Section 11 Cold Strip Mill Plant

Contents

1. General

1.1 Condition of raw materials

Cold strip mill plant requires hot coils to produce its products.
Hot coils are supplied from the hot strip mill plant within the steelworks.

(1) Required amount

Step 1 : approx. 770,000 Ton/Y (including P/O)
Step 2 : approx. 1,310,000 Ton/Y (including P/O)

(2) Hot coil conditions

- Thickness : 2.0～4.0 mm (for cold rolling/coating sheets)
  1.8～6.0 mm (for P/O)
- Width : 610～1,350 mm
- Outer diameter : Max. ϕ 2,000 mm
- Inner diameter : ϕ 762 mm
- Max. weight : 25 Ton
- Specific weight : 20 Ton/m-width

1.2 Products of the cold strip mill plant & metal finishing plant

Products of the cold strip mill plant & metal finishing plant decided from market study are as follows.

(1) Size range and typical sizes for products

Size range and typical sizes for products are summarized in Table 11-1.

Table 11- 1 Size range and typical sizes for products

Products	Size range (mm)		Typical size(mm)
	Thickness	Width	Thickness × Width
Pickled and oiled sheet (P/O)	1.80～6.0	610～1,350	2.8 × 1,100
Cold rolled steel sheet	0.35～1.6	610～1,300	0.9 × 1,000
Galvanized steel sheet	0.18～1.6	610～1,250	0.4 × 1,000
Tin plate	0.18～0.4	610～1,100	0.22 × 820

(2) Grades of products

Grades of products are summarized in Table 11- 2.

Table 11- 2 Grades of products

Products	Steel grade (JIS)
Pickled and oiled sheet (P/O)	Refer to chapter of the hot strip mill plant
Cold rolled steel sheet	SPCC SPCD SPCE
Galvanized steel sheet	SGCC SGCH
Tin plate	SPTE

(3) Annual production

Annual production for each product is summarized in Table 11-3.

Table 11- 3 Annual production for each products

(Ton/Y)

	Step1		Step2	
	Hot coil	Product	Hot coil	Product
Pickled and oiled sheet	105,200	100,000	210,400	200,000
Cold rolled steel sheet	550,600	500,000	767,400	700,000
Galvanized steel sheet	109,500	100,000	219,200	200,000
Tin plate	0	0	117,100	100,000
TOTAL	765,300	700,000	1,314,100	1,200,000

(4) Method of product shipment and packing weight

Specification of product packing is summarized in Table 11-4.

Table 11- 4 Specification of products packing

	Ratio of shipping form (%)		Coil packing weight (Ton)	
	Coil	Sheet	Ave.	Max.
Pickled and oiled sheet	50	50	5	10
Cold rolled steel sheet	50	50	(5)*	(10)*
Galvanized steel sheet	50	50	5	10
Tin plate	0	100	----	----

Note: ( )*: For cold rolled steel sheet, coils which do not go to RCL are divided at coil center to be installed outside of the steelworks. Approx.20 ton coils will be transported in the future from cold strip mill plant to coil center.

1.3 Product yields of each process facility

Product yields of each process facility are described in Table 11-5.

Table 11- 5 Product yields of process facilities

	Yield (%)	Scrap (kg/T)
PL	96.5	35
TCM	99.0	10
ECL	99.0	10
BAF	100.0	0
SPM	99.0	10
TPM	99.0	10
RCL	97.0	30
CPL	97.0	30
SHL	97.0	30
CGL	97.0	30
ETL	97.0	30

In this plant, all the generated materials are classified as scrap.

1.4 Production flow

The production flow of the cold strip mill plant and metal finishing plant are attached in the following pages.

- Figure 11- 1 : Production flow of cold strip mill & metal finishing plant at Step 1
- Figure 11- 2 : Production flow of cold strip mill & metal finishing plant at Step 2

The above production flow has been prepared considering the following conditions :

(1) As described at item 1.2 (3) in page 3, this plant is to process the products which quantity is required in 2005 and 2010 by Market study, taking into account the JV production capacity.

(2) This plant is to process four kind of products i.e P/O, cold rolled steel sheet, galvanized steel sheet and tin plate.
And initial investment costs should be minimum.

(3) As described at explanation of each facilities (Chapter Ⅳ, Part 6, Section 11 and 12), Process facilities are recommended taking into account the Viet Nam condition.

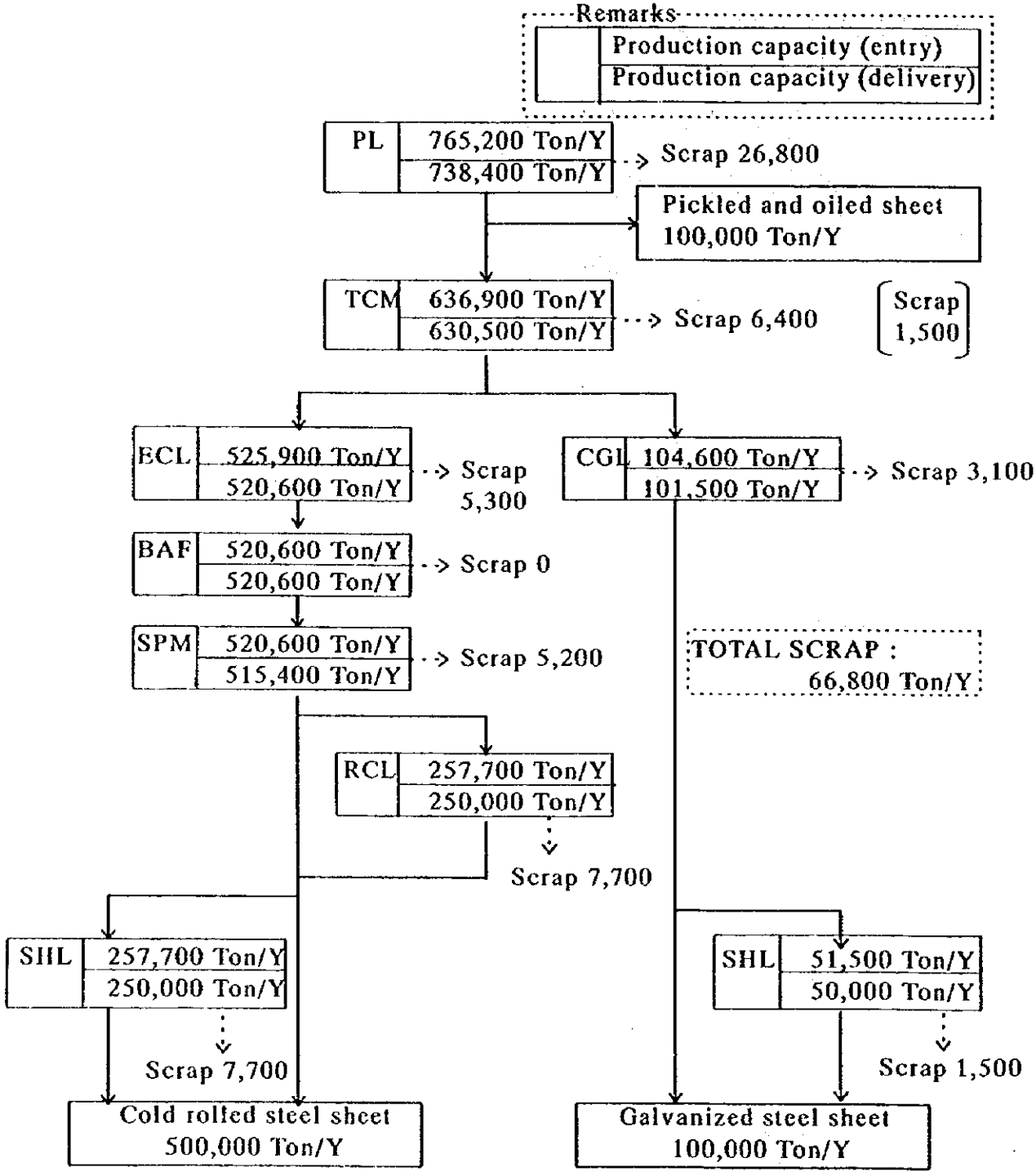


Figure 11-1 : Production flow of cold strip mill & metal finishing plant at Step 1

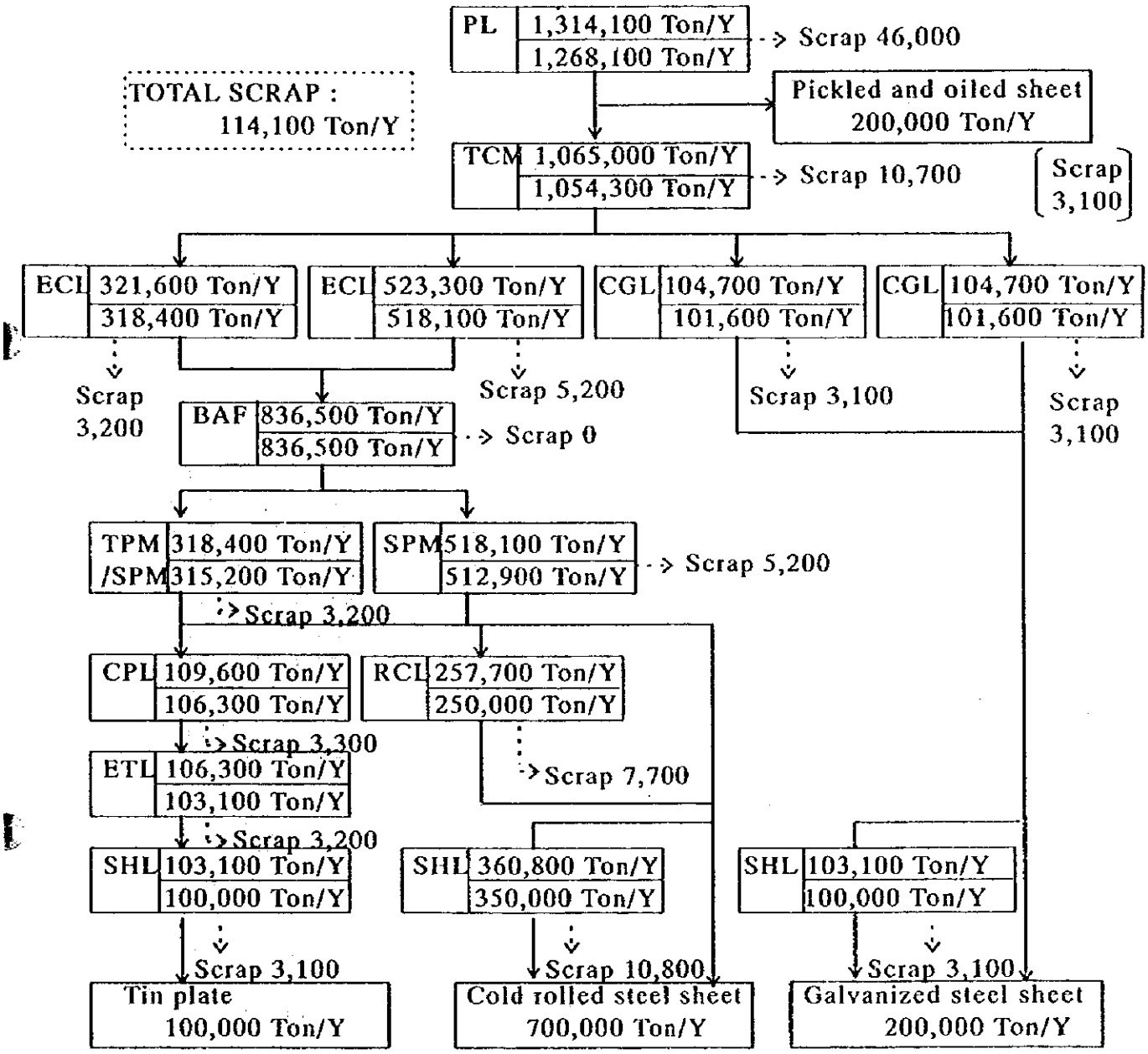


Figure 11-2 : Production flow of cold strip mill & metal finishing plant at Step 2

1.5 Production hours of each process facility

(1) Working hour : 24hours without meal break
3 shift by 4 crew

(2) Production hours of each process facility

Production hours of each process facility are summarized in Table 11-6.

Table 11- 6 Production hours of process facilities

	Maintenance		Available Hours	Working Ratio (%)	Production Hours
	Annual(Days)	Monthly(Hrs)			
PL	6	32	8,232	90	7,409
TCM	6	32	8,232	83	6,833
ECL	5	30	8,280	93	7,700
BAF	5	30	8,280	100	8,280
SPM	5	30	8,280	74	6,127
TPM	5	30	8,280	70	5,796
RCL	5	20	8,400	93	7,812
CPL	5	20	8,400	91	7,644
SHL	5	20	8,400	94	7,896
CGL	14	38	7,968	80	7,171
ETL	14	34	8,016	85	6,814

1.6 Manning plan of cold strip mill & metal finishing plant

Manning plan is summarized in Table 11-7.

Table 11- 7 Manning plan of cold strip mill & metal finishing plant

	Step 1		Step 2	
	Cold strip mill	Metal finishing	Cold strip mill	Metal finishing
Manager	4	1	4	1
Assistant Manager	11	2	12	4
Engineer	21	5	21	10
Secretary	1	0	1	0
Foreman	54	12	55	24
Skilled worker	592	116	700	278
Un-skilled worker	120	23	140	55
TOTAL	803	159	933	372

1.7 Utility consumption of each process facility

Unit consumptions of utilities are summarized in Table 11-8.

Table 11-8 Utility consumption of process facilities

	Fuel(Nm^3/t)		Electricity (kWh/t)	Nitrogen ($N m^3$/t)	Industrial water (m^3/t)	Steam (kg/t)
	Step.1 LPG *1	Step.2 COG *1	Step.1,2	Step.1,2	Step.1,2	Step.1,2
PL	-	-	10	-	2.0	30
TCM	-	-	100	-	0.5	15
ECL	-	-	20	-	1.0	40
BAF	4	20	30	2 *2	-	-
SPM	-	-	10	-	-	-
TPM	-	-	30	-	-	-
RCL	-	-	10	-	-	-
CPL	-	-	10	-	-	-
SHL	-	-	10	-	-	-
CGL	16	80	60	30	1.0	5
ETL	-	-	150	-	2.5	150

*1: LPG: approx. 23000 kcal/Nm^3, COG: approx. 4800 kcal/Nm^3

*2: For purging

At step 1, the cold strip mill plant & metal finishing plant will be installed prior to the upstream plants such as the ironmaking plant and steelmaking plant .
As a result of this condition, it is necessary to have utility supply systems such as LPG gas, steam etc. in this plant.

2. The facilities in the cold strip mill plant

The facilities in the cold strip mill plant include the process facilities and the auxiliary facilities as follows.

(1) Process facilities

- Pickling line (PL)
- Cold rolling mill (CM)
- Electrolytic cleaning line (ECL)
- Box annealing furnace (BAF)
- Skin pass mill (SPM)
- Temper mill(TPM)
- Recoiling line (RCL)
- Coil preparation line (CPL)
- Shearing line (SHL)

(2) Auxiliary facilities

- Water treatment facilities including hydrochloric acid recovery system
- Utility supply system including steam, compressed air, LPG etc.
- Roll shop and local maintenance shop
- Level 3 computer system for cold strip mill plant
- Local plant office
- Cranes and lifting equipment
- Packing material shop
- Building and Foundation for cold strip mill plant

3. Pickling line (PL)

3.1 General

One line of PL is considered necessary to be installed in this plant.
Taking into consideration of pickled and oiled sheet (P/O) production, this project is planned to install PL and CM individually.
At step 2 this line is expanded.
(Addition to mechanical descaling unit, reel, etc.)

3.2 Outline specification of PL

(1) Production capacity :

As described in Figure 11- 1 and Figure 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of PL (delivery) is

- Step 1 : 740,000 Ton/Y
- Step 2 : 1,270,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed will be around 1.8-6mm
Strip width to be processed will be around 610-1,350mm

(3) Descaling type :

Conventional dip type (Pickling acid : HCL)

4. Cold rolling mill (CM)

4.1 General

There are two types of cold rolling mill as follows.

- Tandem cold rolling mill (T-CRM)
- Reverse cold rolling mill (R-CRM)

According to the trend of production, at Step 1, T-CRM to be installed. At Step 2, T-CRM capacity to be increased.

4.2 Outline specification of CM

(1) Production capacity :

As described in Figure 11- 1 and Figure 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of CM (delivery) is :

- Step 1 : 630,000 Ton/Y
- Step 2 : 1,050,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed will be around 2.0-4.0mm (Entry)
0.18-1.6mm (Delivery)
Strip width to be processed will be around 610-1,300mm

(3) Mill type :

Tandem cold rolling mill (5 stands)

- Step 1 : Conventional batch type
  The equipment layout is planned to have a possibility of remodelling to the fully continuous type, taking into consideration of step 2.
- Step 2 : Fully continuous type

5. Electrolytic cleaning line (ECL)

5.1 General

One line of ECL is considered necessary to be installed at Step 1, and another line of ECL is considered necessary to be installed at Step 2.
At Step 1, product of this line is cold rolled steel sheet (as cold).
At Step 2, products of this line are cold rolled steel sheet (as cold) and substrate of tin plate (as cold).

5.2 Outline specification of ECL

(1) Production capacity :

As described in Figure 11- 1 and Figure 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of ECL (delivery) is :

- Step 1 : 520,000 Ton/Y (#1 ECL)
- Step 2 : 840,000 Ton/Y (#1 ECL + #2 ECL)
  * #2 ECL : 320,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed with be around 0.35-1.6mm (#1 ECL)
0.18-1.2mm (#2 ECL)
Strip width to be processed with be around 610-1,300mm (#1,2 ECL)

(3) Cleaning type : Electrolytic + mechanical cleaning

- Chemicals : Orthosodium silicate solution

6. Box annealing furnace (BAF)

6.1 General

Type of annealing facilities including BAF (Box annealing furnace), Sheet-CAL (Continuous annealing line)and Tin-CAL are reviewed.
In this project, BAF seems to be most appropriate.
The reasons are as follows.

a) This cold rolling mill and metal finishing plant are planned at two stage construction, i.e. the year of 2005 and 2010. The evaluation of the annealing facilities is shown in Table 11-9.
For the total equipment cost, BAF seems to be most appropriate.

Table 11-9 Evaluation of the annealing facilities.

