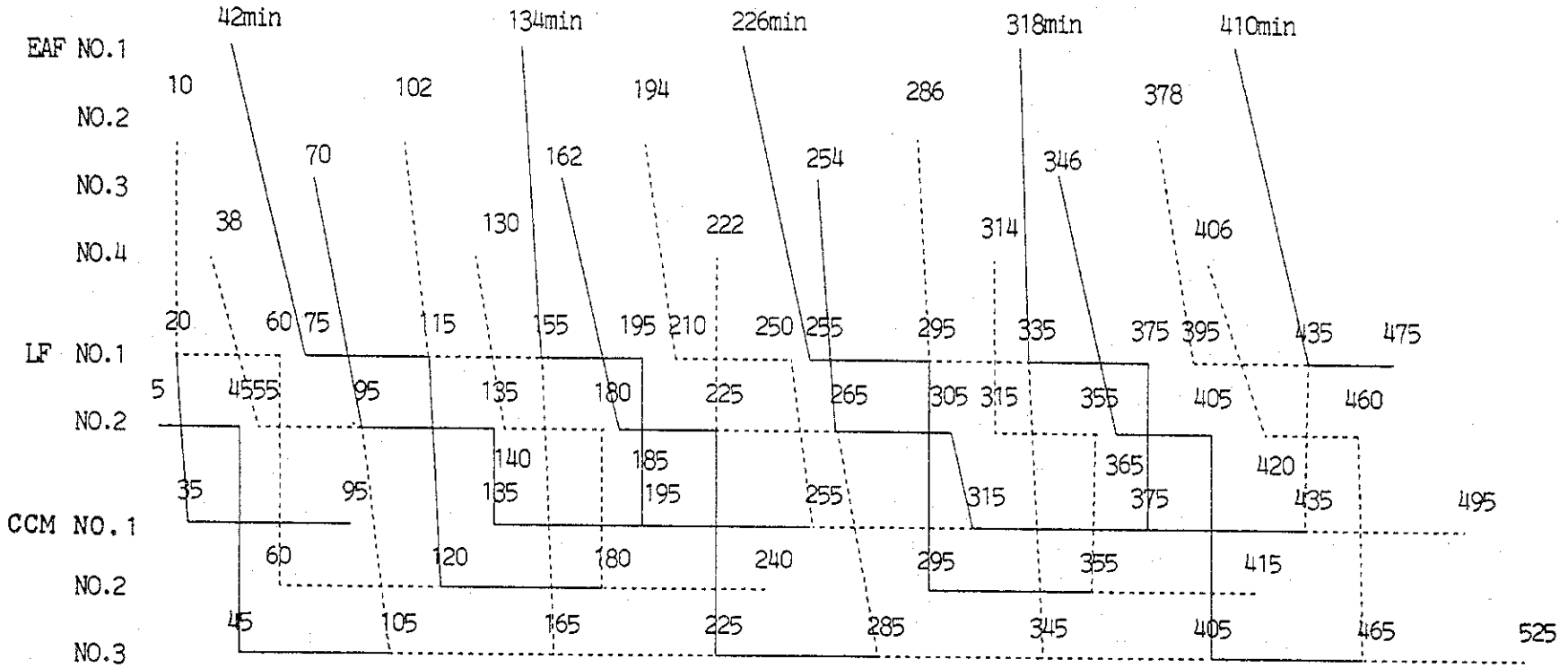
Personnel of EAF, CC and Refractory subsections is shown in Table 6.4.2-4.

5) Layout

Layout of SMP after the expansion is shown in DWG NO. JICA-SMP-001.

6) Equipment list

Equipment list of SMP is given in Table 6.4.2-5.



Operation conditions : Tap-to-tap time :92 min. Casting time :60 min. CCC/TD :8 ht
Preparation time:40 min for 8 heats, LF time :40 min/ht

