

## 5-2-10. Maintenance facilities

### 1) Outline

Iron and steel making facilities in these days have been much improved with a view of ensuring efficient and safe operation, improvement of product quality and cost reduction and showed a great progress. On the other hand, the importance of maintenance is stressed for maintaining those modern facilities, and development of systems and progress of technology in this field are indeed remarkable. At the planning stage, El Dikheila Works contemplated introduction of modern maintenance system and is achieving effective and economical maintenance work.

### 2) Basic policy of maintenance

Maintenance work can be divided to preventive maintenance and post-operation maintenance.

Preventive maintenance is applied mainly to on-line equipment and change of spare parts and others is regularly done before shut-down or trouble occurs. Inspection and maintenance of equipment is performed under the following policy.

- (1) Maintenance and repair plan of each facilities is drawn up based on the maintenance standard set up by ANSDK.
- (2) Maintenance and repair of equipment is classified into the following categories and carried out accordingly.
  - Scheduled repair: Periodical maintenance and repair scheduled weekly or monthly
  - Major repair: Repair requiring several days once a year
  - Unscheduled repair: Repair required during daily operation

(3) Repair and maintenance planning meetings are held by Coordination Section of Maintenance Department with attendance of those concerned of plants and coordinate the plan with production plan and decide the date and method of the repair and maintenance.

Post-operation maintenance is for off-line equipment and performed whenever unexpected trouble occurred and best efforts are made to avoid unexpected trouble by preventive maintenance. Incidentally, daily inspection, lubrication, cleaning, house-keeping and others are also important items of maintenance work, but they are responsibility of operation groups.

### 3) Maintenance shop

There are two buildings for maintenance work; one houses machining shop, assembly shop, electric and instrument repair shop while the other is processing shop.

A list of major equipment of Maintenance shop is given in Table 5.2.10-1.

### 4) Control of spares, materials and equipment

Control of spares and materials required for periodical repair and repair of troubles is one of the important work of Maintenance Dept. The department formulates purchasing 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.

Table 5.2.10-1 Equipment List 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 : 5,000 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 : 2500 mm Main motor : 7.5 kw Overall dimension (approx.) : 4215L x 1333W x 1340H mm	4 ton
MS 1104	Lathe (460 x 1,000)	1	Swing over bed : 460 mm Center distance : 1000 mm Main motor : 3.7 kw Overall dimension (approx.) : 2468L x 1203W x 1285H mm	2 ton
MS 1105	Heavy Duty Face Lathe	1	Swing over bed : 1300 mm Center distance : 1500 mm Main motor : 22 kw Overall dimension (approx.) : 5000L x 2500W x 1980H mm	12.5 ton
MS 1106	Universal Milling Machine	1	Table working surface : 1550 x 300 mm Main motor : 5.5 kw Overall dimension (approx.) : 2070L x 2417W x 2105H mm	3.5 ton
MS 1107	Slotting Machine	1	Ram stroke : 310 mm Main motor : 3.7 kw Overall dimension (approx.) : 1690L x 2770W x 2915H mm	3.8 ton
MS 1108	Shaping Machine	1	Ram stroke : 800 mm Main motor : 5.5 kw Overall dimension (approx.) : 2715L x 1382W x 1882H mm	4.2 ton
MS 1109	Double Housing Planning Machine	1	Cutting capacity : 3000L x 1500W x 1300H mm Generator drive motor: 30 kw Overall dimension (approx.) : 10800L x 4300W x 3700H 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 500 $\phi$ mm Main motor : 5.5 kw Overall dimension (approx.) : 2215L x 1380W x 2315H mm	5.2 ton
MS 1111	Surface Grinder	1	Max. work size : 1200L x 500W mm Main motor : 7.5 kw Overall dimension (approx.) : 4600L x 2460W x 2200H mm	6.5 ton
MS 1102	Cylindrical Roll Grinder	1	Max. Work size : 600 $\phi$ x 2500L mm Main motor : 11 kw Overall dimension (approx.) : 8000L x 2720W x 2100H mm	15.7 ton
MS 1113	Radial Drilling Machine	1	Drilling capacity (steel) : 80 $\phi$ mm Main motor : 7.5 kw Overall dimension (approx.) : 3050L x 1400W x 3120H mm	7.1 ton
MS 1114	Horizontal Band Sawing Machine	1	Cutting capacity: 360 $\phi$ mm Main motor : 3.7 kw Overall dimension (approx.) : 2220L x 1010W x 1220H mm	1.6 ton
MS 1115	Universal Tool and Cutter Grinder	1	Table size: 1060L x 200W mm Main motor: 0.75 kw Overall dimension (approx.) : 1300L x 1300W x 1520H 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 1110H 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 1230H mm	0.4 ton
MS 1118	Layout Surface Plate	1	Surface plate size : 2000 x 2000 x 250 mm	2.3 ton
MS 1119	Clamping Tool	26		0.1 ton

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.) : 6050L x 2000W x 2000H 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 2143H 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 : 18.5 kw Overall dimension (approx.) : 1700L 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.) : 1210L x 470W x 652H mm	0.35 ton x 3 pcs
MS 1206	Safety Scaffold	1	Main frame size : 1524H x 1219W mm Overall dimension (approx.) : 10L x 1.2W x 16.7H m	3.6 ton
MS 1207	Submergible Water Pump	2	Volume : 60 m <sup>3</sup> /Hr	0.1 ton x 2 pcs
MS 1208	Surface Plate (box type)	2	3000L x 1500W 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.) : 1610L x 1425W x 1400H mm	1.4 ton
MS 1210	Dynamic Balance Machine	1	Work size: 1600φ x 2000L mm Main motor : 7.5 kw Overall dimension (approx.) : 3100L x 1000W x 1590H 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	Heavy Duty Guillotine Shear	1	Cutting capacity : 16t x 3050w mm Main motor : 37 kw Overall dimension (approx.) : 4270L x 2950W x 2460H mm	18 ton
MS 1302	Hydraulic Side frame Press	1	Capacity : 300 ton Main motor : 22 kw Overall dimension (approx.) : 3200L x 1500w x 4080H mm	18 ton
MS 1303	Bending Roller Machine	1	Bending capacity : 16t x 2000W mm Main motor : 7.5 kw Overall dimension (approx.) : 4200L x 1720W x 1600H mm	7 ton
MS 1304	Metal-Coating Spray Gun (Metallizing)	1	Max. work size : 600 $\phi$ x 2500L mm Main motor : 15 kw Overall dimension (approx.) : 5400L x 1300w x 1370H mm	8 ton
MS 1305	Tig Welding Machine	1	Capacity : 300 Amp. Rated power : 28 KVA Overall dimension (approx.) : 430L x 510W x 1345H mm	0.2 ton
MS 1306	Mig Welding Machine	1	Capacity : 350 Amp. 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.) : 1049L x 660W x 1057H mm	0.23 ton
MS 1308	Movable Hydraulic Pipe Bender	1	Bending capacity : 3.8t x 60.5 $\phi$ mm Motor power : 0.4 kw Overall dimension : 800L x 700W x 500H mm	0.1 ton
MS 1309	Heating Furnace	1	Inside dimension : 1200L x 1400W x 1000H mm Motor power : 3.7 kw (Blower)	22.5 ton

3. Equipment for Fabricating (continued)

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.) : 4700L x 1950W x 4850H mm	45 ton
MS 1311	Forklift with Rotating Clamp for Forging Operation	1	Handling capacity : 500 kg Overall dimension (approx.) : 4700L x 1330W x 2200H mm	6 ton
MS 1312	Facility of Heat Treatment	1	Inside dimension : 3000L x 1650W x 1200H mm Motor power : 41 kw (total)	24.5 ton
MS 1313	Surface Plate (Hole Type)	1	3000L x 2000W x 250H mm	3.7 ton
MS 1314	Surface Plate (Hole Type)	5	1200L 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.) : 1015L x 810W x 875H mm	0.3 ton
MS 1402	Hand Feeding Single Side Surface Planner	1	Table size : 2000L x 300w mm Motor power : 4.4 kw (total) Overall dimension (approx.) : 2000L 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.) : 1075L x 990W x 1200H mm	0.78 ton
MS 1404	Band Saw	1	Table size : 825L x 800W mm Motor power: 5.9 kw (total) Overall dimension (approx.) : 1345L x 1580W x 2150H mm	0.75 ton
MS 1405	Wood Lathe	1	Swing over bed : : 250 mm Center distance : 1040 mm Motor power : 0.75 kw Overall dimension (approx.) : 1980L x 655W x 1255H mm	0.5 ton
MS 1406	Radial Arm Drill Press	1	Drilling capacity (wood) : 36φ mm Motor power : 0.4 kw Overall dimension (approx.) : 1100L 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 : 2500L x 1500W x 1500H mm Electric power: 83.7kw (total) Overall dimension (approx.) : 11250L x 3500W x 3360H mm	5 ton
MS 1502	Automatic Layer Winder	1	Max. work size: 750φ x 870L mm Motor power : 0.75 kw Overall dimension (approx.) : 1650L x 720w x 1200H mm	0.45 ton
MS 1503	Winding Machine	1	Max. work size : 1900φ x 1700L mm Motor power : 3.7 kw Overall dimension (approx.) : 2930L x 790W x 1470H 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.) : 1500φ x 850H mm	0.2 ton
MS 1506	Hydraulic Coil Press	1	Pressing force Horizontal : 7718 kg Vertical : 3632 kg Electric power : 8.3 kw (total) Overall dimension (approx.) : 1092L x 1056W x 1570H mm	0.9 ton
MS 1507	Shear	1	Cutting capacity : 4.5t x 1280W mm Motor power : 2.2 kw Overall dimension (approx.) : 2450L x 1800W x 1350H mm	2.1 ton
MS 1508	Treadle Shear	1	Cutting capacity : 2.0t x 1000W mm	0.4 ton
MS 1509	Insulation Cutter	1	Cutting capacity : 2t x 1000W mm Overall dimension (approx.) : 900L x 1500w x 900H mm	0.12 ton
MS 1510	Surface Plate (Rail Type)	15	Overall dimension of one rail : 5000L x 200W x 300H mm	1 ton x 15 pcs

5. Equipment for Electrical Repair (continued)

Item No.	Name of Equipment	Q'ty	Short Spec.	Weight (approx.)
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./Hr Electric power : 0.31 kw	0.2 ton
MS 1514	Transfer Car	1	Car size : 1500w x 2000L mm	0.5 ton

6F Electrical, Pneumatic and Hand Tools for Maintenance shop

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

Item No.	Name of Equipment	Qty	Short Spec.	Weight (approx.)
1)	Electric floor grinder	1	Wheel dimension: 255 $\phi$ x 25W mm Electric power : 1.15 kw	103 kg x 3 pcs
2)	Double head bench grinder	16	Wheel dimension: 205 $\phi$ x 19W mm Electric power : 590 W	24 kg x 16 pcs
3)	Bench drilling machine	16	Capacity (steel): 13 mm Electric power : 200 W	53 kg x 16 pcs
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 15 pcs
7)	Portable electric disc sander (angle type)	11	Wheel size : 100 $\phi$ mm Electric power : 480 W	1.8 kg x 11 pcs
8)	Portable electric disc grinder (angle type)	2	Wheel size : 205 $\phi$ mm Electric power : 1.35 kw	6.8 kg x 2 pcs
9)	Electric hand grinder	4	Wheel size : 32 $\phi$ mm Electric power : 240 W	1.9 kg x 4 pcs
10)	Portable electric disc sander	3	Wheel size : 180 $\phi$ mm Electric power : 820 W	5.0 kg
11)	Electric hand grinder	3	Wheel size : 125 $\phi$ 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 : 125 $\phi$ 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 W	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 : 60 $\phi$ mm Electric power : 3.7 kw	70 kg x 11 pcs
19)	Movable electric vacuum cleaner	8	Capacity : 8.0 m <sup>3</sup> /min Electric power : 3.4 kw	35 kg x 8 pcs
20)	Industrial cooling fan for workers	20	Capacity : 340 m <sup>3</sup> /min Electric power : 800 W	15.5 kg x 20 pcs
21)	Portable electric blower	8	Capacity : 2.3 m <sup>3</sup> /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 29 pcs
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 : 65 $\phi$ mm	1.3 kg x 3 pcs
25)	Pneumatic angle grinder	3	Wheel size : 150 $\phi$ mm	2.8 kg x 3 pcs
26)	Air drill	2	Capacity (steel): 10 mm	1.4 kg x 2 pcs
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

6F.1 Electrical and pneumatic tools (continued)

Item No.	Name of Equipment	Q'ty	Short Spec.	Weight (approx.)
29)	Coal pick hammer (Pneumatic)	1	No. of striking : 1250/min	9.0 kg
30)	Portable exhaust fan (Propeller fan)	3	Capacity : 70 m <sup>3</sup> /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)

## 5-2-11. Analysis and inspection facilities

### 1) Outline

ANSDK's analysis and inspection facilities are supplied by Shimazu Co. A contract was signed in December 1984 and analysis work was begun in May 1986. Modern analysis equipment are 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

Sample preparation section consists of cutting tools, grinding tools, saws, crushers, etc. and prepares samples prior to the analysis and testing at Chemical section and Metallurgical section. Samples of Steelmaking plant are sent by pneumatic tube very fast to this Sample preparation sec. This section prepares the samples and at the same time keeps the samples.

Chemical analysis section consists of such facilities as fluorescent X-ray analyzer, optical emission spectrometer, carbon & sulfur determinator, automatic absorption & flame emission spectrometer, etc. and performs chemical analysis of raw materials and products of production facilities such as DR, LC, SMP and RMP, chemical analysis for water treatment facilities and that 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.

Metallurgical section consists of tension and compression tester, hardness tester and impact tester and mainly performs mechanical strength test 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.

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

Table 5.2.11-1 Samples and chemical items

Samples	Purpose of analysis	Actions according to analysis results	Analysis items	Analyzer
1	Sample in EF Analysis of elements in molten steel	Control of EF refining condition	C, S  O <sub>2</sub> , N <sub>2</sub> Si, Mn, P, Ni, Cr, Mo, Al, V, Cu, Sn, S, Pb, Sb, As, Ti	C & S determinator Optical emission spectrometer  N & O determinator  Fluorescent X-ray analyzer Optical emission spectrometer Wet chemical analysis
2	Sample in ladle Representative chemical composition of the charge	Acceptance of judgement according to the specified steel grade Steel grade decision	C, S  O <sub>2</sub> , N <sub>2</sub> Si, Mn, P, Ni, Cr, Mo, Al, V, Cu, Sn, S, Pb, Sb, As, Ti	C & S determinator Optical emission spectrometer  N & O determinator  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 <sub>2</sub> , CaO, MgO, Al <sub>2</sub> O <sub>3</sub> , TiO <sub>2</sub> , V <sub>2</sub> O <sub>5</sub> , P  M-Fe, T-Fe C, S	Fluorescent X-ray analyzer Wet chemical analysis  Wet chemical analysis  C & S determinator
4	Oxide pellets & lump ore Analysis samples for new purchases	Evaluation and judgement according to the requirement	T-Fe, SiO <sub>2</sub> , CaO, MgO, Al <sub>2</sub> O <sub>3</sub> , TiO <sub>2</sub> , V <sub>2</sub> O <sub>5</sub> , P S FeO, T-Fe	Fluorescent X-ray analyzer Wet chemical analysis  C & S determinator  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 <sub>2</sub> , S	C & S determinator
			SiO <sub>2</sub> , CaO, Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , MgO, K <sub>2</sub> O, Na <sub>2</sub> O, P	Fluorescent X-ray analyzer Wet chemical analysis
6	Limestone Analysis samples for new purchase	Evaluation and judgement according to the requirement	Coarse grain titlation	
			SiO <sub>2</sub> , CaO, Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , MgO, K <sub>2</sub> O, P, L.O.I	Fluorescent X-ray analyzer Wet chemical analysis
7	EF slag Analysis of basicity and FeO content	Control of basicity and chemical composition in molten steel	S	C & S determinator
			T-Fe, SiO <sub>2</sub> , CaO, MnO, Al <sub>2</sub> O <sub>3</sub> , MgO, V <sub>2</sub> O <sub>5</sub> , S, TiO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub>	Fluorescent X-ray analyzer Wet chemical analysis
8	Natural gas Monitor of H <sub>2</sub> S and CO <sub>2</sub> Contents in natural gas Investigation data		FeO, T-Fe	Wet chemical analysis
			H <sub>2</sub> S, CH <sub>4</sub> , CmHn, N <sub>2</sub> , CO <sub>2</sub> , CO, O <sub>2</sub>	Gas chromatograph
			CO <sub>2</sub> , CO, O <sub>2</sub> , H <sub>2</sub>	Orsat gas analysis 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 Cl, Ca, Mg, SiO <sub>2</sub> , SO <sub>4</sub> , Alkalinity NH <sub>4</sub> Suspended solid Inhibitor Absorbed O <sub>2</sub> Turbidity	Water testing meter Wet chemical analysis Nessler analysis Filtration Spectrophotometer/ Wet chemical analysis Water testing meter Wet chemical analysis
10	Liquid oxygen	Checking the C <sub>2</sub> H <sub>2</sub> content, and protection against explosion	Control of C <sub>2</sub> H <sub>2</sub> content	C <sub>2</sub> H <sub>2</sub>	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 <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , TiO <sub>2</sub> , CaO, MgO, Cr <sub>2</sub> O <sub>3</sub>	Fluorescent X-ray analyzer Wet chemical analysis

Table 5.2.11-2 Samples and physical testing items

ITEM	SAMPLE NAME	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 Tumble 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, Lime)	Drop test, Screen analysis Cold Crushing strength Moisture Content
8.	Briquette (DRI, Lime)	Drop test, Screen analysis Cold Crushing strength Moisture Content

Table 5.2.11-3 Receiving Samples List

ITEM	SAMPLE NAME	NO. OF RECEIVING TIME	RECEIVING CONDITION	RECEIVING ROOM
1.	EF SAMPLE	4-6 TIMES/ CHARGE	TEMP.: BELOW 700°C SIZE: $\phi$ 35/30 x 70	SENDING STATION OF SAMPLE TRANS. SYSTEM IN EF
2.	LADLE SAMPLE	ONCE/ CHARGE	TEMP.: BELOW 700°C SIZE: $\phi$ 35/30 x 70	SENDING STATION OF SAMPLE TRANS. SYSTEM IN CC
3.	EF SLAG	2-3 TIMES/ DAY	TEMP.: BELOW 100°C SIZE: $\phi$ 35/30 x 70	SENDING STATION OF SAMPLE TRANS. SYSTEM IN EF
4.	BAR & ROD *1 SAMPLE	ONCE/DAY	300 mm l/ SIZE AND CHARGE- WISE	UNIVERSAL TESTING MACHINE ROOM
5.	SPONGE IRON SAMPLE	ONCE/2 HRS.	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/ MONTH	WEIGHT: 5 kg SIZE: 20 - 50 mm	- Ditto -
8.	BURNT LIME SAMPLE	ONCE/2 HRS.	WEIGHT: 5 kg SIZE: <40 mm	- Ditto -
9.	NATURAL GAS SAMPLE	ONCE/WEEK	GAS COLLECTING TUBE OR GAS SAMPLING BUBBLER	GAS ANALYSIS ROOM
10.	INDUSTRIAL WATER SAMPLE * CIRCULATION WATER * RAW WATER * MAKE-UP WATER	ONCE/WEEK	4 liters/EACH SAMPLE WATER BY SAMPLING BOTTLE	ANALYSIS ROOM (LIQUID)
11.	OIL AND LUBRICANT	ACCORDING TO THE REQUIRE- MENT	2 liters or 2 kg	ANALYSIS ROOM (OIL)

ITEM	SAMPLE NAME	NO. OF RECEIVING TIME	RECEIVING CONDITION	RECEIVING ROOM
12.	REFRACTORY	ACCORDING TO THE REQUIREMENT	5 pcs of STANDARD SIZE BRICK AND 5 kg CASTABLE	PREPARATION ROOM (NON-METAL)
13.	LIQUID OXYGEN	ONCE/WEEK	Al CONTAINER	GAS ANALYSIS ROOM

\*1: Quantity depends on the Egyptian Standard No. ES262-1974.

