

**Appendix 10-8**

**Main Specifications for Improvement**

## Appendix 10-8 Main Specifications for Improvement

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## 2.Stomana Steelworks

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Appendix 10-8-1 Main Specifications for Improvement

Plant : Coke & Chemical Plant

NO.	Equipment	Quantity	Main specifications
1	De-S equipment for COG	1 set	Design conditions Crude Coke Oven gas Volume treated : 55,000 Nm <sup>3</sup> /h H <sub>2</sub> S Component : 7 g/Nm <sup>3</sup> Reduction rate of sulfur by plan : 90% By-product recovered: molten sulfur  Type Wet type sulfur recovery process with NH <sub>3</sub>
2	Repair of Coke Oven refractories	1 set	Flame gunning (Fosbel) To be executed by Kremikovtzi
3	Door maintenance of Coke Oven	1 set	Prevention of gas leakage To be carried out by Kremikovtzi
4	Improvement of combustion control	1 set	To be carried out by Kremikovtzi
5	De-SO <sub>x</sub> equipment	1 set	To be studied in future
6	De-NO <sub>x</sub> equipment	1 set	To be studied in future

Appendix 10-8-2 Main Specifications for Improvement

Plant : Sinter Plant

NO.	Equipment	Quantity	Main specifications
1	Ignition burner  Type Dimension  Height  Gas & air for combustion  Air fan  Material	4 sets	Direct ignition, open box type Length : Approx. 2.5 m Width : For 2.8 m wide pallet 500 mm + 200 mm - 200 mm (Adjustable by jacks) Natural gas Max. 180 Nm <sup>3</sup> /h Calorie : 8000 kcal/Nm <sup>3</sup> Pressure: Min. 250 mmAq (At header) Air Max. 1220 Nm <sup>3</sup> /h Pressure: Min. 250 mmAq (At header) Type : Radial fan Air flow : 16000 Nm <sup>3</sup> /h Pressure : 600 mmAq Speed : 3600 rpm  Cast iron and cast steel Carbon steel Piping Refractory  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                         80000 — 15000 kcal/t or Less                     </div>

NO.	Equipment	Quantity	Main specifications
2	Hearth layer material charging equipment	4 sets	
(1)	Hopper		Capacity : 10 m <sup>3</sup> Damper : Manual type 1 set / hopper
(2)	Screen		Type : Double deck Capacity : Charging 300 t/h Recovery 30 t/h Aperture Upper : 10 mm Lower : 6 mm
(3)	Belt conveyer		Capacity : 30 t/h Main line : 2 lines Branch : 4 lines Length : Main approx. 300 m/line Branch approx. 20 m/line Width : 600 mm Damper : 2 sets
(4)	Level detector		1 set/hopper
(5)	Electrical and instrumentation equipment		

NO.	Equipment	Quantity	Main specifications
3	Automation	4 sets	<p>To be studied in future</p> <p>Process computer</p> <p>DCS (Distributed Control System)</p> <p>PLC (Programmable Logic Controller)</p> <p>Modification of weighing system</p> <p>Modernization of instrumentation equipment</p>
4	Replacement of pallet side wall		
(1)	Pallet	320 sets	<p>Increase in side wall from 250 to 500 mm</p>
(2)	Fan	4 sets	<p>Replacement</p> <p>Gas volume : 320000 Nm<sup>3</sup>/h</p> <p>Gas temperature : 150 degree cel.</p> <p>Gas pressure : -2000 mmAq</p>
5	Prevention of air leakage	4 sets	<p>To be carried out by Kremikovtzi</p>
6	Improvement of dedusting efficiency	4 sets	
(1)	Preduster		<p>To be discussed in the environmental control section report</p>



NO.	Equipment	Quantity	Main specifications
(2)	Electric precipitator	4 sets	Gas volume : 320000 Nm <sup>3</sup> /h Gas temperature : 150 degree cel. Dust contents : Inlet 5 g/Nm <sup>3</sup> Outlet 30 mg/Nm <sup>3</sup>
7	De-SOx equipment		To be studied in future
8	De-NOx equipment		To be studied in future

Appendix 10-8-3 Main Specifications for Improvement

Plast : Blast Furnace

NO.	Equipment	Quantity	Main specifications
1	Pulverized coal injection system (PCI)	2 sets	
1.1	Coal preparation system		
(1)	Raw coal silo	2 sets	Volume : 120 m <sup>3</sup> (96 ton)
(2)	Coal feeder	2 sets	Sealed chain conveyor
			2 to 15 t/h variable
			Chain speed : < 10 m/min VVVF
(3)	Pulverizer	2 sets	Negative pressure, vertical type
			Hydraulic or mechanical roller
			pressing
			Capacity : Max. 12 t/h (dry base)
			Min. 6 t/h (dry base)
			Outlet gas rate : Approx. 28000 Nm <sup>3</sup> /h
			Gas temperature : Max. 260 degree cel.
			Min. 85 degree cel.
(4)	Hot gas generator	2 sets	Capacity : Max. 1350000 kcal/h
			Fuel gas : COG Nor. 15 Nm <sup>3</sup> /h
			BFG Max. 1690 Nm <sup>3</sup> /h
			Outlet gas : Approx. 25500 Nm <sup>3</sup> /h
			Max. 260 degree cel.
(5)	Combustion air fan	2 sets	Air volume : 19 Nm <sup>3</sup> /min
			Pressure : 400 mmAq
(6)	Bag filter	2 sets	Full case, pulse jet type
			Gas volume : 700 m <sup>3</sup> /min
			at 85 degree cel.
			Pressure : -1000 mmAq
			Filter area : Approx. 700 m <sup>2</sup>
			Heat resistant
			Outlet dust : 0.03 g/Nm <sup>3</sup>

NO.	Equipment	Quantity	Main specifications
(7)	Main blower	2 sets	Double bearing support Centrifugal type Capacity : 700 m <sup>3</sup> /min at 85 degree cel. Pressure : -950 mmAq. +50 mmAq Noise : 85 dB(A) or less at 1 m
(8)	Vibrating screen	2 sets	Single stage, tight seal type Capacity : 12 t/h (dry base) Aperture : 8 mm Angle : 0 degree
(9)	Reject tank	2 sets	Volume : 0.18 m <sup>3</sup>
(10)	Rotary valve	4 sets	2 sets serially for 1 line Tight seal type Capacity : 12 t/h (dry base) Drive : Geared motor & chain Anti-abrasion material for vane
(11)	PC bin	2 sets	Volume (net): 180 m <sup>3</sup> (100 ton)
(12)	Bin filter	2 sets	Bin-mount, pulse jet type Gas volume : 40 m <sup>3</sup> /min at 80 degree cel. Pressure : 400 mmAq Filter area : Approx. 35 m <sup>2</sup> Heat resistance (Up to 110 degree cel.) Outlet dust : 0.03 g/Nm <sup>3</sup>
(13)	Steel structure	2 sets	For pulverizer station
(14)	Piping, duct and accessories	2 sets	

Plant : Blast Furnace

NO.	Equipment	Quantity	Main specifications
1.2	Coal injection and distribution equipment		
(1)	Intermediate tank	2 sets	Volume : Net 12 m <sup>3</sup> Gross 15 m <sup>3</sup> Pressure : 9.9 kg/cm <sup>2</sup> G Aeration pad at the bottom Load cells
(2)	Injection tank	2 sets	Volume : Net 20 m <sup>3</sup> Gross 25 m <sup>3</sup> Pressure : 9.9 kg/cm <sup>2</sup> G Aeration pad at the bottom Load cells
(3)	Double bellows	2 sets	Pressure equalizing type Size : 500 mm dia.
(4)	Automatic and manual valves	2 sets	
(5)	PC transport piping and lance	2 sets	Piping for NOs. 1 BF & 3 BF 25 A x 250 m x 14 lines x 2 BFs Material : STPG 370 or equivalent Sch 80  Lance 25 A x 14 sets x 2 BFs Material : Stainless steel  Flexible hose 25 A x 14 sets x 2 BFs Material : Stainless steel Interlocking type
(6)	Checking tank	2 sets	For calibration check of PC rate Volume : 0.5 m <sup>3</sup> Pressure : 7.0 kg/cm <sup>2</sup> G Aeration pad, load cells

Plant : Blast Furnace

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NO.	Equipment	Quantity	Main specifications
(7)	Steel structures	2 sets	
(8)	Piping, duct and accessories	2 sets	
1.3	Utilities		
(1)	Air compressor and ancillary equipment	3 sets	Oil-free screw type (water cooled) Capacity : 39 Nm <sup>3</sup> /min Pressure : 10.8 kg/cm <sup>2</sup> G at delivery Ancillary equipment Air dryer Instrumentation air dryer Air receiver Instrumentation air dryer
(2)	N <sub>2</sub> compressor and ancillary equipment	3 sets	Oil-free reciprocating type (Water cooled) Capacity : 27 Nm <sup>3</sup> /min Pressure : 9.9 kg/cm <sup>2</sup> G at delivery Ancillary equipment N <sub>2</sub> receiver N <sub>2</sub> dryer Pressure tank Gas heater (shell and tube : steam) 1 set : For intermediate tank and PC bin 1 set : For injection tank
(3)	Steel structures	2 sets	
(4)	Automatic and manual valves	2 sets	
(5)	Piping, duct and accessories	2 sets	

Plant : Blast Furnace

NO.	Equipment	Quantity	Main specifications
(6)	Heat insulation	2 sets	
(7)	Electrical equipment	2 sets	
(8)	Instrumentation equipment	2 sets	Including control system
2	Oxygen analyzer for Hot Stove waste gas		
(1)	Oxygen analyzer	6 sets	<p>For NOs. 1 BF &amp; 3 BF</p> <p>Direct insertion type</p> <p>Zirconia oxygen analyzer</p> <p>Range : 0 to 5 % (% O<sub>2</sub>)                    0 to 10 % (% O<sub>2</sub>)                    0 to 25 % (% O<sub>2</sub>)</p> <p>Output : 4 to 20 mA</p> <p>Gas conditions :</p> <p>Temp. : Max. 600 degree cel.</p> <p>Dust : Max. 30 g/Nm<sup>3</sup></p> <p>Pressure: Approx. 500 mmHg</p> <p>SO<sub>x</sub> : 0 to 2000 ppm</p> <p>NO<sub>x</sub> : 0 to 500 ppm</p> <p>Electricity : AC 100 V +10 V            -10 V</p>
(2)	Air control valve	3 sets	<p>For NO. 3 BF</p> <p>Butterfly valve (electrical drive)</p> <p>Diameter: 800 mm dia.</p>
(3)	Electrical and instrumentation equipment	6 sets	Including control system

NO.	Equipment	Quantity	Main specifications
3	Repair and modification of Hot Stoves	1 set	To be carried out by Kremikovtzi
4	Screen under ore bin for sintered ore	1 set	For NO. 1 BF To be installed by Kremikovtzi during the relining period in 1996
5	Modernization of dosing system for raw materials	1 set	For NO. 1 BF To be carried out by Kremikovtzi during the relining period in 1996
6	Charging material distribution control equipment and sensors	2 sets	For NOs. 1 BF & 3 BF To be studied by Kremikovtzi in future

Appendix 10-8-4 Main Specifications for Improvement

(1)

LD-KGC bottom stirring system

Argon gas blowing system from the converter bottom, for the purpose of molten steel stirring

1 set/converter

No	Equipment	Quantity	Main specifications
1	Type		Bottom gas blowing system via special tuyeres
2	Blowing gas		Argon gas, Nitrogen gas Blowing ratio : 0.6~25 Nm <sup>3</sup> /min Pressure : Maximum 3,000 kPa
3	Valve stand	1 unit	Argon gas : 1 set Nitrogen gas : 1 set
4	Piping	1 unit	Argon gas : 50A Nitrogen gas : 50A
5	Rotary joint	1 unit	Type : Double pass rotary joint
6	Tuyere	4 sets	Component : Stainless steel pipes + Refractory
7	Process control	1 unit	PLC control system



(2)

## Sublance device for converter

Temperature check and sampling device in the converter during oxygen blowing operation

1 set/converter

No	Equipment	Quantity	Main specifications
1	Sublance type		Water cooled, triple-tube structure Mast slewing and lance carriage vertical movement type
2	Size of lance		OD = 140mm × 20m (approximate) Medium pipe = 100mm, Inner pipe = 50mm
3	Cooling water		Flow rate : Max. 70m <sup>3</sup> /h Pressure : 1,200kPa
4	Sublance hoisting device	1 set	Twin wire rope type driven by AC motor with pneumatic motor for emergency  Hoist speed : High 100m/min Low 5m/min  Hoisting stroke: Approximately 15m  Motor : High AC 90KW Low AC 7.5KW
5	Mast slewing device	1 set	Slewing arm : Approximately 5m Slewing speed : Approximately Max.3 rpm
6	Probe setting device	1 set	Probe storage capacity : 100 pieces Probe setting : Pneumatic mechanism
7	Probe removing device	1 set	Probe removing : Pneumatic mechanism
8	Sample collecting chute	1 set	250mm steel pipe × 10m
9	Slide gate assembly	1 set	Operation : Pneumatic mechanism
10	Utilities Valve stands	1 unit	Cooling water Nitrogen gas Air
11	Operation panels	1 unit	Operation panel in pulpit : 1 set (Automatic control, PLC type)  Operation panel at site : 2 sets

(3)

## Gunning device for converter

Hot repair device of converter, refractory spray equipment for furnace inner wall repair

1 set/converter

No	Equipment	Quantity	Main specifications
1	Type		Gunning lance device mounted on car (Car is driven by diesel engine)  Powder feeding device + Gunning lance
2	Powder feeding device	1 set	Powder chamber volume : 0.65 m <sup>3</sup> Water tank volume : 740l Hose size : 50mm  Powder feeding capacity : 80~140kg/min
3	Gunning lance device	1 set	Type : Arm tilting & swiveling, nozzle rotating type  Length of lance : 5m ↔ 10m Telescopic motion Angle of arm tilting : Up 15° Down 30° Angle of arm swiveling : ±30° Angle of nozzle rotation: 360° Rotating speed of nozzle: Approx. 7 rpm
4	Car	1 unit	Size : 3,000L × 1,600W × 2,300H (mm)  Turning radius : 2,800mm Speed : 0 - 5km/h Engine : Diesel, approx. 20HP
5	Panel	1 unit	Operation panel : 1 set on car
6	Auxiliary equipment	1 unit	Water pump : 1 set Hose changeover equip. : 1 set Ceramic hose 25A × 20m : 1 set 40A × 20m : 2 sets
7	Utilities	1 unit	Compressed air : 500 ~ 700kPa More than 8Nm <sup>3</sup> /min  Water : 200 ~ 300kPa More than 100l/min
8	Weight		App. 5.0 tons

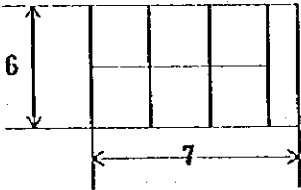
Appendix 10-8-7 Main Specifications for Improvement

(4)

LD Alloy addition system for steel ladle

System for alloy to ladle during tapping from converter; alloy is transferred from alloy system above the converter.

1 Unit/converter

No	Equipment	Quantity	Main specifications														
1	Alloy hopper	7 sets	Capacity <table style="margin-left: 20px; border: none;"> <tr><td>CaF<sub>2</sub></td><td>= 20 m<sup>3</sup></td></tr> <tr><td>Coke</td><td>= 20 m<sup>3</sup></td></tr> <tr><td>Ore</td><td>= 20 m<sup>3</sup></td></tr> <tr><td>FeMn</td><td>= 20 m<sup>3</sup></td></tr> <tr><td>SiMn</td><td>= 20 m<sup>3</sup></td></tr> <tr><td>FeSi</td><td>= 20 m<sup>3</sup></td></tr> <tr><td>Al</td><td>= 20 m<sup>3</sup></td></tr> </table> Feeder      100kg/min × 7	CaF <sub>2</sub>	= 20 m <sup>3</sup>	Coke	= 20 m <sup>3</sup>	Ore	= 20 m <sup>3</sup>	FeMn	= 20 m <sup>3</sup>	SiMn	= 20 m <sup>3</sup>	FeSi	= 20 m <sup>3</sup>	Al	= 20 m <sup>3</sup>
CaF <sub>2</sub>	= 20 m <sup>3</sup>																
Coke	= 20 m <sup>3</sup>																
Ore	= 20 m <sup>3</sup>																
FeMn	= 20 m <sup>3</sup>																
SiMn	= 20 m <sup>3</sup>																
FeSi	= 20 m <sup>3</sup>																
Al	= 20 m <sup>3</sup>																
2	Weigh Hopper	2 sets	Capacity      5m <sup>3</sup> × 2 Feeder      100kg/min × 2														
3	Chute	1 set	φ 300mm × 10m														
4	Conveyor unit	1 set	600mm × 200 m with one tripper 60ton/h 120m/min														
5	Weight Conveyor Hopper		120kg/m × 200 m = 24ton  Height = 6m <div style="text-align: right; margin-top: 10px;">  </div> Approximate weight <table style="margin-left: 20px; border: none;"> <tr><td>Hopper</td><td>60ton/unit</td></tr> <tr><td>Weigh Hopper</td><td>7 ton/unit</td></tr> <tr><td>Chute</td><td>3 ton/unit</td></tr> <tr><td>Others</td><td>1 ton/unit</td></tr> </table>	Hopper	60ton/unit	Weigh Hopper	7 ton/unit	Chute	3 ton/unit	Others	1 ton/unit						
Hopper	60ton/unit																
Weigh Hopper	7 ton/unit																
Chute	3 ton/unit																
Others	1 ton/unit																

(5)

100 ton EAF

1 set/furnace

No	Equipment	Quantity	Main Specifications
1	Type		100ton AC - Electric Arc Furnace (Max. 115 ton . . . normal case)
2	Furnace	1 set	Furnace diameter : 6,400mm Top parts and roof : Water cooled panels
3	Tapping		Type : EBT type Tapping weight : 100 ton /heat, 15 ton hot heel
4	Transformer	1 set	Max 72 MVA
5	Carbon electrode		φ 600mm × 2,500mm × 3
6	Furnace operation	1 set	Hydraulic system  Movement of equipment Electrode holding mast : up & down Holder of electrode : clamp & open Tilting of furnace Hanging of furnace roof: up & down Slewing of roof Stabilizer : stand & down
7	Operation control system	1 unit	Control unit of furnace Operation panel in pulpit Operation panel in site  Operation at pulpit
8	Utilities	1 unit	Oxygen gas Compressed air Nitrogen gas Cooling water 800m <sup>3</sup> /h
9	Auxiliary equipment	1 unit	N-gas burners 3 sets Hot repair device (gunning device) 1 set Oxygen/carbon manipulator 1 set Alloy adding device 1 set

(6)

## Gunning device for EAF

Hot repair device of Electric Arc Furnace, refractory spray equipment for furnace inner wall repair

1 set/furnace

No	Equipment	Quantity	Main specifications
1	Type		Powder feeding device + Gunning lance device
2	Powder feeding device	1 set	Type : Electrical and pneumatic powder feeding type  Chamber volume : 2 m <sup>3</sup> Powder feeding capacity : Max 200kg/min Weigher : Load cell type Feeding motor : 3.7KW
3	Gunning lance device	1 set	Type : Arm tilting & swiveling, nozzle rotating type  Length of arm : Approx. 7m Angle of arm tilting : 60° Angle of arm swiveling : 225° Angle of nozzle rotation: 360° Rotating speed of nozzle: 0.5~5.0 rpm
4	Panels	1 unit	Control panel : 1 set Operation panel : Wireless type pendant : 1 set Wire type pendant : 1 set
5	Auxiliary equipment	1 unit	Water pump : 1 set Hose changeover equip. : 1 set Ceramic hose 50A×20m ×2 : 1 set
6	Utilities	1 unit	Compressed air : 500 ~ 700kPa More than 8Nm <sup>3</sup> /min  Water : 200 ~ 300kPa More than 100l/min
7	Weight		Powder feeding device : App. 3.0 ton Gunning lance device : App. 4.0 ton

Appendix 10-8-10 Main Specifications for Improvement

(7)

Lance manipulator

Oxygen gas and carbon powder injection equipment into the EAF;  
 Oxygen gas and carbon powder are injected by lance during the EAF operation.

1 set/furnace

No	Equipment	Quantity	Main specifications
1	Type		Car type Rail mounted, electric drive
2	Lance system	4 Lance	Lance diameter = ID 40mm/OD 50mm 3 pipes for oxygen blowing (Oxygen flow rate max. 90Nm <sup>3</sup> /min)  1 pipe for carbon injection (Carbon flow rate Max. 100kg/min)  Lance length : Max. 5.5m L pipe×1.5 Pieces
3	Lance movement	4 sets	Feeding stroke : 1,200mm Feeding speed : 5m/min Tilting angle : -5° ~ 20° Swing angle : 0° ~ 15° Lance drive : Electrical drive
4	Pipe connector	4 sets	Connector : Hydraulic press
5	Car	1 set	Traveling speed : 6m/min Motor : 0.75KW Traveling distance : Approximately 5m Rail gauge : 1,500mm
6	Hose attachment	4 sets	3 sets for oxygen 1 set for carbon
7	Valve stand	1 set	Oxygen gas valve stand
8	Operation panel	1 set	Operation panel on car  Lance feed, lance tilting, lance swing Oxygen gas/carbon flow rate indication, Oxygen gas/carbon flow control
9	Safety device	1 set	Rotating yellow lamp Buzzer
10	Weight		Equipment : Approx. 4.5 ton Oxygen valve stand : Approx. 1.0 ton Others : 2~3 ton

Appendix 10-8-11 Main Specifications for Improvement

(8)

Furnace gas burner

N-gas burner system used for scrap heating and melting in the EAF

3 sets/furnace

No	Equipment	Quantity	Main specifications
1	Burner	3 sets	Capacity 4.2 MW (3.6×10 <sup>6</sup> kcal/h)/unit Fuel (gas) = Max. 450 Nm <sup>3</sup> /h/unit Oxygen = Max. 800 Nm <sup>3</sup> /h/unit Air = Max. 80 Nm <sup>3</sup> /h/unit
2	Valve Stand	1 set	Flow control valve Check valve Solenoid valve Pressure gauge, etc. Control unit
3	Utility	1 set	N-Gas 300 kPa, min. 23 Nm <sup>3</sup> /min Oxygen Min. 700 kPa, min. 4Nm <sup>3</sup> /min Air Min. 500 kPa, min. 5Nm <sup>3</sup> /min
4	Piping	1 unit	50A × 200 m 80A × 200 m
5	Weight		Burner : Approximately 200 kg/unit

Appendix 10-8-12 Main Specifications for Improvement

(9)

Ladle transfer car

1 set/furnace

No	Equipment	Quantity	Main Specifications
1	Car Capacity	--	Load : Max. 180 ton Ladle weight 50 ton Molten steel Max. 130 ton
2	Car	1 set	Type : Steel structure, welded type covered with refractory (castable) Height of ladle stand from rail : 2,000mm {Ladle=Top $\phi$ 3,100mm $\times$ 3,700mm H (Appr.)} Castable thickness on car : 100mm H
3	Car driving device	1 set	Travel distance Rail Approximately 40m 100 kg/m rail $\times$ 5m span Speed 20m/min Motor Approximately 30KW Brake Thruster brake Speed control Cushion starter Power feed Cable curtain type
4	Weigh system	1 set	Type Load cell type (4 points support, compression type) Accuracy 1/500 of FS (Full Scale)
5	Lubrication	1 set	Type Centralized greasing type (Manual type)
6	Accessories	1 set 1 set 1 set 1 set 4 sets	a. Piping for Ar gas bubbling 20A b. Piping for air cooling of sliding nozzle 20A c. Wiring for power supply, control and load cells d. Safety device : Patrol type light : 2 Alarm buzzer : 1 e. Buffer device
7	Control method & unit	1 set 1 set	a. Operation panel on car (manual operation, and semi-automatic control) └ Auto. stop at assigned position b. Operation panel on operation deck (Semi-automatic control) Operation panel : Dust-tight, indoor type



(10)

## Carbon powder supply equipment

Carbon powder supply tank for injection into the EAF

1 set/furnace

No	Equipment	Quantity	Main specifications
1	Powder silo	1 set	Silo Volume 20 m <sup>3</sup> Capacitance level instrument 3 sets/silo Bag filter 8 m <sup>2</sup>
2	Blowing tank	1 set	Tank Volume 2 m <sup>3</sup> Blowing Capacity 100 kg/min Load cell
3	Hose with ceramics	1 set	40A × 20 m
4	Utility	1 set	Air Min. 500 kPa, Min. 12m <sup>3</sup> /min
5	Weight		Approximately 40 ton (Equip. + Powder) 10ton 3m 1t/m <sup>2</sup> 4m

Appendix 10-8-14 Main Specifications for Improvement

(1)

Billet caster (500,000ton/year)

A. Required billet

- Heat size : 100ton/charge
- Billet size :  100mm,  120mm,  150mm × Max. length 12m  
  $\phi$  100mm,   $\phi$  120mm,   $\phi$  140mm × Max. length 12m
- Required billet : 457,000 ton/year  
 (Production) (Mainly  120mm,  $\phi$  120mm)
- Required liquid steel : 481,000ton/year
- Available for actual operation : 6,000 hours/year
- Casting time : Maximum 90 minutes

B. Main Specifications

Item number	Equipment	Quantity	specifications
1	Continuous casting machine	1 set	
1.1	Mechanical equipment	1 set	Casting speed : 2.5m/min(Ave.) for <input type="checkbox"/> 120mm Billet, $\phi$ 120mm Billet Strands : 6 Curved tubular mold : 100mm × 100mm $\phi$ 100mm 120mm × 120mm & $\phi$ 120mm 150mm × 150mm $\phi$ 140mm Radius : 7m
1.2	Mold level control	6	Level sensing by $\gamma$ -ray and keeping level by withdrawal speed control
2	Continuous casting machine auxiliary equipment	1 set	
2.1	Ladle turret	1	180ton capacity at each side Weighing system with cooling blower Air receiver for emergency drive Ladle cover and support

Item number	Equipment	Quantity	Specifications
2.2	Tundish and accessories		
(1)	Tundish & cover	8	Weight = Max. 38ton Molten steel = Max 20ton Tundish = Max 15ton Cover = Max 3ton
(2)	Tundish car	2	Motor drive, weighing system
(3)	Tundish preheater & Drying system	3 sets	2 burners / set. Control valve unit
2.3	Secondary cooling zone	6	Guide roller Spray tube assembly Steam exhaust fan
2.4	Withdrawal and straightening unit	6	Hydraulic pressure driven
2.5	Dummy bar device	6	AC motor driven Solid dummy bar type Dummy bar storage
2.6	Discharge system	1	In-line roller table Cutter entry table Cutter delivery table Runout table End table  Billet transfer system Cross transfer carriage Billet pusher Hot charge pusher & table  Storage cooling bed  Stopper (Fixed & disappearing)  Crop handling device
2.7	Strand cutting equipment	6	250ton hydraulic shear Diagonal up cut pendulum type including length measuring
2.8	Lubrication system & hydraulic system	1 set	
2.9	Maintenance equipment for mold and others	1 set	
3	Electrical and instrumentation equipment	1 set	