Fig. 6.4.2-1 Casting cycle

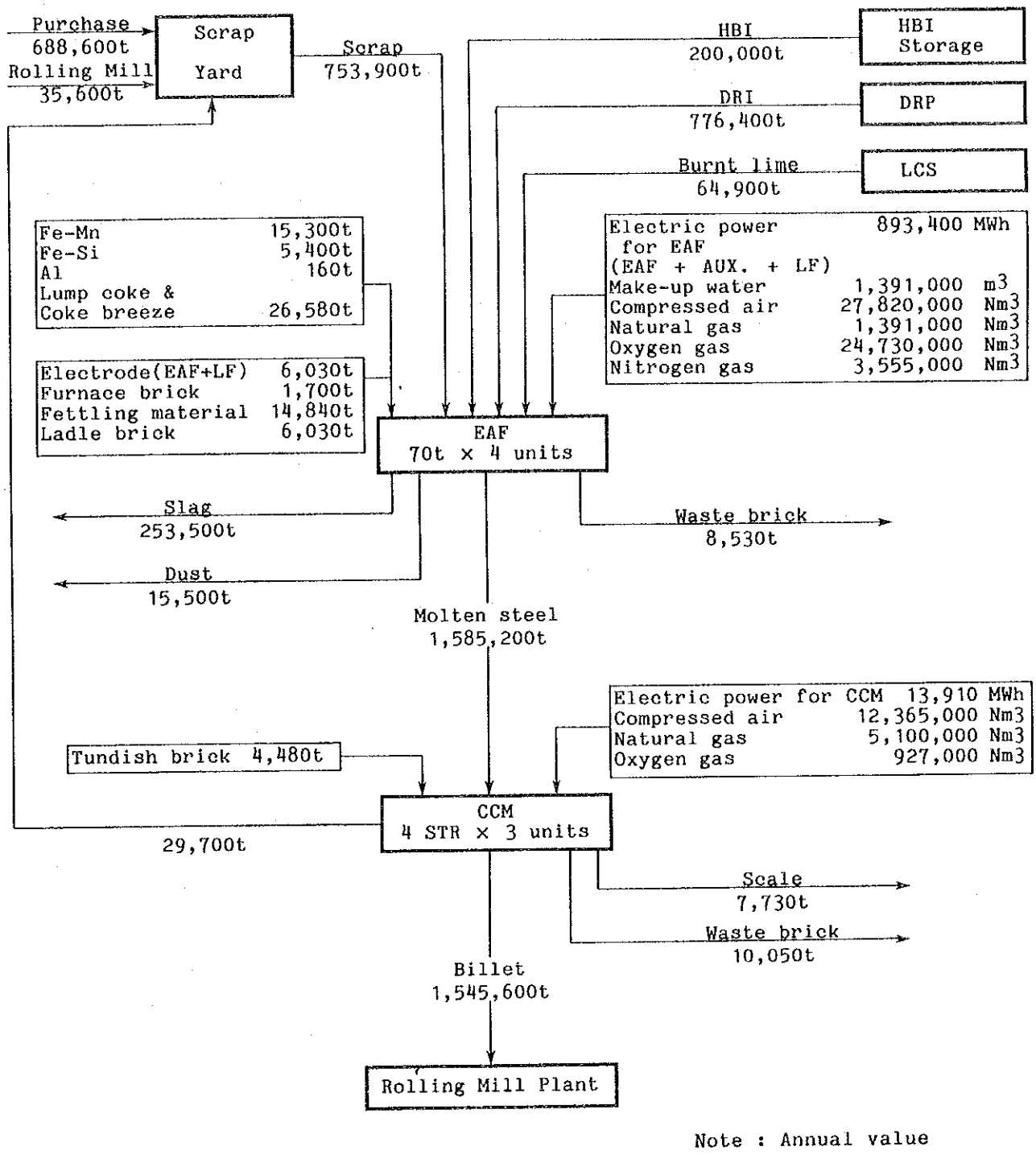


Fig. 6.4.2-2 Material Flow at SMP

Table 6.4.2-3 Unit Consumption of SMP

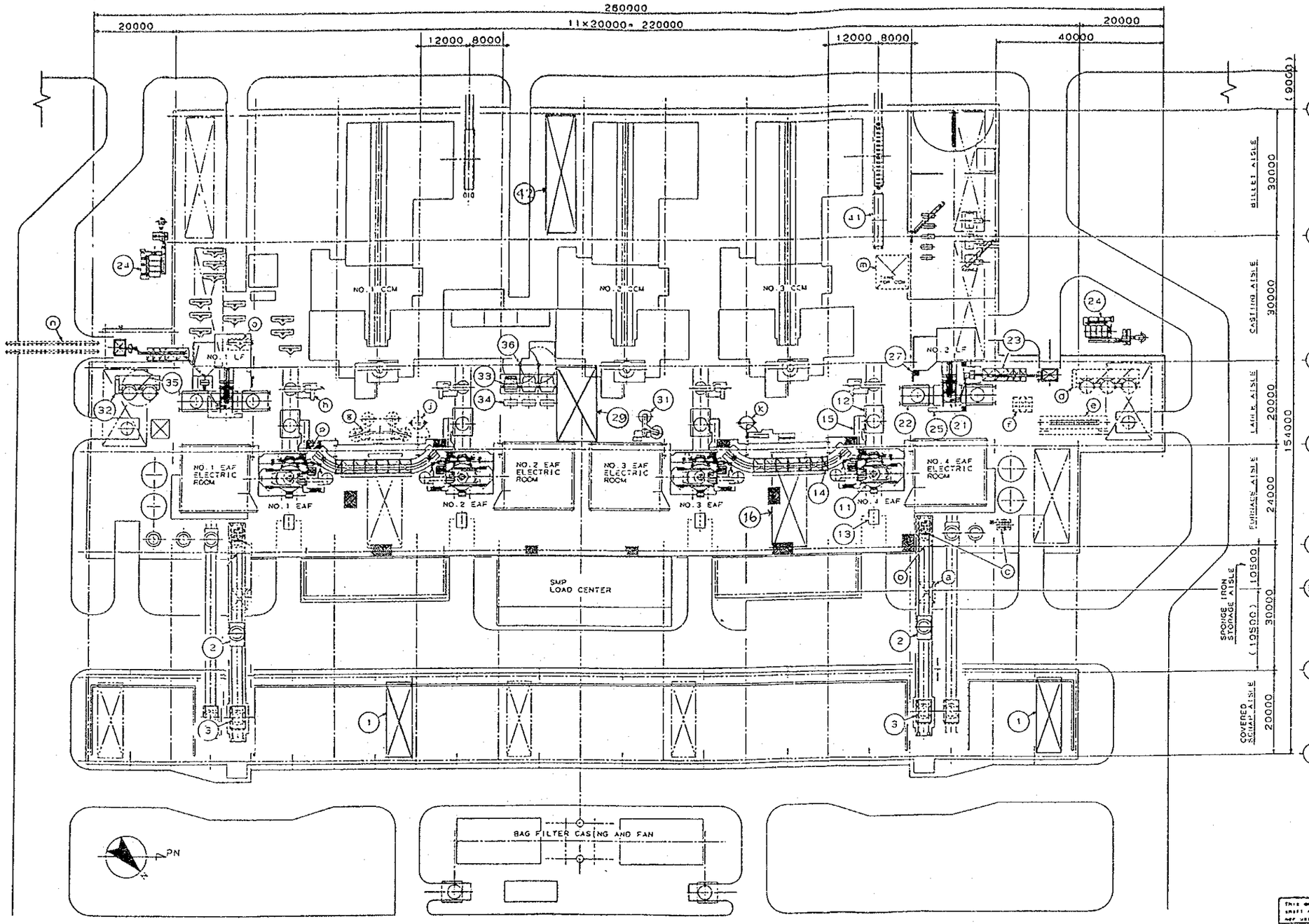
	Item	Unit consumption	Material required		
			Per year	Per month	Per day
1	DRI	678.0 kg/t-BT	776,400 t	64,700 t	2,426 t
2	HBI	129.0	200,000	16,670	625
3	Scrap	488.0	753,900	62,830	2,356
4	Burnt lime	42.0	64,900	5,410	203
5	Fe-Mn	9.9	15,300	1,275	48
6	Fe-Si	3.5	5,410	451	17
7	Al	0.1	160	13	0.5
8	Coke lump/breeze	17.2	26,580	2,216	83
9	Furnace brick	1.1	1,700	142	5
10	Fettling material	9.6	14,840	1,237	46
11	Ladle brick	3.9	6,030	502	19
12	Electrode (EAF+LF)	3.9	6,030	502	19
13	Tundish brick	2.9	4,480	373	14
14	Slag	153.0	253,500	21,130	792
15	Dust	10.0	15,460	1,290	48
16	Scrap from CCM	19.2	29,700	2,480	93
17	Waste brick from EAF	5.5	8,530	710	27
18	Waste brick from CCM	6.5	10,050	840	31
19	Scale	5.0	7,730	640	24
20	Electric power for EAF, LF & Aux	578.0 kWh/t-BT	893,400 MWh	74,450 MWh	2,792 MWh
21	Electric power for CCM	9.0 kWh/t-BT	13,910 MWh	1,160 MWh	43 MWh
22	Make-up water for EAF	0.9 m3/t-BT	1,391,000 m3	115,920 m3	4,347 m3
23	Compressed air for CCM	18.0 Nm3/t-BT	27,820,000 Nm3	2,318,330 Nm3	86,940 Nm3
24	Compressed air for CCM	8.0 Nm3/t-BT	12,365,000 Nm3	1,030,420 Nm3	38,640 Nm3
25	Natural gas for EAF	0.9 Nm3/t-BT	1,391,000 Nm3	115,920 Nm3	4,347 Nm3
26	Natural gas for CCM	3.3 Nm3/t-BT	5,100,000 Nm3	425,000 Nm3	15,940 Nm3
27	Oxygen gas for EAF	16.0 Nm3/t-BT	24,730,000 Nm3	2,060,830 Nm3	77,280 Nm3
28	Oxygen gas for CCM	0.6 Nm3/t-BT	927,000 Nm3	77,250 Nm3	2,897 Nm3
29	Nitrogen gas for EAF & LF	2.3 Nm3/t-BT	3,555,000 Nm3	296,250 Nm3	11,110 Nm3

Table 6.4.2-4 Personnel of SMP

Section/Branch/Work Group	Present						The expansion (Additional)						The expansion total					
	SM	ASM	E	F	AF	W	SM	ASM	E	F	AF	W	SM	ASM	E	F	AF	W
SMP	1												1					
EAF																		
Furnace (EAF)		1	3	4	20	104						8		1	3	4	20	112
Furnace (LF)									1	4	8	36			1	4	8	36
Day-work				2	2	19					2	8				2	4	27
Crane			1	4	8	56						22			1	4	8	78
Sub-total	1	1	4	10	30	179			1	4	10	74	1	1	5	14	40	253
CCM		1	2											1	2			
Casting				4	20	172					8	48				4	28	220
Day-work				2	2	19						5				2	2	24
Sub-total		1	2	6	22	191					8	53		1	2	6	30	244
Refractory		1	1											1	1			
Ladle-preparation				1	4	40						12				1	4	52
Relining (EAF,TD)				2	9	76						20				2	9	96
Sub-total		1	1	3	13	116					8	32		1	1	3	13	148
Grand total	1	3	7	19	65	486			1	4	18	159	1	3	8	23	83	645
	581						182						763					

SM : Section Manager
ASM : Assistant Section Manager
E : Engineer
F : Foreman
AF : Assistant Foreman
W : Worker

REVISION			
MARK	DESCRIPTION	DATE	APP'D
△1			



NO	EQUIPMENT
(1)	SCRAP CRANE (10t/5t)
(2)	SCRAP BUCKET TRANSFER CAR(50t)
(3)	TRACK WEIGH BRIDGE(70t)
(11)	EST ELECTRIC ARC FURNACE (MODIFIED)
(12)	LADLE TRANSFER CAR FOR EAF (140t)
(13)	OXYGEN-CARBON MANIPULATOR
(14)	EAF ADDITIVE FEEDING SYSTEM (MODIFIED)
(15)	TAPPING HOLE MAINTENANCE DECK (SWING TYPE)
(16)	SCRAP CHARGING CRANE (50/20t)
(21)	LADLE FURNACE
(22)	LADLE TRANSFER CAR FOR LF(140t) (MODIFIED)
(23)	LF ADDITIVE FEEDING SYSTEM
(24)	LF DEDUSTING SYSTEM
(25)	TEMP. READING & SAMPLING EQUIPMENT
(26)	BOTTOM SUBBLING VALVE STAND
(27)	ELECTRODE STAND
(28)	LADLE (79t)
(29)	LADLE CRANE (130/40t)
(31)	LADLE DRYER
(32)	LADLE RELINING DECK
(33)	LADLE STAND
(34)	LADLE PREPARATION DECK
(35)	SLEWING JIB CRANE(2t) FOR LADLE RELINING DECK
(36)	SLEWING JIB CRANE(2t) FOR LADLE VALVE
(41)	BILLET TRANSFER CAR(77t)
(42)	BILLET HANDLING CRANE (17t)

JOB NO.	PQ-4477
APPROVED	
CHECKED	
CHECKED	
DESIGNED	
DRAWN	T.HARA
DESIGN SECTION	IRON & STEEL ENGINEERING DIV.

