Appendix 6A-3 HOT STRIP MILL PLANT

Appendix 6A-3-1 HOT STRIP MILL PLANT EQUIPMENT LIST

Appendix 6A-3-2 HOT STRIP MILL DRAWING

Appendix 6A-3-1 Hot Strip Mill Equipment List

No.	Equipment	Q'ty	Specification
HS01	Hot strip mill		
	- Capacity		one (1) million ton/year
	- Type		Semi-Continuous HSM
HS011	Slab yard		
0111	Slab conditioning area	1	Manual scarfing
0112	Slab conveyor	1	Walking beam type
0113	Slab transfer crane	1	
HS012	Slab reheating furnace		
0121	Slab charger	1	
	- Type		Rack & pinion drive type
	- Stroke		Approx. 6,000 mm
0122	Slab reheating furnace	1	
	- Type		Walking beam & Re-gene type burner
	- Capacity		180 t/H (average 150 t/H)
	- Effective length		Approx. 30 m
0123	Slab extractor	1	Double unit rack and pinion type
0124	Slab charging table	1	Individual drive
0125	Slab discharging table	1	Individual drive
HS013	Roughing mill		
0131	Hydraulic scale breaker (HSB)	1	Hydraulic spray (pressure 150 kg/cm^2)
0132	Roughing mill		
	- Type	1	4-Hi reverse attached edger type
	- Roll dimension		
	- Back-up roll		950/850 mm x 1730 mm
	- Work roll		1420/1250 mm x 1730 mm
	- Main drive motor		4000 kw x 2
	- Attached edger		700 kw x 2
	- Descaling device		Hydraulic spray (Pressure 150 kg/cm^2)

No.	Equipment	Q'ty	Specification
0133	Roll changing equipment	1	
	- Back-up roll		Single retractable type
	- Work roll		Sled type (Hydraulic)
0134	Mill side guide	2	
	- Entry side guide		Rack and pinion type motor driven
	- Delivery side guide		Rack and pinion type motor driven
0135	Roller table	1	
	- Type		Line shaft & Indivual drive
HS014	Coil box and crop shear	1	
0141	Side guide	2	
	- Coil box entry side guide		Rack and pinion type
	- Crop shear entry side guide		Rack and pinion type
0142	Coil box	1	
	- type		3-Roll in-line type
	- Bar thickness (Max/Min)		18-35 mm
0143	Crop shear	1	
	- Type		Rotary drum (Double knife)
	- Capacity		40mm max.
0144	Finishing scale breaker	1	
	- Type		Pinch roll type with measuring system
HS015	Finishing mill		
0151	Finishing mill	5	
	- Type		4Hi 5-stand with work roll shift
	- Roll dimension		
	- Back-up roll		
	Diameter		1420/1250 mm
	Barrel length		1730 mm
	- Work roll		
	Diameter		730/650 mm
	Barrel length		2030 mm (work roll shift 300mm)

No.	Equipment	Q'ty	Specification
	(Finishing mill)		
	- Main drive motor		6000 kw AC
	- Hydraulic AGC		F1 to F5
	- Work roll shifting		F1 to F5
0152	Side guide	5	Rack and pinion type
0153	Looper	4	Motor drive
0154	Roll changing equipment	5	
	- Back-up roll		Sled type (hydraulic)
	- Work roll		Push puller and side shift type
0155	Instruments		
	-Width meter	1	
	-Thickness meter	1	x-ray
	-Thickness profile meter	1	x-ray
HS016	Run-out table		
0161	Run-out table	1	Individually motor driven
0162	Run-out cooling system	1	
	- Type		
	- Top		Laminar flow nozzle type
	- Bottom		Spray nozzle type
	- Cooling capacity		From 900℃ to 550℃
	- Control method		Computer control
HS017	Down coiler		
0171	Coiler entry side guide	1	Screw-nut motor drive with quick opening device
0172	Pinch Roll	1	Housing type
0173	Down coiler	1	
	- Type		Stationary hydraulic type
	- Mandrel		Double expansion wedge type mandrel
	- wrapper roll		Three wrapper rolls
0174	Coil stripping equipment	1	Coil car type
0175	Coil inspection line	1	
	- Capacity		Thickness = 1.6-6.0mm
HS018	Coil conveyor		

No.	Equipment	Q'ty	Specification
0181	Coil banding machine	1	Automatic (Single row strap)
0182	Coil marking device	1	Automatic operation
0183	Coil weighing device	1	Automatic operation
0184	Coil conveyor	1	
	- Type		Chain type
HS019	Roll shop		
0191	Work roll grinder	1	Wheel traverse type
0192	Back up roll grinder	1	Wheel traverse type
0193	Lathe	1	Wheel traverse type
0194	Roll bearing washer	1	Nozzle washing
HS020	Information system for rolling mill		
0201	Process computer system	1	Process automation & data control
0202	Communication system	1	Telephone & paging
HS021	Utility for rolling mill		
0211	Water circuit and cooling system	3	- Furnace cooling system
			- Roll cooling system
0212	Gases and compressed air	1	- Run-out cooling system
0213	Hydraulic system	4	- In works piping
			- Auxiliary Hydraulic system (A)
			- Auxiliary Hydraulic system (B)
			- AGC Hydraulic system
0214	Lubrication system	4	- Down Coiler Hydraulic system
			- Oil lubrication system
			- Rougher and finisher lubrication system
			- Coiler lubrication system
			- Morgoil lubrication system
0215	Centralized grease system	1	
0216	Descaling system	1	- HSB, RM-descaling & FSB
0217	Scale pit	1	- Mill pit
0218	Run out water pit	1	- Run out pit
HS022	Fume exhaust system	1	
HS023	Electrical power supply	1	

No.	Equipment	Q'ty	Specification
	and distribution		
0231	High voltage facilities	1	
0232	Low voltage facilities	1	
0233	Electrical equipment for rolling mill	1	- Motor and accessories - Variable speed drive system - Motor control centers and local starters
0234	Wiring for rolling mill	1	

No.	Equipment	Q'ty	Specification
HS03	Hot coil & Plate finishing line		
HS031	Skinpass line(SKL)	1	Strip : Thickness 1.6-6.0 mm Width 600-1,600 mm Capacity: 500,000 t/y (full operation)
0311	Entry coil saddle	1	Three position
0312	Entry coil car	1	Coil buggy type
0313	Pay off reel	1	Mandrel type
0314	Crop shear	1	Hydraulic up cut shear
0315	Mill	1	
	- Type		4-Hi hydraulic
	- Roll dimension		
	- Work roll		630 x 1730
	- Back up roll		1200 x 1660
	- Rolling Speed		300 mpm max.
	- Bender		Max. 80 ton / two cylinder
0316	Dividing shear	1	Hydraulic up cut shear
0317	Tension reel	1	Mandrel type
0318	Delivery conveyor	1	Walking beam type
0319	Thickness gauge	1	1.6-6.0 mm γ-ray
0320	Coil weighing device	1	Automatic operation
HS032	Plate finishing line	1	Capacity 200,000 t/y
0321	Dividing shear	1	Gas cutting
0322	Cooling bed	1	30 m width x 30 m length
0323	Heavy leveler	1	capacity max. 24 mm
0324	Plate cutting area	2	Semi-automatic gas cutting
0325	Plate stock yard	1	
HS033	Information system	1	Communication system
HS034	Utility for hot finishing line		
0341	Water circuit system	1	
0342	Compressed air	1	
0343	Hydraulic system	1	
0344	Lubrication system	1	

No.	Equipment	Q'ty	Specification
HS035	Electrical equipment for hot finishing line		
0351	Electric equipment	1	- Motor and accessories - Variable speed drive system - Motor control centers and local starters
0352	Wiring	1	
HS040	Crane		
	Over head crane		
	- Slab yard	4	75t/10t x 27.5m span Over head
	- Mill yard	2	75t/40t x 25.5m span Over head
	- Roll shop	1	60t/30t x 27.5m span over head
	- Motor room	1	20t/ 10t x 22.5m span Over head
	- Furnace yard	1	10t x 10 m span Over head
	- Mill scale pit	1	5t x 24 m gantry crane
	- Coil cooling yard	2	35t/ 5t x 27.5m span Over head
	- Skinpass yard	2	35t/ 5t x 27.5m span Over head
	- Plate yard	3	10t/ 5t x 27.5m span Over head
HS041	Handling equipment		
0411	Slab lifter	4	65 ton max.
0412	Slab magnet lifter	1	28 ton max.
0413	Roll lifter	1	30 ton max.
0414	Coil liter	2	28 ton max.
0415	Plate magnet lifter	2	10 ton max.
0416	Roll transfer car	1	60 ton max.
HS042	Slab & coil stock Yard		
0421	Slab stock yard	1	In house
0422	Coil cooling yard	1	For skinpass line
0423	Coil stock yard	1	In house and outside
0424	Plate stock yard	1	In house
HS050	Spare parts and consumable		
0510	spare parts	1	
0520	consumable	1	

Appendix 6A-4 COLD STRIP MILL PLANT

Appendix 6A-4-1 Cold Strip Mill Equipment List

No.	Equipment	Q'ty	Specification
CS1	Pickling Line		1) Capacity: 376,000 ton/year 2) Type: Push-pull type 3) Material: Hot rolled low carbon Steel 4) Line speed: 10-90 mpm (DC variable) 5) Strip thickness: 2.0-5.0 mm 6) Strip width: 700-1,250 mm 7) Pickling agents: Hydrochloric acid 18% by weight
CS11	Entry Section		
1110	Entry coil storage conveyor	1	1) Chain conveyor (6 coil stations)
1112	Entry coil storage saddle	1	1) composed of one station for band removal
1120	Entry coil car	1	1) Pit type
1130	Pay off reel	1	1) Cantilever mandrel type with filler plates
1132	Hold down roll	1	1) Rubber lining rolls 2) motor driven
1134	Coil peeler	1	
1140	Flattener	1	1) Five roller type 2) equipped with pinch roll & side guides
1150	Thickness gauge	1	1) γ ray type
1160	Entry shear	1	1) equipped with pinch roll, scrap conveyor and scrap boxes
1170	Entry threading tables	1 set	
1180	Side guides	1 set	
CS12	Pickling Tank Section		
1210	Pickling tank	3	1) Rubber lining tank
1220	Dam rolls	4 sets	1) Rubber lining roll Motor driven
1230	Fume exhaust system	1 set	1) Blower suction fume scrubber type 2) FRP construction
CS13	Rinse Tank Section		
1310	Rinse spray tank	1	
1320	Wringer rolls	4 sets	1) Rubber lining rolls 2) Motor driven
1330	Dam rolls	2 sets	1) Rubber lining rolls 2) motor driven

No.	Equipment	Q'ty	Specification
1340	Hot air dryer	1	1) Spray nozzle header type 2) heat-exchanged by steam 3) Air temperature: 120 ℃
CS14	Acid Circulation System		
1410	Re-circulation tank	3	1) Rubber lining tank
1420	Heat exchangers	3 sets	
1430	Pumps	1 set	
1440	Storage tank	1	1) Rubber lining tank
1450	Water demineralizing system	1 set	
1460	Installation and valves	1 set	
1470	Acid piping materials	1 set	
CS15	Exit Section		
1510	Exit shear	1	1) equipped with roll quadrant with side guides, pinch rolls, scrap cart and scrap boxes
1520	Steering roll	1	
1530	Side trimmer	1	1) equipped with scrap chopper, scrap conveyor and scrap boxes
1540	Inspection station	1	
1542	Exit threading tables	1 set	1) including loop table
1550	Bridle roll	1	1) Three roll plunger type
1560	Oiler	1	
1562	Deflector pinch roll	1	1) equipped with knock down roll and threading table
1570	Exit edge control	1	
1580	Tension reel	1	1) Cantilever mandrel type with hold down roll, outboard bearing and filler plates
1582	Belt wrapper	1	
1590	Exit coil car	1	1) Pit type
1592	Weigh scale	1	
1594	Coil banding machine	1	
1596	Exit coil storage saddles	1 set	1) composed of three coil stations for maximum size coil

No.	Equipment	Q'ty	Specification
CS16	Electrical Equipment		
1610	Motors and sensors	1 set	
1620	Controller	1 set	1) PLC system(Programmable logical controller)
1630	Wiring	1 set	
CS17	Auxiliary Equipment		
1710	Entry hydraulic system	1 set	1) Entry and delivery
1720	Pneumatic system	1 set	
1730	Grease lubrication system	1 set	
1740	Simple parts	1 set	
CS18	Acid Regeneration Plant		1) Hydrochloric acid
1810	Spray roaster	1	
1820	Pre-concentrator	1	1) including venturi scrubber
1830	Absorber	1	1) including separator, sump and stack
1840	Exhaust fan	1	
1850	Tanks and pumps	1 set	
1860	Oxide storage	1 set	1) Bag house 2) Oxide storage bin
1870	Ducting and piping	1 set	
1880	Acid proof brick	1 set	
CS2	Cold Rolling Mill		1) Capacity: 376,000 ton/year 2) Type: Reversing cold reduction mill 3) Material: Pickled, hot rolled low carbon steel 4) Rolling speed: 0-450/1,200 mpm 5) Roll force: Hydraulic push up 6) Strip thickness Entry: 2.0-5.0 mm Deliver: 0.4-2.5 mm 7) Strip width: 700~1,250 mm
CS21	Entry Section		
2110	Entry coil skid	1	1) composed of three coil stations
2120	Entry coil car	1	1) Pit type
2130	Pay off reel	1	1) Cantilever mandrel type
2140	Strip feeder	1	
2150	Entry tension reel	1	1) Single mandrel reel

No.	Equipment	Q'ty	Specification
CS22	Mill stand equipment		
2210	Mill stand	1	1) 4-Hi single stand
2220	Pinch roll & deflector roll	2 sets	1) Entry & delivery
2222	Mill guides	2 sets	1) Entry & delivery
2230	Dividing shear	1	
2240	Roll changing device	1 set	1) Automatic work roll changing System
2250	Main mill drive & spindles	1 set	1) Single drive
2260	Hydraulic roll positioning system	1 set	
2262	Roll bending system	1 set	1) Increase and decrease
2270	Rolls, bearings and chocks	1 set	
2272	Mill hood and shutter	1 set	
2274	Mill piping	1 set	
CS23	Exit Section		
2310	Delivery tension reel	1	1) Single mandrel reel
2320	Belt wrapper	1	
2330	Delivery coil car	1	1) Pit type
2340	Delivery coil skid	1 set	1) composed of three coil stations for maximum size coil
2350	Safety cage	1	
2360	Coil banding machine	1	1) Automatic machine
CS24	Auxiliary Equipment		
2410	Hydraulic system	1 set	1) Push up hydraulic system 2) Auxiliary hydraulic system 3) Valve stands
2420	Lubrication system	1 set	1) Gear lubrication system 2) Oil mist lubrication system
2430	Roll coolant system	1 set	
2440	Fume exhaust system	1 set	
2450	Cellar ventilation system	1 set	
2460	Pneumatic system	1 set	
2470	Sump drainage system	1 set	
2480	Inter connecting piping	1 set	
CS25	Electrical Equipment		
2510	Motors and sensors	1 set	

No.	Equipment	Q'ty	Specification
2520	Controller	1 set	1) PLC system
2530	Wiring	1 set	
CS26	Roll shop		
2610	Roll grinder	2	1) one for Back up rolls 2) one for Work rolls
2620	Shot blast machine	1	
2630	Bearing washer	1 set	
2640	Chock remover	2 sets	1) for Back up & Work rolls
2650	Chock tilter	1 set	
CS3	Batch Annealing Furnaces		1) Capacity: 272,000 ton/year 2) Type: 100% hydrogen single stack annealing furnace 3) Material: Cold rolled low carbon steel 4) Strip thickness: 0.5-2.5 mm 5) Strip width: 700-1,250 mm
CS31	Annealing base	21	1) High convention "O" ring design annealing base
CS32	Inner cover	21	1) Stainless steel "O" ring seal inner cover 2) Atmosphere gas: Hydrogen
CS33	Heating furnace	10	1) Single stack tangential direct fired annealing furnace 2) Movable furnace
CS34	Cooling cover	11	1) Forced cooling type by recirculation fan
CS35	Convector plate	63	1) Mild steel construction
CS36	Instrumentation		
3610	Controller	1 set	1) DCS(Digital control system)
3620	Thermocouples	1 set	
3630	Control valves and wiring	1 set	
CS37	Electrical Equipment		
3710	Motors and sensors	1 set	
3720	Wiring	1 set	
CS38	Auxiliary Equipment		
3810	Lifting ring	1 set	1) Inner covers and convectors lifting ring
3820	Coil conveyor	1 set	1) Chain conveyor with up-ender
3830	Utility piping	1 set	

No.	Equipment	Q'ty	Specification
CS4	Temper Mill		1) Capacity: 680,000 ton/year 2) Type: 4-Hi single stand combination mill 3) Material: Annealed, cold rolled low carbon steel 4) Rolling speed: 1,000 mpm 5) Strip thickness: 0.5-2.5 mm 6) Strip width: 700-1,250 mm
CS41	Entry Section		
4110	Entry conveyor	1	1) Chain conveyor 2) Five coil stations 3) Equipped with down-ender
4120	Coil preparation station	1 set	
4130	Entry coil skid	1 set	1) One coil station
4140	Entry coil car	1 set	1) Pit type
4150	Pay off reel	1 set	1) Single mandrel type
CS42	Mill Stand Equipment		
4210	Mill stand	1 set	1) 4-Hi single stand
4220	Deflector roll & pinch roll	2 sets	1) Entry and delivery
4230	Tension bridle	2	1) Entry and delivery 2) Two roll type
4240	Dividing shear	1	
4250	Roll changing device	1	1) Automatic work roll changing system
4260	Main drive and spindles	1 set	1) Single drive
4270	Rolls and bearings	1 set	
4280	Mill hood and shutter	1 set	
4280	Mill piping	1 set	
CS43	Exit Section		
4310	Delivery tension reel	1	1) Single mandrel reel
4320	Belt wrapper	1	
4330	Delivery coil car	1	1) Pit type
4340	Delivery coil skid	1 set	1) composed of three coil stations
4350	Safety cage	1 set	
4360	Coil banding machine	1	
CS44	Auxiliary equipment		

No.	Equipment	Q'ty	Specification
4410	Hydraulic system	1 set	1) Push up hydraulic system 2) Auxiliary hydraulic system 3) Valve stands
4420	Lubrication system	1 set	1) Gear lubrication system 2) Oil mist lubrication system
4430	Roll coolant system	1 set	
4440	Fume exhaust system	1 set	
4450	Cellar ventilation system	1 set	
4460	Pneumatic system	1 set	
4470	Sump drainage system	1 set	
4480	Inter connecting piping	1 set	
CS45	Electrical equipment		
4510	Motors and sensors	1 set	
4520	Controller	1 set	1) PLC system
4530	Wiring	1 set	
CS5	Hot Dip Galvanizing Line		1) Capacity: 100,000 ton/year 2) Type: Non oxygen horizontal furnace type 3) Material: Cold rolled low carbon steel 4) Line speed: Max. 90 mpm 5) Strip thickness: 0.4–1.6 mm 6) Strip width: 700–1,250 mm
CS51	Entry section		
5110	Entry coil skid	2 sets	1) Two coil stations for each pay off reel 2) V-shape top
5112	Entry coil car	2 sets	1) Scissors type 2) Floor mounted 3) V-shape top
5120	Pay-off reel	2 sets	1) Cantilever mandrel type 2) Uncoiling direction: over-winding 3) Centering adjustment: ±150 mm 4) Drive: DC motor drive
5121	Outer board bearing	2 sets	1) Bearing bottom support type
5122	Snubber roll	2 sets	1) Rubber lining
5123	Threading guides	2 sets	

No.	Equipment	Q'ty	Specification
5124	Guide tables	1 set	
5125	No.1 pinch roll	1	1) Rubber lining
5126	No.1 Double pinch roll	1	
5130	Thickness gauge	2 sets	1) γ-ray thickness gauge
5140	Double cut shear	1	1) Double rake up-cut shear 2) actuated by hydraulic cylinder 3) equipped with entry & exit feed rolls
5142	Scrap disposal device	1 set	1) Tilting table 2) Retractable scrap piling table
5144	No.1 Deflector roll	1	
5146	3-Hi pinch roll	1	
5150	Welder	1	1) Narrow lap seam welder 2) Welding time: < One minutes
5152	No.2 pinch roll	1	1) Rubber lining
5160	Degreasing tank	1	1) Horizontal tank 2) Alkali(NaOH) brush scrubber type 3) equipped with wringer and dam rolls
5162	Hot water rinse tank	1	1) Horizontal tank 2) High pressure spray nozzle type 3) equipped with wringer and dam rolls
5164	Water circulation system	1 set	1) equipped with circulation tanks, neat tank, pump, etc.
5166	No.1 Dryer unit	1	1) Hot air slit nozzle spray type 2) Hot air temperature: 120 ℃ 3) heat-exchanged with steam
5170	No.1 Bridle roll	1	1) Two roll type 2) DC motor drive
5180	Entry looper	1	1) Horizontal four strand looper 2) Effective stroke: 45 m 3) Effective length: 180 m(2 min.)
5182	Deflector roll	4	
5184	No.1 & 2 Steering roll	2 sets	1) one roll horizontal swing type
5186	No.3 Steering roll	1	1) Two small diameter deflector roll swing type
5188	No.4 Steering roll	1	1) Two roll vertical swing type
CS52	Center Section		

No.	Equipment	Q'ty	Specification
5210	No.2 Bridle roll	1	1) Two roll type 2) DC motor drive
5212	Tension meter roll	1	1) Three roll type 2) equipped with load cell
5214	Dancer roll	1	1) Air cylinder valance type
5220	Furnace casing	1 set	1) NOF furnace: Approx. 17.8 m 2) RTH furnace: Approx. 18 m (Atmosphere gas: HNX) 3) No.1 JC zone: Approx. 7 m (Atmosphere gas: HNX) 4) LTH zone: Approx. 15 m (Atmosphere gas: HNX) 5) No.2 JC zone: Approx. 5 m (Atmosphere gas: HNX)
5221	Furnace structure	1 set	
5222	Heating equipment	1 set	1) NOF: Nozzle mix direct fired burner RTH : U-type radiant tube burner LTH : Electrical heater
5223	Cooling equipment	2 sets	1) Gas jet nozzle spray type 2) Atmosphere gas: HNX gas
5224	Furnace roll drive system	1 set	1) Support rolls: 30 pieces 2) NOF & RTH rolls: Water cooled
5225	Furnace instrumentation	1 set	1) Control valves, sensors etc. 2) DCS(Digital control system)
5226	Refractory	1 set	
5227	Turn down roll	1	1) One roll type
5228	Snout	1	1) Equipped with stainless steel tip
5230	Zinc Pot	1	1) Ceramic pot with inductors 2) Capacity: approx. 100 ton
5231	Gas wiping equipment	1	1) Compressed air gas wiping 2) Equipped with sink roll and stabilizing rolls
5232	Air cooling device	2 sets	1) Air nozzle spray type 2) equipped with support rolls
5233	Top deflector roll	2	1) Chromium-plated water cooled roll

