8. Technical regulations

(1) Order of installation
This should be based on 12. accompaning documents (12), but changes are accepted according to the proceeding of construction work with agreement of supervisor or manager.

(2) Outline of welding

A. Outline of welding

Kind of welding	Outline of welding
Fillet welding	Depth of weld should be over 70% & under 100% of thinner base metal's thickness.
Butt-welding	Beveling type should be 60°V type or 50°V type.

B. Recommendation of welding rod

Welding materials	Welding rod in use
SS, SGP	Sumitomo welding rod 01A, 200, 300
STPG	" " 03A
SUS304	" " 308

C. Note

a. Temper color caused by welding of SUS304 should be removed by the sandpaper, etc.
b. Outline of each welding should be followed by the drawings.

(3) Outline of painting

A. Necessary place of painting
   a. weld fitting parts of pipes & processing ones in site
   b. connecting parts of structure
   c. setting bolts, head of anchor bolts
   d. weld fitting part
   e. touch up painting parts
   f. fluid name of pipes, flow sign

B. Unnecessary place of painting
   a. place painted in Japan
   b. SUS pipes
   c. cast metals such as slag pot
   d. standard device of maker (valve, oil cylinder, etc.)

C. Outline of painting and coloring

Outline of painting is refered to 12. accompanying document (13).
Coloring should be matched surrounding.

(4) Inspection and passing standard

A. Assignment of work

Item	Contractor	Supervisor
Inspection enforcement	o	
Reports preparation	o	
Judgement of passing		o

B. Item of inspection

No	Item	contents	Passing standard	Note
1	Structure	each floor level	± 3mm	
2	Main & Sub-lance elevator	position of installtion hight of installation horizontal, vertical	± 2mm 0.1mm/m	
3	Rotaring facilities pump blower,etc.	centering of shaft	under 0.05mm in face and circle	measured by dial gauge, space gauge
4	Piping, sleeve flange weld	color check	normal	depth of weld, Out of bead
5	Weld except item 4.	outlook	normal	
6	Painting	coloring and spots	judged by attendance	
7	Pipes airtight test	shown in following page		

Outline of pipes airtight test
These should be done before the pipe painting work.

No.	Piping line	kg/cm^2G test pressure	contents of inspection	passing standard
1	O_2	(N_2) 10	Soap test	No bubbling
2	Pulverized coal + N_2	(N_2) 10	"	"
3	N_2	(N_2) 10	"	"
4	LPG	(N_2) 2	"	"
5	Air for combusion	(air) blower pressure	"	"
6	Make up water for air conditioner	(water) pump pressure	Check of leak by watching	No leak
7	Cooling water(go) (device is not included)	(water) pump pressure	"	"
8	Cooling water (return)	(water) 2	"	"
9	Compressed air	(air) 6	Soap test	No bubbling
10	Oil pressure each using pressure	(hydraulically-operated oil)	Check of leak by watching	No leak

9. Outline of test works

(1) Outline

Each item of this outline shall be used for estimation of man power for organization of
accident prevention and checking points in test run period.
Contents in detail and passing standard is checked by supervisor according to data prepared by each maker.
And,for reference,independent equipments like motor,fan, pump, dryer, and so forth have been tested in Japan and their inspection sheets & reports of test run are packed with each equipment.

(2) Organization of test run

A. No-load test run

	Contractor (Mechanical, Electrical instrumentation)
Conductor	o
Assistant of conductor	o
Operator	o
Check, record	o

B. Individual load test, Synthetic load test run

	Operation manager (IEE)	Operator (IEE)	Supervisor of installation work (IEE)
Conductor	o		
Assistant of conductor			o
Operator		o	
Check, record		o	

(Note) Contractor should attend this period.

(3) Preparation for test run (checking items in following table)

	Checking items
Electricity	(1) Measurement of earth resistance (circuit, equipment) (2) Sequence check (3) Idling test (conductor, solenoid volve, LS) (4) Direction of motor's revolution (5) Alarm, indication
Oil pressure	(1) Quantity of oil in the oil unit (MF, Hood) (2) Oil temp. (3) Pressure (4) Reduction of air
Utility	(1) Pressure (2) Flow rate (3) Operating of dryer for instrument
Instrumentation	(1) Range adjustment of equipments (2) 0 point ajustment (3) Sequence check (4) Confirmation of indicator & controller by transmitter's signal
Others	(1) Flashing of pipes

(4) No-load test run

No.	Name	Objective device	Checking items
1	Electrical rotar	Coal pulverizer Screw feeder Rotary feeder I.D.F. Dust collecting fan Burner fan	Abnormal sound Abnormal vibration Mortar amp. Bearing temp.
2	Electrical reciprocator	Incling machine of Gasifier Main lance elevator Sub-lance elevator Slag pot car	Time required & limit switch adjustment Motor amp. Abnormal sound Abnormal vibration
3	Hydraulic reciprocator	Incling machine of M.F. Hood for gasifier	Stroke, time required pressure, Abnormal sound Indication of gauge
4	equipments drived by air cylinder	Valves drived by air cylinder Instrument control valve	Speed controller adjustment L.S. adjustment Indication of gauge Operating confirmation from controller
5	Blow tank's loadcell for P.C. injection	Loadcell	Adjustment Accuracy confirmation by weighing test
6	Overall	M.F. Runner for pig iron Gasifier Hood for gasifier Lance & Sub-lance elevator Others	Relative location Intervention Inter-rock test Sequence idling test

(5) Individual load tests

No.	test item	Contents	Checking items
1	Utilities	(1)Passing cooling water (2)Ajustment of O_2,N_2,LPG Reducing valves, etc. (3)Meter constant adjustment of controller	°Flow rate °Pressure
2	Emergency test	(1)Power failure (2)Suspension of water supply (3)Compressed air failure (4)Engine pump operation	°"open"&"close" of valves (cylinder valve, solenoid valve) °Counter weight of lance&sub-lance °Automatic operating of engine generator
3	Burner, Combustion test	(1)Burner's ignition for furnace (2)Burner's ignition for runner	°Rising temp. of furnace
4	Flare stack, Ignition test	Flare stack's ignition & accidental fire test	Inspection of accidental fire (thermo-couple)
5	Melting test	Feed the pig iron in gasifier after scrap melting	°Rising temp. of cooling water °Melting time °Temp. of pig iron °Locus of discharging pig iron °Electricity, Voltage, Amp.
6	Gasifier keeping test	Discharge the pig iron from gasifier after keeping in it for certain time	°Rising temp. of cooling water °Measurement by sub-lance °Locus of discharging pig iron °Amp., Electricity

No.	Item	Contents	Checking items
7	Coal drying test	Banko coal (120kg) drying in coal dryer	°Moisture measurement of coal before and after drying °Check of Amp.& smoke °Required time
8	Coal pulverizing	Pulverizing the dried coal & storing into blow tank	°Required time for pulvering °Grain size of pulverized coal °Amp. of motor
9	P.C.injection test	Giving pressure to blow tank and inject the P.C. and gather it by dummy bug filter	°Pressure of blow tank °Flow rate of N_2 °RPM of rotary feeder °Volume of P.C. recovered °Amp. of rotary feeder °Comparison of caluculated volume of PC with recoved volume of it

(6) Synthetic load test run

Items of (5) Individual load tests are done in accordance with actual operation system.
Operation plans are prepared by the operation manager of IEE.

10. General matters

(1) When extension of construction work out of contractor's scope occurs, another agreement should be done.
(2) The period of guarantee is one year from the day of completion of construction (after load tests of each facility).
(3) Overhead crane lended free from Indonesia and fork lift transportated may be possible to use. But their operation should be done by contractor.
(4) Necessary drawings for installation in site should be supplied afterwards. But adjustment in site should be treated in site condition, if necessary.
(5) Fitting and installation should be done by drawings and each specification. Order of construction and construction schedule should be determined with supervisor.
(6) Assembling of disintegrated facilities for the purpose of convenience in transportating should be done according to the marking which had been assembled in Japan or assembly drawings. And at this time,accracy of assembling should be keeped. (Fragile facilities are not apt to assemble.)
This item should be in the scope of contractor.
(7) Plant enforcement should be done by the lisenced welder.
(8) Plant installation site should be cleaned and put in order every day.
(9) Additional materials & man-hour by the modification for constructive convenience should not be regarded as the additional construction work.
Also,necessary incidental works judged by common sence which are not listed on specification and drawings should not be regarded as the additional ones.

11. Construction acceptance

Construction acceptance is done by inspection of supervisor or operation manager after the completion of the construction and synthetic load test run. This should be regarded as JICA's passing and construction acceptance.

12. Accompaning documents

(1) Location of construction site, PUSPIPTEK

(2) Whole plan

(3) Front view, side view

(4) Grand floor layout, First floor layout
2nd, 3rd floor layout

(5) Piping diagram (1/2)
" " (2/2)

(6) Electrical drawings
A. External shape of control panel, operating panel, etc.
B. Developing connection diagram
C. Wiring work drawings
(distribution diagram, mutual connection diagram, etc.)

(7) Instrument drawings
A. External shape of indication panel, gascro anlyzer
B. Hook up chart
C. Wiring work drawings
D. Pipe work drawings

(8) Cable tray arrangement drawing

(9) Lighting, Receptables, welder for repair

(10) Anchor plan

(11) Utilities match point

(12) Procedure of installation

(13) Specification of painting

(14) Work schedule (for reference)

ATTACHMENT 8-3

		Page
1.	Test Conditions	105
2.	Test Results	161

1. Test Conditions

RUN	Coal gasification - 1	RUN No.	CG001

DATE	1987.08.19. (Wed.)

1. PURPOSE of RUN
   1) Coal gasification for BUIA1 & BUIIA1 coal
   2)
   3)
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE – A

Sample number	BUIA1, BUIIA1				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	22.21 %	C	75.1 %	SiO2	%
Ash	5.21 %	H	5.6 %	Al2O3	%
V.M.	35.03 %	N	1.1 %	CaO	%
F.C.	36.17 %	O	17.7 %	K2O	%
T.S.	0.31 %			Na2O	%

OPERATION CONDITION – A

Weight of molten iron	300	Kg
Flow rate of Oxygen	16.0	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	30.0	Kg/hr
Position of main-lance over bath surface	200, 150	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car	≅ 1350	℃
Basicity of slag	1.5	
Weight of coal	≅ 50	wet Kg
Weight of burnt lime	2 + 2	Kg

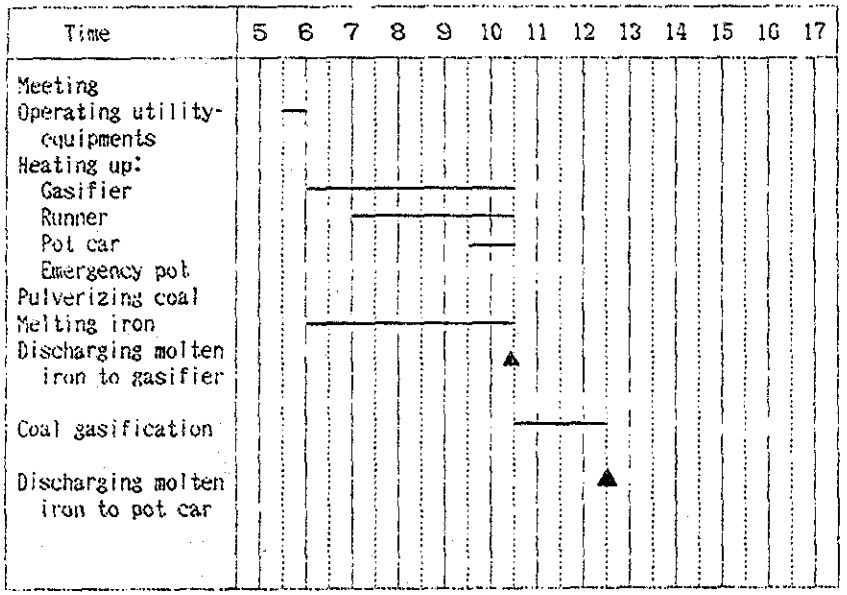
COAL SAMPLE – B

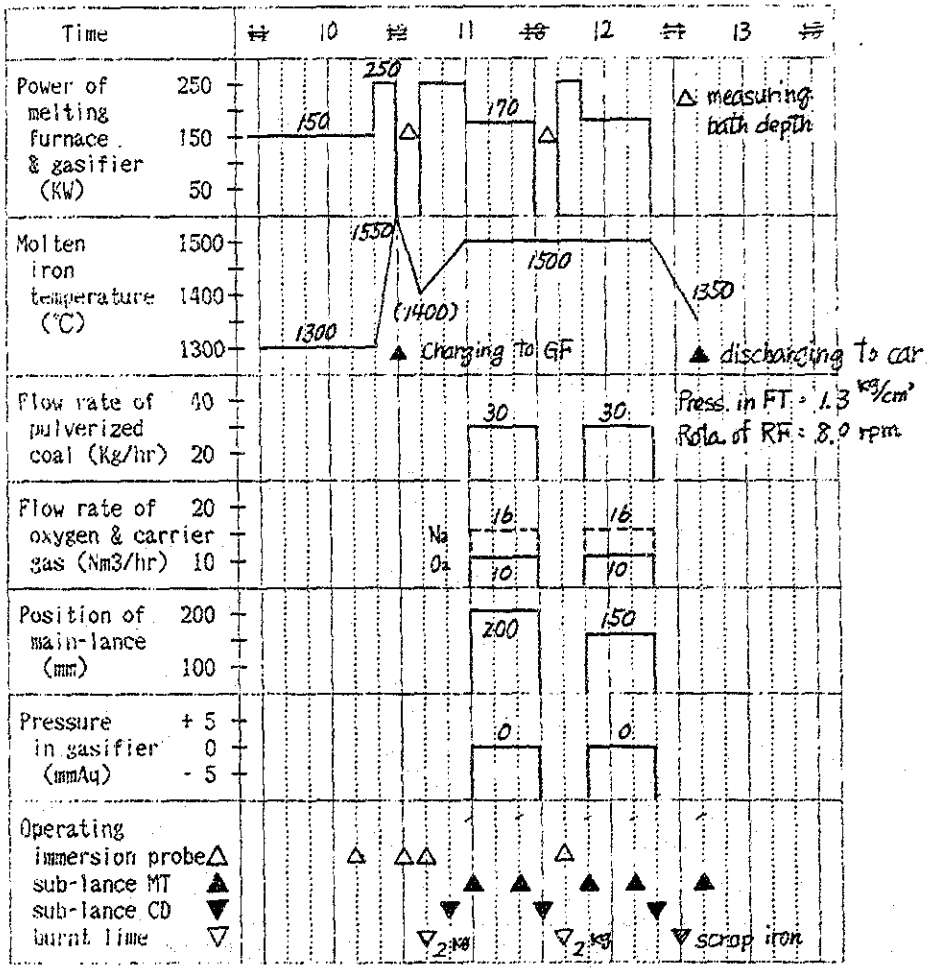
Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	%	SiO2	%
Ash	%	H	%	Al2O3	%
V.M.	%	N	%	CaO	%
F.C.	%	O	%	K2O	%
T.S.	%			Na2O	%

OPERATION CONDITION – B

Weight of molten iron	300	Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on dischare to pot car		℃
Basicity of slag	1.5	
Weight of coal		wet Kg
Weight of burnt lime		Kg

4.SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car


Time
10 11 12 13
Power of melting furnace & gasifier (KW) 250 150 50
150
250
170
△ measuring bath depth
Molten iron temperature (°C) 1500 1400 1300
1300
1550
(1400)
1500
1350
▲ Charging to GF
▲ discharging to car
Flow rate of pulverized coal (Kg/hr) 40 20
30
30
Press. in FT = 1.3 kg/cm²
Rota. of RF = 8.0 rpm
Flow rate of oxygen & carrier gas (Nm3/hr) 20 10
N2
O2
16
16
10
10
Position of main-lance (mm) 200 100
200
150
Pressure in gasifier (mmAq) + 5 0 - 5
0
0
Operating
immersion probe △
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽
▽2kg
▽2kg
▽ scrap iron

DATA	1987.08.~~10~~.27. (Thu.)

RUN	2nd Coal Gasification Test Run	RUN No.	CG002

1. PURPOSE of RUN

1) Coal Gasification Test for BSIA2 & BSIIA2 Coal.

2)

3)

4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	BSIA2 & BSIIA2				
Proximate analysis (dry base)		Ultimate analysis		Ash components	
Moisture	4.00 %	C	75.73 %	SiO2	%
Ash	4.32 %	H	5.89 %	Al2O3	%
V.M.	43.80 %	N	1.16 %	CaO	%
F.C.	47.88 %	O	17.03 %	K2O	%
~~T.S.~~	%	S	0.21	Na2O	%

COAL SAMPLE－B

Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	%	SiO2	%
Ash	%	H	%	Al2O3	%
V.M.	%	N	%	CaO	%
F.C.	%	O	%	K2O	%
T.S.	%			Na2O	%

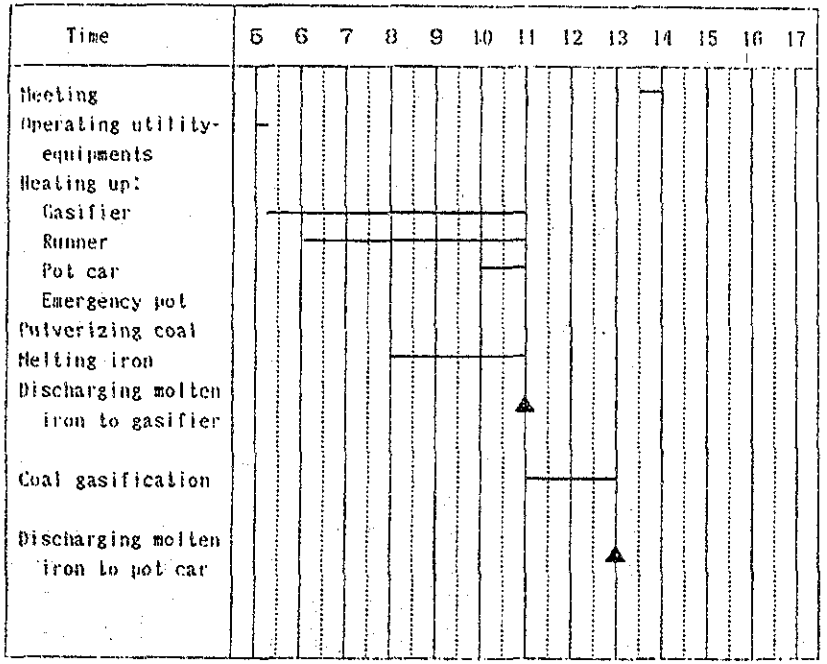
OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	12, 15	Nm3/hr
Flow rate of carrier gas	10	Nm3/hr
Flow rate of pulverized coal	20, 25	Kg/hr
Position of main-lance over bath surface	200, 170	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car	≒1350	℃
Basicity of slag	1.5	
Weight of coal	30	wet Kg
Weight of burnt lime	(1)	Kg

