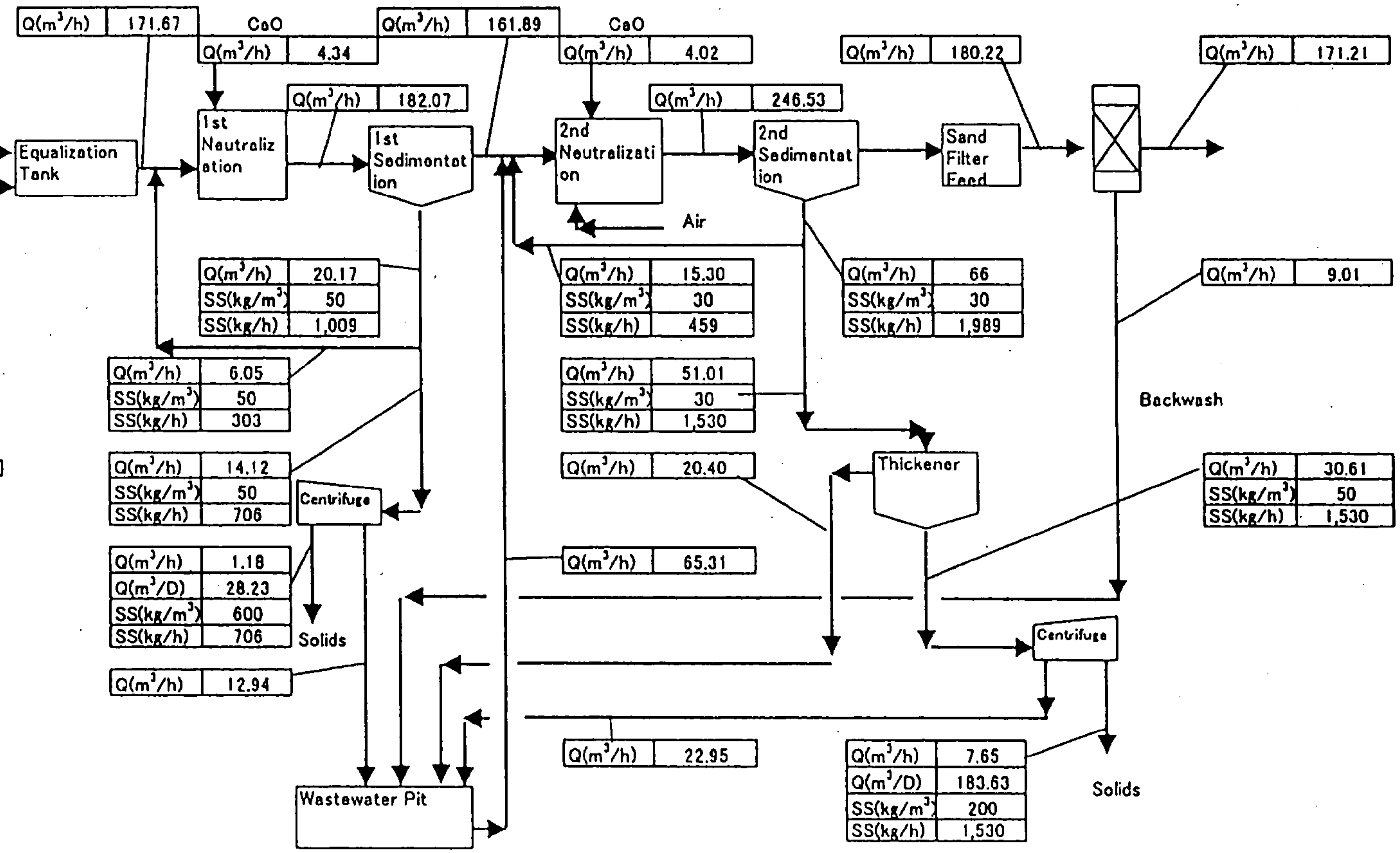
Case 1 Base Case

Acid Wash Water		
	for Solids	Hydraulics
Q(m^3/h)	150	170
H_2SO_4(kg/m^3)	2.5	
$FeSO_4$(kg/m^3)	3.5	

Waste Acid	
Q(m^3/h)	1.67
H_2SO_4(kg/m^3)	120
$FeSO_4$(kg/m^3)	180

H_2SO_4 loading (kg/h)	575
$FeSO_4$ loading (kg/h)	825



Solids Production Unit
1st stage gypsum
[H_2SO_4 loading] * 1.755 − [2.0 kg/m^3 * Q m^3/h]
2nd stage $Fe(OH)_3$
[$FeSO_4$ loading] * 0.704
2nd stage gypsum
[$FeSO_4$ loading] * 1.133
2nd stage others
[0.1 kg/m^3 * Q m^3/h]

Lime Requirement as CaO
1st stage
[H_2SO_4 loading] * 0.572
2nd stage
[$FeSO_4$ loading] * 0.369

Solids Production

1st stage gypsum 706 kg/h

2nd stage $Fe(OH)_3$
580 kg/h
2nd stage gypsum
935 kg/h
2nd stage others
15 kg/h

2nd stage total 1,530 kg/h

1st + 2nd total 2,236 kg/h 53,666 kg/D

Lime Requirement as CaO

1st stage 329 kg/h

2nd stage 305 kg/h

Lime Solution: 10% as $Ca(OH)_2$ = 7.57% as CaO

1st + 2nd total 633 kg/h 15201 kg/D

3,690 kg/1000m^3-wastewater

Molecular weight	
H_2SO_4	98.1
$CaSO_4 \cdot 2H_2O$	172.2
$FeSO_4$	151.9
$Fe_2(SO_4)_3$	399.9
$Fe(OH)_3$	106.9
CaO	56.1
$Ca(OH)_2$	74.1

CHEMICAL REACTION and WATER BALANCE

1st stage Gypsum Poduction

$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

2nd stage Iron Oxidation and Gypsum Production

$FeSO_4 + 5H_2O + 1/2O_2 \rightarrow Fe(OH)_3 \downarrow + H_2SO_4$

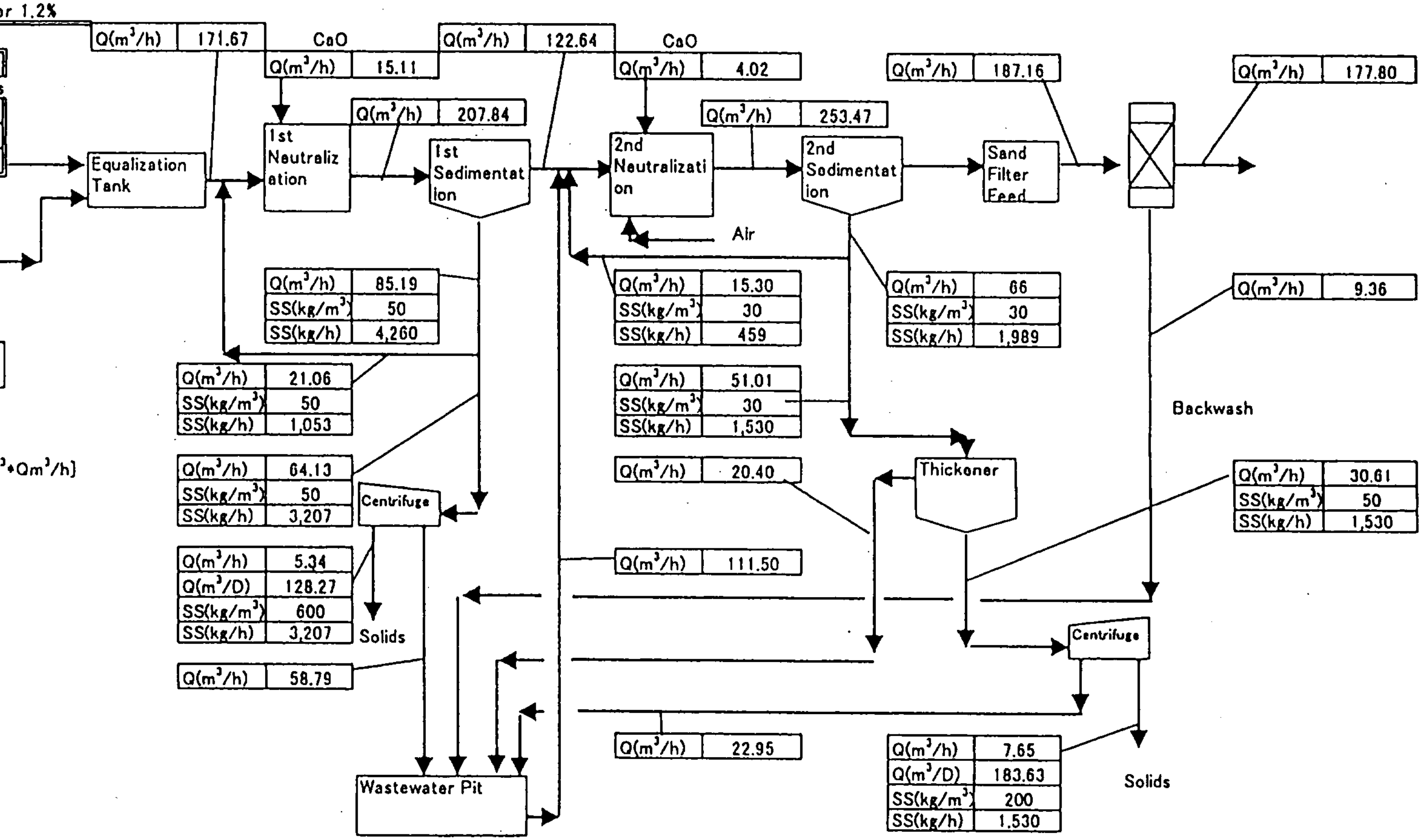
$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

Case 2 H_2SO_4 in Waswater 1.2%

Acid Wash Water	for Solids	Hydraulics
Q(m^3/h)	150	170
H_2SO_4(kg/m^3)	12	
$FeSO_4$(kg/m^3)	3.5	

Waste Acid	
Q(m^3/h)	1.67
H_2SO_4(kg/m^3)	120
$FeSO_4$(kg/m^3)	180

H_2SO_4 loading (kg/h)	2000
$FeSO_4$ loading (kg/h)	825



Solids Production Unit
1st stage gypsum
[H_2SO_4 loading] * 1.755 − [2.0 kg/m^3*Qm^3/h]
2nd stage $Fe(OH)_3$
[$FeSO_4$ loading] * 0.704
2nd stage gypsum
[$FeSO_4$ loading] * 1.133
2nd stage others
[0.1 kg/m^3 * Q m^3/h]

Lime Requirement as CaO
1st stage
[H_2SO_4 loading] * 0.572
2nd stage
[$FeSO_4$ loading] * 0.369

Solids Production

1st stage gypsum
3,207 kg/h

2nd stage $Fe(OH)_3$
580 kg/h

2nd stage gypsum
935 kg/h

2nd stage others
15 kg/h

2nd stage total
1,530 kg/h

1st + 2nd total
4,737 kg/h
113,687 kg/D

Lime Requirement as CaO

1st stage
1,144 kg/h

Lime Solution:
10% as $Ca(OH)_2$
= 7.57% as CaO

2nd stage
305 kg/h

1st + 2nd total
1,448 kg/h
34756.6 kg/D
8,436 kg/1000m^3-wastewater

Molecular weight	
H_2SO_4	98.1
$CaSO_4 \cdot 2H_2O$	172.2
$FeSO_4$	151.9
$Fe_2(SO_4)_3$	399.9
$Fe(OH)_3$	106.9
CaO	56.1
$Ca(OH)_2$	74.1

CHEMICAL REACTION and WATER BALANCE

1st stage Gypsum Poduction

$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

2nd stage Iron Oxidation and Gypsum Production

$FeSO_4 + 5H_2O + 1/2O_2 \rightarrow Fe(OH)_3 \downarrow + H_2SO_4$

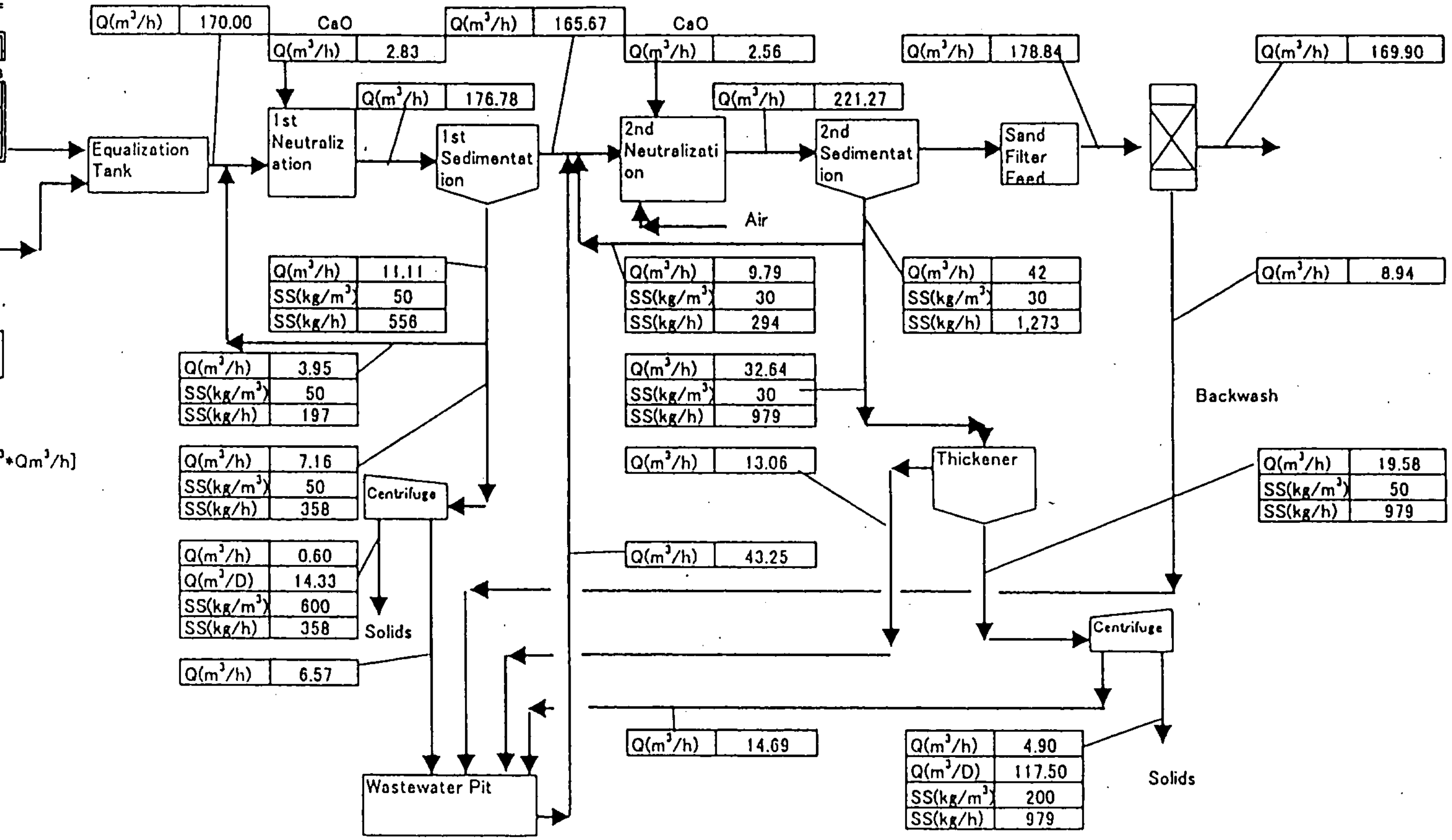
$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

Caso 3 Wash Water Only

Acid Wash Water	for Solids	Hydraulics
$Q(m^3/h)$	150	170
$H_2SO_4(kg/m^3)$	2.5	
$FeSO_4(kg/m^3)$	3.5	

Waste Acid	
$Q(m^3/h)$	0.00
$H_2SO_4(kg/m^3)$	120
$FeSO_4(kg/m^3)$	180

H_2SO_4 loading (kg/h)	375
$FeSO_4$ loading (kg/h)	525



Solids Production Unit
1st stage gypsum
[H_2SO_4 loading] * 1.755 - [2.0 kg/m³*Qm³/h]
2nd stage $Fe(OH)_3$
[$FeSO_4$ loading] * 0.704
2nd stage gypsum
[$FeSO_4$ loading] * 1.133
2nd stage others
[0.1 kg/m³ * Q m³/h]

Lime Requirement as CaO
1st stage
[H_2SO_4 loading] * 0.572
2nd stage
[$FeSO_4$ loading] * 0.369

Solids Production

1st stage gypsum 358 kg/h

2nd stage $Fe(OH)_3$ 369 kg/h
2nd stage gypsum 595 kg/h
2nd stage others 15 kg/h

2nd stage total 979 kg/h

1st + 2nd total 1,337 kg/h 32,095 kg/D

Lime Requirement as CaO

1st stage 214 kg/h

Lime Solution: 10% as $Ca(OH)_2$ = 7.57% as CaO

2nd stage 194 kg/h

1st + 2nd total 408 kg/h 9790.12 kg/D

2,402 kg/1000m³-wastewater

Molecular weight	
H_2SO_4	98.1
$CaSO_4 \cdot 2H_2O$	172.2
$FeSO_4$	151.9
$Fe_2(SO_4)_3$	399.9
$Fe(OH)_3$	106.9
CaO	56.1
$Ca(OH)_2$	74.1

CHEMICAL REACTION and WATER BALANCE

1st stage Gypsum Poduction

$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

2nd stage Iron Oxidation and Gypsum Production

$FeSO_4 + 5H_2O + 1/2O_2 \rightarrow Fe(OH)_3 \downarrow + H_2SO_4$

$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

Client: JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Project Name: THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT

Factory Name: EGYPTIAN IRON AND STEEL CO.

BASIC DESIGN
(ORIGINAL)

Document Title:

CALCULATION SHEET FOR W.W.T. DEMONSTRATION PLANT

Issued Date September 2000

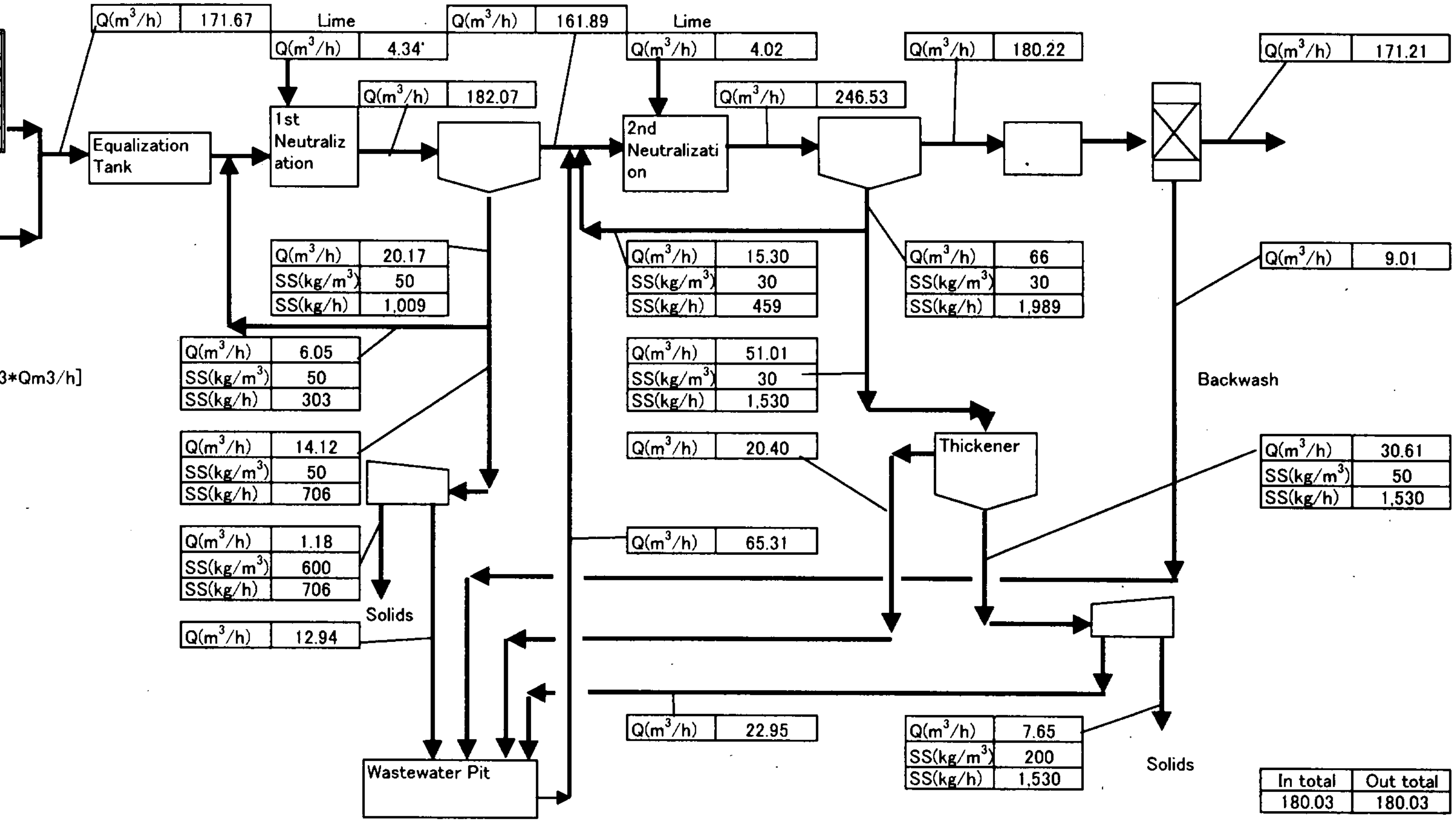
Consultant: JICA STUDY TEAM

CHIYODA DAMES AND MOORE CO.

CHIYODA CORPORATION

Acid Wash	for Solids	Hydraulics
Q(m3/h)	150	170
H2SO4(kg/m3)	2.5	
FeSO4(kg/m3)	3.5	

Waste Acid	
Q(m3/h)	1.67
H2SO4(kg/m3)	120
FeSO4(kg/m3)	180



Solids Production Unit
1st stage gypsum
[H2SO4 loading] * 1.755 - [2.0 kg/m3*Qm3/h]
2nd stage Fe(OH)3
[FeSO4 loading] * 0.704
2nd stage gypsum
[FeSO4 loading] * 1.133
2nd stage others
[0.1 kg/m3 * Q m3/h]

Lime Requirement
1st stage
[H_2SO_4 loading] * 0.572
2nd stage
[$FeSO_4$ loading] * 0.369

Solids Production

1st stage gypsum
706 kg/h

2nd stage $Fe(OH)_3$
580 kg/h
2nd stage gypsum
935 kg/h
2nd stage others
15 kg/h

2nd stage total
1,530 kg/h

1st + 2nd total
2,236 kg/h
53,666 kg/D

Molecular weight	
H2SO4	98.1
CaSO4·2H2O	172.2
FeSO4	151.9
Fe2(SO4)3	399.9
Fe(OH)3	106.9
CaO	56.1
Ca(OH)2	74.1

Lime Requirement as CaO

1st stage lime
329 kg/h

2nd stage lime
305 kg/h

Lime Solution:
10% as $Ca(OH)_2$
= 7.57% as CaO

1st + 2nd total
633 kg/h
15201 kg/D

CHEMICAL REACTION and WATER BALANCE

Dec. 15. 1999
H. Toyohara

1st stage Gypsum Poduction
$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

2nd stage Iron Oxidation and Gypsum Production

$FeSO_4 + 5H_2O + 1/2O_2 \rightarrow Fe(OH)_3 \downarrow + H_2SO_4$
$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

Sludge Production and Water Balance

For Solids calculation, 150 m3/h flow rate is applied.

1. Design Basis

Inlet wastewater				
Q	m3/h	150		
	m3/D	3600		
H2SO4	%	0.25	estimated	
FeSO4	%	0.35		

EISC said on Dec. 07		
H2SO4	1.2	%
FeSO4	2.3	%
EISC said on Nov. 18		
H2SO4	1.2	%
FeSO4	1.5	%
TIMS Analysis Nov. 17		
H2SO4	0.24	%
FeSO4	0.2	%

Waste Acid		
Q	m3/d	40
H2SO4	%	12
FeSO4	%	18

EISC said on Nov. 18,Dec. 07		
H2SO4	10-12	%
FeSO4	16-18	%

MW	
H2SO4	98.1
CaSO4·2H2O	172.2
FeSO4	151.9
Fe2(SO4)3	399.9
Fe(OH)3	106.9
CaO	56.1
Ca(OH)2	74.1

TIMS Analysis Nov. 17		
H2SO4	17	%
FeSO4	16	%

WWT Inlet				
Q	m3/h	151.67		
H2SO4	%	0.379	kg/m3	3.791209
FeSO4	%	0.544	kg/m3	5.43956

2. Sludge Production

1st Stage Gypsum Production

$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow$

			(Wash)	(Acid)
H2SO4 to be treated	kg/h	575	375	200
	kg/D	13,800	9000	4800
CaSO4·2H2O	kg/h	**1,009**	<- Total Production (Solids + Dissolved	
	kg/D	24,225		
Concentration in WW	kg/m3	6.66		
Saturated concentration	kg/m3	2.00	<- To be discharged in wastewater	
Gypsum to be sedimented	kg/m3	4.66		
	kg/h	**706**	<- To be dehydrated in Centrifuge	
	kg/D	16,759		

2nd stage Sludge

FeSO4 (Wash) (Acid)

$FeSO_4 + 5H_2O + 1/2O_2 \rightarrow Fe(OH)_3 \downarrow + H_2SO_4$

$Fe(OH)_3 + H_2SO_4 + Ca(OH)_2 \rightarrow Fe(OH)_3 \downarrow + CaSO_4 \cdot 2H_2O \downarrow + H_2O$

			(Wash)	(Acid)
FeSO4 to be oxidized	kg/h	825	525	300

		19,800	12600	7200	
Fe to be treated	kg/h	303			
	kg/D	7,279			
Fe(OH)3 to be generated	kg/h	580			
	kg/D	13,929			
2nd stage gypsum					
Gypsum from FeSO4					
SO4 in FeSO4	kg/h	522			
CaSO4·2H2O	kg/h	935			
Other Solids					
	kg/h	15.17			
	kg/D	364			
	kg/m3	0.1			
1st Lime Injection					
H2SO4 to be treated	kg/h	575			
Lime amount Ca(OH)2	kg/h	434.4			0.571787
Lime amount CaO	kg/h	328.8			0.571787
Lime Milk Conc.	%	10.0	7.568622		
Lime Milk Flow Rate	m3/h	4.3			
2nd Lime Injection					
SO4 to be treated in 2nd stage	kg/h	522			0.369165
Required lime Ca(OH)2	kg/h	402			0.369165
Lime Amount CaO	kg/h	305			
Lime Milk Conc.	%	10.0			
Lime Milk Flow Rate	m3/h	4.0			
Total lime consumption					
CaO	kg/h	633.3			
	kg/D	**15,200**			
Ca(OH)2	kg/h	836.8			
	kg/D	20,083			
Lime Milk Flow rate Total	m3/h	8.4			

	kg/h	kg/D		
1st stage Gypsum production	**706**	**16,945**		
2nd stage Gypsum production	935.05	22,441		61.1
2nd stage Fe(OH)3	580.39	13,929		37.9
2nd stage others	15.17	364	@as 100 ppm	1.0
2nd stage total	**1,531**	**36,735**		100.0
TOTAL solids	2,236.67	53,680		

1st Dehydrator			
Solids to be treated	kg/h	706	for Balance Calc.
Operation	h/D	12	
No. of Equipment in operation		1	
Concentration to be fed	%	5	
Capacity	m3/h	28.24	for Equipment Calc.
2nd Dehydrator			

Solids to be treated	kg/h	1,531
Operation	h/D	24
No. of Equipment in operation		1
Concentration to be fed	%	5
Capacity	m3/h	30.61

Water Balance (Case 3: 2 stage lime injection)

No.		Solids kg/m3	Solids kg/h	Flow m3/h	H2SO4 kg/m3	FeSO4 kg/m3	
1	Washwater			170	2.5	3.5	
2	Waste Acid			1.67	120	180	
3	Wastewater			171.67	3.79	5.44	
	Backflow from WWT			65.32			
3	WWT In			171.67			
	Recycle from 1st Clarifier			6.06			
	Neutralization in			177.72			
	Lime in 1			4.34			
4	1st Settling Tank In			182.07			
	1st Settling Tank Overflow			161.89			
	1st Settling Tank Bottom	50	1,009	20.18			
	To Recycle	50	303	6.06			30 % of gypsum generated from H2SO4 is recycled.
	To 1st Centrifuge	50	706	14.12			24 hours operation Basis. 3 times flow rate for mech. Design
9	1st Centrifuge Sludge	600	706	1.18			
	1st Centrifuge Supernatant		(3.9)	12.94			
	Lime in 2			4.02			
	Recycle from 2nd Clarifier			15.31			
5	2nd Clarifier In			246.54			
6	2nd Clarifier Overflow			180.22			
	2nd Clarifier Bottom	30	1,990	66.33			
	To recycle	30	459	15.31			30 % of generated gypsum is recycled.
	To Thickener	30	1,531	51.02			
	Thickener Bottom/To Centrifuge	50	1,531	30.61			
	Thickener supernatant			20.41			
8	2nd Centrifuge sludge	200	1,531	7.65			
	2nd Centrifuge supernatant		(6.9)	22.96			
	Sand Filter In			180.22			
7	Sand Filter Out			171.20			
	Sand Filter Backwash			9.01			

Concrete Basisn

		Z-01 Gypsum Pit	Z-02 Clarified Water Pi
Flow rate (Normal)	m3/h	14.12	161.89
HRT	h	4	0.5
Density	kg/m3	1055	1055
Capacity	m3	56.48498458	80.94468846
Diameter	m		
Length	m	5.0	5.0
Width	m	6.5	6.5
Height	m	2.2	3.1
Operating Level	m	1.7	2.5
Volume	m3	72	101
Fluid Volume	m3	56	81
Fluid Velocity	m/h	1.7	2.5
D／OL	—		
Number of Vessels	—	1	1
1m3当りの重量(RC)	kg/m3	2,200	2,200
1m3当りの重量(Rubber	kg/m3	(1,000)	(1,000)
厚さ(RC)	mm	200	200
厚さ(Coat)	mm	4	4
安全係数	—	1.05	1.05
空時(1槽当り)	ton	38.7	48.4
運転時(1槽当り)	ton	98.3	133.8
厚さ	mm	—	—
面積	m2	—	—
1槽当りの表面積 ・密閉式；屋根+側面+底 ・開放式；側面+底	m2	83	104