No.	Equipment	Q'ty	Specification
5234	Water cooling tank	1	1) Water dipping type 2) Cooling temperature: < 50 ℃
5235	No.2 Wringer roll unit	1	1) Two sets of wringer rolls
5236	No.2 Dryer unit	1	1) Hot air slit spray nozzle type 2) Hot air temperature: 90 ℃
5237	No.5 Steering roll	1	1) Two roll vertical swing type
5238	Coating weight gauge	1	1) Fluorescence X-ray gauge
5240	No.3 Bridle roll	1	1) Two roll type with snubber roll 2) DC motor drive
5242	Skin pass mill	1	1) 4-Hi singe stand 2) Hydraulic push-up system 3) Wet rolling mill
5244	No.4 Bridle roll	1	1) Four roll type with snubber roll 2) DC motor drive
5246	Tension leveler	1	1) Upper unit swing type 2) consists of elongation and C- bent correction units
5248	No.5 Bridle roll	1	1) Four roll type with snubber roll 2) DC motor drive
5250	Chromate tank	1	1) Horizontal spray nozzle type 2) equipped with two sets of wringer rolls
5252	Chromate circulation system	1 set	1) consists of circulation tank, neat tank, exhaust water pit, pumps etc.
5254	No.3 Dryer	1	1) Hot air slit nozzle spray type 2) Hot air temperature: 120 ℃
5260	No.6 Bridle roll	1	1) Two roll type with snubber roll 2) DC motor drive
CS53	Delivery Section		
5310	Delivery looper	1	1) Four strand horizontal looper 2) Effective stroke: 35 m 3) Effective length: 140 m
5312	Deflector roll	4	
5314	No.6 Steering roll	1	1) Two roll vertical swing type
5316	No.7 & 8 Steering roll	2 sets	1) One roll horizontal swing type
5320	No.7 Bridle roll	1	1) Two roll type with snubber roll 2) DC motor drive

No.	Equipment	Q'ty	Specification
5322	Deflector roll	1	
5330	Inspection table	1	1) Length: Approx. 4 m
5340	Oiling machine	1	1) Spray and roll coating type
5342	Shear pinch roll	1 set	
5344	Measuring roll	1	1) Roller follower type
5350	Exit shear	1	1) Up cut shear with double rake
5352	Sample conveyor	1	1) equipped with scrap bucket
5354	Tension reel EPC	1	
5356	Exit deflector roll	1	
5358	Threading tables	1 set	
5360	Tension reel	1	1) Cantilever mandrel type 2) Winding direction: over & under 3) Centering adjustment: ±150 mm 4) Drive: DC motor drive
62	Snubber roll	2	
5364	Outer board bearing	1	
5366	Belt wrapper	1	
5370	Delivery coil car	1	1) Scissors type 2) Floor mounted
5372	Delivery coil skid	1 set	1) Two coil stations
5374	Banding machine	1	
5376	Weigh scale	1	
CS54	Auxiliary Equipment		
5410	CPC system	8 sets	
5420	EPC system	1 set	
5430	Hydraulic system	2 sets	1) Entry and delivery
5440	Grease lubrication system	1 set	
5450	Pneumatic system	1 set	
5460	Entry and delivery structure	1 set	
5470	Piping	1 set	
5480	Safety equipment	1 set	
CS55	Electrical Equipment		
5510	Motors and sensors	1 set	
5520	Controller	1 set	1) PLC system
5530	Wiring	1 set	

No.	Equipment	Q'ty	Specification
CS6	Recoiling Line		1) Capacity: 300,000/year 2) Line speed: Max. 300 mpm 3) Material: Annealed, cold rolled low carbon steel and galvanized steel 4) Strip thickness: 0.4-2.5 mm 5) Strip width: 700-1,250 mm
CS61	Mechanical Equipment		
6110	Entry coil skid	1 set	1) Three coil stations
6111	Entry coil car	1	1) Scissors type 2) Floor mounted
6120	Pay off reel	1	1) Cantilever mandrel type 2) equipped with holddown rolls 3) Winding direction: Over & under
6121	Entry EPC device	1 set	
6122	Entry deflector pinch roll	1 set	
6130	Entry shear	1	1) Up-cut shear 2) equipped with pinch rolls and scrap bucket
6140	Side trimmer	1	
6141	Scrap handling equipment	1 set	1) Baller 2) Scrap bucket
6150	Inspection table	1	
6160	Oiling machine	1	1) Nozzle spray and roll coating
6170	Exit shear	1	1) Up-cut shear with pinch rolls and scrap bucket
6180	Exit EPC device	1 set	
6181	Exit deflector pinch roll	1	
6182	Tension reel	1	1) Cantilever mandrel type 2) equipped with snubber rolls
6190	Delivery coil car	1	1) Scissors type 2) Floor mounted
6191	Delivery coil skid	1 set	1) Three coil stations
6192	Banding machine	1	
6193	Weigh scale	1	
CS62	Auxiliary Equipment		
6210	EPC system	2 sets	1) Entry and exit
6230	Hydraulic system	1 set	

No.	Equipment	Q'ty	Specification
6240	Pneumatic system	1 set	
6250	Grease lubrication system	1 set	
6260	Piping	1 set	
CS63	Electrical Equipment		
6310	Motors and sensors	1 set	
6320	Controller	1 set	1) PLC system
6330	Wiring	1 set	
CS7	Auxiliary Equipment		
CS71	Over head travel crane		
7110	Pickling yard crane	2	1) 30t/5t x 18.5 m span
7120	Mill yard crane	1	1) 65t/30t x 28.5 m span
		1	2) 30t/5t x 28.5 m span
7130	Batch annealing yard crane	1	1) 50t/5t x 28.5 m span
7140	Recoiling yard crane	2	1) 30t/5t x 28.5 m span
7150	CGL yard crane	2	1) 30t/5t x 18.5 m span
CS72	Handling Equipment		
7210	Coil lifter	8	1) 25 ton max.
7220	Magnetic coil lifter	2	1) 25 ton max.
7230	Coil transfer car	2	1) 50 ton max.
7240	Chain conveyer	2	1) 2,500 mm pitch x 6 saddles
			2) 125 ton max.

Figure 6-4-2 Push-pull Pickling Line Arrangement
(Reference Drawing)

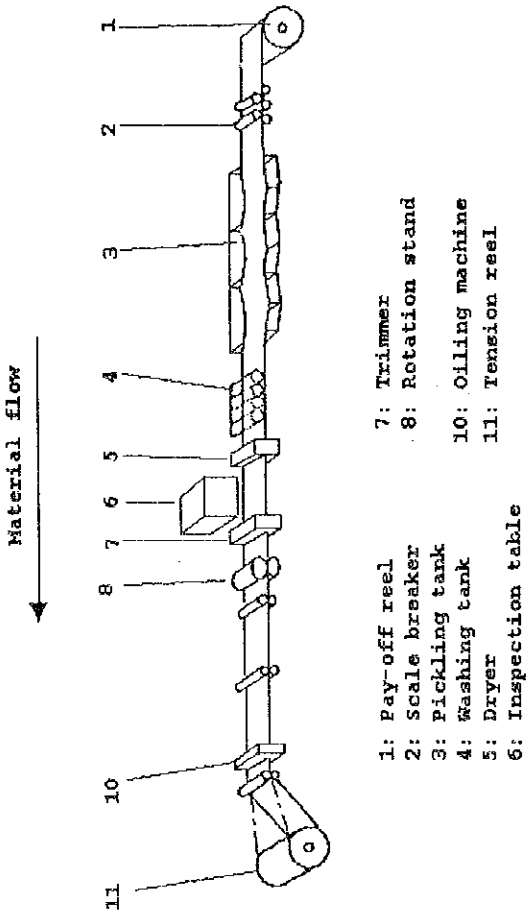


Figure 6-4-3 Reversing Cold Mill Arrangement
(Reference Drawing)

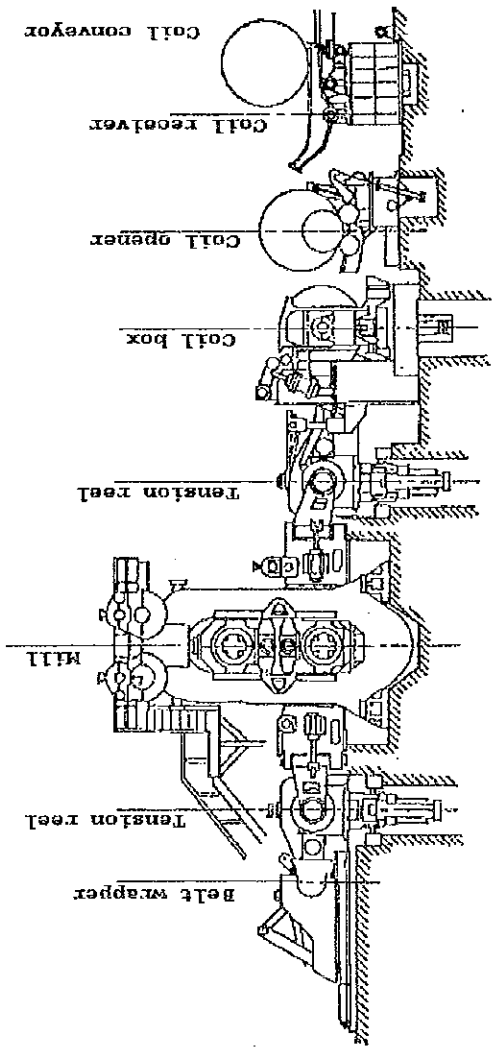


Figure 6-4-4 Single Stack Annealing Furnace Arrangement
(Reference Drawing)

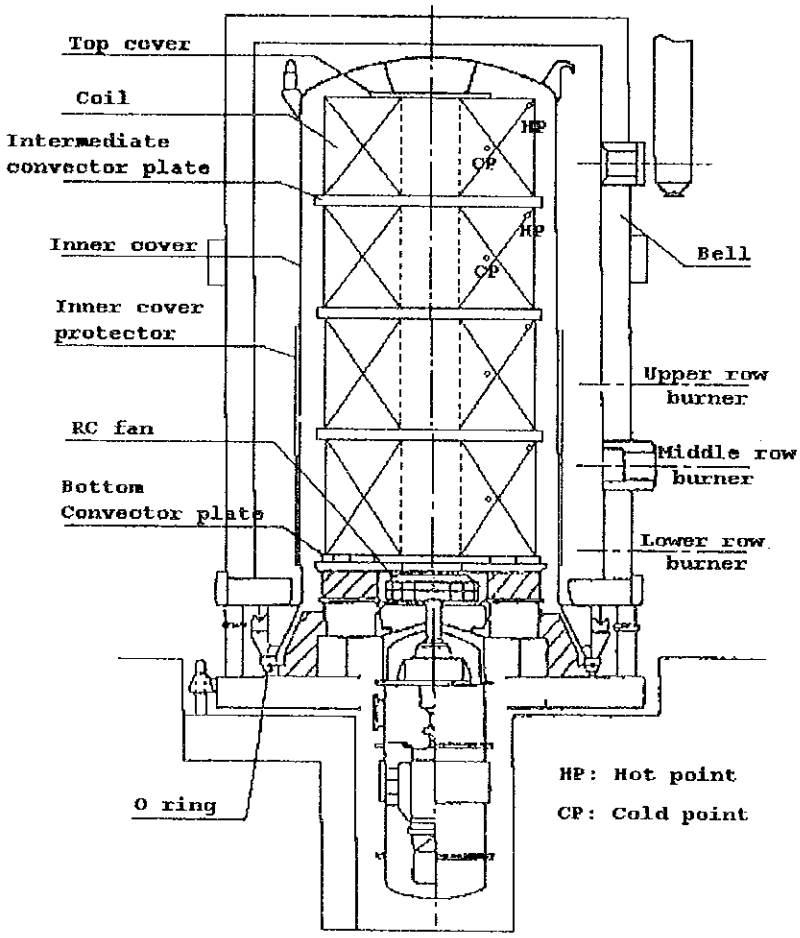


Figure 6-4-5 Temper Mill Arrangement
(Reference Drawing)

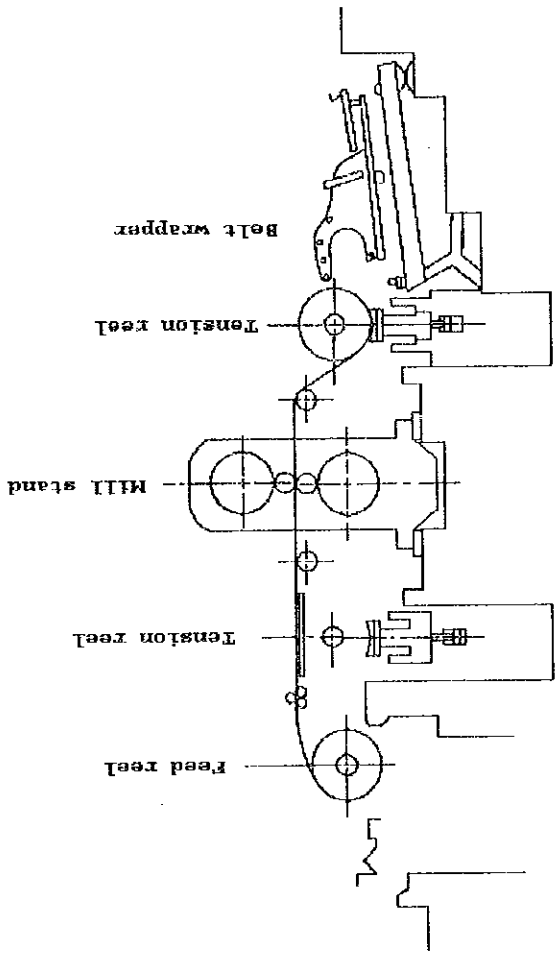


Figure 6-4-6 CGL Arrangement

(Reference Drawing)

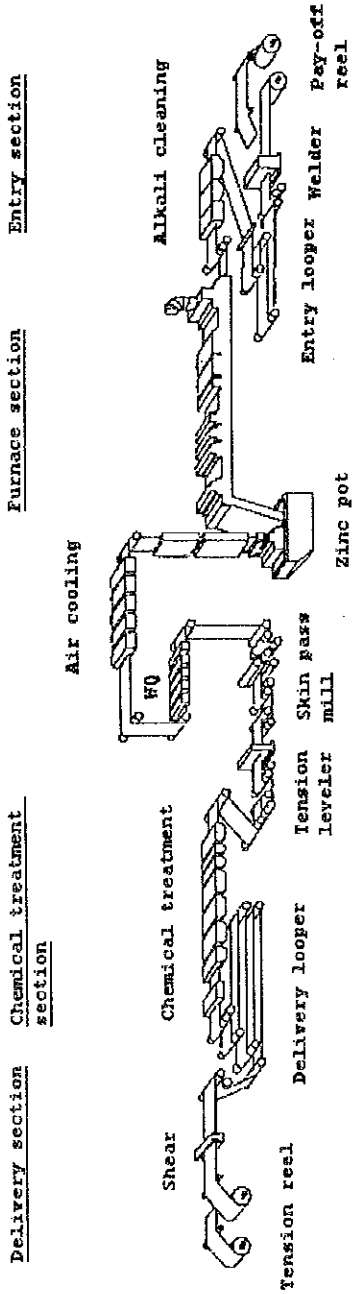
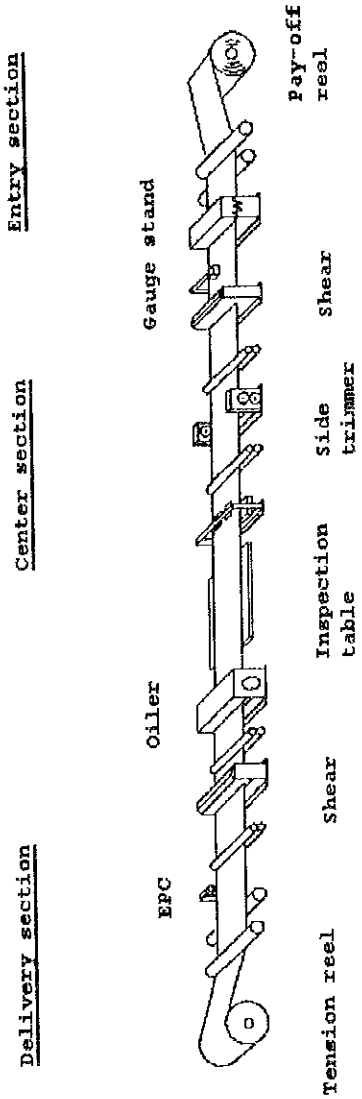


Figure 6-4-7 RCL Arrangement
(Reference Drawing)



Appendix 6A-5 LIME CALCINING PLANT

Appendix 6A-5-1 LIME CALCINING PLANT EQUIPMENT LIST

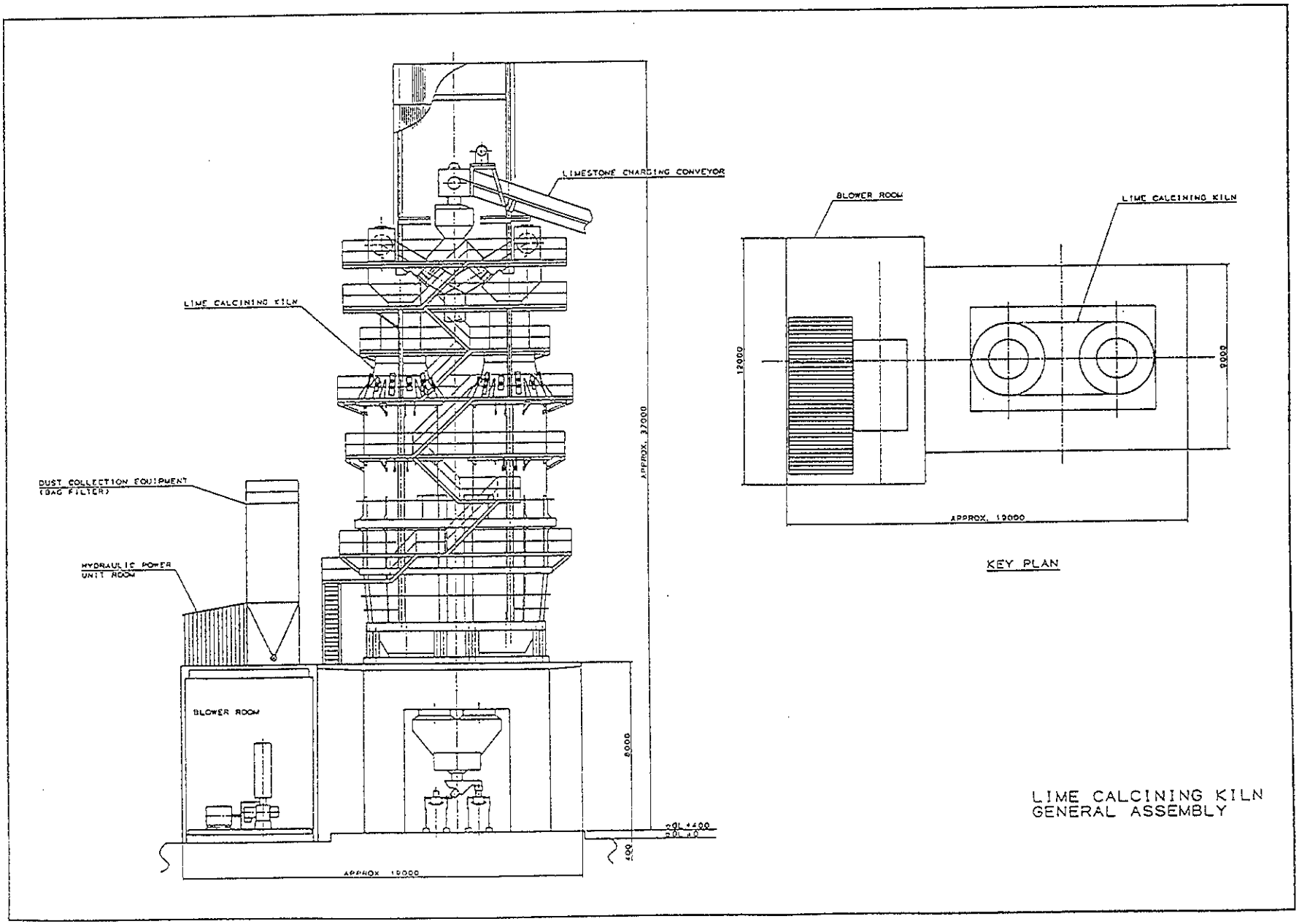
Appendix 6A-5-2 LIME CALCINING PLANT DRAWINGS

Appendix 6A-5-1 Lime Calcining Plant Equipment List

No.	Equipment	Q'ty	Specification
LC01	Raw Material Receiving Section		
0101	Receiving hopper	1	
0102	Vibrating feeder	1	100 t/h
0103	Belt conveyor	1	100 t/h
0104	Single deck screen	1	72 t/h
0105	Belt conveyor	1	100 t/h
0106	Fines hopper	1	
0107	Conveyor scale	1	100 t/h
0108	Belt conveyor	1	60 t/h
0109	Submergible pump	1	
LC02	Lime Calcining Plant		
0201	Limestone storage bin	1	
0202	Belt conveyor	1	
0203	Calcining kiln	1	Shaft kiln type, 160 t/d
LC03	Product Handling System		
0301	Belt conveyor	1	20 t/h
0302	Damper	1	20 t/h
0303	Belt conveyor	1	20 t/h
0304	Belt conveyor	1	20 t/h
0305	Vibrating screen	2	200 t/h
0306	Jaw crusher	1	10 t/h
0307	Belt conveyor	1	20 t/h
0308	Belt conveyor	1	20 t/h
0309	Screw conveyor	1	3 t/h
0310	Chain conveyor	1	3 t/h
0311	Cushion hopper	1	15 t
0312	Screw conveyor	1	3 t/h
0313	Briquetting machine	1	2.5 t/h
0314	Belt conveyor	1	20 t/h
0315	Product bin	1	
0316	Vibrating feeder	1	200 t/h
0317	Belt conveyor	1	200 t/h
0318	Conveyor scale	1	200 t/h

No.	Equipment	Q'ty	Specification
0319	OHT hoist crane	1	5 t
0320	Dust collector	1	Bag type
0321	Bag filter	4	
LC04	Electrical Equipment		
0400	Power receiving and distribution system	1 set	
0420	Motors and motor controls	1 set	
0440	DC power supply system	1 set	
0460	Ancillary equipment	1 set	
0480	Cables and installation materials	1 set	
LC05	Instrumentation		
0500	Process supervising, sequencing control and data logging system	1 set	
0520	Instruments	1 set	
0540	Uninterruptible power supply system	1 set	
0560	Instrumental miscellaneous	1 set	

Appendix 6A-5-2 Lime Calcining Plant (Sectional View)