Appendix 10-8-15 Main Specifications for Improvement

(12)

Billet caster (300,000ton/year)

A. Required billet

Heat size : 100ton/charge

Billet size :  120mm × Max. length 12m  
  $\phi$  100mm,   $\phi$  120mm,   $\phi$  140mm × Max. length 12m

Required billet : 225,000 ton/year  
 (Production) (Mainly  120mm,   $\phi$ 120mm )

Required liquid steel : 237,000ton/year

Available for actual operation : 6,000 hours/year

Casting time : Maximum 90 minutes

B. Main Specifications

Item number	Equipment	Quantity	Specifications
1	Continuous casting machine	1 set	
1.1	Mechanical equipment	1 set	Casting speed : 2.5m/min(Ave.) for <input type="checkbox"/> 120mm Billet, $\phi$ 120mm Billet Strands : 4 Curved tubular mold : 120mm × 120mm & $\phi$ 100mm $\phi$ 120mm $\phi$ 140mm Radius : 7m
1.2	Mold level control	4	Level sensing by $\gamma$ -ray and keeping level by withdrawal speed control
2	Continuous casting machine auxiliary equipment	1 set	
2.1	Ladle turret	1	180ton capacity at each side Weighing system with cooling blower Air receiver for emergency drive Ladle cover and support

Item number	Equipment	Quantity	Specifications
2.2	Tundish and accessories		
(1)	Tundish & cover	6	Weight = Max. 38ton Molten steel = Max 20ton Tundish = Max 15ton Cover = Max 3ton
(2)	Tundish car	2	Motor drive, weighing system
(3)	Tundish preheater & Drying system	3 sets	2 burners / set Control valve unit
2.3	Secondary cooling zone	4	Guide roller Spray tube assembly Steam exhaust fan
2.4	Withdrawal and straightening unit	4	Hydraulic pressure driven
2.5	Dummy bar device	4	AC motor driven Solid dummy bar type Dummy bar storage
2.6	Discharge system	1	In-line roller table Cutter entry table Cutter delivery table Runout table End table  Billet transfer system Cross transfer carriage Billet pusher Hot charge pusher & table  Storage cooling bed  Stopper (Fixed & disappearing)  Crop handling device
2.7	Strand cutting equipment	4	250ton hydraulic shear Diagonal up cut pendulum type including length measuring
2.8	Lubrication system & hydraulic system	1 set	
2.9	Maintenance equipment for mold and others	1 set	
3	Electrical and instrumentation equipment	1 set	

Appendix 10-8-16 Main Specifications for Improvement

(3)

Billet caster (300,000ton/year)

A. Required billet

Heat size : 100ton/charge  
 Billet size :  100mm,  $\phi$  115mm,  $\phi$  150mm  $\times$  Max. length 12m  
 Required billet : 232,000 ton/year  
 (Production) (Mainly  115mm)  
 Required liquid steel : 245,000ton/year  
 Available for actual operation : 6,000 hours/year  
 Casting time : Maximum 90 minutes

B. Main Specifications

Item number	Equipment	Quantity	Specifications
1	Continuous casting machine	1 set	
1.1	Mechanical equipment	1 set	Casting speed : 2.7m/min(Ave.) for <input type="checkbox"/> 115mm Billet  Strands : 4 Curved tubular mold : 100mm $\times$ 100mm 115mm $\times$ 115mm 150mm $\times$ 150mm Radius : 7m
1.2	Mold level control	4	Level sensing by $\gamma$ -ray and keeping level by withdrawal speed control
2	Continuous casting machine auxiliary equipment	1 set	
2.1	Ladle turret	1	180ton capacity at each side Weighing system with cooling blower Air receiver for emergency drive Ladle cover and support

Item number	Equipment	Quantity	Specification
2.2	Tundish and accessories		
(1)	Tundish & cover	6	Weight = Max. 38ton Molten steel = Max 20ton Tundish = Max 15ton Cover = Max 3ton
(2)	Tundish car	2	Motor drive, weighing system
(3)	Tundish preheater & Drying system	3 sets	2 burners / set Control valve unit
2.3	Secondary cooling zone	4	Guide roller Spray tube assembly Steam exhaust fan
2.4	Withdrawal and straightening unit	4	Hydraulic pressure driven
2.5	Dummy bar device	4	AC motor driven Solid dummy bar type Dummy bar storage
2.6	Discharge system	1	In-line roller table Cutter entry table Cutter delivery table Runout table End table  Billet transfer system Cross transfer carriage Billet pusher Hot charge pusher & table  Storage cooling bed  Stopper (Fixed & disappearing)  Crop handling device
2.7	Strand cutting equipment	4	250ton hydraulic shear Diagonal up cut pendulum type including length measuring
2.8	Lubrication system & hydraulic system	1 set	
2.9	Maintenance equipment for mold and others	1 set	
3	Electrical and instrumentation equipment	1 set	

Appendix 10-8-17 Main Specifications after Improvement

Rod mill replacement

	Equipment	Quantity	Main Specifications
1.	Reheating furnace	1 set	Material 150x150---12,000 length partially improved
2.	Mill	1 set	The equipment after finishing mill is replaced. (1) Rolling size $\phi$ 5.5~16 (2) Material SWRM (mild steel), SWRH(for wire C%<0.7), SWRY( for electrode ), SS (steel structure) SR (reinforced bar) SD (deformed bar) (3) Rolling speed Max 100 m/s (for $\phi$ 5.5) (4) Strand 1 (5) Capacity 320,000 ton/year (6) Finishing mill train 10 stands
3.	Cooling zone	1 set	Direct patenting equipment
4.	Coil conveyor	1 set	Power and free hook carrier type
5.	Bundling equipment	1 set	Bundling point 4 non-sliding type



Plant : NDI Line (Seamless) of TRM in Kremikoytzi

## 1. Equipment List

No.	Equipment	Quantity	Main Specifications
1	Inlet table	1	Inclined skid table 4,800 mm (W) x 11,000 m (L)
2	Kick-in device	1	Common drive link lifter with pneumatic cylinder
3	Roller conveyer	2	Individual motor driven V-shape roller conveyer
4	NDI system	1	Encircling type eddy current tester
5	Kick-out device	1	Pneumatic cylinder driven rotating wheel type kicker
6	Outlet table	2	Inclined skid table with pipe rack

## 2. Specification of Equipment

No.	Equipment	Detailed Specifications
1	Inlet table	1) Type : Inclined skid table 2) Dimension : Width : 4,800 mm (Table end to centerline of conveyor) Length : 11,000 mm Height : 1,485 mm at higher end 3) Incline angle : 5°
2	Kick-in device	1) Type : Common drive link lifter with pneumatic cylinder 2) Operation mode : Operated with the push button on the operation desk 3) No. of lifters : 7 4) Pneumatic cylinders: $\phi 200 \times 75 \text{ mm st} \times 3$

N.	Equipment	Detailed Specifications
3	Roller conveyors	1) Type : Individual motor driven V-shape roller conveyor 2) Length : 13,200 mm and 15,600 mm 3) Roller dimensions : 240 mm bottom dia. x 250 mm width 4) Roller pitch : 1,200 mm 5) Conveying speed: 100 m/min 6) Drive motors : AC 0.75KW x 26
4	NDI system	1) Type : Encircling type eddy current tester 2) Object pipe Type : Seamless pipe O.D. : 50 ~ 159 mm Wall thickness : 4.0 ~ 14 mm 3) Test frequency : 1 ~ 600 KHz 4) Flow detectability: As per ISO 9302 5) Detecting speed : Max. 100 m/min
5	Kick-out device	1) Type : Pneumatic cylinder driven rotating wheel type kicker 2) No. of claws : Three for each 3) No. of kickers : Two sets (one for prime pipe, one for reject pipe) 4) Pneumatic cylinders: $\phi 200 \times 300$ mm st x 8

No.	Equipment	Detailed Specifications				
6	Outlet table	1) Type : Inclined skid table with pipe rack 2) No. of tables : Two (for prime pipe and reject pipe) 3) Dimension				
		Prime Pipe		Reject Pipe		
		Table	Rack	Table	Rack	
		Width	3,000 mm	1,100 mm	2,000 mm	1,000 mm
		Length	11,000 mm	11,000 mm	11,000 mm	11,000 mm
		Height	1,240 mm	1,080 mm	1,240 mm	1,080 mm
		Incline	5°	-	5°	-

## Plant : NDI Line (Welded) of TRM on Kremikoytzi

## 1. Equipment List

No.	Equipment	Quantity	Main Specifications
1	Inlet table	1	Inclined skid table 4,800 mm (W) x 7,500 m (L)
2	Kick-in device	1	Common drive link lifter with pneumatic cylinder
3	Roller conveyor	2	Individual motor driven V-shape roller conveyor
4	NDI system	1	Encircling type eddy current tester
5	Kick-out device	1	Pneumatic cylinder driven rotating wheel type kicker
6	Outlet table	2	Inclined skid table with pipe rack

## 2. Specification of Equipment

No.	Equipment	Detailed Specifications
1	Inlet table	1) Type : Inclined skid table 2) Dimension Width : 4,800 mm (Table end to centerline of conveyor) Length : 7,500 mm Height : 1,485 mm at higher end 3) Incline angle : 5°
2	Kick-in device	1) Type : Common drive link lifter with pneumatic cylinder 2) Operation mode : Operated with the push button on the operation desk 3) No. of lifters : 7 4) Pneumatic cylinders: $\phi 150 \times 50$ mm st x 3

No.	Equipment	Detailed Specifications
3	Roller conveyors	1) Type : Individual motor driven V-shape roller conveyor 2) Length : 9,600 mm and 13,200 mm 3) Roller dimension: 240 mm bottom dia. x 150 mm width 4) Roller pitch : 1,200 mm 5) Conveying speed : 100 m/min 6) Drive motors : AC 0.4KW x 21
4	NDI system	1) Type : Encircling type eddy current tester 2) Object pipe . Type : ERW pipe . O.D. : 15.2 ~ 89.0 mm . Wall thickness: 2.5 ~ 4.0 mm 3) Test frequency: 1 ~ 600 KHz 4) Flaw detectability: As per ISO 9302 5) Detecting speed: Max. 100 m/min
5	Kick-out device	1) Type : Pneumatic cylinder driven rotating wheel type kicker 2) No. of claws: Three for each 3) No. of kickers: Two sets (one for prime pipe, one for reject pipe) 4) Pneumatic cylinders: $\phi 120 \times 200$ mm st x 4

No.	Equipment	Detailed Specifications																														
6	<p data-bbox="300 309 443 338">Outlet table</p> <p data-bbox="347 501 528 530">3) Dimension</p> <table border="1" data-bbox="416 562 1378 866"> <thead> <tr> <th data-bbox="416 562 571 618"></th> <th colspan="2" data-bbox="571 562 959 618">Prime Pipe</th> <th colspan="2" data-bbox="959 562 1378 618">Reject Pipe</th> </tr> <tr> <th data-bbox="416 618 571 674"></th> <th data-bbox="571 618 754 674">Table</th> <th data-bbox="754 618 959 674">Rack</th> <th data-bbox="959 618 1166 674">Table</th> <th data-bbox="1166 618 1378 674">Rack</th> </tr> </thead> <tbody> <tr> <td data-bbox="416 674 571 719">Width</td> <td data-bbox="571 674 754 719">3,000 mm</td> <td data-bbox="754 674 959 719">1,100 mm</td> <td data-bbox="959 674 1166 719">2,000 mm</td> <td data-bbox="1166 674 1378 719">1,000 mm</td> </tr> <tr> <td data-bbox="416 719 571 763">Length</td> <td data-bbox="571 719 754 763">7,500 mm</td> <td data-bbox="754 719 959 763">7,500 mm</td> <td data-bbox="959 719 1166 763">7,500 mm</td> <td data-bbox="1166 719 1378 763">7,500 mm</td> </tr> <tr> <td data-bbox="416 763 571 808">Height</td> <td data-bbox="571 763 754 808">1,240 mm</td> <td data-bbox="754 763 959 808">1,080 mm</td> <td data-bbox="959 763 1166 808">1,240 mm</td> <td data-bbox="1166 763 1378 808">1,080 mm</td> </tr> <tr> <td data-bbox="416 808 571 866">Incline</td> <td data-bbox="571 808 754 866">5°</td> <td data-bbox="754 808 959 866">-</td> <td data-bbox="959 808 1166 866">5°</td> <td data-bbox="1166 808 1378 866">-</td> </tr> </tbody> </table>		Prime Pipe		Reject Pipe			Table	Rack	Table	Rack	Width	3,000 mm	1,100 mm	2,000 mm	1,000 mm	Length	7,500 mm	7,500 mm	7,500 mm	7,500 mm	Height	1,240 mm	1,080 mm	1,240 mm	1,080 mm	Incline	5°	-	5°	-	<p data-bbox="794 309 1353 376">1) Type : Inclined skid table with pipe rack</p> <p data-bbox="794 412 1318 479">2) No. of tables: Two (for prime pipe and reject pipe)</p>
	Prime Pipe		Reject Pipe																													
	Table	Rack	Table	Rack																												
Width	3,000 mm	1,100 mm	2,000 mm	1,000 mm																												
Length	7,500 mm	7,500 mm	7,500 mm	7,500 mm																												
Height	1,240 mm	1,080 mm	1,240 mm	1,080 mm																												
Incline	5°	-	5°	-																												

Plant : Heat-input Control System for Welded  
Pipe Mill of TRM in Kremikovtzi

## 1. Equipment List

No.	Equipment	Quantity	Main Specification
1	Controller	1	Two color pyrometer and two pen recorder
2	Optical head and optical fiber	1	Flexible head with 5 m length fiber
3	Cooling box	1	
4	14-core cable	1	8 m length

## 2. Specification of Equipment

No.	Equipment	Detailed Specification
1	Controller	1) Measurement range: 1,000 ~ 1,500 °C  2) Accuracy . Measurement : Within $\pm 2^{\circ}\text{C}$ . Control : Within $\pm 10^{\circ}\text{C}$  3) Calibration : Automatic  4) Indicator : Digital display
2	Optical head and optical fiber	1) Length : 5 m
3	Cooling box	1) Type : Refrigerator
4	14-core cable	1) Length : 8 m

## Plant : Pipe Galvanizing Line of TRM in Kremikovtzi

## 1. Equipment List

No.	Equipment	Quantity	Main Specifications
1	Drying equipment	1	Continuous pipe drying equipment using waste heat of galvanizing furnace, consisting of : 1 set - Aligning device 1 set - Walking beam device 1 set - Drying furnace 1 set - Combustion device 1 set - Hot air circulation fan 2 sets - Damper devices 1 set - Stack & accessories
2	Galvanizing equipment	1	Continuous pipe dipping type galvanizing equipment having the function of outside zinc sweeping and inside zinc blowing-off, consisting of: 1 set - Galvanizing furnace 1 set - Zinc kettle 1 set - Pit cover 1 set - Combustion device 1 set - Dipping device 1 set - Pick-up device 1 set - Withdrawal unit 1 set - Blow box and duct unit
3	Quenching equipment	1	Continuous water quenching equipment, consisting of : 1 set - Quenching tank 1 set - Lifting device



## 2. Specification of Equipment

No.	Equipment	Detailed Specifications
1	<p>Drying equipment</p> <p>1. Aligning device</p> <p>2. Walking beam device</p> <p>3. Drying furnace</p> <p>4. Combustion device</p>	<p>1) Four (4) skid type feeding tables</p> <p>2) Four (4) pipe take out fingers installed on common axle</p> <p>3) Four (4) aligning rolls rotating at right angles to the take out axle</p> <p>1) Four (4) walking beams</p> <p>2) One (1) drive unit with a 7.5kw electric motor with a variator which is used in common with the preceding aligning device</p> <p>1) One (1) drying furnace frame Material : Mild steel</p> <p>2) One (1) heat exchanger Material : Mild steel</p> <p>3) One (1) drying chamber Dimension : Approx. 8,550(W) x 5,605(L) x 450(H)mm</p> <p>1) One (1) gas burner Capacity : 250,000 kcal/Hr</p> <p>2) One (1) turbo blower Capacity : 5m<sup>3</sup>/min. at 650 mm H<sub>2</sub>O Motor : 1.5 kw</p> <p>3) One (1) automatic ignition device</p>



No.	Equipment	Detailed Specifications
	4. Combustion device	1) One (1) flow meter 2) Twelve (12) gas burners Capacity : 250,000 kcal/Hr 3) Automatic ignition device and safety controls 4) Two (2) turbo blowers Capacity : 36 m <sup>3</sup> /min at 700 mm H <sub>2</sub> O 5) Zinc kettle failure alarm system
	5. Dipping device	1) One (1) frame, hood, and duct unit 2) One (1) star wheel with two brackets 3) Four (4) sinker bars 4) Four (4) receiving racks Material : Special steel plate 5) One (1) drive unit Drive motor: 2.2kw AC with a variator 6) One (1) stopper 7) Four (4) kicker levers with shaft 8) Four (4) entry kickers with shaft
	6. Pick up device	



## DETAILED EQUIPMENT LIST (1/2)

PLANT : Energy control system

No.	Equipment	Detailed Specification
1	<p>1-1 Hardware</p> <p>(1) Process computer</p> <p>(2) Terminals</p> <p>(3) Remote I/O unit</p>	<p>CPU : 32 bit CPU  OS : Unix basis  Main storage : 80 MB or more  Auxiliary storage : 1 GB hard disk and  1 GB auxiliary hard disk or more  Back up system : Duplex system</p> <p>Operator station : 21 inches desktop type  color display with serial printer  and hard copy  32 bit CPU, 20MB or more of main storage  and 850 MB or more of aux.  storage  Q'ty ; 3 sets</p> <p>Work station : 17 inches desktop type  color display with laser beam printer  32 bit CPU, 20MB or more of main storage  and 850 MB or more of aux.  storage  Q'ty ; 4 sets</p> <p>Remote I/O center unit ( installation  at process computer room ), Q'ty ; 1 set  This unit receives various instrument  signals transmitted from local  transmitters through main wiring and  transfers these signals to process  computer.  Back up system ; Cold stand-by  I/O Q'ty ; 223 + Margin of  ten percent and  more</p> <p>Remote I/O local unit ( installation at  Power plant ) Q'ty ; 1 set ,  This unit receives various instrument  signals of Power plant and transfers  these signals to process computer.  Back up system ; Cold stand-by  I/O Q'ty ; 92 + Margin of  ten percent and  more</p>

DETAILED EQUIPMENT LIST (2/2)

PLANT : Energy control system

No.	Equipment	Detailed Specification																																										
	(4) Local area network (LAN)	This network interconnect process computer and terminals. Standard of LAN : Ethernet																																										
	(5) Main wiring	The main wiring consists of instrument cable and terminal boards to interconnect remote I/O and local transmitter. Installation of cable; Approx. 10,000m																																										
	(6) Transmitters	<p>To measure process value (flow rate, press. temperature) of related energy. 24 Vdc power source and 4 ~ 20mA dc output</p> <p>Transmitter Q'ty</p> <table data-bbox="718 784 1324 1232"> <tr> <td>Steam</td> <td>90ata (P + T + Q)</td> <td>: 11 sets</td> </tr> <tr> <td></td> <td>30ata (P + T + Q)</td> <td>: 2 sets</td> </tr> <tr> <td></td> <td>10ata (P + T + Q)</td> <td>: 32 sets</td> </tr> <tr> <td></td> <td>( Q )</td> <td>: 3 sets</td> </tr> <tr> <td>Natural gas</td> <td>(P + T + Q)</td> <td>: 1 sets</td> </tr> <tr> <td></td> <td>(P + T)</td> <td>: 9 sets</td> </tr> <tr> <td></td> <td>( Q )</td> <td>: 7 sets</td> </tr> <tr> <td>Blast furnace gas</td> <td>(P+T+Q)</td> <td>: 4 sets</td> </tr> <tr> <td></td> <td>( Q )</td> <td>: 9 sets</td> </tr> <tr> <td>Coke oven gas</td> <td>(P + T + Q)</td> <td>: 2 sets</td> </tr> <tr> <td></td> <td>(P + T)</td> <td>: 1 sets</td> </tr> <tr> <td></td> <td>( Q )</td> <td>: 8 sets</td> </tr> <tr> <td>Mixed gas</td> <td>(P + T + Q)</td> <td>: 1 sets</td> </tr> <tr> <td></td> <td>( Q )</td> <td>: 5 sets</td> </tr> </table> <p>P : Pressure transmitter T : Temperature transmitter Q : Flow rate transmitter</p>	Steam	90ata (P + T + Q)	: 11 sets		30ata (P + T + Q)	: 2 sets		10ata (P + T + Q)	: 32 sets		( Q )	: 3 sets	Natural gas	(P + T + Q)	: 1 sets		(P + T)	: 9 sets		( Q )	: 7 sets	Blast furnace gas	(P+T+Q)	: 4 sets		( Q )	: 9 sets	Coke oven gas	(P + T + Q)	: 2 sets		(P + T)	: 1 sets		( Q )	: 8 sets	Mixed gas	(P + T + Q)	: 1 sets		( Q )	: 5 sets
Steam	90ata (P + T + Q)	: 11 sets																																										
	30ata (P + T + Q)	: 2 sets																																										
	10ata (P + T + Q)	: 32 sets																																										
	( Q )	: 3 sets																																										
Natural gas	(P + T + Q)	: 1 sets																																										
	(P + T)	: 9 sets																																										
	( Q )	: 7 sets																																										
Blast furnace gas	(P+T+Q)	: 4 sets																																										
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Coke oven gas	(P + T + Q)	: 2 sets																																										
	(P + T)	: 1 sets																																										
	( Q )	: 8 sets																																										
Mixed gas	(P + T + Q)	: 1 sets																																										
	( Q )	: 5 sets																																										
2	2-1 Software	<p>Application software consists of following processing:</p> <ul style="list-style-type: none"> <li>• Data gathering processing</li> <li>• Daily, monthly data processing</li> <li>• Unit production and consumption processing</li> <li>• Energy balance planning processing</li> <li>• Power plant operation control and plan processing</li> <li>• Documentation and picture processing</li> <li>• Flow rate compensation processing</li> </ul>																																										
3	3-1 Power plant combustion control improvement	<p>Waste gas O<sub>2</sub> analyzer : 5 sets</p> <p>Boiler combustion control improvement : 3 sets of boiler</p>																																										

Appendix 10-8-23 Main Specification for Improvement

Equipment List

Item Number	Equipment	Quantity	Specifications
1	Side trimming shear	1 set	Type Rotary side trimming shear  Material Thickness 7~ 25 mm Width 1200~ 2000 mm Length 5.5~ 17.6 m Material low carbon steel
1.1	Mechanical equipment	1 set	
	(1) Rotary shear		
	(2) Scrap shear		
	(3) Pinch roll (plate guiding)		
	(4) Plate aligners		
	(5) Cutting line indicators		
	(6) Scrap removal system		
	(7) Spare parts		
1.2	Electrical equipment	1 set	
	(1) Electrical equipment		
	(2) Cables		
1.3	Erection and commissioning	1 set	
	(1) Erection		
	(2) Cabling		
	(3) Commissioning		
1.4	Foundations	1 set	

Price List

Item Number	Equipment	Quantity	Specification
1	Side trimming shear	1 set	Type Rotary side trimming shear  Material Thickness 7~ 25 mm Width 1200~ 2000 mm Length 5.5~ 17.6 m Material low carbon steel
1.1	Mechanical equipment (1) Rotary shear (2) Scrap shear (3) Pinch roll (plate guiding) (4) Plate aligners (5) Cutting line indicators (6) Scrap removal system (7) Spare parts	1 set	5.5 M US\$
1.2	Electrical equipment (1) Electrical equipment (2) Cables	1 set	0.6 M US\$
1.3	Erection and commissioning (1) Erection (2) Cabling (3) Commissioning	1 set	0.5 M US\$
1.4	Foundations	1 set	1.7 M US\$
	Total		8.3 M US\$



## Promet Improvement of Operation

No	Equipment	Quantity	Main specifications
1	Long life roll	16 sets	Long life material for roll Material ; WC (tungsten - carbide) For finishing train ( 8 stands 2 sets/stand )
2	Long life roller	1 set	Long life material for roller Material ; WC (tungsten - carbide)

Environmental countermeasures : air
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No.	Equipment	Quantity	Main Specifications
C-1	Dedusting system for coal charging car	1 set	Bag filter, 1000 Nm <sup>3</sup> /min 60 c Hood and duct for coal charging car Fixed duct for dust collection Connecting duct Preduster Induced draft fan, motor and stack
	Type	1 lot	
	Equipment	1 lot	
		1 lot	
		1 lot	
		1 lot	

No.	Equipment	Quantity	Main Specifications
C-2	Dedusting system for coke guide car	1 set	Bag filter, 2000 Nm <sup>3</sup> /min 60 c Hood and duct for coke guide car Fixed duct for dust collection Connecting duct Preduster Induced draft fan, motor and stack
	Type	1 set	
	Equipment	1 lot	
		1 lot	
		1 lot	
		1 lot	

No.	Equipment	Quantity	Main Specifications
C-3	COG desulfurization process ; 55000 Nm <sup>3</sup> /H Consisting of: 1 lot of *** Process ***Wet-type, NH <sub>3</sub> recovery process having de-S efficiency of 90%		

No.	Equipment	Quantity	Main Specifications
C-4	Coke oven door	65 doors	Doors equipped with seal plate
	Type		

No.	Equipment	Quantity	Main Specifications
C-5	Water cleaners for coke oven doors	1 set	Jet water cleaner of fixed type
	Type		

No.	Equipment	Quantity	Main Specifications
S-1	Preduster for sinter main exhaust gas		
		4 sets	
	Type		Blow-down with louvers
	Equipment	1 lot	Louvers
		1 lot	Blow-down duct
		1 lot	Dust conveyer

No.	Equipment	Quantity	Main Specifications
s-2	Preduster for sinter cooler gas		
		4 sets	
	Type		Blow-down with louvers
	Equipment	1 lot	Louvers
		1 lot	Blow-down duct
		1 lot	Dust conveyer

No.	Equipment	Quantity	Main Specifications
B-1	Dedusting system for casting house of BF		
		2 sets	
	Type		Bag filter, 7000 Nm <sup>3</sup> /min 60 c
	Equipment	1 lot	Collecting hood
		1 lot	Connecting duct
		1 lot	Preduster
		1 lot	Induced draft fan, motor and stack

No.	Equipment	Quantity	Main Specifications
K-1	Dedusting system for vessel mouth of CV		
		2 sets	
	Type		Bag filter, 2400 Nm <sup>3</sup> /min 40 c
	Equipment	1 lot	Intake manifold and duct
		1 lot	Preduster
		1 lot	Induced draft fan, motor and stack