Z-3 Treated Water Pit	Z-4 Wastewater Pit	Z-5 Sludge Pit
180.22	65.32	30.61
0.5	2	2
1055	1055	1055
90.10779396	130.6450272	61.22437
6.5	12.0	5.0
6.5	6.5	6.5
2.6	2.2	2.4
2.1	1.7	1.9
110	172	78
90	131	61
2.1	1.7	1.9
1	1	1
2,200	2,200	2,200
(1,000)	(1,000)	(1,000)
200	200	200
4	4	4
1.05	1.05	1.05
51.2	74.3	40.9
146.3	212.1	105.5
—	—	—
—	—	—
110	159	88

****ポンプ設計書****																
● 顧客名	JICA / Egyptian Iron and Steel Co.															
● プロジェクト名	Industrial Pollution Contr															
● Job No.																
● 設計日	1999/11/5															
● 設計者	H. Toyohara															
No.			1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Tag No.			PU-01 A/B	PU-02 A/B	PU-03 A/B	PU-04 A/B	PU-05 A/B	PU-06 A/B	PU-07 A/B	PU-08 A/B	PU-09 A/B	PU-10 A/B	PU-11 A/B	PU-12 A/B	PU-13 A/B	PU14 A/B
2 機器名			Wastewater Pump	No. 1 Sludge Pump	Gypsum Sludge Pump	Lime Pump	Coagulant Pump	Polymer A Pump	No. 2 Sludge Pump	No. 3 Sludge Pump	Filter Feed Pump	Backwash Pump	Wastewater return Pump	Treated Water Pump	Sludge Pump	Polymer B Pump
3 用途			RW Feed													
4 型式			Centrifugal	Centrifugal	Centrifugal	Centrifugal	Diaphragm	Diaphragm	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	MOHNO	Diaphragm
5 設計条件	流体 *1)	–	WA	TWW	TWW	TWW	NaHS	NaHS	NWW		GS	GS	GS	GS	NWW	Fe2(SO4)3
	Q;処理量	m3/h	171.7	20.18	28.2	16.7	0.46	0.46	66.3	30.6	180.2	550.0	65.3	171.2	30.6	0.08
	処理量	kg/h	171,666.7	21,186.5	29,654.6	17,656.4	462.9	462.9	69,642.7	32,142.8	180,215.6	550,000.0	65,322.5	171,204.8	30,612.2	152.8
	濃度	%					22	22		50						50
	スラリー濃度	wt%		5	5											
	密度	kg/m3	(1,000)	(1,050)	(1,050)	(1,055)	(1,000)	(1,000)	(1,050)	(1,050)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(2,000)
	粘度	cP	(1.0)	(1.5)	(1.5)	(4.0)	–	–	(1.0)	–	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	–
	pH	–	(1)	(7)	(2)	(2)	–	–	–	–	(2)	(2)	(2)	(2)	–	–
	運転温度	℃	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.
	吸入圧力	m	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	0.0
	吐出圧力	m	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	50.0	15.0	15.0
	材質	–	SUS304	SUS304	SUS304	SUS304	SUS304	SUS304	CS	CS	CS	CS	CS	CS	CS	SUS304
6 機器設計	所要水動力	KW	4.66	0.58	0.81	0.48	0.013	0.013	1.89	0.873	4.90	14.94	1.77	4.65	0.83	0.004
	ポンプ効率	%	50	50	50	50	50	50	50	50	50	30	50	30	50	50
	所要軸動力	KW	9.3	1.2	1.6	1.0	0.03	0.03	3.8	1.75	9.8	49.8	3.5	15.5	1.7	0.01
	吸込配管圧力損失	m														
	吐出配管圧力損失	m														
	合計配管圧力損失	m														
	吸込実揚程	m														
	吐出実揚程	m														
	H;必要な実揚程	m	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	NPSH	m														
7 機器仕様	台数	–	2	2	2	2	2	2	2	2	2	2	2	2	2	2
(メーカー仕様)	型式	–	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Diaphragm	Diaphragm	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	MOHNO	Diaphragm
	流量(Q×1.2)	m3/h	206	24	34	20	0.6	0.6	80	36.7	216	660	78	205	37	0.1
	ヘッド(H×1.5)	m	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	流体	–	WA	TWW	TWW	TWW	NaHS	NaHS	NWW	0.0	GS	GS	GS	GS	NWW	Fe2(SO4)3
	使用温度	℃	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.
	スラリー濃度	wt%	0	5	5	0	0	0	0	0	0	0	0	0	0	0
	密度	kg/m3	(1,000)	(1,050)	(1,050)	(1,055)	(1,000)	(1,000)	(1,050)	(1,050)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(2,000)
	粘度	cP	(1.0)	(1.5)	(1.5)	(4.0)	–	–	(1.0)	–	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	–
	pH	–	1	7	2	2	–	–	–	–	2	2	2	2	–	–
	材質	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	重量	kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	• 必要な軸動力	KW	(16.8)	(2.1)	(2.9)	(1.7)	(0.05)	(0.05)	(6.8)	(3.14)	(17.6)	(89.7)	(6.4)	(27.9)	(3.0)	(0.01)
	• 必要なモーター動力	KW	(22.0)	(3.0)	(3.7)	(2.2)	(0.1)	(0.1)	(11.0)	(5.5)	(22.0)	(110.0)	(11.0)	(33.0)	(5.5)	(0.1)
	軸動力(メーカー仕様)	KW	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	モーター(メーカー仕様)	KW	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Pole	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Volt	415	415	415	415	415	415	415	415	415	415	415	415	415	415
		Hz	50	50	50	50	50	50	50	50	50	50	50	50	50	50

*1)
- 廃酸→W.A.(Waste Acid)
- 石膏スラリー→G.S.(Gypsum Slurry)
- 処理廃水→T.W.W.(Treated Waste Water)
- 中性廃水→N.W.W.(Neutral Waste Water)
- 金属水酸化物+石膏スラリー→HY.+GYP.(HYDROXIDE+GYPSUM)
- 金属硫化物スラリー→S.S.(Sulfide Slurry)
- 消石灰スラリー→L.M.(Lime Milk)
- 硫酸鉄→Fe2(SO4)3
- 水硫化ソーダ→NaHS
- 硫酸→H2SO4
- 高分子凝集剤水溶液→Floc.+H2O(Flocculant+H2O)

＊＊＊＊ポンプ設計書＊＊＊＊

●顧客名	JICA / Egyptian Iron and St
●プロジェクト名	Industrial Pollution Contrc
●Job No.	
●設計日	1999/11/5
●設計者	H. Toyohara

No.			16	17	18	19	20	21	22	合計
1 Tag No.			PU-202A/B	PU-301A/B	PU-302A/B	PU-303A/B	PU-304A/B	PU-305A/B	PU-403A/B/C	
2 機器名			Lime Milk Feed Pump	Fe2(SO4)3 Dosing Pump	#1 NaHS Dosing Pump	#2 NaHS Dosing Pump	#1 H2SO4 Dosing Pump	#2 H2SO4 Dosing Pump	#3 Flocculant Dosing Pump	
3 用途			消石灰スラリー供給	硫酸鉄供給	水硫化ソーダ供給	水硫化ソーダ溶液供給	硫酸供給	希硫酸供給	高分子凝集剤溶液供給	
4 型式			MOHNO	Diaphragm	Diaphragm	Diaphragm	Diaphragm	Diaphragm	Diaphragm	
5 設計条件	流体 *1)	–	L.M.	Fe2(SO4)3	NaHS	NaHS+H2O	H2SO4	H2SO4+H2O	FLOC.+H2O	
	Q;処理量	m3/h	48.6	0.08	0.46	4.63	0.0005	0.0443	0.4316	
	処理量	kg/h	51,273.0	152.8	462.9	4,628.6	0.89	44.30	431.60	
	濃度	%		50	22	10	98	2		
	スラリー濃度	wt%	10						0.1	
	密度	kg/m3	(1,055)	(2,000)	(1,000)	(1,000)	(1,840)	(1,000)	(1,000)	
	粘度	cP	(4.0)	–	–	–	(18)	–	(1)	
	pH	–	–	–	–	–	–	–	–	
	運転温度	℃	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	
	吸入圧力	m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	吐出圧力	m	30.0	10.0	10.0	10.0	10.0	10.0	10.0	
	材質	–	CS+Rubber	SUS304	SUS304	SUS304	SUS304	SUS304	SUS304	
6 機器設計	所要水動力	KW	4.18	0.004	0.013	0.126	2.4E-05	1.2E-03	1.2E-02	49.8
	ポンプ効率	%	50	50	50	50	50	50	50	
	所要軸動力	KW	8.4	0.01	0.03	0.25	0.0000	0.0024	0.0235	125.8
	吸込配管圧力損失	m								
	吐出配管圧力損失	m								
	合計配管圧力損失	m								
	吸込実揚程	m								
	吐出実揚程	m								
	H;必要な実揚程	m	30	10	10	10	10	10	10	
	NPSH	m								
7 機器仕様 (メーカー仕様)	台数	–	2	2	2	2	2	2	3	51
	型式	–	MOHNO	Diaphragm	Diaphragm	Diaphragm	Diaphragm	Diaphragm	Diaphragm	
	流量(Q×1.2)	m3/h	58	0.1	0.6	5.6	0.001	0.053	0.518	
	ヘッド(H×1.5)	m	45	15	15	15	15	15	15	
	流体	–	L.M.	Fe2(SO4)3	NaHS	NaHS+H2O	H2SO4	H2SO4+H2O	FLOC.+H2O	
	使用温度	℃	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	A.T.	
	スラリー濃度	wt%	10	0	0	0	0	0	0.1	
	密度	kg/m3	(1,055)	(2,000)	(1,000)	(1,000)	(1,840)	(1,000)	(1,000)	
	粘度	cP	(4.0)	–	–	–	(18.0)	–	(1.0)	
	pH	–	–	–	–	–	–	–	–	
	材質	–	–	–	–	–	–	–	–	
	重量	kg	–	–	–	–	–	–	–	
	•必要な軸動力	KW	(15.0)	(0.01)	(0.05)	(0.45)	(0.0001)	(0.0043)	(0.0422)	(232.9)
	•必要なモーター動力	KW	(19.0)	(0.1)	(0.1)	(1.1)	(0.1)	(0.1)	(0.1)	(304.4)
	軸動力(メーカー仕様)	KW	–	–	–	–	–	–	–	
	モーター(メーカー仕様)	KW	–	–	–	–	–	–	–	
		Pole	4	4	4	4	4	4	4	
		Volt	415	415	415	415	415	415	415	
		Hz	50	50	50	50	50	50	50	

Motor Selection	
Lad	
0.00	0.1
0.08	0.2
0.16	0.4
0.32	0.75
0.06	1.1
0.88	1.5
1.20	2.2
1.76	3.0
2.40	3.7
2.96	5.5
4.40	7.5
6.00	11.0
8.80	15.0
12.00	19.0
15.20	22.0
19.13	26.0
22.61	30.0
26.09	33.0
28.70	37.0
32.17	45.0
39.13	55.0
47.83	60.0
54.55	75.0
68.18	95.0
86.36	110.0
100.00	150.0
136.36	190.0
172.73	220.0
200.00	260.0
236.36	300.0
272.73	370.0
336.36	400.0
363.64	500.0
454.55	630.0
572.73	800.0

＊＊＊＊ポンプ設計書＊＊＊＊														
● 顧客名	JICA / Egyptian Iron and St													
● ﾌﾟﾛｼﾞｪｸﾄ名	Industrial Pollution Contrd													
● Job No.														
● 設計日	1999/11/5													
● 設計者	H. Toyohara													
No.											12	13	14	15
1 Tag No.											PU-01A/B	PU-02	PU-114A/B	PU-201A/B
2 機器名											Wastewater Pump	No.1 Sludge Pump	Process Water Feed Pump	Lime Milk Transfer Pump
3 用途											RW Feed	Gypsum Withdraw	廃水供給	消石灰ｽﾗﾘｰ供給
4 型式											Centrifugal	Centrifugal	Centrifugal	Centrifugal
5 設計条件	流体 *1)	−									T.W.W.	S.S.	T.W.W.	L.M.
	Q;処理量	m3/h									39.5	1.9	80.6	48.6
	処理量	kg/h									39,500.0	2,194.5	80,600.0	51,273.0
	濃度	%												
	ｽﾗﾘｰ濃度	wt%										20		10
	密度	kg/m3									(1,000)	(1,155)	(1,000)	(1,055)
	粘度	cP									(1.0)	(1.5)	(1.0)	(4.0)
	pH	−									(10)	(7)	(7)	−
	運転温度	℃									A.T.	A.T.	A.T.	A.T.
	吸入圧力	m									0.0	0.0	0.0	0.0
	吐出圧力	m									10.0	10.0	30.0	10.0
	材質	−									CS+Rubber	CS	CS	CS+Rubber
6 機器設計	所要水動力	KW									1.07	0.06	6.57	1.39
	ﾎﾟﾝﾌﾟ効率	%	50	50	50	50	50	50	50	50	50	50	50	50
	所要軸動力	KW									2.1	0.1	13.1	2.8
	吸込配管圧力損失	m												
	吐出配管圧力損失	m												
	合計配管圧力損失	m												
	吸込実揚程	m												
	吐出実揚程	m												
	H;必要な実揚程	m									10	10	30	10
	NPSH	m												
7 機器仕様	台数	−									2	2	2	2
(ﾒｰｶｰ仕様)	型式	−									Centrifugal	Centrifugal	Centrifugal	Centrifugal
	流量(Q×1.2)	m3/h									47	2.3	97	58
	ﾍｯﾄﾞ(H×1.5)	m									15	15	45	15
	流体	−									T.W.W.	S.S.	T.W.W.	L.M.
	使用温度	℃									A.T.	A.T.	A.T.	A.T.
	ｽﾗﾘｰ濃度	wt%									0	20	0	10
	密度	kg/m3									(1,000)	(1,155)	(1,000)	(1,055)
	粘度	cP									(1.0)	(1.5)	(1.0)	(4.0)
	pH	−									10	7	7	−
	材質	−									−	−	−	−
	重量	kg									−	−	−	−
	* 必要な軸動力	KW									(3.9)	(0.2)	(23.6)	(5.0)
	* 必要なﾓｰﾀｰ動力	KW									(5.5)	(0.4)	(30.0)	(7.5)
	軸動力(ﾒｰｶｰ仕様)	KW									−	−	−	−
	ﾓｰﾀｰ(ﾒｰｶｰ仕様)	KW									−	−	−	−
		Pole									4	4	4	4
		Volt									415	415	415	415
		Hz									50	50	50	50

Polymer B Injection

(3-5) Polymer Injection Unit for Centrifuge

Dry Sludge Amount: 1,531 kg/h

1) Dosage		0.5	% as Dry SS=	7.65	kg/h
2) Concentration		2	wt %=	20	g/L
3) Specific gravity		1			
4) Injection rate	Q_{p0}=	382.6523	L/h=	6.38	L/min
5) Req'd Vol.	V_{p0}=	9.18	m^3 (for 3days)		
6) Drum Dimension:	Hpo=	3.00	m (take)	Apo=	3.06 m^2
	Dpo=	1.97	m		

: Take: $2.5m^{ID} x 3.5m^{H}$

Polymer A Injection

(3-2) Polymer Injection Unit for 2ndary sedimentation

Flow Rate: 246.54 m3/h

1) Dosage		200	mg/L			
2) Concentration		0.1	wt %=	1	g/L	(D-09)
3) Specific gravity		1				
4) Req'd Polymer		246.54	g/h=	246.54	L/h	(PU-13)
5) Req'd Vol.	V_{p0}=	5.92	m^3 (1day)			
6) Demension	Hpo=	2.00	m (take)	Apo=	2.96 m^2	
	Dpo=	1.94	m			

: Take: $2.0m^{ID} x 2.5m^{H}$

Coagulant

(3-6) Coagulant $Al_2(SO_4)_3 \cdot 18H_2O$ Injection Unit

1) Dosing Rate:		30	mg/L, Max.	50	mg/L	
2) Concentration:		20	wt % =	222.4	g/L	
3) Specific Gravity:		1.112				
4) Injection Rate:	Q_{p0}=	33.3	L/h=	0.55	L/min	(PU-10)
5) Drum Vol. :	V_{P0}=	5.6	m^3 (for 7days)			
Height:	H_{p0}=	2.0	m (take)	A_{P0}=	2.79 m^2	
Diameter	D_{P0}=	1.9	m			

Take: $2.0m^{ID} \times 2.5m^{H}$

JAPAN INTERNATIONAL COOPERATION AGENCY

MODIFIED

BASIC DESIGN PACKAGE OF

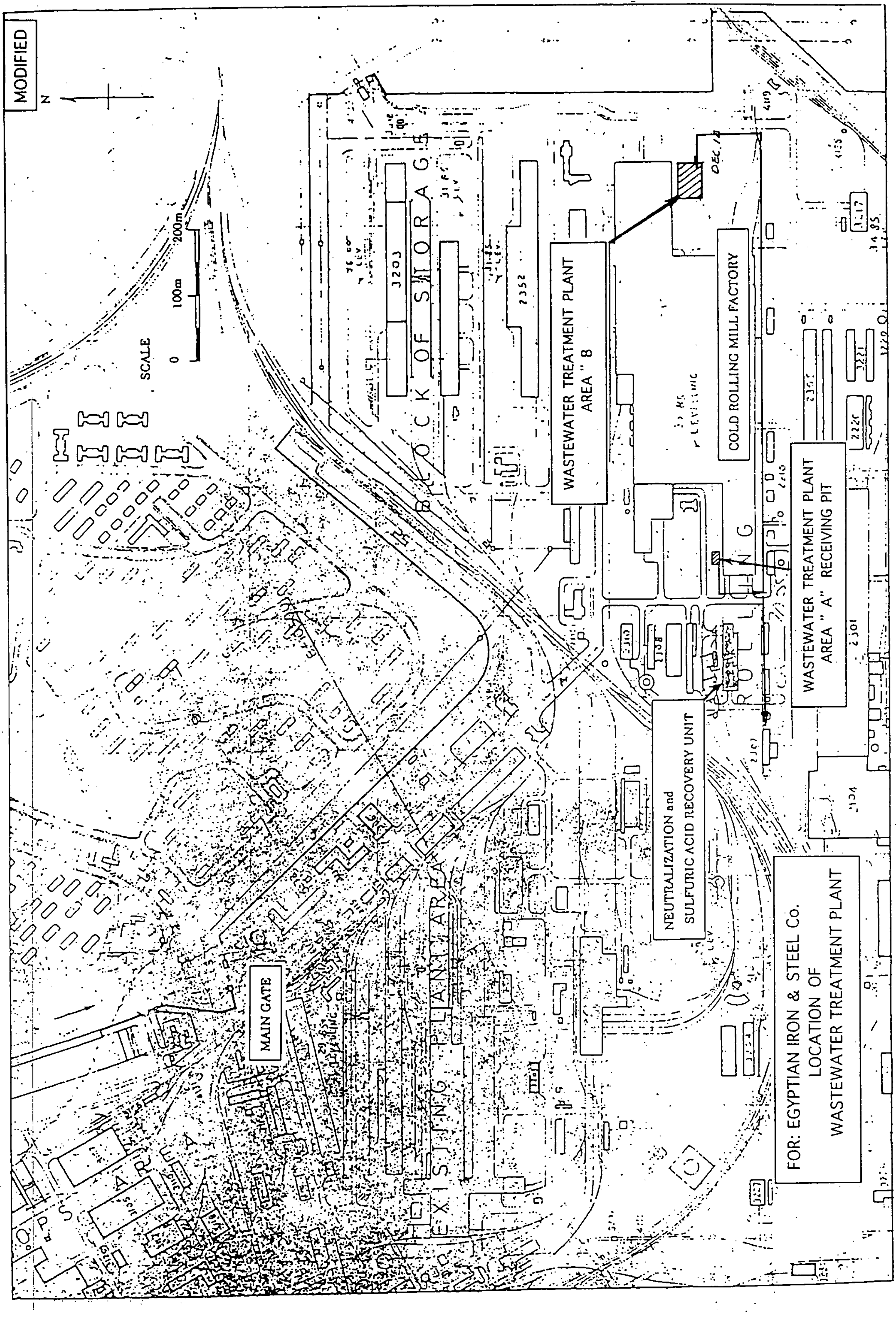
WASTEWATER TREATMENT PLANT

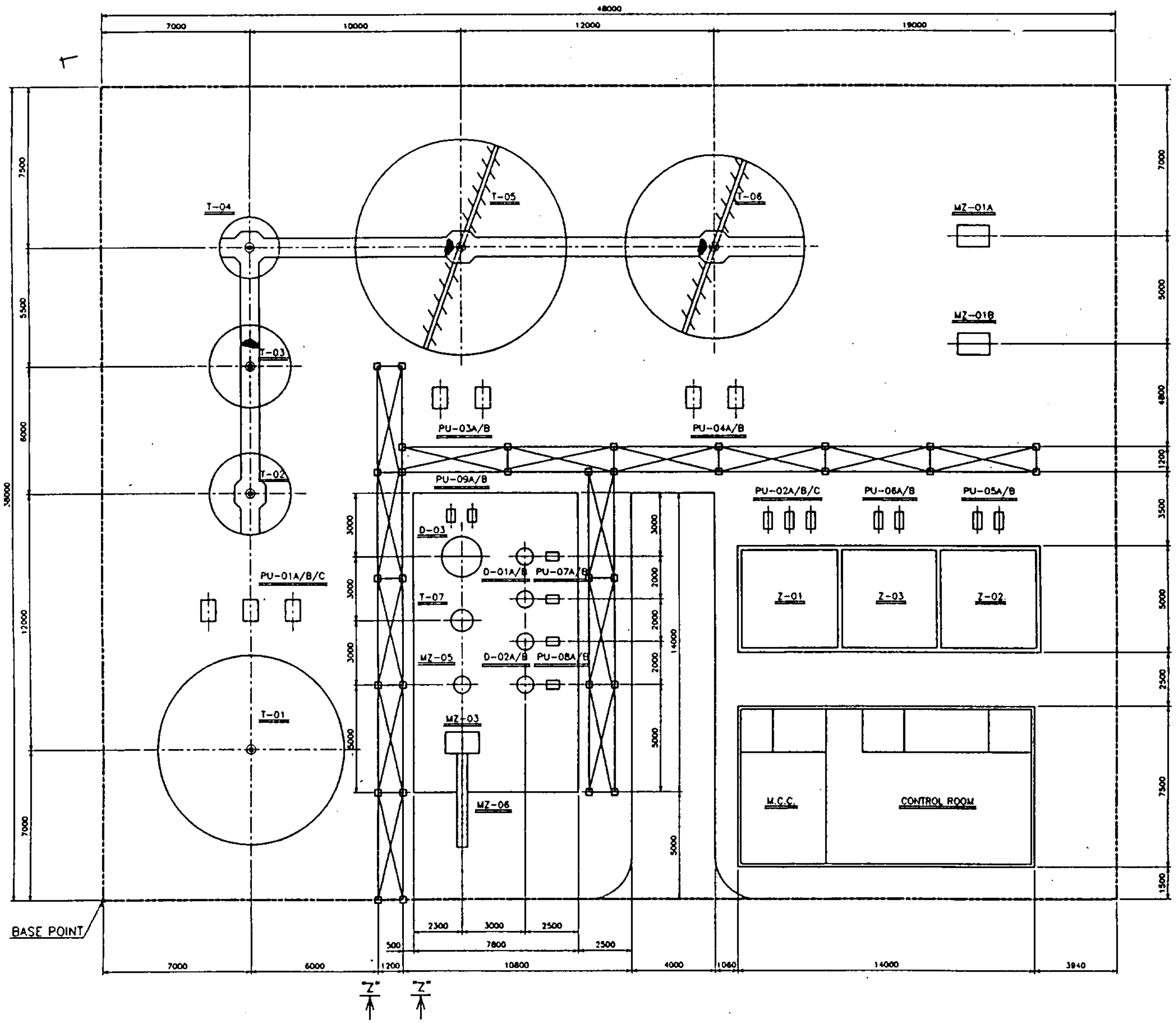
FOR

EGYPTIAN IRON AND STEEL CO.

March 2000

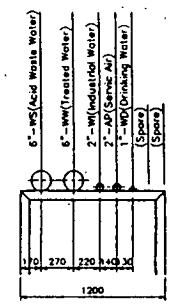
CHIYODA DAMES AND MOORE CO.
CHIYODA CORPORATION


MODIFIED
N
SCALE
0
100m
200m
BLOCK OF STORAGE
3203
2352
WASTEWATER TREATMENT PLANT
AREA " B
COLD ROLLING MILL FACTORY
WASTEWATER TREATMENT PLANT
AREA " A" RECEIVING PIT
NEUTRALIZATION and
SULFURIC ACID RECOVERY UNIT
MAIN GATE
EXISTING PLANT AREA
FOR: EGYPTIAN IRON & STEEL Co.
LOCATION OF
WASTEWATER TREATMENT PLANT



MODIFIED

Equipment NO.	Service	Equipment NO.	Service
T-01	Equalization Tank	PU-02A/B	Treated Water Pump
T-02	1st Neutralization Tank	PU-03A/B	Sludge Return Pump
T-03	2nd Neutralization Tank	PU-04A/B	Sludge Pump
	/Oxydation Tank	PU-05A/B	Thickened Sludge Pump
T-04	Flocculation Tank	PU-06A/B	Return Pump
T-05	Clarifier	PU-07A/B	Polymer A Pump
T-06	Thickener	PU-08A/B	Polymer B Pump
T-07	Tower Mill	PU-09A/B	Lime Pump
D-01A/B	Polymer A Tank	BL-01A/B	Blower
D-02A/B	Polymer B Tank		
D-03	Lime Tank	MZ-01A/B	Dehydrator
		MZ-02A/B	Sludge Hopper
Z-101	Acid Wastewater Pit	MZ-03	Crusher
Z-01	Treated Water Pond	MZ-05	Bucket Elevator
Z-02	Sludge Pit	MZ-06	Belt Conveyor
Z-03	Waste Water Pit	MZ-07	Belt Conveyor
PU-101A/B	Acid Wastewater Pump		
PU-01A/B	Waste Water Pump		



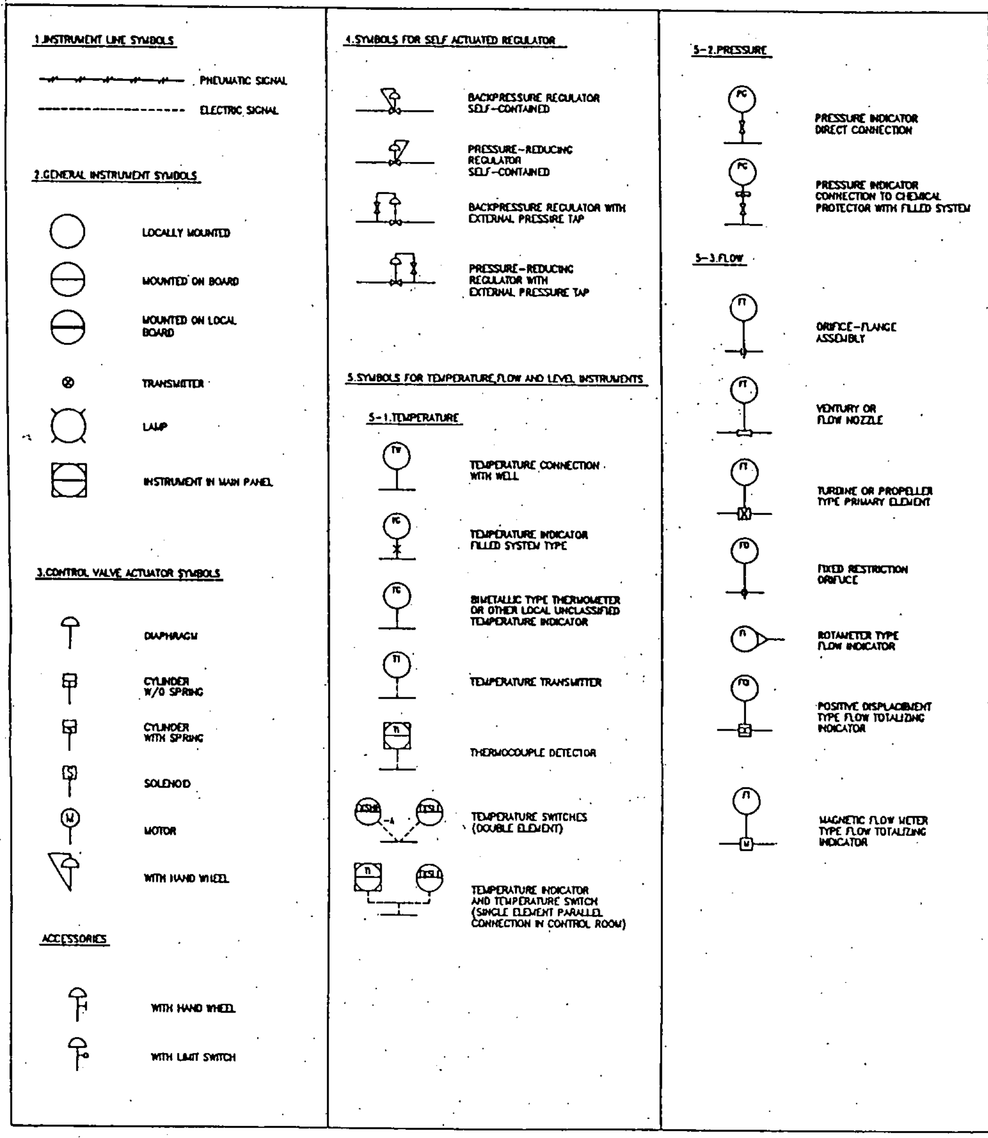
VIEW "Z"-"Z"