Appendix 6A-6 POWER AND DISTRIBUTION FACILITIES

Appendix 6A-6-1 Equipment list of Power and Distribution

No.	Equipment	Q'ty	Specification
PW01	220 kV GIS		
011	Receiving unit	2 sets	
	1) Circuit breaker (CB)		245kV,1250A,40kA,2cycle Oil-hydraulic operation/ SF6 gas insulated
	2) Disconnect switch (DS)		245kV,1250A, 40kA(1 sec.) Motor operation / motor spring charge operation
	3) Earthing switch (ES)		245kV, 40kA(1 sec.) Motor operation / motor spring charge operation
	4) Lightning arrester (LA)		198kV, 10kA, Zinc oxide station type with discharge counter
012	Metering outfit (MOF)	2 sets	
	1) PT		220/√3kV:110/√3V 0.5 class
	2) CT		100/5A 0.5 class
013	Main and feeder bus bar	1 set	
	1) Main bus bar		Double bus bar type 245kV 1250A, 40kA (1 sec.)
	2) Feeder bus bar		Single bus bar type 245kV 1250A, 40kA (1 sec.)
014	PT	2 sets	
	1) Diconnect switch		245kV, 1250A, 40kA (1 sec.) Manual operation
	2) PT		220/√3kV : 110/√3V : 110/3V
015	Bus tie unit	1 set	
	1) Disconnect switch		245kV, 1250A, 40kA (1 sec.) Manual operation
	2) Earthing switch		245kV, 1250A, 40kA (1 sec.) Manual operation
	3) Circuit breaker		245kV, 1250A, 40kA, 2cycle, Oil-hydraulic operation, SF6 gas
016	Transformer feeder unit	3 sets	
	1) Circuit breaker (CB)		245kV, 1250A, 40kA, 2cycle Oil-hydraulic operation, SF6 gas insulated
	2) Disconnect switch (DS)		245kV, 1250A, 40kA (1 sec.) Motor spring charge operation
	3) Earthing switch (ES)		245kV, 40kA (1 sec.) Motor operation
017	Auxiliary devices	1 set	
	1) Local control panel		
	2) Gas monitering device		

Appendix 6A-6-1 Equipment list of Power and Distribution

No.	Equipment	Q'ty	Specification
PW02	220/33 kV power transformer		
021	220/33 kV 3-phase on-load tap changer	2 sets	
	1)Type		Oil immersed outdoor use
	2)Capacity		80/110 MVA at ONAN/ONAF
	3)Rated voltage		3-phase 50Hz, 220/33 kV
	4)Primary taps		220kV+12% to -21% (1.5% tapping) On-load tap changer
	5)Connection		Yyd5
	Primary		Wye (Solid grounding neutral)
	Secondary		Wye (100A resistor grounging neutral)
	Tertiary		Delta (30MVA) with two external terminals closed outside the trans-former.
	6)Oil preservation		Diaphram type
	7)Accessories		
	DS, LA, Buchholz relay		
	8)Fire fighting equipment		
	Water pressure tank		
	Air compressor		
022	220/33 kV 3-phase on-load tap changer	1 set	
	1)Type		Oil immersed outdoor use
	2)Capacity		160MVA at ONAN
	3)Rated voltage		3-phase 50Hz, 220/33kV
	4)Primary taps		220kV+12% to -21% (1.5% tapping) On-load tap changer
	5)Connection		Yyd5
	Primary		Wye (Solid grounding neutral)
	Secondary		Wye (100A resistor grounging neutral)
	Tertiary		Delta with two external terminals closed outside the trans-former
	6)Oil preservation		Diaphram type
	7)Accessories		
	DS, LA, Buchholz relay		
	8)Fire fighting equipment		
	Water pressure tank		
	Air compressor		
PW03	33 kV switchgears		
031	Neutral grounding resistor(NGR)	3 sets	
	1)NGR		33/$\sqrt{3}$kV,100A,190 ohm,10sec.
	2)DS		36kV,400A manual operation

Appendix 6A-6-1 Equipment list of Power and Distribution

No.	Equipment	Q'ty	Specification
032	Main panel 1)VCB	3 sets	 36kV,2400A, 25kA, Motor spring charger operation
033	Bus tie panel 1)VCB	1 set	36kV,2400A, 25kA, Motor spring charger operation
034	Feeder panel 1)VCB	13 sets	 36kV, 1250A, 25kA, Motor spring charger operation
035	GPT panel 1)GPT with fuse		 Single phase resin moded type 33/√3kV : 110/√3V : 110/3V
036	LA panel 1)LA	3 sets	 Zinc oxide type 42kV, 10A
037	SA panel 1)SA	3 sets	 36/√3kV, 0.1 micro F
038	Feeder panel for flicker compensator 1)GCB	2 sets	 36kV, 1250A, 25kA Motor spring charge operation
039	Feeder panel for EAF 1)GCB	2 sets	 36kV, 1250A, 25kA Motor spring charge operation
PW04	Flicker and power factor compensator (FPC) 1) High impedance transformer 2) Thyristor equipment 3) Auxiliary control panel and thyristor control panel 4) Filters 5) FPC supervisory panel	1 set	 30MVA 30MVA 2nd harmonic filter 4th harmonic filter 5th harmonic filter 6th harmonic filter
PW05	33/6.9 kV power transformer 1) Type 2) Capacity 3) Rated voltage 4) Primary taps 5) Connection Primary / Secondary 6) Oil presarvation	2 sets	(including one spare) Oil immersed outdoor use 20/24MVA at ONAN/ONAF 3-phase 50Hz 33/6.6kV 34.5/33.75/32.25/31.5kV at full cap. Dy11 Delta/Wye (10A resistor grounding neutral) Diaphram type

Appendix 6A-6-1 Equipment list of Power and Distribution

No.	Equipment	Q'ty	Specification
PW06	6.6 kV switchgears		
061	NGR panel		
	1) NGR	1 set	6.6/$\sqrt{3}$kV, 10A, 38 ohm continuous
	2) DS		Single phase type 7.2kV 100A manual operation
062	Main panel	1 set	
	1)VCB		7.2kV 2000A, 40kA Motor spring charge operation
063	Feeder panel	11 sets	
	1)VCB		7.2kV, 1250A, 40kA Motor spring charge operation
064	GPT and LA	1 set	
	1)GPT		3-phase resin molded type 6.6kV : 110V : 110/3V
	2)LA		Zinc oxide type 8.4kV, 10kA
065	Station service transformer	1 set	
	1)Type		Oil immersed outdoor type
	2)Capacity		500kVA, ONAN
	3)Rated voltage		6.6kV
	4)Rated secondary voltage		400V
	5)Connection		Delta/Wye, Dy11
	6)Oil preservation		Nitrogen sealed
066	Static capacitor unit	1 set	
	1)Static capacitor type		Outdoor use, mineral oil immersed, self cooled type
	2)Capacity		2000kVAR, 6.9kV
	3)Series reactor with discharging coil		Outdoor use, Oil immersed, self cooled type. 6.9kV 120kVA capacity
PW07	Diesel generators	2 sets	
071	Diesel engine		V-type, trunk piston type with super charger and intercooler output:2870PS, 1000rpm, 12 cylinder
072	Generator	2 sets	6.6kV, 2500kVA, pf : 0.8, insulation : F class, brushless, 6 poles star connection Over speed : 120% Protection : IP-23 ground resistor : 10A continuous

Appendix 6A-6-1 Equipment list of Power and Distribution

No.	Equipment	Q'ty	Specification
073	Distribution panels		
	1)6.6 kV main switchgears	2 sets	
	2)VCB		7.2kV, 1250A, 40kA Motor spring charge operation
	3)ES		7.2kV manual operation
	4)6.6 kV feeder switchgears	10 sets	Vacuum contactor 7.2kV, 450A
	5)Exitor panel		
	6)GPT cubicle		
	7)380 V distribution panel		
	8)NGR panel	2 sets	6.6/$\sqrt{3}$kV, 10A, 381 ohm continuous DS:100A 7.2kV, manual operation
074	Starting system		
	1) Type		Compressed air system
	2)Air tank		Capable of automatically starting 3 times.
	3)Air receiver		300 litre
	4)Air compressor		
075	Cooling system		Closed cooling system in two circuit arrangement for each engine and is equipped with cooling tower, jacket water pump and cooler water pump.
076	Fuel system	1 set	Fuel system is consisting of main storage tank, dry tank,oil transfer pump and fuel oil filter and fuel pump.
PW08	Supervisory control and relay panel	1 set	Supervisory and control panels and centralized monitoring system.
PW09	Fire protection system	1 set	
PW10	Telephone system	1 set	
PW11	Air conditoning system	1 set	
PW12	Cables and Materials	1 set	Cables & sub materials for 33kV, 6.6kV and other, and cable tray

Appendix 6A-7 UTILITIES FACILITIES

Appendix 6A-7-1 Utilities Equipment List

No.	Equipment	Q'ty	Specification
UT-0100	Natural Gas Receiving Station		Capa. : 50,000 Nm^3/h
UT-0101	Filter Separator	2	Material: CS Type : Horizontal Capa. : 50,000 Nm^3/h, Design Press.:10 kgf/cm^2G, Size Particles Removed : 10micron and Over
UT-0102	Pressure Regulation Unit	2	
UT-0103	Flare Stack with Ignitor, Control Panel, Flare Burner, Pilot & Dry Seal	1	Material: CS/SS Type : Guy Wire smokeless Capa. : 50,000 Nm^3/h
UT-0104	Instrument Nitrogen Receiving Tank	1	Material: CS Type : Vertical Capa. : 2.3m^3
UT-0105	Flow Meter	1	Type : Turbine Capa. : 60,000Nm^3/h Accuracy: 71%
UT-0106	Electrical Equipment and Instruments	1 lot	-Lighting System -Local Instrument Panel -Local Mount Instruments
UT-0107	Piping	1 lot	
UT-0108	Wiring Materials	1 lot	
UT-02	Air Compression Station		
UT-0201	Air Compressor with Suction Air Filter	3	Type : Centrifugal Capa. : 9,000Nm^3/h, 7 kgf/cm^2G
UT-0202	Air Receiving Tank	1	Material: CS Type : Vertical Capa. : 30 m^3
UT-0203	Hoist Crane	1	Material: CS Type : Electric Overhead Crane Capa. : 5 tons, Lift 10 m Span 12 m
UT-0204	Piping	1 lot	
UT-0205	Electrical Equipment	1 lot	
UT-0206	Instruments	1 lot	
UT-0207	Wiring Materials	1 lot	

No.	Equipment	Q'ty	Specification
UT-03	Hydrogen Generator		
UT-0301	Hydrogen generator	1 set	
			Type : Reformer-PSA
			Capa. : 80 Nm3/h
			Purity : 99.999 %
			Pressure: 7.0 kg/cm^2
UT-0302	Buffer tank	1	
			Material: CS
			Type : Vertical, cylindrical
			Capa. : 10 m^3
UT-0303	Piping with Necessary Accessories	1 lot	
UT-0304	Analysis Apparatus	1 lot	
UT-0305	Electrical Equipment	1 lot	
UT-0306	Instruments	1 lot	
UT-0307	Wiring Materials	1 lot	
UT-04	Steam boiler		
UT-0401	Demineralizer	1 lot	
			Type : 2B-2T ion exchanger
			Capa. : 5 m^3/h
			TREATED WATER :
	With		<10 micro.S
	Caustic Soda Tank	2	
	Caustic Soda Agitator	2	
	Caustic Soda Injection Pump	2	
	Acid Tank	1	
	Acid Injection Pump	3	
	Demineralized Water tank	1	
	Demineralized Water Pump	2	
UT-0402	Feed water pump	2	
			Type : Turbine
			Capa. : 5 m^3/h x 10m
UT-0403	Steam boiler with deaerator	1	
			Type : Packaged / ACC control
			Capa. : 3,000 kg/h
			Pressure: 8 kg/cm^2
			Fuel : Natural gas
UT-0404	Stack	1	
			Type : CS/Self standing
			Height : 10 m
UT-0405	Piping with Necessary Accessories	1 lot	
UT-0406	Analysis Apparatus	1 lot	
UT-0407	Electrical Equipment	1 lot	
UT-0408	Instruments	1 lot	
UT-0409	Wiring Materials	1 lot	

No.	Equipment	Q'ty	Specification
UT-1100	Raw Water Treatment Station		
UT-1101	Raw Water Basin	1	Material: RC Type : Rectangular Capa. : 3,000m^3
UT-1102	Filter Feed Pump	2	Material: CI/CS Type : Centrifugal Capa. : 520m^3/h x 15 m
UT-1103	Gravity Filter	3	Material: CS/Tar Epoxy Type : Gravity Siphon Filter Capa. : 160m^3/h/unit
UT-1104	Backwash Water Storage Basin	1	Material: RC Type : Rectangular Capa. : 150m^3
UT-1105	Sludge Basin	1	Material: RC Type : Rectangular Capa. : 60m^3
UT-1106	Filtered Water Basin	1	Material: RC Type : Rectangular Capa. : 300m^3
UT-1107	Sodium Chloride Dissolving Basin	1	Material: RC Type : Rectangular Capa. : 45m^3
UT-1108	Make-up Water Storage Basin	1	Material: RC Type : Rectangular Capa. : 450m^3
UT-1109	Surface Water Drain-off Pump	2	Material: CI/CS Type : Centrifugal Capa. : 24m^3/h x 10 m
UT-1110	Portable Sludge Pump	1	Material: CI/Cr-CI Type : Submersible Capa. : 50m^3/h x 15 m
UT-1111	Water Softener Feed Pump	4	Material: CI/CS Type : Centrifugal Capa. : 200m^3/h x 25 m
UT-1112	Water Softener	3	Material: CS/Epoxy Coating Type : Vertical Capa. : 160m^3/h
UT-1113	Make-up Water Supply Pump	3	Material: CI/CS Type : Centrifugal Capa. : 500m^3/h x 40 m

No.	Equipment	Q'ty	Specification
UT-1114	Sodium Chloride Feed Pump	2	
			Material: Cl-R.L
			Type : Centrifugal
			Capa. : 20m^3/h x 20 m
UT-1115	PAC Storage Tank with Agitator	1	
			Material: PE
			Type : Vertical,Cylindrical
			Capa. : 200 l
UT-1116	Vacuum Pump for Gravity Filter	2	
			Material: Cl
			Type : Water Ring
			Capa. : 15m^3/h x 500 mm Aq.
UT-1117	Hypochlorite Storage	1	
			Material: PE
			Type : Vertical,Cylindrical
			Capa. : 200 l
UT-1118	Hypochlorite Injection	2	
			Material: PVC
			Type : Diaphragm
			Capa. : 3.6l/h x 100m
UT-1119	Potable Water Storage	1	
			Material: RC
			Type : Rectangular
			Capa. : 490m^3
UT-1120	Potable Water Supply Unit With Pressure Tank 2m^3	1 Set	
			Material: FC
			Type : Centrifugal
			Capa. : 50m^3/h x 40m
UT-1121	Piping with Necessary Accessories	1 lot	
UT-1122	Analysis Apparatus	1 lot	
UT-1200	Water Treatment Station - 1		
UT-1201	ICW Cooling Tower for EAF,LF and SMP	1	
			Material: RC/FRP
			Type : Counter Flow Film type
			Capa. : 6,000m^3/h (42-32-26°C)
UT-1202	Hot Well	1	
			Material: RC
			Type : Rectangular
			Capa. : 800m^3
UT-1203	Cold Well	1	
			Material: RC
			Type : Rectangular
			Capa. : 2,500m^3
UT-1204	ICW Supply Pump for EAF,LF and SMP	5	
			Material: Cl/CS
			Type : Centrifugal
			Capa. : 1,475m^3/h x 55 m
UT-1205	Hot Water Transfer Pump	5	
			Material: Cl/CS
			Type : Centrifugal
			Capa. : 1,475m^3/h x 20 m

No.	Equipment	Q'ty	Specification
UT-1206	Diesel Pump for EAF,LF	1	Material: Cl/CS Type : Centrifugal Capa. : 825m^3/h x 50 m Diesel Engine : Enclosure Type Automatic Electrical Starting System
UT-1207	Side Stream Filter	2	Material: CS Type : Vertical Capa. : 150m^3/h
UT-1208	Head Tank	1	Material: RC Type : Cylindrical Capa. : 130m^3, 35m High
UT-1209	Chemical Injection facilities	1 lot	
UT-1210	Piping with Necessary Accessories	1 lot	
UT-1300	Water Treatment Station - 2		
UT-1301	Cooling Tower for Air compression station	1	Material: RC/PVC Type : Counter Flow Film Type Capa. : 300m3/h(42-32-26°C)
UT-1302	Cold Well	1	Material: RC Type : Rectangular Capa. : 150m^3
UT-1303	Side Stream Filter	1	Material: CS Type : Vertical Capa. : 20m^3/h
UT-1304	ICW Supply Pump for Air Compressor	2	Material: Cl/CS Type : Centrifugal Capa. : 400m^3/h x 35m
UT-1305	Chemical Injection facilities	1 lot	
UT-1306	Piping with Necessary Accessories	1 lot	
UT-1400	Water Treatment Station - 3		
UT-1401	ICW Cooling Tower for CC and HSM	1	Material: RC/FRP Type : Counter Flow Film Type Capa. : 3,000m^3/h (42-32-26°C)
UT-1402	Cold Well	1	Material: RC Type : Rectangular Capa. : 1,000m^3

No.	Equipment	Q'ty	Specification
UT-1403	ICW Supply Pump for Cooling Tower	3	Material: CI/CS Type : Centrifugal Capa. : 870m^3/h x 30 m
UT-1404	Heat Exchanger for CC	5	Material: SS Type : Plate Type Capa. : Hot : 435m^3/h(48-35°C) Cold: 435m^3/h(32-45°C)
UT-1405	ICW Supply Pump for CC	3	Material: CI/CS Type : Centrifugal Capa. : 870m^3/h x 90 m
UT-1406	ICW Supply Pump for HSM	3	Material: CI/CS Type : Centrifugal Capa. : 500m^3/h x 50 m
UT-1407	Diesel Pump for HSM, CC	2	Material: CI/CS Type : Centrifugal Capa. : 840m3/h x 50 m Diesel Engine : Enclosure Type Automatically Electrical Starting System
UT-1408	Softener	2	Material: FRP Type : Vertical Capa. : 10m^3/h
UT-1409	Softened Water Tank	1	Material: RC Type : Rectangular Capa. : 500m^3
UT-1410	Head Tank	1	Material: RC Type : Cylindrical Capa. : 250m^3, 45m High
UT-1411	Chemical Injection facilities	1 lot	
UT-1413	Piping with Necessary Accessories	1 lot	
UT-1500	Water Treatment Station - 4		
UT-1501	DCW Cooling Tower for HSM	1	Material: RC/FRP Type : Counter Flow, Splash Capa. : 6,000m^3/h (38-32-26°C)
UT-1502	DCW Cooling Tower for HRT in HSM	1	Material: RC/FRP Type : Counter Flow ,Splash Capa. : 450m^3/h (50-32-26°C)

No.	Equipment	Q'ty	Specification
UT-1503	DCW Cooling Tower for CC	1	Material: RC/FRP Type : Counter Flow, Splash Capa. : 700m^3/h/cell x1 cells (45-32-26°C)
UT-1504	Cold Well for HSM	1	Material: RC Type : Rectangular Capa. : 2,500m^3
UT-1505	Cold Well for HRT	1	Material: RC Type : Rectangular Capa. : 150m^3
UT-1506	Cold Well for CC	1	Material: RC Type : Rectangular Capa. : 250m^3
UT-1507	DCW Supply Pump for CC Spray and Mach. Cooling	2	Material: CI/CS Type : Centrifugal Capa. : 680m^3/h x 105 m
UT-1508	DCW Supply Pump for HSM, HRT	2	Material: CI/CS Type : Centrifugal Capa. : 450m^3/h x 45 m
UT-1509	DCW Supply Pump for HSM	5	Material: CI/CS Type : Centrifugal Capa. : 1,775m^3/h x 105m
UT-1510	Diesel Engine Pump for DCW CC	1	Material: CI/CS Type : Centrifugal Capa. : 200m^3/h x 55 m Diesel Engine : Enclosure Type Automatic Electrical Starting System
UT-1511	Head Tank for DCW	1	Material: RC Type : Cylindrical Capa. : 35m^3, 35m High
UT-1512	Sedimentation Basin	1	Material: RC Type : Rectangular Capa. : 6,720m^3
UT-1513	Sludge Remover for Sedimentation Basin	2	Material: CS Type : Gantry Crane with Grab Bucket

No.	Equipment	Q'ty	Specification
UT-1514	Sludge Pump	4	
			Material: Cl/Cr-Cl
			Type : Submersible
			Capa. : $30m^3/h$ x 15 m
UT-1515	Oil Skimmer	4	
			Material: CS
			Type : Mop Skimmer
			Capa. : $10m^3/h$
UT-1516	Floating Pump	4	
			Material: Cl
			Type : Scum Skimmer
			Capa. : $12m^3/h$ x 2 m
UT-1517	Sedimentation Treated Water Basin for HSM	1	
			Material: RC
			Type : Rectangular
			Capa. : $1,920m^3$
UT-1518	Sedimentation Treated Water Basin for CC	1	
			Material: RC
			Type : Rectangular
			Capa. : $640m^3$
UT-1519	Filter Feed Pump for HSM	3	
			Material: Cl/CS
			Type : Centrifugal
			Capa. : $3,000m^3/h$ x 25m
UT-1520	Filter Feed Pump for CC	2	
			Material: Cl/CS
			Type : Centrifugal
			Capa. : $700m^3/h$ x 25m
UT-1521	Pressure Filter	11	
			Material: CS, Anthracite/Sand
			Type : Vertical
			Capa. : $860m^3/h$
UT-1522	Backwash Blower	3	
			Material: Cl/CS
			Type : Rotary
			Capa. : $1,450m^3/h$ x 7000mmAq.
UT-1523	Lub. Oil Pump for Blower	3	
			Material: Cl/CS
			Type : Gear / Lub. Oil Cooler
			Capa. : $0.5m^3/h$ x 3 kgf/cm^2
UT-1524	Backwash Pump	3	
			Material: Cl/CS
			Type : Centrifugal
			Capa. : $950m^3/h$ x 25m
UT-1525	Backwash Water Storage Basin	1	
			Material: RC
			Type : Rectangular
			Capa. : $700m^3$
UT-1526	Backwash Water Transfer Pump	2	
			Material: Cl/Cr-Cl
			Type : Centrifugal
			Capa. : $400m^3/h$ x 20m

No.	Equipment	Q'ty	Specification
UT-1527	Sedimentation Sludge Pit	2	
			Material: RC
			Type : Rectangular
			Capa. : 15m^3
UT-1528	Sludge Pit Pump	4	
			Material: Cl/Cr-Cl
			Type : Submersible
			Capa. : 60m^3/h x 15m
UT-1529	Separated Oil Pit	2	
			Material: RC
			Type : Rectangular
			Capa. : 9m^3
UT-1530	Coagulation Tank with Agitator	1	
			Material: RC/SS
			Type : Rectangular
			Capa. : 20m3
UT-1531	Thickener	1	
			Material: RC, CS/Tar Epoxy
			Type : Rectangular Center Shaft Sludge Scraper with Electrical Lifting Device
UT-1532	Thickener Sludge Pump	2	
			Material: Cl/Cr-Cl
			Type : Centrifugal
			Capa. : 18m^3/h x 15m
UT-1533	Slurry Constant Head Box	1	
			Material: CS
			Type : Rectangular
			Capa. : 250 l
UT-1534	Sludge Storage Basin with Agitator	1	
			Material: RC/SS
			Type : Rectangular
			Capa. : 100m3
UT-1535	Sludge Feed Pump	4	
			Material: Cr-Cl
			Type : Centrifugal
			Capa. : 45m^3/h x 50m
UT-1536	Dehydrator	3	
			Material: CS
			Type : Filter Press with Oil Pressure Unit
			Capa. : 2,500kg-Ds/h
UT-1537	Flushing Pump	3	
			Material: Cl/SS
			Type : Plunger
			Capa. : 6m^3/h x 400m
UT-1538	Air Compressor for Blower	2	
			Material: Cl
			Type : Recipro
			Capa. : 250Nm^3/h x 7 kg/cm^2
UT-1539	Air Receiving Tank	1	
			Material: CS
			Type : Vertical
			Capa. : 2m^3
UT-1540	Flushing Water Tank	1	
			Material: CS
			Type : Vertical
			Capa. : 1.5m^3

