Equipment	Quantity		Specifications
	Stage I	Stage II	
6) Electrical equipment	1 set	1 set	16,200 kW
7) Building and ceiling cranes			
Building	1 set	1 set	Compressor room 2,450 m^2
Ceiling crane	1 set		20 ^{t} x 18 ^{m}, 10 ^{t} x 14 ^{m}
8) Gas tanks			
Oxygen gas tank	2 units		1,000 m^3 x 30 kg/cm^2
Nitrogen gas tank	1 unit		500 m^3 x 9.5 kg/cm^2
Argon gas tank	1 unit		100 m^3 x 15 kg/cm^2

(3) ガスフロー

1) 酸素ガスフロー

Fig 13-14-1 に示す

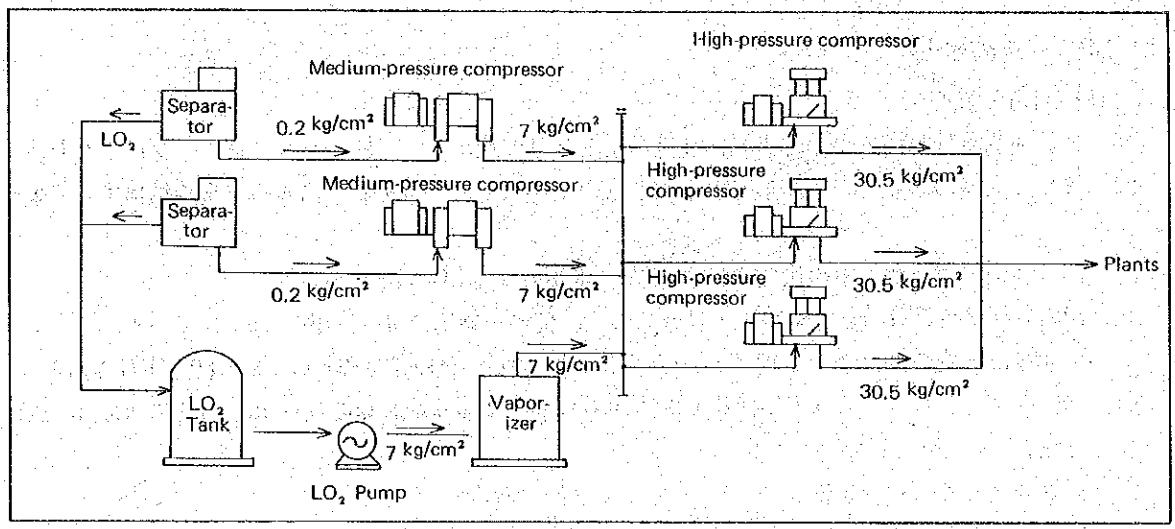


Fig. 13-14-1 Oxygen gas flow

2) 窒素アルゴンガスフロー

Fig 13-14-2 に示す。

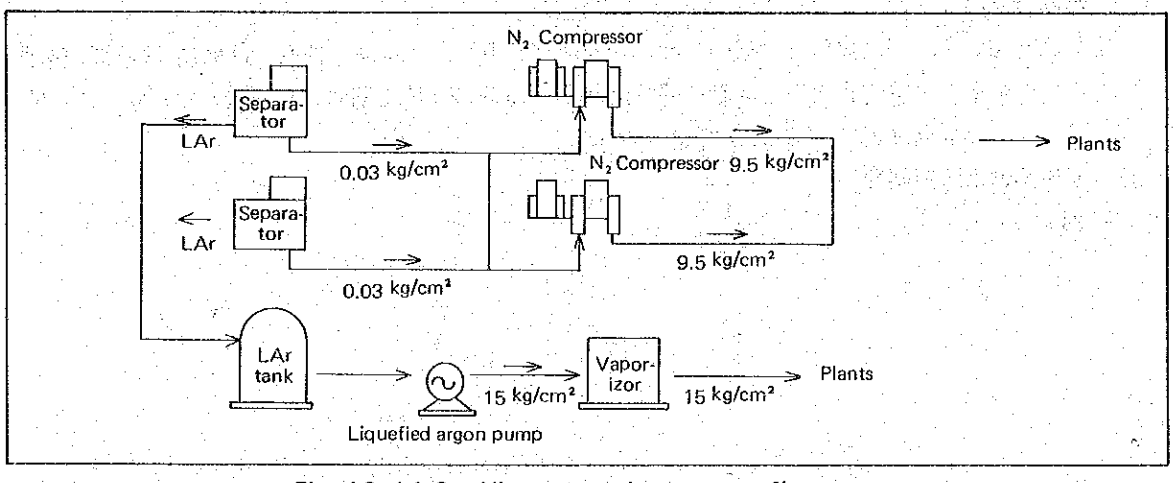


Fig. 13-14-2 Nitrogen and argon gas flow

13-14-4　酸素プラント全体配置

Fig 13-14-3 酸素プラント全体配置を示す。なお，貯槽は使用工場側に設備するので本配置図には含まれていない。

13-14-5　技術説明

(1)　技術的特記事項

1)　連続運転可能時間は1年，但し，往復動圧縮機，液酸ポンプ，液化アルゴンポンプは1ケ月。

2)　爆発，火災の防止のため，製品酸素ガス量の1％以上に相当する液化酸素を常時抽出する必要がある。

3)　同上理由で液化酸素中の炭化水素含有量を40 mg/1 l LO_2以下に管理する。

4)　窒素ガス純度はO_2=0.1％以下と言うことで，他の不純物にはN_2の中に含まれている。

5)　生産量は大気条件により変動する。(計画は気温30℃，気圧760 mmHg，湿度80 %RHである。)

6)　窒素ガス，アルゴンの採取は，もし要求があれば1基当り$N_2$8,000 Nm³/hr, Ar 150 Nm³/hr 迄は採取可能とすることができる。

7)　空気分離装置の減量運転は，定格の70％迄可能である。

8)　酸素プラントに於いては特に「禁油」の措置を心掛けること。

(2)　立上り条件

1)　条　件

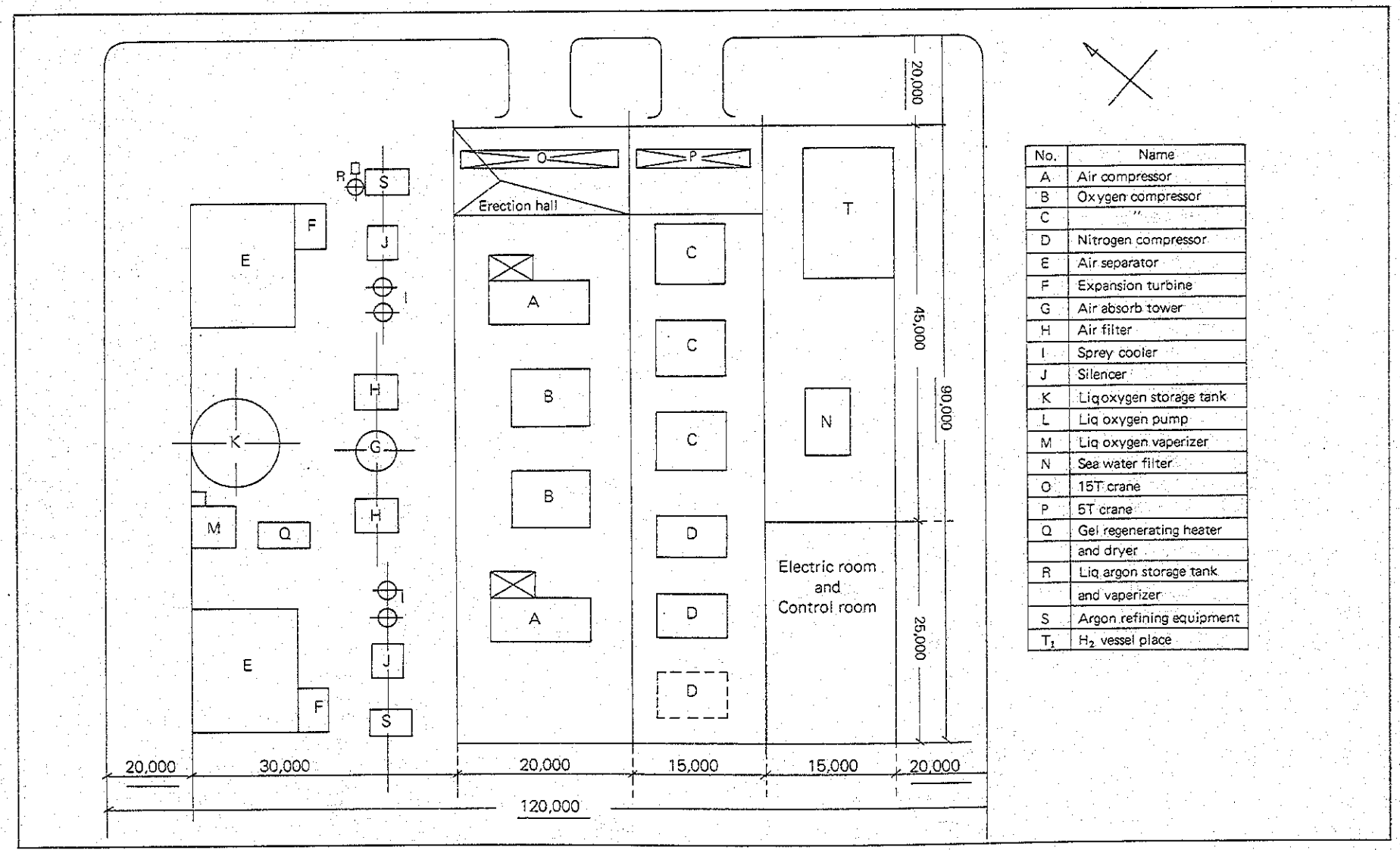
電力，冷却水，蒸気の要求量が確保できること。

2)　起動所要時間

冷却運転開始後，製品採取可能迄の時間は約50時間(但し，アルゴン採取には更に48時間が必要)である。運転中の1時停止後の再起動所要時間は2～10時間（停止期間5日間迄）である。この場合も，アルゴン採取迄は更に24時間が必要である。

3)　全加熱融氷所要時間

約24時間/1プラント



No.	Name
A	Air compressor
B	Oxygen compressor
C	"
D	Nitrogen compressor
E	Air separator
F	Expansion turbine
G	Air absorb tower
H	Air filter
I	Sprey cooler
J	Silencer
K	Liqoxygen storage tank
L	Liq oxygen pump
M	Liq oxygen vaperizer
N	Sea water filter
O	15T crane
P	5T crane
Q	Gel regenerating heater
	and dryer
R	Liq argon storage tank
	and vaperizer
S	Argon refining equipment
T_1	H_2 vessel place

Fig. 13-14-3 Oxygen plant layout

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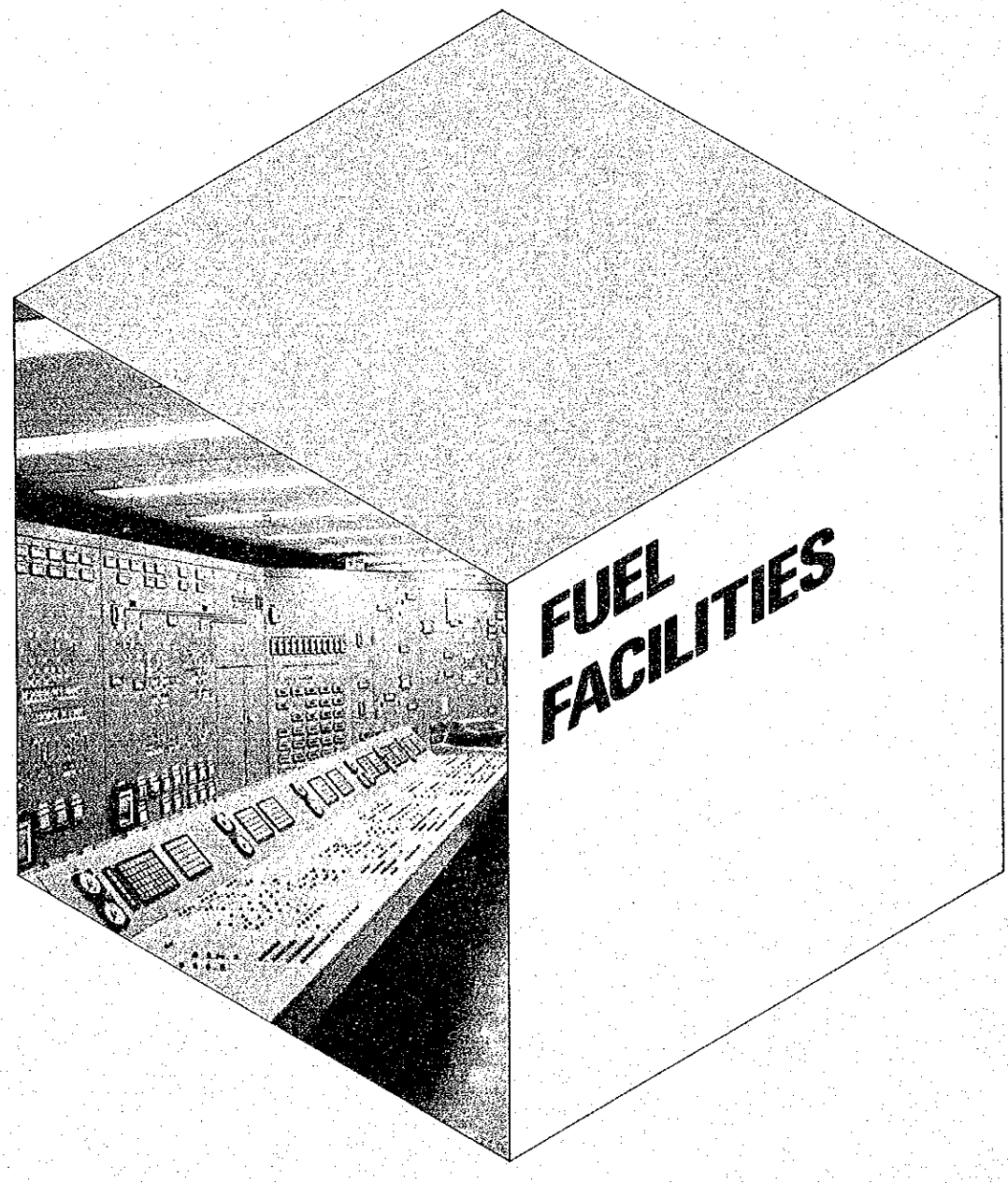

13-15 燃料設備

13-15-1 概　　要

燃料設備は製鉄所で発生する *BFG, COG, LDG* 及び購入燃料の重油を各使用先に供給する設備で構成されている。

13-15-2 計画前提

製鉄所で発生する *BFG, COG, LDG* の発生変動並びに使用先の変動に対応して，各燃料ガスを有効に利用出来るようにガスホルダー設備，ガス放散設備を次のように計画する。

また，使用条件に対応した燃料供給設備として重油設備，ガス昇圧設備を計画する。

(1) *BFG* ホルダーの容量は第II期計画まで考慮した 100,000 m³ とする。

(2) *COG* ホルダーの容量は各使用先燃料切替へに必要な容量を考慮して 40,000 m³ とする。

なお，第II期計画に 30,000 m³ ホルダーを新設し，常時 *COG* 用とし，*BFG* ホルダー定修時の代替ホルダーとして計画する。

(3) *LDG* ホルダー容量は第II期計画まで考慮して 50,000 m³ とする。

(4) BFG, COG の余剰時の放散設備を計画し，BFG 放熱塔は BFG 発生量から高炉熱風炉使用量を減した容量とし，COG 放熱塔は COG 発生量全量とした容量とする。