Case		Step 1	Step 2	Total
	Cold rolled steel	500,000 Ton/Y	+200,000 Ton/Y	Equipment
	Tin plate	-	+100,000 Ton/Y	Cost
1		BAF*1	+BAF	Low
2		BAF	+Tin-CAL*2	Medium
3		Sheet-CAL*3	+BAF	Medium
4		Sheet-CAL	+Tin-CAL	High

*1 : BAF process / CM→ECL→BAF→SPM(TPM) →RCL(CPL)
*2 : Tin-CAL process / CM→Tin-CAL →SPM(TPM) →RCL(CPL)
*3 : Sheet-CAL process / CM→Sheet-CAL →RCL(CPL)

b) For the operational skill, BAF is easy to operate than CAL.
c) For the reprocessing of the products, BAF can be reprocessed by an independent SPM. CAL is difficult to reprocess.
d) For the flexibility to the production volume, BAF is more flexible to the production volume than CAL.

6.2 Outline specification of BAF

(1) Production capacity :

As described in Figure 11- 1 and Figure 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of BAF is :

- Step 1 : 520,000 Ton/Y
- Step 2 : 840,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed with be around 0.18-1.6mm
Strip width to be processed with be around 610-1,300mm

7. Skin pass mill (SPM)

7.1 General

One mill of SPM is considered necessary to be installed at Step 1.
Product of this mill is cold rolled steel sheet.

7.2 Outline specification of SPM

(1) Production capacity :

As described in Figure 11- 1 and Figure 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of SPM (delivery) is :

- Step 1 : 520,000 Ton/Y
- Step 2 : 520,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed with be around 0.35-1.6mm
Strip width to be processed with be around 610-1,300mm

(3) Mill type :

Single stand mill

8. Temper mill (TPM)

8.1 General

One mill of TPM is considered necessary to be installed at Step 2.
Products of this mill are substrate of tin plate and cold rolled steel sheet.

8.2 Outline specification of TPM

(1) Production capacity :

As described in Figure 11- 1 and Figure 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of TPM (delivery) is :

- Step 2 : 320,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed with be around 0.18-1.2mm
Strip width to be processed with be around 610-1,300mm

(3) Mill type

Two stands mill: For cold rolled steel sheet, this mill is operated at only one stand.
For substrate of Tin plate, this mill is operated at two stands.

9. Recoiling line (RCL)

9.1 General

One line of RCL is installed at Step 1 in this plant.
Product of this line is cold rolled steel sheet.

Part of the products of cold rolled steel sheet from SPM and TPM is directly transferred to RCL in the coil center and processed.

9.2 Outline specification of RCL

(1) Production capacity :

As described in Figure 11- 1 and Figure 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of RCL (delivery) is :

- Step 1 : 250,000 Ton/Y
- Step 2 : 250,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed with be around 0.35-1.6mm
Strip width to be processed with be around 610-1,300mm

10. Coil preparation line (CPL)

10.1 General

One line of CPL is considered necessary to be installed at Step 2.
Product of this line is substrate of tin plate.

10.2 Outline specification of CPL

(1) Production capacity :

As described in Figure 11- 1 and Figure 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of CPL (delivery) is :

- Step 2 : 110,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed with be around 0.18-1.2mm
Strip width to be processed with be around 610-1,300mm

11. Shearing line (SHL)

Refer to page Ⅳ-14-12-4

Note: Equipment list and construction schedule of cold strip mill plant and its related equipment are shown in Ⅳ-14-12 together with the metal finishing plant.

Section 12 Metal Finishing Plant

Contents

1. The facilities in the metal finishing plant

The facilities in the metal finishing plant include the process facilities and the auxiliary facilities as follows.

(1) Process facilities

- Continuous galvanizing line (CGL)
- Electrolytic tinning line (ETL)
- Shearing line (SHL)

(2) Auxiliary facilities (common to the cold strip mill plant)

- Water treatment facilities
- Utility supply system including steam, compressed air, LPG etc.
- Local maintenance shop
- Level 3 computer system for metal finishing plant
- Local plant office
- Cranes and lifting equipment
- Packing material shop
- Building and foundation for metal finishing plant

2. Continuous galvanizing line (CGL)

2.1 General

Type of HD-Galvanizing line are as follows.

1) Sheet type
2) Economy type
3) Wheeling type
4) Original selas type
5) Radiant type
6) NOF/DDF type

Among above types conceivable alternatives in Viet Nam in the future will be as follows:

3) Wheeling type
This is flux type of CGL whose plant cost is low, because high temperature furnace is not incorporated in the line.
But following disadvantages are pointed out.

a) Adhesiveness Zinc is not perfect compared with hydrogen activating method. (But much better than wet flux type)
b) Productivity is not high.
c) Annealing of cold rolled strip by BAF is required because no annealing furnace is incorporated in the line.

Generally speaking, this type of CGL is recommended to be installed at dedicated rolling plant (JV), i.e. not recommendable for the new integrated steel plant.

6) NOF/DDF type
The plant cost of this type of CGL is high, but considered most suitable to be installed at the new integrated steel plant because of the following reasons :

a) High productivity is possible.
b) Cold rolled strip is annealed in the line, therefore annealing process by BAF can be eliminated.
c) Adhesiveness of zinc is stable and excellent because of surface activation by hydrogen.

d) For production of DQ, special steel is required.
Such special steel can be produced only by integrated steel plant.

In this project, NOF/DDF seems to be most appropriate.

One line of CGL is considered necessary to be installed at Step 1, and another line of CGL is considered necessary to be installed at Step 2

2.2 Outline specification of CGL

(1) Production capacity :

As described in Figure 11- 1 and 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of CGL (delivery) is :

- Step 1 : 100,000 Ton/Y (#1 CGL)
- Step 2 : 200,000 Ton/Y (#1 CGL + #2 CGL)

(2) Product size to be processed :

Strip thickness to be processed with be around 0.18-1.6mm
Strip width to be processed with be around 610-1,250mm

(3) Type : NOF/DDF Type

3. Electrolytic tinning line (ETL)

3.1 General

One line of ETL is considered necessary to be installed at Step 2.

3.2 Outline specification of ETL

(1) Production capacity :

As described in Figure 11- 1 and 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of ETL (delivery) is

- Step 2 : 100,000 Ton/Y

(2) Product size to be processed :

Strip thickness to be processed with be around 0.18-0.4mm
Strip width to be processed with be around 610-1,100mm

4. Shearing line (SHL)

4.1 General

Two lines of SHL (#1 SHL, #2 SHL) is considered necessary to be installed at Step 1, and another line of SHL (#3 SHL) is considered necessary to be installed at Step 2.

#1 SHL	:	for cold rolled steel sheet	(In the cold strip mill plant)
#2 SHL	:	for galvanized steel sheet	(In the metal finishing plant)
#3 SHL	:	for tin plate	(In the metal finishing plant)

4.2 Outline specification of SHL

(1) Production capacity :

As described in Figure 11- 1 and 11- 2 on page Ⅳ-14-11-6 and 7, the required capacity of SHL (delivery) is :

		#1 SHL	#2 SHL	#3 SHL
- Step 1	:	250,000 Ton/Y	50,000 Ton/Y	-
- Step 2	:	350,000 Ton/Y	100,000 Ton/Y	100,000 Ton/Y

#1 SHL is installed at Step 1, its capacity is 350,000 Ton/Y
#2 SHL is installed at Step 1, its capacity is 100,000 Ton/Y
#3 SHL is installed at Step 2, its capacity is 100,000 Ton/Y

(2) Product size to be processed :

		#1 SHL	#2 SHL	#3 SHL
- Step thickness :	around (mm)	0.35-1.6	0.18-1.6	0.18-0.4
- Step width :	around (mm)	610-1,300	610-1,250	610-1,100

5. List of equipment specifications for cold strip mill & metal finishing plant

	Equipment	Step 1		Step2	
		Quantity	Main specification	Quantity	Main specification
(1)	Pickling line (PL)	1	Pay-off reel	1+1	Pay-off reel
		1	Welder: Flush Butt type		Same as left
				1	Scale Breaker
		1	Entry Looper		Same as left
		1	Pickling equipment		Same as left
		1	Delivery Looper		Same as left
		1	Side Trimmer		Same as left
		1	Oiler		Same as left
		1	Tension Reel	1+1	Tension Reel
		1	Hydrochloric Acid Recovery System		Same as left
(2)	Tandem cold rolling Mill (TCM)	1	Pay-off Reel	1	Same as left
				1	Welder: Flush Butt type
				1	Entry Looper
		5	Mill stand		Same as left
		5	Mill drive		Same as left
		1	Tension Reel	1+1	Tension Reel
(3)	Roll Shop (for TCM, SPM,TPM)	4	Roll Grinder		Same as left
		1	Dull finishing machine		Same as left

	Equipment	Step 1		Step 2	
		Quantity	Main specification	Quantity	Main specification
(4)	#1 Electrolytic Cleaning Line (#1 ECL)	1	Pay-off Reel		Same as left
		1	Welder: Over Lap Seam type		Same as left
		1	Alkali cleaning equipment		Same as left
		1	Electrolytic Cleaning equipment		Same as left
		1	Tension Reel		Same as left
(5)	#2 Electrolytic Cleaning Line (#2 ECL)			1	Pay-off Reel
				1	Welder: Over Lap Seam type
				1	Alkali cleaning equipment
				1	Electrolytic cleaning equipment
				1	Tension Reel
(6)	Box Annealing Furnace (BAF)	Approx. 40	Bases	Approx. 40+25	Same as left
(7)	Skin Pass Mill (SPM)	1	Pay-off Reel		Same as left
		1	Mill Stand		Same as left
		1	Mill Drive		Same as left
		1	Tension Reel		Same as left

	Equipment	Step 1		Step 2	
		Quantity	Main specification	Quantity	Main specification
(8)	Temper Mill (TPM)			1	Pay-off Reel
				2	Mill Stand
				2	Mill Drive
				1	Tension Reel
(9)	Rolling Line (RCL)	1	Pay-off Reel		Same as left
		1	Side Trimmer		Same as left
		1	Oiler		Same as left
		1	Tension Reel		Same as left
(10)	Coil Preparation Line (CPL)			1	Pay-off Reel
				1	Welder: Over Lap Seam type
				1	Side Trimmer
				1	Oiler
				1	Tension Reel

	Equipment	Step 1		Step 2	
		Quantity	Main specification	Quantity	Main specification
(11)	#1 Continuous Galvanizing Line (#1 CGL)	1	Pay-off Reel		Same as left
		1	Welder: Over Lap Seam type		Same as left
		1	Entry Looper		Same as left
		1	Heating furnace		Same as left
		1	Cooling furnace		Same as left
		1	Pot		Same as left
		1	Coating equipment		Same as left
		1	Delivery Looper		Same as left
		1	Tension Leveller		Same as left
		1	Tension Reel		Same as left

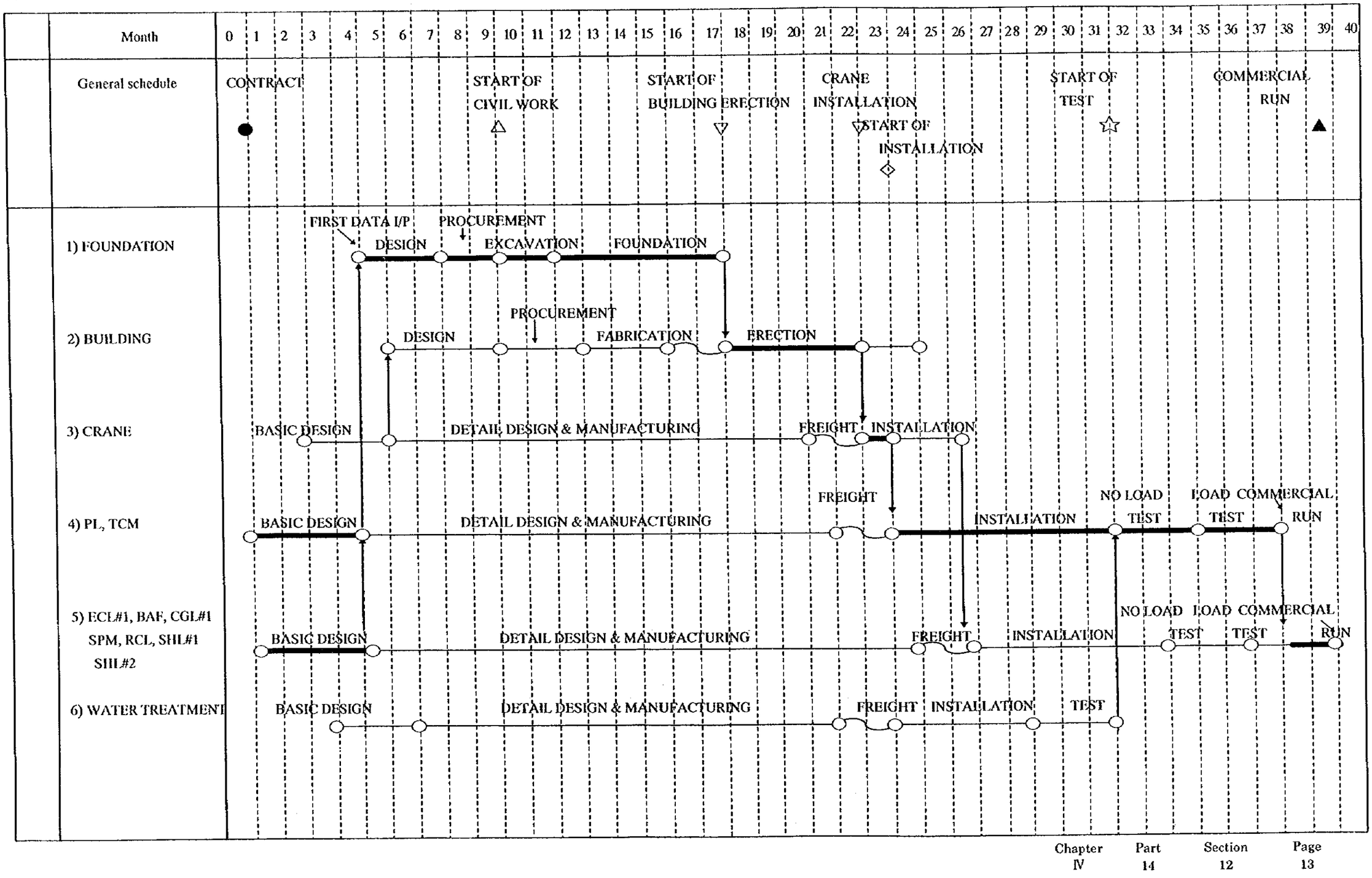
	Equipment	Step 1		Step 2	
		Quantity	Main specification	Quantity	Main specification
(12)	#2 Continuous Galvanizing Line (#2 CGL)			1	Pay-off Reel
				1	Welder: Over Lap Seam type
				1	Entry Looper
				1	Heating furnace
				1	Cooling furnace
				1	Pot
				1	Coating equipment
				1	Delivery Looper
				1	Tension Leveller
				1	Tension Reel

	Equipment	Step 1		Step 2	
		Quantity	Main specification	Quantity	Main Specification
(13)	Electrolytic Tinning Line (ETL)			2	Pay-off Reel
				1	Welder: Over Lap Seam type
				1	Entry Looper
				1	Cleaning & Pickling equipment
				1	Plating equipment
				1	Reflow equipment
				1	Post-treatment equipment
				1	Oiler
				2	Tension Reel
(14)	#1 Shear Line (#1SHL) (for Cold rolled steel sheet)	1	Pay-off Reel		Same as left
		1	Drum Shear		Same as left
		4	Piler		Same as left
(15)	#2 Shear Line (#2SHL) (for Galvanized steel sheet)	1	Pay-off Reel		Same as left
		1	Drum Shear		Same as left
		4	Piler		Same as left

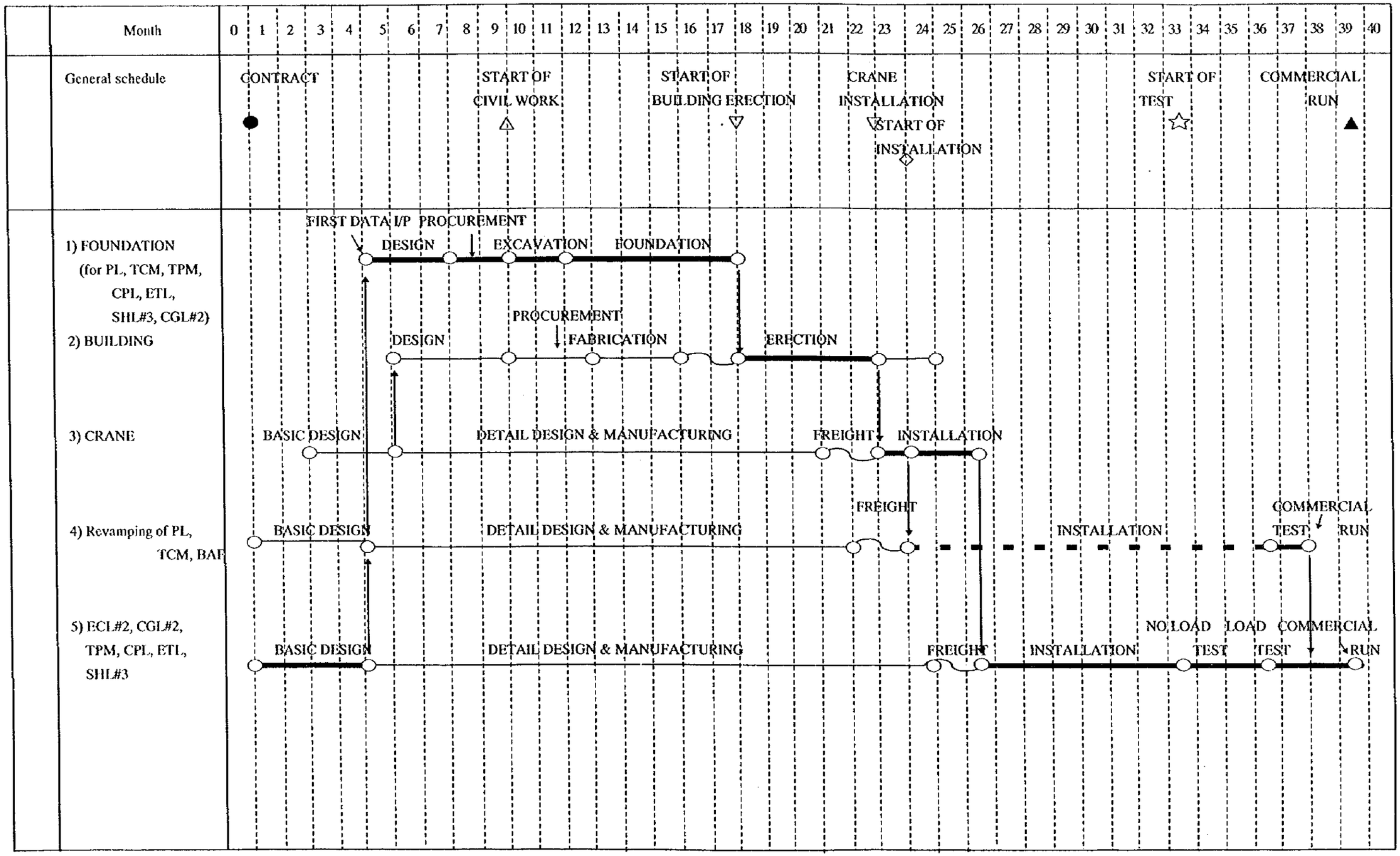
	Equipment	Step 1		Step 2	
		Quantity	Main specification	Quantity	Main specification
(16)	#3 Shear Line (#3 SHL) (for Tin Plate)			1 1 4	Pay-off Reel Drum Shear Piler
(17)	Crane	Approx. 22		Approx. 22+8	
(18)	Compressor	1			Same as left
(19)	Boiler	1			Same as left
(20)	Water Treatment	1 1 1 1 1 1 1	Raw Water Treatment Filtered Water Treatment Demineralized Water Treatment Potable Water Treatment Cooling Water Treatment Weak Acid Waste Water Treatment Alkaline & Oily Waste		Same as left Same as left Same as left Same as left Same as left Same as left Same as left
(21)	Packing	1	Manual Packing on Floor		Same as left