No.	Equipment	Quantity	Main Specifications
k-2	Dedusting system for main gas from converters		
		1 set	
	Type		Wet electric precipitator, 8000 Nm <sup>3</sup> /min 100 c
	Equipment	1 lot	Wet type electric precipitator
		1 lot	Connecting duct (gases are led together)

No.	Equipment	Quantity	Main Specifications
E-1	Dedusting system for vessel mouth and secondary air of EAF	2 sets	
	Type	1 lot	Bag filter, 8200 Nm <sup>3</sup> /min 45 c
		1 lot	Intake manifold and duct
		1 lot	Preduster
		1 lot	Induced draft fan, motor and stack

No.	Equipment	Quantity	Main Specifications
L-1	Dedusting system for lime kiln main gas	1 set	
	Type	1 lot	Air-supplied gas cooling,
		1 lot	Bag filter, 4700 Nm <sup>3</sup> /min 180 c
	Equipment	1 lot	Air-supplier
		1 lot	Preduster
		1 lot	Induced draft fan and motor

--- KW

No.	Equipment	Quantity	Main Specifications
L-1	Dedusting system for lime kiln main gas	1 set	
	Type	1 lot	Air-supplied gas cooling,
		1 lot	Bag filter, 4700 Nm <sup>3</sup> /min 180 c
	Equipment	1 lot	Air-supplier
		1 lot	Preduster
		1 lot	Induced draft fan and motor

--- CTOMAHA

Appendix 10-8-26 Main Specification for Improvement

B-I. Improvement of the Wastewater Treatment Plant( final treatment plant at Krenikovtzi)

1. Design Condition

Raw waste water(Inlet of waste water treatment plant): Treated water  
 Flow Rate : 3360 m<sup>3</sup>/h : 500 m<sup>3</sup>/h(For river)  
 SS : Max. 150 ppm : < 2 ppm  
 Oil : Max. 40 ppm : < 0.3 ppm

Equipment List

No.	Equipment	Quantity	Specification	Remark
1	Screen	1 set	Conveyer x 2	
2	Oil Separators	9 sets	24mW x 36mL x 3.0(2.0)mH (1728 m <sup>3</sup> )	
3	Pump Station	1 set		
4	Breakdown Basins	2 sets	50mW x 60mL x 2.8(2.5)mH (7500 m <sup>3</sup> )	
5	Multipurpose House	1 set		
6	Pressurized Flotation Tank Rake Sludge Pump	4 sets	10mφ x 1.5mH 10mφ x 1kw Centrifugal Type 15m x 20m <sup>3</sup> /h x 5kw	Modify Modify Install
7	Lagoons	4		
8	Utility Building	1 set		
9	Pressurization Tank	8 sets	1.6mφ x 4.3mH ( 8m <sup>3</sup> )	Improve
10	Mixing Basin	4 sets	60m <sup>3</sup> x4 Agitator x16	Install
11	PAC Tank	1 set	40 m <sup>3</sup> x 2 Pump:20m x 300 l/h x(4+1)	Install
12	Polyelectrolyte Tank	1 set	Tank 3 m <sup>3</sup> Pump: 5 l/h x(4+1)	Install
13	Filter	1 set	Capacity 500 m <sup>3</sup> /h x 2	Install
14	Active carbon adsorption	1 set	Capacity 125 m <sup>3</sup> /h x 4	Install
15	Piping	1 lot	Consisting of: Water piping, valves, and fittings	Install

Foundation and Basin List

Item	Description	Concrete Volume Unit:m <sup>3</sup>
Foundation for equipment	·Filter etc.	(Total 582 m <sup>3</sup> )
Basin	·Mixing Basin etc.	(Total 356 m <sup>3</sup> )

B-2. Installation of oil-containing waste water treatment(for Hot rolling mill)

1. Design Condition

Raw waste water(Inlet of waste water treatment) : Treated water  
 Flow Rate : 100 m<sup>3</sup>/h : 100 m<sup>3</sup>/h  
 SS : Ave. 50 ppm ( Max. 100 ppm ) : < 10 ppm  
 Oil : Ave. 100 ppm ( Max 1000 ppm ) : < 5 ppm

Equipment List

No.	Equipment	Quantity	Specification
1	Dissolved air flotation method	4 sets	Emulsion breaker, NaOH, PAC, polymer
	Chemical	3 sets	
	Mixing Tank	1 set	
	Dissolved air flotation tank	1 set	
	Scum Hopper	1 set	7.0mφ x 2.0mH (A=28m <sup>2</sup> ) Capacity 10m <sup>3</sup> (5m <sup>3</sup> x 2)

Foundation and Basin List

Item	Description	Concrete Volume Unit:m <sup>3</sup>
Foundation for equipment	Total	( 91 m <sup>3</sup> )
Basin	·Dissolved air flotation tank etc.	( 262 m <sup>3</sup> )

B-3. Installation of coke oven-gas liquor treatment plant

1. Design Condition

Raw waste water(for ammonia stripping)	:	Treated water
Flow Rate	:	50 m <sup>3</sup> /h                      150 m <sup>3</sup> /h
COD	:	4000 - 6000 ppm                      < 70 ppm
SCN	:	400 - 600 ppm                      < 10 ppm
T-NH <sub>3</sub>	:	6000 - 9000 ppm                      < 100 ppm
T-CN	:	50 - 100 ppm                      < 2 ppm
Phenols	:	900 - 1500 ppm                      < 0.05 ppm
Oil	:	800 - 1200 ppm                      < 2 ppm
Temperature: Max.	:	80 °C
SS	:	< 5 ppm

Equipment List

No.	Equipment	Quantity	Main Specification
1	Pre-treatment system Oil Separator Coke Filter(Tar catcher)	1 set	Capacity 50 m <sup>3</sup> /h Depilator type
2	Buffer Tank	1 set	Capacity 600m <sup>3</sup>
3	Ammonium stripping system	1 set	Capacity 50 m <sup>3</sup> /h Ammonium Stripping Tower
4	Biological treatment system Chemicals Aeration Basin Blower Thickener Dehydrator	1 set	Capacity 75 m <sup>3</sup> /h(+ Diluent water 75 m <sup>3</sup> /h) 6000m <sup>3</sup> x 2 0.55kg/cm <sup>2</sup> x 8400Nm <sup>3</sup> /h x (2+1) 20mφ x 2 Decanter type
5	Raw Water Tank	1 set	Capacity 600 m <sup>3</sup>
6	Filter	1 set	Capacity 150 m <sup>3</sup> /h
7	Piping	1 lot	
8	Building(Rooms) Chemicals Tanks, Blower, Operation(& Analysis), Electrical, Dehydrator	1 set	

Foundation and Basin List

Item	Description	Unit	Concrete Volume Unit:m <sup>3</sup>
Foundation for equipment	Raw water tank	2 sets	600 m <sup>3</sup> (300 x 2) (Total 1200 m <sup>3</sup> )
Basin	Aeration Basin	2 sets	2996 m <sup>3</sup> (Total 4038 m <sup>3</sup> )
Foundation for Building and equipment	Foundation & Floor	1 set	130 m <sup>3</sup>

B-4. Installation of Cyanogen removal facility for BF waste water

Equipment List

No.	Equipment	Quantity	Specification
1	Chemicals injection	3 sets	NaOH, Polyelectrolyte etc.

B-5. Installation of oil-containing waste water treatment in Stomana Steel Works

1. Design Condition

Raw waste water (inlet of waste water treatment) : Treated water  
 Flow Rate : 120 m<sup>3</sup>/h ( Max. 140 m<sup>3</sup>/h ) : 120 m<sup>3</sup>/h  
 SS : 50 ppm ( Max. 100 ppm ) : < 2 ppm  
 Oil : 100 ppm ( Max 1000 ppm ) : < 0.3 ppm

Equipment List

No.	Equipment	Quantity	Specifications
1	Dissolved air flotation method	1	Capacity 120 m <sup>3</sup> /h
	Raw Water Pit (& suction pit)	3 sets	NaOH, PAC, Polyelectrolyte
	Chemical	4 sets	
	Mixing Tank	2 sets	
	Dissolved Air Flotation Tank	1 set	Capacity 20m <sup>3</sup> (5m <sup>3</sup> x 4)
Scum Hopper			
2	Filter	1 set	Capacity 140m <sup>3</sup> /h
3	Active carbon adsorption	1 set	Capacity 140m <sup>3</sup> /h

Foundation and Basin List

Item	Description	Concrete Volume Unit: m <sup>3</sup>
Foundation for equipment	· Dissolved Air Flotation Tank etc.	( 157 m <sup>3</sup> )
Basin	· Raw Water Pit etc.	( 537 m <sup>3</sup> )

Water treatment facility for Billet CC.

1. Design Condition

A. Direct cooling water recirculation

a. Raw waste water	b. Treated water
Flow Rate : Ave. 400 m <sup>3</sup> /h ( Except Scale Flushing )	: Max. 400 m <sup>3</sup> /h
SS : Ave. 50 ppm ( At Outlet Scale Pit )	: Max. 5 ppm
Oil : Ave. 5 ppm ( At Outlet Scale Pit )	: Ave. 2 ppm
Temperature: Max. 55 °C ( At Outlet Scale Pit )	: Max. 35 °C

B. Indirect cooling water recirculation

a. Raw water	b. Treated water
Flow Rate : Max. 600 m <sup>3</sup> /h	: Max. 600 m <sup>3</sup> /h
SS : Ave. 3 ppm	: Ave. 3 ppm
Oil : Ave. 1 ppm	: Ave. 1 ppm
Temperature: Max. 46 °C	: Max. 31 °C

2. Others

Capacity of Steel Production 300,000 T/Yr

Equipment list

No.	Equipment	Quantity	Specification
1	Direct cooling water recirculation	1 set	Capacity 400 m <sup>3</sup> /h
	Scale Pit	(1 set )	
	Waste Oil Pit	(1 set )	
	Thickener	(1 set )	24m $\phi$ Capacity 1356m <sup>3</sup>
	Filter	(1 set )	Capacity 500 m <sup>3</sup> /h x (1+1) )
	Cooling Tower(Direct cooling),Well Supply Water Pump	(1 set ) (1 set )	500 m <sup>3</sup> /h 55-35°C at wt27°C
2	Indirect cooling water recirculation	1 set	Capacity 600 m <sup>3</sup> /h
	Filter(for make up water)	(1 set )	Capacity 50 m <sup>3</sup> /h
	Cooling Tower(Indirect cooling),Well Supply Water Pump	(1 set ) (1 set )	600 m <sup>3</sup> /h 46-31°C at wt27°C
	Chemical equipment	(1 set )	
	Emergency Over Head Tank	1 set	Capacity 30m <sup>3</sup> (50 ml)
4	Pump Station(& Electrical,Blower Room)	1 set	
5	Piping	1 lot	Water Piping, valves, fittings, and Piping supports

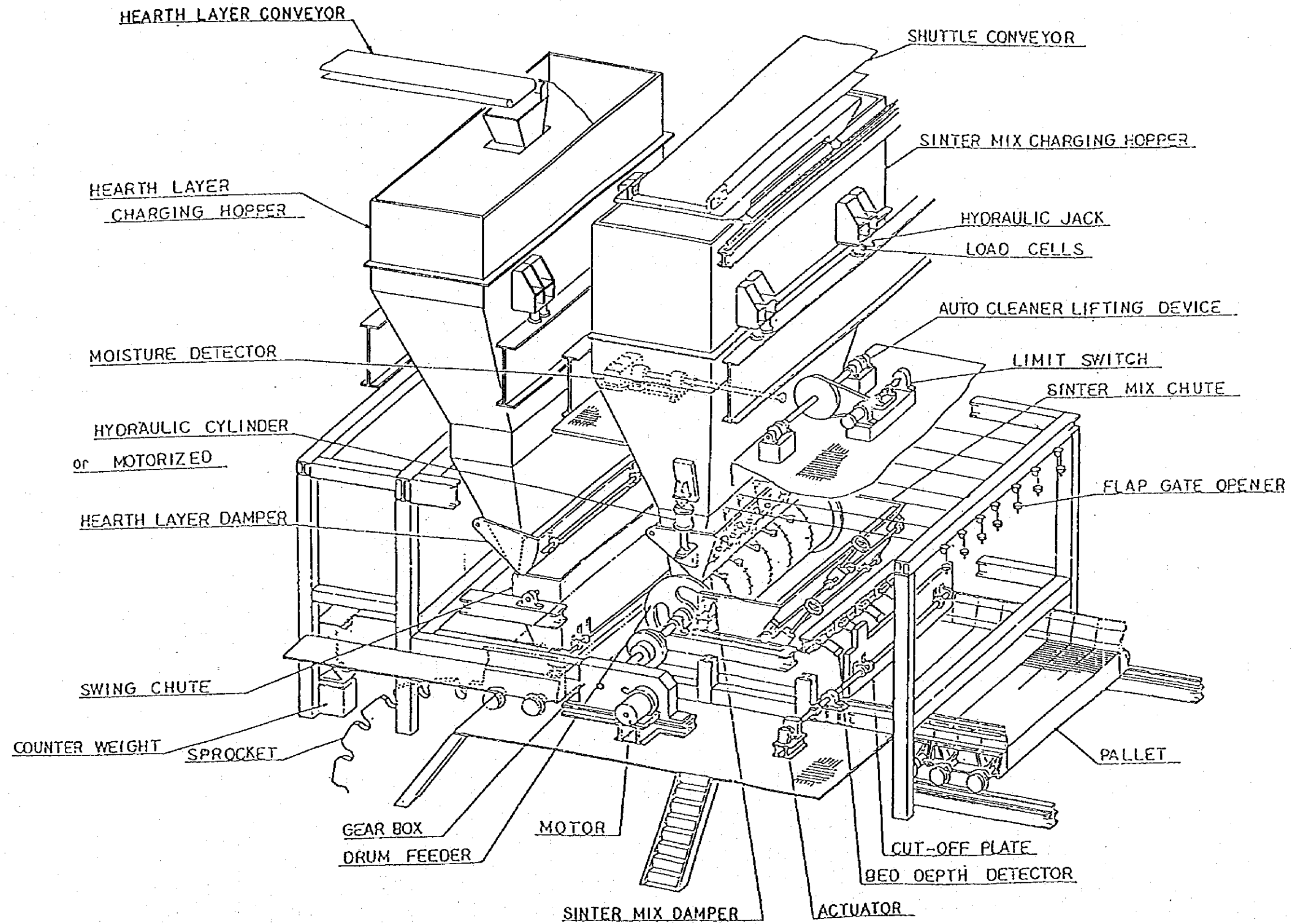
Foundation and Basin List

Item	Description	Concrete Volume Unit:m <sup>3</sup>
Foundation for equipment	·Filter etc.	316 m <sup>3</sup>
Basin	·Scale pit etc.	776 m <sup>3</sup>
Foundation for Building and equipment	·Pump Station	162 m <sup>3</sup>

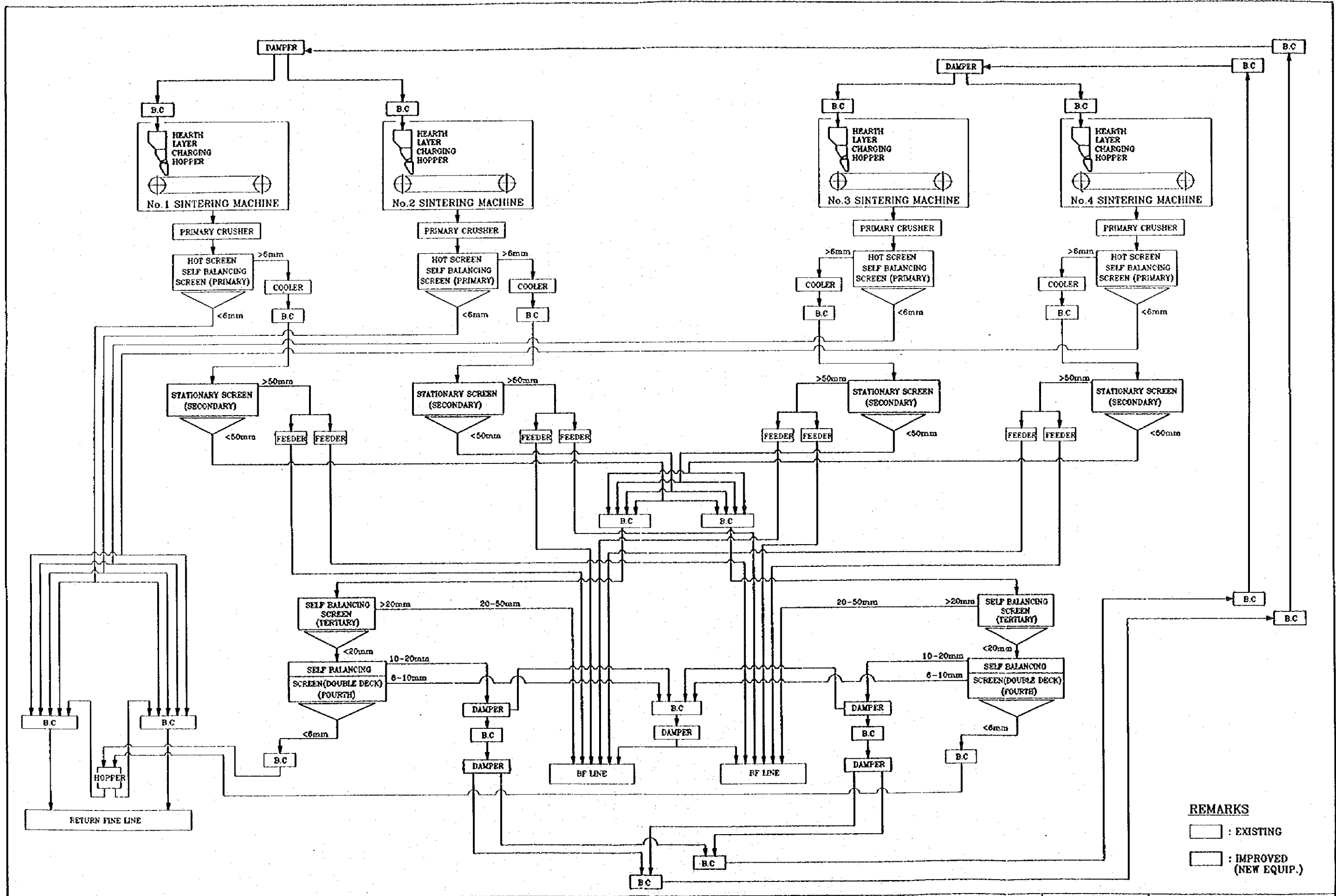


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# SINTERING MACHINE CHARGING SYSTEM

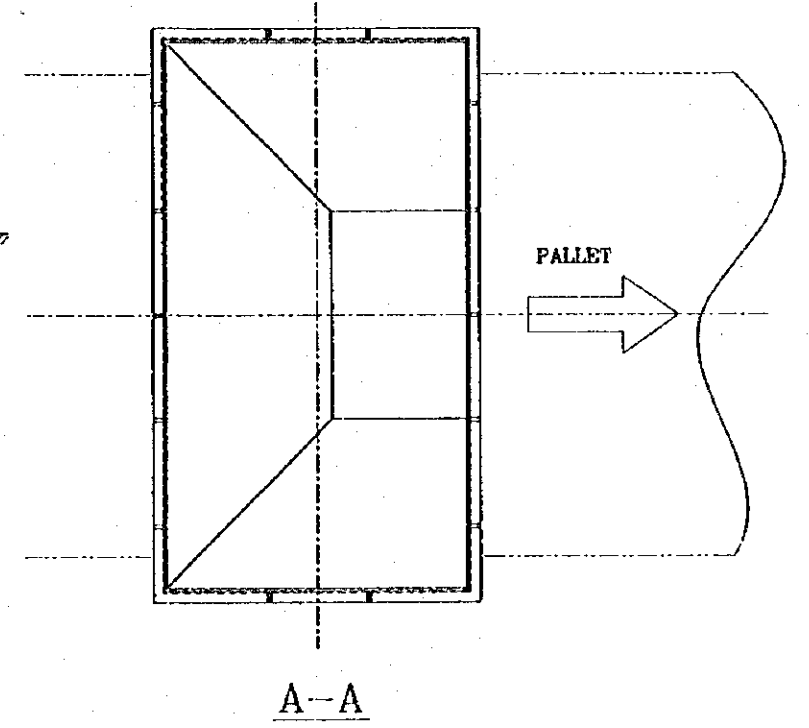
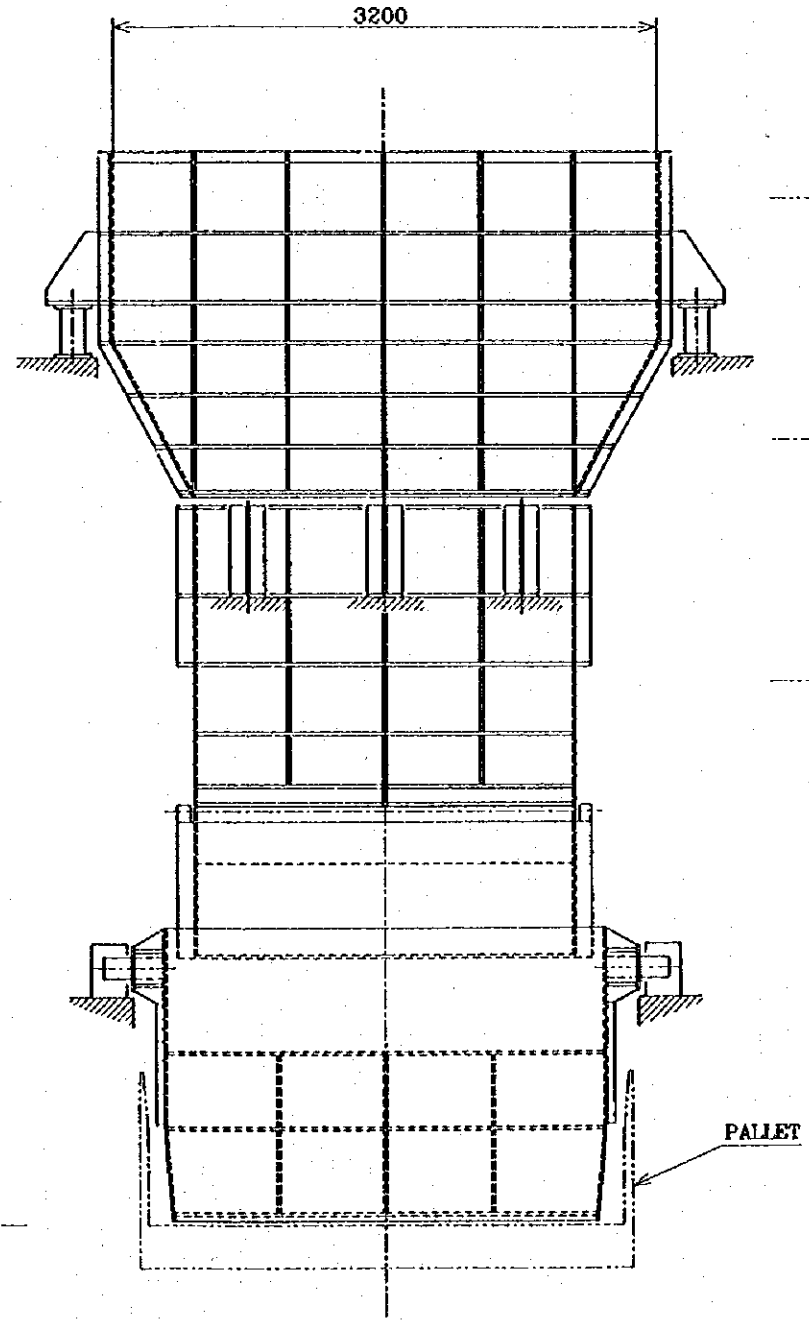
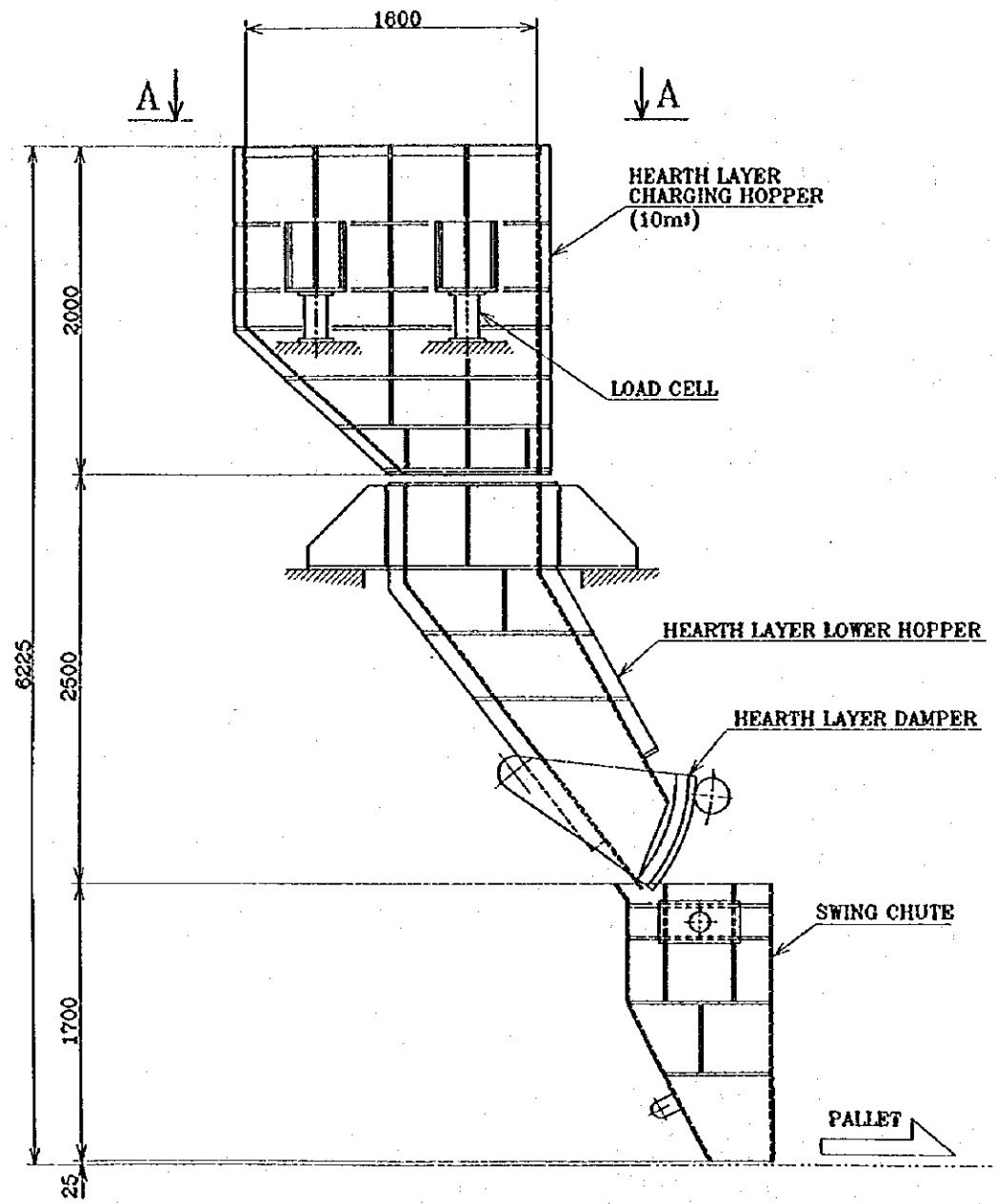