OPERATION CONDITION－B

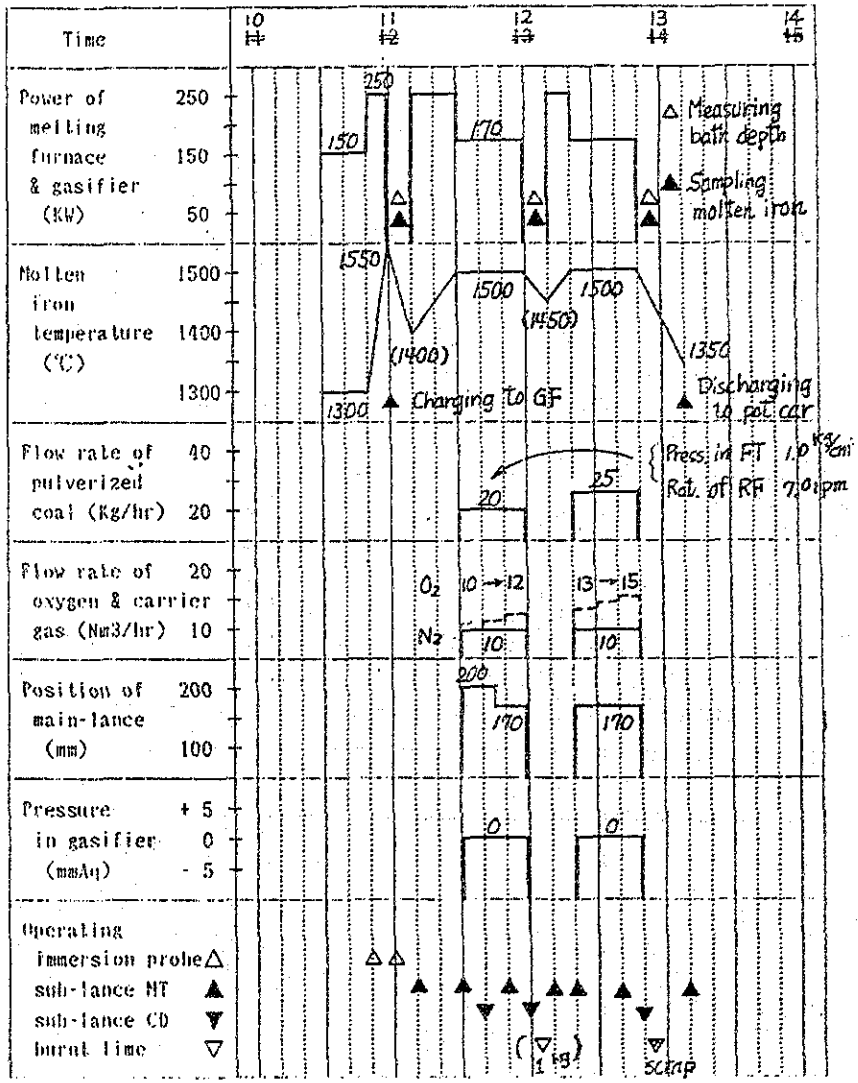
Weight of molten iron	300	Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on dischare to pot car		℃
Basicity of slag	1.5	
Weight of coal		wet Kg
Weight of burnt lime		Kg

4. SCHEDULE



After measuring bath depth

1) Raising bath temperature
2) Injecting Oxygen
3) Checking burning
4) Injecting PC



TEST000-1

DATA	1987. ~~09.10.~~ 9. 3.

RUN	Coal Gasification Test	RUN No.	CG003

1. PURPOSE of RUN

1) Coal Gasification Test for BUⅢB2

2)

3)

4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	BUⅢB2				
Proximate analysis (dry base)		Ultimate analysis (d.a.f.)		Ash components	
Moisture	%	C	73.10 %	SiO2	%
Ash	2.29 %	H	5.80 %	Al2O3	%
V.M.	47.58 %	N	1.25 %	CaO	%
F.C.	48.02 %	O	18.51 %	K2O	%
~~T.S.~~	%	S		Na2O	%

COAL SAMPLE－B

Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	%	SiO2	%
Ash	%	H	%	Al2O3	%
V.M.	%	N	%	CaO	%
F.C.	%	O	%	K2O	%
T.S.	%			Na2O	%

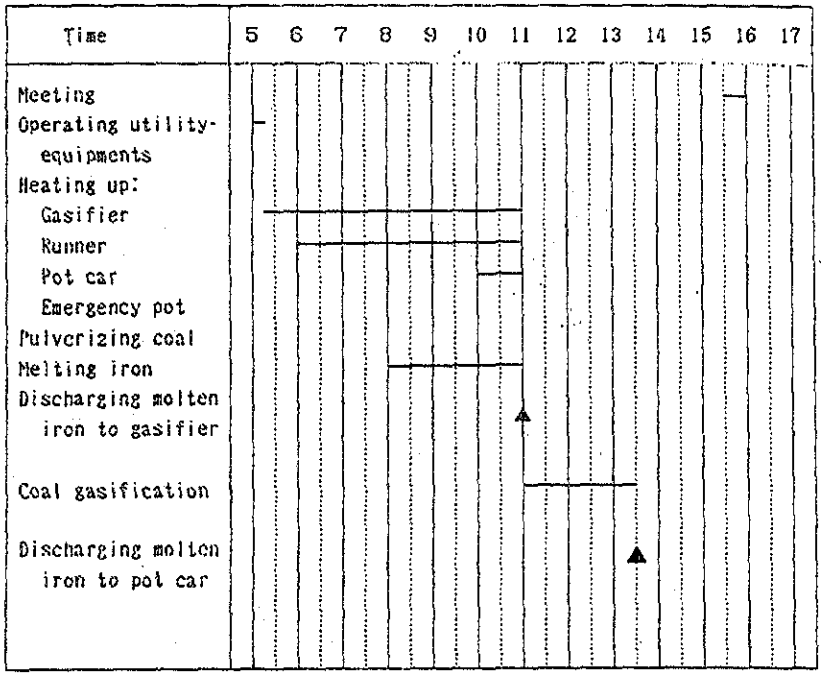
OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.7	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car	≃ 1350	℃
Basicity of slag	1.5	
Weight of coal	30.	wet Kg
Weight of burnt lime	(1)	Kg

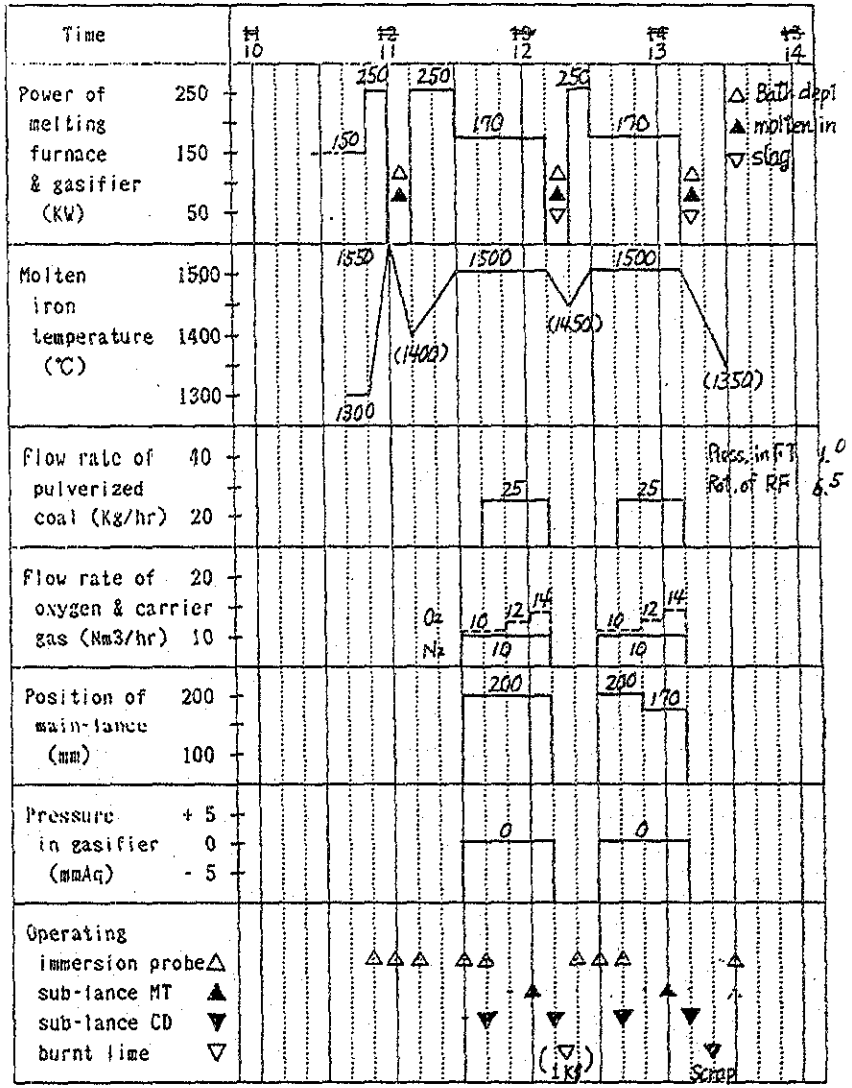
OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on dischare to pot car		℃
Basicity of slag	1.5	
Weight of coal		wet Kg
Weight of burnt lime		Kg

4. SCHEDULE



After measuring bath depth
1) Raising bath temperature
2) Injecting Oxygen
3) Tilting gasifier
4) Checking burnin
5) Injecting PC



RUN	4th Coal Gasification Test Run	RUN No.	CG004

DATE	1987.09.08 . (Tu)

1. PURPOSE of RUN
   1) Coal gasification test run for BSⅣB coal.
   2)
   3)
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number		BSⅣB			
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	73.69 %	SiO2	%
Ash	%	H	5.86 %	Al2O3	%
V.M.	%	N	1.13 %	CaO	%
F.C.	%	O	19.07 %	K2O	%
T.S.	%	T.S.	0.26	Na2O	%

COAL SAMPLE－B

Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	%	SiO2	%
Ash	%	H	%	Al2O3	%
V.M.	%	N	%	CaO	%
F.C.	%	O	%	K2O	%
T.S.	%			Na2O	%

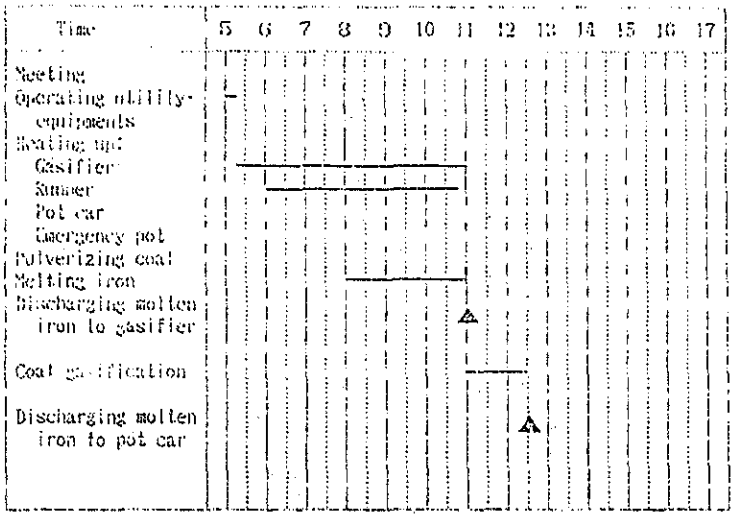
OPERATION CONDITION－A

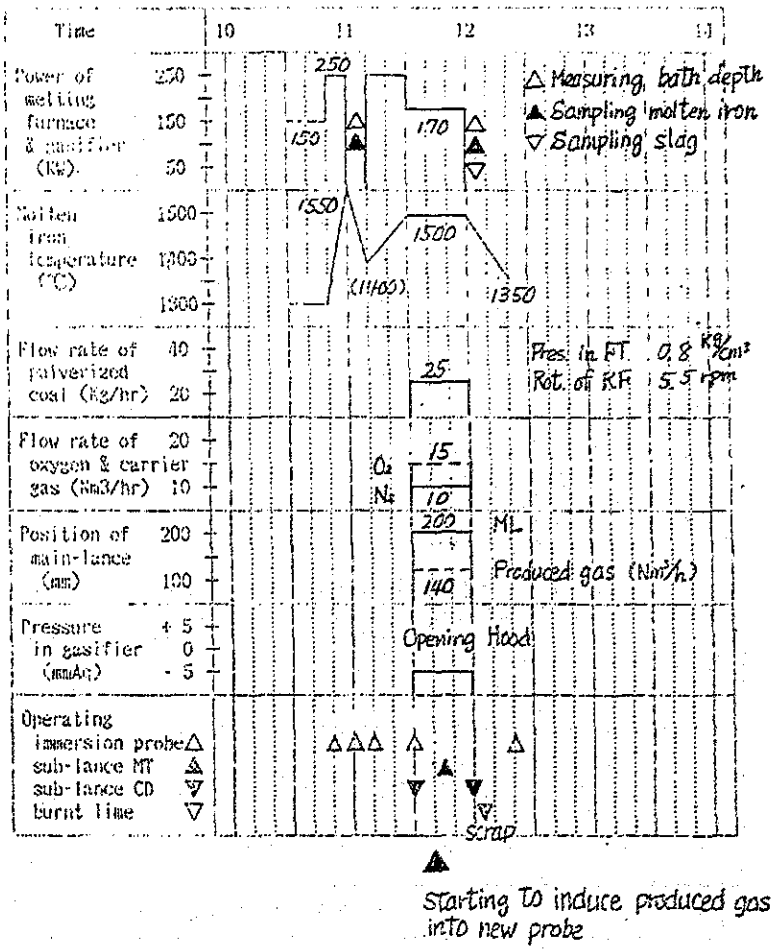
Weight of molten iron	300	Kg
Flow rate of Oxygen	7.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	15.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on dischare to pot car		℃
Basicity of slag	1.5	
Weight of coal		wet Kg
Weight of burnt lime		Kg

4. SCHEDULE





1) Measuring bath depth.
2) Heating up bath temperature.
3) Confirming bath temperature about 1500°C
4) Setting new probe for produced gas
5) Purging N_2 in new probe
6) Injecting O_2
7) Confirming burning
8) Injecting PC.

↓ after 10 min.

9) Inducing produced gas into new probe.

RUN	5th Coal Gasification Test Run	RUN No.	CG005

DATE	1987.09.11 . (Fr)

1. PURPOSE of RUN
   1) Coal gasification test run for BSIC1 coal.
   2)
   3)
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	BSIC1				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	76.44%	SiO2	%
Ash	2.65 %	H	5.83 %	Al2O3	%
V.M.	46.95 %	N	1.40 %	CaO	%
F.C.	50.40 %	O	15.76 %	K2O	%
T.S.	0.58 %	T.S.	0.60	Na2O	%

COAL SAMPLE－B

Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	%	SiO2	%
Ash	%	H	%	Al2O3	%
V.M.	%	N	%	CaO	%
F.C.	%	O	%	K2O	%
T.S.	%			Na2O	%

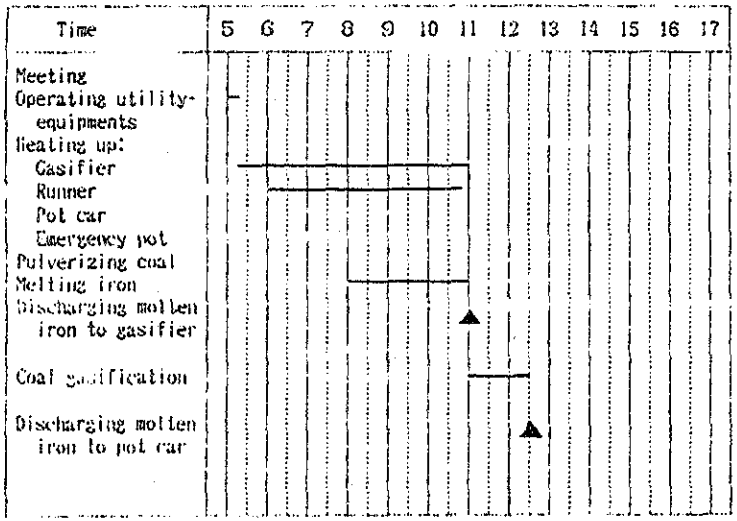
OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	14.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

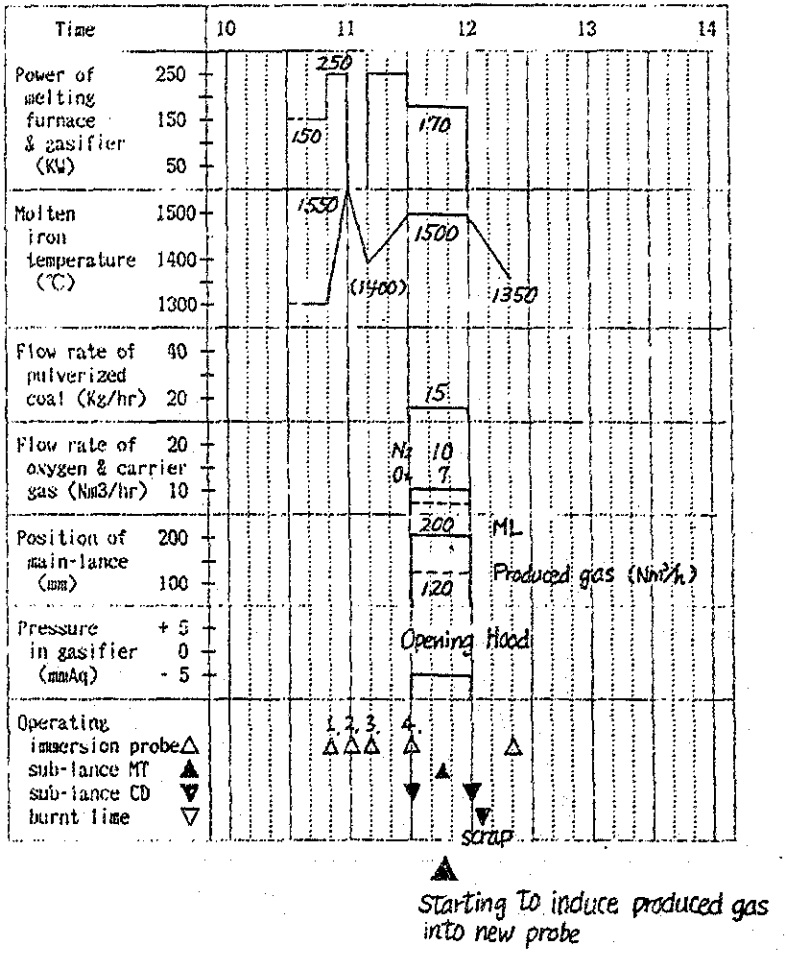
OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on discharge to pot car		℃
Basicity of slag	1.5	
Weight of coal		wet Kg
Weight of burnt lime		Kg

4.SCHEDULE



1) Measuring bath depth.
2) Heating up bath temperature.
3) Confirming bath temperature about 1500°C
4) Setting new probe for produced gas
5) Purging N_2 in new probe
6) Injecting O_2
7) Confirming burning
8) Injecting PC.
   ↓ after 15 min.
9) Inducing produced gas into new probe.



