6.4.4. Utilities

1) Basic concept of the expansion

To study a plan of utility facilities for the expansion, a comparison is provided in Table 6.4.4-1, which shows the design capacity of existing utility facilities, present consumption of utilities, estimated requirements of utilities for the expansion, and total utility requirements. The study for the expansion of utility facilities has been made in the following points of view:

- Use the surplus capacity of existing utility facilities as much as possible and effectively.
- Minimize the modification work of existing utility facilities.
- Minimize the construction cost for new utility facilities.
- Consider further expansion of utility facilities.

The results of the study for the expansion plan of utility facilities in accordance with the above points of view are shown below.

a) Utility facilities that do not require any modification

- Raw water treatment station
- Recirculation water treatment station (Water treatment stations-Ⅰ, Ⅱ, Ⅲ)
- Sewage treatment station
- Drainage pumping station
- Natural gas station
- Water supply facilities for outdoor fire hydrants

b) Utility facilities that require modification

· Yard piping

c) Utility facilities that have to be newly installed or expanded

· New recirculation water treatment station (Water treatment stations-Ⅳ, Ⅴ, Ⅵ)
· New oxygen shop
· Expansion of air compression station
· New pumping stations No.8 and No.9 for sewage
· New hydrants for fire fighting around RMP

The design capacity, utility requirements, and surplus capacity of utility facilities after the expansion are compared in Table 6.4.4-2. The equipment of utility facilities for the expansion is listed in Table 6.4.4-3.

2) Expansion plan

The expansion plan of utility facilities is summarized below.

a) Water treatment station-Ⅳ

Indirect cooling water (ICW) for the new rolling mill plant (RMP) will be supplied and treated in the water treatment station-Ⅳ (WTS Ⅳ) because the existing water treatment station-Ⅰ (WTS Ⅰ) does not have enough capacity for the expansion, so the surplus capacity of ICW in WTS Ⅰ will be reserved for further expansion.

In order to recycle 1,080 m3/h of ICW for new RMP, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.

Direct cooling water (DCW) for the new and existing rod mill plants and the existing steelmaking plant (SMP) will be supplied and treated in the existing WTS I and DCW for the existing bar mill plant will be supplied and treated in WTS Ⅳ. The surplus capacity of DCW for the existing WTS I will be reserved for further expansion.

In order to recycle 590 m3/h of DCW for the existing bar mill plant, facilities consisting of sedimentation basin, pressure filters, cooling tower, cold well, pumps, etc. will be installed.

The space for further expansion is considered in the layout of WTS Ⅳ.

For dehydration of sludge, the existing dehydration system in the WTS I will be used because it has surplus capacity.

These treatment facilities will be installed on the west of the existing WTS I.

Flow sheet of these facilities is shown in DWG JICA-UT-001 and -002 and general layout is shown in DWG JICA-UT-006.

b) Water treatment station-V

Since the existing water treatment station-II (WTS II) has no surplus capacity of indirect cooling water

(ICW) for the steelmaking plant, water treatment station- V (WTS V) will be installed in the northern part of the existing SMP. Therefore, ICW for SMP will be supplied and treated by WTS II and WTS V.

The existing WTS II will cover the facilities of southern part of SMP consisting of Nos.1, 2, and 3 electric arc furnaces (EAF), Nos.1 and 2 continuous casting machines (CCM), and No.1 ladle furnace (LF), and WTS V will cover the facilities of northern part of SMP consisting of No.4 EAF, No.3 CCM, and No.2 LF.

So the existing WTS II will have the surplus capacity and this surplus capacity of ICW in WTS II will be reserved for further expansion.

In order to recycle 2,440 m3/h of ICW in WTS V, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.
The space for further expansion is considered in the layout of WTS V.

Flow sheet of this station is shown in DWG JICA-UT-001 and -002 and general layout is shown in DWG JICA-UT-007.

c) Water treatment station-VI

Water treatment station-VI will be installed on the east of the existing water treatment station-I to supply and treat the indirect cooling water for the new oxygen shop, additional air compressors and new substation because the existing water treatment station-III has no surplus capacity.

In order to recycle 230 m3/h of ICW in WTS VI, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.
The space for further expansion is considered in the layout of WTS VI.

Flow sheet of this station is shown in DWG JICA-UT-001 and -002 and general layout is shown in DWG JICA-UT-008.

d) Oxygen shop

Since a large quantity of oxygen gas has to be injected into EAF for melting a large quantity of scrap, a new oxygen shop will be installed on the east of the existing WTS I.
The pressure swing adsorption system will be applied to the new oxygen shop instead of the existing cryogenic separation system due to required purity of oxygen gas into EAF and installation cost.

Oxygen gas produced by pressure swing adsorption system will be only supplied into EAF and oxygen gas for other plants will be supplied by the existing cryogenic separation system.

So, surplus capacity of the existing oxygen shop will be reserved for further expansion.

In order to produce 2,400 Nm3/h of oxygen gas, facilities consisting of suction filter, air blower, oxygen gas generation units, oxygen gas compressors, high pressure oxygen holder, etc. will be installed.
The space for further expansion is considered in the layout of the new oxygen shop.

The present consumption of nitrogen gas is the same as the design capacity (550 Nm3/h) of nitrogen gas generation unit because nitrogen gas consumption of DRP is increased by the use of nitrogen gas instead of seal gas generated in the DR process due to oxygen rich quality of seal gas. So, this nitrogen gas consumption will be able to be reduced to 450 Nm3/h by producing and using proper seal gas in DRP.

Table 6.4.4-1 shows that the estimated requirement of nitrogen gas is higher than the existing design capacity, but this difference is quite small and the inert gas from the direct reduction plant can be used for purging the DRI bunker of EAF. Therefore, the new nitrogen gas generation unit is not required, but the layout of air compression station considers the space for new nitrogen gas generation unit as further expansion.

Flow sheet of these facilities is shown in DWG JICA-UT-003 and general layout is shown in DWG JICA-UT-009 and -010.

e) Air compression station

Two air compressor units will be added to the existing air compression station to supply the compressed air to the expanded plants because the existing air compression station does not have enough capacity for the expansion.

The new air compressor units will have the same capacity of the existing unit in consideration of easy operation.

In order to supply 4,500 Nm3/h of compressed air, facilities consisting of air compressor units and air receiver tank will be installed.

The space for further expansion is considered in the layout of air compression station.

Flow sheet of this system is shown in DWG JICA-UT-004 and general layout is shown in DWG JICA-UT-009.

f) Pumping stations No.8 and No.9

The pumping stations No.8 and No.9 will be installed around the new oxygen shop and water treatment station-V to transfer the sewage from the plants to the existing sewage treatment station. The pump pit with rough screen and sewage pump will be installed in the pumping station.

g) Hydrants for fire fighting

Hydrants and piping for the fire fighting will be installed around the new RMP.

h) Yard piping

In order to supply utilities to the plants and facilities for the expansion, the following yard piping will have to be modified or installed:

- Potable water
- Make-up water
- Direct cooling water
- Indirect cooling water

- Emergency water
- Sewage
- Drainage
- Oxygen gas
- Nitrogen gas
- Compressed air
- Natural gas
- Fire fighting water

i) Personnel requirement for the expansion facilities

Required personal and organization for utility facilities after the expansion is shown in Table 6.4.4-4.

Table 6.4.4-1 Utility Requirements for Expansion

Station/Shop	Design capacity of existing utility facilities	Present consumption	Estimated requirement for the expansion	Total requirement
1. Raw Water Treatment Station				
・Raw'water	930 m^3/h	550 m^3/h	114 m^3/h	664 m^3/h
・Make-up water	890 m^3/h	500 m^3/h	110 m^3/h	610 m^3/h
・Potable water	50 m^3/h	20 m^3/h	4 m^3/h	24 m^3/h
2. Water Treatment Station-I				
・Direct cooling water	3,190 m^3/h	2,300 m^3/h	1,480 m^3/h	3,780 m^3/h
・Indirect cooling water	2,000 m^3/h	1,500 m^3/h	1,080 m^3/h	2,580 m^3/h
3. Water Treatment Station-II				
・Indirect cooling water	7,150 m^3/h	7,150 m^3/h	1,890 m^3/h	9,040 m^3/h
4. Water Treatment Station-III				
・Indirect cooling water	284 m^3/h	284 m^3/h	230 m^3/h	514 m^3/h
5. Sewage Treatment Station				
・Sewage	500 m^3/d	320 m^3/d	37 m^3/d	357 m^3/d
6. Drainage Pumping Station				
・Drainage	1,950 m^3/h	290 m^3/h	32 m^3/h	322 m^3/h
7. Oxygen Shop				
・Oxygen gas	400 Nm^3/h	200 Nm^3/h	2,375 Nm^3/h	2,575 Nm^3/h
・Nitrogen gas	550 Nm^3/h	450 Nm^3/h	116 Nm^3/h	566 Nm^3/h
8. Air Compression Station				
・Compressed air	12,800 Nm^3/h	10,800 Nm^3/h	6,570 Nm^3/h	17,370 Nm^3/h
9. Natural Gas Station				
・Natural gas	50,000 Nm^3/h	33,000 Nm^3/h	1,660 Nm^3/h	34,660 Nm^3/h
10. Outdoor Fire Hydrants				
・Fire water	240 m^3/h	0 m^3/h	0 m^3/h	240 m^3/h

Table 6.4.4-2 Utility Requirements after Expansion

Station/Shop	Design capacity of utility facilities for the expansion	Utility requierment for the expansion	Surplus capacity of utility facilities after the expansion
1. Raw Water Treatment Station			
・Raw water	930 m^3/h	664 m^3/h	266 m^3/h
・Make-up water	890 m^3/h	610 m^3/h	280 m^3/h
・Potable water	50 m^3/h	24 m^3/h	26 m^3/h
2. Water Treatment Station-I			
・Direct cooling water	3,190 m^3/h	3,190 m^3/h	0 m^3/h
・Indirect cooling water	2,000 m^3/h	1,500 m^3/h	500 m^3/h
3. Water Treatment Station-II			
・Indirect cooling water	7,150 m^3/h	6,506 m^3/h	644 m^3/h
4. Water Treatment Station-III			
・Indirect cooling water	284 m^3/h	284 m^3/h	0 m^3/h
5. Water Treatment Station-IV			
・Direct cooling water	590 m^3/h	590 m^3/h	0 m^3/h
・Indirect cooling water	1,080 m^3/h	1,080 m^3/h	0 m^3/h
6. Water Treatment Station-V			
・Indirect cooling water	2,440 m^3/h	2,440 m^3/h	0 m^3/h
7. Water Treatment Station-VI			
・Indirect cooling water	230 m^3/h	230 m^3/h	0 m^3/h
8. Oxygen Shop (PSA)			
・Oxygen gas	2,700 Nm^3/h	2,400 Nm^3/h	300 Nm^3/h
9. Air Compression Station			
・Compressed air	6,400 Nm^3/h	4,500 Nm^3/h	1,900 Nm^3/h

Table 6.4.4-3 Equipment List

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-100	WATER TREATMENT STATION-IV		
UT-110	Indirect Cooling Water System		
UT-111	Cooling tower	1	Type : Cross flow and film type Capacity : 1,080 m^3/h Filling : Hard PVC
UT-112	Cold well	1	Capacity : 400 m^3 Material : Reinforced concrete
UT-113	RM supply pump for ICW	1 + 1	Type : Centrifugal, end suction Capacity : 1,190 m^3/h Head : 55 m
UT-114	Diesel pump for RM	1	Type : Centrifugal, end suction Capacity : 400 m^3/h Head : 45 m Engine power : 100 HP
UT-115	Head tank for RM	1	Capacity : 70 m^3 Material : Reinforced concrete
UT-116	Chemical dosing units	1 lot	Corrosion inhibitor dosing unit Scale inhibitor dosing unit pH controller dosing unit

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-120	Direct Cooling Water System		
UT-121	Colling tower	1	Type : Cross flow and splash type Capacity : 590 m^3/h Filling : Polypropylene
UT-122	Cold well	1	Capacity : 450 m^3 Material : Reinforced concrete
UT-123	RM supply pump for DCW	1 + 1	Type : Centrifugal, end suction Capacity : 640 m^3/h Head : 45 m
UT-124	Sedimentation basin	1	Capacity : 1,000 m^3 Material : Reinforced concrete Accessories: Oil skimming equipment, Oil pump, Separated oil pit, etc.
UT-125	Sludge remover	2	Type : Moving submerged pump
UT-126	Sedimentation treated water basin	1	Capacity : 300 m^3 Material : Reinforced concrete Accessories : Air bubbling unit
UT-127	Filter feed pump	2 + 1	Type : Centrifugal, end suction Capacity : 330 m^3/h Head : 25 m
UT-128	Pressure filter	4	Type : Dual media type, vertical Size : 2,800 x 3,050 SH Vessel material : Carbon steel

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-129	Backwash pump	1 + 1	Type : Centrifugal, end suction Capacity : 540 m^3/h Head : 20 m
UT-130	Backwash blower	1 + 1	Type : Rotary blower Capacity : 7 Nm^3/min Pressure : 5,000 mmAq
UT-131	Sedimentation sludge pit	1	Capacity : 6 m^3 Material : Reinforced concrete
UT-132	Thickener	1	Type : Center shaft sludge scraper Capacity : 190 m^3
UT-133	Backwash water storage basin	1	Capacity : 200 m^3 Material : Reinforced concrete Accessories : Sludge scraper
UT-134	Backwash water transfer pump	1 + 1	Type : Slurry pump Capacity : 55 m^3/h Head : 10 m
UT-135	Coagulation tank	1	Capacity : 3.3 m^3 Material : Carbon steel Accessories : Agitator
UT-136	Constant head tank	1	Capacity : 100 lit Material : Carbon steel
UT-137	Sludge storage basin	1	Capacity : 30 m^3 Material :**Reinforced concrete** Accessories : Agitator

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-138	Sludge feed pump	1 + 1	Type : Slurry pump Capacity : 6 m^3/h Head : 30 m
UT-139	Sludge pump-I	1 + 1	Type : Submerged pump Capacity : 6 m^3/h Head : 6 m
UT-140	Sludge pump-II	1 + 1	Type : Slurry pump Capacity : 8 m^3/h Head : 9 m
UT-141	Sludge pump-III	1 + 1	Type : Slurry pump Capacity : 5 m^3/h Head : 27 m
UT-142	Chemical dosing units	1 lot	Flocculant dosing unit Polymer dosing unit pH controller dosing unit
UT-150	Auxiliary System		
UT-151	Piping with accessories	1 lot	
UT-152	Instrumentation	1 lot	
UT-153	Electrical equipment	1 lot	

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-154	Modification work for connecting points on existing system	1 lot	
UT-200	WATER TRATMENT STATION-V		
UT-210	Indirect Cooling Water System		
UT-211	Colling tower	1	Type : Cross flow and film type Capacity : 2,440 m^3/h Filling : Hard PVC
UT-212	Cold well	1	Capacity : 800 m^3 Material : Reinforced concrete
UT-213	Hot well	1	Capacity : 200 m^3 Material : Reinforced concrete
UT-214	S.M. supply pump - 1	2 + 1	Type : Centrifugal, end suction. Capacity : 990 m^3/h Head : 40 m
UT-215	S.M. supply pump - 2	1 + 1	Type : Centrifugal, end suction Capacity : 700 m^3/h Head : 40 m
UT-216	Hot water transfer pump	2 + 1	Type : Centrifugal, double suction Capacity : 1,080 m^3/h Head : 15 m

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-217	Chemical dosing units	1 lot	Corrosion inhibitor dosing unit Scale inhibitor dosing unit pH controller dosing unit
UT-220	Auxiliary System		
UT-221	Piping with accessories	1 lot	
UT-222	Instrumentation	1 lot	
UT-223	Electrical equipment	1 lot	
UT-224	Modification work for connecting points on existing system	1 lot	
UT-300	WATER TREATMENT STATION-VI		
UT-310	Indirect Cooling Water System		
UT-311	Colling tower	1	Type : Cross flow and film type Capacity : 230 m^3/h Number of cells : 1 Filling : Hard PVC

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-312	Cold well	1	Capacity : 150 m^3 Material : Reinforced concrete
UT-313	Cooling water supply pump	1 + 1	Type : Centrifugal, end suction Capacity : 250 m^3/h Head : 45 m
UT-314	Chemical dosing units	1 lot	Corrosion inhibitor dosing unit Scale inhibitor dosing unit pH controller dosing unit
UT-320	Auxiliary System		
UT-321	Piping with accessories	1 lot	
UT-322	Instrumentation	1 lot	
UT-323	Electrical equipment	1 lot	
UT-324	Modification work for connecting points on existing system	1 lot	
UT-400	OXYGEN SHOP		

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-401	Oxygen gas generating unit	3	Type : PSA method Capacity : 900 Nm^3/h Accessories : Air blowers, Vacuum pumps,Receiver tanks,Suction filters
UT-402	Oxygen compressor	3 + 1	Type : Reciprocating type Capacity : 900 Nm^3/h Discharge pressure : 10 $kgf/cm^2.G$
UT-403	High pressure oxygen compressor	1 + 1	Type : Reciprocating type Capacity : 950 Nm^3/h Discharge pressure : 30 $kgf/cm^2.G$
UT-404	High pressure oxygen holder	1	Type : Vertical type Capacity : 40 m^3 Storage pressure : 30 $kgf/cm^2.G$
UT-405	Overhead crane	1	Lifting weight : 3.5 t Span : 20 m
UT-410	**Auxiliary System**		
UT-411	Piping with accessories	1 lot	
UT-412	Instrumentation	1 lot	
UT-413	Electrical equipment	1 lot	

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-500	AIR COMPRESSION STATION		
UT-501	Air compressor unit	2	Type : Centrifugal type Capacity : 3,200 Nm^3/h Pressure : 7.0 $kgf/cm^2.G$
UT-502	Air receiver tank	1	Type : Vertical type Water capacity : 20 m^3 Storage pressure : 7.0 $kgf/cm^2.G$
UT-510	**Auxiliary System**		
UT-511	Piping with accessories	1 lot	
UT-512	Instrumentation	1 lot	
UT-513	Electrical equipment	1 lot	
UT-514	Modification work for connecting points on existing system	1 lot	
UT-600	OUTDOOR FIRE HYDRANTS		

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-601	Hydrant	3 sets	Type : Stand post type with inlet valve Accessories : Hose with nozzle and hose box
UT-602	Block valve	2	Type : 300A post indicator type Material : Ductile iron
UT-610	**Auxiliary System**		
UT-611	Piping with accessories	1 lot	
UT-612	Modification work for connecting points on existing system	1 lot	
UT-700	SEWAGE TREATMENT STATION AND DRAINAGE PUMPING STATION		
UT-701	Pump pit	2	Capacity : 4 m^3 Material : Reinforced concrete
UT-702	Rough screen	2	Type : Bar screen
UT-703	Basket	2	Type : Box type

Equipment List PLANT : UTILITY FACILITIES

NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-704	Sewage pump	4	Type : Submersible type Accessories : Quick discharge connector
UT-705	Pump lifting hanger	2	Type : Self-standing pipe
UT-710	**Auxiliary System**		
UT-711	Piping with accessories	1 lot	
UT-712	Instrumentation	1 lot	
UT-713	Electrical equipment	1 lot	
UT-800	YARD PIPING		
UT-801	Make-up water piping with accessories	1 lot	
UT-802	Portable water piping with accessories	1 lot	

