Fig 3.6.1.1 Flow sheet

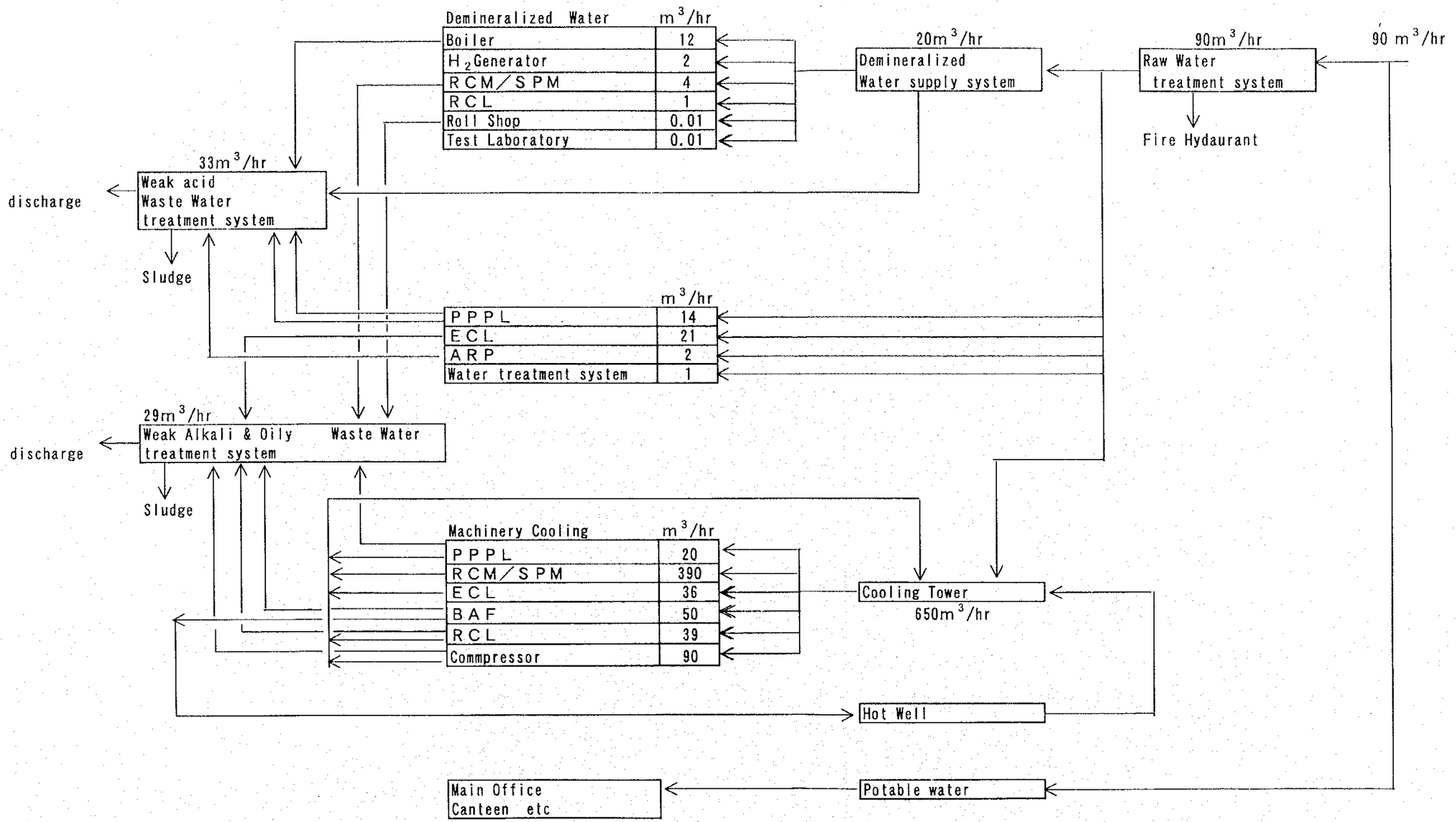
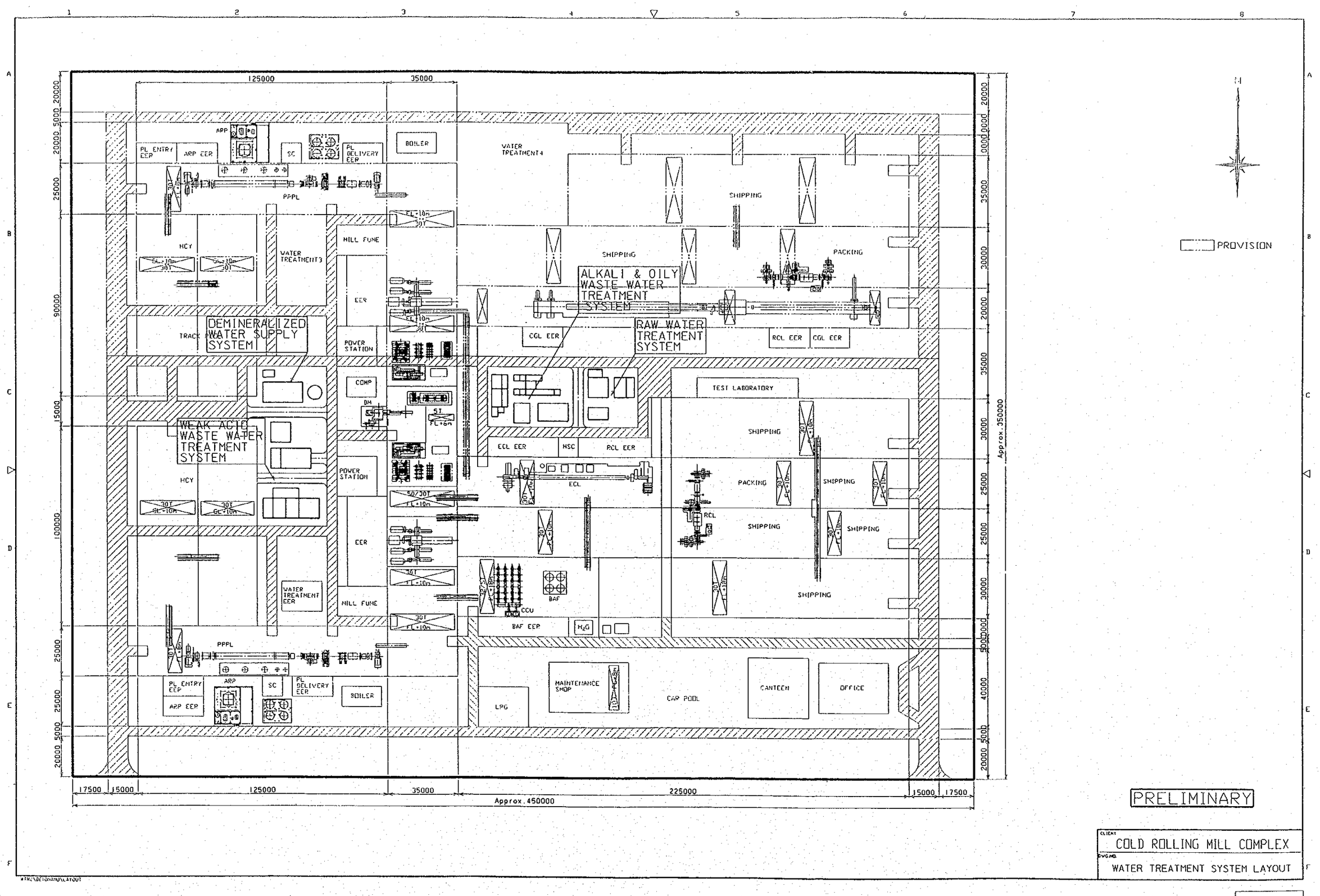