RUN	6th Coal Gasification Test Run	RUN No.	CG006

DATE	1987.09.16 . (Wed)

1. PURPOSE of RUN
   1) Coal gasification test run for BUIA2 & BUIIA2 coal
   2) Coal gasification test run for BUIIC1
   3)
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	BUIA2 & BUIIA2				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	75.91 %	SiO2	%
Ash	3.29 %	H	6.03 %	Al2O3	%
V.M.	46.08 %	N	1.08 %	CaO	%
F.C.	50.63 %	O	16.73 %	K2O	%
T.S.	0.24 %	S	0.25	Na2O	%

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	14.4	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car	－	℃
Basicity of slag	1.5	
Weight of coal	15	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample number	BUIIC1				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	74.50 %	SiO2	%
Ash	1.90 %	H	5.43 %	Al2O3	%
V.M.	46.04 %	N	1.36 %	CaO	%
F.C.	52.06 %	O	18.26 %	K2O	%
T.S.	0.44 %	S	0.45	Na2O	%

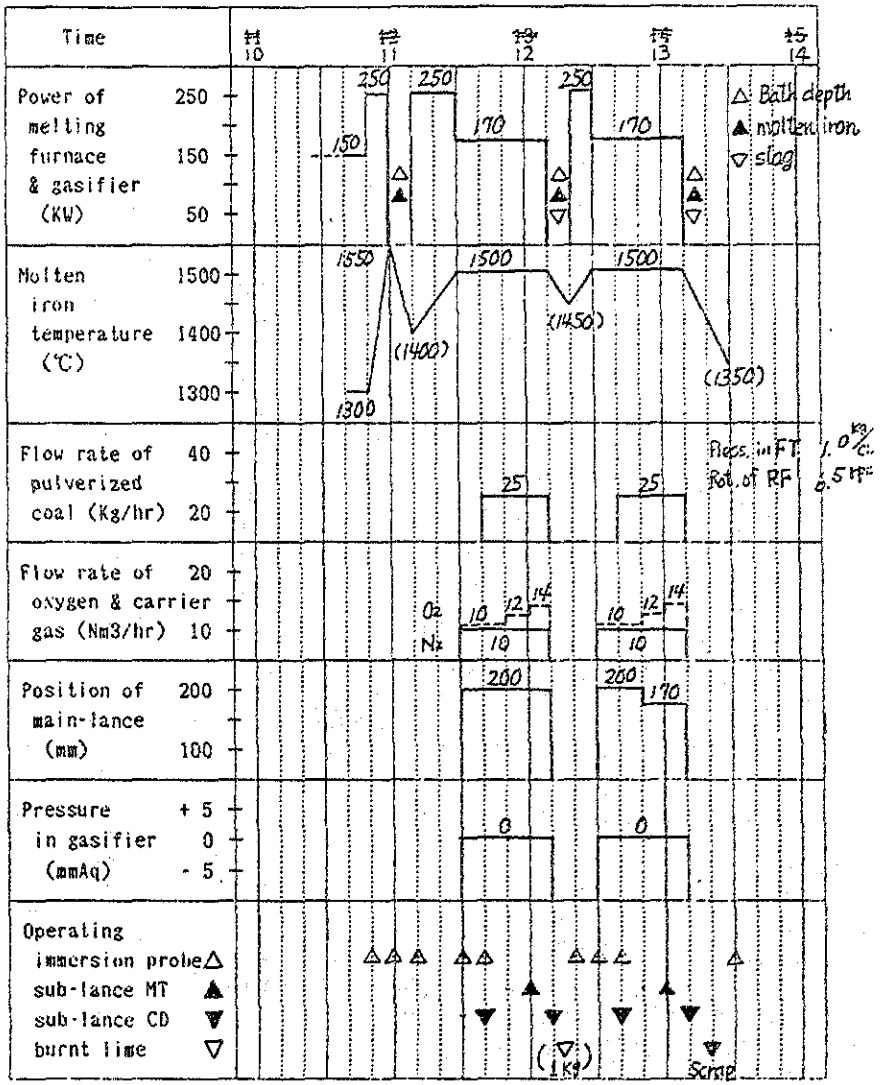
OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.9	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	－	℃
on coal gasification	1500	℃
on dischare to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	15	wet Kg
Weight of burnt lime	0	Kg

4. SCHEDULE

Time	5	6	7	8	9	10	11	12	13	14	15	16	17
Meeting													
Operating utility-equipments													
Heating up:													
Gasifier													
Runner													
Pot car													
Emergency pot													
Pulverizing coal													
Melting iron													
Discharging molten iron to gasifier							▲						
Coal gasification													
Discharging molten iron to pot car										▲			

After measuring bath depth
1) Raising bath temperature
2) Injecting Oxygen
3) Tilting gasifier
4) Checking burnin
5) Injecting PC



RUN	7th Coal Gasification Test Run	RUN No.	CG007

DATE	1987.09.22 . (Tu)

1. PURPOSE of RUN
   1) Coal gasification test run for CBB1
   2) Coal gasification test run for CBB2
   3) Coal gasification test run for AR
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	CBB1				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	71.82 %	SiO2	%
Ash	5.79 %	H	5.83 %	Al2O3	%
V.M.	47.12 %	N	1.27 %	CaO	%
F.C.	47.09 %	O	20.73	K2O	%
T.S.	0.33 %	S	0.35	Na2O	%

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of oxygen	12.6	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischargeto pot car	－	℃
Basicity of slag	1.5	
Weight of coal	13	wet Kg
Weight of burnt lime	－	Kg

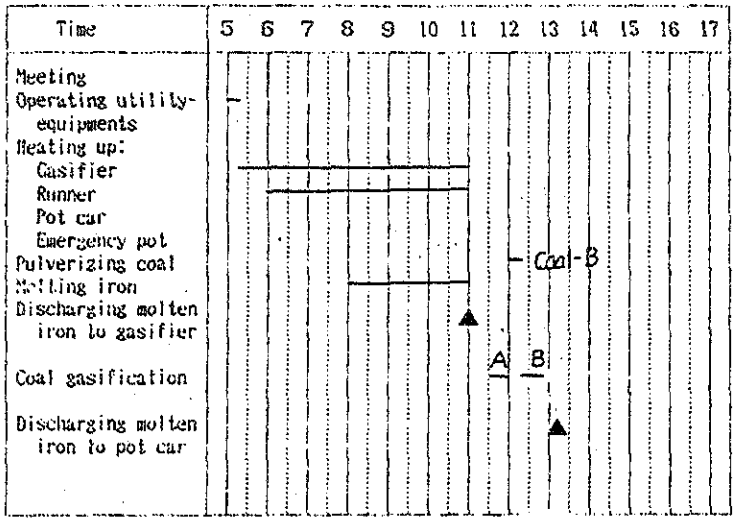
COAL SAMPLE－B

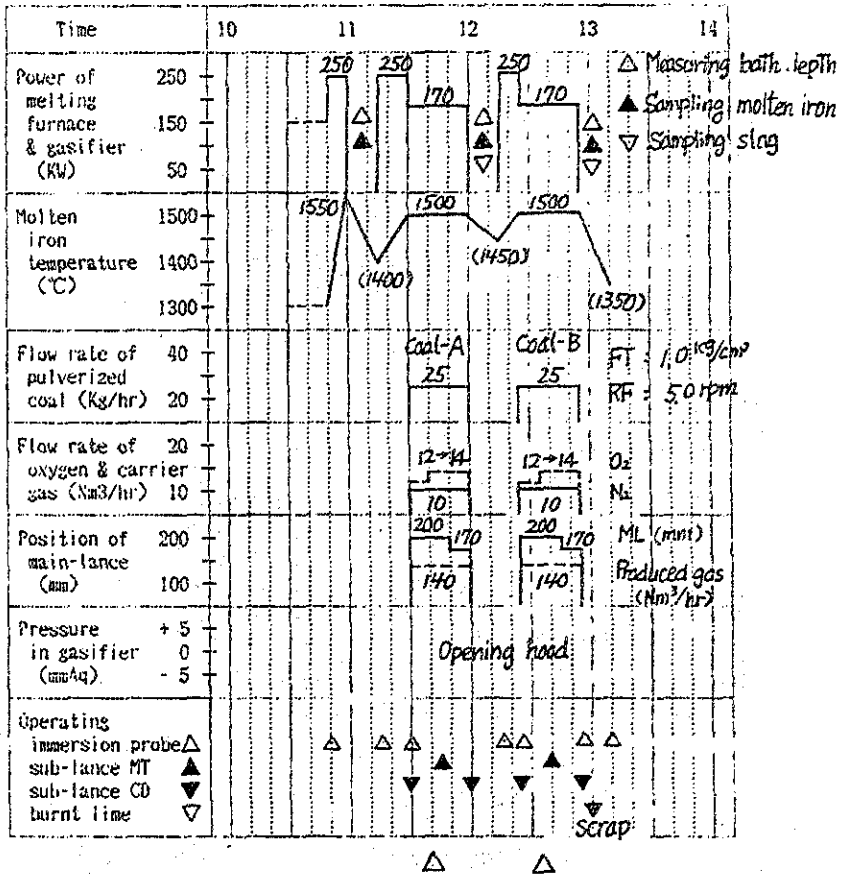
Sample number	CBB2				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	73.08 %	SiO2	%
Ash	5.96 %	H	5.73 %	Al2O3	%
V.M.	46.15 %	N	1.24 %	CaO	%
F.C.	47.89 %	O	19.59 %	K2O	%
T.S.	0.34 %	S	0.36	Na2O	%

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	12.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	－	℃
on coal gasification	1500	℃
on dischargeto pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	13	wet Kg
Weight of burnt lime	－	Kg

4. SCHEDULE





After coal gasification test run for coal-A

1) Operating sublance-CD
2) Sampling slag
3) Removing slag
4) Sampling molten iron
5) Turning of GF at 250 KW
6) Confirming bath temperature at 1500 °C
7) Setting new probe for produced gas

1) Releasing feed tank pressure.
2) Pulverizing coal-B
3) Closing pressure-releasing valve for feed tank

4) Pressurizing in feed tank

8) Injecting O_2

RUN	8th coal gasification test run	RUN No.	CG008

DATE	1987.09.25 . (Fri)

1. PURPOSE of RUN
   1) Coal gasification test run for BUIIB1, BUIVB1 & BUVB1 coal
   2) Coal gasification test run for BSIA2 & BSIIA2 coal
   3) Coal gasification test run for AL coal
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	BUIIB1, BUIVB1, BUVB1				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	73.19 %	SiO2	%
Ash	4.08 %	H	5.69 %	Al2O3	%
V.M.	45.92 %	N	1.20 %	CaO	%
F.C.	50.00 %	O	18.97 %	K2O	%
T.S.	0.91 %	S	0.95	Na2O	%

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.2	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car		℃
Basicity of slag	1.5	
Weight of coal	15	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample number	BSIA2, BSIIA2				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	75.73 %	SiO2	%
Ash	4.50 %	H	5.87 %	Al2O3	%
V.M.	45.62 %	N	1.16 %	CaO	%
F.C.	49.88 %	O	17.03 %	K2O	%
T.S.	0.20 %	S	0.21	Na2O	%

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	141	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on dischare to pot car	--	℃
Basicity of slag	1.5	
Weight of coal	15	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG008

DATE	1987.09.25 . (Fri)

1. PURPOSE of RUN

2)

4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE - C

Sample number	AL				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	— %	C	73.16 %	SiO2	%
Ash	15.12 %	H	6.11 %	Al2O3	%
V.M.	41.91 %	N	1.21 %	CaO	%
F.C.	42.97 %	O	17.25 %	K2O	%
T.S.	1.93 %			Na2O	%

COAL SAMPLE — D

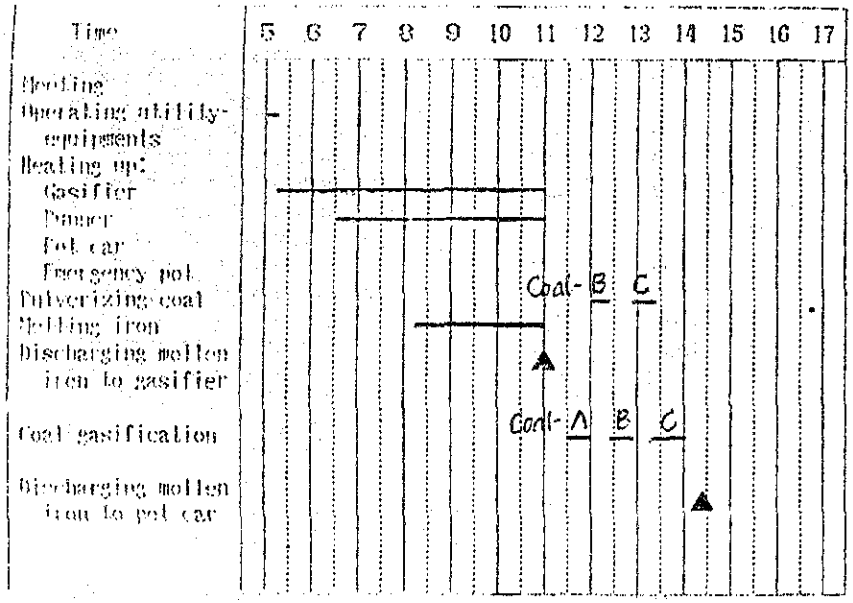
Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	%	SiO2	%
Ash	%	H	%	Al2O3	%
V.M.	%	N	%	CaO	%
F.C.	%	O	%	K2O	%
T.S.	%			Na2O	%

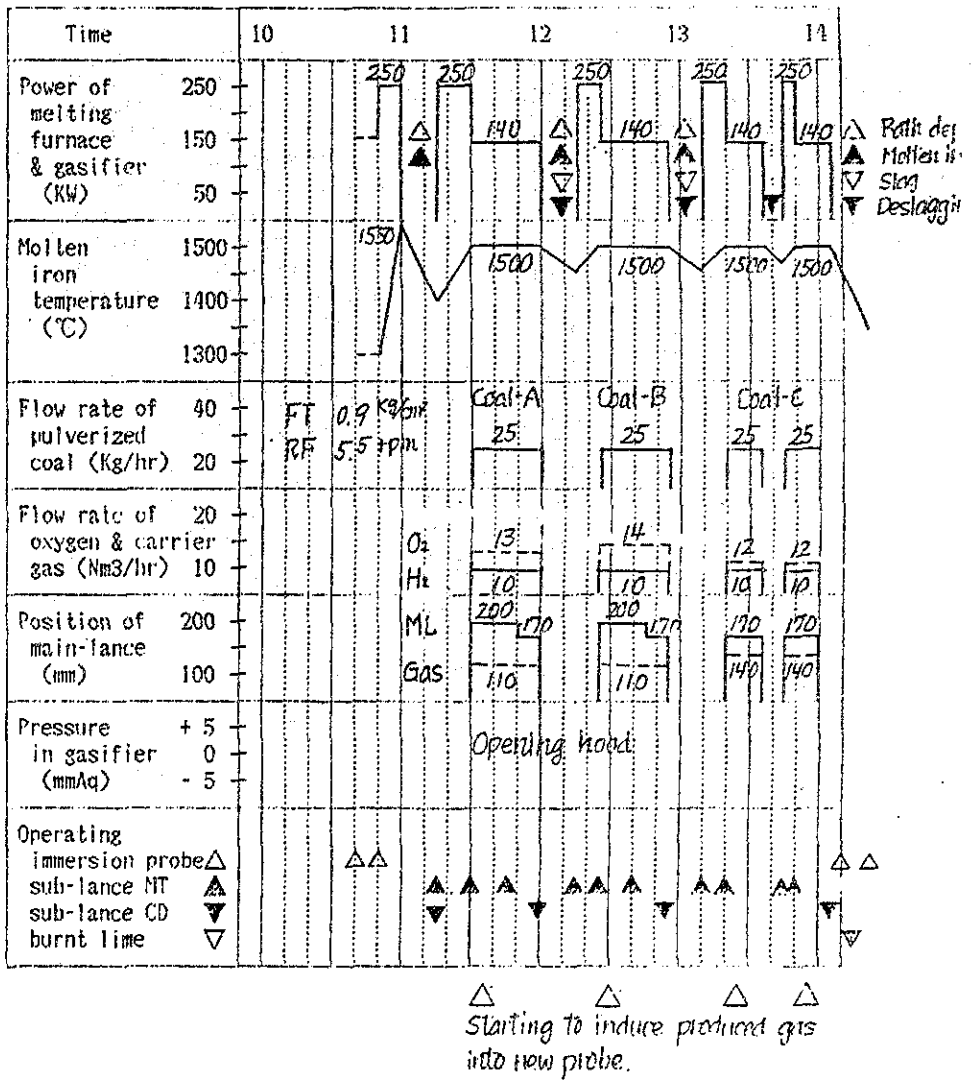
OPERATION CONDITION — C

Weight of molten iron	300	Kg
Flow rate of Oxygen	11.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on dischare to pot car	1350	℃
Basicity of slag	1.3	
Weight of coal	15	wet Kg
Weight of burnt lime	0	Kg

OPERATION CONDITION — D

Weight of molten iron		Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on dischare to pot car		℃
Basicity of slag		
Weight of coal		wet Kg
Weight of burnt lime		Kg


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Heating
Operating utility-equipments
Heating up:
Gasifier
Power
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal-B
C
Coal-A
B
C


Time
10 11 12 13 14
Power of melting furnace & gasifier (KW)
250 150 50
250 250 140 140 140 140
Rath dep
Molten ir
Slag
Desloggi
Molten iron temperature (℃)
1300 1400 1500
1550 1500 1500 1500 1500
Flow rate of pulverized coal (Kg/hr)
20 40
FT
RF
0.9 Kg/cm²
5.5 rpm
Coal-A
Coal-B
Coal-C
25 25 25 25
Flow rate of oxygen & carrier gas (Nm3/hr)
10 20
O₂
H₂
13 14 12 12
10 10 10 10
Position of main-lance (mm)
100 200
ML
Gas
200 200 170 170 170 170
110 110 140 140
Pressure in gasifier (mmAq)
+ 5 0 - 5
Opening hood
Operating
immersion probe
sub-lance MT
sub-lance CD
burnt lime
Starting to induce produced gas into new probe.

RUN	9th coal gasification test run	RUN No.	CG009

DATE	1987.09.30 . (Wed.)

1. PURPOSE of RUN
   1) Investigation of gasification-characteristic
   ≒ for SJE1, SJE2 and BJS coal.
   3)
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	SJE2				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	70.41 %	SiO2	%
Ash	2.68 %	H	5.48 %	Al2O3	%
V.M.	50.15 %	N	1.10 %	CaO	%
F.C.	47.17 %	O	22.84 %	K2O	%
T.S.	－ %	S	0.17	Na2O	%

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	12.1	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car	－	℃
Basicity of slag	1.5	
Weight of coal	16	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample number	BJS				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	68.52 %	SiO2	%
Ash	4.24 %	H	5.68 %	Al2O3	%
V.M.	49.97 %	N	1.15 %	CaO	%
F.C.	45.79 %	O	24.13 %	K2O	%
T.S.	－ %	S	0.52	Na2O	%

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	11.3	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on dischare to pot car	－	℃
Basicity of slag	1.5	
Weight of coal	17	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG009

DATE	1987.09.30 . (Wed.)