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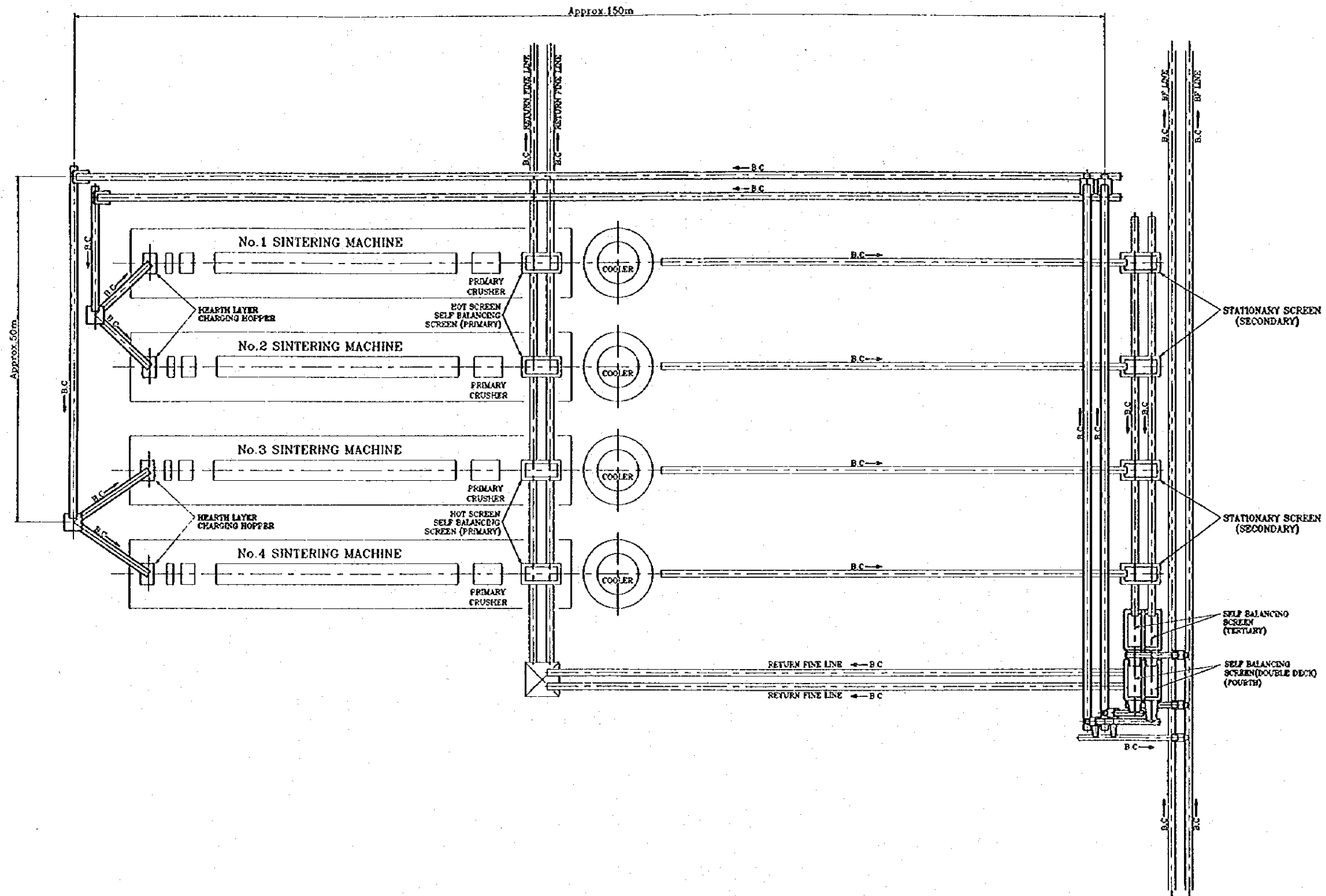


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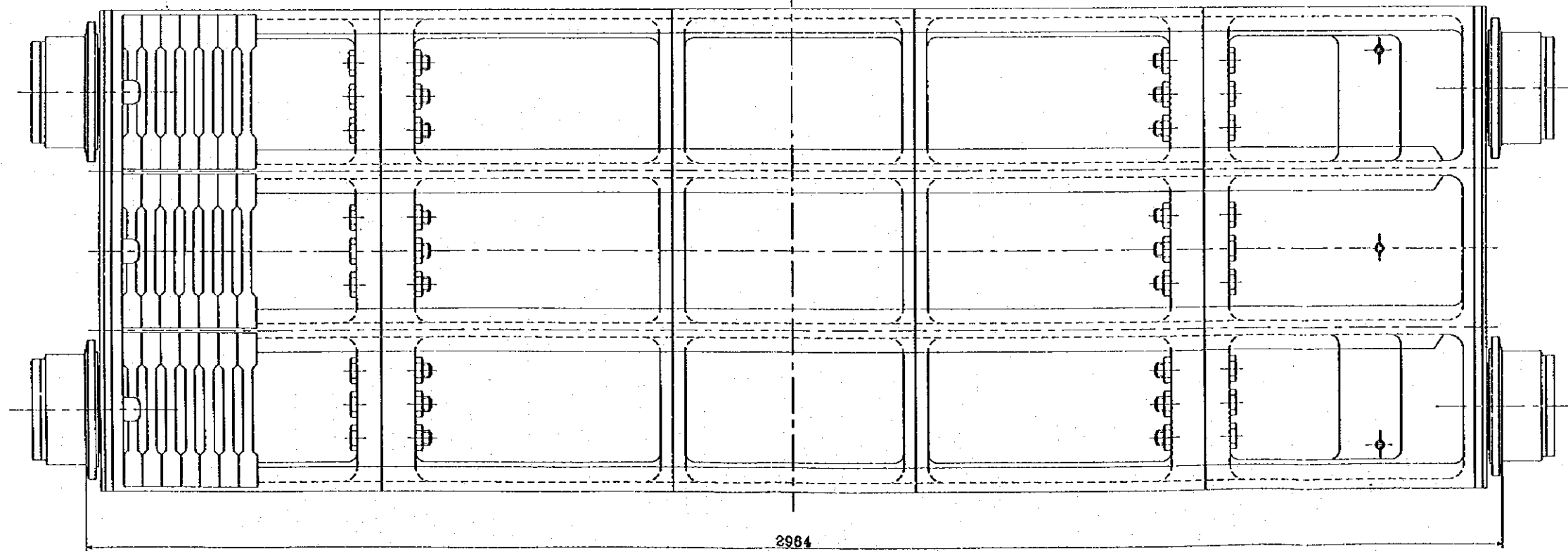
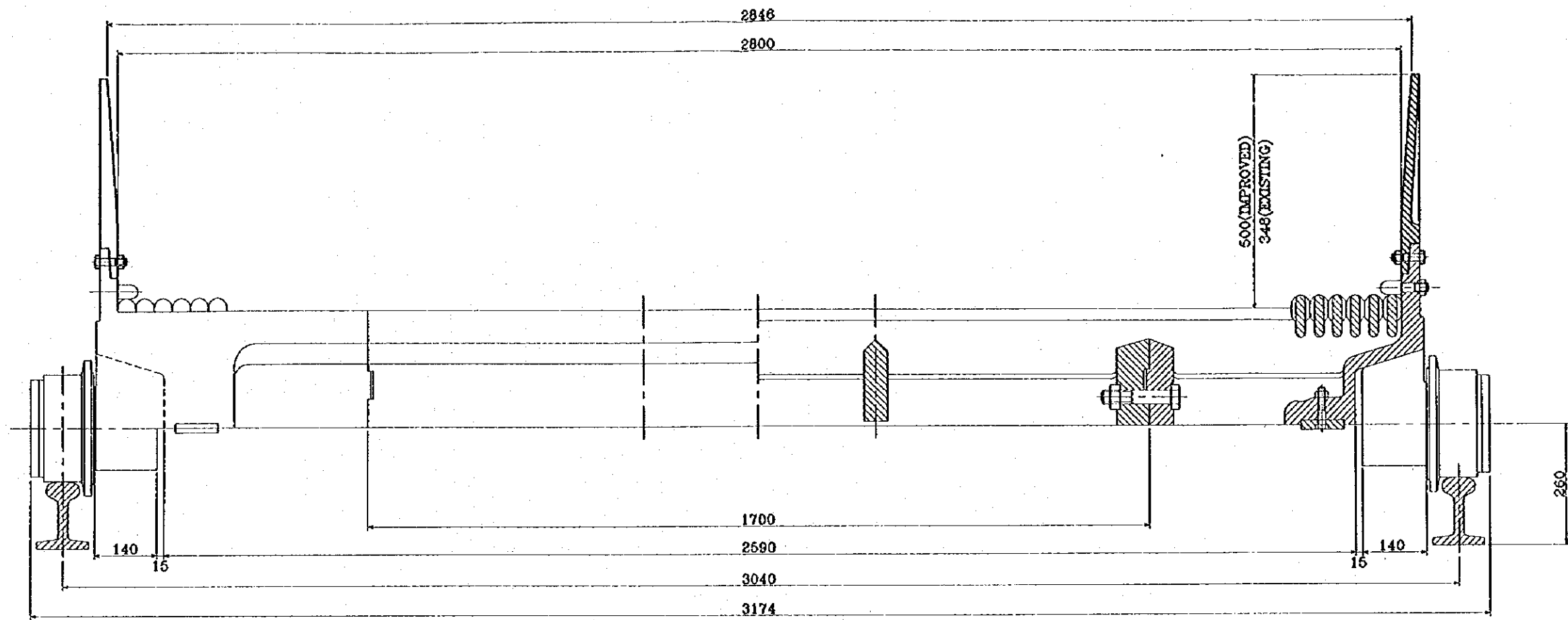


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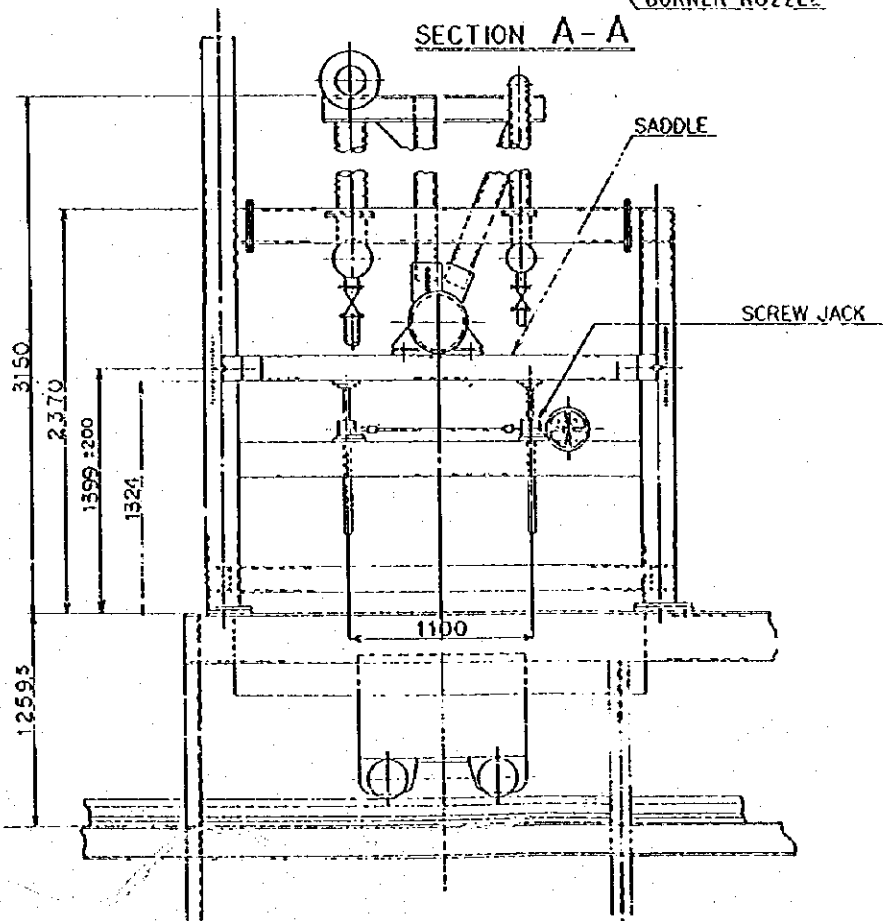
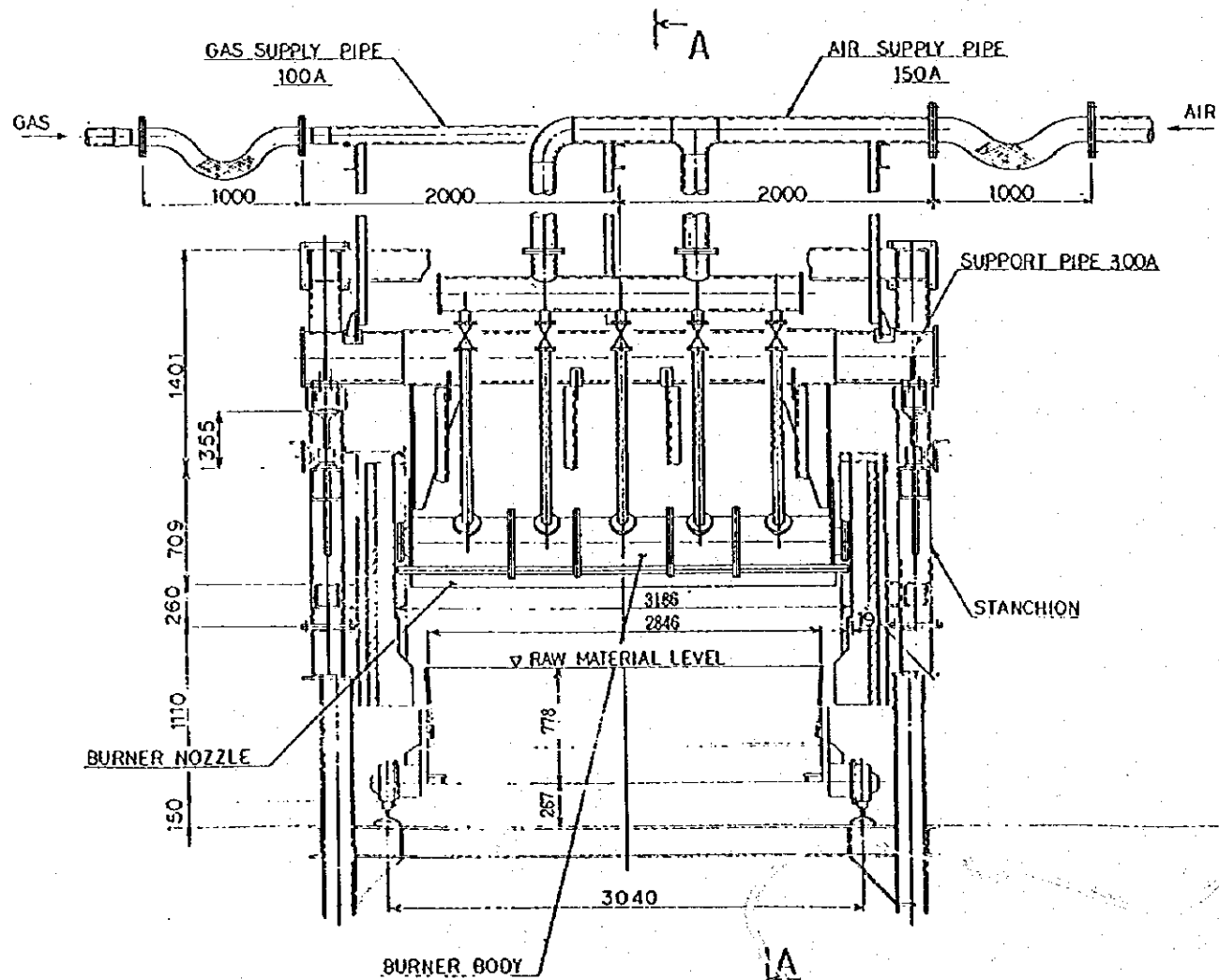
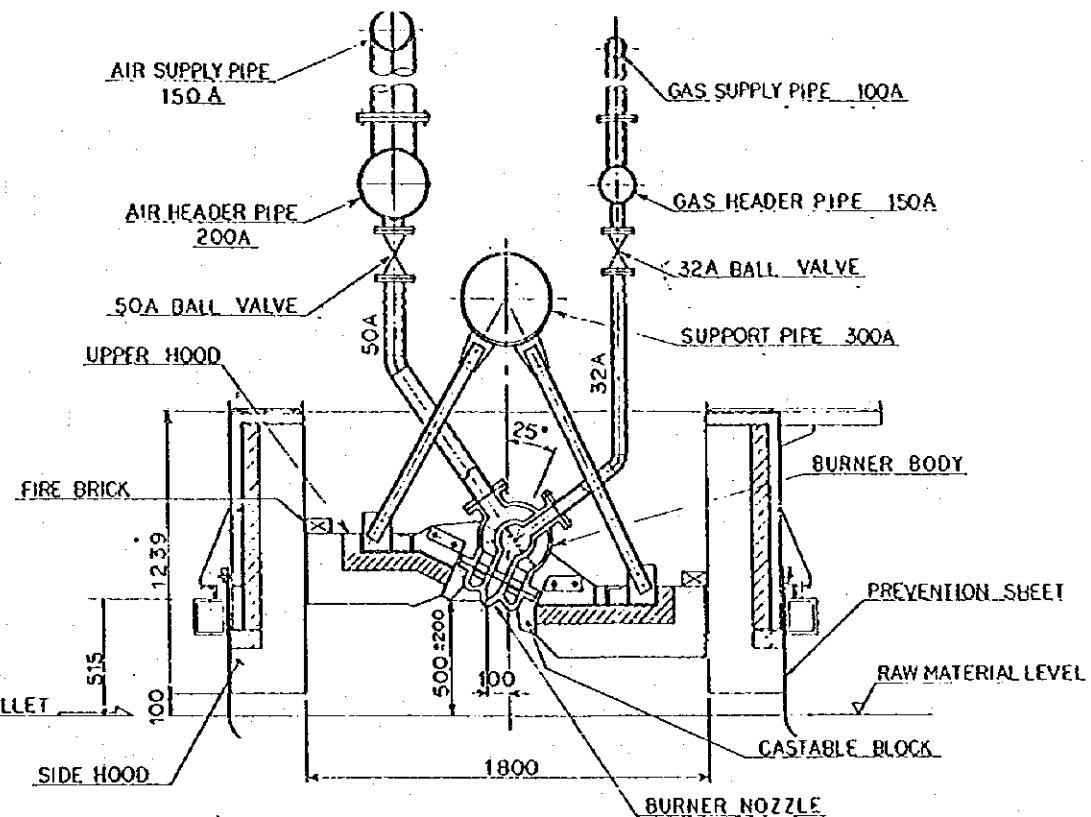
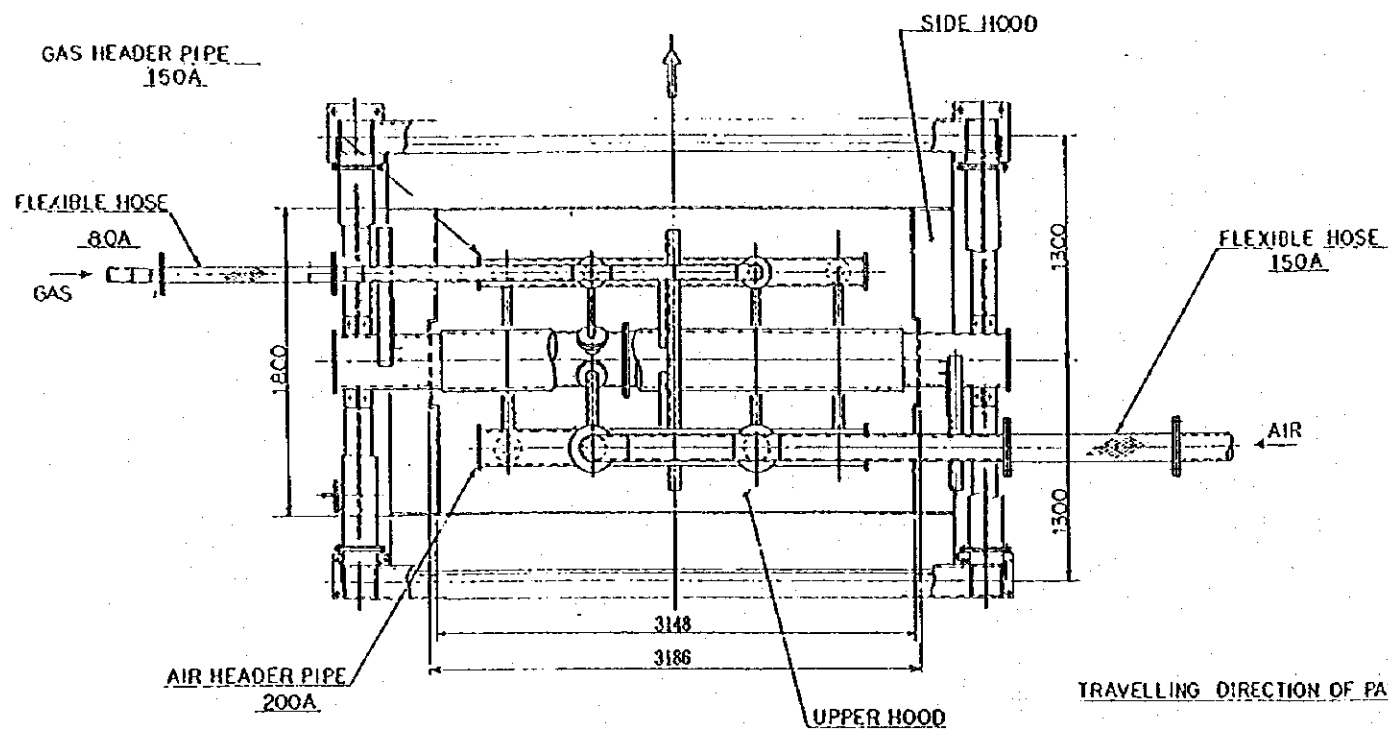


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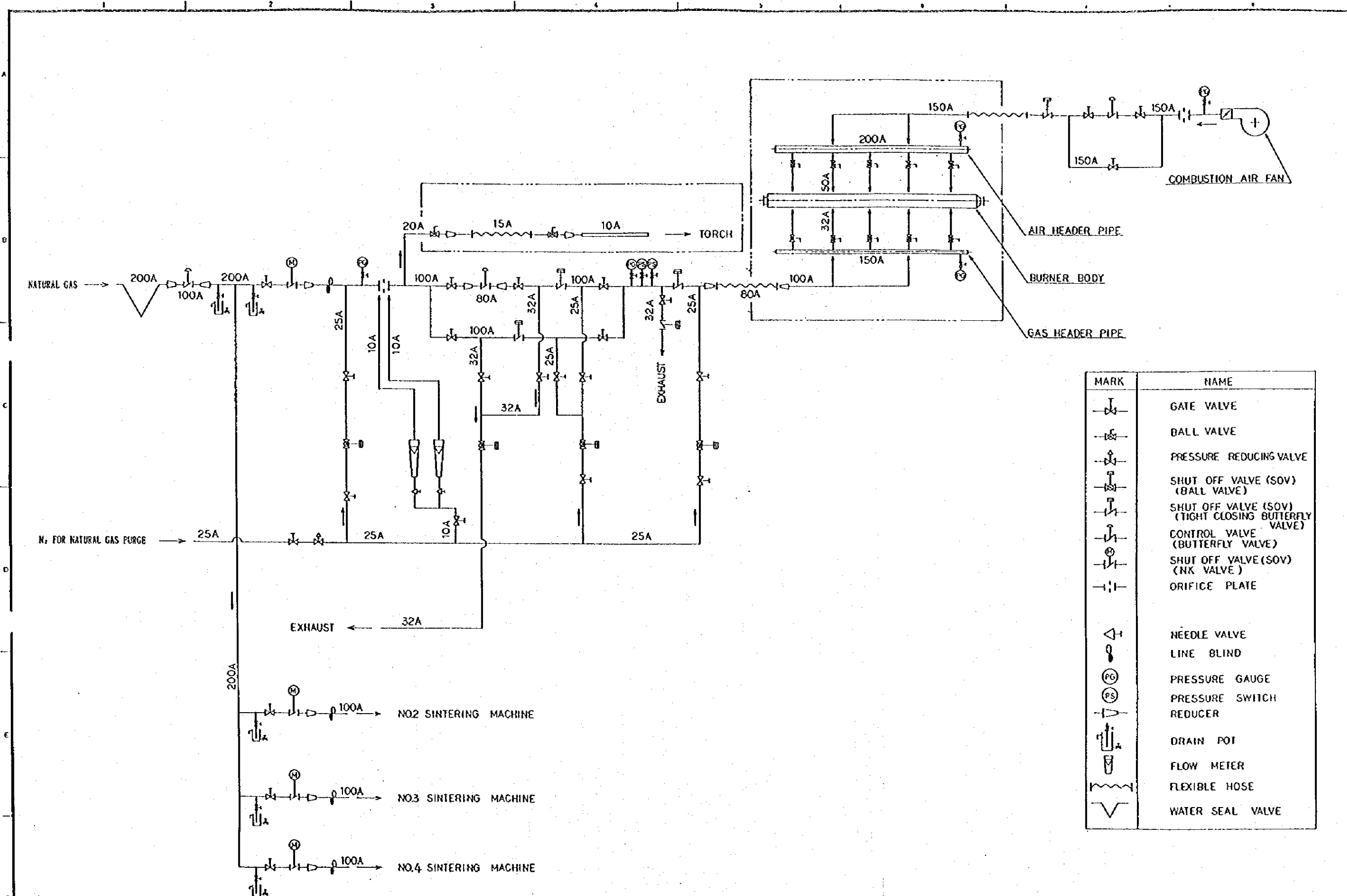
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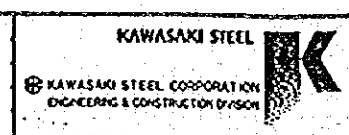