Fig. V-2-8 Water Treatment Flow of New Cold Rolling Mill Complex



PRELIMINARY

CLIENT: COLD ROLLING MILL COMPLEX

DWG NO.: WATER TREATMENT SYSTEM LAYOUT

Fig.V-2-9 Water Treatment System Layout

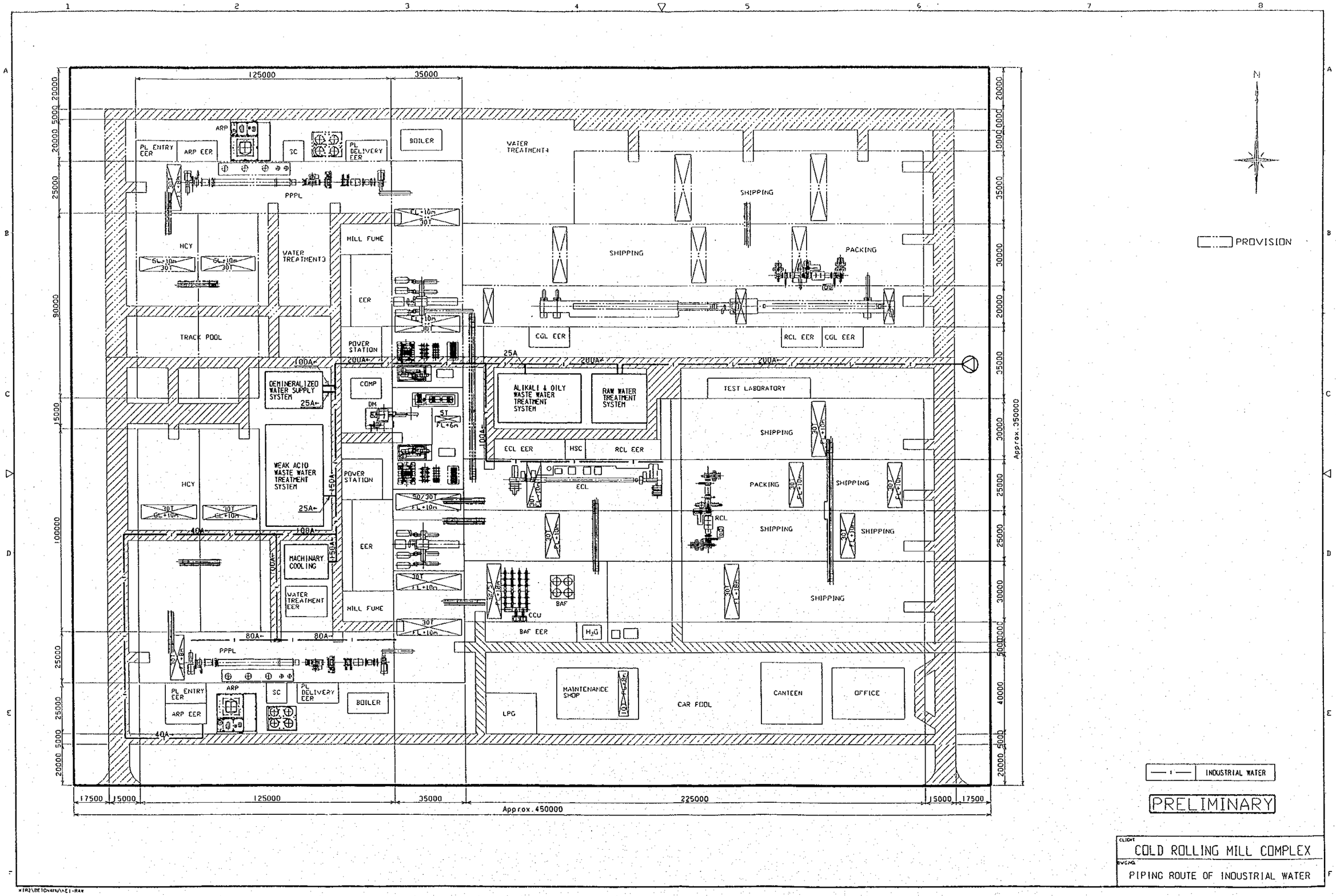


Fig.V-2-10 Piping Route Of Industrial Water

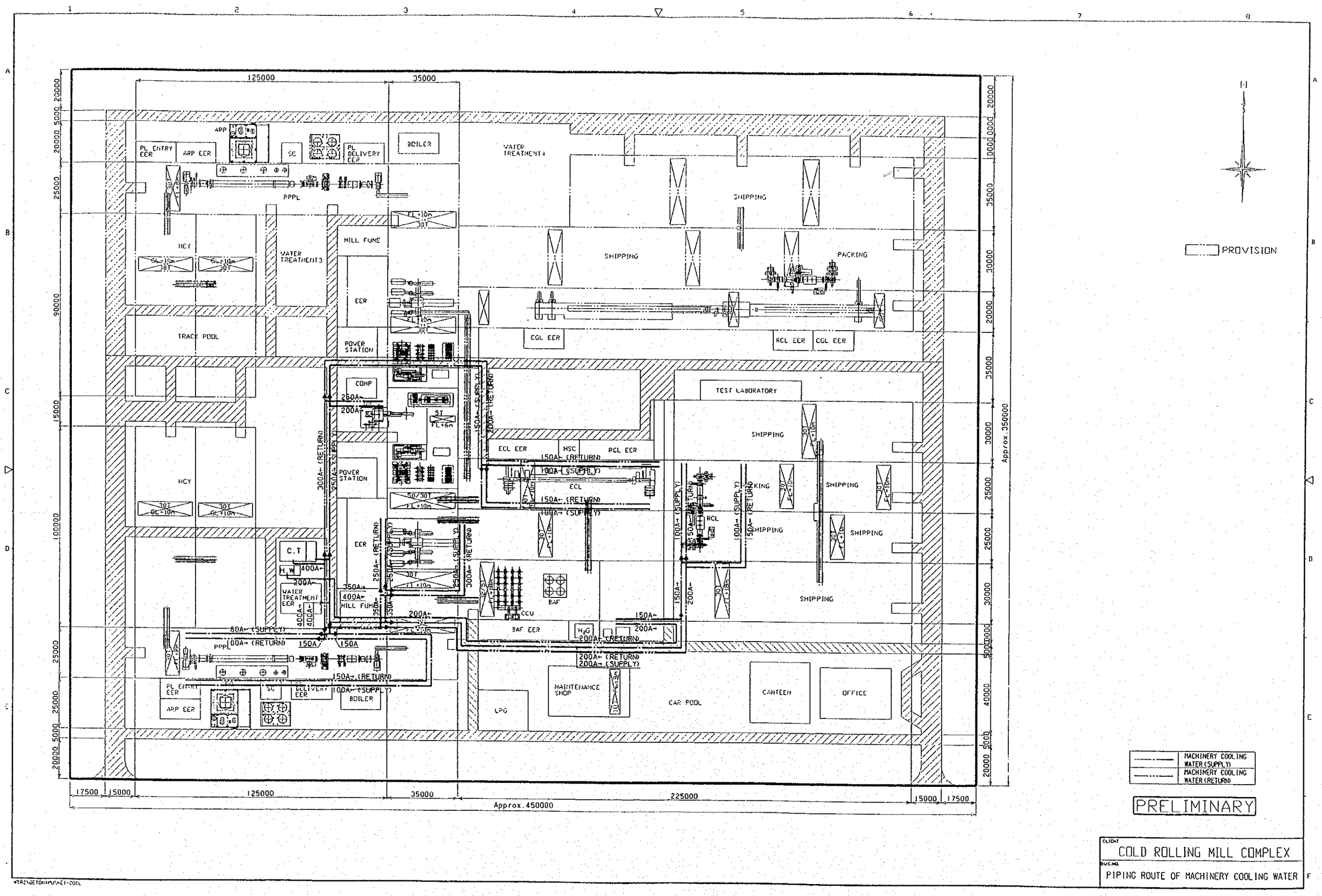
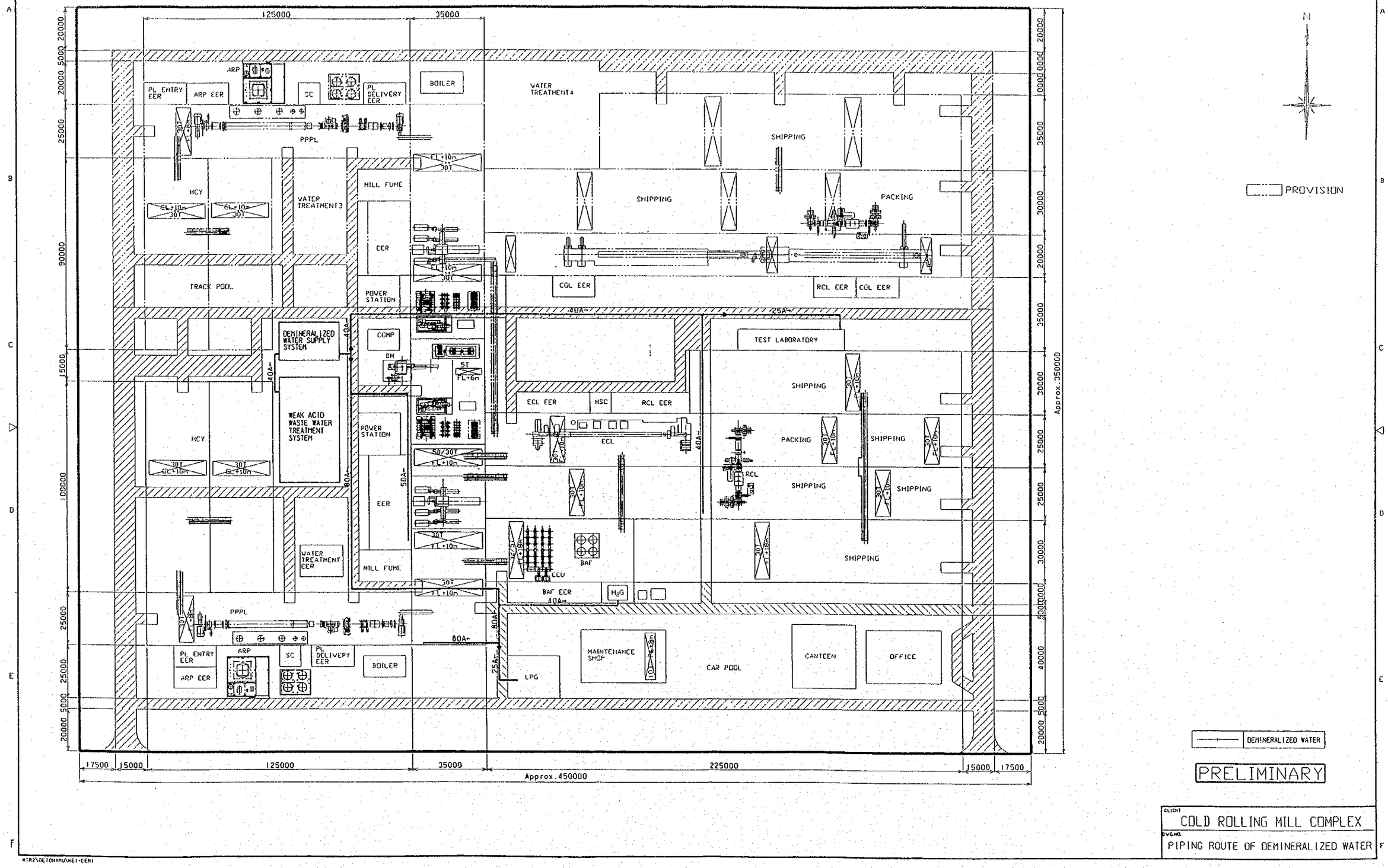


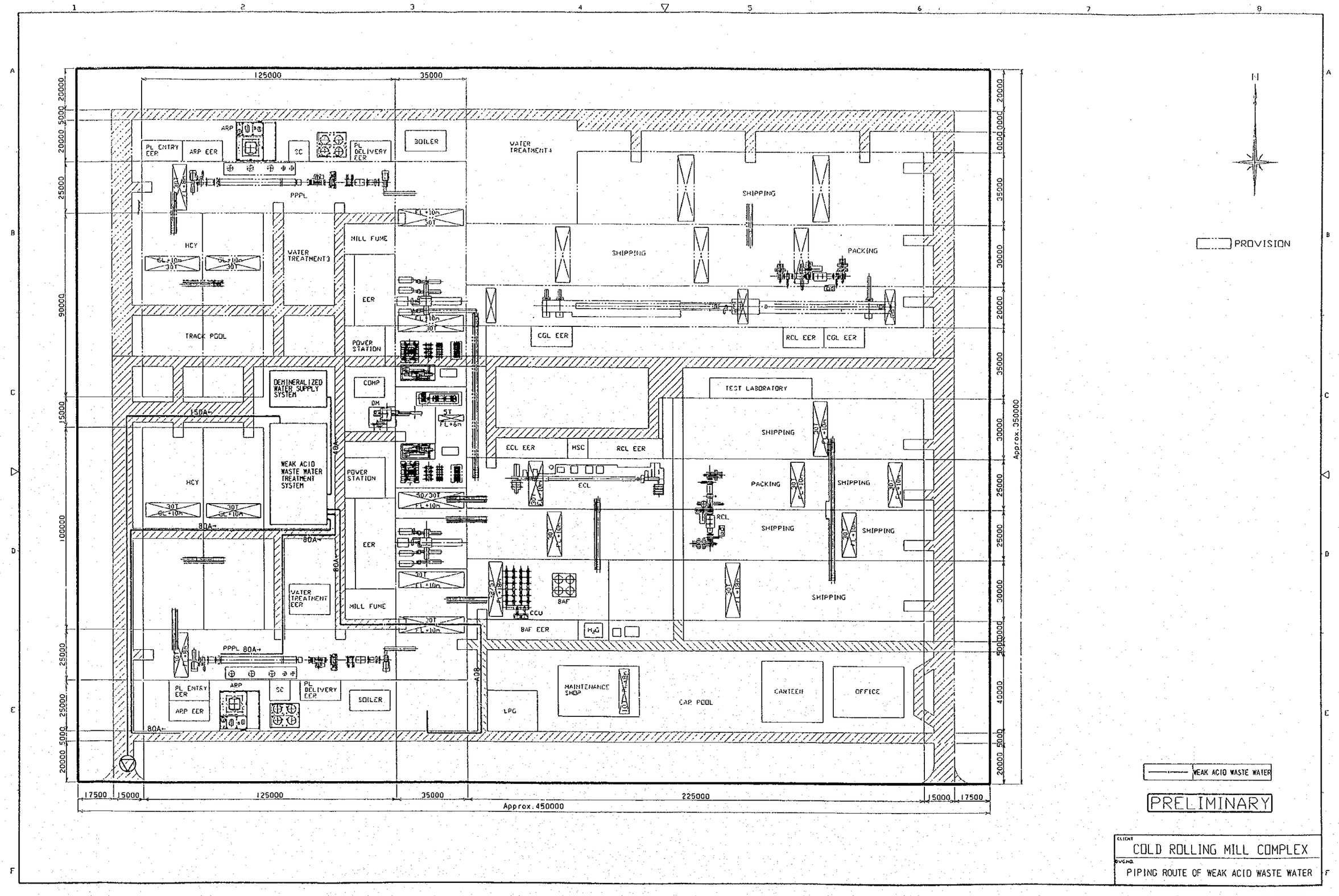
Fig.V-2-11 Piping Route Of Machinery Cooling Water