CUSTOMER: ALEXANDRIA NATIONAL IRON AND STEEL COMPANY.S.A.E

PROJECT: EXPANSION PROJECT

TITLE: General layout

NKK NKK CORPORATION

DWG NO. JICA-SMP-001

Table 6.4.2-5 Equipment List of SMP

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
	MECHANICAL EQUIPMENT		
SMP-100	ELECTRIC ARC FURNACE Furnace Equipment		
SMP-101	Furnace Shell	4	Capacity:Nominal 70t Max. 79t+10t (hot heel) Inside diameter: 5,800mm Height : 4,300mm Transformer : 46MVAx120%
SMP-102	Water Cooled Panels for Shell	4	Cooling area : above sill level
SMP-103	Pouring System	4	EBT system with maintenance equip.
SMP-104	Furnace Platform and Rocker	4	
SMP-105	Tilt Device	4	Driven by Hydraulic cylinder for tilting Tilting angle 20° (tapping side)
SMP-106	Access Platform Heat Protector	4	Attached to furnace platform
SMP-107	Piping for Water and Compressed Air	4	Composed of pipes, fittings, valves, hoses, support, etc.
SMP-108	Hydraulic Power System	4	Hydraulic pumps, valves and piping
SMP-109	Tilt and Swing Lock Post Device	4	Driven by Pneumatic Cylinder for tilt lock post Hydraulic cylinder for tilt lock pin, swing lock pin
SMP-110	Additive Feeding System	4	Sand bunker 5 m3 Additive chute for ladle
SMP-120	Refractory		
SMP-121	Refractory for Furnace	4	For wall and bottom
SMP-122	Refractory for Miscellaneous	4	For floor deck access platform

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-150	LADLE FURNACE Furnace Equipment	2	Type : Mast type Capacity : Nominal 70 t Maximum 79t Transformer : Rating 12 MVA, 120% Over -load Electrode : 14 inch Φ Stationary structures Electric hoisting system : Stationary mast and moving arm type Driven by motor Electrode clamping : Air cylinder operation Roof lifting system : Driven by motor
SMP-152	Dedusting System	2	Suction type bag filter Dedusting capacity : 800m3 /min
SMP-153	Additive Feeding System	2	Conveyor System (including burnt lime, supply & receive system for LF)
SMP-154	LF Auxiliaries	2	Bubbling stand, Temp. Measuring and Sampling device, Electrode stand
SMP-155	Roof	2	Roof with water cooled panels
SMP-156	Electrode	6	14 inch Φ (356mm Φ), 1800 mm length
SMP-157	Ladle Transfer Car for LF	4	Type : Electric self-travelling with cabtyre cable Capacity : 130 t (Max.140 t)
	Steel Handling Facilities		
SMP-221	Steel Ladle	4	Capacity: 79t of molten steel with porous-plug piping height 3,840mm dia 3,000mm
SMP-222	Ladle Valve	4	Type : Rotary Nozzle

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-223	Ladle Transfer Car for EAF	4	Type: Electric self-travelling with cabtyre cable(with weigher) Capacity: 130t(Max.140t) Travel speed: Max.20m/min
SMP-224	Refractory for Ladle	4	High quality brick
	Preparation and Miscellaneous Facilities		
SMP-231	Nozzle Preparation Stand	1	Steel fabrication
SMP-232	Ladle Relining Stand	1	For 2 ladles
SMP-233	Ladle Dryer	1	Vertical type, Natural drafting Fuel : Natural gas Heating temp. : Approx. 400 ~ 1000°C /1.5Hr
SMP-234	Billet Transfer Car	1	Type : Electric self-travel-ling with cabtyre cable Capacity : 77 t
SMP-235	Scrap Bucket Transfer Car & Weight Bridge	2	Pay load : Max 20 m/min
SMP-236	Manipulator for Oxylancing and Carbon Injection	4	Lancing pipe : 1 inch x 2 pcs.(up/down inclination, for forward/backward) Injection lance x 1 pc.
SMP-237	Piping for Utilities	1	
SMP-238	Scrap Bucket	2	Type : Clam-shell Volume : 35m3/bucket
SMP-500	CRANE AND HOIST		
SMP-501	Scrap Handling Crane 10t/5t	2	Same spec. as existing 10t/5t Cr.
SMP-502	2t Jib Crane	2	
SMP-503	Charging Crane 50t/20t	1	Same spec. as existing 50t/20t Cr.

NO.	EQUIPMEN	Q'TY	MAIN SPECIFICATION
SMP-504	Ladle Crane 130t/40t	1	Same spec. as existing 130t/40tCr.
SMP-505	Billet Handling Crane 17t	1	Same spec. as existing 17t Cr
	ELECTRICAL EQUIPMENT Ladle Furnace		
SMP-601	Furnace Transformer		Type : Indoor use, forced oil forced water cooling Rating : 3-phase, rating 12MVA, 120% over load Primary voltage : 33kV Accessories : Standard accessories
SMP-602	33kV Furnace Switchgear		Composed of : 1 pc.-Disconnecting switch 1 pc.-Furnace circuit switching device 1 pc.-Potential transformer (33kV/110V) 1 pc.-Power fuse for potential transformer 1 pc.-Lightning arrester 1 pc.-Surge suppressor
SMP-603	Secondary Flexible Cable	2	Type : Water cooled cable
SMP-604	Electrode Positioning Control System	2	Composed of : 3 - Electrode hoisting motor Type:Totally enclosed induction type 3 - Accessories including brake, thermostat, etc. 1 - Cooling blower for hoisting motors
SMP-605	Electrode Controller	2	Type:Indoor use, self-standing type
SMP-606	Control Panel	2	Furnace control panel including control and power supply Type:Indoor use, self-standing type

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-607	Supervisory Device	2	Centralizing panels in pulpit for ladle furnace operation, including 1pc.-Supervisory panel 1pc.-Metering panel 1pc.-Furnace control desk
SMP-608	Power Factor Correction Equipment	2	Apparent power:12 MVA x 1.2
SMP-609	Wiring Material	1	
SMP-800	COMMON ELECTRICALS LV-Power Distribution System		
SMP-801	Load Center	1	Extension to the existing 6.6kV switchgear 380 V power branch,etc.
SMP-802	Power Distribution Board for Common Item	1	Type:Indoor use, enclosed & self-standing type Mounted:1 lot-Moulded case circuit breaker
SMP-803	Wiring Materials	1	
SMP-811	Lighting Apparatus	1	Composed of:1 lot-Lighting distribution board Type:Indoor use, enclosed and self-standing type Mounted:Moulded case circuit breaker 1 lot-Sodium vapour lamp 1 lot-Mercury vapour lamp 1 lot-Fluorescent lamp
SMP-812	Wiring Materials Intercommunication	1	
SMP-821	Paging System	1	Intercommunication for SMP L/C, 4 EAFs, 3 CCMs, 2LFs
SMP-822	Television for Supervision	1	Monitoring LF status
SMP-823	Wiring Materials Air Conditioning, Ventilation & Small Power	1	

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-831	Ventilation for Furnace Transformer Room	1	Type :Forced air cooling typ
SMP-832	Air Conditioning for Control Room & Others	1	Type:Air or water cooling type
SMP-833	Power Distribution Board	1	Type:Indoor use, enclosed & self-standing type
SMP-834	Outlet	1	
SMP-835	Wiring Materials	1	
	Fire Alarm and Extinguishing System		
SMP-841	Fire Alarm Control Panel	1	Type:Indoor use, enclosed and self-standing type
SMP-842	Detector for Fire Alarm	1	
SMP-843	Fire Extinguishing Unit	1	Type:Halon and power type
SMP-844	Wiring Materials	1	
	Lightning and Earthing		
SMP-851	Lightning pole	1	
SMP-852	Grounding Electrode	1	
	INSTRUMENTATION		
	ELECTRIC ARC FURNACE HANDLING FACILITIES		
SMP-912	Wiring Materials Handling	1	
SMP-913	Ladle Dryer Control Post	1	Type:Enclosed, wall mount Mounted:PBS, flow meter,etc.
	COMPUTER CONTROL SYSTEM		
SMP-931	Data Collecting Device	3	
SMP-932	Data Printing Device	3	
SMP-933	Operating Guidance Device	3	
SMP-934	LF Operation Control Device	3	

6.4.3. Rolling Mill Plant

1) Outline

a) Basic concept

(1) Production tonnage

In the expansion project, BAR facilities will be kept as it is and ROD facilities will be increased from one strand to two strands.