5-2-12. Administration facilities

Administration facilities of El Dikheila Works include administrative building, 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	No. of persons Accommodated	Construction
Main office	2,386 m <sup>2</sup>	4,193 m <sup>2</sup>	290	RC
Restaurant	797	826	-	RC
SMP site office	468	936	170	RC
RMP site office	432	864	155	RC
T.R. site office	300	300	72	RC
M.T. site office	585	585	161	RC
Guard office	220	220	40	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 office of DR control room with area of 129 m<sup>2</sup> 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 Mediterranean climate and annual rainfall is about 200 mm, but in the rainy season (Nov. - Mar.), rain often falls 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 standard of Egypt and adequate care is paid for measures against pollution of the open sea and water quality.

### 3) Housing facilities

On the west of the Works, there are company housing for 170 families in 10 buildings and welfare facilities such as club house, swimming pool, tennis court, and volleyball court. Of the company housing, 54 flats in 3 buildings are occupied by JC Management team and the rest by Egyptian employees of ANSDK. When the Management contract expires, all the buildings will be used by Egyptian employees.

Table 5.2.12-2 Outline of Housing Facilities

	No. of Building	No. of Flat	Total Floor Area (m <sup>2</sup> )
Housing	10	170	19,900 m <sup>2</sup> (84 m <sup>2</sup> /Flat)
Club house	1	-	1,040 "

### 5-3. Present status of infrastructure

#### 5-3-1. Natural gas supply

At present, natural gas used in ANSDK is supply by pipe line from Abu Qir gas field, about 45 km northeast of the Works. Natural gas reserves at Abu Qir gas field is not published, but the present agreement between ANSDK and the Egyptian General Petroleum Corporation (EGPC) assures the supply up to 2002. The gas is high quality gas as shown in Table 5.3.1-1. Problem, if any, in the gas supply is that as the 450-mm pipeline is single without spare and passes the urban area of Alexandria, any trouble may cause stop of the gas supply. In fact, in March this year, the gas supply was stopped for four days due to damage on the pipeline. No other particularly critical problems exist.

#### Present condition:

Supply capacity:	92,000 Nm <sup>3</sup> /h
Pipeline to ANSDK:	450 mm $\phi$ , 30 kg/cm <sup>2</sup> G
Receiving capacity of ANSDK - Desinged:	50,000 Nm <sup>3</sup> /h, 7 kg/cm <sup>2</sup> G
Actual:	60,000 Nm <sup>3</sup> /h, 7 kg/cm <sup>2</sup> G
Consumption:	28,000 Nm <sup>3</sup> /h (February 1987)
	30,000 Nm <sup>3</sup> /h (Estimated, at full operation)
Calorific value:	9,540 kcal/Nm <sup>3</sup>



Table 5.3.1-1 NATURAL GAS QUALITY IN ANSOX

ITEM	ACTUAL
NITROGEN (%)	0.27
CARBON DIOXIDE (%)	0.21-0.72
METHANE (%)	94.31-95.94
ETHANE (%)	2.43-3.45
PROPANE (%)	0.16-1.28
I-BUTANE (%)	0.04-0.38
N-BUTANE (%)	0.02-0.31
I-PENTANE (%)	0.01-0.11
N-PENTANE (%)	0.01-0.08
HEXANES (%)	0.20
MOLECULAR WEIGHT	17.63
DENSITY g/L AT NTP	0.7469
DENSITY g/L 60°F AND 14.696 PSI	0.7458
RELATIVE DENSITY (air <sup>m</sup> 1) 15.6°C (60°F)	0.6086
TOTAL SULFUR (Max.)	80 PPM (Calculated as H <sub>2</sub> S)
ORGANIC SULFUR (Max.)	0 PPM
DEW POINT°C, AT DELIVEERY CONDITIONS	below 0
GROSS CALORIFIC VALUE Kcal/m <sup>3</sup> at NTP	9,540
MAXIMUM TEMPERATURE	30°C
MAXIMUM PRESSURE	11kg <sup>f</sup> /cm <sup>2</sup> G
MINIMUM PRESSURE	9kg <sup>f</sup> /cm <sup>2</sup> G

### 5-3-2. Industrial water

Industrial water and potable water used in ANSDK are supplied by waterworks of AWA. Water quality is as shown in Table 5.3.2-1. As seen from the table, total hardness is high and the water is being used after 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/cm<sup>2</sup> as against rated pressure of 3 kg/cm<sup>2</sup>).

#### Present condition:

Supply capacity:	2,000 m <sup>3</sup> /h
Pipeline to ANSDK:	700 mm $\phi$ , 1-3 kg/cm <sup>2</sup> G
Receiving capacity:	930 m <sup>3</sup> /h
Receiving piping:	450 mm $\phi$ , 1-3 kg/cm <sup>2</sup> G
Consumption:	250 m <sup>3</sup> /h (February 1987)
	560 m <sup>3</sup> /h (Estimated, at full operation)

Table 5.3.2-2 RAW WATER QUALITY IN ANSDK

ITEM	ACTUAL
TURBIDITY	2.6-3.0 NTU
SMELT	Normal
TASTE	Normal
COLOR	Normal
PH	7.0-8.1
CL	30.2-88.00 ppm
CL <sub>2</sub> (Free)	0.1-0.6 ppm
TOTAL ALKALINITY AS CaCO <sub>3</sub>	129.2-174.0 ppm
TOTAL HARDNESS AS CaCO <sub>3</sub>	137.5-205.0 ppm (Avr.159.6 ppm)
FREE NH <sub>3</sub>	0.082-0.42 ppm
ALBUMINOID NH <sub>3</sub>	0.041-0.190 ppm
ABSORBED O <sub>2</sub> (during 3hours 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 u Mho/cm
MAXIMUM TEMPERATURE	30°C
MINIMUM PRESSURE	2 kg <sup>f</sup> /cm <sup>2</sup> G
TOTAL FLOW RATE	930 m <sup>3</sup> /hr. (max.)

### 5-3-3. Electric power

At present, ANSDK receives electric power through two circuit, 405-mm sq. power transmission lines via Ameria substation and El Dikheila substation from Kafr Dawar Power Station of Egyptian Electricity Authority (EEA). However, power is chronically short, resulting in voltage drop and power failure once or twice a month.

EEA's power supply capacity to the entire Alexandria area is only 620 MW at present, and when ANSDK is in full operation, it will consume about one fourth of the capacity. But a transmission line (under construction) from Abu Qir power station is scheduled to be completed by the end of 1987 and it is expected that the power supply condition may be somewhat improved.

#### 1) Present power supply condition

##### (1) Power supply in the entire Egypt

a) Max. power generating capacity	5,742 MW (Dec.'86)
b) Ave. power demand	4,190 MW (Dec.'86)
c) Max. power demand	5,742 MW (Dec.'86)

##### (2) Power supply in the Alexandria area

a) Max. power generating capacity	620 MW (Dec.'86)
b) Ave. power demand	488.7 " (Dec.'86)
c) Max. power demand	620 " (Dec.'86)

##### (3) Power supply to ANSDK

###### a) Contracted power with EEA

15 minute demand	166 MW
Instant	207 MW

b) Actual power consumption

15 minute demand 116 MW (Feb.'87)

c) Estimated consumption at full operation

	3 EAFs	4 EAFs
15 minute demand	135 MW	150 MW
Momentary demand	169 MW	188 MW

d) Transmission line to ANSDK

Ameria line: From Ameria substation to Dikheila substation

Voltage 220 kV  
Cable size 405 mm<sup>2</sup>  
Distance 5.8 km  
No. of line 2 circuits

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

Voltage 220 kV  
Cable size 405 mm<sup>2</sup>  
Distance 46 km  
No. of line 2 circuits

e) 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 (-"-)

f) Power factor

Permissible ave. value: Contracted value 90% min.  
Actual value 99%

g) Flicker regulation

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

#### 5-3-4. Raw material receiving facilities

Raw material berths, ore storage yard and transporting facilities were constructed by Industrial Mining Complexes (IMC) and completed at the end of 1986. At present, those facilities are under the control of IMC, but in future a new company for cargo handling will be established and the new company will supply pellet, ore, imported scrap, etc. to ANSDK. In addition, there is an idea to use the facilities not only for ANSDK alone but also for supplying coal to a power station which is planned to be built in Alexandria area and for other purposes. However, they are being used for supplying raw materials to ANSDK alone, resulting in low operating rate.

At present, raw materials supplied to ANSDK are 1) unloaded by unloader cranes from a raw material vessel at Raw material berth and 2) transported by belt conveyor to ore storage yard where 3) the materials are piled by stacker crane at the yard. The raw materials are 4) reclaimed by reclaimer crane from a pile and 5) transported by conveyor crossing the public road to Oxide storage bin of ANSDK. The main specification of each facilities is given below and their capacity is adequate for satisfying the raw material requirements of ANSDK.

##### Main specification:

##### 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 travelling  
distance 310 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 travelling  
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) Stock yard

Area Approx. 30,000 m<sup>2</sup>

Capacity Approx. 300,000 t

## Chapter VI. EXPANSION PLAN





## 6. Expansion Plan

### 6-1. Basic policy of expansion plan

#### 6-1-1. Product mix and production

In planning expansion of El Dikheila Iron and Steel Works, whether product mix is to be Re-bar as at the existing plants or other products should be determined after overall study of many factors such as demand/supply balance of steel products in Egypt, price trend or profitability, layout, scale and workability of the existing facilities, and operating technique.

As discussed in Chapter 3, steel consumption in Egypt shows an increasing trend from year to year and is expected to reach about 6.72 million tons in 2000. In newly industrialized developing countries, as industrial base expands and infrastructure is improved, steel consumption calls for not only increase in quantity but also an increased variety of steel products. It can be expected that in Egypt also, such development will occur in the structure of steel demand.

In Egyptian steel industry, Hadisolb plays the central role and is pushing on expansion project so as to cope with the change in demand structure in future. Therefore, it can be said that there is least cause for other steelmakers in public sector or private sector companies including ANSDK to pursue expansion of product mix now immediately.

In order to fill the supply gap of steel products, in particular re-bar, resulting from the growth of steel demand, there are numbers of construction or remodelling projects in both the public sector and private sector, but the imbalance of demand and supply has not been solved so far. The demand/supply condition that the shortage of re-bar is filled by import is expected to continue in future.

Worldwide re-bar market shows a slightly excess supply and the price is kept at a stable low level. But in view of its excellent location condition, high productivity, and stable operation, El Dikheila Works can compete successfully in the international market, which is proved by the financial analysis.

In consideration of the above, increased production of re-bar was made the basic policy in planning the expansion project of El Dikheila Works.

Because of the relation with the existing facilities, the production scale of the Works will be increased to 1.1 to 1.2 million t/y from about 745,000 t/y at present.

In addition, full consideration will be given to the layout or facilities with respect to production of higher grade steel or construction of a mill of secondary processing of rods.

## 6-1-2. Expansion of kinds of steel (Quality steel)

As described above, there are few factors directing toward expansion of the range of product types, but only the possibility is studied in this report.

### 1) Limitation in shape

Rolling facilities of ANSDK can produce bars (10-32 mm  $\phi$ , straight bars) and rods (5.5-13 mm  $\phi$ , in coil), and if quality steel is produced, its shape has to be in this range of bars and rods. Therefore, the kinds of steel shown in Table 6.1.2-1 are considered.

### 2) Limitation in quality

Quality generally required of quality steel is that the steel must be superior in composition, surface condition and inner quality.

#### (1) Composition

(a) It is needless to say that as compare with ordinary rebar, quality steel must have least dispersion in composition and this can be attained with ladle furnace.

(b) Though oxygen content in steel can be reduced to an extent by using ladle furnace, but not so effectively as seen in RH and other degassing processes. Therefore it is impossible to produce wire rods for core wire of covered electrode, for which Si needs be 0.03% max., extremely soft steel wire rods with C being 0.06% max., and super-clean steel, e.g. bearing steel with oxygen in steel being required to be 10 ppm or less.

(c) Steel which needs quench-temper treatment, e.g. carbon steels for machine structural use and structural steel with specified hardenability bands, must have uniform fine grains in crystals, and for this it is necessary to have Sol. Al in steel 0.010% or more. However, in casting 130 sq. billets, if the steel contains Sol. Al

0.010% or more,  $\text{Al}_2\text{O}_3$  segregates and clogs the nozzle, making casting impossible. There is taken a process to add Ca to molten steel in the ladle furnace to prevent nozzle clogging, but if the steel contains high S, CaS segregates and clogs the nozzle. Therefore, casting of molten steel with high content of Sol. Al is done in the form of bloom and it is difficult to cast it into 130 sq.billet.

## (2) Surface defects of billet

In order to prevent surface defect of billet, namely, defects caused by blow holes, it is necessary not only to perform sufficient deoxidation in the ladle furnace but also to make a prevention of oxidation and acceleration of removal of inclusions and slag during casting by use of submerged nozzle and prevent occurrence of blow holes through stirring liquid steel in mold with electromagnetic stirrer.

In addition, equipment to remove defects of billet such as shot blast, magnetic-particle detector, and automatic grinder are necessary in producing products requiring stricter surface condition such as low carbon steel rods for cold heading, high carbon steel wire rods for PC wire, piano wire, valve spring, carbon steels for machine structural use, and structural steel with specified hardenability bands.

However, the above measures to ensure quality of steel cannot be used effectively unless a considerable demand for those steels are anticipated domestically in Egypt.

## (3) Inclusions

For production of clean steel with least inclusions, it is necessary to perform adequate deoxidation of molten steel and removal of inclusions which rise to the surface of liquid steel by stirring in ladle furnace, and

cast liquid steel without oxidation at CCM and promote separation of inclusions by electromagnetic stirring in mold. High degree of cleanliness is required for the steels as mentioned in (2) above. When such steels are produced, usually it is advantageous to use large tundishes to facilitate rising of inclusions and employ slow casting speed to promote rising of inclusions in the mold and the steels are cast into blooms which permits use of submerged nozzle with sidewise hole. This method is difficult for 130 sq. billets.

#### (4) Segregation

In order to prevent segregation of composition of the steel, generally liquid steel is cast at lower temperature than normal, thereby controlling growth of crystal of columnar structure from the outer layer while promoting growth of crystal of equiaxed structure in the center. Consequently casting it into blooms is generally adopted. Low temperature casting is difficult for the billet CCM due to the restriction in nozzle diameter. Needless to say, electromagnetic stirrer is effective for reducing segregation.

#### 3) Reconditioning of billet, inspection of product and process control

Billets which satisfy the above strict quality have to be treated further to remove surface defects by shot blast, magnetic-particle detector and automatic grinder. And products of rolling plants themselves are often to undergo processes such as forging, cutting, bending and heat treatment in subsequent processes. Therefore, it is necessary to fully inspect and control the products by Eddy current flaw detection and Magnaflux detector.

Bar products vary in kind of steel and diameter. Inversely, orders by kind of steel and by size from users are in small lots. Consequently, at the mill, when one

charge of a certain kind of steel is tapped, it is cast into billets and stockpiled. As rolling size schedule is available, a small quantity of billets are taken out of the stockpile. As the number of kind of steel are big, there are a large number of stockpile groups of similar billets. This necessitates the space to keep the stock of many billets and workers to operate the yard. This holds true to the stock control of products. Namely, products by kind of steel and by size in small lots each have to be stocked in a large quantity, and this requires the space and workers.

- 4) Because of the limitation in quality with respect to the small cross-section, 130 sq billet in particular mentioned above and complexity of reconditioning and inspection control and process control of billet and product, the kind of steel which ANSDK can contemplate may be limited to those shown in Table 6.1.2-1.