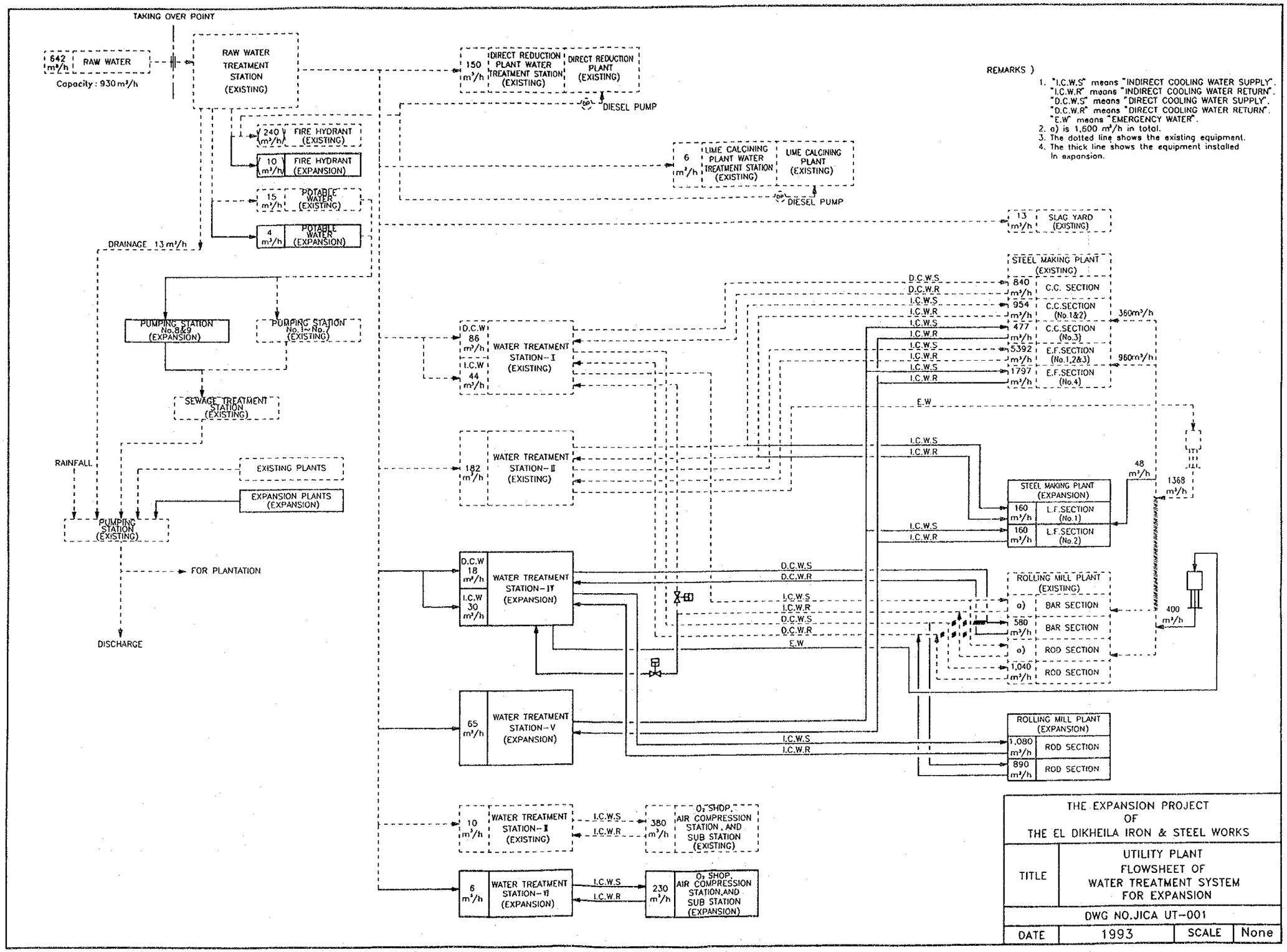
Equipment List PLANT : UTILITY FACILITIES

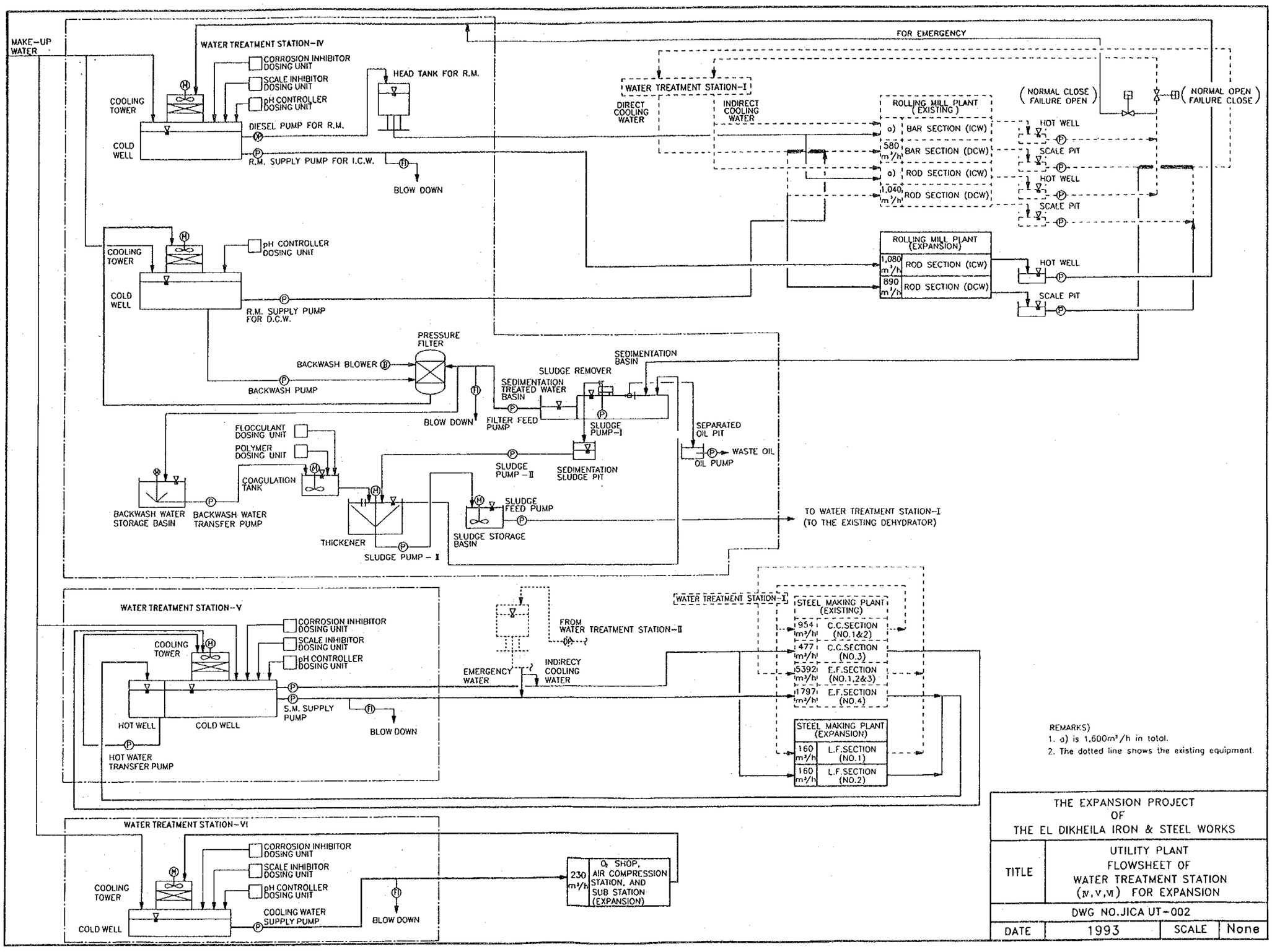
NO.	EQUIPMENTT	Q'TY	MAIN SPECIFICATION
UT-803	Direct cooling water piping with accessories	1 lot	
UT-804	Indirect cooling water piping with accessories	1 lot	
UT-805	Emergency water piping with accessories	1 lot	
UT-806	PSA oxygen gas piping with accessories	1 lot	
UT-807	Sewage water piping with accessories	1 lot	
UT-808	Natural gas piping with accessories	1 lot	
UT-809	Connection piping with accessories	1 lot	
UT-810	Structures (Rack and Stanchion)	1 lot	

Table 6.4.4-4. Personnel of Utility Facilities

	Existing						For the expansion						After the expansion					
	SM	ASM	E	F	AF	W	SM	ASM	E	F	AF	W	SM	ASM	E	F	AF	W
Utility facilities	1	1											1	1				
Water			2	1	4	28						12			2	1	4	40
Gas			1	1	4	16					4	8			1	1	8	24
Maintenance			1	1	1	10					1	4			1	1	2	14
Subtotal	1	1	4	3	9	54					5	24	1	1	4	3	14	78
Total	72						29						101					

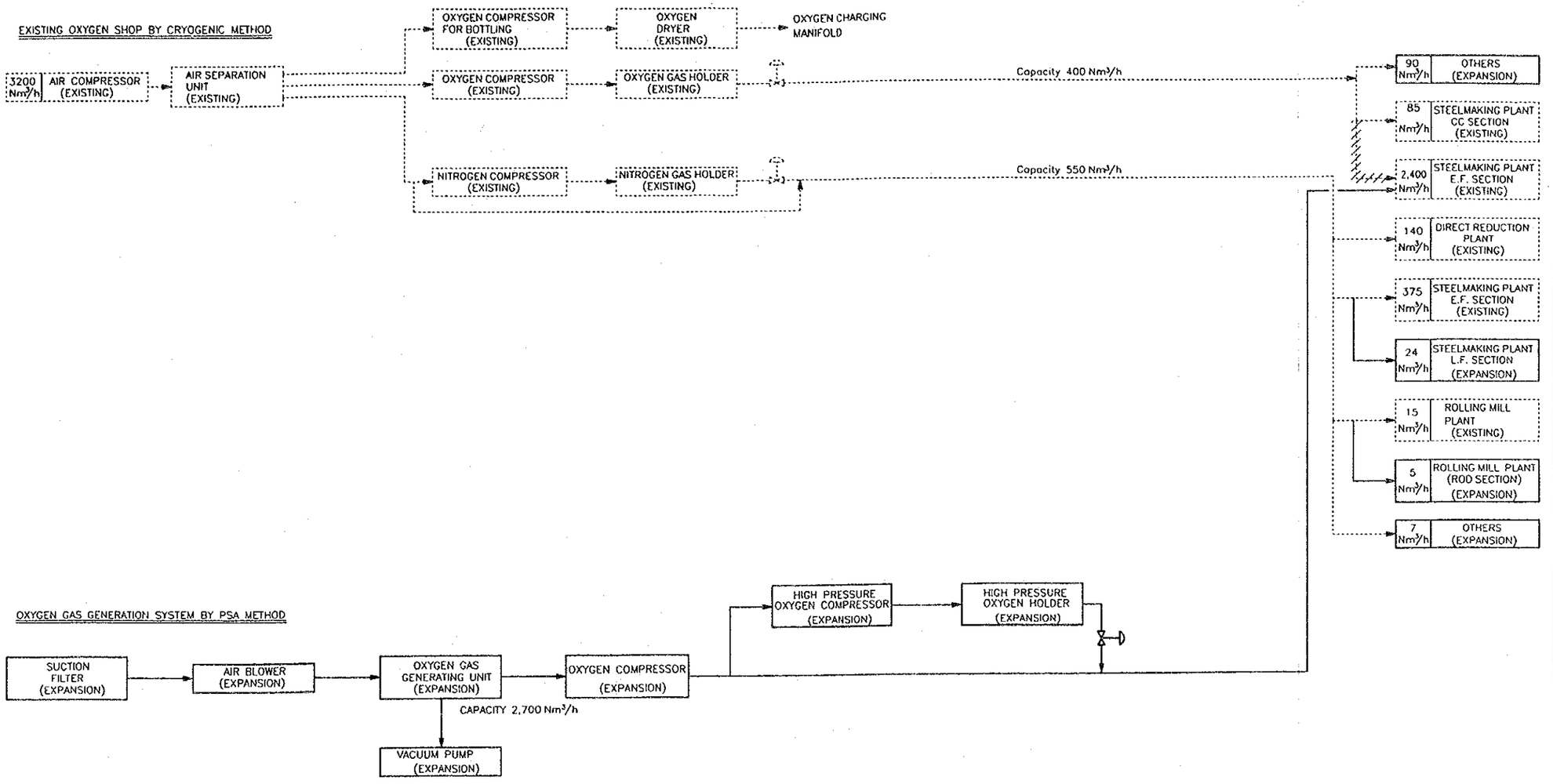
SM : Section manager
ASM : Assistant section manager
E : Engineer
F : Foreman
AF : Assistant foreman
W : Worker


TAKING OVER POINT
642 m³/h RAW WATER
Capacity : 930 m³/h
RAW WATER TREATMENT STATION (EXISTING)
150 m³/h DIRECT REDUCTION PLANT WATER TREATMENT STATION (EXISTING)
DIRECT REDUCTION PLANT (EXISTING)
DIESEL PUMP
240 m³/h FIRE HYDRANT (EXISTING)
10 m³/h FIRE HYDRANT (EXPANSION)
15 m³/h POTABLE WATER (EXISTING)
4 m³/h POTABLE WATER (EXPANSION)
6 m³/h LIME CALCINING PLANT WATER TREATMENT STATION (EXISTING)
LIME CALCINING PLANT (EXISTING)
DIESEL PUMP
DRAINAGE 13 m³/h
13 m³/h SLAG YARD (EXISTING)
PUMPING STATION No.8&9 (EXPANSION)
PUMPING STATION No.1~No.7 (EXISTING)
SEWAGE TREATMENT STATION (EXISTING)
RAINFALL
EXISTING PLANTS
EXPANSION PLANTS (EXPANSION)
PUMPING STATION (EXISTING)
FOR PLANTATION
DISCHARGE
D.C.W 86 m³/h
I.C.W 44 m³/h
WATER TREATMENT STATION-I (EXISTING)
182 m³/h WATER TREATMENT STATION-II (EXISTING)
D.C.W 18 m³/h
I.C.W 30 m³/h
WATER TREATMENT STATION-IV (EXPANSION)
65 m³/h WATER TREATMENT STATION-V (EXPANSION)
10 m³/h WATER TREATMENT STATION-III (EXISTING)
6 m³/h WATER TREATMENT STATION-VI (EXPANSION)
D.C.W.S
D.C.W.R
I.C.W.S
I.C.W.R
E.W
STEEL MAKING PLANT (EXISTING)
840 m³/h C.C. SECTION
954 m³/h C.C.SECTION (No.1&2)
477 m³/h C.C.SECTION (No.3)
5392 m³/h E.F.SECTION (No.1,2&3)
1797 m³/h E.F.SECTION (No.4)
360m³/h
960m³/h
STEEL MAKING PLANT (EXPANSION)
160 m³/h L.F.SECTION (No.1)
160 m³/h L.F.SECTION (No.2)
48 m³/h
1368 m³/h
ROLLING MILL PLANT (EXISTING)
a) BAR SECTION
580 m³/h BAR SECTION
a) ROD SECTION
1,040 m³/h ROD SECTION
400 m³/h
ROLLING MILL PLANT (EXPANSION)
1,080 m³/h ROD SECTION
890 m³/h ROD SECTION
380 m³/h O₂ SHOP, AIR COMPRESSION STATION, AND SUB STATION (EXISTING)
230 m³/h O₂ SHOP, AIR COMPRESSION STATION, AND SUB STATION (EXPANSION)
REMARKS)
1. "I.C.W.S" means "INDIRECT COOLING WATER SUPPLY". "I.C.W.R" means "INDIRECT COOLING WATER RETURN". "D.C.W.S" means "DIRECT COOLING WATER SUPPLY". "D.C.W.R" means "DIRECT COOLING WATER RETURN". "E.W" means "EMERGENCY WATER".
2. a) is 1,600 m³/h in total.
3. The dotted line shows the existing equipment.
4. The thick line shows the equipment installed in expansion.
THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS
TITLE
UTILITY PLANT FLOWSHEET OF WATER TREATMENT SYSTEM FOR EXPANSION
DWG NO.JICA UT-001
DATE 1993 SCALE None



REMARKS)
1. o) is 1,600m³/h in total.
2. The dotted line shows the existing equipment.

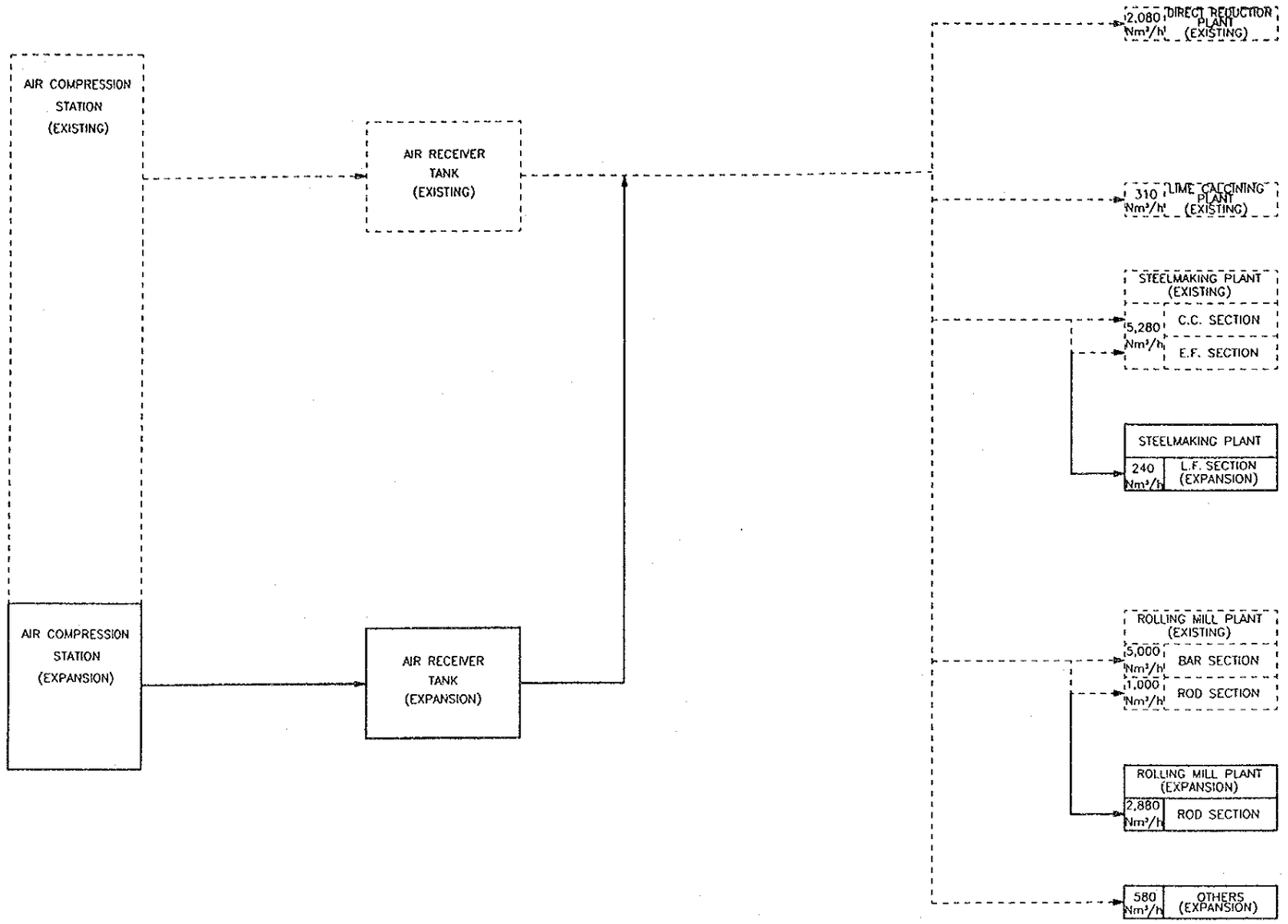
THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	UTILITY PLANT FLOWSHEET OF WATER TREATMENT STATION (IV,V,VI) FOR EXPANSION
DWG NO.JICA UT-002	
DATE 1993	SCALE None



REMARKS)

1. The dotted line shows the existing equipment.
2. The thick line shows the equipment installed in expansion.
3. An Oxygen compressor is equipped with a receiver tank.