MARK	NAME
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	BALL VALVE
	PRESSURE REDUCING VALVE
	SHUT OFF VALVE (SOV) (BALL VALVE)
	SHUT OFF VALVE (SOV) (TIGHT CLOSING BUTTERFLY VALVE)
	CONTROL VALVE (BUTTERFLY VALVE)
	SHUT OFF VALVE (SOV) (NK VALVE)
	ORIFICE PLATE
	NEEDLE VALVE
	LINE BLIND
	PRESSURE GAUGE
	PRESSURE SWITCH
	REDUCER
	DRAIN POT
	FLOW METER
	FLEXIBLE HOSE
	WATER SEAL VALVE

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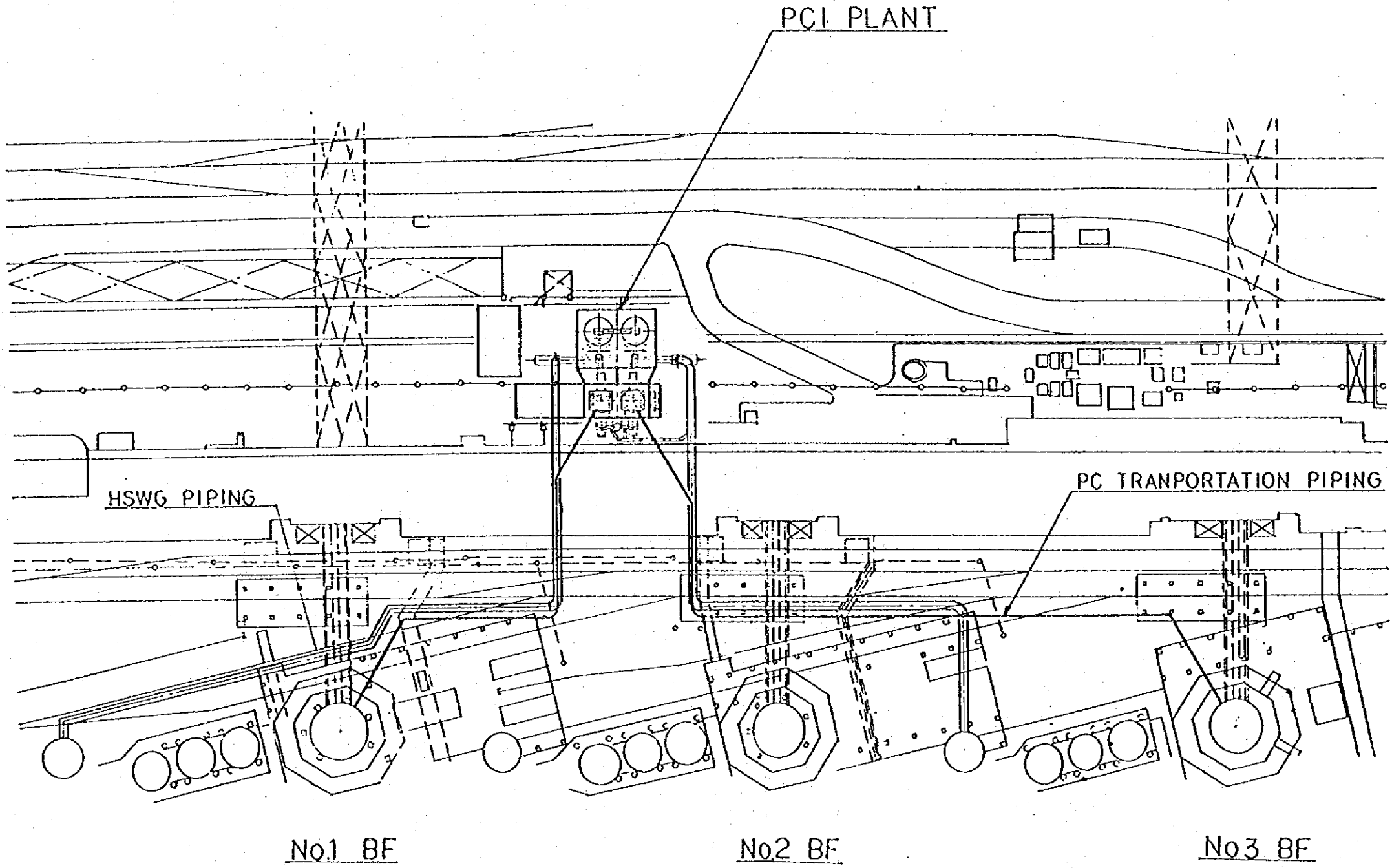


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CUSTOMER:	KREMIKOV TZI
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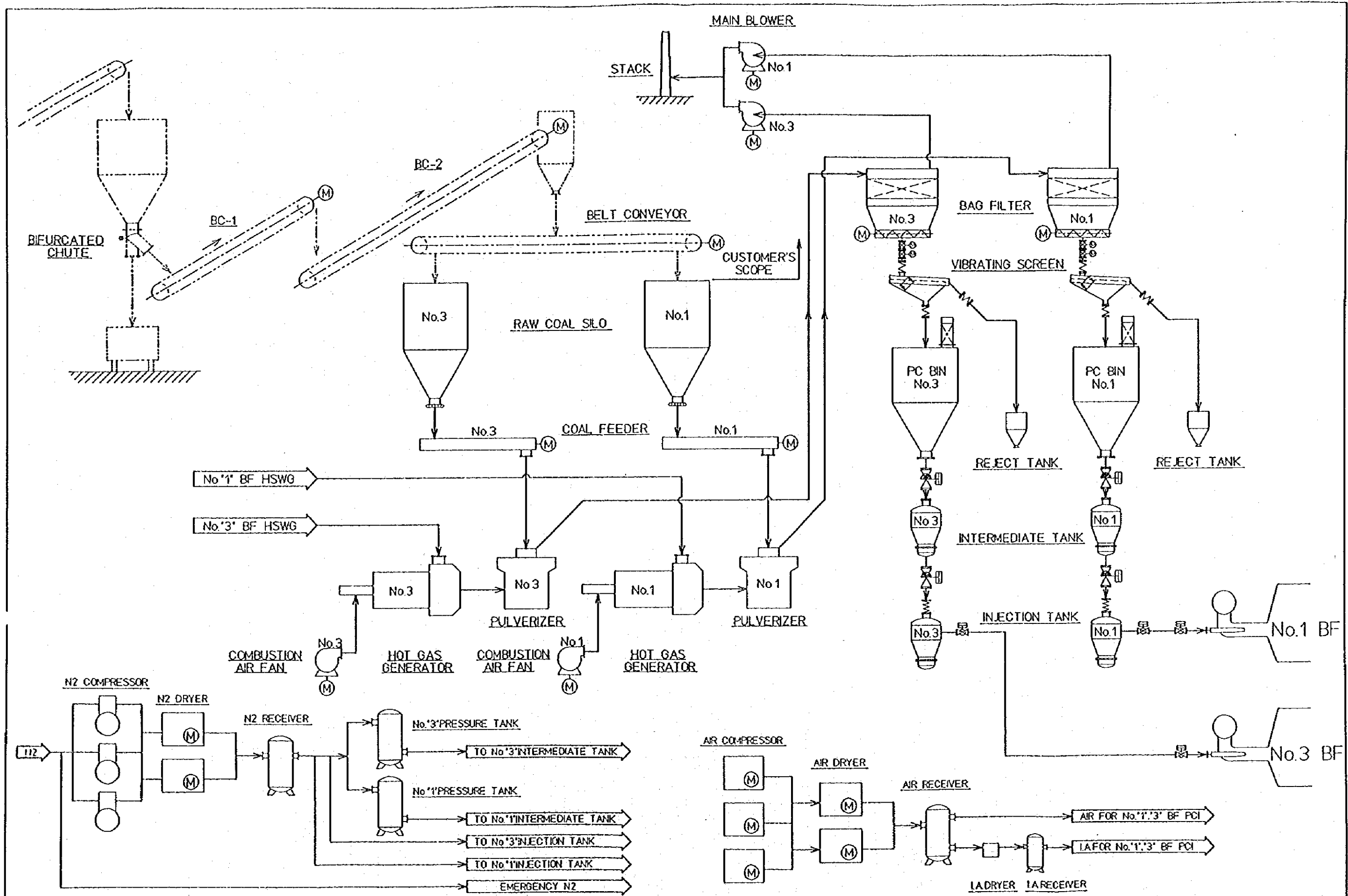
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PIPING  
FLOW SHEET

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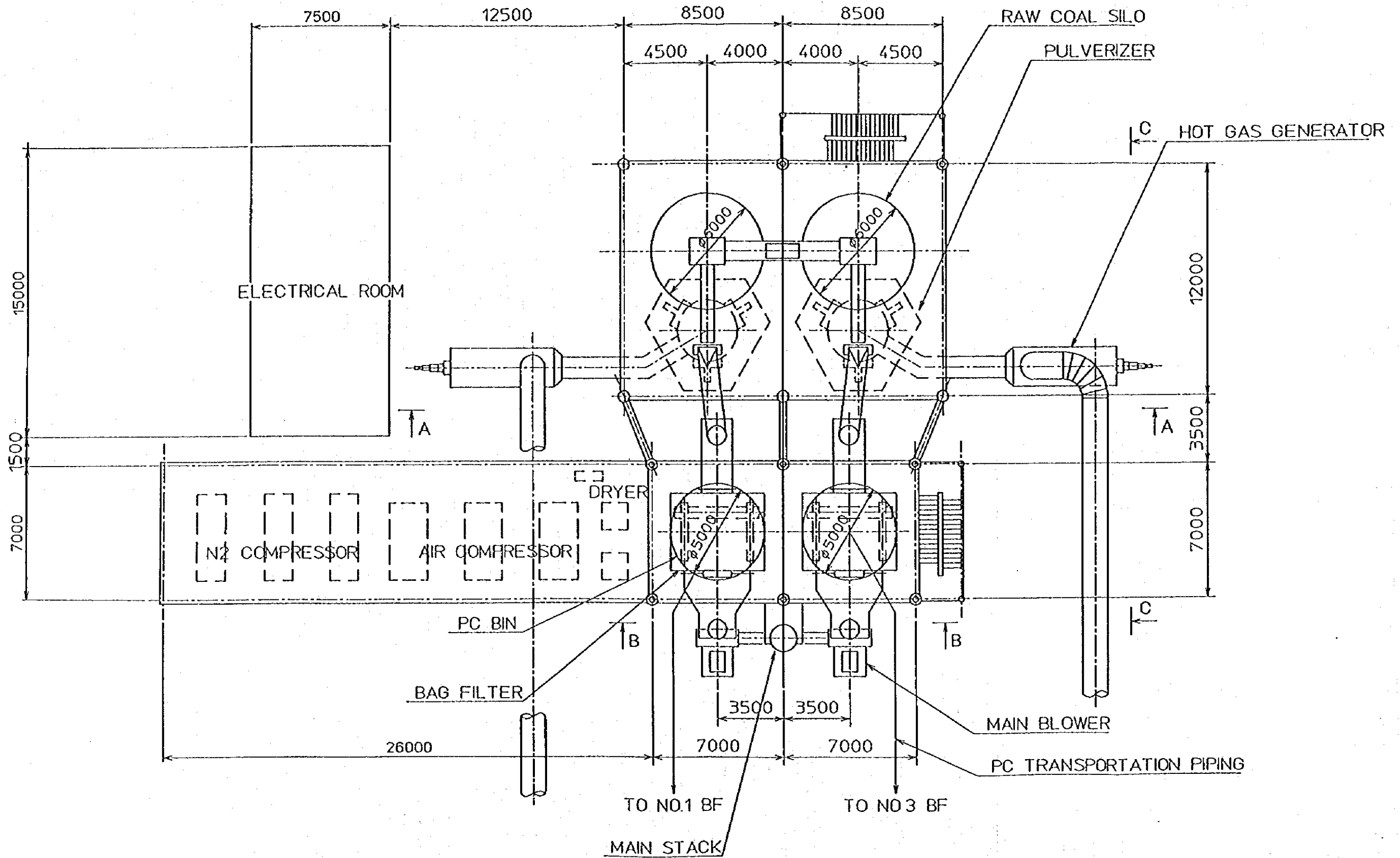


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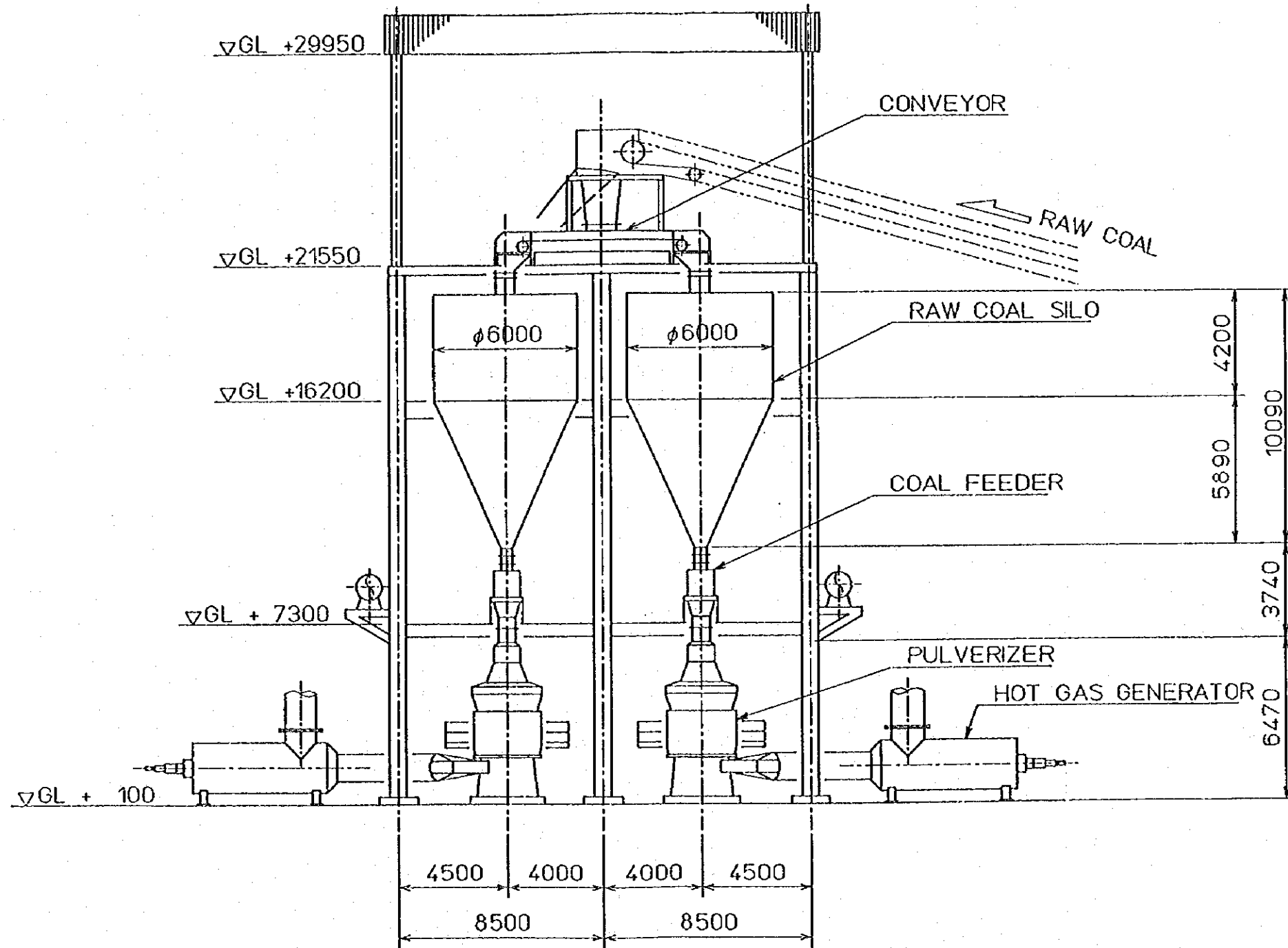
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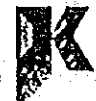
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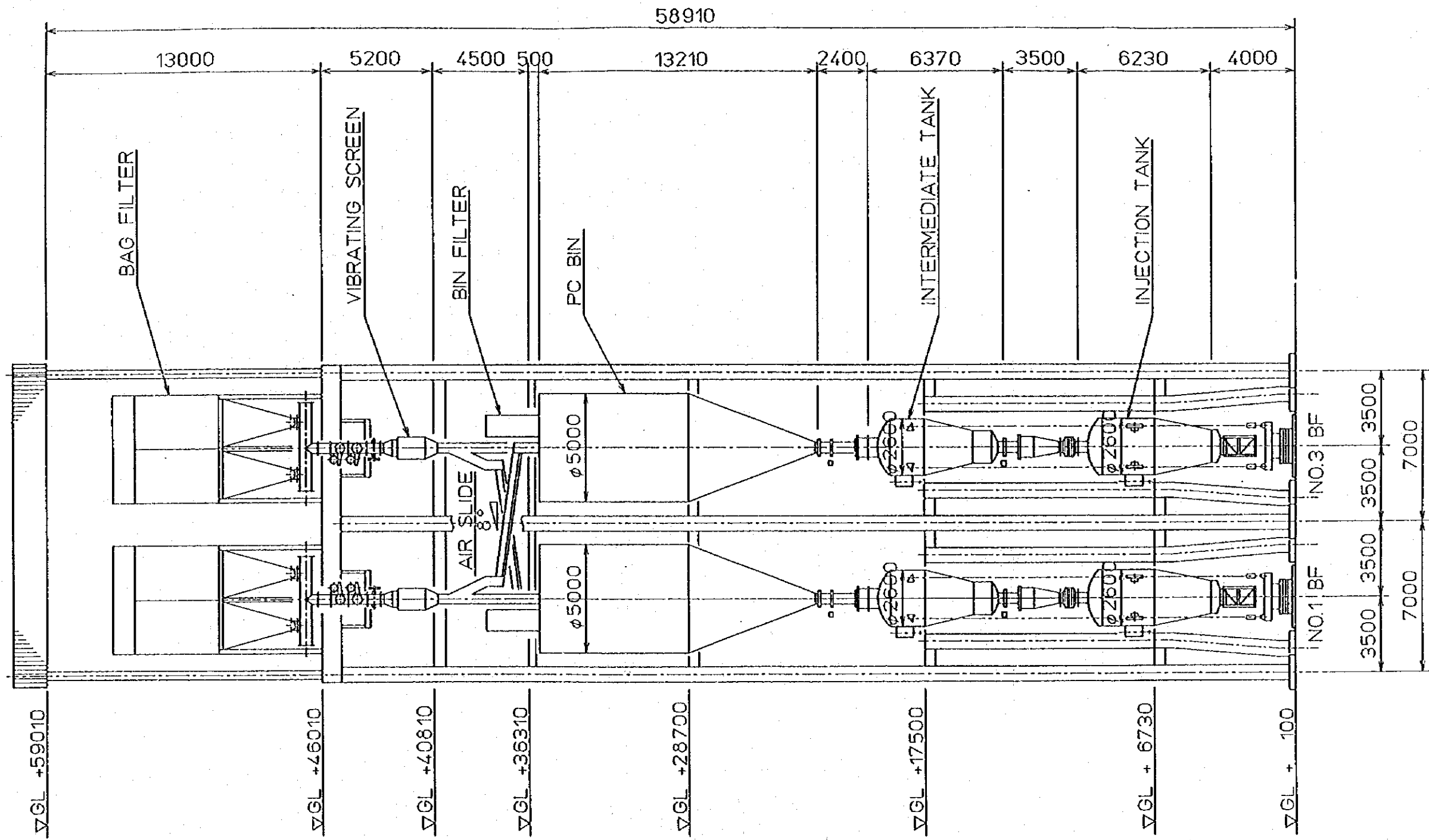


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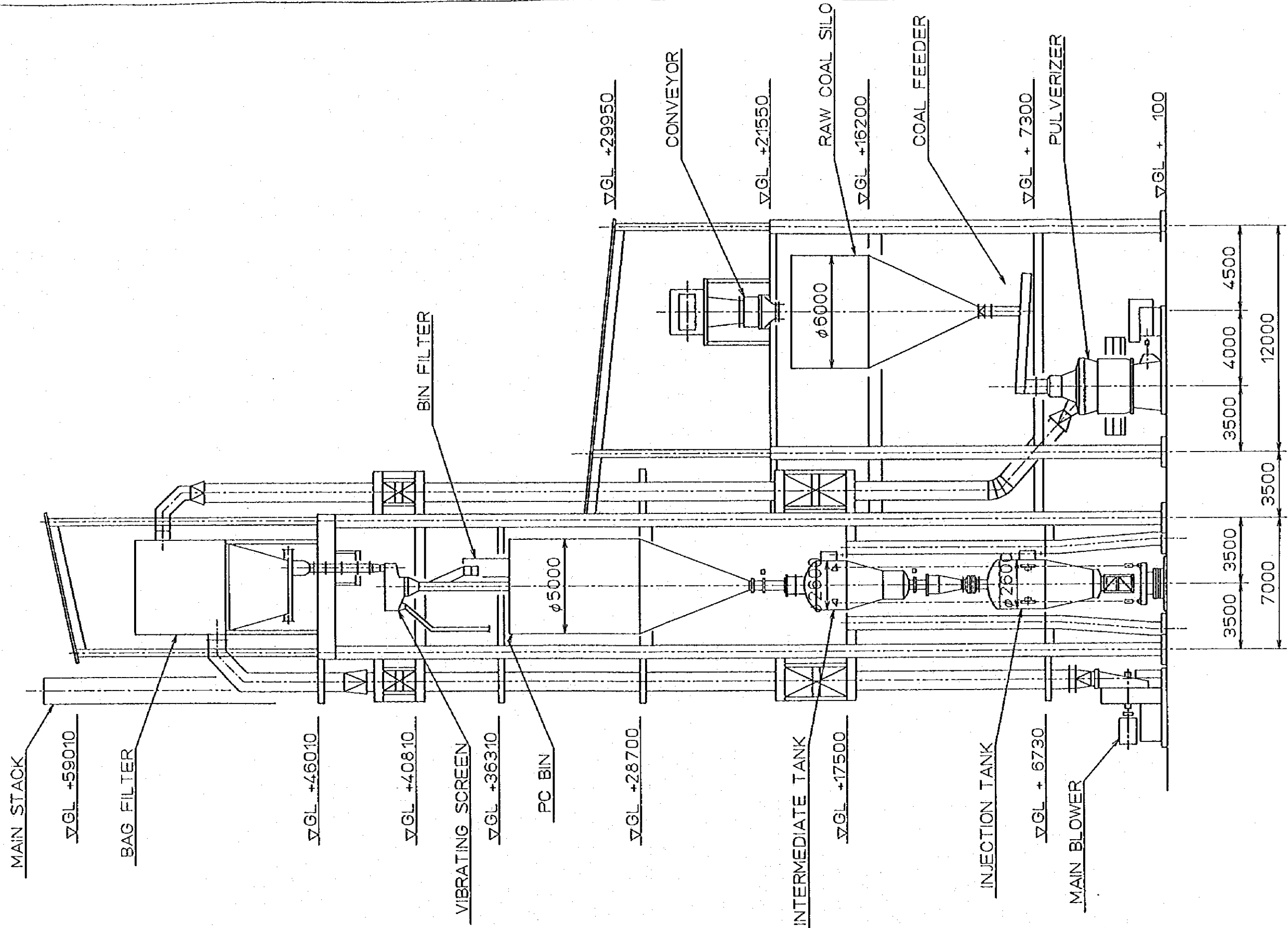
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NOTE			KAWASAKI STEEL  KAWASAKI STEEL CORPORATION ENGINEERING & CONSTRUCTION DIVISION	APPROVED	NO.	DATE	FOR	CUSTOMER	DWG. TITLE	PROJECT
REVISION	DATE	BY		CHECKED			APPROVAL	KREMUKOVITZI STEEL WORKS PCI	SECTIONAL ARRANGEMENT (1/3)	PULVERIZER COAL INJECTION SYSTEM
			DRAWN			RETURN	CONSULT:		DWG. NO.	SHEET
			DATE OF DWG.			SHOP	SCALE	1/200	10-8-38	
						FINAL				



