Appendix 10-8

Main Specifications for Improvement

Appendix 10-8 Main Specifications for Improvement

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2.Stomana Seelworks

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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 Nm3/h H2S Component : 7 g/Nm3 Reduction rate of sulfur by plan : 90% By-product recovered:molten sulfur Type Wet type sulfur recovery process with NH3
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-SOx equipment	1 set	To be studied in future
6	De-NOx 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	4 sets	
	Type		Direct ignition, open box type
	Dimension		Length : Approx. 2.5 m
			Width : For 2.8 m wide pallet
	Height		500 mm + 200 mm - 200 mm (Adjustable by jacks)
	Gas & air for combustion		Natural gas Max. 180 Nm3/h Calorie : 8000 kcal/Nm3 Pressure: Min. 250 mmAq (At header) Air Max. 1220 Nm3/h Pressure: Min. 250 mmAq (At header)
	Air fan		Type : Radial fan Air flow : 16000 Nm3/h Pressure : 600 mmAq Speed : 3600 rpm
	Material		Cast iron and cast steel Carbon steel Piping Refractory
			80000 —— 15000 kcal/t or Less

NO.	Equipment	Quantity	Main specifications
2	Hearth layer material charging equipment	4 sets	
(1)	Hopper		Capacity : 10 m3 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 conveyor		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		

Plant : Sinter Plant

NO.	Equipment	Quantity	Main specifications
3	Automation	4 sets	To be studied in future Process computer DCS (Distributed Control System) PLC (Programable Logic Controller) Modification of weighing system Modernization of instrumentation equipment
4	Replacement of pallet side wall		
(1)	Pallet	320 sets	Increase in side wall from 250 to 500 mm
(2)	Fan	4 sets	Replacement Gas volume : 320000 Nm3/h Gas temperature : 150 degree cel. Gas pressure : -2000 mmAq
5	Prevention of air leakage	4 sets	To be carried out by Kremikovtzi
6	Improvement of dedusting efficiency	4 sets	
(1)	Preduster		To be discussed in the environmental control section report

Plant : Sinter Plant

NO.	Equipment	Quantity	Main specifications
(2)	Electric precipitator	4 sets	Gas volume : 320000 Nm3/h Gas temperature : 150 degree cel. Dust contents : Inlet 5 g/Nm3 Outlet 30 mg/Nm3
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 m3 (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 Nm3/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 Nm3/h BFG Max. 1690 Nm3/h Outlet gas : Approx. 25500 Nm3/h Max. 260 degree cel.
(5)	Combustion air fan	2 sets	Air volume : 19 Nm3/min Pressure : 400 mmAq
(6)	Bag filter	2 sets	Full case, pulse jet type Gas volume : 700 m3/min at 85 degree cel. Pressure : -1000 mmAq Filter area : Approx. 700 m2 Heat resistant Outlet dust : 0.03 g/Nm3

NO.	Equipment	Quantity	Main specifications
(7)	Main blower	2 sets	Double bearing support Centrifugal type Capacity : 700 m3/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 m3
(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 m3 (100 ton)
(12)	Bin filter	2 sets	Bin-mount, pulse jet type Gas volume : 40 m3/min at 80 degree cel. Pressure : 400 mmAq Filter area : Approx. 35 m2 Heat resistence (Up to 110 degree cel.) Outlet dust : 0.03 g/Nm3
(13)	Steel structure	2 sets	For pulverizer station
(14)	Piping, duct and accessories	2 sets	

NO.	Equipment	Quantity	Main specifications
1.2	Coal injection and distribution equipment		
(1)	Intermediate tank	2 sets	Volume : Net 12 m3 Gross 15 m3 Pressure : 9.9 kg/cm2G Aeration pad at the bottom Load cells
(2)	Injection tank	2 sets	Volume : Net 20 m3 Gross 25 m3 Pressure : 9.9 kg/cm2G Aeration pad at the bottom Load cells Nozzle for blow-off of PC
(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 m3 Pressure : 7.0 kg/cm2G Aeration pad, load cells

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 Nm3/min Pressure : 10.8 kg/cm2G at delivery Ancillary equipment Air dryer Instrumentation air dryer Air receiver Instrumentation air dryer
(2)	N2 compressor and ancillary equipment	3 sets	Oil-free reciprocating type (Water cooled) Capacity : 27 Nm3/min Pressure : 9.9 kg/cm2G at delivery Ancillary equipment N2 receiver N2 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	

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	For NOs. 1 BF & 3 BF Direct insertion type Zirconia oxygen analyzer Range : 0 to 5 % (% 02) 0 to 10 % (% 02) 0 to 25 % (% 02) Output : 4 to 20 mA Gas conditions : Temp. : Max. 600 degree cel. Dust : Max. 30 g/Nm3 Pressure: Approx. 500 mmAq SOx : 0 to 2000 ppm NOx : 0 to 500 ppm Electricity : AC 100 V +10 V -10 V
(2)	Air control valve	3 sets	For NO. 3 BF Butterfly valve (electrical drive) Diameter: 800 mm dia.
(3)	Electrical and instrumentation equipment	6 sets	Including control system

Plant : Blast Furnace

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^3/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

Appendix 10-8-5 Main Specifications for Improvement

(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. 70m³/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

Appendix 10-8-6 Main Specifications for Improvement

(3) Gunning device for converter

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

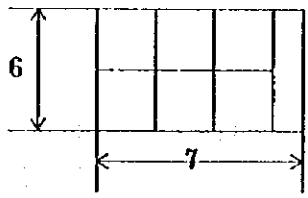
1 set/converter

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 m³ 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 8Nm³/min Water : 200 ~ 300kPa More than 100l/min
8	Weight		App. 5.0 tons

(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 CaF_2 = 20 m^3 Coke = 20 m^3 Ore = 20 m^3 FeMn = 20 m^3 SiMn = 20 m^3 FeSi = 20 m^3 Al = 20 m^3 Feeder 100kg/min × 7
2	Weigh Hopper	2 sets	Capacity 5m^3 × 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  Approximate weight Hopper 60ton/unit Weigh Hopper 7 ton/unit Chute 3 ton/unit Others 1 ton/unit

Appendix 10-8-8 Main Specifications for Improvement

(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 800m³/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 m³ 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 8Nm³/min Water : 200 ~ 300kPa More than 100l/min
7	Weight		Powder feeding device : App. 3.0 ton Gunning lance device : App. 4.0 ton

(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. 90Nm³/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 (3.6×10^6kcal/h)/unit Fuel (gas) = Max. 450 Nm^3/h/unit Oxygen = Max. 800 Nm^3/h/unit Air = Max. 80 Nm^3/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^3/min Oxygen Min. 700 kPa, min. 4Nm^3/min Air Min. 500 kPa, min. 5Nm^3/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

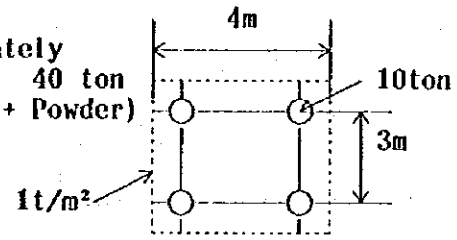
No	Equipment	Quantity	Main Specifications
1	Car Capacity	--	Load : Max. 180 ton Ladle weight 50 ton Molten steel Max. 130 ton
2	Car	1 set	Type : Steel structure, welded type covered with refractory (castable) Height of ladle stand from rail : 2,000mm {Ladle=Top ϕ3,100mm ×3,700mm H (Appr.)} Castable thickness on car : 100mm H
3	Car driving device	1 set	Travel distance Approximately 40m Rail 100 kg/m rail× 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 tytpe)
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

Appendix 10-8-13 Main Specifications for Improvement

(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 m³ Capacitance level instrument 3 sets/silo Bag filter 8 m²
2	Blowing tank	1 set	Tank Volume 2 m³ 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. 12m³/min
5	Weight		Approximately 40 ton (Equip. + Powder) 

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
ϕ 100mm、ϕ 120mm、ϕ 140mm × Max. length 12m

Required billet : 457,000 ton/year
(Production) (Mainly □ 120mm、ϕ120mm)

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 □ 120mm Billet, ϕ120mm Billet Strands : 6 Curved tubular mold : 100mm× 100mm ϕ100mm 120mm× 120mm & ϕ120mm 150mm× 150mm ϕ140mm Radius : 7m
1.2	Mold level control	6	Level sensing by γ-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
ϕ 100mm、ϕ 120mm、ϕ 140mm × Max. length 12m

Required billet : 225,000 ton/year
(Production) (Mainly □ 120mm、ϕ120mm)

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 □ 120mm Billet, ϕ120mm Billet Strands : 4 Curved tubular mold : 120mm× 120mm & ϕ100mm ϕ120mm ϕ140mm Radius : 7m
1.2	Mold level control	4	Level sensing by γ-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

03 Billet caster (300,000ton/year)

A. Required billet

Heat size : 100ton/charge

Billet size : □ 100mm、φ 115mm、φ 150mm× 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 □ 115mm Billet Strands : 4 Curved tubular mold : 100mm× 100mm 115mm× 115mm 150mm× 150mm Radius : 7m
1.2	Mold level control	4	Level sensing by γ-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 ϕ 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 ϕ 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

Appendix 10-8-18 Main Specifications for Improvement

Plant : NDI Line (Seamless) of TRM in Kremikovtzi

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 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 : 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: ϕ200 x 75 mm st x 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: ϕ200 x 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°	-

Appendix 10-8-19 Main Specifications for Improvement

Plant : NDI Line (Welded) of TRM on Kremikovtzi

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: ϕ150 x 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: ϕ120 x 200 mm st x 4

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	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°	-

Appendix 10-8-20 Main Specifications for Improvement

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 ± 2°C . Control : Within ± 10°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

Appendix 10-8-21 Main Specifications for Improvement

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	Drying equipment	
	1. Aligning device	1) Four (4) skid type feeding tables
		2) Four (4) pipe take out fingers installed on common axle
		3) Four (4) aligning rolls rotating at right angles to the take out axle
	2. Walking beam device	1) Four (4) walking beams
		2) One (1) drive unit with a 7.5kw electric motor with a variator which is used in common with the preceding aligning device
	3. Drying furnace	1) One (1) drying furnace frame Material : Mild steel
		2) One (1) heat exchanger Material : Mild steel
		3) One (1) drying chamber Dimension : Approx. 8,550(W) x 5,605(L) x 450(H)mm
	4. Combustion device	1) One (1) gas burner Capacity : 250,000 kcal/Hr
		2) One (1) turbo blower Capacity : 5m^3/min. at 650 mm H_2O Motor : 1.5 kw
		3) One (1) automatic ignition device

No.	Equipment	Detailed Specifications
	5. Hot air circulation fan	Capacity : 400 m^3/min Hot air temperature : about 150 degree C Motor : 11 kw AC
	6. Damper devices	
	7. Stack & accessories	Dimension : 700(O.D.) x 10,000 (H)mm Material : Mild steel
2	Galvanizing equipment	
	1. Galvanizing furnace	1) One (1) galvanizing furnace frame Material : Mild steel 2) One (1) set of refractories for furnace Furnace dimensions: Approx. 3,800 (W) x 2,890(D) x 12,300(L)mm Materials : Standard fire bricks: SK-32, SK-34, SK-36, and mortar Insulating fire bricks: B-1, B-3 and mortar Insulating ceramic fiber
	2. Zinc kettle	Dimensions : 1,750(W) x 2,000(D) x 9,800(L) x 50(T)mm (Effective inside dimension) Material : "AG" plate (Kawasaki Steel)
	3. Pit cover for emergency runout pit	

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^3/min at 700 mm H_2O 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	

No.	Equipment	Detailed Specifications
	7. Withdrawal unit	1) One (1) pipe separator and guide 2) One (1) magnet roll bank 3) One (1) exterior wiping nozzle for each 4) Six (6) sets of receiving rolls 5) Three (3) transfers 6) One (1) interior steam blow-off device 7) One (1) base frame
	8. Blow box and duct unit	1) One (1) blow box 2) One (1) duct
3	Quenching equipment	
	1. Quenching tank	1) One (1) tank Tank dimensions: Approx. 2,150/1,219(W) x 9,000(L) x 1,200(D) mm 2) Accessories (a) One (1) steam injection tube (2" NB) (b) One (1) valve for drainage (c) One (1) thermometer (0 - 120°C)
	2. Lifting device	Type : Chain conveyor Driving unit : 3.7 kw with cycle reducer

DETAILED EQUIPMENT LIST (1/2) PLANT : Energy control system

No.	Equipment	Detailed Specification
1	1-1 Hardware	
	(1)Process computer	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
	(2)Terminals	Operator station : 21inches 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 Work station : 17inches 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
	(3)Remote I/O unit	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 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

DETAILED EQUIPMENT LIST (2/2)　　PLANT : Energy control system

No.	Equipment	Detailed Specification
	(4)Local area network (LAN)	This network interconnect process computer and terminls. 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	To measure process value(flow rate,press. temperature)of related energy. 24 Vdc power source and 4 ～ 20mA dc output Transmitter Q'ty 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 P : Pressure transmitter T : Temperature transmitter Q : Flow rate transmitter
2	2-1 Software	Application software consists of following processing: ・Data gathering processing ・Daily,monthly data processing ・Unit production and consumption processing ・Energy balance planning processing ・Power plant operation control and plan processing ・Documentation and picture processing ・Flow rate compensation processing
3	3-1 Power plant combustion control improvement	Waste gas O_2 analyzer : 5 sets Boiler combustion control improvement : 3 sets of boiler

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 corbon 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 corbon steel
1.1	Mechanical equipment	1 set	5.5 M US$
(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	0.6 M US$
(1)	Electrical equipment		
(2)	Cables		
1.3	Erection and commissioning	1 set	0.5 M US$
(1)	Erection		
(2)	Cabling		
(3)	Commissioning		
1.4	Foundations	1 set	1.7 M US$
	Total		8.3 M US$

Appendix 10-8-24 Main Specifications after Improvement

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)

Appendix 10-8-25 Main Specification for Improvement

Environmental countermeasures : air

No.	Equipment	Quantity	Main Specifications
C-1	Dedusting system for coal charging car		
		1 set	
	Type		Bag filter, 1000 Nm3/min 60 c
	Equipment	1 lot	Hood and duct for coal charging car
		1 lot	Fixed duct for dust collection
		1 lot	Connecting duct
		1 lot	Preduster
		1 lot	Induced draft fan, motor and stack

No.	Equipment	Quantity	Main Specifications
C-2	Dedusting system for coke guide car		
		1 set	
	Type		Bag filter, 2000 Nm3/min 60 c
	Equipment	1 set	Hood and duct for coke guide car
		1 lot	Fixed duct for dust collection
		1 lot	Connecting duct
		1 lot	Preduster
		1 lot	Induced draft fan, motor and stack

No.	Equipment	Quantity	Main Specifications
C-3	COG desulfurization process ; 55000 Nm3/H Consisting of: 1 lot of *** Process ***Wet-type, NH3 recovery process having de-S efficiency of 90%		

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

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

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 conveyor

No.	Equipment	Quantity	Main Specifications
B-1	Dedusting system for casting house of BF		
		2 sets	
	Type		Bag filter, 7000 Nm3/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 Nm3/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 Nm3/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		Bag filter, 8200 Nm3/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		Air-supplied gas cooling, Bag filter, 4700 Nm3/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		Air-supplied gas cooling, Bag filter, 4700 Nm3/min 180 c
	Equipment	1 lot	Air-supplier
		1 lot	Preduster
		1 lot	Induced draft fan and motor

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Appendix 10-8-26 Main Specification for Improvement

B-1. Improvement of the Wastewater Treatment Plant(final treatment plant at Kremikovtzi)

1. Design Condition

Raw waste water(Inlet of waste water treatment plant): Treated water

Flow Rate :	3360 m3/h	:	500 m3/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 m3)	
3	Pump Station	1 set		
4	Breakdown Basins	2 sets	50mW x 60mL x 2.8(2.5)mH (7500 m3)	
5	Multipurpose House	1 set		
6	Pressurized Flotation Tank	4 sets	10mφ x 1.5mH	Modify
	Rake		10mφ x 1kw	Modify
	Sludge Pump		Centrifugal Type 15m x 20m3/h x 5kw	Install
7	Lagoons	4		
8	Utility Building	1 set		
9	Pressurization Tank	8 sets	1.6mφ x 4.3mH (8m3)	Improve
10	Mixing Basin	4 sets	60m3 x4 Agitator x16	Install
11	PAC Tank	1 set	40 m3 x 2 Pump:20m x 300 l/h x(4+1)	Install
12	Polyerectrolyte Tank	1 set	Tank 3 m3 Pump: 5 l/h x(4+1)	Install
13	Filter	1 set	Capacity 500 m3/h x 2	Install
14	Active carbon adsorption	1 set	Capacity 125 m3/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:m3
Foundation for equipment	·Filter etc.	(Total 582 m3)
Basin	·Mixing Basin etc.	(Total 356 m3)

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 m3/h	:	100 m3/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		
	Chemical	4 sets	Emulsion breaker,NaOH,PAC,polymer
	Mixing Tank	3 sets	
	Dissolved air flotation tank	1 set	7.0mφ x 2.0mH (A=28m2)
	Scum Hopper	1 set	Capacity 10m3(5m3 x 2)

Foundation and Basin List

Item	Description	Concrete Volume Unit:m3
Foundation for equipment	Total	(91 m3)
Basin	·Dissolved air flotation tank etc.	(262 m3)

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

1. Design Condition

Raw waste water(for ammonia stripping)		Treated water
Flow Rate	50 m3/h	150 m3/h
COD	4000 - 6000 ppm	< 70 ppm
SCN	400 - 600 ppm	< 10 ppm
T-NH3	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	1 set	Capacity 50 m3/h
	Oil Separator		Depilator type
	Coke Filter(Tar catcher)		
2	Buffer Tank	1 set	Capacity 600m3
3	Ammonium stripping system	1 set	Capacity 50 m3/h
			Ammonium Stripping Tower
4	Biological treatment system	1 set	Capacity 75 m3/h(+ Diluent water 75 m3/h)
	Chemicals		
	Aeration Basin		6000m3 x 2
	Blower		0.55kg/cm2 x 8400Nm3/h x (2+1)
	Thickener		20mφ x 2
	Dehydrator		Decanter type
5	Raw Water Tank	1 set	Capacity 600 m3
6	Filter	1 set	Capacity 150 m3/h
7	Piping	1 lot	
8	Building(Rooms)	1 set	
	Chemicals Tanks,Blower,Operation(& Analysis),Electrical,Dehydrator		

Foundation and Basin List

Item	Description	Unit	Concrete Volume Unit:m3
Foundation for equipment	·Raw water tank	2 sets	600 m3(300 x 2)
			(Total 1200 m3)
Basin	·Aeration Basin	2 sets	2996 m3
			(Total 4038 m3)
Foundation for Building and equipment	Foundation & Floor	1 set	130 m3