After the expansion, production tonnage by BAR will be 559,000 t/y, production by ROD will be 938,000 t/y, and total production of RMP will be 1,498,000 t/y.

(2) Expansion of ROD facilities

(a) 2 strands rolling
Rolling line of ROD will be expanded from one strand to two strands.

(b) Expansion of billet yard

In line with increase of billet handling, the area of billet yard will be expanded.

(c) Expansion of coil yard

In line with increase of coil handling, the area of coil yard will be expanded.

(d) Layout

Fig. 6.4.3-1 and Fig. 6.4.3-2 are the layout.

Fig. 6.4.3-1 shows the relation between SMP and RMP, and the expansion building of RMP. Fig. 6.4.3-2 shows the expansion of ROD.

b) Production

In 1992, production by BAR was 514,000 tons and production by ROD was 520,000 tons. Therefore, total production was 1,034,000 tons.

After the expansion, production by BAR will be 559,000 t/y, and production by ROD will be 983,000 t/y. Therefore, total production will be 1,498,000 t/y.

c) Steel grade

Steel grade after the expansion will be mainly rebar and partially low carbon steel as in the present stage.

d) Main facilities

The main facilities to be expanded in ROD are as follows.

(1) Billet yard

4 spans of billet yard, 1 billet handling crane

(2) Reheating furnace

Reheating capacity 150 t/h, billet switch plate

(3) Mill equipment (For No. 2 strand)

No. 2 intermediate mill, finishing mill, cropping and chopping shear

(4) Finishing facilities (For No. 2 strand)

Water cooling zone, pinch roll and laying cone, cooling conveyor, reforming tub, coil transportation system including C-hook and ladder, coil compact machine, coil offloading equipment

(5) Other equipment

Lubrication systems, hydraulic systems, water cooing systems, piping for compressed air, natural gas, N_2 gas

(6) Coil yard

8 spans of coil yard, 1 coil handling crane

2) Production plan

a) Product mix

Table 6.4.3-1 shows the product mix.

b) Size composition

Table 6.4.3-1 also shows the size composition.

c) Effective rolling hour

Table 6.4.3-2 shows the effective rolling hour.

d) Rolling productivity (t/h)

Table 6.4.3-3 shows the rolling productivity(t/h).

e) Yield and by-products

Table 6.4.3-4 shows the yield and by-products.

f) Utilities unit consumption

Table 6.4.3-5 shows the utilities unit consumption.

g) Learning curve after ROD start-up

Table 6.4.3-6 shows the learning curve after ROD start-up.
After ROD start-up, it will take 7 months for many kinds of ajustment, and 8th month will be expected to attain the stable operation.

3) Organization and employees

Table 6.4.3-7 shows the organization and employees.

4) ROD equipment list to be expanded

Table 6.4.3-8 shows the ROD equipment list to be expanded.

Table 6.4.3-1 Product Mix

Mill	Dia	Products		Rolling productivity	Rolling hour	Effective rolling hour
		ton	ratio			
	mm	1,000t/y	%	Product-t/y	h/y	h/y
ROD	5.5	46.9	5	99.8	470	
	6	131.3	14	124.2	1,058	
	6.5	28.1	3	147.0	192	
	7	18.7	2	147.0	127	
	7.5	18.7	2	147.0	127	
	8	145.5	15.5	147.0	990	
	9	18.7	2	147.0	127	
	10	310.0	33	147.0	2,109	
	12	215.8	23	147.0	1,468	
	13	4.7	0.5	147.0	32	
	Total	938.4	100	147.0	6,700	6,700
BAR	10	112.0	20	62.6	1,789	
	12	156.8	28	83.1	1,886	
	13		0		0	
	14	5.6	1	94.5	59	
	16	173.5	31	106.0	1,636	
	18	50.4	9	108.2	465	
	19		0		0	
	20	5.6	1	108.7	51	
	22	22.4	1	109.1	205	
	25	22.4	4	109.1	205	
	28	5.6	1	108.0	51	
	32	5.6	1	108.0	51	
	Total	559.9	100		6,398	6,398
ROD + BAR		1,498.3				

Table 6.4.3-2 Effective Rolling Hour

No.	Item	Basis	Unit	After expansion		
				BAR	ROD	
					Expan-sion	Without expan-sion
(1)	Calendar hour	365d/y × 24d/y=8,760h/y	h/y	8,760	8,760	8,760
(2)	Scheduled maintenance hour	(a) Major repair				
		BAR 8days + 1 shift=200h/y	h/y	200		
		ROD 9days + 1 shift=224h/y	h/y		224	224
		(b) Minor repair				
		5days + 1 shift=128h/y	h/y	128	128	128
		(c) Periodic repair				
		365d/y ÷ 14d/time=26times/y				
		(26-2)times/y × 16h/time				
		=384h/y		384	384	384
		(d) Total (a) + (b) + (c)	h/y	712	736	736
(3)	Operation hour	(1) - (2)	h/y	8,048	8,024	8,024
(4)	Effective rolling hour ratio		%	79.5	83.5	87.0
(5)	Effective rolling hour ratio	(3) × (4)	h/y	6,398	6,700	6,980

Table 6.4.3-3 Rolling Productivity (t/h)

Mill	str and No.	Dia (mm)	Productivity (Billet-t/h)			Yield (%)			Prudüc-tivity (Product -t/h)
			1992	Sep/92 - Feb/93	Expan-sion (A)	1992	Sep/92 - Feb/93	Expan-sion (A)	Expan-sion (A)x(B)
ROD	1	5.5	50.8	51.6	52.0	95.1	95.8	96.0	49.9
		6	63.0	63.6	64.0	96.6	96.7	97.0	62.1
		6.5,7,7.5	-	65.2	86.0	-	98.7	98.0	84.3
		8	85.9	85.5	86.0	98.0	97.4	98.0	84.3
		9	-	-	-	-	-	-	-
		10	85.9	85.7	86.0	98.0	98.1	98.0	84.3
		12	85.9	86.1	86.5	98.0	98.0	98.0	85.8
		13	86.7	88.2	88.5	98.3	97.7	98.0	86.7
	2	5.5	-	-	52.0x2 =104.0	-	-	96.0	99.8
		6	-	-	64.0x2 =128.0	-	-	97.0	124.2
		6.5,7,7.5	-	-	150.0	-	-	98.0	147.0
		8	-		150.0	-	-	98.0	147.0
		9	-	-	150.0	-	-	98.0	147.0
		10	-	-	150.0	-	-	98.0	147.0
		12	-	-	150.0	-	-	98.0	147.0
		13	-	-	150.0	-	-	98.0	147.0
BAR	1	10	65.5	65.5	65.5	94.9	95.1	95.5	62.6
		12	86.6	86.5	87.0	95.5	95.6	95.5	83.1
		14	-	98.9	99.9	-	93.9	95.5	94.5
		16	110.4	111.0	111.0	95.2	95.4	95.5	106.0
		18	100.0	99.6	111.0	97.2	96.9	97.5	108.2
		19	111.5	111.1	111.5	97.2	96.8	97.5	108.7
		20	110.1	110.1	111.5	96.6	96.6	97.0	108.7
		22	112.1	112.5	112.5	96.9	95.3	97.0	109.1
		25	112.0	112.4	112.5	96.2	97.3	97.0	109.1
		28	111.8	111.8	112.5	95.5	95.6	96.0	108.0
		32	108.2	108.1	112.5	96.1	96.1	96.0	108.0

Table 6.4.3-4 Yield and By-products

Unit : %

	Item	BAR			ROD		
		Actual		Expan-sion	Actual		Expan-sion
		1992	Sep/92-Feb/93		1992	Sep/92-Feb/93	
A	Products						
	Long products (12m Bar,Coil)	95.2	95.7	95.7	97.7	97.7	97.7
	Short products (6-12m Bar)	1.4	1.4	1.4	0	0	0
	Sub-total	96.9	97.1	97.1	97.7	97.7	97.7
B	By-products						
	Scrap	1.3	1.3	1.3	1.9	2.0	2.0
	Cobble	1.7	1.5	1.5			
	Scale	1.3	1.4	1.3	1.3	1.2	1.2
	Sub-total	4.3	4.2	4.1	3.2	3.2	3.2
C	Total (A+B)*	101.2	101.3	101.2	100.9	100.9	100.9

TOTAL (A+B)*

The excess % than 100% may be caused by difference between actual billet weight and calculated billet weight and by billet oxidation in the reheating furnace.