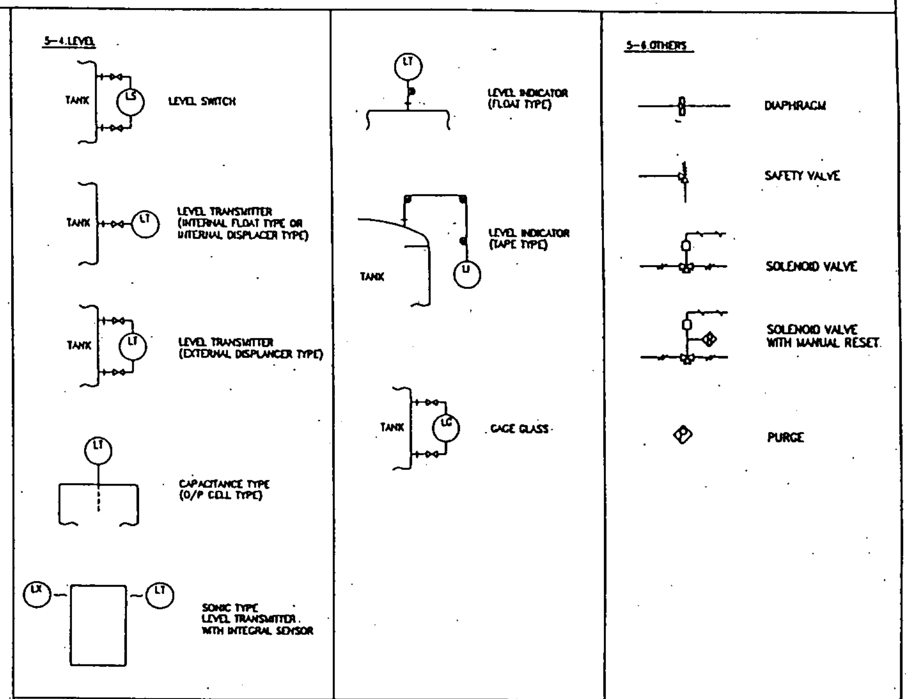
JICA	Chck	Tech	Appr						
Sign									
Date									
CHYSL	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date				REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGIPTIAN IRON AND STEEL CO. PLOT PLAN FOR WASTEWATER TREATMENT PLANT
ISSUED DATE	SCALE 1/100
DWG NO DS-80-12-01	REV. 0

MODIFIED

INSTRUMENTION SYMBOLS AND LEGEND





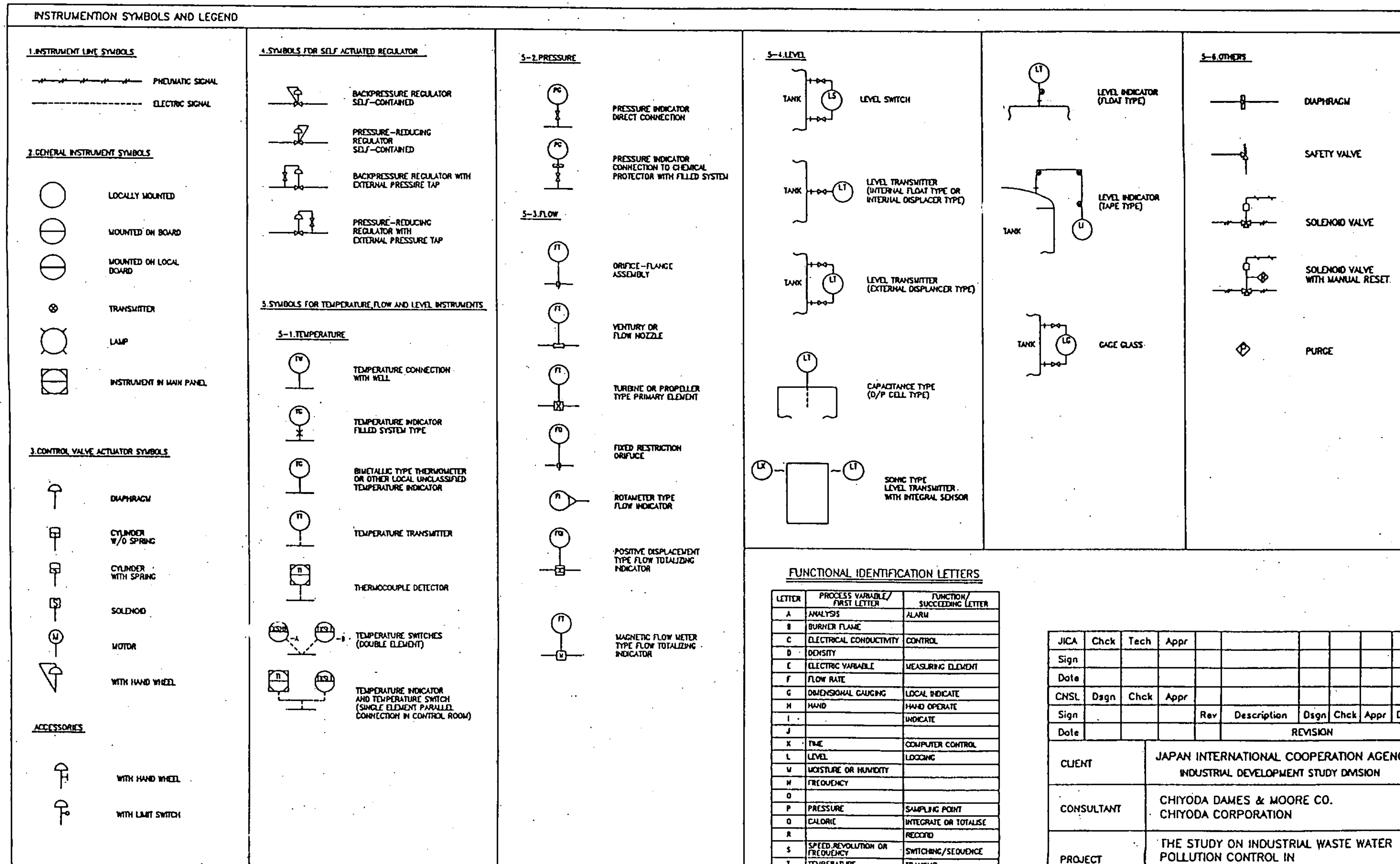
FUNCTIONAL IDENTIFICATION LETTERS

LETTER	PROCESS VARIABLE/ FIRST LETTER	FUNCTION/ SUCCEEDING LETTER
A	ANALYSIS	ALARM
B	BURNER FLAME	
C	ELECTRICAL CONDUCTIVITY	CONTROL
D	DENSITY	
E	ELECTRIC VARIABLE	MEASURING ELEMENT
F	FLOW RATE	
G	DIMENSIONAL GAUGING	LOCAL INDICATE
H	HAND	HAND OPERATE
I		INDICATE
J		
K	TIME	COMPUTER CONTROL
L	LEVEL	LOGGING
M	MOISTURE OR HUMIDITY	
N	FREQUENCY	
O		
P	PRESSURE	SAMPLING POINT
Q	CALORIE	INTEGRATE OR TOTALISE
R		RECORD
S	SPEED,REVOLUTION OR FREQUENCY	SWITCHING/SEQUENCE
T	TEMPERATURE	TRANSMIT
U	UNCLASSIFIED OR MULTIPLE VARIABLE	UNCLASSIFIED OR MULTIPLE FUNCTION
V	VIBRATION	VALVE,DAMPER OR LOUVER
W	WEIGHT OR FORCE	WELL
X	OTHER VARIABLE	OTHER FUNCTION
Y		COMPUTE OR RELAY
Z		SAFETY OR EMERGENCY

JICA	Chck	Tech	Appr					
Sign								
Date								
CNSL	Dsgn	Chck	Appr					
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date				REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR ENGINEERING FLOW DIAGRAM LEAD SHEET(2/2)
ISSUED DATE	SCALE: None
DWG NO	REV. 0

MODIFIED

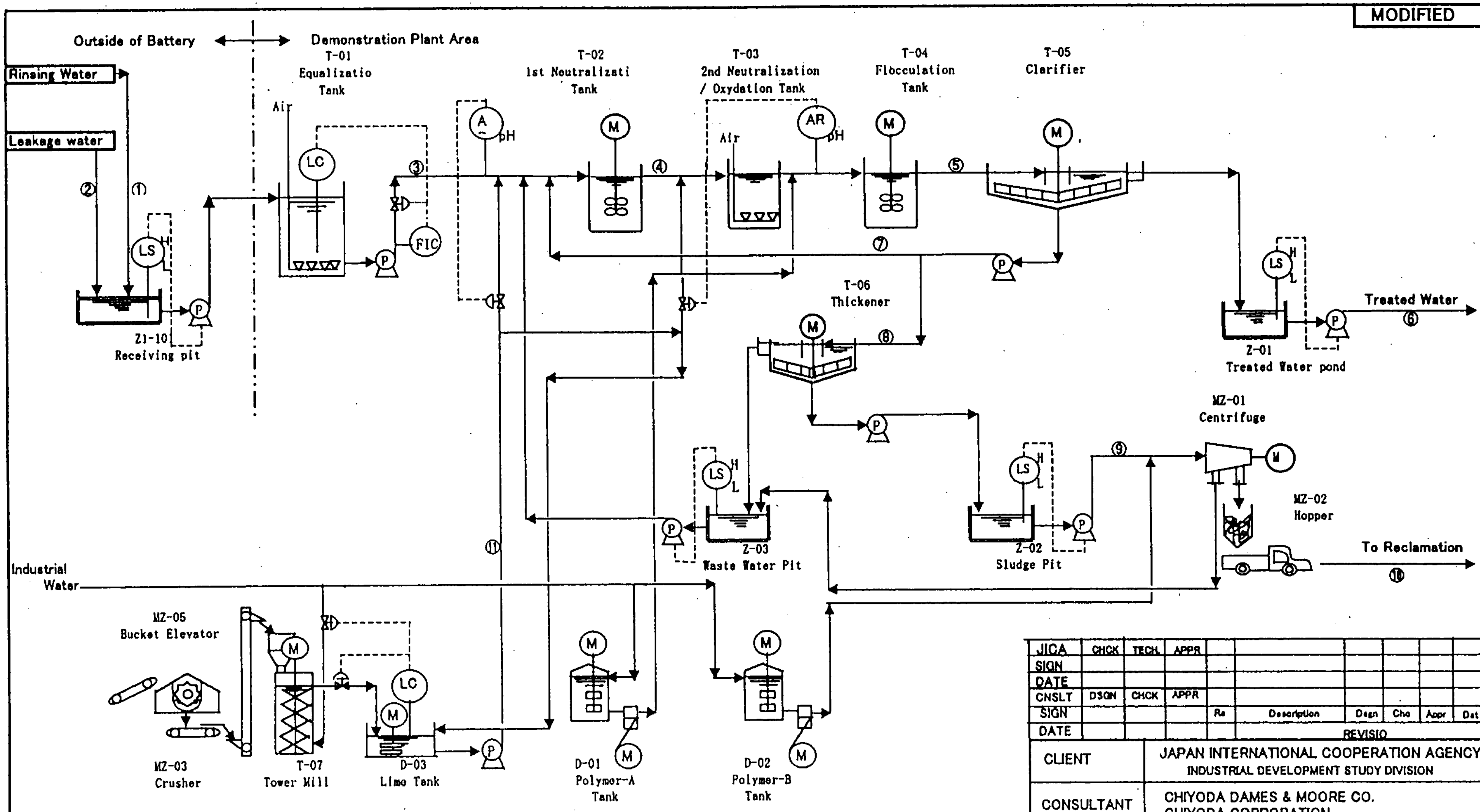


FUNCTIONAL IDENTIFICATION LETTERS

LETTER	PROCESS VARIABLE/ FIRST LETTER	FUNCTION/ SUCCEEDING LETTER
A	ANALYSIS	ALARM
B	BURNER FLAME	
C	ELECTRICAL CONDUCTIVITY	CONTROL
D	DENSITY	
E	ELECTRIC VARIABLE	MEASURING ELEMENT
F	FLOW RATE	
G	DIMENSIONAL GAUGING	LOCAL INDICATE
H	HAND	HAND OPERATE
I		INDICATE
J		
K	TIME	COMPUTER CONTROL
L	LEVEL	LOGGING
M	MOISTURE OR HUMIDITY	
N	FREQUENCY	
O		
P	PRESSURE	SAMPLING POINT
Q	CALORIE	INTEGRATE OR TOTALISE
R		RECORD
S	SPEED,REVOLUTION OR FREQUENCY	SWITCHING/SEQUENCE
T	TEMPERATURE	TRANSMIT
U	UNCLASSIFIED OR MULTIPLE VARIABLE	UNCLASSIFIED OR MULTIPLE FUNCTION
V	VIBRATION	VALVE,DAMPER OR LOUVER
W	WEIGHT OR FORCE	WELL
X	OTHER VARIABLE	OTHER FUNCTION
Y		COMPUTE OR RELAY
Z		SAFETY OR EMERGENCY

JICA	Chck	Tech	Appr					
Sign								
Date								
CNSL	Dsgn	Chck	Appr					
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date				REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR ENGINEERING FLOW DIAGRAM LEAD SHEET(2/2)
ISSUED DATE		SCALE	None
DWG NO		REV.	0



Stream No. / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	Law48/82 Regulation
Flow Rate(Max)	m^3/h	80	10	90	113	115	91	4	24	16	4 ton/h	5	-
Flow Rate(Nor)	m^3/h	36	6	40	63	65	41	4	24	16	4 ton/h	5	-
pH	—	0.5 - 2		0.5-2.0	4.0-5.0	8-8.6	8-8.5	8-8.6	8-8.5	8-8.6	8-8.6	-	6~9
H_2SO_4	mg/L	2,025	21,800	4,300	≒ 0	≒ 0	≒ 0	-	-	-	-	-	-
$FeSO_4$	mg/L	2,025	21,800	4,300	4,300	≒ 0	≒ 0	-	-	-	-	-	-
$CaSO_4 \cdot 2H_2O$	mg/L	-	-	-	6,000	9,700	2,000	38,750	38,750	62,000	930 kg/h	-	-
$Fe(OH)_3$	mg/L	-	-	-	-	2,400	≒ 0	11,250	11,250	18,000	270 kg/h	-	-
$Ca(OH)_2$	mg/L	-	-	-	-	-	-	-	-	-	-	100,000	-
SS	mg/L			-	4,000	10,100	<30	50,000	50,000	80,000	30 wt%	-	30

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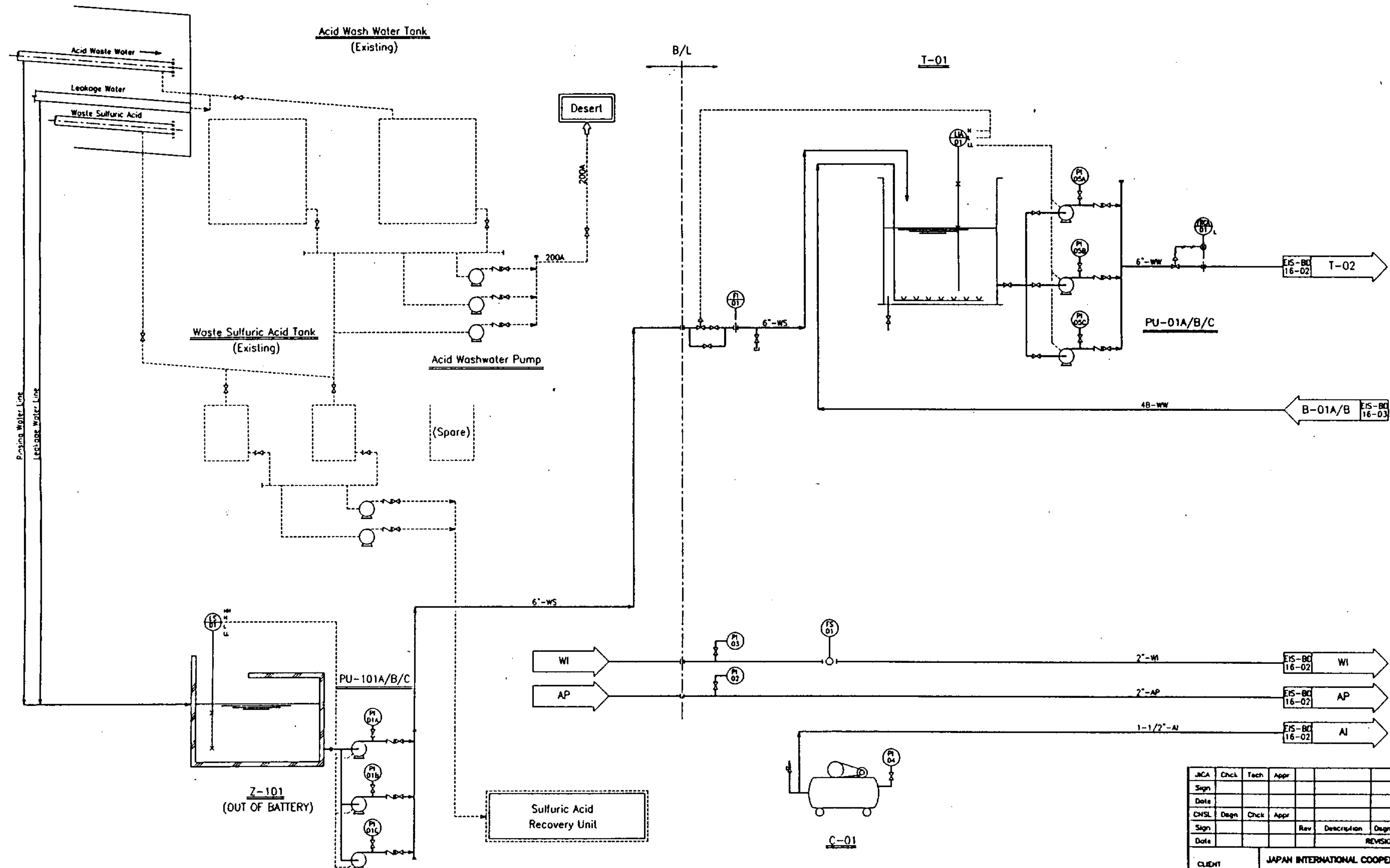
SIGN								
DATE								
CNSLT	DSGN	CHCK	APPR					
SIGN				Re	Description	Dsgn	Chc	Appr	Dat
DATE				REVISIO				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE	FOR EGYPTIAN IRON AND STEEL CO. PROCESS FLOW DIAGRAM OF WASTEWATER TREATMENT PLANT (without Spent Sulfuric Acid)		
ISSUED DATE		SCALE	NONE
DWG NO	EIS-BD-15-01	REV.	0

MODIFIED



ITEM No	Z-101	PU-101A/B/C	T-01	PU-01A/B/C	C-01
SERVICE	Acid Wastewater Pit	Acid Wastewater Pump	Equalization Tank	Waste Water Pump	Air Compressor W/Dryer
SIZE(m)	5000^{W}x6000^{L}x6000^{H}x45m^3	45m^3/hx30mHx7.5kW	8719øx10635^{H}x540m^3	45m^3/hx15mHx3.7kW	200L/minx0.7MPax0.75kW
DESIGN PRESS(MPa)	Full Water	0.3	Full Water	0.15	0.7
DESIGN TEMP.(°C)	Amb.	Amb.	Amb.	Amb.	200
MATERIAL/TYPE	RC/Open Basin	FC+R.Lining/Centri.Horiz.	CS+R.Lining/Verti.	FC+R.Lining/Centri.Horiz.	CS/Baby com.

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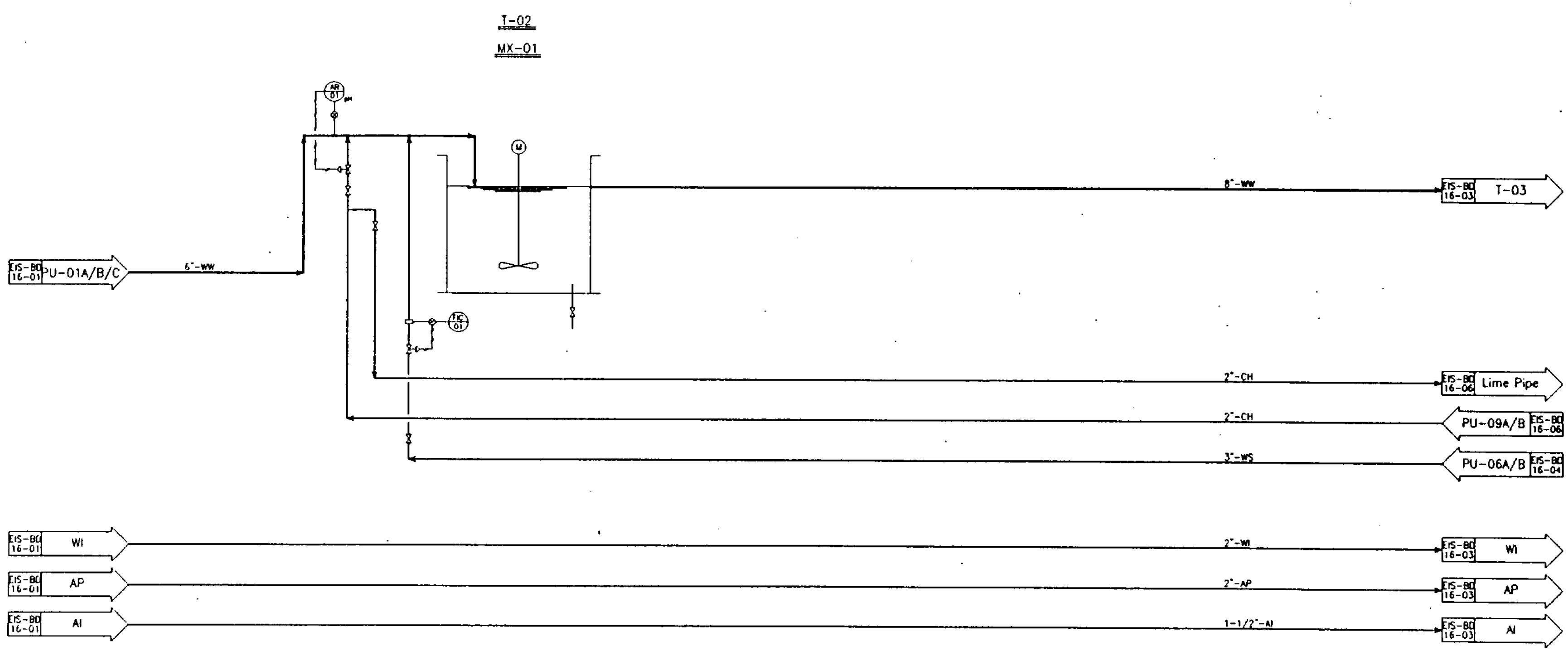
CNSL	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date				REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON & STEEL CO. ENGINEERING FLOW DIAGRAM FOR WASTE WATER TREATMENT PLANT(1/8)
ISSUED DATE	SCALE: None
DWG NO: EIS-BD-16-01	REV. 0

MODIFIED



ITEM No.	T-02	MX-01
SERVICE	1st Neutralization Tank	1st Neutralization Mixer
SIZE(m)	3872ø×4595ᴴ×45m³	7.5kw
DESIGN PRESS(MPa)	Full Water	Full Water
DESIGN TEMP (°C)	Amb.	Amb.
MATERIAL/TYPE	CS+R.Lining/Verti.	CS+R.Lining/Verti.

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Date								
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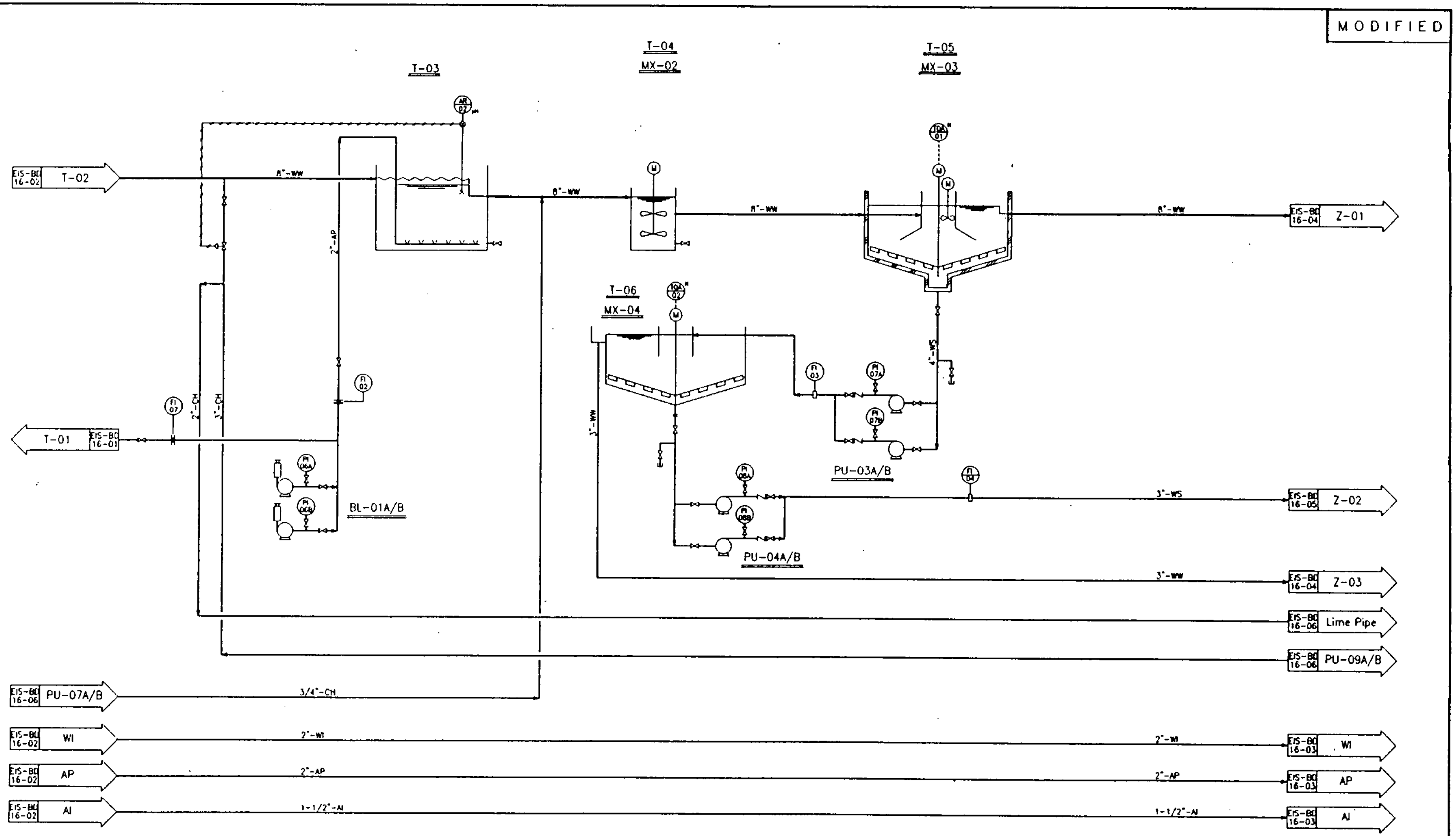
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date				REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON & STEEL CO. ENGINEERING FLOW DIAGRAM FOR WASTE WATER TREATMENT PLANT(2/8)
ISSUED DATE	SCALE: None
DWG NO: EIS-BD-16-02	REV. 0



ITEM No.	T-03	T-04	T-05	T-06	MX-02	MX-03	MX-04	BL-01A/B	PU-03A/B	PU-04A/B
SERVICE	[illegible]	Flocculation Tank	Clarifier	Thickener	Flocculator	Clarifier Rake	Thickener Rake	Blower	Sludge Return Pump	Sludge Pump
SIZE(m)	3872φx4595"x45m³	2680φx3500"x23m³	10000φx4500"	8500φx4500"	5.5kW	0.75kW	0.75kW	6Nm³/minx5mAqx11kW	30m³/hx20mHx3.7kW	20m³/hx20mHx2.2kW
DESIGN PRESS(MPa)	Full Water	Full Water	Full Water	Full Water	Full Water	Full Water	Full Water	0.05	0.2	0.2
DESIGN TEMP.(°C)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	100	Amb.	Amb.
MATERIAL/TYPE	CS+R.Lining/Verti.	CS+R.Lining/Verti.	CS+R.Lining/Verti.	CS+E.Coating/Verti.	CS+R.Lining/Verti.	CS+R.Lining/Center Drive	CS+R.Lining/Center Drive	FC/FC/Rool	SCS/Centri. Horiz.	SCS/Centri. Horiz.

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Date									
CNSL	Dsgn	Chck	Appr						
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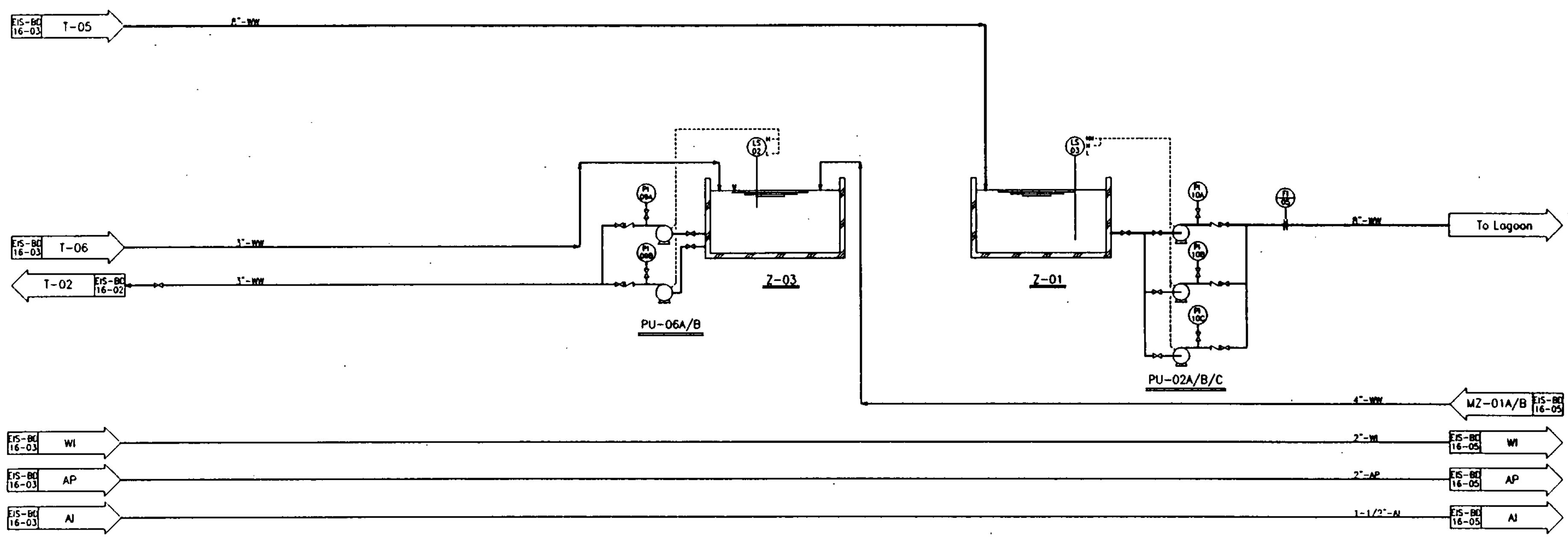
Date					REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON & STEEL CO. ENGINEERING FLOW DIAGRAM FOR WASTE WATER TREATMENT PLANT(3/8)
ISSUED DATE		SCALE	None
DWG NO	EIS-BD-16-03	REV.	0

MODIFIED



ITEM No.	Z-03	Z-01	PU-06A/B	PU-02A/B/C
SERVICE	Waste Water Pit	Treated Water Pond	Return Pump	Treated Water Pump
SIZE(m)	4500^{L}x5000^{L}x2500^{H}x45m^{3}	4500^{L}x5000^{L}x2500^{H}x45m^{3}	20m^{3}/hx20mHx2.2kW	45m^{3}/hx50mHx11.5kW
DESIGN PRESS(MPa)	Full Water	Full Water	0.2	0.5
DESIGN TEMP.(°C)	Amb.	Amb.	Amb.	Amb.
MATERIAL/TYPE	RC/Rectangular	RC/Rectangular	SCS/Centri. Horiz.	SCS/Centri. Horiz.