Table 6.1.2-1 Applicable steel grade and products

	Steel grade	Size		Unrecommenable reason (X)								
		Bar	Rod	A	B	C	D	E	F	G		
1	Recommendable											
1-1	JIS G3505: Low carbon steel wire rods ° General structural use ° Annealed wire ° Nails ° Galvanized wire (→Wire net, Barbed wire)		○ ○ ○ ○									
1-2	JIS G3506: High carbon steel wire rods ° Wire for spring for bed, chair, car seat ° Wire for rope		○ ○									
1-3	JIS G3101: Rolled steel for general structure	○										
2	Un-recommendable											
2-1	JIS G3505: Low carbon steel wire rods ° Cold heading	○	○	X	X							
2-2	JIS G3506: High carbon steel wire rods ° PC wire, piano wire, valve spring		○ ○	X	X	X						
2-3	JIS G3503: Wire rods for core of covered electrode		○			X	X			X		
2-4	JIS G4051: Carbon steels for machine structural use	○		X	X	X	X				X	
2-5	JIS G4052: Structural steel with specified Hardnability Bands	○		X	X	X	X				X	X

Unrecommenable reason

A = Surface defect sensitivity B = Inclusion C = Segregation D = SolAl 0.010% Min  
 for grain size control E = Si 0.03% Max. F = Small order lots.



### 6-1-3 Expansion plan of principal facilities

#### (1) Basic plan

The following new or additional facilities are installed to achieve a production scale of re-bars of about 1.1 million tons:

- DR Plant: a new 600,000 tons/year unit is installed;
- Steelmaking Plant: two 70 tons/ht electric arc furnaces and a 4-strand CC are added;
- Rod Mill Plant: a rod mill line of the same scale as the existing one is added (only for the portion following No.2 Intermediate Mill).

Along with the above-mentioned expansion of the main facilities, the water treatment station, the power receiving and distribution facilities and transportation facilities are expanded or enhanced accordingly.

Natural gases, electric power and industrial water necessary for the implementation of the expansion project and raw materials handling and transportation facilities are to be expanded by the Egyptian government.

#### (2) Background of expansion plan

##### 1) Selection of DR plant

##### A) Case study

A case study was made to determine whether supply of iron source in the expansion project depends on scrap or DRI which is produced at a new DR plant, and the capacity of the new DR plant if it is installed. The result is shown in Table 6.1.3-1.

Premises employed in the case study are as follows:

- a. Production: Bar 427,000 t/y Rod 693,000 t/y
- b. Raw material cost, selling price and personnel cost are deemed to be all constant without escalation.
- c. DRI is produced in quantity needed without surplus.
- d. Scrap price: Domestic US\$57.855/t delivered at EAF  
Imported 113.43/t      "-"
- e. Price of DR grade pellet: US\$34.165/t      "- at DRP
- f. Selling price of product: US\$260/t
- g. Natural gas price: 0.05775 \$/Nm<sup>3</sup> (1.5\$/M.BTU),  
0.08707 \$/Nm<sup>3</sup> (2.3\$/M.BTU)
- h. Project year: 20 years

#### B) Review of case study

Based on Table 6.1.3-1, study was made on each Case.

Case 1: The premises in this Case are that one 400 module DR plant is newly installed, purchased scrap in the quantity of 237,500 t/y is entirely covered by domestic scrap and no imported scrap is used.

In this Case, IRR is the highest among the seven Cases as the required scrap is entirely filled by cheap domestic scrap, 12.34% in case of natural gas price 0.05775 \$/Nm<sup>3</sup> and 10.81% in case of 0.08707 \$/Nm<sup>3</sup>. Similarly described in the following. However, it is considered very hard to obtain that much of domestic scrap and besides it has disadvantage of being fully exposed to the effect of wide fluctuation of scrap price.

Case 2: This Case assumes use of 180,000 t/y of domestic scrap and 57,500 t/y of imported scrap. Compared to Case 1, IRR is about 1% lower, namely 11.22%/9.50%.

Case 3: This is the case in which use of domestic scrap is lowered further as compared to Case 1 to 105,200 t/y. The study reveals that IRR drops further to 9.66%/7.58%.

Case 4: This Case means that one 600 module DR plant is to be newly installed and DRI blending ratio at EAF raised to 90% to minimize use of scrap. The scrap is assumed to be all domestic. IRR in this Case is 10.19%/8.17%.

Case 5: This shows the case in which DRI blending ratio is lowered as compared to Case 4 and use of domestic scrap increased. IRR in Case 5 is 10.66%/9.02%.

Case 6: This Case assumes that as compared to Case 4, DRI blending ratio is further lowered and domestic scrap used to the maximum. IRR in this Case is 10.97%/9.60%. However this case requires to obtain much domestic scrap as 237,500 t/y and so similar difficulty as Case 1.

Case 7: This is the case in which no DR plant is added. DRI blending ratio is 48% with 180,000 t/y domestic scrap and 544,900 t/y imported scrap. IRR in this Case is 7.63%/8.00% which are low. This Case againsts the idea to utilize domestic natural gas, which is one of base idea from beginning. And additional scrap handling facilities are required to handle such large amount of scrap.

As a result of the above study, the case in which no DR plant is newly installed can not be recommended.

As regards the comparison between 400 module and 600 module of DR plant, it is difficult to determine which is better based on the figures of IRR alone and it was found that the ranking may be reversed depending on the quantity and price of domestic scrap purchased.

In this F/S, not only from the comparison in IRR but also considering future demand/supply condition and price fluctuation of scrap, installation of a new 600 DR plant was made the basic policy of the expansion project. The reason is given in the following.

- a) As discussed in Chapter 4, demand/supply of scrap in Egypt is expected to show a fairly large shortage of scrap in future. Besides, at HADISOLB who is a big supply source of domestic scrap, the supply is expected to decrease gradually as its plant efficiency is improved.
- b) Though domestic scrap is at low price level now, the time will come in the near future when it is forced to depend on imported scrap as the steel industry as a whole grows in Egypt, and then it can be expected that domestic scrap price will become close to imported scrap price.
- c) Imported scrap too is at the bottom price at present and it is risky to anticipate that the condition will continue as it is, and in fact, a rapid rise in scrap price is being observed.
- d) With the quantity of domestic scrap available to ANSDK being a little more than 100,000 t/y, IRR is almost same whether the new DR plant is 600 module or 400 module. It is considered advisable to produce DRI from iron ore or pellet whose supply sources are stable and not to rely on operation with scrap whose supply and price condition is unstable. Installation of a new 600 module DR plant will make the operation of the Works more stable. As discussed in Annex 6, there is a possibility of selling surplus DRI, which it is considered may contribute toward ensuring iron sources for the entire Egyptian steel industry and saving foreign exchange.

e) When production of higher quality steel is contemplated, increase of DRI blending ratio dilutes the impurities in scrap and facilitates operation.

f) Adoption of a new 600 module DR plant permits use of spares and consumables in common with the existing facilities and ensures economical operation in a long run. New education and training of operators is not necessary, and stable operation is possible in a short period after the expansion.

Table 6.1.3-1 Case study for selection of DR plant

Case	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Each Item							
Expansion Facilities							
DRP	400 module	400 module	400 module	600 module	600 module	600 module	----
EAF	2	2	2	2	2	2	2
LF/CC	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Scrap procurement							
Return	42.4	42.4	42.4	42.2	42.2	42.2	43.2
Local	237.5	180.0	105.2	105.2	180.0	237.5	180.0
Foreign	0	57.5	132.3	0	0	0	544.9
Total (Unit: 1000t)	279.9	279.9	279.9	147.4	222.2	279.7	768.1
DRI ratio (%)	81	81	81	90	85	81	48
Natural gas price (\$/Nm <sup>3</sup> )	0.087 0.058	0.087 0.058	0.087 0.058	0.087 0.058	0.087 0.058	0.087 0.058	0.087 0.058
Internal rate of return (%)	10.81 12.34	9.50 11.22	7.58 9.66	8.17 10.19	9.02 10.66	9.60 10.97	8.00 7.63

\* Natural gas price (Nm<sup>3</sup>) 0.058\$/0.087\$

## 2) Steelmaking Plant:

The steelmaking plant should take a very important part quantitatively as well as qualitative in an integrated iron and steel works. The steelmaking capacity should in general be capable of sufficiently coping not only with the achievement of a prescribed quantity of production, but also with variations of operations in quantity as well as in quality to some extent of upstream and downstream production facilities (DRP and RMP in the present project). More particularly, steelmaking facilities should not be designed for extreme conditions, but should be designed with some room.

From the above-mentioned point of view, the prerequisites for the achievement of an annual production of 1,200,000 tons, or a production increase of 50%, should include DRI operation, an electric arc furnace (EAF) capacity of 70 tons/ht, and net operating days of 300 days/year from considerations of the existing facilities and operations, and these assumptions require six EAFs.

If, on the assumption of an EAF capacity of 75 tons/ht, five EAFs are installed, achievement of an annual molten steel production of 1,200,000 tons would require net operating days of more than 320 days/year, and this is unpracticable in management of the steelmaking plant.

With regard to the production increasing merits of the introduction of ladle furnace (LF), the EAF/LF combination operation usually leads to a higher efficiency since melting and refining taken charge of by EAFs in the conventional practice are shared by EAFs and LF. This is particularly the case with a high-quality product. In the case of ANSDK, however, a remarkable reduction of tap-to-tap cannot be expected, since this is a grade of steel for re-bar. If steel tapped from EAFs is totally treated in LF, production increasing

effect would be available to some extent even for re-bar steel. However, the present plan sets out only part of steel to be treated in LF, thus permitting no marked production increasing effect. From these considerations as described above, two EAFs should be added IInd stage expansion.

### 3) Rolling mill plant

The product production tonnage increases from 745,000 tons/year in Ist stage to 1,120,000 tons/year in IInd stage. In this case, the bar mill facilities are in the state completed in Ist stage, whereas the rod mill facilities are in the incomplete state in an anticipation of expansion in the expansion.

More specifically, rod mill rolling which has been 1-strand rolling in Ist stage is enhanced to 2-strand rolling in IInd stage to double the production. The size range is to cover the same sizes as in Ist stage. The product steel grades are to center around the re-bar grade.

Producing a higher grade of steel would require billet conditioning facilities and product conditioning facilities well coping with it. However, because the basic plan covers only re-bar grade, billet and product conditioning facilities are not taken into account in the expansion project.

### 4) Lime calcining plant

The existing lime calcining plant has an annual production capacity of 52,800 tons (160 tons/day x 330 day/year). The SMP after expansion have on the other hand an annual burnt lime demand of about 50,400 tons (about 33,000 tons at presnet).

Thus, the lime calcining plant, having a sufficient supply capacity even after expansion, is to continue to keep its current facilities.



6-2. Production plan

6-2-1. Size composition and production of products

Composition of rebars by size and annual production plan are shown in Table 6.2.1-1. 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 decided by the import in the 1985. It is expected that larger sizes will increase as demand from civil engineering structure increasing, but there will be some room in billet capacity after the expansion and it is possible to increase production to some extent.

Table 6.2.1-1 Size Composition and Annual Production of Rebars

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

## 6-2-2. Material balance sheet

Material balance sheet used as basic model in this F/S is shown in Fig. 6.2.2-1. Base consumption unit and yield of raw materials, auxiliary raw materials and intermediate products at each plant were established based on the actual results of EL DIKHEILA Works.

Fig. 6.2.2-1 shows the material balance at the maximum production at whole plants with DRI ratio at EAFs being 90% and on the condition that surplus production of DRI and billets are to be sold.

Material Flow (Stage II)  
DRI ratio in EAF 90%

(Unit: 1,000 tons)

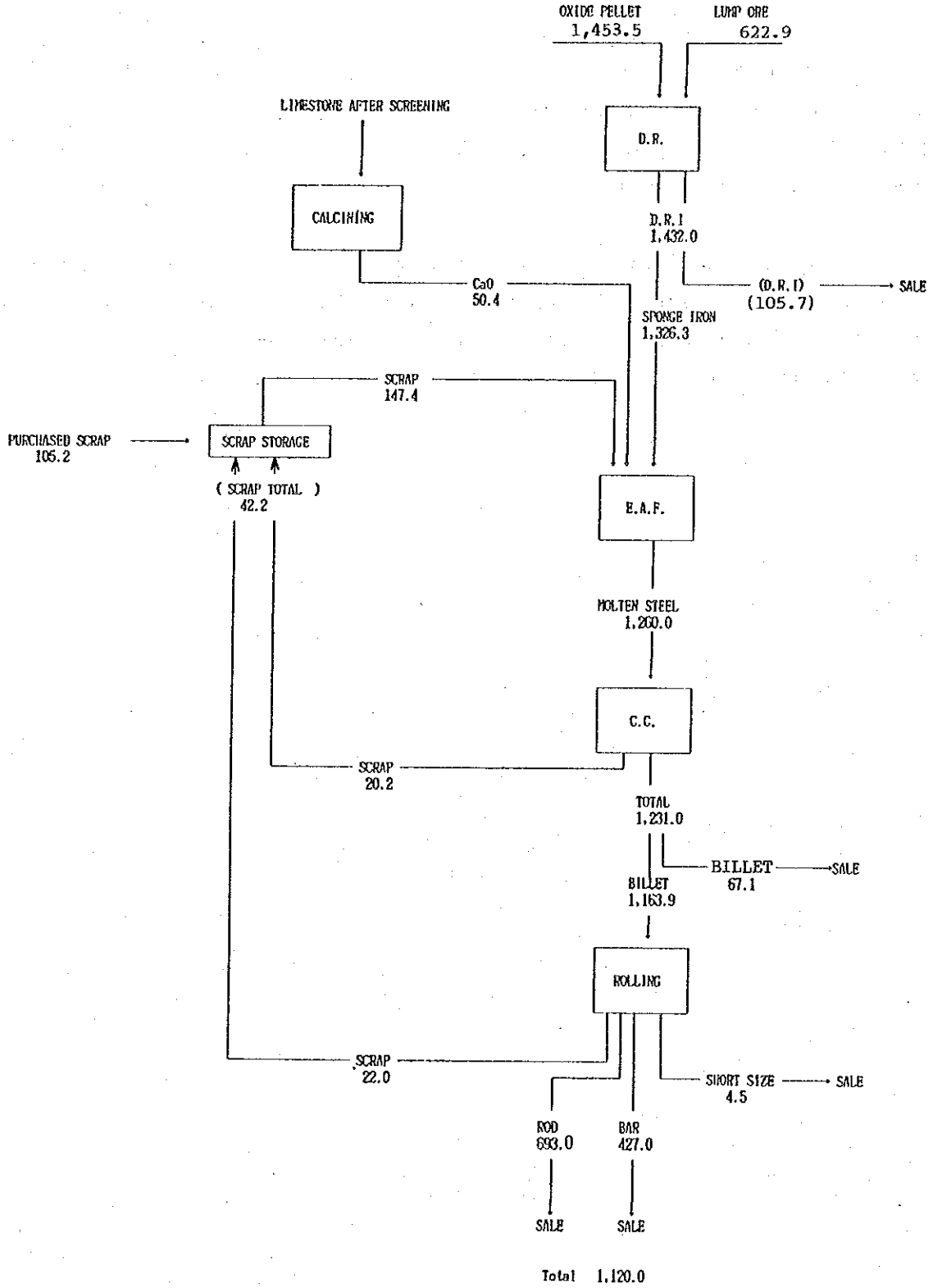


Fig. 6.2.2-1 Material Balance at EL DIKHEILA Works

### 6-3. Facilities plan

#### 6-3-1. Facilities to be expanded

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

- (1) DR plant
- (2) Steelmaking plant
- (3) Rod mill plant
- (4) Utilities
- (5) Power receiving and distributing facilities
- (6) Maintenance facilities
- (7) In-plant transportation facilities
- (8) Inspection and analysis facilities
- (9) Others (Offices, roads, sewerage, etc.)

Necessity of expansion plan of each plant/shop and improvement of infrastructure will be discussed in Sections 6-4 and 6-5.