1. PURPOSE of RUN
   1)
   2)
   3)
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－C

Sample number	SJE 1				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	70.32 %	SiO2	%
Ash	7.49 %	H	5.90 %	Al2O3	%
V.M.	51.00 %	N	1.03 %	CaO	%
F.C.	41.51 %	O	22.51 %	K2O	%
T.S.	－ %			Na2O	%

COAL SAMPLE－D

Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	%	SiO2	%
Ash	%	H	%	Al2O3	%
V.M.	%	N	%	CaO	%
F.C.	%	O	%	K2O	%
T.S.	%			Na2O	%

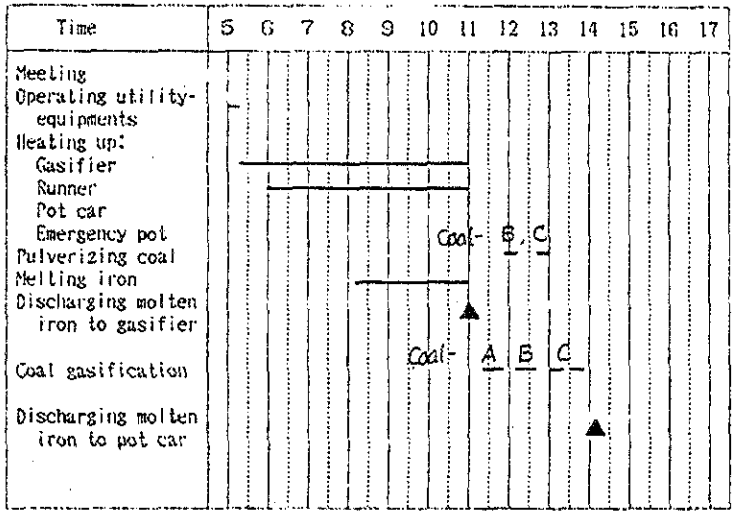
OPERATION CONDITION－A

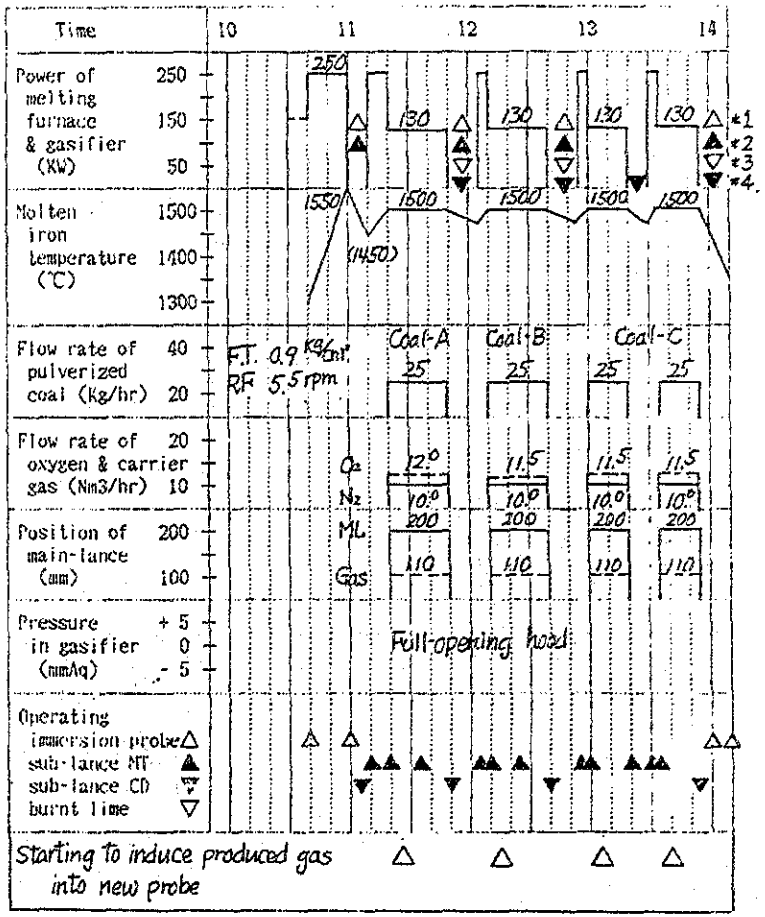
Weight of molten iron	300	Kg
Flow rate of Oxygen	11.6	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	－	℃
on coal gasification	1500	℃
on dischare to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	15	wet Kg
Weight of burnt lime	0	Kg

OPERATION CONDITION－B

Weight of molten iron		Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on dischare to pot car		℃
Basicity of slag		
Weight of coal		wet Kg
Weight of burnt lime	0	Kg

4. SCHEDULE





*1 △ Measuring bath depth
*2 ▲ Sampling molten iron
*3 ▼ Sampling slag
*4 ▽ Deslagging

RUN	10th coal gasification test run	RUN No.	CG010

DATE	1987.10.6 . (Tu)

1. PURPOSE of RUN
   1) Investigation of gasification-characteristic
   ⇌ for CBC, CBA1 and CBA2 coal
   3)
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	CBC				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	72.22 %	SiO2	%
Ash	6.15 %	H	5.88 %	Al2O3	%
V.M.	47.08 %	N	1.48 %	CaO	%
F.C.	46.77 %	O	20.05 %	K2O	%
T.S.	－ %	S	0.37	Na2O	%

COAL SAMPLE－B

Sample number	CBA2				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	71.56 %	SiO2	%
Ash	10.94 %	H	5.73 %	Al2O3	%
V.M.	45.01 %	N	1.16 %	CaO	%
F.C.	44.05 %	O	21.20 %	K2O	%
T.S.	－ %	S	0.35	Na2O	%

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	12.6	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car	－	℃
Basicity of slag	1.5	
Weight of coal	16	wet Kg
Weight of burnt lime	－	Kg

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	11.5	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	－	℃
on coal gasification	1500	℃
on dischare to pot car	－	℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	－	Kg

RUN		RUN No.	CG010

DATE	1987.09. . ( )

1.PURPOSE of RUN

1)

2)

3)

4)

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－C

Sample number	CBA1						
Proximate analysis			Ultimate analysis		Ash components		
Moisture	—	%	C	69.60 %	SiO2		%
Ash	17.03	%	H	5.76 %	Al2O3		%
V.M.	42.73	%	N	1.12 %	CaO		%
F.C.	40.24	%	O	21.81 %	K2O		%
T.S.	—	%	S	1.71	Na2O		%

COAL SAMPLE－D

Sample number						
Proximate analysis		Ultimate analysis		Ash components		
Moisture	%	C	%	SiO2		%
Ash	%	H	%	Al2O3		%
V.M.	%	N	%	CaO		%
F.C.	%	O	%	K2O		%
T.S.	%			Na2O		%

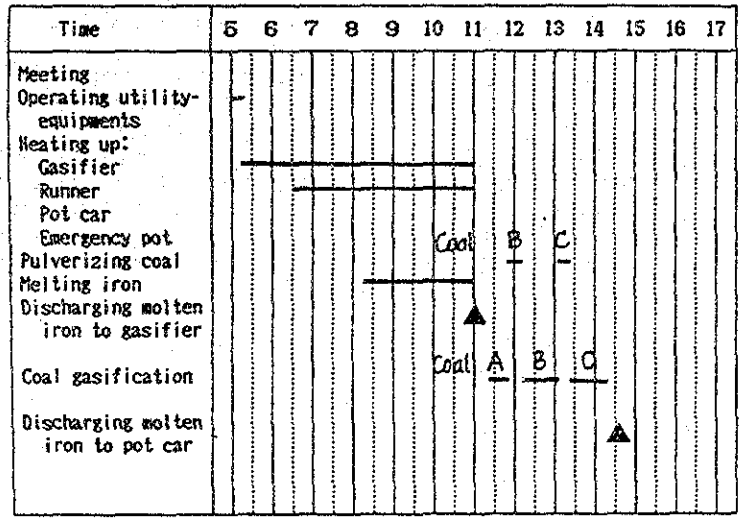
OPERATION CONDITION－C

Weight of molten iron	300	Kg
Flow rate of Oxygen	10.1	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	—	℃
on coal gasification	1500	℃
on dischare to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

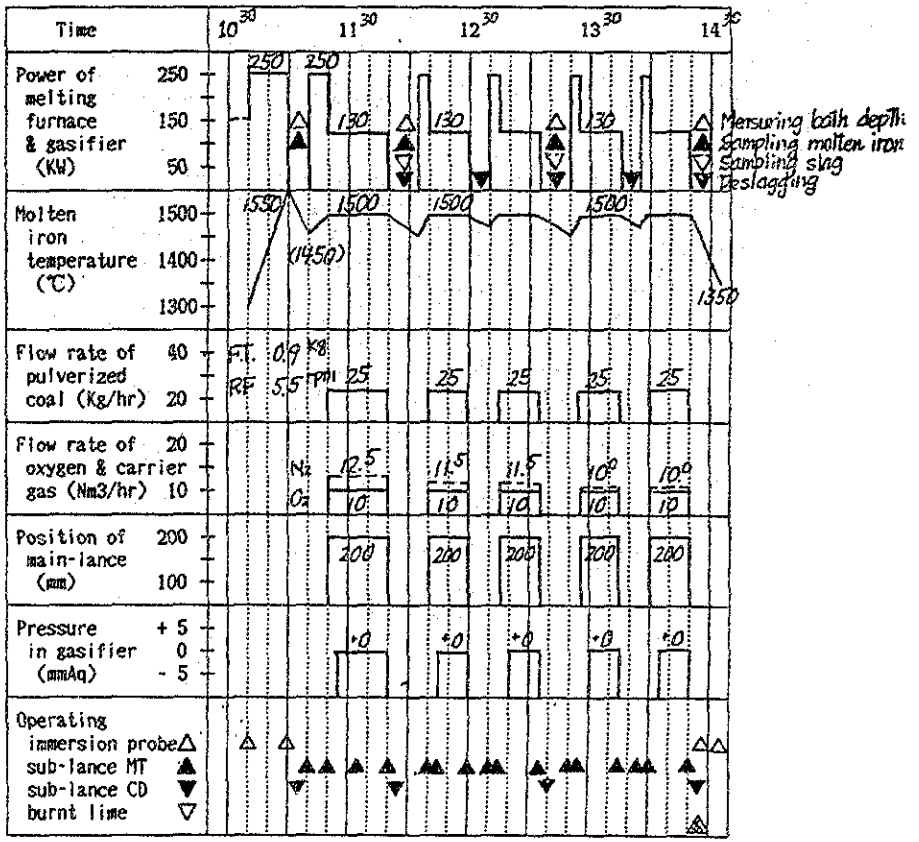
OPERATION CONDITION－D

Weight of molten iron		Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on dischare to pot car		℃
Basicity of slag		
Weight of coal		wet Kg
Weight of burnt lime		Kg

4.SCHEDULE



TEST000-2



RUN	11th coal gasification Test run	RUN No.	CG011

DATE	1987.10.09 . (Fri)

1. PURPOSE of RUN
   1) Investigation of gasification-characteristics
   2) for BSIIA1, BU1A1 and SJJ coal
   3)
   4)

2. COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample	BSIA1 & BSIIA1					
Proximate analysis		Ultimate analysis		Ash components		
Moisture	－ %	C	73.13 %	SiO2	%	
Ash	4.29 %	H	5.72 %	Al2O3	%	
V.M.	46.63 %	N	1.14 %	CaO	%	
F.C.	49.08 %	O	19.30 %	K2O	%	
T.S.	－ %	S	0.71	Na2O	%	

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	15.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on dischare to pot car	－	℃
Basicity of slag	1.5	
Weight of coal	15	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample	BUIIA1					
Proximate analysis		Ultimate analysis		Ash components		
Moisture	－ %	C	76.73 %	SiO2	%	
Ash	7.06 %	H	5.97 %	Al2O3	%	
V.M.	44.92 %	N	1.28 %	CaO	%	
F.C.	48.02 %	O	15.43 %	K2O	%	
T.S.	－ %			Na2O	%	

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	16.1	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on dischare to pot car	--	℃
Basicity of slag	1.5	
Weight of coal	15	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG011

DATE	1987.10.09 . (Fri)

1.PURPOSE of RUN
1)
2)
3)
4)

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－C

Sample number	SJJ				
Proximate analysis		Ultimate analysis		Ash components	
Moisture	－ %	C	67.83 %	SiO2	%
Ash	11.95 %	H	5.67 %	Al2O3	%
V.M.	47.28 %	N	1.06 %	CaO	%
F.C.	40.77 %	O	25.18 %	K2O	%
T.S.	－ %.	S	0.26	Na2O	%

COAL SAMPLE－D

Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Moisture	%	C	%	SiO2	%
Ash	%	H	%	Al2O3	%
V.M.	%	N	%	CaO	%
F.C.	%	O	%	K2O	%
T.S.	%			Na2O	%

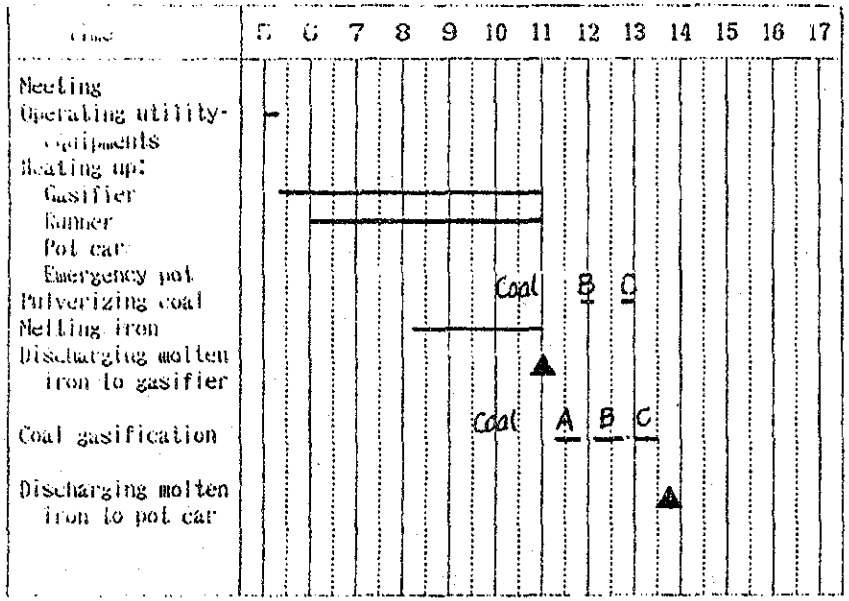
OPERATION CONDITION－C

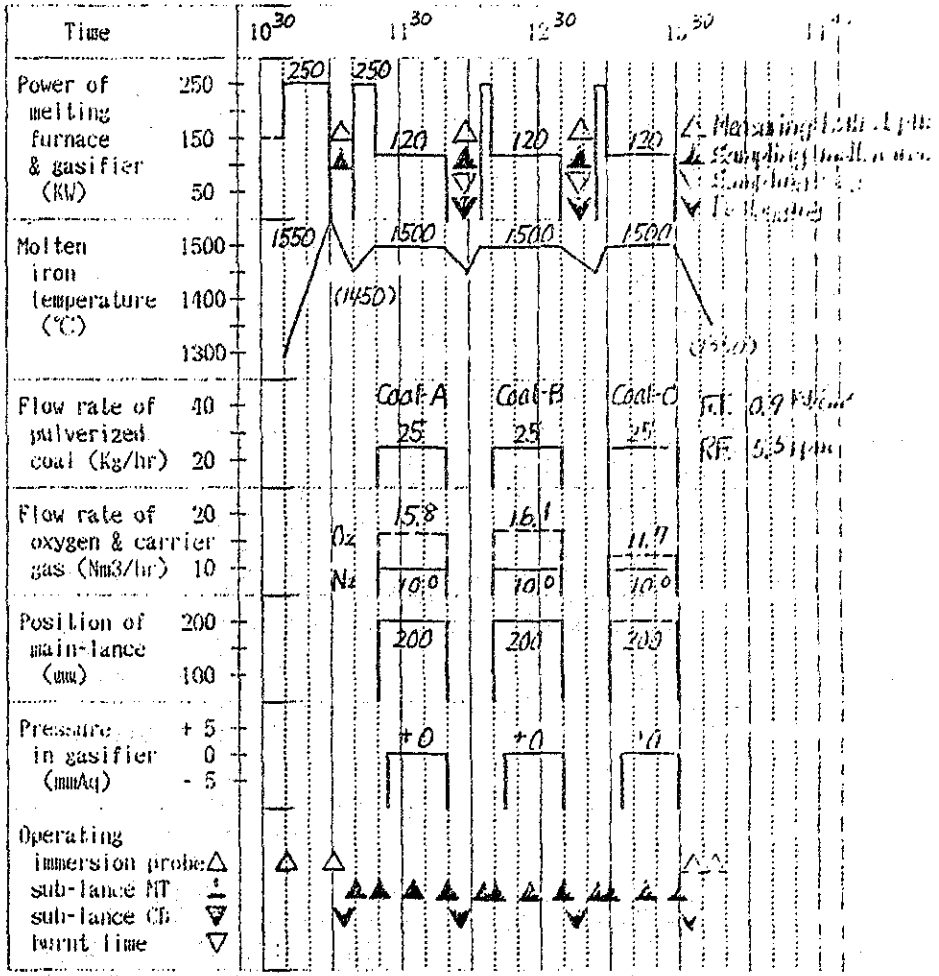
Weight of molten iron	300	Kg
Flow rate of Oxygen	11.7	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	25.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on dischare to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	16	wet Kg
Weight of burnt lime	0	Kg

OPERATION CONDITION－D

Weight of molten iron		Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas		Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface		mm
Molten iron temperature		
on discharge to gasifier		℃
on coal gasification		℃
on dischare to pot car		℃
Basicity of slag		
Weight of coal		wet Kg
Weight of burnt lime		Kg

4. SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Burner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal
A
B
C
Coal
A
B
C


Time
10 30
11 30
12 30
Power of melting furnace & gasifier (KW)
250
150
50
250
250
120
120
120
Molten iron temperature (℃)
1500
1400
1300
1550
1500
1500
1500
(1450)
Flow rate of pulverized coal (Kg/hr)
40
20
Coal-A
25
Coal-B
25
Coal-C
25
Flow rate of oxygen & carrier gas (Nm3/hr)
20
10
O2
N2
15.8
10.0
16.1
10.0
11.7
10.0
Position of main-lance (mm)
200
100
200
200
200
Pressure in gasifier (mmAq)
+ 5
0
- 5
+0
+0
Operating
immersion probe
sub-lance MT
sub-lance CB
burnt line

RUN	12 TH COAL GASIFICATION TEST RUN	RUN No.	CG012

DATE	1987.10. 15 . (Thu.)

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for BⅢB2, BSIC1 and BSⅣB coal

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	BⅢB2				
Proximate analysis		Ultimate analysis		Ash components	
Ash	2.29 %	C	73.10 %	SiO2	%
V.M.	47.58 %	H	5.80 %	Al2O3	%
F.C.	50.13 %	N	1.25 %	CaO	%
	%	O	18.15 %	K2O	%
		S	1.70 %	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	18.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	30.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	18	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample number	BSIC1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	2.65 %	C	76.41 %	SiO2	%
V.M.	46.95 %	H	5.83 %	Al2O3	%
F.C.	50.40 %	N	1.40 %	CaO	%
	%	O	15.76 %	K2O	%
		S	0.60 %	Na2O	%

(DRY BASE) (D.A.F.)