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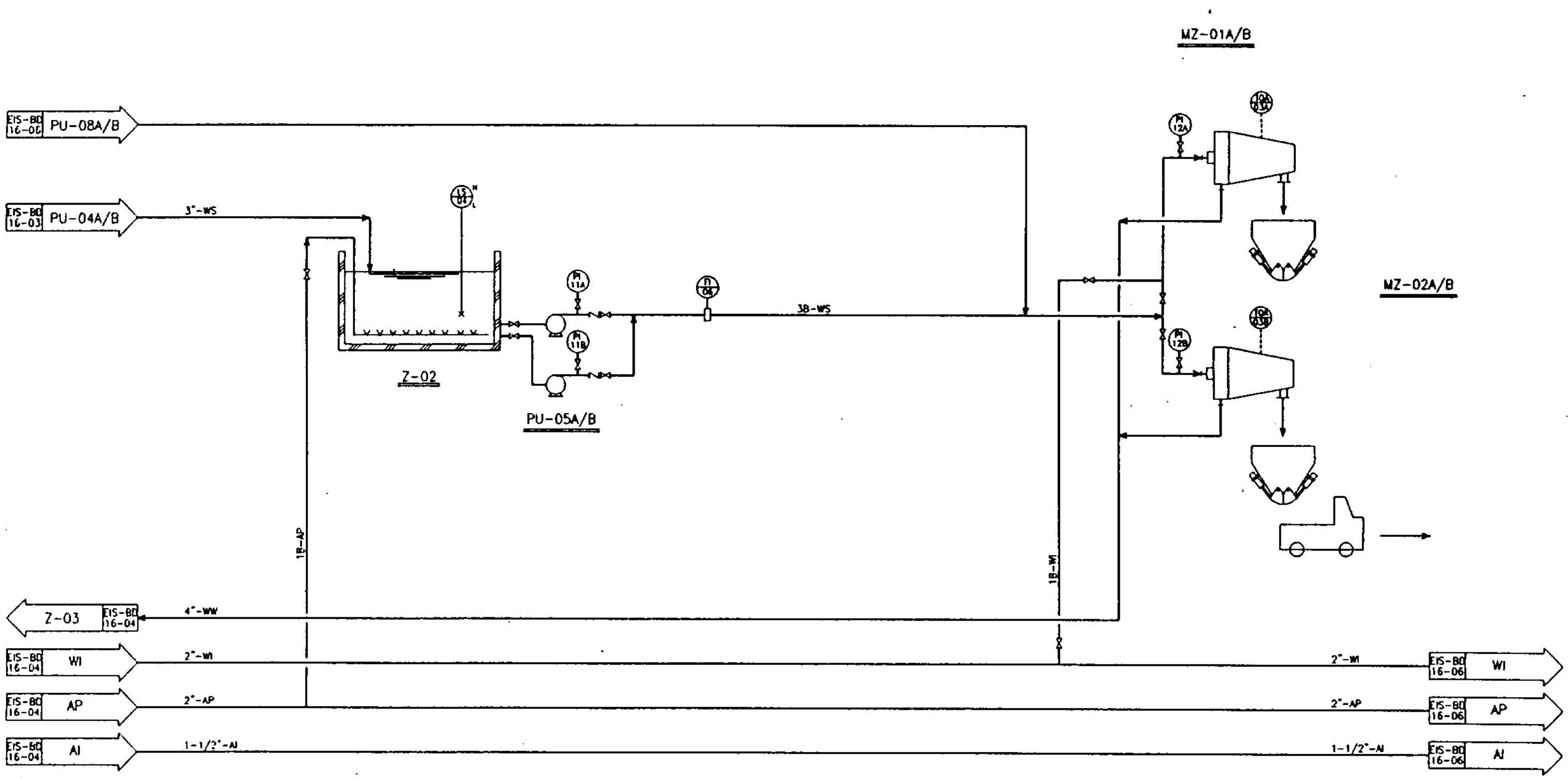
CNSL	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date					REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE -	FOR EGYPTIAN IRON & STEEL CO. ENGINEERING FLOW DIAGRAM FOR WASTE WATER TREATMENT PLANT(4/6)		
ISSUED DATE		SCALE	None
DWG NO	EIS-BD-16-04	REV.	0

MODIFIED



ITEM No.	Z-02	PU-05A/B	MZ-01A/B	MZ-02A/B
SERVICE	Sludge Pit	Thickened Sludge Pump	Dehydrator	Sludge Hopper
SIZE(m)	4500ᴸx5000ᵂx2500ᴴx45m³	20m³/hx20mHx2.2kW	15m³/hx45kW+7.5kW	2500ᴸx3500ᵂx3000ᴴx24m³
DESIGN PRESS.(MPa)	Full Water	0.2	Amb.	Amb.
DESIGN TEMP.(°C)	Amb.	Amb.	Amb.	Amb.
MATERIAL/TYPE	RC/Rectangular	SCS/Centri. Horiz.	SUS/Centrifuge	CS/Vertical

JICA	Chck	Tech	Appr						
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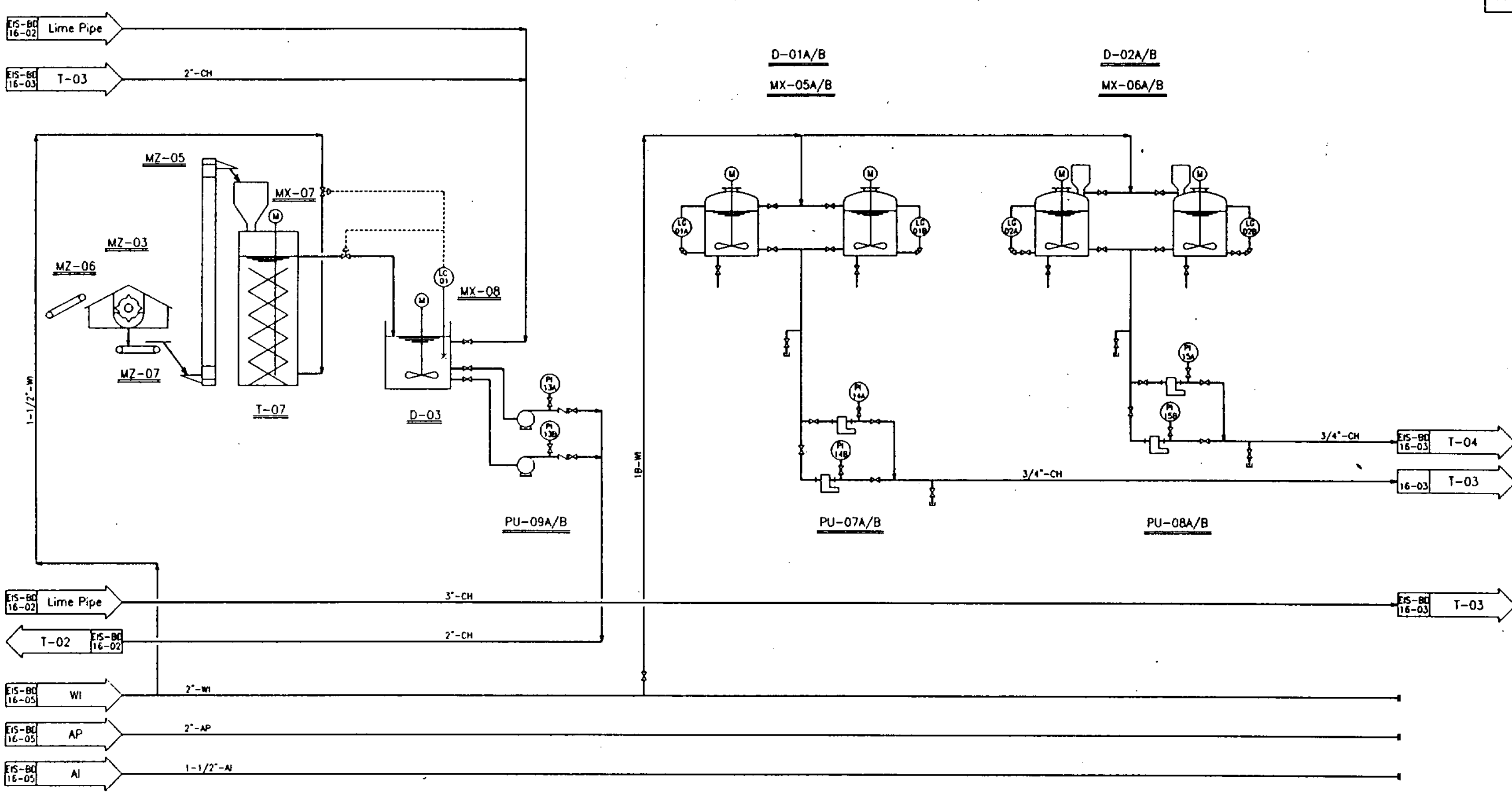
CNSL	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date					REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON & STEEL CO. ENGINEERING FLOW DIAGRAM FOR WASTE WATER TREATMENT PLANT(5/8)
ISSUED DATE	SCALE: None
DWG NO	EIS-BD-16-05 — REV. 0

MODIFIED



ITEM No	MX-08	MZ-03	MZ-04	MZ-05	MZ-06	MZ-07
SERVICE	Lime Mixer	Crusher	Feeder	Bucket Elevator	Belt Conveyer	Belt Conveyer
SIZE(m)	1.5kW	700kg/h,11kw	700kg/h,0.4kw	700kg/h,0.4kw	700kg/h,0.4kw	700kg/h,0.4kw
DESIGN PRESS(MPa)	Full Water	Full Water	Full Water	Full Water		
DESIGN TEMP.(°C)	Amb.	Amb.	Amb.	Amb.		
MATERIAL/TYPE	SUS/Verti.	CS/Ball Mill	SUS/Table Feeder	CS/Vertical		

ITEM No.	D-01A/B	D-02A/B	D-03	T-07	PU-07A/B	PU-08A/B	PU-09A/B	MX-05A/B	MX-06A/B	MX-07
SERVICE	Polymer A Tank	Polymer A Tank	Lime Tank	Tower Mill	Polymer A Pump	Polymer B Pump	Lime Pump	Polymer A Mixer	Polymer B Mixer	Tower Mill
SIZE(m)	800φx1000Hx0.4m³	800φx1000Hx0.4m³	1910φx3000Hx6m³	1050φx7700H	3L/hx0.3MPax0.4kW	500L/hx0.3MPax0.75kW	15m³/hx25Hx2.2kW	0.4kW	0.4kW	1050φx7700H
DESIGN PRESS(MPa)	Full Water	Full Water	Full Water	Full Water	0.3	1	0.2	Full Water	Full Water	Full Water
DESIGN TEMP.(°C)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.
MATERIAL/TYPE	FRP/Cylind. Verti.	FRP/Cylind. Verti.	FRP/Cylind.Verti.	CS/Verti.	SCS/Reciprocating	SCS/Reciprocating	SCS/Centri. Horiz.	SUS/Verti.	SUS/Verti.	SUS/Verti.

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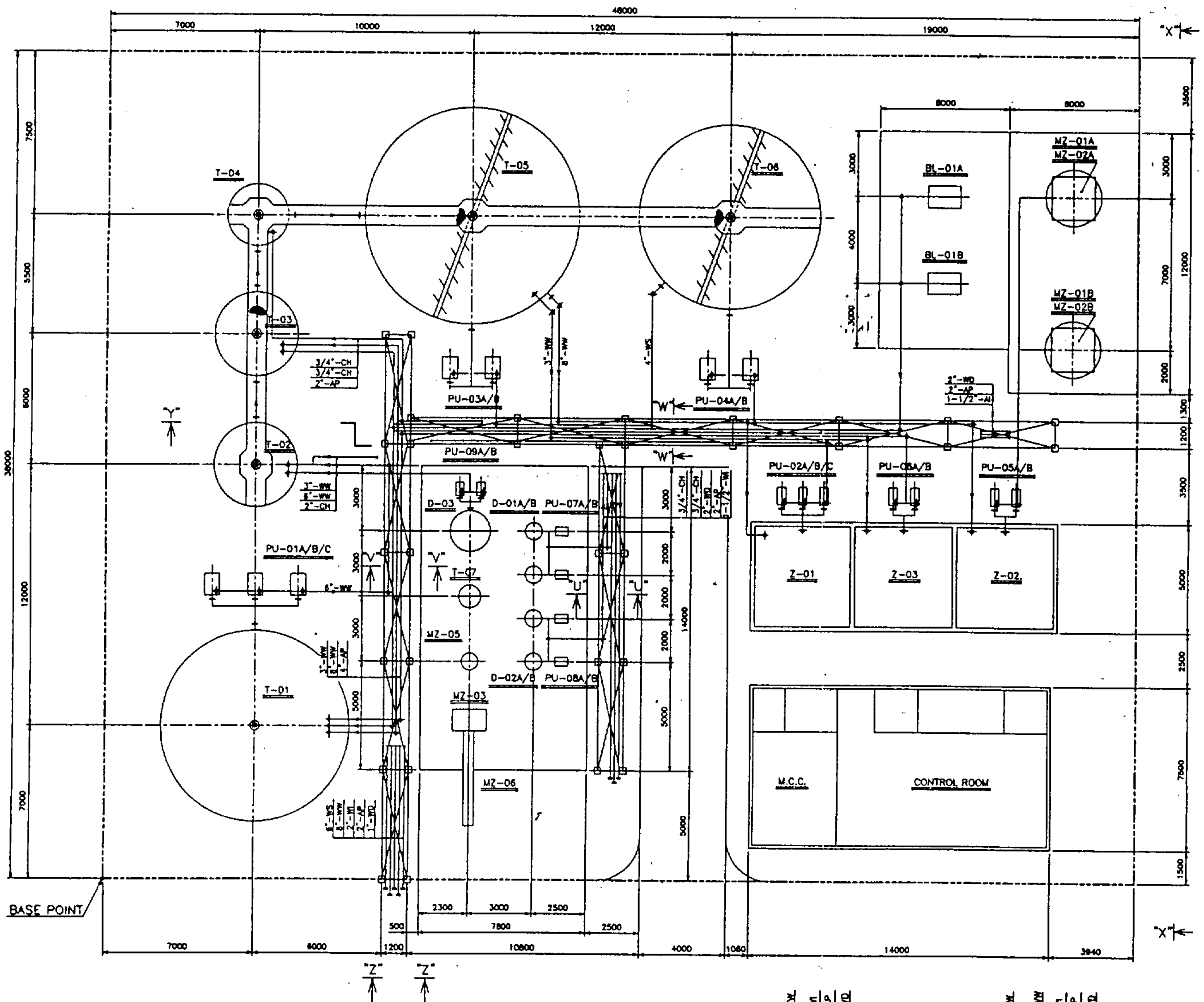
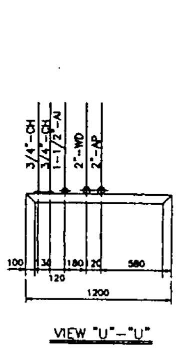
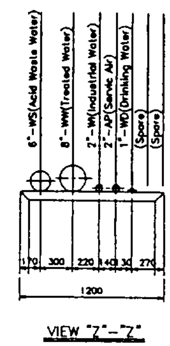
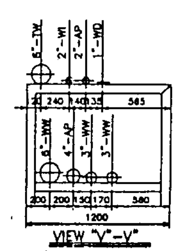
Date					REVISION				

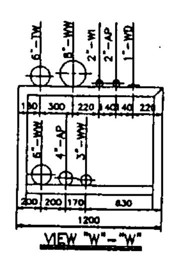
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON & STEEL CO. ENGINEERING FLOW DIAGRAM FOR WASTE WATER TREATMENT PLANT(6/6)
ISSUED DATE		SCALE None
DWG NO	EIS-BD-16-06	REV. 0











Equipment NO.	Service	Equipment NO.	Service
T-01	Equalization Tank	PU-02A/B	Treated Water Pump
T-02	1st Neutralization Tank	PU-03A/B	Sludge Return Pump
T-03	2nd Neutralization Tank	PU-04A/B	Sludge Pump
	/Oxydation Tank	PU-05A/B	Thickened Sludge Pump
T-04	Flocculation Tank	PU-06A/B	Return Pump
T-05	Clarifier	PU-07A/B	Polymer A Pump
T-06	Thickener	PU-08A/B	Polymer B Pump
T-07	Tower Mill	PU-09A/B	Lime Pump
D-01A/B	Polymer A Tank	BL-01A/B	Blower
D-02A/B	Polymer B Tank		
D-03	Lime Tank	MZ-01A/B	Dehydrator
		MZ-02A/B	Sludge Hopper
Z-01	Treated Water Pond		
Z-02	Sludge Pit	MZ-05	Bucket Elevator
Z-03	Waste Water Pit	MZ-06	Belt Conveyor
		MZ-07	Belt Conveyor

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. PLOT PLAN FOR WASTEWATER TREATMENT PLANT
ISSUED DATE	SCALE 1/100
DWG NO DS-BD-12-01	REV. 0

JICA	Chck	Tech	Appr	Rev	Description	Dsgn	Chck	Appr	Date
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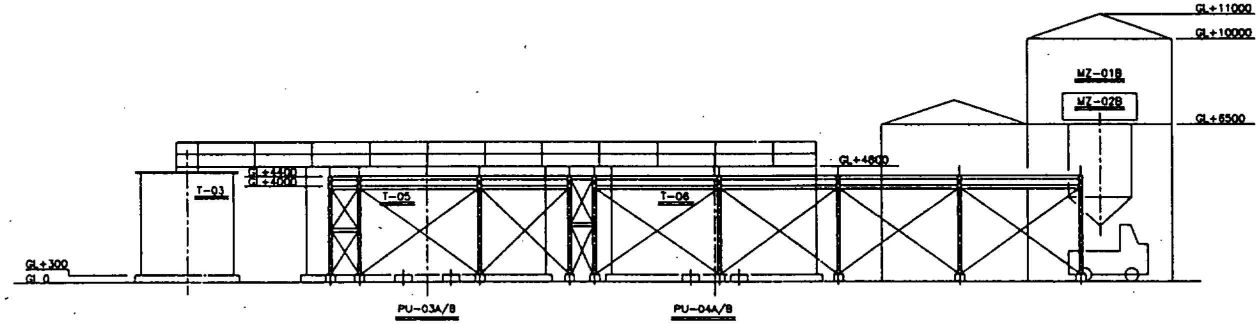
Date					REVISION				

MODIFIED

Equipment NO.	Service	Equipment NO.	Service
T-01	Equalization Tank	PU-02A/B	Treated Water Pump
T-02	1st Neutralization Tank	PU-03A/B	Sludge Return Pump
T-03	2nd Neutralization Tank	PU-04A/B	Sludge Pump
	/Oxydation Tank	PU-05A/B	Thickened Sludge Pump
T-04	Flocculation Tank	PU-06A/B	Return Pump
T-05	Clarifier	PU-07A/B	Polymer A Pump
T-06	Thickener	PU-08A/B	Polymer B Pump
T-07	Tower Mill	PU-09A/B	Lime Pump
D-01A/B	Polymer A Tank	BL-01A/B	Blower
D-02A/B	Polymer B Tank		
D-03	Lime Tank	MZ-01A/B	Dehydrator
		MZ-02A/B	Sludge Hopper
Z-01	Treated Water Pond		
Z-02	Sludge Pit	MZ-05	Bucket Elevator
Z-03	Waste Water Pit	MZ-06	Belt Conveyor
		MZ-07	Belt Conveyor



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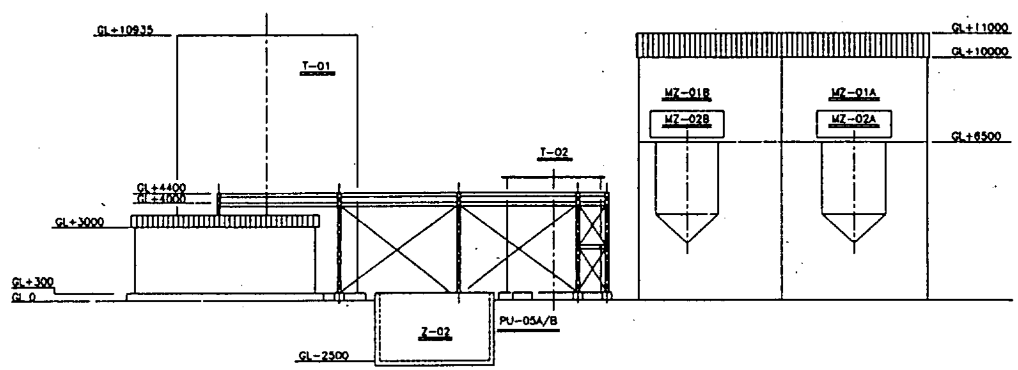

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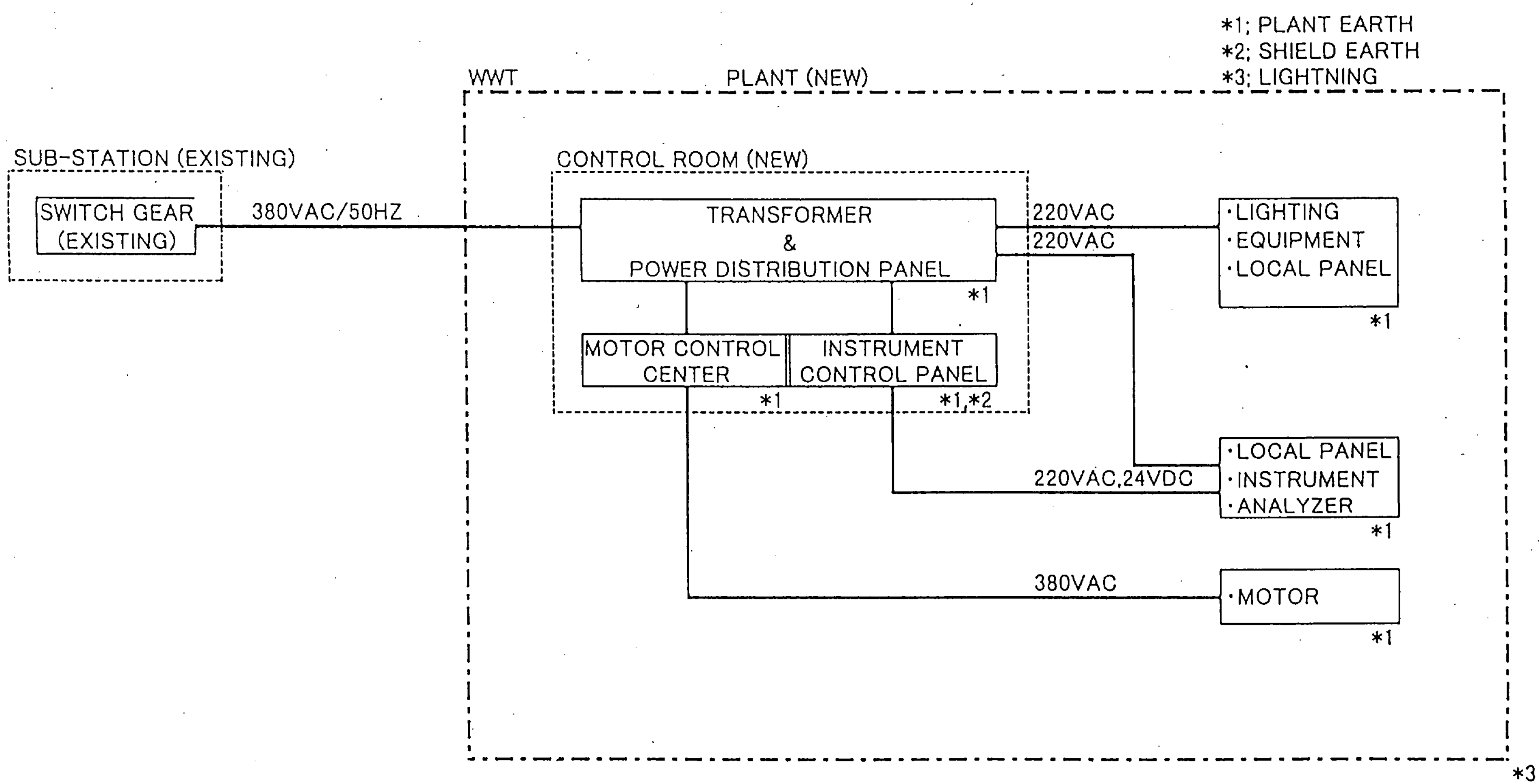
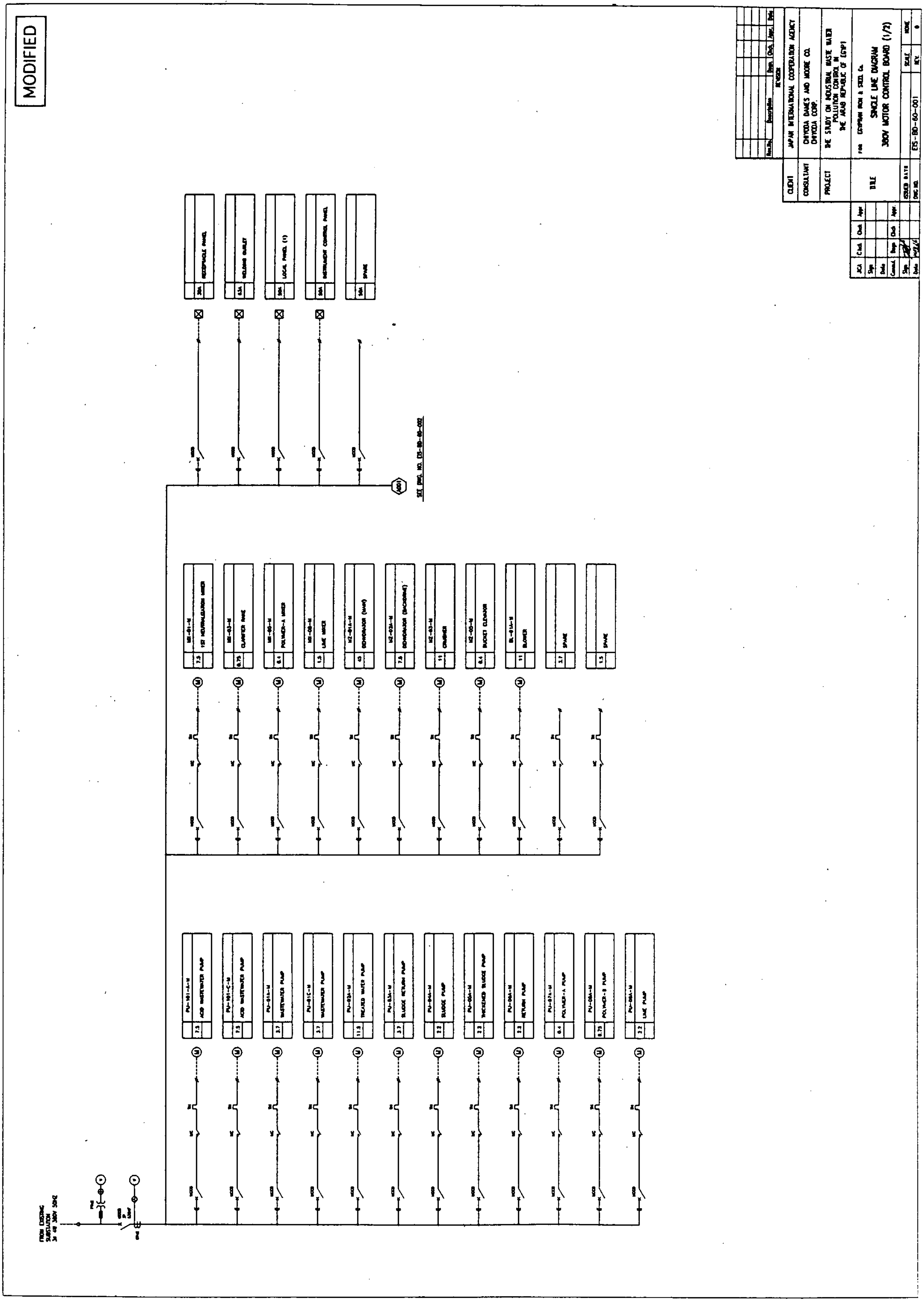
Date									
CHSL	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date				REVISION					