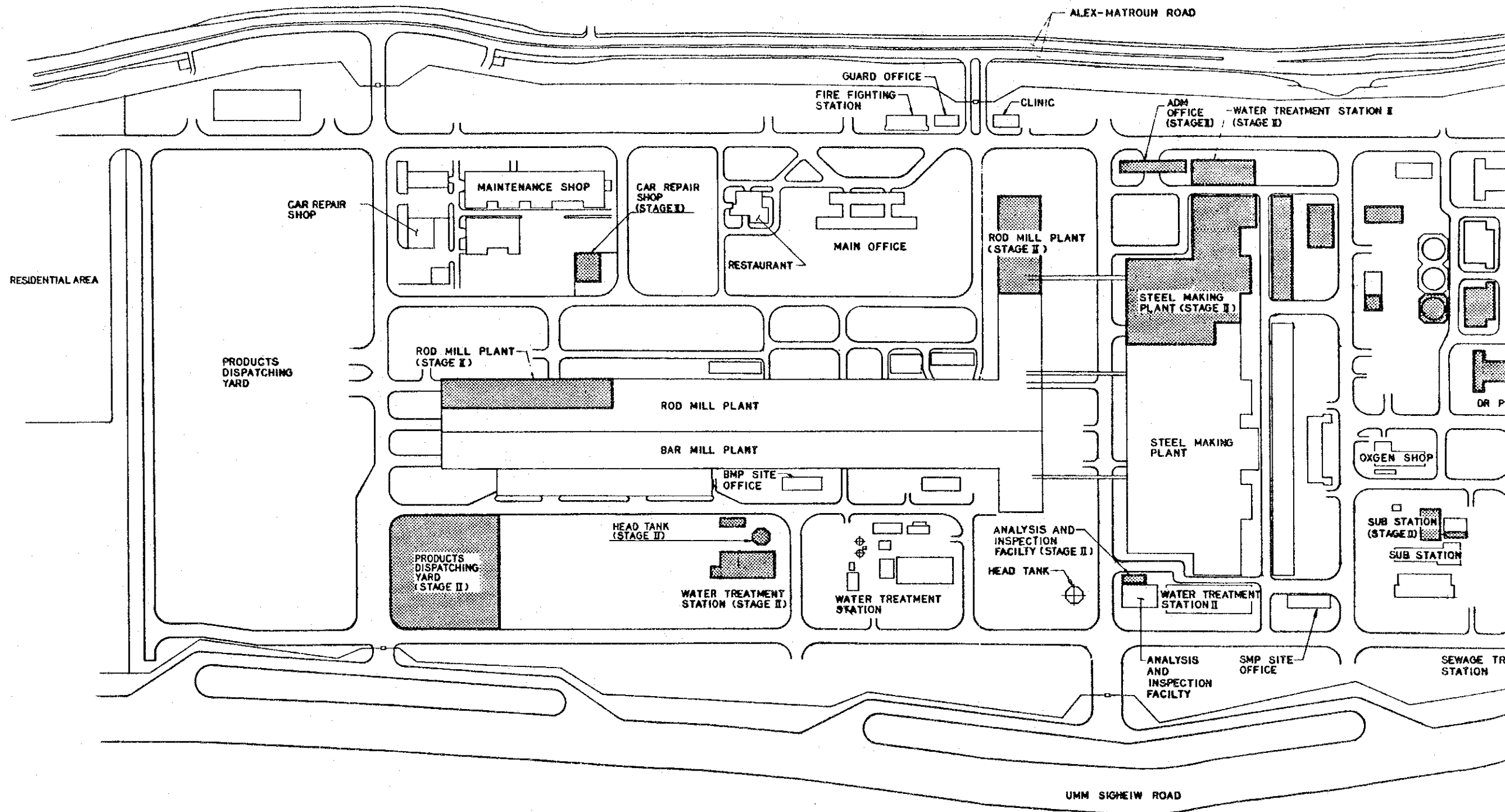
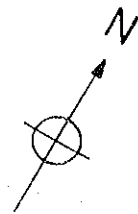
#### 6-3-2. Plant layout

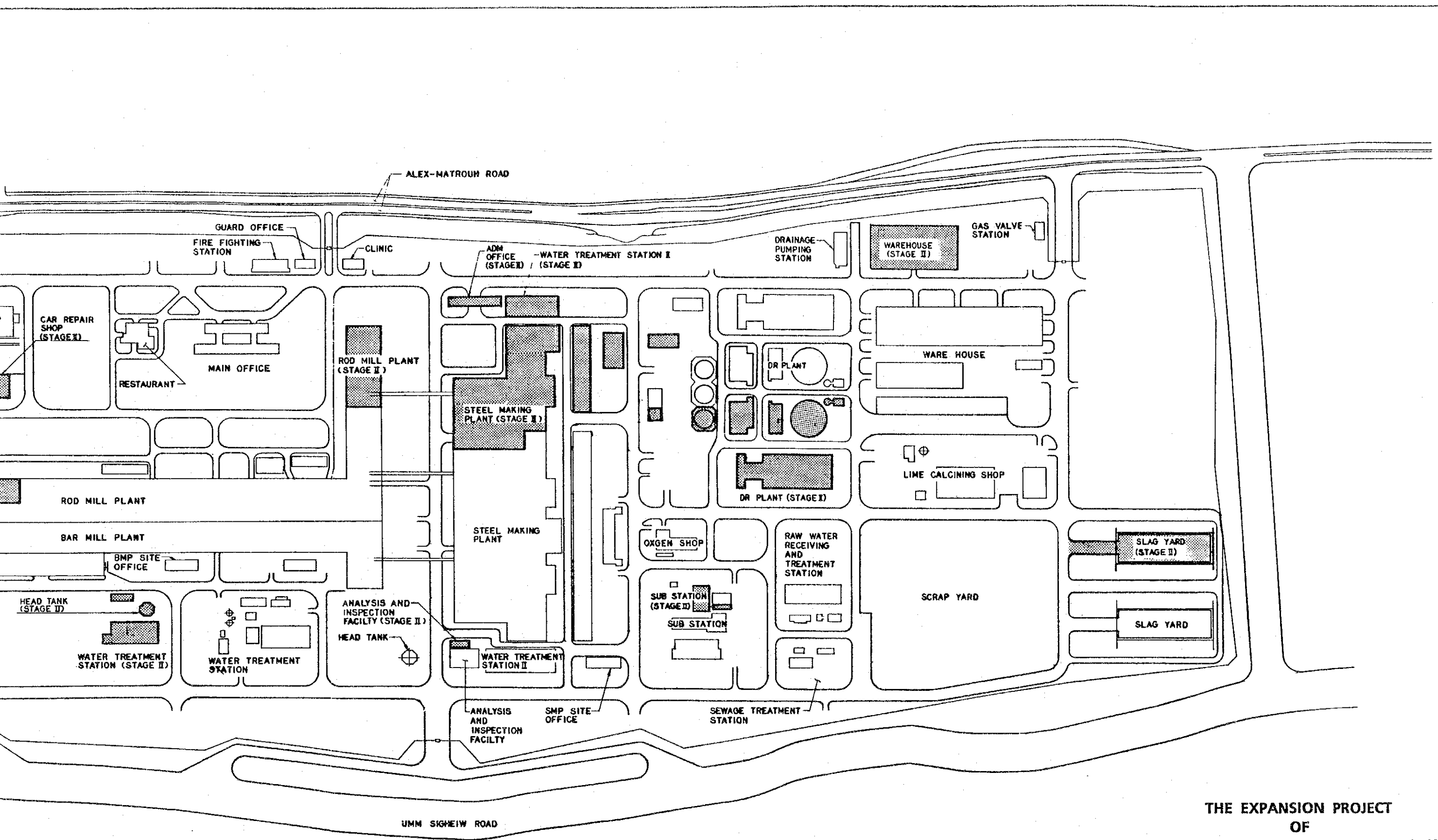
As mentioned in the preceding Chapter and Section 6-1-1, the existing facilities were constructed in a layout to permit their expansion in future and there is adequate site for installing expanded facilities. As the newly constructed facilities can be installed next to the existing ones, raw materials handling and transport is 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.









THE EXPANSION PROJECT  
OF  
THE EL DIKHEILA IRON & STEEL WORKS

TITLE GENERAL LAYOUT

DWG NO. JICA-G-003

DATE DEC. 1987

SCALE N.A.





#### 6-4. Details of facilities plan

##### 6-4-1. DR plant

###### (1) DR process

Direct reduction process includes Gaseous DR Process using natural gas and Solid Fuel DR Process using solid fuel such as coal, but in Egypt, because of abundant reserves of natural gas, Gaseous DR Process similar to that installed in the 1st stage construction is better suited.

ANSDK's steelworks built under the 1st stage project receives natural gas from Abu Qir gas field near Alexandria. After the expansion, the steelworks is to receive natural gas not only from Abu Qir gas field but also natural gas pipeline network from Red Sea area and availability of natural gas should pose no problem.

As gaseous DR process, MIDREX process, HyL III process, etc. are well known. MIDREX process has been used in about 30 units of DR plant throughout the world and was adopted in the 1st stage project of ANSDK. On the other hand, HyL III process is an improvement of HyL I of static bed type which was installed at Monterrey, Mexico, and there are reportedly two units, but the process cannot be said to have adequate performance record on commercial base.

Considering the actual performance and reliability of those processes and also the fact that MIDREX process was already adopted in the 1st stage DR at ANSDK, this F/S was made on the premise that MIDREX process is to be adopted for the present expansion project.

###### (2) Description of DR plant

The expansion of DR plant is to be carried out at the site chosen for the expansion and close to the existing DR

plant. The so-called "core" system consisting of reduction shaft furnace, reformer, etc. will be of same type as in the 1st stage and so is the water treatment system. As regards material handling facilities, furnace charge and discharge conveyor and others necessary for the expanded plant are installed and one more unit of product storage bin built in the area of existing plant.

The existing cold briquetting system is based on 8-hour operation a day. After the expansion, the system can be operated 16-hour a day to meet the requirement, and so the system will not be expanded.

### (3) Plant layout

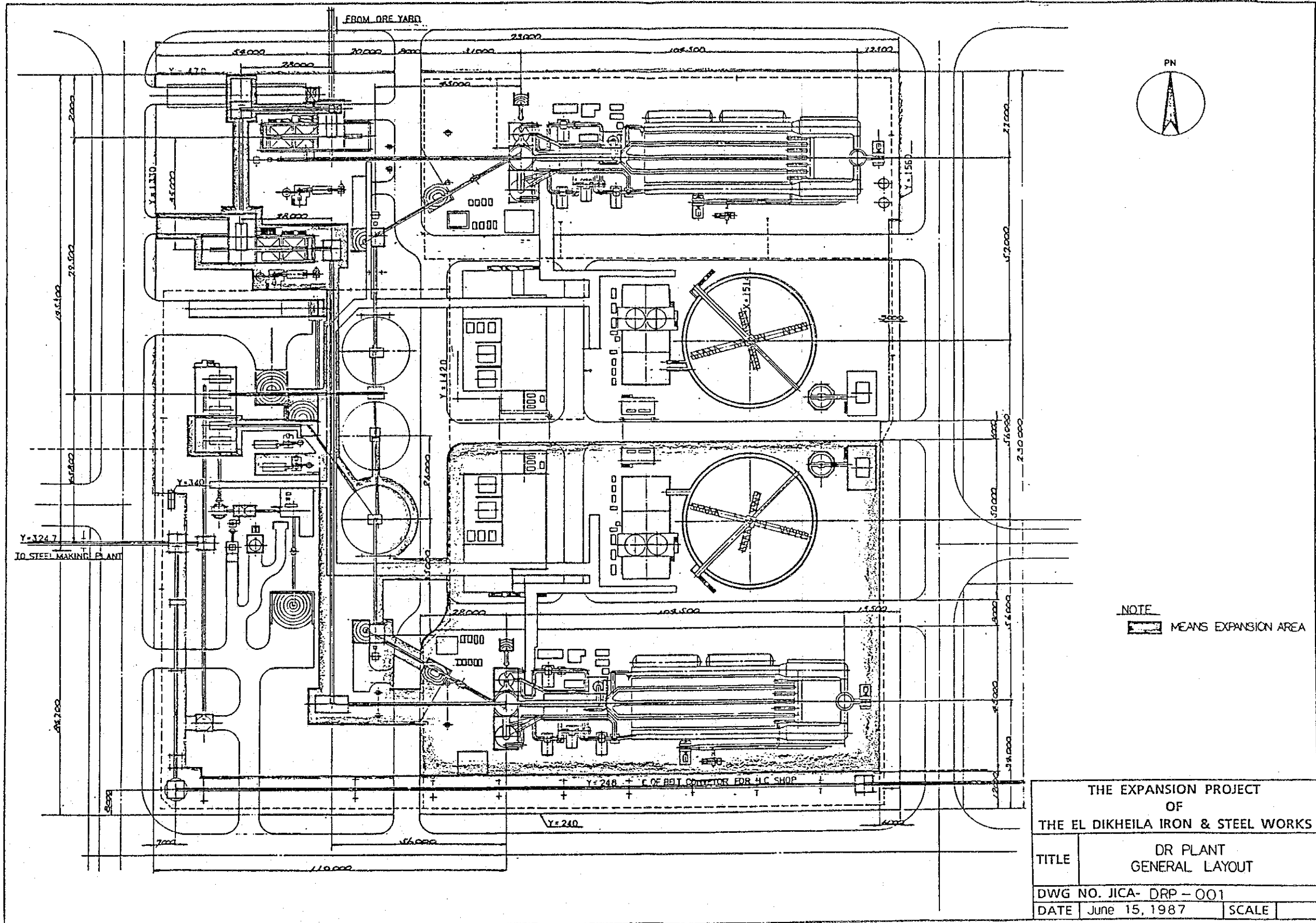
The layout of DR plant after the expansion is shown in DWG JICA-DRP-001. The core system centering on reduction shaft furnace and reformer and the water treatment system are installed symmetrically with the existing plant in the expansion area on the south of the existing facilities.

DWG JICA-DRP-002 shows the side view of the core system. Same as the existing plant, reduction shaft furnace, auxiliary machinery such as compressor, reformer, recuperator and stack are installed in that order from the south side of the plant.

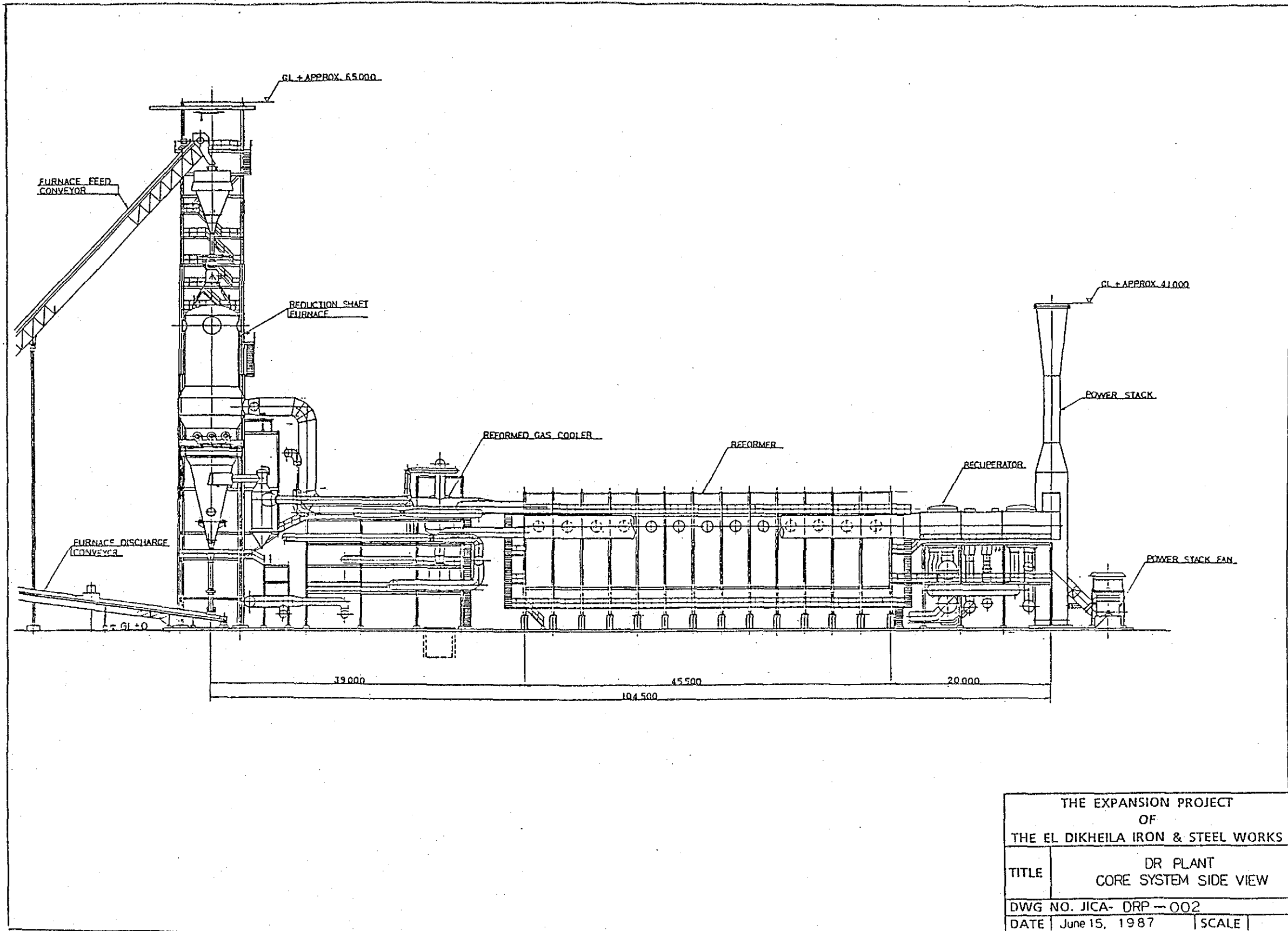
As shown in DWG JICA-DRP-001, material handling system includes conveyors, bins and screens required in the expansion. They will be installed in the existing material handling area.

As for the entire plant, no movement will be made of the existing facilities, and the facilities required for the expansion will be installed at the present vacant lots.





THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	DR PLANT GENERAL LAYOUT
DWG NO.	JICA- DRP - 001
DATE	June 15, 1987
SCALE	



THE EXPANSION PROJECT		
OF		
THE EL DIKHEILA IRON & STEEL WORKS		
TITLE	DR PLANT CORE SYSTEM SIDE VIEW	
DWG NO.	JICA- DRP - 002	
DATE	June 15, 1987	SCALE



(4) Equipment list

Name, quantity and rough specification of major equipment of the expanded DR plant are given in Equipment List below.