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	16.1	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	30.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	18	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG012

COAL SAMPLE－C

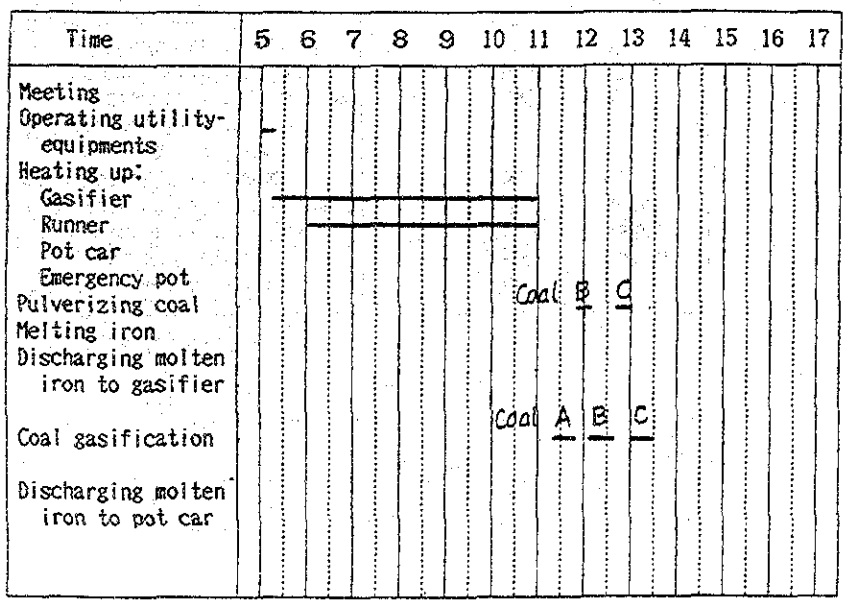
Sample number	BSⅣB				
Proximate analysis		Ultimate analysis		Ash components	
Ash	4.49 %	C	73.12 %	SiO2	%
V.M.	47.25 %	H	5.74 %	Al2O3	%
F.C.	48.26 %	N	1.13 %	CaO	%
	%	O	19.74 %	K2O	%
		S	0.26 %	Na2O	%

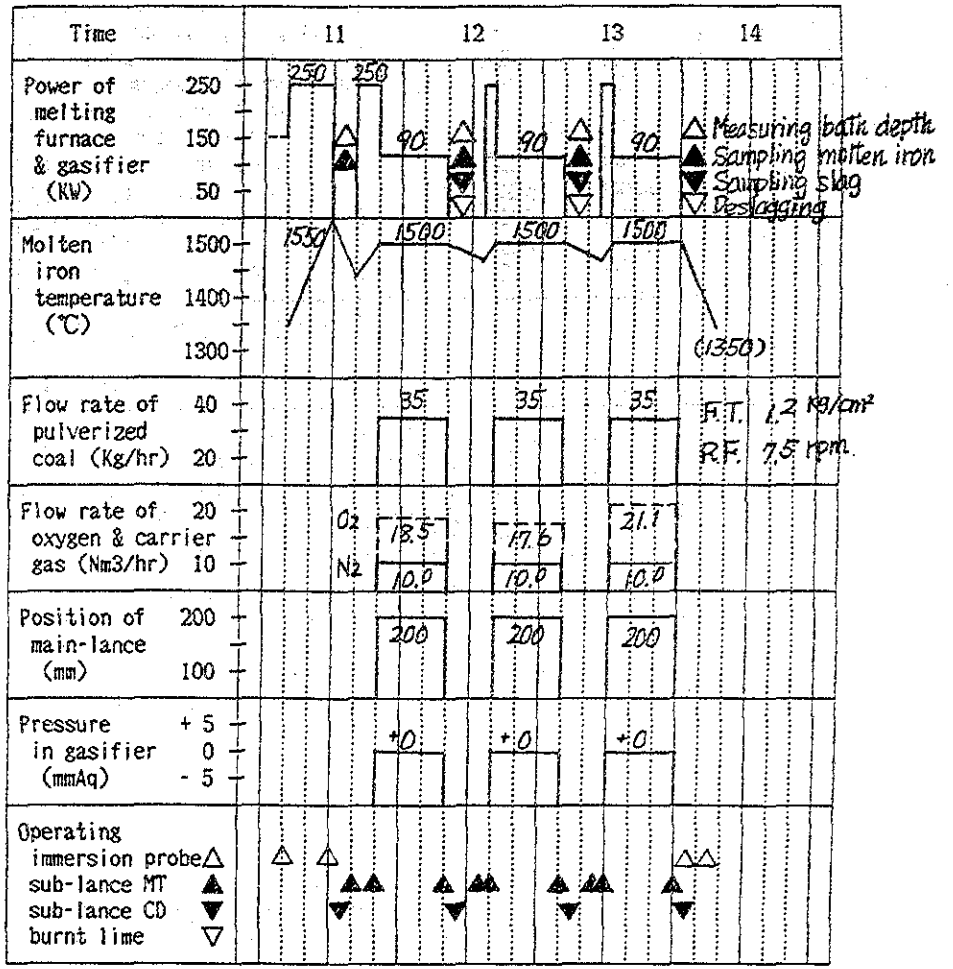
(DRY BASE)　　(D.A.F)

OPERATION CONDITION－C

Weight of molten iron	300	Kg
Flow rate of Oxygen	18.0	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	30.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	~~1550~~	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	17.	wet Kg
Weight of burnt lime	0	Kg

4.SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal
B
C
Coal
A
B
C


Time
11 12 13 14
Power of melting furnace & gasifier (KW)
250
150
50
250
250
90
90
90
Measuring bath depth
Sampling molten iron
Sampling slag
Deslagging
Molten iron temperature (℃)
1500
1400
1300
1550
1500
1500
1500
(1350)
Flow rate of pulverized coal (Kg/hr)
40
20
35
35
35
F.T. 1.2 kg/cm²
R.F. 7.5 rpm
Flow rate of oxygen & carrier gas (Nm3/hr)
20
10
O2
N2
18.5
17.6
21.1
10.0
10.0
10.0
Position of main-lance (mm)
200
100
200
200
200
Pressure in gasifier (mmAq)
+ 5
0
- 5
+0
+0
+0
Operating
immersion probe△
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽

RUN	13 TH COAL GASIFICATION TEST RUN	RUN No.	CG013

DATE	1987.10. 20 . (Tue)

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for BUIA2, BUIIC2 and BUIIB1

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	BUIA2, BUIIA2				
Proximate analysis		Ultimate analysis		Ash components	
Ash	3.29 %	C	75.91 %	SiO2	%
V.M.	46.08 %	H	6.03 %	Al2O3	%
F.C.	50.63 %	N	1.08 %	CaO	%
	%	O	16.73 %	K2O	%
		S	0.25 %	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	18.5	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	－	℃
Basicity of slag	1.5	
Weight of coal	21	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample number	BUIIC1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	1.90 %	C	74.50 %	SiO2	%
V.M.	46.04 %	H	5.43 %	Al2O3	%
F.C.	52.06 %	N	1.36 %	CaO	%
	%	O	18.26 %	K2O	%
		S	0.45 %	Na2O	%

(DRY BASE) (D.A.F.)

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	17.6	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	－	℃
Basicity of slag	1.5	
Weight of coal	21	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG013

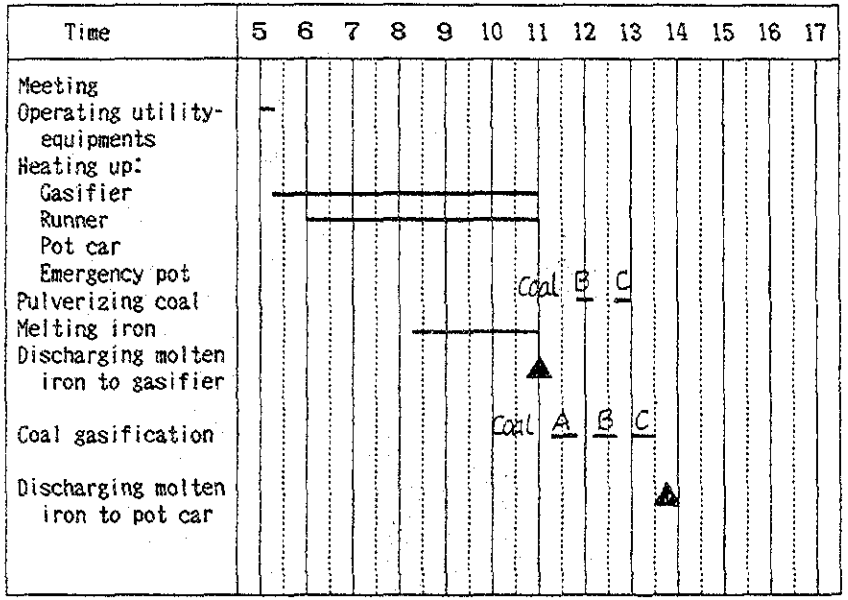
COAL SAMPLE— C

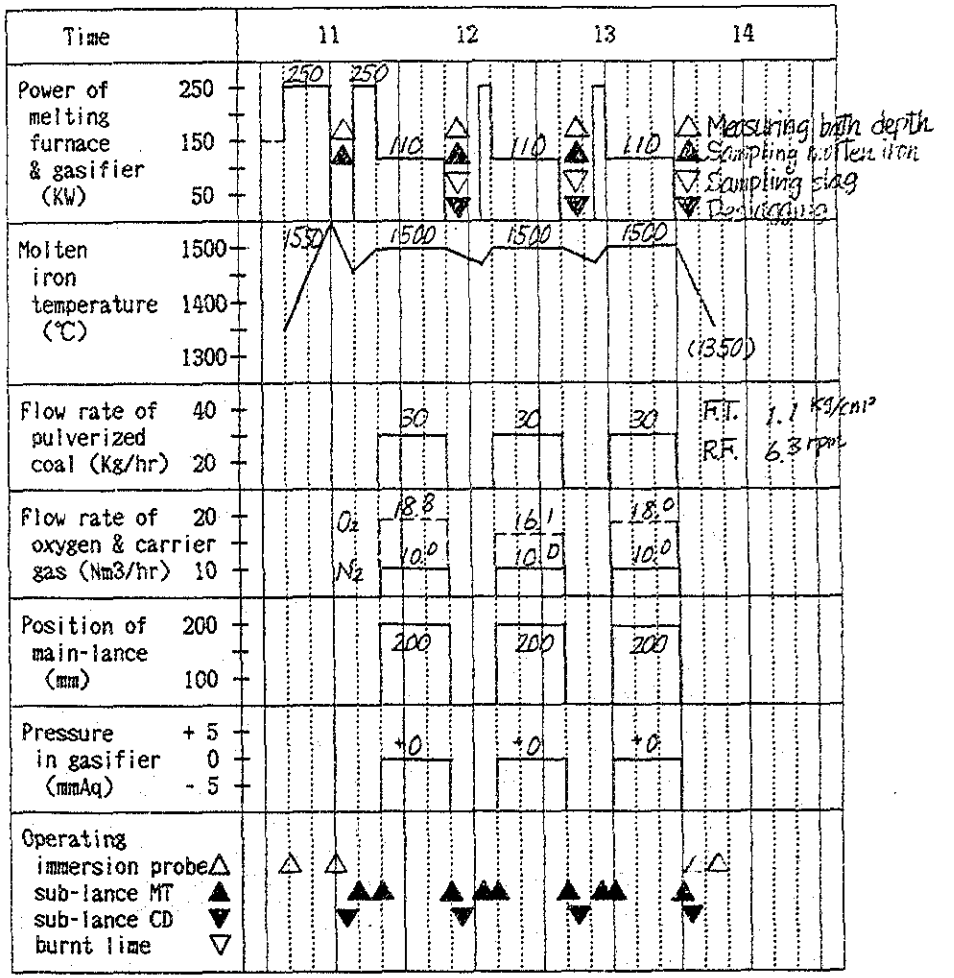
Sample number	BuIIB1, BuIVB1, BuVB1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	4.08 %	C	73.19 %	SiO2	%
V.M.	45.92 %	H	5.69 %	Al2O3	%
F.C.	50.00 %	N	1.20 %	CaO	%
	%	O	18.97 %	K2O	%
		S	0.95 %	Na2O	%
	(DRY BASE)		(D.A.F)		

OPERATION CONDITION— C

Weight of molten iron	300	Kg
Flow rate of Oxygen	21.1	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	~~550~~	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	21	wet Kg
Weight of burnt lime	0	Kg

4.SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal B C
Coal A B C


Time
11 12 13 14
Power of melting furnace & gasifier (KW) 250 150 50
250 250 110 110 110
Molten iron temperature (℃) 1500 1400 1300
1550 1500 1500 1500 (1350)
Flow rate of pulverized coal (Kg/hr) 40 30
30 30 30
F.T. 1.1 Kg/cm²
R.P. 6.3 rpm
Flow rate of oxygen & carrier gas (Nm3/hr) 20 10
O₂ N₂
18.8 10.0 16.1 10.0 18.0 10.0
Position of main-lance (mm) 200 100
200 200 200
Pressure in gasifier (mmAq) + 5 0 - 5
+0 +0 +0
Operating
immersion probe△
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽
Measuring bath depth
Sampling molten iron
Sampling slag
Deslagging

RUN	14 TH COAL GASIFICATION TEST RUN	RUN No.	CG014

DATE	1987.10.23 . (Fri)

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for CBB1, CBC and SJJ

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	CBB1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	5.79 %	C	71.82 %	SiO2	%
V.M.	47.12 %	H	5.83 %	Al2O3	%
F.C.	47.09 %	N	1.27 %	CaO	%
	%	O	20.73 %	K2O	%
		S	0.35 %	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	144	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	22	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample number	CBC				
Proximate analysis		Ultimate analysis		Ash components	
Ash	6.15 %	C	72.22 %	SiO2	%
V.M.	47.08 %	H	5.88 %	Al2O3	%
F.C.	46.77 %	N	1.48 %	CaO	%
	%	O	20.05 %	K2O	%
		S	0.37 %	Na2O	%

(DRY BASE) (D.A.F.)

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	145	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	22	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG014

COAL SAMPLE－C

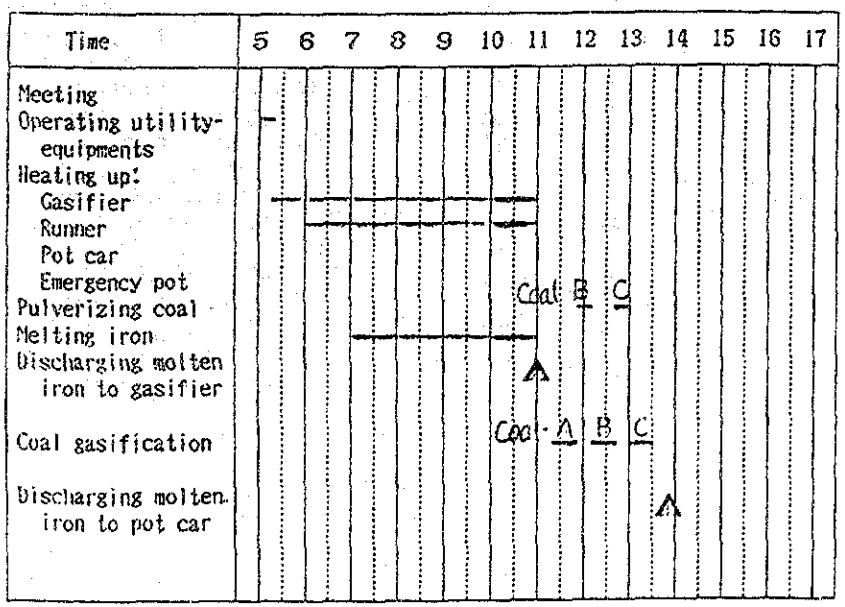
Sample number	SJJ				
Proximate analysis		Ultimate analysis		Ash components	
Ash	11.95 %	C	67.83 %	SiO2	%
V.M.	47.28 %	H	5.67 %	Al2O3	%
F.C.	40.77 %	N	1.06 %	CaO	%
	%	O	25.18 %	K2O	%
		S	0.26 %	Na2O	%

(DRY BASE)　　(D.A.F)

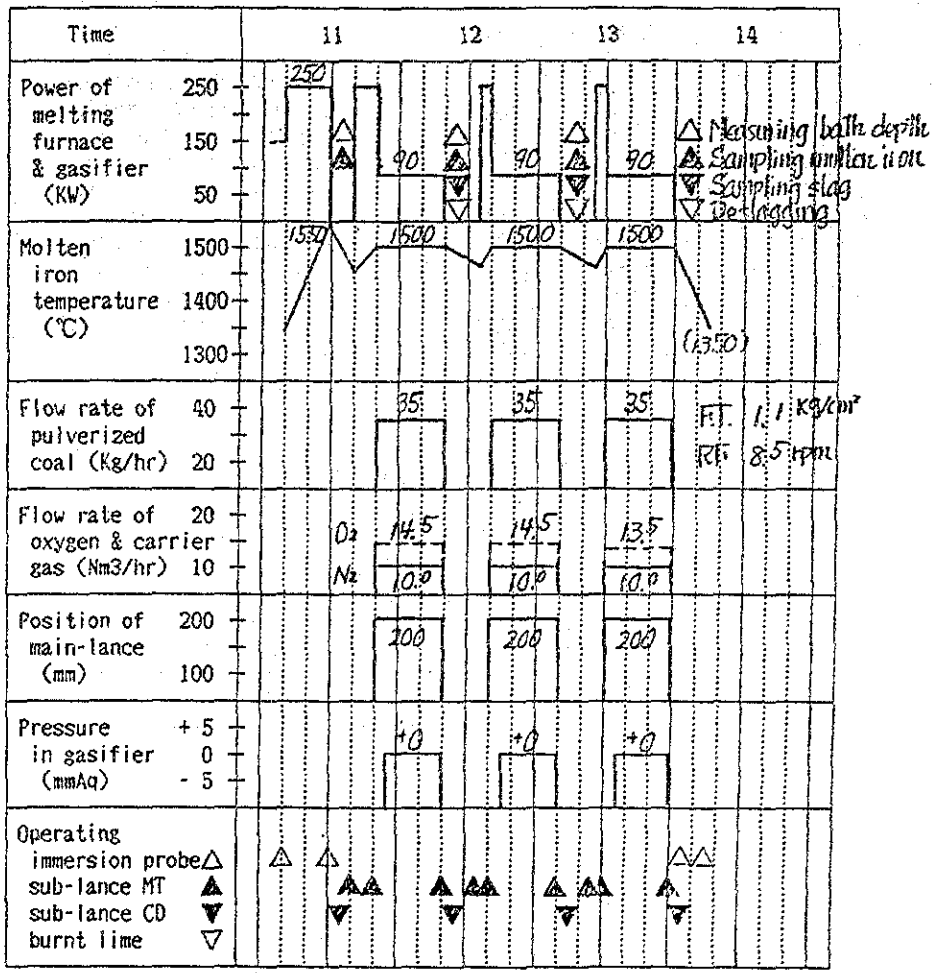
OPERATION CONDITION－C

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.6	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	~~1550~~	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	21	wet Kg
Weight of burnt lime	0	Kg

4.SCHEDULE



TEST000-2



RUN	15 TH COAL GASIFICATION TEST RUN	RUN No.	CG015

DATE	1987.10.27 . (Tue.)