6. Construction schedule of cold strip mill & metal finishing plant

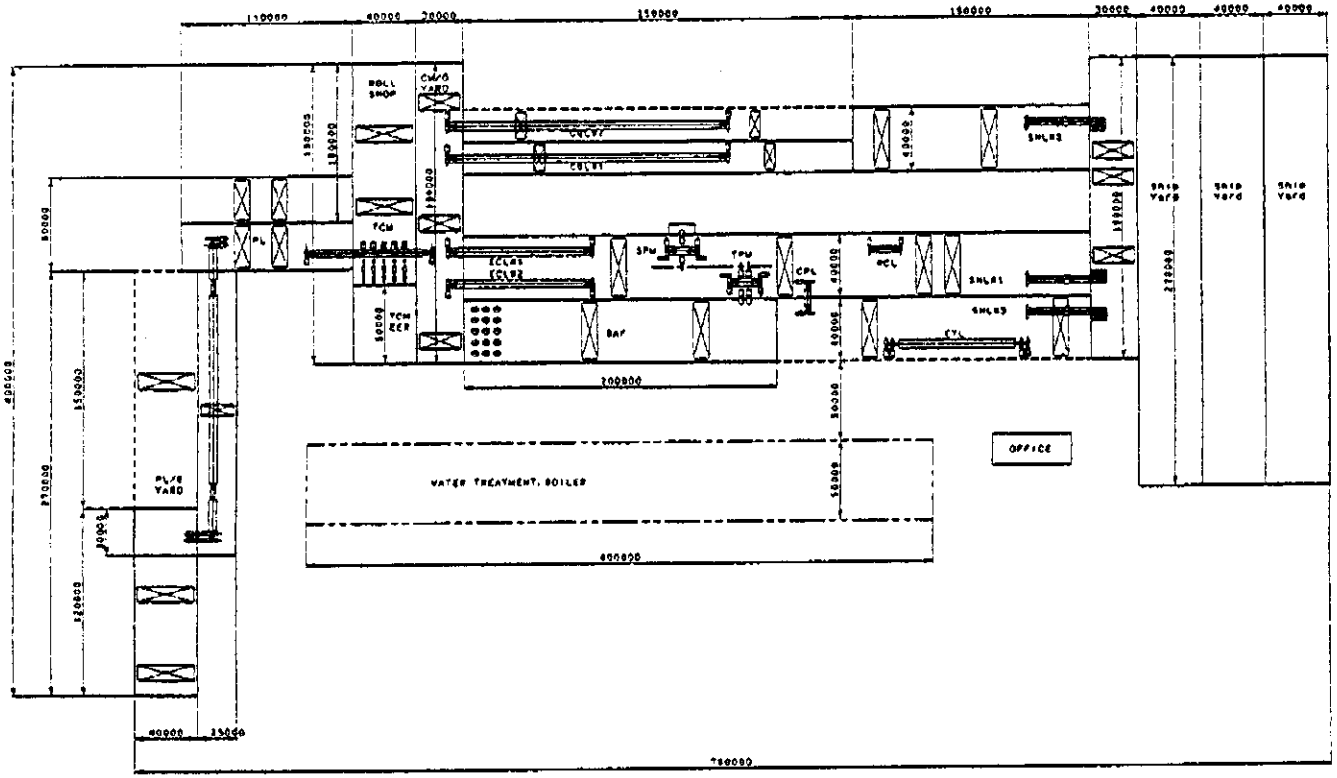
(1) Step 1



(2) Step 2


Month
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
General schedule
CONTRACT
START OF CIVIL WORK
START OF BUILDING ERECTION
CRANE INSTALLATION
START OF INSTALLATION
START OF TEST
COMMERCIAL RUN
1) FOUNDATION (for PL, TCM, TPM, CPL, ETL, SHL#3, CGL#2)
2) BUILDING
FIRST DATA I/P
PROCUREMENT
DESIGN
EXCAVATION
FOUNDATION
PROCUREMENT
DESIGN
FABRICATION
ERECTION
3) CRANE
BASIC DESIGN
DETAIL DESIGN & MANUFACTURING
FREIGHT
INSTALLATION
4) Revamping of PL, TCM, BAF
BASIC DESIGN
DETAIL DESIGN & MANUFACTURING
FREIGHT
INSTALLATION
COMMERCIAL TEST
RUN
5) ECL#2, CGL#2, TPM, CPL, ETL, SHL#3
BASIC DESIGN
DETAIL DESIGN & MANUFACTURING
FREIGHT
INSTALLATION
NO LOAD TEST
LOAD TEST
COMMERCIAL RUN

7. General layout of cold strip mill & metal finishing plant



Section 13 Power Receiving and Distribution Facilities

Contents

Page

1. General

Power receiving and distribution facilities are to distribute required electric power with suitable voltage to productive plants in the new integrated steelworks receiving electric power from outside power company and in-plant power plant.

Total power supply and demand of the new integrated steelworks are estimated at each step as shown in the following Table 13-1 which was made on the basis of the Energy balance Table 13-2,13-3 and 13-4 attached herewith.

Table 13-1 Total power supply and demand

Construction step	Consumption		Generation		Purchase	
	Average (MWh/h)	Max. power (MWh/h)	Average (MWh/h)	Available power (Mwh/h)	Average (MWh/h)	Max. power (MWh/h)
Step 1 (HOT + COLD)	43.2	71.4	-	-	43.2	71.4
Step 2 (BF x 1, BOF x 2)	177.4	209	135.4	142.5	42	209
Step 3 (BF x 2, BOF x 3)	269.8	317	270.8	285	-1	174.5

These facilities consist of the following main equipment:

- Power receiving station and main substations
- Distribution lines between receiving station and main substation
- Emergency diesel generator plant
- Erection power supply equipment before 220kV power receiving

2. Conditions and basic concept

2.1 Power flow

The following Figure 13-1, 13-2 and 13-3 show required electric power flow to be estimated at each step.

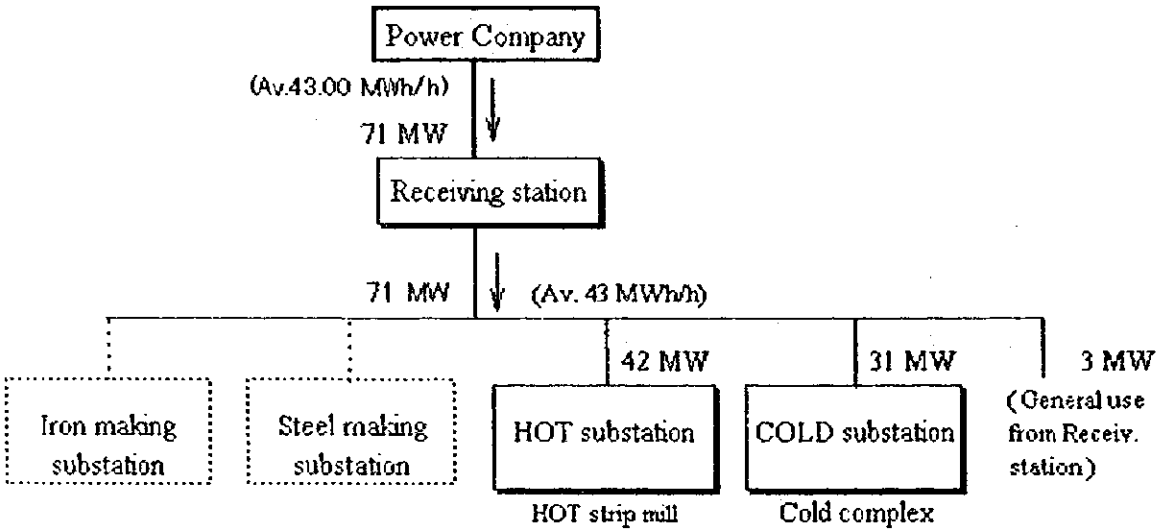


Figure 13-1 Power flow of Step 1, HOT and COLD plan

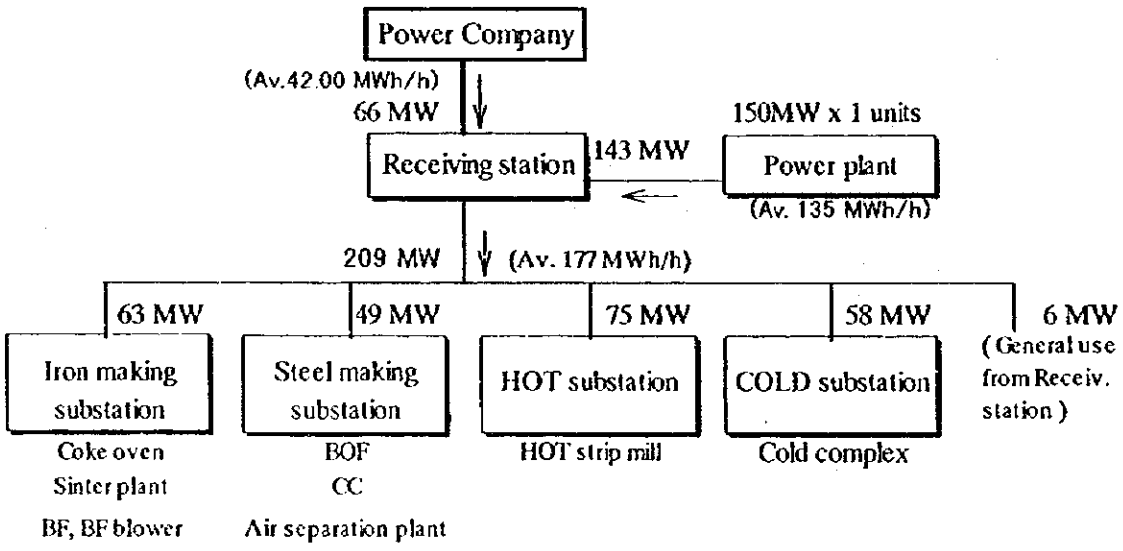


Figure 13-2 Power flow of Step 2, BF x 1 and BOF x 2 plan

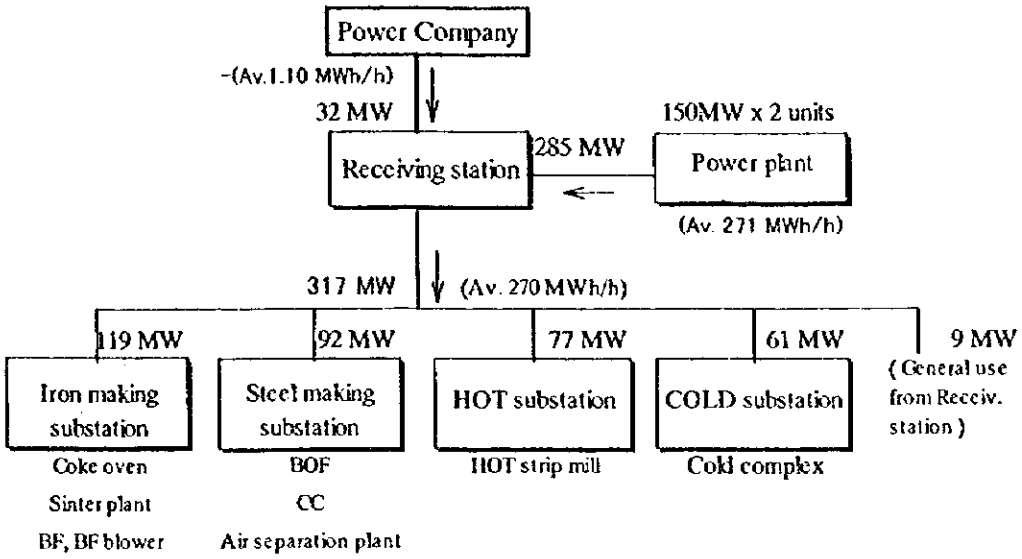


Figure 13-3 Power flow of Step 3, BF x 2 and BOF x 3 plan

The Figures in the above power flow show estimated maximum power demand per hour
(Av. MWh/h) means annual average consumption power per hour.

2.2 Basic planning conditions for power distribution

2.2.1 Power receiving

Electric power will be received at 220kV with 2 lines of 350MVA capacity or more.

The short circuit level at the 220 kV substation on the power company's side will be estimated to be approx. 2,790 MVA in 2005.

2.2.2 Main substations

Main substations consist of one(1) receiving station and four(4) main substations, iron making substation, steel making substation, HOT rolling substation and COLD rolling substation, which will be located at each corresponding area.

Substation supply capacity is planned on the basis of power flow indicated in Figure 13-1, 13-2 and 13-3.

2.2.3 Power distribution inside the steelworks

Distribution voltage from the receiving station to the main substation is 66 kV and the supply voltage to each plant is 11 kV in principle, however, HOT finisher and BF blower each have 66 kV.

Distribution lines from main substation to each plant is planned in the scope of related plant.

2.2.4 Prevention of voltage fluctuation

To prevent harmful voltage fluctuation, a SVC(Static var compensator) with suitable capacity should be introduced at step 1 because there is no installation of an in-plant power plant.

2.2.5 Operation of power distribution

Required persons will be stationed at each substation to operate the receiving station and main substations.

2.2.6 Emergency diesel generator plant

2 sets of diesel generators with 1,000 kW output/ set will be installed to secure emergency power for the Blast furnace in case of a black out in the power system.

2.2.7 Erection power supply

Erection power supply with an estimated volume of approx.5 MVA will be needed at step 1 before 220 kV power receiving.

3. Equipment plan

3.1 Basic one line diagram

The following Figure 13-4 shows planned basic one line diagram at step 3, 4.5million ton per year plan.

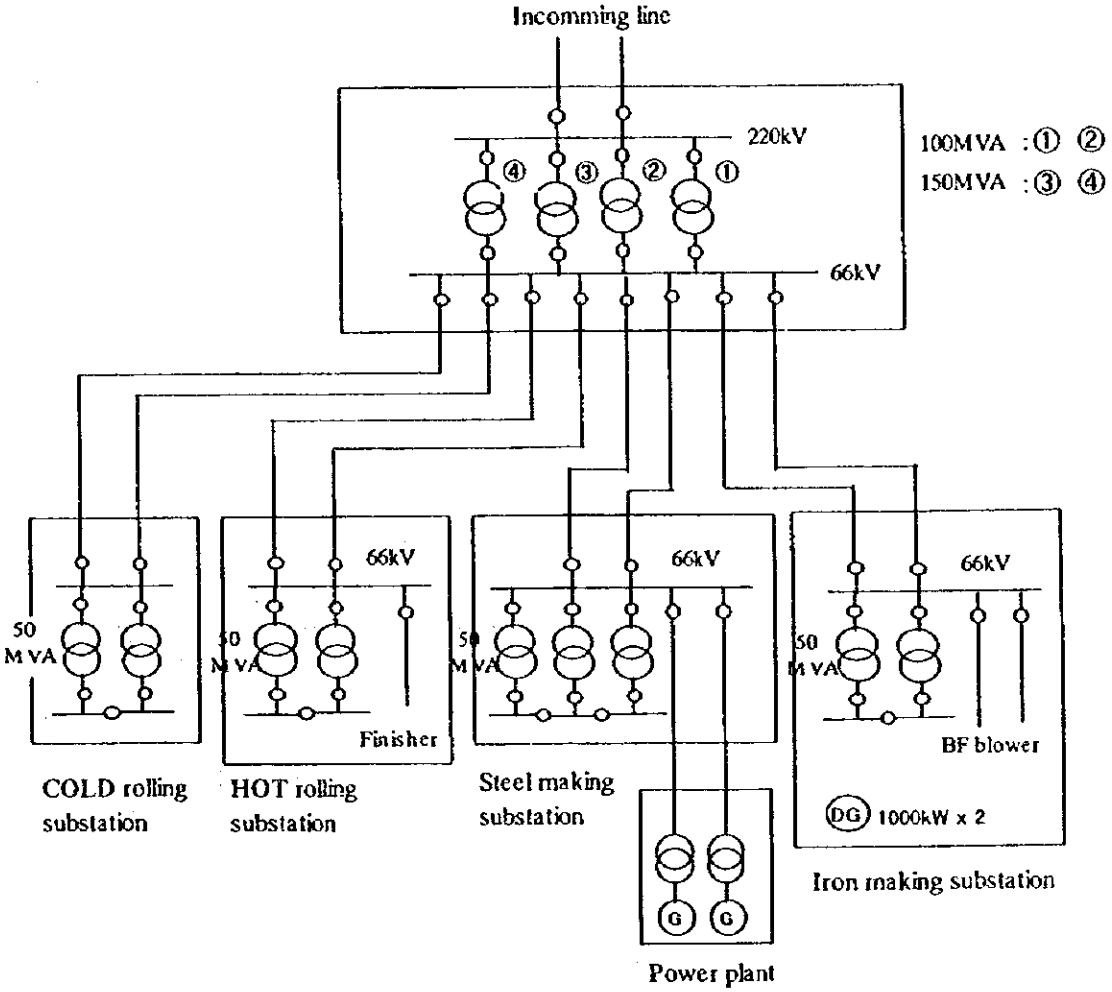


Figure 13-4 Planned basic one line diagram

3.2 Equipment list and basic specifications

Table 13-5 shows equipment list and basic specifications for power receiving and distribution facilities at each steps.