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 m3/h(Max. 140 m3/h)	:	120 m3/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		Capacity 120 m3/h
	Raw Water Pit(& suction pit)	1	
	Chemical	3 sets	NaOH,PAC,Polyelectrolyte
	Mixing Tank	4 sets	
	Dissolved Air Flotation Tank	2 sets	
	Scum Hopper	1 set	Capacity 20m3(5m3 x 4)
2	Filter	1 set	Capacity 140m3/h
3	Active carbon adsorption	1 set	Capacity 140m3/h

Foundation and Basin List

Item	Description	Concrete Volume Unit:m3
Foundation for equipment	·Dissolved Air Flotation Tank etc.	(157 m3)
Basin	·Raw Water Pit etc.	(537 m3)

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 m3/h (Except Scale Flushing)	: Max. 400 m3/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 m3/h	: Max. 600 m3/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

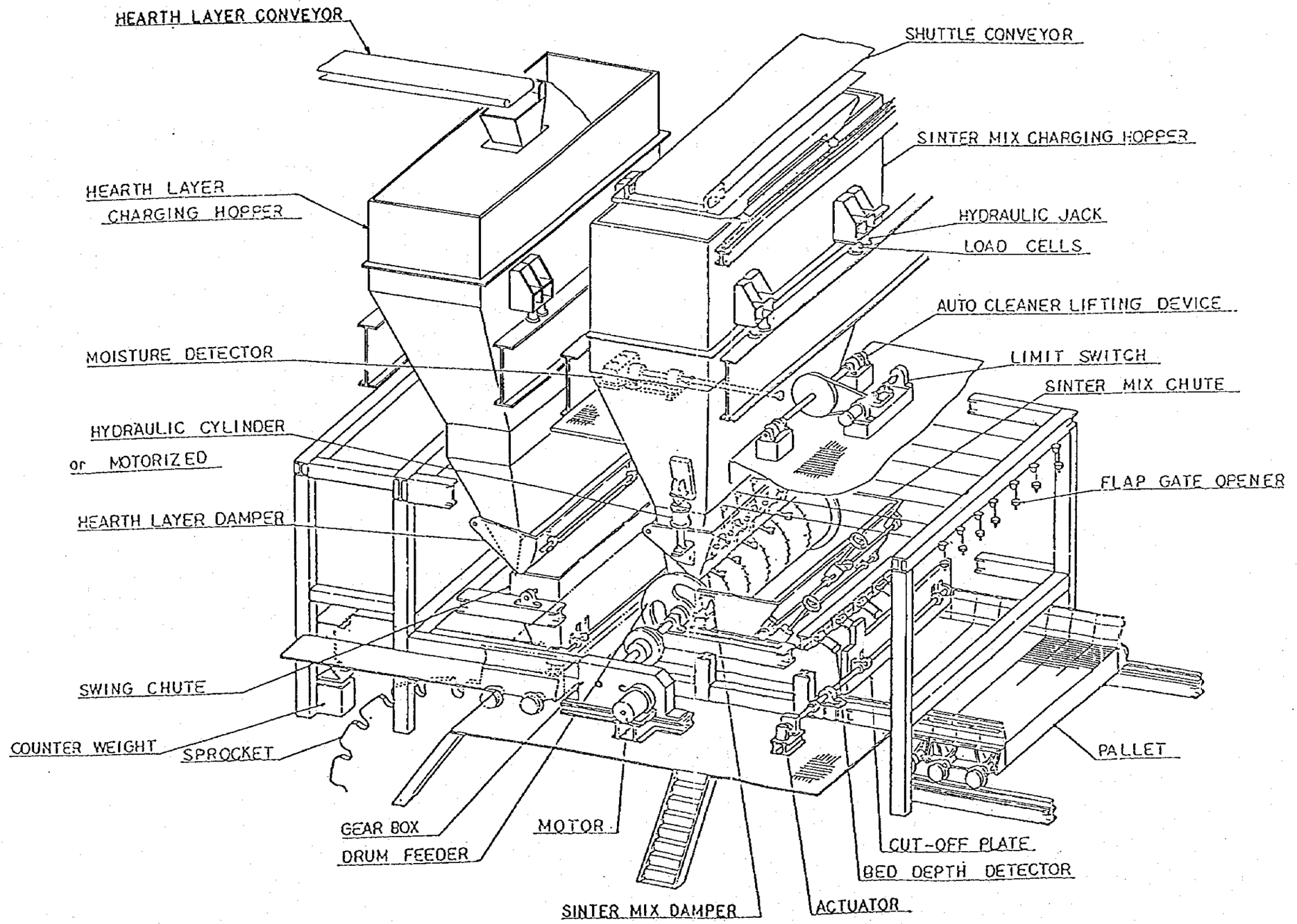
Equipment list

No.	Equipment	Quantity	Specification
1	Direct cooling water recirculation	1 set	Capacity 400 m3/h
	Scale Pit	(1 set)	
	Waste Oil Pit	(1 set)	
	Thickener	(1 set)	24mφ Capacity 1356m3
	Filter	(1 set)	Capacity 500 m3/h x (1+1))
	Cooling Tower(Direct cooling),Well	(1 set)	500 m3/h 55-35°C at wt27°C
	Supply Water Pump	(1 set)	
2	Indirect cooling water recirculation	1 set	Capacity 600 m3/h
	Filter(for make up water)	(1 set)	Capacity 50 m3/h
	Cooling Tower(Indirect cooling),Well	(1 set)	600 m3/h 46-31°C at wt27°C
	Supply Water Pump	(1 set)	
	Chemical equipment	(1 set)	
3	Emergency Over Head Tank	1 set	Capacity 30m3(50 mH)
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:m3
Foundation for equipment	·Filter etc.	316 m3
Basin	·Scale pit etc.	776 m3
Foundation for Building and equipment	·Pump Station	162 m3

SINTERING MACHINE CHARGING SYSTEM



NO.	REVISION	DATE	BY

NOTE:

CAD FN:KREM-5R0

KAWASAKI STEEL

KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

		NO	DATE	FOR
APPROVED				APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG.	Sep.7'95			SHOP
				FINAL

CUSTOMER: KREMIKOVTZI

CONSULTANT:

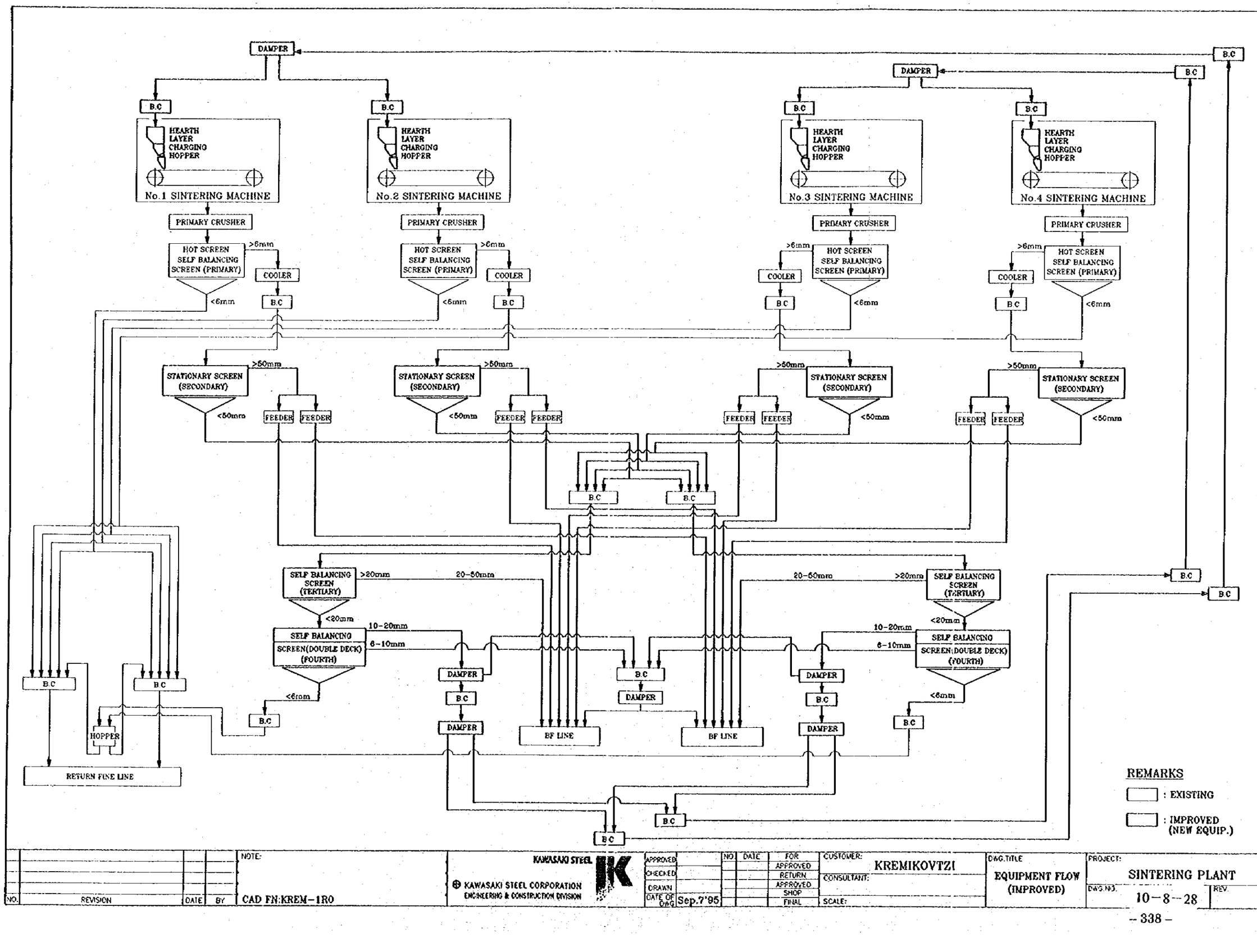
SCALE:

DWG. TITLE: SINTERING MACHINE CHARGING SYSTEM

PROJECT: SINTERING PLANT

DWG NO. 10-8-27

REV.



NO.	REVISION	DATE	BY

NOTE:
CAD FN:KREM-1R0

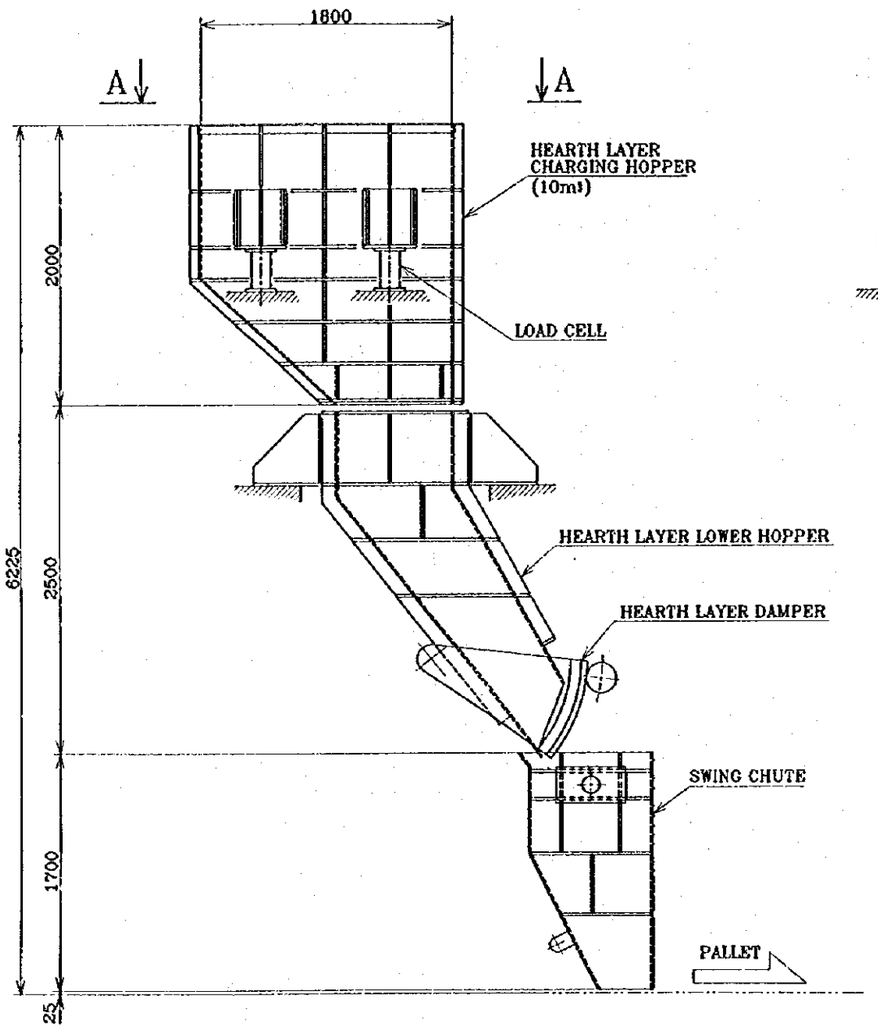
KAWASAKI STEEL
KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

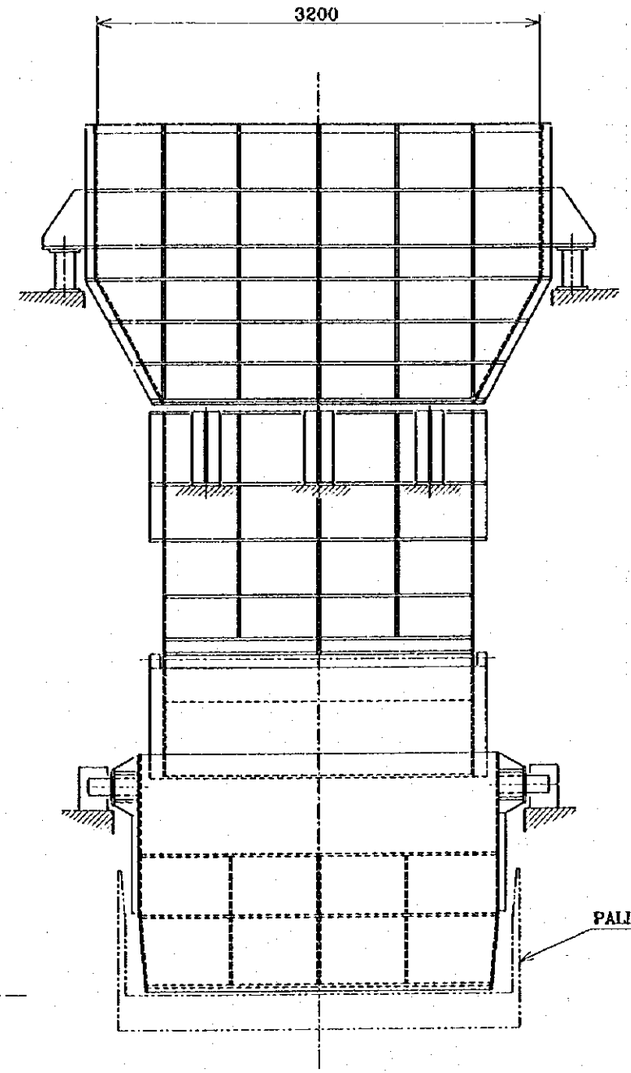
		NO	DATE	FOR
APPROVED				APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	Sep.7'95			SHOP
				FINAL

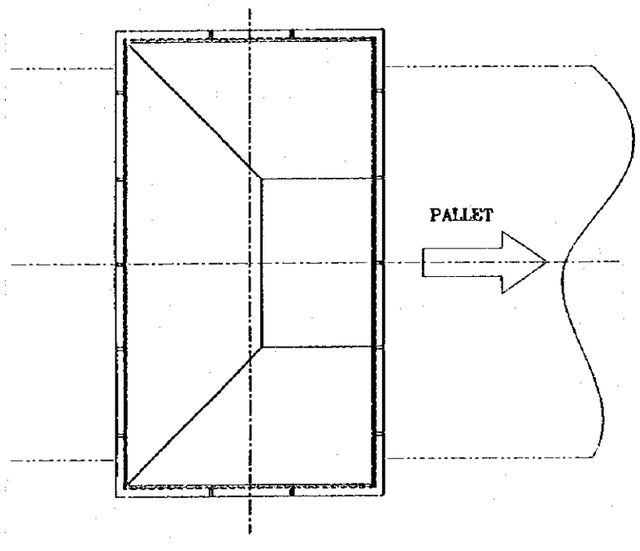
CUSTOMER: KREMIKOVTZI
CONSULTANT:
SCALE:

DWG.TITLE: EQUIPMENT FLOW (IMPROVED)

PROJECT: SINTERING PLANT
DWG.NO. 10-8-28
REV.