CLIENT
COLD ROLLING MILL COMPLEX

DWG.NO.
PIPING ROUTE OF DEMINERALIZED WATER

Fig.V-2-12 Piping Route Of Demineralized Water



CLIENT: COLD ROLLING MILL COMPLEX

DWG.NO.: PIPING ROUTE OF WEAK ACID WASTE WATER

Fig. V-2-13 Piping Route Of Acid Waste Water

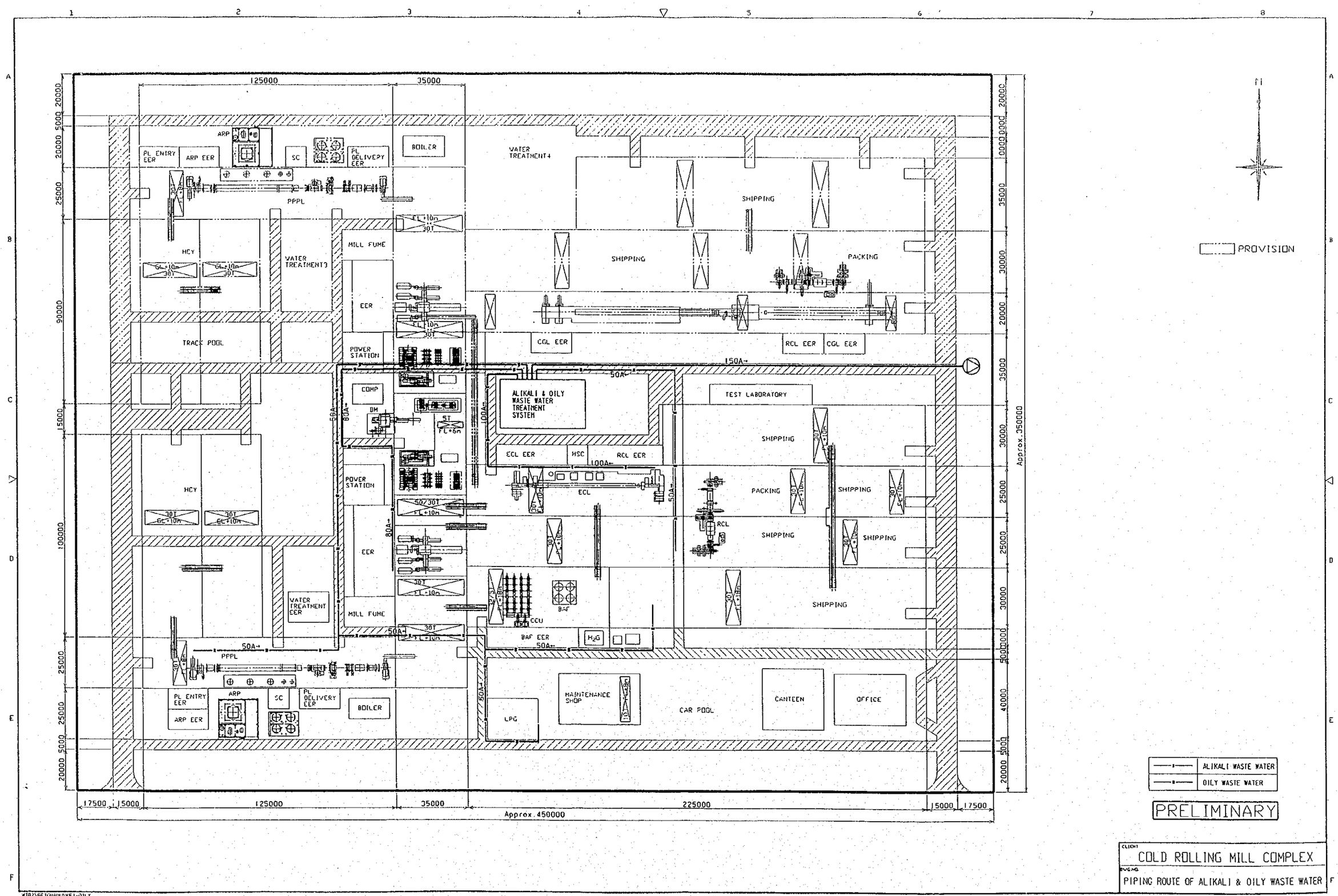


Fig.V-2-14 Piping Route Of Alikali & Oily Waste Water

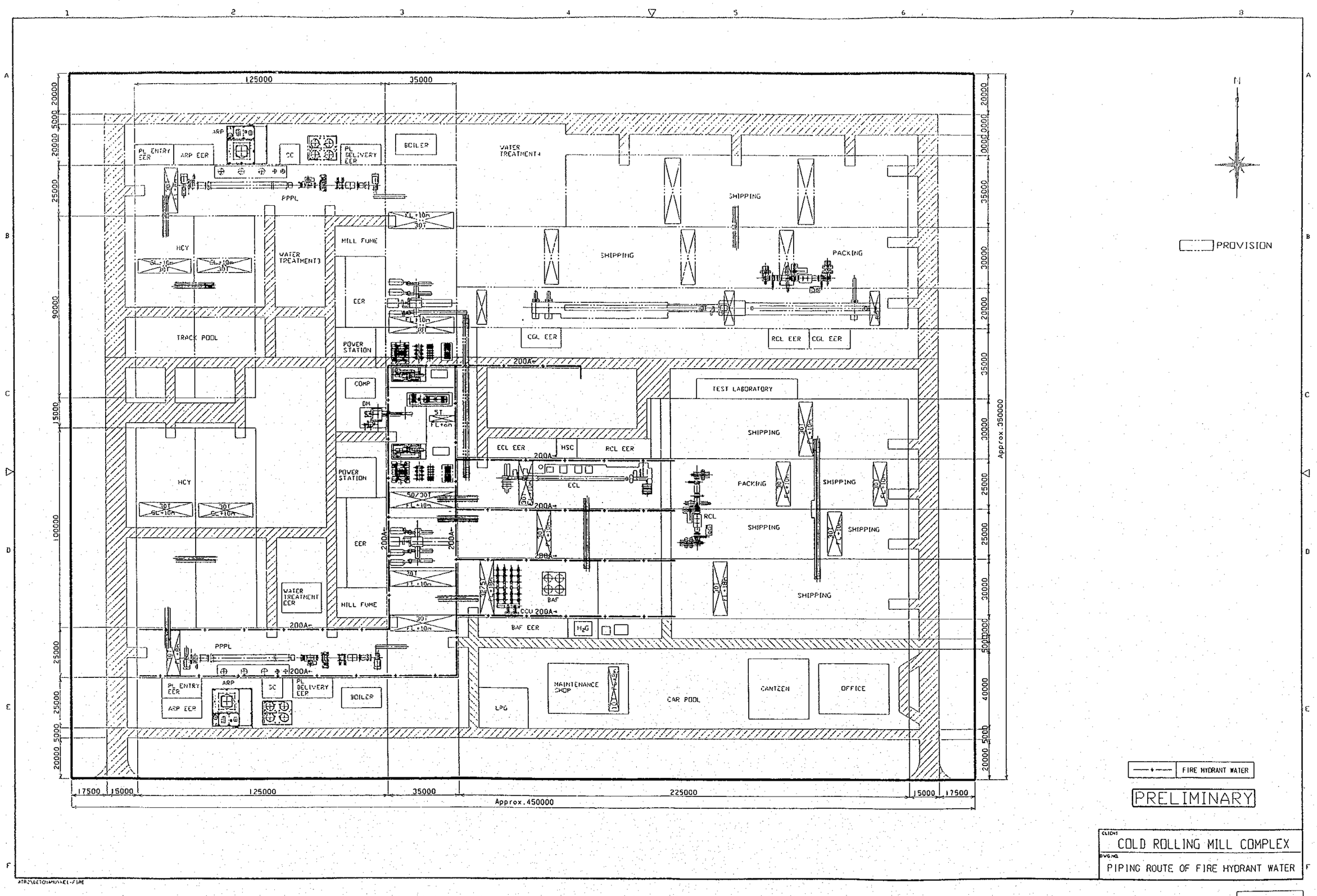
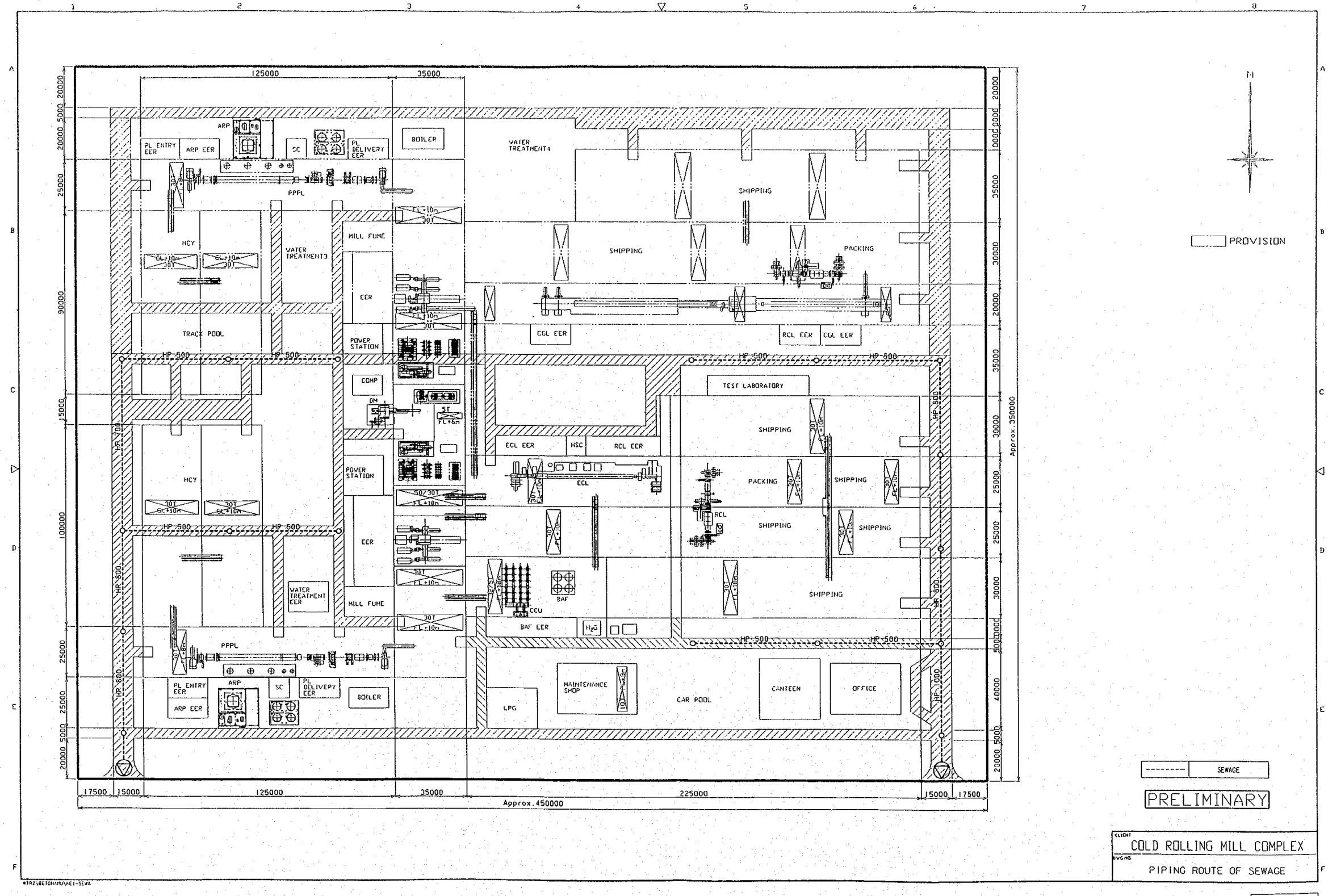


Fig.V-2-15 Piping Route Of Fire Hydrant Water



CLIENT: COLD ROLLING MILL COMPLEX

DWG.NO.: PIPING ROUTE OF SEWAGE

Fig.V-2-16 Piping Route Of Sewage

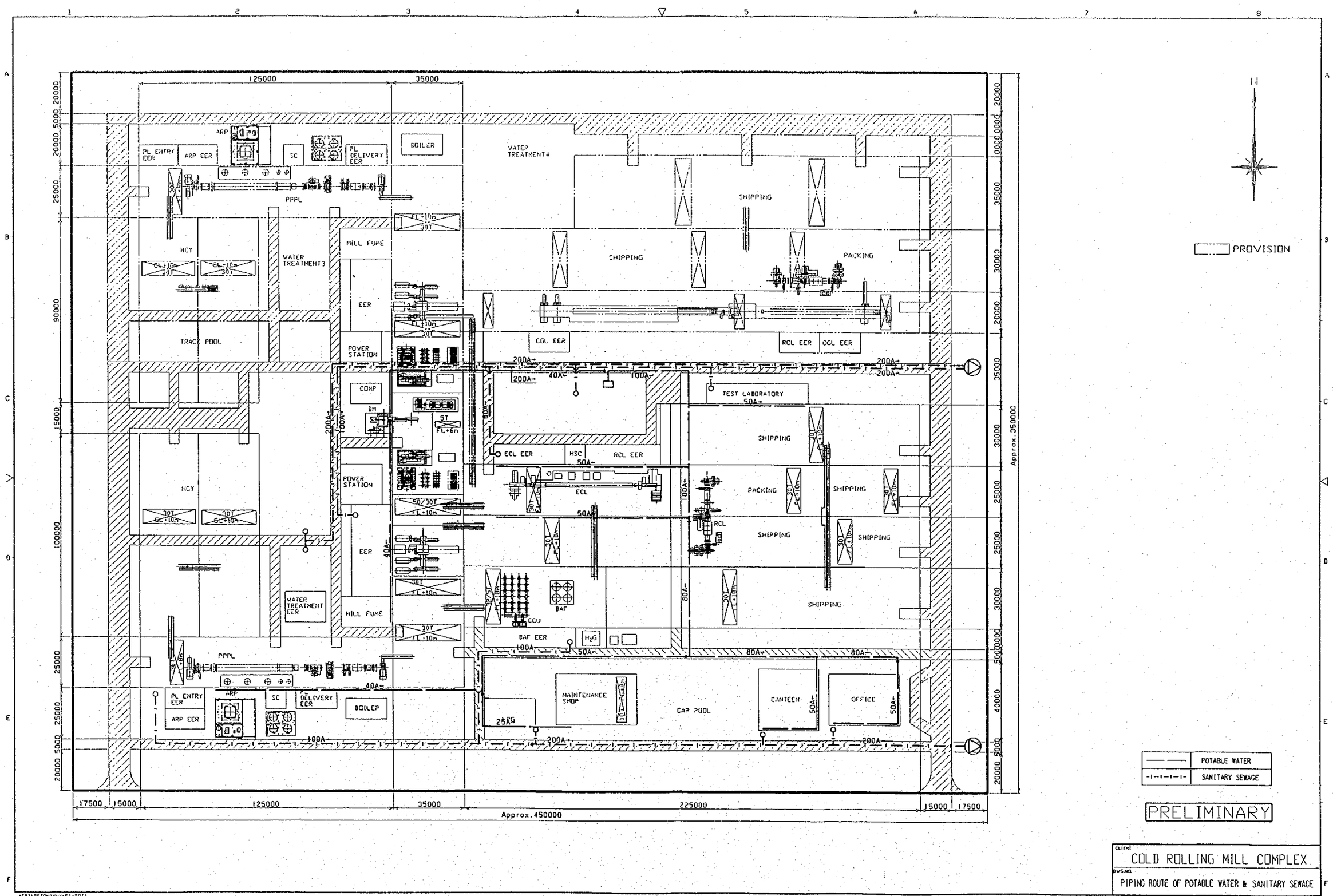


Fig.V-2-17 Piping Route Of Potable Water & Sanitary Sewage

2.7.2 Electric Power Receiving and Distribution Equipment

Specification of electric power receiving and distribution equipment plan for the cold rolling mill complex is shown below.

(1) Electric power receiving capacity

Electric power receiving capacity and receiving voltage is decided by demand prediction.

Table V-2-8 shows the demand prediction for each process equipment.

This demand prediction (kVA) is obtained from the total active power (kW) and reactive power (kVar) of the load in each equipment, considering available factor and power factor. This gives the total prediction value of 14.4 MVA.

Preconditions for the said demand prediction are as follows ;

1) Available factor conditions

Main cold rolling mill motor and auxiliary mill motors (Pay Off Reel : POR, Tension Reel : TR) are 1.0, line drive motors 0.5, pump and blower motors 0.7, crane motors 0.3 and lighting equipment 1.0.

2) Power factor conditions

High power factor drive equipment is adopted in this FS to control large capacity motors such as main cold rolling mill, POR and TR. High power factor drive equipment can reduce required electric power receiving capacity.

- Drive equipment for main cold rolling mill——1.0 is available using Gate Turn Off thyristor (GTO) drive.
- Drive equipment for POR, TR and other line motors——Over 0.8 is available using common converter system with thyristor component.
- Drive equipment for pump and blower motors are 0.85, and lighting equipment 1.0.

Table V-2-8 Demand Electric Power Prediction

Equipment	Equipment capacity(kW)	Active power(kW)	Reactive power(kVar)	(kVA)
Hot coil yard	250	110	40	117
Pickling line	1,600	950	550	1,098
Cold rolling and skinpass mill	7,900	7,100	2,800	7,632
Batch annealing furnace	1,400	1,150	420	1,224
Electrolytic cleaning line	2,450	1,600	1,000	1,887
Recoiling line and shipping yard	2,500	1,600	970	1,871
Water treatment	400	280	170	328
Maintenance shop and office	350	310	10	310
Total	16,850	13,100	5,960	14,392
After installing Power condenser	16,850	13,100	3,960	13,685

(2) Voltage fluctuation measures

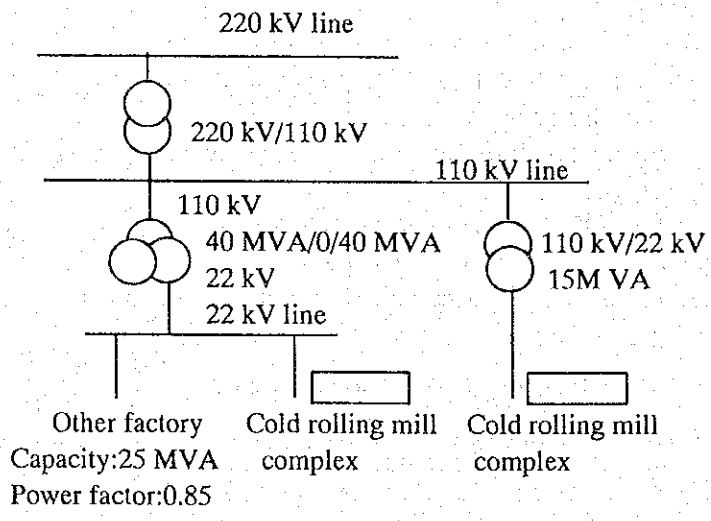
Voltage fluctuation at take over point must be maintained at less than 3.8%. This is the critical value to keep the lighting equipment normal (not to cause flicker), during the operation including the cold rolling mill acceleration timing. Accordingly, power condenser of 2,000 kVA must be installed in the main motor line (22 kV).

After installing the power condenser, the demand prediction becomes 13.7 MVA.

Considering 10% upper allowance, the power receiving transformer capacity of 15 MVA is adopted in this FS.

(3) Electric power receiving voltage

For electric power receiving voltage in the cold rolling mill complex, there are two possibilities, namely 110 kV or 22 kV. Both cases of 110 kV or 22 kV are studied here based on maintaining the voltage fluctuation value at less than 3.8% based on the demand prediction.



1) Case 1:Power receiving from 110 kV line

At 110 kV take over point, short circuit current is 20 kA and percent impedance is 0.4%. Percent impedance for power receiving transformer of 15 MVA (110 kV/22 kV) is assumed to be 7.5%. Voltage fluctuation is calculated from these percent impedance and voltage fluctuation at 110 kV take over point. This gives the voltage fluctuation 4.7% and exceeds the critical value of 3.8%. However, the voltage fluctuation can be lowered down to 3.7% by installing the power condenser of 2,000 kVA.