4. Construction schedule

Table 13-6 shows outlined construction schedule at each step.

5. Manning plan

The manning plan for power receiving and distribution facilities is shown in Table 13-7 "Manning plan for Energy section in the Equipment division".

Table 13-2 Estimated energy balance at Step 1, HOT COLD plan

	Production		Consumed power		Produced fuel		Consumed fuel		C/(C+B)	Consumed fuel com(E6kcal/h)			Remarks
	kt/y	ton/h	kWh/t	MWh/h	Mcal/t	E6kcal/h	Mcal/t	E6kcal/h	(Cal %)	LPG	H. oil		
Coke Oven	0	0.0		0.0		0.0		0.0	34.7%	0.0	0.0	0.0	
Sinter Plant	0	0.0		0.0		0.0		0.0	100.0%	0.0	0.0	0.0	
BF	0	0.0		0.0		0.0		0.0	20.7%	0.0	0.0	0.0	
	0	0.0		0.0		0.0		0.0	100.0%	0.0	0.0	0.0	
	0	0.0		0.0		0.0		0.0	100.0%	0.0	0.0	0.0	
BOF	0	0.0		0.0		0.0		0.0	100.0%	0.0	0.0	0.0	
CC	0	0.0		0.0		0.0		0.0	100.0%	0.0	0.0	0.0	
HOT	1,680	191.8	113	21.7		0.0	300	57.5	100.0%	0	57.5	0.0	
COLD(TA)	765	87.3	170	14.8		0.0	92.0	6.9	100.0%	6.9	0.0	0.0	
	0	0.0	0	0.0		0.0		0.0		0.0	0.0	0.0	
CGL	105	12.0	60.0	0.7		0.0	368.0	4.4	100.0%	4.4	0.0	0.0	
		0.0	0	0.0		0.0	0	0.0	100.0%	0.0	0.0	0.0	
ETL	0	0.0	150	0.0		0.0	0	0.0	100.0%	0.0	0.0	0.0	
		0.0		0.0		0.0		0.0	100.0%	0.0	0.0	0.0	
		0.0	0	0.0		0.0		0.0		0.0	0.0	0.0	
BF Blower	0	0.0	0	0.0		0.0		0.0		0.0	0.0	0.0	
Air sep. plant	(KNm3/h)	0.0	0	0.0		0.0		0.0		0.0	0.0	0.0	
Process steam	0	0.0		0.0		0.0		6.4	100.0%	0	6.4	0.0	
Other, Loss	2,445	279.1	20.0	6.0		0.0		2.3	100.0%	2.3	0.0	0.0	
Sub total		0.0		43.2		0.0		77.5		13.6	63.9	0.0	
Power plant	Generator terminal end	0 MW		0.0		0.0		0		0.0	0.0	0.0	
Total		0.0		43.2		0.0		0.0		13.6	63.9	0.0	77.5
Purchased energy			Purchased power(MW)	43.2			Purchased Fuel	77.5					

Table 13-3 Estimatesd energy balance at Step 2. BF x 1, BOF x 2 , 2.3 million ton/year plan

	Production		Consumed power		Produced fuel		Consumed fuel		C/(C+B)	Consumed fuel com(E6kcal/h)				Remarks
	kt/y	ton/h	kWh/t	MWh/h	Mcal/t	E6kcal/h	Mcal/t	E6kcal/h	(Cal %)	COG	BFG	BOFG	Heavy oil	
Coke Oven	1,561	178.2	50	8.9	1,440	256.6	552	98.4	34.7%	34.1	64.2	0.0	0.0	Cal : HLV basis
Sinter Plant	3,302	376.9	30	11.3		0.0	14.4	5.4	100.0%	5.4	0.0	0.0	0.0	BFG 800 kcal/Nm3
BF	2,266	258.7	35	9.1	1,280	331.1	464.0	120.0	20.7%	24.8	95.2	0.0	0.0	COG 4800 kcal/Nm3
(PCI caol)	227	25.9	0	0.0	0	0.0		0.0	100.0%	0.0	0.0	0.0	0.0	BOFG 2000 kcal/Nm3
	0	0.0	0	0.0		0.0		0.0	100.0%	0.0	0.0	0.0	0.0	H. oil 10000 kcal/kg
BOF	2,342	267.4	30	8.0	180	48.1	28.8	7.7	100.0%	7.7	0.0	0.0	0.0	
Lime	2,342	267.4	2.5	0.7			89.6	24.0	100.0%	24.0	0.0	0.0	0.0	
CC	2,224	253.9	24	6.1		0.0	13.4	3.4	100.0%	3.4	0.0	0.0	0.0	
HOT	2,224	253.9	102	37.6		0.0	200	50.8	100.0%	50.8	0.0	0.0	0.0	
(Imported slab)	1,001	114.3					300	34.3	100.0%	34.3	0.0	0.0	0.0	
COLD(TA)	1,314	150.0	170	25.5		0.0	96.0	12.1	100.0%	12.1	0.0	0.0	0.0	
	0	0.0	0	0.0		0.0		0.0		0.0	0.0	0.0	0.0	
CGL	209	23.9	60.0	1.4		0.0	384.0	9.2	100.0%	9.2	0.0	0.0	0.0	
		0.0	0	0.0		0.0	0	0.0	100.0%	0.0	0.0	0.0	0.0	
ETL	106	12.1	150	1.8		0.0	0	0.0	100.0%	0.0	0.0	0.0	0.0	
		0.0	0	0.0		0.0		0.0	100.0%	0.0	0.0	0.0	0.0	
		0.0	0	0.0		0.0		0.0		0.0	0.0	0.0	0.0	
BF Blower	2,266	258.7	80	20.7		0.0		0.0		0.0	0.0	0.0	0.0	
Air sep. plant	(KNm3/h)	25.2	885	22.3		0.0		0.0		0.0	0.0	0.0	0.0	BF O2 injection 35.0 Nm3/t
Process steam		267.4		0.0		0.0	115	30.7	6.0%	1.8	28.9	0.0	0.0	BOF O2 injection 56.0 Nm3/t
Other. Loss		267.4	90.0	24.1		0.0	46.8	12.5	100.0%	12.5	0.0	0.0	0.0	
Sub total		253.9		177.4		635.8		408.5		220.2	188.3	0.0	0.0	
Power plant(PP)	Generator terminal end	150 MW	PP own use(MW)	7.1			2263 kcal/kwh	323		36.4	142.8	48.1	95.1	227.4 (By- pro. gas for power plant .)
Total				184.5		635.8		731.0		256.6	331.1	48.1	95.1	635.8 (By-pro. gas total)
Purchased energy			Purchased power	42.0	Purchased Fuel	95.1								95.1 (Purchased fuel for power plant.)

Power plant operation condition	Generation by by-pro.gas	100.5	Average gen. power	142.5MW	PP efficiency	0.38
	Generation by Purchased fuel	42.0	PP own use rate	0.05	PP operation ratio	0.95

Table 13-4 Estimatesd energy balance at Step 3. BF x 2. BOF x 3 . 4.5 million ton/year plan

	Production		Consumed power		Produced fuel		Consumed fuel		C/(C+B)	Consumed fuel com(E6kcal/h)				Remarks
	kt/y	ton/h	kWh/t	MWh/h	Mcal/t	E6kcal/h	Mcal/t	E6kcal/h	(Cal %)	COG	BFG	BOFG	Heavy oil	
Coke Oven	3,025	345	50.0	17.3	1,440	497.3	552	190.6	34.7%	66.1	124.5	0	0	Cal : HLV basis
Sinter Plant	6,395	730	30.0	21.9		0.0	14.4	10.5	100%	10.5	0.0	0	0	BFG 800 kcal/Nm3
BF	4,389	501	35.0	17.5	1,280	641.3	464	232.5	20.7%	48.1	184.4	0	0	COG 4800 kcal/Nm3
(PCI coal)	439	50	0.0	0.0	0	0.0		0.0	100%	0.0	0.0	0	0	BOFG 2000 kcal/Nm3
	0	0	0.0	0.0		0.0		0.0	100%	0.0	0.0	0	0	Heavy oil 10000 kcal/kg
BOF	4,535	518	30.0	15.5	180	93.2	28.8	14.9	100%	14.9	0.0	0	0	
Lime	4,535	518	2.5	1.3			89.6	46.4	100%	46.4	0.0	0	0	
CC		493	24.0	11.8		0.0	13.44	6.6	100%	6.6	0.0	0	0	
HOT		368	102.0	37.6		0.0	200	73.6	100%	73.6	0.0	0	0.0	
													0	
COLD(TA)	1,314	150	170.0	25.5		0.0	96	12.1	100%	12.1	0.0	0	0	
	0	0	0.0	0.0		0.0		0.0		0.0	0.0	0	0	
CGL	209.4	24	60.0	1.4		0.0	384	9.2	100%	9.2	0.0	0	0	
		0	0.0	0.0		0.0	0	0.0	100%	0.0	0.0	0	0	
ETL	106.3	12	150.0	1.8		0.0	0	0.0	100%	0.0	0.0	0	0	
		0	0.0	0.0		0.0		0.0	100%	0.0	0.0	0	0	
		0	0.0	0.0		0.0		0.0		0.0	0.0	0	0	
BF Blower	4,389	501	80.0	40.1		0.0		0.0		0.0	0.0	0	0	
Air sep. plant	(KNm^3/h)	49	885.0	43.4		0.0		0.0		0.0	0.0	0	0	BF O_2 injection 35.0 Nm3/t
Process steam	4,320	493		0.0		0.0	85.6	42.2	6%	2.5	39.7	0	0	BOF O_2 injection 56.0 Nm3/t
Other. Loss	4,320	493	70.0	34.5		0.0	38.9	19.2	100%	19.2	0.0	0	0	
Sub total		493		269.7		1,232		658		309.3	348.5	0	0.0	
Power plant(PP)	Generator terminal end	300	PP own use(MW)	14.3			2,263	645		188.0	292.8	93.2	71.1	(By- pro. gas for 573.9 power plant)
Total				283.9		1,232		1,303		497.3	641.3	93.2	71.1	1,232 (By-pro. gas total)
Purchased energy			Purchased power	-1.1	Purchased Fuel	71.1								(Purchased fuel for 71.1 power plant.)

Power plant operation condition	Generation by by-pro.gas	254	Average gen. power	285.0	PP efficiency	0.38
	Generation by Purchased fuel	31	PP own use rate	0.05	PP operation ratio	0.95

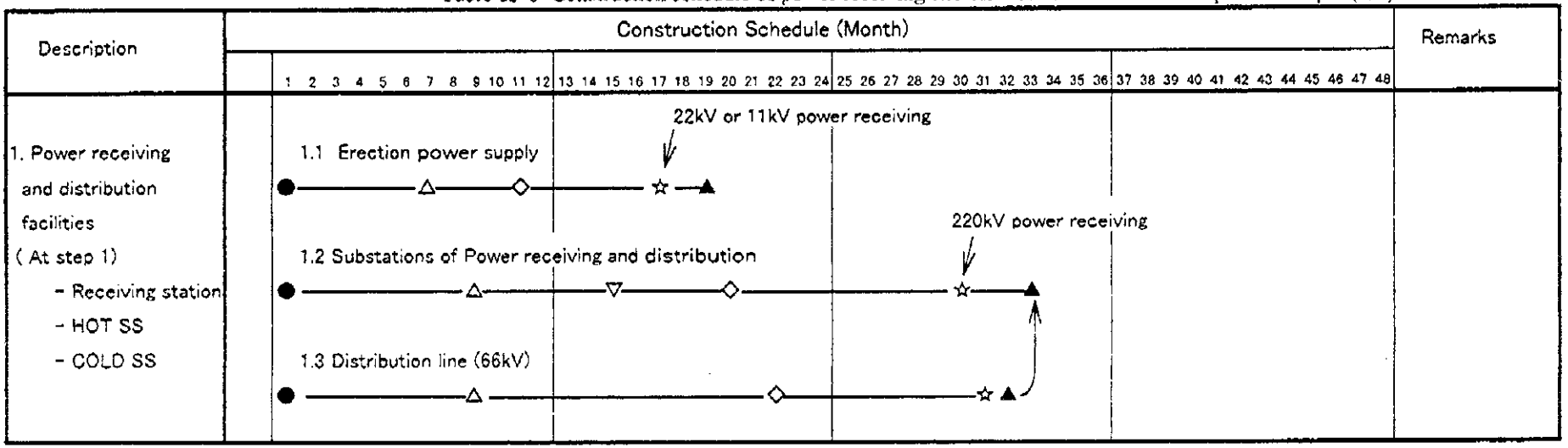
Table 13-5 Equipment list and basic specifications of power receiving and distribution facilities (1/2)

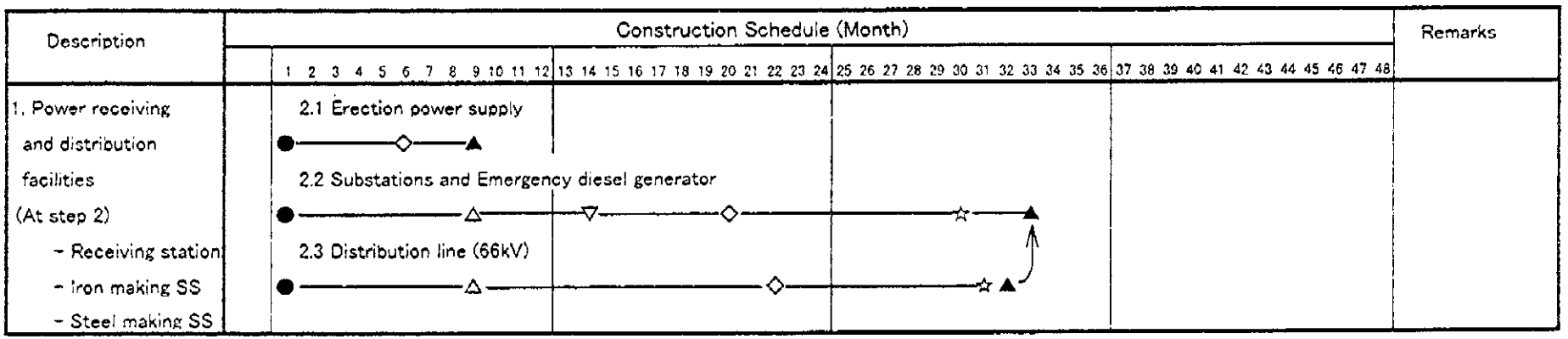
Equipment	Step 1 (HOT + COLD)		Step 2 (2.3 million t/y)		Step 3 (4.5 million t/y)	
	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications
1. Power receiving station	2 units	Main transformers 100 MVA 220kV/66kV	1 unit	Main transformer 150 MVA 220kV/66kV	1 unit	Main transformer 150 MVA 220kV/66kV
	1 set	220kV, 66kV switchgears	1 set	220kV, 66kV switchgears	1 set	220kV, 66kV switchgears
	1 set	Static Var Compensator				
	1 set	3.3kV power source for general use				
2. Main substations		(HOT rolling substation)		(Iron making substation)		(Iron making substation)
	2 units	Main transformers 50 MVA, 66kV/11kV	2 units	Main transformers 50 MVA, 66kV/11kV	1 set	66kV,11kV switchgears (Expansion)
	1 set	66kV,11kV switchgears	1 set	66kV,11kV switchgears		
	1 set	3.3kV power source for general use	1 set	3.3kV power source for general use		

Table 13-5 Equipment list and basic specifications of power receiving and distribution facilities (2/2)

Equipment	Step 1 (HOT + COLD)		Step 2 (2.5 million t/y)		Step 3 (4.5 million t/y)	
	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications
		(COLD rolling substation)		(Steel making substation)		(Steel making substation)
	2 units	Main transformers	2 units	Main transformers	1 units	Main transformer
		50 MVA, 66kV/11kV		50 MVA, 66kV/11kV		50 MVA, 66kV/11kV
	1 set	66kV,11kV switchgears	1 set	66kV,11kV switchgears	1 set	66kV,11kV switchgears (Expansion)
	1 set	3.3kV power source for general use	1 set	3.3kV power source for general use		
3. Emergency Diesel generator plant			2 units	Output 1000 kW		
4. Power distribution lines	1 set	66kV underground lines	1 set	66kV underground lines	1 set	66kV underground lines
5. Erection power supply equipment	1 set	Erection power receiving station (22kV or 11kV)				
	1 set	Overhead lines	1 set	Overhead lines	1 set	Overhead lines
	1set	Transformer units	1set	Transformer units	1set	Transformer units

Table 13-6 Construction schedule of power receiving and distribution facilities at Step 1 and Step 2 (1/2)





< Remarks >

● : Contract with bidders
△ : Start of civil works
▽ : Start of building works
◇ : Start of installation works
☆ : Start of test run
▲ : Commecial run

Table 13-6 Construction schedule of power receiving and distribution facilities at Step 3, BF x 2, BOF x 3 plan (2/2)

Description	Construction Schedule (Month)	Remarks
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	
1. Power receiving and distribution facilities (At step 3)	3.1 Erection power supply 3.2 Expansion of Substations 3.3 Distribution line (66kV)	

Table 13-7 Manning plan for energy section in equipment division (1/2)