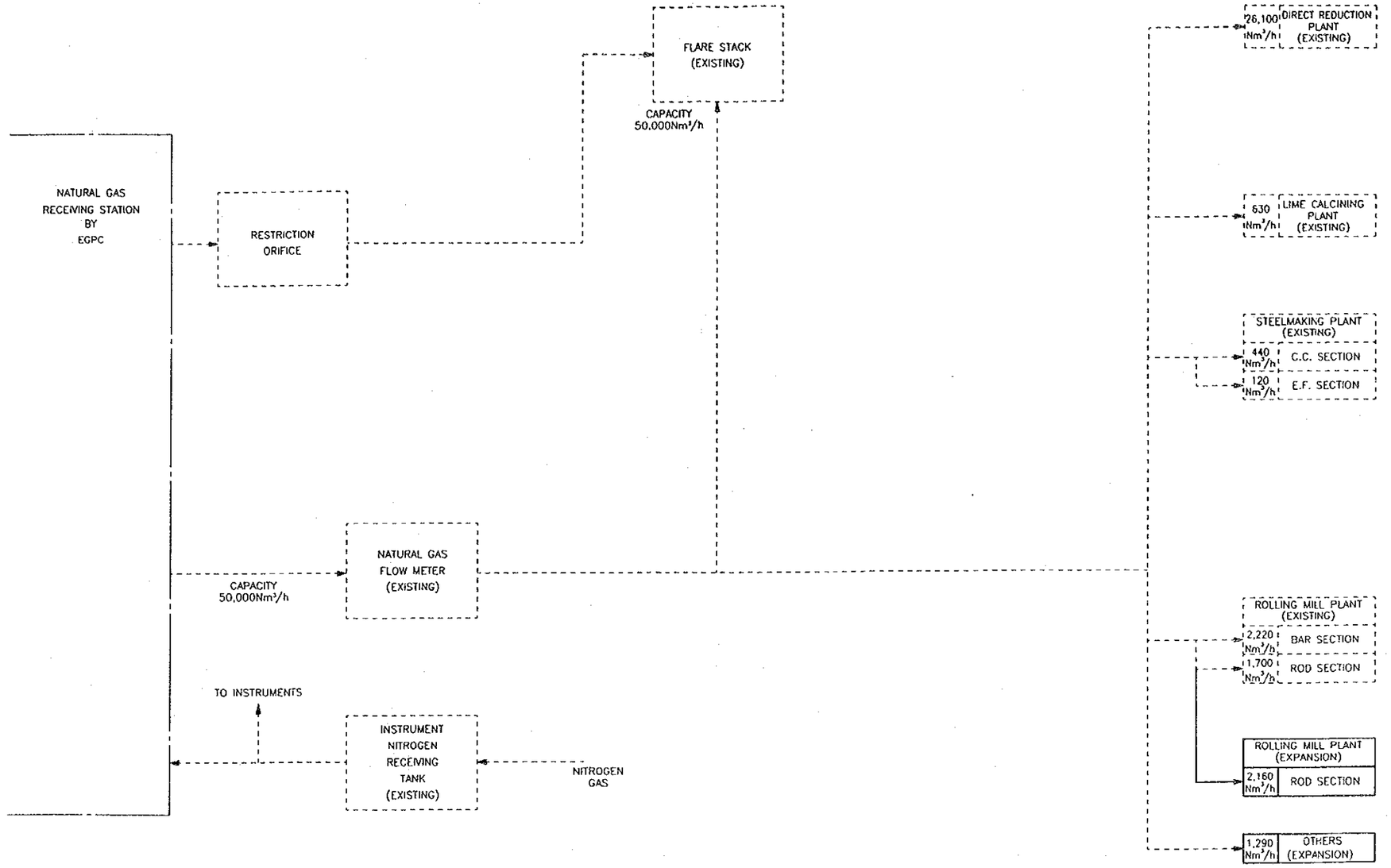
THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	UTILITY PLANT FLOWSHEET OF OXYGEN AND NITROGEN FOR EXPANSION
DWG NO.JICA UT-003	
DATE 1993	SCALE None



REMARKS)

1. The dotted line shows the existing equipment.
2. The thick line shows the equipment installed in expansion.

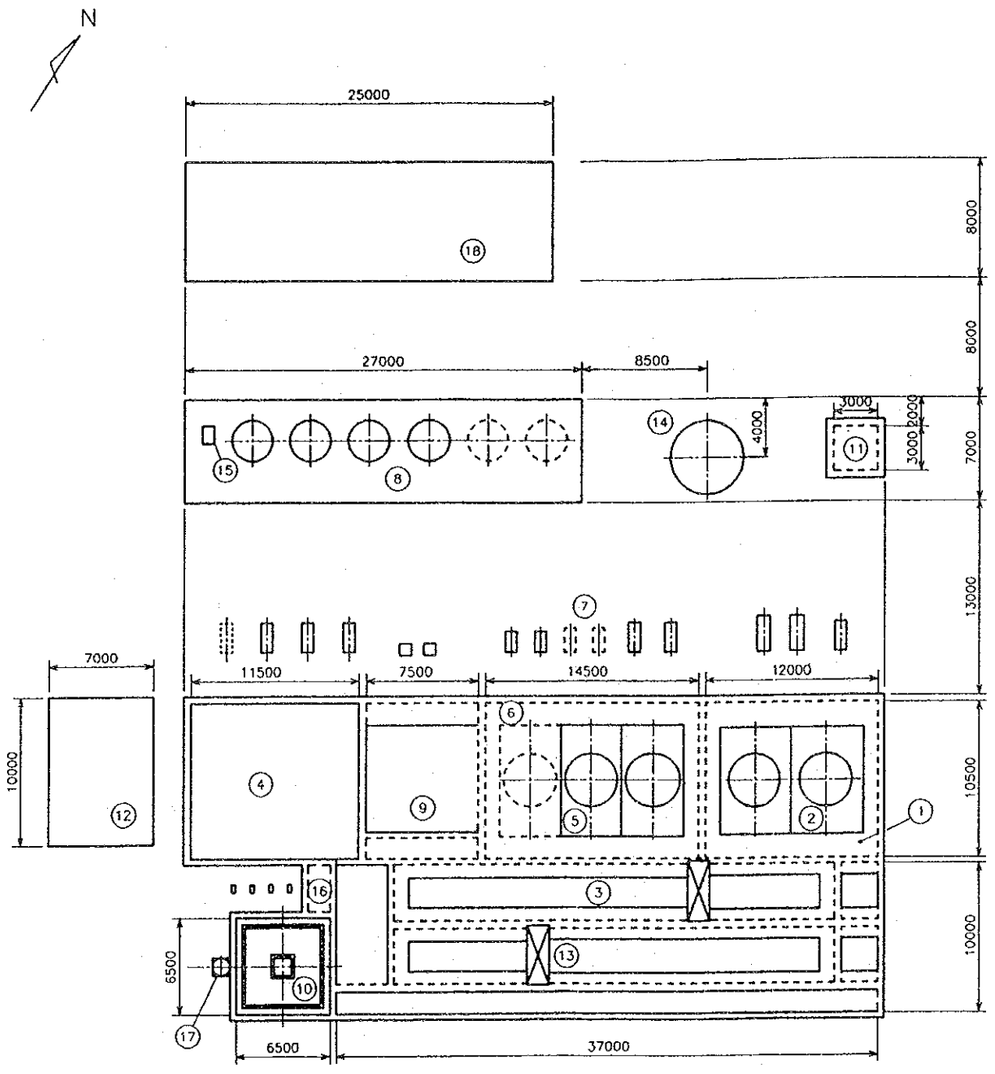
THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS			
TITLE	UTILITY PLANT FLOWSHEET OF COMPRESSED AIR FOR EXPANSION		
DWG NO.JICA UT-004			
DATE	1993	SCALE	None



REMARKS)

1. The dotted line shows the existing equipment.
2. The thick line shows the equipment installed in expansion.

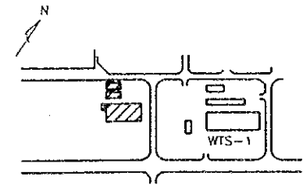
THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS			
TITLE	UTILITY PLANT FLOWSHEET OF NATURAL GAS FOR EXPANSION		
DWG NO.JICA UT-005			
DATE	1993	SCALE	None



1. COLD WELL (INDIRECT COOLING WATER)
2. COOLING TOWER (INDIRECT COOLING WATER)
3. SEDIMENTATION BASIN
4. SEDIMENTATION TREATED WATER BASIN
5. COOLING TOWER (DIRECT COOLING WATER)
6. COLD WELL (DIRECT COOLING WATER)
7. PUMPS
8. PRESSURE FILTER
9. BACKWASH WATER STORAGE BASIN
10. THICKENER
11. SLUDGE STORAGE BASIN
12. CHEMICAL HOUSE
13. SLUDGE REMOVER
14. HEAD TANK FOR R.M.
15. BACKWASH BLOWER
16. SEDIMENTATION SLUDGE PIT
17. COAGULATION TANK
18. CONTROL ROOM

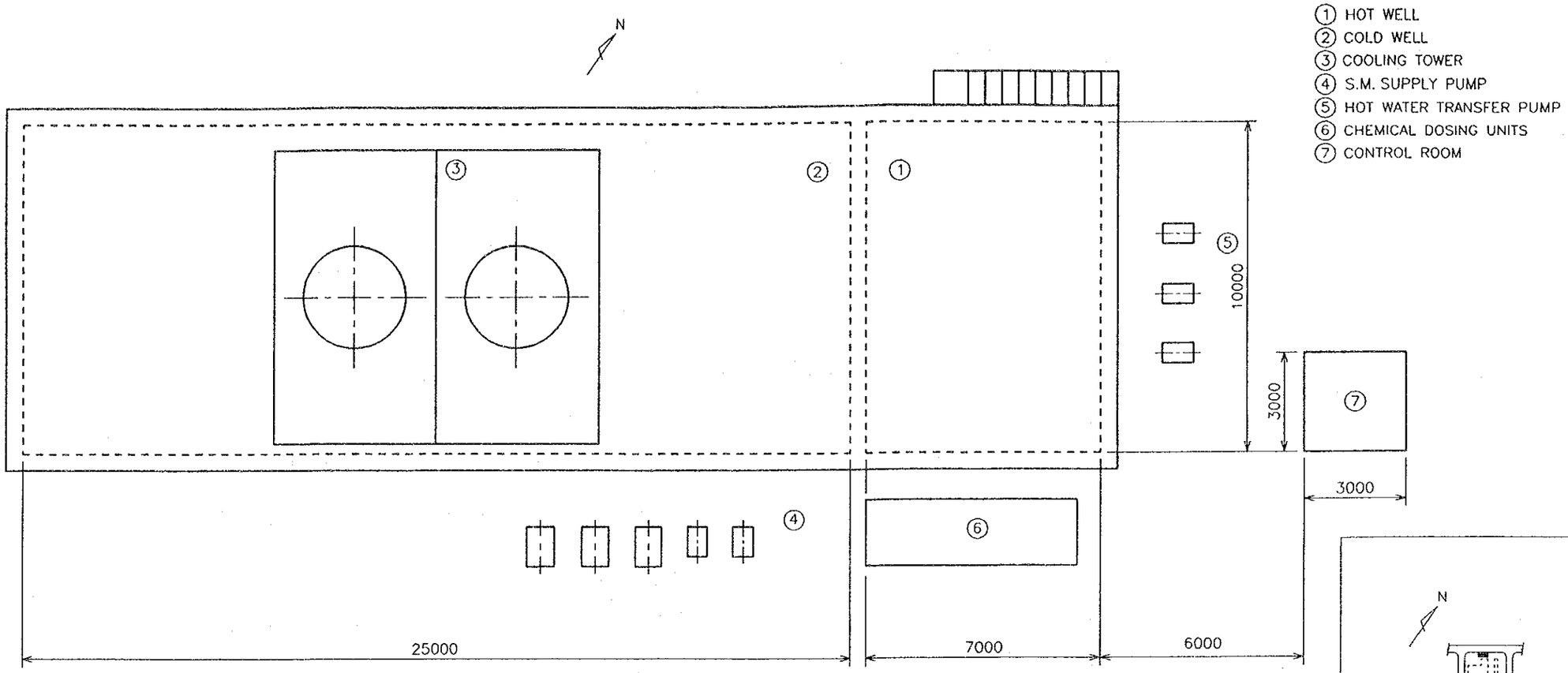
REMARKS)

Equipment drawn by dotted line will be installed in further expansion.



PLOT PLAN

THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS			
TITLE	UTILITY PLANT GENERAL LAYOUT OF WATER TREATMENT STATION-IV FOR EXPANSION		
DWG NO.JICA UT-006			
DATE	1993	SCALE	None



THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS			
TITLE	UTILITY PLANT GENERAL LAYOUT OF WATER TREATMENT STATION – V FOR EXPANSION		
DWG NO.JICA UT-007			
DATE	1993	SCALE	None

N

NEW OXYGEN SHOP

CHEMICAL DOSING UNITS

COOLING TOWER

COLD WELL

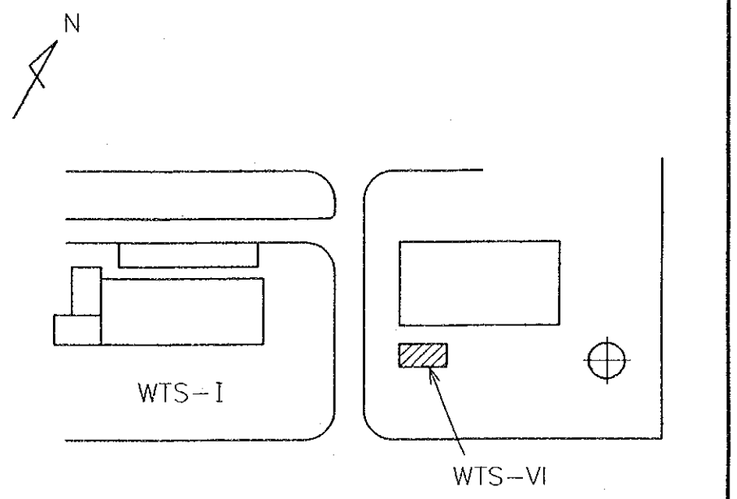
COOLING WATER
SUPPLY PUMP

4000

5000

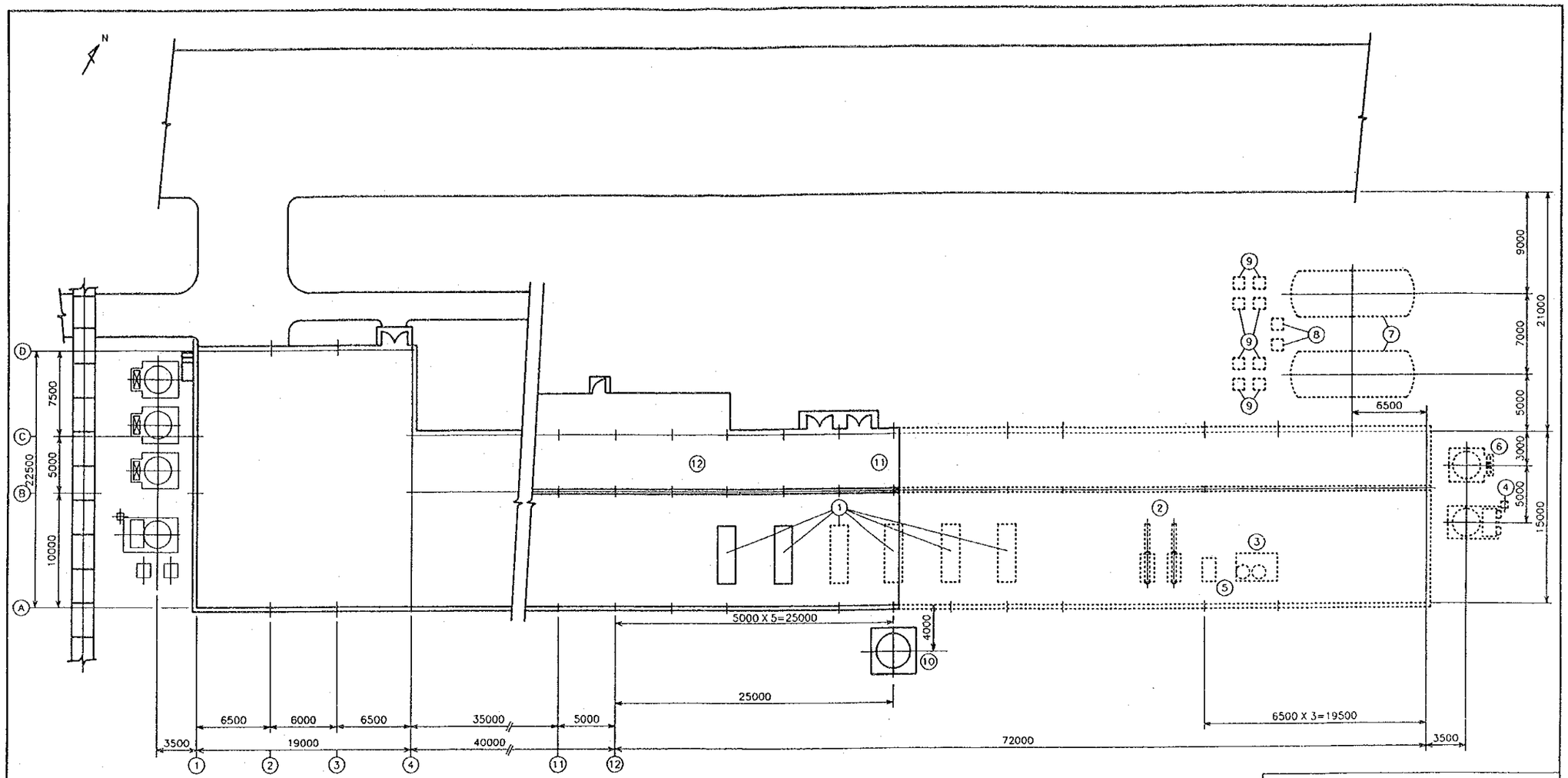
10000

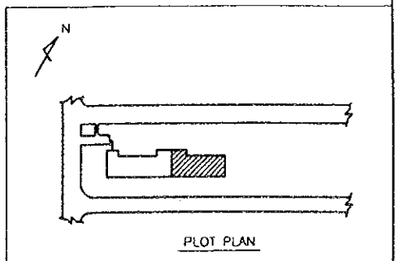
REMARKS)
Equipment drawn by dotted line will be installed in further expansion.



PLOT PLAN

THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	UTILITY PLANT GENERAL LAYOUT OF WATER TREATMENT STATION- VI FOR EXPANSION
DWG NO.JICA UT-008	
DATE 1993	SCALE None

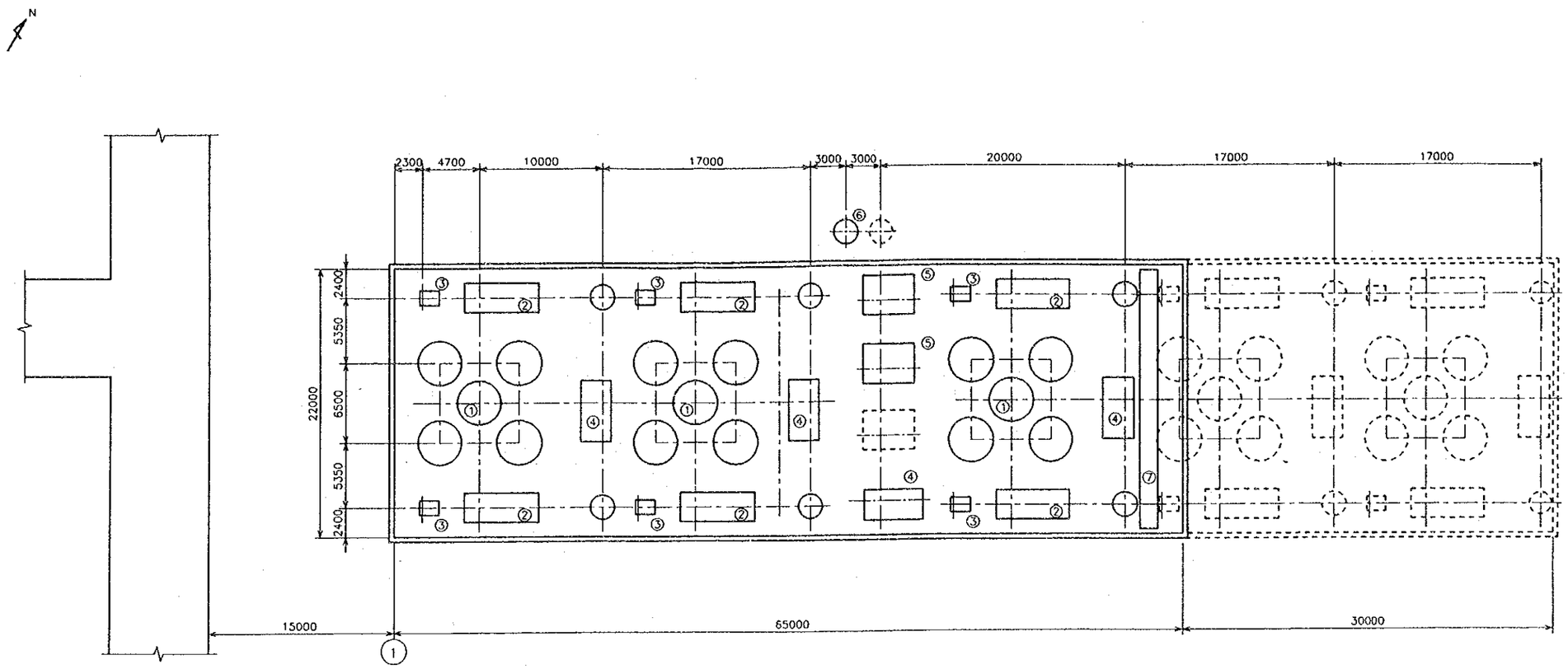




① AIR COMPRESSOR UNIT
② FREON REFRIGERATION UNIT
③ DESICCATION AND DECARBONATION UNIT
④ NITROGEN GENERATING UNIT
⑤ NITROGEN COMPRESSOR
⑥ NITROGEN GAS HOLDER
⑦ LIQUID NITROGEN STRAGE TANK
⑧ LIQUID NITROGEN PUMP
⑨ LIQUID NITROGEN VAPORIZER
⑩ AIR RECEIVER TANK
⑪ ELECTRIC ROOM
⑫ CONTROL ROOM

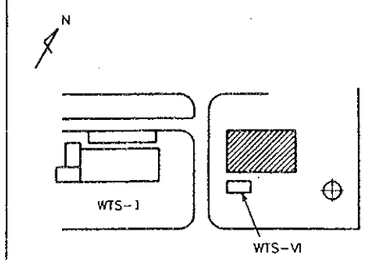
REMARKS)
Equipment drawn by dotted line will be installed in further expansion.

THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS			
TITLE	UTILITY PLANT GENERAL LAYOUT OF OXYGEN SHOP AND AIR COMPRESSION STATION FOR EXPANSION-- 1/2		
DWG NO. JICA UT-009			
DATE	1993	SCALE	None



① OXYGEN GAS GENERATING UNIT
② VACUUM PUMP
③ AIR BLOWER
④ OXYGEN COMPRESSOR
⑤ HIGH PRESSURE OXYGEN COMPRESSOR
⑥ HIGH PRESSURE OXYGEN HOLDER
⑦ OVERHEAD CRANE

REMARKS)
Equipment drawn by dotted line
will be installed in further exponsion.



PLOT PLAN

THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	UTILITY PLANT GENERAL LAYOUT OF OXYGEN SHOP AND AIR COMPRESSION STATION FOR EXPANSION-2/2
DWG NO.JICA UT-010	
DATE 1993	SCALE None

6.4.5. Power receiving and substation facilities

1) Outline

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

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

Communication system
Load lighting
Ancillary facilities

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

a) Construction of new SMP consisting of two 70-ton LF (ladle furnace)

b) Addition of one strand in Rod Mill plant

c) Construction of new Water Treatment Station IV for SMP and Rod.

d) Construction of new oxygen shop and air compression station

e) Expansion of warehouse and product dispatching yard

Most of the existing facilities in the substaion scope have been designed, provided and installed in anticipation of their expansion related to the above-mentioned plant expansions.

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

Some minor expansion and modification, however, will be necessary for the rest of the substation items as foreseen in the previous project.

2) Distribution scheme

a) Power demand for production

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

The power demand requires the present network of distribution to be expanded as shown in heavy line on single line diagram DWG-PW002.

The expansion plan features:

(1) 3 new 33 kV lines for new NO.1 LF, No.2 LF and Rod Mill (One line for each load)

(2) Rolling mill (referring to the combination of Bar Mill and Rod Mill) will be equipped with an additional 33 kV/6.6 kV receiving transformer. This third transformer is for back-up purpose

in case one of two 3 kV/6.6 kV working transformers gets out of order.

(3) 4 new 6.6 kV lines for new WTS IV and new oxygen shop (dual lines per station)

b) Emergency power

Expansion results in increase of emergency loads as well as normal production loads. Estimate of additional emergency power is shown in Table 6.4.5-2. Total of required emergency power for the portion of expansion amounts to about 345 kW, which will be accommodated by the present emergency generators.

3) Design basis

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

Fundamental requirements include:

a) Power distribution

(1) Receiving voltage conditions

(a) Receiving voltage: 220 kV, 2 phase, 50 Hz directly grounded
(b) Fluctuation : 220kV ± 10%
550Hz ± 2% normally
(c) Short circuit capacity of 220 kV system

Max. 15,000MVA (40kA at 220kV)
Min. 4,000MVA (10kA at 220kV)

(2) Distribution design data

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

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

(3) Insulation level

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

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

(5) Circumstances

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

b) Communication system

(1) In-works telephone
Handsets of a given type to be used
(2) Public address
Speakers of a given type to be used
(3) Power telephone
Subscriber stations of a given type to be used
(4) Fire alarm
Modification of indication board
(5) Clock distribution
Clock of a given type to be used

Note: Given type refers to that of the existing equipment.

c) Road lighting

(1) Area to be illuminated
Main road passing the area in the scope of works'expansion, and some part of perimeter roads of new plants
(2) Lighting arrangement
Lighting fixtures to be located every 50 m along one side of the load

d) Ancillary facilities

(1) Scope
Warehouse and product dispatching yard
(2) Power supply
Lighting fixtures, power tools, cranes to be fed through 380V or 220V system

e) Data logging system

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

(1) To relieve operators of trouble for gathering readings on meters and other data.

(2) To quickly obtain accurate data.

4) Location and cabling plan

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

a) Feeding switchgear (see layout drawing DWG-PW-001)

(1) 33 kV feeders for 33 kV lines of ROD No.2, NO. 1 LF and No. 2 LF.

Existing 33 kV metal-clad switchgear panel will be extended over the future space.

(2) However spare parts, etc. are placed here at present. Therefore, the equipment room will be extended to ensure the storage space for spare parts and the testing area for the circuit breakers and relays.

(3) 6.6kV feeders for 6.6kV lines of new WTS IV 1 and 2, and new 2 OXYGEN 1 and 2.

Existing 6.6kV metal-clad switchgear panel will be extended over the future space.

b) Cabling route:

(1) ROD No.2 33kV line
To run in parallel with ROD No. 1 33kV line through the existing cable tunnel

(2) No.1 LF and No.2 LF 33kV lines
New cable will be laid in the cable tray supported by the building structure around south end of the SMP main building, branching from the existing cable tunnel (No. 1 LF). Another cable will be laid in the cable tray supported by the building structure similarly after crossing the future main building area by the new cable tunnel, extending from the existing cable tunnel(NO.2 LF).

(3) New WTS Ⅳ 1 and 2 6.6kV lines and emergency line
New WTS IV will be situated about 100 meters west of the present WTS I. They will be taken through the same route as the existing cables for the existing station up to there. Then they will be passed through a burried route up to the new station.

(4) New 2 oxygen 1 and 2 6.6kV lines
New cables will be laid underground along the existing cables to oxygen shop from the main substation.

5) Equipment list

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

Table 6.4.5-1 Electricity Balance after Expansion

Plant	Unit cons. kWh/t	Production x 10^3t/y	Operating Hr h/y	Average Power kW	Load Factor	Demand Power kW
DRI	110	776.4	7,680	11,100	0.9	12,400
Lime Calcining	60	64.9	7,680	500	0.9	600
SMP (EAF,CC)	578	1,545.6	7,680	116,300	0.7	166,200
BAR	60.9	559.9	6,398	5,300	0.7	7,600
ROD	100.8	938.4	6,700	14,100	0.9	20,200
Utilities and services			7,680	10,300	0.9	11,400
Total				157,600		218,400

The given diversity factor of total load to demand factor is 1.1, and works overall demand is
218,400 kW / 1.1 = 198,500 kW

Table 6.4.5-2 Emergency Load Increase

Plant	Motor kW	Control kW	Lighting, etc. kW	Total kW
Direct reduction	0	0	0	0
Steelmaking	332	10	0	342
Rolling mill	—	15	10	25
Utilities	109	45	18	172
Total	441	70	28	539
Estimated actual loads				345

Table 6.4.5-3 Equipment List of Substation

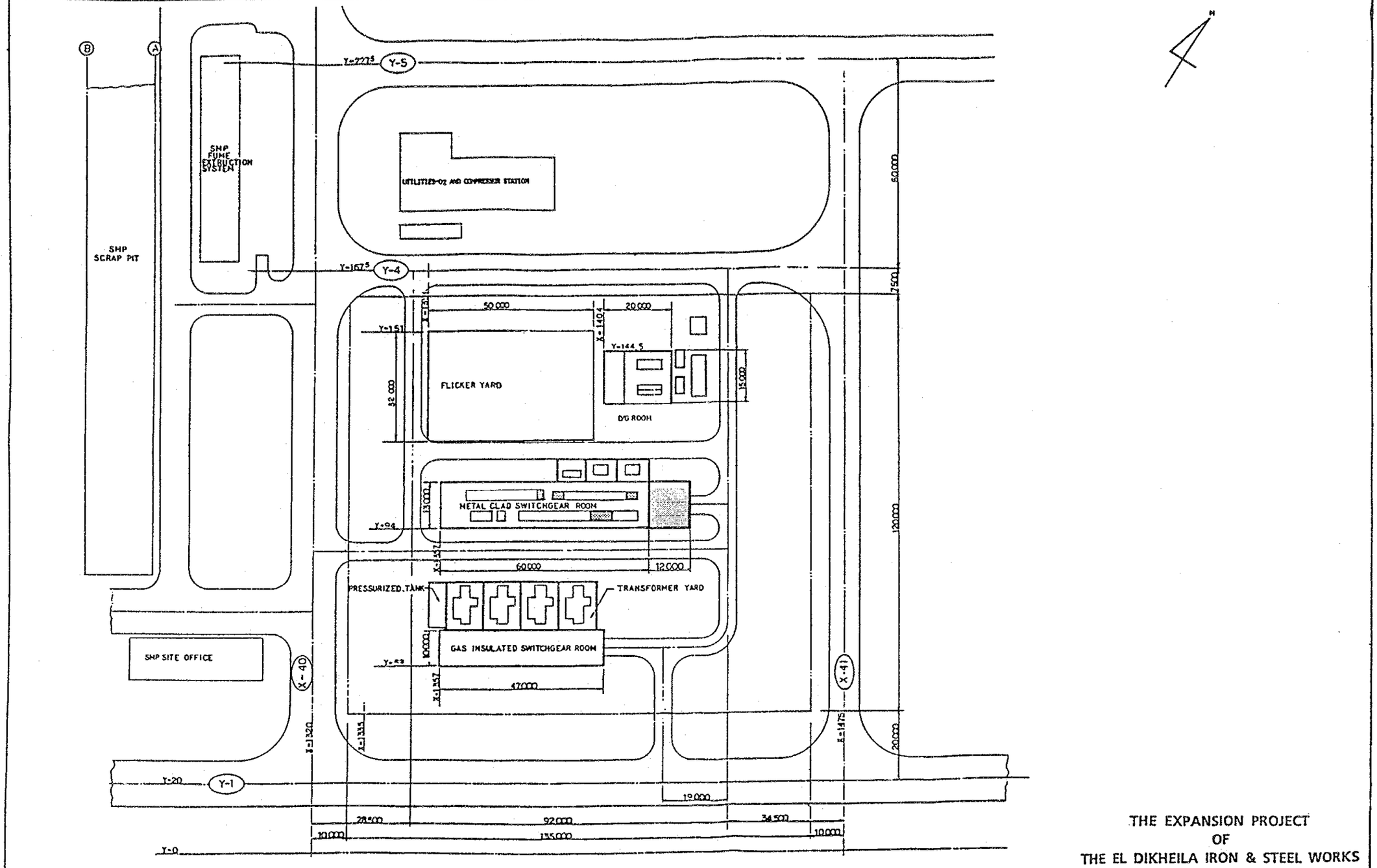
EQUIPMENT LIST			PLANT:Substation (1)	
No.	EQUIPMENT	Q'ty	MAIN SPECIFICATION	REMARKS
1	33kV Equipment			
	Feeder Panel	3	Metal clad switchgear Indoor type CB-36kV,1250A,25kA (1 sec.) 3 Feeders: 33kV No.1 BUS: -ROD No.2 33kV No.5 BUS: -No.1 LF, -No.2 LF	
2	6.6kV Equipment			
	Feeder Panel	4	Metal clad switchgear Indoor type CB-7.2kV,1250A,40kV 4 Feeders: 6.6kV No.1 BUS: -New Water treatment IV-1, -2 Oxygen-1 6.6kV No.2 BUS: -New Water treatment IV-2, -2 Oxygen-2	

Table 6.4.5-3 Equipment List of Substation

EQUIPMENT LIST		PLANT:Substation (2)		
No.	EQUIPMENT	Q'ty	MAIN SPECIFICATION	REMARKS
3	Data Logging System			
	Supervising Control and Data Acquisition System	1	Computer based control and monitoring system	
	Supervisory Control Panel	1	Addition of protection relays and control switches etc.	
4	Cable & Materials			
	Power Cable	1	33kV, 6.6kV, 400V Including: Cable head material and supporting material	

Table 6.4.5-3 Equipment List of Substation

EQUIPMENT LIST			PLANT:Substation (3)	
No.	EQUIPMENT	Q'ty	MAIN SPECIFICATION	REMARKS
	Control Cable	1		
	Grounding Wire and Material	1		
	Steel and Other Material	1		
5	Communication Systems			
	In-works Telephone	1	Addition of terminal stations	less than 10% to 15%
	Public Address	1	- do -	- do -
	Power Telephone	1	- do -	- do -
	Fire Alarm	1	- do -	- do -
	Clock Distribution	1	Addition	
6	Road Lighting			
	Lighting apparatus and wiring	1	For part of expansion	
7	Ancillary Facilities	1	Including:	
	Electrical Equipment for Warehouse II		Distribution, lighting, crane power feeding and fire alarm system.	
8	Spare Parts	1	Covering items 1 to 6 above.	



NOTE: STAGE II

THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL WORKS

TITLE LAYOUT OF SUBSTATION

DWG NO. JICA-PW-001
DATE Jun. 1993 SCALE N.A.

; EXPANSION

SUPPLY OF POE DIST.CR.

ROD II

DR PLANT

ROLLING MILL

24 MVA

WATER TREATMENT I

WATER TREATMENT II

WATER TREATMENT IV

2 OXYGEN

STEEL MAKING PLANT

70T LADLE FURNACE

THE EXPANSION PROJECT
OF
THE EL DIKHEILA IRON & STEEL WORKS

TITLE SINGLE LINE DIAGRAM
- EXPANSION -

DWG NO. JICA-PW-002

DATE Jun. 1993

6.4.6. Maintenance facilities

1) Facilities

In CHAPTER 5, facilities of maintenance shop of El Dikheila Works and its maintenance system are discussed. By utilizing those facilities and system in full, maintenance work required after the expansion can be performed smoothly with some reinforcement which eliminates the bottlenecks. Outline of the equipment to be reinforced is described below, and a list of the equipment is shown in Table 6.4.6-1, also Fig. 6.4.6-1 and Fig. 6.4.6-2 show new maintenance shops and a layout of the equipment, respectively.

a) Mechanical

(1) Existing maintenance shop does not have sufficient space to perform scheduled repairs of spare parts and units taken apart from lines. Therefore, new maintenance shop will be built for assembling and/or disassembling of spare parts and units. The building will be located on the south of the fabrication shop, and two 10-ton overhead travelling cranes and necessary machine tools for repairs will be installed.

(2) Machine tools which work at high operation rate and necessary ones for manufacturing spare parts in the Works will be provided.

(3) Purchase of measuring instruments
For checking of spares and units which are maintained in the new shop, and for inspection of purchased spares, some measuring instruments will be purchased.

b) Electrical

(1) A new maintenance shop for electrical maintenance work such as management of electrical spare parts and repair of air-conditioning and communication facilities will be built on the south of existing repair shop. The new building (28m×15m) will be equipped with a five-ton hoist.

(2) A set of special tools for maintenance of air conditioning will be provided.

(3) One forklift for cable drum handling will be provided.

2) Personnel plan

The expansion project under study consists mainly of new construction of two LFs in SMP, one strand for Rod mill in RMP and utility plants required in relation with those facilities. Increase of maintenance personnel is planned by taking those plants into consideration as shown in Table 6.4.6-2.

Table 6.4.6-1 Maintenance Shop Equipment List (1/2)

No.	Equipment	Q'ty	Main Specification	Note
MS-100	Building and crane			
-101	Building for mechanical repair	1	20m x 30 m = 600 m2 For overhaul & assembling	
-102	QH-service crane for the above MS-101	2	Capacity 10 t	
-103	Building for electrical repair	1	28 m x 15 m = 420 m2 For electrical spare parts and air-con, communication system repair	
MS-200	Equipment for mechanical repair			
-201	Lathe (1 M)	1	Swing over bed: 460 mm Center distance: 1,000 mm Main motor: 3.7 kW	
-202	Lathe (2.5 M)	1	Swing over bed: 560 mm Center distance: 2,500 mm Main motor: 7.5 kW	
-203	Universal milling machine	1	Table working surface: 1,370 mm x 310 mm Main motor: 5.5 kW	

Table 6.4.6-1 Maintenance Shop Equipment List (2/2)

No.	Equipment	Q'ty	Main Specification	Note
MS-204	Slotting machine	1	Ram stroke: 310mm, Table dia.: 550 mm dia.	
-205	Small boring machine	1	Main motor: 3.7 kW Spindle diameter: 100mm Head stock vertical travel:1000 mm Table cross traverse: 1,400 mm Table logitudinal travel: 800mm	
-206	Internal grinding machine	1	Internal diameter:6 mm~200 mm Grinding stoke: 200 mm Max. table stroke: 500 mm	
-207	Surface plate	1	300 mm × 1,500 mm × 2,000 mm	
-208	Measuring tool	1	Inspection for purchased spare parts	
MS-300	Equipment for electrical repair	lot		
-301	Fork lift car	1	Capacity: 3 t	
-302	Special tools for air-conditioning equipment	1 lot	Gas welder kit Cleaner for air-con equipment Vacuum pump Others	
-303	5t hoist for new E/M shop	1	Capacity: 5 t Hoist motor: 5 kW	