No.	Equipment	Q'ty	Specification
UT-1541	Waste Water Pit	1	
			Material: RC
			Type : Rectangular
			Capa. : 1.5m^3
UT-1542	Waste Water Pump	2	
			Material: CI/Cr-CI
			Type : Submergible
			Capa. : 20m^3/h x 20m
UT-1543	Cake Hopper	3	
			Material: CS/Tar Epoxy
			Type : Box Open Gate with Air Cylinder
			Capa. : 20m^3
UT-1544	Chemical Injection facilities	1 lot	
UT-1545	Piping with Necessary Accessories	1 lot	
UT-1600	Water Treatment Station - 5		
UT-1601	ICW Cooling Tower for CRM	1	
			Material: RC/FRP
			Type : Counter Flow Film type
			Capa. : 660m^3/h/cell x 1 cells (42-32-26°C)
UT-1602	Cold Well	1	
			Material: RC
			Type : Rectangular
			Capa. : 200m^3
UT-1603	ICW Supply Pump for CRM	3	
			Material: CI/CS
			Type : Centrifugal
			Capa. : 660m^3/h x 40 m
UT-1604	Side Stream Filter	1	
			Material: CS
			Type : Vertical
			Capa. : 35m^3/h
UT-1605	Chemical Injection facilities	1 lot	
UT-1606	Demineralizer Unit	1	
			Type: Mixed bed Ion Exchanger Production
			a)Capacity: 5m^3/h b) Quality of Treated Water E. Conductivity: Max.5 microS
-1	Mixed bed Ion Exchanger	1	
-2	Caustic Soda Tank	2	
-3	Caustic Soda Agitator	2	
-4	Caustic Soda Injection Pump	2	
-5	Acid Tank	1	
-6	Acid Injection Pump	3	
-7	Mixing Blower	2	
-8	Demineralized Water tank	1	
-9	Demineralized Water Pump	2	

No.	Equipment	Q'ty	Specification
UT-1607	Piping with Necessary Accessories	1 lot	
UT-1608	Alkaline Raw Water Tank	1	Type : FRP Lining Capa. : 30 m^3
UT-1609	Acid Raw Water Tank	1	Type : FRP Lining Capa. : 120 m^3
UT-1610	Chromate Raw Water Tank	1	Type : FRP Lining Capa. : 20 m^3
UT-1611	Oily Raw Water Tank	2	Type : RC Capa. : 100 m^3
UT-1612	Cr Reduction Tank	2	Type : FRP Lining Capa. : 2 m^3
UT-1613	pH Control Tank	2	Type : FRP Lining Capa. : 30 m^3
UT-1614	Coagulation Tank	1	Type : RC Capa. : 10 m^3
UT-1615	Settling Tank	2	Type : RC Capa. : 350 m^3
UT-1616	Neutralization Tank	2	Type : RC Capa. : 20 m^3
UT-1617	Filter Feed Tank	1	Type : RC Capa. : 50 m^3
UT-1618	Pressure Filter	2	Type : Double Media Pressure Filter 3200d x 2400h
UT-1619	Discharged Water Storage Tank	1	Type : RC Capa. : 100 m^3
UT-1620	Back Wash Water Storage Tank	1	Type : RC Capa. : 100 m^3
UT-1621	Thickener	1	Type : Center Shaft Sludge Scraper Capa. : 64 m^3
UT-1622	Dehydrator	2	Type : Screw Press Capa. : 100kg-ss/d
UT-1623	Dehydrator	2	Type : Filter Press Capa. : 2100kg-ss/d
UT-1624	Sludge Storage Pit	1	Capa. : 60 m^3
UT-1625	Scum Storage Tank	1	Capa. : 30 m^3
UT-1626	Lime Milk Dissolving Tank	1	Capa. : 50 m^3
UT-1627	Analysis Apparatus	1 lot	

No.	Equipment	Q'ty	Specification
UT-1700	Pumping Station		
UT-1701	Pump Pit	7	Material: RC Type : Rectangular Capa. : $4m^3$
UT-1702	Rough Screen	7	Material: CS Type : Bar Screen, Pitch : 30 mm
UT-1703	Basket	7	Material: SS Type : 5 Mesh, Rectangular Capa. : 20 l
UT-1704	Sewage Pump	14	Material: CI Type : Submersible with Quick Discharge Connector Capa. : $7.5m^3/h \times 15m$
UT-1705	Pump Lifting Hanger	7	Material: CS Type : Selfstanding
UT-1706	Piping with Necessary Accessories	1 lot	

No.	Equipment	Q'ty	Specification
UT-1800	Sewage Treatment Station		
			Capa. : 500m^3/day
			BOD5 : Outlet 20ppm
UT-1801	Rough Screen	1	
			Material: CS
			Type : Bar Screen
UT-1802	Basket	1	
			Material: SS
			Type : 5 Mesh
UT-1803	Diffuser for Aerated Grid Chamber	1 lot	
			Material: ABS
			Type : Disc
			Capa. : 0.25 m^3/min. x 5 m
UT-1804	Spray Nozzle for Aerated Grit Chamber	1 lot	
			Material: ABS
			Capa. : 0.25 m3/min. x 5 m
UT-1805	Gate	1 lot	
			Material: PVC
			Type : Slide Gate
UT-1806	Grit Pump	1	
			Material: PVC
			Type : Air Lift
			Capa. : 6 m^3/h x 5 m
UT-1807	Grid Separator	1	
			Material: RC
			Type : Rectangular
UT-1808	Aerated Grid Chamber with Baffle Board	1	
			Material: RC, CS/Tar Epoxy
			Type : Rectangular
			Capa. : 6 m^3
UT-1809	Comminutor	1	
			Material: CI/SCS
			Type : Control Type
			Capa. : 630 m^3/day-3,150 m^3/day
UT-1810	Flow Control Basin	1	
			Material: RC
			Type : Rectangular
			Capa. : 200 m^3
UT-1811	Feed Pump	2	
			Material: CI
			Type : Submersible
			Capa. : 24 m^3/h x 5 m
UT-1812	Diffuser for Flow Control Basin	1 lot	
			Material: ABS
			Type : Disc
			Capa. : 0.25 m^3/min.
UT-1813	Constant Head Box	1	
			Material: CS
			Type : V-Notch Weir
			Capa. : 21 m^3/h
UT-1814	Sludge Storage Basin	1	
			Material: RC
			Type : Rectangular
			Capa. : 36 m^3

No.	Equipment	Q'ty	Specification
UT-1815	Aeration Basin	2	Material: RC Type : Rectangular Capa. : 250 m^3
UT-1816	Diffuser for Aeration Basin	1 lot	Material: ABS Type : Disc Capa. : 0.25 m^3/min.
UT-1817	Sludge Measuring Box	1	Material: CS/Tar Epoxy Type : V-Notch Weir Capa. : 20 m^3/h-60 m^3/h
UT-1818	Sedimentation Basin	1	Material: RC Type : Cylindrical Capa. : 20.8 m^3 /h
UT-1819	Sludge Return Pump	1	Material: PVC Type : Air Lift Capa. : 0.35 m^3/min. x 1.5 mAq
UT-1820	Sludge Collector	1	Material: CS/Tar Epoxy Type : Center Shaft With Drive Unit
UT-1821	Spray Pump Pit	1	Material: RC Type : Rectangular Capa. : 2 m^3
UT-1822	Chlorination Basin	1	Material: RC Type : Rectangular Capa. : 5.2 m^3
UT-1823	Spray Pump	1	Material: CI Type : Submersible with Quick Discharge Connector Capa. : 12 m^3/h x 15 m
UT-1824	Blower for Aeration	2	Material: CI Type : Rotary Type / Silencer Capa. : 17.5 m^3/min. x 4,000 mmAq
UT-1825	Hoist	1	Material: CS Type : Electrical Lifting & Travelling Capa. : 0.5 ton
UT-1826	Hypochlorite Tank with Agitator	1	Material: PE, CS/RL Type : Cylindrical Capa. : 1 m^3
UT-1827	Hypochlorite Pump	2	Material: PVC Type : Diaphragm Capa. : 3.6 l/h x 10 kgf/cm^2

No.	Equipment	Q'ty	Specification
UT-1828	Surface Water Drain-off Pump	2	Material: Cl Type : Submersible Capa. : 0.2 m^3/min. x 4 m
UT-1829	Hoist for Chemical Storage Room	1	Material: CS Type : Electrical Lifting & Travelling Capa. : 0.5 ton
UT-1830	Piping with Necessary Accessories	1 lot	
UT-1831	Analysis Apparatus	1 lot	
UT-1832	Electrical Equipment for Water Treatment Station	1 lot	
UT-1833	Instruments for Water Treatment Station	1 lot	
UT-1835	Wiring Materials for Water Treatment Station	1 lot	
UT-2000	Fire Hydrant System		
UT-2001	Fire pump	2	Material: Cl/CS Type : Centrifugal Capa. : 250m^3/h x 85 m
UT-2002	Jockey Pump	2	Material: Cl/CS Type : Centrifugal Capa. : 20m^3/h x 50 m
UT-2003	Fire Diesel Pump	1	Material: Cl/CS Type : Centrifugal Capa. : 250m^3/h x85 m Diesel : Enclosure Type Engine Automatic Electrical Starting System
UT-2004	Pressure Tank	1	Material: CS Type : Cylindrical Capa. : 10m^3
UT-2005	Hydrant With Hose Box	1 lot	
UT-2006	Piping with Necessary Accessories	1 lot	
UT-2007	Analysis Apparatus	1 lot	
UT-2008	Electrical Equipment for Water Treatment Station	1 lot	
UT-2009	Instruments for Water Treatment Station	1 lot	
UT-2010	Wiring Materials for Water Treatment Station	1 lot	
UT-3000	Yard piping		
UT-3001	Piping with Necessary Accessories	1 lot	

No.	Equipment	Q'ty	Specification
UT-3002	Pipe rack and stanchion	1 lot	
UT-3003	Electrical equipment	1 lot	
UT-3004	Instrumentation	1 lot	
UT-3005	Auxiliary equipment	1 lot	
UT-9800	Initial fill Quantity shall be of 6 Months Operation	1 lot	
UT-9900	Spare Parts Quantity shall be of 2 years operation	1 lot	

Figure 6-7-13 Layout Drawing of Natural Gas Receiving Staition

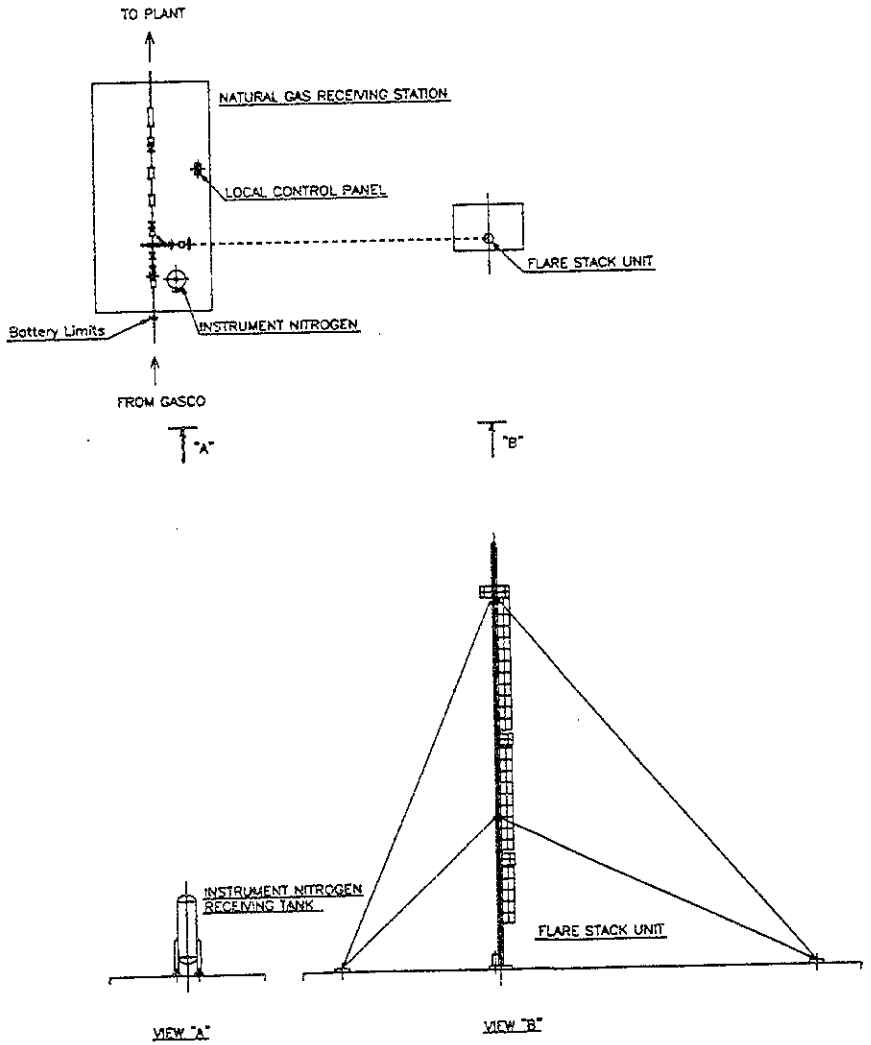


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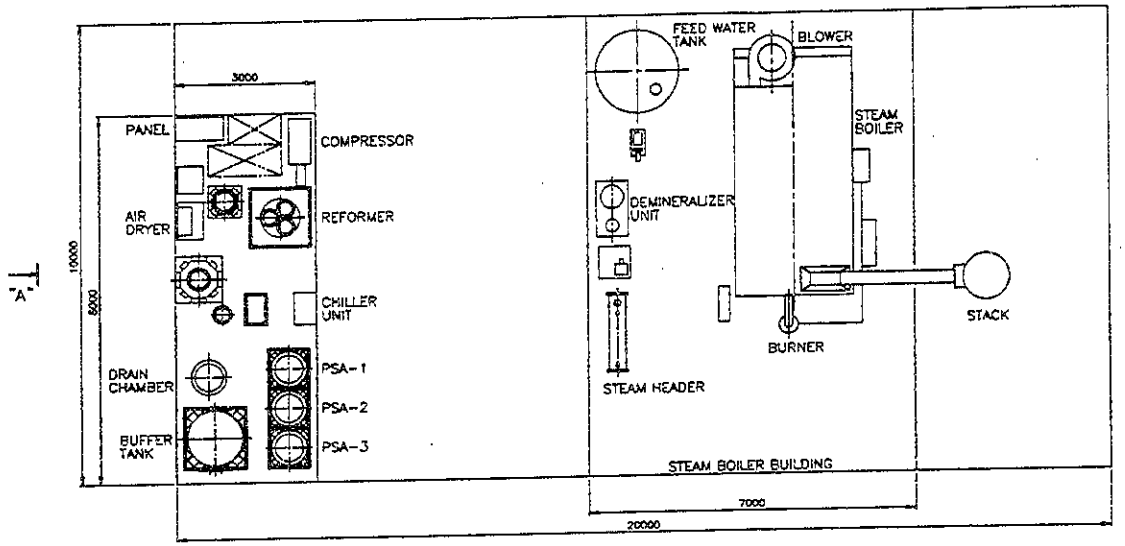
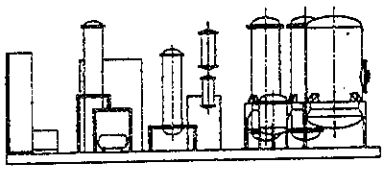
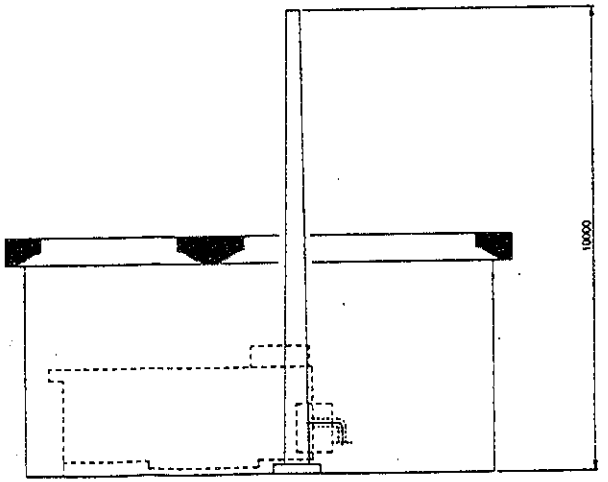
Figure 6-7-14 Layout Drawing of Hydrogen Gas Generator and Steam Generation Staition





VIEW "A"



VIEW "B"

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Figure 6-7-15 Layout Drawing of Raw Water Receiving Station

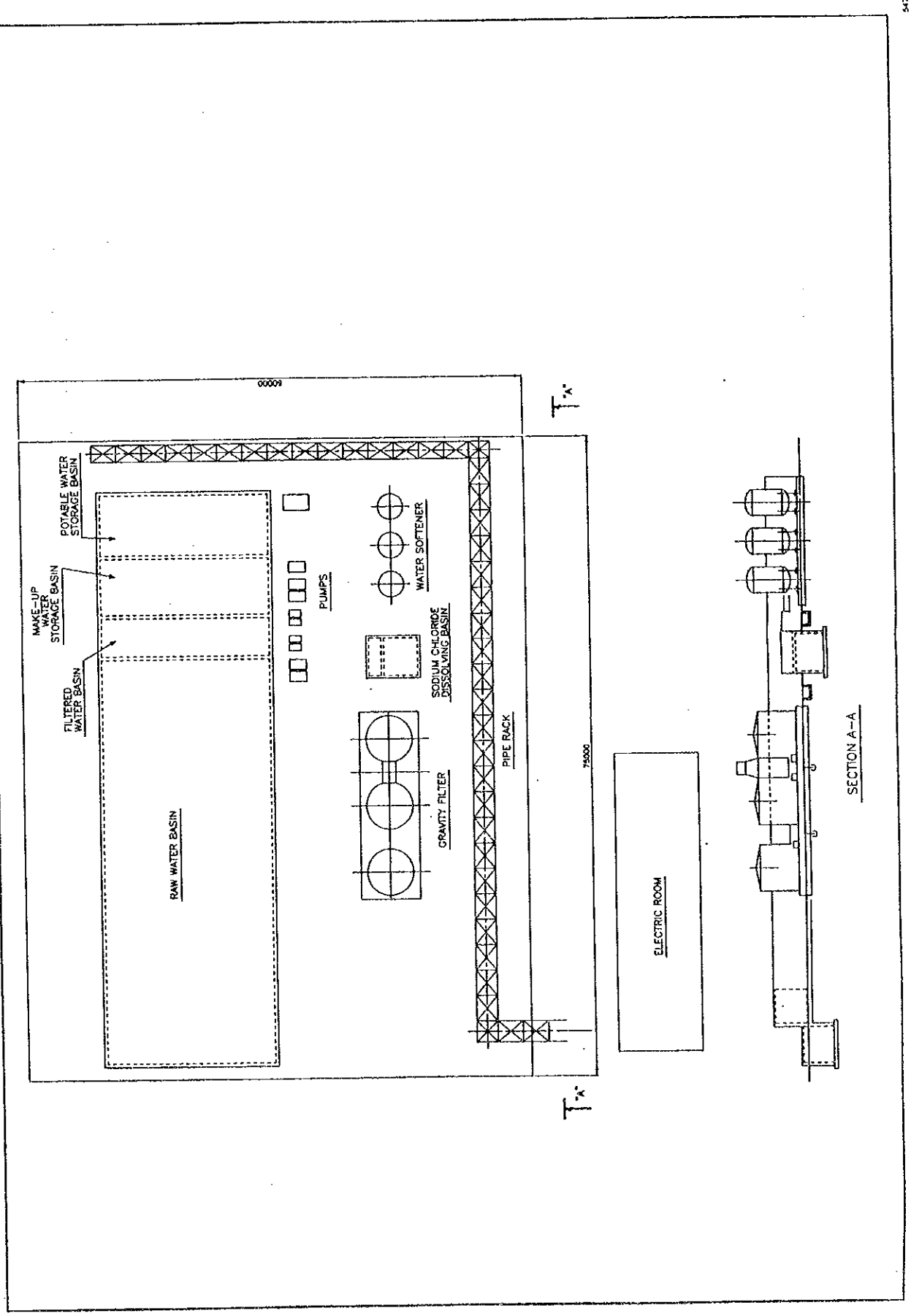


Figure 6-7-16 Layout Drawing of ICW Treatment Staition and Air Compresstion Staition