A－A

NO.	REVISION	DATE	BY

NOTE:

CAD FN:KREM-3R0

KAWASAKI STEEL

KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

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APPROVED				APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	Sep.7'95			SHOP
				FINAL

CUSTOMER: KREMIKOVTZI

CONSULTANT:

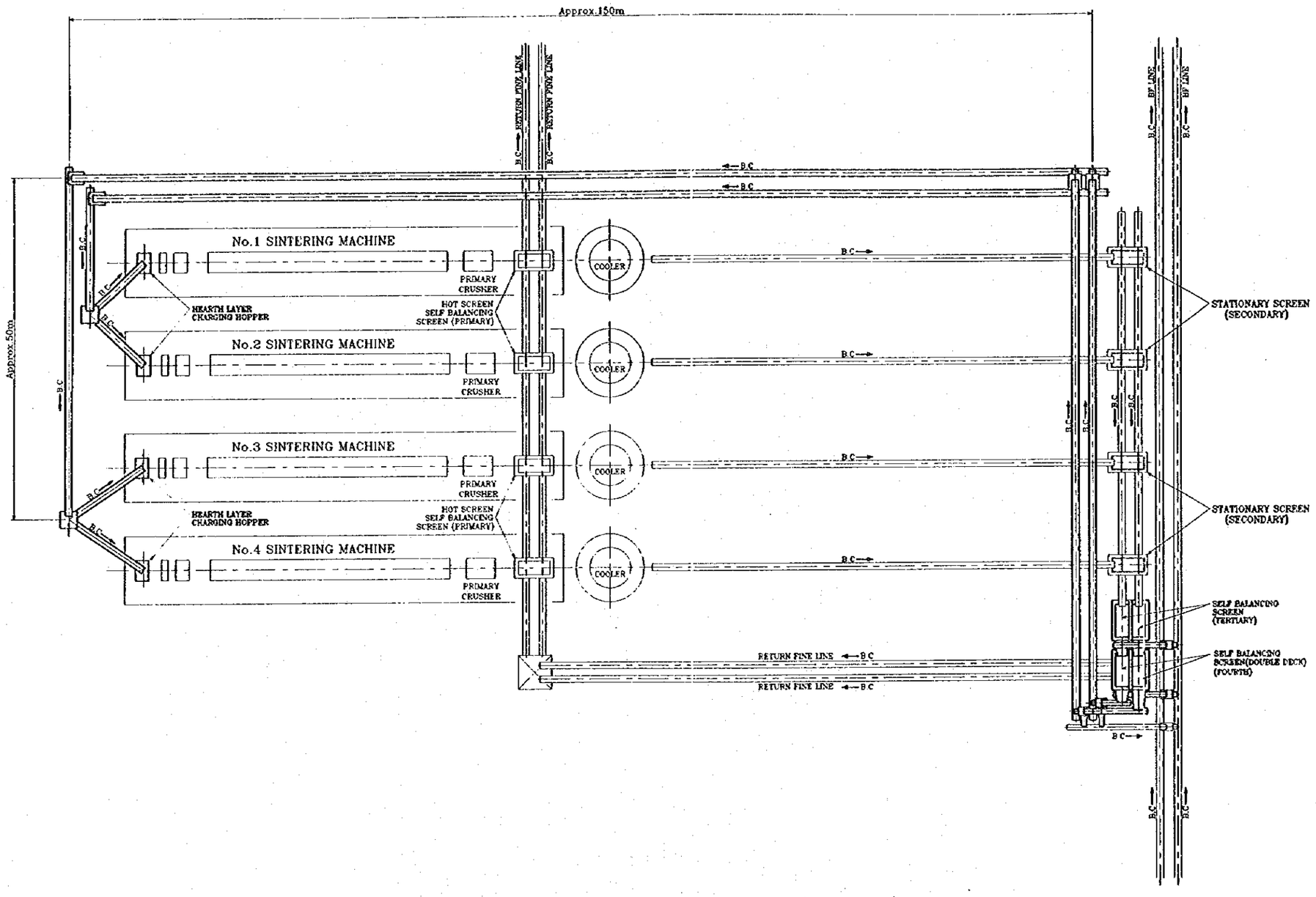
SCALE: 1/20

DWG.TITLE
HEARTH LAYER
CHARGING HOPPER
ARRANGEMENT
(10m³)

PROJECT:
SINTERING PLANT

DWG NO. 10－8－29

REV.



REMARKS

: EXISTING

: IMPROVED (NEW EQUIP.)

NO.	REVISION	DATE	BY

NOTE:

CAD FN:KREM-4R0

KAWASAKI STEEL

KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

		NO	DATE	FOR
APPROVED				APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	Sep.8'95			SHOP
				FINAL

CUSTOMER: KREMIKOVTZI

CONSULTANT:

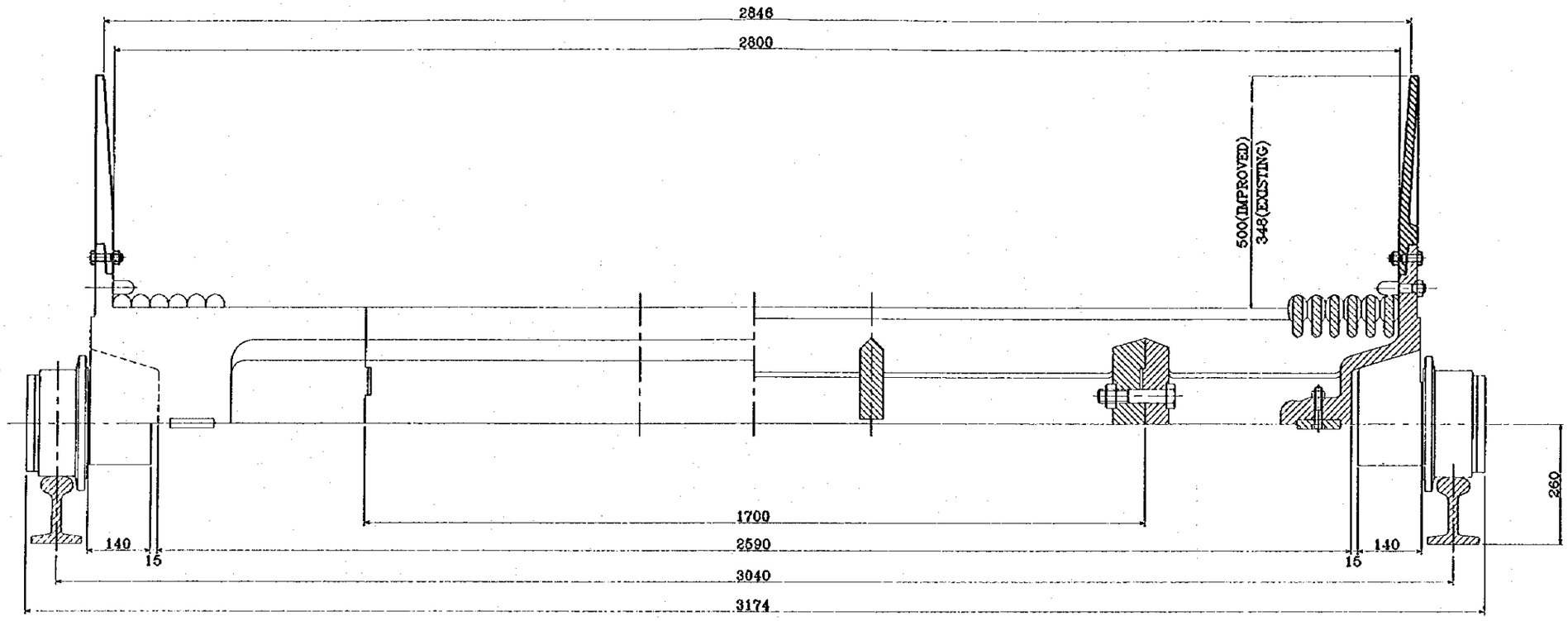
SCALE: 1/300

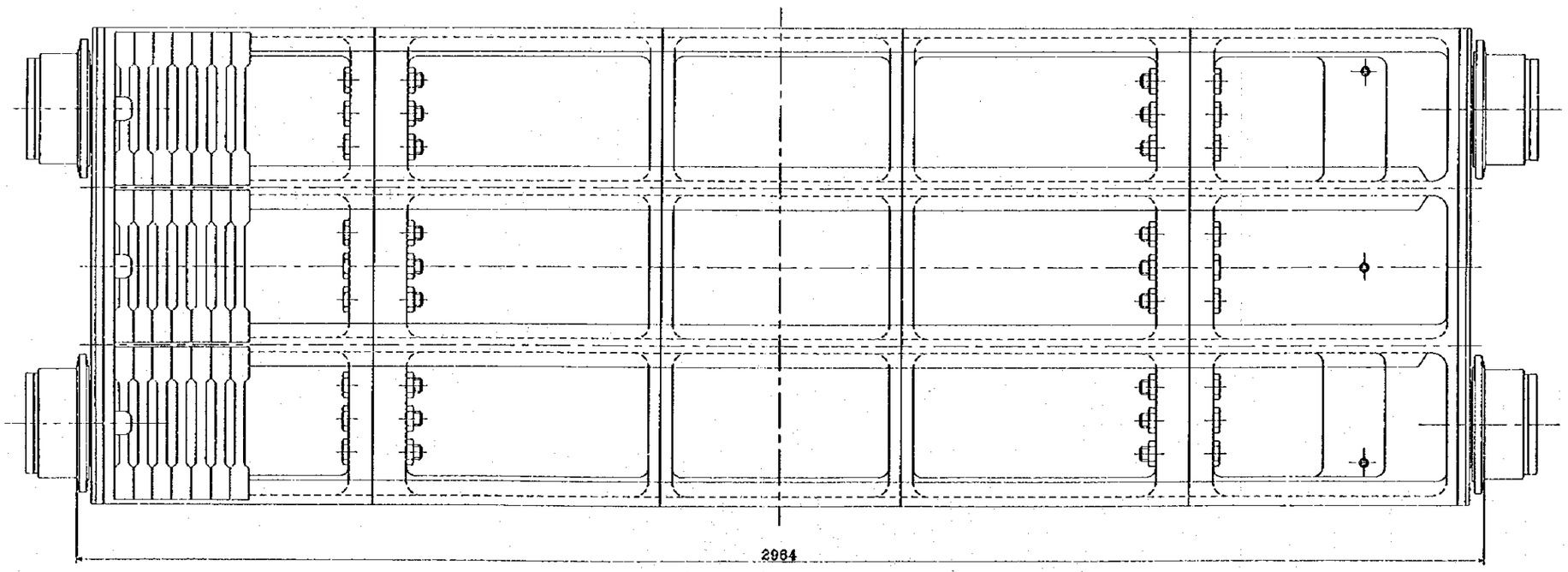
DWG.TITLE: LAYOUT PLAN (IMPROVED)

PROJECT: SINTERING PLANT

DWG NO: 10-8-30

REV.





NO.	REVISION	DATE	BY

NOTE:
CAD FN:KREM-2R0

KAWASAKI STEEL
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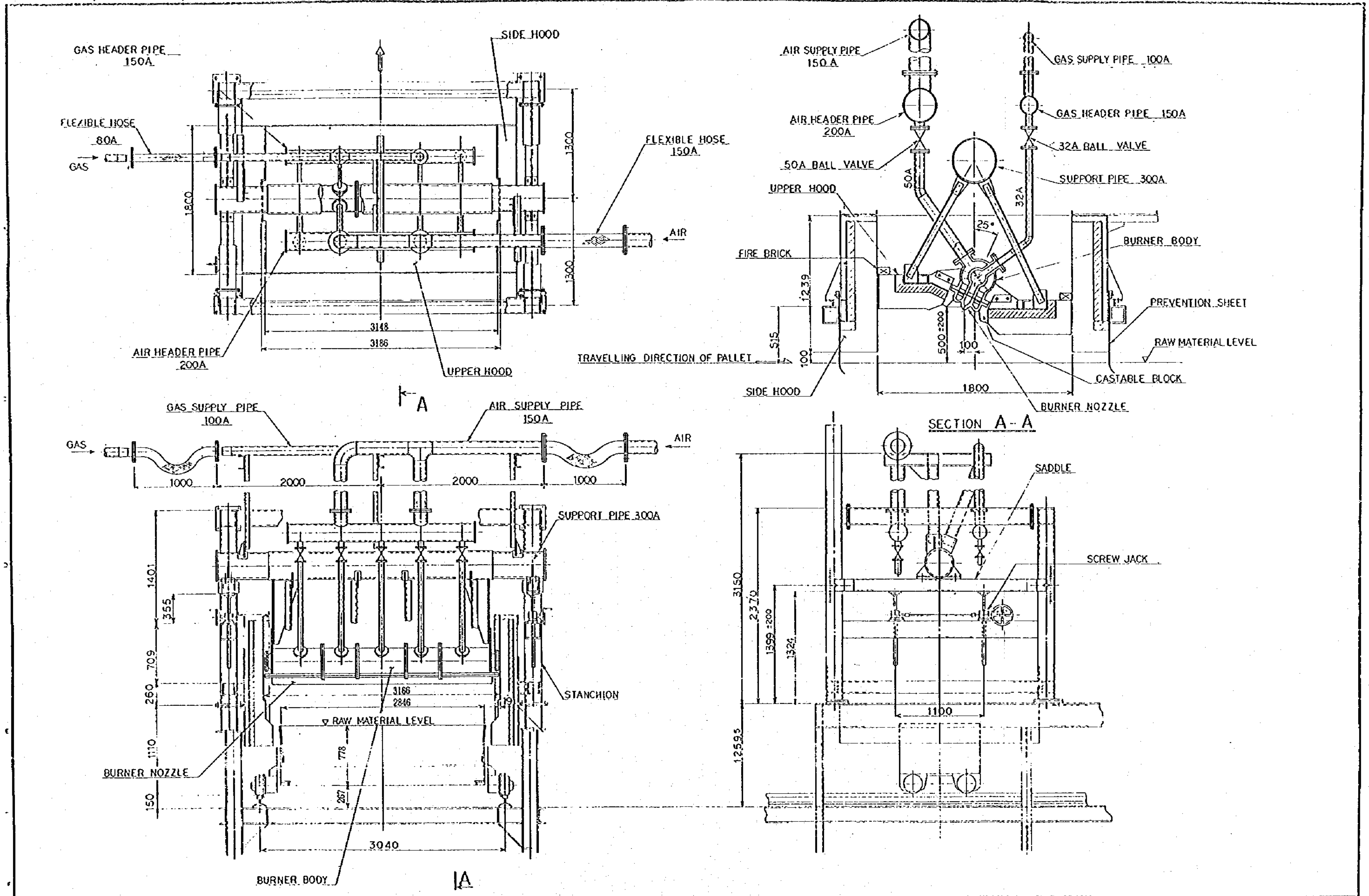
		NO.	DATE	FOR
APPROVED				APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	Sep.7'95			SHOP
				FINAL

CUSTOMER: KREMIKOVTZI
CONSULTANT:
SCALE: 1/6

DWG.TITLE: PALLET (IMPROVED PLAN)

PROJECT: SINTERING PLANT
DWG.NO: 10-8-31
SHEET:



REVISION	DATE	BY	NOTE

KAWASAKI STEEL
KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

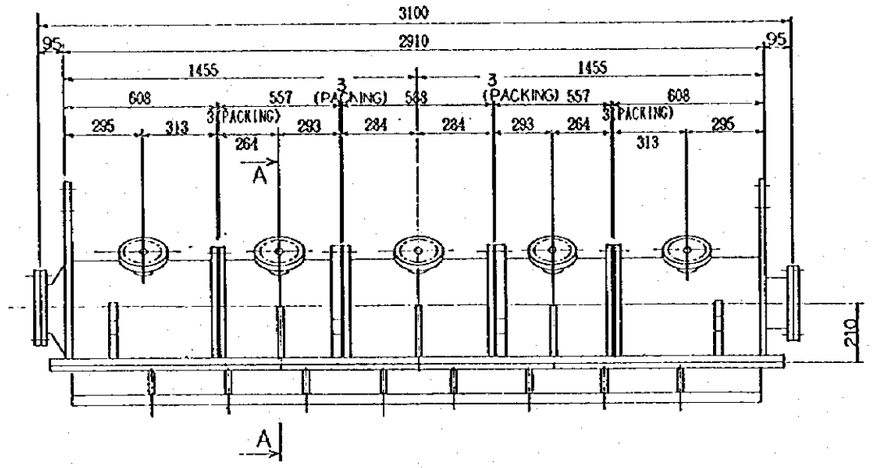
APPROVED	
CHECKED	
DRAWN	
DATE OF DRG.	Oct. 9 '95

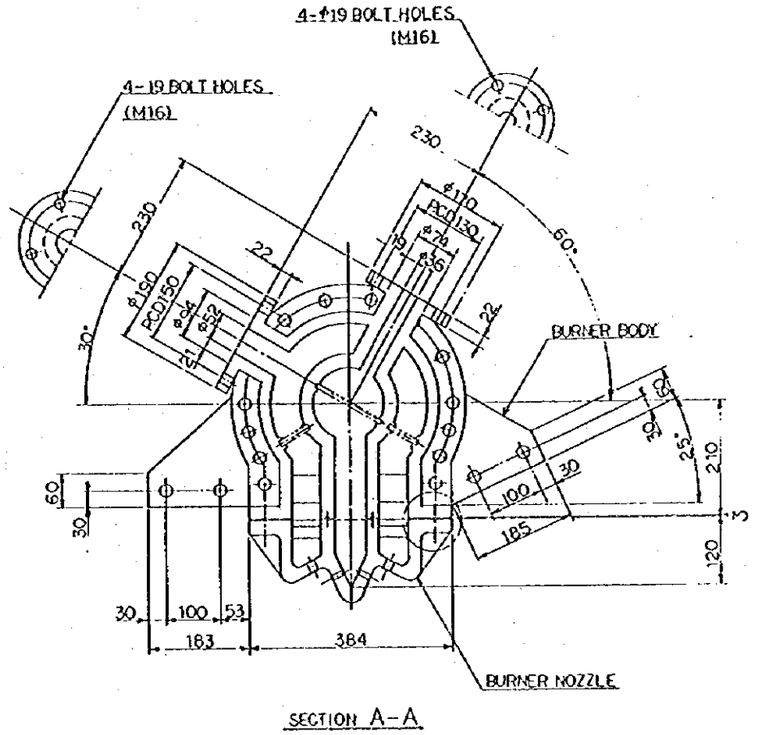
NO.	DATE	FOR
		APPROVAL
		RETURN
		APPROVED
		SHOP
		FINAL

CUSTOMER: KREMIKOVTZI
CONSULT:
SCALE: 1/15

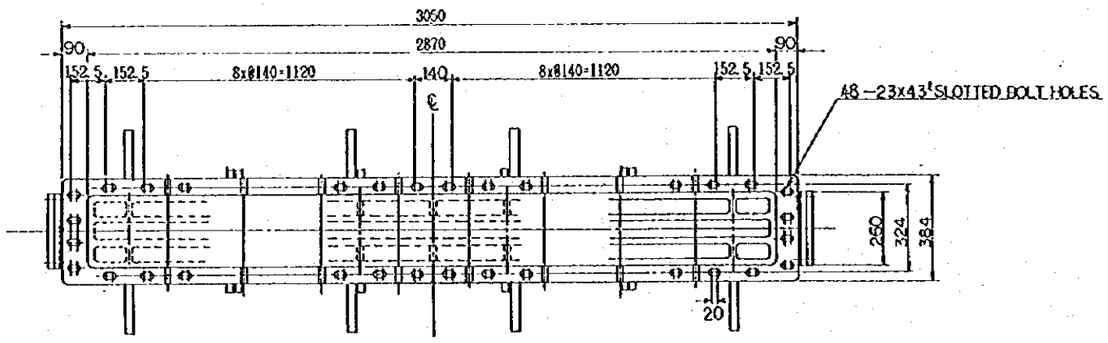
DWG. TITLE: ASSEMBLY OF IGNITION APPARATUS

PROJECT: SINTERING PLANT IGNITION APPARATUS
DWG. NO. 10-8-32
SHEET





SECTION A-A



NO	REVISION	DATE	BY

NOTE:

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		NO	DATE	FOR
APPROVED				APPROVAL
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	Oct. 9. '95			SHOP
				FINAL

CUSTOMER: KREMIKOVTZI

CONSULT.