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for AR, CBB2 and AL

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	AR				
Proximate analysis		Ultimate analysis		Ash components	
Ash	2.25 %	C	71.13 %	SiO2	%
V.M.	47.99 %	H	5.58 %	Al2O3	%
F.C.	49.76 %	N	1.01 %	CaO	%
	%	O	20.04 %	K2O	%
		S	2.24 %	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	14.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	22.	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample number	CBB1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	5.96 %	C	73.08 %	SiO2	%
V.M.	46.15 %	H	5.73 %	Al2O3	%
F.C.	47.89 %	N	1.24 %	CaO	%
	%	O	18.42 %	K2O	%
		S	0.36 %	Na2O	%

(DRY BASE) (D.A.F.)

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	14.7	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	21.	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG015

COAL SAMPLE－C

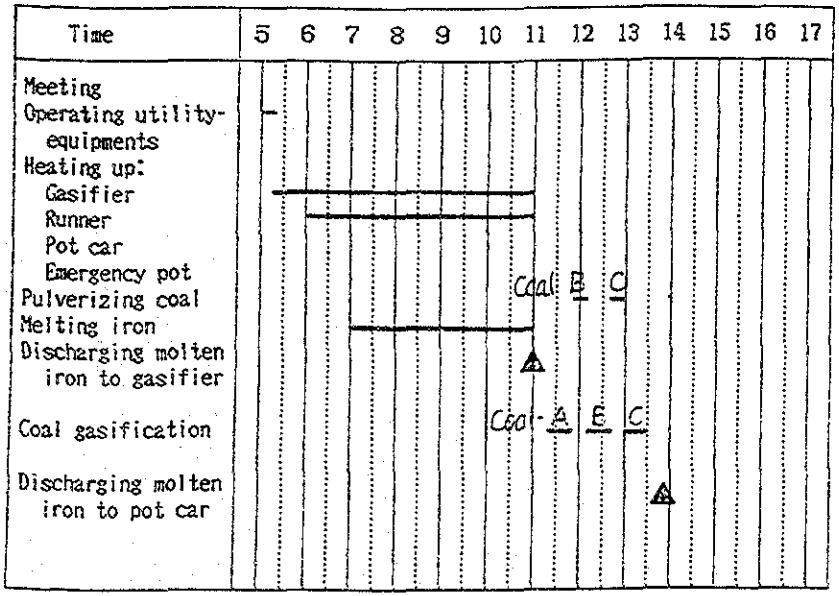
Sample number	AL				
Proximate analysis		Ultimate analysis		Ash components	
Ash	15.12 %	C	62.10 %	SiO2	%
V.M.	41.91 %	H	5.19 %	Al2O3	%
F.C.	42.97 %	N	1.03 %	CaO	%
	%	O	14.63 %	K2O	%
	%	S	1.93 %	Na2O	%

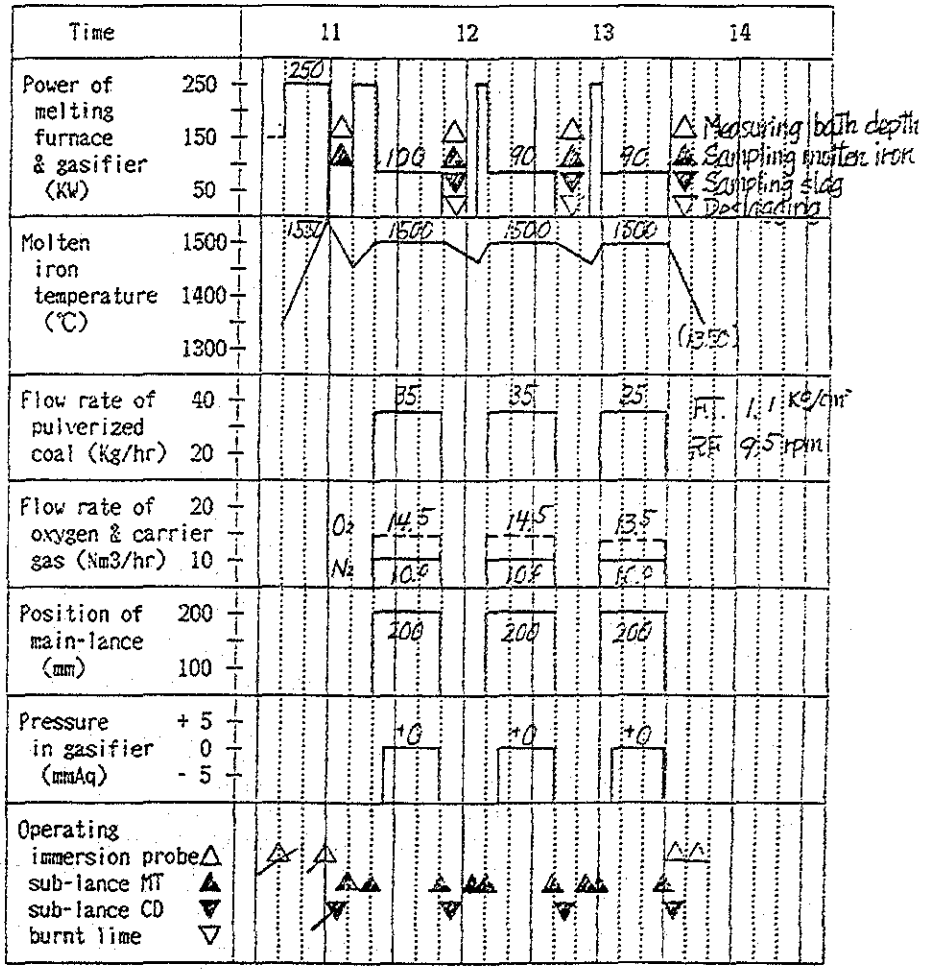
(DRY BASE) (D.A.F)

OPERATION CONDITION－C

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.6	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	~~1550~~	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

4-SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal
B
C
Coal
A
B
C


Time
11 12 13 14
Power of melting furnace & gasifier (KW)
250
150
50
250
100
90
90
Measuring bath depth
Sampling molten iron
Sampling slag
Deslagging
Molten iron temperature (℃)
1500
1400
1300
1530
1500
1500
1500
1350
Flow rate of pulverized coal (Kg/hr)
40
20
35
35
25
1.1 Kg/cm²
9.5 rpm
Flow rate of oxygen & carrier gas (Nm3/hr)
20
10
O₂
N₂
14.5
14.5
13.5
10.9
10.9
10.9
Position of main-lance (mm)
200
100
200
200
200
Pressure in gasifier (mmAq)
+ 5
0
- 5
+0
+0
+0
Operating
immersion probe△
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽

RUN	16 TH COAL GASIFICATION TEST RUN	RUN No.	CC016

DATE	1987.10.30 . (Fri.)

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for BSIA2, SJE1 and CBA2

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE—A

Sample number	BSIA2				
Proximate analysis		Ultimate analysis		Ash components	
Ash	4.50 %	C	75.73 %	SiO2	%
V.M.	45.62 %	H	5.87 %	Al2O3	%
F.C.	49.88 %	N	1.16 %	CaO	%
	%	O	17.03 %	K2O	%
		S	0.21 %	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION—A

Weight of molten iron	300	Kg
Flow rate of Oxygen	16.1	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	22	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE—B

Sample number	SJE1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	7.49 %	C	70.32 %	SiO2	%
V.M.	51.00 %	H	5.90 %	Al2O3	%
F.C.	41.53 %	N	1.03 %	CaO	%
	%	O	22.51 %	K2O	%
		S	0.24 %	Na2O	%

(DRY BASE) (D.A.F.)

OPERATION CONDITION—B

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.5	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	21.	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG016

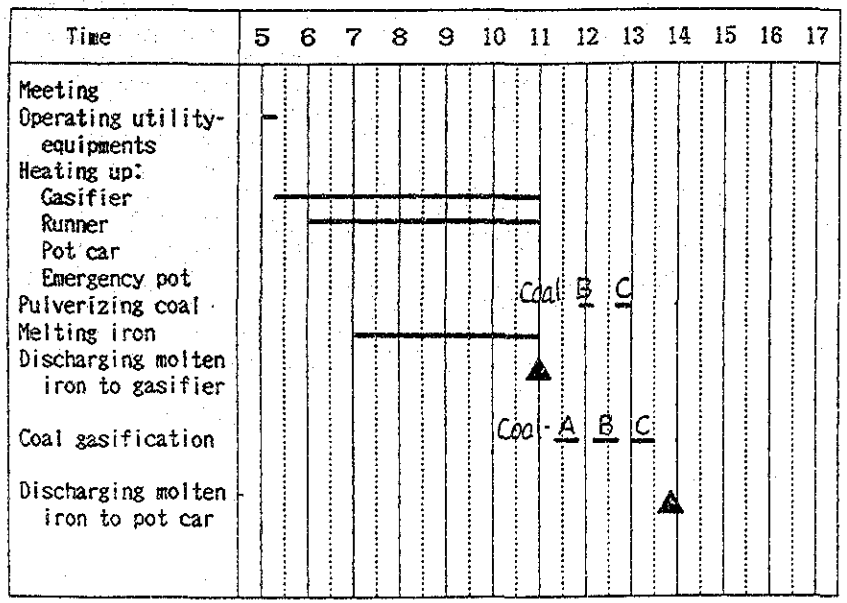
COAL SAMPLE－C

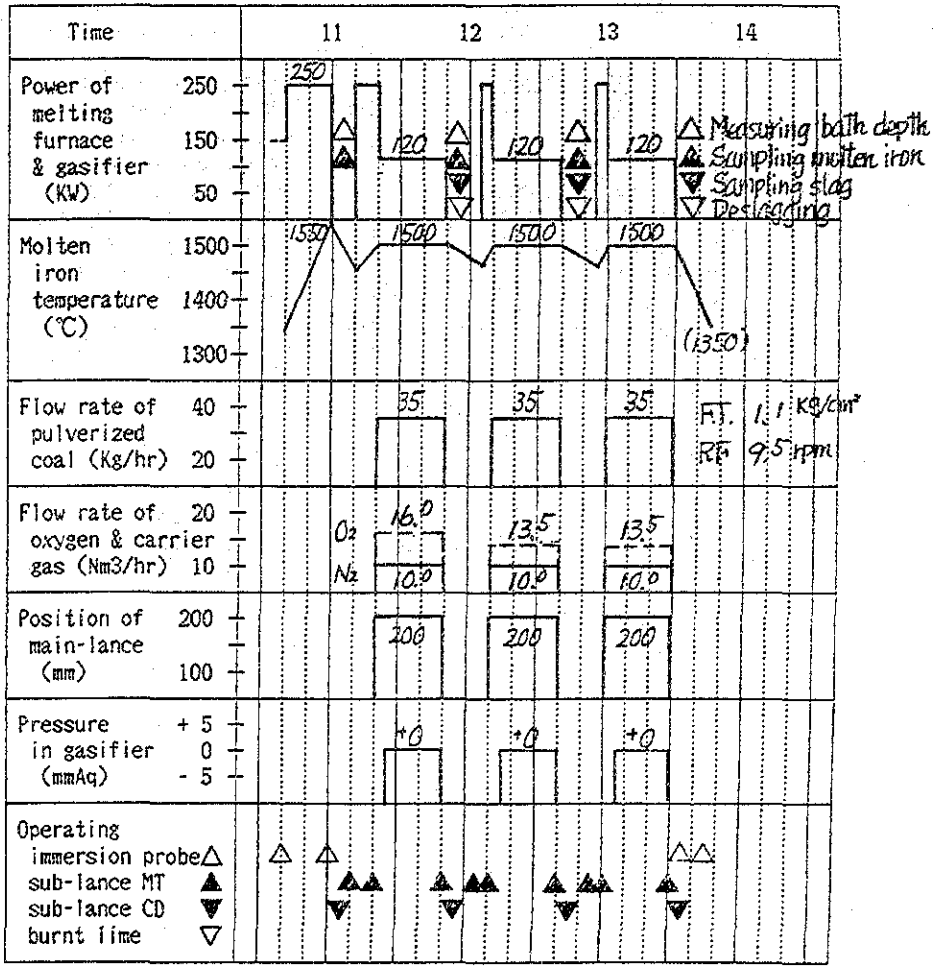
Sample number	CBA2				
Proximate analysis		Ultimate analysis		Ash components	
Ash	10.94 %	C	71.56 %	SiO2	%
V.M.	45.01 %	H	5.73 %	Al2O3	%
F.C.	44.05 %	N	1.16 %	CaO	%
	%	O	21.20 %	K2O	%
	%	S	0.35 %	Na2O	%
(DRY BASE)		(D.A.F)			

OPERATION CONDITION－C

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.3	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	~~1550~~	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	21.	wet Kg
Weight of burnt lime	0	Kg

4. SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal A B C
Coal A B C


Time
11 12 13 14
Power of melting furnace & gasifier (KW) 250 150 50
250
120
120
120
Measuring bath depth
Sampling molten iron
Sampling slag
Deslagging
Molten iron temperature (℃) 1500 1400 1300
1550
1500
1500
1500
(1350)
Flow rate of pulverized coal (Kg/hr) 40 20
35
35
35
FT 1.1 Kg/cm²
RT 9.5 rpm
Flow rate of oxygen & carrier gas (Nm3/hr) 20 10
O2
N2
16.0
10.0
13.5
10.0
13.5
10.0
Position of main-lance (mm) 200 100
200
200
200
Pressure in gasifier (mmAq) + 5 0 - 5
+0
+0
+0
Operating
immersion probe △
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽

RUN	17 TH COAL GASIFICATION TEST RUN	RUN No.	CG017

DATE	1987.11. 5 . (Thu.)

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for CBA2, SJE2 and CBA1 coal.

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	CBA2				
Proximate analysis		Ultimate analysis		Ash components	
Ash	10.94 %	C	71.56 %	SiO2	%
V.M.	45.01 %	H	5.73 %	Al2O3	%
F.C.	44.05 %	N	1.16 %	CaO	%
	%	O	21.20 %	K2O	%
		S	0.35 %	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.3	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	—	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

Sample number	SJE2				
Proximate analysis		Ultimate analysis		Ash components	
Ash	2.68 %	C	70.41 %	SiO2	%
V.M.	50.15 %	H	5.48 %	Al2O3	%
F.C.	47.17 %	N	1.10 %	CaO	%
	%	O	22.84 %	K2O	%
		S	0.17 %	Na2O	%

(DRY BASE) (D.A.F.)

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	14.0	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	22	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG017

COAL SAMPLE－C

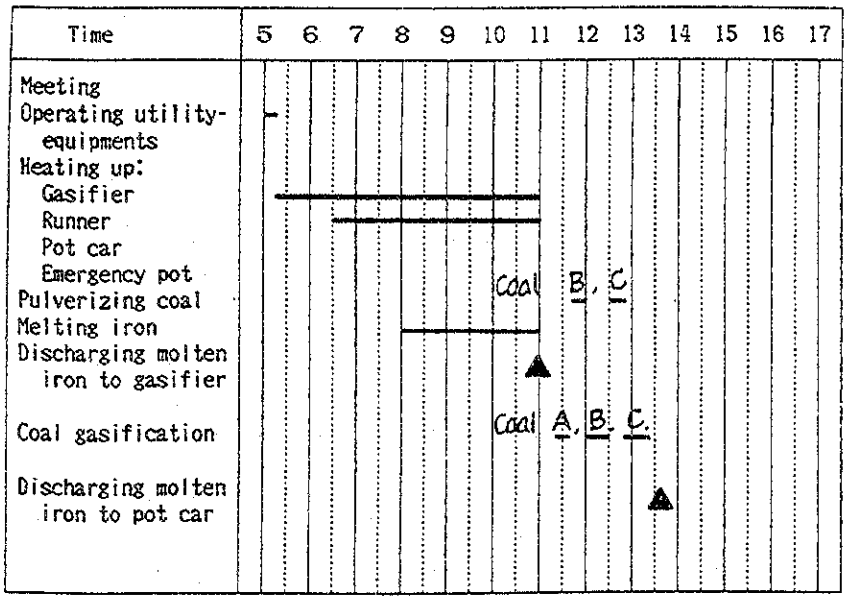
Sample number	CBA1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	17.03 %	C	69.60 %	SiO2	%
V.M.	42.73 %	H	5.76 %	Al2O3	%
F.C.	40.24 %	N	1.12 %	CaO	%
	%	O	21.81 %	K2O	%
		S	1.71 %	Na2O	%

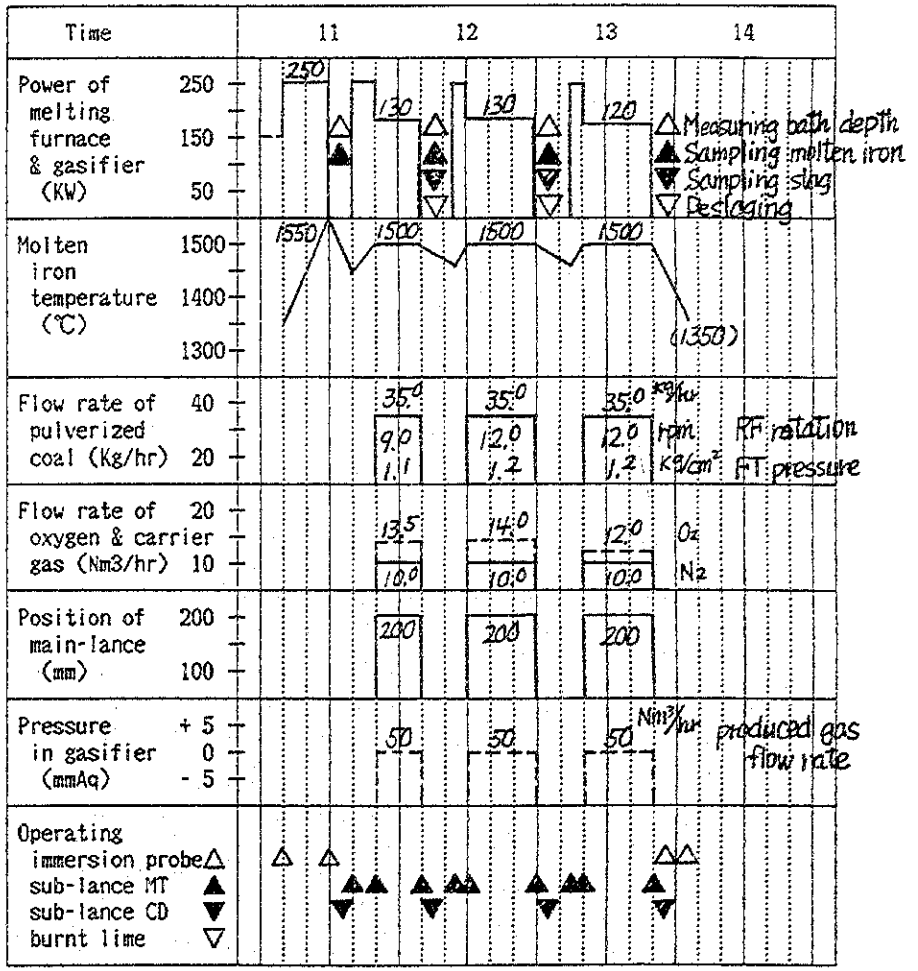
(DRY BASE)　　(D.A.F)

OPERATION CONDITION－C

Weight of molten iron	300	Kg
Flow rate of Oxygen	11.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	~~1550~~	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	21.	wet Kg
Weight of burnt lime	0	Kg

4.SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal
B, C
Coal
A, B, C


Time
11 12 13 14
Power of melting furnace & gasifier (KW)
250
150
50
Molten iron temperature (℃)
1500
1400
1300
Flow rate of pulverized coal (Kg/hr)
40
20
Flow rate of oxygen & carrier gas (Nm3/hr)
20
10
Position of main-lance (mm)
200
100
Pressure in gasifier (mmAq)
+ 5
0
- 5
Operating
immersion probe△
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽
250
130
130
120
△Measuring bath depth
▲Sampling molten iron
▼Sampling slag
▽Deslagging
1550
1500
1500
1500
(1350)
35.0
35.0
35.0 kg/hr
9.0
1.1
12.0
1.2
12.0
1.2
rpm
kg/cm²
RF rotation
FT pressure
13.5
10.0
14.0
10.0
12.0
10.0
O₂
N₂
200
200
200
50
50
50
Nm³/hr
produced gas flow rate

RUN	18 TH COAL GASIFICATION TEST RUN	RUN No.	CG018

DATE	1987.11. 12 . (Thu.)