	Organization						[ ]: Step 1, ( ): Step 2, : Step3			Total		
Devision	General manager	Section	Manager		Assistant manager	Engineer		Foreman	Skilled worker	Unskilled worker	Step 3	Step 2	Step 1
Equipment Div.		Utility Supply	1(1) [1]	Power receiving and distribution	1(1) [1]	1(1) [1]	(Operation)	1x 4 (1 x 4) [1 x 4]	5 x 4 (5x4) [3 x 4]	5 x 4 (5x4) [3 x 4]			
							Total	4(4) [4]	20 (20) [12]	20 (20) [12]	47	(47)	[31]
							(Plant management)	1 (1) [1]	1 (1) [1]	1 (1) [0]	3	(3)	[2]
				Fuel ditribution	1(1) [0]	1(1) [0]	(Operation)	1x 4 (1 x 4) [0]	3x 4 (3x4) [0]	2 x 4 (1x4) [0]			
							Total	4 (4) [0]	12 (12) [0]	8 (4) (0)	26	(22)	[0]
							(Plant management)	1 (1) [0]	1 (1) [0]	1 (1) [0]	3	(3)	[0]
				Water supply and sewerage	1(1) [1]	1(1) [1]	(Operation)	1x 4 (1 x 4) [1 x 4]	4 x 4 (4x4) [4x 4]	2 x 4 (2x4) [1 x 4]			
								4 (4) [4]	16 (16) [16]	8 (8) [4]	30	(30)	[26]
							(Plant management)	1 (1) [1]	1 (1) [1]	1 (1) [0]	3	(3)	(2)
				Plant maitenannce	2(2) [2]	1(1) [0]	(Mechanics) for fuel	1 (1) [0]	7 (5) [0]	7 (4) [0]	16	(11)	[0]
						1(1) [1]	(Mechanics) for water	1 (1) [1]	7 (5) [2]	7 (4) [2]	18	(13)	[8]
						1(1) [1]	(Electricity)	2 (2) [2]	8 (6) [4]	8 (5) [2]	19	(14)	[9]
						1(1) [1]	(Instrumentation)	1 (1) [1]	4 (3) [2]	4 (3) [2]	10	(8)	[6]
						1(1) [1]	(Telepohone)	1 (1) [1]	3 (3) [3]	3 (3) [2]	8	(8)	[7]
							Shift		2 x 4 (2 x 4) [2x4]	1 x 4 (1 x 4) [0]			
							Total		8 (8) [8]	4 (4) [0]	12	(12)	[8]
			1 (1) [1]		5 (5) [4]	8 (8) [6]		21 (21) [15]	88 (81) [49]	72 (58) [24]	195	(174)	[99]

Table 13-7 Manning plan for energy section in equipment division (2/2)

	Organization						[ ] : Step 1, ( ) : Step 2, : Step 3			Total		
Devision	General manager	Section	Manager		Assistant manager	Engineer		Foreman	Skilled worker	Unskilled worker	Step 3	Step 2	Step. 1
Equipment Div.		Power and Air sep. plant		Power plant			(Operation)	1 x 4 (1 x 4)	5 x 4 (3x 4)	3x 4 (2x 4)			
			1		1	1	Total	4 (4)	20 (12)	12 (8)	39	(27)	[0]
			(1)		(1)	(1)	(Plant management)	1 (1)	2(2)	1(0)	4	(3)	[0]
				Air separation plant			(Operation)	1 x 4 (1 x 4)	5 x 4 (3x 4)	3x 4 (2x 4)			
					1	1	Total	4 (4)	20 (12)	12 (8)	38	(26)	[0]
					(1)	(1)	(Plant management)	1 (1)	2(2)	1(0)	4	(3)	[0]
				Plant maitenannce	1	1 (1)	(Mechanics)	2 (2)	12(6)	12(6)	28	(16)	[0]
					(1)	1 (1)	(Electricity)	1 (1)	5 (3)	5(2)	12	(7)	[0]
						1 (1)	(Instrumentation)	1 (1)	4 (2)	4 (2)	10	(6)	[0]
			1 (1)		3 (3)	5(5)		14 (14)	65 (39)	47 (26)	135	(88)	[0]

Section 14 Power Plant

Contents

Page

1. General

The power plant will be installed for effective use of by-product gas produced from iron and steel making processes and for securing stable power to supply to productive plants in the new integrated steelworks. The power plant generates not only electric power but also process steam consumed in the steelworks.

2 units of 150 MW output at power plant will be required at Step 3, 4.5 million ton per year plan.

2. Conditions and basic concept

2.1 Capacity

The capacity of unit is adopted to be 150MW at Step 2 and same capacity at step 3 according to required average power estimated by energy balance shown in Table 13-2,13-3 and 13-4. One(1) unit for Step 2 and for Step 3 respectively will be constructed, and two(2) units will be in normal operation at step3 without a spare unit.

The averaged process steam volume produced by the power plant is estimated to be 42 ton/h at step 2 and 60 ton/h at step 3. Steam balance is shown in the following Table 14-1.

Table 14-1 Estimated process steam balance at Step 2 and 3

Const-ruction step	Plant	Coke	BF	HOT	COLD	CGL	ETL	Other/ loss	Total
	Unit consumption (kg/t)	70	10	6	85	5	150	30%	
Step 2	Average (ton/h)	12.5	2.6	2.2	12.8	0.1	1.8	9.6	42
	Max. (ton/h)								75
Step 3	Average (ton/h)	24.2	5.0	2.2	12.8	0.1	1.8	13.9	60
	Max. (ton/h)								126

2.2 Basic concept

2.2.1 Kind of fuel

In the power plant, all by-product gas such as COG, BFG and BOFG will be fired, moreover purchased heavy oil as additional fuel will be used.

The power plant also has the important function of adjusting the difference of supply and demand of by-product gas in the steelworks by means of changing the consumed volume of by-product gas in the power plant.

2.2.2 Type of power plant

The conventional type, which comprises boiler, steam turbine and generator will be adopted because of description of the above item 2.2.1.

2.2.3 Generator operation

During normal operation generators will be in parallel operation with the power company system. When power failure occurs in power company system, the generator will be disconnected from the power company system to supply power continuously to the steelworks.

3. Equipment plan

3.1 Equipment flow

Typical equipment flow is shown in the following Figure 14-1.

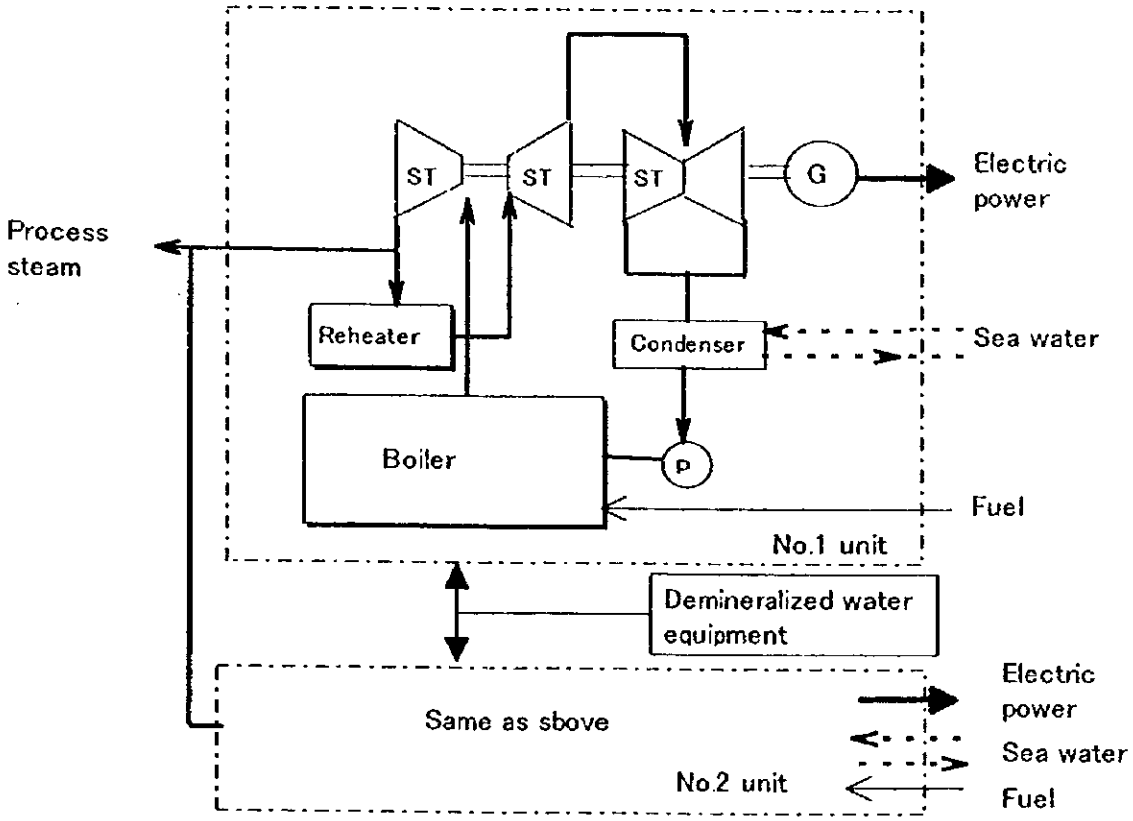


Figure 14-1 Typical equipment flow

3.2 Equipment list and basic specifications

Table 14-2 shows equipment list and basic specifications for the power plant at each step.

4. Construction schedule

Table 14-3 shows the outlined construction schedule at each step.

5. Manning plan

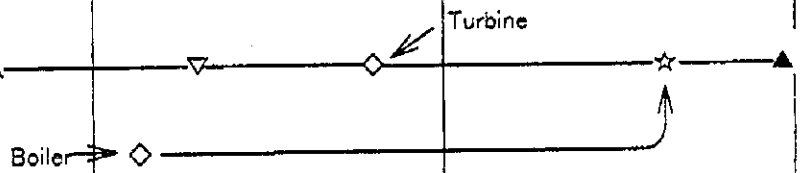
The manning plan for the power plant is shown in Table 13-7 "Manning plan for Energy section in the Equipment division".

Table 14-2 Equipment list and basic specifications of power plant

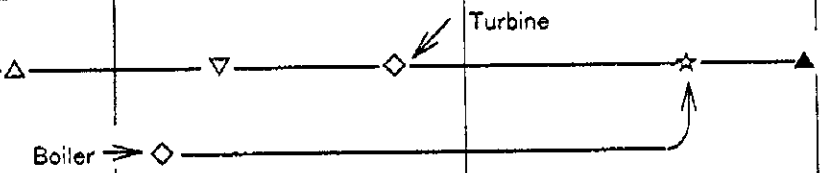
Equipment	Step 1 (HOT + COLD)		Step 2 (2.3 million t/y)		Step 3 (4.5 million t/y)	
	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications
1.Boiler, turbine,generator set			1 unit	Boiler, turbine, generator set Gross output : 150MW Extracted steam : 80 t/h Receiving voltage : 66kV	1 unit	Boiler, turbine, generator set Gross output : 150MW Extracted steam : 80 t/h
2.Auxiliary equipment			2 unit	Demineralized water equipment		

Table 14-3 Construction schedule of power plant at Step 2 and Step 3

Description	Construction Schedule (Month)	Remarks
Power Plant 150 MW x 1 unit (At step 2)	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	



Description	Construction Schedule (Month)	Remarks
Power Plant 150 MW x 1 unit (At step 3)	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	



< Remarks >

● : Contract with bidders
△ : Start of civil works
▽ : Start of building works
◇ : Start of installation works
☆ : Start of test run
▲ : Commecial run

Section 15 BF Blower Plant

Contents

1. General

2 sets of the blast furnace blower are built in step 2 and 1 set is built in step 3. 1 set is used for a spare blower.

2. Equipment plan

2.1 Equipment specification

Main equipment specifications of blast furnace blower is shown in Table 15-1.

Table 15-1 Specifications of blast furnace blower

	Unit	Step 2	Addition at step 3
		Specification	Specification
Blast furnace blower	set	2	+1
Maximum blast volume	Nm^3/min	6,000	6,000
Maximum blast pressure	kg/cm^2	4.5	4.5
Maximum shaft input	kW	30,000	30,000

2.2 Process flow

Process flow of the blast furnace blower is shown in Figure 15-1.

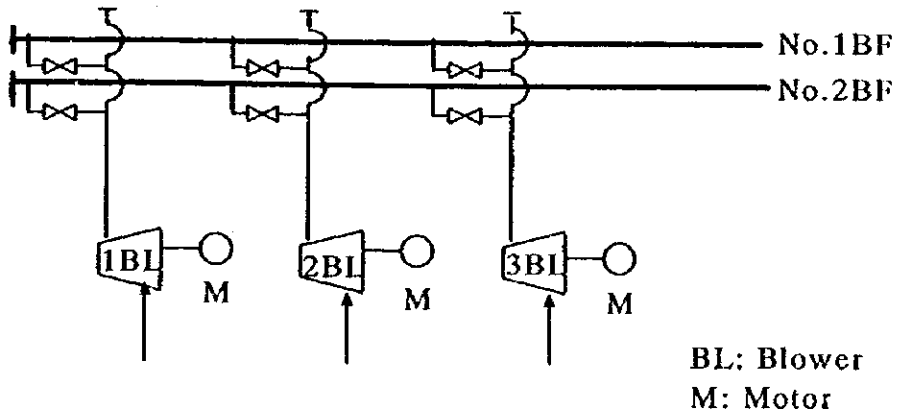


Figure 15-1 Process flow of blast furnace blower

2.3 Utility consumption

Utility consumption of the blast furnace blower is shown in Table 15-2.

Table 15-2 Utility consumption and quantity of utilities

	Unit consumption	Quantity	
		Step 2	Step 3
Electric power	80 kWh/t-pig	530,000 kWh/d	960,000 kW/d
Sea water	13 m^3/t-pig	86,000 m^3/d	160,000 m^3/d

2.4 Manning plan

Manning plan is shown in Table 15-3.

Table 15-3 Manning plan of blast furnace blower

	Manager	Section manager	Staff	Foreman	Skilled worker	Unskilled worker	Sub-total
Step 2	0	0	0	0	12	0	12
Step 3	0	0	0	0	4	0	4
Total	0	0	0	0	16	0	16

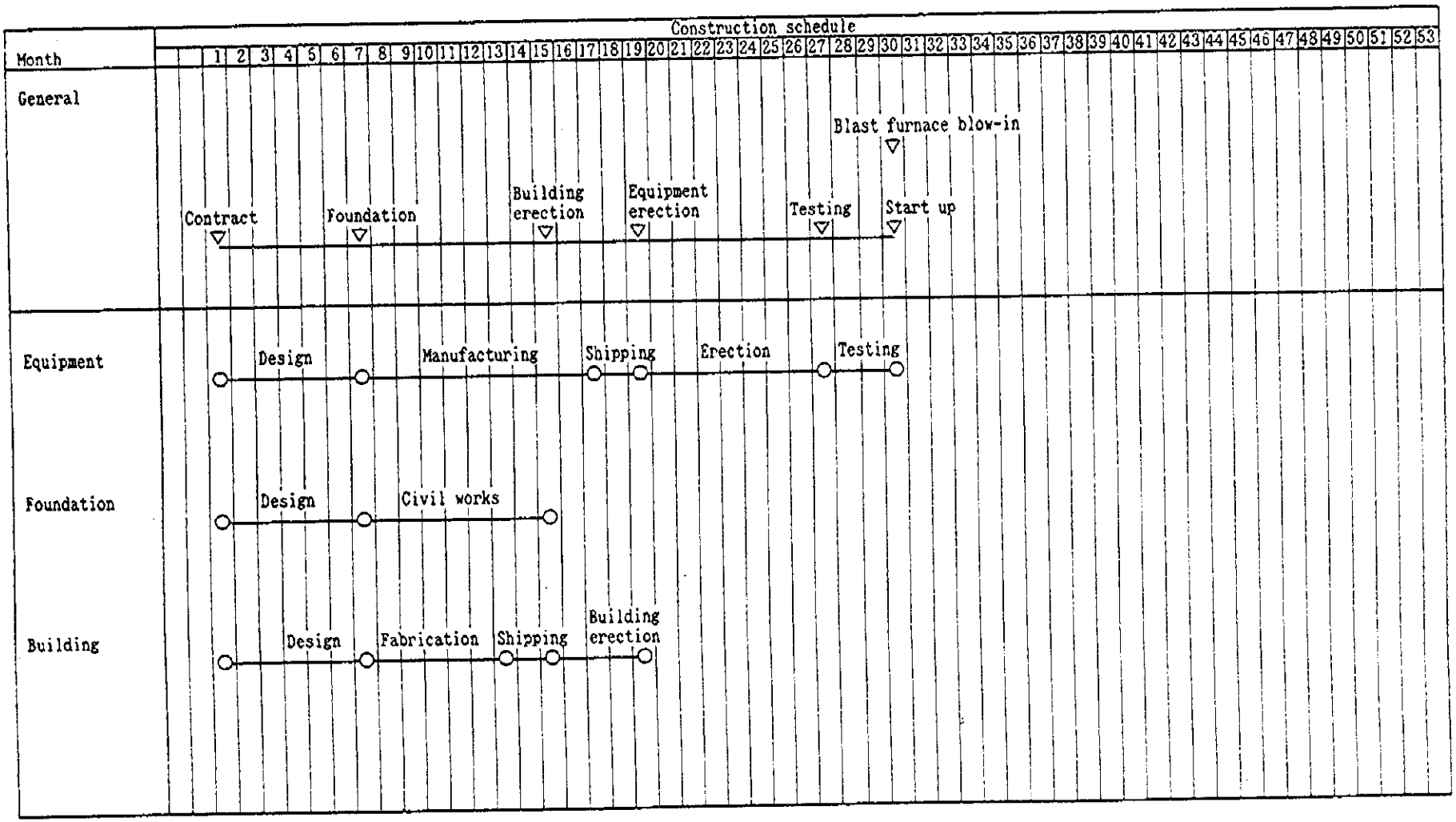
3. Technical explanation

The maximum blast volume is set at the required maximum volume of blast furnace operation and filling blast volume for hot stove.

4. Construction plan

The construction plan of blast furnace blower is shown in Table 15-4.
The construction plan of step 3 is as same as step 2.

Table 15-4 Construction schedule of blast furnace blower



Section 16 Air Separation Plant

Contents

1. General

The air separation plant produces the required oxygen volume of 33 kNm^3/h at Step 2, 2.3 million ton/year plan and 62kNm^3/h at step 3, 4.5million ton/year plan to supply oxygen mainly to the BOF plant and the Blast furnace.
The air separator generates the required nitrogen and argon in the steelworks as well as oxygen.

Three(3) sets of 33 kNm^3/h air separators will be required at Step 3.
The air separation plant consists of the following main equipment.

- Air separators with argon rectifier
- Compressed oxygen delivery equipment
- Compressed nitrogen delivery equipment

2. Conditions and basic concept

2.1 Capacity

The capacity of the plant is planned on the basis of estimated oxygen and nitrogen balance at Step 2 and Step 3 shown in Table 16-1 and Table 16-2. Two(2) units of 33 kNm^3/h oxygen production capacity per unit will be installed at Step 2 and one(1) unit of the same capacity at Step 3 in the air separation plant.