(5) 重油タンクの容量は通常使用量及び船（コースタルタンカー）の大きさを考慮したものとし，また，満タンで通常使用量の 30 日分の備蓄日数を目標とする。

第II期計画時さらに 1 基増設し定期開放検査にも対応出来るよう計画する。

(6) ボイラへの *BFG,COG* 供給はガスホルダー圧力を利用するが，コークス炉，熱延工場などへはガスブロワーを設置する。

ガスブローは BFG, COG の混合ガス用と COG 用の 2 種を計画し，夫々に予備機 1 基を設置する。また，混合ガス用は熱延，ビレット工場の休転を考慮して 2 機運転 1 基予備とする。

(7) *LDG* は *OG* 設備の集じん性を考慮してホルダー圧力を低くし，ホルダー後にブロワーを設置する。また，電気集じん機を設け，*LDG* 含じん量を 10 *mg/N*m³ 以下にして発電送風プラントへ供給する。

(8) 各種燃料の需給監視，調整及び燃料供給設備の遠隔集中操作が出来るよう燃料センターを計画する。

但し，電力，蒸気は発電送風プラントで，O_2, N_2, *Ar* については酸素プラントで夫々管理する。

(9) 工場用蒸気は通常時発電タービンの抽気によりまかなえるが，新製鉄所立ち上り時を考慮して，*7 t/hr* 容量の低圧ボイラを 1 缶設置する。

13-15-3 設備計画

(1) 設備仕様

燃料設備の仕様を *Table 13-15-1* に示す。

Table 13-15-1 Main specification

Equipment	Stage I		Stage II	
	Quantity	Specifications	Quantity	Specifications
1) B-gas holder	1	Capacity: 100,000 m^3 Pressure: 600 $mm\ H_2O$		
2) C-gas holder	1	Capacity: 40,000 m^3 Pressure: 600 $mm\ H_2O$	1	Capacity: 30,000 m^3 Pressure: 600 $mm\ H_2O$
3) LD-gas holder	1	Capacity: 50,000 m^3 Pressure: 300 $mm\ H_2O$		
4) B-gas flare stack	1	Discharge capacity: Max. 250,000 Nm^3/hr Height: 50 m Diameter: 1,800 $mm\phi$	1	Same as left
5) C-gas flare stack	1	Discharge capacity: Max. 50,000 Nm^3/hr Height: 50 m Diameter: 800 $mm\phi$	1	Same as left
6) Heavy oil tank	1	Capacity: 6,000 t Inside diameter: 22,000 $mm\phi$ Height: 18 m	1	Same as left
7) M-gas blowers (For billet and hot rolling use)	3 (2+1)	Capacity: 35,000 Nm^3/hr Delivery pressure: 1,500 $mm\ H_2O$		
8) C-gas blowers (For coke oven M-gas use)	2 (1+1)	Capacity: 6,500 Nm^3/hr Delivery pressure: 1,300 $mm\ H_2O$	1	Same as left
9) C-gas blower (For general use)	2 (1+1)	Capacity: 6,500 Nm^3/hr Delivery pressure: 1,300 $mm\ H_2O$	1	Same as left

Equipment	Stage I		Stage II	
	Quantity	Specifications	Quantity	Specifications
10) LD-gas blower	2 (1+1)	Capacity: 20,000 Nm^3/hr Delivery pressure: 1,000 mm H_2O	1	Same as left
11) Electric dust collector for LD-gas use	1	Capacity: 20,000 Nm^3/hr Efficiency: 95%	1	Same as left
12) General low pressure boiler	1	Amount of evaporation: 7 t/hr Steam pressure: 12 kg/cm^2G Fuel: heavy oil		

(2) 燃料フロー

1) BFGフロー

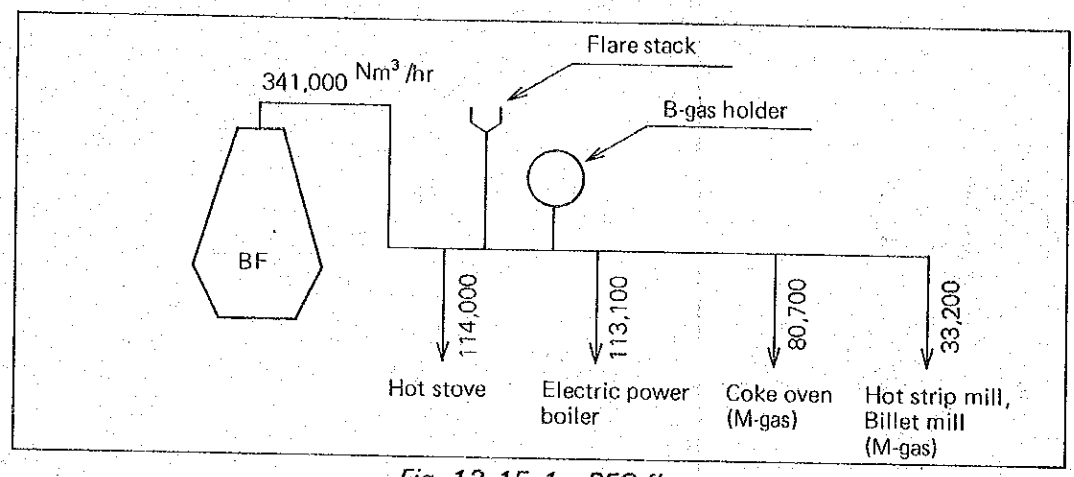

Fig. 13-15-1 BFG flow

2) COGフロー

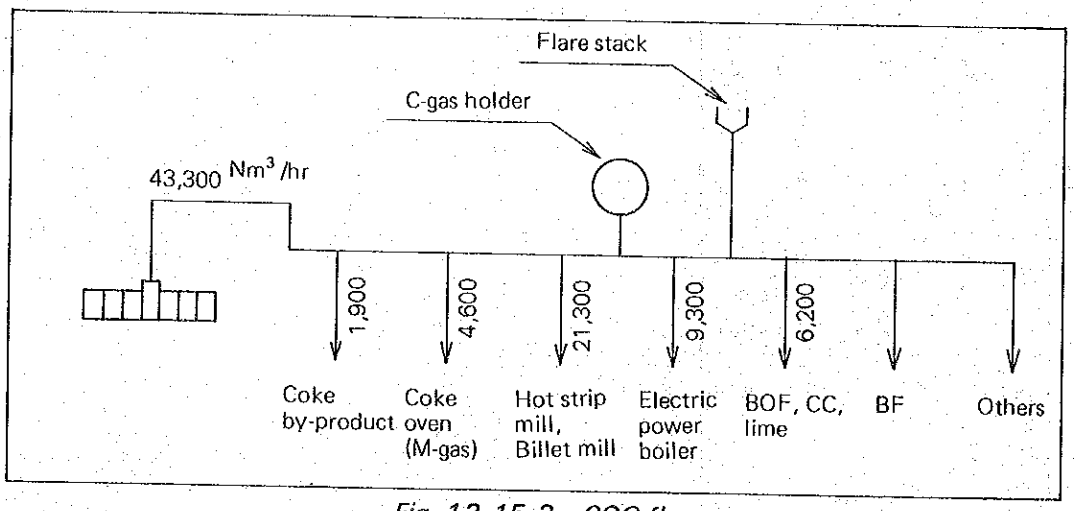

Fig. 13-15-2 COG flow

3) Mガスフロー

(1) 2250 Kcal/Nm³系（熱延，ビレット用）

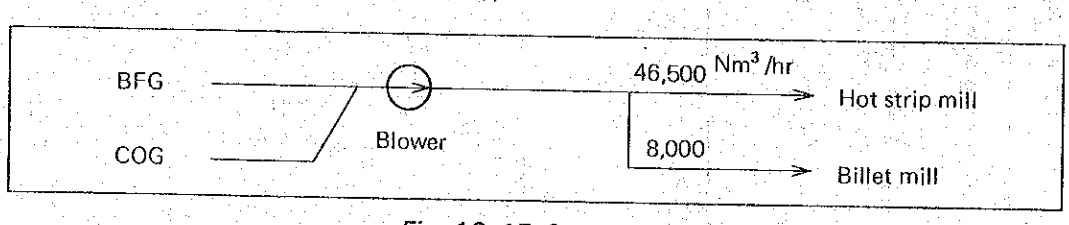

Fig. 13-15-3 M-gas flow

(2) 1,000 Kcal/Nm³系（コークス炉用）

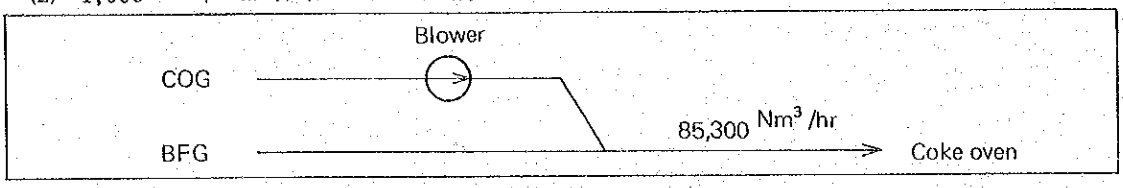

Fig. 13-15-4 1,000 kcal/Nm³ system (Coke oven use)

4) LDG フロー

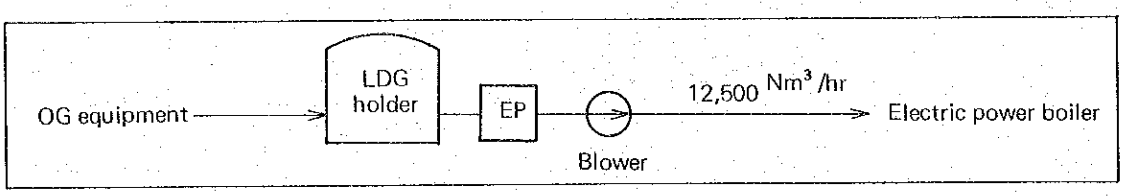

Fig. 13-15-5 LDG flow

5) 重油フロー

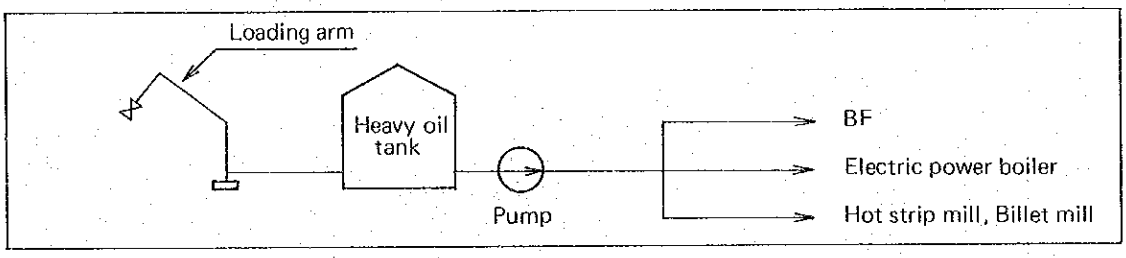

Fig. 13-15-6 Heavy oil flow

13-15-4 燃料設備配置

Fig 13-15-7 各燃料設備の配置図を示す。

13-15-5 技術説明

(1) 立ち上り条件

燃料設備では重油設備関係が特に発電所の立上りと関係がある。したがって重油設備は発電所のテストランの約1ケ月前に完成させる必要がある。

(2) 燃料需給管理

製鉄所で発生する BFG, COG, LDG を有効に使用するため，燃料需給管理の集中管理方式を採用するが，各設備配置もこれに便なるように集中化した。

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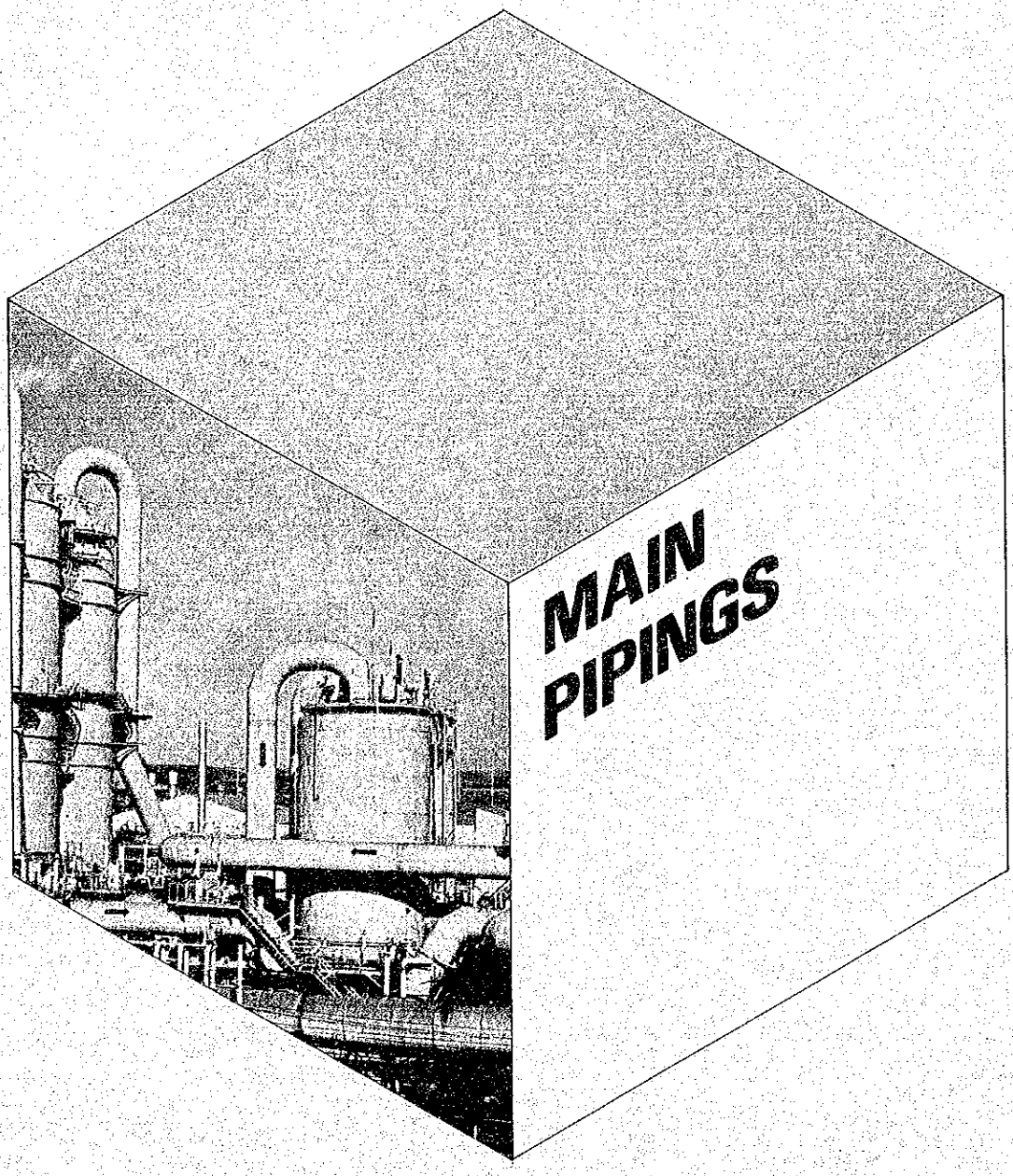