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for BJS and BuIIC1 coal.

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE—A

Sample number	BJS				
Proximate analysis		Ultimate analysis		Ash components	
Ash	4.24 %	C	68.52 %	SiO2	%
V.M.	49.97 %	H	5.68 %	Al2O3	%
F.C.	45.79 %	N	1.15 %	CaO	%
	%	O	24.13 %	K2O	%
		S	0.52 %	Na2O	%

(DRY BASE) (D.A.F)

COAL SAMPLE—B

Sample number	BuIIC1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	1.90 %	C	74.50 %	SiO2	%
V.M.	46.04 %	H	5.43 %	Al2O3	%
F.C.	52.06 %	N	1.36 %	CaO	%
	%	O	18.26 %	K2O	%
		S	0.45 %	Na2O	%

(DRY BASE) (D.A.F.)

OPERATION CONDITION—A

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.3	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	28	wet Kg
Weight of burnt lime	0	Kg

OPERATION CONDITION—B

Weight of molten iron	300	Kg
Flow rate of Oxygen	12.6	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	27.	wet Kg
Weight of burnt lime	0	Kg

RUN		RUN No.	CG01

COAL SAMPLE－C

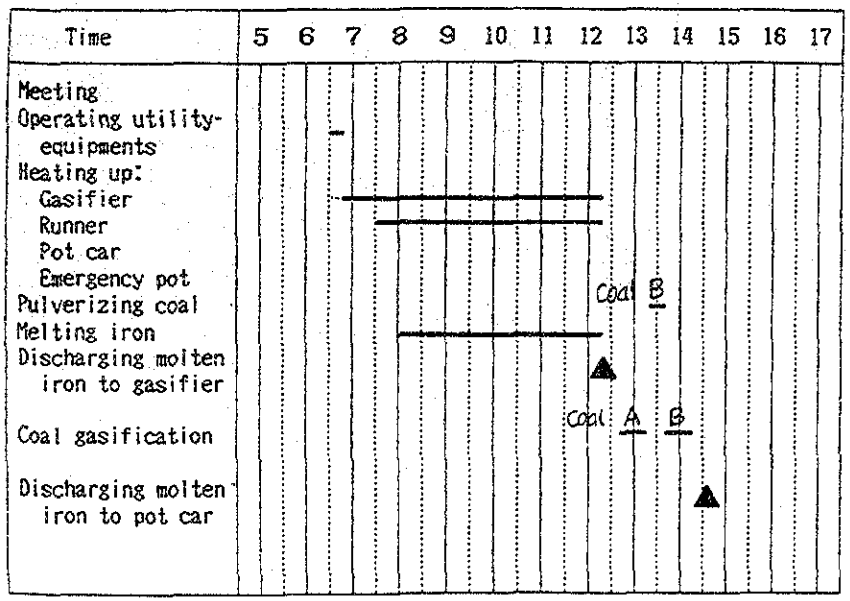
Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Ash	%	C	%	SiO2	%
V.M.	%	H	%	Al2O3	%
F.C.	%	N	%	CaO	%
	%	O	%	K2O	%
		S	%	Na2O	%

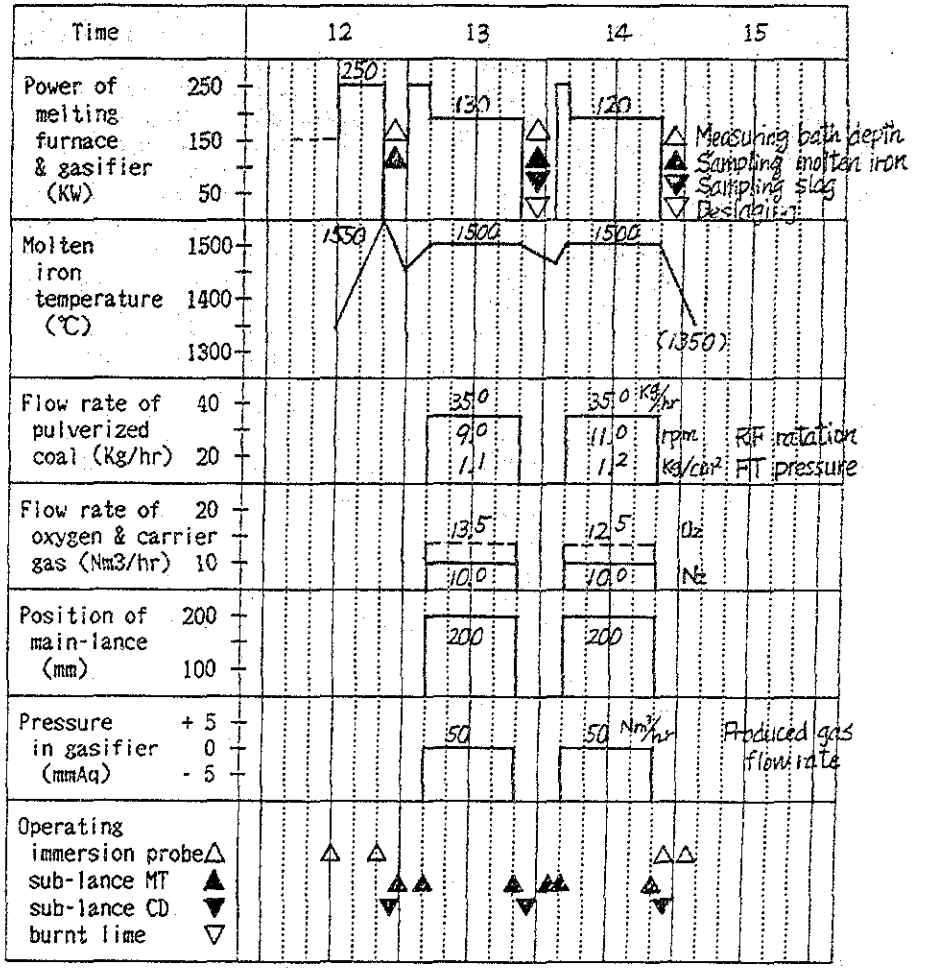
(DRY BASE)　　(D.A.F)

OPERATION CONDITION－C

Weight of molten iron	300	Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car		℃
Basicity of slag	1.5	
Weight of coal		wet Kg
Weight of burnt lime	0	Kg

4. SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal B
Coal A B


Time
12 13 14 15
Power of melting furnace & gasifier (KW)
250
150
50
Molten iron temperature (℃)
1500
1400
1300
Flow rate of pulverized coal (Kg/hr)
40
20
Flow rate of oxygen & carrier gas (Nm3/hr)
20
10
Position of main-lance (mm)
200
100
Pressure in gasifier (mmAq)
+ 5
0
- 5
Operating
immersion probe△
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽
250
130
120
1550
1500
1500
1500
(1350)
350 Kg/hr
90
11.0 rpm RF rotation
1.1
1.2 Kg/cm² FT pressure
13.5
12.5
O2
10.0
10.0
N2
200
200
50
50 Nm³/hr
Measuring bath depth
Sampling molten iron
Sampling slag
Deslagging
Produced gas flow rate

RUN	19 TH COAL GASIFICATION TEST RUN	RUN No.	CG019

DATE	1987.11. 18 . (Wed.)

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for BJS and BSIA1 coal

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE－A

Sample number	BJS				
Proximate analysis		Ultimate analysis		Ash components	
Ash	4.24 %	C	69.52 %	SiO2	%
V.M.	49.97 %	H	5.68 %	Al2O3	%
F.C.	45.79 %	N	1.15 %	CaO	%
	%	O	24.13 %	K2O	%
		S	0.52 %	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION－A

Weight of molten iron	300	Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	22	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE－B

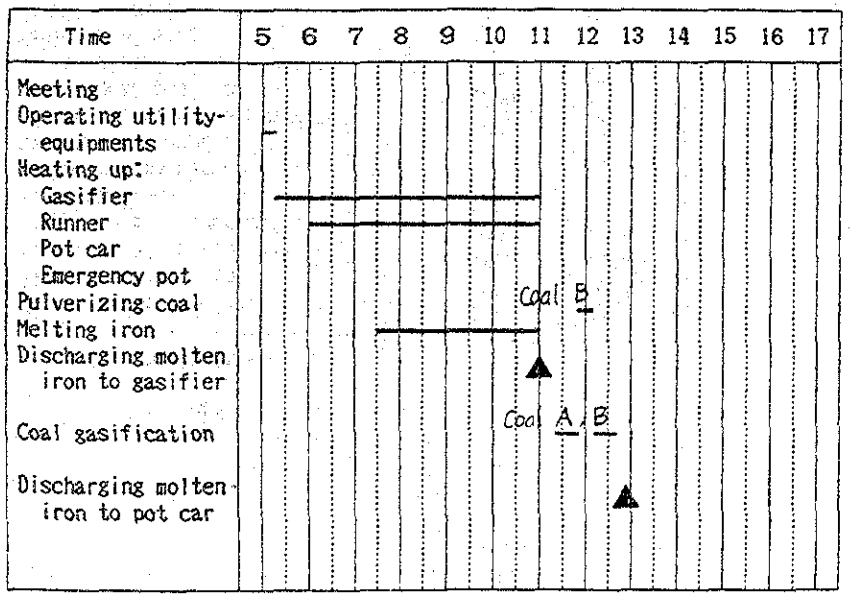
Sample number	BSIA1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	4.29 %	C	73.13 %	SiO2	%
V.M.	46.63 %	H	5.72 %	Al2O3	%
F.C.	49.08 %	N	1.14 %	CaO	%
	%	O	19.30 %	K2O	%
		S	0.71 %	Na2O	%

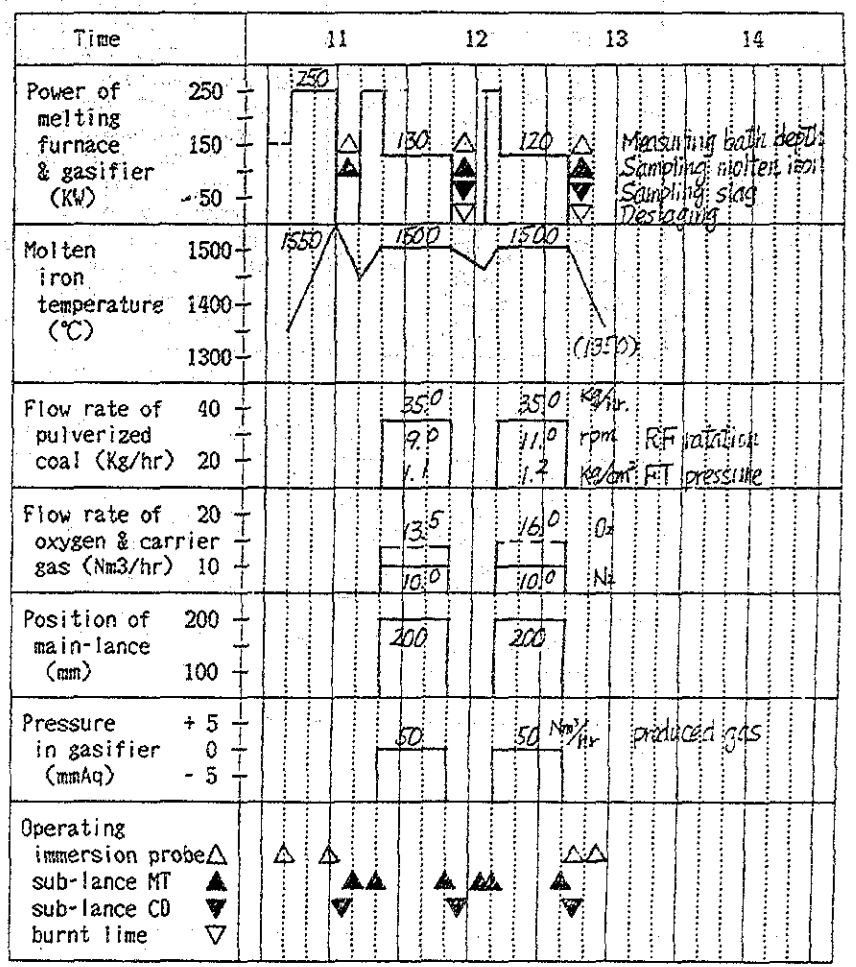
(DRY BASE) (D.A.F.)

OPERATION CONDITION－B

Weight of molten iron	300	Kg
Flow rate of Oxygen	15.8	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	21.	wet Kg
Weight of burnt lime	0	Kg

4.SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal B
Coal A
B


Time
11 12 13 14
Power of melting furnace & gasifier (KW)
250
150
50
250
130
120
Measuring bath depth
Sampling molten iron
Sampling slag
Deslagging
Molten iron temperature (℃)
1500
1400
1300
1550
1500
1500
(1350)
Flow rate of pulverized coal (Kg/hr)
40
20
350
9.0
1.1
350
11.0
1.2
Kg/hr.
rpm RF rotation
Kg/cm² F/T pressure
Flow rate of oxygen & carrier gas (Nm3/hr)
20
10
13.5
10.0
16.0
10.0
O₂
N₂
Position of main-lance (mm)
200
100
200
200
Pressure in gasifier (mmAq)
+ 5
0
- 5
50
50
Nm³/hr produced gas
Operating
immersion probe△
sub-lance MT ▲
sub-lance CO ▼
burnt lime ▽

26.Nov.87

RUN	TH COAL GASIFICATION TEST RUN	RUN No.	CG01 - 20

DATE	1987.10. - ( )

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE—A

Sample number BS4B					
Proximate analysis		Ultimate analysis		Ash components	
Ash	4.49 %	C	73.12 %	SiO2	%
V.M.	47.25 %	H	5.74 %	Al2O3	%
F.C.	48.26 %	N	1.13 %	CaO	%
	%	O	19.74 %	K2O	%
		S	0.27 %	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION—A

Weight of molten iron	300	Kg
Flow rate of Oxygen	15.0	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE—B

Sample number B42B2					
Proximate analysis		Ultimate analysis		Ash components	
Ash 2.29	%	C	73.10 %	SiO2	%
V.M. 47.58	%	H	5.80 %	Al2O3	%
F.C. 50.13	%	N	1.25 %	CaO	%
	%	O	18.15 %	K2O	%
		S	1.70 %	Na2O	%

(DRY BASE) (D.A.F.)

OPERATION CONDITION—B

Weight of molten iron	300	Kg
Flow rate of Oxygen	15.7	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	—	℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

DATE	1987.~~10~~.26 . (Thu.)

COAL SAMPLE—E

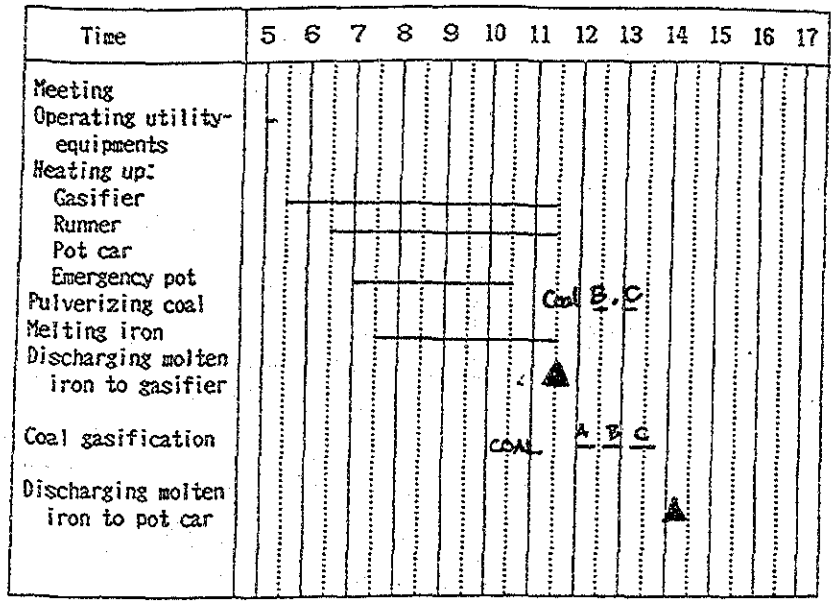
Sample number	BU2A1				
Proximate analysis		Ultimate analysis		Ash components	
Ash	7.06 %	C	76.73 %	SiO2	%
V.M.	44.92 %	H	5.97 %	Al2O3	%
F.C.	48.02 %	N	1.28 %	CaO	%
	%	O	15.43 %	K2O	%
	%	S	0.59 %	Na2O	%

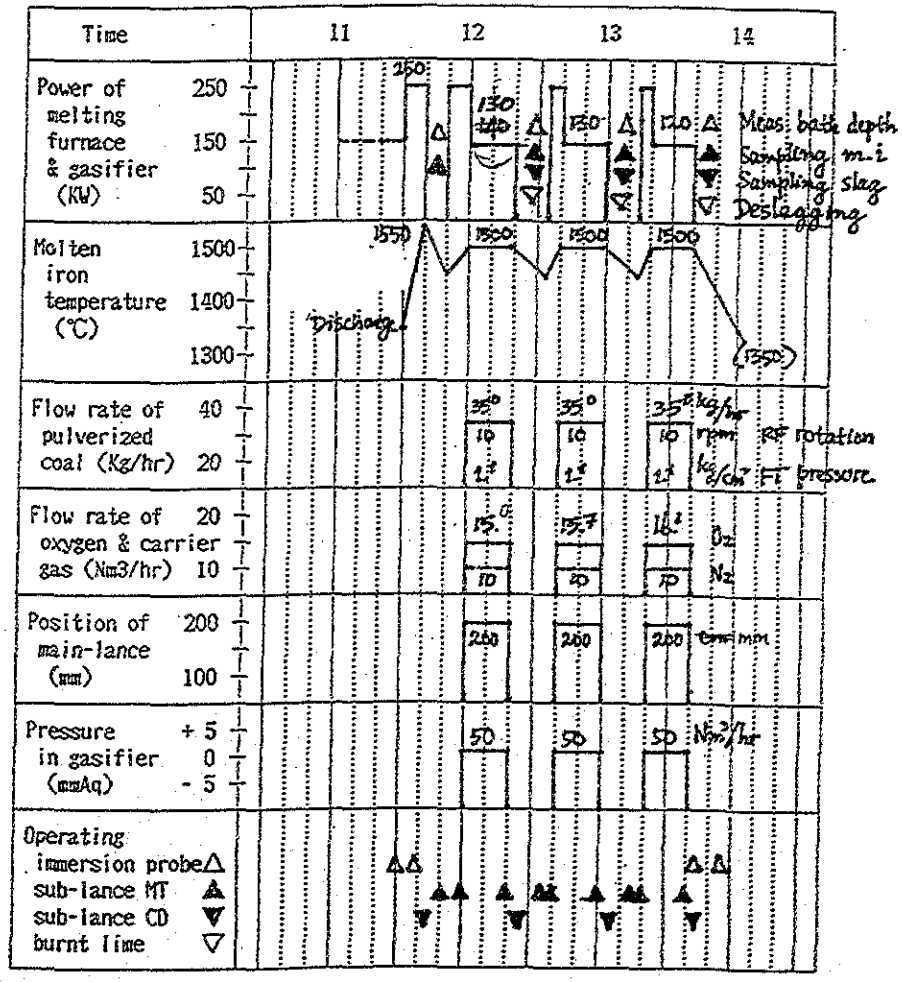
(DRY BASE) (D.A.F.)