Table 16-1 Estimated oxygen balance

Construction step	Plant		BF	BOF/CC	Others	Total
	Unit consumption	Nm^3/t	35	56		
Step 2	Production	ton/h	259	267		
	Consumption (Average)	kNm^3/h	9	15	1.2	25.2
	Consumption (Max)	kNm^3/h				33
Step 3	Production	ton/h	501	518		
	Consumptio (Average)	kNm^3/h	17.5	29	2.5	49.0
	Consumption (Max)	kNm^3/h				62

Table 16-2 Estimated nitrogen balance

Consumption step	Plant		BF	Coke	BOF	BAF	CGL	Others	Total
	Unit consumption	Nm3/t	30	0.4	14.4	2	30	20%	
Step 2	Production	ton/h	259	178	267	150	24		
	Consumption (Average)	kNm3/h	7.8	0.07	3.8	0.3	0.7	2.5	15.2
	Consumption (Max)	kNm3/h							20
Step 3	Production	ton/h	501	345	518	150	24		
	Consumption (Average)	kNm3/h	15.0	0.1	7.5	0.3	0.7	4.7	28.3
	Consumption (Max)	kNm3/h							40

2.2 Operation condition

Two(2) units of three(3) air separators will be in operation and one (1) unit for stand-by.

3. Equipment plan

3.1 Outline equipment flow

The outline oxygen and nitrogen flow are shown in the following Figure 16-1.and Figure 16-2.

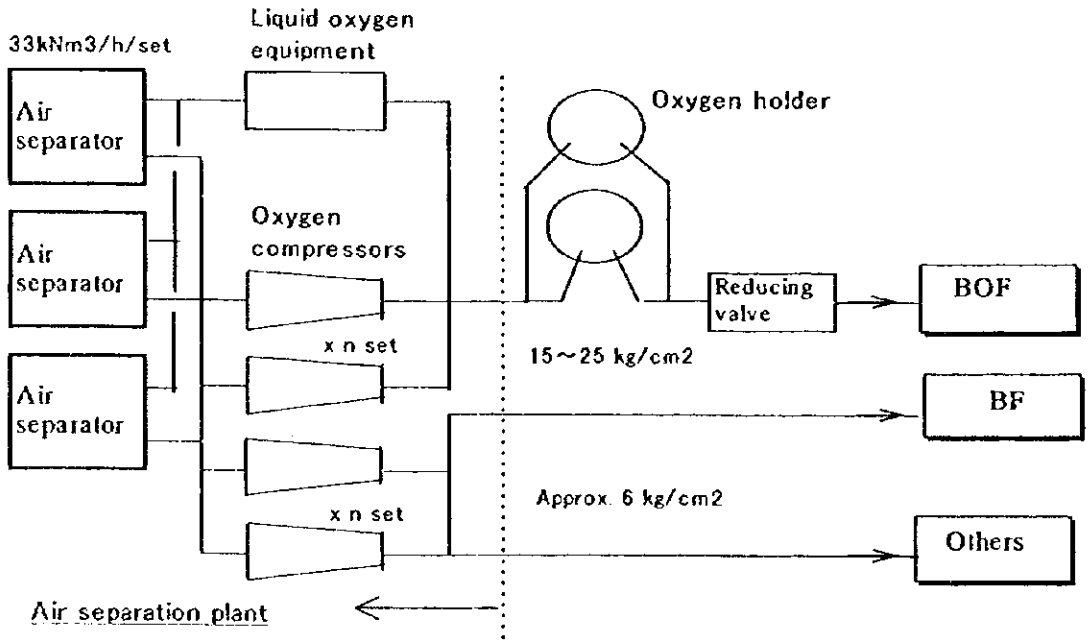


Figure 16-1 Outline of oxygen flow

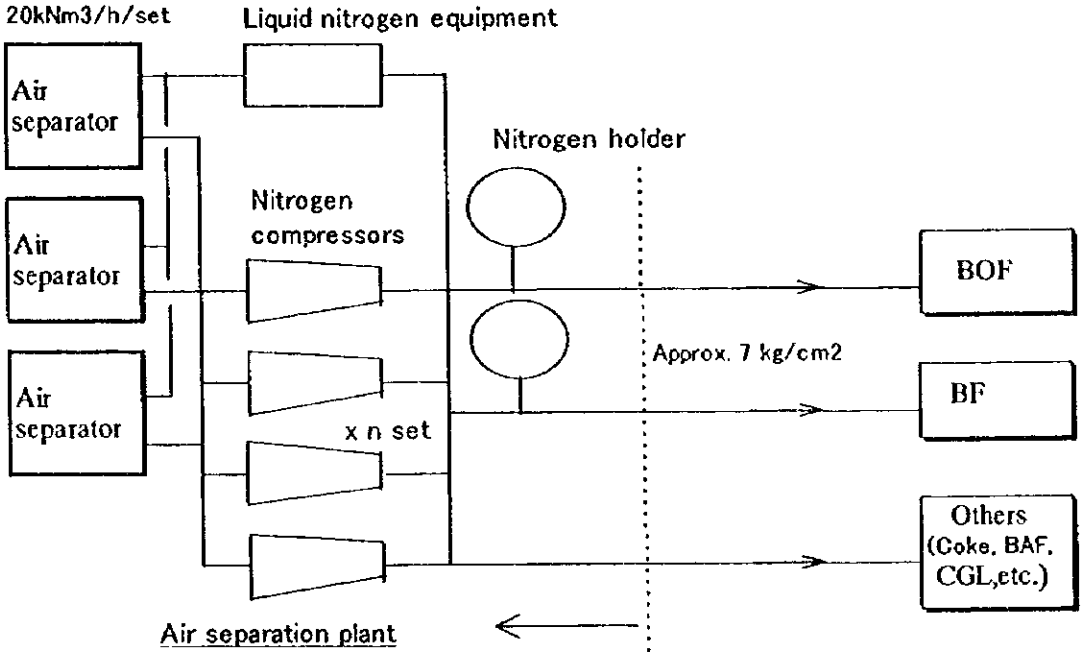


Figure 16-2 Outline of nitrogen flow

3.2 Equipment list and basic specifications

Table 16-3 shows the equipment list and basic specifications for the air separation plant.

4. Construction schedule

Table 16-4 shows the outlined construction schedule at each step.

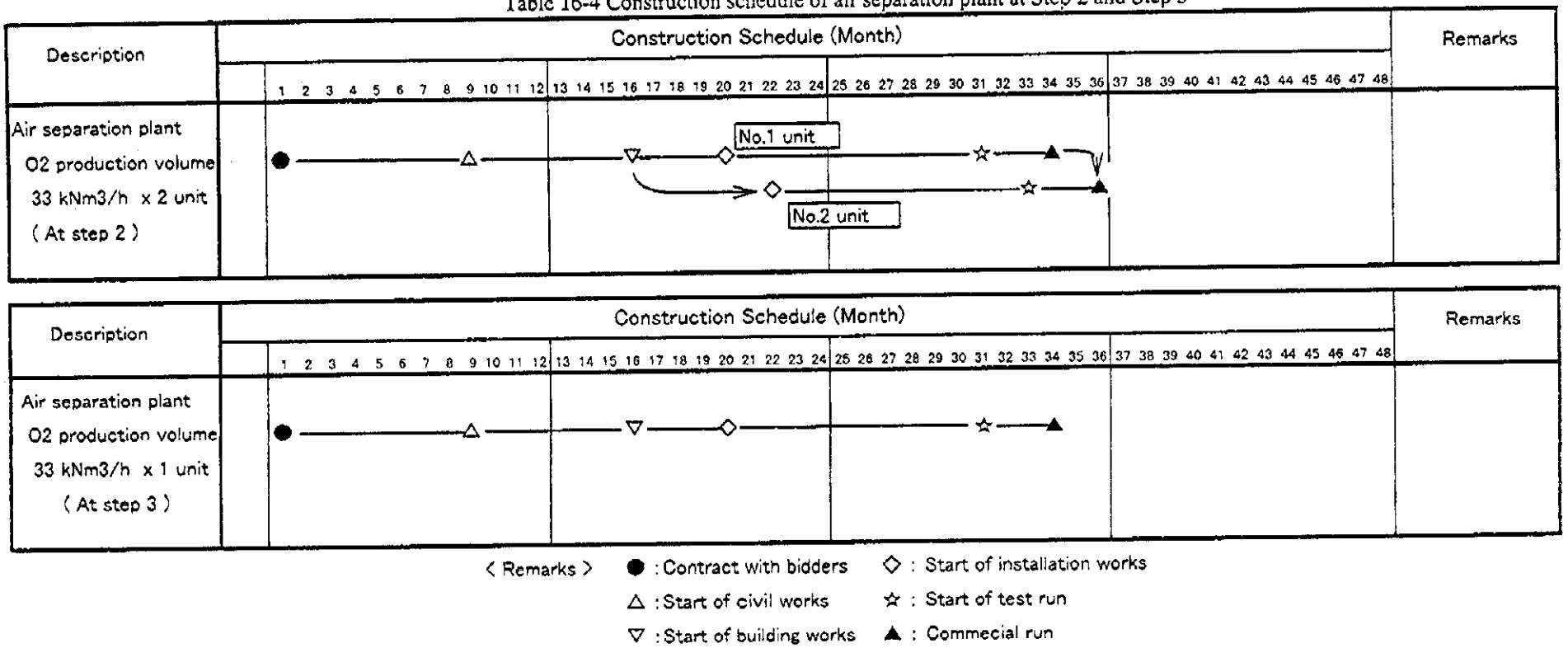
5. Manning plan

The manning plan for the air separation plant is shown in the Table 13-7 "Manning plan for Energy section in Equipment division".

Table 16-3 Equipment list and basic specifications of air separation plant

Equipment	Step 1 (HOT + COLD)		Step 2 (2.3 million t/y)		Step 3 (4.5 million t/y)	
	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications
1. Air separation equipment			2 unit	Capacity : Oxygen 33 kNm3/h Nitrogen 20 kNm3/h	1 unit	Capacity: Oxygen 33 kNm3/h Nitrogen 20 kNm3/h
2. Delivery equipment			1set	Oxygen compressors	1set	Oxygen compressors
			1set	Nitrogen compressors	1set	Nitrogen compressors
			1set	Liquid oxygen and nitrogen equipment		

Table 16-4 Construction schedule of air separation plant at Step 2 and Step 3



Section 17 Fuel Gas Facilities

Contents

Page

1. General

Fuel gas facilities are to distribute the by-product gases produced from iron and steel making processes such as coke oven gas (COG), blast furnace gas (BFG), and basic oxygen furnace gas (BOFG) to productive plants in the new integrated steelworks. In case of shortage of by-product gases required from plants, heavy oil will be purchased as additional fuel.

The total fuel supply balance of the steelworks is estimated at each step in the following Table 17-1 which was made on the basis of the energy balance Table 13-2, 13-3, and 13-4 attached herewith.

Table 17-1 Total supply balance of fuel

Construction step	Generation			Purchase	
	COG G cal/h	BFG G cal/h	BOFG G cal/h	LPG G cal/h	Heavy oil G cal/h
Step 1 (HOT + COLD)	0	0	0	13.6	63.9
Step 2 (BF x 1, BOF x 2)	256.6	331.1	48.1	0	95.5
Step 3 (BF x 2, BOF x 3)	497.3	641.3	93.2	0	71.1

This facilities consist of the following main equipment:

- BFG holder and flare stack equipment
- COG holder and flare stack equipment
- COG gas station
- Utility main piping for BFG, COG, BOFG, process steam, oxygen, nitrogen and heavy oil

2. Conditions and basic concept

2.1 Fuel flow

The following Figures 17-1, 17-2 and 17-3 show estimated fuel flow at each step.

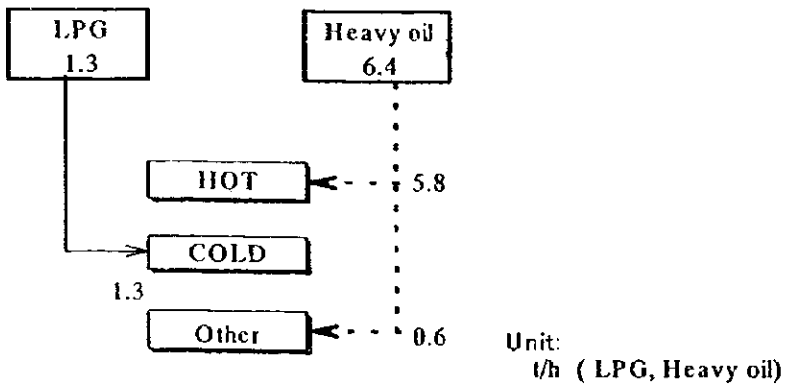


Figure 17-1 Fuel flow of Step 1, HOT and COLD plan

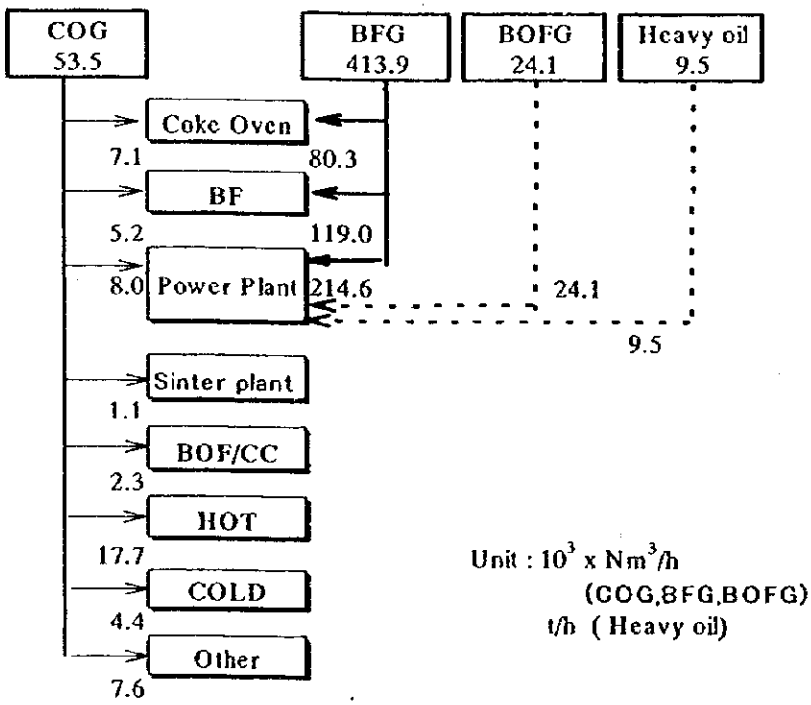


Figure 17-2 Fuel flow of Step 2, BF x 1 and BOF x 2 plan

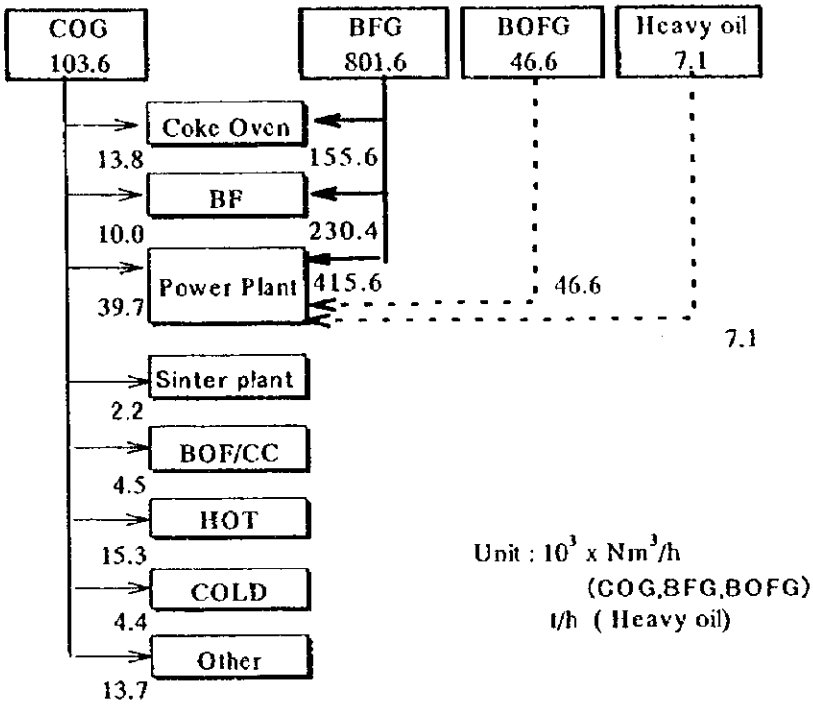


Figure 17-3 Fuel flow of Step 3, BF x 2 and BOF x 3 plan

Fuel flow (Nm3/h, t/h) means annual average production and consumption per hour.

2.2 Basic planning conditions for fuel gas facilities

2.2.1 Kind of fuel in the productive plant

The following Table 17-2 shows kind of fuel used in each plant.

Table 17-2 Kind of fuel used in each plant

	COG	BFG	BOFG	Heavy oil	LPG
Power plant	O	O	O	O	
Coke oven	O	O			
Sinter plant	O				
BF	O	O			
BOF, CC	O				
HOT rolling	O			O	
COLD rolling	O				O
Miscellaneous	O				

2.2.2 Basic concept

The capacity of fuel distribution should be planned , based on the fuel flow in the above Figures 17-1, 17-2 and 17-3.

The following equipment related to fuel distribution will be planned in the other facilities.

- BOFG gas station (holder, EP, gas blower) by steel making area
- COG booster station to BF and coke oven plant by iron making area
- Heavy oil storage tank by hot rolling area

The COG will be boosted to distribute to each plant except power plant, BF, and Coke oven plant

One(1) set of spare holder used for both BFG and COG should be considered at Step 3.

(Note)
EP : Electric precipitator

2.2.3 Operation for fuel distribution

As the energy control center will not be installed in this steelworks, adjustment for the supply and demand of the by-product gases, operation of the flare stack and supervision of fuel distribution will be made at the power plant control room.

3. Equipment plan

3.1 Fuel distribution system flow

The following Figure 17-4 shows the planned basic fuel distribution system flow in the integrated steelworks.