Table 6.4.1-1 Expanded DR Plant Major Equipment List

Equipment Name	Q'ty	Specification
1. Reduction Shaft	1	Vertical shaft type Refractory lined steel fabrication 5.5 m inside dia 55 m hight
2. Reformer	1	Box type Refractory lined steel fabrication 468 pc reforming tube of 200 mm dia
3. Top Gas Scrubber	1	Venturi and packed type
4. Cooling Gas Scrubber	1	Venturi and packed type
5. Reformed Gas Cooler	1	Packed type
6. Inert Gas Cooler	1	Packed type
7. Recuperator	2	Box and tube type Preheat air, feed gas, natural gas
8. Stack	1	Ejector type 40 m height
9. Process gas compressor	3	Positive displacement type Rotary lobe compressor
10. Cooling gas compressor	1	Positive displacement type Rotary lobe compressor
11. Main air blower	1	Centrifugal type
12. Auxiliary air blower	1	Centrifugal type
13. Inert gas compressor	1	Screw type

Equipment Name	Q'ty	Specification
14. Inert gas system	1 set	Consisting of dryer, compressor, inert gas generator, and tank
15. Water system	1 set	Consisting of cooling tower, pumps, dehydrator, and clarifier
16. Oxide storage bin	1 set	Upper concrete lower steel construction 1200 ton storage x 3 rooms
17. Product storage bin	1	Upper steel lower concrete construction 7500 ton storage
18. Product screen	1	Single deck vibrating type
19. Conveyor system	1 set	Consisting of Oxide incoming conveyor, Oxide screen feed conveyor, Shuttle conveyor, Oxide bin discharge conveyor, Oxide transfer conveyor, Furnace feed conveyor, Furnace discharge conveyor, Product bin feed conveyor, Product bin discharge conveyor, Product screen feed conveyor
<p>* Product screen discharge conveyor, Truck bin feed conveyor, Product fines conveyor, and Product fines bucket elevator to be modified by replacing motors and reducers with those of higher capacity.</p>		

(5) Personnel

Required personnel in DR plant after expansion is as follows:

SM	ASM	Engineer	Asst. Engineer	Foreman	Asst. Foreman	Worker	Total
1	2	4	7	7	14	60	95

SM: Section manager

ASM: Assistant section manager

Working condition of the personnel is of 3-crew 3-shift system. There will be three operating crews each for the existing plant and the new plant and in addition, one more crew which engages in general work including control of spares and stores used in the both plants in common will be organized.

If there are spare personnel, it is better to have 4-crew 3-shift system, but in this F/S, the 3-crew 3-shift is employed as in Stage I plant.

## 6-4-2. Steelmaking plant (SMP)

### (1) Outline

#### 1) Basic concept of the expansion project

##### a) Production

Production of molten steel at Steelmaking plant (SMP) is to be 1,260,000 t/y, up 50% from 840,000 t/y at present.

##### b) Expansion of facilities

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

- i) Building to be extended to the north of present building
- ii) With a view of having commonness in operation, maintenance and building, two units of electric arc furnace (EAF) and one unit of continuous casting machine (CCM), both of same specification and capacity as the existing ones, to be installed in the building mentioned in i) above
- iii) In order to increase handling capacity of direct reduced iron (DRI) as consumption of DRI increases, DRI conveyor lines from storage bins in Direct Reduction Plant (DRP) to hoppers of SMP to be modified
- iv) Dust collecting ducts for existing Nos. 3 and 4 EAFs installed on the north side of existing building to be modified so that charging cranes at EAF yard can travel in both the existing and extended buildings
- v) One unit of ladle furnace (LF) to be installed to ensure control of temperature and composition of molten steel tapped and efficient matching between tapping of EAF and casting of CCM and also to expand kinds of steel produced in future
- vi) Mold repair shop of CCM to be moved to the north side of extended building

vii) In line with construction of new EAFs and CCM, indoor scrap yard, dust collectors, cranes, raw material handling facilities, molten steel handling facilities, tundish repair shop, ladle repair shop, control room, electric facilities and other related facilities to be expanded

2) Production

Production of molten steel at SMP after the expansion project is to be 1,260,000 t/y, which is produced by 6 EAFs and cast to billets by 4 CCMs. Annual production of billets is to be 1,231,000 t.

3) Product

Product is to be medium & low carbon steel for rebar and size of billets to be 130 mm square x 16 long.

4) Main facilities

Major production facilities of SMP are as follows:

Item	Existing	New	Total
EAF:			
Number	4	2	6
Capacity	70t/ht	Same as left	
Capacity of transformer	46 mVA	"-	
CCM:			
Number	3	1	4
Number of strand	4	Same as left	

5) Basic design

a) EAF

Main raw materials used in EAF, both existing and new, consist of DRI 90% and scrap 10%, and effective working days of EAF are 300 days/year on three shifts.

b) CCM

Both existing and new CCMs employ in principle 3-heats sequence casting.

c) Specification, capacity and operation

In principle new facilities are of the same specification and capacity and operated with the same method as the existing ones.

d) Increase of kinds of steel

To prepare for increase of kinds in steel in future, one unit of ladle furnace as well as electric magnetic molten steel stirring equipment in the new CCM are to be installed.

(2) Production plan

1) 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	Number of Heats
Yearly production	1,260,000 t	1,231,000 t	18,000 heats
Monthly production	105,000	102,600	1,500
Daily production	4,200	4,100	60

2) Operating hours

Based on 365 calendar days a year and non-operating hours due to repair, shutdown and others shown in Table 6.4.2-2 effective operating days of EAFs are to be 300 days a year.

Table 6.4.2-2 Non-operating Hours of SMP

Item	Frequency & Hours	Hours/Year
Overall repair	Once/two years x 7 days	84
Periodical repair	Once/week x 8 hours	417.1
Change of furnace roof	Once/100 heats x 3 hours	87.4
Repair of furnace banks	Once/120 heats x 25 hours	606.9
Adjustment & shutdown	365 days x 3.5%	306.6
Total		1,502.0 = 62.6 days

365 days - 62.6 days = 302.4 days --- 300 days

### 3) Steelmaking capacity of EAFs

If the capacity of two new EAFs is same as that of the existing ones and DRI blending ratio 90%, time required for melting charged materials is 75 minutes and tap-to-tap time is 144 minutes and the number of heats is 10.0 a day.

Charging time	5 min
Melting time	75*
Slag-off & heating time	14
Refining time	25
Fettlings time	25
Tap-to-tap	144

Note: Melting time

$$\frac{70 \times 625}{46,000 \times 1.2 \times 0.69 \times 0.94 \times 0.98} = 1.25 \text{ hr} = 75 \text{ min}$$

where 70: t/hr, molten steel  
 625: kWh/t-MS, electric power required for melting one ton of molten steel  
 46,000: kVA, transformer capacity  
 1.2: Overload of transformer  
 0.69: Power factor  
 0.94: Power input efficiency  
 0.98: Voltage drop factor

Therefore, steelmaking capacity of EAFs is 1,260,000 t/y.

$70 \text{ t/heat} \times 10 \text{ heats/day} \times 6 \text{ furnces} \times 300 \text{ days/year}$   
 $= 1,260,000 \text{ T/Y}$

#### 4) Casting capacity of CCMs

If the capacity of the new CCM is to be same as that of the existing ones and if 6 EAFs and 4 CCMs are divided into two groups to adopt 3-heats sequence casting which enables smooth and natural matching of steel tapping and casting, the casting cycle will be as shown in Fig. 6.4.2-1, and with operating rate of 76%, the CCMs will have 68 minutes of free time and can meet the steelmaking capacity of EAFs adequately.

#### 5) 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.



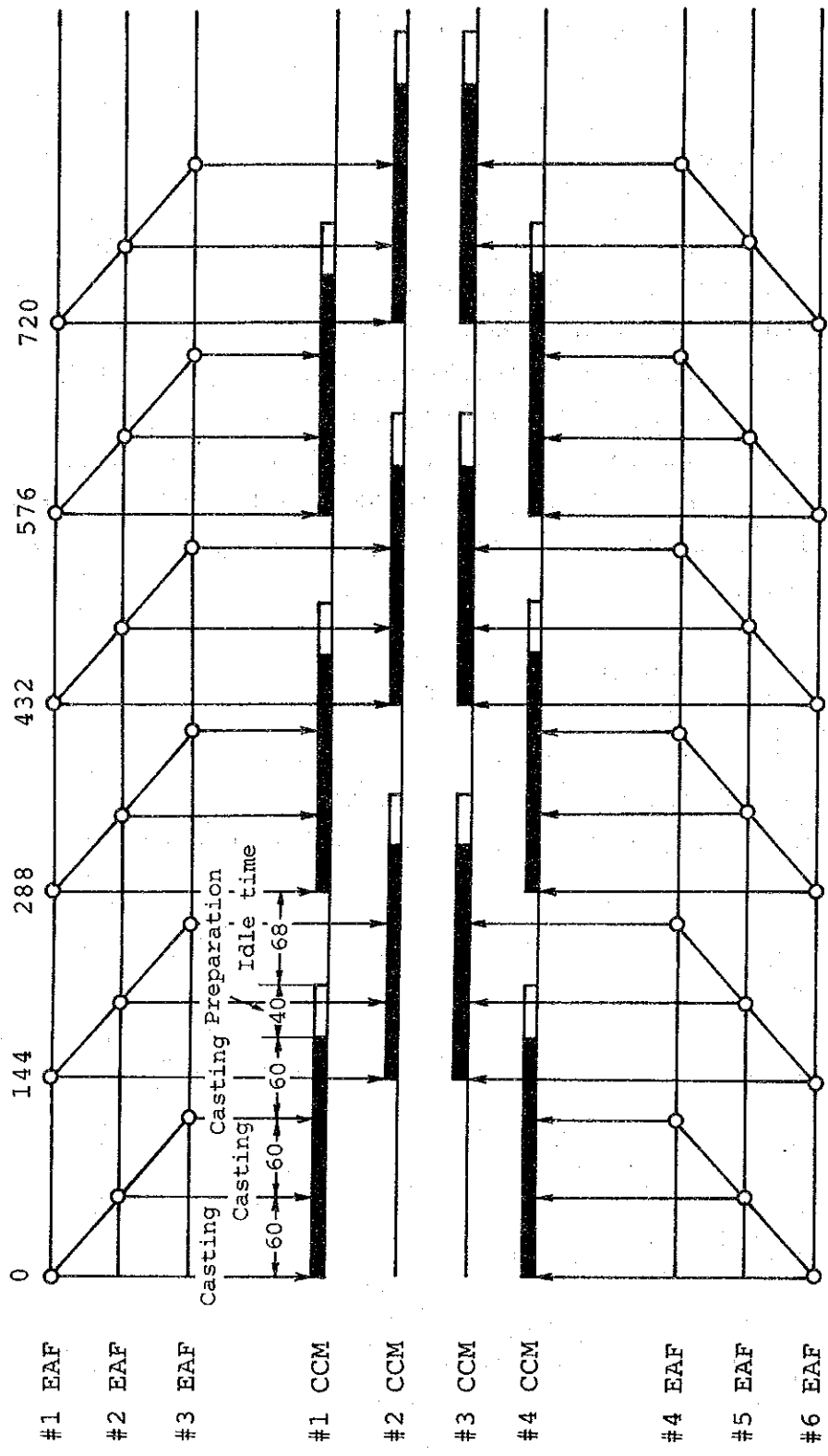


Fig. 6.4.2-1 Casting Cycle

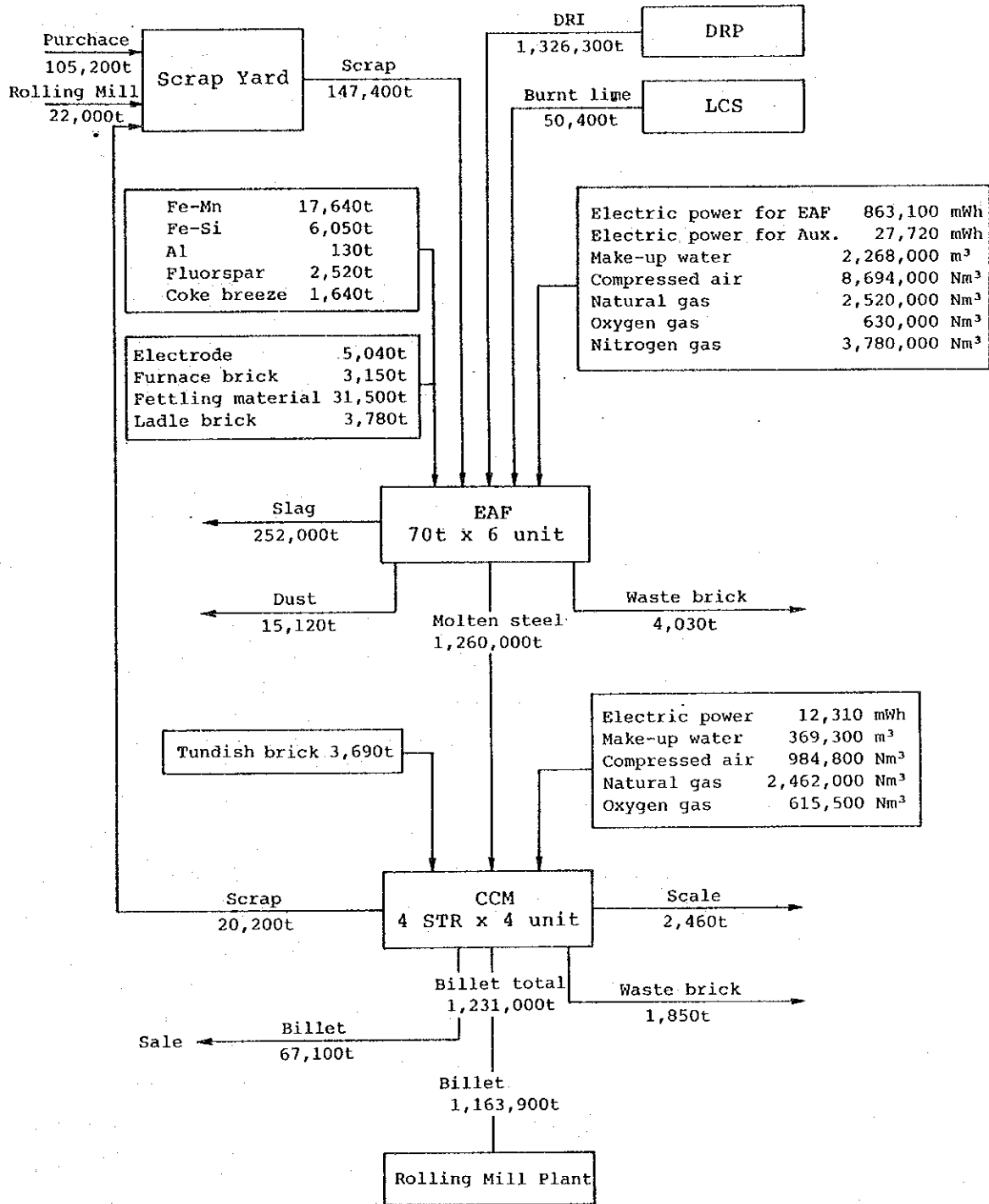
Table 6.4.2-3 Unit consumption of SMP

Item	Unit Consumption	Material required		
		Per year	Per month	Per day
1. DRI	1052.6 kg/t-MS	1,326,300	110,530	4,421
2. Scrap	117.0	147,400	12,280	491
3. Burnt lime	40	50,400	4,200	168
4. Fluorspar	2	2,520	210	8
5. Fe-Mn	14.0	17,640	1,470	59
6. Fe-Si	4.8	6,050	500	20
7. Al	0.1	130	10	0.4
8. Coke breeze	1.3	1,640	140	5
9. Furnace brick	2.5	3,150	260	11
10. Fettling materials	25.0	31,500	2,630	105
11. Ladle brick	3.0	3,780	320	13
12. Electrode	4.0	5,040	420	17
13. Tundish brick	3.0 kg/t-BT	3,690	310	12
14. Slag	200 kg/t-MS	252,000	21,000	840
15. Dust	12	15,120	1,260	50
16. Scrap from CCM	16.4 kg/t-BT	20,200	1,680	67
17. Waste brick from EAF	3.2 kg/t-MS	4,030	340	13
18. Waste brick from CCM	1.5 kg/t-BT	1,850	150	6
19. Scale	2	2,460	210	8
20. Electric power for EAF	685 kWh/t-MS	863,100 mWh	71,930 mWh	2,877 mWh
21. Electric power for CCM	10 kWh/t-BT	12,310	1,030	41
22. Electric power for auxiliaries	22 kWh/t-MS	27,720	2,310	92
23. Make-up water for EAF	1.8 m <sup>3</sup> /t-MS	2,268,000 m <sup>3</sup>	189,000 m <sup>3</sup>	7,560 m <sup>3</sup>
24. Make-up water for CCM	0.3 m <sup>3</sup> /t-BT	369,300	30,780	1,230
25. Compressed air for EAF	6.9 Nm <sup>3</sup> /t-MS	8,694,000 Nm <sup>3</sup>	724,500 Nm <sup>3</sup>	28,980 Nm <sup>3</sup>
26. Compressed air for CCM	0.8 Nm <sup>3</sup> /t-BT	984,800	82,070	3,280

Item	Unit Consumption	Material required		
		Per year	Per month	Per day
27. Natural gas for EAF	2.0 Nm <sup>3</sup> /t-MS	2,520,000 Nm <sup>3</sup>	210,000 Nm <sup>3</sup>	8,400 Nm <sup>3</sup>
28. Natural gas for CCM	2.0 Nm <sup>3</sup> /t-BT	2,462,000	205,170	8,210
29. Oxygen gas for EAF	0.5 Nm <sup>3</sup> /t-MS	630,000	52,500	2,100
30. Oxygen gas for CCM	0.5 Nm <sup>3</sup> /t-BT	615,500	51,290	2,050
31. Nitrogen gas	3.0 Nm <sup>3</sup> /t-MS	3,780,000	315,000	12,600

6) Material flow

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



Note: annual value

Fig. 6.4.2-2 Material Flow at SMP

### (3) Outline of major facilities

#### 1) Scrap handling facilities

In the expansion, scrap blending ratio will be 10%, but it is planned to install covered scrap yard, charging bucket, scrap crane with lifting magnet, scrap transfer car and weigh bridge so that SMP can be operated with scrap blending ratio up to 25% as with the existing facilities.

#### 2) DRI and burnt lime handling facilities

In the expansion, as consumption of DRI and burnt lime increases, their receiving facilities, or conveyors, are modified to increase their handling capacity.

Storage hopper and discharging facilities are to be of the same capacity as that of the existing facilities.