Table 6.4.3-5 Utilities Unit Consumption

Mill	Utility item	Unit	Actual		Without expansion	Phase-1
			1992	Sep/92-Feb/93		
BAR	Natural gas	Nm3/billet-t	33.1	33.0	33.0 (34.5)	Same as left
	Electric power	kWh/billet-t	59.8	58.3	58.3 (60.9)	"
	Direct water & Indirect water	m3/billet-t	18.1	18.2	18.2 (19.0)	"
	Compressed air	Nm3/billet-t	99.4	100.3	100.3 (104.8)	"
ROD	Natural gas	m3/billet-t	29.8	28.7	28.7(29.4)	27.3(27.9)
	Electric power	kWh/billet-t	105.8	103.7	103.7(106.1)	98.5(100.8)
	Direct water& Indirect water	m3/billet-t	28.8	26.6	26.6(27.2)	25.3(25.8)
	Compressed air	Nm3/billet-t	18.2	16.4	16.4(16.8)	15.6(16.0)

Above values are the case of per billet ton.
values in brackets ( ) are the case of per product ton, and these are calculated as follows.

BAR product value = BAR billet value ÷ 95.7%
ROD product value = ROD billet value ÷ 97.7%

Table 6.4.3-6 ROD Start-up Plan (Learning Curve)

Month after start up	ROD						BAR	Total
	2 Strand operation total shift	Rolling condition				Ton	Ton	Ton
		1st shift XYZ	2nd shift XYZ	3rd shift XYZ	Total	1,000 t/Mo	1,000 t/Mo	1,000 t/Mo
1st	1	2/10P x2x1/3	10/10P x1x1/3	10/10P x1x1/3	24/30P	31.2	46.6	77.8
2nd	1	3/10P x2x1/3	10/10P x1x1/3	10/10P x1x1/3	24/30P	33.8	"	80.4
3rd	2	4/10P x2x1/3	4/10P x2x1/3	10/10P x1x1/3	26/30P	33.8	"	80.4
4th	3	5/10P x2x1/3	5/10P x2x1/3	5/10P x2x1/3	30/30P	39.0	"	85.6
5th	3	6/10P x2x1/3	6/10P x2x1/3	6/10P x2x1/3	36/30P	46.0	"	93.5
6th	3	7/10P x2x1/3	7/10P x2x1/3	7/10P x2x1/3	42/30P	54.7	"	101.3
7th	3	8/10P x2x1/3	8/10P x2x1/3	8/10P x2x1/3	48/30P	62.5	"	109.1
8th	3	10/10P x2x1/3	10/10P x2x1/3	10/10P x2x1/3	60/30P	78.1	"	124.7

(1) P=Full rolling capacity in the case of one strand
=938,400 t/y ÷ 2 strands ÷ 12 Mo/y=39,100 t/Mo
(2) X=Effective rolling ratio
(3) Y=No. of rolling strands
(4) Z=1/3 (8 hours working per shift in a day)
(5) BAR tonnage=559.9 x 1,000 t/y=46.6 x 1,000 t/Mo
(6) Idea after start-up
6-1) JC idea
Above plan is based on the adjustment of electrical equipment.
6-2) ANSDK idea
ANSDK idea is based on 4 crew operation chance for 2 strands training.
1st 40 days=one shift,2 strands; Next 20days=two shifts, 2 strands
3rd month=three shifts, 2 strands

Table 6.4.3-7 Organization and Employees (BAR)

1) Bar mill

Job group & job unit	Existing(A)				Expansion(B)				(B) - (A)			
	FM	AFM	Work-er	Total	FM	AFM	Work-er	Total	FM	AFM	Work-er	Total
(1)Bar reheating furnace												
· Foreman(FM)	1x1											
· Assistant FM(AFM)		2x4										
· BT receiving			1x4									
· Charging to f'ce			1x4									
· Discharging from f'ce			1x4									
· For meal			1x4									
· Relief			1x4									
Total	1	8	20	29	ditto				0	0	0	0
(2) Bar rolling mill												
· FM	1x4											
· AFM		2x4										
· Pulpit			1x4									
· Oil cellar			1x4									
· Roughing mill			1x4									
· Intermediate mill			1x4									
· Sample measurement			1x4									
· Finishing mill			1x4									
· Cooling bed			1x4									
· For meal			1x4									
· Relief			1x4									
Total	4	8	36	48	ditto				0	0	0	0
(3)Bar finishing												
· FM	1x4											
· AFM		3x4										
· Cooling bed			1x4									
· Cold shear			1x4									
· Short bundle & inspection			3x4									
· Controlling bar rolling process			1x4									
· Bending machine & labeling			2x4									
· Hooking hanging			4x4									
· For meal			4x4									
· Relief			2x4		ditto							
Total	4	12	72	88					0	0	0	0
Total (1)+(2)+(3)	9	28	128	165	9	28	128	165	0	0	0	0

Table 6.4.3-7 Organization and Employees (ROD)

2) Rod mill

Job group & job unit	Existing(A)				ExPANSION(B)				(B) - (A)			
	FM	AFM	Work-er	Total	FM	AFM	Work-er	Total	FM	AFM	Work-er	Total
(1)Rod reheating furnace												
· Foreman(FM)	1x1				1x1							0
· Assistant FM(AFM)		2x4				2x4						0
· Billet receiving			1x4				2x4				1x4	4
· Charging to f'ce			1x4				1x4					0
· Discharging from f'ce			1x4				1x4					0
· For meal			1x4				1x4					0
· Relief			1x4				1x4					0
Total	1	8	20	29	1	8	24	33	0	0	4	4
(2) Rod rolling mill												
· FM	1x4				1x4							0
· AFM		2x4				3x4				1x4		4
· Pulpit			1x4				1x4					0
· Oil cellar			1x4				2x4				1x4	4
· Roughing mill			1x4				2x4				1x4	4
· Intermediate mill			2x4				2x4					0
· Finishing mill			1x4				2x4				1x4	4
· For meal			1x4				1x4					
· Relief			1x4				1x4					
Total	4	8	32	44	4	12	44	60	0	4	12	16
(3)Coil finishing												
· FM	1x4				1x4							0
· AFM		3x4				3x4						0
· Arranging coil			1x4				2x4				1x4	4
· Operating in pulpit			1x4				1x4					0
· Receiving station			1x4				2x4				1x4	4
· Inspection point			1x4				2x4				1x4	4
· Compacting machine			2x4				3x4				1x4	4
· Labeling machine			1x4				1x4					0
· Off loading station			1x4				2x4				1x4	4
· Coil storage yard			0				1x4				1x4	4
· For meal			2x4				2x4					0
· Relief			1x4				2x4				1x4	4
Total	4	12	44	60	4	12	72	88	0	0	28	28
Total (1) + (2) + (3)	9	28	96	133	9	32	140	181	0	4	44	48

Table 6.4.3-7 Organization and Employees (Roll shop & Crane)

3) Roll shop & crane

Job group & job unit	Existing(A)				Expansion (B)				(B) - (A)			
	FM	AFM	Work-er	Total	FM	AFM	Work-er	Total	FM	AFM	Work-er	Total
(1)Roll shop												
· Foreman(FM)	1x4				1x4							0
	+1	2x4			+1	2x4						
· Assistant FM(AFM)		+3				+3						0
· Roll turning lathe												
· Sintered roll grinder			3x4				5x4				2x4	8
· Roll grooving												
· Roll assembling(A)			8x4				10x4				2x4	2
· Roll assembling(B)												
· Spare parts			1x4				1x4					
			+10				+12				+2	2
· For meal			0				0				0	
· Relief			0				0				0	
Total	5	11	58	74	5	11	76	92	0	0	18	18
(2) Crane												
· FM	1x1				1x1							0
· AFM		2x4				2x4						0
· Billet yard			2x4				3x4				1x4	4
· Bar mill yard			2x4				2x4					0
· Rod mill yard			2x4				2x4					0
· Bar finishing			2x4				2x4					0
· Rod finishing			2x4				4x4				2x4	8
· For meal			0				0					0
· Relief			0				0					0
Total	1	8	40	49	1	8	52	61	0	0	12	12
Total (1) + (2)	6	19	98	123	6	19	128	153	0	0	30	30
Grand Total of RMP												
Bar mill	9	28	128	165	9	28	128	165	0	0	0	0
Rod mill	9	28	96	133	9	32	140	181	0	4	44	48
Rod shop & crane	6	19	98	123	6	19	128	153	0	0	30	30
Grand Totai	24	75	322	421	24	79	396	499	0	4	74	78