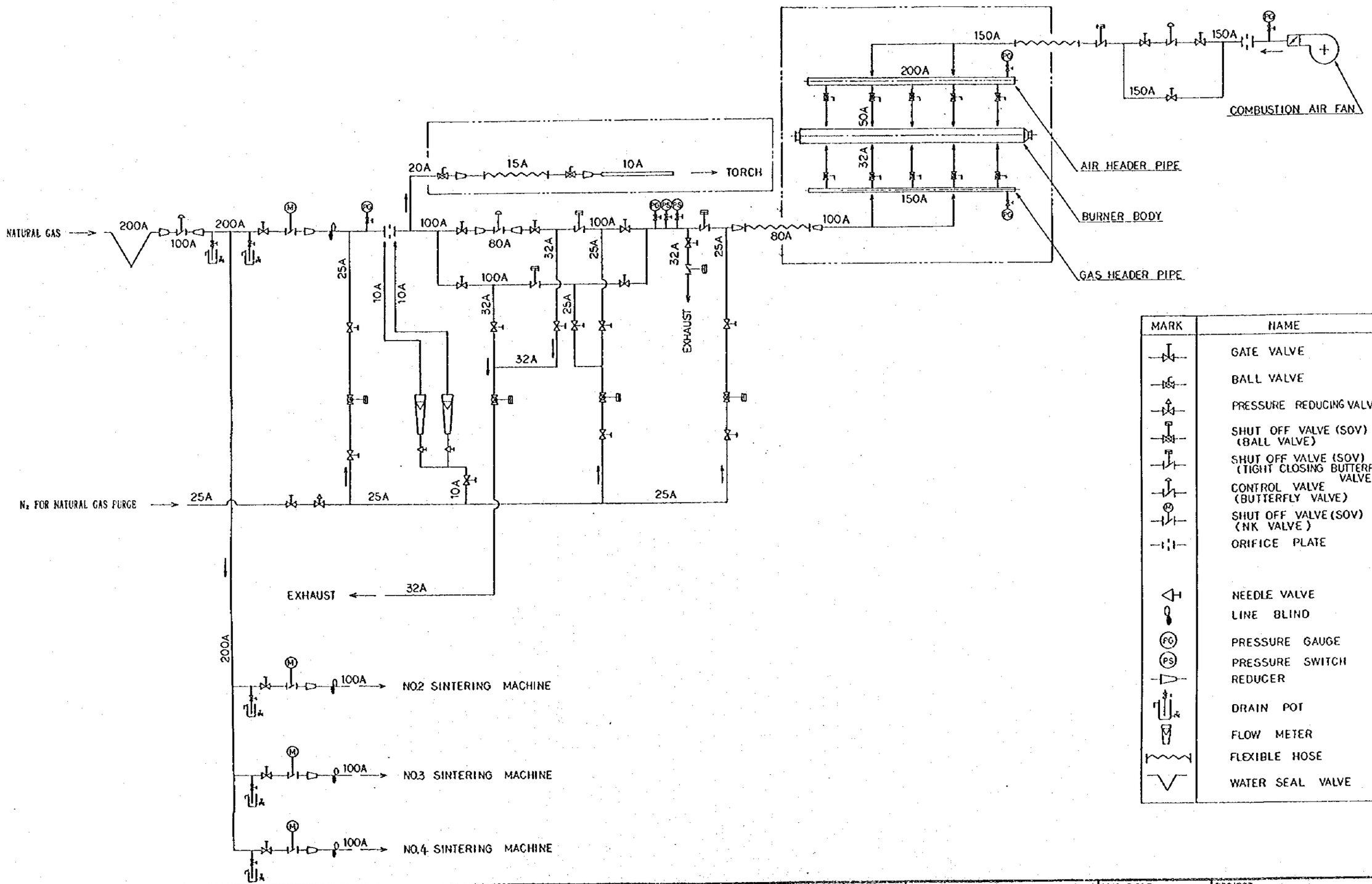
SCALE: 1/10 1/4

DWG. TITLE: ASSEMBLY OF LINE BURNER

PROJECT: SINTERING PLANT IGNITION APPARATUS

DWG. NO: 10-8-33

SHEET



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

NO	REVISION	DATE	BY

NOTE:

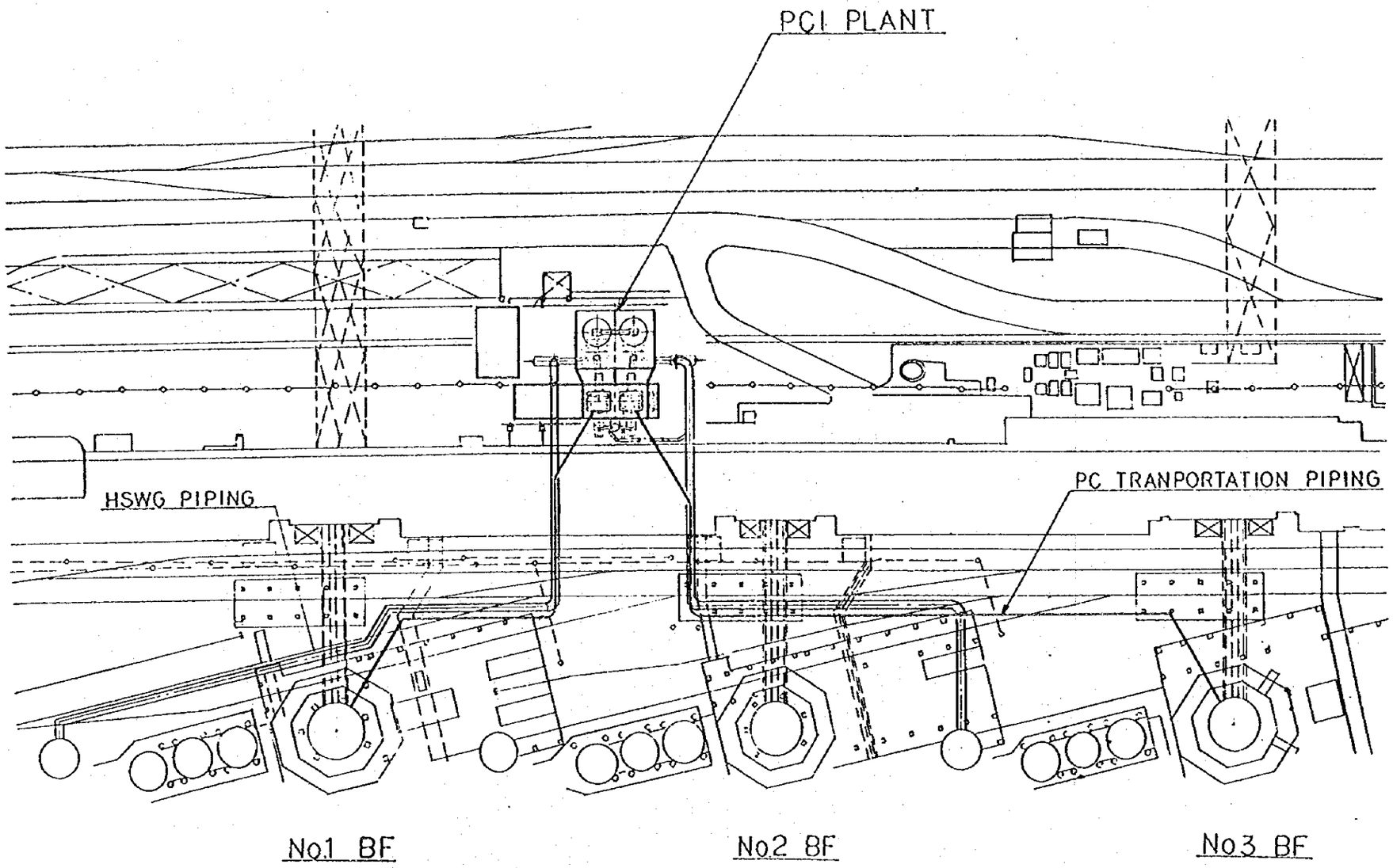
KAWASAKI STEEL
KAWASAKI STEEL CORPORATION ENGINEERING & CONSTRUCTION DIVISION

		NO	DATE	FOR
APPROVED				APPROVAL
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG.	Oct. 9, '85			SHOP FINAL

CUSTOMER: KRBMIKOVTZI
CONSULTANT:
SCALE

DWG. TITLE: PIPING FLOW SHEET

PROJECT: SINTERING PLANT IGNITION APPARATUS
DWG. NO. 10-8-34
SHEET



NO	REVISION	DATE	BY

NOTE:

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DRAWN	
DATE OF DWG.	

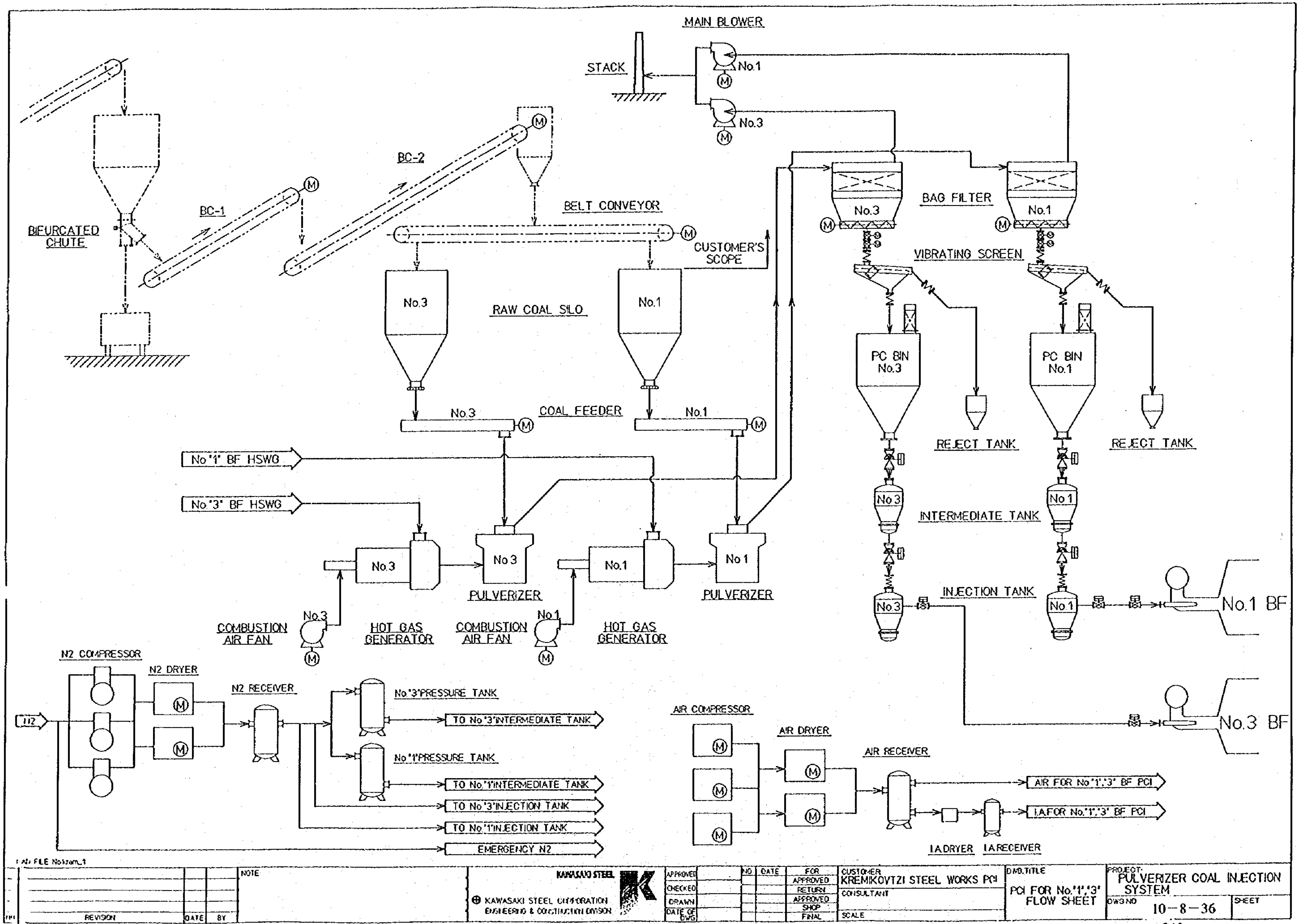
NO	DATE

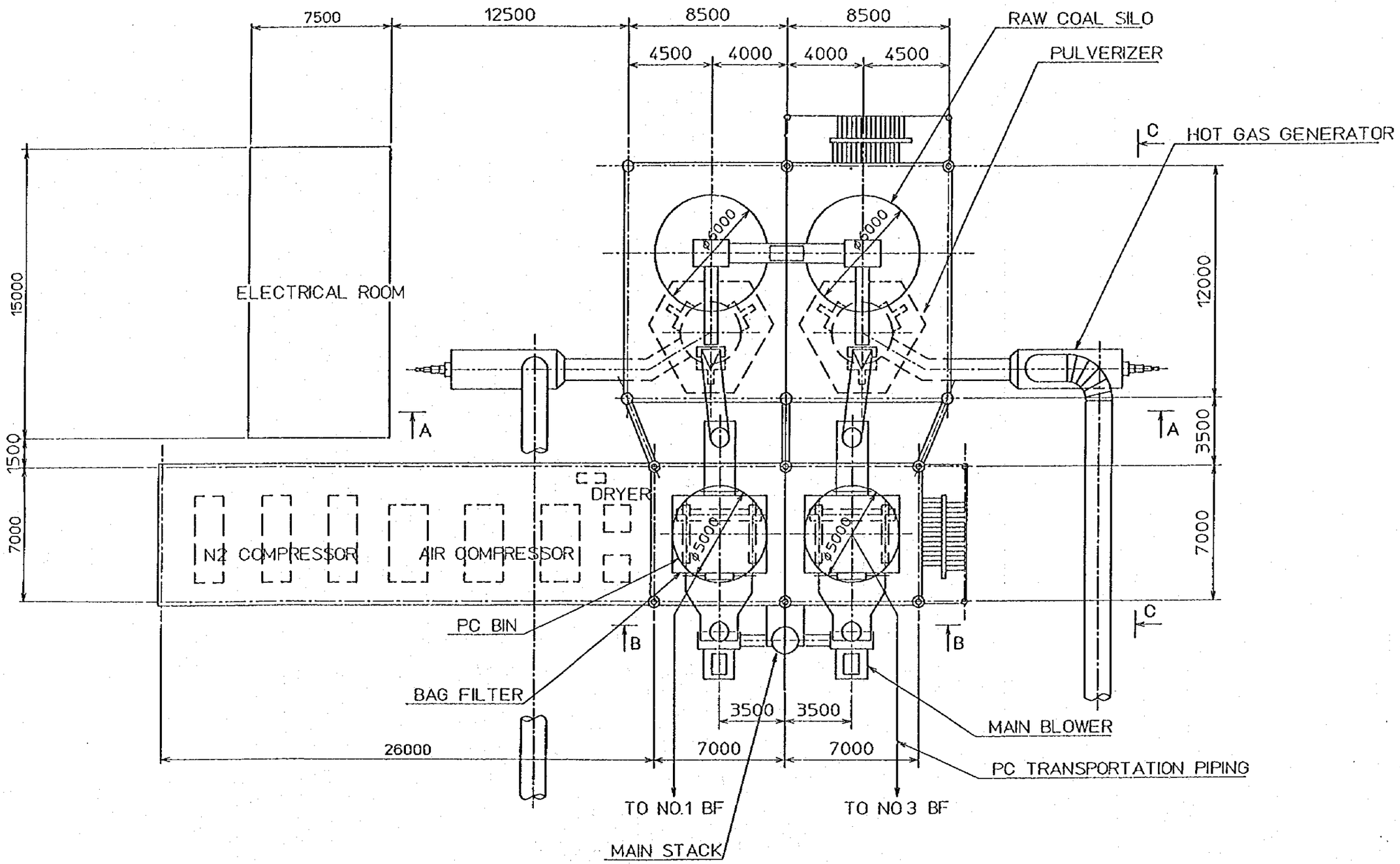
FOR APPROVED / RETURN / APPROVED / SHOP / FINAL

CUSTOMER: KREMIKOVTZI STEEL WORKS
CONSULTANT:
SCALE: 1:1000

DWG. TITLE: PLANT LAYOUT

PROJECT: PULVERIZER COAL INJECTION SYSTEM
DWG. NO. 10-8-35
SHEET


MAIN BLOWER
STACK
No.1
No.3
BC-2
BC-1
BIFURCATED CHUTE
BELT CONVEYOR
BAG FILTER
No.3
No.1
CUSTOMER'S SCOPE
VIBRATING SCREEN
RAW COAL SILO
No.3
No.1
PC BIN No.3
PC BIN No.1
REJECT TANK
REJECT TANK
COAL FEEDER
No.3
No.1
No '1' BF HSWG
No '3' BF HSWG
INTERMEDIATE TANK
No 3
No 1
PULVERIZER
PULVERIZER
No 3
No 1
No.3
No.1
COMBUSTION AIR FAN
HOT GAS GENERATOR
COMBUSTION AIR FAN
HOT GAS GENERATOR
INJECTION TANK
No 3
No 1
No.1 BF
No.3 BF
N2 COMPRESSOR
N2 DRYER
N2 RECEIVER
N2
No '3' PRESSURE TANK
TO No '3' INTERMEDIATE TANK
No '1' PRESSURE TANK
TO No '1' INTERMEDIATE TANK
TO No '3' INJECTION TANK
TO No '1' INJECTION TANK
EMERGENCY N2
AIR COMPRESSOR
AIR DRYER
AIR RECEIVER
AIR FOR No '1','3' BF PCI
I.A FOR No '1','3' BF PCI
I.A DRYER
I.A RECEIVER
REVISION
DATE
BY
NOTE
KAWASAKI STEEL
KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION
APPROVED
CHECKED
DRAWN
DATE OF DWG
NO
DATE
FOR APPROVED
RETURN
APPROVED
SHOP
FINAL
CUSTOMER
KREMIKOVTZI STEEL WORKS PCI
CONSULTANT
SCALE
DWG TITLE
PCI FOR No '1','3' FLOW SHEET
PROJECT
PULVERIZER COAL INJECTION SYSTEM
DWG NO
10-8-36
SHEET



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NOTE

KAWASAKI STEEL
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APPROVED	
CHECKED	
DRAWN	
DATE OF DWG.	