2) Case 2:Power receiving from 22 kV line

Percent impedance of 40 MVA (110 kV/22 kV) transformer is 8.7%. Voltage fluctuation is calculated from this percent impedance, voltage fluctuation at 22 kV take over point and reactive power from other factory. This gives 8.9% and exceeds far over the critical value of 3.8%. Even if the power condenser is installed, the voltage fluctuation can not be

lowered below the critical value due to the reactive power generated in the mill complex.

3) Result
Based on the calculations for the above Case 1 and 2, electric power receiving voltage of 110 kV is adopted in this FS. In addition, 110 kV power receiving has advantage compared to 22 kV with regard to power failure and electric power charge.

(4) Number of electric power receiving line
Number of electric power receiving line is one due to the following reasons ;
1) Frequency of power failure is quite limited (3~4 times/year)
2) Continued time of power failure is short (less than one hour).
3) Initial investment cost is to be minimized.

(5) Operating and monitoring of electric power receiving and distribution equipment
The operating and monitoring panel is to be installed in the electric power receiving and distribution station and at every operating room of each process equipment.

(6) Diesel generator for emergency
Diesel generator for emergency of about 300 kVA is to be installed to protect the equipment.

(7) Single line diagram
The single line diagram is shown in Fig. V-2-18.

(8) Electric power for construction
Electric power of about 2 MVA is required for construction of cold rolling mill complex.
Electric power receiving voltage is 22 kV.

(9) Application of electric power receiving
For application of electric power receiving the following documents are to be submitted to the relevant offices of province and city.
1) Mill complex location map
2) Mill complex layout
3) Single line diagram
4) Copy of investment license
5) Copy of construction certificate
6) Copy of land permit
7) Copy of business permit

(10) Electric power receiving inspection
Receiving of electrical power is to start after passing the electrical power receiving inspection imposed by Power Company -2.

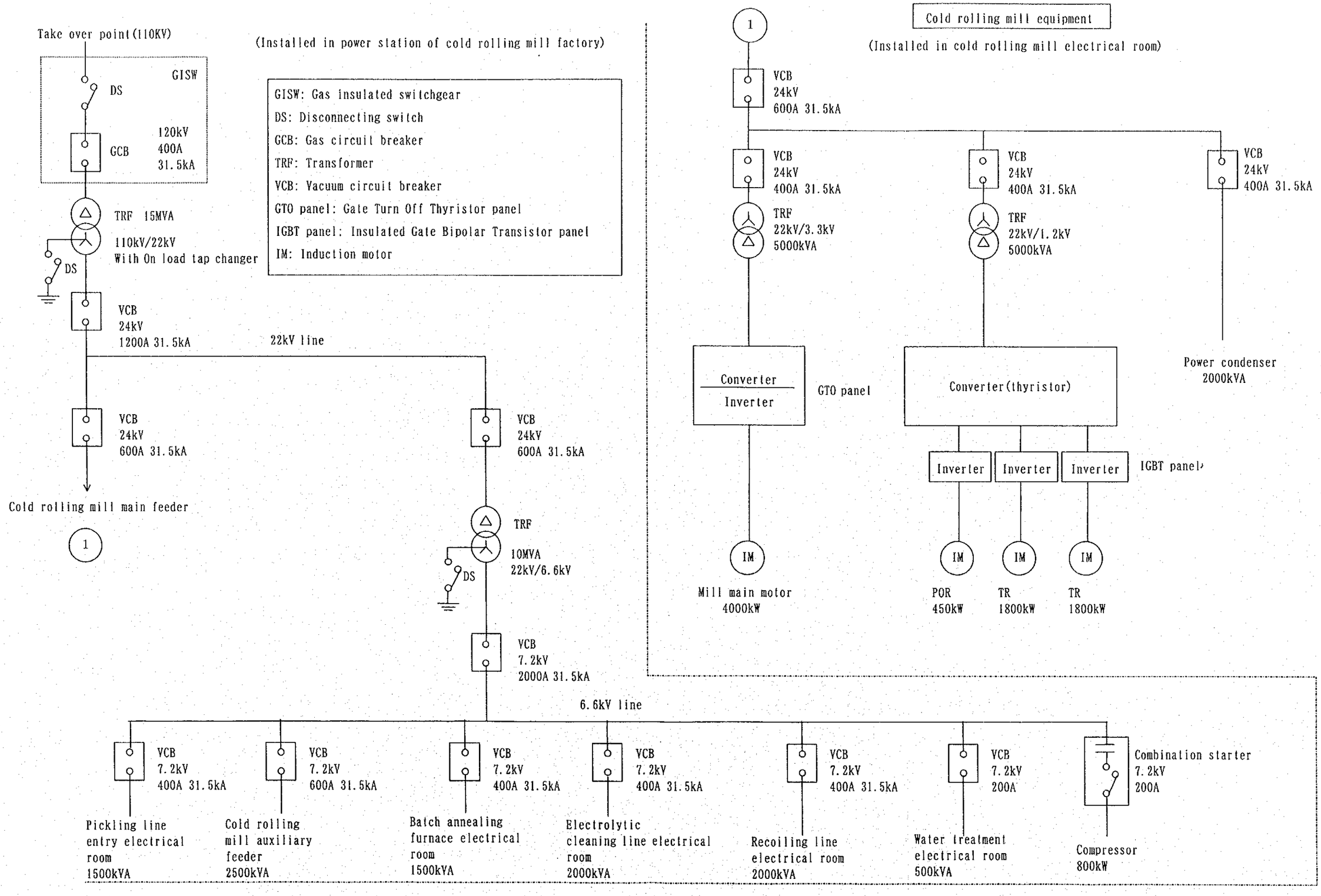


Fig. V-2-18 Single Line Diagram

2.7.3 Roll Shop

At the roll shop grinding of the rolls used in the cold rolling mill and in the skinpass mill, namely work rolls (WR), intermediate rolls (IMR) and back-up rolls (BUR), dull finishing (flecked texture) of the rolls, inspection, disassembly and assembly of the roll chock are executed. The following equipment is to be installed in the roll shop ;

1) Roll grinder : 1 unit
2) Dull finishing machine : 1 unit
3) WR, IMR chock extractor : 1 unit
4) BUR chock extractor : 1 unit
5) BUR chock tilter : 1 unit
6) Roll storage rack for WR and IMR : 1 unit
7) Cooling tank for rolls : 1 unit

2.7.4 Crane

Cranes are to be equipped in the mill complex for the following purposes ;

1) Transferring the coils in the mill complex
2) Conveying the equipment and materials at the time of installation and maintenance.

For the planned cold rolling mill complex 16 cranes are to be equipped. The major specifications of these cranes are shown in Table V-2-9 .

Table V-2-9 Main Specifications of Cranes

NO	Type	Place for installation	Load(tons) × Span (m)
1	OHC *1	Hot coil yard	30 tons×27.5 m
2	OHC	Hot coil yard	30 tons×27.5 m
3	OHC	Entry of PL	30 tons×22.5 m
4	OHC	Exit of PL	30 tons×32.5 m
5	OHC	Entry of RCM	30 tons×32.5 m
6	OHC	Exit of RCM	50/30 tons×32.5 m
7	OHC	Annealing	32/5 tons×27.5 m
8	OHC	Annealing～Shipping	30 tons×27.5 m
9	OHC	Entry of RCL	30 tons×22.5 m
10	OHC	RCL～Shipping	30 tons×22.5 m
11	OHC	Entry of ECL	30 tons×22.5 m
12	OHC	RCL～Packing	30 tons×22.5 m
13	OHC	Packing～Shipping	30 tons×22.5 m
14	OHC	Shipping Yard	30 tons×27.5 m
15	SGC *2	Roll Shop	5 tons×15 m
16	SGC	Maintenance Shop	10 tons×15 m

*1 : Overhead crane

*2 : Semi gantry crane

2.7.5 Coil Conveyor

A coil conveyor is used for transferring the coils between buildings. This conveyor is equipped with the motor in itself and supplied with electricity from outside and moves on the track. For the planned cold rolling mill complex seven conveyors in total are to be installed.

2.7.6 Equipment of Maintenance Shop

At the maintenance shop relatively small scale maintenance in the mill complex listed below is carried out.

1) Disassembly and conditioning of chocks and bearings of table rolls, bridle rolls and so on.
2) Disassembly and conditioning of hydraulic and air cylinders
3) Repair of piping

On the other hand, the following maintenance items are to be done by the outside contractors.

1) Grinding of rubber rolls
2) Polishing of blades
3) Disassembly and conditioning of large equipment such as compressor, blowers and reels
4) Disassembly and conditioning of motors
5) Other works which can not be done in the maintenance shop of the mill complex.

For the rolls used in the mill the maintenance is to be done in the roll shop. The equipment of the maintenance shop is shown in Table V-2-10.

TableV-2-10 Equipment of the Maintenance Shop

Purpose	Devices and Equipment
Disassembly and conditioning of chocks, bearings and cylinders	Chock extractor, Ring heater
Repairing pipes	High speed cutter, Pipe bender, Gas burner, Screw cutting machine, Welder
Common machining	Lathe, Milling cutters, Boring machine, Desktop grinder

2.7.7 Equipment of Test Laboratory

The following functions are to be secured in the test laboratory.

1) Test to certify the specified quality of the products of CRS and GIS produced in the cold rolling mill complex. The tests required are tensile strength, hardness and roughness.
2) Analysis for the operation of cold rolling mill complex. The analysis required is the concentration analysis of acid, alkaline and oil.

The following are the facilities to be installed in the test laboratory.

1) Tensile test machine
2) Hardness test machine
3) Roughness test machine
4) Test piece preparation machine
5) Concentration analysis machine

2.7.8 Acid Regeneration Plant (ARP)

The waste acid from the pickling line is regenerated at Acid Regeneration Plant (ARP). According to the findings obtained from the site surveys of JICA Team, at the moment there is not enough capacity of strong waste acid treatment in Viet Nam. Accordingly, ARP is requested to be newly installed in this FS.

The waste acid is put into the roaster heated-up at high temperature, and the water content is taken away by evaporation. Then ferric chloride is reacted with oxygen, and the acid is dissolved thermally into ferric oxide and hydrochloric acid. The reaction is described as below ;

$$4\ FeCl_2 + 4\ H_2O + O_2 \rightarrow 2\ Fe_2O_3 + 8\ HCl$$

Fe_2O_3 is taken away from the roaster gas of high temperature at the cyclone. Then the gas is cooled down and HCL in the gas is absorbed in the absorption tower, giving the regenerated HCL with 18 % concentration. Major specifications are as follows ;

1) Flow rate of waste acid : 1,300 litter/hr
2) Precondition of Fe content in the waste acid : average 120 gr/litter
3) Precondition of free HCL in the waste acid : average 40 gr/litter
4) Concentration of the recovered acid : around 18 %
5) Fuel : LPG

2.7.9 Hydrogen Gas Generator

The hydrogen gas is used as the atmosphere gas of BAF. The site surveys of JICA Team have revealed that there is no possibility of having the enough supply of hydrogen gas from outside, which necessitates the installation of hydrogen gas generator in the mill complex. In this generator the demineralized water is electrolyzed, giving the hydrogen gas. Major specifications are as follows ;

1) Amount of gas generated : maximum 50 Nm^3/hour
2) Water to be supplied : Pure water (to be supplied from water treatment equipment)

2.7.10 Storage Tanks for Nitrogen Gas, LPG and Heavy Oil

(1) Storage tank for nitrogen gas

The nitrogen gas is used as the purging gas at BAF. The site surveys of JICA Team have revealed the existence of enough possibility of obtaining the nitrogen gas from outside.

Accordingly, a storage tank is to be installed and the gas is procured from outside and transported by tank lorries. The necessary piping is to be made from the storage tank to BAF. Major specification are as follows ;

1) Storage period : 7 days
2) Tank capacity : 8 m^3
3) Evaporator : Cold evaporator type

(A gas tank with 20 kg pressure is also to be installed to avoid the pressure variation)

(2) Storage tank for LPG

LPG is used as the fuel for BAF and ARP. A storage tank is to be installed and LPG is procured from outside and transported by tank lorries. The necessary piping is to be made from the storage tank to BAF and ARP. Major specification are as follows ;

1) Storage period : 7 days
2) Tank capacity : 100 m^3

(3) Storage tank for heavy oil

The heavy oil is used as the fuel for boiler for evaporating. A storage tank is to be installed and heavy oil is procured from outside and transported by tank lorries. The necessary piping is to be made from the storage tank to the boiler. Major specification are as follows ;

1) Storage period : 7 days
2) Tank capacity : 200 m^3

2.7.11 Air Compressor

Compressed air is used as one source of possible powers, and the air compressor needs to be installed. Major specification are as follows ;

1) Number of compressor :2
2) Amount of discharge air : 6,000 Nm^3/hour (total)
3) Pressure of discharge air:0.7MPa
4) Receiver tank volume : 8 m^3

2.7.12 Boiler

In the mill complex the steam is used for heating-up the equipment. The site surveys of JICA Team have revealed that there is no possibility of having the enough supply of steam from outside, which necessitates the installation of boiler within the mill complex. The necessary piping is to be made from the boiler to each equipment. Major specification are as follows ;

1) Amount of steam generated : maximum 12 tons/hour
2) Steam pressure for ordinary use:1MPa
3) Temperature of steam : 260 ℃

4) Fuel : Heavy oil (ASTM.D240)
5) Water to be supplied : Demineralized water (to be supplied from water treatment equipment)

2.7.13 Devices for Packing

Paper packing is to be done for the coils produced. This packing work is done manually, however the following devices are needed in the packing yard ;

1) Cutting machines of the packing materials in accordance with the coil sizes.
2) Devices for packing such as portable banding machine and so on

Packing materials such as paper, banding hoop and seal are to be procured from outside.

2.8 Consumption of Utility and Sub-Material of Each Equipment

The cold rolling mill requires various utilities and sub-materials for its operation. This is the case both for the main equipment and for the ancillaries. In this FS the utilities and sub-materials required for each ancillary is included in the main equipment which is most related to the specific ancillary. The consumption of utility and sub-material of each equipment is shown in Table V-2-11. The figures in the table are obtained based on the real operational indices in the existing cold rolling mill in Japan. The consumption of water is described in the section of water treatment.