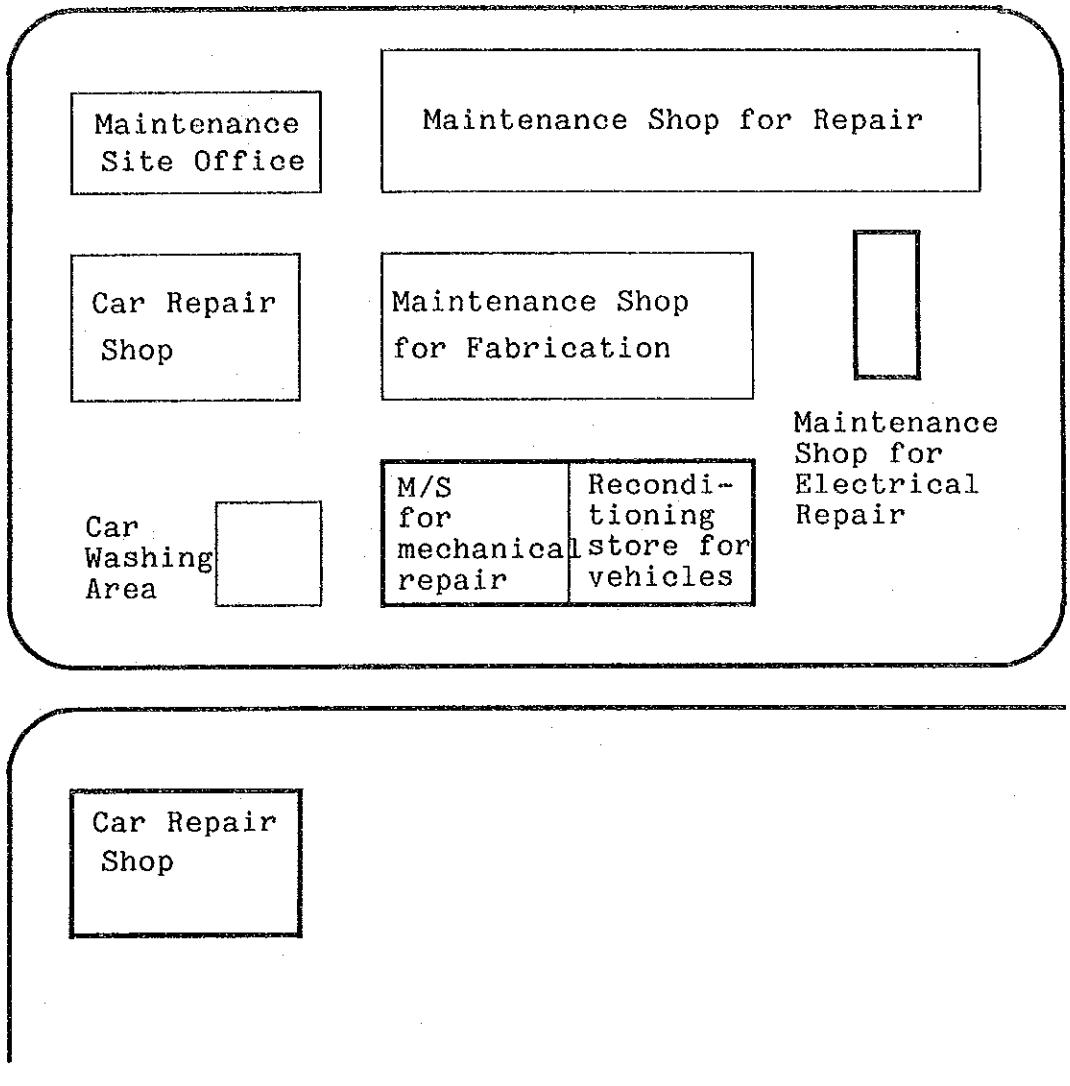


Fig. 6.4.6-1 General Layout of the Maintenance Shop Building

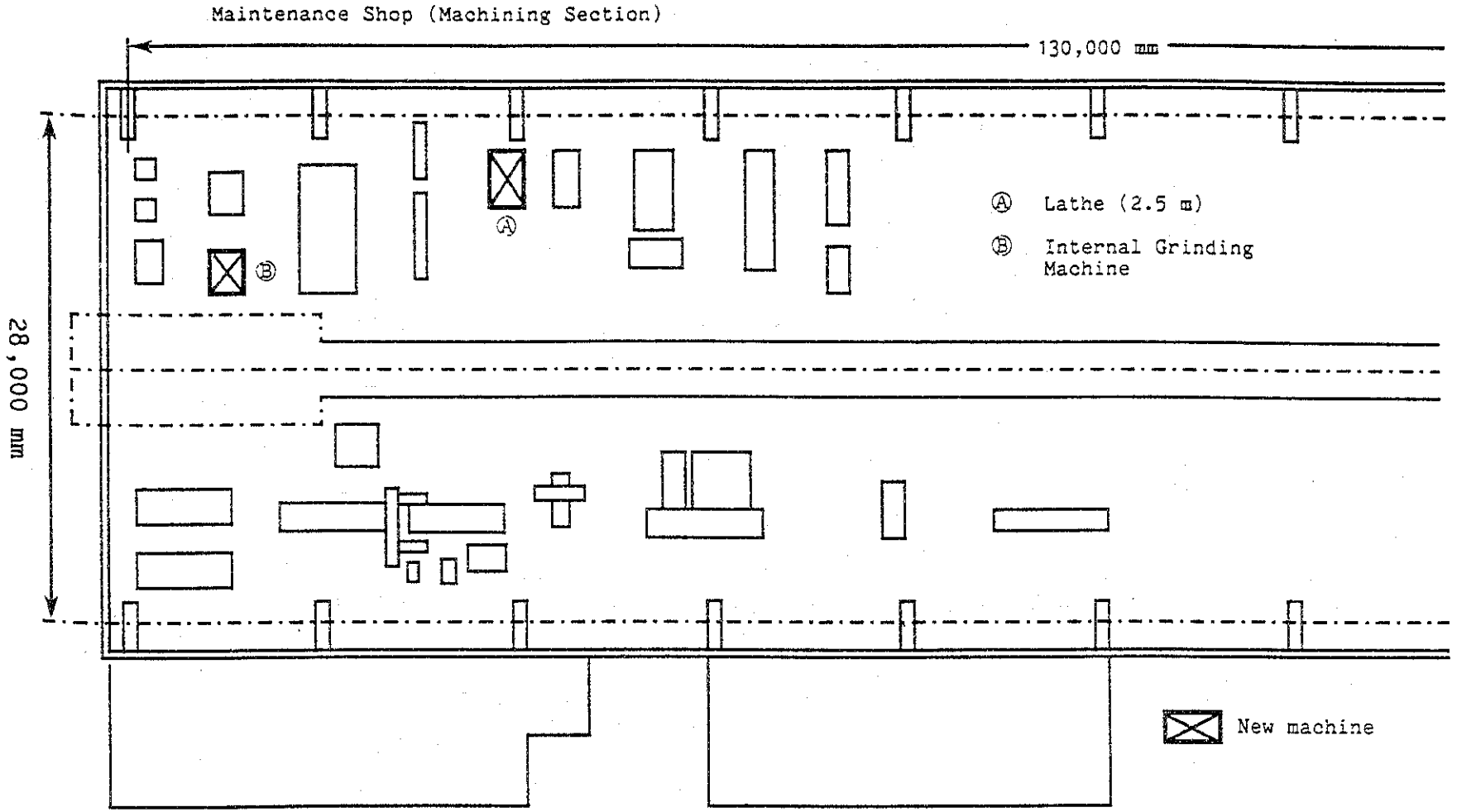


Fig. 6.4.6-2 (1/2) Layout of New Machine

Maintenance Shop (New overhaul and assembling section)

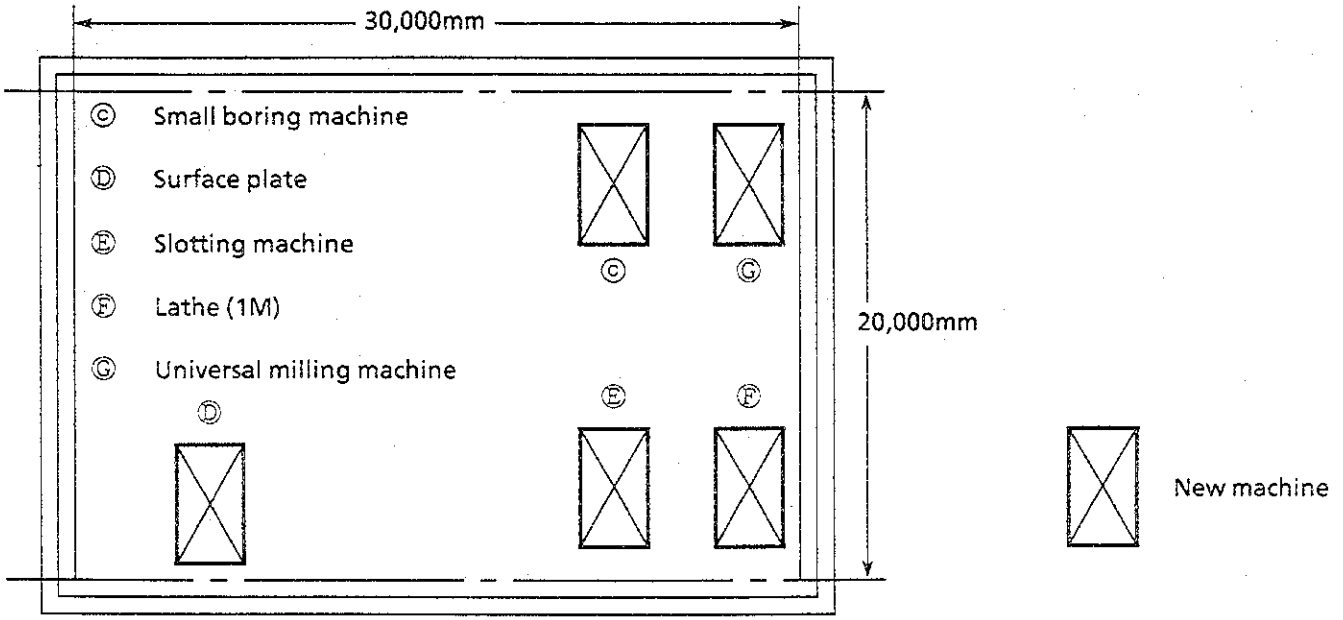


Fig. 6.4.6-2 (2/2) Layout of New Machine

Table 6.4.6-2 Personnel Plan of Maintenance

Section / Branch Work Grop	After expansion				
	ASM	E	F	AF	W
Coordination					
Planning	3	12		1	2
Mechnical					
DRP	1	2	1	5	15
SMP	1	3	1	15	52
RMP	2	4	2	10	34
Repair	1	9	4	34	166
Electrical					
DRP	1	2	1	5	16
SMP	1	3	1	6	33
RMP	1	4	1	6	36
PW	1	2	1	6	18
Instrum.	1	4	1	5	27
Repair	1	3	3	10	46

6.4.7. In-works transportation facilities

1) Outline

a) Basic concept of the expansion project

In 1992, ANSKD produced 1.035 million tons of rebar, and the handling amount such as raw materials, by-products and products was more than four times as much as that. Section in charge of in-works transportation greatly assisted this sharp production increase through the material handling. Materials to be handled and transported within the Works vary greatly in kinds as well as in shape and volume.
Facilities vary in kind or handling quantity of materials, and also working condition varies between facilities.
In the expansion project, facilities of In-works transportation will be expanded in proportion to the production increase, and the actual working ratio of vehicles managed by ANSDK will be referred to.
Table 6.4.7-1 shows working hour and working rate of vehicles per unit.

b) Volume of materials to be handled

Table 6.4.7-2 shows the actual amount of main materials to be handled in the Works in 1992. Although the amount of each material is proportional to production, the ratio of handling quantity between after and before expansion is corrected by the unit consumption revised when it is different between after and before expansion. The rate in the table is a rate of handling amount (t/y) between after and before expansion.

2) Expansion plan

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

a) Transport vehicles and related equipment

The number of existing equipment and that of additional equipment required in the expansion are shown in Table 6.4.7-3.

b) Scrap yard

As existing scrap yard will not be sufficient for a large quantity of purchased scrap, re-arrangement of the existing yard (30,000m^2) and a new scrap yard with space of 14,400m^2 which is located on the north side of slag yard will be provided.

c) Indoor warehouse

With the increase of materials, a new warehouse and expansion of the existing warehouses are planned as mentioned below.

(1) Warehouse for brick

A new warehouse with space 3,450m^2 will be built on the north side of the existing warehouse for brick.

(2) Warehouse for spare parts

To cope with the increase of spare parts of equipment and to be convenient for the inventory control, space of 1,600m^2 will be reserved in the brick warehouse with partition.

(3) Warehouse for additives

As the space for additives will be shortage, the warehouse will be expanded 3m in width and 10m on east side.

d) Products yard

In line with increase of production, about 20,000m^2 of products yard (capacity about 17,000s ton of rods) will be constructed on the south side of Bar mill plant.

e) Slag yard

As increased quantity of slag will be generated, a slag yard having the same capacity as that of the existing one will be provided.

f) Truck weighing station

The existing equipment is adequate and no increase will be planned.

g) Vehicle repair shop

Considering the increase in the number of vehicles since the start-up of ANSDK and also the fact that repair of existing vehicles will be more frequent as they get old in years, a new vehicle repair shop will

be constructed. The scale and contents of the shop will be the same as those of existing one. After the expansion, 2 vehicles maintenance groups will be organized. One is in charge of existing car repair shop and another one is for the new car repair shop. Both groups will have 30 personnel including assistant foreman instead of 34 personnel of existing group.

h) Warehouse for vehicle spare parts

To cope with the increase of vehicles, a warehouse for vehicle spare parts will be built at the south of the existing parking area.

The equipment list is shown in Table 6.4.7-4.

3) Personnel plan for In-works transportation

Personnel plan for in-works transportation after the expansion is shown in Table 6.4.7-5.

Table 6.4.7-1 Working Hours and Rate of Transportation Facilities

NO.	Vehicle Type	Q'ty	Specification	Monthly Hours /Unit	Daily Hours/ Unit	Working Rate/ Unit
1	Forklift in auxiliary	2	3.5 ton	110	4.4	90 %
2	Forklift in brick	2	2.5 ton	24	1.0	20 %
3	Forklift for carrying	1	1.5 ton	19	0.76	15 %
4	Wheel loader	7	1.5 m3 bucket	208	8.3	56 %
5	Mini-wheel loader	1	0.2 m3 bucket	6.5	0.25	----
6	Crawler shovel	5	2 m3 class	66.85	2.7	55 %
7	Power breaker	2	1.2 m3 bucket class	108.3	3.6	73 %
8	Bulldozer	2	16 ton angledozer	85.9	3.4	69 %
9	Self-loading dump truck	4	45 ton slag pot	206	6.9	46 %
10	Dump truck (scrap)	11	14 ton scrap	231.2	9.2	187 %
11	Dump truck (slag)	12	14 ton tall gate door	112	4.5	92 %
12	Dump truck for silty wastes	5	14ton tall gate seal type vessel	132.2	5.3	108 %
13	Dump truck for oxide ferrous fines	4	14ton tall gate door type vessel	137	5.5	112 %
14	Small dump truck	1	4ton tall gate door	25.25	1.00	20 %
15	Flat deck truck crane	1	3.5 ton	80	3.2	65 %
16	Flat deck truck	7	15ton body length 8m	58.3	2.3	48 %
17	Vacuum dumper	1	4 ton	47	1.9	38 %
18	Water sprinking car	1	15 ton tank	106	4.2	85 %
19	Lorry for refueling	1	4ton hose length 20m	104	4.1	83 %
20	Double-cab truck	2	Capacity 6 persons	117	4.7	96 %
21	Crawler mounted crane	5	35 ton	313	10.4	212 %
22	Suzuki patrol jeep	1		88	3.5	71 %
23	Trailer	1	35 ton low-bed type	13	0.5	10 %
24	Dump truck with crane	1	4 ton	76	3	61 %

Table 6.4.7-2 Material Transported and the Quantity (1/2)

(Data in 1992)

NO.	MATERIAL	QUANTITY t/y	Unit t/BT-t	Rate EXP/ EXST
	DRP			
* 1	DRI (SEMI PRO & T.BIN)	89,372	0.078	1.0
* 2	CLUSTER	40,071	0.035	1.0
* 3	DRI DUST	12,079	0.010	1.0
* 4	REMET (SEMI PRO.)	10,497	0.009	1.0
* 5	MID. OXIDE FINES	11,633	0.010	1.0
* 6	OXIDE FINE	2,779	0.002	1.0
7	DRI RECLAIMING	67,542	0.059	1.0
8	DRI (PILI. & TR. FER.)	225,738	0.196	1.0
9	REMET (PILING)	42,828	0.037	1.0
10	PILING O. FINES	34,948	0.030	1.0
11	PILLING AT H.B.I.	40,000	0.035	1.0
12	LUMP ORE (L. & P.)	13,126	0.011	1.0
*13	OXIDE FINES	34,948	0.030	1.0
*14	OXIDE THICKENER CAKE.	25,971	0.023	1.0
15	REMET SCREENING	92,155	0.080	1.0
16	OTHER AT DRP	107,702	0.094	1.0
	LCP			
*17	LIME STONE	66,648	0.058	1.35
*18	LIME STONE FINES	6,607	0.006	1.35
19	PILING LIME STONE	44,385	0.039	1.35
	BAR-ROD			
*20	COBBL CUT (BAR)	9,219	0.008	1.06
*21	SCRAP (BAR)	6,012	0.005	1.06
*22	SCALE (BAR) - WET.	7,196	0.006	1.06
*23	SCRAP (ROD)	10,293	0.009	1.72
*24	SCALE (ROD) - WET.	6,753	0.005	1.72
	PTD-PTCD			
25	ARRANGEMENT	20,000	0.017	1.35
26	LEVE. (BD) B. STORE	90,000	0.078	1.35
27	SCALE. (PTCD)	57,584	0.050	1.35
	MJ & OTHER			
28	AL. KABMI (PRO. & T. BIN)	438	0.000	1.00
29	H.B.I.	28,769	0.025	1.00
30	ARRANGE. AT YARD M.J.	7,446	0.006	1.00
31	CLEANING AT ANSDK	1,500	0.001	1.35
32	OTHER	196,171		1.35

Table 6.4.7-2 Material Transported and the Quantity (2/2)

(Data in 1992)

NO.	MATERIAL	QUANTITY t/y	Unit t/BT-t	Rate EXP/ EXST
	SMP			
33	PURCHASED SCRAP	240,035	0.208	2.32
34	FLUORSPAR	39	0.000	1.35
35	Fe-Mn	11,711	0.010	1.20
36	Fe-Si	4,783	0.004	1.22
37	COKE BREEZE	4,457	0.004	4.64
38	AI	99	0.000	1.35
39	FURNACE/LADLE-BRICK	15,033	0.013	1.24
40	GUNNING MATERIAL	8,416	0.007	1.17
41	ELECTRODE	4,718	0.004	1.39
42	HOT SLAG (EF)	160,580	0.139	1.35
43	HOT SLAG (LADLE)	51,106	0.044	1.35
44	FURNACE WASTE BRICKS	5,040	0.004	1.24
45	LADLE WASTE BRICKS	4,200	0.004	1.76
46	DUST (EF)	30,764	0.027	1.35
47	SCRAP (CC)	7,600	0.007	1.35
48	TUNDISH WASTE BRICKS	2,795	0.003	1.35
49	TUNDISH SLAG	3,374	0.003	1.35
50	SCALE (CC)	5,489	0.005	1.35
51	SCRAP (CONT. WITH SLAG)	25,628	0.022	1.35
52	SLAG COLD	163,384	0.142	1.35
53	SCRAP - SLAG	15,029	0.013	1.35
54	COBBLE CUT (BAR)	2,118	0.002	1.06
55	METTL (CC)	1,043	0.001	1.35
56	INGOT (CC)	805	0.001	1.35
57	BRIQUETTE	21,753	0.019	1.00
58	PRO. FINES	7,367	0.006	1.00
59	H.B.I.	134,139	0.116	1.03
60	UNLOADING SCRAP	60,293	0.052	2.32
61	SLAG EAF (TR POTS)	14,568	0.013	1.35
63	DOLOMITE	0	0.000	1.35
64	ARRANGEMENT AT SLAG	623,372	0.368	1.35
65	PILING SCALE	19,438	0.017	1.35
66	PILING AT C.S.Y.	15,000	0.013	2.32
67	LOADING H.B.I.	134,139	0.116	1.03
68	LOADING SCRAP	240,035	0.208	2.32
69	PILING AT O.S.Y.	116,232	0.101	2.32
70	LOADING DRY & BRI & CLS.	123,056	0.107	1.00
71	ARRANGEMENT AT WH/1 & 3	60,000	0.052	1.22
72	MIDD. FINES	3,357	0.003	1.00

* Rate : ton/year of billet production after expansion divided by ton/year of existing billet production

Table 6.4.7-3 Equipment List for In-works Transportation (1/3)

No.	Equipment	Q'ty	Main Specification	Remarks
TR-100	Vehicles (Transportation Section)			Existing
101	Fork lift car	2	3.5 ton	20
102	Wheel loader	1	1.5 m^3 bucket	11 (W. Shovel)
103	Excavator loader	1	3.5 m^3 bucket	5 (C. Shovel)
104	Power breaker	1	Breaker operating weight 1.5 ton	2
105	Self loading dump truck	1	45 ton	4
106	Dump truck for Cold Slag	1	14 ton	12
107	" " Scrap	1	14 ton	11 } 32
108	" " Scale	1	14 ton	5
109	" " Oxide	1	14 ton	4
110	Flat deck truck with crane	1	6 ton	2
111	Vacuum dumper	1	6 ton	1
112	Refuse dump truck with crane	1	with 3 ton hydraulic crane	1
113	Vacuum cleaner	1	4 ton brush type	0
114	Magnet crawler crane	1	35 ton	6 (C. Crane)
115	Water sprinkling car	1	15 ton (14,500 ℓ water tank)	1 (W. Car)
116	Lorry for refueling	1	6 ton (7,000 ℓ fuel tank)	1

Table 6.4.7-3 Equipment List for In-works Transportation (2/3)

No.	Equipment	Q'ty	Main Specification	Remarks
TR-150	Container			Existing
151	- For light weight refuse	20	Capacity: 1.2 m^3	20
152	- For heavy weight refuse	20	Capacity: 1.2 m^3	20
153	- For burnt lime	-	Capacity: 20 ton	(Sealed type)
TR-200	Vehicles (Products Shipping Section)			
201	Ram type fork lift car	5	4 ton (high-lift type)	0
202	Tractor and trailer	1	5 th wheel load 16 ton, payload 35 t	6
TR-300	Building for transportation			
301	- For car repair shop	1	28 m × 36 m (with equipment as same as the existing one)	28 m × 36 m 10 m × 60 m
302	- For vehicle spare parts	1	28 m × 50 m	
TR-400	Building for warehouse			
401	- For brick material	1	46 m × 75 m	45 m × 190 m
402	- For spare parts	1	20 m × 80 m (Space reserved in the existing warehouse for brick)	30 m × 100 m 17 m × 35 m
403	- For additives	1	3 m × 150 m + 10 m × 23 m	15 m × 150 m

Table 6.4.7-3 Equipment List for In-works Transportation (3/3)

No.	Equipment	Q'ty	Main Specification	Remarks
TR-500	Slag yard for hot slag	1		
TR-600	Products dispatching yard	1	20,000 m^2	
TR-700	Scrap yard			
	1) New scrap yard	1	120 m × 120 m	
	2) Existing scrap yard	1	100 m × 200 m	to be rearranged
TR-800	Limestone storage yard	1	40 m × 50 m	

Table 6.4.7-4 Equipment List of Vehicle Repair shop

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

Table 6.4.7-5 Personnel Plan for In-works Transportation

Section/Branch Work Group	After expansion					
	SM	ASM	E	F	AF	W
Coordination	1	1	5			
Raw Materials	1	2	7	2	3	26
Machinery & Supplies	1	4	23	2	5	23
Transportation	1					
Vehicle Repair		1	3	3	6	79
Transportation		1	3	5	16	150
Product Shipping	1	2	6	7	24	157

6.4.8. Analysis and inspection facilities

As a backup for the production facilities such as DR plant, SMP, and RMP (Bar mill & Rod mill), there are the analysis and inspection facilities which perform analysis and inspection as shown in Tables 5.2.11-1 and 5.2.11-2.