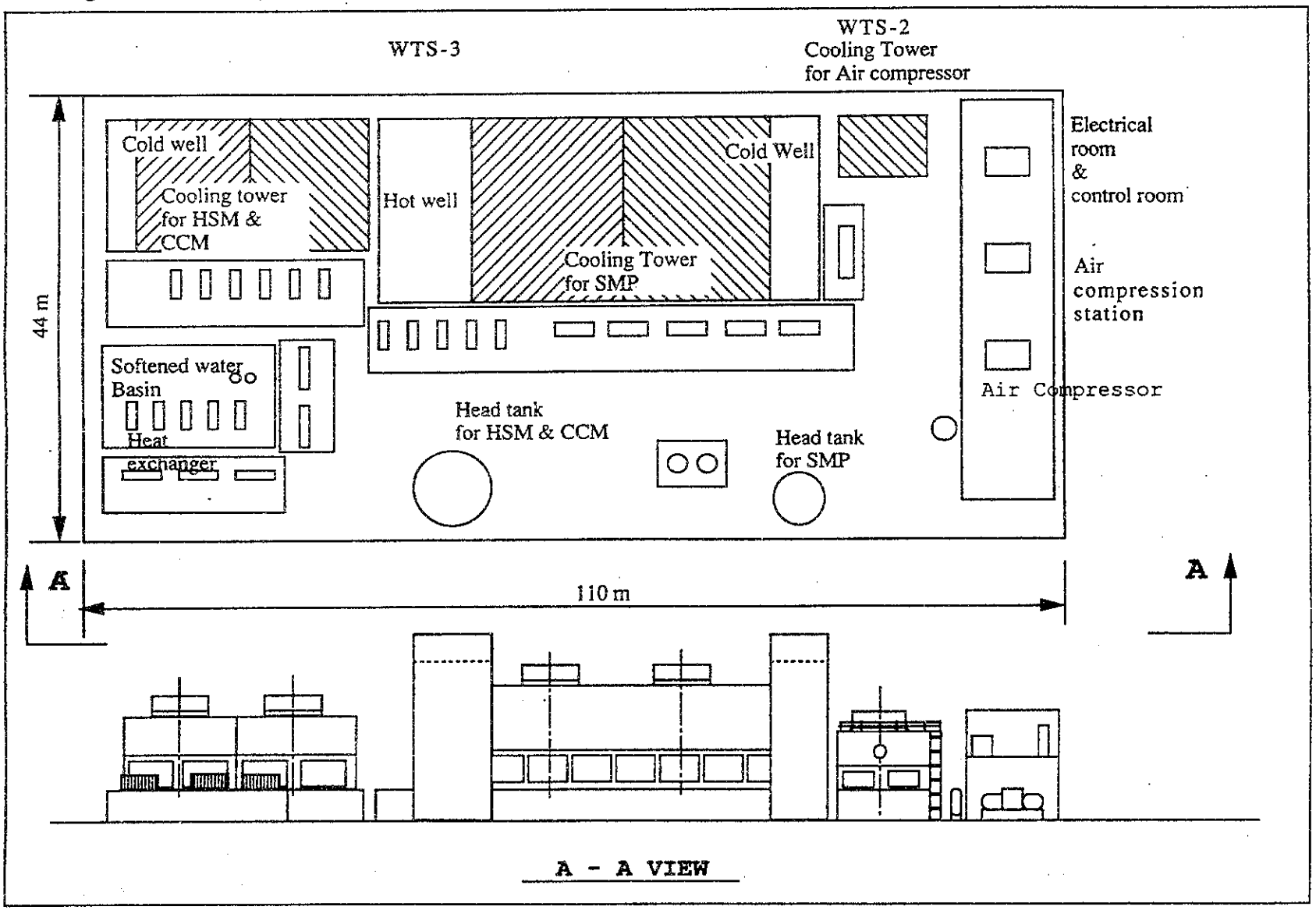


Figure 6-7-17 Layout Drawing of DCW Treatment Station

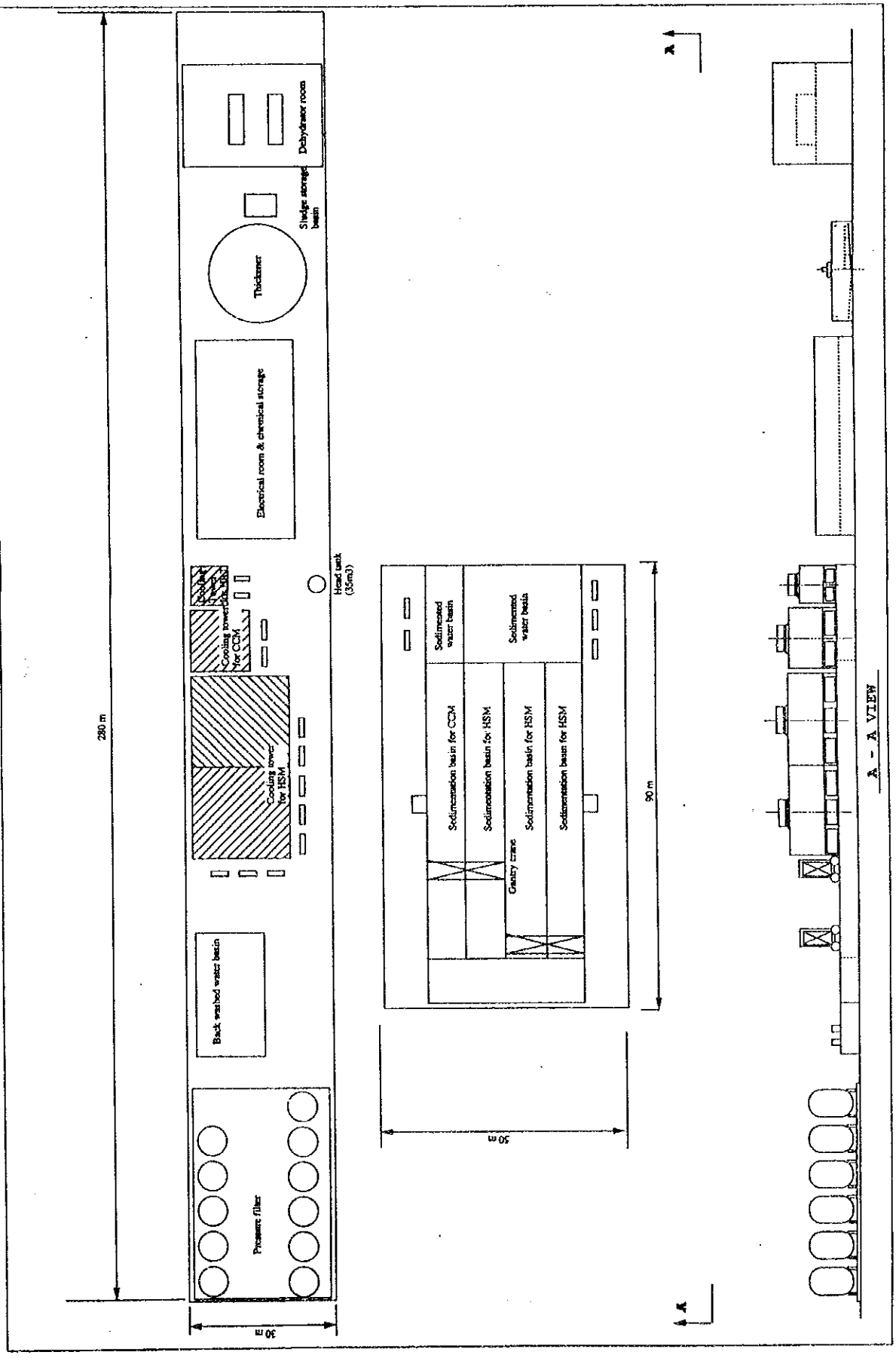
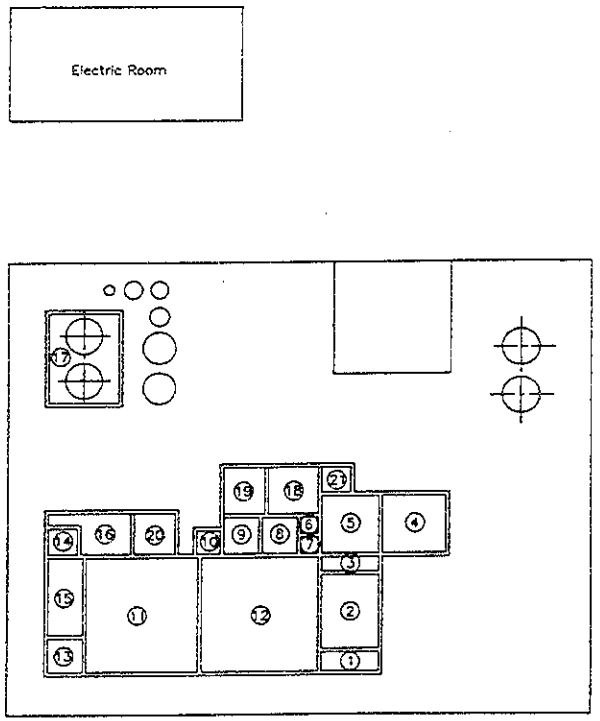
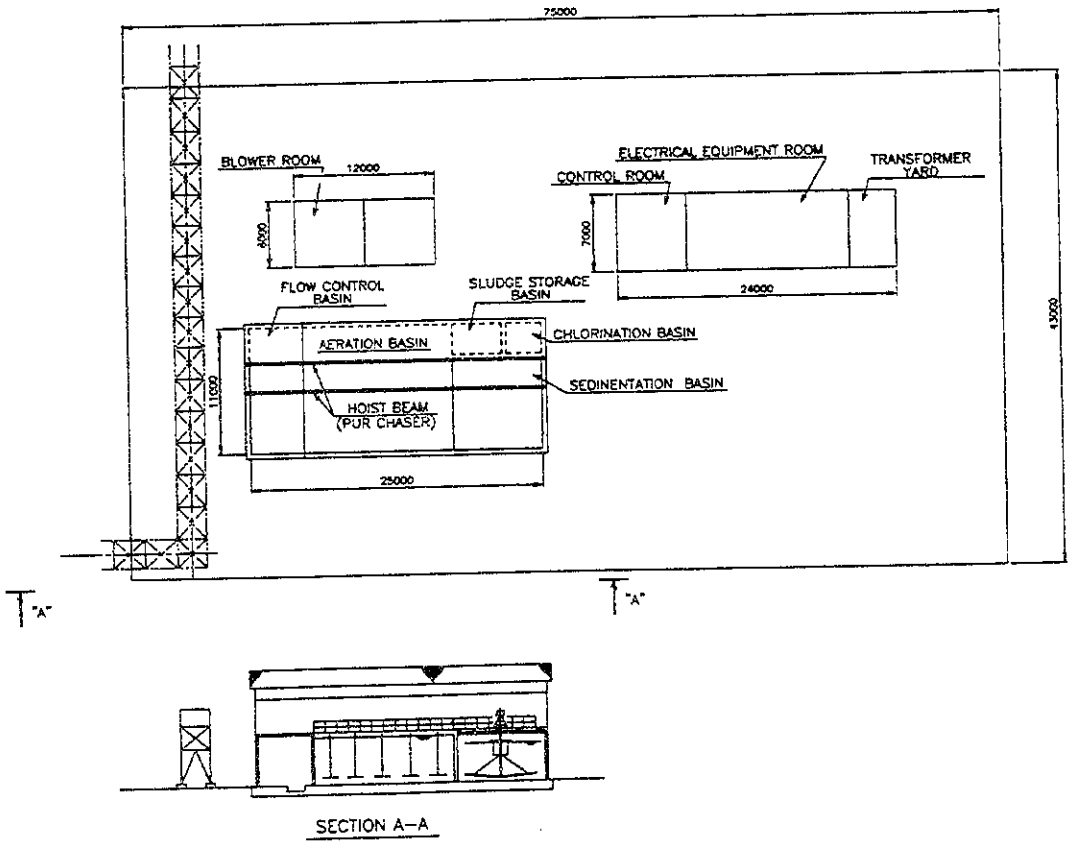


Figure 6-7-18 Layout Drawing of Waste Water Treatment Staition (Category 2)



① Alkaline raw water tank
② Acid raw water tank
③ Chromate raw water tank
④ No.1 Oily raw water tank
⑤ No.2 Oily raw water tank
⑥ No.1 Cr reduction tank
⑦ No.2 Cr reduction tank
⑧ No.1 pH controlling tank
⑨ No.2 pH controlling tank
⑩ Coagulation tank
⑪ No.1 Settling tank
⑫ No.2 Settling tank
⑬ No.1 Neutralization tank
⑭ No.2 Neutralization tank
⑮ Filter feed tank
⑯ Discharged water storage tank
⑰ Sockwash waste water storage tank
⑱ Thickener
⑲ Sludge storage pit
⑳ Lime milk dissolving tank
㉑ Scum storage tank

Figure 6-7-19 Layout Drawing of Sewage Water Treatment System (Category 3)



Appendix 6A-8 IN-WORKS TRANSPORTATION FACILITIES

Appendix 6A-8-1 EQUIPMENT LIST OF IN-WORKS TRANSPORTATION FACILITIES

Appendix 6A-8-1 In-works Transportation Equipment List

No.	Equipment	Q'ty	Specification
TR01	Material handling		
HS011	Handling of slage and waste		
0111	Crawler crane	2	35 ton
0112	Crawler shovel	4	2 m^3
0113	Wheel shovel	6	1.5 m^3
HS012	Handling of scrap and waste		
0121	Forklift truck	2	1.5 ton
0122	Dump truck	16	14 ton
0123	Flat deck truck	2	10 ton
0124	Slag pot carrier	2	60 ton

Appendix 6A-9 ANALYSIS AND INSEPECTION FACILITIES

Appendix 6A-9-1 EQUIPMENT LIST OF ANALYSIS AND INSPECTION FACILITIES

Appendix 6A-9-1 Equipment List of Analysis and Inspection Facilities

NO.	Equipment	Q'ty	Specification
AI01	Analysis Center		
0101	Abrasive Cut-off Machine	1	Wet cutting type
0102	Automatic Sample Preparation for Lollipop Samples	1	
0103	Double Head Pedestal Grinding Machine	1	
0104	Double Head Pedestal Belt Grinder	1	
0105	Disk Vibrating Mill	1	Batch type
0106	Dust Collector for Grindstone	1	
0107	Vacuum Emission Spectrometer	1	with data processing unit
0108	Fluorescent X-Ray Analyzer	1	with data processing unit and x-ray protection
0109	Carbon and Sulphur Determinator	1	
0110	Nitrogen and Oxygen Determinator	1	
0111	Inductively Coupled Plasma Analyzer	1	
0112	Gas Chromatograph	1	
0113	Orsat Gas Analysis Apparatus	1	
0114	Calorimeter	1	Junker's type
0115	Direct Reading Balance	3	Capacity: 200g Readability: 0.1mg
0116	Electronic Reading Balance	3	Weighing capa: 2800g x 2 sets, 500g x 1 set
0117	Shakers of Separated Funnel	2	
0118	Water Bath	2	Propeller stirring type
0119	Sand Bath (Hot Plate)	2	
0120	Drying Oven	3	Temp. range: 40 to 300°C
0121	Muffle Furnace	2	Electrically heated type Temp.: Max. 1200°C
0122	Annular Electric Furnace	2	
0123	Magnetic Stirrer	2	Reverse & one -way revolution drive
0124	Pure Water Making Apparatus	2	Distillation capa: 1.8 l/h
0125	Ion Regenerator	1	Normal flow rate: 50 l/h
0126	Draft Chamber	3	

NO.	Equipment	Q'ty	Specification
0127	Refrigerator	1	
0128	PH Meter	2	
0129	Moisture Tester	1	
0130	Water Testing Meter	1	
0131	Oil Content Analizer	1	
0132	Water Bath for Viscosimeter	1	
0133	Centrifuge	1	
0134	Interfacial Tensionmeter for oil	1	
0135	Cloud and Pour Point Apparatus	1	
0136	Dropping Point Tester	1	
0137	Sample Transportation System for EAF, CC, LF	1	One-way reversible compressed air carrier type
0138	Waste Water Treatment Installation	1	
0139	Glass and Polyethylene Wares	1 lot	
0140	Laboratory Furniture	1 lot	
0141	Automatic Voltage Regulator	1	
0142	Miscellaneous	1 lot	
AI02	Material Testing Center		
0201	Polishing Machine	1	
0202	Horizontal Band Saw	1	
0203	Shearing Machines	2	
0204	Milling Machine for Tensile Test Piece	1	
0205	Refrigerator	1	
0206	Ultrasonic Flaw Detector	1	Portable type
0207	Tensile Tester for YP, TS, and Elongation	1	Capacity: Max. 50 tons Full automatic type
0208	Universal Testing Machine	1	Vertical, hydraulic loading type Capacity: Max. 30 tons
0209	Shore Hardness Tester	1	Dial gauge type
0210	Brinell Hardness Tester	1	
0211	Rockwell Hardness Tester	1	
0212	Deep Drawing Tester for Erichsen Test, CCV Test	1	Punching power: 12 tons
0213	Surface Roughness Tester	1	

NO.	Equipment	Q'ty	Specification
0214	Charpy Impact Tester	1	Capacity: 50 kgf-m
0215	V-Bend Press Machine (Powdering test)	1	
0216	Impact press Machine	1	
0217	Lock Forming Tester	1	
0218	Salt Spray Test Apparatus	1	
0219	Fluorescent X-ray Spectrometer for Coating Mass Test of Zn	1	X-ray generator capa.: Max. 3kw Measurement range: 20-400g/m2
0220	Sampling Puncher for Coating Mass Test	1	Punching diameter: 64.5mm
0221	Universal Projector	1	Vertical optical axis type
0222	Optical Metallographic Microscope	1	
0223	Dark Room Equipment	1	
0224	Pickling Equipment	1	
0225	Jaw Crusher	1	
0226	Rotary Grind Divider	1	Cone type
0227	Disk Vibration Mill	1	
0228	Siever Shaker	1	Square sieve type
0229	Increment Reduction Instrument	1	
0230	Briquette Press	1	Max. load: 50 tons
0231	Specimen Mounting Press	1	Capacity: Max. 5000 Kg
0232	Sample Mixer	1	
0233	Refractory Cutting Machine	1	
0234	Refractory Drilling Machine	1	
0235	Refractory Grinding Machine	1	
0236	ISO Type Drum Testing Machine	1	Tumbler tester
0237	Furnace for Refractoriness Test	1	
0238	Compression Testing Equipment	1	
0239	Refractoriness Tester under Load	1	
0240	Thermal Conductivity Tester	1	
0241	Thermal Expansion Tester	1	
0242	Permeability Apparatus	1	
0243	Optical Pyrometer	1	
0244	Laboratory Furniture	1 lot	
0245	Miscellaneous	1 lot	

Appendix 6A-10 MAINTENANCE SHOP

Appendix 6A-10-1 EQUIPMENT LIST OF MAINTENENCE SHOP

Appendix 6A-10-1 Maintenance Shop Equipment List

No.	Equipment	Q'ty	Specification
MT01	Maintenance shop		
MT011	Mechanical repair		
0111	Lathe	1	1 m
0112	Lathe	1	2.5 m
0113	Lathe	1	5 m
0114	Milling machine	1	
0115	Slotting machine	1	
0116	shaping machine	1	
0117	Boring machine	1	
0118	Radial drilling machine	1	
MT012	Overhaul and assembly shop		Disassembling and assembling
0121	Horizontal press	1	200 ton press
0122	Assembly surface plate		
MT013	Fabrication shop		
0131	Bending roll	1	
0132	Radial drilling machine	1	
0133	Welding machine	1	
MT014	Electrical repair shop		
0141	Winding machine for DC	1	up to 100 kW motor
0142	Winding machine for AC	1	up to 200 kW motor
MT015	Car repair shop		Tool for inspection

Appendix 8A-1　ENVIRONMENTAL SIMULATION FOR ASSESSMENT

(環境評価のためのシミュレーション)

Appendix 8A-1　ENVIRONMENTAL SIMULATION FOR ASSESSMENT
(環境評価のためのシミュレーション)

薄板製造工場設置後の環境条件を判定するため、環境評価として、調査団は調査データと新製鉄所から排出される予想される汚染物質の量とからシミュレーションによって汚染物質の分布を試算した。

1. 基礎データ

1-1　気象および海象

1-1-1　気象

1)　大気温度 (°C)

年間平均	: 20.1
月最高平均	: 24.2
月最低平均	: 16.3

2)　気圧 (mbar)

年間平均	: 1,014.6
月最高平均	: 1,020.2
月最低平均	: 1,009.2

3)　相対湿度 (%)

年間平均	: 68
月最高平均	: 73
月最低平均	: 64

4)　降雨量 (mm)

年間平均	: 168.0

5)　降雨量 1.0 mm 以上の日数: 年間 23.4 日

6) 風

優勢な風向:	春	北北西から北北東
	夏	北から北北西
	秋	北から北北東
	冬	西南西から北北東

平均風速 : 年間平均 9.3 ノット

風についての詳細データを表 8A-1-1 と 8A-1-2 に示す。

1-1-2 海 象

1) 潮位

満潮位	: + 0.52 m
平均潮位	: + 0.33 m
干潮位	: + 0.11 m

2) 潮流

速度 (m/s)	: 0.08 - 0.23
方位	: 東/東南東および北西/北北西

3) 波高

高さ (m)	: 0.2 - 0.5 および 1.0 - 1.4
周期 (s)	: 8.5 - 9.2

Table 8A-1-1 Surface Wind Direction at El Dekhiela

Month	Mean scalar wind speed (knots)	Frequency percentage by direction													
		345° / 014°	015° / 044°	045° / 074°	075° / 104°	105° / 134°	135° / 164°	165° / 194°	195° / 224°	225° / 254°	255° / 284°	285° / 314°	315° / 344°	Variable	Calm
Jan	10.2	5.8	2.9	1.9	2.5	4.2	5.1	4.6	10.2	18.6	11.5	16.2	14.4	0.1	2.0
Feb	9.1	14.7	13.1	5.3	7.7	5.4	5.8	4.2	4.8	3.8	4.6	10.0	18.9	0.1	1.7
Mar	10.5	13.0	7.2	6.4	5.9	7.7	7.6	4.7	4.2	3.7	5.5	10.6	20.6	0.4	2.5
Apr	9.8	15.1	14.4	10.3	9.5	10.4	5.2	3.2	1.8	0.9	2.5	6.9	18.1	0.3	1.4
May	9.0	22.2	22.7	9.0	4.6	4.1	3.9	1.6	0.9	0.7	2.3	5.7	20.4	0.1	1.8
Jun	9.8	33.5	15.3	3.1	1.2	1.2	1.4	0.7	0.6	0.8	1.0	7.8	31.0	0.1	2.2
Jul	9.4	28.8	7.3	0.8	0.5	0.1	0.7	0.1	0.4	0.5	2.5	12.9	43.8	0.1	1.5
Aug	10.2	32.0	5.8	1.2	0.0	0.0	0.0	0.0	0.5	0.6	1.0	9.3	49.3	0.0	0.3
Sep	9.0	38.4	18.8	2.6	0.6	0.5	1.5	1.9	1.2	0.7	0.7	4.2	27.1	0.2	0.6
Oct	8.0	21.2	21.6	11.8	6.6	5.1	6.2	3.0	3.2	2.6	1.7	3.3	12.5	0.1	1.1
Nov	8.0	12.5	17.6	13.6	11.7	5.5	2.8	3.8	4.8	3.4	3.2	6.6	11.1	0.1	3.3
Dec	8.2	9.2	10.3	9.1	10.9	7.9	5.9	7.2	8.3	13.6	5.8	2.7	6.0	0.4	2.7
Annual mean	9.3	20.5	13.1	6.2	5.1	4.3	3.9	2.9	3.4	4.2	3.5	8.0	22.8	0.2	1.9

Table 8A-1-2 Surface Wind Speed at El Dekhiela

Month	Frequency percentage by speed							
	1 - 3 knots	4 - 6	7 - 10	11 - 16	17 - 21	22 - 27	28 - 33	> 33
Jan	11.5	17.8	25.8	27.7	10.1	4.5	0.6	0.0
Feb	13.7	22.1	29.3	25.6	5.3	1.6	0.7	0.0
Mar	9.1	13.8	29.2	32.7	10.4	2.2	0.1	0.0
Apr	9.1	15.9	36.4	32.7	3.9	0.6	0.0	0.0
May	11.2	18.3	37.8	29.8	1.1	0.0	0.0	0.0
Jun	7.7	14.0	39.4	33.9	2.8	0.0	0.0	0.0
Jul	8.9	16.3	38.3	33.1	1.9	0.0	0.0	0.0
Aug	7.0	11.8	36.0	40.6	4.3	0.0	0.0	0.0
Sep	10.0	14.0	36.6	36.1	1.7	0.0	0.0	0.0
Oct	14.8	19.7	35.8	27.5	1.1	0.0	0.0	0.0
Nov	17.2	21.3	30.4	23.9	3.4	0.5	0.0	0.0
Dec	20.3	25.4	28.3	18.8	2.5	1.7	0.3	0.0
Annual mean	11.7	17.5	33.5	30.4	4.0	0.9	0.1	0.0

1-2 雰囲気環境

1-2-1 大気環境

Table 8A-1-3 Air Quality Data (NOx, SOx, and T.S.P.)

unit: $\mu g/m^3$

Pollutant	Data
NOx	39.0
SOx	10.4
T.S.P.	30.2

1-2-2 騒音レベル

Table 8A-1-2 Noise Data

Measurement period	Feb. - Mar. /1995
Measurement point	south gate at ANSDK
Noise	64.8 dB