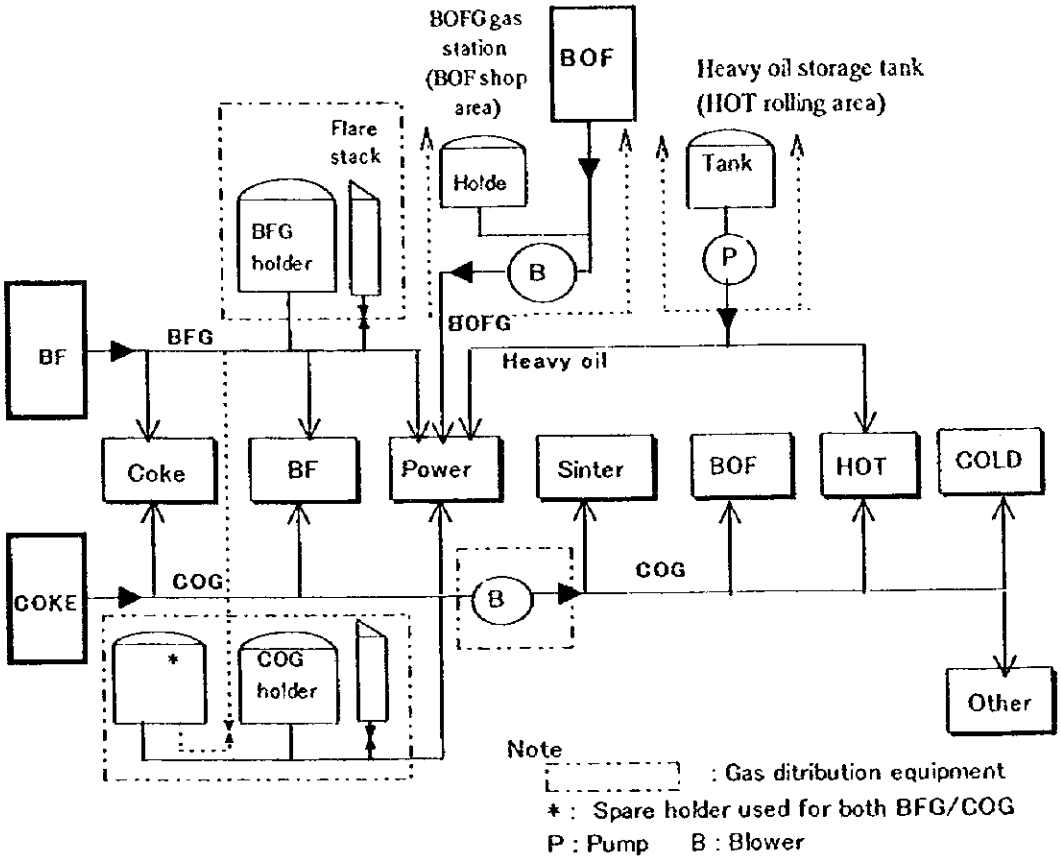


Figure 17-4 Planned basic fuel distribution system flow

3.2 Equipment list and basic specification

Table 17-3 shows the equipment list and basic specification for fuel gas facilities at each step.

4. Construction schedule

Table 17-4 shows the outlined construction schedule at each step.

5. Manning plan

The manning plan for fuel gas facilities including utility piping is shown in Table 13-7 "Manning plan for energy section in the equipment division".

Table 17-3 Equipment list and basic specifications of fuel gas facilities and utility piping

Equipment	Step 1 (HOT + COLD)		Step 2 (2.3 million t/y)		Step 3 (4.5 million t/y)	
	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications
1. BFG equipment			1 unit	100 km3 holder	1 unit	70 km3 holder used for both BFG
				Flare stack		and COG
2. COG equipment			1 unit	70 km3 holder		
				Flare stack		
			1 set	COG gas blowers	1 set	COG gas blowers
3. Utility piping			1 set	BFG piping	1 set	BFG piping
				COG piping		COG piping
				BOFG piping		BOFG piping
				Process steam piping		Process steam piping
				Oxygen piping		Oxygen piping
				Nitrogen piping		Nitrogen piping
				Heavy oil piping		Heavy oil piping
				Total weight : approx. 7000ton		Total weight : approx. 5000ton

Table 17-4 Construction schedule of fuel gas facilities and utility piping

Description	Construction Schedule (Month)	Remarks
1. Fuel gas facilities and piping (At step 2)	1. BF, COG holder/Flare stack 2. COG Booster 3 Utility piping	

Description	Construction Schedule (Month)	Remarks
1 Fuel gas facilities and piping (At step 3)	15.1 Holder(for spare) for both BFG and COG 15.2 COG Booster 15.3 Piping	

< Remarks >
● : Contract with bidders
△ : Start of civil works
▽ : Start of building works
◇ : Start of installation works
☆ : Start of test run
▲ : Commecial run

Section 18 Water Supply

Contents

1. General

The water supply for the new steelworks relies on two sources, river water and sea water. Water taken from the reservoir and/or outside river first enters the reservoir in the site. Then it is sent to the potable water/industry water system, where it is treated in the coagulation sedimentation basin and aeration into the industrial water and potable water.
The industrial water thus separated is distributed through an industrial water line to each water recirculation system for use as make-up water.
The potable water, on the other hand, filtered and sterilized with chlorine after being treated in the coagulation-sedimentation basin mentioned above, is distributed through a potable water line.
Sea water is taken from the sea area near the new integrated steelworks and transported, after removal of rubbish by a traveling screen and sterilization with chlorine, and is distributed through a sea waterline.

2. Precondition

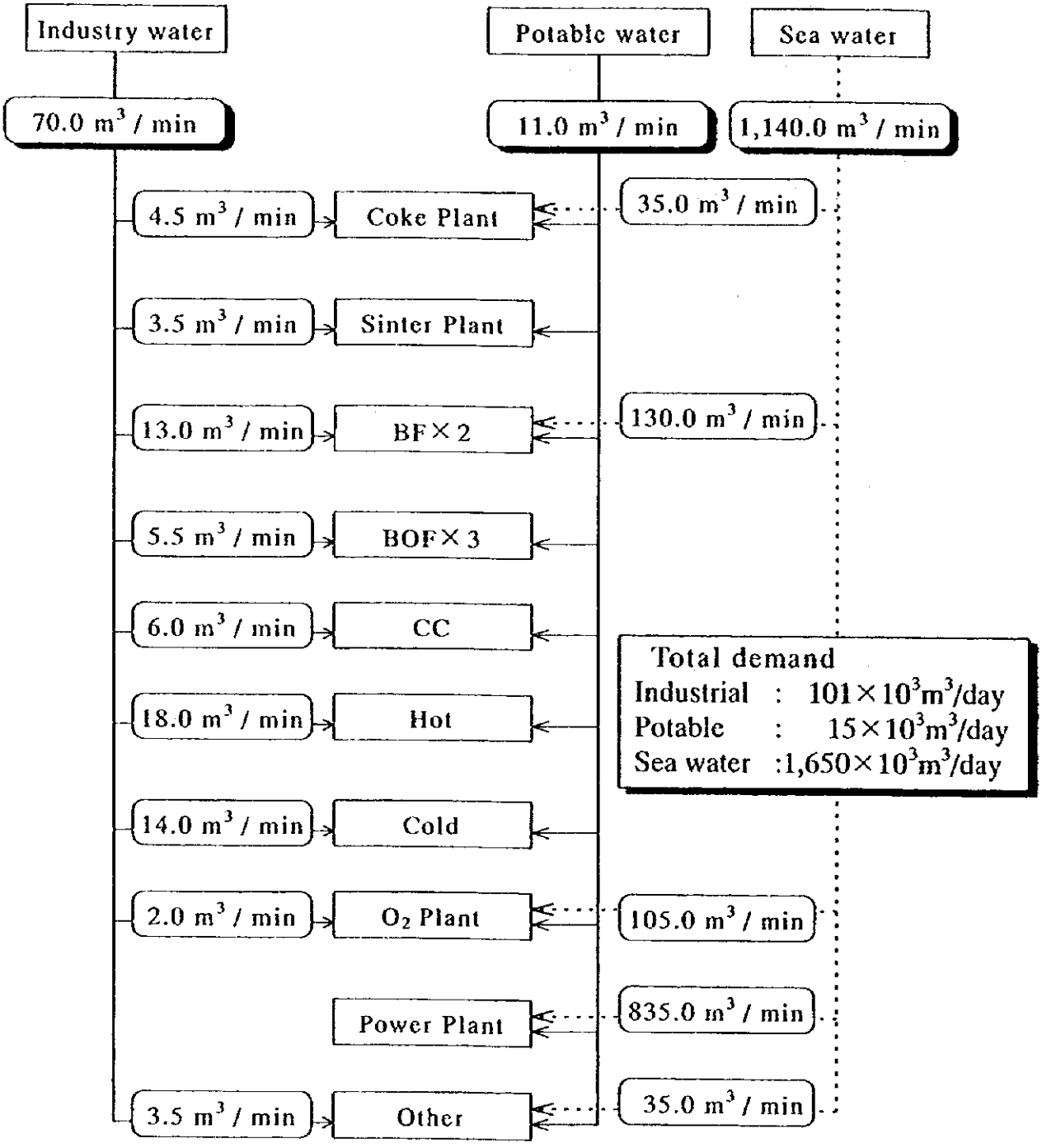
- Industrial/potable water for the new integrated steelworks is supplied from the existing Song Rac reservoir without new investment except installation of water pipeline.
- The water pipeline is to be laid by Viet Nam government. In this case, construction cost is added to water supply charge, resulting that the total water cost is estimated to be 1,000VND / m^3. There is no need to pay connection charge etc. except water supply charge.

3 Technical explanation

3.1 Quantity of required water by each plant

Balance of required industry/potable/sea water by each plant is shown in Table 18-1.

Table 18-1 Balance of required industry/potable/sea water by each plant



3.2 Specifications of required facilities by each step

Specifications of required facilities by each step are shown in Table 18-2

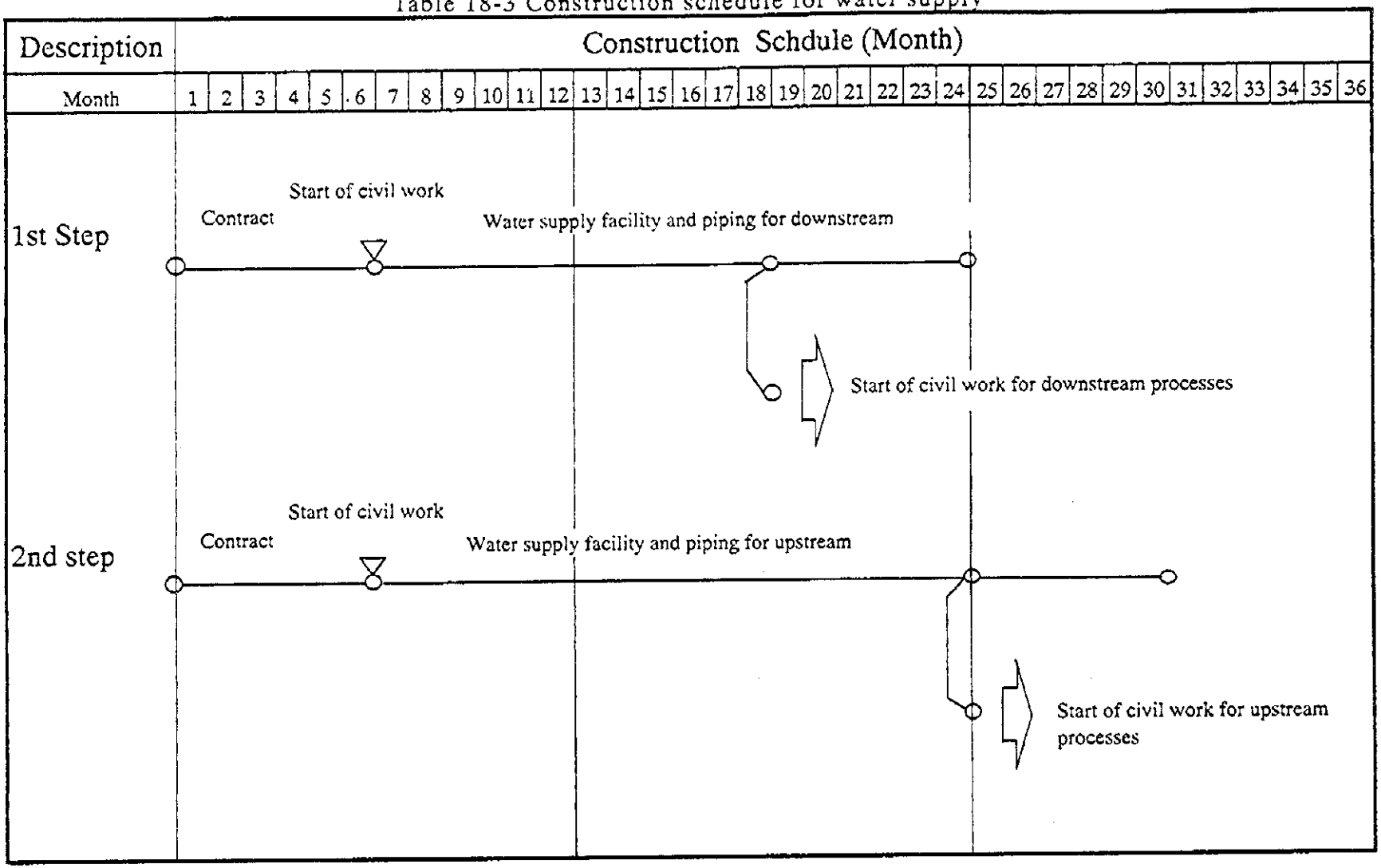
Table 18-2 Specifications of facilities by each step

Facility	Step 1	Step 2	Step 3
Water supply	Reservoir in site 1set For downstream plants -Facility and main piping for industry, and potable water 1set	For upstream plants -Facility and main piping for industry, potable and sea water 1set	

3.3 Construction schedule

Construction schedule is shown in Table 18-3.

Table 18-3 Construction schedule for water supply



Section 19 Intraworks Transportation Equipment

Contents

Page

1. Consideration for intraworks transport equipment

The scope of the intraworks transport equipment covers the equipment for transporting between production equipment units while that of the equipment for transport within each particular plant is included in each production equipment unit plan.
The intraworks transport equipment plan should be based on the quantities of raw materials, materials and products, and transport distance and efficiency, etc. in each step.

1.1 Precondition of transport equipment planning

(1) Transport quantities

Table 19-1 Transport quantities for each step (Unit:1,000t/y)

Materials	Step 1	Step 2	Step 3
Hot pig iron	0	2,266	4,389
Excess coke	0	4	32
BF slag	0	684	1,325
BOF slag	0	187	363
Ferroalloy	0	23	45
Purchased slab	1,680	1,001	0
Billet for outside sale	0	0	1,095
Hot rolled coil for outside sale	550	1,200	1,200
Hot rolled sheet/plate for outside sale	300	360	360
P/O sheet/plate for outside sale	100	200	200
Cold rolled coil/sheet for outside sale	500	700	700
Galvanized coil/sheet for outside sale	100	200	200
Tinplate coil/sheet for outside sale	0	100	100
Hot/cold mill scrap and scale	110	190	190
Miscellaneous iron and steelmaking raw materials dust	0	33	65

(2) Transport materials, method of transport and transport distance

Table 19-2 Method of transport and transport distance

Materials	Start point	End point	Method	Distance
Hot pig iron	BF plant	BOF plant	Railway	3 km
Excess coke	Coke plant	Sub material yard	Dump truck	2 km
BF slag	BF plant	Slag yard	Railway	3 km
BOF slag	BOF plant	Slag yard	Railway	3 km
Ferroalloy	Sub-material berth	BOF plant	Truck	2 km
Purchased slab	Product berth	Hot strip mill	Tractor & trailer	1.5km
Billet for outside sale	CC plant	Product berth	Tractor & trailer	1.5km
Hot coil for outside sale	Hot strip mill	Product berth	Tractor & trailer	1.5km
Hot rolled coil/sheet for outside sale	Hot strip mill	Product berth	Tractor & trailer	1.5km
P/O sheet/plate for outside sale	Hot strip mill	Product berth	Tractor & trailer	1.5km
Cold coil/sheet for outside sale	Cold strip mill	Product berth	Tractor & trailer	1.5km
Galvanized coil/sheet for outside sale	Metal coating plant	Product berth	Tractor & trailer	1.5km
Tinplate coil/sheet for outside sale	Metal coating plant	Product berth	Tractor & trailer	1.5km
Hot/cold scrap and scale	Hot/cold mill	Scrap yard	Track	1.5km
Miscellaneous iron and steelmaking raw materials dust	BF/BOF plant	Sub-material yard	Track	2 km

1.2 Result of transport equipment planning

Table 19-3 Required quantity & specification of transport equipment

Equipment	Step 1	Step 2	Step 3	
Locomotive	0	6	12	Tractive capacity: 65t Speed : 10 km/h
Torpedo car	0	13	26	Loading capacity : 250t
Tractor	9	9	10	Loading capacity : 80t Speed : 20 km/h
Trailer	27	27	44	Loading capacity : 80t Speed : 20 km/h
Dump truck	4	6	8	Loading capacity : 80t Speed : 40 km/h
Truck	4	6	8	Loading capacity : 80t Speed : 40 km/h

Table 19-4 Railway equipment plan

Railway	Step 1	Step 2	Step 3	Specification
Railway extension distance	0 km	7 km	3 km	Rail gauge : 1,435 mm Rail size : 60kg/m

Table 19-5 Construction cost of intraworks transport equipment

Unit : Million $

Cost item	Step 1	Step 2	Step 3	Total
Equipment (CIF)	7.8	19.9	21.5	49.2
Civil work cost	0	19.0	8.0	27.0
Civil work materials cost	0	12.0	5.0	17.0
Grand total	7.8	50.9	34.5	93.2

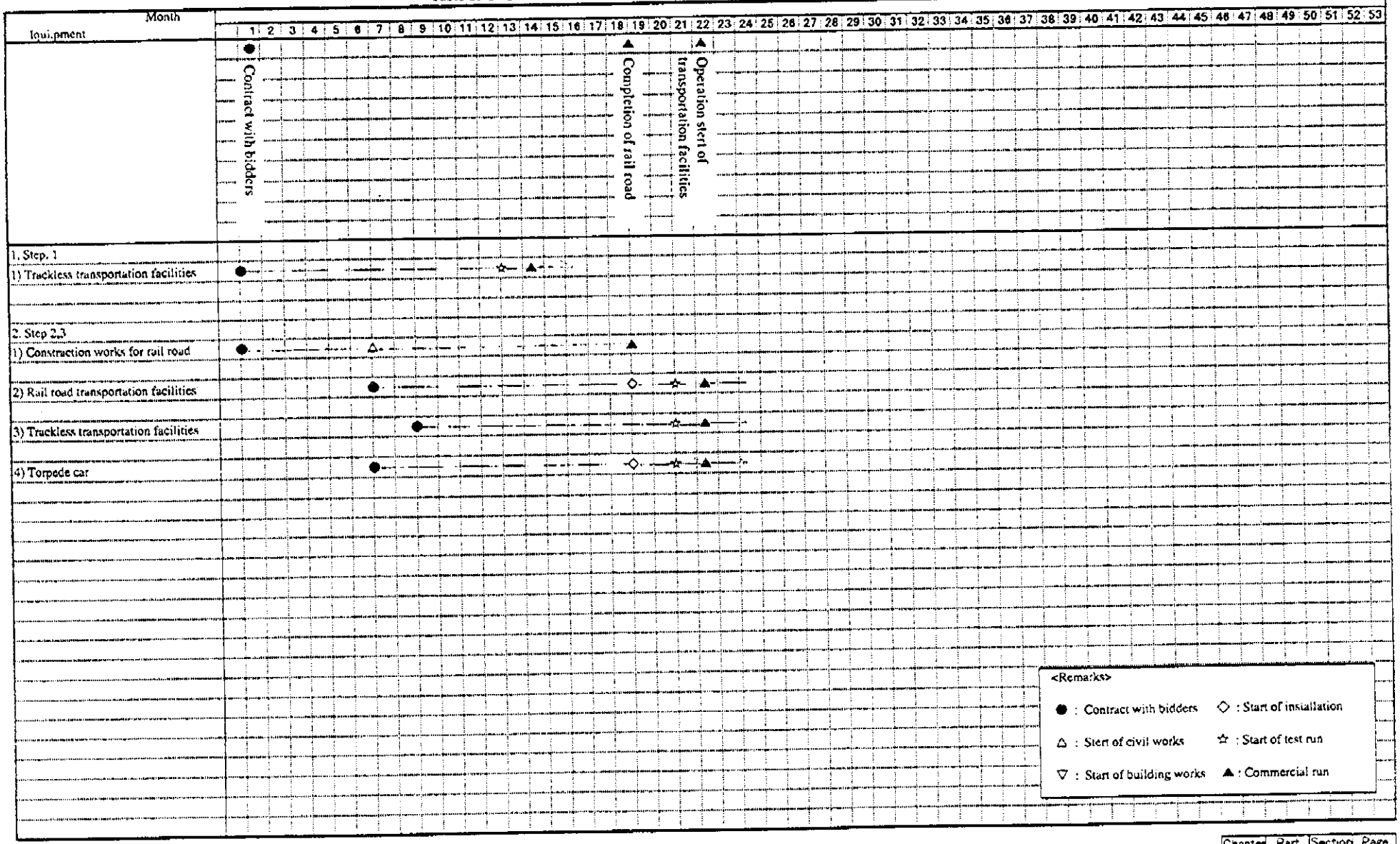
1.3 Intraworks transport equipment construction schedule

The intraworks transport equipment will consist of road transport equipment to be purchased as complete assembled equipment and railways.