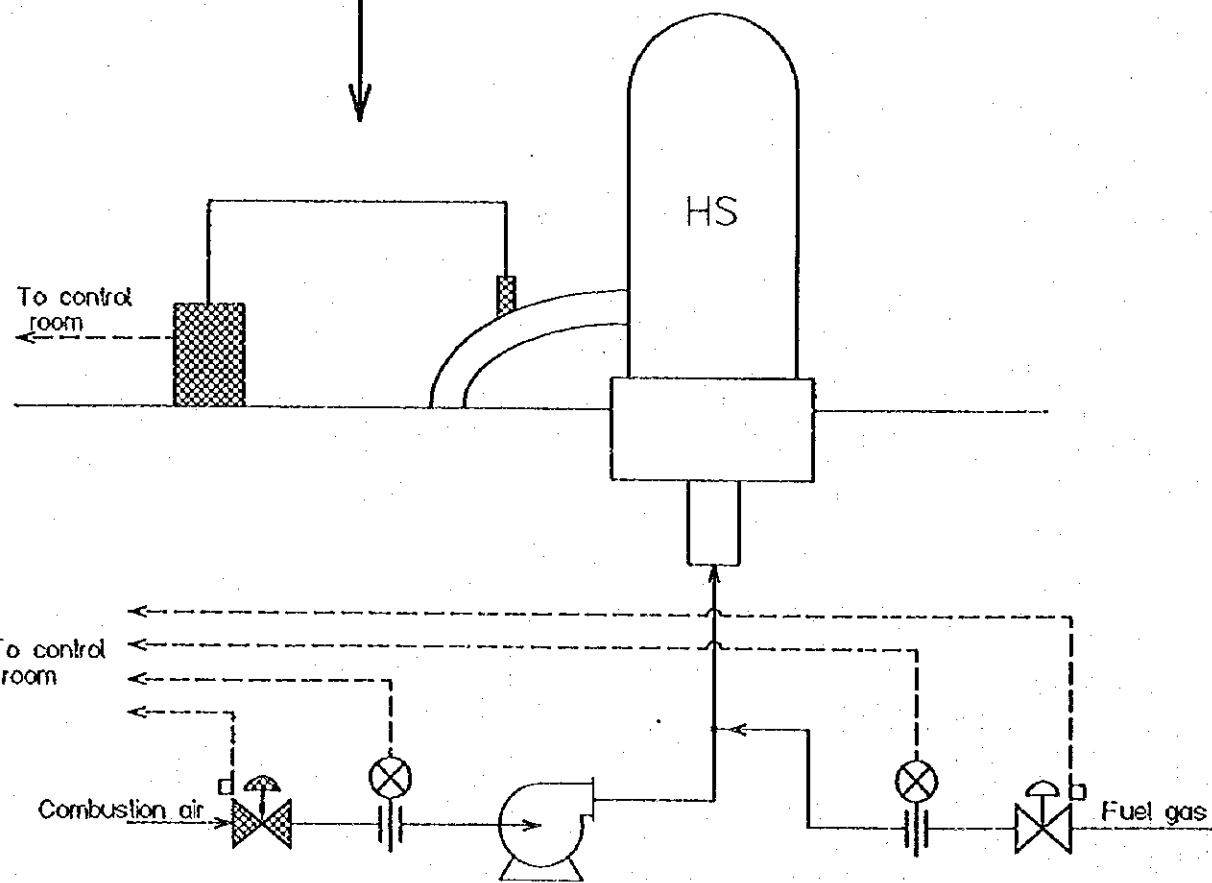
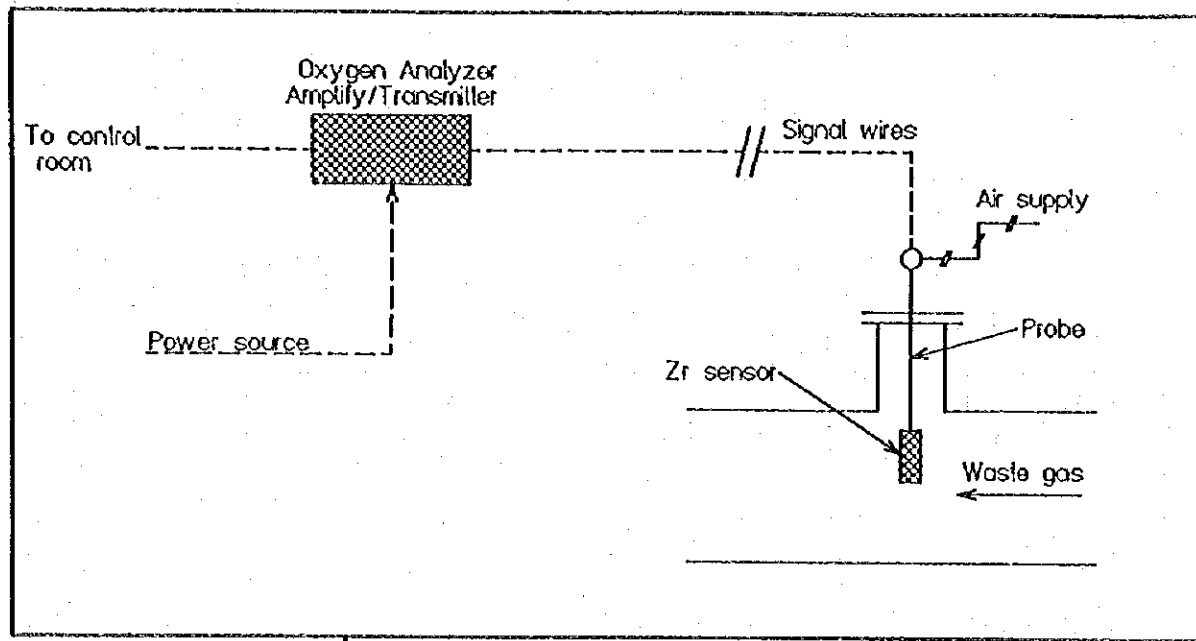
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REVISION		DATE	BY	NOTE	KAWASAKI STEEL KAWASAKI STEEL CORPORATION ENGINEERING & CONSTRUCTION DIVISION	APPROVED CHECKED DRAWN DATE OF DWG	NO. DATE FOR APPROVAL RETURN APPROVED SHOP FINAL	CUSTOMER KREMUKOVITZI STEEL WORKS PCI CONSULT: SCALE 1/200	DWG. TITLE: SECTIONAL ARRANGEMENT (2/3)	PROJECT: PULVERIZER COAL INJECTION SYSTEM DWG. NO. 10-8-39	SHEET

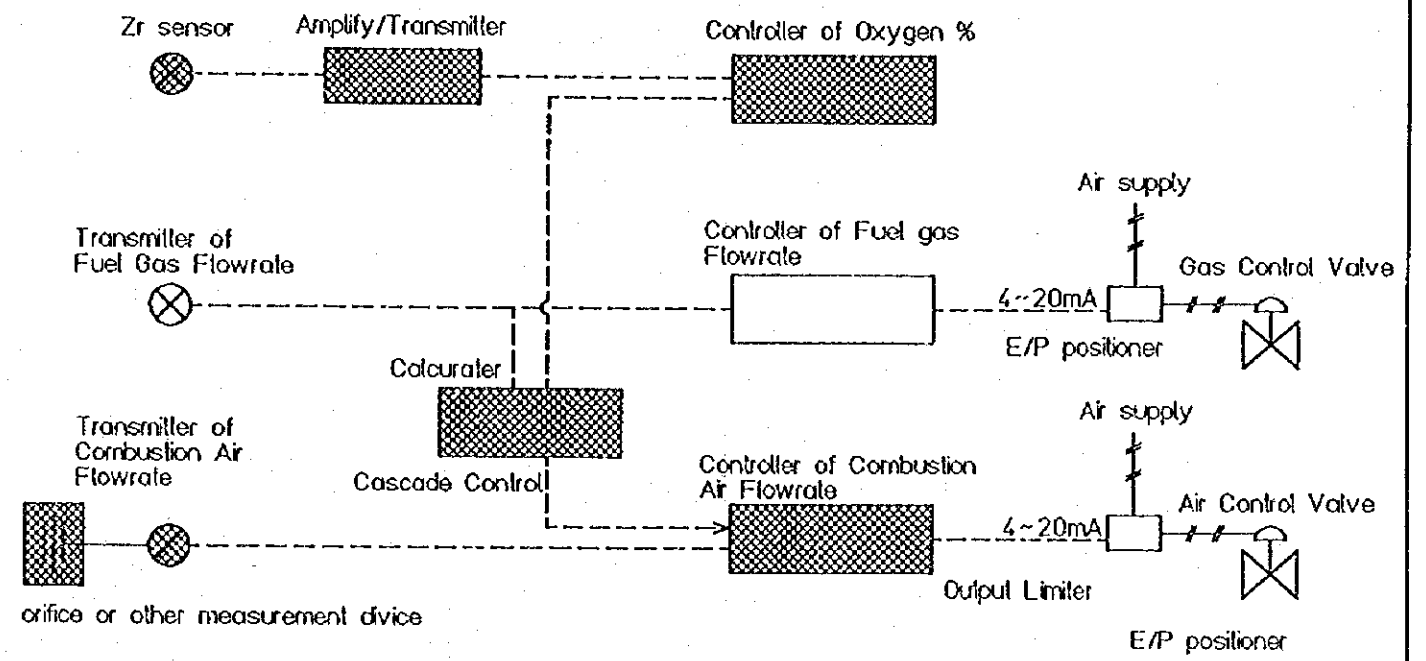




VIEW C-C

NO.				REVISION				DATE				BY				NOTE																			
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Measuring Method



 To be newly supplied  
 Existing equipments

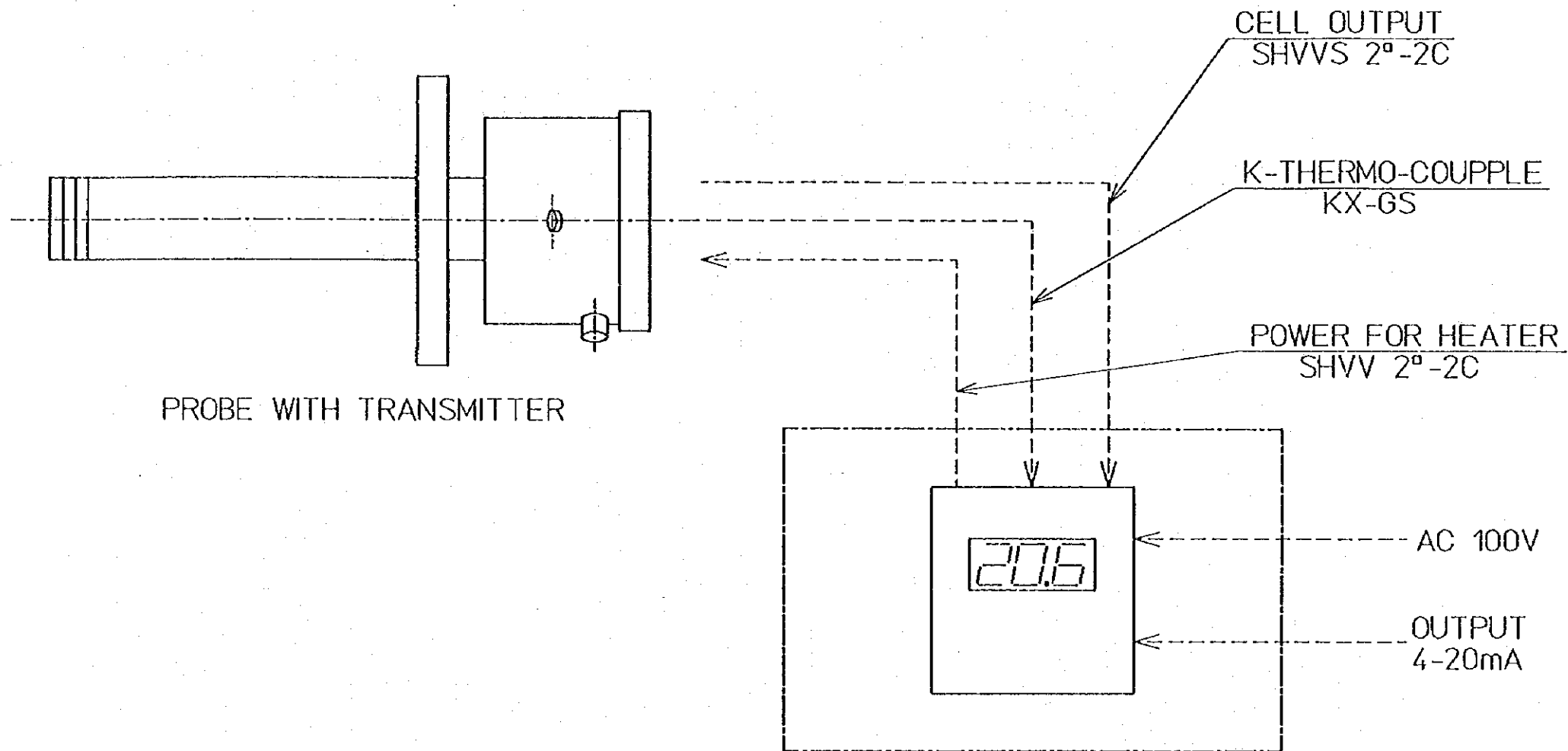
Control System Configuration

CAD FILE No krem\_2

NO	REVISION	DATE	BY	NOTE

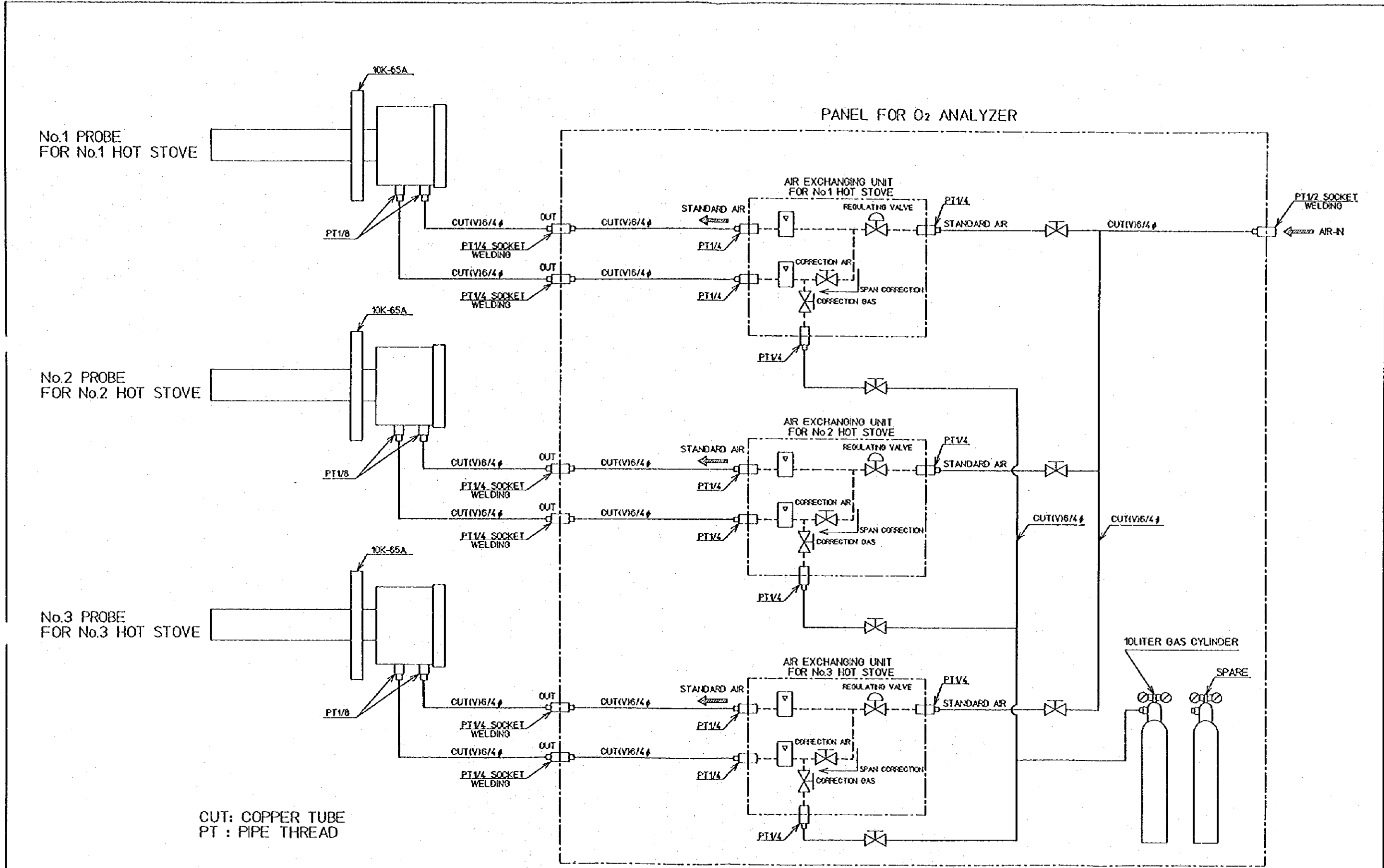
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CHECKED			APPROVED	KREMKOVITZI STEEL WORKS PCI	SYSTEM DESIGN OF OXYGEN ANALYSIS IN THE HOT STOVE WASTE GAS	
DRAWN			RETURN	CONSULTANT.		
DATE OF DWG	JAN 25 '95		APPROVED			
			SHOP			
			FINAL			
				SCALE		





CAD FILE No.krem\_2


			NOTE:				APPROVED CHECKED DRAWN DATE OF DWG	NO DATE FOR APPROVED RETURN APPROVED SKIP FINAL	CUSTOMER KREMKOVTZI STEEL WORKS PCI CONSULTANT	DWG.TITLE	PROJECT:	
NO	REVISION	DATE	BY		KAWASAKI STEEL CORPORATION ENGINEERING & CONSTRUCTION DIVISION	JAN 25 '05					DWG NO 10-8-42	SHEET



CAD FILE No. krom\_3

NO.	REVISION	DATE	BY

NOTE:

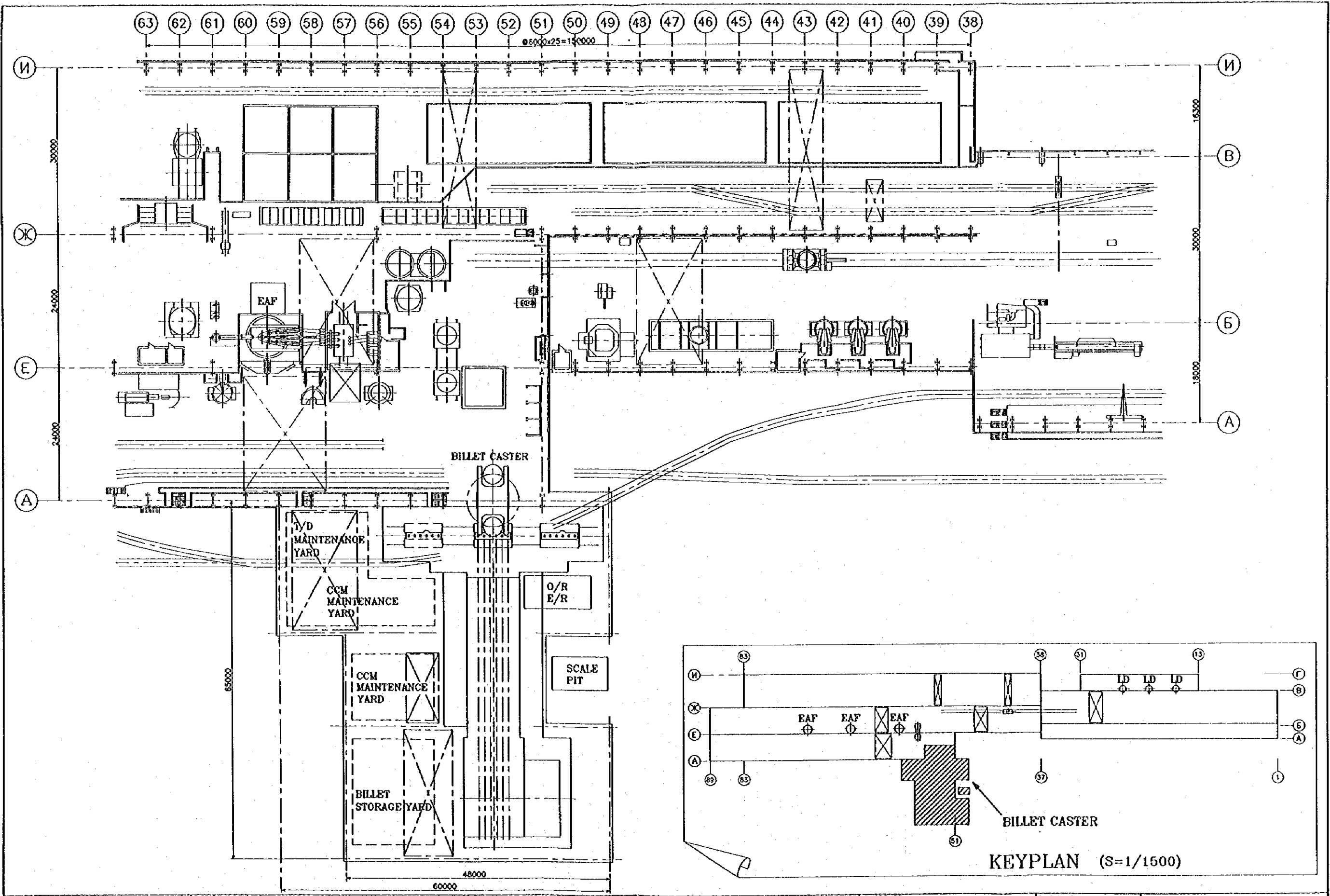
**KAWASAKI STEEL**  
  
 KAWASAKI STEEL CORPORATION  
 ENGINEERING & CONSTRUCTION DIVISION

APPROVED	NO.	DATE	FOR
CHECKED			APPROVED
DRAWN			RETURN
DATE OF DWG			APPROVED
			SHOP
			FINAL

CUSTOMER  
**KREMKOVTZI STEEL WORKS PCI**  
 CONSULTANT

DWG. TITLE  
**O<sub>2</sub> ANALYZER  
 FOR HOTSTOVE**

PROJECT:  
 DWG. NO. **10-8-43** SHEET



NO.	REVISION	DATE	BY

NOTE:  
 CAD FN:KREM-BT1.DWG

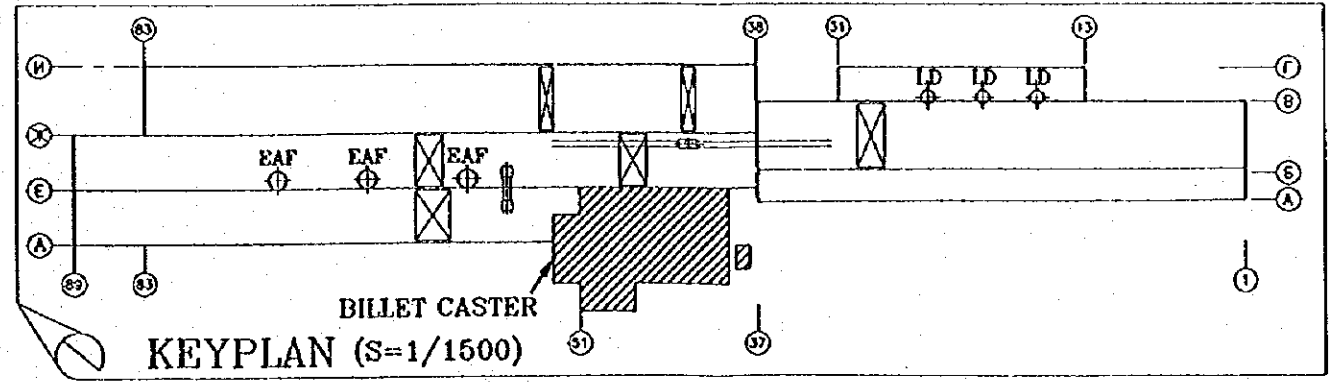
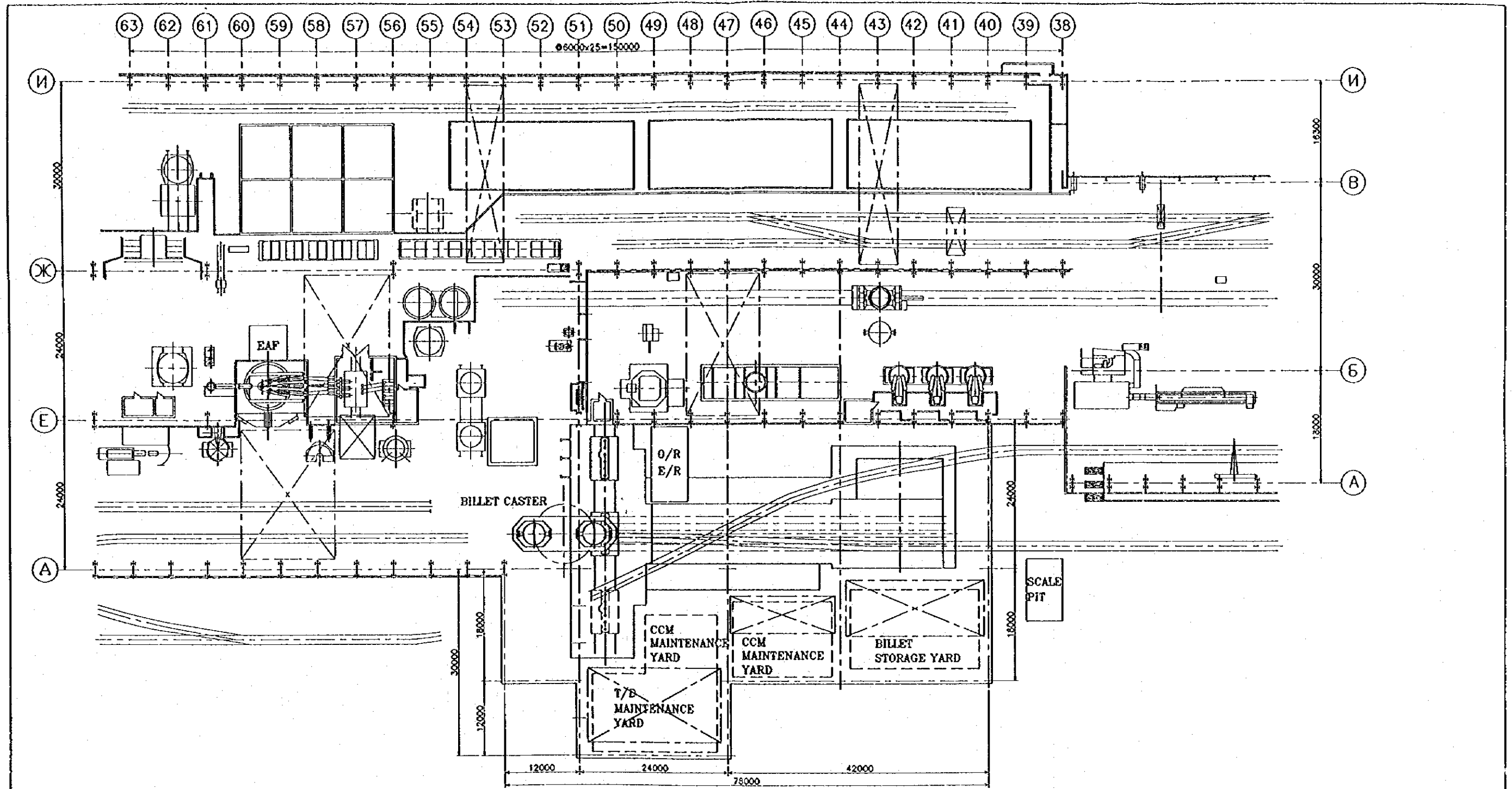
KAWASAKI STEEL  
**IK**  
 KAWASAKI STEEL CORPORATION  
 ENGINEERING & CONSTRUCTION DIVISION