Table V-2-11 Consumption of Utilities and Sub-materials of Each Equipment

(per one ton product at the delivery of each equipment)

		PL	RCM	ECL	BAF	SPM	RCL
Electricity	(kwh/ton)	17	136	36	43	46	27
Vapor	(kg/ton)	30	15	40	0	15	0
LPG	(Nm3/ton)	1.3	0	0	4.5	0	0
N2 gas	(Nm3/ton)	0	0	0	2.4	0	0
H2 gas	(Nm3/ton)	0	0	0	2.4	0	0
Hydrochloric acid	(kg/ton)	4	0	0	0	0	0
Inhibitor	(kg/ton)	0.03	0	0	0	0	0
Roll	(kg/ton)	0	0.15	0	0	0.02	0
Orcho sodium silicate	(kg/ton)	0	0	0.7	0	0	0
Lubricant	(litter/ton)	0	0.7	0	0	0.2	0
Rust preventive oil	(litter/ton)	0.15	0	0	0	0	0.8

【Complement】

1) Ancillaries included in the main equipment are as follows ;

PL : Acid regeneration plant(ARP), Hot coil yard, Crane, Coil conveyor

RCM・SPM : Roll shop, Air compressor, Crane, Coil conveyor

ECL : Water treatment facilities, Boiler, Crane, Coil conveyor

BAF : H2 generator, Maintenance shop, Crane, Coil conveyor

RCL : Packing yard, Shipping yard, Test laboratory, Crane, Coil conveyor, Office

2) Vapor is produced by the boiler in the cold rolling mill complex with a capacity of 12 tons/hour. Heavy oil is used as fuel (Heavy oil 0.09 kg - ASTM. D240 for 1 kg vapor)

3) LPG is used as fuel for BAF and ARP.

4) N2 gas is used for purging at BAF.

5) H2 gas is produced from demineralized water in the cold rolling mill complex and is used as atmosphere gas of BAF.

6) Most of the hydrochloric acid is the recovered acid from ARP with 18 % concentration. For supplement new hydrochloric acid with 36 % concentration is used. The figure of the consumption of hydrochloric acid is the basis of new acid with 36 % concentration.

7) Roll consumption is the total figure covering work rolls, back-up rolls and intermediate rolls in case of 6-Hi mill.

8) Orcho sodium silicate is used as cleaner of ECL equipment.

9) Lubricant is sprayed during rolling between strip and work rolls to decrease the friction.

10) Rust preventive oil is used for coating the surface of final products at the last process of production.

3. Specification of Electricity, Instrumentation and Process Computer

In defining equipment specification, the following three factors are very important;

(1) Proven technologies which are widely used at the existing steel industry are to be adopted.
(2) The initial investment cost is to be minimized.
(3) Equipment is to be automated with regard to the key functions such as unified quality and yield improvement. Accordingly, process computers which make the data setting to electrical equipment and instrumentation equipment are to be introduced at CRM and SPM.

3.1 Specification of Electrical Equipment

3.1.1 Power Supply Equipment

The single line diagrams for CRM and PL which describe the distribution voltage to each process equipment after power receiving at 110 kV are shown in Fig.V-3-1 and Fig.V-3-2 respectively. The voltage is transformed down to 22 kV by the transformer after power receiving at 110 kV. For CRM which has a large load capacity, power supply is made with 22 kV to minimize the power transmission loss. On the other hand, for other process equipment power supply is made with 6.6 kV. The power received at each equipment with the voltage of 6.6 kV is further transformed down to the application voltage specific to equipment such as control power, roll drive power, crane power and so on.

3.1.2 Motor Drive Device

There are two possible variable speed drive systems for mill, reel and roll which are to be driven with variable speed, namely the variable speed system of alternating current (AC) and that of direct current (DC). The comparison of these two systems is shown in Table V-3-1. AC system is to be adopted in this FS as it is better in accuracy of speed control, speed response and maintainability. In addition, at the moment it is a fact that AC system can be manufactured by most of the major electrical manufacturers in the world.

Table V-3-1 Comparison of Variable Speed Drive System of Alternating Current (AC) and That of Direct Current (DC)

	Variable speed drive system of AC	Variable speed drive system of DC
Accuracy of speed control	◎	○
Speed response	◎	○
Maintainability of motor	◎	△
Power factor	◎	○
Equipment cost	Almost same	
Judge	◎	○

◎:Excellent ○:Good △:Fair

Application of variable speed drive system of AC is shown in Table V-3-2.

Table V-3-2 Application of Variable Speed Drive System of Alternating Current

Capacity	Inverter element by application and system	Application equipment
Over 4000 kVA	GTO	Motor for mill
1200 kVA~4000 kVA	IGBT 3 level	Motor for POR and TR
Under 1200 kVA	IGBT 2 level	Motor for BR and PR

Note: GTO (Gate Turn Off thyristor)、IGBT (Insulated Gate Bipolar Transistor)
3 level (Output voltage of converter 3 level changing control system)
2 level (Output voltage of converter 2 level changing control system)

Motor driving with constant speed for pump and blower is controlled by magnetic contactor.

3.1.3 Motor

Squirrel cage induction motor is to be adopted with maintainability and equipment cost taken into consideration. Voltage specification and protection system are described below.

(1) Voltage specification

Voltage specifications are as follows considering the power system and mechanical specifications.

- Motor for variable speed ----manufacturer standard
- Motor for constant speed----from the viewpoint of efficiency, low tension voltage with 380 V three phases for below 250 kW, and high tension voltage with 6.6 kV three phases for over 250 kW.

(2) Protection system

Protection system of motor is shown in Table V-3-3.

Table V-3-3 Protection System of Motor

Location	Protection system
Indoor	Totally enclosed indoor type
Outdoor	Totally enclosed outdoor type
Pickling tank	Totally enclosed Acid proof type
Alkali tank	Totally enclosed Alkali proof type
Oil cellar	Totally enclosed increased safety type

3.1.4 Master Control Device

Control by PLC (Programmable Logic Controller) and that by relay sequence are used depending on the required function after taking into consideration the timing of commissioning and function of each equipment. Classification of control method by the required function for electrical equipment is shown in Table V-3-4.

Table V-3-4 Classification by Control Function of Electrical Equipment

Control function	Control
Speed control of roll and tension control of strip	PLC or sequencer
Run and stop of pump and blower	Sequencer or relay logic
Emergency stop and lock switch	PLC or sequencer and relay logic(buck up)

Control items of major electrical equipment at each process are described below.

(1) Pickling line

Main control items of electrical equipment for pickling line are shown in Table V-3-5.

Table V-3-5 Main Control Items of Electrical Equipment for Pickling line

Control items	Manual	Automatic
Coil car transfer control of entry and exit section	○	
Strip threading control of entry and exit section	○	
Shear cutting control of entry and exit section	○	
Automatic slow down of entry and exit section		○
Line speed control		○
Tension control of POR and TR		○
APC control of leveler		○
Coil diameter calculation of POR and TR		○
Catenary control in acid tank		○
knife width APC of side trimmer		○

Note: APC (Automatic Position Control)

(2) Cold rolling mill

Main control items of electrical equipment for Cold rolling mill are shown in Table V-3-6.

Table V-3-6 Main Control Items of Electrical Equipment for Cold Rolling Mill

Control items	Manual	Automatic
Coil car transfer control of entry and exit section		○
Strip threading control of entry and exit section		○
Automatic slow down of entry and exit section		○
Line speed control		○
Tension control of POR and TR		○
Automatic gauge control		○
Coil diameter calculation of POR and TR		○

(3) Skinpass mill

Main control items of electrical equipment for skinpass mill are shown in Table V-3-7.

TableV-3-7 Main Control Items of Electrical Equipment for Skinpass Mill

Control items	Manual	Automatic
Coil car transfer control of entry and exit section		○
Strip threading control of entry and exit section		○
Automatic slow down of entry and exit section		○
Line speed control		○
Tension control of POR and TR		○
Strip elongation control		○
Coil diameter calculation of POR and TR		○

(4) Batch annealing furnace

Main control items of electrical equipment for batch annealing furnace are shown in Table V-3-8.

Table V-3-8 Main Control Items of Electrical Equipment for Batch Annealing Furnace

Control items	Manual	Automatic
Coil transfer control	○	
Run and stop control of blower and pump		○

(5) Electrolytic cleaning line

Main control items of electrical equipment for electrolytic cleaning line are shown in Table V-3-9.

Table V-3-9 Main Control Items of Electrical Equipment for Electrolytic Cleaning Line

Control items	Manual	Automatic
Coil car transfer control of entry and exit section	○	
Strip threading control of entry and exit section	○	
Shear cutting control of entry and exit section	○	
Automatic slow down of entry and exit section		○
Line speed control		○
Tension control of POR and TR		○
Coil diameter calculation of POR and TR		○

(6) Recoiling line

Main control items of electrical equipment for recoiling line are shown in Table V-3-10.

Table V-3-10 Main Control Items of Electrical Equipment for Recoiling Line

Control items	Manual	Automatic
Coil car transfer control of entry and exit section	○	
Strip threading control of entry and exit section	○	
Shear cutting control of entry and exit section	○	
Automatic slow down of entry and exit section		○
Line speed control		○
Tension control of POR and TR		○
Coil diameter calculation of POR and TR		○
Strip elongation control		○

3.1.5 Operating and Monitoring Device

Operating panel and monitoring panel are to be installed at each operating room to monitor the operation and conditions of the equipment. In addition to the operating room, the operating panel is also to be installed close to the equipment for efficient maintenance and commissioning.

3.2 Specification of Instrumentation Equipment

Control by DDC (Direct Digital Controller) and that by relay sequence are used depending on the required function after taking into consideration the timing of commissioning and function of each equipment. The classification of control method by the required function for instrumentation equipment is shown in Table V-3-11.

For equipment with a small number of control loops, one loop controller which can be purchased at low price is occasionally used.

Table V-3-11 Classification by Control Function of Instrumentation Equipment

Control function	Control
Temperature and density control of liquid	DDC or one loop controller
Shut off valve circuit etc.	DDC or one loop controller and relay logic(buck up)

Specifications for gauge meters installed at CRM and RCL are described in Section V.3.2.3.

3.2.1 Main Control Items of Main Instrumentation Equipment

Control items of major electrical equipment at each process are described below.

(1) Pickling line

Main control items of instrumentation equipment for pickling line are shown in Table V-3-12.

Table V-3-12 Main Control Items of Instrumentation Equipment for Pickling Line

Control items	Manual	Automatic
Temperature control of acid liquid		○
Temperature control of rinse liquid		○
Density control of acid liquid	○	
Level control of acid liquid tank		○
Level control of rinse liquid tank		○

(2) Cold rolling mill

Main control items of instrumentation equipment for cold rolling mill are shown in Table V-3-13 .

Table V-3-13 Main Control Items of Instrumentation Equipment for Cold Rolling Mill

Control items	Manual	Automatic
Temperature control of rolling liquid		○
Level control of rolling liquid		○
Density control of rolling liquid	○	
Pressure control of rolling liquid		○
Level control of oil cellar drainage pit		○

(3) Skinpass mill

Main control items of instrumentation equipment for skinpass mill are shown in Table V-3-14.

Table V-3-14 Main Control Items of Instrumentation Equipment for Skinpass Mill

Control items	Manual	Automatic
Temperature control of rolling liquid		○
Level control of rolling liquid		○
Density control of rolling liquid	○	
Pressure control of rolling liquid		○
Level control of oil cellar drainage pit		○

(4) Batch annealing furnace

Main control items of instrumentation equipment for batch annealing furnace are shown in Table V-3-15.

Table V-3-15 Main Control Items of Instrumentation Equipment for Batch Annealing Furnace

Control items	Manual	Automatic
Temperature control in furnace		○

(5) Electrolytic cleaning line

Main control items of instrumentation equipment for electrolytic cleaning line are shown in Table V-3-16.

Table V-3-16 Main Control Items of Instrumentation Equipment for Electrolytic Cleaning Line

Control items	Manual	Automatic
Temperature control of acid liquid		○
Temperature control of rinse liquid		○
Density control of acid liquid	○	
Level control of acid liquid tank		○
Level control of rinse liquid tank		○

(6) Recoiling line

There is no instrumentation control for RCL.

3.2.2 Operating and Monitoring Device

Operating panel and monitoring panel are to be installed at each operating room to monitor the operation and conditions of equipment. In addition to the operating room, the operating panel is also to be installed close to the equipment for efficient maintenance and commissioning.

3.2.3 Specification of Gauge Meter

X-ray gauge meter and γ -ray gauge meter are to be adopted at CRM and RCL respectively with the required function and equipment cost taken into consideration. The comparison of the said two gauge meters is shown in Table V-3-17.

Table V-3-17 Comparison of Gauge Meter

Items	X-ray gauge meter	γ -ray gauge meter
Accuracy of setting	◎	◎
Response speed	◎	○
Equipment cost	High	Low
Application	On line control for AGC	For Monitoring
Application equipment	Cold rolling mill	Recoiling

◎:Excellent ○:Good

3.3 Specification of Process Computer

To improve the quality uniformity and yield, process computers which make the data setting to electrical equipment and instrumentation equipment are to be introduced at CRM and SPM. Control items of process computers are shown in Table V-3-18.

Table V-3-18 Main Control Items of Process Computer Equipment

Classification of function	Function	Main function
Setting and control	(1)Setting to AGC device	Coil No., Coil code, Strip width, Target gauge, Tension etc.
	(2)Setting to gauge meter	Coil No., Target gauge etc.
	(3)Setting to oil cellar panel	Flow pattern of rolling liquid
Tracking	Tracking in mill zone	Tracking in mill zone and rolling condition
Data logging	Actual data of constant length	Statistics control of actual data of constant length (gauge)
Input and output for operator	(1)Rolling schedule	Monitoring and revision of rolling schedule
	(2)Actual rolling time	Input of not operating time (line stop etc.)

3.4 Production Control

Considering the production capacity and number of grades, the production control such as planning and monitoring is to be made by operators.

3.5 Specification of Telecommunication Equipment

The required telephone equipment, paging equipment and broadcasting equipment are described below.

(1) Telephone equipment
The exchange machine through which communication both within the mill complex and to outside the mill complex can be made is to be installed. The required number of lines is twenty.

(2) Paging equipment
For the purpose of communication in each process equipment, paging is to be installed at operating rooms, machine sides and electrical rooms.

(3) Broadcasting equipment
For the purpose of broadcasting in the overall mill complex, a microphone and main device are to be installed in the main office and speakers at required points in the mill complex.

3.6 Erection and Wiring Work Items for Electricity, Instrumentation and Process Computer

The required works for erection and wiring are as follows ;

(1) Erection and wiring work of power receiving and distribution equipment
(2) Erection and wiring work of main equipment (electricity, instrumentation and process computer)
(3) Temporary electrical power for construction
(4) Wiring work from power station to each process equipment
(5) Miscellaneous electric work (listed below)
   1) Lighting work for main building
   2) Lighting work in operating room and electrical room
   3) Spot lighting work in each process equipment
   4) Lighting work for road
   5) Erection and wiring work for telecommunication equipment
   6) Trolley wiring work for crane
   7) Wiring work for maintenance power

8) Automatic fire alarm work
9) Undergrounding work of earth plate and bar
10) Lightning and grounding work
11) Fire hydrant wiring work
12) Erection and wiring work for industrial television

3.7 Law and Regulation

With regard to electrical work, an application is to be made for automatic fire alarm equipment and lubrication unit installed in oil cellar for motor bearing of mills. The application is to be made to, and the inspection is made by the relevant province and city fire offices.