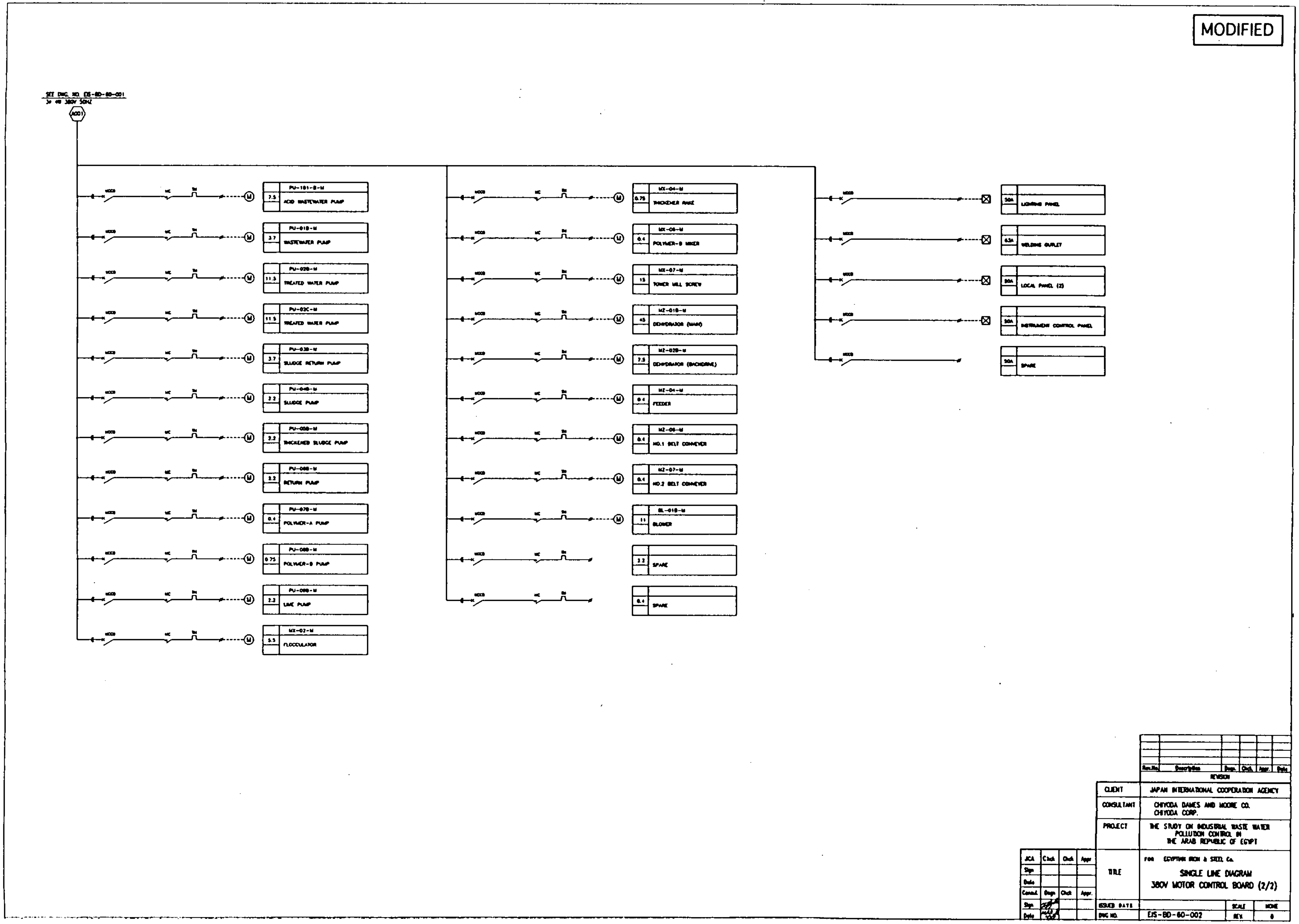
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. PLOT PLAN FOR WASTEWATER TREATMENT PLANT(ELEVATION)
ISSUED DATE	SCALE 1/100
DWG NO ES-BD-12-02	REV. 0

MODIFIED

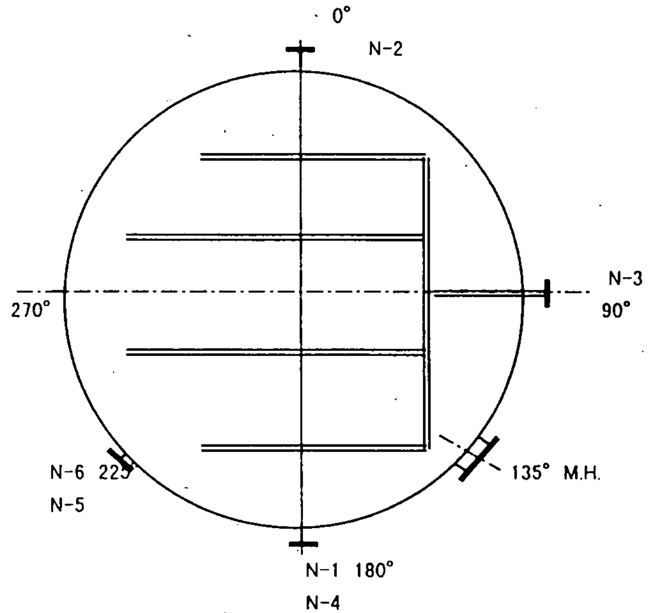
CONFIGURATION OF ELECTRICAL & INSTRUMENTATION SYSTEM FOR PLANT

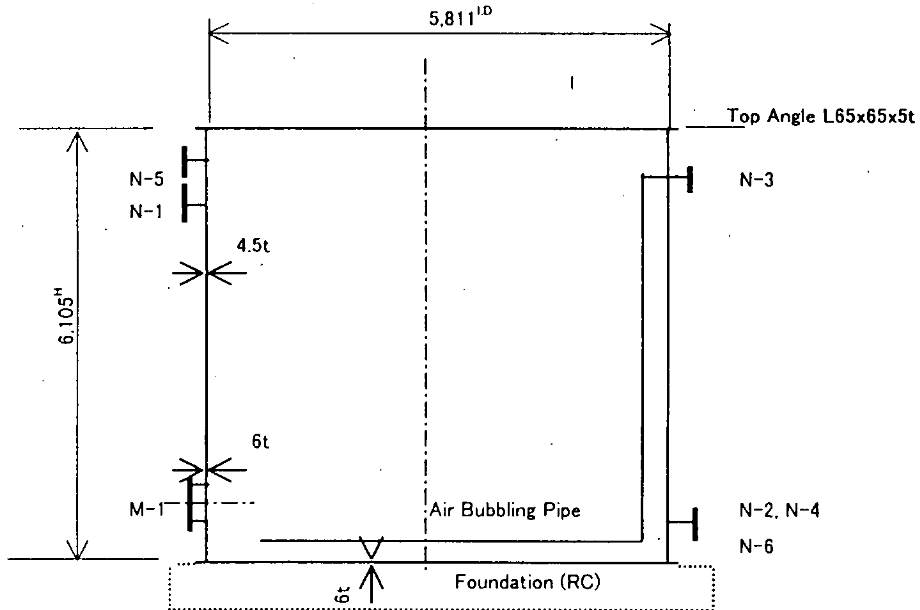



MODIFIED
JAPAN INTERNATIONAL COOPERATION AGENCY
CHIYODA DAMES AND MOORE CO.
CHIYODA CORP.
THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
SINGLE LINE DIAGRAM
380V MOTOR CONTROL BOARD (1/2)
ES-BD-60-001


MODIFIED
SEE DWG. NO. EJS-BD-80-001
3φ 4W 380V 50HZ
A001
PU-101-B-M 7.5 ACID WASTEWATER PUMP
PU-01B-M 3.7 WASTEWATER PUMP
PU-02B-M 11.3 TREATED WATER PUMP
PU-02C-M 11.5 TREATED WATER PUMP
PU-03B-M 3.7 SLUDGE RETURN PUMP
PU-04B-M 2.2 SLUDGE PUMP
PU-05B-M 2.2 THICKENED SLUDGE PUMP
PU-06B-M 2.2 RETURN PUMP
PU-07B-M 0.4 POLYMER-A PUMP
PU-08B-M 0.75 POLYMER-B PUMP
PU-09B-M 2.2 LIME PUMP
MX-02-M 5.5 FLOCCULATOR
MX-04-M 0.75 THICKENER RAKE
MX-06-M 0.4 POLYMER-B MIXER
MX-07-M 15 TOWER MILL SCREW
MZ-01B-M 45 DEHYDRATOR (MAIN)
MZ-02B-M 7.5 DEHYDRATOR (BACKDRIVE)
MZ-04-M 0.4 FEEDER
MZ-06-M 0.4 NO.1 BELT CONVEYER
MZ-07-M 0.4 NO.2 BELT CONVEYER
BL-01B-M 11 BLOWER
2.2 SPARE
0.4 SPARE
30A LIGHTING PANEL
63A WELDING OUTLET
30A LOCAL PANEL (2)
30A INSTRUMENT CONTROL PANEL
30A SPARE
CLIENT JAPAN INTERNATIONAL COOPERATION AGENCY
CONSULTANT CHIYODA DAMES AND MOORE CO. CHIYODA CORP.
PROJECT THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
FOR EGYPTIAN IRON & STEEL Co.
TITLE SINGLE LINE DIAGRAM 380V MOTOR CONTROL BOARD (2/2)
DWG NO. EJS-BD-80-002
SCALE NONE
REV. 0

MODIFIED





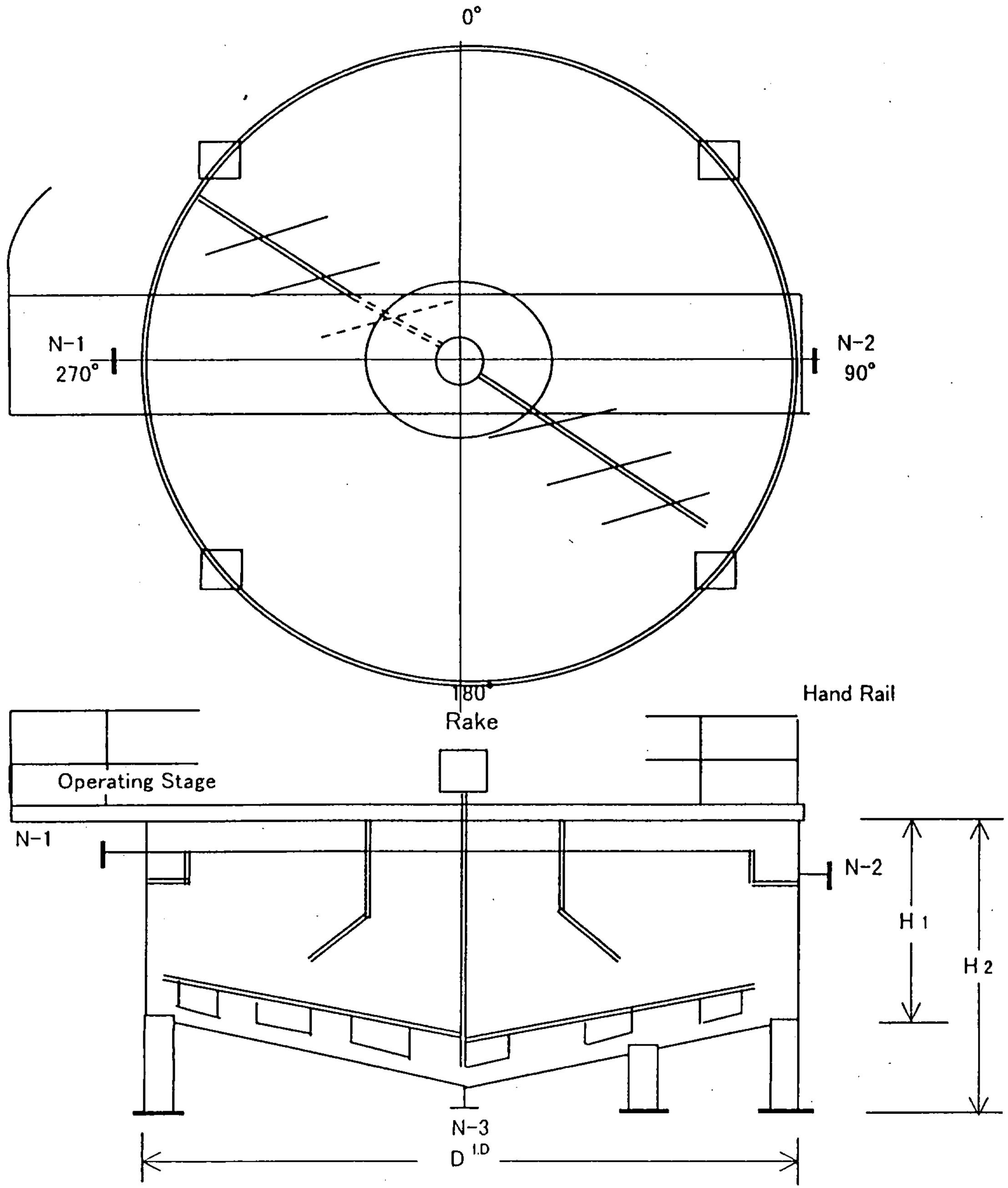
NOTE:
1)Type : Vertical Cylindrical Tank
(Open Top Tank)
2)Materials : Carbon Steel
Inside Resin Lining
3)Accessories: Stairway
Inside Ladder
Air Bubbling Tube

Loading Data :
: Empty Weight 24.8 ton
: Full Water 600 ton

No	Name	Size	No	Note
M-1	Manhole	500Φ	1	
N-6	Level Instrument	2"	1	
N-5	Over Flow	4"	1	
N-4	Drain	2"	1	
N-3	Bubbling Air Inlet	2"	1	
N-2	Waste Water Outlet	6"	1	
N-1	Waste Water Inlet	6"	1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY		
TYTLE	FOR: EGYPTIAN IRON AND STEEL CO. EQUALIZATION TANK WASTEWATER TREATMENT PLANT		
DWG. NO	EIS - BD - 22 - SK01	REV.	0

MODIFIED



NOTE:
1)Type : Vertical Cylindrical Tank (Open Top Tank)
2)Materials : Carbon Steel
Inside Resin Lining
3)Accessories: Stairway
Inside Ladder

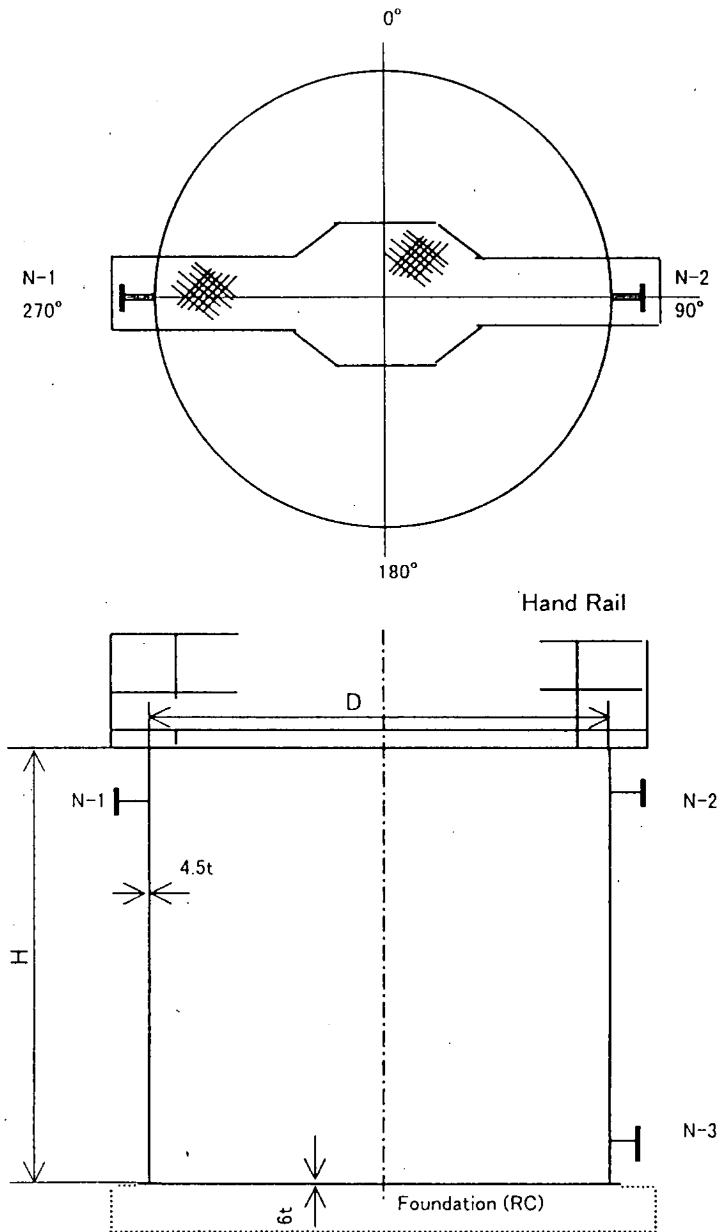
Equuipment No	Service	D	H_1	H_2	W_1	W_2
T-05	Clarifier	10,000	3,000	4,000	12.0	310
T-06	Thickener	8,500	3,000	4,000	9.7	230

W_1 : Empty Weight ton
W_2 : Full Water ton

N-4				
N-3	Sludge Outlet	2B	1	
N-2	Water Outlet	6B	1	
N-1	Water Inlet	6B	1	
No	Name	Size	No	Note

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: EGYPTIAN IRON AND STEEL CO. CLARIFIER & THICKENER WASTEWATER TREATMENT PLANT
DWG. NO.	EIS - BD - 22 - SK02 — REV. 0

MODIFIED



NOTE:
1)Type : Vertical Cylindrical Tank (Open Top Tank)
2)Materials : Carbon Steel, Inside Epoxy Coating
3)Accessories: Stairway

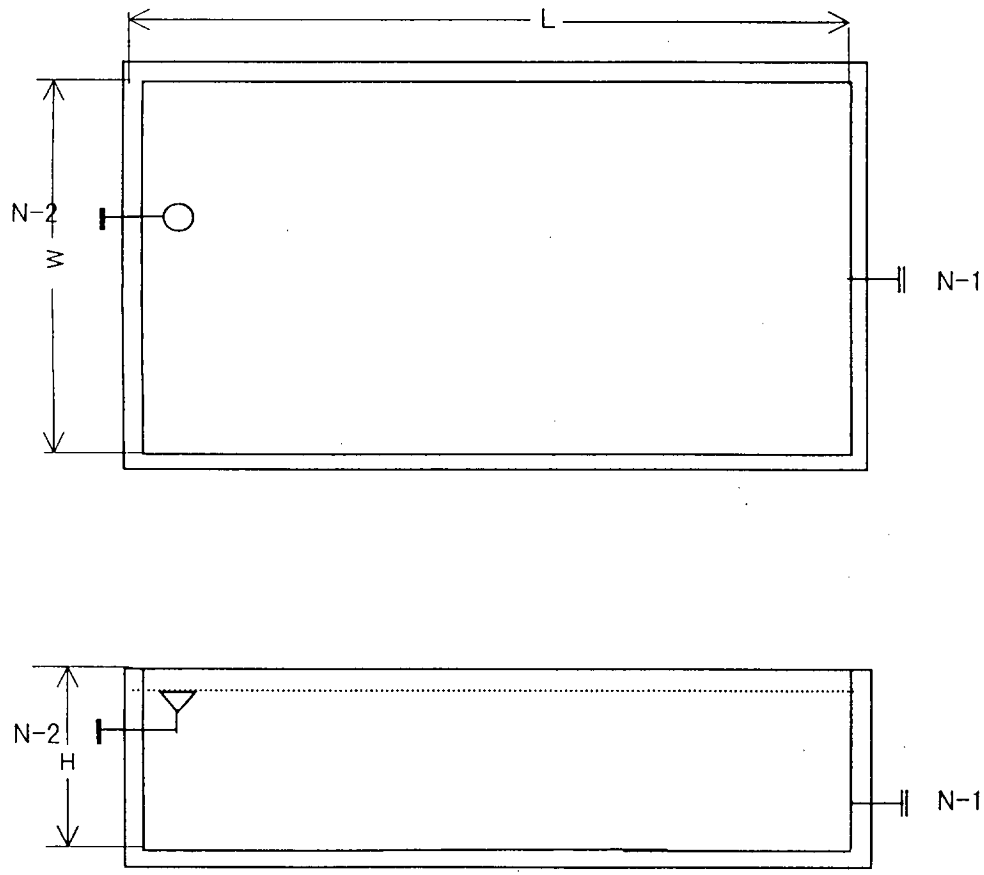
Equuipment No	Service	D	H	W_1	W_2
T-02	Coagulant Tank	3,872	4,595	4.8	52
T-03	Flocculation Tank	3,872	4,595	4.8	52
T-03	Flocculation Tank	2,860	3,500	2.7	23

W_1 : Empty Weight ton
W_2 : Full Water ton

No	Name	Size	No	Note
N-3	Drain	2"	1	
N-2	Wastewater Outlet	8"	1	
N-1	Wastewater Inlet	8"	1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY		
	FOR: EGYPTIAN IRON AND STEEL CO.		
TYTLE	1ST , 2ND NEUTRALIZATION & FLOCCULATION TANK WASTEWATER TREATMENT PLANT		
DWG. NO	EIS - BD - 22 - SK03	REV.	0

MODIFIED



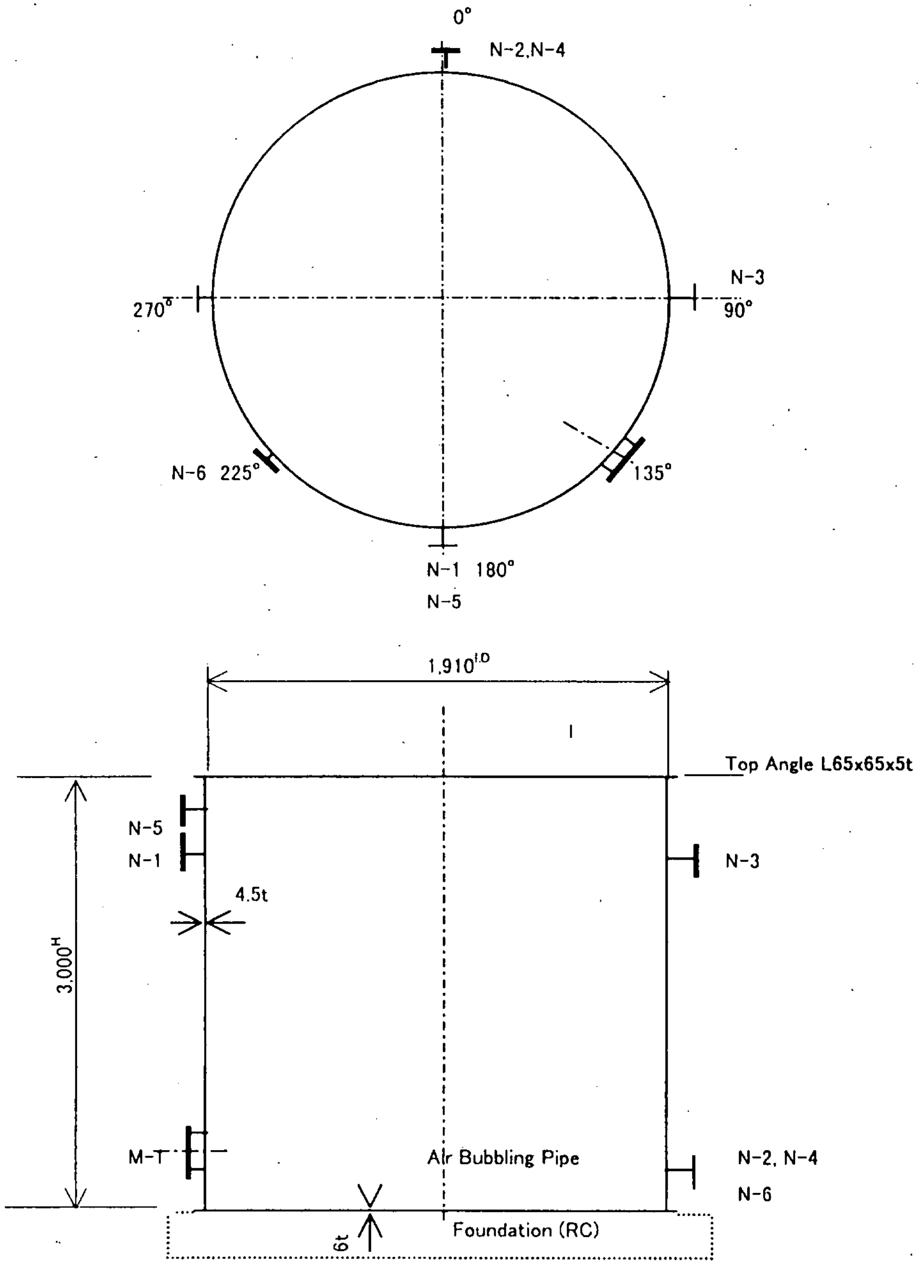
Material : Reinforced Concrete
Accessories : Operating Stage
Stairway
Air Distributing pipings
(without Z-01)

Equuipment No	Service	W	L	H	m^3
Z-01	Treated Water Pond	4,500	5,000	2,500	45
Z-02	Sludge Pit	4,500	5,000	2,500	45
Z-03	Wastewater Pit	4,500	5,000	2,500	45

No	Name	Size	No	Note
N-2	Over Flow		1	
N-1	Waste Water Outlet		1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY		
TYTLE	FOR: EGYPTIAN IRON AND STEEL CO. Treated Water Pond, Sludge Pit & Waste Water Pit WASTEWATER TREATMENT PLANT		
DWG. NO	EIS - BD - 22 - SK04	REV.	0

MODIFIED



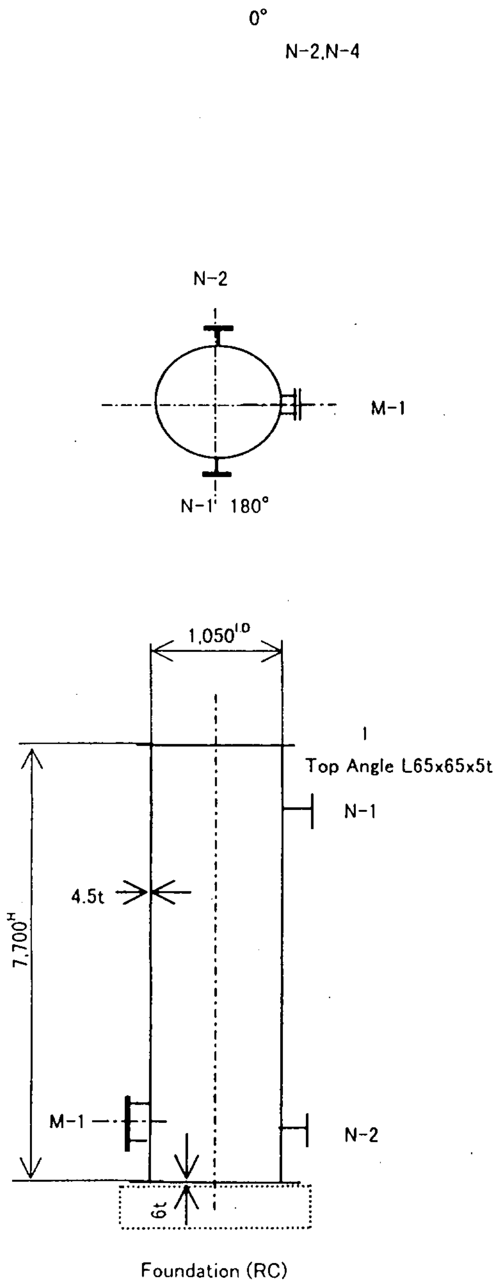
NOTE:
1)Type : Vertical Cylindrical Tank (Open Top Tank)
2)Materials : Carbon Steel
Inside Resin Coating

Loading Data :
: Empty Weight 1.5 ton
: Full Water 9.5 ton

No	Name	Size	No	Note
M-1	Manhole	500Φ	1	
N-6	Level Instrument	2"	1	
N-5	Over Flow	2"	1	
N-4	Drain	2"	1	
N-3	Return Line	2"	1	
N-2	Lime Milk Outlet	2"	1	
N-1	Lime Milk Inlet	2"	1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY		
TYTLE	FOR: EGYPTIAN IRON AND STEEL CO. LIME TANK WASTEWATER TREATMENT PLANT		
DWG. NO	EIS - BD - 22 - SK05	REV.	0

MODIFIED



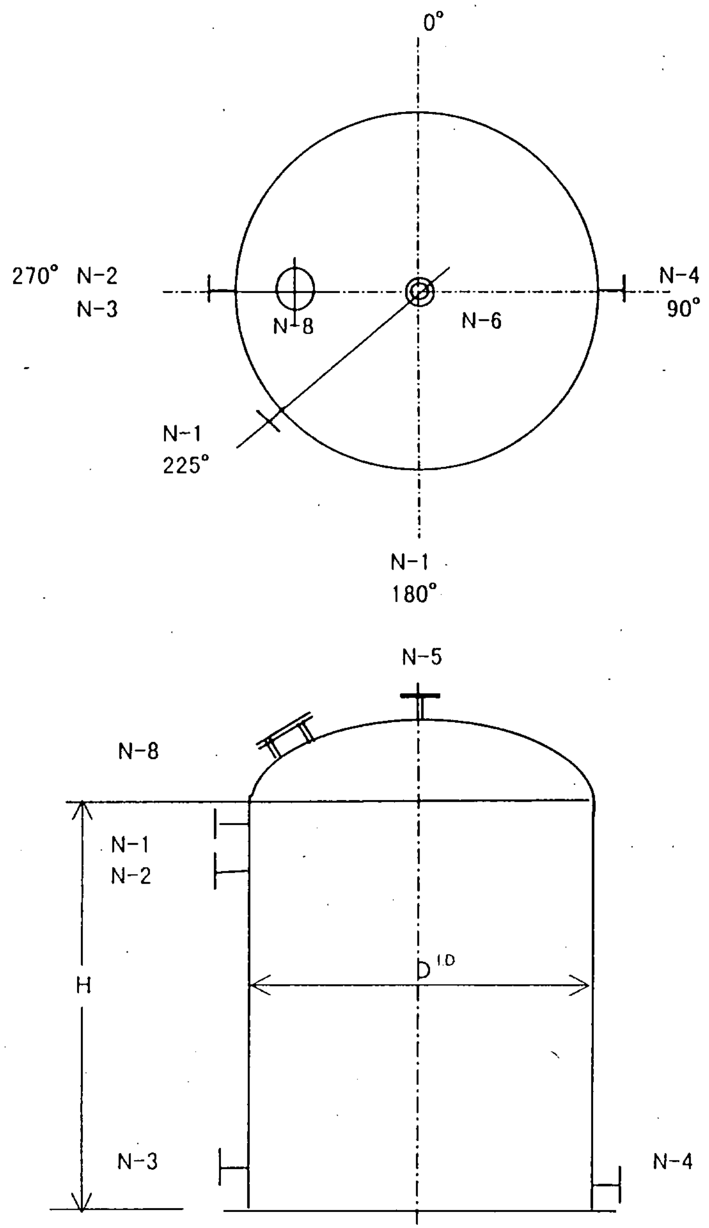
NOTE:
1)Type : Vertical Cylindrical Tank
(Open Top Tank)
2)Materials : Carbon Steel
Inside Resin Coating

Loading Data :
: Empty Weight 0.5 ton
: Full Water 9.0 ton

M-1	Manhole	450^{Φ}	1	
N-2	Water Inlet	2"	1	
N-1	Lime Milk Outlet	2"	1	
No	Name	Size	No	Note

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY		
TYTLE	FOR: EGYPTIAN IRON AND STEEL CO. TOWER MILL WASTEWATER TREATMENT PLANT		
DWG. NO	EIS - BD - 22 - SK06	REV.	0