APPROVED	CHECKED	DRAWN	DATE OF DWG
			Oct. 20 '95

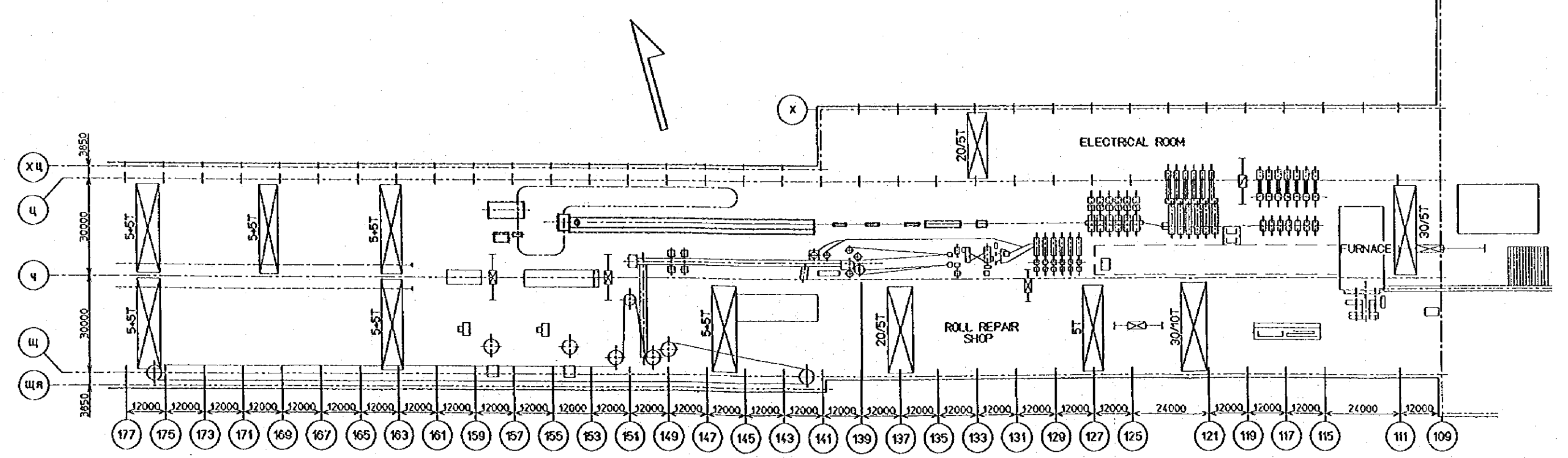
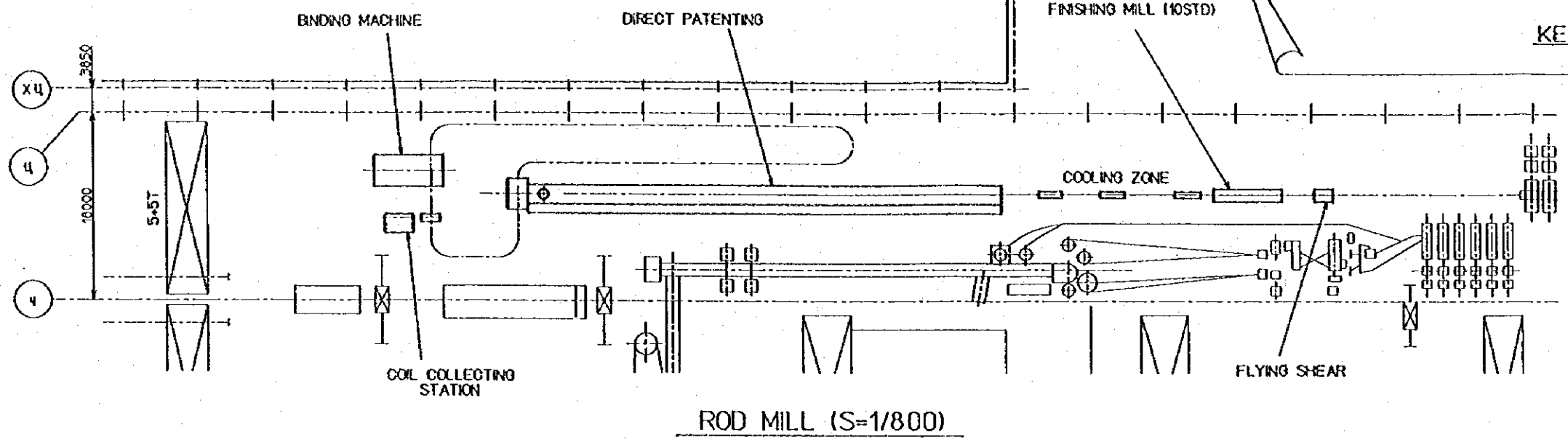
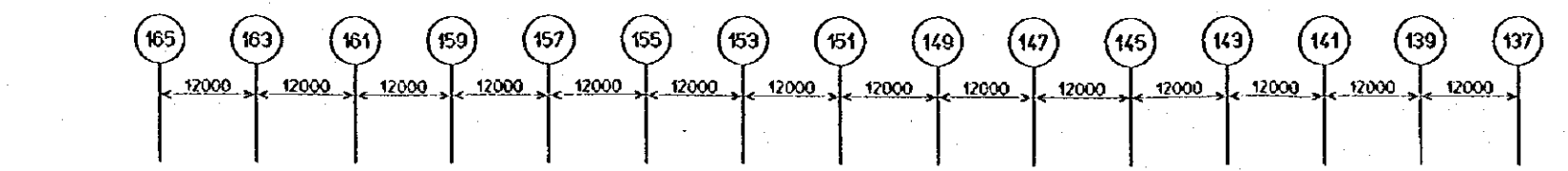
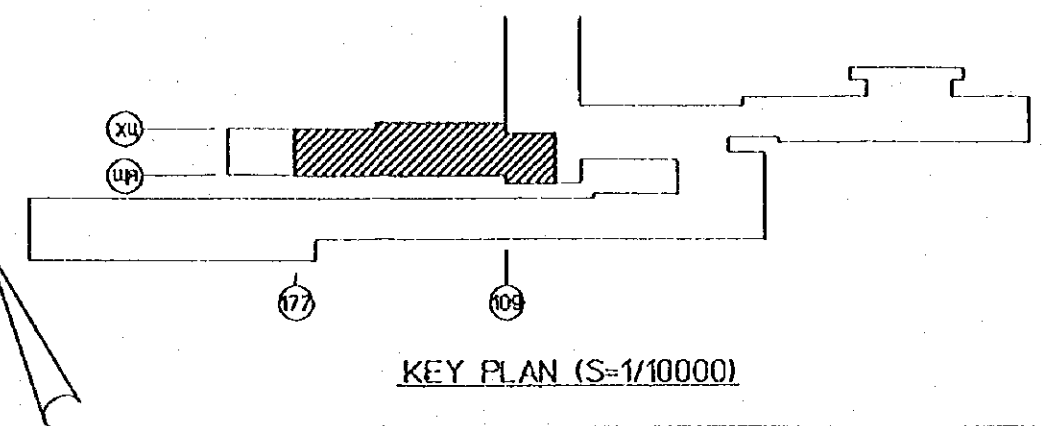
NO.	DATE	FOR APPROVED RETURN APPROVED SHOP FINAL

CUSTOMER: KREMIKOV TZI  
 CONSULTANT:  
 SCALE: 1/300

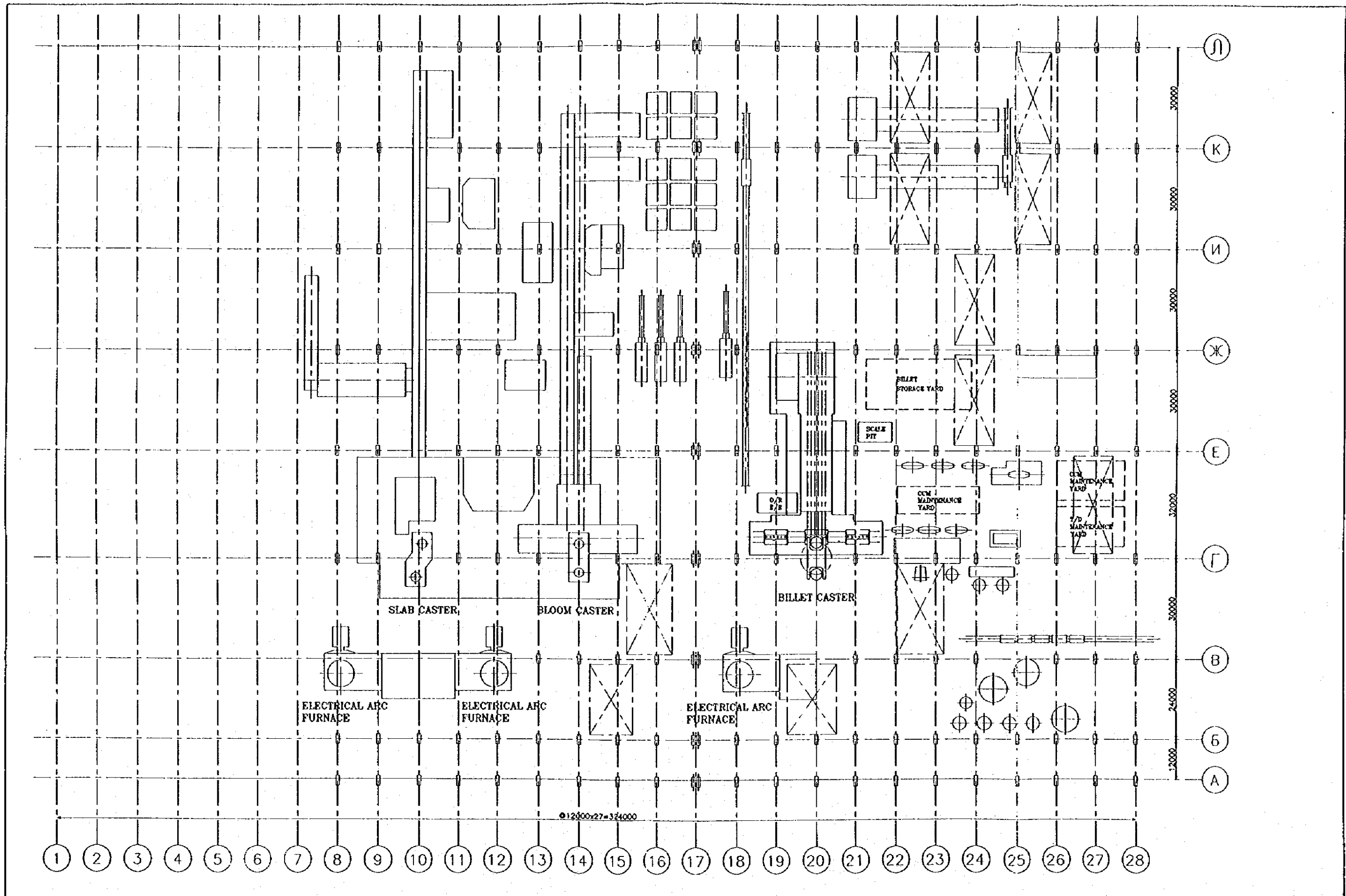
DWG. TITLE	PROJECT:
BILLET CASTER LAYOUT (PLAN-1)	BILLET CASTER
DWG. NO. 10-8-44	REV.



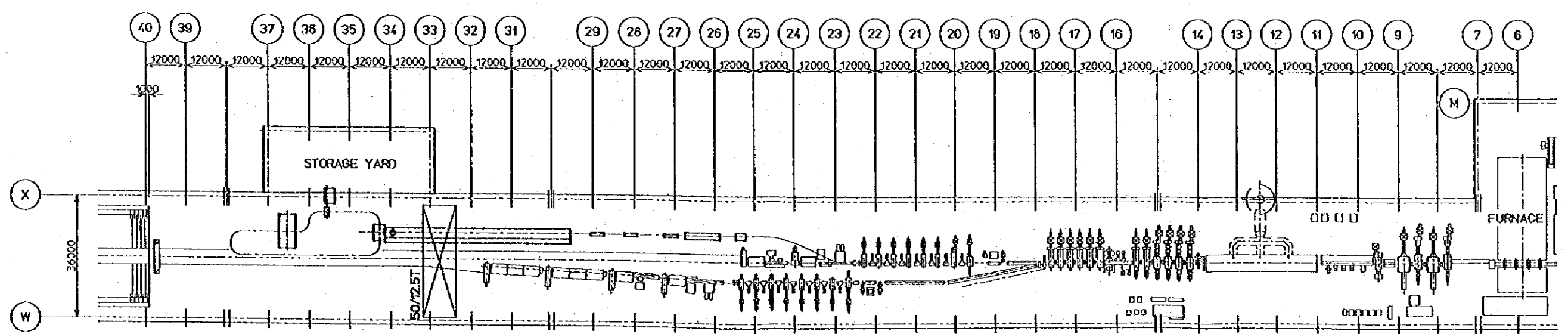
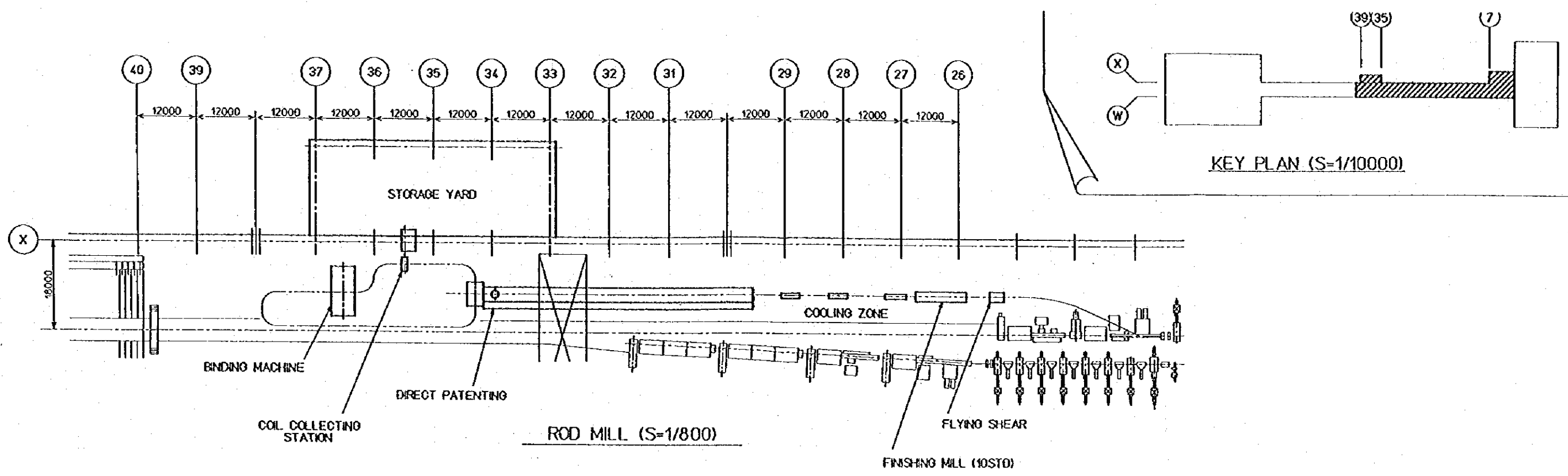
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CAD FN:KREM-BT2.DWG				ENGINEERING & CONSTRUCTION DIVISION		DRAWN			RETURN	CONSULTANT:		DWG. NO.
						DATE OF DWG			APPROVED SHOP	SCALE: 1/300		REV.
							Oct. 17 '95		FINAL			10-8-45



NO			REVISION			DATE			BY			NOTE			KAWASAKI STEEL KAWASAKI STEEL CORPORATION ENGINEERING & CONSTRUCTION DIVISION			APPROVED CHECKED DRAWN DATE OF Dwg 2. N. N. N. Dec 21 1955			NO. DATE FOR APPROVED RETURN APPROVED SHOP FINAL			CUSTOMER KREMNIKOVITZI STEEL WORKS CONSULTANT: SCALE: 1/1200			DWG. TITLE PARTIAL REPLACEMENT OF ROD MILL			PROJECT: THE STUDY OF RESTRUCTURING AND MODERNIZING THE STEEL INDUSTRY OF THE REPUBLIC OF BULGARIA DWG. NO. 10-8-46 SHEET		
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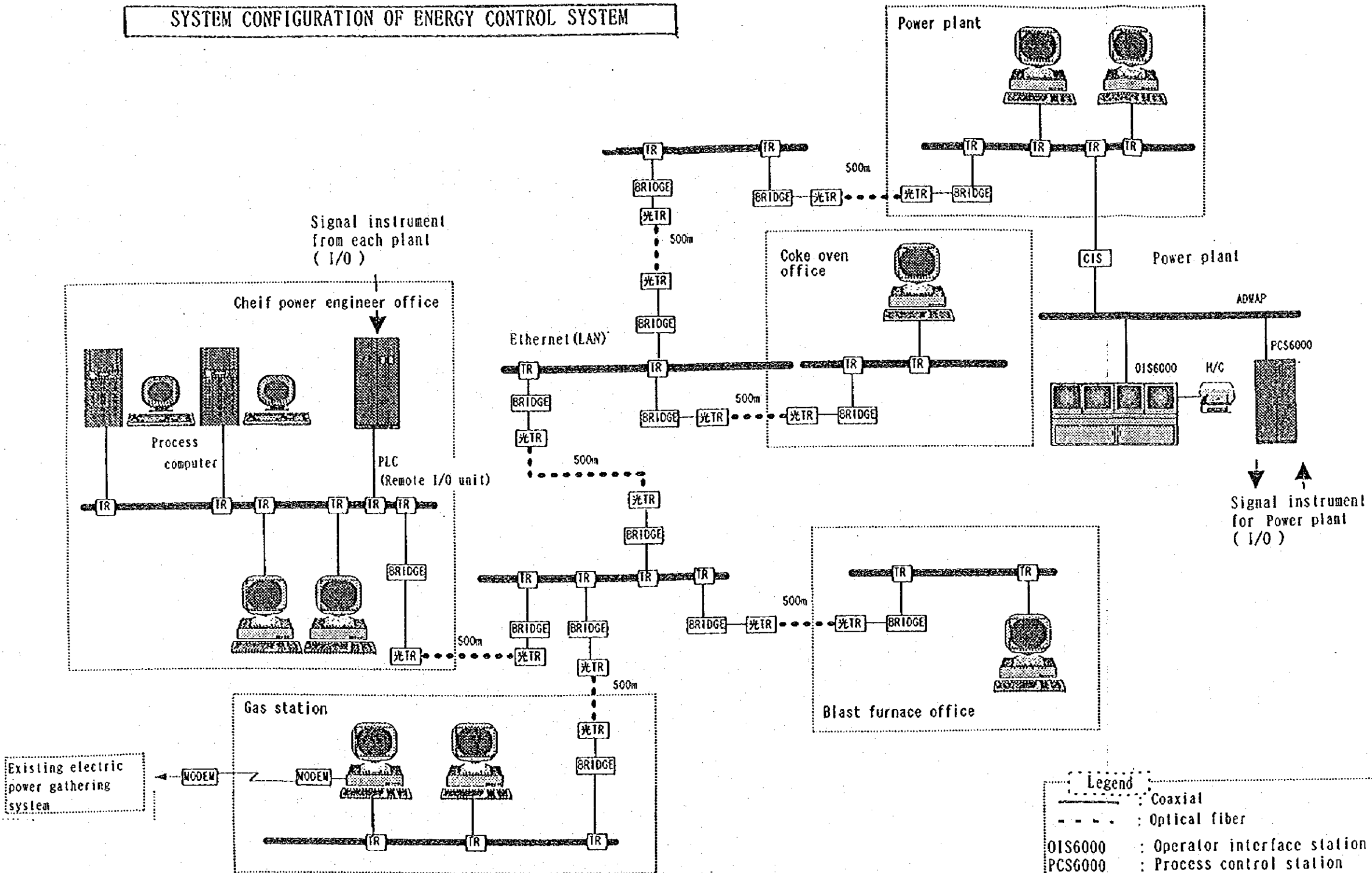
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					CAD FN:STOMANA1.DWG			Oct. 17 '95					



Verf. No. 2 95.12.18

NO.			REVISION	DATE	BY	NOTE:	<b>KAWASAKI STEEL</b> KAWASAKI STEEL CORPORATION ENGINEERING & CONSTRUCTION DIVISION		APPROVED: <i>Z. Hristov</i> CHECKED: DRAWN: DATE OF DRG: Dec. 21 1995	NO. DATE FOR APPROVED RETURN APPROVED SHOP FINAL	CUSTOMER: <b>PROMET STEEL WORKS</b> CONSULTANT: SCALE: 1/1200	DWG. TITLE: <b>PARTIAL REPLACEMENT OF ROD MILL</b>	PROJECT: <b>THE STUDY OF RESTRUCTURING AND MODERNIZING THE STEEL INDUSTRY OF THE REPUBLIC OF BULGARIA</b> DWG. NO. <b>10-8-48</b>	SHEET
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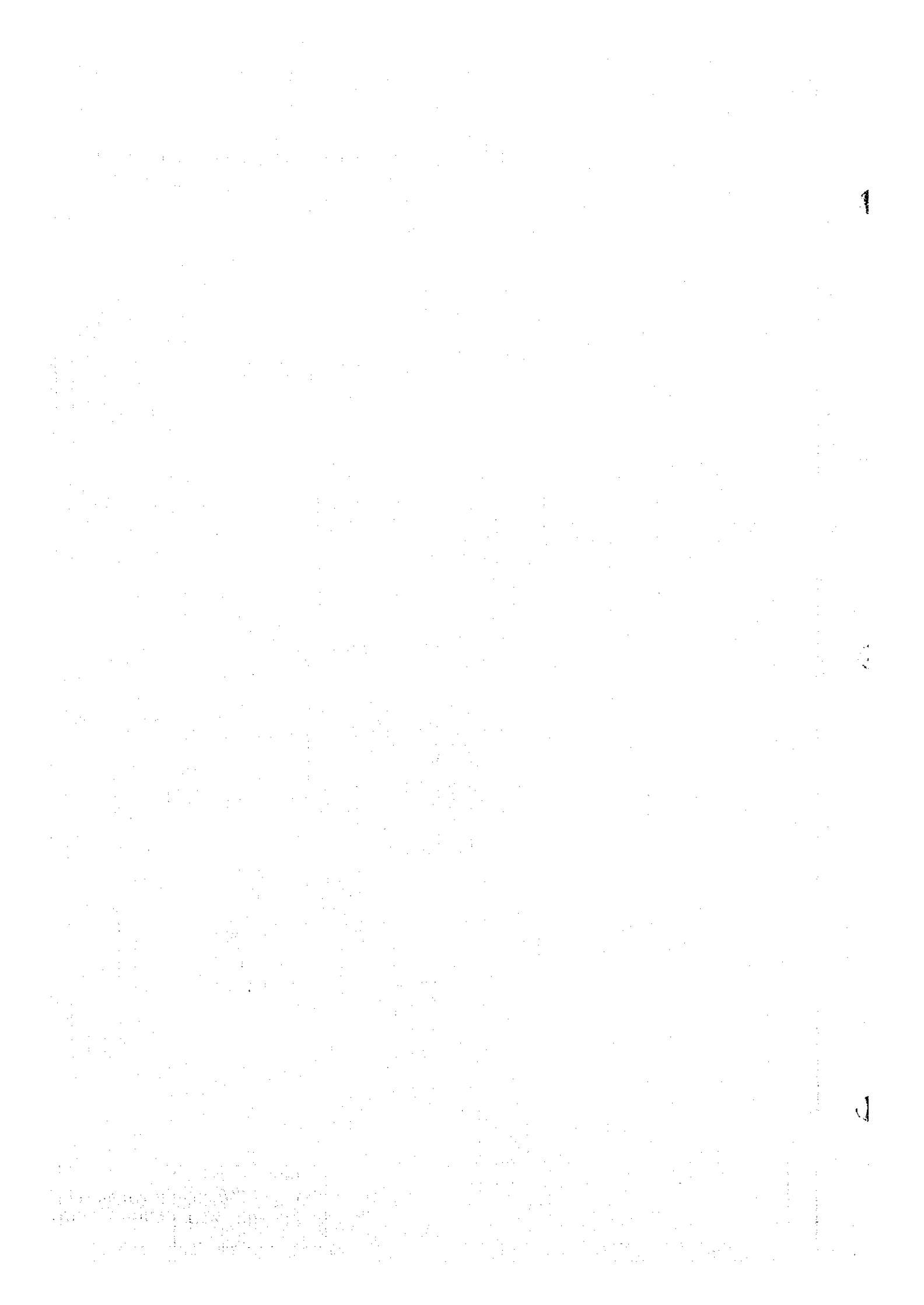
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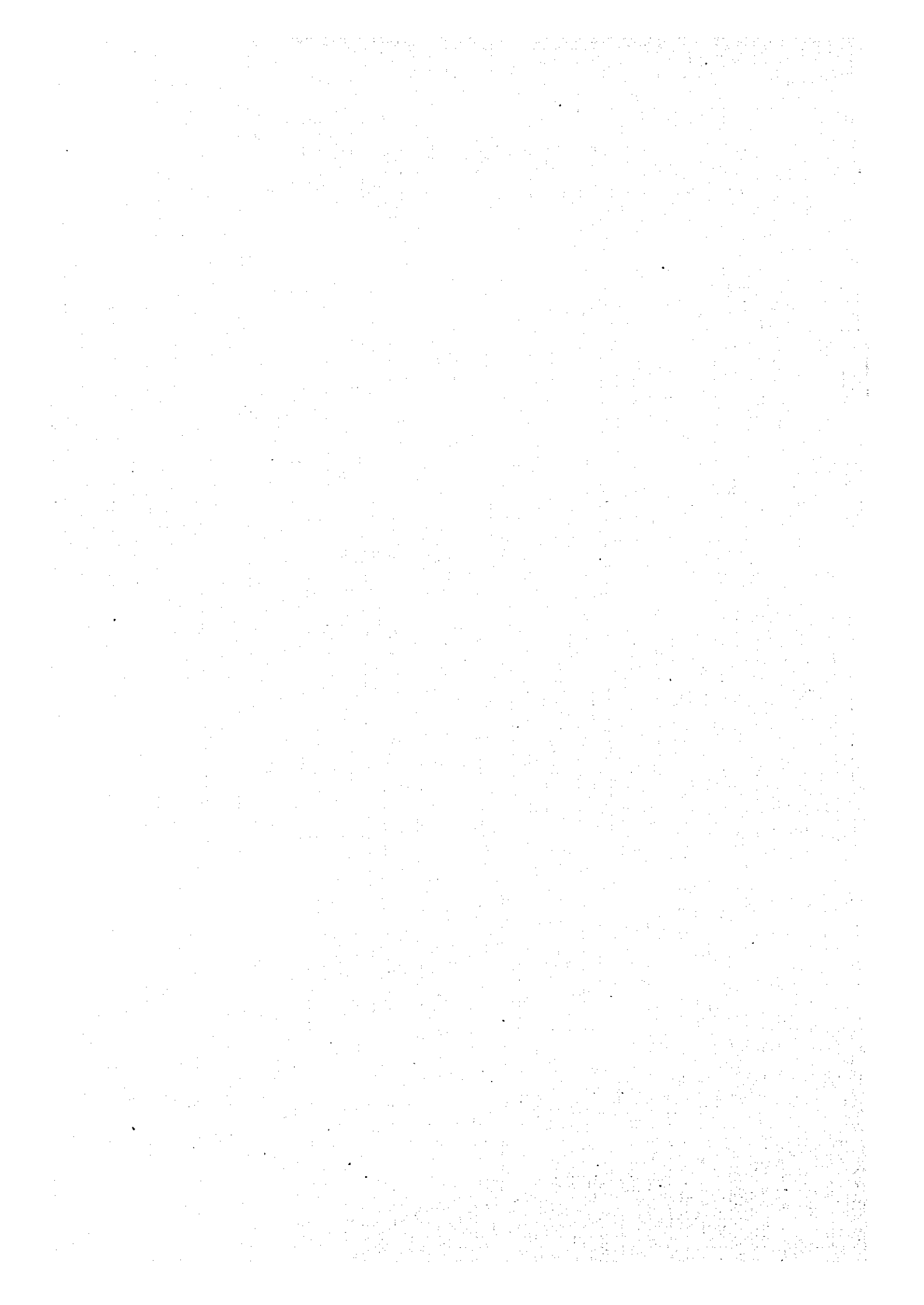