Therefore, the construction schedule described here is concerned with the schedule of purchasing road transport equipment and schedule of constructing railways.

For the construction schedule, refer to Fig.19-1.

Table 19-5 Construction schedule



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Section 20 Intraworks Telecommunication Network

Contents

Page

1. General

This facility is a telephone system for internal communication in the new integrated steelworks and external communication, and consists of the following main equipment:

- PABX (Private automatic branch exchange)
- PAX (Private automatic exchange)
- Terminal (Telephone handset, facsimile, etc.)
- Communication cable lines

2. Conditions and basic concept

2.1 Basic concept

Two(2) kinds of telephone exchange will be used. One is PAX for internal communication only and the other is PABX for both external communication and internal communication, however, it is possible to communicate between the PAX and PABX system.

2.2 Capacity of exchange

Considering the organization and the number of people in the steelworks, the following capacity will be planned:

- PABX : 200 lines
- PAX : 1,000 lines

3. Equipment plan

3.1 Equipment flow

Figure 20-1 shows the outlined telecommunication system flow.

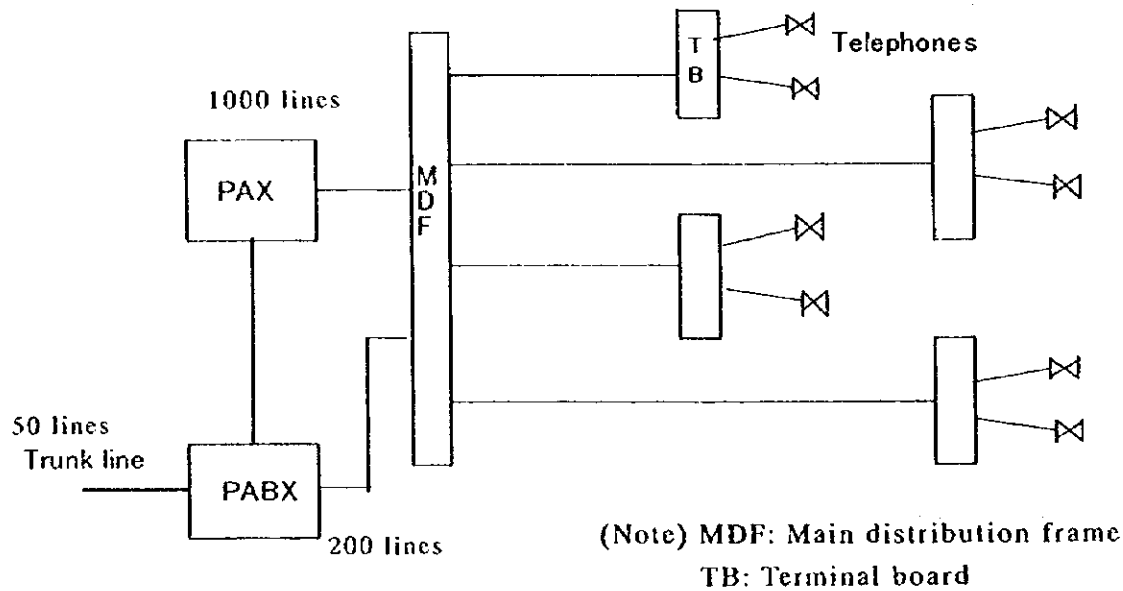

Figure 20-1 Outlined telecommunication system flow

3.2 Equipment list and basic specification

Table 20-1 shows the equipment list and basic specification for intraworks telecommunication facility.

4. Construction schedule

Table 20-2 shows the outlined construction schedule at each step.

5. Manning plan

The manning plan for intraworks telecommunication facilities is shown in Table 13-7 "Manning plan for energy section in the equipment division".

Table 20-1 Equipment list and basic specifications of intraworks telecommunication facilities

Equipment	Step 1 (HOT + COLD)		Step 2 (2.3 million t/y)		Step 3 (4.5 million t/y)	
	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications
1.Telephone exchange	1 unit	PABX				
		Capacity : 200 lines				
	1 unit	PAX				
		Capacity : 1,000 lines				
	1 lot	Telephone handsets	1 lot	Telephone handsets	1 lot	Telephone handsets
	1 lot	Communication lines	1 lot	Communication lines	1 lot	Communication lines

Table 20-2 Construction schedule of intraworks telecommunication facilities at Step1, Step2 and Step 3

Description	Construction Schedule (Month)	Remarks
Intraworks Telecom-unication Facilities (At step 1)	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	

Description	Construction Schedule (Month)	Remarks
Intraworks Telecom-unication (At step 2)	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	

Description	Construction Schedule (Month)	Remarks
Intraworks Telecom-unication (At step 3)	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	

< Remarks > ● : Contract with bidders ▽ : Start of building works ☆ : Start of test run
△ : Start of civil works ◇ : Start of installation works ▲ : Commecial run

Section 21 Central Maintenance Shops

Contents

Page

1. Basic concept of maintenance shop

The central maintenance shop is planned for the purpose of major repairs of the integrated steelworks, manufacture of mechanical parts, electric and instrumental equipment repairs, vehicle repairs, refractory repairs for hot metal and steel ladles and furnaces, etc.
The central maintenance shop will be expanded in pace with the phased expansion plan for the integrated steelworks, and take its final shape in step 2.

1.1 Central maintenance shop and expansion plan

A construction plan for each of central maintenance shop in two steps is shown in Table 21-1.

Table 21-1 Construction plan for each phase

Name of shop	Step 1	Step 2
Machining shop	●	
Fabrication shop	●	
Casting shop		●
Forging shop		●
Vehicle repair shop	●	
Mechanical repair shop	●	
Electrical & instrumental repair shop	●	
Refractory repair shop		●
Materials warehouse	●	

1.2 Function of each of shop held by the central maintenance.

The function of each of the shops held by the central maintenance is shown in Table 21-2.

Table 21-2 Function of each shop

Name of shop	Functions
Machining shop	Manufacture of mechanical parts, processing and manufacture of steel frames, and machine assembling.
Fabricating shop	Processing, repairing and assembling of structures and structure welding repair.
Casting shop	Manufacture of casting machine parts, and manufacture of service tools.
Forging shop	Processing and production of mechanical parts material, and manufacture of service tools.
Vehicle repair shop	Repair of intraworks transport vehicles such as locomotives, ordinary vehicles, etc.
Mechanical repair shop	Overhaul repair, finishing, and assembling of machinery and devices.
Electric & instrumental repair shop	Overhaul repair of electrical and instrumental equipment and testing of electrical and mechanical devices.
Refractory repair shop	Repair of hot metal and steel ladles including torpedo cars and ladles, and repair of furnaces.
Materials warehouse	Control and management of maintenance parts and spare parts used by the central maintenance shops.

1.3 Main equipment arrangement plan for each shop

Table 21-3 Main machinery arrangement

Name of shop	Major equipment
Machining shop	Various type of machine tools including lathe, planer, milling machine, drilling machine, surface plate, grinding machine, etc. and overhead traveling crane.
Fabricating shop	Press machine, bending roller, pipe bender, cutter, drilling machine, welding machine, and overhead crane.
Casting shop	Cupola, electric furnace, wood-pattern and mold machine, shot blaster, annealing furnace, overhead crane.
Forging shop	Various types of air hammer, heating furnace, shearing machine, various type of bender and overhead traveling crane.
Vehicle repair	Hydraulic jack, lathe, drilling machine, grinding

shop	machine, balancing machine, press, cutting machine, compressor, and oil incinerator.
Mechanical repair shop	Various types of machine tools, and machine checker.
Electric & instrumental repair shop	Lathe, surface plate, drying furnace, various types of testing apparatus, and overhead traveling crane.
Refractory repair shop	Brick cutter, polishing machine, mortar mixer, fused refractory gun, brickwork tools, compressor, and pig machine.
Materials warehouse	Overhead traveling crane, forklift truck, and mow-truck.

2. Central maintenance shop manning plan

A manning plan for each of shop of central maintenance at its final stage is shown in Table 21-4.

Table 21-4 Manning plan

Name of shop	Section manager	Staff	Forman	Skilled worker	Unskilled worker	Total
Machining shop	1	6	2	85	25	119
Fabricating shop	2	6	3	75	20	106
Casting shop	1	6	3	75	20	105
Forging shop	1	3	1	25	10	40
Vehicle repair shop	1	6	3	56	14	80
Mechanical repair shop	1	9	3	160	40	213
Electrical & instrumental repair shop	1	9	3	120	30	163
Refractory repair shop	1	4	3	65	30	103
Materials warehouse	1	3	3	30	10	47
Total	10	52	24	691	199	976

3. Layout

Layout of central maintenance shop is shown in Figure 21-1

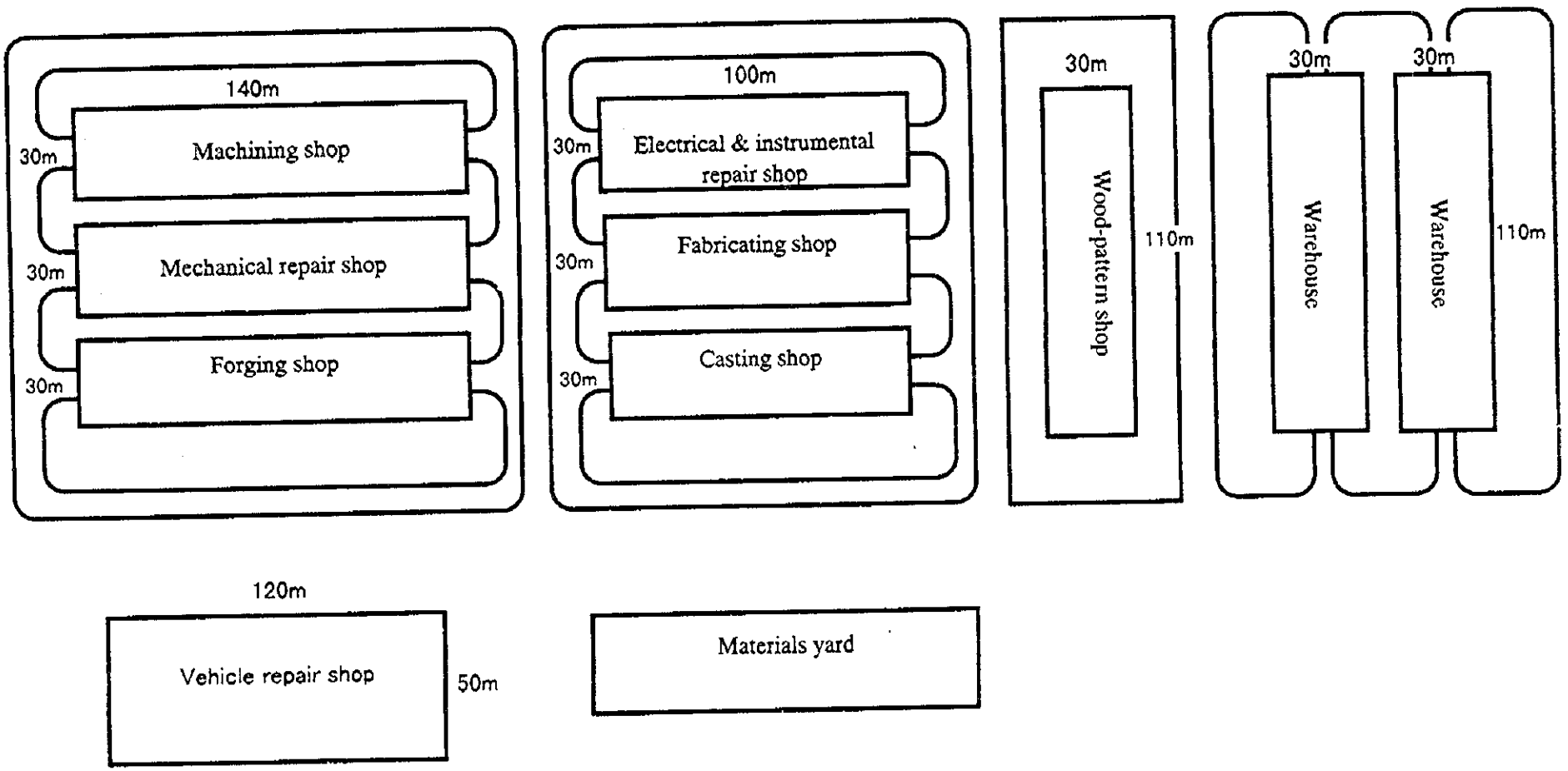

Figure 21-1 Layout of central maintenance shop

Section 22 Testing and Analysis Facilities

Contents

1. Central test and analysis equipment planning concept

- Central test and analysis job is assigned to Technical Division.
- Central test and analysis job is to perform and analysis necessary for purchase transaction in raw materials and fuels and sales transaction in products and semi-products.
- Central test and analysis job is to carry out test and analysis related to environmental control including water quality test and air quality measurement.
- Test and analysis necessary for production control should be performed at each plant because quick response is required for such test and analysis.
- Central test and analysis job does not possess the functions of R&D.
- Central test and analysis job should be stepped up in accordance with the advance from step 1 to 2 of the construction of the integrated steelworks.
  Namely, product analysis equipment and environment measurement and test equipment should be installed during step 1, and central test and analysis equipment should take its final shape during step 2.

2. Function and test and analysis item of central test and analysis equipment

Table 22-1 Function and test and analysis item

Test & analysis item	Test item	Test equipment and main item
Raw materials verification test	Raw materials and, sub-materials test & analysis	Various type of sampler, sample handling equipment, proximate analysis apparatuses, physical tester (grain size, strength etc.)
Analytical verification test	Analysis of raw materials, sub-materials, ferroalloys, purchased fuels, semi-products	Various type sample preparation equipment Chemical analyzer(element) Spectroscopic analyzer Gas analysis Distillation analyzer
Special verification test	Material test for iron & steel products, semi-products	Coking property tester Test oven Ore reduction tester
Product verification test	Iron & steel production and semi-production mechanical test	Tensile tester, bending tester, impact tester, hardness tester
Environmental measurement test	Air quality measurement test, Water quality test	Various type of sampler, Suspended dust measuring instrument, Noise measuring apparatus, NOX & SOX analyzer, Various type of water quality tester, Photoelectric colorimeter pH meter

3. Central test and analysis manning plan

The number of personnel for each test process in the central test and analysis facilities in its final stage is shown Table22-2.

Table 22-2 Manning plan

Test & analysis process	Section manager	Staff	Fore man	Skilled worker	Unskilled worker	Total
Raw material verification test	1	5	1	23	15	45
Analytical verification test	0	5	2	45	20	72
Special verification test	0	3	1	15	5	24
Product verification test	0	8	3	45	20	76
Environment measurement test	0	2	1	10	6	19
Total	1	23	8	138	66	236

Section 23 Administration and Common Facilities

Contents

Administration and common facilities

The plant for the main equipment of the administration and common facilities for the integrated steelworks is described blow.

1. Administration center

The administration center house the technical division members except the central test and analysis center personnel, the production scheduling division members except transport personnel, and members of administrative division except the maintenance & utilities division.
The administration center comprises office rooms, meeting rooms, a hall, and an employee canteen.

2. Motor pool

The motor pool will have a space sufficient to park about 200 motor vehicles, for visitors, company's official uses, and employees.
The motor pool will be located adjacent to the administration center.

3. Production warehouses

The product warehouses will comprise 3 hot-rolled product warehouses and 3 cold-rolled product warehouses with a total capacity of about 30-day stock for shipping.
Each product warehouses is size to 250m x 40m, and will be equipped with at 25t overhead traveling crane in consideration of future increases in coil weight.
These product warehouses will be located near the shipping berth for higher transport efficiency.

4. Production control system

4.1 Structuring of the production control system

As has been mentioned in part 6, the overall production control system covering all steelworks will be implemented when the production and management structures of the integrated steelworks are known.
In phase 2, when the iron-making plant and the steel plant start operating, a system for smooth operation and production control between the steel plant and hot strip mill will be constructed.