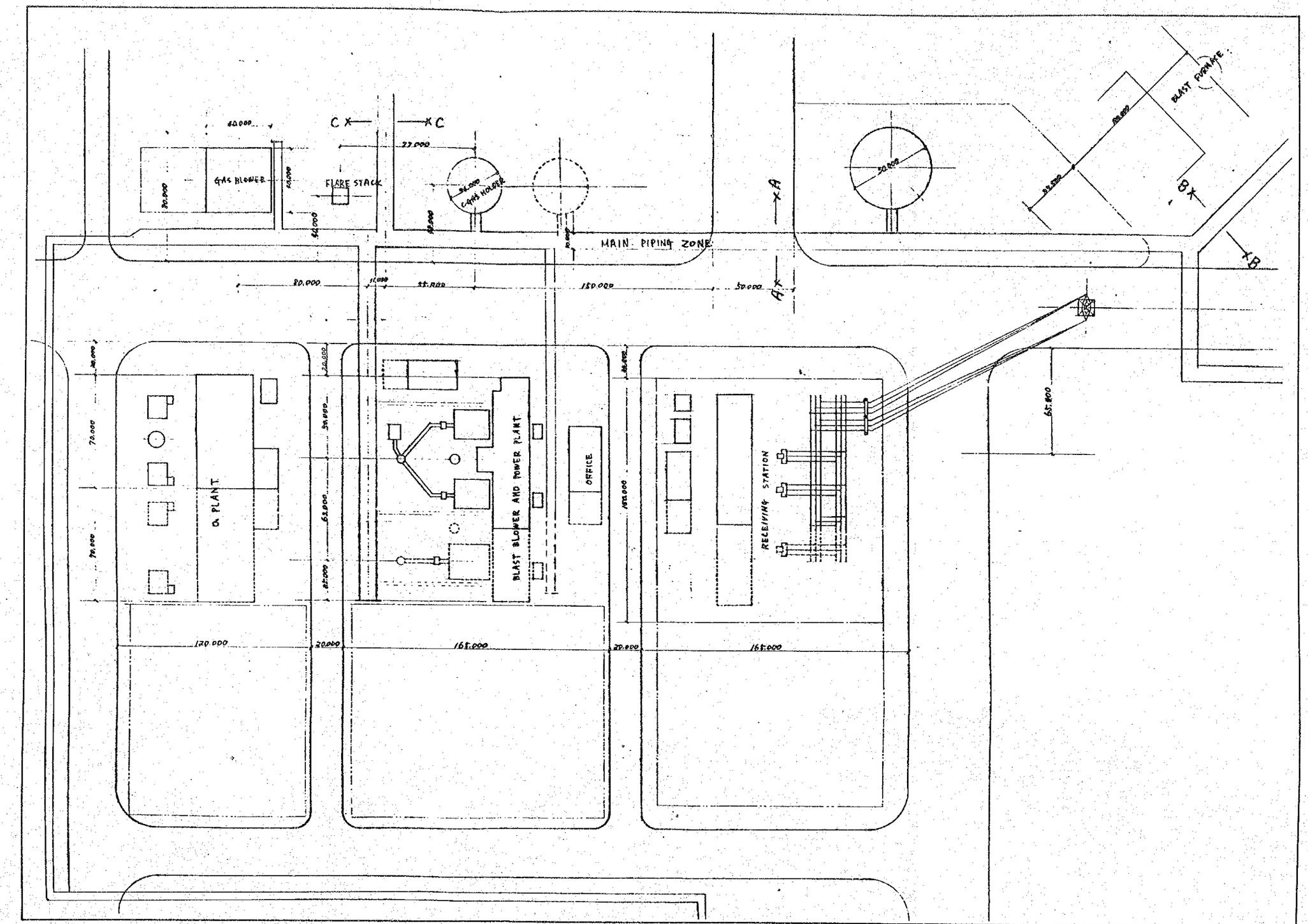

Fig. 13-15-7Utility equipment layout

13-16 動力配管設備

13-16-1 概　　要

新製鉄所内で発生する BFG, COG, LDG や，酸素プラントで発生する酸素（O_2）窒素（N_2）および重油，蒸気等を各使用先で有効に使用出来るよう配管ルートを計画する。

配管は大口径のガス管を主体とし，小配管はその上に乗せる。メイン配管については第II期時まで考慮している。各ユーティリティー毎の配管図を *Fig 13-16-2 ～ Fig 13-16-8* に示す。

13-16-2 設備仕様

動力配管設備を *Table 13-16-1* に示す。

Table 13-16-1 Equipment specifications for yard piping

Line	Pipe diameter mmϕ	Line length m	Remarks
(1) BFG line			
Mains	3,600	1,200	
(2) COG line			
Mains (1)	1,700	1,100	
Mains (2)	800	200	
To I.D	700	1,000	
To BF	400	800	
To pig casting machine	200	800	
(3) Mixed gas line			
Mains (1)	2,000	500	2,250 Kcal/Nm^3
Mains (2)	1,700	170	〃
To hot strip mill	1,600	700	〃
To billet mill	600	120	〃
To cokes	2,300	200	1,000 Kcal/Nm^3
(4) LDG line			
To holder	2,300	150	
To power plant	1,000	1,500	
(5) Steam line			
Mains	300	250	
To B.F.	250	770	
To hot strip mill	200	1,100	
To cokes	150	80	
To billet mill	100	120	
To pig casting machine	80	600	
To main office	50	600	
To heavy oil tank	100	1,400	
To oxygen plant	50	100	
(6) BF blast line	1,700	800	
(7) Heavy oil line			
Mains	100	2,300	
To hot strip mill	80	1,100	
To billet mill	50	120	
(8) Oxygen line			
Mains	250	700	STP G38 sch40
To BOF	250	500	〃
To BF	50	200	〃
To pig casting machine	25	900	〃
(9) Nitrogen line			
Mains	250	700	
To BOF	250	500	
To BF	250	200	
To hot strip mill	100	1,100	
To cokes	100	80	
To pig casting machine	25	900	
(10) Compressed air line			
Mains	25	700	
To BOF	25	500	
To BF	25	200	
To warehouse	25	400	

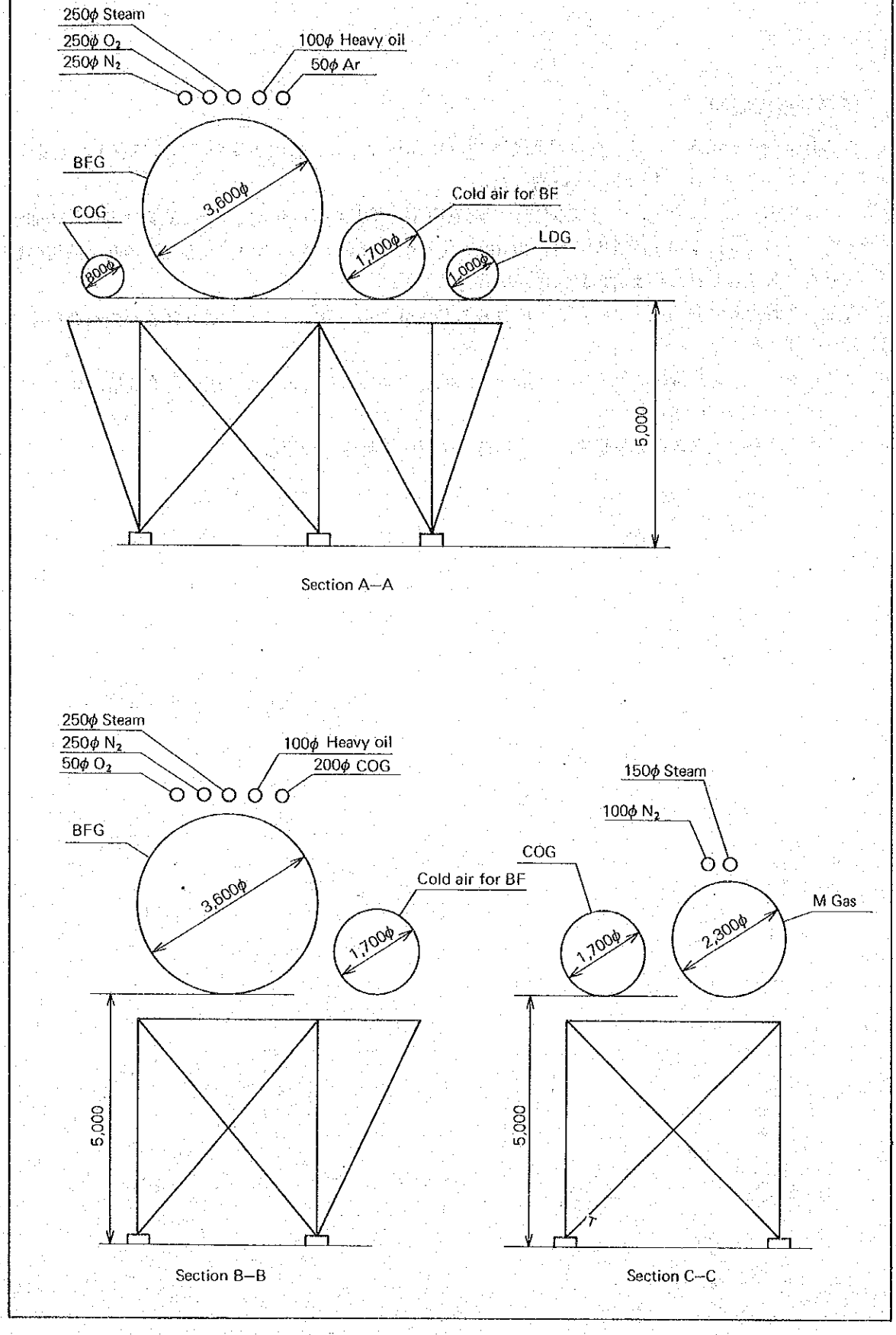

Fig. 13-16-1 Cross-section of pipe line

13-16-3 技術説明

(1) 配管径は管内の流速をガスについては最終 12~15 m/s にとり，管内流体の圧力降下を大きくせず，経済的にバランスのとれたものとして計画した。

(2) 配管は出来るだけまとめ，配管架台には大径管(BFG, COF,LDG etc,)をのせ，配管サポートの間隔を小さくとらねばならない小配管(O_2, N_2, steam, oil etc.)は径の大きい BFG 管の上にのせ，設備の経済性を計ると共に，これら小配管の点検保守を容易にした。