#### 3) Additive handling facilities

Storage hopper and the system to add ferro-alloys to an EAF or ladle are to be same as the existing ones, but in view of easy working, conveyor will be used to receive the additives in the storage hopper.

#### 4) EAFs and transformers

The new EAFs and transformers are to be of the same specification as the existing ones and their capacity to be 70 t/heat and 46 mVA. respectively.

#### 5) Flicker and power factor compensation facilities

By adopting the same reactor control system using thyristor as the existing facilities and by making the short-circuit capacity at power receiving point 4,000 MVA the same as the present, the capacity of the facilities based on UK Standard Engineering Recommendation P 7/2 and G 5/3 will be as follow:

	Flicker	Static Capacitor
Capacity after expansion	78 mVA	121 mVA
Existing capacity	52 mVA	87 mVA
Increment in the expansion	26 mVA	34 mVA

#### 6) 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 it is necessary to perform efficiently tapping of 6 units of EAF and casting of 4 units of CCM and so one unit of ladle furnace is to be installed, which permits not only ensuring uniform molten steel temperature and composition but also heating molten steel. Besides, this equipment will serve as an effective means in expanding kind of steel in future. It is also designed that argon gas can be blown.

In addition, ladle, ladle valve and ladle transfer car are to be similar to the existing ones.

#### 7) Computer control system

The same system as used in the existing facilities is to be added in order to perform operation guidance, automatic control of some equipment and data logging.

#### 8) CCM

The facilities of CCM are to be of the same specification as the existing ones and 4-strand vertical-bending type with 6 m R, but to prepare for expansion of kind of steel in future, it is so designed that liquid steel can be shrouded in argon gas atmosphere between a ladle and a tundish and that aluminium can be added by aluminium wire feeding device while liquid steel is fed from a tundish to a mold. Electromagnetic stirrer is to be installed to mold and secondary cooling device.

#### 9) Cranes

One more crane each is installed at EAF yard, casting yard and billet yard, and those cranes are to be of the same specification as the existing ones. However, at scrap yard and ladle yard, two more units each are to be installed in view of increase in handling. They are to be of the same specification as the existing ones.

#### (4) Organization and personnel

Of those of SMP, personnel of EAF and CC subsections is shown in Table 6.4.2-4.

#### (5) Layout

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

#### (6) Equipment list

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

Table 6.4.2-4 Personnel of SMP

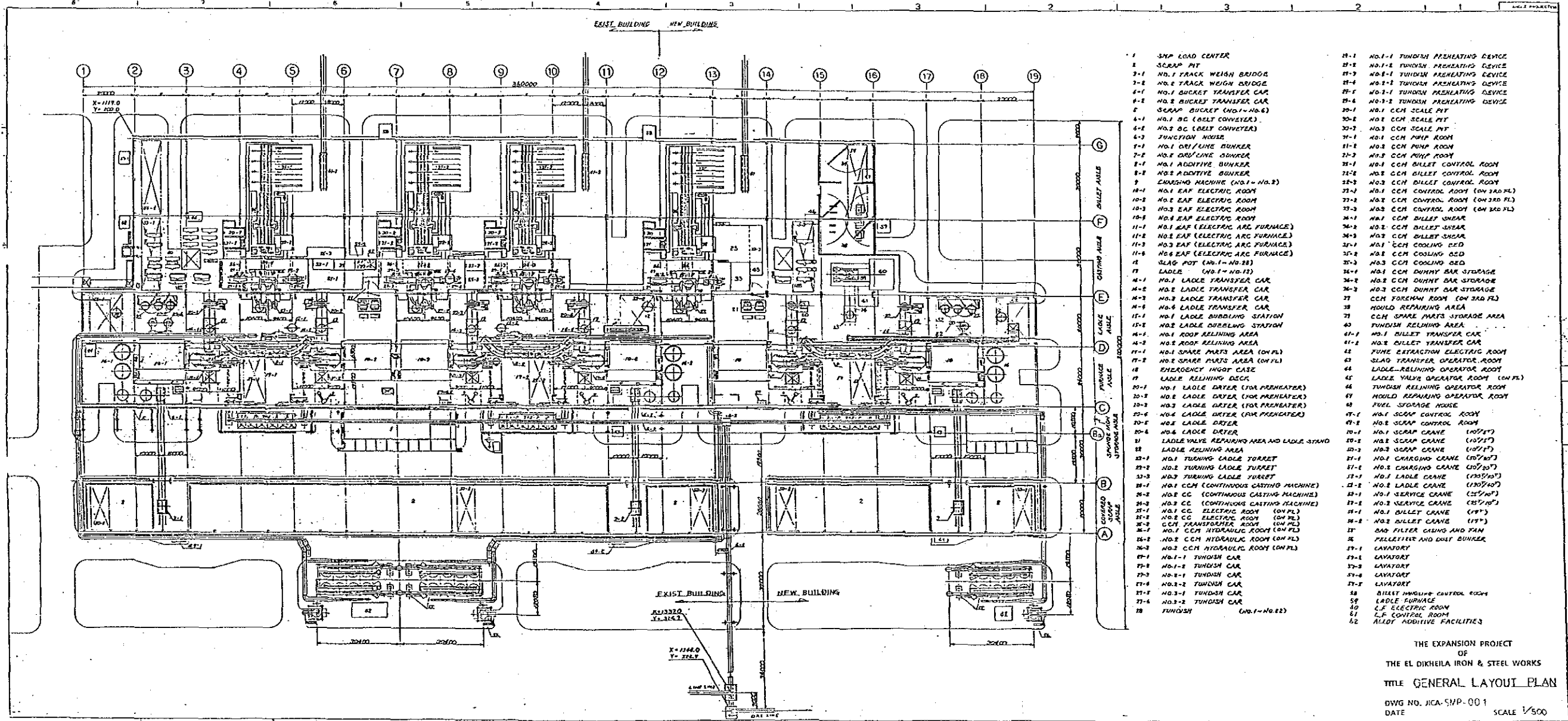
Section/ Branch/ Work Group	Ist Stage						The expansion (Additional)						The expansion Total						
	SM	ASM	E	F	AF	W	SM	ASM	E	F	AF	W	SM	ASM	E	F	AF	W	
SMP	1												1						
EAF		1	3																
Furnace				3	18	118				9		67			3	27	185		
Day-work				1	2	17						10			1	2	27		
Crane				4	6	64						30			4	6	94		
Sub-total		1	3	8	26	199				9		107		1	3	8	35	306	
CCM		1	3											1	3				
Casting				3	18	159				6		73				3	24	232	
Day-work				1	2	17						6				1	2	23	
Refractory				1	2	34						18				1	2	52	
Sub-total		1	3	5	22	210				6		97		1	3	5	28	307	
Grand-total	1	2	6	13	48	409				15		204	1	2	6	13	63	613	
							479												698

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









- |      |  |       |   |
|------|--|-------|---|
| 1    | SMP LOAD CENTER                            | 31-1  | NO.1-1 TUNDISH PREHEATING DEVICE          |
| 2    | SCRAP PIT                                  | 31-2  | NO.1-2 TUNDISH PREHEATING DEVICE          |
| 3-1  | NO.1 TRACK WEIGH BRIDGE                    | 31-3  | NO.1-3 TUNDISH PREHEATING DEVICE          |
| 3-2  | NO.2 TRACK WEIGH BRIDGE                    | 31-4  | NO.1-4 TUNDISH PREHEATING DEVICE          |
| 4-1  | NO.1 BUCKET TRANSFER CAR                   | 31-5  | NO.1-5 TUNDISH PREHEATING DEVICE          |
| 4-2  | NO.2 BUCKET TRANSFER CAR                   | 31-6  | NO.1-6 TUNDISH PREHEATING DEVICE          |
| 5    | SCRAP BUCKET (NO.1-NO.6)                   | 32-1  | NO.1 CCM SCALE PIT                        |
| 6-1  | NO.1 BC (BELT CONVERTER)                   | 32-2  | NO.2 CCM SCALE PIT                        |
| 6-2  | NO.2 BC (BELT CONVERTER)                   | 32-3  | NO.3 CCM SCALE PIT                        |
| 6-3  | JUNCTION HOUSE                             | 31-1  | NO.1 CCM PUMP ROOM                        |
| 7-1  | NO.1 OBI/LINE BUNKER                       | 31-2  | NO.2 CCM PUMP ROOM                        |
| 7-2  | NO.2 OBI/LINE BUNKER                       | 31-3  | NO.3 CCM PUMP ROOM                        |
| 8-1  | NO.1 ADDITIVE BUNKER                       | 31-4  | NO.1 CCM BILLET CONTROL ROOM              |
| 8-2  | NO.2 ADDITIVE BUNKER                       | 31-5  | NO.2 CCM BILLET CONTROL ROOM              |
| 9    | EXHAUST MACHINE (NO.1-NO.2)                | 31-6  | NO.3 CCM BILLET CONTROL ROOM (ON 3RD FL.) |
| 10-1 | NO.1 EAF ELECTRIC ROOM                     | 31-7  | NO.1 CCM CONTROL ROOM (ON 3RD FL.)        |
| 10-2 | NO.2 EAF ELECTRIC ROOM                     | 31-8  | NO.2 CCM CONTROL ROOM (ON 3RD FL.)        |
| 10-3 | NO.3 EAF ELECTRIC ROOM                     | 31-9  | NO.3 CCM CONTROL ROOM (ON 3RD FL.)        |
| 10-4 | NO.4 EAF ELECTRIC ROOM                     | 31-10 | NO.1 CCM BILLET SNEAR                     |
| 11-1 | NO.1 EAF (ELECTRIC ARC FURNACE)            | 31-11 | NO.2 CCM BILLET SNEAR                     |
| 11-2 | NO.2 EAF (ELECTRIC ARC FURNACE)            | 31-12 | NO.3 CCM BILLET SNEAR                     |
| 11-3 | NO.3 EAF (ELECTRIC ARC FURNACE)            | 31-13 | NO.1 CCM COOLING BED                      |
| 11-4 | NO.4 EAF (ELECTRIC ARC FURNACE)            | 31-14 | NO.2 CCM COOLING BED                      |
| 11-5 | SLAG POT (NO.1-NO.3)                       | 31-15 | NO.3 CCM COOLING BED                      |
| 12   | LADLE (NO.1-NO.13)                         | 31-16 | NO.1 CCM DUMPHY BAR STORAGE               |
| 13-1 | NO.1 LADLE TRANSFER CAR                    | 31-17 | NO.2 CCM DUMPHY BAR STORAGE               |
| 13-2 | NO.2 LADLE TRANSFER CAR                    | 31-18 | NO.3 CCM DUMPHY BAR STORAGE               |
| 13-3 | NO.3 LADLE TRANSFER CAR                    | 31-19 | CCM FOREMAN ROOM (ON 3RD FL.)             |
| 13-4 | NO.4 LADLE TRANSFER CAR                    | 31-20 | NO.1000 REPAIRING AREA                    |
| 13-5 | NO.1 LADLE BUBBLING STATION                | 31-21 | CCM SPARE PARTS STORAGE AREA              |
| 13-6 | NO.2 LADLE BUBBLING STATION                | 31-22 | TUNDISH RELINING AREA                     |
| 14-1 | NO.1 ROOF RELINING AREA                    | 31-23 | NO.1 BILLET TRANSFER CAR                  |
| 14-2 | NO.2 ROOF RELINING AREA                    | 31-24 | NO.2 BILLET TRANSFER CAR                  |
| 14-3 | NO.1 SPARE PARTS AREA (ON FL)              | 31-25 | TUNE EXTRACTION ELECTRIC ROOM             |
| 14-4 | NO.2 SPARE PARTS AREA (ON FL)              | 31-26 | SLAG TRANSFER OPERATOR ROOM               |
| 15   | ENERGOSCT INGOT CASE                       | 31-27 | LADLE-RELINING OPERATOR ROOM              |
| 16   | LADLE RELINING DECK                        | 31-28 | LADLE VALVE OPERATOR ROOM (ON FL)         |
| 20-1 | NO.1 LADLE DRYER (FOR PREHEATER)           | 31-29 | TUNDISH RELINING OPERATOR ROOM            |
| 20-2 | NO.2 LADLE DRYER (FOR PREHEATER)           | 31-30 | NO.1000 REPAIRING OPERATOR ROOM           |
| 20-3 | NO.3 LADLE DRYER (FOR PREHEATER)           | 31-31 | NO.1 SCRAP CONTROL ROOM                   |
| 20-4 | NO.4 LADLE DRYER (FOR PREHEATER)           | 31-32 | NO.2 SCRAP CONTROL ROOM                   |
| 21   | LADLE VALVE REPAIRING AREA AND LADLE STAND | 31-33 | NO.1 SCRAP CRANE (100T)                   |
| 22   | LADLE RELINING AREA                        | 31-34 | NO.2 SCRAP CRANE (100T)                   |
| 23-1 | NO.1 TURNING LADLE TURRET                  | 31-35 | NO.3 SCRAP CRANE (100T)                   |
| 23-2 | NO.2 TURNING LADLE TURRET                  | 31-36 | NO.1 CHARGING CRANE (100T)                |
| 23-3 | NO.3 TURNING LADLE TURRET                  | 31-37 | NO.2 CHARGING CRANE (100T)                |
| 24-1 | NO.1 CCM CONTINUOUS CASTING MACHINE        | 31-38 | NO.1 LADLE CRANE (100T)                   |
| 24-2 | NO.2 CCM CONTINUOUS CASTING MACHINE        | 31-39 | NO.2 LADLE CRANE (100T)                   |
| 24-3 | NO.3 CCM CONTINUOUS CASTING MACHINE        | 31-40 | NO.1 SERVICE CRANE (100T)                 |
| 24-4 | NO.4 CCM CONTINUOUS CASTING MACHINE        | 31-41 | NO.2 SERVICE CRANE (100T)                 |
| 25-1 | NO.1 CC ELECTRIC ROOM (ON FL)              | 31-42 | NO.1 BILLET CRANE (100T)                  |
| 25-2 | NO.2 CC ELECTRIC ROOM (ON FL)              | 31-43 | NO.2 BILLET CRANE (100T)                  |
| 26-1 | CCM TRANSFORMER ROOM (ON FL)               | 31-44 | NO.1 FILTER CASING AND FAN                |
| 26-2 | NO.1 CCM HYDRAULIC ROOM (ON FL)            | 31-45 | PELLETIZER AND DUST BUNKER                |
| 26-3 | NO.2 CCM HYDRAULIC ROOM (ON FL)            | 31-46 | LAVATORY                                  |
| 31-1 | NO.1-1 TUNDISH CAR                         | 31-47 | LAVATORY                                  |
| 31-2 | NO.1-2 TUNDISH CAR                         | 31-48 | LAVATORY                                  |
| 31-3 | NO.1-3 TUNDISH CAR                         | 31-49 | LAVATORY                                  |
| 31-4 | NO.1-4 TUNDISH CAR                         | 31-50 | LAVATORY                                  |
| 31-5 | NO.1-5 TUNDISH CAR                         | 31-51 | LAVATORY                                  |
| 31-6 | NO.1-6 TUNDISH CAR                         | 31-52 | LAVATORY                                  |
| 31-7 | TUNDISH (NO.1-NO.22)                       | 31-53 | DIRECT DRIVING CONTROL ROOM               |
|      |  | 31-54 | LADLE FURNACE                             |
|      |  | 31-55 | EAF ELECTRIC ROOM                         |
|      |  | 31-56 | CCM CONTROL ROOM                          |
|      |  | 31-57 | ALLOY ADDITIVE FACILITIES                 |

THE EXPANSION PROJECT  
 OF  
 THE EL DIKHEILA IRON & STEEL WORKS  
 TITLE GENERAL LAYOUT PLAN  
 DWG NO. JICA-SMP-001  
 DATE SCALE 1/500



Table 6.4.2-5 Equipment List of SMP

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
MECHANICAL EQUIPMENT			
SMP-100	<u>ELECTRIC ARC FURNACE</u>		
	<u>Furnace Equipment</u>		
SMP-101	Furnace Shell with Jacket	2	Type : Non-split Capacity : Nominal 70t Maximum 75t Inside diameter : 5,800 mm Height : 4,300 mm
SMP-102	Water Cooled Panels for Shell	2	Cooling area : Approx. 65% of the area above the sill level
SMP-103	Pouring System	2	
SMP-104	Furnace Door with Hoisting Device and Slag Apron	2	Driven by hydraulic cylinder
SMP-105	Roof Ring	4	Out diameter : 6,100 mm
SMP-106	Water Cooled Panels for Roof	4	Cooling area : Approx. 70%
SMP-107	Furnace Platform, Rocker and Pedestal	2	
SMP-108	Roof Swing and Lift Device	2	Driven by hydraulic cylinder Swung toward to pouring side with angle of 55°
SMP-109	Tilt and Swing Lock Device	2	Driven by Pneumatic cylinder for tilt lock post Hydraulic cylinder for tilt lock pin, swing lock pin
SMP-110	Tilt Device	2	Driven by electric motor and reducer
SMP-111	Electrode Holding and Hoisting Device	2	Driven by pneumatic cylinder for holding and electric motor for hoisting
SMP-112	Secondary Bus Tube	2	Current way from transformer to electrode holder

No.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-113	Access Platform and Heat Protector	2	Attached to furnace platform, roof lift beam
SMP-114	Piping for Water and Compressed Air	2	Composed of pipes, fittings, valves, hoses, support, etc.
SMP-115	Hydraulic Power System	2	Motor capacity : 37 KW
SMP-116	Centralized Lubricating System	2	Manual Operation
	<u>Refractory</u>		
SMP-121	Refractory for Furnace	2	For wall and bottom
SMP-122	Refractory for Roof	4	For center portion
SMP-123	Refractory for Miscellaneous	2	For floor deck, access platform
	<u>Graphite Electrode</u>		
SMP-131	Graphite Electrode	18 pcs	20 inch $\phi$ (508 mm $\phi$ ), 2,400 mm length
SMP-200	<u>HANDLING, PREPARATION MISCELLANEOUS FACILITIES</u>		
	<u>Scrap Handling Facilities</u>		
SMP-201	Scrap Charging Bucket	3	Type : Clam shell Capacity : 35 m <sup>3</sup>
SMP-202	Scrap Bucket Transfer Car	1	Type : Electric self-travelling with cabtyre cable Capacity : 50t
SMP-203	Track Weighbridge	1	Type : Load cell with digital indicator Capacity : 80t