MODIFIED



NOTE:
1)Type : Vertical Cylindrical Tank

2)Materials : FRP

3)Accessories: Level Gauge
Man-hole

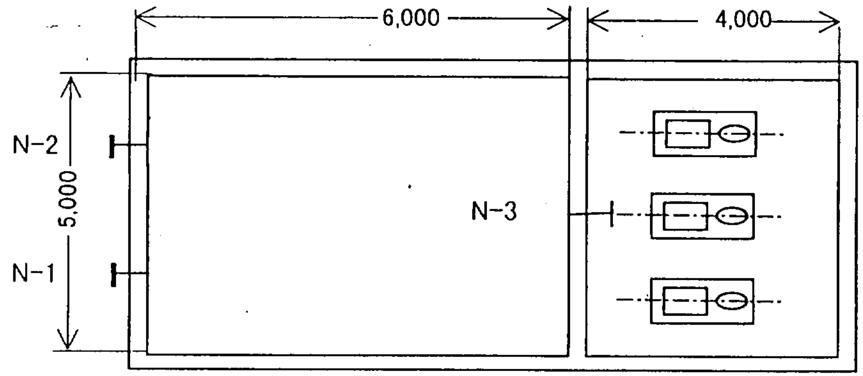
Equuipment No	Service	D	H		W_1	W_2
D-01A/B	Polymer-A Tank	800	1,000		0.06	0.5
D-02A/B	Polymer-B Tank	800	1,000		0.06	0.5

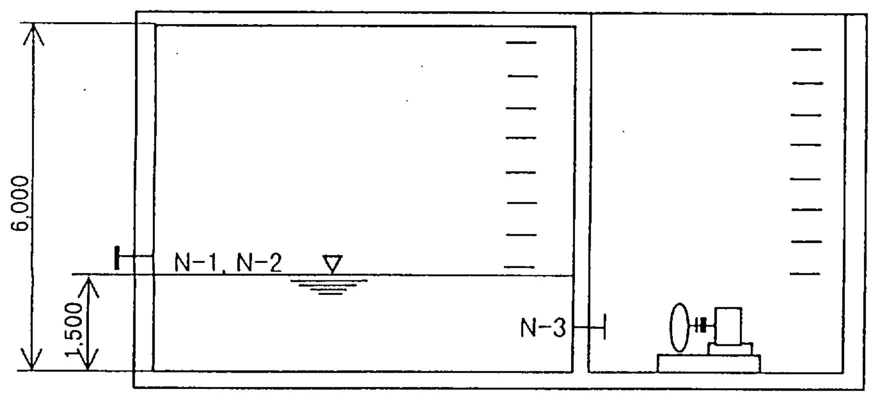
W_1 : Empty Weight ton
W_2 : Full Water ton

No	Name	Size	No	Note
M-1	Manhole	400Φ	1	
N-5	Vent	1"	1	
N-4	Drain	1"	1	
N-3	Level Gauge	3/4"	1	
N-2	Level Gauge	3/4"	1	
N-1	Water Inlet	1"	1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: EGYPTIAN IRON AND STEEL CO. POLYMER-A AND B TANK WASTEWATER TREATMENT PLANT
DWG. NO	EIS - BD - 22 - SK07 REV. 0

MODIFIED





Material : Reinforced Concrete with Resin Lining

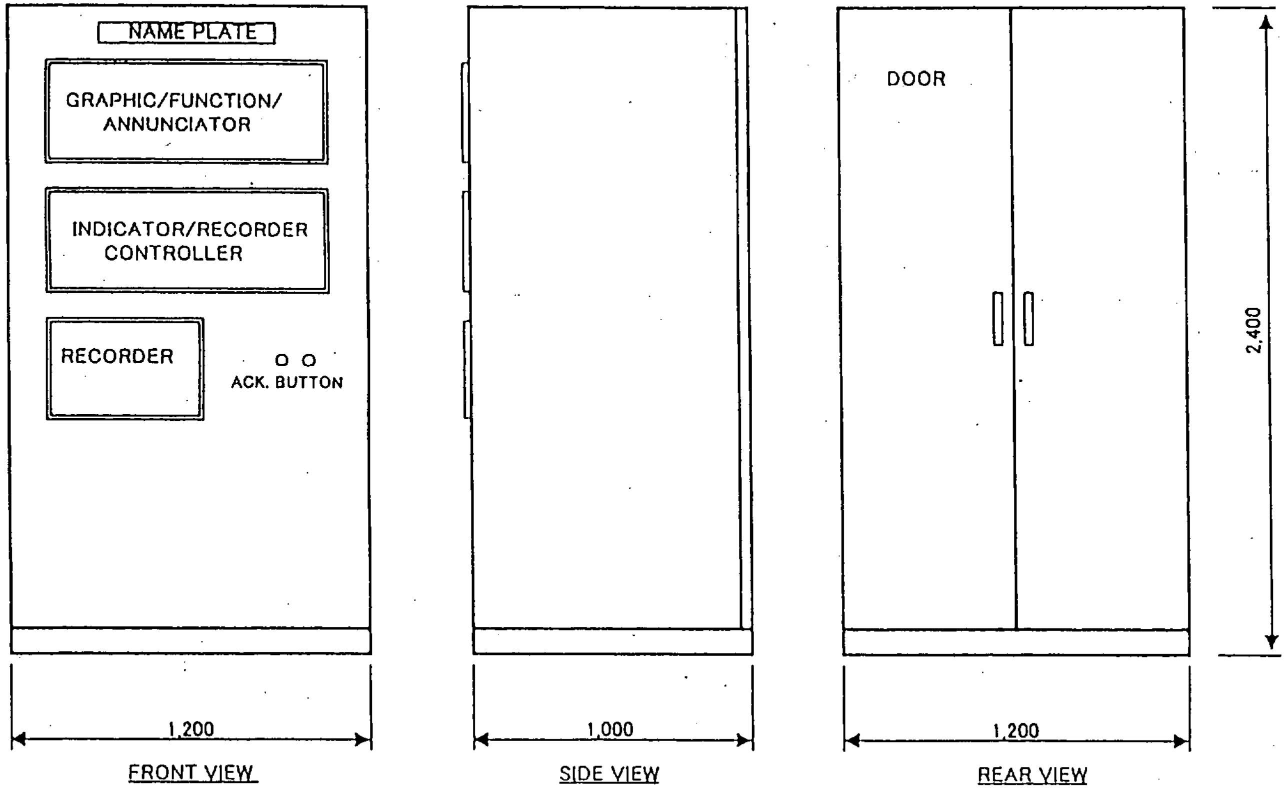
Accessories : Ladder

Note : Acid wastewater pump and level switch are supplied by JICA. The bottom of existing pipe tunnel should be confirmed at detail design.

No	Name	Size	No	Note
N-3	Waste Water Outlet	8"		
N-2	Leakage Water Inlet	4"	1	
N-1	Rinsing Water Inlet	8"	1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY		
TYTLE	FOR: EGYPTIAN IRON AND STEEL CO. RECEIVING PIT WASTEWATER TREATMENT PLANT		
DWG. NO	EIS - BD - 22 - SK08	REV.	0

MODIFIED



PANEL SPECIFICATION

1. SELF STANDING TYPE FOR INDOOR
2. STRUCTURE : 3.2MM STEEL
3. COLOR : YELLOW GREEN
4. CABLE ENTRY : BOTTOM

CONTROL PANEL OUTLINE FOR WASTEWATER TREATMENT PLANT
(SCALE : NONE)
(UNIT: MM)

JICA	Chck	Tech.	Appr
Sign			
Date			
CNSLT	Dsgn	Chck	Appr
Sign	[signature]		
Date	Dec. '97		

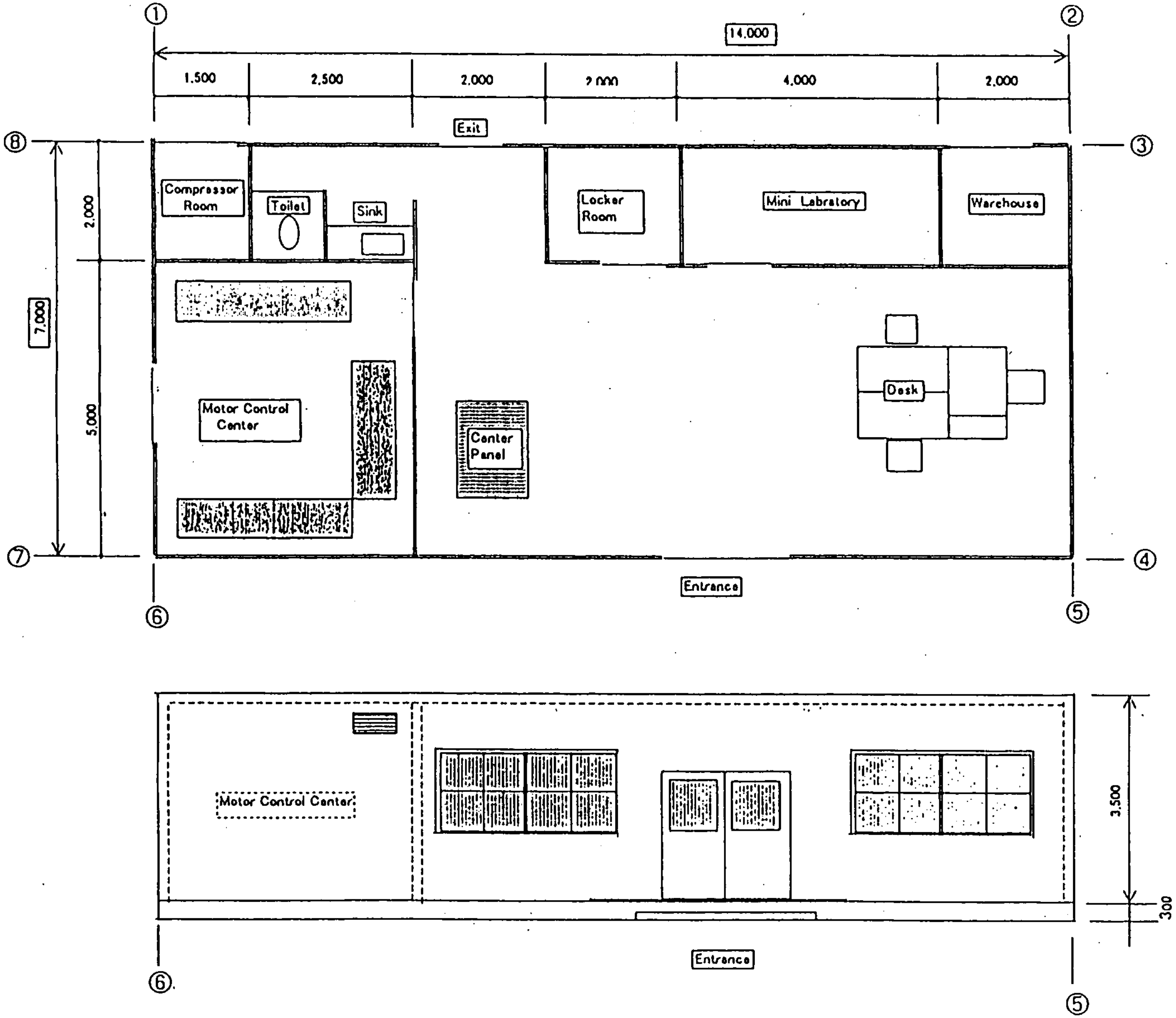
Re	Descri	Dsgn	Chc	Appr	Date

REVISION

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN IRON AND STEEL CO. CONTROL PANEL OUTLINE FOR WASTEWATER TREATMENT PLANT

ISSUED DATE		SCALE	NONE
DWG NO	IS - BD - 70 - 1	REV.	0

MODIFIED



CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR WASTEWATER TREATMENT PLANT CONTROL ROOM

ISSUED		SCALE	None
DWG	00-BD-56-01	REV	0

EQUIPMENT LIST for Egyptian Iron and Steel Co. MODIFIED

DOC. NO. EIS-BD-L01

(1/4)

CLIENT :Japan International Cooperation Agency

PROJECT :The Study on Industrial Waste Water Plant

PLANT :W.W.T. Demonstration Plant

WASTE W. :Rinsing Water + Leakage Water

REV	1	2	3	MADE	T.Yasukawa
BY				CKD	H.Takahashi
APVE				APVE	I.Nagahama
DATE				DATE	

Equipment NO.	Service	No. Req'd	Type of Equipment	Remarks
T-01	Equalization Tank	1	Vertical Cylindrical Type	Carbon Steel/Resin
			$8,719^{\phi} \times 10,635^{H} \times 540\ m^3$	Lining
T-02	1st Neutralization Tank	1	Vertical Cylindrical Type	Carbon Steel/Resin
			$3,872^{\phi} \times 4,595^{H} \times 45\ m^3$	Lining
T-03	2nd Neutralization Tank	1	Vertical Cylindrical Type	Carbon Steel/Resin
	/Oxidation Tank		$3,872^{\phi} \times 4,595^{H} \times 45\ m^3$	Lining
T-04	Flocculation Tank	1	Vertical Cylindrical Type	Carbon Steel/Resin
			$2,860^{\phi} \times 3,500^{H} \times 23\ m^3$	Lining
T-05	Clarifier	1	Vertical Cylindrical Type	Carbon Steel/Resin
			$10,000^{\phi} \times 4,500^{H}$	Lining
T-06	Thickener	1	Vertical Cylindrical Type	Carbon Steel/Epoxy
			$8,500^{\phi} \times 4,500^{H}$	Coating
T-07	Tower Mill	1	Vertical Cylindrical Type	Carbon Steel
			$1,050^{\phi} \times 7,700^{H}$	
D-01A/B	Polymer-A Tank	2	Vertical Cylindrical Type	FRP
			$800^{\phi} \times 1,000^{H} \times 0.4\ m^3$	
D-02A/B	Polymer-B Tank	2	Vertical Cylindrical Type	FRP
			$800^{\phi} \times 1,000^{H} \times 0.4\ m^3$	
D-03	Lime Tank	1	Vertical Cylindrical Type	FRP
			$1,910^{\phi} \times 3,000^{H} \times 8\ m^3$	

Note:

EQUIPMENT LIST for Egyptian Iron and Steel Co. MODIFIED

DOC. NO. EIS-BD-L01 (2/4)

CLIENT :Japan International Cooperation Agency
PROJECT :The Study on Industrial Waste Water Plant
PLANT :W.W.T. Demonstration Plant
WASTE W. Rinsing Water + Leakage Water

REV	1	2	3	MADE	T.Yasukawa
BY				CKD	H.Takahashi
APVE				APVE	I.Nagahama
DATE				DATE	

Equipment NO.	Service	No. Req'd	Type of Equipment	Remarks
Z-101	Acid Wastewater Pit	1	Rectangular, Underground	R.C with Resin lining
			$5{,}000^W \times 6{,}000^L \times 6{,}000^H \times 45\ m^3$	(out of Battery)
Z-01	Treated Water pond	1	Rectangular, Aboveground	Reinforced Concrete
			$4{,}500^W \times 5{,}000^L \times 2{,}500^H \times 45\ m^3$	
Z-02	Sludge Pit	1	Rectangular, Aboveground	R.C
			$4{,}500^W \times 5{,}000^L \times 2{,}500^H \times 45\ m^3$	
Z-03	Waste Water Pit	1	Rectangular, Aboveground	R.C
			$4{,}500^W \times 5{,}000^L \times 2{,}500^H \times 45\ m^3$	
PU-101	Acid Wastewater Pump	3	Horizontal Centrifugal Type	FC/Rubber Lining
A/B/C			$45\ m^3/h \times 30\ m \times 7.5\ kW$	
PU-01	Waste Water Pump	3	Horizontal Centrifugal Type	FC/Rubber Lining
A/B/C			$45\ m^3/h \times 15\ m \times 3.7\ kW$	
PU-02	Treated Water Pump	3	Horizontal Centrifugal Type	SCS
A/B/C			$45\ m^3/h \times 50\ m \times 11.5\ kW$	
PU-03A/B	Sludge Return Pump	2	Horizontal Centrifugal Type	SCS
			$30\ m^3/h \times 20\ m \times 3.7\ kW$	
PU-04A/B	Sludge Pump	2	Horizontal Centrifugal Type	
			$20\ m^3/h \times 20\ m \times 2.2\ kW$	
PU-05A/B	Thickened Sludge Pump	2	Horizontal Centrifugal Type	
			$20\ m^3/h \times 20\ m \times 2.2\ kW$	
PU-06A/B	Return Pump	2	Horizontal Centrifugal Type	
			$20\ m^3/h \times 20\ m \times 2.2\ kW$	

Note:

EQUIPMENT LIST for Egyptian Iron and Steel Co. MODIFIED

DOC. NO. EIS-BD-L01 (3/4)

CLIENT :Japan International Cooperation Agency

PROJECT :The Study on Industrial Waste Water Plant

PLANT :W.W.T. Demonstration Plant

WASTE W. : Rinsing Water + Leakage Water

REV	1	2	3	MADE	T. Yasukawa
BY				CKD	H. Takahashi
APVE				APVE	I. Nagahama
DATE				DATE	

Equipment NO.	Service	No. Req'd	Type of Equipment	Remarks
PU-07A/B	Polymer-A Pump	2	Reciprocating Type	SCS/SCS
			3 L/h×0.3 MPa×0.4 kW	
PU-08A/B	Polymer-B Pump	2	Reciprocating Type	SCS/SCS
			500 L/h×0.3 MPa×0.75 kW	
PU-09A/B	Lime Pump	2	Horizontal Centrifugal Type	SCS/SCS
			15 m^3/h×25 m×2.2 kW	
BL-01A/B	Blower	2	Root Type	FC/FC
			6 Nm^3/min×5 m×11 kW	
MX-01	1st Neutralization Mixer	1	Vertical Type	Carbon Steel with
			7.5 kW	Resin Lining
MX-02	Flocculator	1	Vertical Type	Carbon Steel with
			5.5 kW	Resin Lining
MX-03	Clarifier Rake	1	Center Drive Type	Carbon Steel with
			0.75 kW	Resin Lining
MX-04	Thickener Rake	1	Center Drive Type	Carbon Steel with
			0.75 kW	Resin Lining
MX-05A/B	Polymer-A Mixer	2	Vertical Type	SUS
			0.4 kW	
MX-06A/B	Polymer-B Mixer	2	Vertical Type	SUS
			0.4 kW	
MX-07	Tower Mill Screw	1	Vertical Type	SUS
			15 kW	
MX-08	Lime Mixer	1	Vertical Type	SUS
			1.5 kW	

Note:

EQUIPMENT LIST for Egyptian Iron and Steel Co. MODIFIED

DOC. NO. EIS-BD-L01

CLIENT :Japan International Cooperation Agency

PROJECT :The Study on Industrial Waste Water Plant

PLANT :W.W.T. Demonstration Plant

WASTE W. Rinsing Water + Leakage Water

REV	1	2	3	MADE	T.Yasukawa
BY				CKD	H.Takahashi
APVE				APVE	I.Nagahama
DATE				DATE	

Equipment NO.	Service	No. Req'd	Type of Equipment	Remarks
MZ-01A/B	Dehydrator	2	Centrifuge Type	SUS
			15 m^3/h×45 kW + 7.5 kW	Sharpies PM-50000
MZ-02A/B	Sludge Hopper	2	Vertical Type	Carbon Steel
			2,500^W×3,500^L×3,000^H×24 m^3	
MZ-03	Crusher	1	Ball Mill Type	Carbon Steel
			700 kg/h, 11 kW	
MZ-04	Feeder	1	Table Feeder Type	SUS
			700 kg/h, 0.4 kW	
MZ-05	Bucket Elevator	1	Vertical Type	Carbon Steel
			700 kg/h, 0.4 kW	
MZ-06	Belt Conveyer	1	700 kg/h, 0.4 kW	
MZ-07	Belt Conveyer	1	700 kg/h, 0.4 kW	

Note:

INSTRUMENT LIST for Egyptian Iron and Steel Co.   MODIFIED

DOC. NO. EIS-BD-L2-(1/3)

CLIENT :Japan International Cooperation Agency

PROJECT :The Study on Industrial W. W. Pollution Control

PLANT :W.W.T. Demonstration Plant

WASTE W. :Rinsing Water + Leakage Water

REV	1	2	3	MADE	T.Yasukawa
BY				CKD	H.Takahashi
APVE				APVE	I.Nagahama
DATE				DATE	

Equipment NO.	Service	No. Req'd	Type of Equipment	Remarks
AR-01	T-02 Inlet	1	pH 0～14	
			pH Analyzer	C.P.
AR-02	T-03 Outlet	1	pH 0～14	
			pH Analyzer	C.P.
FRCA-01	PU-01 Outlet Line	1	40 m^3/h～100 m^3/h	
			Flow Recording Controller	
FI-01	T-01 Inlet	1	40 m^3/h～100 m^3/h	
			Flow Meter	
FI-02	Blower Outlet	1	2～10 Nm^3/min	
			Flow Meter	
FI-03	PU-03A/B Outlet	1	10 m^3/h～40 m^3/h	
			Magnetic Flow Meter	
FI-04	PU-04A/B Outlet	1	10 m^3/h～40 m^3/h	
			Magnetic Flow Meter	
FI-05	PU-02A/B Outlet	1	40 m^3/h～100 m^3/h	
			Flow Meter	
FI-06	PU-05A/B Outlet	1	10 m^3/h～40 m^3/h	
			Magnetic Flow Meter	
FS-01	AP Line	1	Flow Integrator	
FIC-01	Return Line	1	20 m^3/h～10 m^3/h	
			Flow Indicating Controller	
LS-01	Z-101 Acid Wastewater Pit	1	1,000 mm～1,500 mm	
			Level Switch HH,H,L,LL	
LS-02	Z-03 Wastewater Pit	1	1,000 mm～2,000 mm	
			Level Switch H,L	

Note: C.P. = Center Panel Mount

L.P. = Local Panel Mount

INSTRUMENT LIST for Egyptian Iron and Steel Co. MODIFIED

DOC. NO. EIS-BD-L2-(2/3)

CLIENT :Japan International Cooperation Agency

PROJECT :The Study on Industrial W. W. Pollution Control

PLANT :W.W.T. Demonstration Plant

WASTE W. : Rinsing Water + Leakage Water

REV	1	2	3	MADE	T.Yasukawa
BY				CKD	H.Takahashi
APVE				APVE	I.Nagahama
DATE				DATE	

Equipment NO.	Service	No. Req'd	Type of Equipment	Remarks
LS-03	Z-01 Treated Water Pond	1	500 mm～2,000 mm	
			Level Switch H,L	
LS-04	Z-02 Sludge Pit	1	500 mm～2,000 mm	
			Level Switch H,L	
LIA	T-01 Equalization Tank	1	1,000 mm～9,000 mm	
			Level Indicating Alarm	
LG-01A/B	D-01A/B Polimer A Tank	2	Tubular	
			Level Gage	
LG-02A/B	D-02A/B Polimer B Tank	2	Tubular	
			Level Gage	
LC-01	D-03 Lime Tank	2	Level Controller	
			1,000 mm～2,500 mm	
PI-01A/B/C	PU-101A/B/C Outlet	3	Diaphragm	
			Pressure Indicator	
PI-02	WI Line	1	Buldon Tube	
			Pressure Indicator	
PI-03	AP Line	1	Buldon Tube	
			Pressure Indicator	
PI-04	Instrument Air Line	1	Buldon Tube	
			Pressure Indicator	
PI-05A/B/C	PU-01A/B/C Outlet	3	Diaphragm	
			Pressure Indicator	
PI-06A/B	BL-01A/B Outlet	2	Buldon Tube	
			Pressure Indicator	
PI-07A/B	PU-03A/B Outlet	2	Diaphragm	
			Pressure Indicator	

Note: C.P. = Center Panel Mount

L.P. = Local Panel Mount

PU-05A/B Outlet

INSTRUMENT LIST for Egyptian Iron and Steel Co.   MODIFIED

DOC. NO. EIS-BD-L2-(3/3)

(3/3)

CLIENT :Japan International Cooperation Agency
PROJECT :The Study on Industrial W. W. Pollution Control
PLANT :W.W.T. Demonstration Plant
WASTE W. :Acid Wastewater

REV	1	2	3	MADE	T.Yasukawa
BY				CKD	H.Takahashi
APVE				APVE	I.Nagahama
DATE				DATE	

Equipment NO.	Service	No. Req'd	Type of Equipment	Remarks
PI-08A/B	PU-04A/B Outlet	2	Diaphragm	
			Pressure Indicattor	
PI-09A/B	PU-06A/B Outlet	2	Diaphragm	
			Pressure Indicattor	
PI-10A/B/C	PU-02A/B/C Outlet	3	Buldon Tube	
			Pressure Indicattor	
PI-11A/B	PU-05A/B Outlet	2	Diaphragm	
			Pressure Indicattor	
PI-12A/B	MZ-01A/B Inlet	2	Diaphragm	
			Pressure Indicattor	
PI-13A/B	PU-09A/B Outlet	2	Diaphragm	
			Pressure Indicattor	
PI-14A/B	PU-07A/B Outlet	2	Diaphragm	
			Pressure Indicattor	
PI-13A/B	PU-08A/B Outlet	2	Diaphragm	
			Pressure Indicattor	
TQA-01	MX-03 Clarifier Rake	1	Torque Alarm	
TQA-02	MX-04 Thickener Rake	1	Torque Alarm	

Note: C.P. = Center Panel Mount
L.P. = Local Panel Mount

DOC.NO. : EIS-BD-60-L1

INDUCTION MOTOR LIST

MODIFIED

CLIENT :Japan International Cooperation Agency
PROJECT :The Study on Industrial Waste Water Plant
PLANT :Egyptian Iron and Steel Co.
WASTE W. :Acid Wastewater

REV	1	2	3	MADE	
BY				CKD	
APVE				APVE	
DATE				DATE	

Motor No.	Service	No. Required	Type	Output		Speed Chrst	Revolu tion	Pole / r.p.m	V-Φ-Hz	Time Rating	Starting		Insula tion	Enclose.	Cable	Mounting	Drive	Bearing	Acc.	Location	Color Finish	Remarks
				Estimate	Final						Currrent	Torque										
PU-101-A-C-M	Acid wastewater Pump	3	SC	7.5		C	CW	4/1500	380-3-50	C				TEFC		H	D			OD		
PU-01A-C-M	Waste water Pump	3	SC	3.7		C	CW	4/1500	380-3-50	C				TEFC		H	D			OD		
PU-02A-C-M	Treated Water Pump	3	SC	11.5		C	CW	4/1500	380-3-50	C				TEFC		H	D			OD		
PU-03A/B-M	Sludge Retun Pump	2	SC	3.7		C	CW	4/1500	380-3-50	C				TEFC		H	D			OD		
PU-04A/B-M	Sludge Pump	2	SC	2.2		C	CW	4/1500	380-3-50	C				TEFC		H	D			OD		
PU-05A/B-M	Thickened Sludge Pump	2	SC	2.2		C	CW	4/1500	380-3-50	C				TEFC		H	D			OD		
PU-06A/B-M	Return Pump	2	SC	2.2		C	CW	4/1500	380-3-50	C				TEFC		H	D			OD		
PU-07A/B-M	Polymer-A Pump	2	SC	0.4		C	CW	4/1500	380-3-50	C				TEFC		H	G			OD		
PU-08A/B-M	Polymer-B Pump	2	SC	0.75		C	CW	4/1500	380-3-50	C				TEFC		H	G			OD		
PU-09A/B-M	Lime Pump	2	SC	2.2		C	CW	4/1500	380-3-50	C				TEFC		H	D			OD		
MX-01-M	1st Neutralization Mixer	1	SC	7.5		C	CW	4/1500	380-3-50	C				TEFC		V	G			OD		
MX-02-M	Flocculator	1	SC	5.5		C	CW	4/1500	380-3-50	C				TEFC		V	G			OD		
MX-03-M	Clarifier Rake	1	SC	0.75		C	CW	4/1500	380-3-50	C				TEFC		V	G			OD		
MX-04-M	Thickener Rake	1	SC	0.75		C	CW	4/1500	380-3-50	C				TEFC		V	G			OD		
MX-05-M	Polymer A Mixer	2	SC	0.4		C	CW	4/1500	380-3-50	C				TEFC		V	G			OD		
MX-06-M	Polymer B Mixer	2	SC	0.4		C	CW	4/1500	380-3-50	C				TEFC		V	G			OD		
MX-07-M	Tower Mill Screw	1	SC	15		C	CW	4/1500	380-3-50	C				TEFC		V	G			OD		
MX-08-M	Lime Mixer	1	SC	1.5		C	CW	4/1500	380-3-50	C				TEFC		V	G			OD		
MZ-01A/B-M	Dehydrator (main)	2	SC	45		C	CW	4/1500	380-3-50	C				TEFC		H	G			ID		
MZ-01A/B-M	Dehydrator (Backdrive)	2	SC	7.5		C	CW	4/1500	380-3-50	C				TEFC		H	G			ID		
MZ-03-M	Crusher	1	SC	11		C	CW	4/1500	380-3-50	C				TEFC		H	G			OD		
MZ-04-M	Feeder	1	SC	0.4		C	CW	4/1500	380-3-50	C				TEFC		H	G			OD		
MZ-05-M	Bucket Elevator	1	SC	0.4		C	CW	4/1500	380-3-50	C				TEFC		H	B			OD		
MZ-06-M	No.1 Belt Conveyer	1	SC	0.4		C	CW	4/1500	380-3-50	C				TEFC		H	B			OD		
MZ-07-M	No.2 Belt Conveyer	1	SC	0.4		C	CW	4/1500	380-3-50	C				TEFC		H	B			OD		
BL-01A/B-M	Blower	2	SC	11		C	CW	4/1500	380-3-50	C				TEFC		H	B			ID		

Notes:

1. Type : SC = Squirrel Cage. W = Wound Rotor.
2. Speed : C = Constant. M = Multi. A = Adjustable. V = Varying.
3. Revolution Direction : Direction when viewed from coupling side.
   CW = Clockwise. CCW = Counter-Clockwise.
4. Voltage : Rated Voltage
5. Time Rating : C = Continuouse. ST = Short Time. P = Periodic.
6. Enclosure : TEFC = Totally-Enclosed Fan-Cooled.
   DR = Drip-Proof.
7. Cable(or Wire) : T = Top. B = Bottom. S = Side. H = Hub for conduit tube or flexible tube.
8. Mounting : H = Horizontal. V = Vertical
9. Drive : D = Direct. B = Belt. C = Chain. G = Gear.
10. Location : ID = Indoor. OD = Outdoor.