(3) 配管の塗装の寿命の向上をはかること。塗装の寿命はふんい気に大きく左右されるが概ね 3 年位で適宜補修の要がある。

(4) ガス管中のドレンを排出させるシールポットは低圧ガスに対しては，ガス圧の約 2.5 倍，昇圧ガスについては約 1.5 倍が好ましい。

(5) ガス管には安全上系統を分離出来るよう適当な場所に水封弁を設ける。

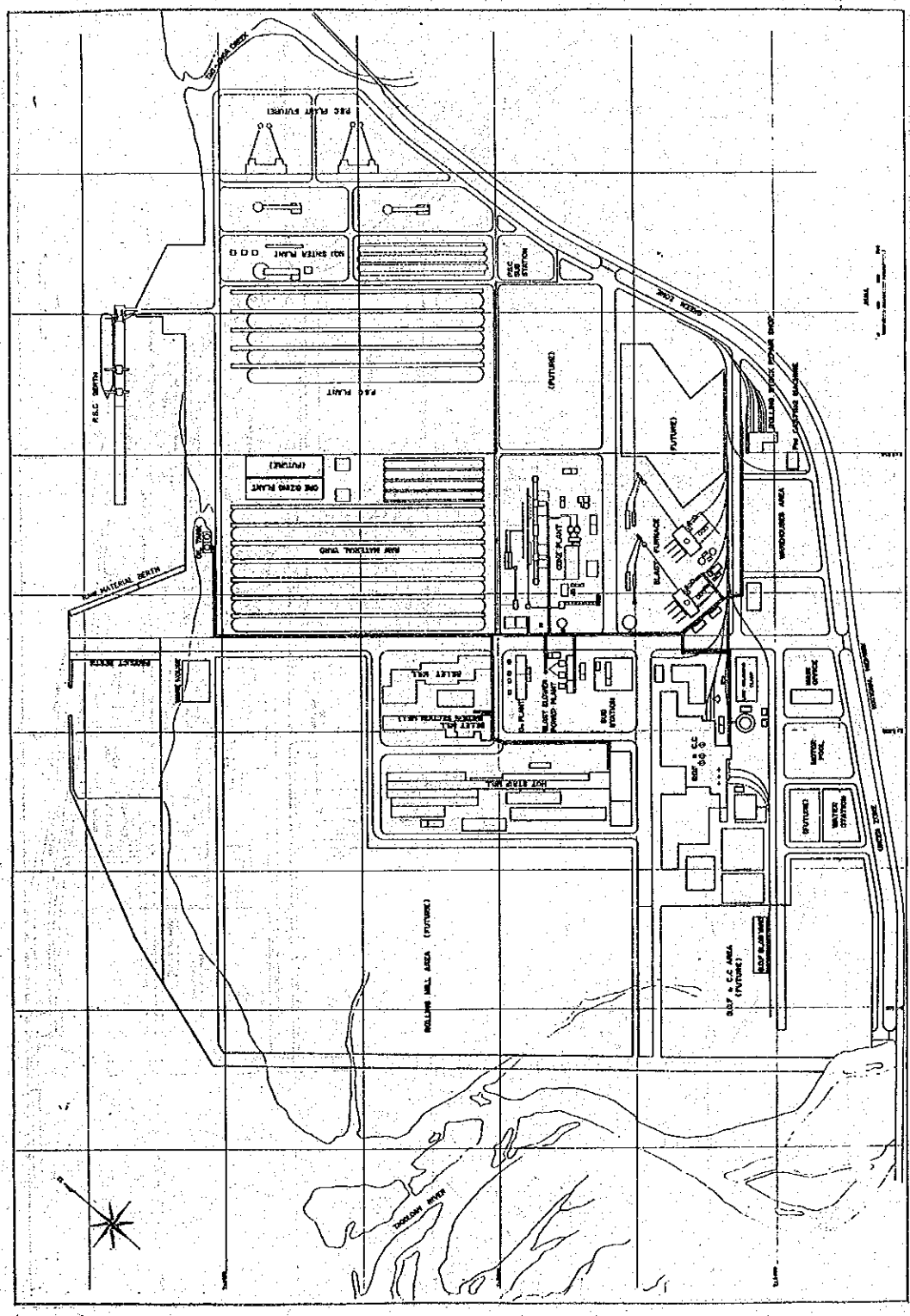

Fig. 13-16-2 General piping zone

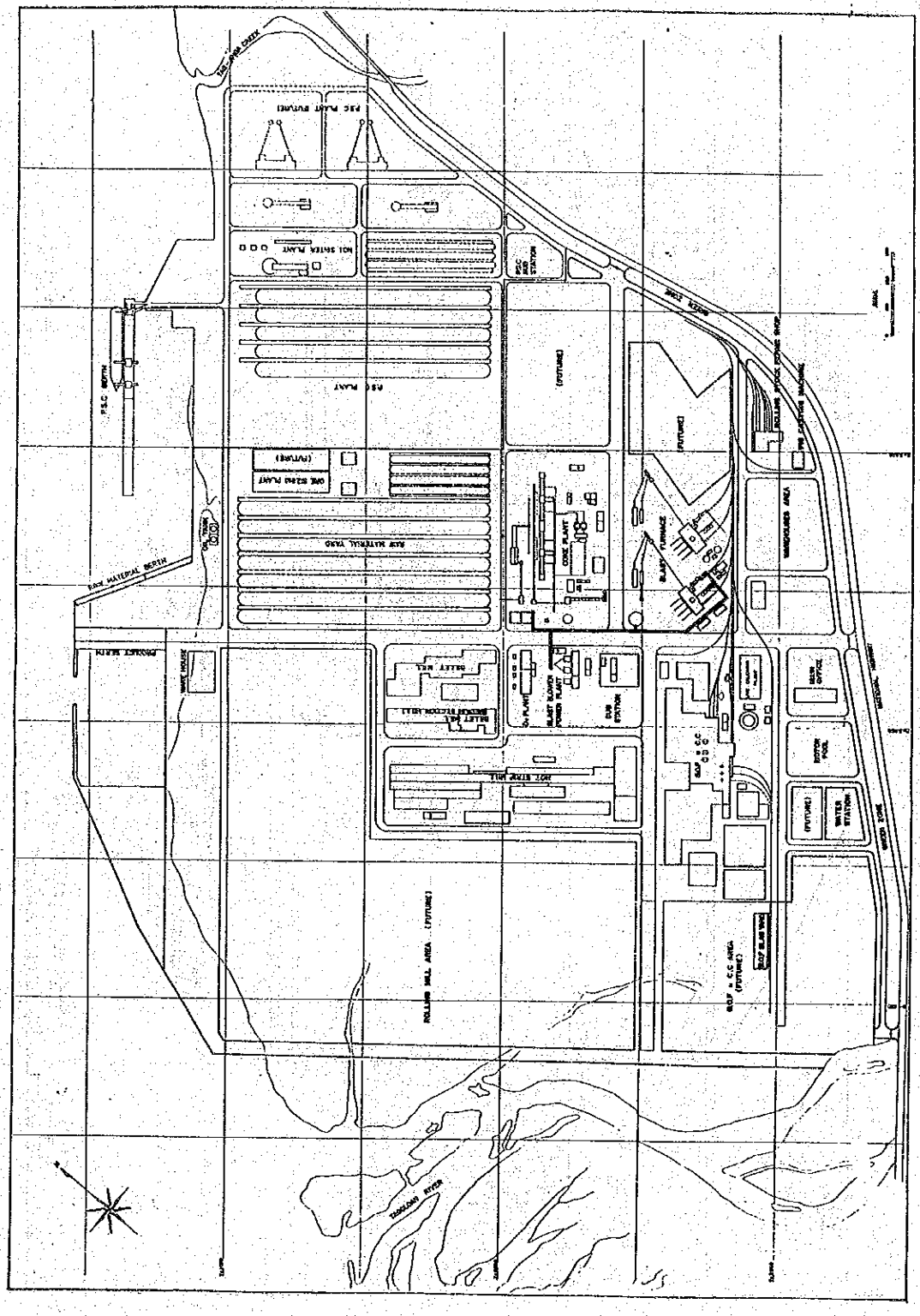

Fig. 13-16-3 BFG line

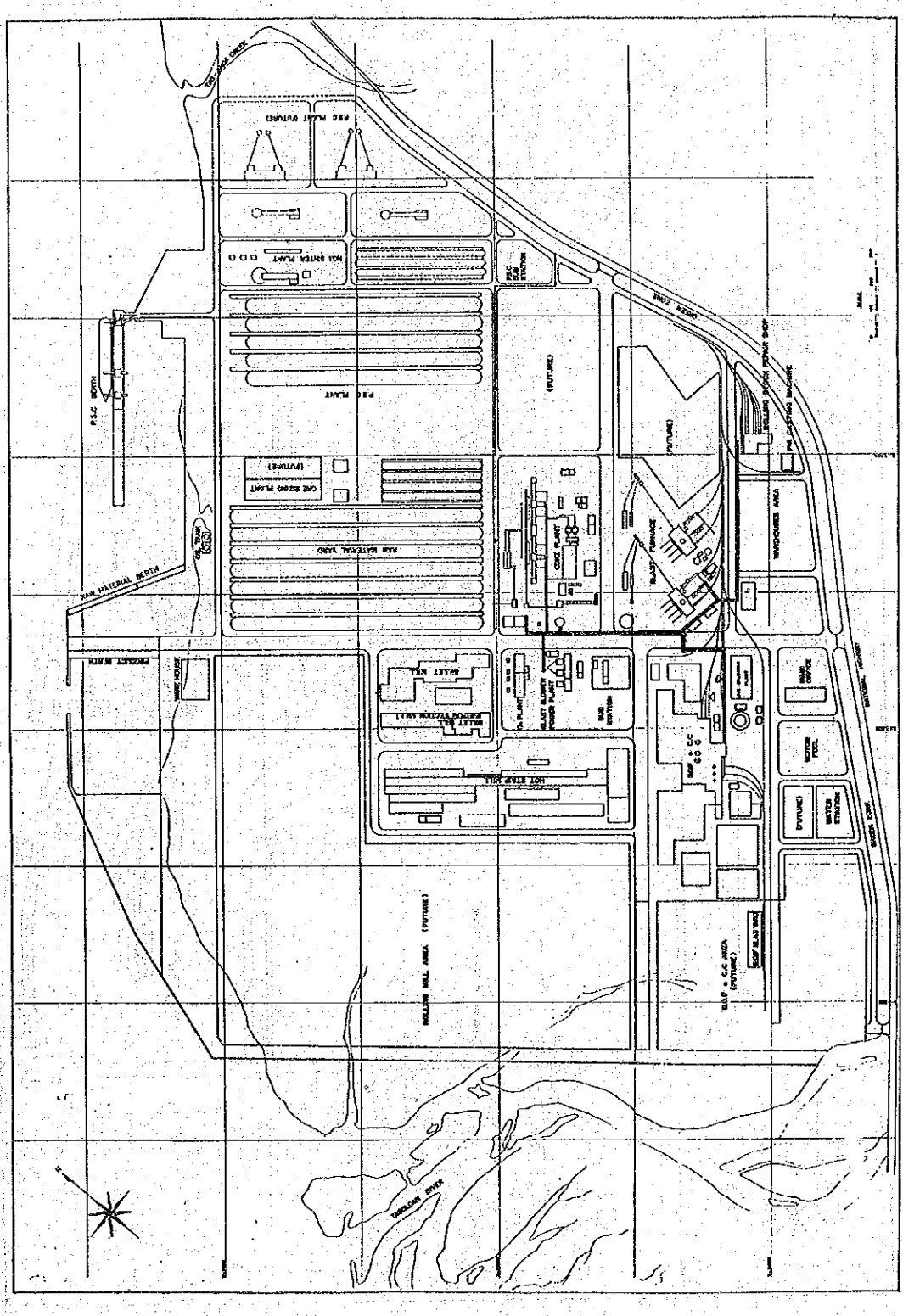

Fig. 13-16-4 COG line

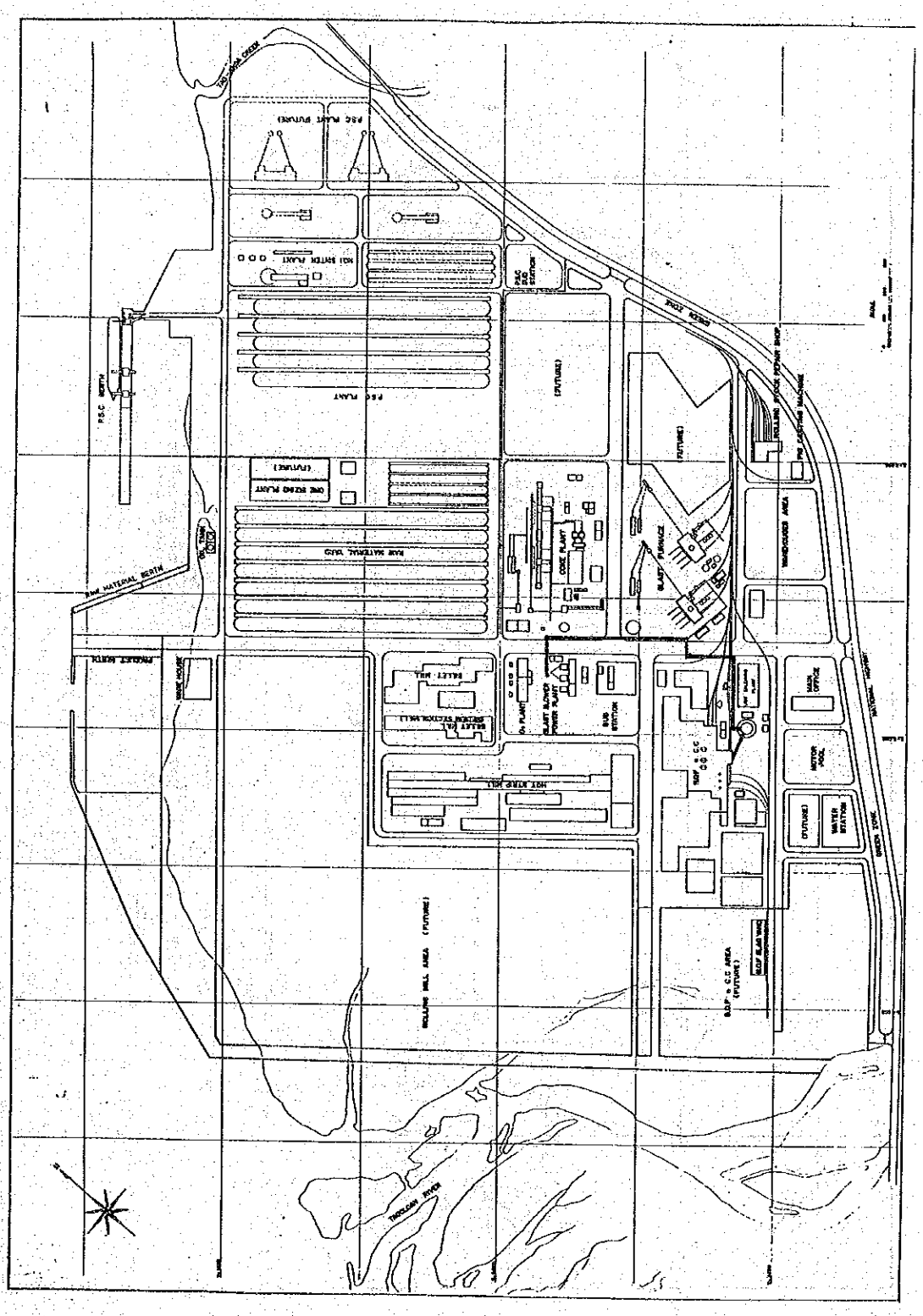

Fig. 13-16-5 LDG line

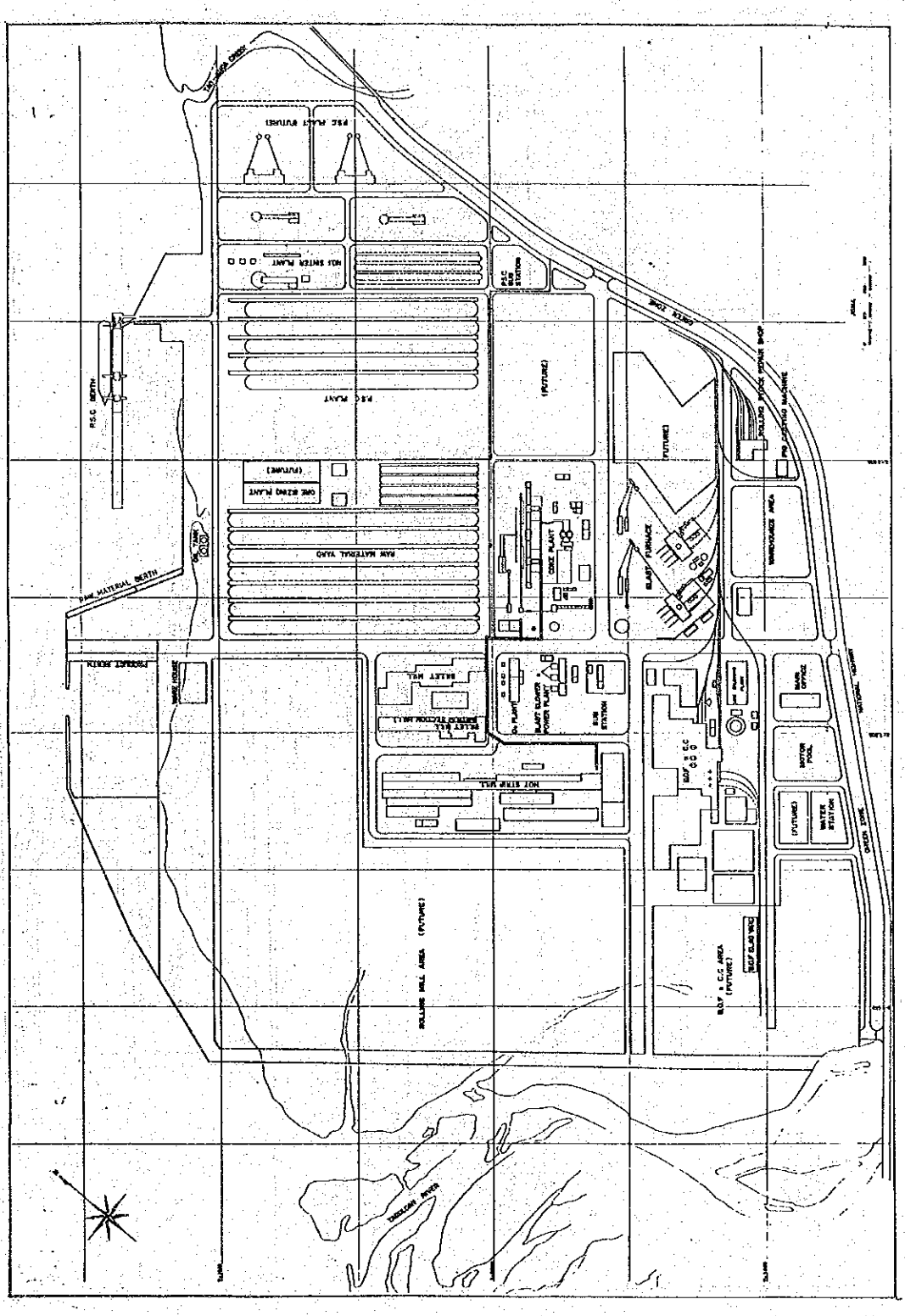

Fig. 13-16-6 Mixed gas line

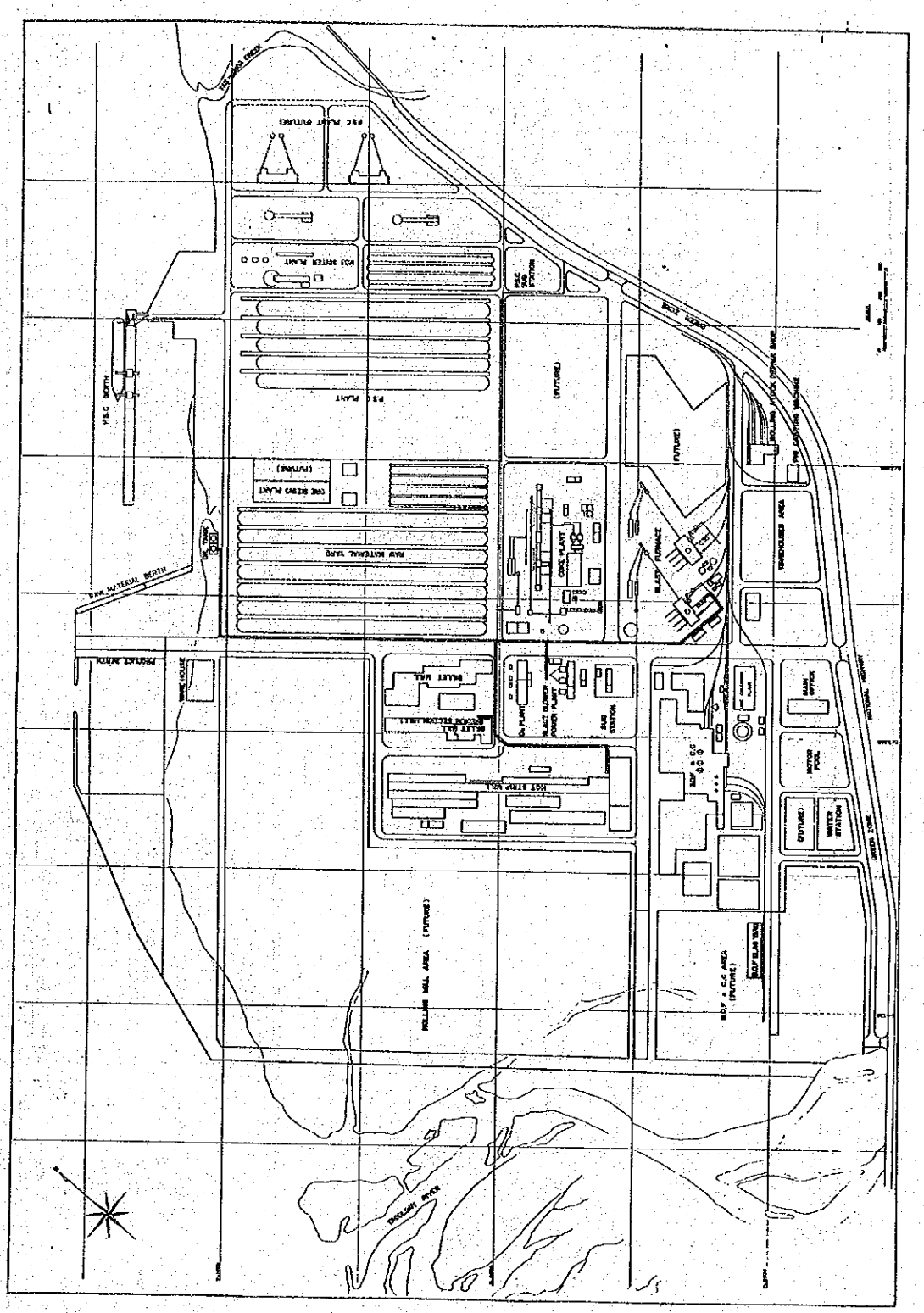

Fig. 13-16-7 Oil line

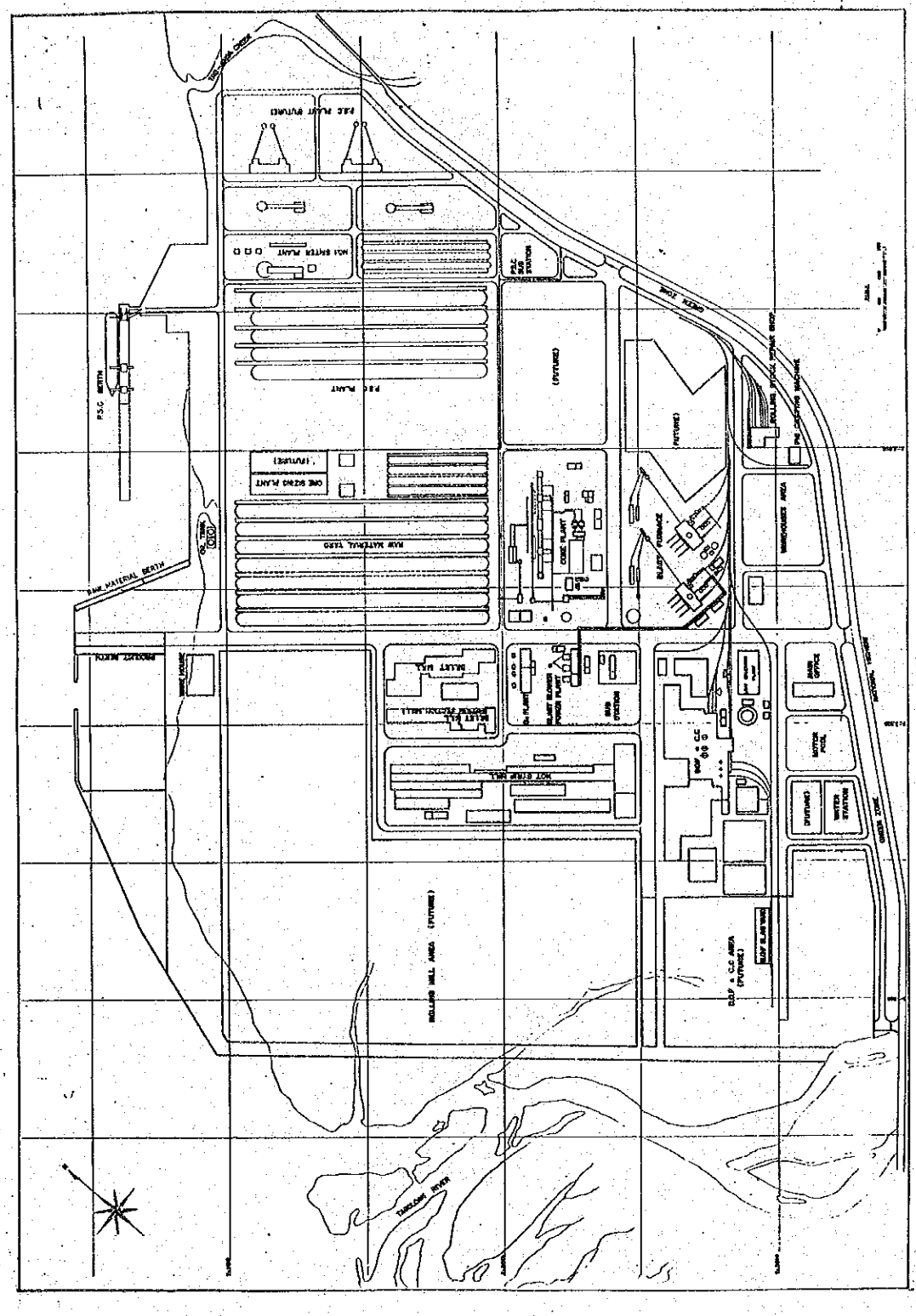

Fig. 13-16-8 Blast line

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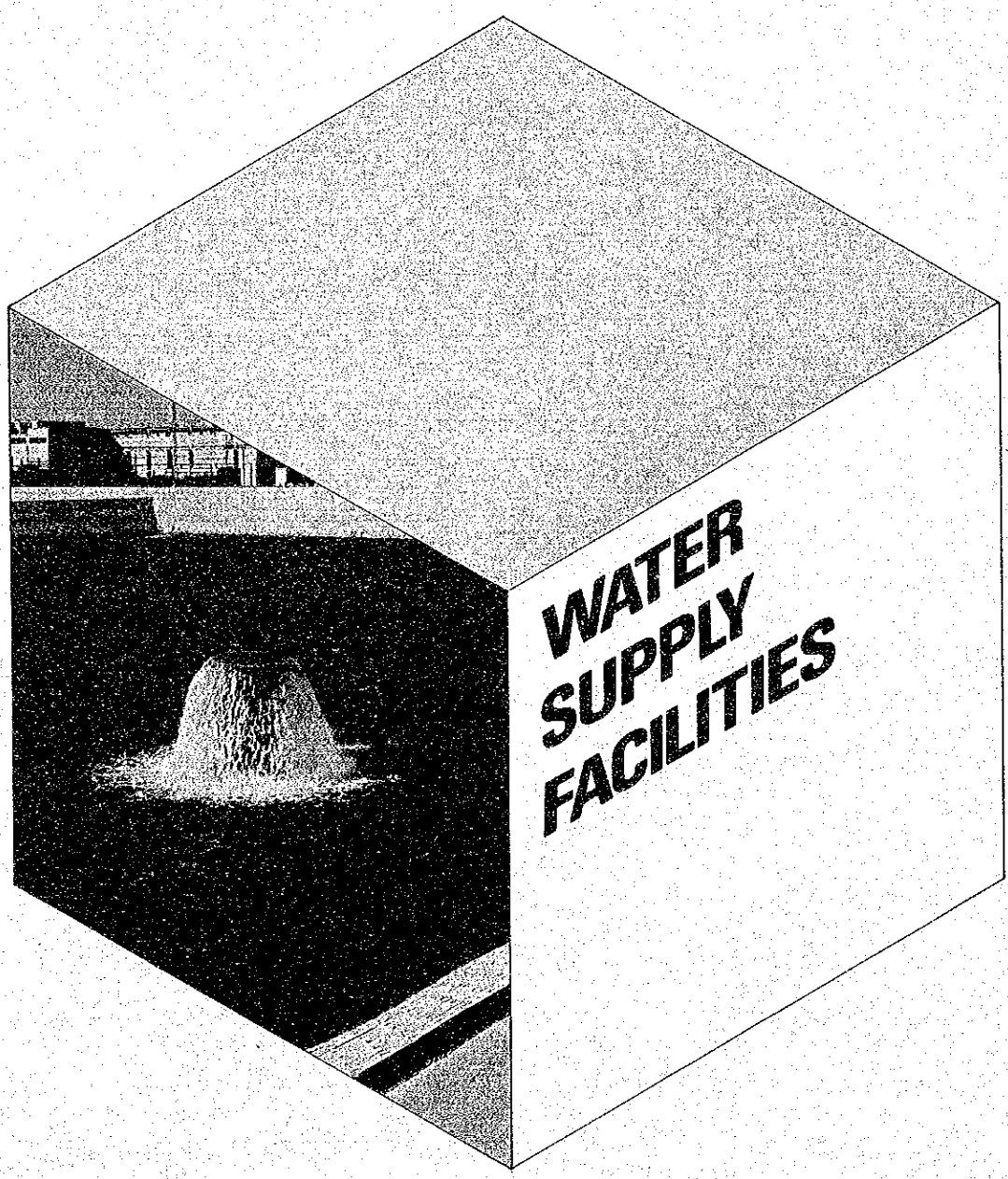


13-17 給水設備

13-17-1

新一貫製鉄所の水源水は，河川水と海水である。河川水はまず貯水池へ入り，次に浄工水センター設備へ送られ，凝集沈澱処理された後，工水系と浄水系に分けられる。

工水系の水は高架タンク経由で工水管にて配給され，各戻水設備等の補給水となる。

一方，浄水系の水は，前記凝集沈澱処理に加え，濾過処理され，塩素滅菌された後，高架タンク経由で浄水管にて機器冷却水及び生活用水として配給される。

海水は本製鉄所の先端の海より取水し，トラベルスクリーン等で除塵され，塩素消毒した後，海水管にて酸素，コークス化成，及び発電所へ給水される。なお，非常時対策として工水系と海水系にはディーゼルポンプを設置する。

Table 13-17-1 Quantity of required water

(Unit: m^3/min)

No.	Plant name	Stage I			Stage II		
		I.W.	D.W.	S.W.	I.W.	D.W.	S.W.
1	Coke plant	1.70	0.11	32.2	3.47	0.14	64.4
2	B.F.	11.19	0.04	–	19.38	0.07	–
3	B.O.F.	3.25	0.56	–	6.50	1.13	–
4	Lime calcining	0.63	0.02	–	1.26	0.04	–
5	C.C.	4.92	0.13	–	9.84	0.25	–
6	Billet (1st)	0.58	0.22	–	1.32	0.23	–
7	Billet (2nd)	–	–	–	1.64	0.23	–
8	Hot strip mill	11.0	0.9	–	15.0	1.20	–
9	Main office	–	0.18	–	–	0.18	–
10	Power plant	0.5	0.01	300	1.2	0.01	520
11	O_2 plant	1.0	0.01	30.5	1.5	0.01	61.0
12	Scrap yard	0.12	0.18	–			
13	Raw material yard	0.6	–	–			
14	Ware houses	–	0.18	–			
15	Pig machine	–	0.12	–			
16	Yard office	–	0.06	–			
17	Coal berth	–	0.48	–			
18	Product berth	–	0.54	–			
	Total	35.49	3.74	362.7			

Remarks I.W. : Industrial water
D.W.: Drinking water
S.W. : Sea water

13-17-2 前提条件

各系統の使用水量を *Table 13-17-1* に示す。

各系統の水質等を *Table 13-17-2* に示す。

Table 13-17-2 Quality and others of water

No.	Item	Conditions	