1-2-3 海水の水質

Table 8A-1-3 Sea Water Quality Data

unit: mg/l

Parameter	Analysis method	Value
COD(Mn)	permanganate method	4.3

1-3　排出汚染物質想定値

1-3-1　大気物質

Table 8A-1-4 Estimated Air Pollutant Emissions

Element		NOx	SOx	Dust	
Plant		DRP			SMP
Facility		Reformer			EAF
Emission value	(mg/m^3)	69.0	2.4	2.1	0.5
Exhaust gas					
volume	(Nm^3/hr)	560,000			750,000
temperature	(°C)	300			53
Stack					
height	(m)	40			20
diameter	(m)	5.4			5.3

1-3-2　騒　音

Table 8A-1-5　Estimated Noise Levels

Parameter	Process	Facility	Value (dB)
Noise	DRP	Reformer	95 - 105
	SMP	EAF	105
	HSM	Mill	105
	Utility	Air Compressor	95

1-3-3　排水水質

海域に排出される排水水質の想定値を表 8A-1-6 に示す。

Table 8A-1-6　Estimated Waste Water Quality

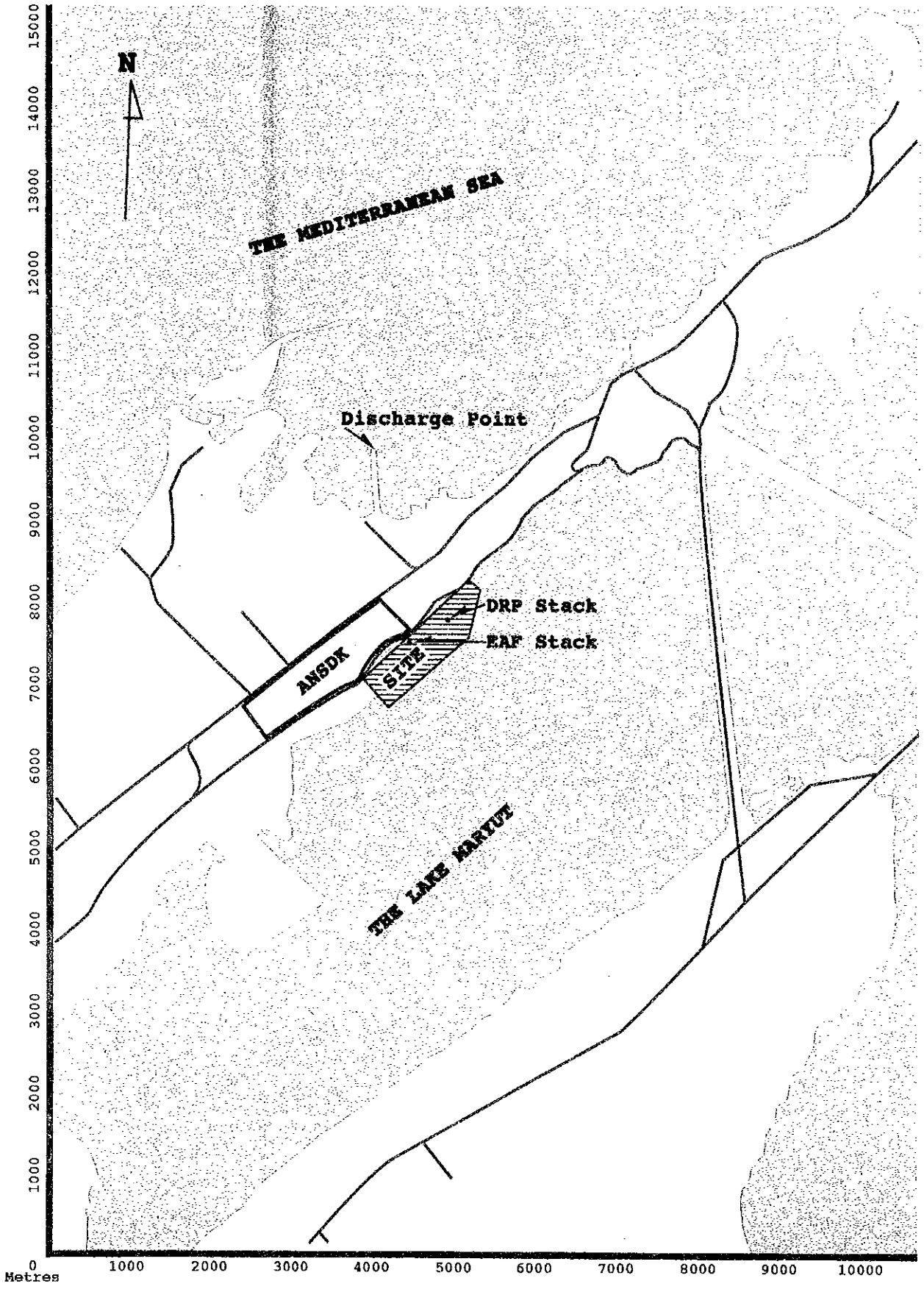
Parameter	Unit	Value
Quantity	m^3/hr	150
Temp	℃	31.7
COD	mg/l	1.4

2. 影響予測

2-1　予測地域

汚染物質の排出および排水口の位置を図 8A-2-1 に示す。

Figure 8A-2-1 Study Area



2-2 大気環境

新工場稼動後の大気雰囲気環境におよぼす影響を推定するために、日平均窒素酸化物(NOx)濃度、年平均硫黄酸化物(SOx)濃度、および年平均全浮遊粒子状物質(T.S.P.)を予測した。

2-2-1 予測方法

(1) 予測式

予測式には、有風時は点源プルーム(Plume)式を、弱風または無風時には点源パフ(Puff)式を適用した。

1) 点源プルーム式

$$C(x,y,z)=\frac{Q_p}{2\pi\sigma_y\sigma_z u}\cdot\exp\left(-\frac{y^2}{2\sigma_y^2}\right)\cdot\left[\exp\left\{-\frac{(z-He)^2}{2\sigma_z^2}\right\}+\exp\left\{-\frac{(z+He)^2}{2\sigma_z^2}\right\}\right]$$

ただし、計算は風向を16方位に区分しておこない、一つの風向内では長期的には濃度が一様と考えられるため、次の式を用いる。

$$C(R,z)=\sqrt{\frac{1}{2\pi}}\cdot\frac{Q_p}{\frac{\pi}{8}R\sigma_z u}\cdot\left[\exp\left\{-\frac{(z-He)^2}{2\sigma_z^2}\right\}+\exp\left\{-\frac{(z+He)^2}{2\sigma_z^2}\right\}\right]$$

ここで,

C(R,z)	: 計算点(R,z)における汚染物質濃度
R	: 点煙源と計算点の水平距離 (m)
z	: 計算点のz座標(高さ方向) (m)
Qp	: 点煙源排出強度 (μg/s)
u	: 風速 (m/s)
He	: 有効煙突高さ (m)
σ_z	: 鉛直方向拡散パラメーター (m)

2) 点源弱風パフ式

$$C(R,z)=\sqrt{\frac{1}{2\pi}}\cdot\frac{Q_p}{\frac{\pi}{8}\gamma}\cdot\left[\frac{1}{\eta_-^{\,2}}\exp\left\{-\frac{u^2(z-He)^2}{2\gamma^2\eta_-^{\,2}}\right\}+\frac{1}{\eta_+^{\,2}}\exp\left\{-\frac{u^2(z-He)^2}{2\gamma^2\eta_+^{\,2}}\right\}\right]$$

$$\eta_-^{\,2}=R^2+\frac{\alpha^2}{\gamma^2}(z-He)^2$$

$$\eta_+^{\,2}=R^2+\frac{\alpha^2}{\gamma^2}(z+He)^2$$

$$R^2=x^2+y^2$$

ここで、

C(R,z)	：	計算点(R,z)における汚染物質濃度
R	：	点煙源と計算点の水平距離 (m)
z	：	計算点の z 座標（高さ方向） (m)
Qp	：	点煙源排出強度 (μg/s)
u	：	風速 (m/s)
He	：	有効煙突高さ (m)
α	：	水平方向の拡散パラメーター (m/s)
γ	：	鉛直方向の拡散パラメーター (m/s)

弱風時風向出現率の補正は以下の通り。

16 方位による風向を一般に、i, i+1, ...等で表し,観測による各風向の出現率をそれぞれ f_i, f_{i+1}, ...とする。このとき、計算時に使用する風向 i の出現率 f_i は風速 u と水平拡散パラメーターαとによって次のように補正する。

$u/\alpha<1$	のとき	$\hat{f}_i=\sum_{i=1}^{16} f_i/16$
$1\le u/\alpha<1.5$	のとき	$\hat{f}_i=\left(f_{i-4}+2\sum_{k=-3}^{3} f_{i+k}+f_{i+4}\right)/16$
$1.5\le u/\alpha<2$	のとき	$\hat{f}_i=\left(f_{i-3}+2\sum_{k=-2}^{2} f_{i+k}+f_{i+3}\right)/12$
$2\le u/\alpha<3.3$	のとき	$\hat{f}_i=\left(f_{i-2}+2\sum_{k=-1}^{1} f_{i+k}+f_{i+2}\right)/8$
$3.3\le u/\alpha<6$	のとき	$\hat{f}_i=\left(f_{i-1}+2f_i+f_{i+1}\right)/4$
$6\le u/\alpha$	のとき	$\hat{f}_i=f_i$

3) 点源無風パフ式

$$C(R,z)=\frac{Qp}{(2\pi)^{3/2}\gamma}\left\{\frac{1}{R^2+\frac{\alpha^2}{\gamma^2}(He-z)^2}+\frac{1}{R^2+\frac{\alpha^2}{\gamma^2}(He+z)^2}\right\}$$

(2) 拡散パラメーター

プルーム式（有風時1.0m/s以上）に用いる拡散パラメーターσ_r，σ_zは、表8A-2-1に示すPasquill-Gofford図の近似関数を用いた。

Table 8A-2-1 Pasquill-Gofford Approximations

$\sigma_r(x)=\gamma_y\cdot x^{\alpha y}$

Stability	α_y	γ_y	Downwind distance
A	0.901	0.426	0 - 1,000
	0.851	0.602	1,000 -
B	0.914	0.282	0 - 1,000
	0.865	0.396	1,000 -
C	0.924	0.1772	0 - 1,000
	0.885	0.232	1,000 -
D	0.929	0.1107	0 - 1,000
	0.889	0.1467	1,000 -
E	0.921	0.0864	0 - 1,000
	0.897	0.1019	1,000 -
F	0.929	0.0554	0 - 1,000
	0.889	0.0733	1,000 -
G	0.921	0.0380	0 - 1,000
	0.896	0.0452	1,000 -

$\sigma_z(x) = \gamma_z \cdot x^{\alpha z}$

Stability	α_z	γ_z	Downwind distance
A	1.122	0.0800	0 – 300
	1.514	0.00855	300 – 500
	2.109	0.000212	500 –
B	0.964	0.1272	0 – 500
	1.094	0.0570	500 –
C	0.918	0.1068	0 –
D	0.826	0.1046	0 – 1,000
	0.632	0.400	1,000 – 10,000
	0.555	0.811	10,000 –
E	0.788	0.0928	0 – 1,000
	0.565	0.433	1,000 – 10,000
	0.415	1.732	10,000 –
F	0.784	0.0621	0 – 1,000
	0.526	0.370	1,000 – 10,000
	0.323	2.41	10,000 –
G	0.794	0.0373	0 – 1,000
	0.637	0.1105	1,000 – 2,000
	0.431	0.529	2,000 – 10,000
	0.222	3.62	10,000 –

弱風パフ式（風速 0.5 - 0.9 m/s）に用いる拡散パラメーターα、γは表 8A-2-2 に示す値を用いた。

Table 8A-2-2 Weak Wind Condition Diffusion

Pasquil stability class	α	γ
A	0.748	1.569
A – B	0.659	0.862
B	0.581	0.474
B – C	0.502	0.314
C	0.435	0.208
C – D	0.342	0.153
D	0.270	0.113
E	0.239	0.067
F	0.239	0.048
G	0.239	0.029

無風パフ式（風速0.4m/s以下）に用いる拡散パラメーターα、γは表8A-2-3に示す値を用いた。

Table 8A-2-3　Dead Calm Diffusion

Pasquil stability class	α	γ
A	0.948	1.569
A－B	0.859	0.862
B	0.781	0.474
B－C	0.702	0.314
C	0.635	0.208
C－D	0.542	0.453
D	0.470	0.113
E	0.439	0.067
F	0.439	0.048
G	0.439	0.029

(3)　有効煙突高さの設定

有効煙突高さは、以下の式を用いて設定した。

Concawe式（有風時）

$$\Delta H = 0.175 \times Q_H^{1/2} u^{-3/4}$$

Briggs式（無風、弱風時）

$$\Delta H = 1.4 \times Q_H^{1/4} (d\theta / dz)^{-3/8}$$

ここで、Q_H（排出熱量、 cal/s）$= \rho \cdot Q \cdot Cp \cdot \Delta T$

近似的には　$\rho = 1.293 \times 10^3$ g/m³（0 °Cにおける排出ガス密度）

Q　：単位時間当たりの排出ガス量（Nm³/s）

Cp　：0.24 cal/°K g（定圧比熱）

ΔT　：$T_G - 15$（排出ガス温度T_Gと気温よの温度差、°C）

u　：煙突頭頂部の風速（m/s）

$d\theta/dz$　：$dT/dz - \Gamma d$（温位傾度、°C/m）

Γ_d　：0.0098 ℃（乾燥断熱気温減率）

(4) 重合計算

各予測式により算出された濃度は、気象条件（風向、風速）によって、以下の通り重合し、年平均濃度を算出した。

$$C = \sum_i \sum_j \left[C_u(i,j) \cdot f_u(i,j) + C_j(i,j) \cdot f_j(i,j) \right] + C_c f_c$$

C	：	年平均濃度
$C_u(i,j)$	：	有風時、風向 i、風速階級 j の時の濃度
$f_u(i,j)$	：	有風時、風向 i、風速階級 j の時の出現率
$C_j(i,j)$	：	弱風時、風向 i、風速階級 j の時の濃度
$f_j(i,j)$	：	弱風時、風向 i、風速階級 j の時の出現率
C_c	：	無風時の時の濃度
f_c	：	無風時の時の出現率

2-2-3 予測条件

(1) 気象条件の設定

予測に用いる気象モデルは、現地調査の結果（表 8A-1-1 および 8A-1-2）を基に設定した。

風速は月別平均風速を用い、風向は 12 方位およびカームの現地調査結果を 16 方位およびカームの出現頻度に変換した。また大気安定度は中立状態である D を用いた。

予測区域における変換後の月別および年平均風配図を表 8A-2-2 に示す。

Figure 8A-2-2 Wind Direction Ratio(1)

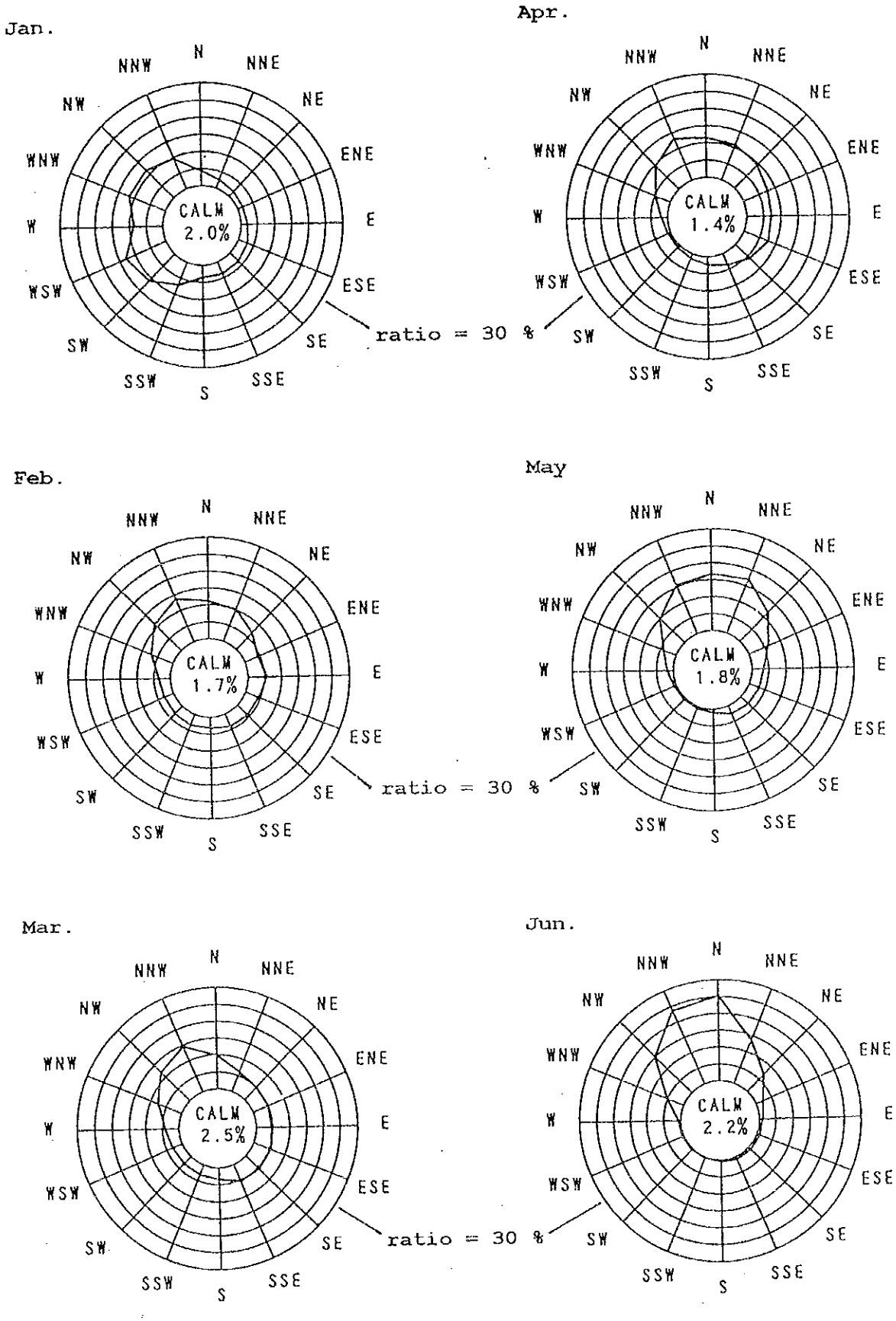


Figure 8A-2-2 Wind Direction Ratio(2)

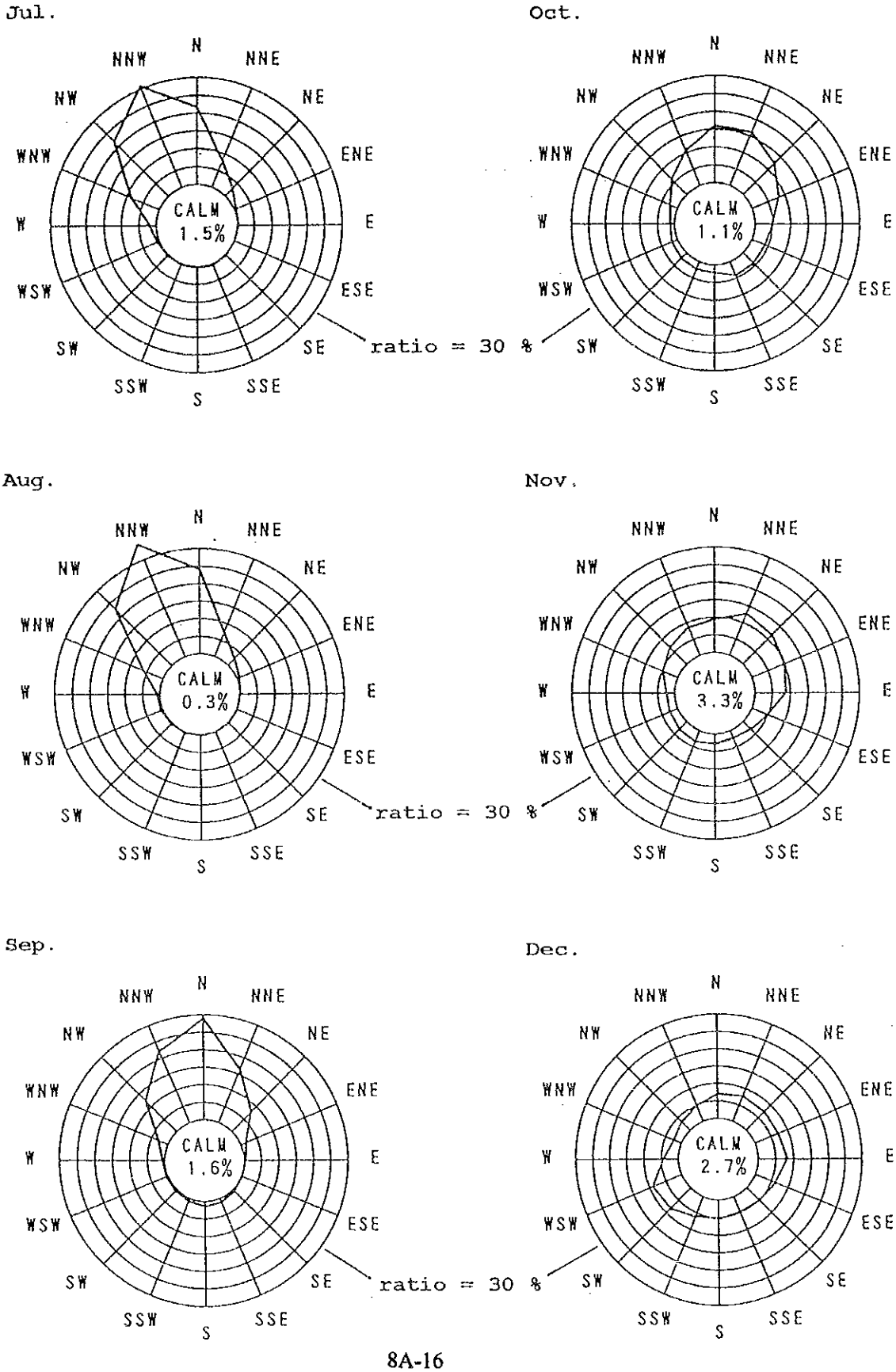
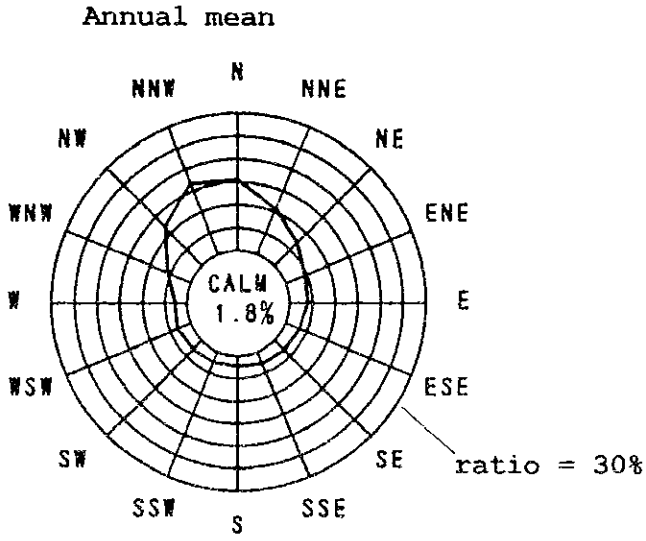


Figure 8A-2-2　Wind Direction Ratio(3)