3.8 Possibility of Domestic Procurement in Viet Nam for Electricity, Instrumentation and Process Computer Equipment.

The result of evaluation on the possibility of domestic procurement for electrical, instrumentation and process computer equipment and work material is shown in Table V-3-19. Power equipment such as high tension voltage panel, low tension voltage panel and transformer are manufactured at the moment in Viet Nam by local manufacturers, and there is a possibility of the domestic procurement with some limitation. There is no manufacturers of driving device and controller. Work materials such as cables can be procured locally in Viet Nam.

Table V-3-19 Possibility of Domestic Procurement in Viet Nam

Equipment and material	Local maker	Application equipment	Remarks
High tension voltage panel	Exist	Incidental equipment and temporary power	
Transformer	Exist	Incidental equipment and temporary power	
Low tension voltage panel	Exist	Incidental equipment and lighting panel	
Motor drive device	Non	Non	
Controller(PLC.DDC etc.)	Non	Non	
Telecommunication equipment	Non	Non	
Cable	Exist	Main equipment work and incident equipment work	Adoption of Cable for special high tension voltage(over 22 kV) is early.
Cable rack and pipe	Exist	Main equipment work and incident equipment work	
Lighting device and trolley	Non	Non	

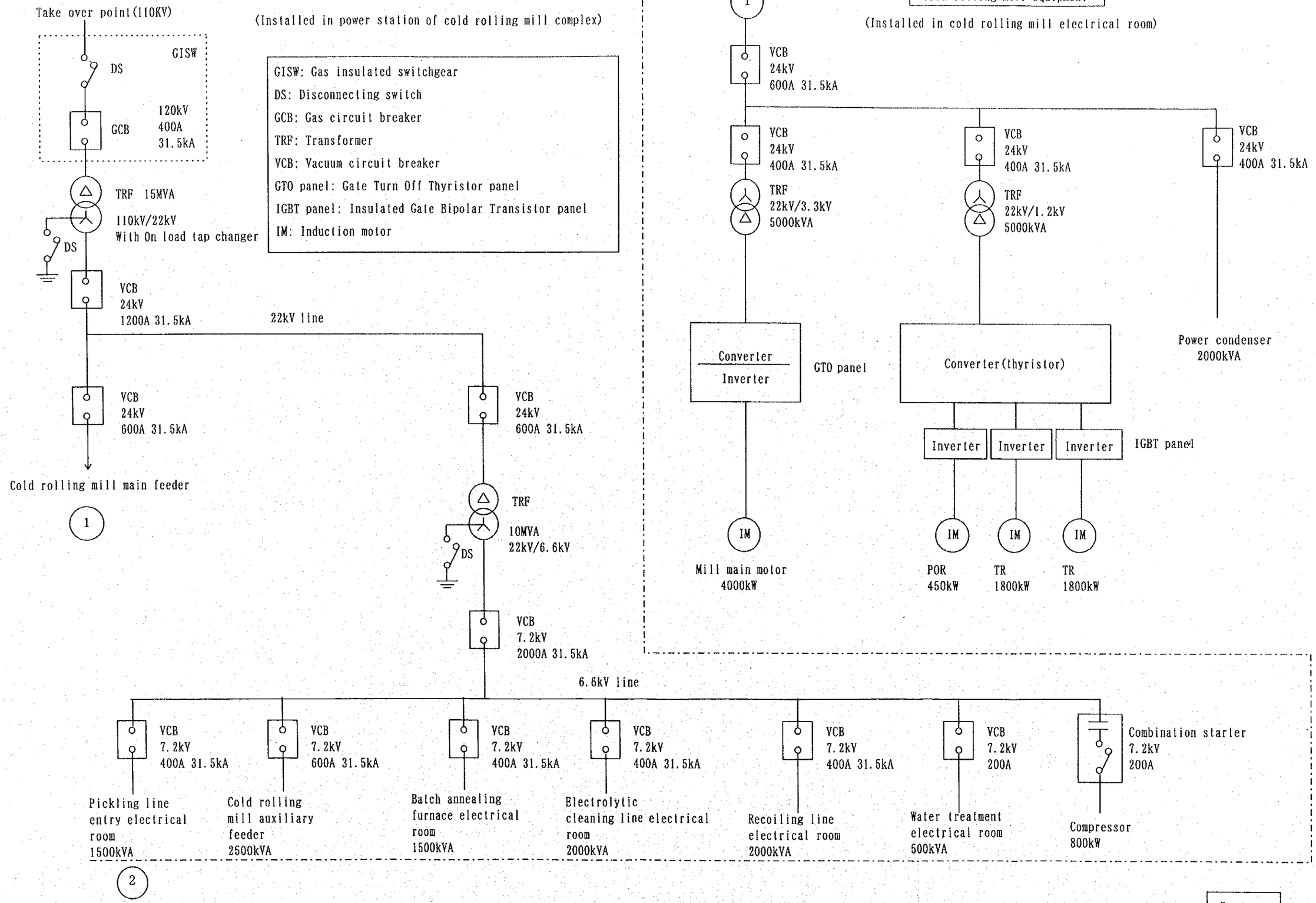


Fig. V-3-1 Single Line Diagram for Cold Rolling Mill

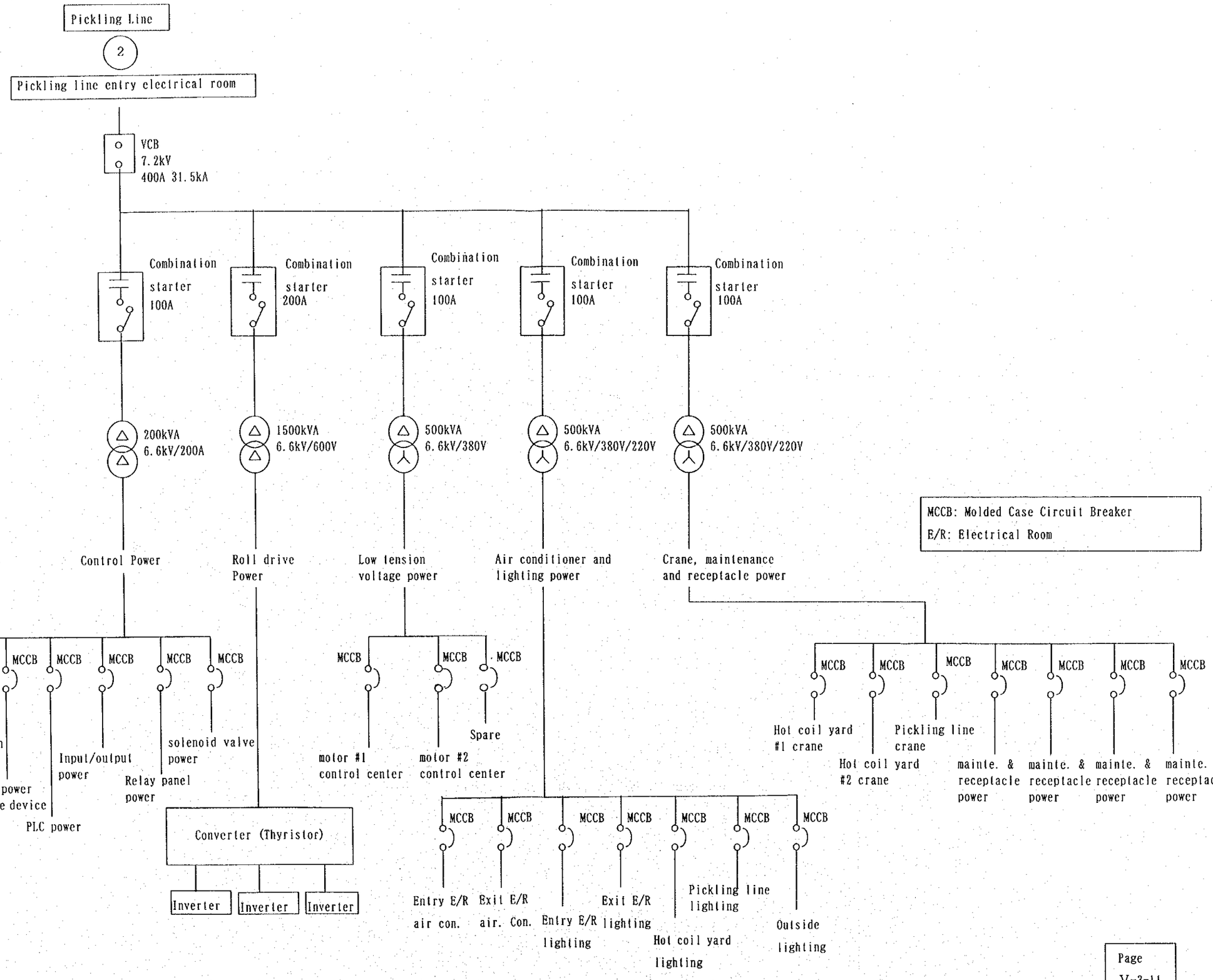


Fig. V-3-2 Single Line Diagram for Pickling Line

4. Layout

4.1 Basic Idea for Designing Mill Complex Layout

The mill complex layout is considered for the processes defined in Chapter V.2. In addition, the material flow and the provision for future expansion are taken into consideration.

(1) Equipment to be considered

1) Production equipment:

①Push pull type pickling line
②1 stand reversing cold rolling mill (combination line with Skinpass mill)
③Electrolytic cleaning line
④Box annealing furnace (and Coil cooling unit)
⑤Recoiling line

2) Ancillaries:

①Roll shop
②Electric power receiving and distribution equipment
③Water treatment facilities
④Acid regeneration plant
⑤H_2 gas generator and N_2 gas, LPG, Heavy oil storage tanks
⑥Air compressor
⑦Boiler
⑧Crane
⑨Coil conveyor
⑩Test laboratory
⑪Maintenance shop
⑫Hot coil yard
⑬Packing yard
⑭Shipping coil yard
⑮Office and Canteen

(2) Basic idea for major items affecting the layout

1) Production equipment:

The equipment layout is studied by taking into consideration the production capacity and processes such as line length of PPPL, ECL and RCL, number of furnaces and so on.
Coil yard area and maintenance area are considered so as not to interfere the operation in principle.

2) Ancillaries:

Among the ancillaries listed above hot coil yard and shipping coil yard affect much the layout.
The conditions for these yards are shown in Table V-4-1.

Table V-4-1 Idea of Hot Coil Yard and Shipping Coil Yard

	Storage capacity	Outdoor / Indoor	Number of stack	Coil transfer
⑫Hot coil yard	30 days	Outdoor (Not roofed)	2	Crane & Conveyor
⑭Shipping Coil yard	15 days	Indoor (Roofed)	1	Crane & Conveyor

(3) Material flow of the new cold rolling mill complex

Layout is studied from a viewpoint of avoiding complicated flows concerning the following items;

1) Hot coil receiving and product coil shipping
2) Coil flows between the production equipment

Material flow of the new cold rolling mill complex is shown in Fig. V-4-1.

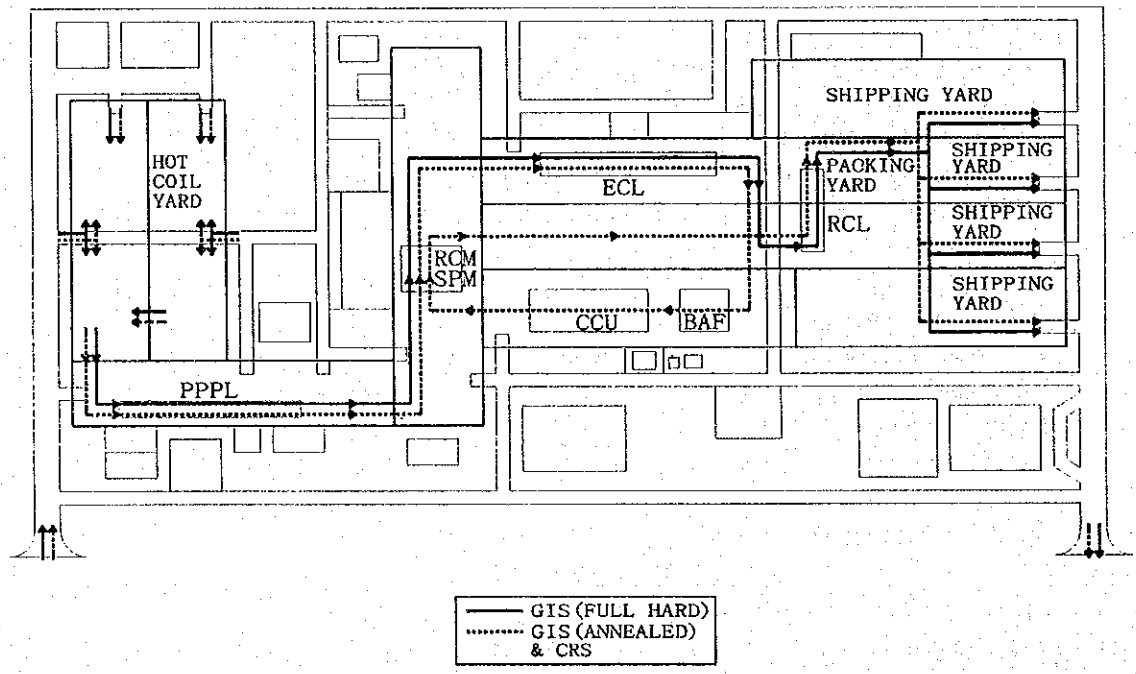


Fig. V-4-1 Material Flow of New Cold Rolling Mill Complex

4.2 Recommended Mill Complex Layout

Although the future expansion plan of the cold rolling mill complex has not been yet specified, the land space is secured with the following assumptions. As a result of this consideration, the land space is set to be the size of 450 m×350 m.

1) Production capacity is to be increased from 250,000 tons/year to 500,000 tons/year.
2) New equipment to be newly installed for the expansion is one push pull type pickling line, one stand reversing cold rolling mill, one continuous galvanizing line (CGL) of Nonoxidization furnace (NOF) type and one recoiling line for inspection.

The recommended mill complex layout is shown in Fig. V-4-2.