Table 6.4.3 - 8 ROD Expansion Equipment List (Mechanical - 1)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
100	Reheating furnace	-	Capacity 150 billet t/h
101	Burner	20	16 burners(Nm^3/h) 75/each 4 burners(Nm^3/h) 325/each
102	Combustion air piping after recuperator	1 set	20 pipes connections for the 20 burners
103	Natural gas piping after main pipe	1 set	ditto
104	Nitrogen gas piping after main pipe	1 set	ditto
105	Combustion control system	1 set	Control system for 150 t/h heating capacity
*	Blower for combustion air and recuperater	-	Existing 2 blowers and 2 recuperaters sets are enough
200	Billet switch plate	1 set	Hydraulically driven, 400 mm shifting distance
300	Mill equipment		
310	No.2 intermediate mill train		
311	Mill stand including shaft & bearing for rolls & pinion gears	4 1 set	Stand No. 12 - 15 Compact mill type
312	Gears including reduction & bevel gears & those housing	4	Stand No. 12 - 15
320	Finishing block mill	1	Stand No. 16 - 25
321	Finishing block mill including gear, shafts, housing & bearings		Max rolling speed : 100 m/s Products dia : 5.5 - 16 mm
330	Roll changing rigs		
331	Roll changing rigs	1 set	10", 8", 6" ring roll mounting & dismounting tool, movable hydraulic unit, portable pump carriage

Table 6.4.3 - 8 ROD Expansion Equipment List (Mechanical - 2)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
340	Guide equipment		
341	Mill guide for the roughing mill the No.1 intermediate mill the No.2 intermediate mill the finishing block mill	1 set	Static entry & delivery guides, roller guide, roller entry guide
342	Interstand trough & loopers	1 set	Guide trough in the roughing mill Guide trough between roughing & intermediate mill Side looper in front of intermediate mill No. 2 Up looper between compact stands Side looper in front of finishing block mill
350	Cropping & chopping shears	1 set	At back of stand No. 7, ahead of finishing block mill
400	Finishing facilities		
410	Water cooling zone	1 set	38(m) length, 3 zones
420	Pinch roll & laying cone	1 set	Products ring dia 1,050 mm
430	Cooling conveyor	1 set	Total length 98,000 mm, 5 radial fans
440	Reforming tub including transfer equipment to the coil transportation system		Coil forming chamber 3 knives dividing shear Double mandrel receiving station Coil transfer car
450	Coil transportation system including C-hooks	1 set	35 C-hooks Conveyor length 145 m approx.
460	Coil compacting & binding machine including wire magazines		Max compression : 40 tons No. of tying wires : 4 Tie wire dia : 6 mm
470	Coil offloading equipment	1 set	New type equipment : pump is fixed on the ground. (Existing equipment pump is contained on the car.)

Table 6.4.3-8 ROD Expansion Equipment List (Mechanical - 3)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
500	Utility systems		
510	Lubrication systems		
511	Centralized oil lubrication systems		
511-1	For stand 1 - 15 and No. 1 rotary shear (OA system)	1 set	Existing tanks and heaters capacity are enought. Only pipe line connections for new gear unit (12 - 15) and gear unit of rotary shear No. 1.
511-2	For stands No. 12 - 15 (OB system)	1 set	Existing tanks and heaters capacity are enough. Only pump station, pressure tanks, filters, and pipe line connections are needed.
511-3	For finishing block pinch roll set rod laying head No. 2 rotary shear (OC system)	1 set	Existing tanks and heaters capacity are enough. Only pump station, pressure tanks, filters and pipe line connections are needed.
512	Air oil lubrication system		
512-1	For additional mill guides of stands No. 1 - 11 (OD system)	1 set	Existing tanks and pumps capacity are enough. Only 3-oil distributors and pipe line connections are needed.
512-2	For mill guides of the stands No. 12 - 15, finishing block, and rollers of the loopers	1 set	Oil tank capacity : 250 Ltr Number of pumps : 2 (Running 1/stand-by 1)

Table 6.4.3-8 ROD Expansion Equipment List (Mechanical -4)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
513	Grease lubrication systems		
513-1	Furnace and furnace facilities	-	Existing system is enough.
513-2	Stands No. 1 - 15	-	Existing system is enough
513-3	Coil station	1 set	Pump Running/stand-by : 1/1 0.3 kW
513-4	Coil compacting, binding machine	1 set	Pump Running/stand-by : 1/1 0.75 kW
513-5	Coil offloading car	1 set	Pump Running/stand-by : 1/0 0.185 kW
514	Hydraulic systems		
514-1	Furnace (Walking beam)	-	No additional expanion
514-2	Roughing train and intermediate mill No. 1	1 set	The existing hydraulic system with its components (Oil tank with heaters, pump station, accumulators, cooler and filter unit) are designed for 2 strands. Only adding two hydraulic cylinders are necessary. One for billet switch plate, and other one for rotary shear No. 1 with controlling solenoid valves.
514-3	Coil station	1 set	The existing hydraulic system with its components (Oil tank with heaters, cooling & filter unit, circulating pump) are designed for 2 strands. Only pump station, accumulator stand, conrol stands are necessary.

Table 6.4.3-8 ROD Expansion Equipment List (Mechanical -5)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
514-4	Compacting and binding facilities	1 set	1. More reliable machine is needed to overcome the existed machines troubles. 2. To follow up the modification done for existing machines and give a feed back to original supplier to be taken into consideration for future expansion equipment.
514-5	Coil unloading station	1 set	1. More reliable machines are needed to overcome the existing machines troubles. 2. To follow up the modification done for existing machines and give a feed back to supplier for future expansion consideration.
515	Water system		
515-1	Booster pumps for compact stands, finishing block and water cooling zone (water cellar)	1 set	Actual existing pumps: Two pumps for 6 bar and two pumps for 12 bar. Additional one pump (6 bar) and one pump (12 bar) for 2 strands are necessary after modifying existing (6 bar) pump.
*	Pipeline ROD Max : 2,350 m^3/h BAR Max : 590 m^3/h Total : 2,940 m^3/h	-	Capacity of pipeline from battery limit to water cellar is enough.
515-2	Scale pit pump for utility water treatment station	1 set	Actual existing pumps: 3 (running 2/stand-by 1) Additional pump: 1 x 55 kW
*	Pipeline		Capacity of pipeline from scale pit to battery limit is enough.

Table 6.4.3-8 ROD Expansion Equipment List (Mechanical -6)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
515-3	Scale pit pump for scale sluice flushing	1 set	Actual existing pumps: 2 (running 1/stand-by 1) Additional pump: 1 x 22 kW
*	Pipeline		Capacity of pipe line from scale pit to flushing point is enough.
*	Indirect water system & pipeline ROD Max : 1,600 m^3/h BAR Max : 836 m^3/h Total : 2,436 m^3/h	-	Only connectings are necessary. Capacity of pipeline from battery limit is enough.
516	Gas and air supply system		
516-1	Natural gas system	1 set	Connecting pipes for burners are necessary.
*	Pipeline	-	Existing pipeline dia (200 mm) from battery limit to manifold point is enough.
516-2	Compressed air system	1 set	Connecting pipes for consumer point are necessary.
*	Pipeline	-	Existing pipeline dia from battery limit to connecting start point is enough.
516-3	N_2 (Nitogen) gas system	1 set	Connecting pipes for burners are necessary.
*	Pipeline	-	Existing pipeline dia from battery limit to manifold point is enough.

Table 6.4.3-8 ROD Expansion Equipment List (Mechanical-7)