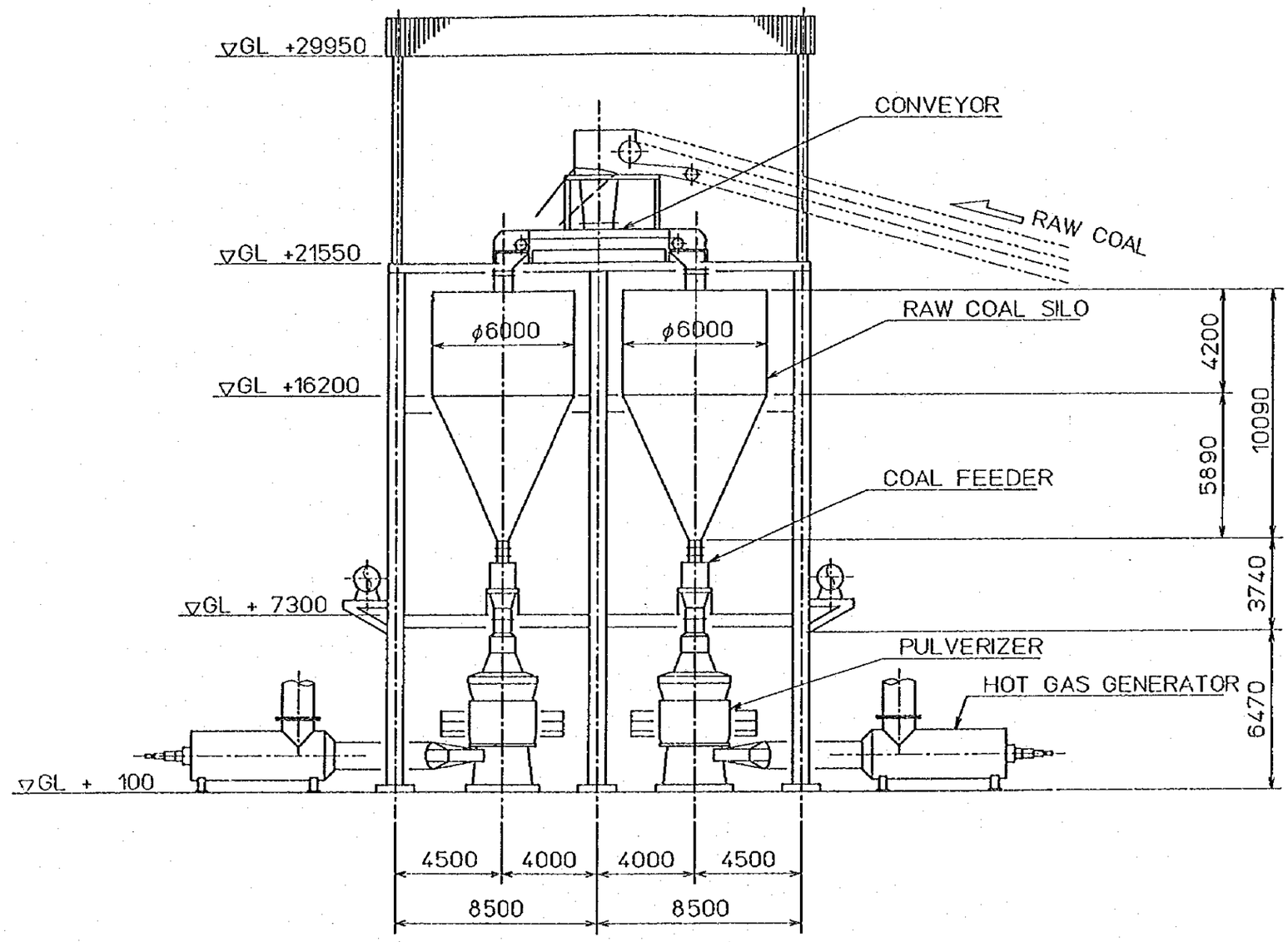
NO.	DATE	FOR
		APPROVAL
		RETURN
		APPROVED
		SHOP
		FINAL

CUSTOMER: KREMIKOVTZI STEEL WORKS PCI
CONSULT:
SCALE: 1/200

DWG.TITLE: GENERAL ARRANGEMENT

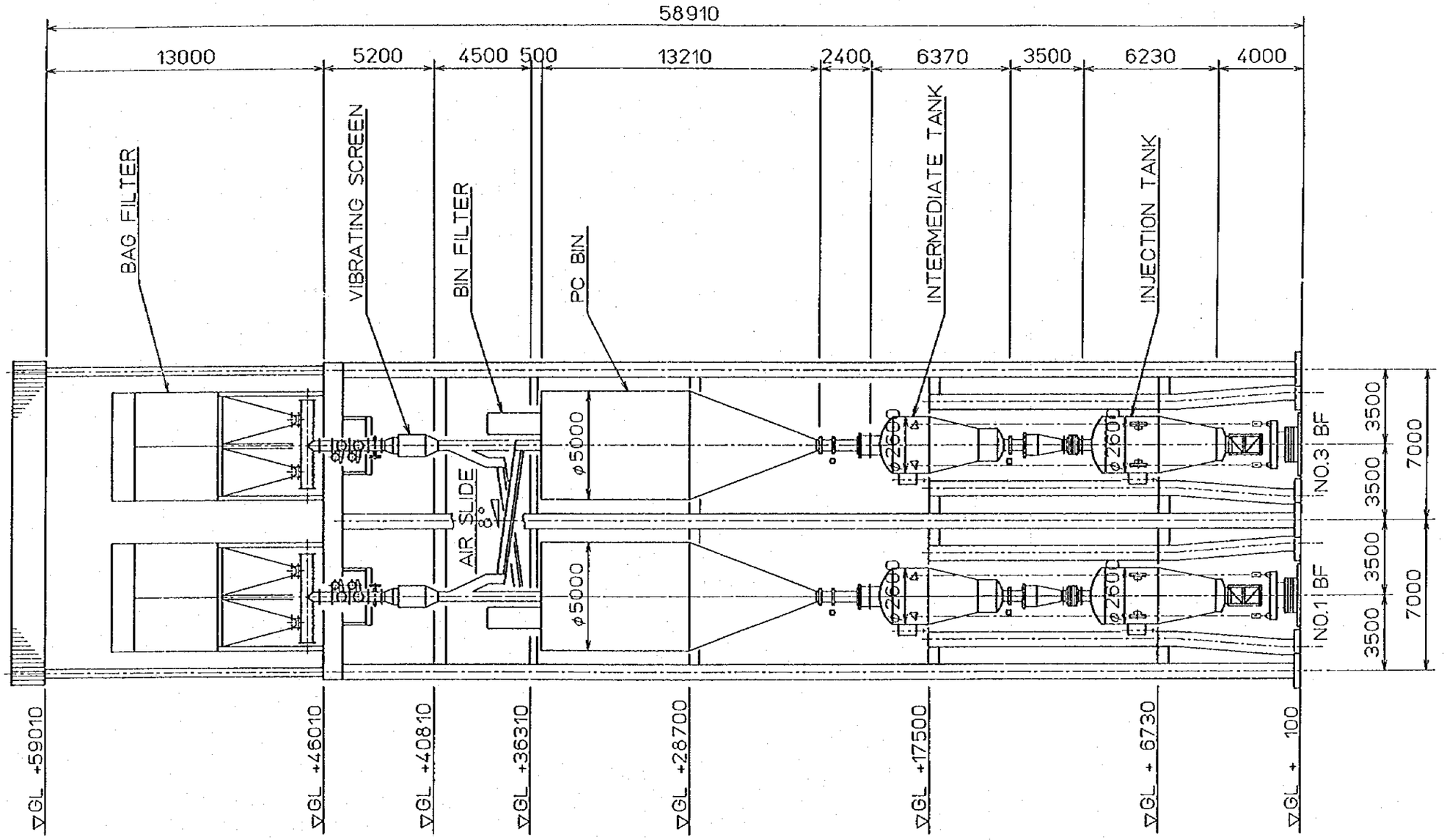
PROJECT: PULVERIZER COAL INJECTION SYSTEM
DWG.NO. 10-8-37
SHEET

A-150



VIEW A-A

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



VIEW B-B

NO.	REVISION	DATE	BY	NOTE

KAWASAKI STEEL
KAWASAKI STEEL CORPORATION ENGINEERING & CONSTRUCTION DIVISION

APPROVED	
CHECKED	
DRAWN	
DATE OF DWG	

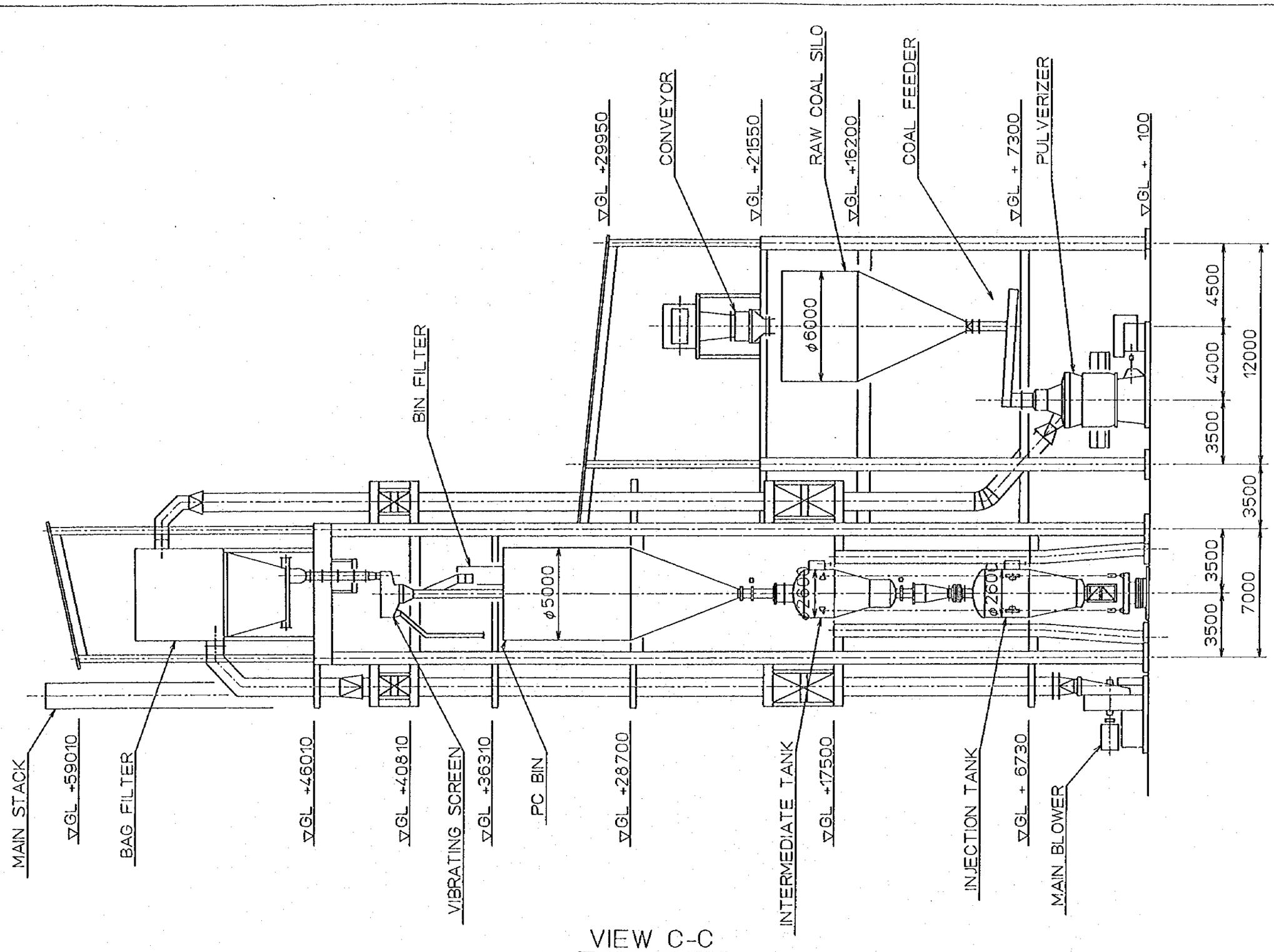
NO.	DATE	FOR	CUSTOMER
		APPROVAL	KREMIKOVTZI STEEL WORKS PCI
		RETURN	CONSULT:
		APPROVED	
		SHOP	
		FINAL	SCALE 1/200

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

KAWASAKI STEEL
KAWASAKI STEEL CORPORATION ENGINEERING & CONSTRUCTION DIVISION

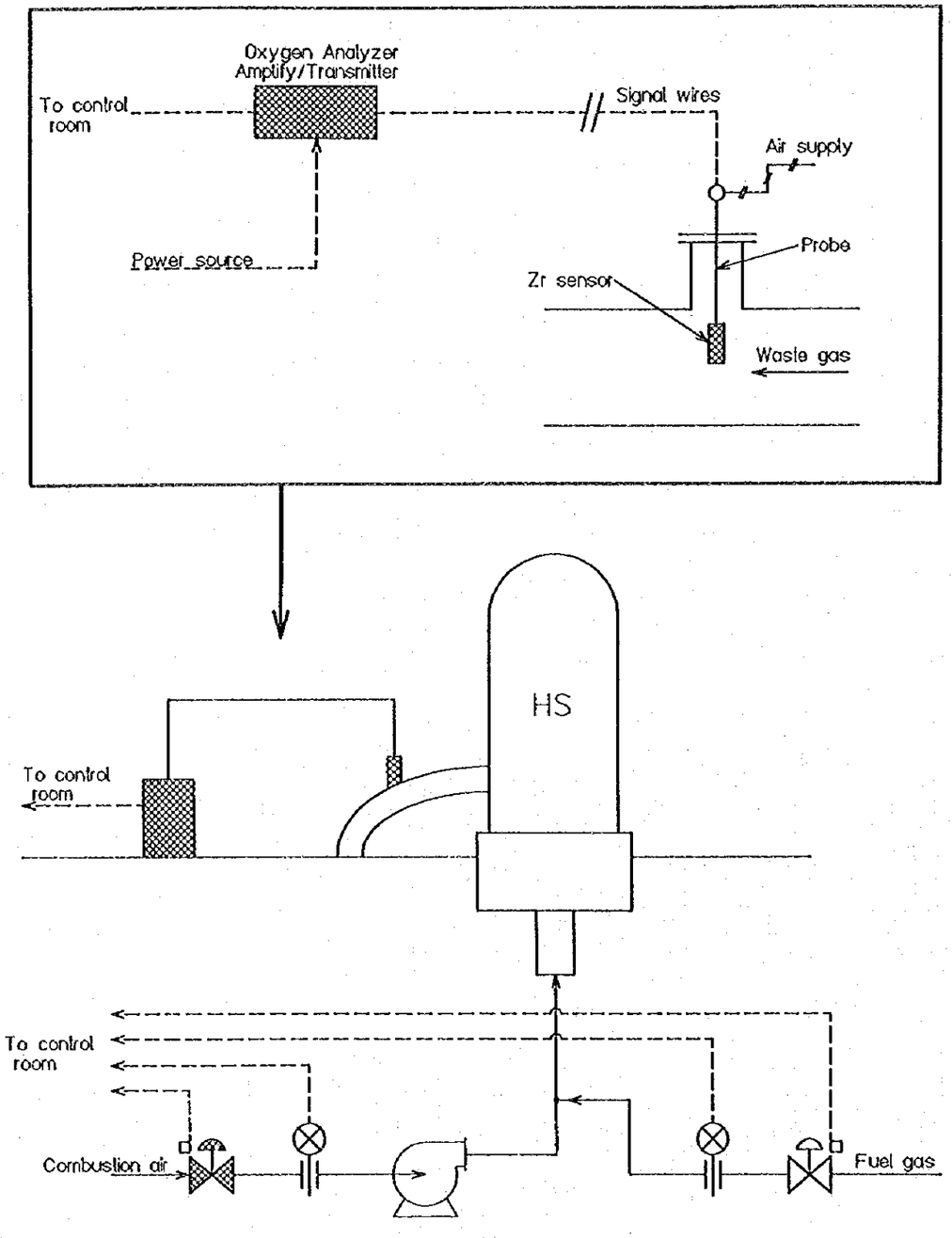
APPROVED	
CHECKED	
DRAWN	
DATE OF DWG	

NO.	DATE	FOR
		APPROVAL
		RETURN
		APPROVED
		SHOP
		FINAL

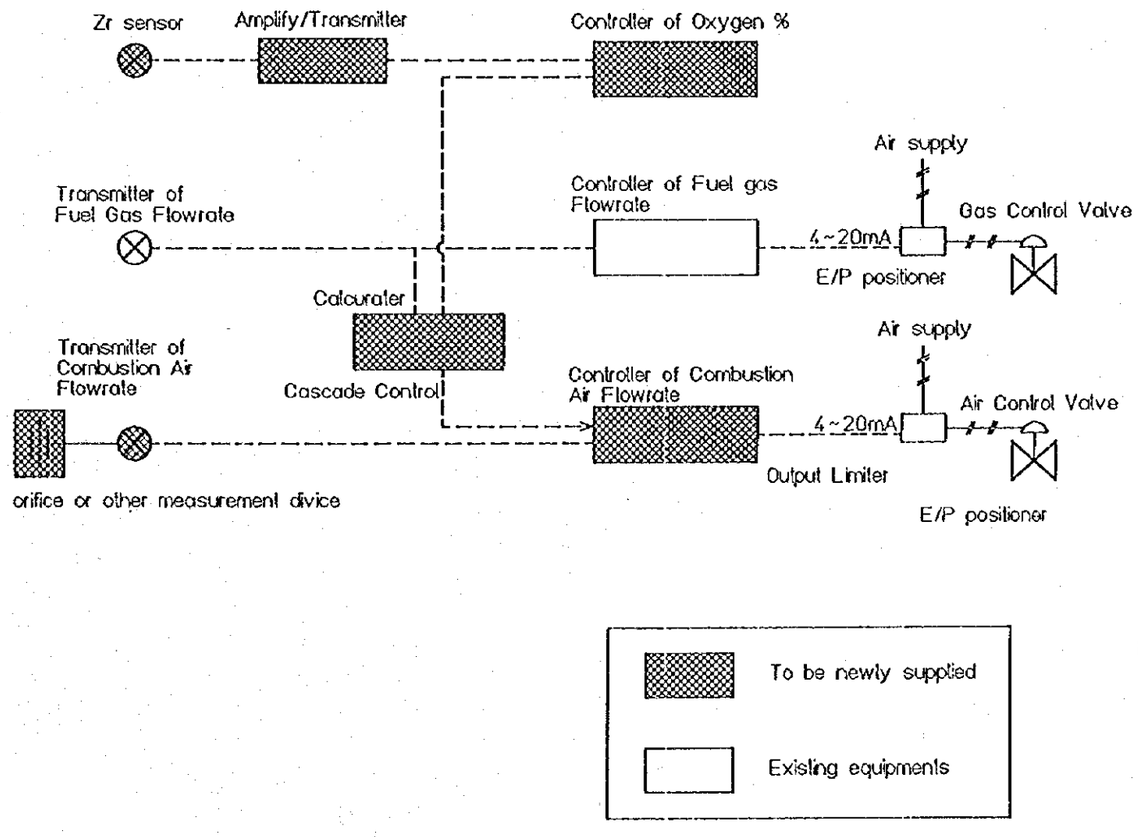
CUSTOMER: KREMIKOVTZI STEEL WORKS PCI
CONSULT:
SCALE 1/200

DWG.TITLE: SECTIONAL ARRANGEMENT(3/3)

PROJECT: PULVERIZER COAL INJECTION SYSTEM
DWG.NO. 10--8--40
SHEET



Measuring Method



Control System Configuration

CAD FILE No krem_2

NO	REVISION	DATE	BY

NOTE:

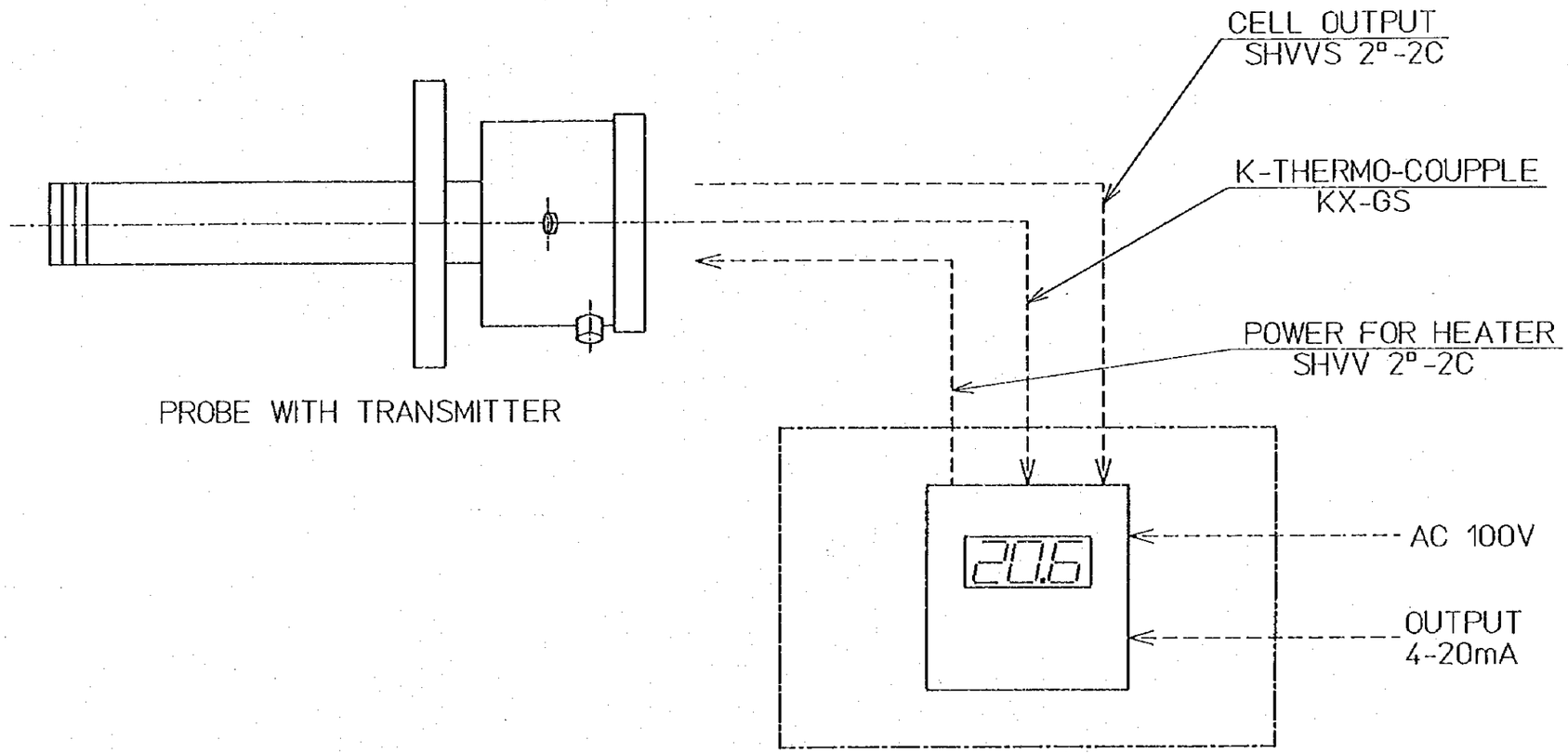
KAWASAKI STEEL
KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

		NO	DATE	FOR
APPROVED				APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	JAN 25 '95			SHOP
				FINAL

CUSTOMER: KREMIKOVTZI STEEL WORKS PCI
CONSULTANT
SCALE:

DWG.TITLE: SYSTEM DESIGN OF OXYGEN ANALYSIS IN THE HOT STOVE WASTE GAS

PROJECT:
DWG NO 10-8-41
SHEET



CAD FILE No.krem_2

NO	REVISON	DATE	BY

NOTE:

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KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

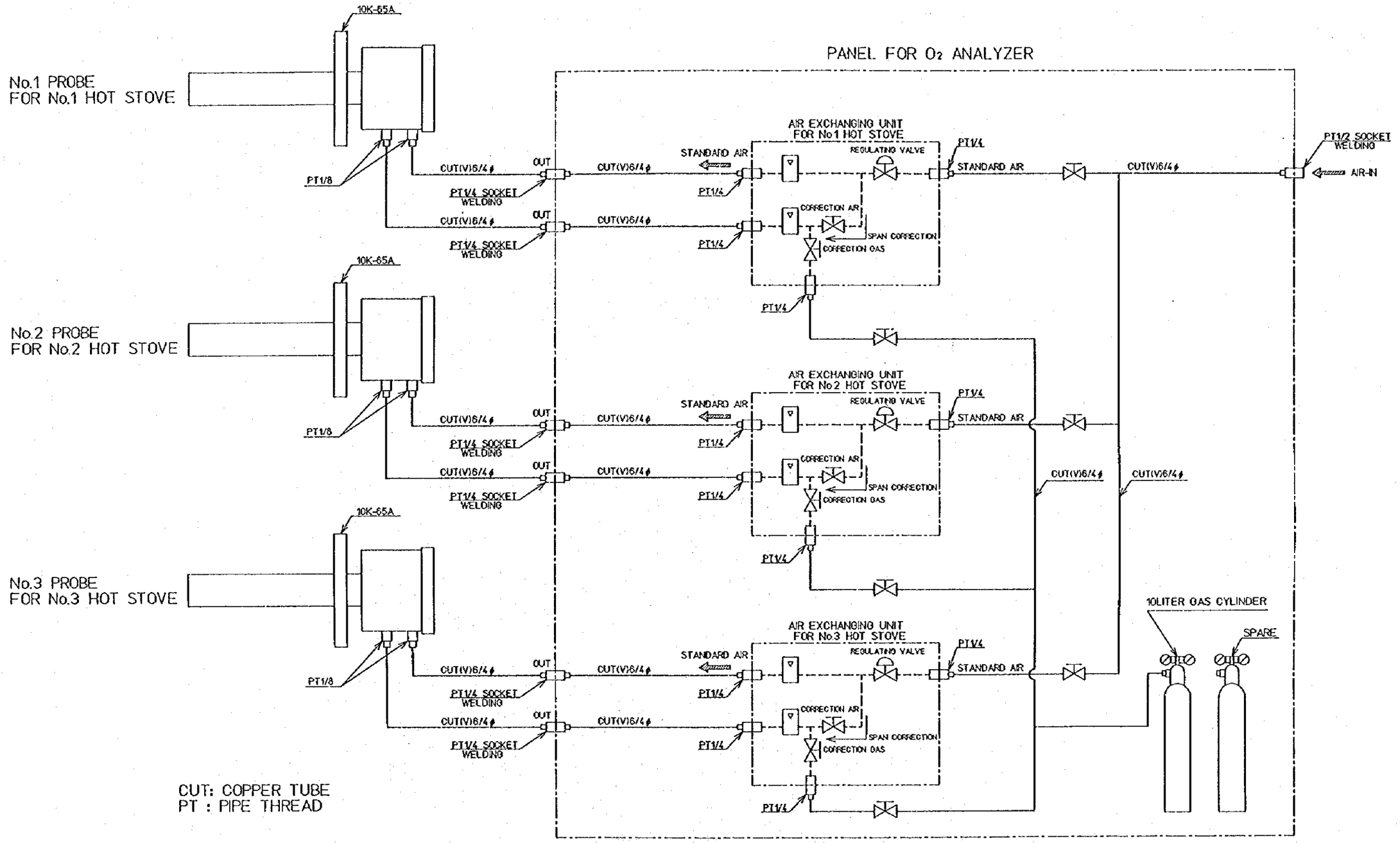
		NO	DATE	FOR
APPROVED				APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	JAN.25 '95			SHOP
				FINAL

CUSTOMER: KREMIKOVTZI STEEL WORKS PCI
CONSULTANT:
SCALE:

DWG.TITLE:

PROJECT:

DWG NO: 10-8-42 SHEET



CAD FILE No. krem_3

NO	REVISION	DATE	BY

NOTE:

KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

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

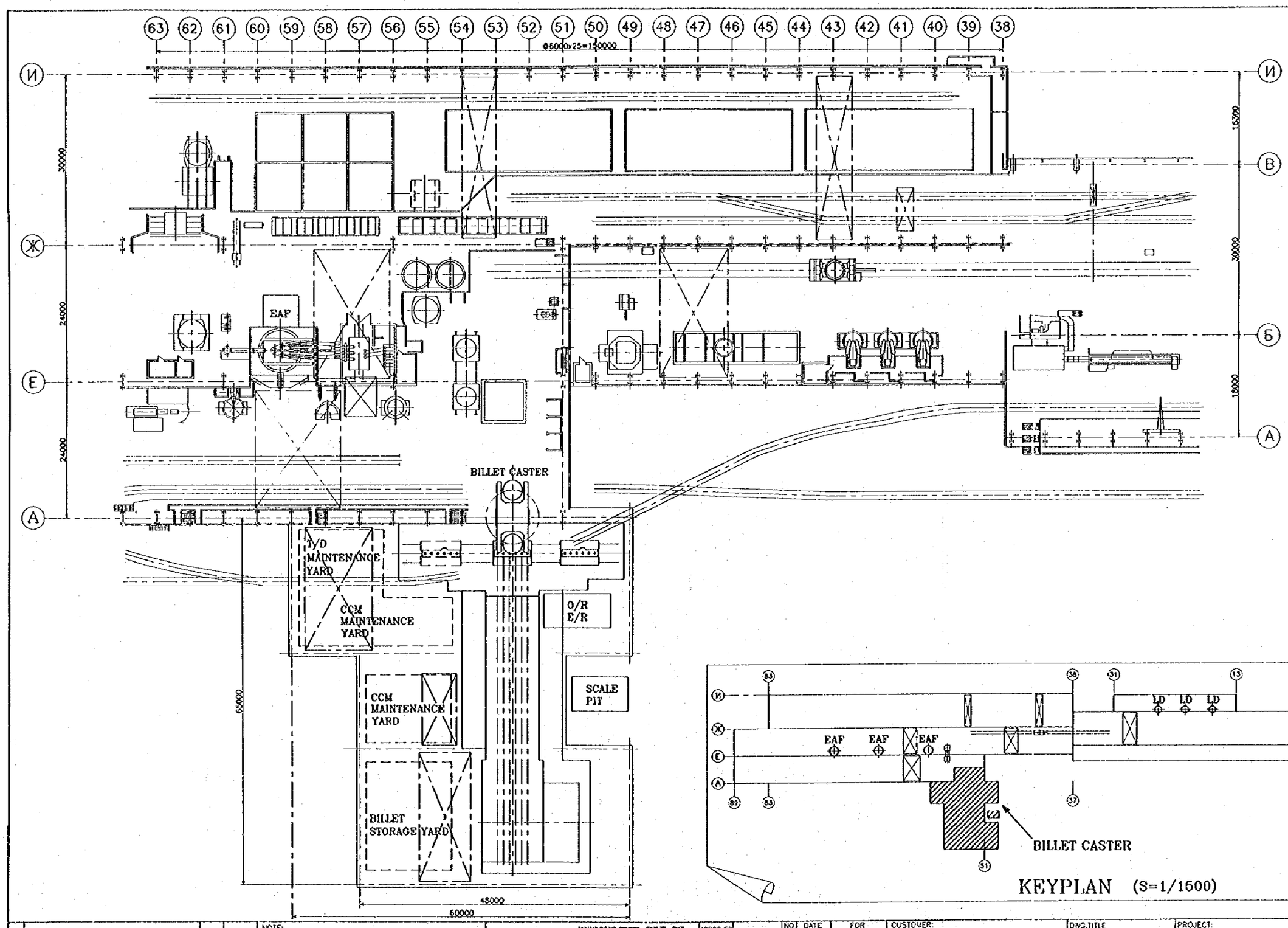
CUSTOMER: KREMKOVTZI STEEL WORKS PCI
CONSULTANT:
SCALE:

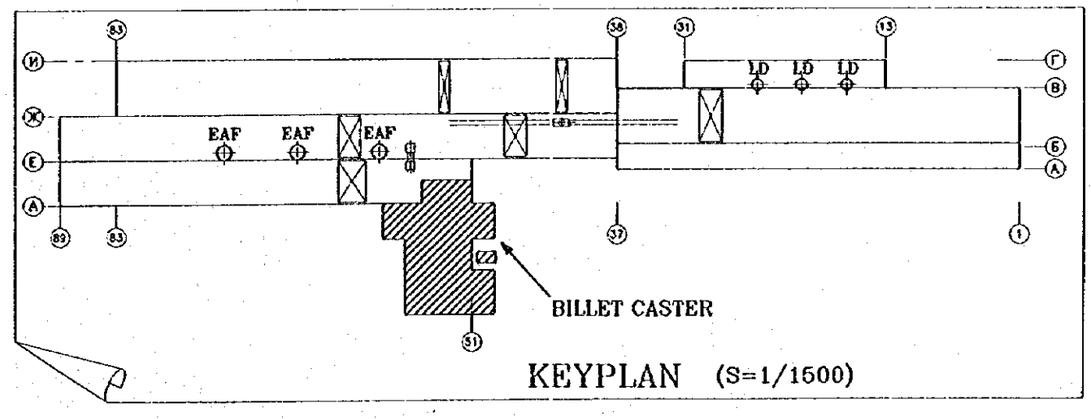
DWG. TITLE: O2 ANALYZER FOR HOTSTOVE

PROJECT:

DWG NO: 10-8-43

SHEET:





KEYPLAN (S=1/1500)

NO.	REVISION	DATE	BY

NOTE:

CAD FN:KREM-BT1.DWG

KAWASAKI STEEL

KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

APPROVED	
CHECKED	
DRAWN	
DATE OF DWG	Oct.20'95

NO.	DATE	
		FOR APPROVED
		RETURN
		APPROVED
		SHOP
		FINAL

CUSTOMER: KREMIKOVTZI

CONSULTANT:

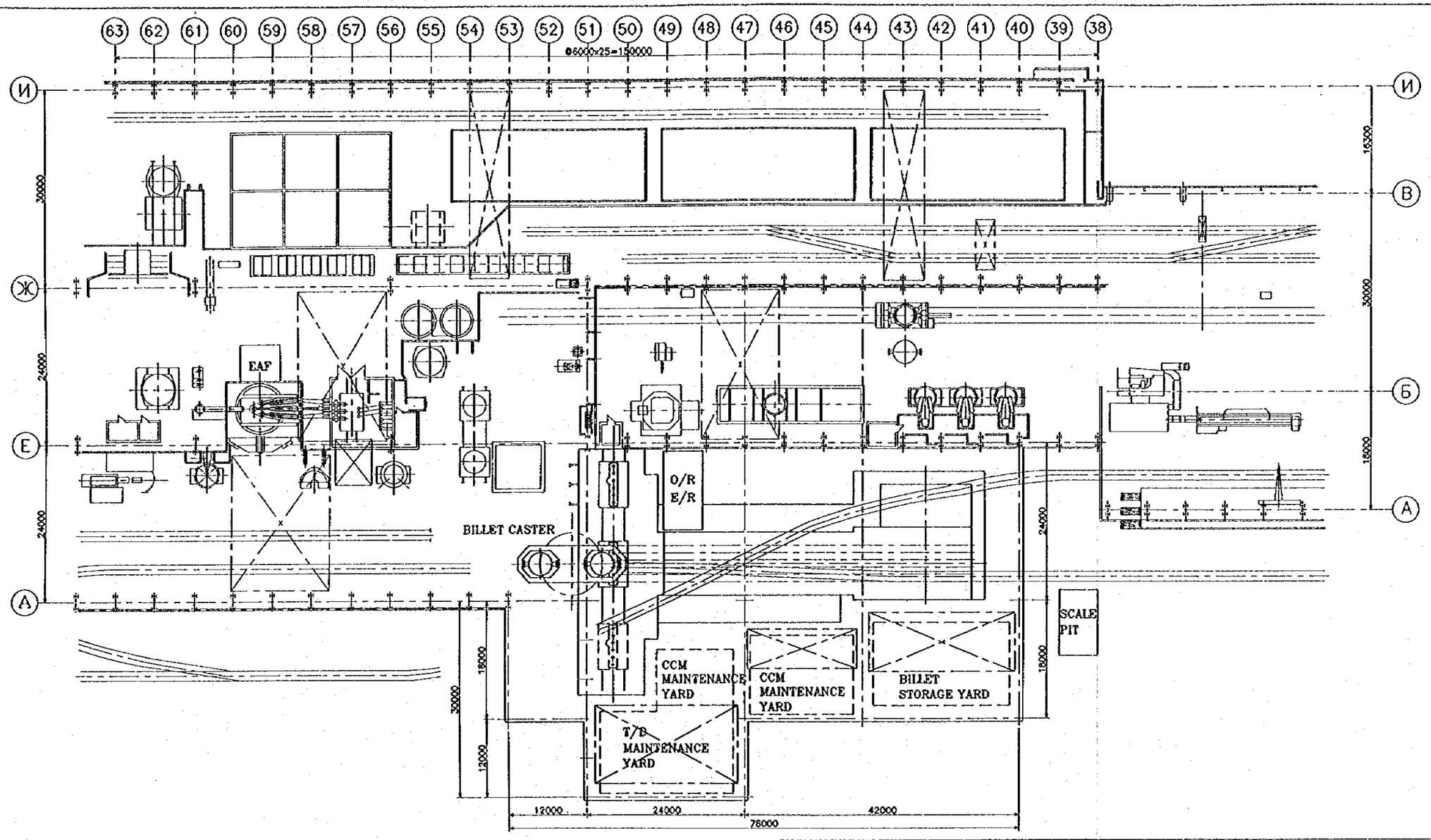
SCALE: 1/300

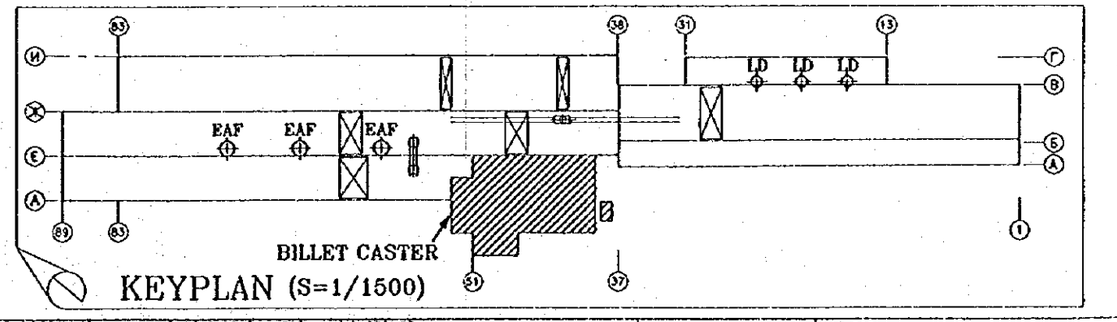
DWG.TITLE: BILLET CASTER LAYOUT (PLAN-1)

PROJECT: BILLET CASTER

DWG NO. 10-8-44

REV.