Phase 1 Study

Overall Schedule for Implementation of Demonstration Plant (Preliminary)

Dec. 11, 1999

Major Activities for Implementation

1 Preparatory Activities before Bid for Supply and Construction of Demonstration Plant
- 1.1 Selection of Demonstration Factory — 11/24'99
- 1.2 Compilation of Detailed Design Package, including:
  - List of Materials and Equipment
  - List of Construction works
- 1.3 Short Listing of Suppliers who can supply the Plant as a whole
- 1.4 Short Listing of Construction Contractors in Egypt to be qualified by JICA
- 1.5 Agreement for Implementation of Phase 2 Study between JICA and Egyptian Side
- 1.6 Contract between JICA and Phase 2 Study Team

2 Supply of the Plant
- 2.1 Selection of the Plant Supplier by Competitive Bid
- 2.2 Design Verification and Development by Supplier
- 2.3 Procurement of Materials and Equipment by Supplier
- 2.4 Manufacturing and Preassembling as necessary
- 2.5 Inspection and Test before Shipment
- 2.6 Shipping

3 Construction of the Plant
- 3.1 Selection of Construction Contractor by Qualification by JICA and Study Team
- 3.2 Site Preparation and Temporary Facilities Installation
- 3.3 Civil & Building Works: including Foundations, Concrete Basins, Control Room, Underground Piping, etc.
- 3.4 Shop fabrication and installation of Locally procured Tanks, Structures, Pipes, etc.
- 3.5 Unloading, Customs Clearance, Inland Transportation of Imported Mat'l & Eq
- 3.6 Receiving, Storing
- 3.7 Equipment Installation
- 3.8 Piping
- 3.9 Electrical
- 3.10 Instrumentation
- 3.11 Painting
- 3.12 Precommissioning
- 3.13 Mechanical Completion
- 3.14 Commissioning

4 Operation of the Plant
- 4.1 Performance Test
- 4.2 Operation and Demonstration

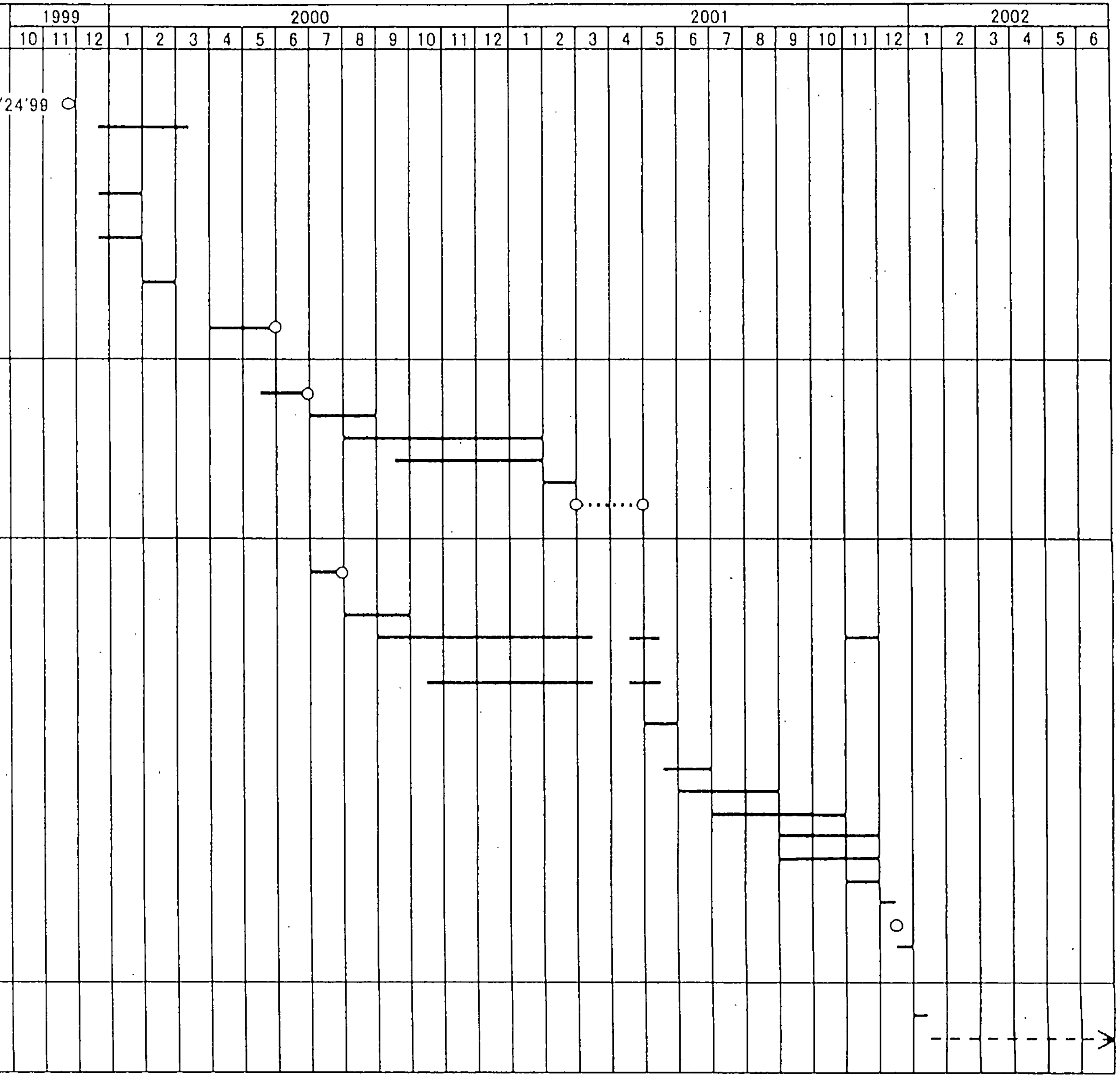


Table ESTIMATED CONSTRUCTION COST FOR EISCO).

2000/3/23

ITEM	Inside B/L		Outside B/L		Paid by (1000yen)	
	Japan(Myen)	Egypt (LE)	Japan(Myen)	Egypt (LE)	Japan	Egypt
1. Equipment, Instruments						
(1)Machinery	164,500					
(2)Pipings	8,830					
(3)Electrical	15,400					
(4)Instruments	17,540					
(5)Test Equipment	3,000					
1. Subtotal	**209,270**	**0**	**0**	**0**	**209,270**	**0**
2. Field Works						
(1)Tank Installation		1,075,868				
(2)Corrosion Proof		474,792				
(3)Instal. Machines		46,900				
(4)Piping		453,127		1,814,336		61,700
(5)Foundation		532,758				0
(6)RC Basins		300,590				0
(7)Paving, Road		42,888				0
(8)Structure		611,567				0
(9)pipe Rack, Stage		55,271				0
(10)Painting		165,600				0
(11)Electrical		132,000				0
(12)Instrumentation		150,000				0
(13)Test Operation		50,000				0
2. Subtotal	**0**	**4,091,361**	**0**	**1,814,336**	**139,100**	**61,700**
(1+2)Total	**348,376 x1000yen**		**61,687 x1000yen**			
3. Indirect Cost						
(1)Packing, Ocean Freight	19,500				19,500	0
(2)Tax., In Transportation*1		1,779,000				60,500
(3)Temporary Works*2		245,482		---	8,300	
(4)Construction Expense*3		1,022,840		---	34,800	
(5)Insurance, Tax *4		9,406		1,666	300	100
(6)Supervisor Field Expense	10,000				10,000	
3. Subtotal	**29,500**	**3,056,728**	**0**	**1,666**	**72,900**	**60,600**
(1+2+3) Total	**238,770**	**7,148,089**	**0**	**1,816,002**	**421,270**	**122,300**
Total (1000yen)	**238,770**	**243,100**	**0**	**61,800**		
[IBL/OBL] Total (1000yen)	**481,870**		**61,800**			
Grand Total	**543,670**				**421,370**	**122,300**

Note*1 :(Equipment/Instruments + packing/Ocean Freight) x 25%

Note*2 : Field Works Cost x 6%

Note*3 : Field Works Cost x 25%

Note*4 :[1+2 (except Superviser Fee)] x 2.7%

Notes:(a) Piping Works except discharge pipeline is allocated in Inside B/L.

(b)The Cost is estemated as Japanese Contractor basis.

Unit Cost for Estimation of W.W.T. Demonstration Plant (Reference)

Factory Name: Egyptian Iron and Steel Co.
Design Case: Basic Design (Modified Case)

1. Major Equipment

Equipment Name	Unit Cost [x10^3Yen]	Note
(1) Acid water pumps	2,300~3,600	Material: SCS
(2) Clarifier Rake	15,000	1 set
(3) Thickener Rake	12,000	1 set
(4) Dehydrator	25,000	2 sets
(5) Limestone grinding System	19,000	1 set
(6) Motor Control Center	12,000	
(7) Center Control Panel	3,000	1 set

2. Field Work

Work Item	unit	unit Cost[LE]	Note
(1) Site Preparation	[m^2]	8	
(2) Civil (Earth Work)	[m^3]	34	
(3) RC Work	[m^3]	1,500	Foundation, Water Basin
(3) Storage Tank	[ton]	3,430	Equalization Tank, Chemical tank Neutralization Tanks
(4) Structural Steel	[ton]	2,000	Pipe rack, Operating Stage
(5) Equipment Installation	[ton]	400	Pumps, Clarifier rakes, Dehydrator
(6) Piping	[ton]	3,970	Except valves
	[in-m]	30	Except valves
(7) Painting	[m^2]	50	
(8) Local Building	[m^2]	2,600	W.W.T Control Room
(9) Electrical	[cable-m]	3	

Running Cost-Egyptian Iron and Steel Co.

MODIFIED

Items	Treating Capacity (m^3/h)	Feeding Ratio (mg/L)	Consump. (kg/h)	Unit Cost (LE/kg)	Cost-1 (LE/h)	Cost-2 (LE/day)	Cost-3 LE/year)	Unit Cost (LE/m^3)	Remarks
1.1 Chemical Cost									
1) CaO	90	4,000	360	0.15	54.00	1,296	427,680	0.600	
2) Polymer-A (Anionic)	90	0.1	0.01	27	0.24	6	1,925	0.003	
3) Polymer-B (Anionic)	—	—	2.4	27	64.80	1,555	513,216	0.720	
Sub-Total	—	—	—	—	119.04	2,857	942,821	1.323	
			kWh/d	LE/kWh					
1.2 Power Consumption			2,761	0.12	13.80	331.28	109,323	0.153	
			m^3/day	LE/m^3					
1.3 Industrial Water or Potable Water			200	0.528	4.40	105.60	34,848	0.049	
1.4 Maintenance Fee	15,144,000				57.36	1376.73	454,320	0.637	
(Plant Cost * 3 %/year) 514,900,000/34=15,144,000 LE									
Item 1 Total								2.16	
			Person/d	LE/P/year					
2. Operator including sludge handling	4 Persons*3 Shift+1S		16	10,000	20.20	484.85	160,000	0.22	
	(2 persons : operation								
	2 persons : sludge)								
Total Operation Cost	—	—	—	—	215	5,155	1,701,311	2.39	

Power Consumption

Tag No.	kW	No. of Ope.	Operation	Consump.
PU-101	7.5	2	24	360.00
PU-01	3.7	2	24	177.60
PU-02	11.5	2	24	552.00
PU-03	3.7	1	24	88.80
PU-04	2.2	1	24	52.80
PU-05	2.2	1	24	52.80
PU-06	2.2	1	24	52.80
PU-07	0.4	1	24	9.60
PU-08	0.4	1	24	9.60
PU-09	2.2	1	24	52.80
MX-01	7.5	1	1.5	11.25
MX-02	5.5	1	24	132.00
MX-03	0.75	1	24	18.00
MX-04	0.75	1	24	18.00
MX-05	0.4	1	1	0.40
MX-06	0.4	1	24	9.60
MX-07	15	1	24	360.00
MX-08	1.5	1	24	36.00
MZ-01	52.5	1	24	1260.00
MZ-03	11	1	24	264.00
MZ-04	0.4	1	24	9.60
MZ-05	0.4	1	12	4.80
MZ-06	0.4	1	12	4.80
MZ-07	0.4	1	24	9.60
BL-01	11	1	24	264.00
Total	—	—	—	3,450.85 kWh/d

Client: JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Project Name: THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT

Factory Name: EGYPTIAN IRON AND STEEL CO.

BASIC DESIGN
(MODIFIED)

Document Title: STUDY REPORT FOR W.W.T. DEMONSTRATION PLANT

Issued Date September 2000

Consultant: JICA STUDY TEAM

CHIYODA DAMES AND MOORE CO.

CHIYODA CORPORATION

1. Purpose

This report states the studies and discussions concerning to the detail design for Wastewater Treating Plant for Egyptian Iron and Steel Co. (hereinafter EIS)、 that treats wastewater from the Pickling Plant in Cold Rolling Mill Factory.

The new wastewater treating plant is defined as Modified Wastewater Treating Plant (Modified Case) .

2. Basic Design (Modified Case)

2.1 Design Conditions

[1]

The Wastewater Treating Plant is designed to treat the rinsing water from the Pickling Plant except spent sulfuric acid after the existing Spent Sulfuric Acid Recovery Plant will be improved in the future.

[2]

In case that the Spent Sulfuric Acid Recovery Plant can not be operated, spent sulfuric acid should be neutralized and disposed independently.

[3]

The following water supply piping system to the Pickling Plant should be improved (Installation of new water supply pumps, replacement of piping) ;

(1) Process water is supplied as spray water of Rinsing Bath and side washing water of Pickling Bath.

(2) Potable water is supplied as make-up water to Rinsing Bath

2.2 Design Package

The following design drawings and documents were prepared:

(1) Process Flow Diagram (PFD)

(2) Engineering Flow Diagram (EFD)

(3) Layout

(4) Skeleton Drawings of Major Equipment

(5) Single Line Diagram for Motor Control Board

(6) Equipment List, Instrument List, Motor List

(7) Construction Cost, Running Cost

3. Existing Wastewater Sewer System

The existing wastewater sewer system is shown on the attached drawings-1.

Almost all wastewater is recycled through the lagoon, and a part of wastewater is discharged to the Desert approx. 10km from the Factory.

4. Design Conditions

4.1 Wastewater to be treated

The wastewaters to be treated are as follows;

(1) Rinsing Water (including side washing water of Pickling Plant) —Continuously

(2) Leakage Water in Wastewater Pipe Trench Continuously

4.2 Wastewater Flow Rate and Qualities

(1) Wastewater Flow Rate

The results of flow rate measurement are shown on Table-1.

Table-1 Wastewater Flow Rate

Wastewater	Ave. Flow Rate [m^3/h]	Min-Max Flow [m^3/h]	Note
Rinsing Water	16.9	9.8 – 21.5 peak Max. 32.0	Electro-magnetic Type---Continuous
Leakage Water	2.0	1.1 – 5.6 (11.2)*	Electro-magnetic Type—Spot (6 times)

Note 1. Rinsing Water is always discharged except long stoppage of Pickling Plant.

2. Peak Max. Flow of Rinsing Water means the peak value recorded on the Flow Recorder Sheet.

3. Leakage water decreases during stoppage of Pickling Plant operation, but flow rate will not reach to zero.

4. * mark: The data is measured on 10th February at pre-survey.

5. Pickling Plant stopped several times during our survey due to decreasing of steam pressure and mechanical troubles.

(2) Wastewater Qualities

The survey results are as follows;

1) Rinsing Water

Table-2 Rinsing Water Qualities

Item		Ave.	Min.–Max.	Note
H_2SO_4	[mg/l]	3,300	1,000– 7,600	
$FeSO_4$	[mg/l]	4,100	500–10,700	
pH	[–]	1.17	0.65–1.53	except pH4.6
Total Fe	[mg/l]	681	169–1,350	
Fe^{2+}	[mg/l]	501	111– 923	
Fe^{3+}	[mg/l]	180	38– 595	
COD	[mg/l]	134	62– 227	
TDS	[mg/l]	2,940	720–7,725	
Water Temp.	[℃]	45.0	37.9–49.3	

Note 1. Number of samples=13

2. pH is recorded continuously.

2) Leakage Water

Table-3 Leakage Water Qualities

Item	Ave.	Min.－Max.	Note
H_2SO_4 [mg/l]	43,600	22,700－66,100	
$FeSO_4$ [mg/l]	31,700	8,700－61,200	
Total Fe [mg/l]	26,158	3,102－55,800	
Fe^{2+} [mg/l]	22,203	2,078－45,833	
Fe^{3+} [mg/l]	3,955	1,024－13,300	
pH [－]	2.20	1.00－3.75	
Water Temp. [℃]	27.9	23.8－32.2	

Note 1. Number of samples＝6

3) Calculated Wastewater Flow Rate and Qualities to be treated

The wastewater to be treated is mixed wastewater of rinsing water and leakage water. Therefore, wastewater flow rate and qualities are estimated based on calculation results.

Table-4 Calculated Flow Rate and Qualities to be treated

Item	Ave.	Min.－Max.	Note
Flow Rate [m^3/h]	18.9	10.9 － 27.1	
H_2SO_4 [mg/l]	7,565	3,296 －13,790	
$FeSO_4$ [mg/l]	7,021	1,368 －16,044	
Water Temp. [℃]	43.2	36.2 － 47.2	

Note. Wastewater qualities are calculated at average flow rate, it means that maximum concentration must not occur at the maximum flow rate.

4.3 Design Wastewater Flow Rate and Qualities

4.3.1 Design Conditions at Present

(1) Wastewater Flow Rate

1) Rinsing water

[Average flow rate]

＝Average flow rate measured (16.9 [m^3/h]) x (1 ＋approx.20%)

＝ 20 [m^3/h]

[Maximum flow rate]

＝30 [m^3/h]

Maximum flow rate measured at sampling period was 21.5 [m^3/h], but it is decided considering 32 [m^3/h] of maximum flow rate that had been recorded on the recorder chart.

2) Leakage Water

[Average flow rate]

=5.0 [m^3/h]

The average flow rate measured during survey was 2.0 [m^3/h], but enough allowance is considered because of old wastewater piping adhered to scale.

[Maximum flow rate]

=10 [m^3/h]

The maximum flow rate measured during survey was 5.6 [m^3/h], and 11.2[m^3/h] had been recorded during pre-survey.

(2) Wastewater Qualities

1) The average wastewater qualities equal to the average values analyzed at the laboratory.

The average pollutant load:

It is defined as follows;

Average pollutant load =(Average flow rate) x (Wastewater qualities)

2) Concentration at the maximum flow rate:

It is assumed that the average pollutant load is always constant, only water increases at the maximum flow rate. Therefore, the concentration at the maximum flow rate is calculated as follows;

Concentration at the maximum flow rate:

=(Average pollutant load) / (Maximum flow rate)

Table-5 Basic Wastewater Flow Rate and Qualities

Item		Rinsing Water	Leakage Water	Mixed Wastewater
Flow Rate [m^3/h]	Ave.	20	5	25
	Max.	30	10	40
H_2SO_4 Conc. [mg/l]	Ave.	3,300	43,600	11,360
	Flow Max.	2,200	21,800	7,100
H_2SO_4 Load [kg/h]	Ave.	66	218	284
	Flow Max.	66	218	284
$FeSO_4$ Conc. [mg/l]	Ave.	4,100	31,700	9,620
	Flow Max.	2,733	15,850	6,013
$FeSO_4$ Load [kg/h]	Ave.	82	158.5	240.5
	Flow Max.	82	158.5	240.5

4.3.2 Design Base considering to Improvement of Water Supply Unit

(1) Necessity of Consideration

We are informed by EIS that flow rate of Rinsing Water (they called as Acid Wash Water) is 150 [m^3/h]. It has been cleared that 150 [m^3/h] is the design base data by Soviet Manufacturer of Pickling Plant and nobody has confirmed to be correct or not.

1) Based on our survey results, wastewater flow rate from Pickling Plant was

measured to be around 20～30 [m^3/h].

2) The estimated flow rate based on the pipe size, opening of valves and water pressure may be 60～70 [m^3/h] (Refer to the attached table).

3) Flow meter of ultra-sonic type could not be worked to the supply water pipeline to Rinsing Bath. One of the reasons is supposed that ultra-sonic transmittal / receiver ability is interfered by much scale on the interior surface of pipe.

On the other hand, it was informed that EIS has his plan to install new water feeding pumps and to replace water supply pipes in order to increase supply water flow rate.

(2) Design Base of Wastewater Flow Rate and Qualities

1) $[\text{Wastewater flow rate}]_{\text{Design Base}}$

(a) Basic wastewater flow rate

Maximum flow rate based on Table-5

· Rinsing water:	30 [m^3/h]
· Leakage water:	10 [m^3/h]
Total	40 [m^3/h]

(b) Design base of Maximum flow rate

Considering future improvement, the maximum flow rates were decided as follows;

i) Rinsing water:

Supply water flow rate will be two times of basic flow rate.

30 [m^3/h] x 2 = 60 [m^3/h]

Leakage water:

The flow rate must not increase anymore.

10 [m^3/h]

Wastewater to be treated (=Rinsing Water+Leakage Water):

60 [m^3/h] + 10 [m^3/h] = 70 [m^3/h]

ii) $[\text{Wastewater flow rate}]_{\text{Design Base}}$:

It is taken as approx. 30% design allowance (margin).

70 [m^3/h] x (1+0.3) = 91→ 90 [m^3/h]

2) $[H_2SO_4]_{\text{Design Base}}$

(a) $[H_2SO_4\ \text{load}]_{\text{Design Base}}$

i) At basic wastewater flow rate (40[m^3/h])

284 [kg/h] (from Table-5)

It is taken approx. 1/3 (33.3%) as a design allowance (margin).

284 [kg/h] x (1+0.33)= 377.7→380 [kg/h]

ii) At the maximum flow rate (90[m^3/h]),

380 [kg/h] (as same as the above)

(b) $[H_2SO_4\ \text{conc.}]_{\text{Design Base}}$

i) At basic wastewater flow rate (40[m^3/h])

{ 380 [kg/h]／40[m^3/h] } x 10^3 = 9,500 [mg/l]

ii) At the maximum flow rate (90[m^3/h]) ,

{ 380 [kg/h]／90[m^3/h] } x 10^3 = 4,220→4,300 [mg/l]

3) [$FeSO_4$]Design Base

(a) [$FeSO_4$ load]Design Base

Based on Table-5, the ratio "a" of [$FeSO_4$] /[H_2SO_4] is as follows;

a =240.5/284 = 0.85

The other hand, the ratios calculated based on the data given by EIS are;

- Dec.12～16, 1999 a=1.04
- Jan.17～30, 2000 a=2.13

Therefore, the ratio is assumed to be 1.0, that is, concentration of $FeSO_4$ is same as H_2SO_4.

i) At basic wastewater flow rate (40[m^3/h]) :

380 [kg/h]

ii) At the maximum flow rate :

380 [kg/h] (same as the above)

(b) [$FeSO_4$ conc.]Design Base

i) At basic wastewater flow rate (40[m^3/h]) :

=380[kg/h]/40[m^3/h]=9,500 [mg/l]

ii) At the maximum flow rate (90[m^3/h]) :

=380[kg/h]/90[m^3/h]=4,300 [mg/l]

Table－6 Design Base of Wastewater Flow Rate and Qualities

	Flow Rate Max.	Conc. Max	Note
Flow Rate [m^3/h]	40	90	
H_2SO_4 [mg/l] [kg/h]	9,500 380	4,300 380	
$FeSO_4$ [mg/l] [kg/h]	9,500 380	4,300 380	
pH [－]	0.5－1.0	0.5－2.0	

4.4 Target of Treated Water

(1) Water quality of dispose water

Dispose water quality is applied to the most stringent Wastewater Discharge Regulation of Egyptian Standard , that is 「Discharge into Underground Reservoir & Nile Branches / Canals」 of Law 48/82.

(2) Consideration of TDS

Rinsing water contains high concentration of sulfuric acid, therefore TDS concentration of rinsing water is also too high (several 1,000mg/l). The treated

water (neutralized wastewater by lime) may contain approx. 2,000mg/l of gypsum in solution (saturate concentration).
TDS is specified as 800 mg/l at the Wastewater Discharge Regulation in Egypt.
In order to meet the regulation, the following two methods may be applied.

1) Dilution:
   A large amount of low TDS water will be required.
2) Desalination
   The expensive desalination plant such as RO (reverse osmosis), Ion Exchanger (resin, membrane) , Evaporator will be required. But, in this case, a little condensed waste may be generated.

In this basic design, neither dilution nor desalination is applied. Therefore, discharge wastewater quality meets to Law 48/82 except to TDS.

5. System Design

5.1 Wastewater Treating Plant

The Wastewater Treating Plant consists of the following units:

(1) Wastewater Collecting Unit : Area "A"
(2) Wastewater Treating Unit : Area "B"

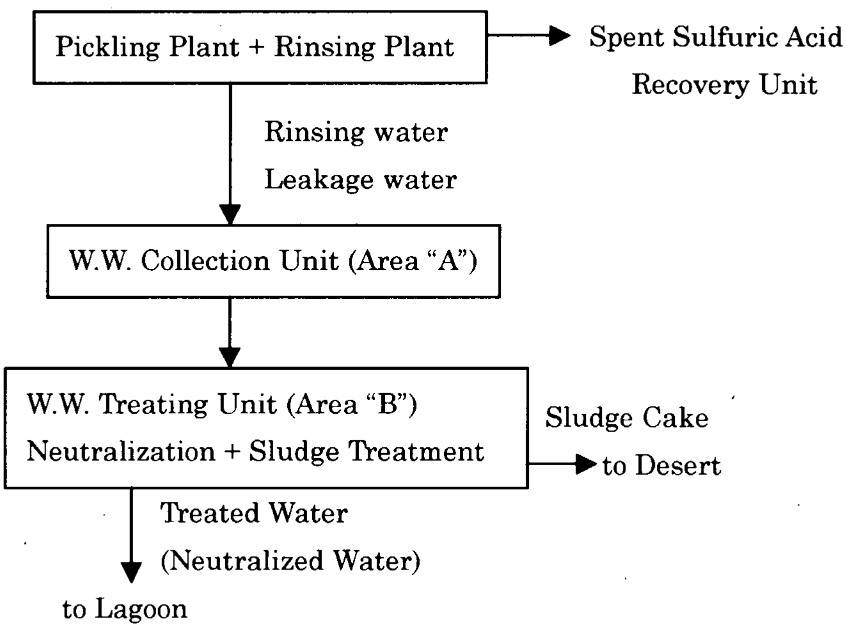


Fig.-1 Flow Scheme of Wastewater

5.2 Collection and Supply of Wastewater

(1) A new receiving pit will be provided besides the existing pipe trench outside of Cold Roll Mill Plant (Area "A") .
(2) Two acid wastewater pumps controlled automatically by water level will be

provided at the above receiving pit.

5.3 Wastewater Treating System

(1) Wastewater quality to be treated

1) p H control

pH of wastewater from Pickling Plant is 0.5-2. Therefore, neutralization is required.

2) COD

COD of wastewater is higher than regulation value (COD=40[mg/l]. But almost COD components come from reducing Fe^{2+}, so that, COD value is easily reduced by air-oxidization.

3) Oil & Grease :

Oil and grease is contaminated, but not so high, so that it may be removed during neutralization coagulation process. Therefore, an oil separator is not required.

4) Heavy metals :

High concentration of soluble Fe is contained. It can be removed by neutralization at around pH 9 . Any other heavy metals are not contained or a little negligibly.

(2) Design of Wastewater Treating System

The wastewater treatment plant consists of the following treating units:

(Refer to Section 7)

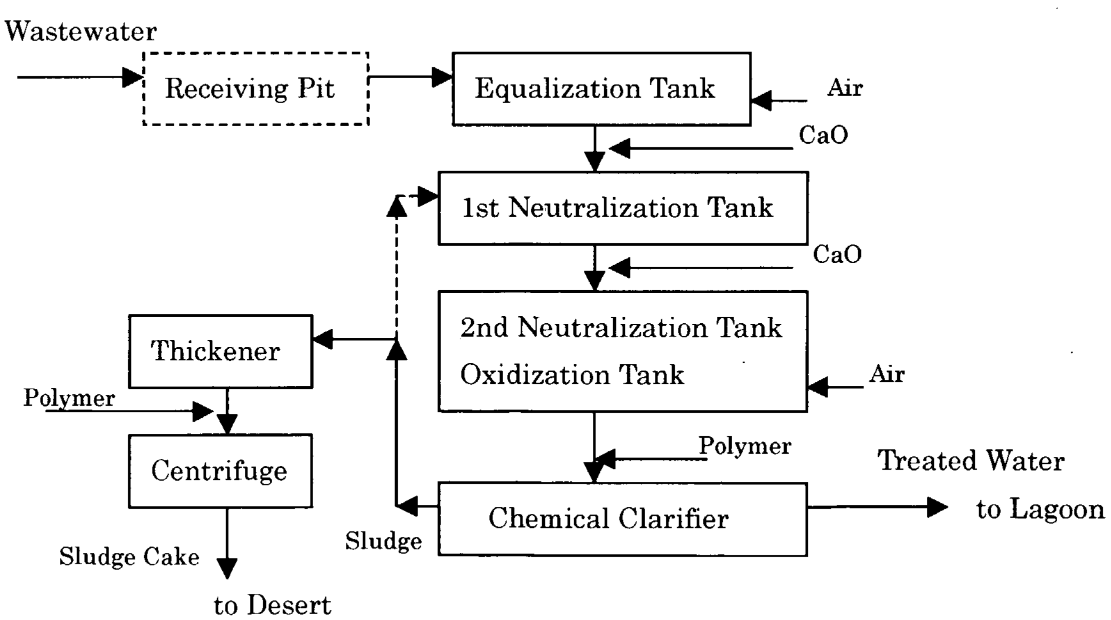


Fig-2 Flow Scheme of Wastewater Treatment System

5.4 Description of Treating Unit

(1) Equalization Tank

1) Purpose

(a) Wastewater qualities of rinsing water and leakage water are very deferent.

(b) Flow rate of wastewater and qualities are not always constant.

(c) Pickling Plant may stop several times in a day.

To treat such wastewater stably, Equalization Tank is provided to equalize flow rate and qualities of wastewater. And, aeration devices are provided in the tank to promote equalization and air-oxidization.

2) Specification, design base

(a) Shape: Open top tank of circular and vertical type, installed above ground.

(b) Material: Carbon steel with resin lining on the inner surface.
Steel is easy to fabricate at shop and field, and inexpensive.

(c) Volume: equal to 6 hours-retention time of maximum flow rate as general.

(d) Attachment: Air bubbling devices (blower, air piping).