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

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

And it is recommended to provide an oil analyzer of portable type for checking the deterioration of lubrication oils.

The existing 100-ton compression tester will be used exclusively for the bending test and so a 70-ton tensile testing machine should be added for the tensile testing.

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

Additional equipment required for the expansion is shown in Table 6.4.8-1.

Relocation of the existing equipment in the building will provide the space for the above equipment for the expansion.

The number of the personnel in the analysis and inspection facilities will be increased by 18 after the expansion.

Table 6.4.8-1 Equipment List for Expansion

NO.	EQUIPMENT	QTY	MAIN SPECIFICATION	REMARKS
1	Inductively coupled plasma emission spectrometer (ICP)	1	Spectrometer : Concave diffraction grating in Paschen-Runge mounting Application : For analyzing total Fe of sponge iron as major job and others	
2	Carbon and sulphur determinator	1	Actual analysis time : 30 sec. Consisting of : Analyzer, control console, induction furnace, AC stabilizer, computer interface unit and transformer	
3	70-t tensile testing machine	1	Type : Vertical hydraulic loading type Max. capacity : 70 tons Grip-to-grip distance : Max. 1000 mm	

NO.	EQUIPMENT	QTY	MAIN SPECIFICATION	REMARKS
4	Sample transportation system	1 lot	Type : One way, plant air, non-carrier type Sample size : 35/30 mm dia. x 70 mm No. of stations: 1 - Laboratory 2 - LF stations	
5	Oil analyzer	1	Type : Handy labo type Application : For analyzing water content, acid number and contamination	
6	Abrasive cut-off machine	1	Type : Dry cutting type Cutting capa. : 75 mm dia. and 55 mm square in steel	

NO.	EQUIPMENT	QTY	MAIN SPECIFICATION	REMARKS
7	Double head pedestal grinding machine (Bench type grinding)	2	Type : Double head disc type Wheel size : 205 mm dia. × 19 mm 2 - For LFs	
8	Double head pedestal belt grinding machine	1	Type : Double head, endless belt, dry type Belt size : 915 m × 100 mm in width Belt speed : 520 mm	
9	Sample grinder	1	Type : Double head disc type Wheel size : 205 mm dia. × 19 mm Grinding material : Ferrovanadium, hot briquette iron	

NO.	EQUIPMENT	QTY	MAIN SPECIFICATION	REMARKS
10	Electrical equipment	1 lot	Consisting of: Materials for wiring work, rack/duct, grounding, analytical data feedback system, etc.	
11	Analytical data feedback system	1 lot	The existing AI5100 analytical data feedback system will be modified as follows: 1. To receive the answer-back of the SMP's computer. 2. To enable the system to treat the data of additional analyzers.	
12	Instruments	1 lot	Consisting of: Cable, pipes, installation material, etc.	

6.4.9. Civil engineering and building work

List of civil engineering structure (foundation work, floor pavement, roads and sewerage) and buildings required in relation with construction and expansion of production facilities and ancillary facilities are shown in Tables 6.4.9-1 to 6.4.1-12.

Table 6.4.9-13 shows volume of major works of civil engineering and building work.

Foundation Lists

Table 6.4.9-1 Foundation List for STEELMAKING PLANT

Item	Description			Concrete Volume
Foundation for buildings	- Spread Foundation		3 sets	210 m^3
	- Ancillary Building Foundation			100 m^3
Foundation for machinery and equipment	- Modification of E.A.F.		4 sets	200 m^3
	- Modification of Ladle Transfer Car		4 sets	880 m^3
	- Ladle Furnace		2 sets	630 m^3
	- Ladle Furnace Electric room		2 sets	420 m^3
	- Billet Transfer Car	70t	1 set	170 m^3
	- Ladle Relining Car			120 m^3
	- Additive Bunker			160 m^3
	- Scrap Bucket Transfer Car	50t	2 sets	440 m^3
	- Scrap Truck Scale	70t	2 sets	120 m^3
Culverts	- Piping Tunnel			260 m^3
Floor slabs	- Ground Floor Slab			430 m^3
Others				360 m^3
Other civil work	- Road and Paving			
	. Bituminous base course (5.0 cm thick)		2,000 m^2	
	- Pipe Installation			
	. Drainage pipe for storm water (Concrete pipe ∅ 200-300 mm)		200 m	

Table 6.4.9-2 Foundation List for ROD MILL PLANT

Item	Description			Concrete Volume
Foundation for buildings	- Spread Foundation		16 sets	660 m^3
Foundation for machinery and equipment	- Billet Yard			
	. Billet storage yard	33,000t (Common use of Bar Mill Plant)		780 m^3 e
	. Billet transfer car	70t	1 set	260 m^3
	- Mill Yard			
	. Intermediate mill (2)		4 stands	630 m^3
	. Finishing mill		10 stands	910 m^3
	- Finishing Facilities			
	. Water cooling zone			300 m^3
	. Laying head			120 m^3
	. Stelmor			570 m^3
	. Reforming tub & coil loading station			820 m^3
	. Coil compacting station		1 set	190 m^3
Culverts	- Cable Culvert		100 m	540 m^3
Floor slabs	- Ground Floor Slabs			140 m^3
	- Others			200 m^3
Other civil work	- Roads and Paving			
	. Bituminous base course (5.0 cm thick)		4,260 m^2	
	. Crushed stone paving		5,700 m^2	
	- Pipe Installation			
	. Drainage pipe for storm water (concrete pipe Ø 200-Ø300 m/m)		310 m	
	. Sanitary sewage pipe (P.V.C Ø150 m/m)		50 m	

Table 6.4.9-3 Foundation List for UTILITY SUPPLY SYSTEM

Item	Description		Concrete Volume
Foundation for buildings	- Oxigen and Air Compression Main Building		
	. Water Treatment Station No. 4	930 m^2	270 m^3
	. Electrical equipment room	200 m^2	240 m^3
	. Chemical storage building	70 m^2	100 m^3
	. PSA shop building	1980 m^2	600 m^3
	- Water Treatment Station No. 5		
	. Electrical equipment room	200 m^2	250 m^3
Foundation for machinery and equipment	-Water Treatment Station No. 4		
	50 x 21 x 3.5		2,000 m^3
	- Water Treatment Station No. 5		
	12.5 x 7 x 4		350 m^3
	- Water Treatment Station No. 6		
	10 x 6 x 3		200 m^3
	- Head Tank 4		450 m^3
	- Oxigen Shop and Air Compression Station		700 m^3
	- Yard Piping		550 m^3
	- Others		500 m^3
Other civil work	- Road and Paving		
	. Bituminous base course (5.0 cm thick)	4900 m^2	
	. Asphalt curbs		
	- Pipe Installation		
	. Sleeve pipe concrete pipe	720 m	
	. Sanitary sewage		

Table 6.4.9-4 Formation List for POWER DISTRIBUTION SYSTEM

Item	Description		Concrete Volume
Foundation for building	- MCSG Building		430 m^3
Other civil work	- Roads and Paving		
	. Bituminous base course (5.0 cm thick)	100 m^2	
	. Crushed stone paving	300 m^2	
	- Pipe Installation		
	. Drainage pipe for storm water (concrete pipe Ø200 m/m)	100 m	

Table 6.4.9-5 Foundation List for IN-WORKS TRANSPORTATION FACILITIES

Item	Description		Concrete Volume
Foundation for buildings	- Warehouse for Additive		500 m^3
	- Warehouse for Brick		1,100 m^3
	- Warehouse for Vehicle Spare Parts		700 m^3
	- Car Repari Shop		600 m^3
	- Reconditioning Store		300 m^3
Foundation for machinery	- Slag Yard		800 m^3
	- Others		400 m^3
Other civil work	- Road and Paving		
	1) Product dispatching yard		
	. Bituminous base course (5.0 cm thick)	8,000 m^2	
	. Crushed stone paving	12,000 m^2	
	2) Warehouse for additive		
	. Bituminous base course (8.5 cm thick)	600 m^2	
	3) Scrap storage yard		
	. Crushed stone paving	34,400 m^2	
	4) Car repair shop		
	. Bituminous base course (5.0 cm thick)	1,550 m^2	
	5) Slag yard		
	. Bituminous base course (8.5 cm thick)	3,600 m^2	
	. Crushed stone paving	11,100 m^2	
	6) Lime storage yard		
	. Crushed stone paving	2,000 m^2	
	. Bituminous base course	1,800 m^2	
	- Pipe Installation		
	. Drainage pipe for storm water (concrete pipe Ø200 m/m)	1,360 m	

Table 6.4.9-6 Foundation List for MAINTENANCE SHOP

Item	Description		Concrete Volume
Foundation for buildings	- Maintenance Shop for Repair	600 m^2	300 m^3
	- Electrical Maintenance Wrokshop and Warehouse	420 m^2	210 m^3
Other civil work	- Roads and Paving		
	. Bituminous base course (5.0 cm thick)	100 m^2	
	- Pipe Installation		
	. Drainage pipe for storm water (concrete pipe Ø200 m/m)	150 m	

Building Lists

Table 6.4.9-7 Building List for STEELMAKING PLANT

Name of Building	No. of Buildings	No. of Floors	1st Floor Level GL+(m)	Building Height GL+(m)	Dimension Dimension (m)x(m)	Building Area (sq.m)	Total Floor Area (sq.m)	Structure	Roofing	Siding
Main Building										
- Ladle aisle	1	1	0.4	31.5	20x40	800	800	S	MS	MS
Subtotal	1					800	800			
Ancillary Building										
- LF Electric Room	2	2	05	11.0	10x10	300	600	RC	RCS	RC
- LF Operation Room	1	1	7.5	11.0	5x5	25	25	RC	RCS	RC
-Fuel Storage House	1	1	0.4	4.3	4.2x5.5	22	22	RC	MS	RC
- LF Additive Feeding House	1	1	0.4	15.0	8.5x17.0	145	145	S	MS	MS
Subtotal	5						492	792		
Total	7						1,292	1,592		

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced Concrete Slab, MB: Masonry Brick

Table 6.4.9-8 Building List for ROD MILL PLANT

Name of Building	No. of Buildings	No. of Floors	1st Floor Level GL+(m)	Building Height GL+(m)	Dimension Dimension (m)x(m)	Building Area (sq.m)	Total Floor Area (sq.m)	Structure	Roofing	Siding
Billet Storage Yard	1	1	0.4	19.2	40x56	2,240	2,240	S	-	-
Coil Storage Yard	1	1	0.4	18.8	28x80	2,240	2,240	S	MS	MS
Total	2					4,480	4,480			

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced Concrete Slab, MB: Masonry Brick

Table 6.4.9-9 Building List for UTILITY SUPPLY SYSTEM

Name of Building	No. of Buildings	No. of Floors	1st Floor Level GL+(m)	Building Height GL+(m)	Dimension Dimension (m)x(m)	Building Area (sq.m)	Total Floor Area (sq.m)	Structure	Roofing	Siding
W.T.S.-IV E.E.R.	1	1	0.4	4.4	8x25	200	200	RC	RCS	RC
W.T.S.-IV Chemical Storage	1	2	0.4	11.8	7x10	70	140	RC	RCS	RC
W.T.S.-V E.E.R.	1	1	0.4	4.4	10X20	200	200	RC	RCS	RC
O_2 & Air Compression - Main Building	1	1	0.4	7.9	15x62	930	930	S+RC	MS	MS+RC
O_2 & Air Compression - PSA shop	1	1	0.4	8.5	22x90	1,980	1,980	S+RC	MS	MS+RC
Total	5					3,380	3,450			

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced Concrete Slab, MB: Masonry Brick

Table 6.4.9-10 Building List for POWER DISTRIBUTION SYSTEM

Name of Building	No. of Buildings	No. of Floors	1st Floor Level GL+(m)	Building Height GL+(m)	Dimension Dimension (m)x(m)	Building Area (sq.m)	Total Floor Area (sq.m)	Structure	Roofing	Siding
MCSG Building	1	1	0.4	4.8	13x12	156	156	RC & S	RCS	MB
Total	1					156	156			

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced Concrete Slab, MB: Masonry Brick

Table 6.4.9-11 Building List for IN-WORKS TRANSPORTATION FACILITIES

Name of Building	No. of Buildings	No. of Floors	1st Floor Level GL+(m)	Building Height GL+(m)	Dimension Dimension (m)x(m)	Building Area (sq.m)	Total Floor Area (sq.m)	Structure	Roofing	Siding
Warehouse for Additive	1	1	0.4	9.2	10x23+150x3	680	680	S+RC	MS	MS+RC
Warehouse for Bricks	1	1	0.4	6.6	46x75	3,450	3,450	S	MS	MS
Warehouse for Spare parts	1	1	0.4		20x80	1,600	1,600	Modification of existing warehouse		
Car Repair Shop										
- Car repair shop	1	1	0.4		28x36	1,008	1,008	S	MS	MS
- Warehouse for vehicle spare parts	1	1	0.4		28x50	1,400	1,400	S	MS	MS
- Reconditioning Store	1	1	0.4		20x30	600	600	S	MS	MS
Total	6					8,738	8,738			

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced Concrete Slab, MB: Masonry Brick

Table 6.4.9-12 Building List for MAINTENANCE SHOP

Name of Building	No. of Buildings	No. of Floors	1st Floor Level GL+(m)	Building Height GL+(m)	Dimension Dimension (m)x(m)	Building Area (sq.m)	Total Floor Area (sq.m)	Structure	Roofing	Siding
Maintenance Shop for Repair	1	1	0.4	12.6	20x30	600	600	S	MS	MS
Electrical Maintenance Shop for Repair	1	1	0.4	4.2	15x28	420	420	RC	RCS	MB
Total	2					1,020	1,020			

Abbreviation: S: Steel, RC: Reinforced Concrete, MS: Metal Sheet, RCS: Reinforced Concrete Slab, MB: Masonry Brick

Table 6.4.9-13 VOLUME OF MAJOR WORKS OF CIVIL & BUILDING WORKS

ITEM / FACILITY	EXCAVATION M3	CONCRETE M3	RE-BAR TON	EMBEDDED STEEL TON	STRUCT. STEEL TON	ROOFING M2	SIDING M2	PIPE INSTALL M	BIT. BASE COURSE M2
1. D.R.P.									
2. S.M.P.	7,500	5,000	560	117.0	300	1,250	2,900	200	2,000
3. R.M.P.	19,400	6,200	520	90.0	790	2,900	2,000	310	4,260
4. UT									
1) UT-02	2,100	310	22	6.2	16	250	200	50	100
2) UT-COMP	8,400	660	48	15.0	64	1,000	800	100	200
3) UT	14,000	6,600	620	50.0	0	0	0	570	4,600
UT SUB-TOTAL	24,500	7,570	690	71.2	80	1,250	1,000	720	4,900
5. SUBSTATION	2,000	350	35	5.0	13	0	0	100	100
6. TRANSPORTATION	6,400	2,840	244	180.0	174	5,033	518	1,510	18,000
7. MAINTENANCE SHOP	1,590	610	62	5.0	90	760	760	150	730
8. CAR REPAIR SHOP	4,500	1,600	230	14.0	440	3,900	3,500	240	2,400
9. ADMI FACILITIES	0	0	78	0.0	0	0	0	50	320
TOTAL	65,890	24,170	2,419	482.2	1,917	15,093	10,678	3,280	32,710

6.5. Infrastructure

6.5.1. Supply of natural gas

1) Consumption

As stated in Section 5.3.1, the present natural gas consumption is approximately 33,000 Nm3/h. The entire consumption after the expansion will be 35,000 Nm3/h.

2) Supply source of natural gas for the expansion project

The present contract between ANSDK and EGPC assures the supply up to 2002. And the supply capacity of this pipeline and receiving capacity of EGPC stationed in ANSDK is both 92,000 Nm3/h, which is sufficient for the expansion project.

3) Facilities for supplying natural gas

The existing receiving capacity in ANSDK is designed at 50,000 Nm3/h. Therefore, it is not necessary to modify or expand the facilities.

4) Heavy hydrocarbon in natural gas

The heavy hydrocarbon in the natural gas affects, especially, even the existing DR plant operation/production as expalined in Section 5.3.1. In addition, it is very difficult to predict the heavy hydrocarbon quantities contained in the natural gas after the expansion.

Therefore, it is very necessary for ANSDK to study how to solve this problem jointly with EGPC because the problem has already appeared since October 1990.

6.5.2. Industrial water supply

The existing supply capacity of Alexandria Water Authority is 2,000 m3/h, which is sufficient. The existing receiving capacity is 930 m3/h, which need not be increased because this capacity will meet the required quantity of approximately 642 m3/h for the expansion.

Here, it is very important to secure stable supply of water. In summer the demand in Alexandria City naturally increases and the demand in EI Alamain area to the west of Alexandria is rapidly increasing due to the resort development there. As a result, pressure drop and stop of water supply would frequently occur at ANSDK in the summer.

Considering these conditions, ANSDK needs to open negotiations with Alexandria Water Authority for raising the pumping capacity.