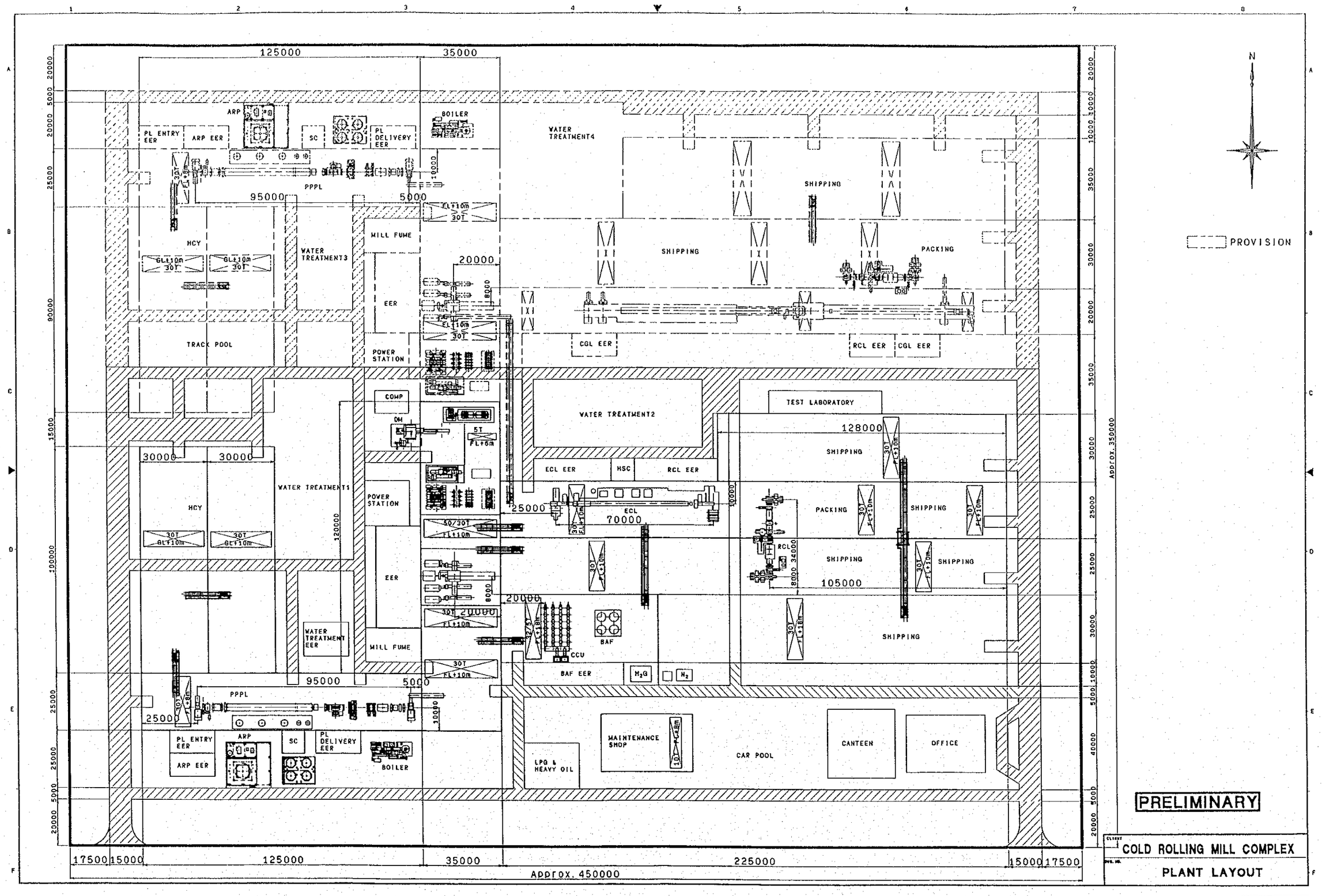


Fig. V-4-2 New Cold Rolling Mill Complex Layout

5. Specification of Civil and Building

5.1 Specification of Civil

5.1.1 Soil Condition

(1) Fig. V-5-1 shows boring data at PHU MY Industrial Zone. Soil characteristics, thickness of layer and N values are described as follows;

1) The first layer (GL～GL-2m) is clay. N value is 6.
2) The second layer (GL-2m～GL-7m) is clay. N value is 24.
3) The third layer (GL-7m～GL-24m) is sandy-clay with gravel. N value is 19
4) The fourth layer (GL-24m～GL-36.5m) is sandy-clay. N value is 24.

(2) Except for the first layer, N value is almost constant along the depth of the soil layers and the bearing capacity is sufficient for foundation of the New Cold Rolling Mill Complex.

5.1.2 Plan of Foundation for New Cold Rolling Mill Complex

(1) The recommended foundation type for the cold rolling mill complex at PHU MY

In general, the foundation type of a cold rolling mill complex is selected between pile-foundation and spread foundation (without pile). The selection is to be made in consideration of the loading condition of the equipment, the depth of foundation level and the soil condition.

Spread foundation (without pile) is recommended for the new cold rolling mill complex due to the following reasons;

1) Depth of foundation level for the new cold rolling mill complex is predicted as GL-2m to GL-9m. The contact pressure of underlying foundation is estimated as 5t/m^2 to 15 t/ m^2.
2) The heaviest equipment is the rolling mill with 400t to 500t, and an oil cellar may be constructed below the mill. Therefore, both the mill and the oil cellar should be sustained by the common foundation. The common foundation is to make sure the reduction of contact pressure to the safety range within 15 t/ m^2.
3) The soil layers mentioned above seem to possess high bearing capacity.
4) Utilizing spread foundation can save the construction cost compared to the pile-foundation.

(2) Drawings of foundation planning

Following figures show the foundation planning for the new cold rolling mill complex .

1) Fig. V-5-2 : General Plan of Foundation
2) Fig. V-5-3 : Foundation Plan of PPPL YARD
3) Fig. V-5-4 : Foundation Plan of RCM・R/S YARD
4) Fig. V-5-5 : Foundation Plan of ECL, CCU･BAF YARD
5) Fig. V-5-6 : Foundation Plan of RCL YARD

A cold rolling mill complex needs numerous construction of deep foundation because some equipment and utilities are constructed in an underground space. Accordingly, it will be important to carry out not only the structural design but also the functional design of underground space in the stage of detailed design.

PHU MY

Bore hole No. : PM111

Layer	Depth (m)	Thickness (m)	Soil	Sample depth	Blow count
1	2.0	2.0	clay	1.3-1.5	6
2	7.0	5.0	clay	3.3-3.5	24
3	24.0	17.0	sandy clay with gravel	9.3-9.5	19
4	36.5	12.5	sandy clay	30.0-30.6	24
5	37.5	1.0	clay		
6	40.0	2.5	cleyey sand	38.0-38.2	24