1	Industrial water	Raw water quality:	SS max. 1,000 mg/1 ave. 30 mg/1 PH 5.8 – 8.6
		Quality of treated water:	SS max. 15 mg/1 PH 5.8 – 8.6 Other variables should be in accordance with Japanese standards for industrial water quality.
		Water temperature:	29 ± 5°C
2	Drinking water	Raw water quality:	SS max. 15 mg/1 PH 5.8 – 8.6
		Quality of treated water:	Turbidity – not more than 2°, PH 5.8 – 8.6 Other variables should be in accordance with Japanese standards for potable water quality.
		Water temperature:	29 ± 5°C
3	Sea water	Sea water temperature:	Around 30°C
		Sea water level:	HWL + 1,280 LWL ± 0

13-17-3 設備計画

(1) 設備仕様

Table 13-17-3 Specification

Item	Stage I	Stage II
(1) Water reservoir facilities	150^{m} x 100^{m} x 6^{mH} x 1 reservoir Semi-underground $90{,}000^{m^3}$ HWL GL + 600^{mm} LWL GL – $5{,}400^{mm}$	Constructed in stage I so as to supply the quantity of water that will be used in stage I and II.
(2) Potable water/industrial water center facilities		
1) Coagulation sedimentation basin	$2{,}500^{m^3}$ x 1 basin (with declined parallel plates)	Same as at left
2) Treated water tank	$1{,}500^{m^3}$ x 1 tank	〃
3) Filtration tank	5^{m} x 10^{m} x 5^{mH} x 1 tank	〃
4) Potable water storage tank	$1{,}000^{m^3}$ x 1 tank	〃
5) Sterilizing equipment	1 set	〃
6) Head tank (for industrial water)	200^{m^3} x 1 unit	〃
7) Head tank (for potable water)	100^{m^3} x 1 unit	〃
8) Pumps & others	1 set	〃
(3) Potable water line	Piping & valve, 1 set	〃
(4) Industrial water line	Piping & valve, 1 set	〃
(5) Sea water intake facilities		
1) Water intake tower	$8^{m\phi}$ x 2.5^{mH} x 2 units	Constructed in stage I so as to supply the quantity of water that will be used in stage I and II.
2) Screening facilities	1 set	
3) Water supply tank	$1{,}500^{m^3}$ x 2 tanks	
4) NaClO generator	1 set	
(6) Sea water supply facilities		
1) Pumps & others	1 set	Same as at left
2) Sea water line	Piping & valve, 1 set	〃

(2) 給水系統図

Fig 13-17-1 工水給水系統図
Fig 13-17-2 工水給水管配置図
Fig 13-17-3 浄水給水系統図
Fig 13-17-4 浄水給水管配置図
Fig 13-17-5 海水給水系統図
Fig 13-17-6 海水給水管配置図