(2) 1st Neutralization Unit

1) Purpose

Described on the above, wastewater is neutralized at pH 3-4 by addition of CaO in the tank. In the tank, gypsum will generate under the following reaction:

$$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \cdot 2H_2O \downarrow \quad \cdots\cdots\cdots\cdots \quad (1)$$

2) Specification, Design base

2-1) 1st neutralization tank

(a) Shape: Open top tank of circular and vertical type, installed above ground.

(b) Material: Carbon steel with resin lining on the inner surface.

(c) Volume: equal to 30 minutes-retention time of maximum flow rate considering reaction time.

(d) Attachment: Vertical type of mixer

(e) All gypsum slurry will be sent to 2nd neutralization tank not to draw-off gypsum.

2-2) Lime Injection Unit

Alkali chemical is applied to CaO stone used same as the existing plant.

CaO injection unit consists of the following equipment:

(a) Crusher

(b) Bucket elevator

(c) Tower type of mill

(d) Injection pumps

(e) pH control system (Instrument, control valves)

3) Description

In order to neutralize wastewater of pH 0.5-2, a large amount of CaO is consumed

at pH 3-4 and gypsum ($CaSO_4$) slurry is produced.
Amount of gypsum slurry is not so much because H_2SO_4 concentration of wastewater is not so high. Therefor, gypsum is not recovered and gypsum slurry is sent to 2nd neutralization tank.

(3) 2nd Neutralization Unit

1) Purpose

In order to neutralize at pH 8.5-9 completely, more CaO is injected and mixed to gypsum slurry of pH 3-4. And air is injected from the bottom of tank to accelerate oxidization of slurry.
In this reaction, ferrous sulfate ($FeSO_4$) will be ferric sulfate ($Fe_2(SO_4)_3$), and ferric hydrate ($Fe(OH)_3$) by oxidization, then they will be settled at the sedimentation tank.
Reaction at 2nd neutralization is as follows:

$$FeSO_4 + 5H_2O + 1/2\ O_2 \rightarrow Fe(OH)_3 \downarrow + H_2SO_4 \quad \cdots\cdots(2)$$
$$Fe(OH)_3 + H_2SO_4 + Ca(OH)_2 \rightarrow Fe(OH)_3 + CaSO_4 \cdot 2H_2O + H_2O \quad \cdots\cdots(3)$$

The unit consists of the following equipment to complete the above reactions:

(a) 2nd neutralization tank
(b) Coagulation tank
(c) Sedimentation tank
(d) Chemical injection unit

2) Specification, Design base

(a) Shape of tanks: Open top tank of circular and vertical type, installed above ground.
(b) Material of tanks: Carbon steel with epoxy coating on the inner surface.
(c) 2nd neutralization tank
- Volume: equal to 30 minutes-retention time of maximum flow rate considering reaction time.
- Attachment: Air bubbling devices (blower, aeration piping)

(d) Coagulation tank
- Volume: equal to 15 minutes-retention time of maximum flow rate considering reaction time.
- Attachment: Vertical type of mixers

(e) Sedimentation tank
- Surface load: $36m^3/m^2/day=1.5m^3/m^2/hours$ based on the result of laboratory test

· Attachment: Center driven type of sludge collecting rake, supporting bridge

(e) Chemical injection unit

The unit consists of chemical drums with mixers and chemical pumps.
Polymer will be injected at the inlet of coagulant tank as coagulant aid.

3) Description

In order to neutralize the residue of ferrous sulfate and sulfuric acid at pH 3-4, more CaO is added until pH 8.5-9 at 2nd neutralization, then air-oxidization is proceeded. As a result, ferric hydrate and hydrate of heavy metals (Zn, Pb, etc.) can be removed as settled sludge at the sedimentation tank.

(4) Sludge Treating Unit

(4-1) Sludge Thickener

1) Purpose

In order to dehydrate effectively, a thickener is provided to thicken sludge before feeding to a dehydrator.
A part of thickened sludge from the thickener bottom will be returned to the inlet of 1st neutralization tank as seeding sludge.

2) Specification, design base

(a) Shape: Open top tank of circular and vertical type, installed above ground.
(b) Material of tanks: Carbon steel with epoxy coating on the inner surface.
(c) Surface load: $12m^3/m^2/day=0.5m^3/m^2/hours$ (standard)
(d) Attachment: Center driven type of sludge collecting rake, supporting bridge

(4-2) Dehydrator (Centrifuge)

1) Purpose

In order to reduce sludge volume and to be able to treat as solid state, a dehydrator is provided to dehydrate sludge from the thickener.

2) Specification, design base

(a) Shape: horizontal type of centrifuge, made of stainless steel
(b) Operation: 12 hours/day x 2 sets or
24 hours/day x 1 set + 1 set spare
(c) SS contents: Feed sludge approx. 5 % ($50kg/m^3$)
Sludge cake approx. 20 % ($200kg/m^3$)
(d) Chemical feeding unit: chemical drums with mixers and pumps
(e) Polymer (cation or anion) is used as coagulant.

3) Description

There are many type of dehydrating equipment such as a filter press (like as the existing unit), a vacuum filter (filter cloth) and a centrifuge.
In this basic design, a centrifuge is provided as following reasons;

1) Easy to operate and maintain

2) Compact.

3) Water content of dehydrated cake can be expected less than 80%.

Filtrate from centrifuge is returned to the inlet of 1st neutralization basin to treat again.

(5) Electrical·Instrumental Design

1) Electrical Design

(a) Primary power cables (380V-AC x 3 phase x 50 HZ) will be laid between the switch gear at the existing electric substation and a receiving/distributing board, transformer at the new electric substation in the W.W.T control room.

(b) Secondary power cables (380-AC x 3 phase x 50 HZ) will be laid between MCC (Motor Control Center) at the new substation in the W.W.T. control room and each motors of equipment.

(c) Lighting cables (220V-AC) will be laid between transformer, distribution board and each lighting implements.

(d) Earthing work is required for steel equipment, piping and structure adequately.

(f) EIS should be designed and constructed for primary power supplying work between the existing substation and the receiving board at the new substation in W.W.T control room.

2) Instrumental Design

(a) The center instrument panel will be installed at W.W.T. control room. Indicators, recorders, alarms and sequence timers etc. will be mounted on the board, and W.W.T. control system can be designed so as to be operated automatically by the center control panel.

(b) Control cables (220V-AC, 24V-DC) will be laid between transformer, center panel and each instruments at field

(c) Electric implements and instruments are applied to tropical and dust proof type.

(d) Control valves are operated pneumatically by compressed air.

6 . Consideration in design

6.1 Location of Plant

(1) All equipment will be installed outdoor except dehydrator unit to protect noise.

(2) The plant (including piping and cable) layout should be designed considering and operability maintenance of equipment, instruments, piping and cables.

(3) All W.W.T area is classified as non-hazardous.

6.2 Other requirements

(1) Operation day of W.W.T. is designed as 330 days a year.

(2) A spare pump is provided for all pumps operated in normal.

(3) Holding capacity of chemical tanks is designed as 1 week for normal condition.

(4) The W.W.T. control room will have the following rooms:

1) Center panel room (operator working room)
2) Electric substation
3) Mini. laboratory
4) Toilet
5) Locker room
6) Warehouse

(5) Mini-laboratory will provide the following lab-equipment:

1) Jar tester (Coagulation / flocculation & sedimentation test)
2) pH meter, Electric conductivity, Turbidity meter, Water content meter
3) Simplified balance
4) Glass ware for sampling and test

7. Discussions

7.1 Study of Gypsum ($CaSO_4$) Recovery

The Wastewater Treating Plant on the Basic Design (Original Case) has Gypsum Recovery Unit. In this modified case, H_2SO_4 concentration in wastewater is lower than the original case. It was studied by neutralization test in the laboratory that gypsum recovery is feasible or not in this case.

(1)Product of gypsum will be decreased due to low H_2SO_4 concentration comparing to the original case.

(2) Gypsum recovery plant is complicated and expensive, and running cost and manpower will increase.

(3) Purity of gypsum may not be pure due to mixture of ferrous sulfate.

(4) Settling velocity of sludge will decrease by removing gypsum, and sludge volume will be almost same as removing of gypsum or not.

As mention the above, gypsum recovery unit is not applied in this basic design (modified case).

7.2 Study of Two Step Separation

In general, settling velocity of high concentration sludge is small so that large surface area is required to separate sludge and water.

Two step separation method was studied (refer to Fig-3);

(1) 1st stage separation

Gypsum sludge which produced at pH 3-4 by adding CaO is separated and removed at 1st sedimentation tank.

(2) 2nd stage separation

CaO is added to supernatant at pH 3-4 until it become around pH9. Then, sludge is separated and removed. But, sludge volume is not so decreased instead of gypsum sludge is removed at 1st stage separation (pH3-4). And settling velocity of sludge became smaller than 1st stage separation, therefore the surface area of settling basin can not be small and not efficiency.

As a result, two step separation can not be applied in this modified basic design.

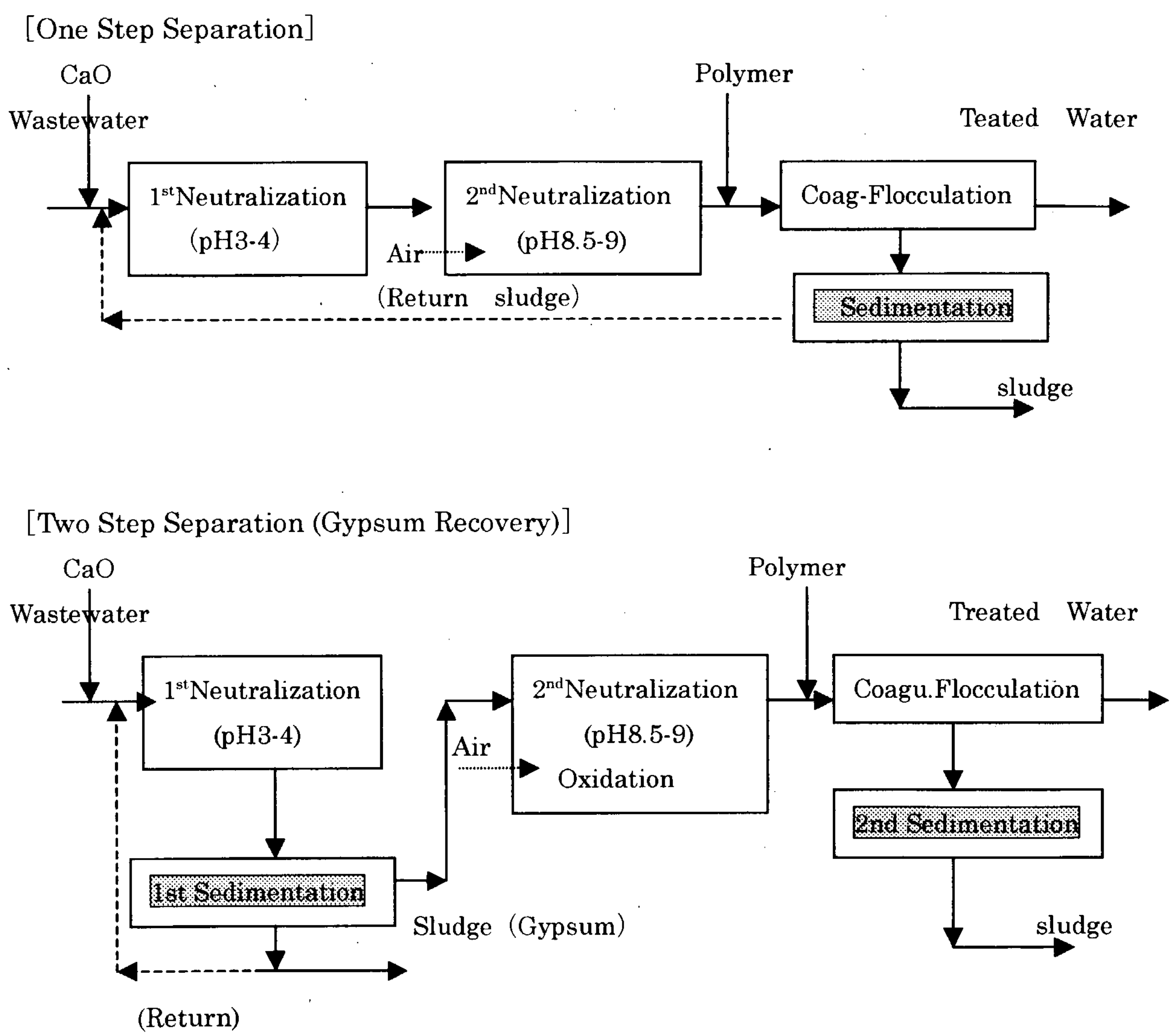


Fig.-3 Block Flow Diagram of One/Two Step Separation

7.3 Oxidation by Aeration

Oxidation (aeration) test was tried using rinsing water of EIS at the laboratory.

Air is blown into neutralized slurry at pH 8.5-9 (pH 9 is upper limit of disposal regulation).

Color of slurry gradually changed from dark green to brown (approx.20min.).

As a result, Fe^{2+} was completely removed, but at below pH 8.5 residual Fe^{2+} was detected in supernatant of sample.

7.4 Selection of Polymer

Settling velocity of slurry (flocs) after neutralization at pH8.5-9 is very small in case of without any coagulant. Effect of polymer as coagulant was tested using Jar Tester at the laboratory. The results of test are as follows;

(1) Cation and anion polymer purchased in Cairo were used.
And it was found that coagulation/flocculation effect of each polymer is remarkable.

(2) Cation polymer is more effective than anion polymer.

(3) Suitable dosing rate of cation polymer is enough around 0.05mg/l based on Jar Test.

7.5 Filtration Effect

At the original basic design, Sand Filter (sand, anthracite as filter media) is planned to provide because of demonstration purpose.
As a result of neutralization test at the laboratory, total suspended solids (TSS) in supernatant at pH8.5- 9 may be less than 30mg/l of disposal regulation.
Therefore, actual wastewater treating plant is not necessary Filter Unit.

7.6 Disposal of Sludge Cake

(1) Sludge hopper

By calculation result, 4-ton/h sludge cake will be generated continuously at average flow rate. In original basic design, sludge cake was piled up outdoors near the plant. In this modified basic design, 2 sets of elevated sludge cake hopper ($24m^3$ x 2sets) are provided to store and to be easy to load sludge cake on a damp truck.

(2) Sludge Cake Disposal

Sludge cake will be disposed to the Desert under management. Metal hydrates such as $Fe(OH)_3$, $Pb(OH)_2$, $Zn(OH)_2$ are contained in sludge cake. That hydrate may not solve into water unless acid rain falls, then they become to metal oxides such as PbO_2, ZnO, Fe_2O_3 at last. But, solution possibility of metal hydrate is not zero completely. Therefore the disposal place at Desert should be managed and metals in permeant water from sludge should be monitored until safety is confirmed.

7.7 Total Dissolved Solids (TDS)

(1) Regulation in Egypt

TDS limitation is specified at Wastewater Discharge Regulation in Egypt.

- The most stringent limitation 800 [mg/l]
- middle 1,200[mg/l]
- Others 2,000[mg/l]

High concentration of H_2SO_4 is contained in acid wastewater and a large amount of CaO is added to neutralize. At this reaction, gypsum ($CaSO_4$) will generate and settle. But, approx. 2,000mg/l of gypsum saturates in water and other substances may contain. Therefor, in order to be met the regulation, dilution by a large amount of fresh water or desalination process should be applied to remove TDS.

(2) Desalination Plant

There are a few kind of desalination process, such as Reverse Osmosis (RO), Ion exchange membrane, evaporator. etc. All desalination plants are very expensive in both construction cost and maintenance cost. And also a little condensed liquid may produce from all desalination plants.
As a result, in this modified basic design, TDS limitation in the regulation is neglected

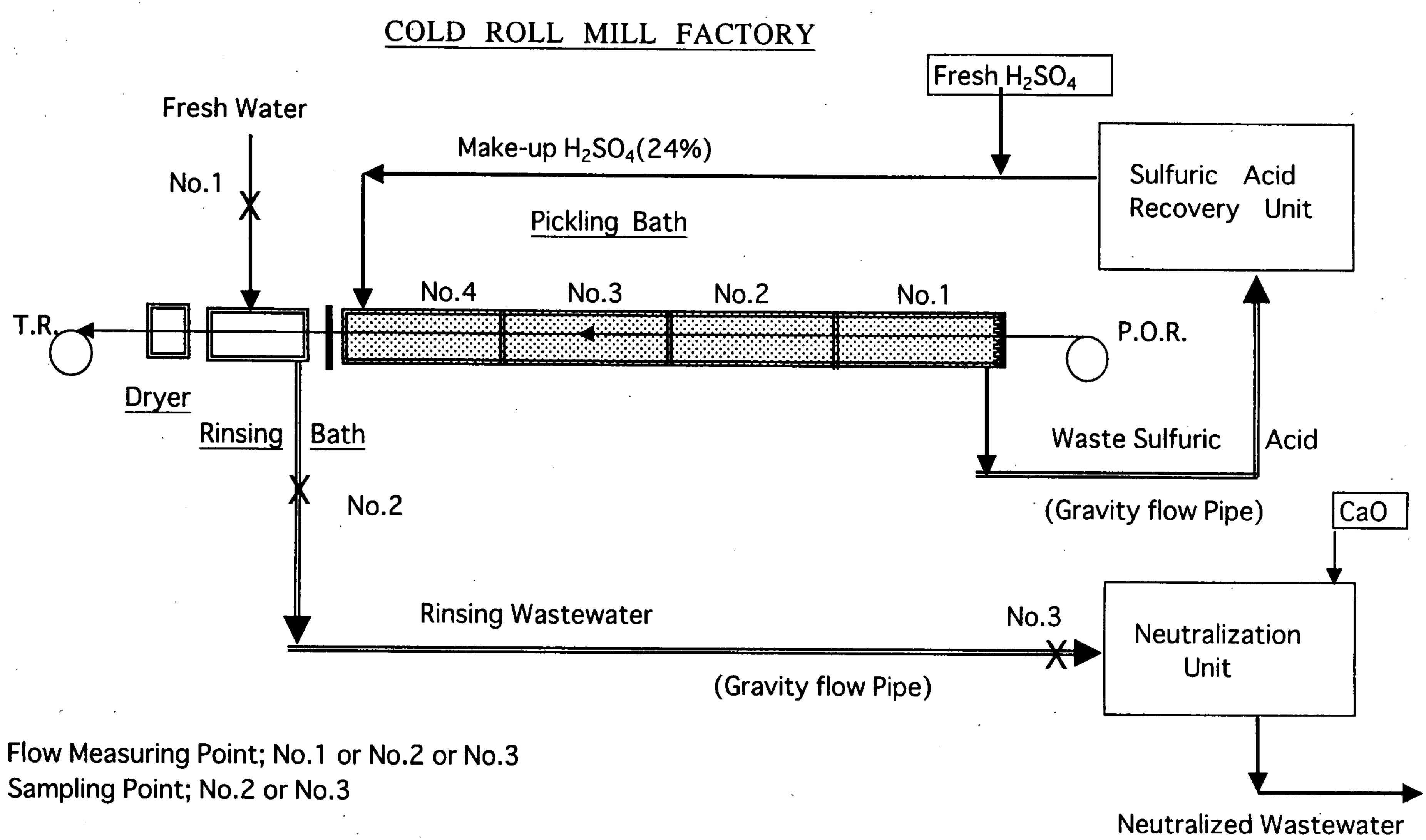
(3) Other Industrial Wastewater

Acid or alkali wastewaters of high TDS are discharged from many factories. And, the Regeneration wastewater of ion exchanger resin is discharged from the factories that high-pressure steam is used. This wastewater is contained high concentration of neutralized salt or soluble substances if neutralized, therefore TDS concentration can not be met the regulation in Egypt.

8. Performance Guarantee

The basic design (Original, Modified) of Neutralization Plant of EIS is designed based on our survey data during limited short period and given data by EIS. This design procedure may be useful.
But, it is recommended to improve the existing Pickling Plant, Rinsing Plant and Utility system and its operation management. As a result, wastewater flow rate and qualities may change from our design basis. Therefore, if the new neutralization plant will be designed and constructed by yourself after some improvements, it is required to verify and settle the design conditions based on supplemental wastewater survey, then the detail design should be proceeded to be satisfied of the specified performance of plant.

This basic design (modified case) is only reference. Therefore, the Study Team can not guarantee the plant performance if any body will construct the new neutralization plant based on this basic design (modified case) package in the future.



◆ Flow Measuring Point; No.1 or No.2 or No.3
◆ Sampling Point; No.2 or No.3

FLOW MEASUREMENT AND SAMPLING OF RINSING WASTEWATER

Client: JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Project Name: THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT

Factory Name: EGYPTIAN IRON AND STEEL CO.

BASIC DESIGN
(MODIFIED)

Document Title:

CALCULATION SHEET FOR W.W.T. DEMONSTRATION PLANT

Issued Date September 2000

Consultant: JICA STUDY TEAM

CHIYODA DAMES AND MOORE CO.

CHIYODA CORPORATION

1. Object

This design calculation sheet is applied to the study of W.W.T. Recommendation Plant planning for 「**Egyptian Iron and Steel Co.**」.

2. Wastewater to be treated

Rinsing Water and Leakage Water except Spent Sulfuric Acid.

3. Design Conditions

(1) Waste management system in the Factory should be organized, and operated adequately under the responsible managers.

(2) Suitable routine works, periodical maintenance should be conducted in the whole company.

4. Contents of Wastewater Treatment plant

(1) Pre-treatment : Equalization Tank

(2) Primary Treatment : Neutralization/Oxidization

(3) Secondary Treatment : Sedimentation

(4) Sludge Treatment : Centrifuge

5. Design Basis

5.1 Qualities and Quantities of Influent Wastewater

Shown on Table-1.

5.2 Qualities and Quantity of Treated Water

The Law 48/82 Non potable Surface Water (Industrial) is to basic design basis.

Treated water qualities are shown on Table-1.

Table－1 Design Basis of Wastewater Qualities and Quantities

Items		Rinsing Water	Leakage water	Acid Waste.	Treated Water	Law48/82
Flow (Max.)	[m^3/h]	80	10	90	90	—
Flow (Nor.)	[m^3/h]	35	5	40	40	—
pH	[-]	0.5 ～2.0		0.5 ～2.0	8 ～9	6 ～9
H_2SO_4	[mg/L]	2,025	21,800	4,300	—	—
$FeSO_4$	[mg/L]	2,025	21,800	4,300	—	—
Oil & Grease	[mg/L]				< 5	< 5
TDS	[mg/L]					< 800
Water Temp.	[℃]	37 ～49		< 35	< 35	< 35

Note: Rinsing water and leakage water qualities are based on flow maximum case.

6. Unit Design

6.1 Acid Wastewater Collection (Out of Battery)/Receiving Pit

The rinsing water and leakage water are stored in Receiving Pit and pumped to Equalization Tank.

(1) Design Condition

1) Retention time : Tr= 0.5 h

2) Specification : Rectangular, Underground, Reinforced Concrete with resin Lining

(2) Sizing

1) Required Volume : Vr= 45 m^3

2) Effective Height : Hr= 1.5 m

3) Required Area : Ar= 30 m^2

4) Dimension : Take $5,000^W \times 6,000^L \times 6,000^H$ (effective $1,500^H$)

6.2 Equalization Tank

The acid wastewater from Acid Wastewater Pump is storaged in the Equalization Tank for equalization of wastewater quantities and qualities for the further treatment.

(1) Design Conditions

1) Quality of Wastewater: Shown on Table-2

2) Retention Time : 6 h

3) Specification : Vertical cylindrical、 1 set

4) Others : Air bubbling device

(2) Sizing

1) Required Volume : 540 m^3

2) Effective Height : 9 m(take)

3) Required Area : Ac= Q/Ah= 60 m^2 Diamete 8.74

Take : $8,719^\phi \times 10,635^H$ (Chiyada Standard Tank)

4) Air Bubbling Device

a) Required Air (design base): 3 $Nm^3/m^2/h$

b) Required Air Quantity: 180 Nm^3/h= 3 Nm^3/min(take)

6.3 1st Neutralization Tank

(1) Design Conditions

1) Retention Time : 0.5 h

2) Specification : Vertical cylindrical、 1 set

3) Others : Mixing device

(2) Sizing

1) Required Volume : 45 m^3

2) Effective Height : 4.5 m(take)

3) Required Area : Ac= Q/Ah= 10 m^2 Diamete 3.57

Take : $3,872^\phi \times 4,595^H$ (Chiyada Standard Tank)

(3) Generated Gypsum

a) H_2SO_4 concentration : 4,300 mg/L

b) Lime concentration : 10 %

c) Solubility of Gypsum: 2,000 mg/L

d) Generated Gypsum : W= 679 kg/h

Actual generated Gypsum W'= 499 kg/h

$H_2SO_4 + Ca(OH)_2 = CaSO_4 \cdot 2H_2O$

98 : 74 = 172

e) Required Lime : Wl= 292 kg/h≒ 3,000 L/h as 10 % $Ca(OH)_2$

$CaO + H_2O = Ca(OH)_2$

56 : 74

Required Lime Stone: Ws= 221 kg/h

6.4 2nd Neutralization Tank

(1) Design Conditions

1) Retention Time : 0.5 h

2) Specification : Vertical Cylindrical、1 set

3) Others : Air mixing device

(2) Sizing

1) Required Volume : 45 m^3

2) Effective Height : 4.5 m(take)

3) Required Area : Ac= Q/Ah= 10 m^2 Diamete 3.57

Take : $3,872^{\phi} \times 4,595^{H}$ (Chiyada Standard Tank)

(3) Generated Sludge

1) $FeSO_4$ concentration: 4,300 mg/L

2) Lime concentration : 10 %

3) Generated Sludge : Wt= 1,210 kg/h as dry base

from $Fe(OH)_3$ W1= 272 kg/h=(22.5 %)

from $CaSO_4 \cdot 2H_2O$: W2= 438 kg/h

$FeSO_4 + Ca(OH)_2 + 2H_2O = Fe(OH)_2 + CaSO_4 \cdot 2H_2O$

152 : 74 = 172

$2Fe(OH)_2 + 1/2O_2 + H_2O = 2Fe(OH)_3$

107

from 1st Neutr. W3= 499 kg/h Total gypsum= 937 kg/h=(77.5 %)

4) Dewatered Sludge : Wg= 4 ton/h= 97 ton/day

Water content = 70 %

5) Required Lime (2nd) Wl= 188 kg/h≒ 1,900 L/h as 10 % $Ca(OH)_2$

$CaO + H_2O = Ca(OH)_2$

56 : 74

Required Lime Stone: Ws= 143 kg/h Total Lime Stone= 364 kg/h as 100 %

6) Total Lime Feed: QT= 4,900 L/h

6.5 Flocculation Tank

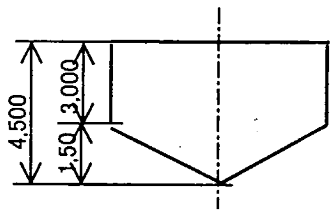
1) Retention Time : 0.25 h (take)
2) Required Volume : V= 23 m^3
3) Specification : Vertical Cylindrical, Carbon Steel with Epoxy Coating
4) Number of Required : 1 set
5) Dimension : H= 3.5 m (take) Req'd Area = 6 m^2
D= 2.86 m

Take : $2,860^{\phi} \times 3,500^{H} \times 1$set

6.6 Clarifier

1) Surface Load : Ls= 1.5 $m^3/m^2/h$ (take)
2) Required Area : As= 63 m^2
3) Specification : Vertical Cylindrical, Carbon Steel with Epoxy Coating
4) Number of Required : 1 set
5) Retention Time : Ts= 2 h (take)=
6) Dimension : H= 3 m (take)
D= 9.0 m

Take : $10,000^{\phi} \times 4,500^{H} \times 1$ set



7) Sludge Draw off(5%): Qs= 24 m^3/h
8) Sludge recycle : Qr= 4 m^3/h
(Generated gypsum*30 % at 1st Neutr.)

6.7 Sludge Thickener

1) Surface Load : Vss= 0.5 $m^3/m^2/h$
2) Total Solids : Lto= 1,210 kg/h
3) Sludge Concentration: Cs= 8 %
4) Required Area Ath= 48 m^2
5) Diameter D_{PO}= 7.85 m

Take: $8,500^{\phi} \times 4,500^{H} \times 1$ set

6) Centrifuge feed rate Qc= 15 m^3/h

6.8 Polymer

(1) Polymer A for Coagulation

1) Dosing Ratio : 0.1 mg/L
2) Concentration : 0.5 wt %
3) Specific Gravity : 1
4) Injection Rate : Q_{ph}= 1.8 L/h
5) Tank Volume : V_{ph}= 0.3 m^3 (7days)
6) Height : H_{p0}= 0.6 m (take) A_{PO}= 0.50 m^2
7) Diameter : D_{PO}= 0.8 m

Take: $800^{\phi} \times 1,000^{H} \times 1$ Set

(2) Polymer-B for Dewatering

1) Dosing Ratio	:	0.2 % as dry SS
2) Injection Rate	:	Wp= 2.4 kg/h
3) Concentration	:	0.5 wt %
4) Specific Gravity	:	Q_{ph}= 484 L/h ⇒ Continuous Injection System

6.9 Air Blower

1) Feed ratio	:	Qf= 1 Nm^3/m^3-H_2O
2) Required Air	:	Qa= 90 Nm^3/h= 1.5 Nm^3/min
3) Total Air	:	Qt= 270 Nm^3/h= 4.5 Nm^3/min

6.10 Treated Water Pond

1) Retention time	:	Tr= 0.5 h
2) Specification	:	Rectangular, Underground, Reinforced Concrete
3) Required Volume	:	Vr= 45 m^3
4) Effective Height	:	Hr= 2 m
5) Required Area	:	Ar= 22.5 m^2
6) Dimension	:	Take $4,500^W \times 5,000^L \times 2,500^H$(effective $2,000^H$)

6.11 Sludge Pit

1) Retention time	:	Tr= 3 h
2) Specification	:	Rectangular, Underground, Reinforced Concrete
3) Required Volume	:	Vr= 45 m^3
4) Effective Height	:	Hr= 2 m
5) Required Area	:	Ar= 23 m^2
6) Dimension	:	Take $4,500^W \times 5,000^L \times 2,500^H$(effective $2,000^H$)

6.12 waste Water Pit

1) Retention time	:	Tr= 2 h
2) Specification	:	Rectangular, Underground, Reinforced Concrete
3) Required Volume	:	Vr= 40 m^3
4) Effective Height	:	Hr= 2 m
5) Required Area	:	Ar= 20 m^2
6) Dimension	:	Take $4,500^W \times 5,000^L \times 2,500^H$(effective $2,000^H$)

6.13 Lime Feeder

Based on vendor specification