6.5.3. Power supply

1) Forecasted pwer demand in Egypt (MW)

	1996	2000
a) Total generating capacity	13,030	15,340
b) Average demand (excluding ANSDK)	5,850	7,410
c) Maximum demand (excluding ANSDK)	9,000	11,400

2) Forecasted pwer demand in Alexandria area (MW)

	1996	2000
a) Total generating capacity	1,213	1,813
b) Average demand (excluding ANSDK)	845	1,066
c) Maximum demand (excluding ANSDK)	1,350	1,640

3) Plan of new power plant in Alexandria area

a) Location	Sidi-Krir
b) Capacity	2 x 300 MW
c) Start of installation	1993/1994
d) Start-up	1997/1998

4) Estimated power demand for the expansion

	Maximum power demand(15 min.) (kW)	Instantaneous max. load (kW)	Annual Consumption (kW)
a) Expansion	198,500	256,800	1,190.7
b) Without expansion	168,500	218,500	1,013.4

5) Idea on power supply for the expansion project at ANSDK

The EAF process consumes a huge quantity of electric power, compared with other processes. Therefore, additional power supply from EEA is essential for expansion project. It takes normally a long time to

increase the power supply capacity. It is recommended that ANSDK will start negotiation with EEA for the supply of increased power as soon as the expansion plan is fixed so that the expansion of ANSDK will be included in EEA's future plan.

6.5.4. Mineral jetty and stock yard

As discussed in Section 5.3.4, the mineral jetty and stock yard have been satisfactorily operated at present.

For the expansion project, the capacities of the mineral jetty and stock yard need not be expanded because a new DR plant is not planned to be installed.

However, it is important for ANSDK to study how much coal will be handled in future with IMC, since it is necessary to expand or rearrange the stock yard if a new DR plant is installed.

6.6. Organization and Personnel Plan after the Expansion

1) Organization

The expansion plan is based on increased production of re-bar, that is, 1.5 times the present production by addition of two ladle furnaces, one strand of wire rod mill, and plant support facilities.

However, there is no necessity to change the existing organization.

2) Personnel

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

Table 6.6-1 MANPOWER REQUIREMENT (1/2)

DEPARTMENT	SECTION	Phase-1												
		DEP. TOTAL	SEC. TOTAL	CMD	JMD	GM	DGM	DM	SM	ASM	E	F	AF	W
0.TOP MANAGEMENT		6		1	1	1	3							
1.TOP MANG. AFFAIRS	TOP MANAGEMENT AFFAIRS	6							1	2	3			
2.EXTERAL RELATIONS	EXTERAL RELATIONS	6						1	1	1	1			2
3.ADMINISTRATION		90						1	5	8	27	2	9	38
	GENERAL AFFAIRS		27						1	1	10	1		14
	PERSONNEL		7						1	2	4			
	LABOUR & WELFARE		15						1	2	7		5	
	SAFETY & TRAINING		7						1	2	4			
	SECURITY		33						1	1	2	1	4	24
4.FINANCE		41						1	3	6	31			
	BUDGET & COST CONTROL		12						1	2	9			
	ACCOUNTING		15						1	2	12			
	FINANCE		7						1	1	5			
	AUDITING(SUB-SECTION)		6							1	5			
5.PURCHASING & TRANSPORTATION		379						1	4	10	43	13	31	277
	COORDINATION		7						1	1	5			
	RAW MATERIALS		41						1	2	7	2	3	26
	MACHINERY & SUPPLY		58						1	4	23	2	5	23
	TRANSPORTATION		270						1	2	7	9	23	228
	LABOR RELATIONS(SUB-SEC)		2							1	1			
6.SALES		25						1	2	4	18			
	SALES		18						1	3	14			
	BILL COLLECTION		6						1	1	4			
7.PRODUCTION		1,472						1	4	11	31	62	185	1,133
	MINERAL JETTY		58						1	2	5	6	9	35
	DRP		61						1	1	4	5	9	41
	SMP		790						1	4	9	27	88	661
	RMP		514						1	3	11	24	79	396
	LABOR RELATIONS(SUB-SEC)		3							1	2			
8.PRODUCTION CONTROL & TECHNICAL COORDINATION		292						1	4	11	30	9	30	207
	TECHNICAL COORDINATION		68						1	2	7	2	6	50
	PRODUCTION CONTROL		8						1	3	4			
	COMPUTER		16						1	3	12			
	PRODUCT SHIPPING		197						1	2	6	7	24	157
	LABOR RELATIONS(SUB-SEC)		2							1	1			

Table 6.6-1 MANPOWER REQUIREMENT (2/2)

DEPARTMENT	SECTION	Phase-1												
		DEP. TOTAL	SEC. TOTAL	CMD	JMD	GM	DGM	DM	SM	ASM	E	F	AF	W
9.MAINTENANCE & UTILITIES		734						1	4	16	54	19	119	521
	MAINTENANCE COORDINATION		19						1	3	12		1	2
	MECHANICAL MAINTENANCE		363						1	5	18	8	64	267
	ELECTRICAL MAINTENANCE		245						1	6	18	8	38	174
	UTILITIES								1	1	4	3	16	78
	LABOR RELATIONS(SUB-SEC)		3							1	2			
10.CONSTRUCTION	CONSTRUCTION	3						1	1	2	3			
11.RESEARCH	RESEARCH	5						1	1	1	2			
	ANSDK TOTAL	3,018		1	1	1	3	10	30	72	243	105	374	2,178

CHAPTER 7. CONSTRUCTION SCHEDULE

7.1. Organization for Execution of Construction Work

7.1.1. Basic policy

Construction period of a steelworks is very long, and in general it takes 30 to 36 months from supply contract of equipment to start-up of the works. If basic designing is required and bidding is added, 50-56 months are required from the decision to implement the project to the commencement of production of products.

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

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

7.1.2. Consultant engineering

As consultant engineers, companies which have experiences and actual records of planning and constructing modern steelworks and can provide plant operation guidance after the completion is desirable. At present, Egyptian staffs

are engaged in the plant management under the consultancy by Japanese staffs at El Dikheila Works. But the consultancy agreement expires in 1995 and when the expansion project is completed, the Japanese staffs will be none. It is considered that by that time, technical transfer will be completed and no external management staffs are necessary, but to cope with troubles early in the start-up, a part of consultancy jobs provided so far should be included in the scope of engineering. The scope of work of consultant engineering in this project will be as follows:

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

7.1.3. Preparatory stage

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

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

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

7.1.4. Execution of basic engineering

Another important matter to be carried out in the preparatory stage is basic engineering. With the object of developing and materializing the feasibility study, basic engineering will make detailed study on alternative plans proposed in the F/S and conditions assumed in the F/S and endorse a concrete plan. Therefore, the basic engineering should cover every field: follow-up of market research, determination of production process, planning of practicable and detailed processes, up-dating of construction expenses and operation cost, and financial and economic analyses.

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

7.1.5. Preparation for tender

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

7.2. Construction Schedule

7.2.1. Basic policy

1) Start-up of main plants

Start-up of main plants such as SMP and ROD is determined to be the same time by taking into consideration the learning period until full operation and the material balance.

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

2) Construction period

The period required from CIF contract to start-up is set to be 28 months for both SMP and ROD.

3) Preparation and tender period

All contracts for this project will be made through limited international tender, and it is assumed that preparation of bidding to signing contract takes 6 months.

7.2.2 Overall construction schedule

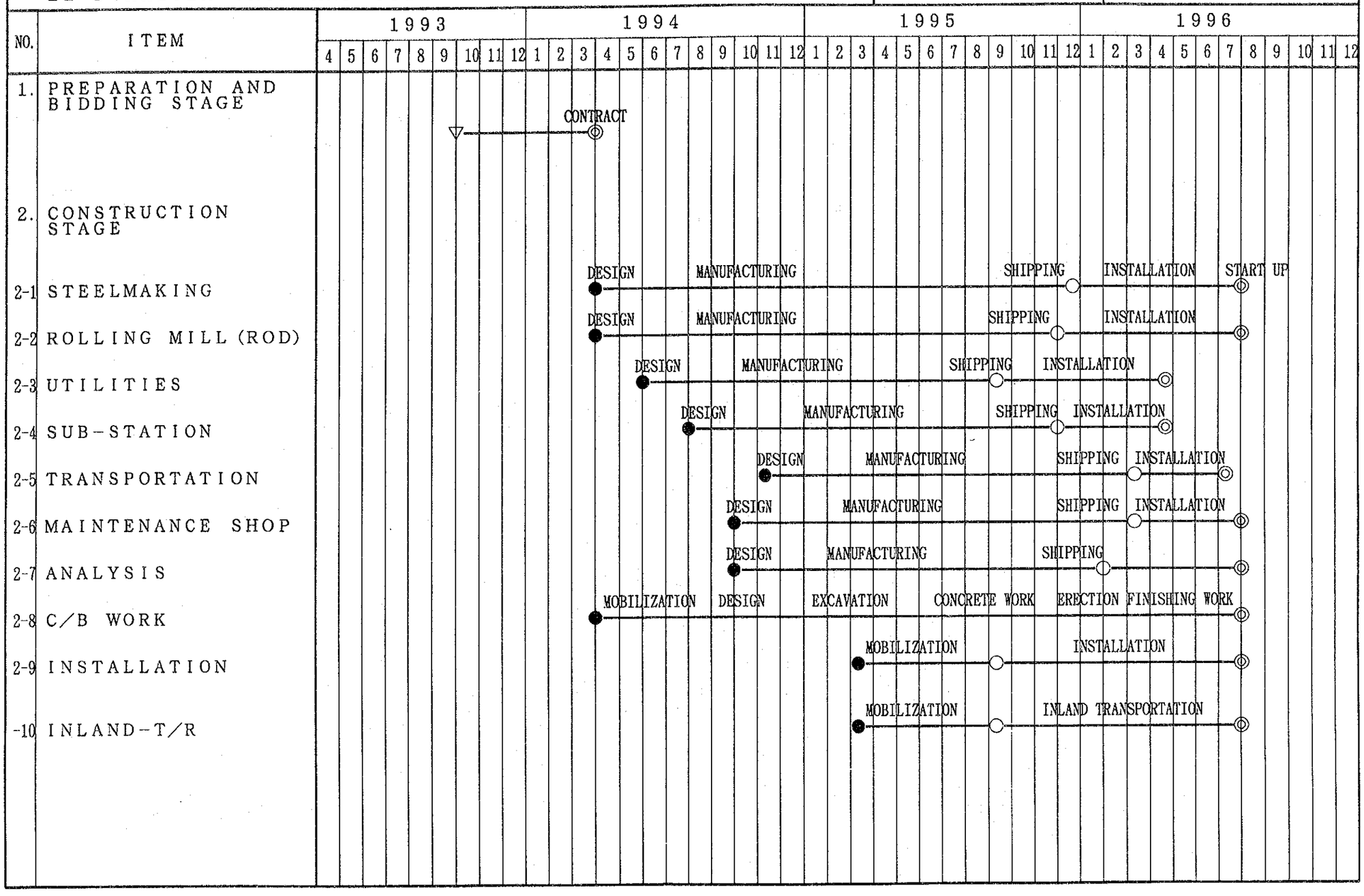
Table 7.2-1 shows the overall schedule for the expansion project based on the above premises. Start-up date of main plants is assumed as follows:

SMP : August 1, 1996
RMP : August 1, 1996

Table 7.2-1 IMPLEMENTATION SCHEDULE
EL DIKHEILA IRON AND STEEL WORKS -EXPANSION PROJECT-

JICA F/S

DATE : 11 JUNE 1993
JICA STUDY TEAM



CHAPTER 8. CALCULATION OF CONSTRUCTION EXPENSES

8.1. Division of Supply Contracts and Method of Supply

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

1) Supply of equipment

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

2) Inland transportation of equipment

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

3) Installation works of equipment

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

4) Civil engineering and building works

Foundation, plant building, warehouses and roads and sewerage works

8.2. Calculation of Capital Cost

8.2.1. Estimation basis

The capital costs consist of the following categories and estimated on international price level in 1993.

The capital costs are expressed in U.S.dollars, for which international procurements and domestic purchases in Egyptian pounds are converted to U.S.dollars by the following rates:

1 U.S.dollar = LE 3.35
1 U.S.dollar = Yen 115.76
1 U.S.dollar = DMK 1.65

8.2.2. Supply of equipment

Equipment cost consists of equipment, auxiliary facilities, materials such as steel frame, brick, cable and piping, spare parts for normal one year operation and consumables for six months start-up operation and supervision for installation work, and is calculated on CIF Alexandria port basis with reference to the prices tendered for construction of the existing facilities by taking into consideration the change in price factors in these past years mainly in prices of industrial goods and the change in exchange rate of currency and also reference estimates obtained from several makers.

8.2.3. Field work

Cost of field work consists of inland transportation of equipment including cost of customs clearance,

installation work of equipment and civil and building work.

Regarding the cost of field work, unit price of each item is set considering the results of the site survey and existing facilities construction, and the total construction expenses are calculated according to BQ method. Construction equipment is found available in Egypt, but is basically to be imported considering the timing of construction and tight schedule.

8.2.4. Engineering fee

The cost of engineering services consists of costs such as man-day fee expense incurred on execution of the following work:

1)Procurement services
2)Preparation of design drawing for civil engineering and building structures
3)Consultancy services for construction work
4)Consultancy services for commissioning

8.2.5. Contingency

As the reserve fund for construction cost in the expansion project, the following contingency is provided.

1) Import taxes

The rate of import taxes levied on imported equipment and materials is assumed to be 5% of the CIF price except the following:

1.Construction equipment and materials for temporary

structures to be re-exported after completion of construction works

These are assumed to be exempted.

2.Materials used permanently in civil work

These are assumed to be calculated in accordance with the customs tariff in Egypt.

The rates of tariff on major materials are shown below. The amount of tariff is assumed to be calculated by converting the CIF price into Egyptian pounds at the exchange rate of LE 3.35/U.S.dollar.

Rolled steel:	Sections	20%
	Steel pipe	20%
	Other steel pipe	30%
	Steel frame and processed rolled steel	50%
	Bolts and nuts	30%
Glass:	3mm or thinner wire glass	20%
	3-5 mm	30%
	5mm or thickner	50%
Building flooring:		60%

2) General sales tax

The general sales tax is levied in accordance with the General Sales Tax Law in Egypt and is calculated by multiplying the total of costs of equipment and additional imported dues by 10% for imported equipment

and by multiplying costs of equipment by 10% for local equipment.

3) Price increase

For the escalation case, the construction costs are calculated by taking into account the price increase from 1993 through the construction periods.
The rate of price increase is assumed to be 4% per year for the international purchase. Though the domestic level within Egypt would rise, price increase is to be 5% in U.S.dollar basis for local procurement.

4) Other contingency

To complement the accuracy of construction costs, 5% each for the equipment and the field work is provided.

8.3. Summary Sheet of Construction Cost

The construction costs of the expansion project estimated based on the above premises are shown in Table 8.3-1 for without-escalation case and Table 8.3-2 for with-escalation case.

As shown in these tables, the construction cost of the expansion project is about U.S.$192 million for without-escalation case and is about U.S.$212 million for with-escalation case.

Civil and building materials will be basically procured from the local market and the local procurement of the equipment is desired as much as possible at the execution stage so that the expansion project would be competitive.

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

Unit: 1000 USD

	Equipment (CIF)			Installation			Civil & Building			Total		
	F	L	T	F	L	T	F	L	T	F	L	T
DRP			0			0			0	0	0	0
SMP	53,631	2,358	55,989	2,773	953	3,726	2,470	1,260	3,730	58,874	4,571	63,445
ROD	29,141	182	29,323	2,823	863	3,686	4,538	1,272	5,810	36,502	2,317	38,819
UT	24,591	1,110	25,701	3,020	812	3,832	2,133	1,932	4,065	29,744	3,854	33,598
PW	1,831	0	1,831	146	41	187	126	153	279	2,103	194	2,297
TR	5,466	0	5,466	64	58	122	2,827	2,595	5,422	8,357	2,653	1,010
MS	1,732	0	1,732	69	26	95	243	309	552	2,044	335	2,379
AI	1,751	0	1,751	38	10	48			0	1,789	10	1,799
ADM	0	0	0	0	0	0						
Sub-Total	118,143	3,650	121,793	8,933	2,763	11,696	12,337	7,521	19,858	139,413	13,934	153,347
Eng. Fees	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	10,000	0	10,000
Contingency												
Price C	0	0	0	0	0	0	0	0	0	0	0	0
Physical C	5,907	183	6,090	447	138	585	617	376	993	6,971	697	7,667
Imp. tax		5,907	5,907	0	0	0		2,502	2,502	0	8,409	8,409
Sales tax		12,770	12,770							0	12,770	12,770
Total	5,907	18,860	24,767	447	138	585	617	2,878	3,495	16,971	21,876	38,847
Grand Total	124,050	22,510	146,560	9,380	2,901	12,281	12,954	10,399	23,353	156,384	35,810	192,194

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

Unit: 1000 USD

	Equipment (CIF)			Installation			Civil & Building			Total		
	F	L	T	F	L	T	F	L	T	F	L	T
DRP			0			0			0	0	0	0
SMP	53,631	2,358	55,989	2,773	953	3,726	2,470	1,260	3,730	58,874	4,571	63,445
ROD	29,141	182	29,323	2,823	863	3,686	4,538	1,272	5,810	36,502	2,317	38,819
UT	24,591	1,110	25,701	3,020	812	3,832	2,133	1,932	4,065	29,744	3,854	33,598
PW	1,831	0	1,831	146	41	187	126	153	279	2,103	194	2,297
TR	5,466	0	5,466	64	58	122	2,827	2,595	5,422	8,357	2,653	1,010
MS	1,732	0	1,732	69	26	95	243	309	552	2,044	335	2,379
AI	1,751	0	1,751	38	10	48			0	1,789	10	1,799
ADM	0	0	0	0	0	0						
Sub-Total	118,143	3,650	121,793	8,933	2,763	11,696	12,337	7,521	19,858	139,413	13,934	153,347
Eng. Fees	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	10,000	0	10,000
Contingency Price C	14,928	547	15,475	1,174	458	1,632	1,566	993	2,559	17,668	1,998	19,666
Physical C	5,907	183	6,090	447	138	585	617	376	993	6,971	697	7,667
Imp. tax		5,907	5,907	0	0	0		2,502	2,502	0	8,409	8,409
Sales tax		12,770	12,770							0	12,770	12,770
Total	20,835	19,407	40,242	1,621	596	2,217	2,183	3,871	6,054	34,639	23,874	58,513
Grand Total	138,978	23,057	162,035	10,554	3,359	13,913	14,520	11,392	25,912	174,052	37,808	211,860

9. PRODUCTION COST AND FINANCIAL ANALYSIS

9.1. Caluculation of Production Cost

9.1.1. Assumption for costing

1) Costing method

a) Process cost accounting

Process cost accounting is adopted by setting the production processes and auxiliary processes.

Production processes

Direct reduction process(DRP)
Lime calcining process(LCP)
Steelmaking process(SMP)
Bar mill process(BAR)
Rod mill process(ROD)

Auxiliary processes

Electric power
Natural gas
Compressed air
Oxygen and nitrogen gas
In-works transportation
Car repair shop
Analysis and inspection
Maintenance shop

In the process cost accounting, total costs of variable and fix costs incurred in each process are

estimated and are regarded as the production cost of the respective process.

As for the production processes, the production cost of a preceding process is added to the production cost of the following process as its raw material cost. Similar calculations are repeated for the succeeding processes until the production cost of final products is obtained.

b) Distribution of auxiliary process costs

The criteria for distribution of the auxiliary process costs are shown in Table 9.1-1. No mutual distribution is assumed among utility processes.

Table 9.1-1 Criteria for Distribution of Auxiliary Process Costs

Process	Criteria for distribution
Electric power	Distributed in proportion to the quantity of services
Natural gas	ditto
Compressed air	ditto
Oxygen and nitrogen gas	ditto
Water	ditto
In-works transportation	ditto
Car repair shop	Distributed to in-works transportation only
Analysis and inspection	Equally distributed among all the production processes
Maintenance shop	Distributed in proportion to the acquisition costs of fixed assets

c) Variable and fixed costs

Variable and fixed costs for each process are discriminated in Table 9.1-2.

Table 9.1-2 Discrimination of Variable and Fixed Costs

Description	Discrimination
Variable costs	Raw materials costs, supply costs such as refractories and other manufacturing supplies, by-product costs and utility costs
Fixed costs	Labor costs, depreciation costs, repair costs, special repair costs and general expenses

2) Estimation basis

a) Exchange rate

The conversion rate to U.S.dollars from other currencies is assumed as follows:

1 U.S.dollar = LE 3.35
1 U.S.dollar = YEN 115.76
1 U.S.dollar = DMK 1.65

Note: The rates at the end of March 1992

b) Price level

Production cost is basically estimated in U.S.dollars based on actual price ANSDK carried out in the latest six months or in 1992 in accordance with the results of discussion with counterparts with the exception of the

capital cost for the expansion facilities described in CHAPTER 8.