13-17-4 技術説明

(1) 貯水池設備

○河川の取水口より自然流下で流入する。
○滞留時間 第Ⅰ期 38.2 *hrs*

(2)浄工水センター設備（Ⅰ期のみ）

1) 凝集沈澱池
○滞留時間 63.7 *min*
○沈降速度 0.1～0.2 *m/min*

2) 処理水槽
○滞留時間 38.2 *min*

3) 濾過槽（重力式急速濾過）
○濾過速度 108 *m/d*
○濾過面積 50 ㎡

4) 飲料水貯槽
○滞留時間 4.6 *hr*

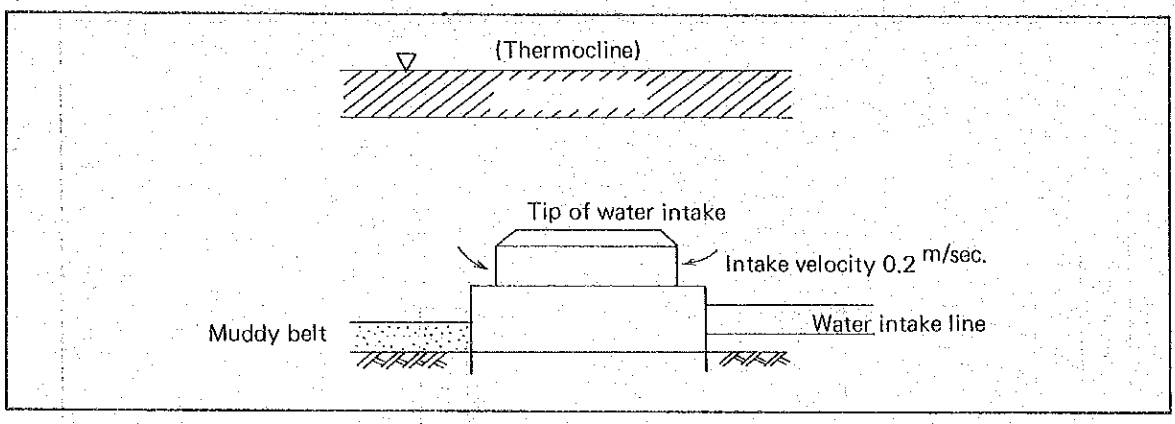
5) 高架タンク（200 ㎥工水系）
○滞留時間 5.6 *min*

6) 高架タンク（100 ㎥浄水系）
○滞留時間 26.7 *min*

(3) 海水取水設備

1) 深層取水方式（海底管取水方式）

温排水，気温等による海水温の変化を最小限に抑えるために深層取水方式を採用し，その中でも浮遊物の流入，波高の影響の小さい海底管取水方式とする。



2) *NaClO* 発生装置

海水を電気分解し，*NaClO* を発生させ，*NaClO* で塩素滅菌する。

（反応式）

陽極　$2Cl^- \rightarrow Cl_2 + 2e^-$

陰極　$2Na^+ + 2H_2O + 2e^- \rightarrow 2NaOH + H_2$

電解槽内で以下の反応

$$Cl_2 + 2NaOH \rightarrow NaClO + NaCl + H_2O$$

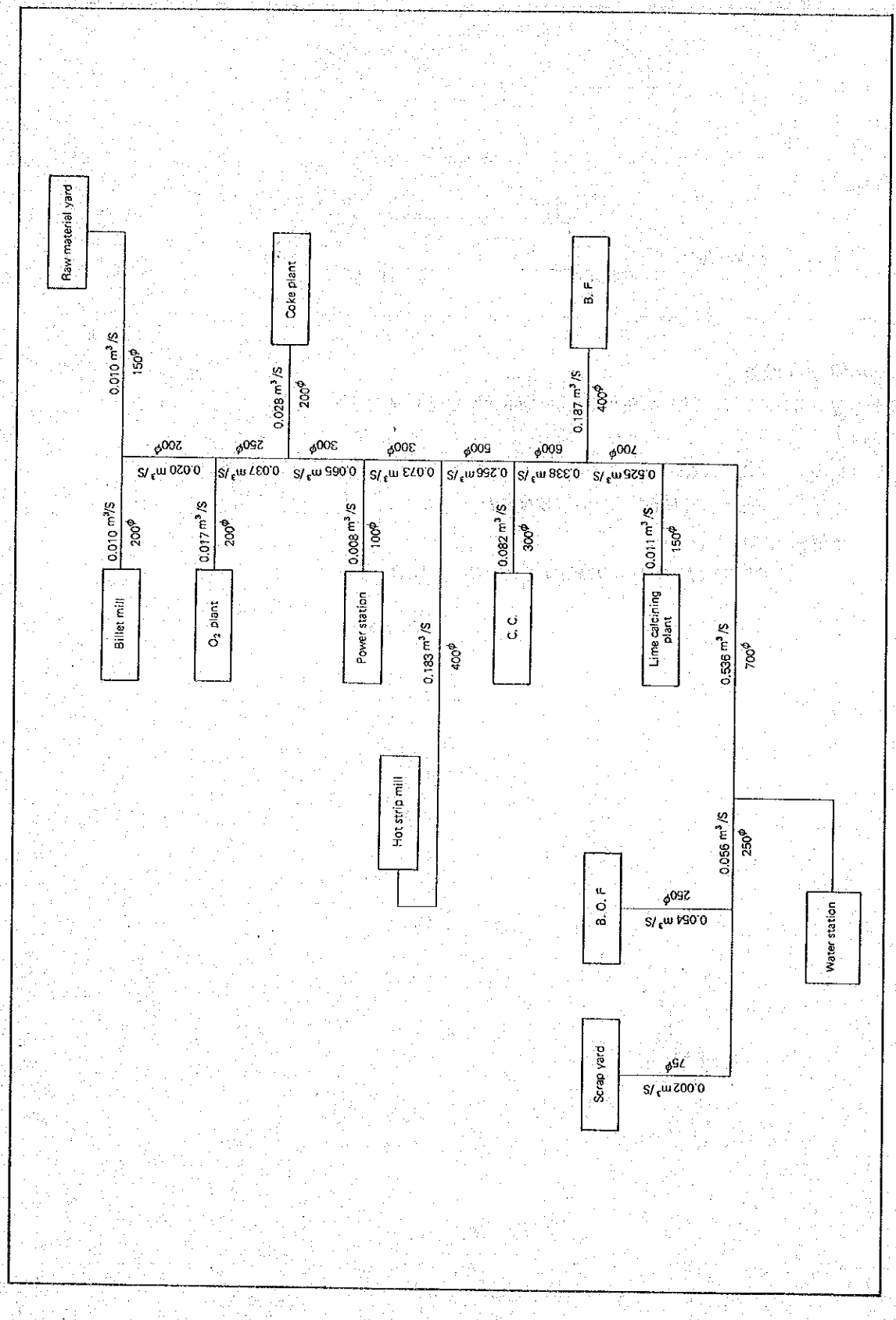


Fig. 13-17-1 Industrial water supply system

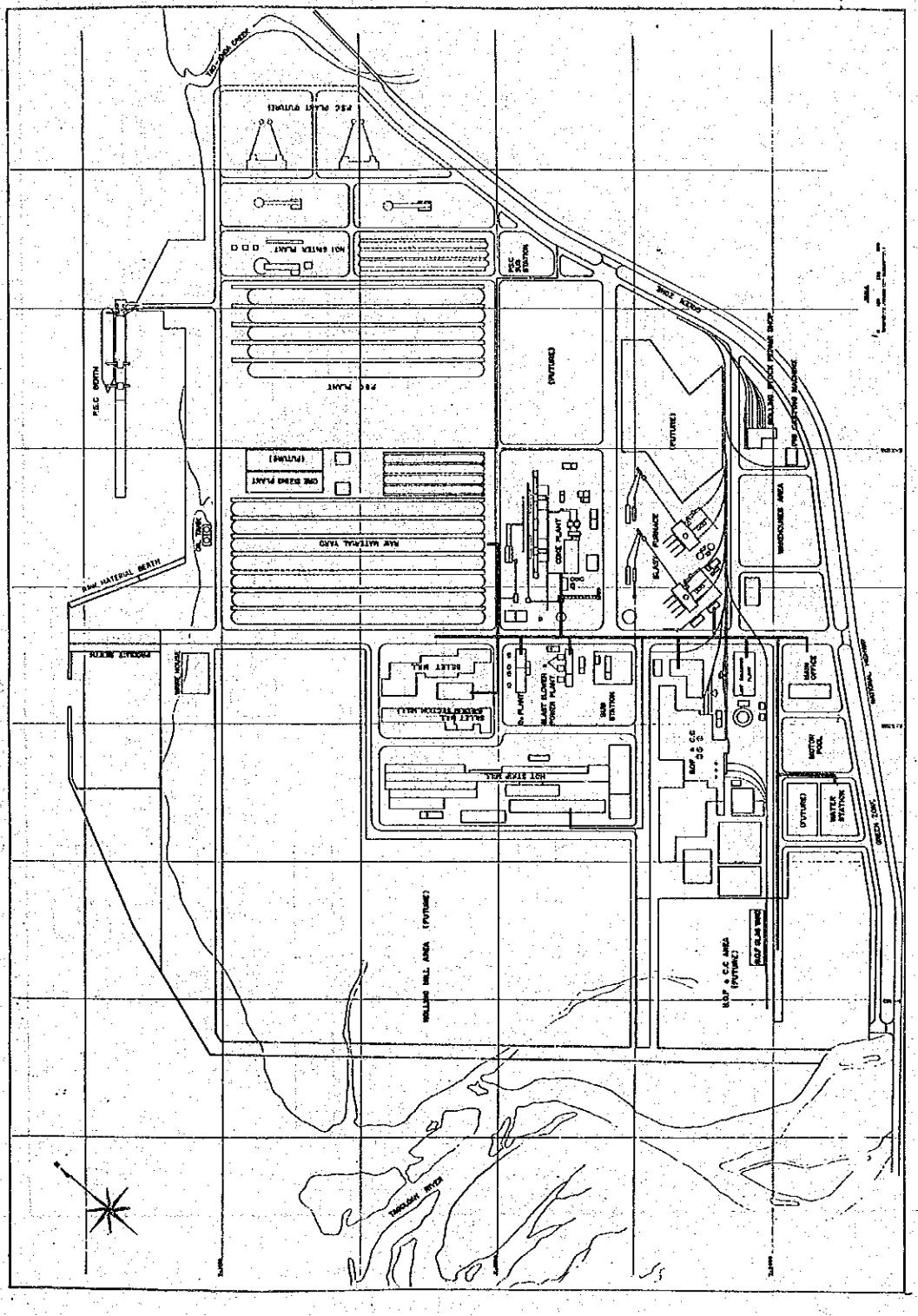


Fig. 13-17-2 Industrial water supply line layout

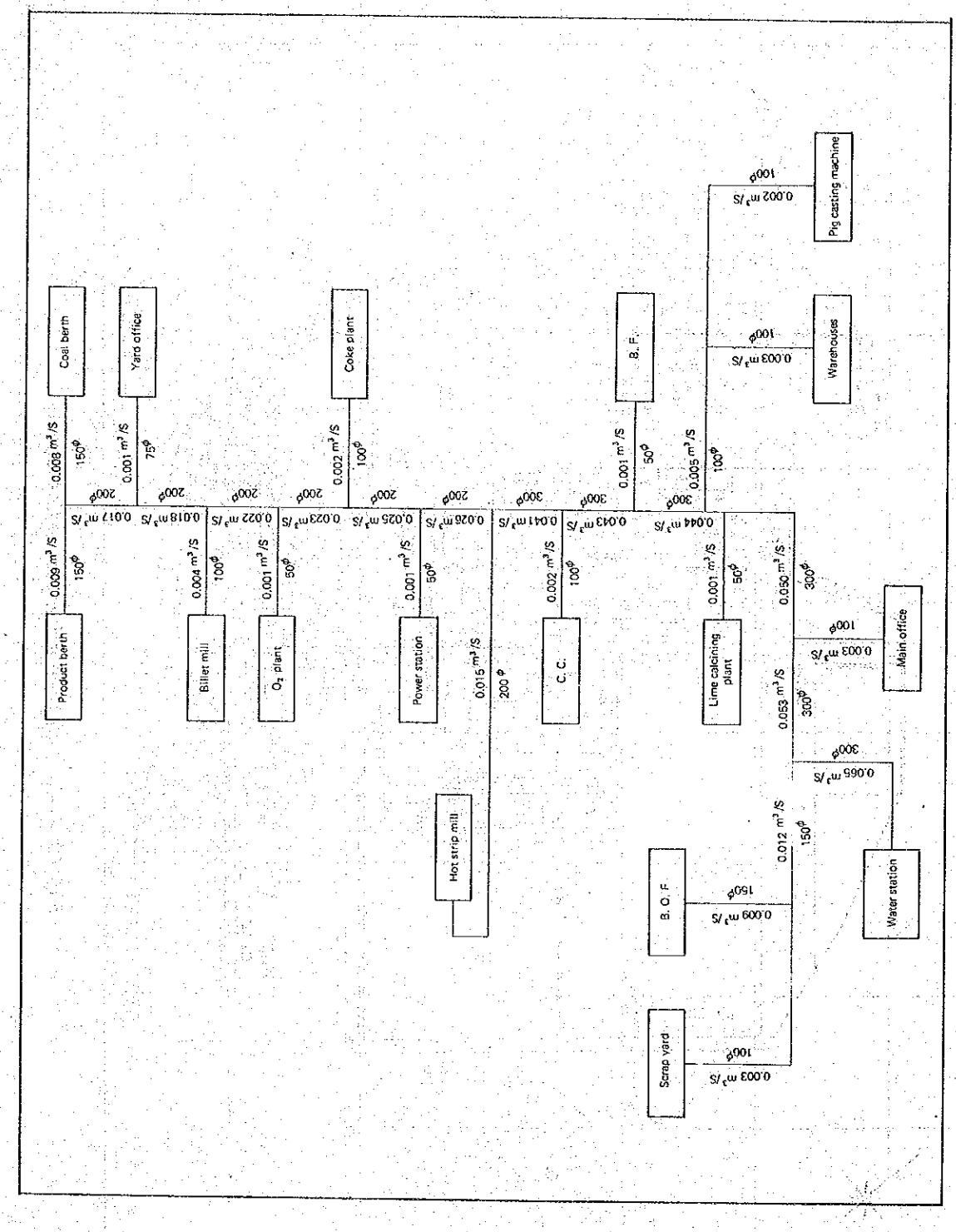


Fig. 13-17-3 Potable water supply system

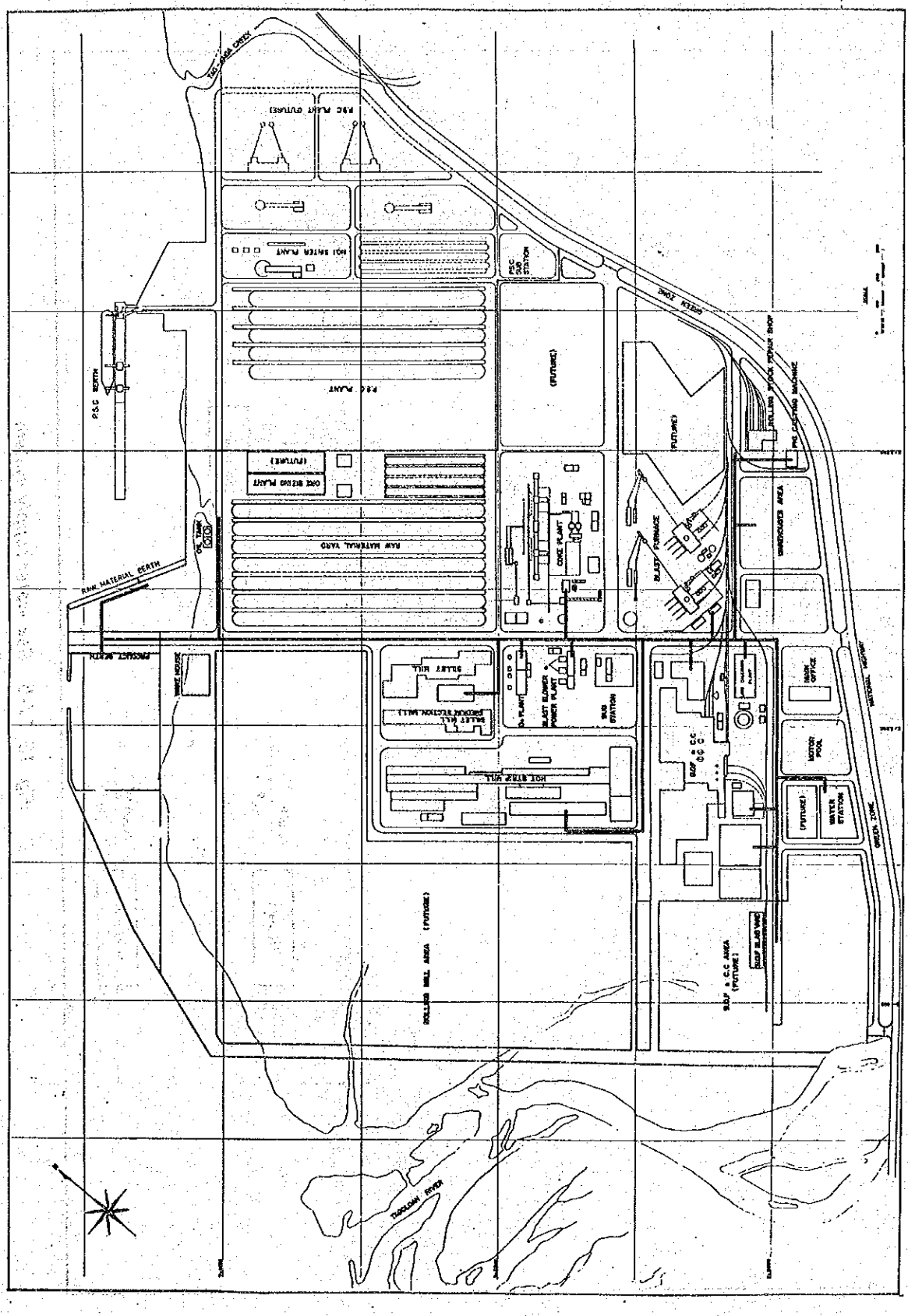


Fig. 13-17-4 Potable water supply line layout

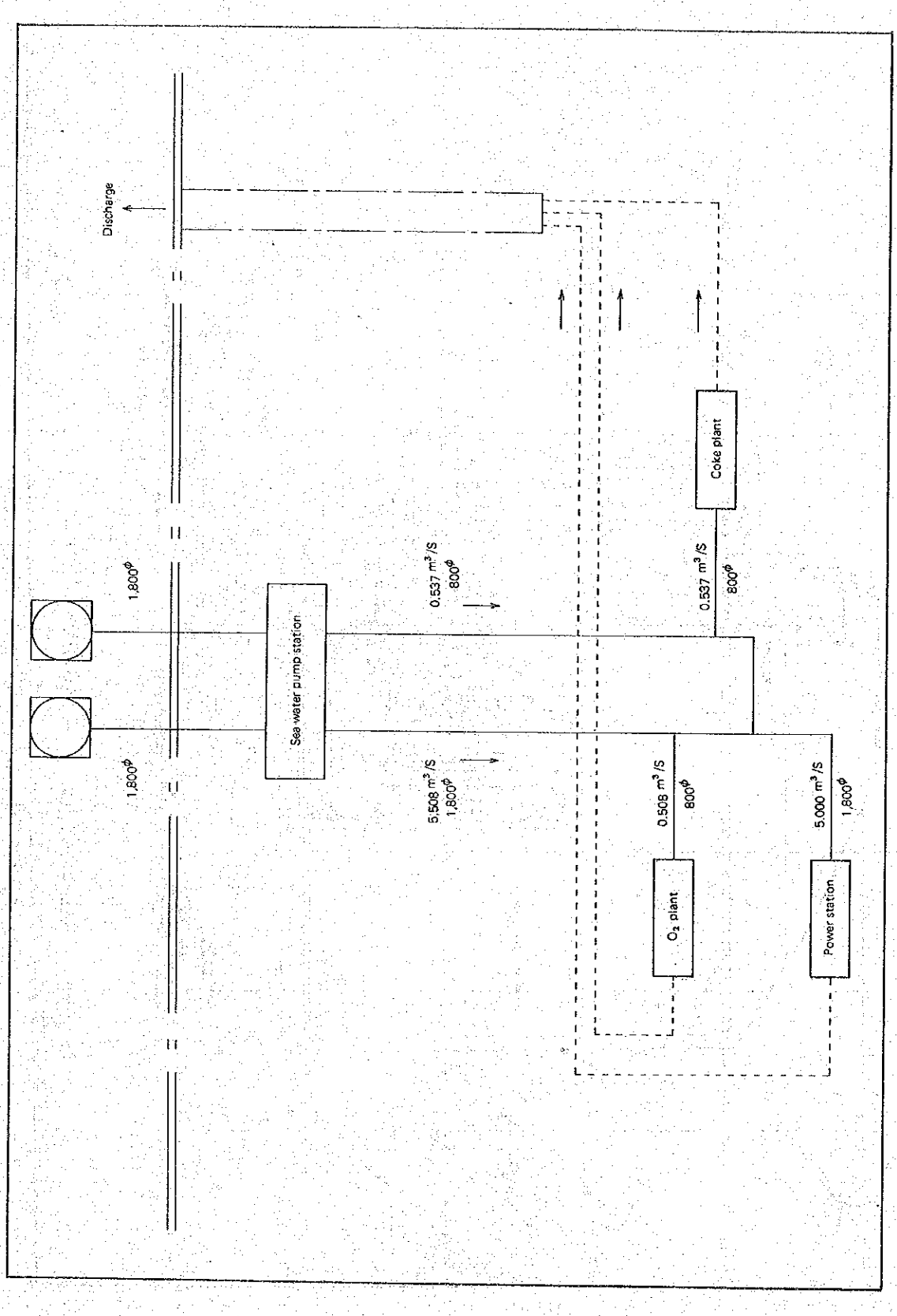


Fig. 13-17-5 Sea water supply system

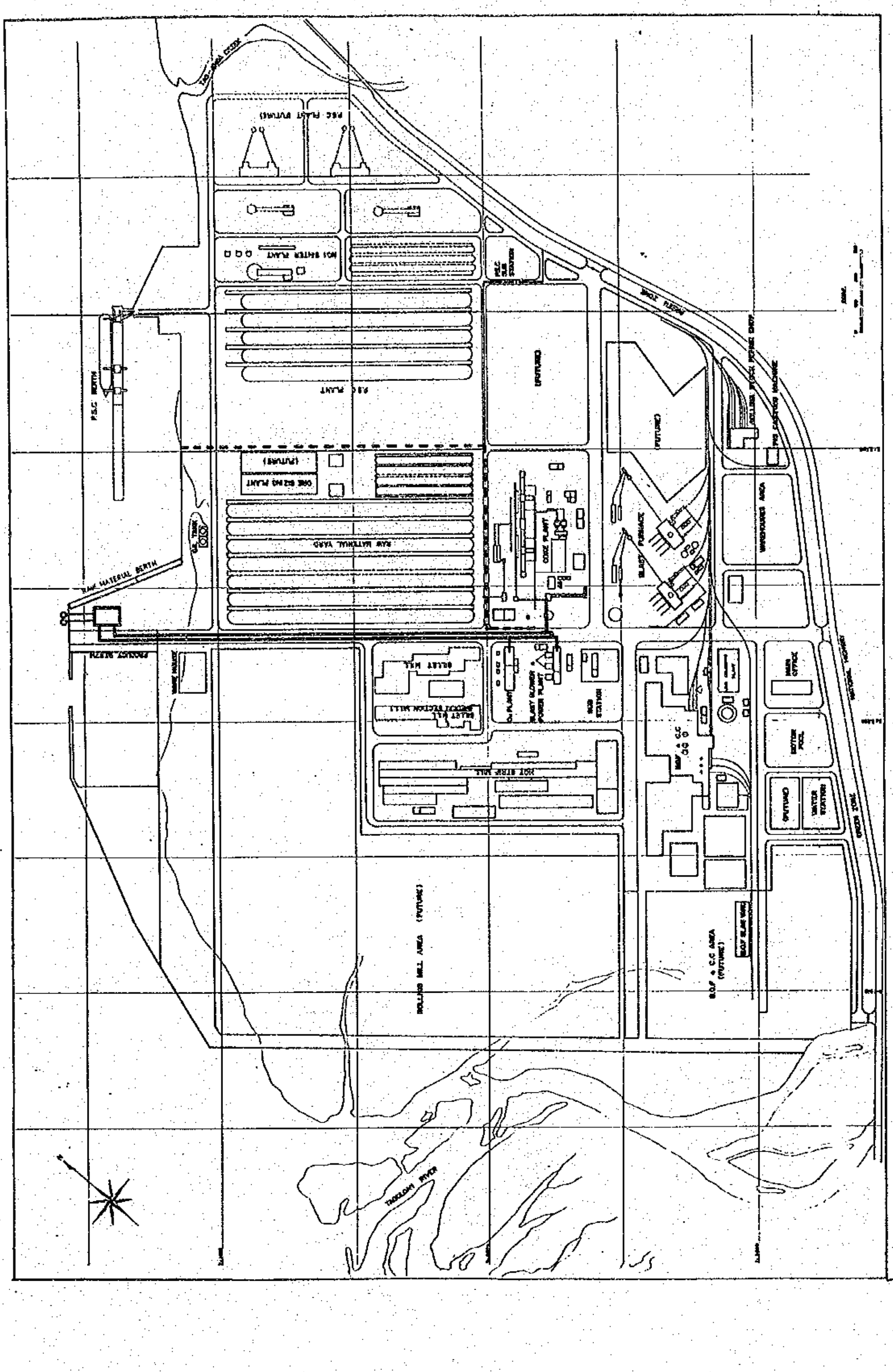
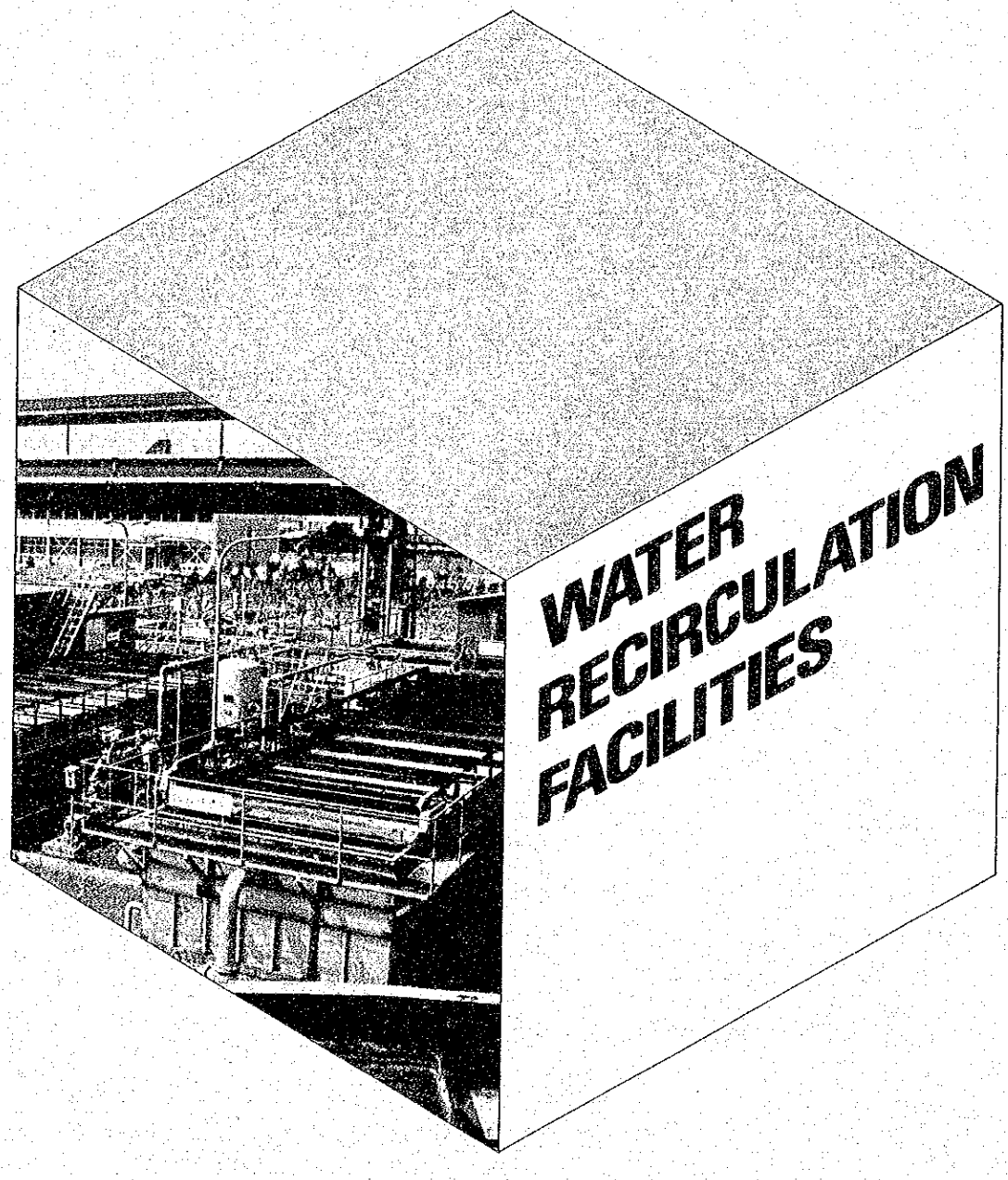


Fig. 13-17-6 Sea water supply line layout

CHAPTER 13-18



13-18 戻水設備

13-18-1 概　　要

各工場で使用する淡水は各工場ごとに設置される戻水設備で処理し，循環される。

循環水は大別して，直接冷却系と間接冷却系に別れる。

直接冷却系では，工場からの戻水は Suspended solids の量，及び水温とも高い。そのため次のような処理をする。スケールピット沈澱池，沪過機で Suspended solids の量を低減させる。その処理は戻水槽に集め，冷却塔に送り，水温を低下させる。またこの循環水の循環回数を増やすと，塩類濃度が高くなるため，強制的に一部の循環水を系外へブローする。

間接冷却系では，工場からの戻水は一般に直接冷却系のように Suspexded solids が付加されず，水温のみが上昇して戻ってくる。まずこの戻水は戻水槽に集められ，冷却塔に送り水温を低下させる。冷却水は給水槽に流れ，ここからポンプにて各工場へ送水される。この循環回数を増すと，塩類濃度が上昇するため，強制的に一部の循環水を系外にブローする。

戻水設備の運転は自動運転を原則とする。但し，工場送水ポンプは工場内運転室よりの遠隔連動操作とする。又戻水設備の監視は各工場内運転室より行なう。なお，脱水機の運転は戻水場に設置される脱水機運転室より行なう。

不断水を必要とする所には高架タンク及びディーゼルエンジンポンプを設ける。

第Ⅰ期時に設置する戻水設備は第Ⅰ期分のみの能力を有する。

13-18-2 前提条件

*Table13-18-1*に前提条件を示す。

Table 13-18-1 Pre-condition for recirculation water