Revisions	Drawn	Date	Name	Title	Dwg.No.
	1996-2-8	SHIBATA	KAWASAKI STEEL CORPORATION ENGINEERING DIVISION	System Configuration of Energy Control System	10-8-49
	1996-2-20	8. Utsunomiya			









**Appendix 10-9**

**Man Power for Training and Operational Improvement**

Appendix 10-9-1 Manpower for Training in Japan

	Manpower (man-months)				Training days			
	First time		Second time		Total	G.C.	E.C.	Total
	Dom.	Bul.	Dom.	Bul.				
1.General guidance	1/4		1/4			1		
2.Management	1		3/4			2	5	
3.Sales	1		3/4			1	5	
4.Production control	1		3/4			2	5	
5.Production control system	1		3/4			2	5	
6.Quality control	1		3/4			2	5	
7.Maintenance (mechanicals)	1		3/4			2	5	
8.Maintenance (electrical)	1		3/4			1	5	
9.Environment	1		3/4			1	5	
10.Energy	1		3/4			1	5	
11.Coke& chemical	1		3/4				5	
12.Sinter	1		3/4				5	
13.Blast furnace	1		3/4				5	
14.Converter	1		3/4				5	
15.Continuous casting	1		3/4				5	
16.Hot rolling	1		3/4				5	
17.Cold rolling, surface treatment	1		3/4				5	
18.Rod, bar and shapes	1		3/4				5	
19.Pipe	1		3/4				5	
20.Administrators	3		2					
Total	21+1/4		15+3/4	37				

G.C. : General course      All managers have study this curriculum      3 weeks  
 E.C. : Expert course      Only experts take this course individually      1 week

Appendix 10-9-2 Manpower for Operational Improvement

1, Kremikovtzi (Dom. : work in Japan Bul : work in Bulgaria)

	Manpower (man-month)				Frequency			
	Engineer		Technician		Total	Engineer	Technician	Total
	Dom	Bul.	Dom	Bul.				
Coke -operation	1	1.5				2		
Coke- maintenance	1	1.5				2		
Chemica-operation	1	1.5				2		
Chemical-maintenance	1	1.5				2		
Sinter - operation	1	1.5				2		
Sinter-maintenance	1	1.5				2		
BF-operation	1	1.5				2		
BF-maintenance	1	1.5				2		
LD - operation	4	2		4		1		2
LD - maintenance	4	2		4		1		2
EAF - operation	4	2		4		1		2
EAF - maintenance	4	2		4		1		2
Hot strip mill-operation	1	5	1	5		2		2
Cold strip mill-operation	4	4	4	4		2		2
Coating-operation		0.5		1		1		1
Rod mill-operation	2	2		1.5		2		2
Pipe making-operation	1	1.5				3		
Total	32	33	5	27.5		30		15

2.Stomana

EAF - operation	4	2		4		1		2
EAF - maintenance	4	2		4		1		2
LF - operation	2	2		2		1		1
CC - operation	6	12		8		6		4
Plate- operation	1	3	1	3		2		2
Total	17	21	1	21		11		11

Appendix 10-10

Energy Balance after Improvement

Appendix 10-10-1

Power Balance after Improvement at Kremikovtzi

Scenario-A-C

1. Electric power - Actual (1993)-

Production	Kt-s/y		Demand
	Average Mw	Annual amount EG-Kwh	
Purchased power	36	857.08	123
Generated power (own use)	40	346.2	
Total power	147	1233.38	
			Products (Kt)
Coke ovens	3	25.7	1135
Sinter	18	155.5	1801.6
BF	1	6.95	1013.4
Converter	2	15.8	1131.5
EF	24	213.2	344.8
Slab/bloom	8	67.4	1252.4
Hot strip	8	66.1	535.5
Billie/rod	5	52.2	629.1
Bar/wire	3	22.12	216.4
Cold rolling	5	39.9	
Oxygen plant	28	247.3	
Nitrogen plant	1	7.2	
Compressed air	7	58.5	
Others	19	164.21	
Loss	7	61.2	
Total	140	1203.28	

Power unit consumption 869 Kwh/t

2. Electric power - after improvement-

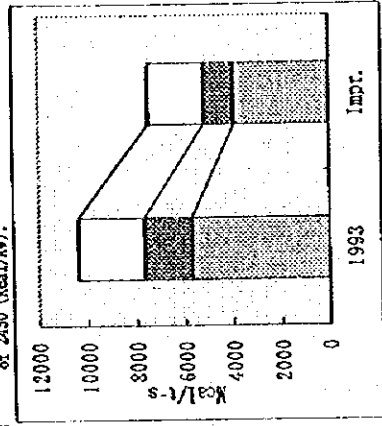
Production	Kt-s/y		Demand
	Average Mw	Annual amount EG-Kwh	
Purchased power	83	730.21	104
Generated power (own use)	40	347.1	
Total power	122	1157.41	
			Products (Kt)
Coke ovens	3	29.6	658
Sinter	9	80	1454
BF	4	34.7	981
Converter	2	21.6	1120
EF	20	177	354
CC	5	44.8	1400
Hot strip	12	103.3	915
Rod/shape	4	34.9	210
Cold rolling	5	44.4	
Oxygen plant	25	215.9	
Nitrogen plant	1	7.2	
Compressed air	7	58.5	
Others	19	164.21	
Loss	7	61.2	
Total	123	1077.31	

Power unit consumption 785 Kwh/t

Crude steel	Energy unit consumption			1993 Sold
	Coal	NG	Power	
1476.3	5689	1976	2683	10385
			1422 *	9124

Crude steel	Energy unit consumption			S.C. - A.C. Sold
	Coal	NG	Power	
1474	3917	1269	2289	7513
			1214 *	6438

\* Adjusted power unit consumption by Japanese value of 2450 (Kcal/tw).



[Note] Calorific value:

- Coking coal: 7400 Kcal/kg
- Natural gas: 8000 Kcal/m<sup>3</sup>
- Electric power: Kremi. 4621 Kcal/kwh, Jptl. 2450 Kcal/kwh
- PCI coal: 5800 Kcal/kg



Appendix 10-10-2

Power Balance after improvement at Kremkoyuzi

Scenario-A-2, C-2

1. Electric power - Actual (1983) -

Production	Kt-m/y		Demand
	Average	Annual amount	
Purchased power	66	857.08	123
Generated power (own use)	40	346.2	
Total power	106	1203.28	
Coke ovens	3	25.7	1335
Sinter	18	155.5	1801.6
BF	1	6.95	103.4
Converter	2	15.8	1131.5
EF	24	213.2	344.8
Slab/Anne	8	67.4	1252.4
Hot strip	8	66.1	585.5
Roller/rod	6	52.2	629.1
Bar/air	3	22.12	216.4
Cold rolling	5	39.3	
Oxygen plant	28	247.3	
Nitrogen plant	1	7.2	
Compressed air	7	58.5	
Others	19	164.21	
Loss	7	61.2	
Total	140	1203.28	

Power unit consumption 859 Kwh/t

2. Electric power - after improvement -

Production	Kt-m/y		Demand
	Average	Annual amount	
Purchased power	74	646.11	36
Generated power (own use)	39	342.8	
Total power	113	988.91	
Coke ovens	4	39.3	873
Sinter	12	107.3	1850
BF	5	46.6	1330
Converter	3	28.4	1474
EF	0	0	0
CC	5	44.8	1400
Hot strip	12	103.3	915
Roll/Anne	0	0	0
Cold rolling	4	34.9	210
Oxygen plant	28	248.8	
Nitrogen plant	1	7.2	
Compressed air	7	58.5	
Others	19	164.21	
Loss	7	61.2	
Total	112	988.91	

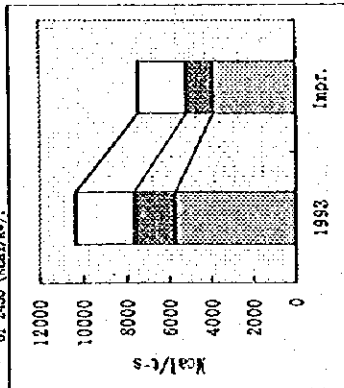
Power unit consumption 725 Kwh/t

Crude steel	Energy unit consumption			1993	Solid
	Coal	NG	Power		
1476.3	5689	1975	2683	51	10385
			1422		9124

Crude steel	Energy unit consumption			1993	Solid
	Coal	NG	Power		
1474	3204	917	2926	51	8185
			1074 *		7233

\*: Adjusted power unit consumption by Japanese value of 2450 (Kcal/Kwh).



(Note)

Calorific value:  
 Coking coal: 7400 Kcal/kg  
 Natural gas: 8000 Kcal/m<sup>3</sup>  
 Electric power: Kremi. 4621 Kcal/Kwh  
 Jpn. 2450 Kcal/Kwh  
 PCI coal: 6800 Kcal/kg

Appendix 10-10-3

Power Balance after improvement at Kremikovtzi

Scenario-8-1, B-2

1. Electric power - Actual (1993) - Production

Production	Kt-s/y		Demand
	Average Kw	Annual amount EB-Kwh	
Purchased power	36	657.08	126
Generated power (own use)	9	346.2	
Total power	147	1233.38	
			Products(Kt)
Coke ovens	3	25.7	1135
Sinter	18	155.5	1801.6
BF	1	6.95	1013.4
Converter	2	15.8	1131.5
EF	24	213.2	344.8
Slab/blank	8	67.4	1252.4
Hot strip	8	66.1	585.5
Billet/rod	6	52.2	629.1
Bar/wire	3	22.12	216.4
Cold rolling	5	39.9	
Oxygen plant	28	247.3	
Nitrogen plant	1	7.2	
Compressed air	7	58.5	
Others	19	164.21	
Loss	7	61.2	
Total	140	1203.28	

Power unit consumption

869 Kwh/t

2. Electric power - after improvement - Production

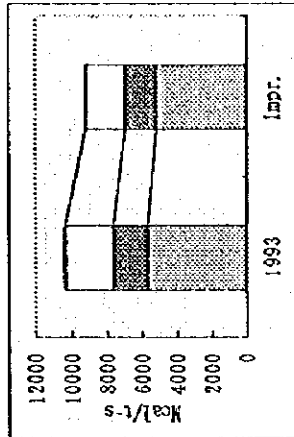
Production	Kt-s/y		Demand
	Average Kw	Annual amount EB-Kwh	
Purchased power	55	475.21	69
Generated power (own use)	9	317	
Total power	100	875.31	
			Products(Kt)
Coke ovens	3	26.4	587
Sinter	8	70.9	1289
BF	4	30.8	878
Converter	2	19.2	993
EF	0	0	0
CC	3	30.2	943
Hot strip	12	103.3	915
Roll/shape	0	0	0
Cold rolling	5	44.4	
Oxygen plant	20	178.9	
Nitrogen plant	1	7.2	
Compressed air	7	58.5	
Others	19	164.21	
Loss	7	61.2	
Total	91	795.21	

Power unit consumption

881 Kwh/t

Crude steel	Energy unit consumption			1993 Sold
	Coal	NG	Power	
1476.3	5689	1975	2683	13
			1422 *	9124
Crude steel	Energy unit consumption			1993 Sold
	Coal	NG	Power	
993	5182	1801	2225	13
			1180 *	8225

\*: Adjusted power unit consumption by Japanese value of 2450 (Kcal/Kwh).



(Note)

Calorific value:  
 Coking coal 7400 Kcal/Kg  
 Natural gas 8000 Kcal/Kwh  
 Electric power Kremi. 4621 Kcal/Kwh  
 Jpn. 2450 Kcal/Kwh  
 PCI coal 6800 Kcal/Kg

Appendix 10-10-4

Power Balance after Improvement at Kremkoytzi

Scenario-D-1, -2, -3

1. Electric power - Actual (1993) -

Products	Kt-s/y		Demand
	Mw	EB-Kwh	
Purchased power	98	457.06	123
Generated power (own use)	40	346.2	
Generated power (own use)	9	80.1	
Total power	147	1283.38	
			Products(Kt)
Coke ovens	3	25.7	1135
Sinter	18	155.5	1801.6
BF	1	6.95	1013.4
Converter	2	15.3	1131.5
EF	24	213.2	344.8
Slab/blade	8	67.4	1252.4
Hot strip	8	66.1	585.5
Roller/rod	6	52.2	829.1
Surf/ire	3	22.12	216.4
Cold rolling	5	38.9	
Oxygen plant	23	247.3	
Nitrogen plant	1	7.2	
Compressed air	7	58.5	
Others	19	164.21	
Loss	7	61.2	
Total	140	1283.28	

Power unit consumption 369 Kwh/t

2. Electric power - after improvement -

Products	Kt-s/y		Demand
	Mw	EB-Kwh	
Purchased power	34	731.3	105
Generated power (own use)	41	359.8	
Generated power (own use)	9	80.1	
Total power	154	1171.4	
			Products(Kt)
Coke ovens	0	0	0
Sinter	0	0	0
BF	0	0	0
Converter	0	0	0
EF	57	496.5	883
GC	3	28.8	580
Hot strip	12	103.3	915
Roll/blade	4	34.3	210
Cold rolling	5	44.4	
Oxygen plant	15	134	
Nitrogen plant	1	7.2	
Compressed air	5	47.3	
Others	15	132.7	
Loss	7	61.2	
Total	124	1091.3	

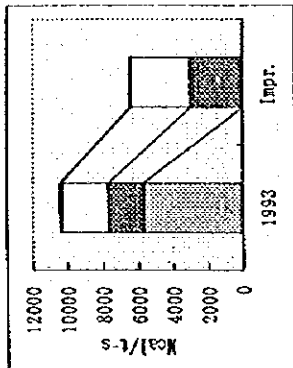
Power unit consumption 1180 Kwh/t

Energy unit consumption			
Crude steel	Coal	NG	Power
1476.3	5639	1975	2683
			1422
			9124

Energy unit consumption			
Crude steel	Coal	NG	Power
983	0	3007	3404
			1805 *
			4862

\*: Adjusted power unit consumption by Japanese value of 2450 (Kcal/te).



(Note) Caloric value :  
Coking coal 7400 Kcal/te  
Natural gas 8000 Kcal/te  
Electric power Kreai: 4621 Kcal/te  
Jpn: 2450 Kcal/te

Scenario- A -C

Appendix 10-10-5 Fuel Balance after improvement at Kremikovtzi

1. Fuel balance -actual (1993)-

Consumption		Power plant	Sinter	Converter	EF	Slab/bloom	HOT	Billet/rod	Bar/wire	Cold	Others	Total
COG	E6-Nm3/y	128					2.5			11.8	39.2	181.5
DES COG	E6-Nm3/y	38.8								7.78		7.78
TAR	E6-K1/y	926.9					6.1			21.7	37	991.7
BFG	E6-Nm3/y	166	19.15	10.5	2.03	53.8	60.4	29.8	12.7	7.4	2.72	364.5
NG	E6-Nm3/y			6.66						1.7	1.14	9.5
H. oil	E6-l/y											

Production Consumm.rate

Purchased		Production	
NG purchased	E6-Nm3/y	364.5	1135
H. oil	E6-l/y	9.5	713
			1013
			1010

Fuel unit consumption 4538 Mcal/t-s

2. Fuel balance -after improvement- Scenario-A -C

Consumption

Consumption		Power plant	Sinter	Converter	EF	CC	HOT	Rod/shape	Cold	Others	Total
COG	E6-Nm3/y	75.02					2.5		11.8	39.2	136.3
DES COG	E6-Nm3/y	22.5							7.78		22.5
TAR	E6-K1/y	1423.1					6.1		21.7	37	1487.9
BFG	E6-Nm3/y	143	2.73	5.26	1.27	8.75	51.47	11.18	7.4	2.72	233.78
NG	E6-Nm3/y			6.66					1.7	1.14	9.5
H. oil	E6-l/y										

Production Consumm.rate

Purchased		Production	
NG purchased	E6-Nm3/y	233.78	235
H. oil	E6-l/y	9.5	98.7
			2231.4
			743.5
			22.5

Fuel unit consumption 3291 Mcal/t-s  
Power generation in average: 40W

Scenario- A-2, C-2

Fuel Balance after Improvement at Kremikovtzi

Appendix 10-10-6

1. Fuel balance -actual (1993)-

Consumption

	Power plant	Sinter	Converter	EF	Slab/bloom	HOT	Billet/rod	Bar/wire	Cold	Others	Total
COG	E6-Nm3/y	128				2.5			11.8	39.2	181.5
DES	E6-Nm3/y	38.8							7.78		7.78
TAR	E6-K1/y	926.9				6.1			21.7	37	991.7
BFG	E6-Nm3/y	166	19.15	10.5	2.03	60.4	29.8	12.7	7.4	2.72	364.5
NG	E6-Nm3/y										
H. oil	E6-l/y			6.66					1.7	1.14	9.5

Purchased

NG purchased	E6-Nm3/y	364.5
H. oil	E6-l/y	9.5

Production

COG production	E6-Nm3/y	395.28
COG own use	E6-Nm3/y	206
BFG production	E6-Nm3/y	2270.7
BFG own use	E6-Nm3/y	1279
Tar production	E6-l/y	38.8

Consumption

	Consumption	765
	Consumption	713
	Consumption	1010

Fuel unit consumption 4538 Mcal/t-s

2. Fuel balance -after improvement- Scenario-A-2, C-2

Consumption

	Power plant	Sinter	Converter	EF	CC	HOT	Rod/shape	Cold	Others	Total
COG	E6-Nm3/y	119.57				2.5			11.8	39.2
DES	E6-Nm3/y	29.86							7.78	
TAR	E6-K1/y	1932				6.1			21.7	37
BFG	E6-Nm3/y	77	3.57	6.93	8.75	51.47	11.18	7.4	2.72	169.02
NG	E6-Nm3/y									
H. oil	E6-l/y			6.66					1.7	1.14

Purchased

NG purchased	E6-Nm3/y	169.02
H. oil	E6-l/y	9.5

Production

COG production	E6-Nm3/y	311.8
COG own use	E6-Nm3/y	130.95
BFG production	E6-Nm3/y	2984.7
BFG own use	E6-Nm3/y	997.9
Tar production	E6-l/y	29.86

Consumption

	Consumption	530
	Consumption	600
	Consumption	600

Fuel unit consumption 3602 Mcal/t-s

Power generation in average: 39Mw

Scenario-B-1, B-2

Fuel Balance after Improvement at Kremikovtzi

Appendix 10-10-7

1. Fuel balance -actual (1993)-

Consumption		Power plant	Sinter	Converter	EF	Slab/boom	HOT	Billet/rod	Bar/wire	Cold	Others	Total
COG	E6-Nm3/y	128					2.5			11.8	39.2	181.5
DES COG	E6-Nm3/y									7.78		7.78
TAR	E6-Kl/y	38.8					6.1			21.7	37	38.8
BFG	E6-Nm3/y	926.9	19.15	10.5	2.03	53.8	60.4	29.8	12.7	7.4	2.72	991.7
NG	E6-Nm3/y	168		5.66						1.7	1.14	364.5
H. oil	E6-l/y											9.5

Purchased		Production Consumm.rate											
NG purchased	E6-Nm3/y	364.5											
H. oil	E6-l/y	9.5											
Production													
COG production	E6-Nm3/y	395.28											
COG own use	E6-Nm3/y	206											
BFG production	E6-Nm3/y	2270.7											
BFG own use	E6-Nm3/y	1279											
Tar production	E6-l/y	38.8											
Fuel unit consumption		4538 Mcal/t-s											

2. Fuel balance -after improvement- Scenario-B-1, -2

Consumption

Consumption		Power plant	Sinter	Converter	EF	CC	HOT	Rod/shape	Cold	Others	Total
COG	E6-Nm3/y	60.37					2.5		11.8	39.2	121.65
DES COG	E6-Nm3/y								7.78		
TAR	E6-Kl/y	20.08					6.1		21.7	37	20.08
BFG	E6-Nm3/y	1255.1	2.42	4.67	0	5.89	51.47	0	7.4	2.72	1319.9
NG	E6-Nm3/y	149		6.66					1.7	1.14	223.57
H. oil	E6-l/y										9.5

Purchased		Production Consumm.rate											
NG purchased	E6-Nm3/y	223.57											
H. oil	E6-l/y	9.5											
Production													
COG production	E6-Nm3/y	209.7											
COG own use	E6-Nm3/y	88.05											
BFG production	E6-Nm3/y	1979.2											
BFG own use	E6-Nm3/y	659.3											
Tar production	E6-Kl/y	20.08											
Fuel unit consumption		4390 Mcal/t-s											
Power generation in average:		36MW											

Production 993 Kt/y

	Power plant	(Lime)	EF	CC	HOT	Rod/shape	Cold	Others	Total
COG	E6-Nm3/y				2.5		11.8	39.2	-
COG DES	E6-Nm3/y						7.78		-
TAR	E6-KG/y								-
BFG	E6-Nm3/y		3.56	5.8	6.1	11.18	21.7	37	-
NG	E6-Nm3/y				51.47		7.4	2.27	-
H.oil	E6-1	6.66					0	1.14	7.8
LP steam	E6-Mcal								551.3
Hot water	E6-Mcal								133.9
Purchased NG	E6-Nm3/y		3.56	5.8	53.33	11.18	19.36	25.57	373.2

Generated power	359.8	E6-Mwh	41.1	Mw
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Fuel unit consumption 3068 Mcal/t-s

Appendix 10-10-9

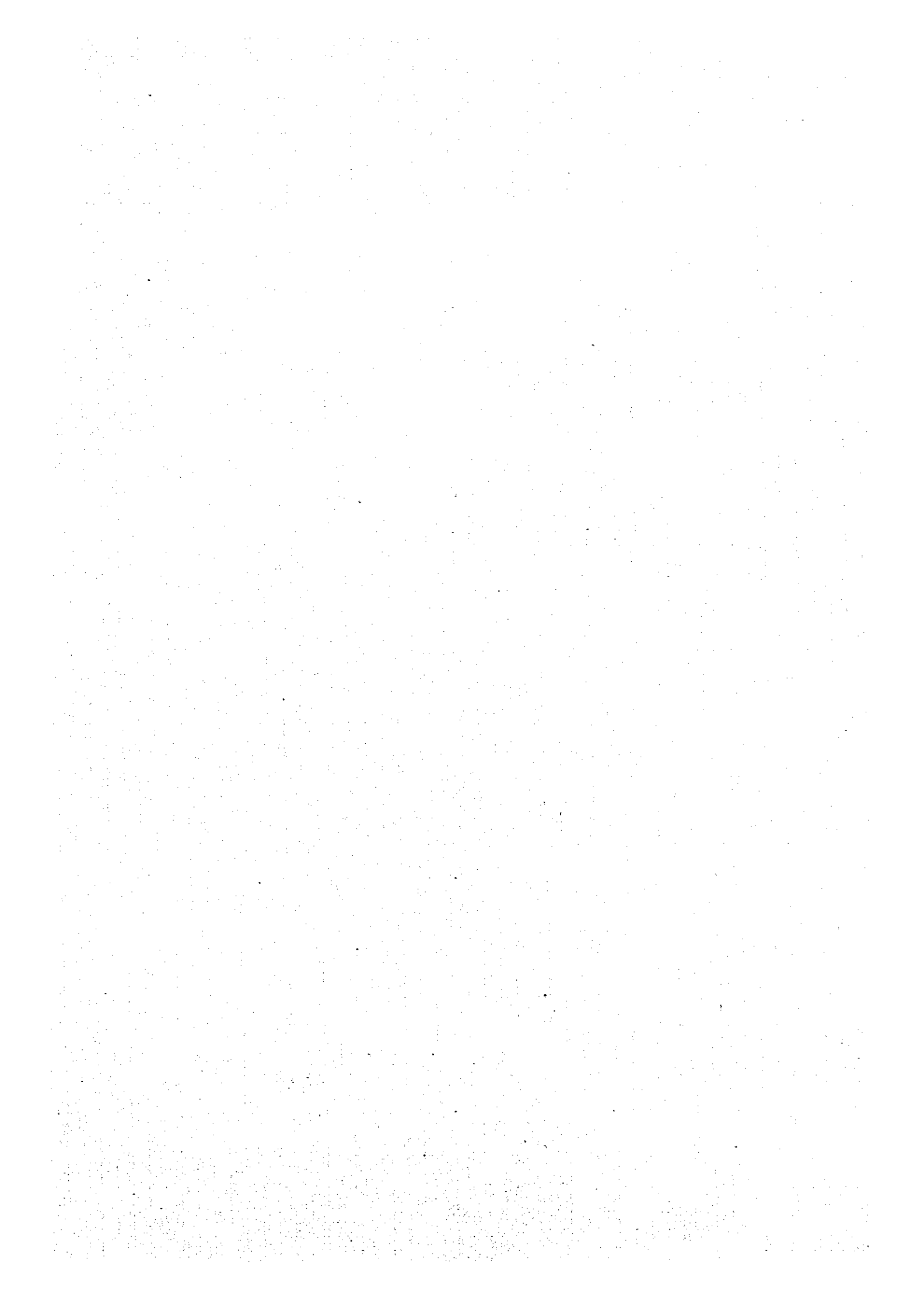
Energy Balance after Improvement

Note: Values show annual production / consumption.

Stomana	Scenario	A-A-2			C, C-2			B-1,D-2			D-1			B-2,D-3			
		Unit consumption (Kwh/t)	Production (Kt)	Power (EB-Kwh) (EB-Mwh)	NC (EB-Mwh)	Production (Kt)	Power (EB-Kwh) (EB-Mwh)	NC (EB-Mwh)	Production (Kt)	Power (EB-Kwh) (EB-Mwh)	NC (EB-Mwh)	Production (Kt)	Power (EB-Kwh) (EB-Mwh)	NC (EB-Mwh)			
BY/CC	610	170	546	383.1	11.6	521	317.8	11.1	1002	611.2	21.3	1027	626.5	21.8	1002	611.2	21.3
Plate	79	1024	210	16.6	26.9	210	16.6	26.9	210	16.6	26.9	210	16.6	26.9	210	16.6	26.9
Middle shape/Bar	125	745	238	29.8	22.2	0	0	0	0	0	0	0	0	0	0	0	0
Lime				3.8	13.9		3.7	13.3		6.5	23.5		6.7	24		6.5	23.5
Air sep.				62.4			60			105.8			108.2			105.8	
Other				65	16.5		63.4	16.1		95	24.1		96.7	24.5		95	24.1
Total				510.7	91.1		461.5	67.4		835.1	95.8		854.7	97.2		835.1	95.8
Unit consump.				935	1335		886	1035		833	765		832	757		833	765
Energy unit consump. per ton of crude steel				3683	3683		3264	3264		2838	2838		2827	2827		2838	2838
Fromet																	
Bar and shape	174	377		238	41.4	11.2	238	41.4	11.2	238	41.4	11.2	238	41.4	11.2	391	58
Other					10	1.4	10	1.4		10	1.4		10	1.4		10	1.4
Total	216	424		953 Total (Mcal/t)	51.4	12.6	51.4	12.6		51.4	12.6		51.4	12.6		78	19.8







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