(2)　発生源における諸条件

発生源における諸条件を表 8A-1-6 に示す。

(3)　バックグラウンド濃度

バックグラウンド濃度を表 8A-1-3 に示す。

(4)　NO_2 conversion

NOx から NO_2 への変換式は、測定値の年平均値の比率より、

$$[NO_2] = 0.565 \times [NOx]$$

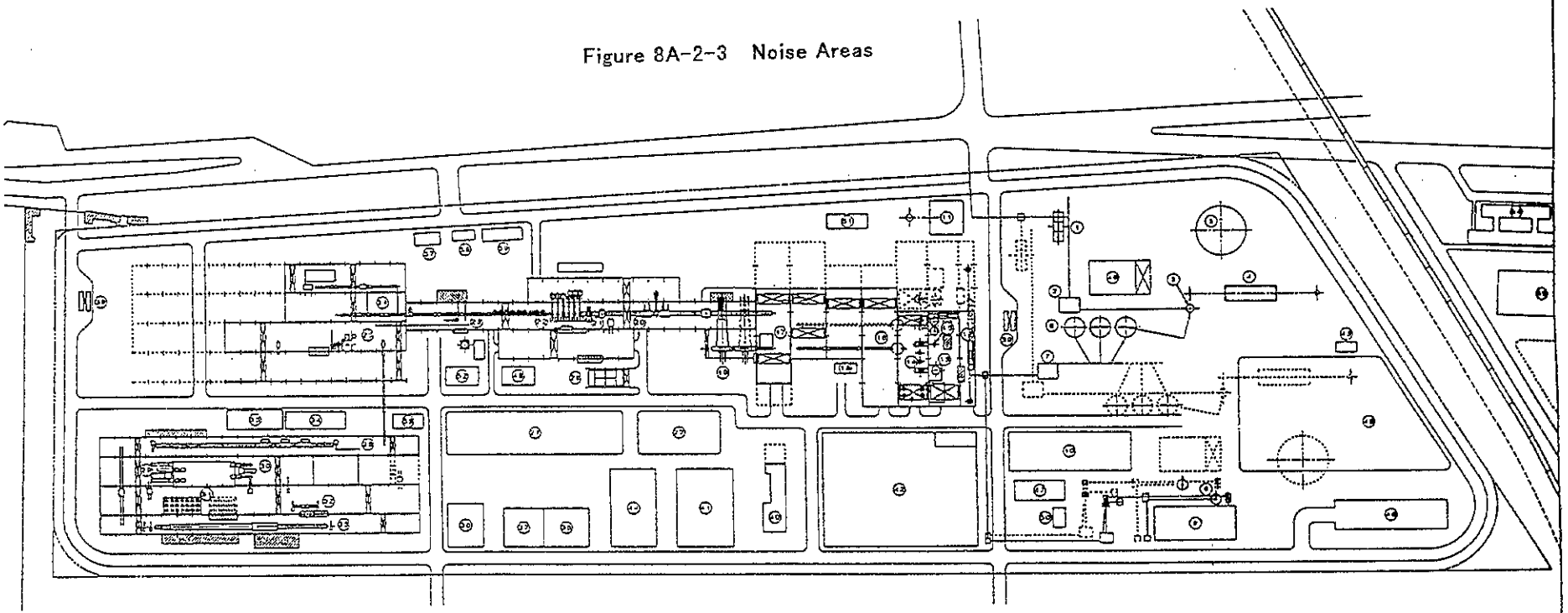
とした。

2-3 騒　音

2-3-1 予測地域

予測地域は図 8A-2-3 に示す工場敷地境界内である。

Figure 8A-2-3 Noise Areas



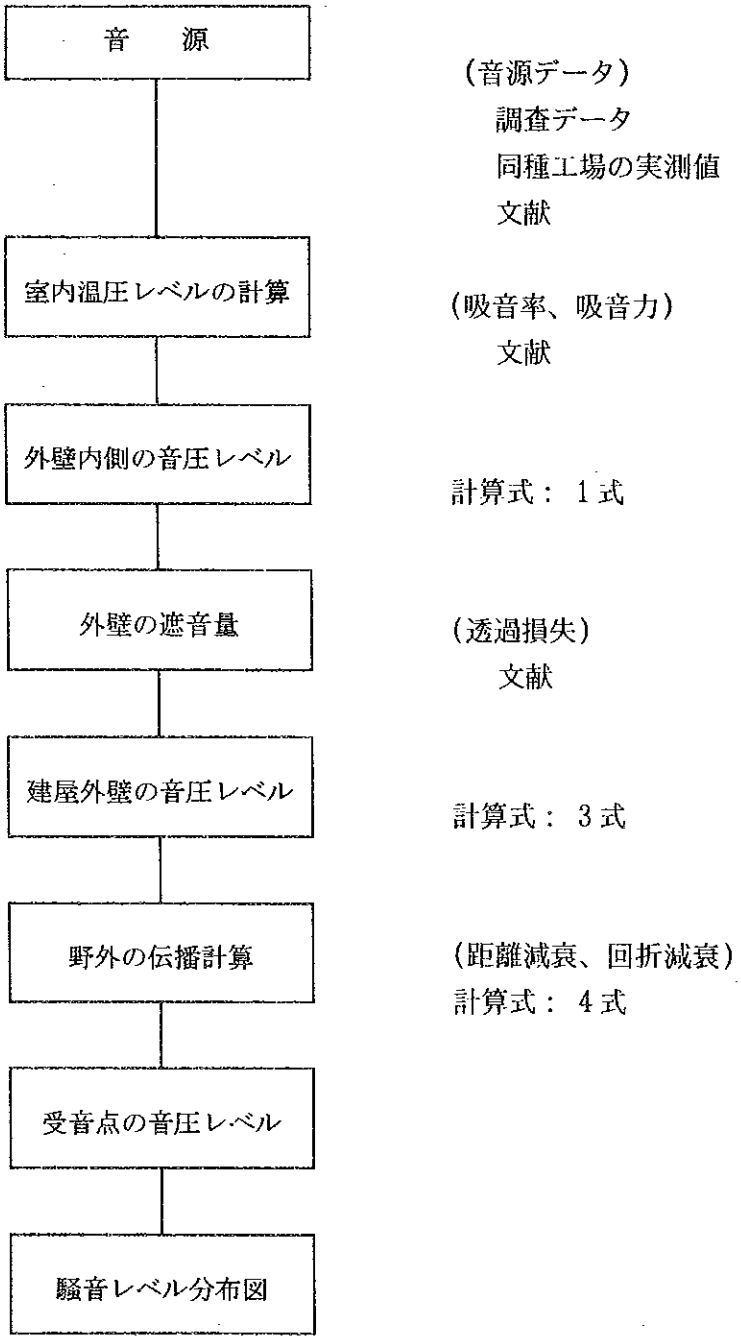
① OXIDE PELLET STORAGE BIN	⑪ DUST COLLECTOR	㉑ COIL BOX	㉛ BATCH ANNEALING FURNACE	㊶ RAW WATER RECEIVING STATION	㊿ SMP OFFICE
② OXIDE PELLET SCREEN	⑫ MATERIAL HANDLING SYSTEM	㉒ FINISHING MILL	㉜ RECOILING LINE	㊷ MAIN SUBSTATION	㊿① HSM OFFICE
③ REDUCTION FURNACE	⑬ ELECTRIC ARC FURNACE	㉓ DOWN COILER	㉝ HOT DIP GALVANIZING LINE	㊸ NATURAL GAS RECEIVING STATION	㊿② CRM OFFICE
④ REFORMER	⑭ LADLE TRANSFER CAR	㉔ PLATE LINE	㉞ ACID REGENERATION	㊹ SEWAGE TREATMENT STATION	㊿③ MAIN OFFICE
⑤ CLARIFIER	⑮ LADLE FURNACE	㉕ SKINPASS MILL	㉟ UTILITY PLANT	㊺ SCRAP YARD	㊿④ MAINTENANCE SHOP
⑥ DRI STORAGE BIN	⑯ SLAB CASTER	㉖ SCALE PIT FOR HSM	㊱ WATER TREATMENT FOR CRM	㊻ SLAG YARD	㊿⑤ REFRACTORIES WAREHOUSE
⑦ DRI SCREEN	⑰ SLAB CONVEYOR	㉗ WATER TREATMENT FOR HSM	㊲ OIL STORE	㊼ ADDITIVE WAREHOUSE	㊿⑥ GUARD OFFICE
⑧ LIME STONE STORAGE YARD	⑱ SCALE PIT FOR CCM	㉘ PICKLING LINE	㊳ WASTE STORE	㊽ LABORATORIES	㊿⑦ CLINIC
⑨ LIME CALCINING PLANT	⑲ REHEATING FURNACE	㉙ REVERSING MILL	㊴ TRUCK SCALE	㊾ DRP OFFICE	㊿⑧ FIRE FIGHTING STATION
⑩ WATER TREATMENT FOR SMP	⑳ ROUGHING MILL	㉚ TEMPER MILL	㊵ AIR COMPRESSOR ROOM	㊿ LCP OFFICE	㊿⑨ RESTAURANT

2-3-2　計算条件

(1)　騒音予測計算のフロー

工場騒音予測計算は、図 8A-2-4 に示す計算フローにしたがって行う。

図 8A-2-4　騒音レベルの計算フロー



(2) 計算式

1) 工場内の任意の位置の音圧レベル計算式

対象工場は非常に大きいが、ここでは次式の条件が成り立つものとして計算した。

(dB) 1式

ここで、

L_r : 工場壁内側の音圧レベル (dB)

L_p : 音源のパワーレベル (dB)

r_0 : 音源から受音点までの距離 (m)

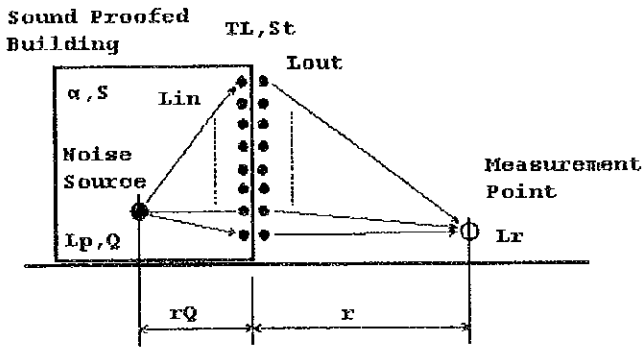
Q : 音源の指向係数

R : 室定数

(m^2) 2式

: 平均吸音率

S : 室内総面積 (m^2)



2) 工場外壁の音圧レベル計算式

$L_{out} = L_r - TL$ (dB) 3式

ここで、

L_{out} : 工場外壁の音圧レベル (dB)

L_r : 工場外壁内側の音圧レベル (dB)

TL : 壁の総合透過損失 (dB)

3) 野外分布の計算式

$$L_r = L_{out}' - 20 \log_{10} r - 8 - \qquad (dB) \quad 4式$$

ここで、

L_r : 音源から r(m)位置の音圧レベル (dB)

L_{out}' : 工場外壁の音圧レベル（補正後） (dB)

(L_{out} に壁の面積などを考慮したレベル)

r : 音源から受音点までの距離 (m)

: 障壁による回折減衰効果 (dB)

(dB)

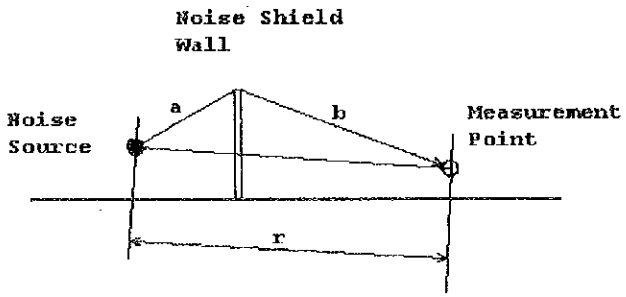
tanh : 双曲正接

N : フレネル ナンバー

C : 音速 (340 m/s)

f : 周波数 (Hz)

: 経路差 (m)



2-3-3 計算条件

(1) 設備機械の騒音レベル

シミュレーション対象の騒音源は表 8A-2-4 に示す 4 つとし、表に示される騒音レベルを試算に使用した。なお、騒音の周波数特性は同種の工場における測定値を参考にして設定した。

Table 8A-2-4　Facility Noise Levels

Facility	Noise level L_{aeq} (dB)	Measurement point
DRP reformer	95 -105	inside of room
SMP EAF	105	inside of building wall
HSM mill	(105)	inside of building
Air compressor	95	inside of room

計算に使用した音源の騒音パワーレベル（推定値）を表 8A-2-5 に示す。

Table 8A-2-5　Noise Source Power Levels and Frequencies

(Property A, unit: dB(A))

Facility	Noise level	1/1 octave band center frequency (Hz)							
		63	125	250	500	1 k	2 k	4 k	8 k
Reformer	108	73	85	97	103	104	101	95	83
EAF	132	100	111	121	127	128	125	116	101
Reheating furnace	118	91	104	114	112	111	105	98	86
Rolling mill	117	78	89	102	110	114	110	101	90
Finishing yard	114	80	89	105	107	108	109	106	100
Compressor	118	83	95	107	113	114	111	105	93

(2)　工場建屋の構成部材と部材の音響特性

コンプレッサー室を除くほかの工場建屋は、床をコンクリート、壁・屋根を折板（カラー鉄板、0.8 ㎜厚）の構造とし、構成部材の音響特性を表 8A-2-6 と 8A-2-7 に示す設定にした。なお、コンプレサー室は、床・壁をコンクリート（150 ㎜厚）、屋根を 折板（カラー鉄板、0.8 ㎜厚）とした。

Table 8A-2-6　Component Material Absorption Rate

unit: %

Material	1/1 octave band center frequency (Hz)							
	63	125	250	500	1 k	2 k	4 k	8 k
Corrugated sheet (0.8 t)	8	22	15	10	8	8	8	8
Concrete	1	1	1	1	2	2	3	3

Table 8A-2-7　Component Material Sound Insulation Volume

unit: dB

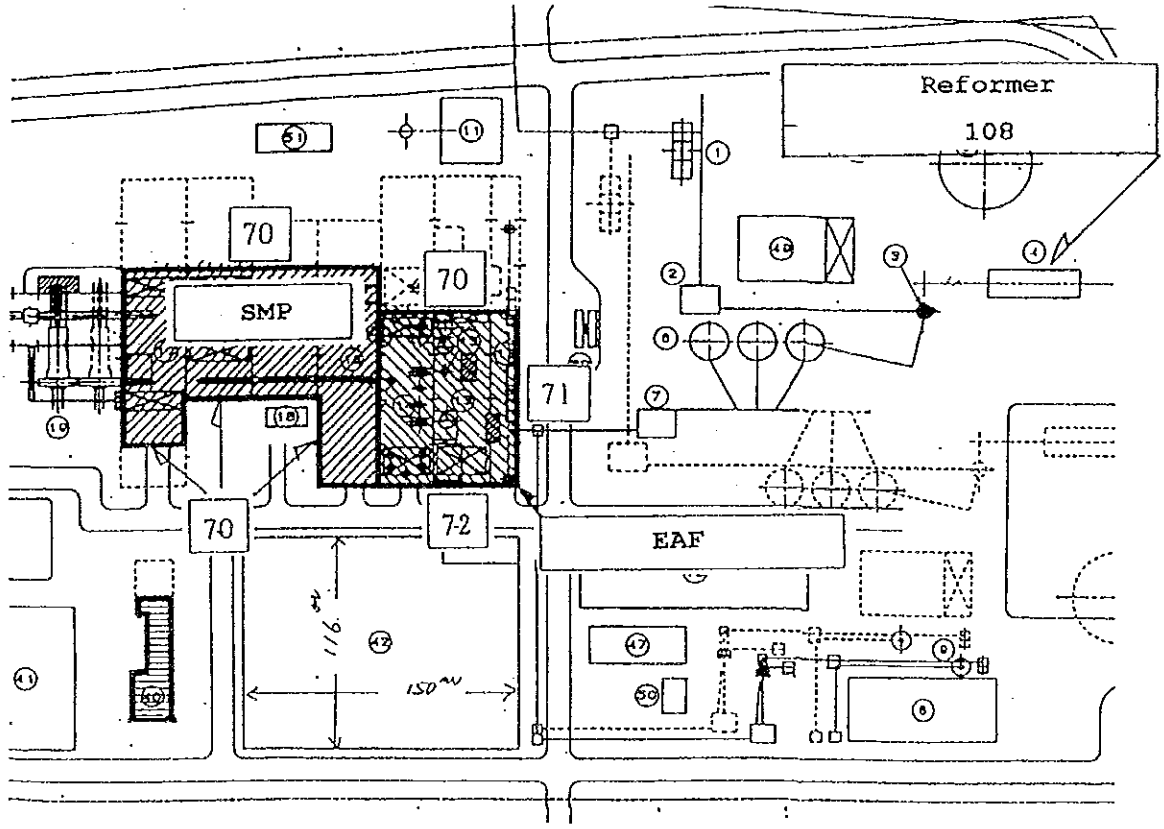
Material	1/1 octave band center frequency (Hz)							
	63	125	250	500	1 k	2 k	4 k	8 k
Corrugated sheet (0.8 t)	10	15	20	25	28	30	30	25
Concrete	22	26	32	37	41	46	46	41

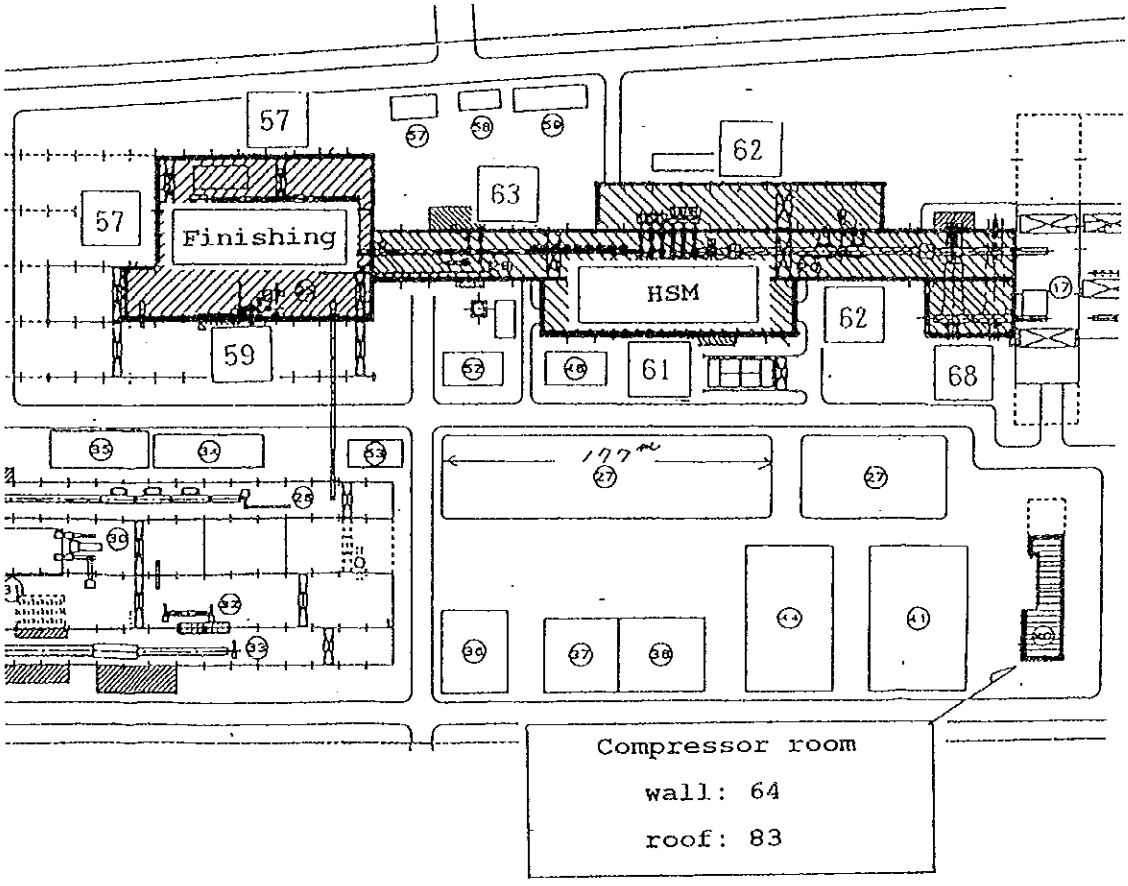
注：安全係数=0.8

(3)　工場外壁の騒音レベル

予測計算に使用した工場外壁の騒音レベルは、計算式1式によって工場外壁の音圧レベルを計算して図8A-2-5に示した。

Figure 8A-2-5 Outer Wall Noise Levels





(4) 計算範囲

騒音レベル予測計算の予測範囲は、任意の原点から水平方向にX軸：1,450 m、Y軸：600 mに囲まれた範囲とし、各方向を40分割した交点とし、高さ方向はZ軸：1.2 mの水平面とした。
なお、野外騒音伝播の計算では、工場（音源）と予測点の間にある建屋を音響障害物として扱ったが、その他ヤード内にある諸設備などは音響障害物から除いて計算した。障害物となる工場建屋の高さは、電気炉工場を42 m、コンプレッサー室を7 m、その他の工場は 20 m とした。

2-3-4 予測計算結果

各工場から放射する騒音レベルを予測計算し、直接還元鉄設備ガス改質設備からの騒音レベル分布を図8A-2-6、空気圧縮機からの騒音レベル分布を図8A-2-7、電気炉からの騒音レベル分布を図8A-2-8、熱延工場からの騒音レベル分布を図8A-2-9にそれぞれ示す。