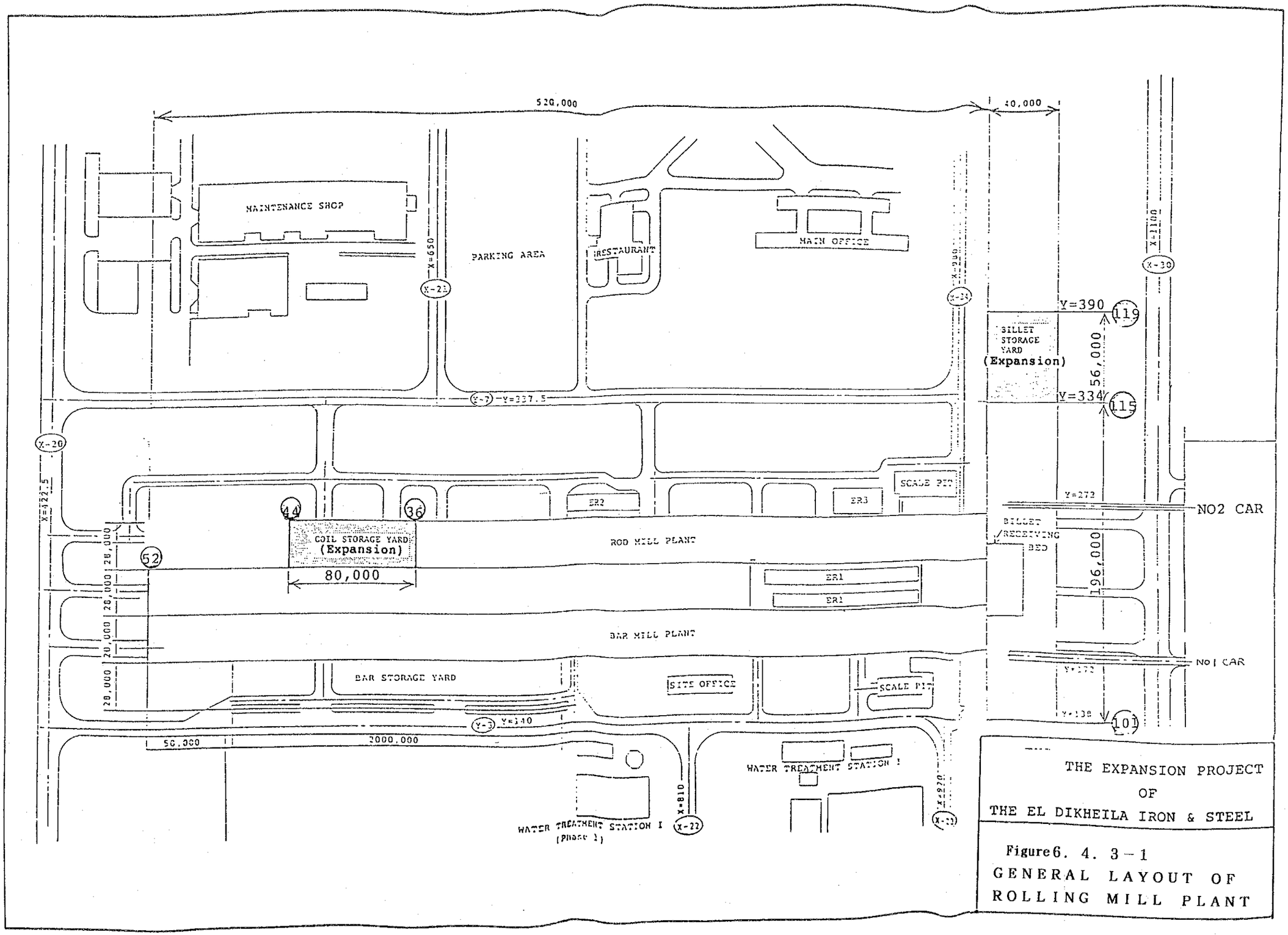
NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
600	Roll shop		- One engine lathe 1 meter is necessary with hydraulic copying machine. - One jib crane is necessary.
*	Ring roll (tungsten carbide) grinding machine	-	Existing 2 grinding machines are enough.
700	Cranes		
710	Billet handling crane	1	Lifting capacity 17.0 t.
720	Coil handling crane	1	Lifting capacity 8.7 t with lifting double C-hook and rotating system.
800	Buildings (Scope of civil and building works)		
810	Billet storage yard	1	40 m x 14 m/span x 4 spans
820	Coil storage yard	1	28 m x 10 m/span x 8 spans Column raw G-F and No. 36 - 44.

Table 6.4.3-8 ROD Expansion Equipment List (Electrical -1)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
801	DC Main mill drive motor		
	For No. 1 intermediate mill	4	1,000 kW, 700/1,200 rpm, 540 V
	For rougher No. 6, 6 mill	2	500 kW, 700/1,200 rpm, 540V
	For finishing block mill	2	2,250 kW, 600/900 rpm, 750V
804	Thyristor power supply for DC main motor	4	For 540 V, 1,000 kW motor unidirectional with by directional field
		2	For 540 V, 500 kW motor
		2	For 750 V, 2,250 kW motor
807	Thyristor transformer for DC main motor	2	2 x 1,860 kVA, 6.6/0.54 kV oil immersed
		1	2 x 930 kVA, 6.6/0.54 kV oil immersed
		2	4,200 kVA, 6.6/0.75 kV oil immersed
821	AC auxiliary motor	1 lot	Total around 1,770 kW
822	Motor control center for AC auxiliary motor	1 lot	Ditto
841	33 kV power transformer	1	24/30 MVA, 33/6.6 kV, oil field
842	33 kV switchgear	1	36 kV, 630 A motor operated load switch
844	6.6 kV switchgear	3	6.6 kV distribution switch gear
		7	6.6 kV combination starter 2 finishing block 2 1st intermediate 1 rougher stand No. 7 1 Aux TPS 1 Field TPS
845	Static VAR compensator	1	10 MVA high impedance transformer 1 unit thyristor cubicle High harmonic filters 5th, 7th, 11th and 13th

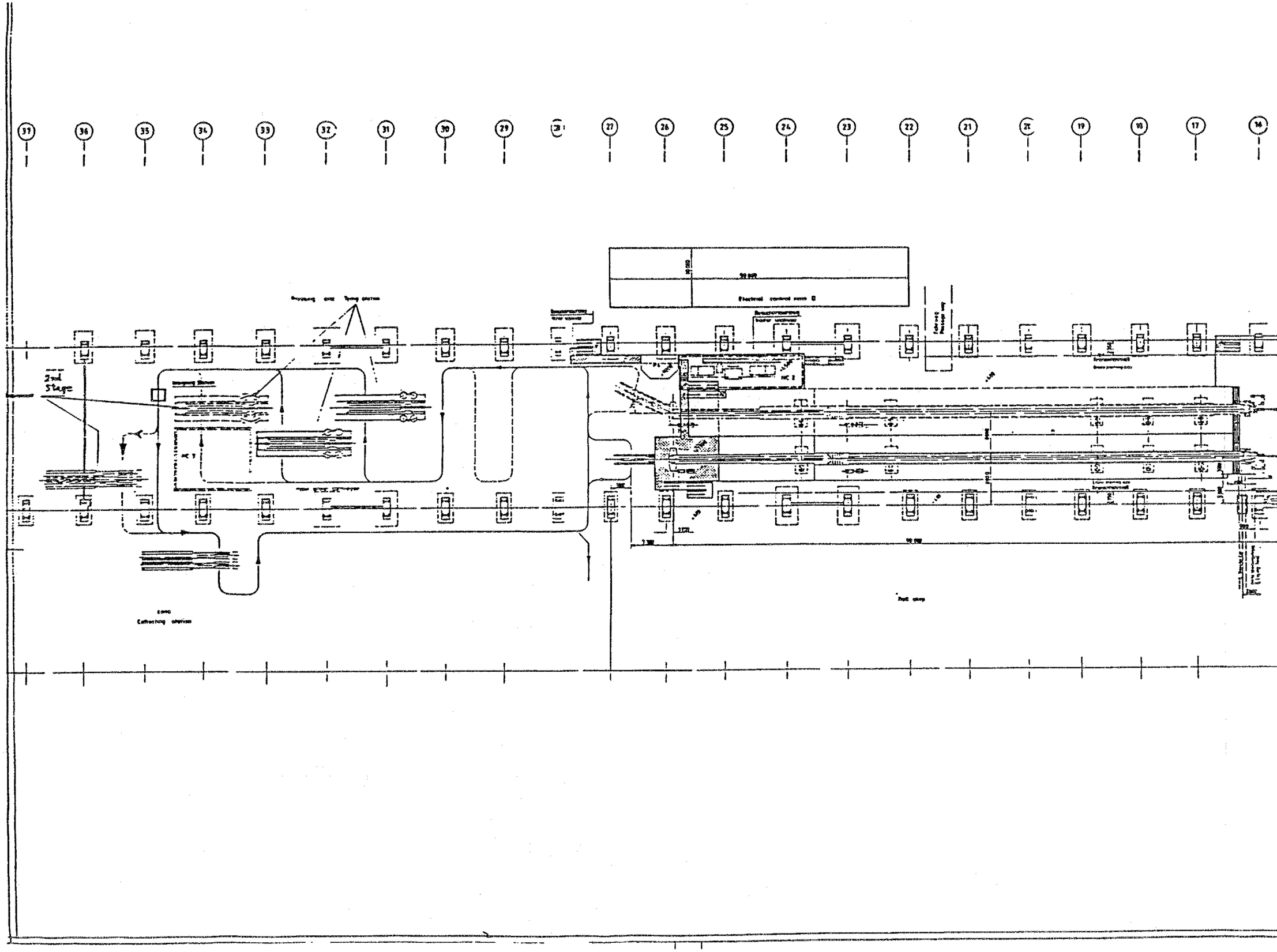
Table 6.4.3-8 ROD Expansion Equiment List (Electrical -2)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
851	Master control	1 lot	Addition of PLC and modification/revision of software are required.
852	Control desk and station	1 lot	Modification of existing panel is included.
853	Supervisory control panel	1 lot	Modification of existing panel is included.
854	Sensors and detectors	1 lot	For second strand and expansion of finishing facilities
856	Combustion control system	1 lot	Necessary control system for additional burners to provide 150 t/h capacity.
858	Process control computer	1 lot	Addition of hardware and software for complete tracking system and modification to two-strand rolling.
861	Lighting and small power system	1 lot	Billet yard 40 m x 56 m Coil yar 28 m x 80 m
863	Ventilation and air conditioning equipment	1 lot	Necessary air-conditioning equipment to cool the additional electrical equipment in the electrical control room.
865	Crane power feeding system	1 lot	Billet yard 56 m in length Coil yard 80 m in length
867	Fire protection system	1 lot	
871	Spare parts	1 lot	
881	Construction materials	1 lot	



THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL

Figure 6. 4. 3 – 1
GENERAL LAYOUT OF
ROLLING MILL PLANT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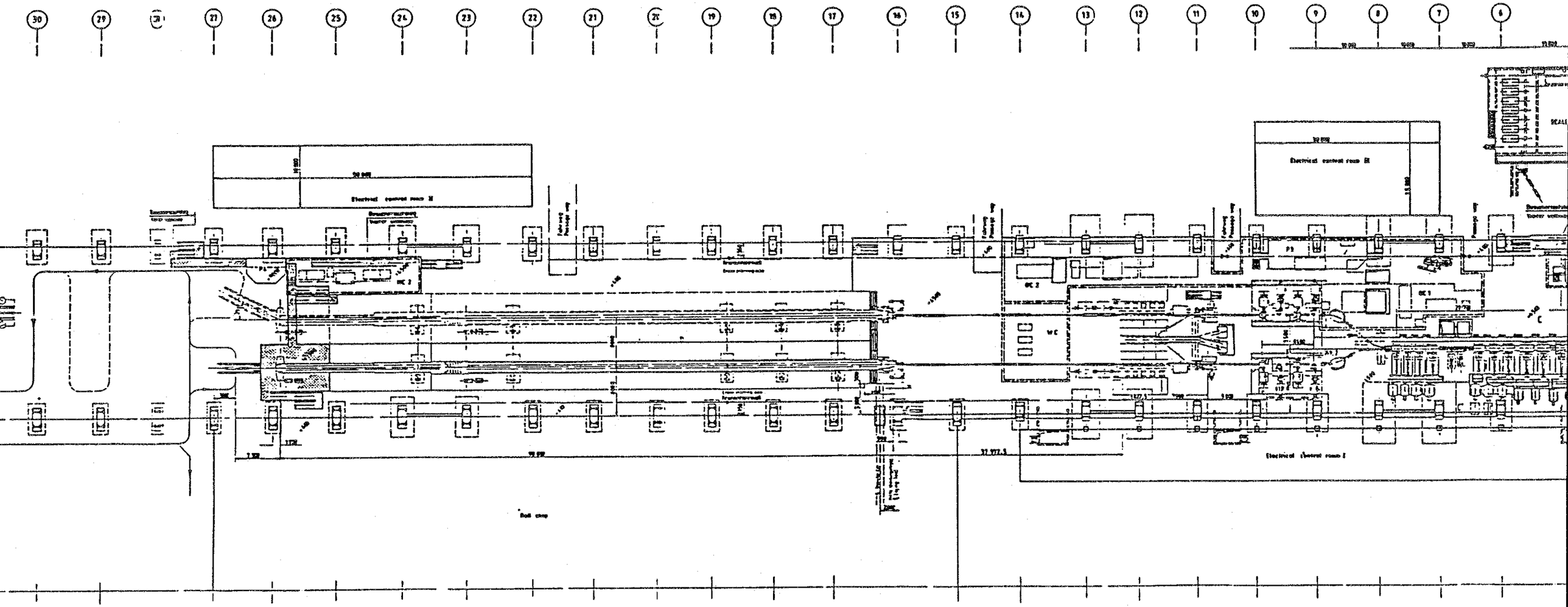
2nd Stage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Electrical control room II
Electrical control room I
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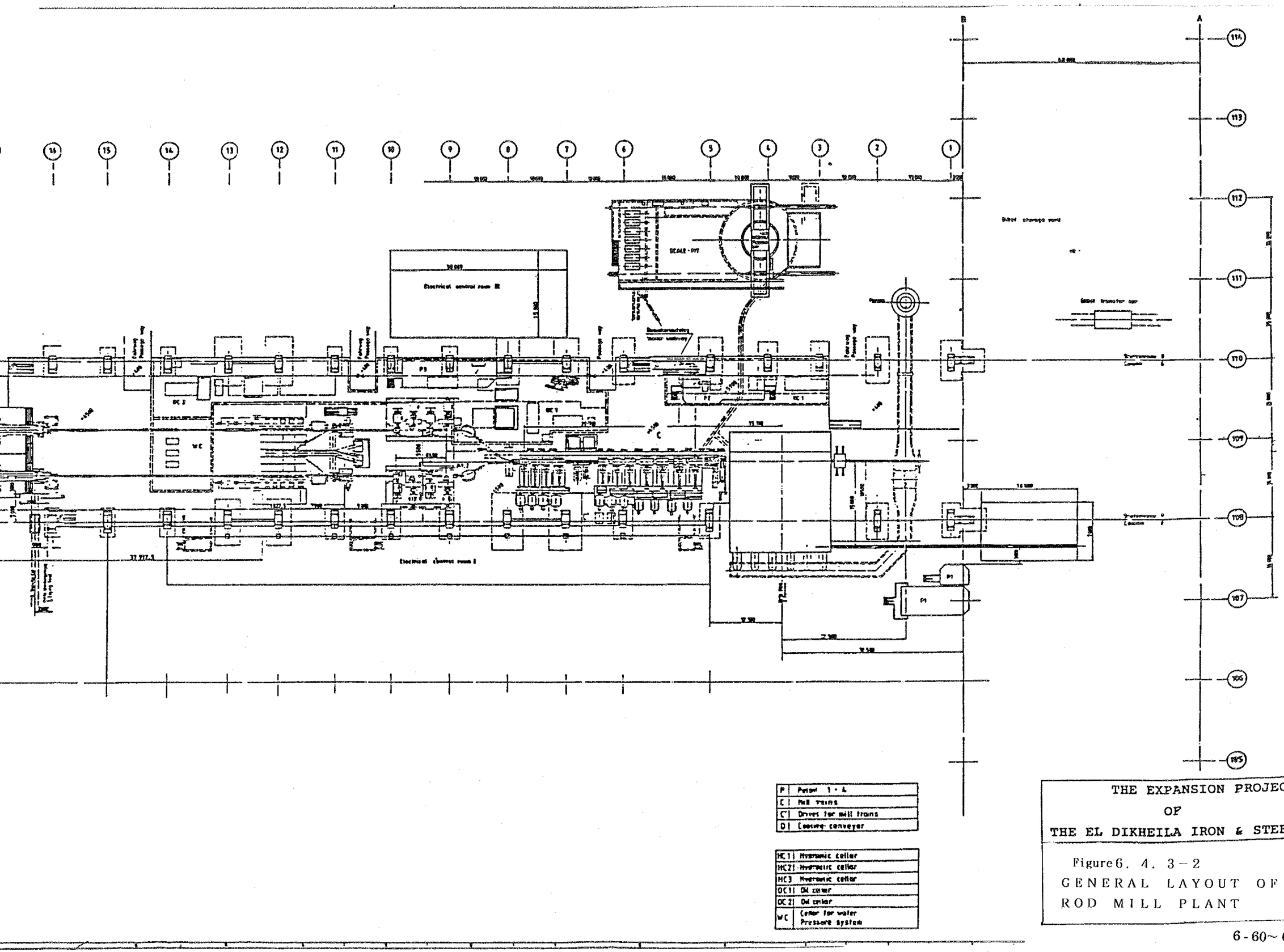

P	Pumps 1 - 4
C	Mill trains
C'	Drives for mill trains
D	Cooling conveyor

HC1	Hydraulic cellar
HC2	Hydraulic cellar
HC3	Hydraulic cellar
OC1	Oil cooler
OC2	Oil cooler
WC	Cooler for water Pressure system

THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL

Figure 6. 4. 3-2
GENERAL LAYOUT OF
ROD MILL PLANT