No.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
<u>Sponge Iron and Burnt Lime Handling Facilities</u>			
SMP-211	Modification of existing No.1 Belt Conveyor, Junction House and No.2 Belt Conveyor with Trippers	1	To increase the capacity to 400 t/h from 250 t/h of existing conveyor by changing the driving electric motor and pulley
SMP-212	No.2 Belt Conveyor with Tripper	1	Girder type construction with cover above the belt Capacity : 400 t/h
SMP-213	Storage Bunker for Sponge Iron	4	Steel structure type Capacity : 150 m <sup>3</sup>
SMP-214	Storage Bunker for Burnt lime	2	Steel structure type Capacity : 100 m <sup>3</sup>
SMP-215	Discharging Equipment below Storage Bunker for Sponge Iron	4	Weigh feeder type Capacity : 70 t/h
SMP-216	Discharging Equipment below Storage Bunker for Burnt Lime	2	Weigh feeder type Capacity : 20 t/h
SMP-217	No.3 Belt Conveyor	2	Capacity : 70 t/h
SMP-218	No.4 Belt Conveyor	2	Capacity : 70 t/h
SMP-219	Bucket Conveyor	2	Internal bucket type Capacity : 70 t/h
SMP-220	Swing Chute	2	Type : Swing-aside single feed type Driven by motor

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
<u>Additives Handling Facilities</u>			
SMP-231	Charging Box	12 pcs	Capacity : 0.35 m <sup>3</sup>
SMP-232	Charging Machine	2	Driven by diesel engine Capacity : 2t
SMP-233	Portable Weigher	1	Capacity : 2t
SNP-234	Additive Receiving Device	1	Belt conveyor type
SMP-235	Storage Bunker	6	Capacity : 6 m <sup>3</sup>
SMP-236	Discharging Equipment below Storage Bunker	6	Vibrating feeder type Capacity ; 6 m <sup>3</sup> /h
SMP-237	Scale Car	1	Capacity : 2t
SMP-238	Additive Charging Device.	2	For ladle, EAF and charging box
<u>Slag Handling Facilities</u>			
SMP-241	Slag Pot	14 pcs	Capacity : 10 m <sup>3</sup>
<u>Steel Handling Facilities</u>			
SMP-251	Steel Ladle	7	Capacity : 80t of molten steel
SMP-252	Ladle Valve	7	Type : Rotary nozzle With preparation and off-line system
SMP-253	Ladle Transfer Car	2	Type : Electric self-travelling with cabtyre cable Capacity : 130t
SMP-254	Refractory for Ladle	7	High quality brick



EQUIPMENT LIST

No.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
	<u>Ladle Furnace</u>		
SMP-261	Furnace Equipment	1	Type : Mast type Capacity : Nominal 70t Maximam 75t Transformer : Rating 12 mVA, 120% overload Electrode : 14"φ Electrode hoisting system : Stationary mast and moving arm type Driven by motor Electrode damping : Air cylinder operation Roof lifting system : Driven by motor Roof with water cooled panels
SMP-262	Refractory for Roof	2	
SMP-263	Electrode	9 pcs	14 inch φ (356 mmφ), 1800 mm length
	<u>Preparation and Miscellaneous Facilities</u>		
SMP-271	Nozzle Preparation Stand	2	Stationary type
SMP-272	Ladle Relining Stand	1	For 3 ladles
SMP-273	Ladle Dryer	3	Vertical type Fuel : Natural gas
SMP-274	Mortar Mixer	3	
SMP-275	Electrode Stand	1	
SMP-276	Bag for Operation	10	
SMP-277	Steel and Concrete Template for Roof	2	
SMP-278	Shell Lining Deck	1	

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-279	Wet Gun	2	Capacity : 2.2 m <sup>3</sup>
SMP-280	Dry Gun	2	Capacity : 2.2 m <sup>3</sup>
SMP-281	Oxygen Lancing Facilities	2	Hand operation type
SMP-282	Mason's Tools and Tackles	1	Pneumatic drill, chipping rammer, etc.
SMP-283	Operational Tools and Tackles	1	
SMP-284	Billet Transfer Car	1	Type : Electric self-travelling with cabtyre cable Capacity : 72 t
SMP-285	Fork Lift	2	Capacity : 2 t
SMP-286	Piping for Utilities	1	
SMP-300	<u>CONTINUOUS CASTING MACHINE</u>		
	<u>Moltel Steel Handling Equipment</u>		
SMP-301	Turning Ladle Turret	1	Type : Motor driven turret type with lifting and locking devices Loading capacity : Max. 130 mt per arm Slewing speed : Approx. 1 rpm Lifting stroke : Approx. 600 mm Distance between : 9,000 mm ladle centers
SMP-302	Tundish	7	Type : Steel plate welded construction, no-stopper type Capacity : Max. 9 mt Distance between nozzle centers : Approx. 1,300 mm

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-303	Tundish Car	2	Type : Self-propelled motor-driven type, steel plate welded construction with tundish centering mechanism, trough, and launders  Loading capacity : Max. 24 mt Rail span : 2,300 mm Wheel base: 5,650 mm
SMP-304	Tundish Pre-heating Device	2	Type : Two burners, swing arm, vertical stand type  Fuel gas : Natural gas Calorific value : 9,540 kcal/Nm <sup>3</sup> 2 - Burner Type : Premixing type Capacity: 350,000 kcal/h per burner 1 - Combustion air blower
SMP-305	Lubricating Equipment for Tundish Car	2	Type : Manually operated, centralized greasing system
SMP-306	Stream Protection Device	1	Type : Shrouding box with castable refractory, inert gas injection type
	Stream Protection Device (Changing parts)	2	
SMP-307	Aluminium Wire Feeding Device	4	Type : DC motor driven, synchronized with billet withdrawal speed, pinch roller wire feeder type
<u>Continuous Casting Machine</u>			
SMP-311	Mould Assembly	4	Type : Straight tubular type with mould electromagnetic stirrer (M-EMS) and foot rollers  Billet size : 130 x 130 mm Tube size : 136 x 134 mm Mould length: 800 mm

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
	Mould Assembly (Changing parts)	8	
SMP-312	Mould Lubricator	1	Type : Plunger pump centralized lubricating system Oil employed : Rapeseed oil or equivalents
SMP-313	Mould Oscillation Mechanism	4	Type : Motor driven, eccentric cam oscillation mechanism Stroke : 14 mm Frequency range : 60 to 120 cycles/min. Oscillation curve pattern : Resembling sine curve
SMP-314	Mould Oscillation Lubricator	1	Type : Centralized oiling system
SMP-315	Mould Cover	4	Type : Steel plate welded construction, strand segment type Dimensions: Approx. 1,610 (W) x 380 (H) x 1,300 (L) mm
SMP-316	Secondary Cooling Equipment	4	Type : Internally water cooled pipe frame, free roller guided type with final solidification zone electromagnetic stirrer (F-EMS) and spray nozzle Length of guide roller apron in cooling zone : Approx. 8,500 mm
	First Roller Apron Assembly (Changing parts)	8	
	Second Roller Apron Assembly (Changing parts)	4	

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-317	Withdrawal/ Straightening Roll Unit	4	Type : Motor driven roll with hydraulic squeezing mechanism Speed : max. 4.3 m/min. Number of rolls: 4 - Withdrawal roll (internally water cooled) 1 - Intermediate support roll (internally water cooled) 1 - Reaction roller 1 - Squeezing mechanism
SMP-318	Hydraulic Equip- ment for Machine Proper	1	Used for : Hydraulic equipment for withdrawal/straightening roll unit, etc.
SMP-319	Hydraulic Equip- ment for Ladle Turret	1	Used for : Hydraulic equipment for ladle turret
SMP-320	Grease Lubricat- ing Equipment for Withdrawal/ Straightening Roll Unit	1	Type : Centralized greasing system
SMP-321	Steam Exhaust System for Secondary Cooling Zone	1	Type : Steel plate welded construction; common to 4 strands 1 - Steam exhaust fan Type : Turbo-fan with manually controlled damper 1 - Duct and hood Type : Steel plate welded construction
SMP-322	Shear Front Table	4	Type : Chain driven hollow roller type; driven together with withdrawal/straightening roll unit Speed : Max. 4.3 m/min.

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-323	Billet Shear	4	Type : Diagonal down-cut pendulum type Capacity : 250 mt Cutting speed : Approx. 80 mm/sec. 1 - Swing cylinder Type : Pneumatic cylinder
SMP-324	Hydraulic Equipment for Billet Shear	4	Used for : Hydraulic equipment for billet shear
SMP-325	Shear Rear Roller Table	4	Type : Chain driven solid roller with depressing mechanism Table length : 13,000 mm Speed : Approx. 6 m/min. 1 - Depressing mechanism Type : Hydraulic cylinder driven type Depressing angle : 45°
SMP-326	Runout Roller Table	4	Type : Chain driven hollow roller type Roll pitch: 1,000 mm Speed : Approx. 17 m/min.
SMP-327	Dummy Bar Storage	4	Type : Hydraulic cylinder driven, side-shift type Carriage length : Approx. 12,750 mm Carriage stroke : Approx. 350 mm
SMP-328	Dummy Bar	4	Type : Link type Length : Approx. 12,600 mm Sectional size : Approx. 132 x 130 mm
	Dummy Bar (Changing parts)	2	
SMP-329	Grease Lubricating Equipment for Roller Table	1	Type : Centralized greasing system

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-330	Billet Transfer	1	Type : Motor driven drag chain type Transfer speed : Approx. 16/5.3 m/min. Transfer stroke: Approx. 6,100 mm Transfer capacity: Approx. 140 mt of billets Number of chains : 4
SMP-331	Cooling Bed	1	Type : Internally water cooled skid type Loading capacity : Max. 140 mt Skid length : Approx. 9,100 mm Loading line: 16,000 mm billet per line; loading 2-heat billets, in parallel, per machine
SMP-341	Steel Structure	1	Used as : Machine support and working platform
<u>Miscellaneous Equipment</u>			
SMP-351	Slag Pot	2	Type : Steel plate welded construction Volume after lining : Approx. 2 m <sup>3</sup>
SMP-352	Intermediate Pot	1	Type : Steel plate welded construction Volume after lining : Approx. 1 m <sup>3</sup>
SMP-353	Intermediate Launder	1	Type : Steel plate welded construction
SMP-354	Crop Bucket	7	Type : Steel plate welded construction Inner volume : Approx. 1.5 m <sup>3</sup>
SMP-355	Floor Cooling Device	1	Type : Package type, vaporizing latent heat by atomizing fresh water Capacity : Approx. 200 m <sup>3</sup> /min.
SMP-356	Fan for Casting Floor	3	Type : Axial fan, portable type Capacity : Approx. 300 m <sup>3</sup> /min.

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-357	Fan for Tundish Cooling	2	Type : Axial fan, portable type Capacity : Approx. 300 m <sup>3</sup> /min.
SMP-358	Tundish Slagging-off Stand	2	Type : Steel plate welded construction
SMP-359	Tundish Nozzle Aligning Table	1	Type : Steel plate welded construction
SMP-360	Refractories	1	Consisting of : 1 - Red bricks for casting floor 1 - Red bricks for emergency ladle area 7 - Refractories for tundishes 7 - Refractories for tundish covers 2 - Refractories for overflow trough 2 - Refractories for slag pots 1 - Refractories for intermediate pots 1 - Refractories for intermediate launders 8 - Refractories for safety launders 1 - Refractories for tundish cleaning pits
SMP-361	AC Welder	1	Welding current : 55 to 300 A
SMP-362	Hand Lamp	4	Wattage : 100 W
SMP-363	Double Head Grinder	1	Type : Double head pedestal type
SMP-364	Brick Cutter	1	Type : Wet cutting type with diamond saw
SMP-365	Mortar Mixer	1	Type : Motor driven propeller mixing type
SMP-366	Potable Drain Water Pump	1	Type : Pump immersed portable type
SMP-367	Air Pump for Replenishment of Rapeseed Oil	1	Capacity : Approx. 33 lit/min.



EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-368	Pneumatic Tools	1	Consisting of : 1 - Large size 1 - Medium size
SMP-369	Hand Cutting Torch	1	Consisting of : 3 - Hand cutting torch (Straight head type) 3 - Hand cutting torch (Right angle type)
SMP-370	Chain Block	1	Consisting of : 1 - Chain block for maintenance of mould oscillation mechanism Capacity : 1 mt 1 - Chain block for normal maintenance work Capacity : 2 mt 1 - Chain block for normal maintenance work Capacity : 1 mt 1 - Chain block for normal maintenance work Capacity : 2 mt
SMP-371	Sling	1	Consisting of : 1 - Sling for tundish lifting 3 - Sling for mould lifting 1 - Sling for crop bag lifting 1 - Sling for mould cover lifting 1 - Sling for tundish upsetting 1 - Sling for billet lifting (1) 1 - Sling for billet lifting (2)
SMP-372	Miscellaneous Small Tools	1	Consisting of : 4 - Pendant arm for casting operation panel 1 - Mould maintenance deck

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-372	Miscellaneous Small Tools (Cont'd)		2 - 1st roller apron maintenance deck 1 - 2nd roller apron maintenance deck 1 - Mould tube hanger 2 - Roller apron alignment gauge 4 - Tool for dummy bar set bolt 1 - Scale bucket (1) for scale pit 1 - Scale bucket (2) for scale pit 1 - Support of intermediate launder 1 lot - Directly embedded bolts 1 lot - Indirectly embedded bolts 1 lot - Wedge liners and plane liners 2 - Billet tongs 1 lot - Templates 1 - Sample cooling bucket 1 - Mould test pump 2 - Stand for fan 1 - Steps for tundish 1 - Beam for chain block 4 - U-bolt for chain block 2 - Partition gate for water pool 1 - Splash board 1 lot - Nameplates 1 lot - Welding rods 1 lot - Spare materials for CCM miscellaneous small tools 1 lot - Decks, covers heat protectors
SMP-374	Scale Pit Water Pump	2	Type : Horizontal single-stage, single-flow centrifugal volute pump
SMP-375	Drain Pit Water Pump	1	Type : Horizontal single-stage, single-flow centrifugal volute pump

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-376	Booster Pump for Spray Water	2	Type : Horizontal single-stage, single-flow centrifugal volute pump
SMP-377	Piping Material for CCM	1	Consisting of : 1 lot - Indirect water piping, valves, and fittings 1 lot - Direct water piping, valves, and fittings 1 lot - Compressed air piping, valves, and fittings 1 lot - Oxygen gas piping, valves, and fittings 1 lot - Natural gas piping, valves, and fittings 1 lot - Emergency water piping, valves, and fittings 1 lot - Potable water piping, valves, and fittings 1 lot - Agron gas piping, valves, and fittings 1 lot - Combustion air piping, valves, and fittings 1 lot - Rapeseed oil piping, valves, and fittings 1 lot - Piping supports
SMP-378	Lubricant and Hydraulic Oil for Initial Fill	1	Consisting of : 1 lot - Oil for reduction gears 1 lot - Grease for lubrication 1 lot - Repeseed oil 1 lot - Hydraulic oil
SMP-379	Solvent and Paint for CCM	1	Used for : Touching up

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-400	ARC FURNACE FUME EXTRACTION SYSTEM		
	<u>Mechanicals</u>		
SMP-401	Bag Filter	2	2 pcs - Casing Type : Cylindrical Dimension : $\phi 4,800$ mm x H 12,000 mm 2 pcs - Hopper Type : Conical Dimension : $\phi 4,800$ mm x H 4,000 mm 1 - Steel structure Construction : Steel truss 1 - Duct Dimension : $\phi 700$ mm ~ $\phi 1,300$ mm 1 - Walk-way & stairs
SMP-402	Accessories for Bag Filter	2	2 pcs - Two-way damper Service : Reverse cleaning Drive : Air cylinder 1 pc - Reverse damper Service : Reverse cleaning Drive : Air cylinder 2 pcs - Double damper Service : Dust discharge Drive : Air cylinder 2 pcs - Manual damper Service : Gas volume regulation 4 pcs - Inspection door Dimension : 600 mm x 1,000 mm 2 pcs - Manhole Dimension : $\phi 600$ mm

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-403	Filter Bag and Accessories	2	Filter bag Dimension : $\phi$ 292 mm x L 10,000 mm Material : Glassfiber Fastening band Thimble and cap Spring Chain with eye bolt Suspension bolt and nut
SMP-404	Elbow	2	Type : Water-cooled
SMP-405	Slide Duct	2	Type : Water-cooled Drive : Motor cylinder
SMP-406	Combustion Chamber	2	Type : Water-cooled Dimension : $\phi$ 2,600 mm x $\phi$ 2,800 mm
SMP-407	Water-cooled Duct	2	Dimension : $\phi$ 1,100 mm x $\phi$ 1,250 mm
SMP-408	Air-cooled Duct	2	Dimension : $\phi$ 1,250 mm
SMP-409	Stack	2	Type : Cylindrical Dimension : $\phi$ 1,900 mm x H 15,000 mm
SMP-410	Chain Conveyor	1 lot	1 - Conveyor for bag filter Capacity: 2 t/h Chain : Roller chain Speed : 5 /min. (Approx.) 1 - Common conveyor Capacity: 4 t/h Chain : Roller chain Speed : 5 m/min. (Approx.)
SMP-411	Bucket Conveyor	1	Capacity : 4 t/h Speed : 10 m/min. (Approx.)
SMP-412	Dust Bunker	1	Capacity : 50 m <sup>3</sup> with constant feeder