Figure 8A-2-6 Noise Distribution Pattern (DRP Reformer)

unit: dB

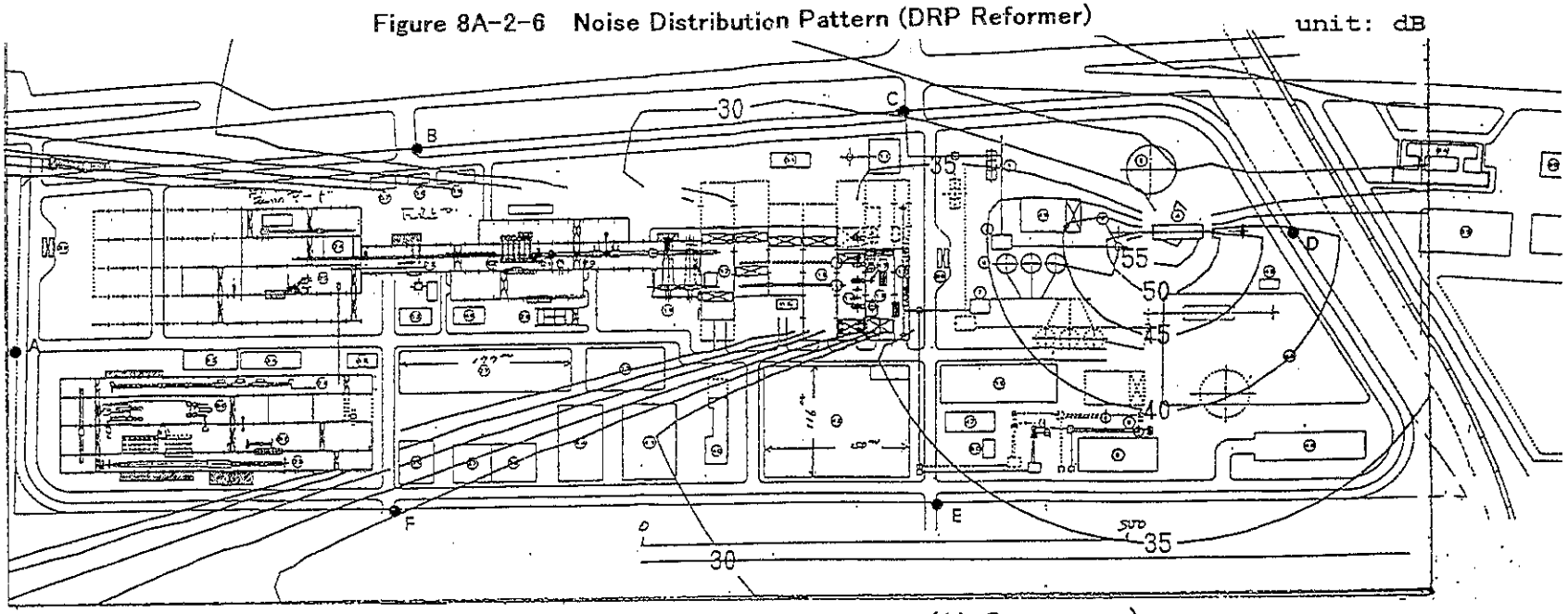
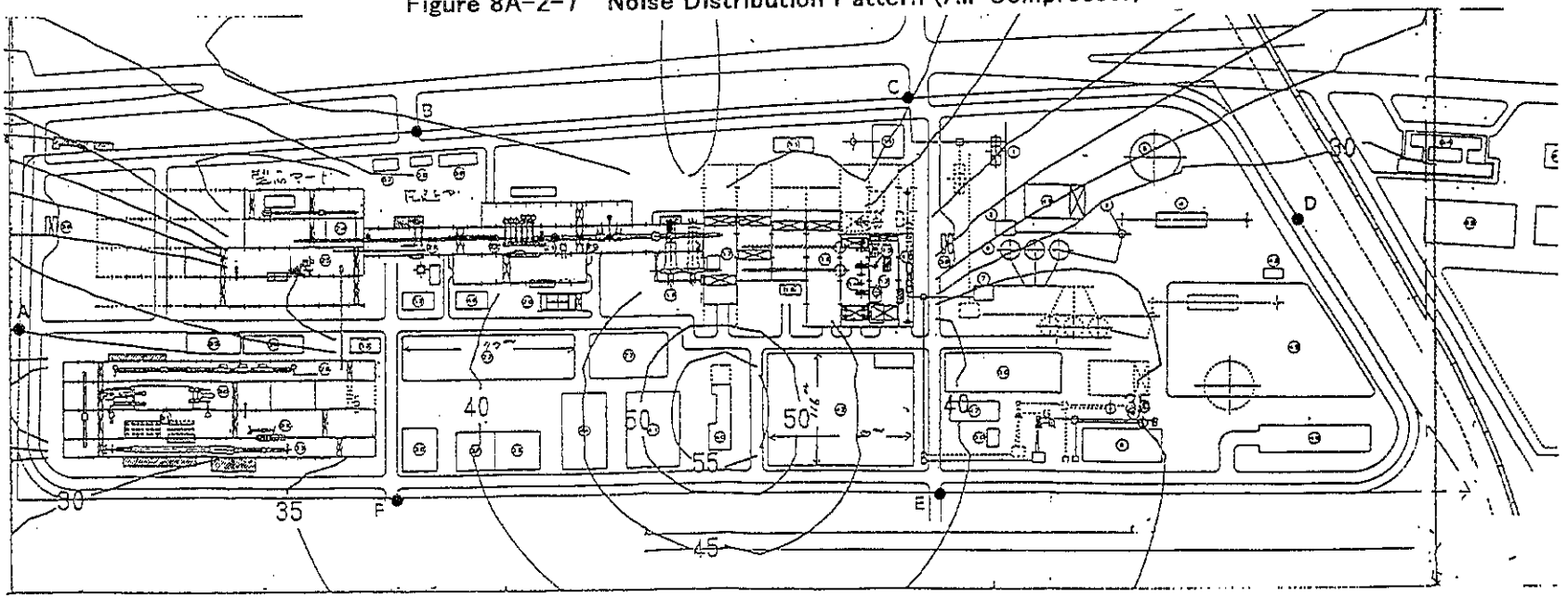


Figure 8A-2-7 Noise Distribution Pattern (Air Compressor)



Prediction height: 1.2 m

Figure 8A-2-8 Noise Distribution Pattern (SMP-EAF)

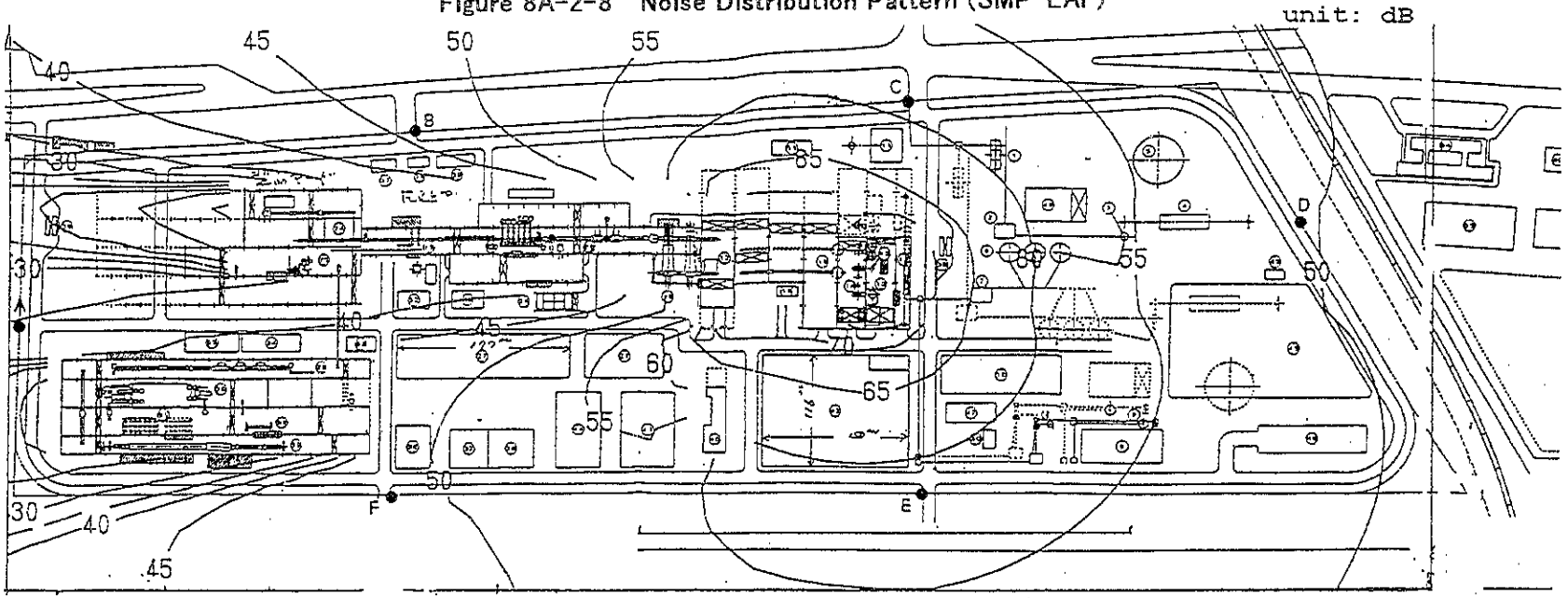
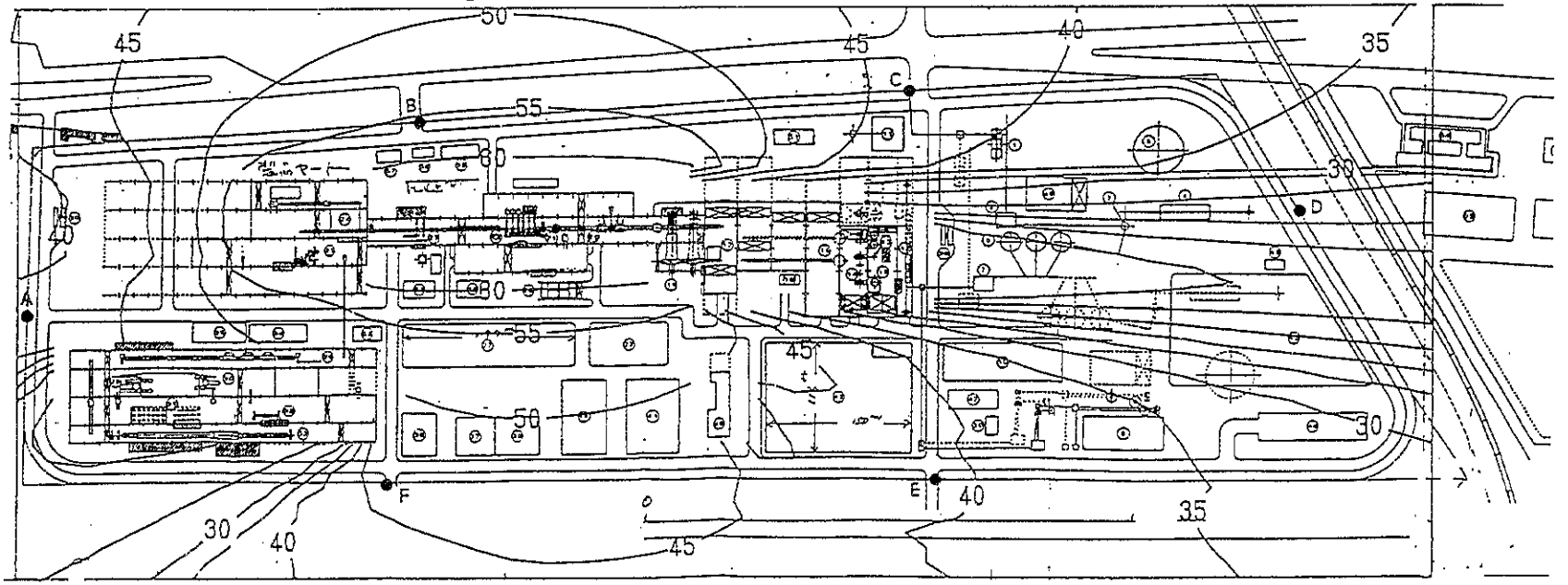


Figure 8A-2-9 Noise Distribution Pattern (HSM)



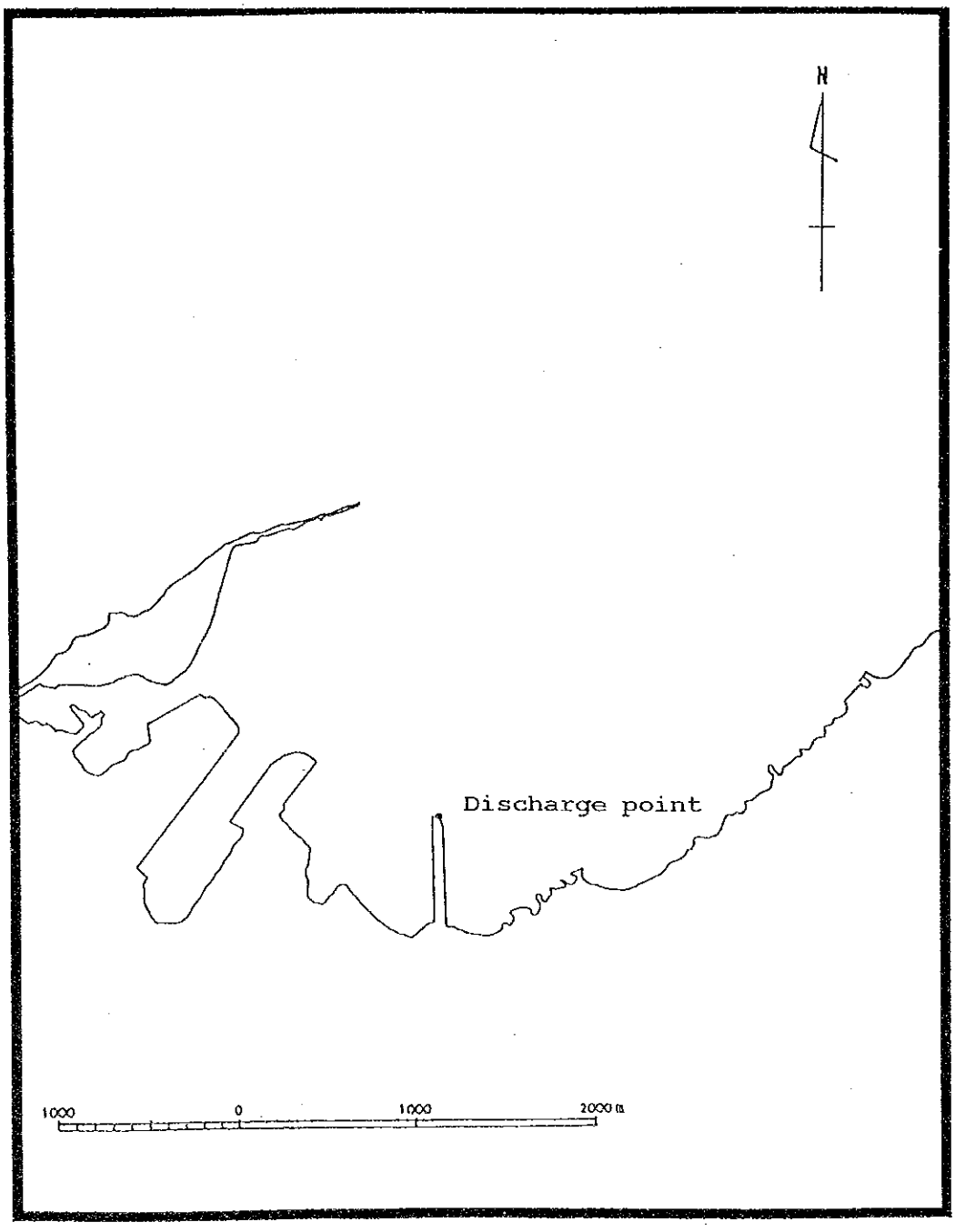
Prediction height: 1.2 m

2-4　水質環境

2-4-1　予測範囲

排水が海水水質に影響する予測範囲を図 8A-2-10 に示す。

Figure 8A-2-10 Sea Water Quality Area



2-4-2　予測方法

一様な一方向の定常流が存在する2次元の無限の広がりをもつ海洋中において、点状汚濁源から連続的に汚濁物質が放出される場合の拡散式として次式を用いた。

$$S = \frac{q}{2\pi d\sqrt{KxKy}} \exp\left[\frac{xu}{2Kx} - \lambda t\right] Ko\left\{\frac{u}{2}\sqrt{\frac{1}{Kx}\left[\frac{x^2}{Kx} + \frac{y^2}{Ky}\right]}\right\} \qquad 1式$$

ここで、

S	：	汚濁濃度（mg/l）
q	：	単位時間当たりの投棄物質量（μg/s）
u	：	x方向の定常流流速（cm/s）
Kx	：	x方向の拡散係数（cm²/s）
Ky	：	y方向の拡散係数（cm²/s）
λ	：	汚濁物質の減少係数（1/s）
d	：	汚濁物質の混合層の厚さ（cm）（平均水深）
x, y	：	x, y方向の原点からの距離（cm）
$K_0(x)$	：	第2種ベッセル関数

$$Ko(x) = \int_0^\infty \frac{\exp(-ux)}{\sqrt{u^2 - 1}} du$$

$$\exp(x) = e^x$$

ただし、予測にあたっては1式をそのまま使用せず、以下の仮定を設けておこなった。

- 汚濁物質の減少は考慮しない（$\lambda = 0$）
- 水平方向の拡散係数は一様とする（$Kx = Ky = K$）

したがって、1式は次式のように書き換えられる。

$$S = \frac{q}{2\pi dK} \exp\left[\frac{xu}{2K}\right] Ko\left[\frac{u}{2K}\sqrt{x^2 + y^2}\right] \qquad 2式$$

また、2式はベッセル関数を含んでいるため、計算には表8A-2-12に示すベッセル関数表を用いて求めた。

Table 8A-2-12 Bessel Function of the 2nd Kind

X	$K_0(x)$	X	$K_0(x)$
1	0.8825696×10^{-1}	10	0.0556711673
2	0.5103757	20	0.0626405968
3	0.3768500	30	- 0.1172957317
4	$-0.1694074 \times 10^{-1}$	50	- 0.0980649955
5	0.3085176	100	- 0.0772443134

2-4-3 予測条件

予測条件を表 8A-2-13 に示す。

Table 8A-2-13 Sea Water Conditions

Parameter	Value
Effluent concentration	1.36 mg/l
Discharge water quantity	150.00 m^3/hr
Horizontal Diffusion coefficient (Kx, Ky)	10^4 cm^2/s
Effluent Reduction coefficient (λ)	0
Average sea water depth	15 m
Tidal direction	E + 11.5° NW + 11.5°
Tidal speed	0.08 m/s 0.23 m/s

2-4-4 予測結果

流速 0.08 m/s での結果を図 8A-2-14、流速 0.23 m/s での結果を図 8A-2-15 に示す。

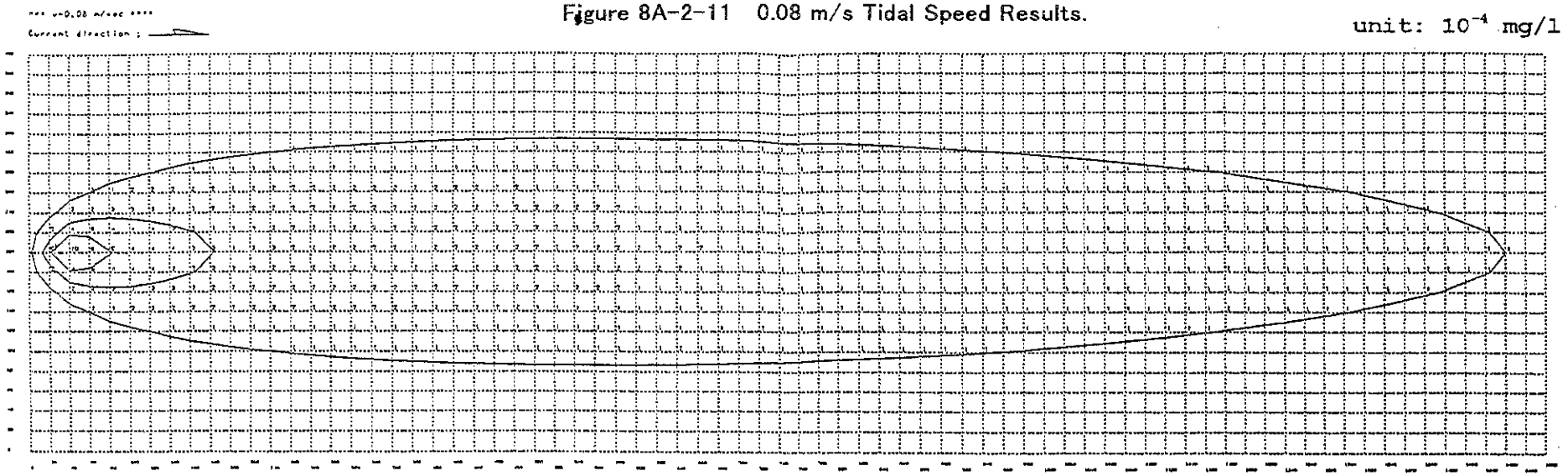


Figure 8A-2-11 0.08 m/s Tidal Speed Results.

unit: 10^{-4} mg/l

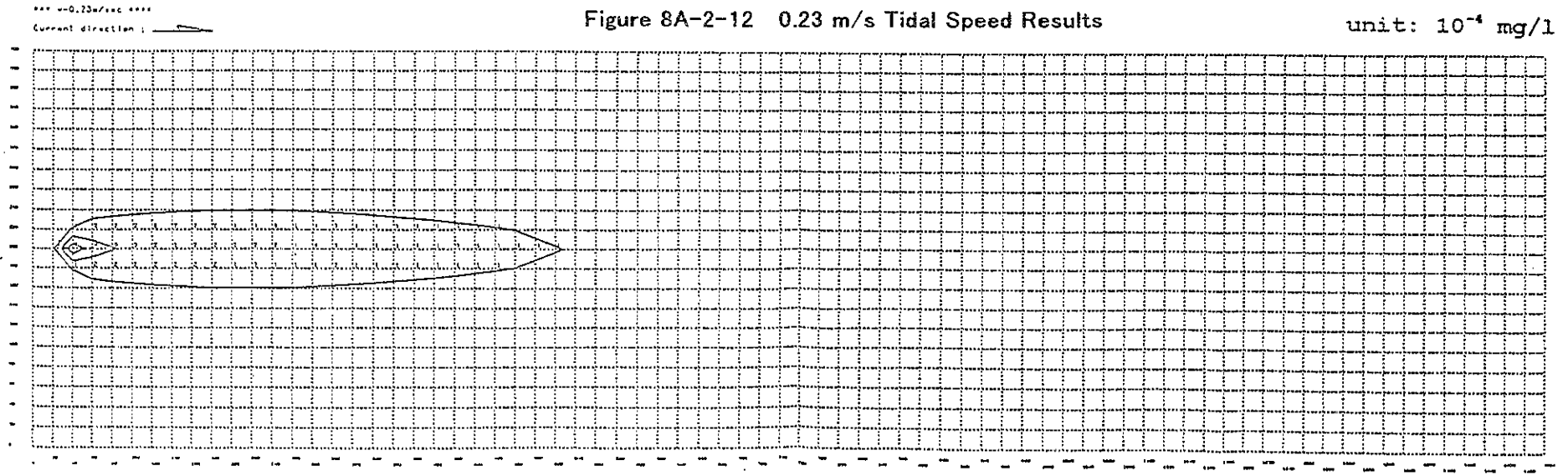


Figure 8A-2-12 0.23 m/s Tidal Speed Results

unit: 10^{-4} mg/l

3. 化学的酸素要求量（COD）分析における重クロム酸法（COD(Cr)）と過マンガン酸法（COD(Mn)）との相関関係

調査団は、8月28日にアレキサンドリア県庁から化学的酸素要求量の数値として300 mg/literを得た。
しかし、この数値300 mg/literは極端で異常に高い。
おそらく、この数値は重クロム酸法によって分析されたと思われるが、この方法は海水中に塩素イオンが含まれるため海水中の化学的酸素要求量の分析には不適当である。この場合、過マンガン酸法を適用すべきである。

この測定値を計算によって過マンガン酸法で分析した数値に換算することは困難である。両方の分析法（重クロム酸法および過マンガン酸法）での実測値によれば、相関係数(COD(Cr)/COD(Mn))の推定値は、重クロム酸法での分析値300 mg/literに対して約70である。
したがって、過マンガン酸法で分析した場合の想定値は300/70 = 4.3となる。

また、国際協力事業団の「スエズ工業地帯開発計画」調査報告書（1993年）によると、化学的酸素要求量の過マンガン酸法による分析値は2.4 - 7.3であった。したがって、数値4.3はエジプト沿岸の海水の化学的酸素要求量の分析値とかけ離れていないと考えられる。

Figure 8A-3-1 Relationship between COD(Cr) and COD(Cr)/COD(Mn)