The above price is managed with the following assumption in the case with escalation.

(1) Domestic purchase

Escalation is applied with annual rate of 5% until the year of start-up of the expansion project.

(2) International purchase

Escalation is applied with annual rate of 4% until the year for start-up of the expansion project.

3) Raw materials prices

The unit prices of raw materials is set on the basis of actual purchase prices carried out by ANSDK in 1992 and detailed in Table 9.1-3.

Table 9.1-3 List of Raw Materials Prices

Unit: US $/ton

Item	Price
Imported	
Oxide pellet	43.43
Scrap	130.47
H.B.I.	126.61
Fe-Mn	534.90
Fe-V	12,629.52
Electrode	2,512.44
Fettling materials	319.53
Furnace brick	1,399.24
Ladle brick	1,047.57
Tundish brick	607.18
Domestic	
Limestone	5.91
Burnt lime	22.39
Scrap	118.24
Fe-Si	537.95
Aluminum	1,611.94
Burnt dolomite	72.84
Lump coke and powder coke	95.19

Note 1: Prices of imported goods consist of CIF, import taxes calculated by the following rates and charges, but exclude the general sales tax.

Note 2: Prices of domestic goods consist of CIF and charges, but exclude the general sales tax

Import taxes rate

Oxide pellet	5%	Electrode	10%
Scrap	5	Fettling materials	10
H.B.I.	5	Furnace brick	15
Fe-Mn	5	Ladle brick	15
Fe-V	5	Tundish	15

4) Utilities prices

The unit prices of electricity, natural gas and water is set on the basis of the purchase prices in the latest six months obtained from ANSDK as detailed in Table 9.1-4.

Table 9.1-4 Purchase Prices of Utilities

Unit: US$

Item	Prices
Electricity	0.0205/kWh
Natural gas	0.0773/Nm3
Water	0.0931/m3

Note: All prices exclude the general sales tax.
Natural gas is managed as imported goods.

The unit prices of compressed air and oxygen/nitrogen gas is estimated by taking account of the total cost such as depreciation cost, repair cost, labor cost and other costs related to the plant.

5) Labor cost

The labor costs such as salaries, wages, bonuses, welfare expenses and other expenses related to the employees are set on the basis of actual results carried out by ANSDK in 1992 and classified in Table 9.1-5.

Table 9.1-5 Labor Cost by Class

Unit: US$/person,year

Class	Payroll	Welfare
Deputy general manager	18,205	670
Department manager	13,755	1,005
Section manager	10,753	832
Assistant section manager	7,863	674
Engineer, asst. engineer and specialist	5,643	609
Foreman, asst. foreman and worker	4,302	855

6) By-products

The price of return scrap recovered from SMP and RMP is assumed to be equal to the local price of domestic scrap purchased in Egypt.

For the sales of scale, lime fine and other by-products, the transfer and disposal costs are assumed to be equal to the sales price.

Therefore, the sales amount and transfer and disposal costs are not calculated.

7) Repair costs and special costs

The 3% of the aquisition cost of production and auxiliary plants is assumed to be the annual repair and maintenance cost including repairing materials cost, labor cost and other relative costs.

Regarding the equipment which is in use more than 15 years since start-up, repair and maintenance cost is to be 6% of the acquisition cost, because smooth and

effective operation of such equipment can be maintained for more than 30 years by due and proper maintenance instead of reconstruction.

The general sales tax is calculated by multiplying the said repair and maintenance costs by 10%.

Special repair costs are considered for DRP and LCP.

8) Depreciation

The fixed assets are classified into eight categories and the depreciation is calculated by straight line method with the depreciation period as shown in Table 9.1-6.

The fixed assets depreciated fully are assumed to be managed as follows:

a) The fixed assets except vehicle and tools

Special depreciation for replacement is calculated in accordance with Egyptian Accounting Standards. The rate for such depreciation is 50% of ordinary depreciation rate during a period of use.

b) Vehicle and tools

Vehicle and tools are re-invested every depreciation period.

The existing facilities as fixed assets are calculated in U.S.dollars after conversion to U.S.dollars by exchange rate of 1 U.S.dollar = LE 3.35 in accordance with balance sheet as of December 31, 1992 as shown in Table 9.1-6.

Table 9.1-6 Depreciation Period and Fixed Assets
(Existing Facilities)

Unit: US$

Description	Depreciation period	Acquisition cost	Book value Dec.31,199
Production plant	15 year	310,784	183,296
Auxiliary plant	15	38,031	22,332
Factory building	33	156,430	129,701
Office building and company house	50	25,520	21,273
Vehicle	5	18,440	3,035
Tool	4	5,107	197
Furniture and office equipment	10	3,569	1,690
Land	-	12,123	12,123

9) General expenses

General expenses such as rental fee of mineral jetty, consultant fee, insurance premium and other miscellaneous expenses are estimated.

9.1.2. Production plan

1) Financial projection period

Financial projection covers the period of twenty-three years from the year 1993.

Financial projection year is calendar year basis, that is, from January through December.

2) Production plan

The production plan is shown in Table 9.1-7 for the without expansion case and Table 9.1-8 for the expansion project.

Table 9.1-7 Production Plan for the Without Expansion

1000 t/y

	1993	1994	1995	1996-
DRP				
DRI	776.4	776.4	776.4	776.4
LCP				
Burnt Lime	41.1	41.1	41.1	41.1
SMP				
Molten Steel	1,171.9	1,171.9	1,171.9	1,171.9
Billet (Normal)	1,142.6	1,142.6	1,142.6	1,142.6
" (Short length)	2.9	2.9	2.9	2.9
BAR				
Bar (Normal)	529.4	544.6	559.9	559.9
(Short length)	7.7	8.0	8.2	8.2
ROD				
Rod	544.7	544.7	544.7	544.7

Table 9.1-8 Production Plan for the Expansion Project

1000 t/y

	1993	1994	1995	1996	1997	1998-
DRP						
DRI	776.4	776.4	776.4	776.4	776.4	776.4
LCP						
Burnt Lime	41.1	41.1	41.1	38.0	64.9	64.9
SMP						
Molten Steel	1,171.9	1,171.9	1,171.9	1,038.2	1,585.2	1,585.2
Billet (Normal)	1,142.6	1,142.6	1,142.6	1,012.2	1,545.6	1,545.6
" (Short length)	2.9	2.9	2.9	2.5	3.9	3.9
BAR						
Bar (Normal)	529.4	544.6	559.9	559.9	559.9	559.9
(Short length)	7.7	8.0	8.2	8.2	8.2	8.2
ROD						
Rod	544.7	544.7	544.7	456.2	898.2	938.4

9.1.3. Manufacturing costs

Manufacturing costs are calculated in accordance with the financial projection case as shown in Table 9.1-9.

Table 9.1-9 Financial Projection Cases

Case 0-1	Case 0-2	Case 1-1	Case 1-2
Without expansion		With expansion	
without escalation Base case	with escalation	without escalation Base case	with escalation

In this section, manufacturing costs are summarized for the year before the expansion and the year of full production after the expansion for the cases without esollation in Table 9.1-10.

For information, output data is attached in APPENDIX 1 for all cases.

Table 9.1-10 Manufacturing Costs by Process
(With Expansion, Without Escalation)

Unit: U.S.$/ton

		1995	1998
DRP	Fixed cost	22.4	22.0
	Variable cost	92.8	93.0
	Total cost	115.2	115.0
LCP	Fixed cost	27.2	16.0
	Variable cost	20.8	21.0
	Total cost	48.0	37.0
SMP	Fixed cost	19.6	19.6
	Variable cost	179.6	181.2
	Total cost	199.2	200.8
BAR	Fixed cost	10.6	10.2
	Variable cost	212.0	214.1
	Total cost	222.6	224.3
ROD	Fixed cost	13.7	12.6
	Variable cost	208.8	211.0
	Total cost	222.5	223.6

9.2. Financial Analysis

9.2.1. Basic policy for financial analysis

In the present financial analysis, the profitability of investments for the expansion facilites is analyzed and evaluated in net effects (profitability after the expansion facilities - profitability in the existing facilities).
The financial analysis of the existing facilities is made in reference to the expansion facilities only. The financial analysis is managed with the following methods:

1) Analysis and evaluation with regard to the following financial statements:
   a) Manufacturing cost sheet

   b) Profit and loss statement

   c) Cash flow

   d) Balance sheet

2) Evaluation in effects of total investment and equity with the internal rate of return

3) Sensitivity analysis

9.2.2. Financial projection case

The financial analysis is made in the financial projection case as shown in Table 9.2-1 and managed with the following conditions:

1) Without escalation case

This is the case that any inflation is not considered and cost calculation and financial projection are made in price level described in CHAPTER 8 CALCULATION OF CONSTRUCTION EXPENSES for construction costs, in price level described in Section 9.1. Calculation of Manufacturing costs for Production Cost and in price level in most recent six months at field survey in March 1993 for sales prices of products.

2) With escalation case

This is the case that inflation is estimated at the price level mentioned in above 1) by the escalation rate as shown in Table 9.2-2 covering a period until the year of start-up of the expansion facilities.

Table 9.2-1 Financial Projection Case

Case 0-1	Case 0-2	Case 1-1	Case 1-2
Without expansion		With expansion	
without escalation	with escalation	without escalation	with escalation

Table 9.2-2 Escalation Rate (Year rate)

Description	Escalation rate
Domestic cost/expense	5%
Import procurement	4
Product sales price	In the proportion of sales in domestic and export

9.2.3. Assumption for financial analysis

In the present financial analysis, the profitability of investments for the expansion facilities is analyzed and evaluated on the basis of construction costs and manufacturing costs already described, taking account of the following assumptions:

1) Financial projection period

Financial projection covers the period of 23 years (20 years after the start-up of the expansion facilities from 1993)and financial projection year is calendar year bases, that is, January to December.

2) Sales price of products

Sales prices of products are assumed as shown in Table 9.2-3.

Table 9.2-3 Sales Price of Products

(Unit:US$/ton)

Description	Without escalation	With escalation			
	Case 0-1 /Case 1-1	Case 0-2 / Case 1-2			
		1993	1994	1995	1996~
Bar	320.1	335.7	351.9	369.0	386.9
Rod	320.1	335.7	351.9	369.0	386.9
Short length bar	291.0	304.5	319.7	335.7	352.6
Billet	258.3	271.2	284.7	299.0	314.0

Note) Billet includes short length billet.

3) Selling expenses

Selling expenses for sales are assumed to be nil because of customers taking over the purchased products at the products stock yard of steelworks.

4) General and administrative expenses

Labor costs, depreciation costs for office buildings and company houses, and other costs associated with the following affairs and departments are estimated as general and administrative expenses:

a) Top management affairs

b) External relation dept.

c) Administration dept.

d) Finance dept.

e) Purchasing and transportation dept. except transportation section

f) Sales dept.

g) Production control and technical coordination dept. except laboratories and inspection

h) Construction dept.

i) Research dept.

And also the consulting costs for the operation of the existing facilities are estimated as general administrative expenses.

5) Corporate income tax

The expansion facilities are assumed to be exempted from corporate income tax for ten years after the subsequent year of the start-up of the expansion facilities under the provision of Investment Law No.230/1989 of Egypt as the existing facilities.
After the tax-exemption period, corporate income tax is estimated by rate of 32% to taxable income in compliance with Corporate Income Tax Law of Egypt.

6) Dividends payable

The amount equal to 9% of year end balance of paid-up capital in the current year is assumed to be distributed in the subsequent year to investors as dividend.

9.2.4. Fund requirement

1) Equipment fund

The payment schedule of the equipment funds described in CHAPTER 8 CALCULATION OF CONSTRUCTION EXPENSES is assumed as shown in Table 9.2-4 and Table 9.2-5.

Table 9.2-4 Payment Schedule of Equipment Fund
Case 1-1 (Without escalation)

(Unit:1000US$)

Description	Total	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Equipment cost	121,793		24,360	78,991	18,442										
Installation cost	11,696			3,891	7,805										
Civil & building cost	19,858		5,050	12,783	2,025										
Engineering fee	10,000		6,391	936	2,673										
Contingency	28,847		3,530	10,770	2,414		348	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263
Total	192,194	0	39,331	107,371	33,359	0	348	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263

Note: Contingency was allocated by year according to the payment of equipment cost, installation cost, and civil and building cost.

Table 9.2-5 Payment Schedule of Equipment Fund
Case 1-2 (With escalation)

(単位:千US$)

Description	Total	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Equipment cost	121,793		24,360	78,991	18,442										
Installation cost	11,696			3,891	7,805										
Civil & building cost	19,858		5,050	12,784	2,024										
Engineering fee	10,000		6,391	936	2,673										
Contingency	48,513		5,823	22,602	6,620		371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299
Total	211,860	0	41,624	119,204	37,564	0	371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299

Note: Contingency was allocated by year according to the payment of equipment cost, installation cost, and civil and building cost.

2) Pre-production cost

The costs and expenses to be incurred in the expansion facilities before the start-up of expansion facilities are estimated as pre-production costs.
The pre-production costs with the payment schedule are shown in Table 9.2-6 and Table 9.2-7.

In this financial projection, only labor costs of fresh employees employed during a period of three months before the start-up of the expansion facilities are estimated as pre-production costs. Training before operation for the expansion facilities is assumed to be unnecessary because of the existing facilities having been operated for more than ten years since the start-up. The pre-production costs are amortized equally during a period of ten years after the start-up of the expansion facilities in account of deferred assets.

Table 9.2-6 Pre-production Cost and Payment Schedule
Case 1-1 (Without escalation)

(Unit:1000US$)

Description	Total	1993	1994	1995	1996
Labor cost	798	0	0	0	798

Table 9.2-7 Pre-production Cost and Payment Schedule
Case 1-2 (With escalation)

(Unit:1000US$)

Description	Total	1993	1994	1995	1996
Labor cost	1,057	0	0	0	1,057

3) Additional working capital fund

The working capital fund yearly increasing before the year 1998 when the normal production of the expansion facilities will be reached is estimated as shown in Table 9.2-8 and Table 9.2-9 in the following assumptions:

a) Cash on hand

Minimum necessary amount for operation after the expansion of facilities is estimated as follows and surplus fund in excess of minimum necessary amount during the year is appropriated for the additional working capital fund in the year:

(Unit:1000US$)

Case 1-1 (Without escalation) : 12,534
Case 1-2 (With escalation) : 14,363

Any surplus fund including surplus fund after making appropriation for the above-mentioned additional working capital fund in projection years is assumed to be made short-term deposits with year interest rate of 3%.

On the other hand, shortage in minimum necessary amount is also assumed to be raised on short-term loans with year interest rate of 5%.

b) Accounts receivable-trade

Collection of sales amount is assumed to be made upon shipment of products.
The resulting accounts receivable-trade are estimated to be nil at the year end.

c) Advances to suppliers

The amount for one month quantity of raw materials and supplies including manufacturing supplies and other repair parts to be consumed in the subsequent year is assumed as year end balance.

d) Raw materials

The quantity for one month to be consumbed in the subsequent year is assumed as year end inventories.

e) Semi-finished products

The quantity for a half month products in the year is assumed as year end inventories.

f) Finished products

The quantity for one month products in the year is assumed as year end inventories.

g) Accounts payable-trade

Payments for purchase of raw materials and supplies including manufacturing supplies and other repair parts are assumed to be made until receipt of goods. The resulting accounts payable-trade are estimated to be nil at the year end.

h) Accounts payable-others

Payments for dividends are assumed to be made in the subsequent year and other transactions are assumed to be made upon cash payments.

Table 9.2-8 Yealy Additional Working Capital Fund
Case 1-1 (Without escalation)

(Unit:1000US$)

Description	1996	1997	1998
Account receivable-trade	0	0	0
Advances to supplies	5,183	0	0
Inventories: Raw materials	5,506	0	0
Semi-finished products	0	354	-345
Finishied products	1,059	5,702	696
Accounts payable-trade	0	0	0
Accounts payable-others	-1,845	-500	-58
Total	9,903	5,556	293
Appropriation of surplus fund	0	0	0
Total of additional working capital	9,903	5,556	293

Table 9.2-9 Yealy Additional Working Capital Fund
Case 1-2 (With escalation)

(Unit:1000US$)

Description	1996	1997	1998
Account receivable-trade	0	0	0
Advances to supplies	59,89	0	0
Inventories: Raw materials	6,291	0	0
Semi-finished products	0	401	-391
Finishied products	1,074	6,637	800
Accounts payable-trade	0	0	0
Accounts payable-others	-2,088	-583	-33
Total	11,266	6,455	376
Appropriation of surplus fund	0	0	376
Total of additional working capital	11,266	6,455	0

4) Interest during construction period

The interest on long-term debts raised for the expansion facilities during construction period is assumed to be amortized equally during a period of ten years after the start-up of the expansion facilities after appropriation to deferred assets as is the case with preproduction cost. Yearly interest during construction period is estimated as shown in Table 9.2-10.

Table 9.2-10 Yealy Interest during Contruction Period

(Unit:1000US$)

Description	Total	1993	1994	1995	1996
Case1-1 Without escalation	22,807	0	2,597	11,701	8,509
Case1-2 With escalation	25,007	0	2,753	12,859	9,395

5) Total investment fund

As a result of estimation based on the assumptions, the total investment fund is shown in Table 9.2-11.

Table 9.2-11 Total Investment Fund

(Unit:1000US$)

Description	Case 1-1 Without escalation	Case 1-2 With escalation
Equipment	192,194	211,860
Pre-production cost	798	1,057
Additional working capital	15,752	17,721
Interest under construction	22,807	25,007
Total	231,551	255,645

9.2.5. Fund raising

1) Capital

As in the case of the existing facilities, 30% of the total investment for the expansion facilities is assumed to be managed with paid-up capital.

The amount of necessary paid-up capital is as follows:

(Unit:1000US$)

Case 1-1 (Without escalation) : 69,471

Case 1-2 (With escalation) : 76,693

2) Long-term debts

The balance of the total investment after deduction of paid-up capital is assumed to be managed on long-term loans with terms and conditions as follows:

a) Interest year rate: 9.0%

b) Loan period : 10 years

c) Grace period : 3 years

3) Hedging of foreign currency fluctuation on long-term debts

Though it is difficult to mention to hedging of foreign currencies fluctuation at present stage because of not being decided by currencies on long-term debts, the following hedging (minimizing) is considered in general:

a) Swapping to stabilized currency in international money market

b) Forward exchange contract in international foreign exchange market

c) Direct settlement with foreign currency earned by export of products

The above-mentioned hedging including other method should be examined and reconsidered concretely after making sure of trend in international money market and foreign exchange market and the best hedging should be decided.

4) Schedule of fund demand and raising

Fund demand and raising schedule for the expansion facilities is shown in Table 9.2-12 and Table 9.2-13.

Table 9.2-12 Schedule of Fund Demand and Raising
Case 1-1 (Without escalation)

(Unit:1000US$)

Description	Total	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Demand:															
Equipment	192,194		39,331	107,371	33,359		348	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263
Pre-production cost	798				798										
Additional working capital	15,752				9,903	5,556	293								
Interest under construction	22,807		2,597	11,701	8,509										
Demand total	231,551	0	41,928	119,072	52,569	5,556	641	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263
Raising:															
Capital	69,471		13,075	17,909	20,505	5,556	641	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263
Long-term loan	162,080		28,853	101,163	32,064										
Raising total	231,551	0	41,928	119,072	52,569	5,556	641	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263

Table 9.2-13 Schedule of Fund Demand and Raising
Case 1-2 (With escalation)

(Unit:1000US$)

Description	Total	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Demand:															
Equipment	211,860		41,624	119,204	37,564		371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299
Pre-production cost	1,057				1,057										
Additional working capital	17,721				11,266	6,455									
Interest under construction	25,007		2,753	12,859	9,395										
Demand total	255,645	0	44,377	132,063	59,282	6,455	371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299
Raising:															
Capital	76,693		13,787	19,779	23,204	6,455	371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299
Long-term loan	178,952		30,590	112,284	36,078										
Raising total	255,645	0	44,377	132,063	59,282	6,455	371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299