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-413	Pelletizer	1	Capacity : 3 t/h Type : Pan type
SMP-414	Fan	2	Type : Turbo. Capacity : 1,900 m <sup>3</sup> /min. x 720 mm H <sub>2</sub> O at 200°C
SMP-415	Modification of Ducts for No.3 and No.4 EAF	1	
SMP-500	<u>CRANE AND HOLST</u>		
SMP-501	10/5 t Scrap Handling Crane	2	With lifting magnet and emergency power supply device
SMP-502	50/20 t Charging Crane	1	
SMP-503	130/40 t Ladle Crane	2	
SMP-504	25/10 t Service Crane	1	
SMP-505	17 t Billet Handling Crane	1	With lifting magnet and emergency power supply device
SMP-506	10 t Hoise Crane	2	
SMP-507	5 t Hoist Crane	1	
SMP-508	2 t Hoist Crane	1	
SMP-509	2 t Jib Crane	2	

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
ELECTRICAL EQUIPMENT			
SMP-600	ELECTRICALS FOR MACHINE		
<u>Electric Arc Furnace</u>			
SMP-601	Furnace Transformer	2	Type : Indoor use, forced oil forced water cooling Rating : 3-phase, 46 MVA Primary voltage : 33 KV Accessories : Oil cooler, etc.
SMP-602	Furnace Circuit Switch & Others	2	Composed of : 2 pcs - Disconnecting switch Type : Indoor use, three-pole single-throw Rating : 36 kV, 1,200 A 2 - Furnace circuit switch Type : Indoor use, vacuum, heavy duty type Rating : 36 kV, 1,200 A 2 pcs - Potential transformer 2 - Power fuses for potential transformer 2 - Lightning arrestor 2 - Surge suppressor
SMP-603	Secondary Flexible Cable	24 pcs	Type : Water cooled cable
SMP-604	Electrode Control System	2	Composed of : 6 - Electrode hoisting motor Type : Totally enclosed, forced air cooled, wound rotor induction type. Rating : AC 380 V, 3-phase, 37 kW, 6P Accessories : Brake, thermostat, etc. 2 - Secondary resistor for electrode hoisting motor

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-604	Electrode Control System (Cont'd)		2 - Blower for electrode hoisting motor 2 - Electrode regulating panel Type : Indoor use, enclosed and self standing type Mounted : Moulded case circuit breaker (MCB), magnetic contactor, thyristor, control unit, auxiliary relay, etc.
SMP-605	Control Panels	1	Composed of : 1 - Centralizing supervisory panel for EF, fume extraction, CCM and power distribution Type : Indoor use, enclosed and self standing desk type Mounted : Mimic, signal amp, annunciator, etc. 2 - Metering panel Type : Indoor use, enclosed and self standing type Mounted : Indicating meter, protective relay, auxiliary relay, annunciator, etc. 2 - Furnace control panel Type : Indoor use, enclosed and self standing type Mounted : Moulded case circuit breaker (MCB), magnetic contactor, auxiliary relay, etc. 2 - Control desk for EF, & fume extraction Type : Indoor use, enclosed and self-standing type Mounted : Control switch, indicating meter, signal lamp, etc. 2 - Furnace tilting control post Type : Enclosed & pipe standing type Mounted : Master controller, push button switch, etc.



EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-605	Control Panels (Cont'd)		2 - Hydraulic unit control post Type : Enclosed & wall mounting type Mounted : Push button switch, signal lamp
SMP-606	Auxiliary Motor & Sensors	1	Composed of : 2 - Tilting motor Type : Totally enclosed, wound rotor type Rating : AC 380 V 3-phase 45 KW 6-pole 2 - Secondary resistor for tilting motor 1 lot - Limit switch
SMP-607	Wiring Materials <u>Handling, Preparation, Miscellaneous</u>	1	
SMP-611	Power Distribution Board	1	Type : Indoor use, enclosed & self standing type Mounted : Moulded case circuit breaker (MCB)
SMP-612	Control Panels	1	Composed of : 1 - Motor starter panel Type : Indoor use, enclosed & self standing type Mounted : MCB, magnetic contactor, control switch, auxiliary relay, signal lamp, etc. 1 - Feeder control panel Type : Indoor use, enclosed & self standing type Mounted : MCB, magnetic contactor, adjuster, etc. 1 - Local control post Type : Outdoor use, enclosed & wall mounting type Mounted : Push button switch, signal lamp, etc.

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-613	Sensors	1	Composed of : 1 lot - Limit switch
SMP-614	Wiring Materials	1	
SMP-615	Modification of Electrical Equipment	1	For existing No.1 and No.2 belt conveyor
	<u>Ladle Furnace</u>		
SMP-621	Furnace Transformer	1	Type : Indoor use, forced oil forced water cooling Rating : 3-phase, rating 12 mVA, 120% overload Primary voltage : 33 kV Accessories : Oil cooler, etc.
SMP-622	Furnace Circuit Switch & Others	1	Composed of : 1 pc - Disconnecting switch 1 pc - Furnace circuit switch 1 pc - Potential transformer 1 pc - Power fuse for potential transformer 1 pc - Lightning arrestor 1 pc - Surge surpressor
SMP-623	Secondary Flexible Cable	1	Type : Water cooled calbe
SMP-624	Electrode Drive Motors	1	Composed of : 3 - Electrode hoisting motor Type : Totally enclosed, unduction type 3 - Accessories including brake, thermostat, etc. 1 - Cooling blower for hoisting motors
SMP-625	Electrode Controller	1	Type : Indoor use, self-standing type

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-626	Control Panel	1	Furnace Control Panel including control and power supply Type : Indoor use, self-standing type
SMP-627	Supervisory-Device	1	Centralizing panels in pulpit for ladle furnace operation including 1 pc - Supervisory-panel 1 pc - Metering panel 1 pc - Furnace control desk
SMP-628	Wiring Materials	1	
<u>Continuous Casting Machine</u>			
SMP-631	High Voltage Switchgear	2	Type : Indoor use, metal enclosed self-standing type Switch Type : 3-pole, single throw, load break disconnecting switch Rated voltage : 7.2 kV Rated current : 200 A Accessory : Earthing switch PT and CT Volt meter Ammeter
SMP-632	Power Transformer	1	Type : Indoor use, oil immersed, self-cooled type (ONAN) Capacity : 1,000 kVA Rated voltage Primary : 6.6 kV Secondary : 400 V Connection : Delta-star with neutral bushing Accessory : Neutral grounding resistor shield separator
SMP-633	Power Transformer	1	Type : Indoor use, oil immersed, self-cooled type (ONAN)

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-633	Power Transformer (Cont'd)	1	Capacity : 1,000 kVA Rated voltage Primary : 6.6 kV Secondary : 400 V Connection : Delta-delta Accessory : Sheilded separator
SMP-634	Low Voltage Switchgear	2	Type : Indoor use, metal enclosed, self-standing, fixed type and multi-tier construction  Circuit breaker Type : Moulded case circuit breaker (MCB) for incoming, MCB and earth leakage circuit breaker (ELB) for feeders  Accessory : Meters, relays
SMP-635	M-EMS Control Panle	4	Type : Indoor use, metal enclosed, self-standing type  Main apparatus : AC Contactor, innerter and control unit
SMP-636	F-EMS Control Panel	4	Type : Indoor use, metal enclosed, self-standing type  Main apparatus : AC Contactor, thyristor controller and control unit.
SMP-637	F-EMS Tie- transformer	4	Type : Indoor use, oil imersed, self-cooled type (ONAN)  Capacity : 320 kVA (160 kVA x 2) Voltage : 380 V, 3-phase/Primary Connection: Scott-connection (/)
SMP-638	Static Capacitor	1	Type : Indoor use, oil imersed type Capacity : 150 kVA x 3 = Total 450 kVA Rated voltage : AC 380 V, 3-phase, 50 Hz Accessory : Net case

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-639	Thyristor Leonard Control Panel for DC Motor	5	<p>Type : Indoor use, metal enclosed, self-standing type</p> <p>Main apparatus:</p> <p>1 - Thyristor leonard control unit, air cooled, 220 V</p> <p>1 - Speed control unit</p> <p>1 - MCB, auxiliary relay, transformer</p> <p>1 - Power source unit for brake</p> <p>Accessory : Cooling fan</p>
SMP-640	Motor Control Center	1	<p>Type : Indoor use, metal enclosed, self-standing type, multitier construction with drawout compartment</p> <p>Accessory : Meter, CT, ZCT</p>
SMP-641	Programmable Sequence Controller	1	<p>Type of cubicle : Indoor use, metal enclosed, self-standing type</p> <p>1</p> <p>Major application : Cutting length control, sequence control</p> <p>Major apparatus : Sequence control unit Power source unit I/O unit</p>
SMP-642	Relay Panel	1	<p>Type : Indoor use, metal enclosed, self-standing type</p> <p>Main apparatus : MCB, magnetic contactor, auxiliary relay and dry type transformer</p>
SMP-643	Operation Board	1	<p>Type : Indoor use, metal enclosed, desk type</p> <p>Application : Shear operation, transfer, dummy bar storage and withdrawal roll</p> <p>Main apparatus : Control switch Push button Indicating lamp Setter Counter</p>

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-644	Local Switch Box	1	Type : Indoor use, metal enclosed, stand type, wall monted type and pendant type Main apparatus : Change-over switch Indicating lamp Speed setter
SMP-645	Sensor	1	Type : Lever type limit switch, float type level switch and electrode type level switch
SMP-646	Ventilating Device for Electrical Equipment Room	1	Blower Type : Turbo-fan Motor output 1.1 kW for No.4 CCM Filter Type : Glass wool rotating type
SMP-647	Wiring and Piping Materials  <u>Fume Extraction System</u>	1 lot	Composed of: Cable and wire, piping materials and accessories including spot lighting fixtures for casting area and withdrawal roll unit
SMP-651	AC Motor	1	Composed of: - H.T. motor for I.D.F. Type : Totally enclosed Rating : AC 6.6 KV, 3-phase, 450 kW - Secondary resistor for H.T. motor
SMP-652	H.T. Motor Starter Panel	1	Type : Indoor use, enclosed & self standing type Mounted : Disconnecting switch, power fuse, H.T. magnetic contactor, over current relay, control switch, etc.

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-653	Control Panels	1	Composed of: 1 lot - Motor control panel Type : Indoor use, enclosed & self standing type Mounted : MCB, magnetic contactor, auxiliary relay, control switch, signal lamp, etc. 1 lot - Local control box for dust bunker Type : Dust collector's level indicator, push button switch, signal lamp, etc.
SMP-654	Sensors	1	Composed of: 1 lot - Pressure switch box 1 lot - Thermometer box
SMP-655	Wiring Materials	1	
<u>Power Feeding System for Crane</u>			
SMP-661	Apparatus	1	Composed of: Feeding switch box and section switch Warning lamp
SMP-662	Wiring Material	1	

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-700	<u>FLICKER &amp; POWER FACTOR COMPENSATION SYSTEM</u>		
SMP-701	Disconnecting Switch	1	Type : Outdoor use, three-pole single-throw  Rating : 36 kV, 600 A
SMP-702	High-Impedance Transformer	1	Type : Outdoor use  Rating : Approx. 26,000 kVA, 3-phase  Primary voltage : 33 kV
SMP-703	Thyristor & Control Equipment	1	Composed of:  1 - Thyristor cubicle  Type : Enclosed & self standing type  Capacity of thyristor : Approx. 26,000 kVA  1 - Thyristor control panel  Type : Enclosed & self standing type  Mounted : Control unit, etc.  1 - Cooling device for thyristor
SMP-704	High-Harmonic Filter/Static Capacitor for Power Factor Correction	1	Type : Outdoor use, self-standing type  Rating : 1 pc - 5 mVA 2nd harmonic 2 pcs-12 mVA 3rd harmonic 1 pc - 1 mVA 4th harmonic 2 pcs- 2 mVA 5th harmonic 2 pcs- 2 mVA 6th harmonic
SMP-705	Supervisory Panel	1	Type : Indoor use, enclosed & self-standing type  Mounted : Protective relay, indicating meter, control switch, signal lamp, etc.
SMP-706	Wiring Materials	1	
SMP-707	Modification on Control System	1	Design and provision of interface connection between existing and new control system



EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-800	<u>COMMON ELECTRICALS</u>		
	<u>Power Distribution System</u>		
SMP-801	6.6 kV Switchboard	1	Type : Indoor use, enclosed & self standing type  Mounted : Circuit breaker Type : Three-pole single throw, draw-out type  Neutral grounding resistor, potential transformer, protective relay, indicating meter, control switch, etc.
SMP-802	Power Transformer	1	Type : Outdoor use, oil immersed self cooling type, with cooler  Rating : 33/6.6 kV, 3-phase
SMP-803	Power Transformer	1	Type : Outdoor use, oil immersed self cooling type  Rating : 6.6/0.4 kV, 3-phase
SMP-804	Load Center	1	Type : Indoor use, enclosed & self standing type  Mounted : Air circuit breaker  Protective relay, control switch, etc.
SMP-805	Battery & Charging Device	1	Type : Indoor use, enclosed & self standing type  Battery : Alkaline storage battery Charger : Thyristor controlled, floating/equalizing charge, with feeder MCB
SMP-806	Power Distribution Board for Common Item	1	Type : Indoor use, enclosed & self standing type  Mounted : 1 lot - Moulded case circuit breaker
SMP-807	wiring materials	1	

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
	<u>Lighting</u>		
SMP-811	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 lamps
SMP-812	Wiring Materials	1	
	<u>Intercommunication</u>		
SMP-821	Paging System	1	
SMP-822	Television for Supervisory	1	
SMP-823	Wiring Materials	1	
	<u>Air Conditioning, Ventilation &amp; Small Power</u>		
SMP-831	Ventilating for Furnace Transformer Room	2	Type : Forced air cooling type
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	

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
<u>Fire Alarm and Extinguishing Sytem</u>			
SMP-841	Fire Alarm Control Panel	1	Type : Indoor use, enclosed and self standing type Mounted : Alarm lamp, auxiliary relay, etc.
SMP-842	Detector for Fire Alarm	1	
SMP-843	Fire Extinguishing Unit	1	Type : Halon and powder type
SMP-844	Wiring Materials	1	
<u>Lightning and Earthing</u>			
SMP-851	Lightning pole	1 lot	
SMP-852	Grounding Electrode	1 lot	

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
INSTRUMENTATION			
<u>ELECTRIC ARC FURNACE HANDLING FACILITIES</u>			
SMP-901	Furnace Bath Temperature Measurement	2	Immersion thermocouple, recorder, holder, local digital indicator
SMP-902	CCM Bath Temperature Measurement	1	Immersion thermocouple, recorder, holder, digital indicator
SMP-903	Furnace Bottom Temperature Measurement	2	CA thermocouple, MV/I, recorder
SMP-904	Temperature Measurement System for Ladle Furnace	1	Immersion thermocouple, recorder, holder, digital indicator
SMP-905	Temperature Monitoring Device for Sponge Iron Bunker	4 pcs	Range : 0 ~ 300°C
SMP-906	Water Flow Monitoring Device for EAF	2	
SMP-907	Lancing Oxygen Flow Meter	2	Orifice type, with integrator
SMP-908	Electrode Position Detector	6	Pulse generator
SMP-909	Instrument Panel for EAF	2	Type : Enclosed, self-standing Mounted : Annunciator, panel instruments, etc.
SMP-910	Monitor Board for No.2 Central Control Room	1	Type : Enclosed, wall mounting Mounted : Annunciators
SMP-911	Power Distribution Board	1	Type : Enclosed, wall mounting Mounted : MCB
SMP-912	Wiring Materials	1	

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-913	Minic Panel for Material Handling	1	Type : Enclosed, self-standing Mounted : Level indicator, monitor switch, lamp, relay, transformer, minic board, etc.
SMP-914	Handling Desk for Sub-Materials at No.2 Central Control Room	1	Type : Enclosed Mounted : Indicator, control or digital switch, pilot lamp, etc.
SMP-915	Ladle Dryer Control Post	3	Type : Enclosed, wall mount Mounted : PBS, flow meter, etc.
SMP-916	Feeding control Desk	2	
<u>CONTINUOUS CASTING MACHINE</u>			
SMP-921	Temperature Measuring of Mould Cooling Water	1	Composed of: Recorder Resistance bulb
SMP-922	Flow Rate Indicator for Mould Cooling Water	4	Composed of: Orifice Differential pressure transmitter
SMP-923	Flow Control of Spray Cooling Water	4	Composed of: Orifice Differential pressure transmitter Indicating controller Control valve with positioner
SMP-924	Molten Steel Level Control in Mould	4	Composed of: Gamma ray radiation source Level detector Signal convertor Indicating controller Caution lamp box

EQUIPMENT LIST

NO.	EQUIPMENT	Q'TY	MAIN SPECIFICATION
SMP-925	Instrument Panel	1	<p>Type : Indoor use, metal enclosed self-standing type</p> <p>Application:</p> <p>For instrument for common</p> <p>For instrument for strand</p> <p>For operation and supervision of machines</p> <p>Main apparatus : Recorder, controller, indicator, annunciator, control switch</p>
SMP-926	Local Instrument	1	<p>Composed of:</p> <p>Pressure indicator with alarm contact</p> <p>Area type flow meter</p>
SMP-927	Wiring and Piping Materials	1 lot	<p>Composed of:</p> <p>Cable and wire, piping material and accessories</p>
<u>COMPUTER CONTROL SYSTEM</u>			
SMP-931	Data Collecting Device	1	
SMP-932	Data Printing Device		
SMP-933	Operation Guidance Device	1	
SMP-934	EAF Molting Control Device		