Items	Stage I	Stage II
Water recirculation facilities for coke oven and coke by-product plant		
(1) Coke oven plant		
1) Quenching tower	Amount of recirculating water: 270 m^3/hr Suspended solids (hereinafter referred to as 'SS') in recirculating water: 100 ppm Feed water temperature: 90°C Return water temp.: 90°C Feed water pressure: 2 kg/cm^2	540 m^3/hr
2) Machinery cooling	Amount of water recirculating: 70 m^3/hr SS in recirculating water: 20 ppm Feed water temperature: 35°C Return water temp.: 40°C Feed water pressure: 3 kg/cm^2	130 m^3/hr
3) Dust collection water for larry car	Amount of recirculating water: 110 m^3/hr SS in recirculating water: 100 ppm Feed water temperature: 60°C Return water temp.: 60°C Feed water pressure: 2 kg/cm^2	210 m^3/hr
4) Miscellaneous water	Amount of feed water: 60 m^3/hr Feed water temperature: 35°C Feed water pressure: 2 kg/cm^2	60 m^3/hr
(2) Coke by-product		
1) Machinery cooling	Amount of recirculating water: 80 m^3/hr SS in recirculating water: 20 ppm Feed water temperature: 35°C Return water temp.: 40°C Feed water pressure: 2 kg/cm^2	150 m^3/hr
2) Metal cooling	Amount of feed water: 20 m^3/hr Feed water temperature: 35°C Feed water pressure: 1 kg/cm^2	40 m^3/hr
Water recirculation facilities for blast furnace		
(1) Cooling system for tuyeres, etc.		
1) Cooling of tuyeres, etc.	Amount of recirculation water: 2,600 m^3/hr SS in recirculating water: 20 ppm Feed water temperature: 35°C Return water temp.: 41°C Feed water pressure: 5 kg/cm^2	5,200 m^3/hr
2) Cooling of cooling plate	Amount of recirculating water: 1,600 m^3/hr SS in recirculating water: 20 ppm Feed water temperature: 35°C Return water temp.: 41°C Feed water pressure: 5 kg/cm^2	3,200 m^3/hr
3) Cooling of hot blast valve	Amount of recirculating water: 700 m^3/hr SS in recirculating water: 20 ppm Feed water temperature: 35°C Return water temp.: 41°C Feed water pressure: 5 kg/cm^2	1,400 m^3/hr