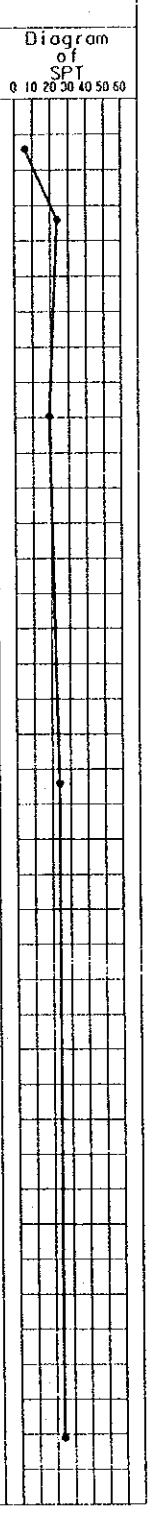


Fig. V-5-1 Boring Data at PHU MY

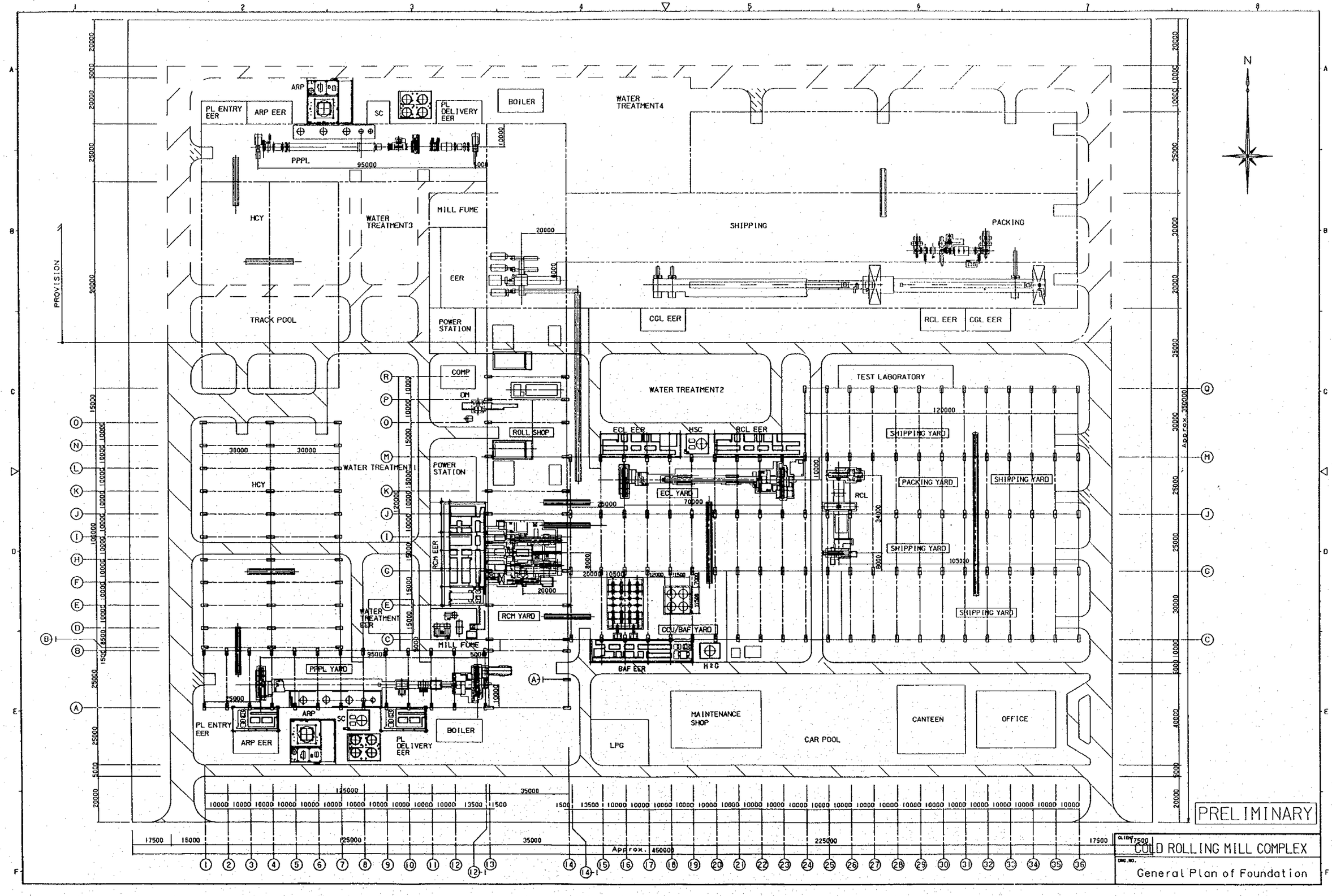


Fig. V-5-2 General Plan of Foundation

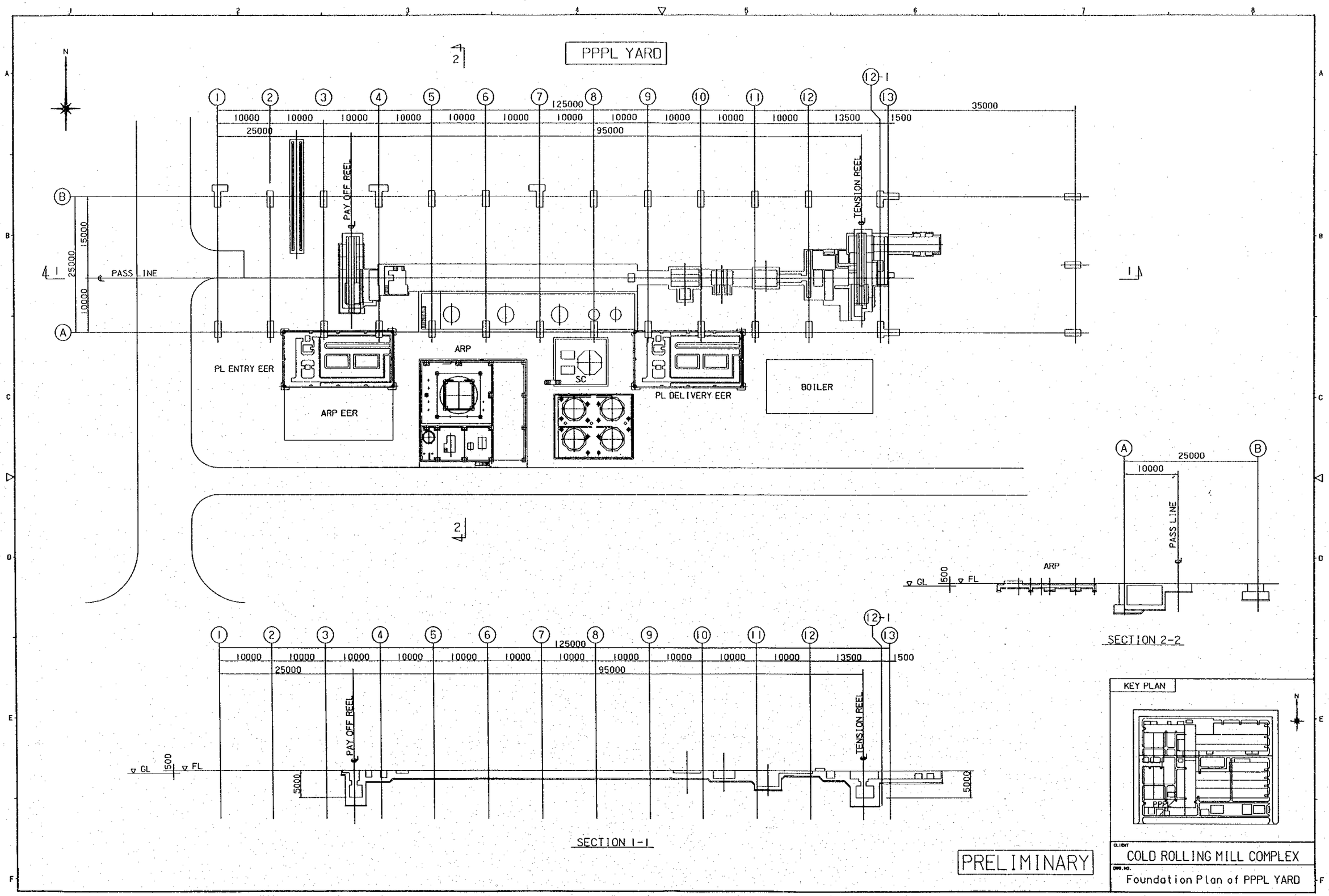


Fig.V-5-3 Foundation Plan of PPPL YARD

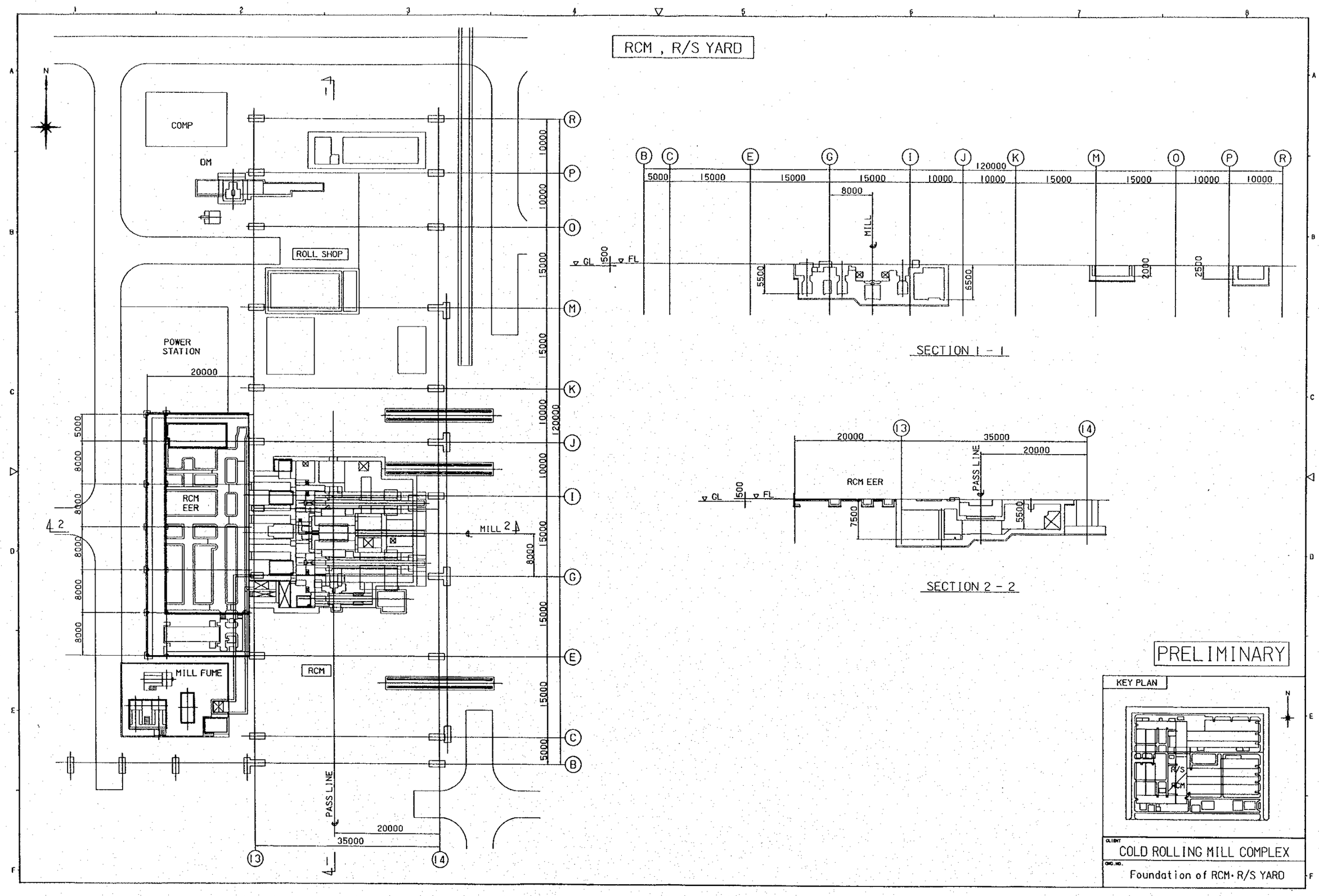
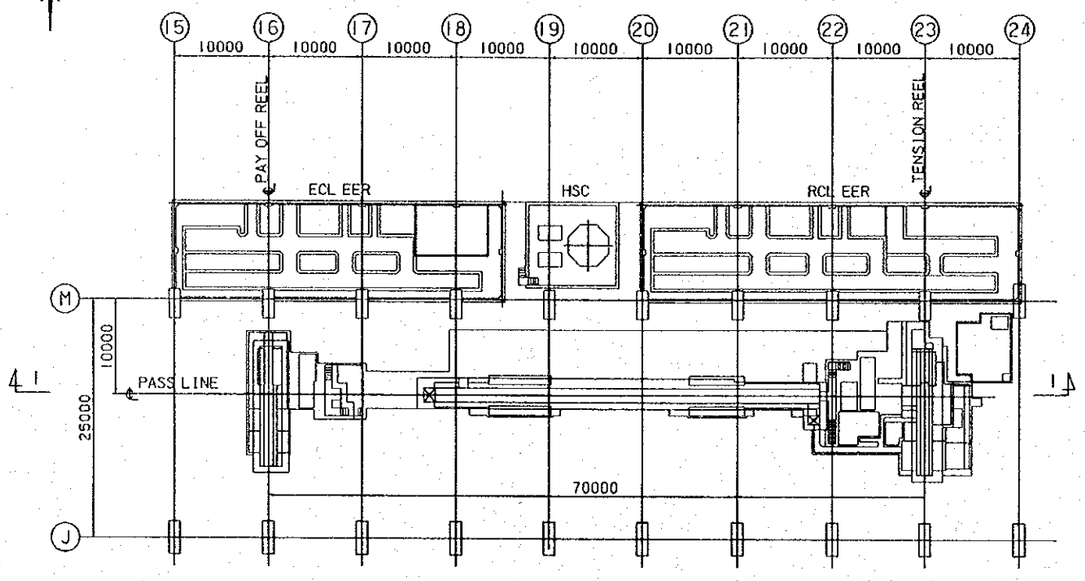
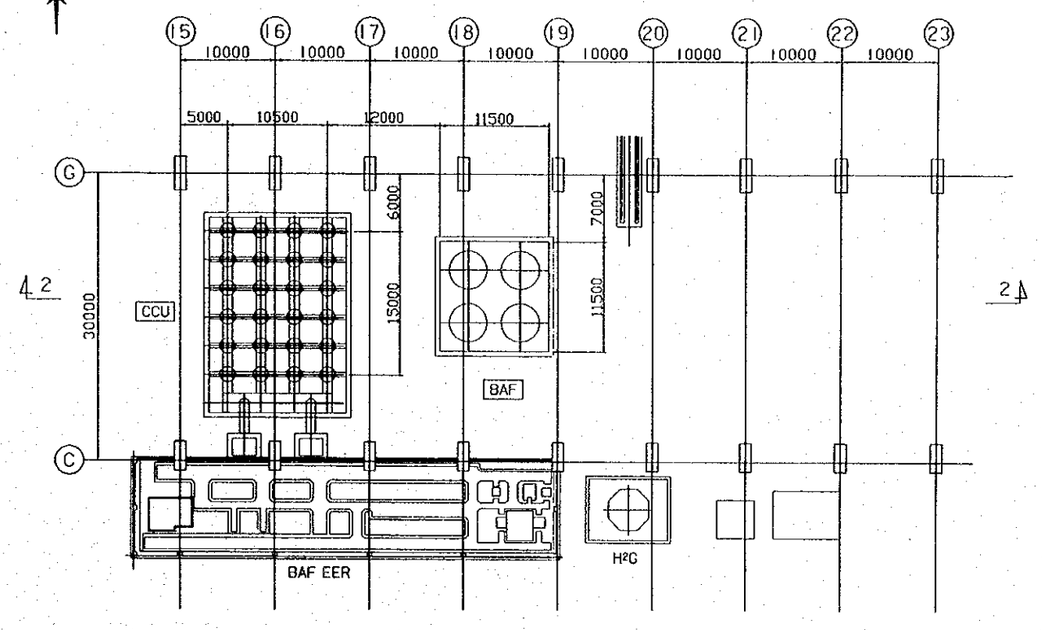


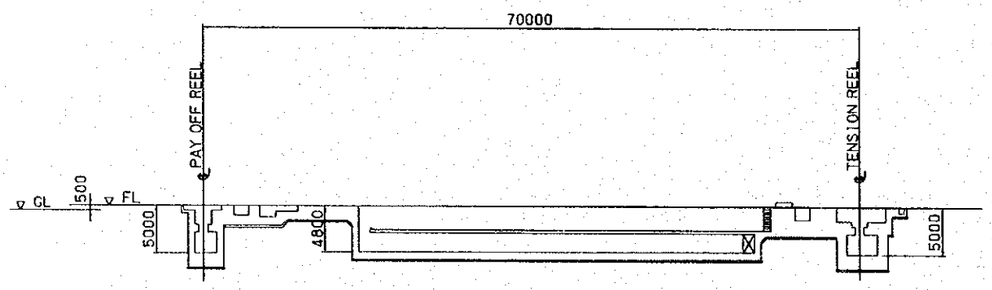
Fig.V-5-4 Foundation Plan of RCM· R/S YARD

ECL YARD S=1/300

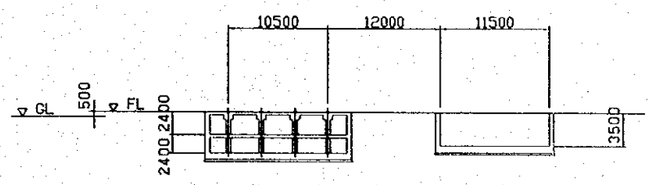


CCU/BAF YARD S=1/300





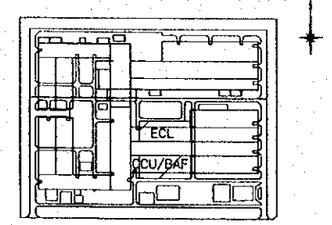
SECTION 1-1



SECTION 2-2

PRELIMINARY

KEY PLAN



CLIENT
COLD ROLLING MILL COMPLEX

DWG. NO.
ECL, CCU/BAF YARD FOUNDATION PLAN

Fig. V-5-5 Foundation Plan of ECL, CCU, · BAF YARD

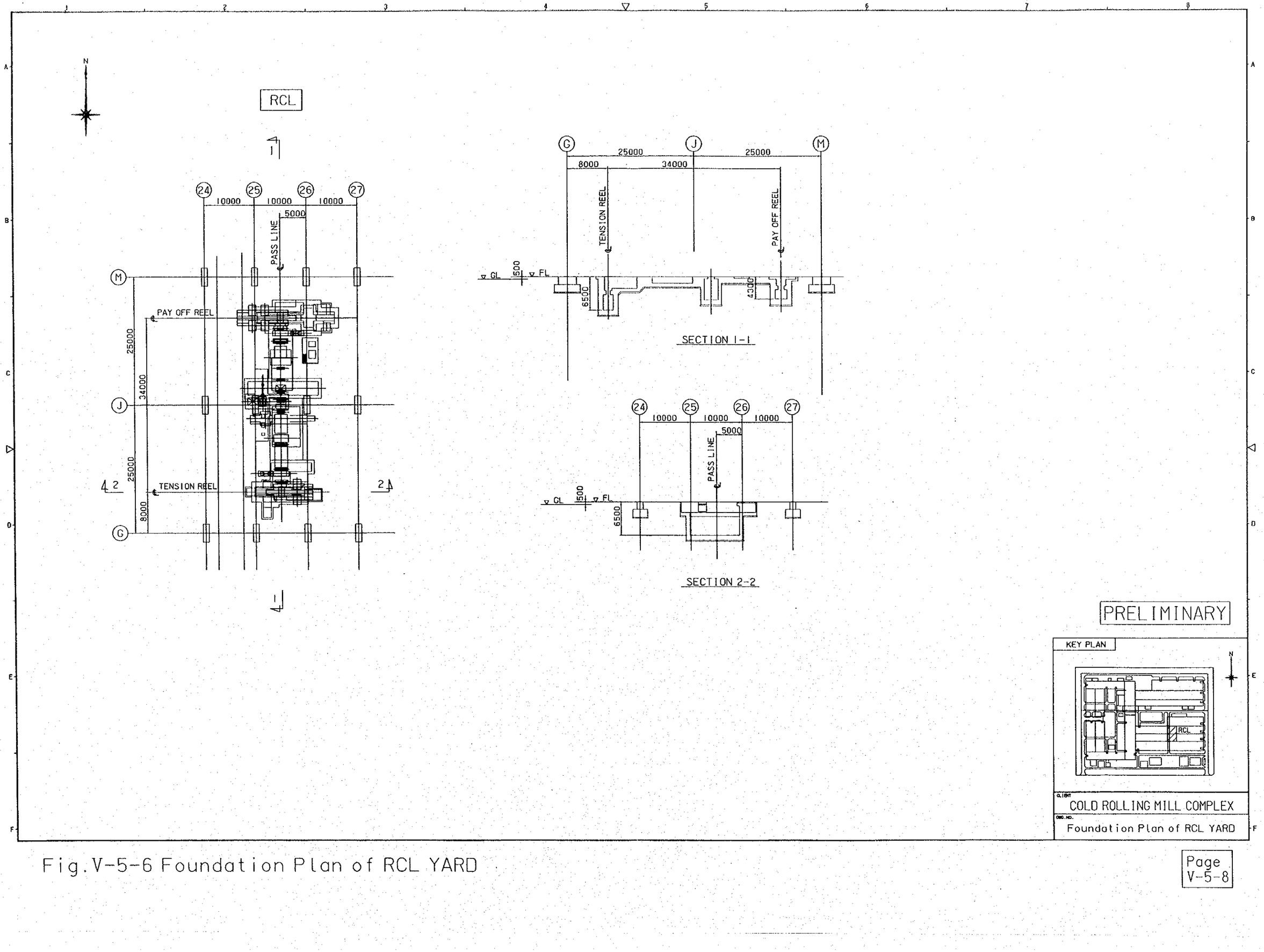


Fig. V-5-6 Foundation Plan of RCL YARD