KEYPLAN (S=1/1500)

NO.	REVISION	DATE	BY

NOTE:
CAD FN:KREM-BT2.DWG

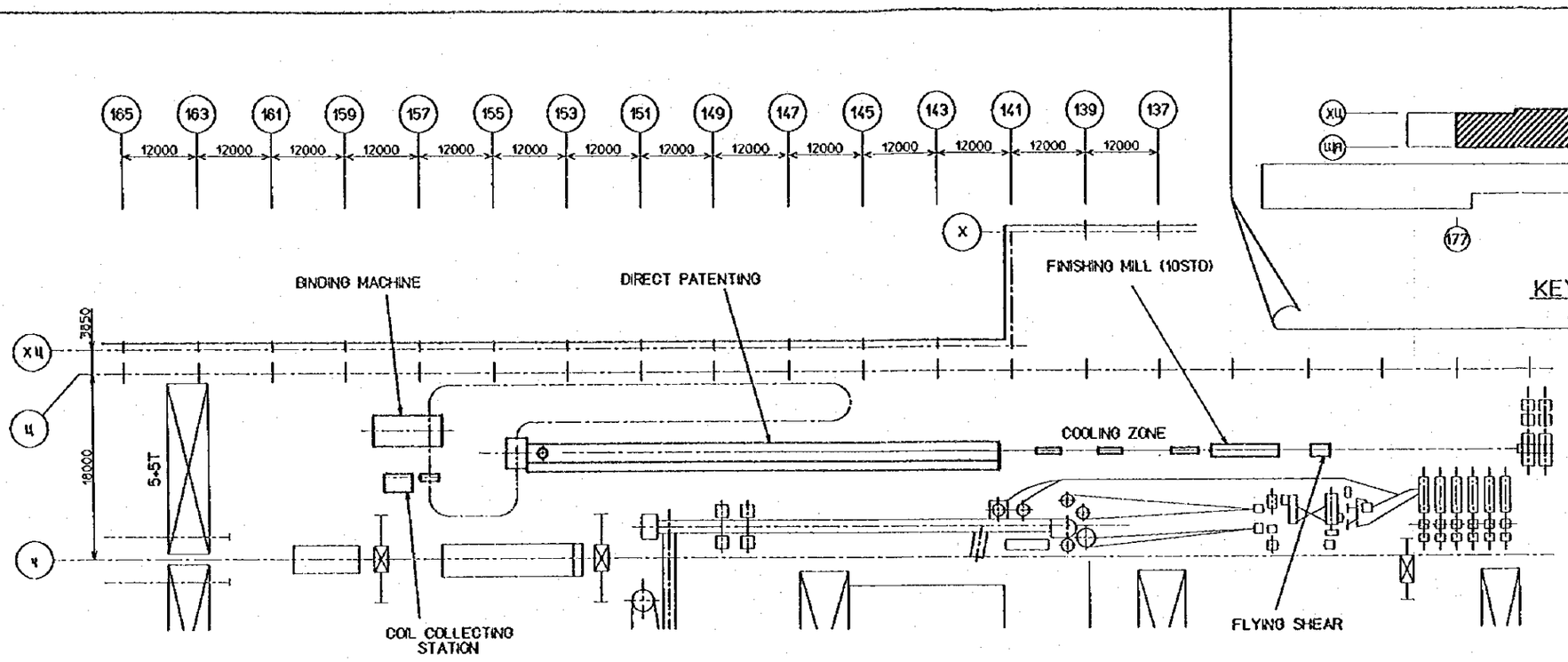
KAWASAKI STEEL
KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

		NO	DATE	
APPROVED				FOR APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	Oct.17'95			SHOP
				FINAL

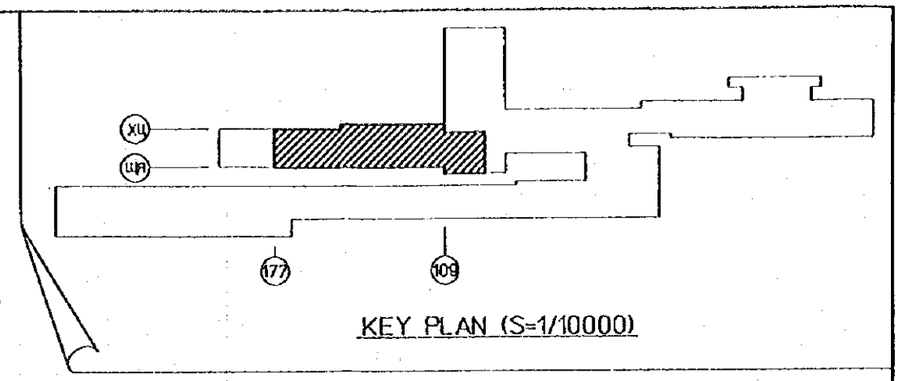
CUSTOMER: KREMIKOVTZI
CONSULTANT:
SCALE: 1/300

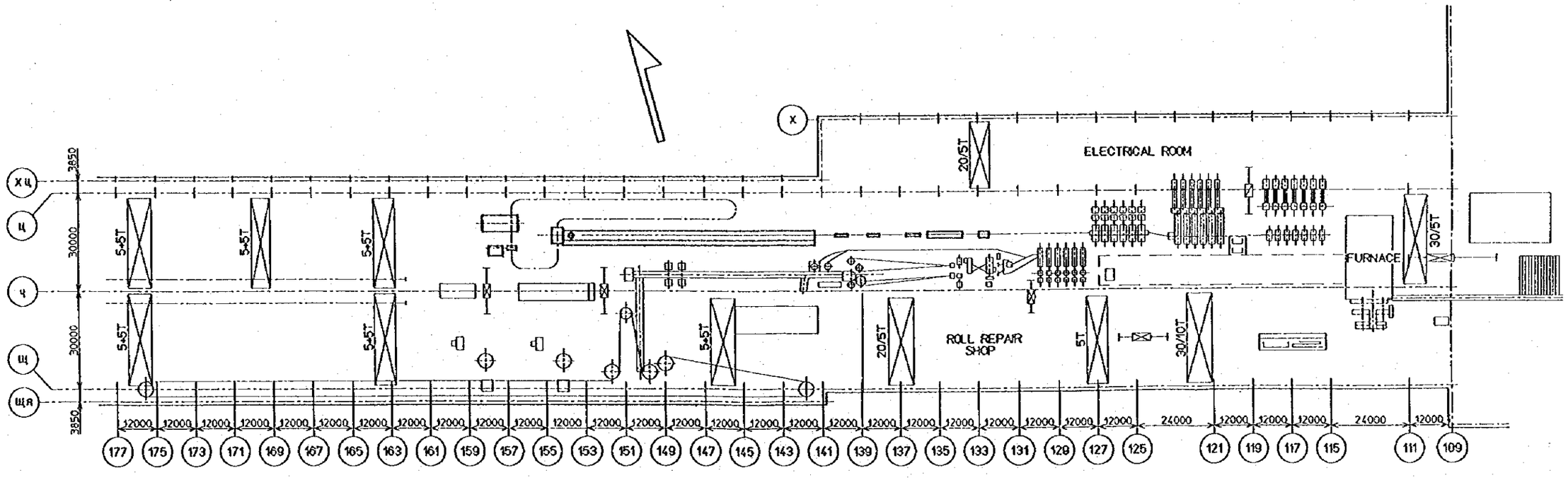
DWG.TITLE
BILLET CASTER
LAYOUT
(PLAN-2)

PROJECT:
BILLET CASTER
DWG.NO. 10-8-45
REV.



ROD MILL (S=1/800)





NO	REVISION	DATE	BY

NOTE:

KAWASAKI STEEL

KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

		NO	DATE	FOR
APPROVED	S. Wakai			APPROVED
CHECKED				RETURN
DRAWN				APPROVED
DATE OF DWG	Dec.2'95			SHOP
				FINAL

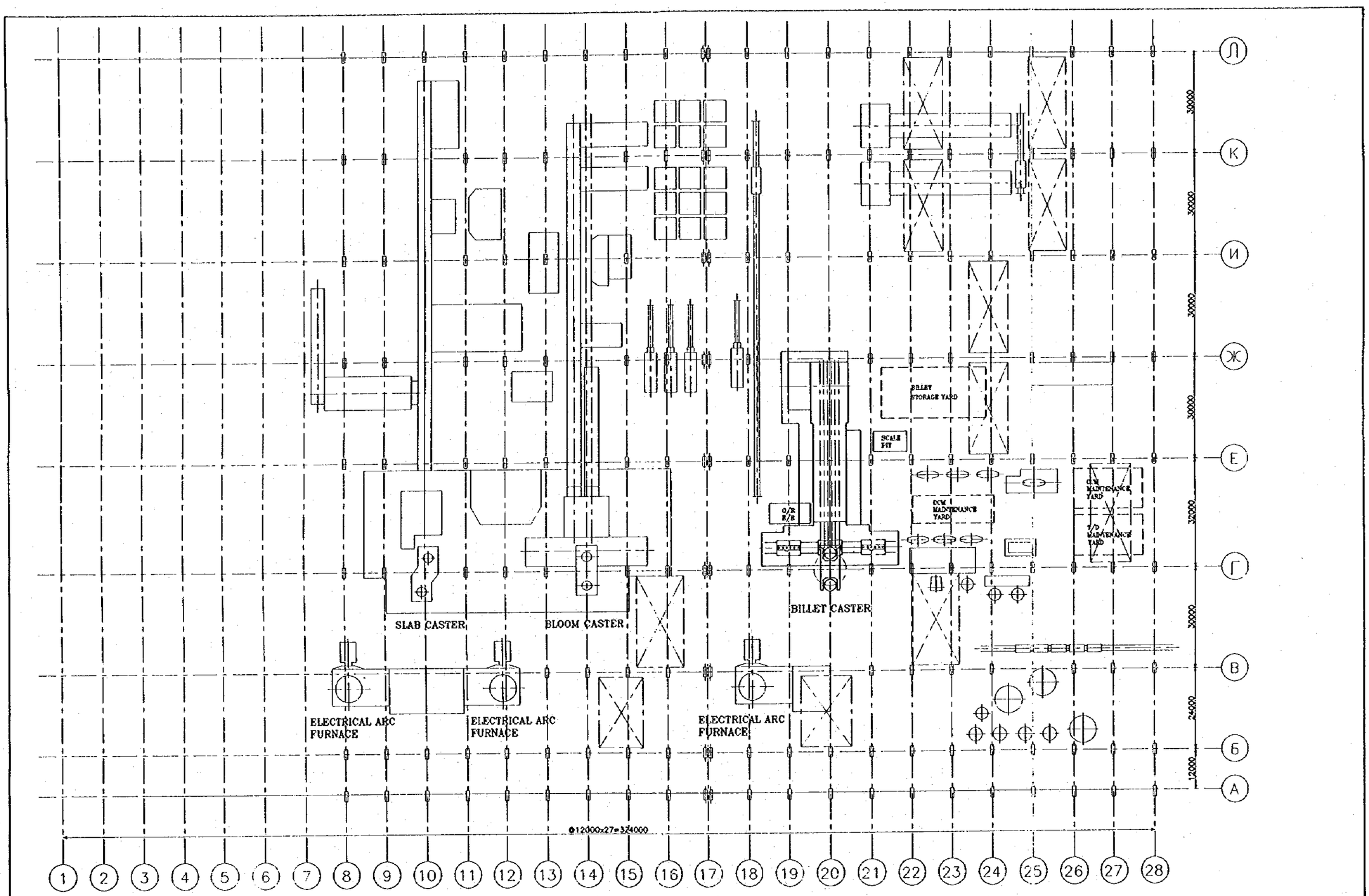
CUSTOMER: KREMIKOVTZI STEEL WORKS
CONSULTANT:
SCALE: 1/1200

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



NO.	REVISION	DATE	BY

NOTE:

CAD FN:STOMANA1.DWG

KAWASAKI STEEL

KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

APPROVED	
CHECKED	
DRAWN	
DATE OF DWG	Oct.17'95

NO.	DATE	FOR
		APPROVED
		RETURN
		APPROVED
		SHOP
		FINAL

CUSTOMER: STOMANA

CONSULTANT:

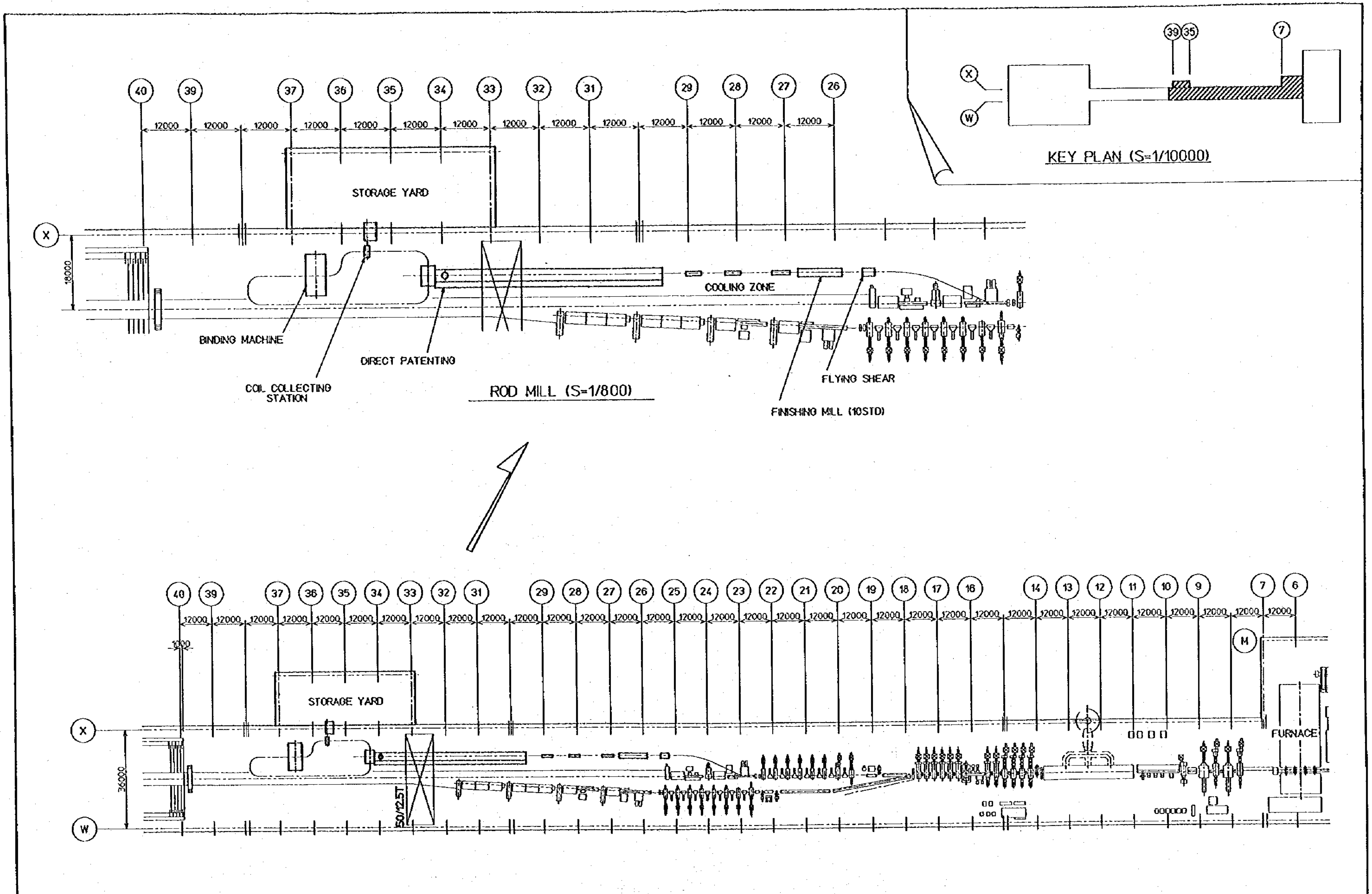
SCALE: 1/500

DWG.TITLE: LAYOUT PLAN

PROJECT: BILLET CASTER

DWG.NO. 10-8-47

REV.



uorkb-rod2 95.12.18

NO	REVISION	DATE	BY	NOTE:

KAWASAKI STEEL
KAWASAKI STEEL CORPORATION
ENGINEERING & CONSTRUCTION DIVISION

		NO	DATE	
APPROVED	8. Urban			FOR APPROVED
CHECKED				RETURN
DRAWN				APPROVED SHOP
DATE OF DWG	Dec.21'95			FINAL

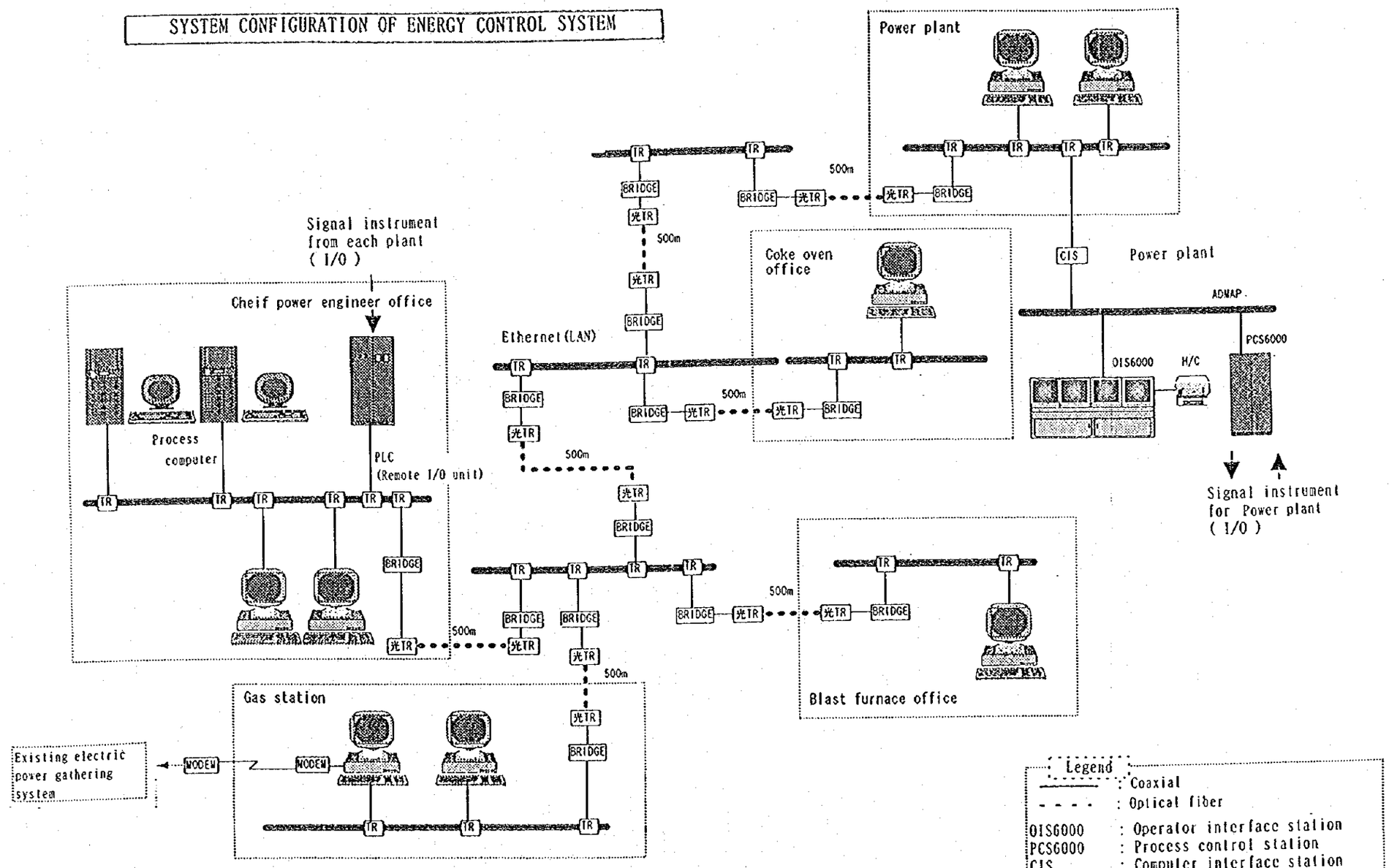
CUSTOMER: PROMET STEEL WORKS
CONSULTANT:
SCALE: 1/1200

DWG.TITLE: PARTIAL REPLACEMENT OF ROD MILL

PROJECT: THE STUDY OF RESTRUCTURING AND MODERNIZING THE STEEL INDUSTRY OF THE REPUBLIC OF BULGARIA

DWG.NO 10-8-48 | SHEET

SYSTEM CONFIGURATION OF ENERGY CONTROL SYSTEM



Legend

———	: Coaxial
- - - -	: Optical fiber
OIS6000	: Operator interface station
PCS6000	: Process control station
CIS	: Computer interface station
H/C	: Hard copier
ADMAP	: Control LAN
光TR	: Optical transceiver
TR	: Transceiver

Revisions		Date	Name
	Drawn	1996-2-8	SHIBATA
	Checked	1996-2-20	

KAWASAKI STEEL CORPORATION
ENGINEERING DIVISION

Title: System Configuration of Energy Control System

Dwg.No.: 10-8-49

Ref.:

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 srip 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 1500

	Average Mw	Annual amount E6-Kwh	Demand Mw
Purchased power	98	857.08	123
Generated power	40	346.2	
(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	15.8	1131.5
EF	24	213.2	344.8
Slab/bloom	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 Kt-s/y 1500

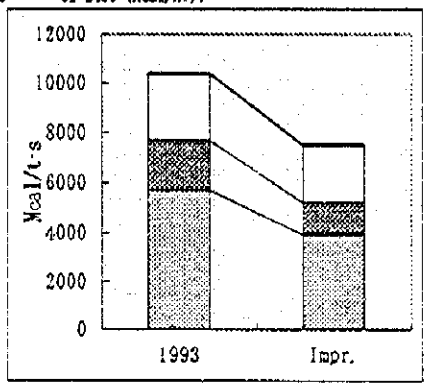
	Average Mw	Annual amount E6-Kwh	Demand Mw	kwh/t	
Purchased power	83	730.21	104		
Generated power	40	347.1			
(own use)	9	80.1			
Total power	132	1157.41			
			Products(Kt)		
Coke ovens	3	29.6	658	45	
Sinter	9	80	1454	55	(PCI kt)
BF	4	34.7	991	35	133
Converter	2	21.6	1120	19.3	
EF	20	177	354	500	
CC	5	44.8	1400	32	
Hot strip	12	103.3	915	112.9	
	0	0	0		
Rod/shape	4	34.9	210	166	
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

Energy unit consumption					1993	Sold
Crude steel	Coal	NG	Power	Oil	Mcal/t-s	Steam
1476.3	5689	1975	2683	51	10285	13
			1422 *		9124	

Energy unit consumption					SCE.-A,C	Sold
Crude steel	Coal	NG	Power	Oil	Mcal/t-s	Steam
1474	3917	1269	2289	51	7513	13
			1214 *		6438	

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



[Note] Calorific value :

Coking coal		7400 Kcal/kg
Natural gas		8000 Kcal/Nm3
Electric power	Kremi.	4621 Kcal/kwh
	Jpn.	2450 Kcal/kwh
PCI coal		6800 Kcal/kg

Appendix 10-10-2 Power Balance after Improvement at Kremikovtzi Scenario-A-2, C-2

1. Electric power - Actual (1993)-

Production	Average	Annual amount	Demand
	Mw	EG-Kwh	Mw
Purchased power	98	857.08	123
Generated power	40	346.2	
(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	15.8	1131.5
EF	24	213.2	344.8
Slab/bloom	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	

Kt-s/y 1500

Power unit consumption 869 Kwh/t

2. Electric power - after improvement-

Production	Average	Annual amount	Demand	kwh/t
	Mw	EG-Kwh	Mw	
Purchased power	74	646.11	93	
Generated power	39	342.8		
(own use)	9	80.1		
Total power	122	1069.01		
		Products(Kt)		
Coke ovens	4	39.3	873	45
Sinter	12	107.3	1950	55
BF	5	46.6	1330	35
Converter	3	28.4	1474	19.3
EF	0	0	0	500
CC	5	44.8	1400	32
Hot strip	12	103.3	915	112.9
	0	0	0	
Rod/shape	4	34.9	210	166
Cold rolling	5	44.4		
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		

Kt-s/y 1500

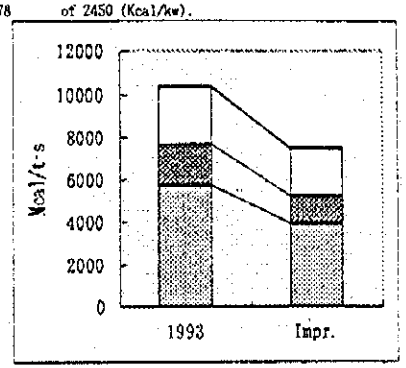
Power unit consumption 725 Kwh/t

(PCI kt) 178

Energy unit consumption					1993	Sold
Crude steel	Coal	NG	Power	oil	Mcal/t-s	Steam
1476.3	5689	1975	2683	51	10385	13
			1422		9124	

Energy unit consumption					SCE.-A-2,C-2	Sold
Crude steel	Coal	NG	Power	oil	Mcal/t-s	Steam
1474	5204	917	2026	51	8185	13
			1074 *		7233	

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



[Note]

Calorific value :

Coking coal		7400 Kcal/kg
Natural gas		8000 Kcal/Nm3
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-B-1, B-2

1. Electric power - Actual (1993) -

Production Kt-s/y 1500

	Average Mw	Annual amount E6-Kwh	Demand Mw	Products(Kt)
Purchased power	98	857.08	123	
Generated power	40	346.2		
(own use)	9	80.1		
Total power	147	1283.38		
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	585.5	
Billet/rod	6	52.2	529.1	
Bar/wire	3	22.12	216.4	
Cold rolling	5	39.9		
Oxygen plant	28	247.5		
Nitrogen plant	1	7.2		
Compressed air	7	58.5		
Others	19	164.21		
Loss	7	51.2		
Total	140	1203.28		

Power unit consumption 869 Kwh/t

2. Electric power - after improvement -

Production Kt-s/y 1000

	Average Mw	Annual amount E6-Kwh	Demand Mw	Products(Kt)	kwh/t
Purchased power	55	478.21	69		
Generated power	36	317			
(own use)	9	80.1			
Total power	100	875.31			
Coke ovens	3	25.4	587		45
Sinter	8	70.9	1289		56
BF	4	30.8	879		35
Converter	2	19.2	993		19.3
EF	0	0	0		500
CC	3	30.2	943		32
Hot strip	12	103.3	915		112.9
	0	0	0		
Rod/shape	0	0	0		166
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	785.21			

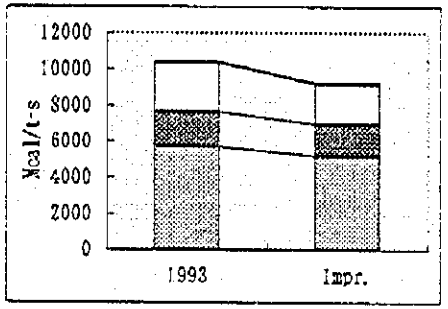
Power unit consumption 881 Kwh/t

Energy unit consumption					1993	Sold
Crude steel	Coal	NG	Power	Oil	Mcal/t-s	Steam
1476.3	5689	1975	2683	51	10385	13
			1422 *		9124	

Energy unit consumption					SCE.-B-1,-2	Sold
Crude steel	Coal	NG	Power	Oil	Mcal/t-s	Steam
993	5182	1801	2225	75	9270	13
			1180 *		8225	

(PCI kt) 118

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



[Note] Calorific value :

Coking coal	7400 Kcal/kg
Natural gas	8000 Kcal/Nm3
Electric power	Kremi. 4621 Kcal/kwh
	Jpn. 2450 Kcal/kwh
PCI coal	6800 Kcal/kg

Appendix 10-10-4 Power Balance after Improvement at Kremikovtzi

Scenario-D-1, -2, -3

1. Electric power - Actual(1993)-

Products Kt-s/y 1500

	Average Mw	Annual amount E6-Kwh	Demand Mw
Purchased power	98	857.08	123
Generated power	40	346.2	
(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	15.8	1131.5
EF	24	213.2	344.8
Slab/bloom	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-

Products Kt-s/y 1000

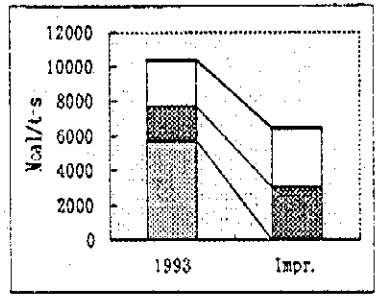
	Average Mw	Annual amount E6-Kwh	Demand Mw	kwh/t
Purchased power	84	731.5	105	
Generated power	41	359.8		
(own use)	3	80.1		
Total power	134	1171.4		
			Products(Kt)	
Coke ovens	0	0	0	
Sinter	0	0	0	
BF	0	0	0	
Converter	0	0	0	
EF	57	496.5	333	500
CC	3	29.8	330	32
Hot strip	12	103.3	315	112.9
	0	0	0	
Rod/shape	4	34.9	210	166
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					1993	Sold
Crude steel	Coal	NG	Power	Oil	Mcal/t-s	Steam
1476.3	5689	1975	2683	51	10385	13
			1422		9124	

Energy unit consumption					SCE.-D-1.-2.-3	Sold
Crude steel	Coal	NG	Power	Oil	Mcal/t-s	Steam
993	0	3007	3404	63	6461	13
			1805 *		4862	

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



[Note] Calorific value :

Coking coal	7400 Kcal/kg
Natural gas	8000 Kcal/Nm3
Electric power	Kremi. 4621 Kcal/kwh
	Jpn. 2450 Kcal/kwh

Appendix 10-10-5 Fuel Balance after Improvement at Kremikovtzi Scenario- A, -C

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									7.78		7.78
TAR	E6-Kl/y	38.8										38.8
BFG	E6-Nm3/y	926.9					6.1			21.7	37	991.7
NG	E6-Nm3/y	166	19.15	10.5	2.03	53.8	60.4	29.8	12.7	7.4	2.72	364.5
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

			Production	Consum.rate
COG production	E6-Nm3/y	395.28	1135	765
COG own use	E6-Nm3/y	206		713
BFG production	E6-Nm3/y	2270.7	1013	
BFG own use	E6-Nm3/y	1279		1010
Tar production	E6-l/y	38.8		

Fuel unit consumption 4538 Mcal/t-s

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

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									7.78		
TAR	E6-Kl/y	22.5										22.5
BFG	E6-Nm3/y	1423.1					6.1			21.7	37	1487.9
NG	E6-Nm3/y	143	2.73	5.26	1.27	8.75	51.47	11.18		7.4	2.72	233.78
H. oil	E6-l/y			6.66						1.7	1.14	9.5
			15	37.6	28.8	50	450	426				

Purchased

NG purchased	E6-Nm3/y	233.78
H. oil	E6-l/y	9.5

Production

			Production	Consum.rate
COG production	E6-Nm3/y	235	658 Kt	530
COG own use	E6-Nm3/y	98.7		600
BFG production	E6-Nm3/y	2231.4	991 Kt	
BFG own use	E6-Nm3/y	743.5		600
Tar production	E6-l/y	22.5		

Fuel unit consumption 3291 Mcal/t-s

Power generation in average: 40Mw

Appendix 10-10-6 Fuel Balance after Improvent at Kremikovtzi Scenario- A-2, C-2

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									7.78		7.78
TAR	E6-Kl/y	38.8										38.8
BFG	E6-Nm3/y	926.9					6.1			21.7	37	991.7
NG	E6-Nm3/y	166	19.15	10.5	2.03	53.8	60.4	29.8	12.7	7.4	2.72	364.5
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

			Production	Consum.rate
COG production	E6-Nm3/y	395.28	1135	765
COG own use	E6-Nm3/y	206		713
BFG production	E6-Nm3/y	2270.7	1013	
BFG own use	E6-Nm3/y	1279		1010
Tar production	E6-l/y	38.8		

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	180.85
DES COG	E6-Nm3/y								7.78		
TAR	E6-Kl/y	29.86									29.86
BFG	E6-Nm3/y	1932					6.1		21.7	37	1996.8
NG	E6-Nm3/y	77	3.57	6.93	0	8.75	51.47	11.18	7.4	2.72	169.02
H. oil	E6-l/y			6.66					1.7	1.14	9.5
			15	37.6	28.8	50	450	426			

Purchased

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

Production

			Production	Consum.rate
COG production	E6-Nm3/y	311.8	873 kt	530
COG own use	E6-Nm3/y	130.95		600
BFG production	E6-Nm3/y	2994.7	1330 Kt	
BFG own use	E6-Nm3/y	997.9		600
Tar production	E6-l/y	29.86		

Fuel unit consumption 3602 Mcal/t-s

Power generation in average: 39Mw

Appendix 10-10-7 **Fuel Balance after Improvement at Kremikovtzi** Scenario-B-1, B-2

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									7.78		7.78
TAR	E6-Kl/y	38.8										38.8
BFG	E6-Nm3/y	926.9					6.1			21.7	37	991.7
NG	E6-Nm3/y	166	19.15	10.5	2.03	53.8	60.4	29.8	12.7	7.4	2.72	364.5
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

Fuel unit consumption 4538 Mcal/t-s

Production

			Production	Consum.rate
COG production	E6-Nm3/y	395.28	1135	765
COG own use	E6-Nm3/y	206		713
BFG production	E6-Nm3/y	2270.7	1013	
BFG own use	E6-Nm3/y	1279		1010
Tar production	E6-l/y	38.8		

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

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										20.08
BFG	E6-Nm3/y	1255.1					6.1			21.7	37	1319.9
NG	E6-Nm3/y	149	2.42	4.67	0	5.89	51.47	0		7.4	2.72	223.57
H. oil	E6-l/y			6.66						1.7	1.14	9.5
			15	37.6		50	450	426				

Purchased

NG purchased	E6-Nm3/y	223.57
H. oil	E6-l/y	9.5

Fuel unit consumption 4390 Mcal/t-s

Power generation in average: 36Mw

Production

			Production	Consum.rate
COG production	E6-Nm3/y	209.7	587 Kt	530
COG own use	E6-Nm3/y	88.05		600
BFG production	E6-Nm3/y	1979.2	879 Kt	
BFG own use	E6-Nm3/y	659.3		600
Tar production	E6Kl/y	20.08		

Appendix 10-10-8

Fuel Balance after Improvement at Kremikovtzi

Scenario D-1, D-2, D-3

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					6.1		21.7	37	-
NG	E6-Nm3/y			3.56	5.8	51.47	11.18	7.4	2.27	-
H.oil	E6-l		6.66					0	1.14	7.8
LP steam	E6-Mcal	551.3								551.3
Hot water	E6-Mcal	133.9								133.9
Purchased NG	E6-Nm3/y	254.4		3.56	5.8	53.33	11.18	19.36	25.57	373.2

Generated power	359.8	E6-Mwh	41.1	Mw

Fuel unit consumption 3069 Mcal/t-s

Appendix 10-10-9

Energy Balance after Improvement

Note: Values show annual production / consumption.

Stomana	Scenario		A,A-2	546 (Kt/t-s)		C, C-2	521 (Kt/t-s)		B-1,D-2	1002 (Kt/t-s)		D-1	1027 (Kt/t-s)		B-2,D-3	1002 (Kt/t-s)	
	Unit consumption (Kwh/t)	(Mcal/t)	Production (Kt)	Power (E6-Kwh)	NG (E6-Nm3)	Production (Kt)	Power (E6-Kwh)	NG (E6-Nm3)	Production (Kt)	Power (E6-Kwh)	NG (E6-Nm3)	Production (Kt)	Power (E6-Kwh)	NG (E6-Nm3)	Production (Kt)	Power (E6-Kwh)	NG (E6-Nm3)
EF/CC	610	170	546	333.1	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.	(Kwh/t-s)	(Mcal/t-s)		935	1335		886	1035		833	765		832	757		833	765
Energy unit consum.per ton of crude steel					3683	(Mcal/t-s)		3264	(Mcal/t-s)		2838	(Mcal/t-s)		2827	(Mcal/t-s)		2838

Promet	(kwh/t)	(Mcal/t)		(Kt)	(E6-Kwh)	(E6-Nm3)	(Kt)	(E6-Kwh)	(E6-Nm3)	(Kt)	(E6-Kwh)	(E6-Nm3)	(Kt)	(E6-Kwh)	(E6-Nm3)
Bar and shape	174	377		238	41.4	11.2	238	41.4	11.2	238	41.4	11.2	391	68	18.4
Other					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		78	19.8