Items	Stage I		Stage II
4) Miscellaneous water	Amount of recirculating water: SS in recirculating water: Feed water temperature: Return water temp.: Feed water pressure:	500 m^3/hr 20 ppm 35°C 41°C 5 kg/cm^2	1,000 m^3/hr
(2) Hearth bottom cooling	Amount of recirculating water: SS in recirculating water: Feed water temperature: Feed water pressure:	1,500 m^3/hr 20 ppm 50°C 2 kg/cm^2	3,000 m^3/hr
(3) Dust collection system			
1) Dust collection water	Amount of recirculating water: 1 vs 850 m^3/hr, 2 vs 850 m^3/hr SS in recirculating water: Feed water temperature: Return water temp.: Feed water pressure:	 100 ppm 35°C 45°C 8 kg/cm^2	1 vs 1,700 m^3/hr 2 vs 1,700 m^3/hr
(4) Dry pit system			
1) Dry pit water	Amount of recirculating water: SS in recirculating water: Feed water temperature: Feed water pressure:	200 m^3/hr 50 ppm 60°C 4 kg/cm^2	400 m^3/hr
(5) Pig casting machine system			
1) Pig casting machine water	Amount of recirculating water: Feed water temperature: Feed water pressure:	600 m^3/hr 75°C 2 kg/cm^2	600 m^3/hr
Water recirculation facilities for lime plant			
(1) Limestone cleaning system	Amount of limestone treated: 219,630 t/y = 25.1 t/hr Amount of treating water: Feed water quality: SS: Temp.: The rate of suspended solid generation is assumed to be 1% of raw limestone. Therefore, the amount of suspended solids will be 250 kg/hr. Feed water pressure: Remarks: The amount of suspended solids varies depending on the extent to which pre-treatment of raw limestone (flushing, cleaning, etc.) has been made in the mine. This plan is based on the assumption that 1% of raw limestone to be treated will be generated as suspended solids. In addition, because of lack of information on the grain size distribution of suspended solids, a course grain separating tank will be installed to prevent coarse grains over 100 in size from entering the sedimentation basin and subsequent processes.	 200 m^3/hr 100 ppm 50°C 4 kg/cm^2	440,540 t/y = 50.3 t/hr 400 m^3/hr 500 kg/hr
(2) Dehydrator cleaning water and dust collecting system	Amount of treating water: Feed water quality: SS: Temp.:	220 m^3/hr 100 ppm 50°C	440 m^3/hr

Items	Stage I	Stage II
	Feed water pressure: Dehydrator system: 3 kg/cm² Dust collector system: 2 kg/cm²	
(3) Machinery cooling system	Amount of recirculating water: 70 m³/hr Feed water quality : SS: 20 ppm Temp.: 35°C Feed warter pressure: 5 kg/cm²	140 m³/hr
Water recirculation facilities for BOF plant		
(1) OG cooling system		
1) OG cooling	Amount of recirculating water: Max. 2,300 m³/hr, Avg. 1,200 m³/hr SS in recirculating water: 5 ppm Feed water temperature: 53°C Return water temp.: 83°C Feed water pressure: 11 kg/cm²	Max. 3,500 m³/hr Avg. 2,400 m³/hr
2) Cooling of lance and vessel	Amount of recirculating water: Max. 700 m³/hr, Avg. 350 m³/hr Return water temp.: 70°C Feed water pressure: 14 kg/cm²	Max. 1,000 m³/hr Avg. 700 m³/hr
(2) Dust collecting system		
1) Dust collecting water	Amount of recirculating water: Max. 1,600 m³/hr, Avg. 800 m³/hr SS in the recirculating water: 100 ppm Feed water temperature: 50°C Return water temp.: 70°C Feed water pressure: 8.5 kg/cm²	Max. 2,400 m³/hr Avg. 1,600 m³/hr
2) High-pressure miscellaneous water	Amount of recirculating water: Max. 250 m³/hr, Avg. 130 m³/hr Feed water temperature: 35°C Feed water pressure: 7 kg/cm²	Max. 380 m³/hr Avg. 260 m³/hr
3) Miscellaneous water	Amount of feed water: Max. 280 m³/hr, Avg. 140 m³/hr	Max. 420 m²/hr Avg. 280 m²/hr
4) Soft water	Amount of water to be treated: 9 m³/hr Quality of raw water: M-alkalinity 50 ~ 62 ppm (as $CaCO_3$) SO_4 5 ~ 38 ppm (as SO_4^{--}) $C1^-$ 5 ~ 10 ppm (as $C1^-$) SiO_2 23 ~ 95 ppm (as SiO_2) Ca 16 ~ 35 ppm (as Ca^{++}) Mg 10 ~ 32 ppm (as Mg^{++}) (Na + K) 10 ppm (as $CaCO_3$) SS 10 ppm Total hardness 129 ~ 166 ppm (as $CaCO_3$) pH 7.5 ~ 8 Quality of treated water: SS 3 ppm Ca 1 ppm (as $CaCO_3$) pH Neutral	18 m³/hr
Water recirculation facilities for continuous casting		
(1) Mould machine system		
1) Mould (slab)	Amount of recirculating water: 840 m³/hr SS in recirculating water: 20 ppm	1,700 m³/hr

Items	Stage I		Stage II
	Feed water temperature:	35°C	
	Return water temp.:	45°C	
	Feed water pressure:	10 kg/cm²	
2) Mould (bloom)	Amount of recirculating water:	600 m³/hr	1,200 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	45°C	
	Feed water pressure:	10 kg/cm²	
3) Machine (slab)	Amount of recirculating water:	1,800 m³/hr	3,600 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temperature:	45°C	
	Feed water pressure:	5 kg/cm²	
4) Machine (bloom) & air conditioner	Amount of recirculating water:	800 m³/hr	1,600 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	45°C	
	Feed water pressure:	5 kg/cm²	
(2) Spray system			
1) Slab	Amount of recirculating water:	840 m³/hr	1,700 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	45°C	
	Feed water pressure:	11 kg/cm²	
2) Bloom	Amount of recirculating water:	740 m³/hr	1,500 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	45°C	
	Feed water pressure:	11 kg/cm²	
(3) Scarfer dust collection system			
1) Scarfer dust collection water	Amount of recirculating water:	150 m³/hr	300 m³/hr
	SS in recirculating water:	50 ppm	
	Feed water temperature:	60°C	
	Feed water pressure:	6 kg/cm²	
(4) Scarfer recirculation system			
1) Scarfer scale removal water	Amount of recirculating water:	1,200 m³/hr	2,400 m³/hr
	SS in recirculating water:	100 ppm	
	Feed water temperature:	60°C	
	Feed water pressure:	15.5 kg/cm²	
2) Scarfer spray	Amount of recirculating water:	300 m³/hr	600 m³/hr
	SS in recirculating water:	100 ppm	
	Feed water temperature:	60°C	
	Feed water pressure:	5 kg/cm²	
Water recirculation facilities for hot strip mill			
(1) Reheating furnace cooling system	Amount of recirculating water:	2,200 m³/hr	3,400 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	55°C	
	Feed water pressure:	3 kg/cm²	
(2) Indirect cooling system	Amount of recirculating water:	2,300 m³/hr	3,500 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	

Items	Stage I		Stage II
	Return water temp.:	40°C	
	Feed water pressure:	3 kg/cm²	
(3) Direct cooling system			
1) Roughing mill cooling water	Amount or recirculating water:	1,900 m³/hr	2,900 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	42°C	
	Feed water pressure:	3 kg/cm²	
2) Finishing mill cooling water	Amount of recirculating water:	4,900 m³/hr	4,900 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	42°C	
	Feed water pressure:	3 kg/cm²	
(4) Runout table cooling system	Amount of recirculating water:	6,200 m³/hr	9,200 m³/hr
	SS in recirculating water:	50 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	39°C	
	Feed water pressure:	3 kg/cm²	
Water facilities for billet mill and medium section mill			
(1) Reheating furnace system			
1) Reheating furnace cooling water	Amount of recirculating water:	360 m³/hr	1,200 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	45°C	
	Feed water pressure:	2.5 kg/cm²	
2) Indirect cooling water	Amount of recirculating water:	360 m³/hr	2,000 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	45°C	
	Feed water pressure:	2.5 kg/cm²	
(2) Direct cooling system			
1) Direct cooling water	Amount of recirculating water:	270 m³/hr	1,300 m³/hr
	SS in recirculating water:	20 ppm	
	Feed water temperature:	35°C	
	Return water temp.:	45°C	
	Feed water pressure:	2.5 kg/cm²	

13-18-3 設備仕様

Table 13-18-2 Specification

Item	Name of equipment	Stage I		Stage II	
		Quantity	Specifications	Quantity	Specifications
(1) Water recirculation facilities for coke oven and by-product plant					
1) Quenching tower	Sedimentation basin	1 unit	680 m^3/unit	1 unit	Same as at left
	Feed water pit	1 unit	70 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
2) Coke oven dust collecting system	Thickener	1 unit	420 m^3/unit		
	Feed water pit	1 unit	60 m^3/unit		
	Pumps, etc.	1 set			
3) Coke by-product machinery cooling system	Return water pit	1 unit	20 m^3/unit	1 unit	Same as at left
	Cooling tower	1 unit	4 m x 4 m x 3 m/unit	1 unit	Same as at left
	Feed water pit	1 unit	50 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
(2) Water recirculating facilities for blast furnace					
1) Cooling system for tuyers, etc.	Return water pit	1 unit	450 m^3/unit	1 unit	Same as at left
	Cooling tower	3 units	12 m x 15 m x 5 mH/unit	3 units	Same as at left
	Feed pump pit	1 unit	900 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
2) Hearth bottom cooling system	Feed water pit	1 unit	250 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
3) Dust collection system	Thickener	2 units	2,100 m^3/unit	1 unit	Same as at left
	Return water pit	1 unit	70 m^3/unit	1 unit	Same as at left
	Cooling tower	1 unit	9 m x 11 m x 6 mH/unit	1 unit	Same as at left
	2 VS Feed water pit	1 unit	210 m^3/unit	1 unit	Same as at left
	1 VS Feed water pit	1 unit	210 m^3/unit	1 unit	Same as at left
	Caustic soda dosing equipment	1 set		1 set	
	Polymer soda dosing equipment	1 set		1 set	
	Pumps, etc.	1 set		1 set	

Item	Name of equipment	Stage I		Stage II	
		Quantity	Specifications	Quantity	Specifications
4) Dry pit system	Return water pit	1 unit	20 m^3/unit	1 unit	Same as at left
	Feed water pit	1 unit	60 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
5) Pig casting machine system	Sedimentation basin	1 unit	600 m^3/unit		
	Feed water pit	1 unit	150 m^3/unit		
	Pumps, etc.	1 set			
(3) Water recirculation facilities for limestone					
1) Limestone cleaning system	Coarse particle separator	2 units	70 m^3/unit	2 units	Same as at left
	Thickener	2 units	520 m^3/unit	1 unit	Same as at left
	Feed water pit	1 unit	90 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
2) Dehydrator cleaning water, dust collector system	Thickener	1 unit	580 m^3/unit	1 unit	Same as at left
	Feed water pit	1 unit	110 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
3) Machinery cooling system	Cooling tower	1 unit	2 m x 3 m x 3 mH/unit	1 unit	Same as at left
	Feed pump pit	1 unit	20 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
(4) Water recirculation facilities for BOF plant					
1) OG cooling system	Cooling tower	1 unit	12 m x 15 m x 9 mH/unit	1 unit	Same as at left
	Feed water pit	1 unit	500 m^3/unit	1 unit	Same as at left
	Anti-corrosive dosing equipment	1 set		1 set	
	Soft water making equipment	1 set		1 set	
	Pumps, etc.	1 set		1 set	
2) Dust collection system	Dust separator	2 units	20 m^3/unit	2 units	Same as at left
	Thickener	2 units	800 m^3/unit	2 units	Same as at left
	Return water pit	1 unit	70 m^3/unit	1 unit	Same as at left
	Cooling tower	1 unit	8.5 m x 9 m x 7 mH/unit	1 unit	Same as at left
	Feed water pit	1 unit	200 m^3/unit	1 unit	Same as at left
	Plymer dosing equipment	1 set		1 set	

Item	Name of equipment	Stage I		Stage II	
		Quantity	Specifications	Quantity	Specifications
	Caustic soda dosing equipment	1 set		1 set	
	Sulfuric acid dosing equipment	1 set		1 set	
	Pumps, etc.	1 set		1 set	
(5) Water recirculation facilities for continuous casting plant					
1) Mould, machine system	Cooling tower	2 units	11 m x 15 m x 6 mH/unit	2 units	Same as at left
	Feed water pit	1 unit	1,000 m^3/unit	1 unit	Same as at left
	Elevated tank	1 unit	210 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
2) Spray system	Sedimentation basin	2 units	600 m^3/unit	2 units	Same as at left
	Filter	5 units	4.5 mφ x 5 mH/unit	5 units	Same as at left
	Cooling tower	2 units	10 m x 12 m x 6 mH/unit	2 units	Same as at left
	Feed water pit	1 unit	600 m^3/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
3) Scarfer dust collection system	Return water pit	1 unit	15 m^3/unit	1 unit	Same as at left
	Thickener	1 unit	300 m^3/unit	1 unit	Same as at left
	Coagulation dosing equipment	1 set		1 set	
	Pumps, etc.	1 set		1 set	
4) Scarfer recirculating system	Cooling tower	1 unit	4 m x 8 m x 8 mH/unit	1 unit	
	Pumps, etc.	1 set		1 set	
(6) Water recirculation faciliteis for hot strip mill					
1) Reheating furnace cooling system	Return water pit	1 unit	190 m^3/unit	1 unit	70 m^3/unit
	Cooling tower	1 unit	12 m x 15 m x 8 mH/unit	1 unit	Same as at left
	Feed water pit	1 unit	370 m^3/unit	1 unit	190 m^3/unit
	Elevated tank	1 unit	560 m^3/unit		
	Pumps, etc.	1 set		1 set	
2) Indirect cooling system	Return water pit	1 unit	190 m^3/unit	1 unit	100 m^3/unit
	Cooling tower	2 units	10 m x 15 m x 5 mH/unit	1 unit	Same as at left
	Feed water pit	1 unit	380 m^3/unit	1 unit	200 m^3/unit
	Pumps, etc.	1 set		1 set	

Item	Name of equipment	Stage I		Stage II	
		Quantity	Specifications	Quantity	Specifications
3) Direct cooling system	Roughing sedimentation basin	2 units	1,100 m^3/unit	1 unit	Same as at left
	Finishing sedimentation basin	2 units	1,700 m^3/unit		
	Filter	8 units	5 $m\phi$ x 5 mH/unit		
	Cooling tower	3 units	12 m x 15 m x 5.5 mH	1 unit	Same as at left
	Feed water pit	1 unit	1,700 m^3/unit	1 unit	300 m^3/unit
	Pumps, etc.	1 set		1 set	
4) Runout table cooling system	Cooling tower	2 units	11 m x 15 m x 5 mH/unit	1 unit	Same as at left
	Pumps, etc.	1 set		1 set	
(7) Water recirculation facilities for billet mill and medium section mill					
1) Reheating furnace system	Return water pit	1 unit	60 m^3/unit	1 unit	210 m^3/unit
	Cooling tower	1 unit	7 m x 10 m x 6 mH/unit	4 units	Same as at left
	Feed water pit	1 unit	120 m^3/unit	1 unit	420 m^3/unit
	Elevated tank	1 unit	60 m^3/unit	1 unit	140 m^3/unit
	Pumps, etc.	1 set		1 set	
2) Direct cooling system	Sedimentation basin	1 unit	320 m^3/unit	2 units	Same as at left
	Filter	2 units	3 $m\phi$ x 4.5 mH/unit	3 units	Same as at left
	Cooling tower	1 unit	5 m x 7 m x 6 mH/unit	3 units	Same as at left
	Feed water pit	1 unit	70 m^3/unit	1 unit	250 m^3/unit
	Pumps, etc.	1 set		1 set	