OPERATION CONDITION—B

Weight of molten iron	300	Kg
Flow rate of Oxygen	16.1	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35.0	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	21	wet Kg
Weight of burnt lime	0	Kg

4.SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal
B, C
COAL
A
B
C


Time
11 12 13 14
Power of melting furnace & gasifier (KW)
250
150
50
Molten iron temperature (℃)
1500
1400
1300
1550
Discharge
Flow rate of pulverized coal (Kg/hr)
40
20
Flow rate of oxygen & carrier gas (Nm3/hr)
20
10
Position of main-lance (mm)
200
100
Pressure in gasifier (mmAq)
+ 5
0
- 5
Operating
immersion probe△
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽
Meas. bath depth
Sampling m.i
Sampling slag
Deslagging
rpm
rotation
pressure
O2
N2
mm
Nm3/hr

RUN	TH COAL GASIFICATION TEST RUN	RUN No.	CG01 021

DATE	1987.12. 2 . ( )

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for BSIC1

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE—A

Sample number	BSIC1						
Proximate analysis		Ultimate analysis			Ash components		
Ash	0.265 %	C	76.4	76.41 %	SiO2		%
V.M.	46.95 %	H		5.83 %	Al2O3		%
F.C.	50.40 %	N		1.40 %	CaO		%
	%	O		15.76 %	K2O		%
		S		0.60 %	Na2O		%

(DRY BASE) (D.A.F)

OPERATION CONDITION—A

Weight of molten iron	300	Kg
Flow rate of Oxygen	13.4	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car		℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE—B

Sample number	BUIC1						
Proximate analysis		Ultimate analysis			Ash components		
Ash	1.90 %	C		74.50 %	SiO2		%
V.M.	46.04 %	H		5.43 %	Al2O3		%
F.C.	52.06 %	N		1.36 %	CaO		%
	%	O		18.26 %	K2O		%
		S		0.45 %	Na2O		%

(DRY BASE) (D.A.F.)

OPERATION CONDITION—B

Weight of molten iron	300	Kg
Flow rate of Oxygen	12.6	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car		℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

RUN	TH COAL GASIFICATION TEST RUN	RUN No.	CG021

DATE	1987-12-2 . ( )

1.PURPOSE of RUN

1) INVESTIGATIONS of GASIFICATION-CHARACTERISTIC for

2.COAL SAMPLE and OPERATION CONDITION

COAL SAMPLE—A

Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Ash	%	C	%	SiO2	%
V.M.	%	H	%	Al2O3	%
F.C.	%	N	%	CaO	%
	%	O	%	K2O	%
		S	%	Na2O	%

(DRY BASE) (D.A.F)

OPERATION CONDITION—A

Weight of molten iron	300	Kg
Flow rate of Oxygen		Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal		Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	1550	℃
on coal gasification	1500	℃
on discharge to pot car		℃
Basicity of slag	1.5	
Weight of coal		wet Kg
Weight of burnt lime	0	Kg

COAL SAMPLE—C CBC

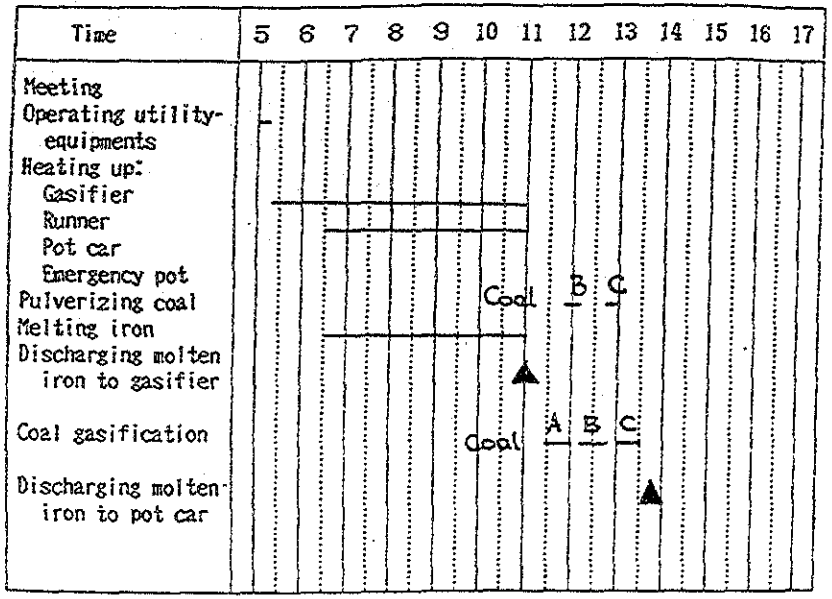
Sample number					
Proximate analysis		Ultimate analysis		Ash components	
Ash	6.15 %	C	72.22 %	SiO2	%
V.M.	47.08 %	H	5.88 %	Al2O3	%
F.C.	46.77 %	N	1.48 %	CaO	%
	%	O	20.05 %	K2O	%
		S	0.37 %	Na2O	%

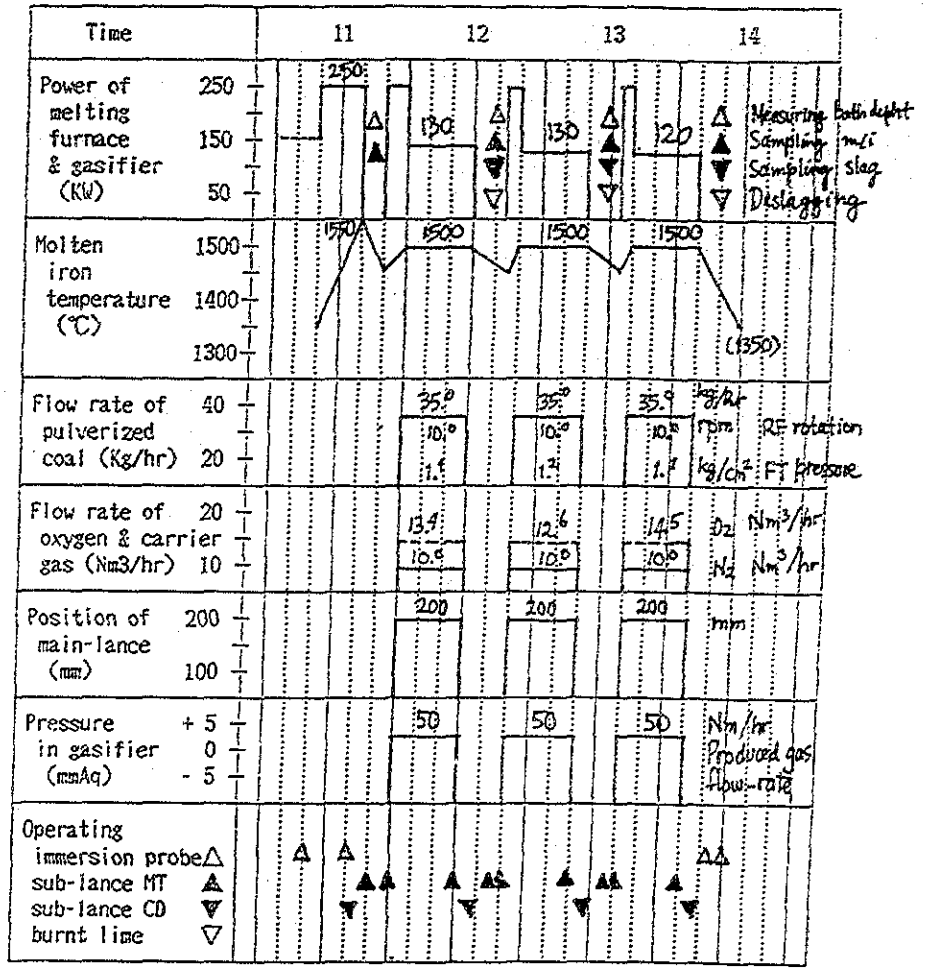
(DRY BASE) (D.A.F.)

OPERATION CONDITION—B

Weight of molten iron	300	Kg
Flow rate of Oxygen	14.5	Nm3/hr
Flow rate of carrier gas	10.0	Nm3/hr
Flow rate of pulverized coal	35	Kg/hr
Position of main-lance over bath surface	200	mm
Molten iron temperature		
on discharge to gasifier	--	℃
on coal gasification	1500	℃
on discharge to pot car	1350	℃
Basicity of slag	1.5	
Weight of coal	20	wet Kg
Weight of burnt lime	0	Kg

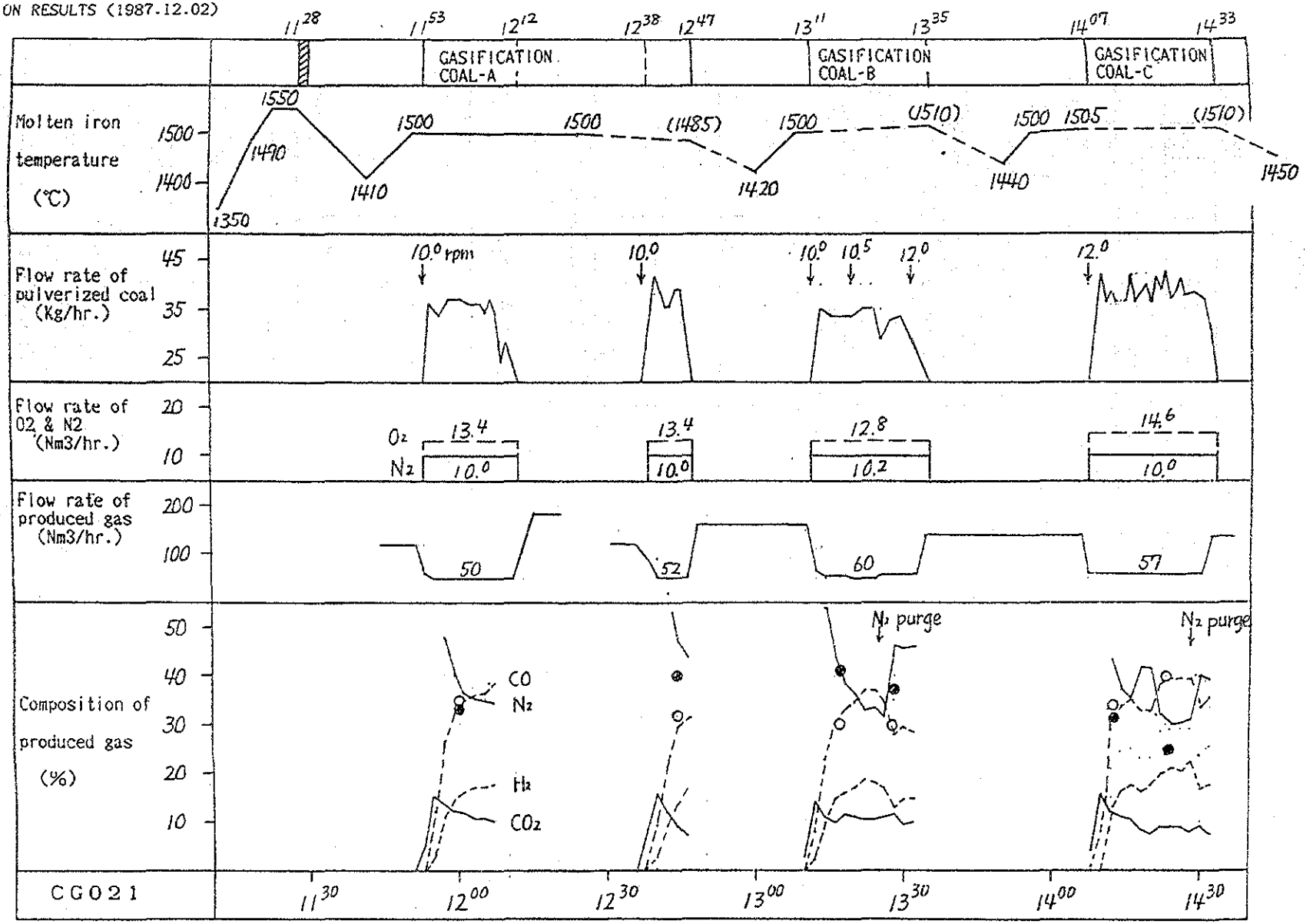
4-SCHEDULE


Time
5 6 7 8 9 10 11 12 13 14 15 16 17
Meeting
Operating utility-equipments
Heating up:
Gasifier
Runner
Pot car
Emergency pot
Pulverizing coal
Melting iron
Discharging molten iron to gasifier
Coal gasification
Discharging molten iron to pot car
Coal
B
C
Coal
A
B
C


Time
11 12 13 14
Power of melting furnace & gasifier (KW)
250
150
50
250
130
130
120
Measuring both depth
Sampling m/c
Sampling slag
Disslagging
Molten iron temperature (℃)
1500
1400
1300
1500
1500
1500
1500
(1350)
Flow rate of pulverized coal (Kg/hr)
40
20
35.0
10.0
1.6
35.0
10.0
1.2
35.0
10.0
1.1
kg/hr
rpm
RF rotation
kg/cm²
FT pressure
Flow rate of oxygen & carrier gas (Nm3/hr)
20
10
13.9
10.0
12.6
10.0
14.5
10.0
O2
N2
Nm³/hr
Nm³/hr
Position of main-lance (mm)
200
100
200
200
200
m/m
Pressure in gasifier (mmAq)
+ 5
0
- 5
50
50
50
Nm/hr
Produced gas flow-rate
Operating
immersion probe△
sub-lance MT ▲
sub-lance CD ▼
burnt lime ▽

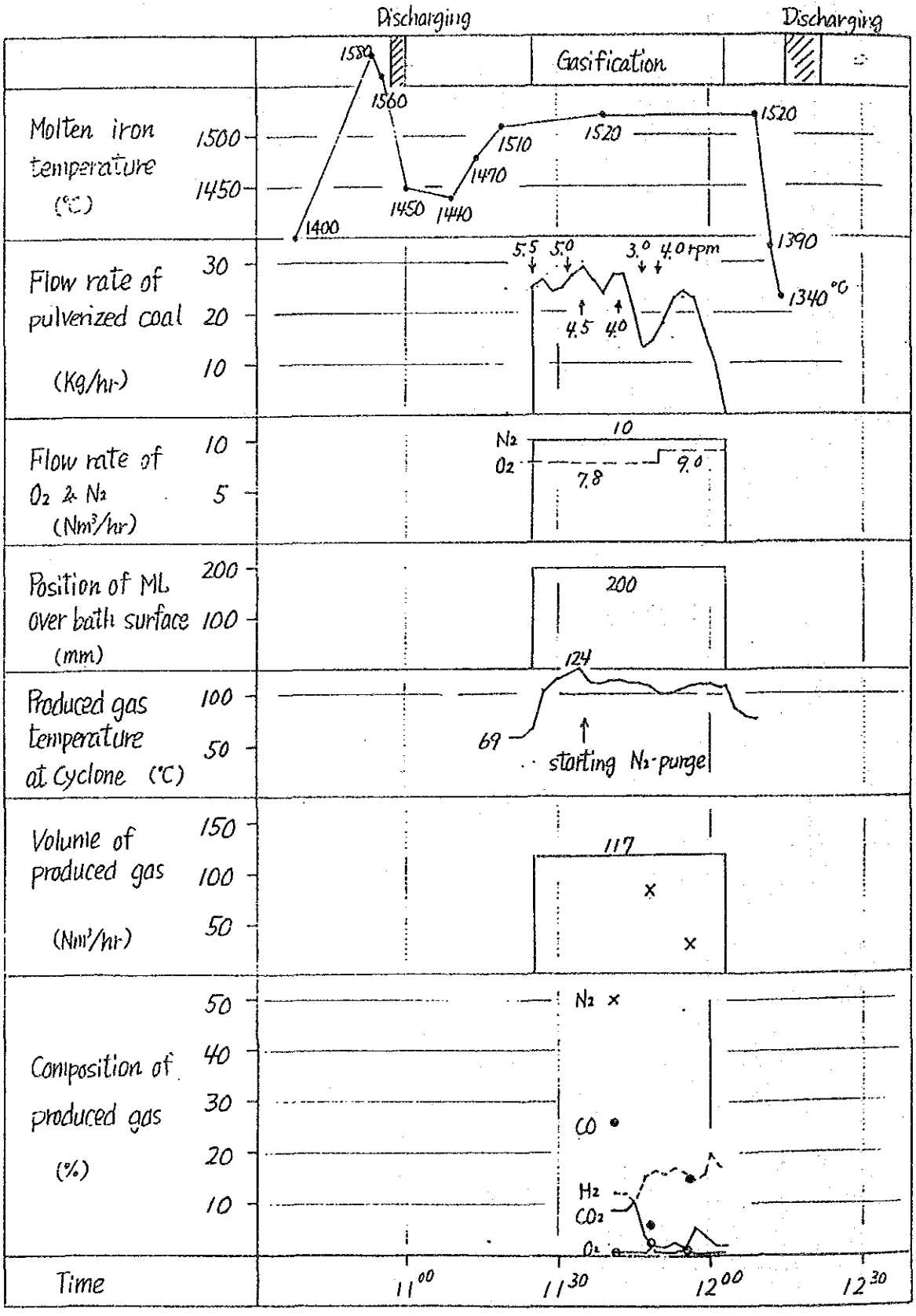
2. Test Results

OPERATION RESULTS (1987.12.02)

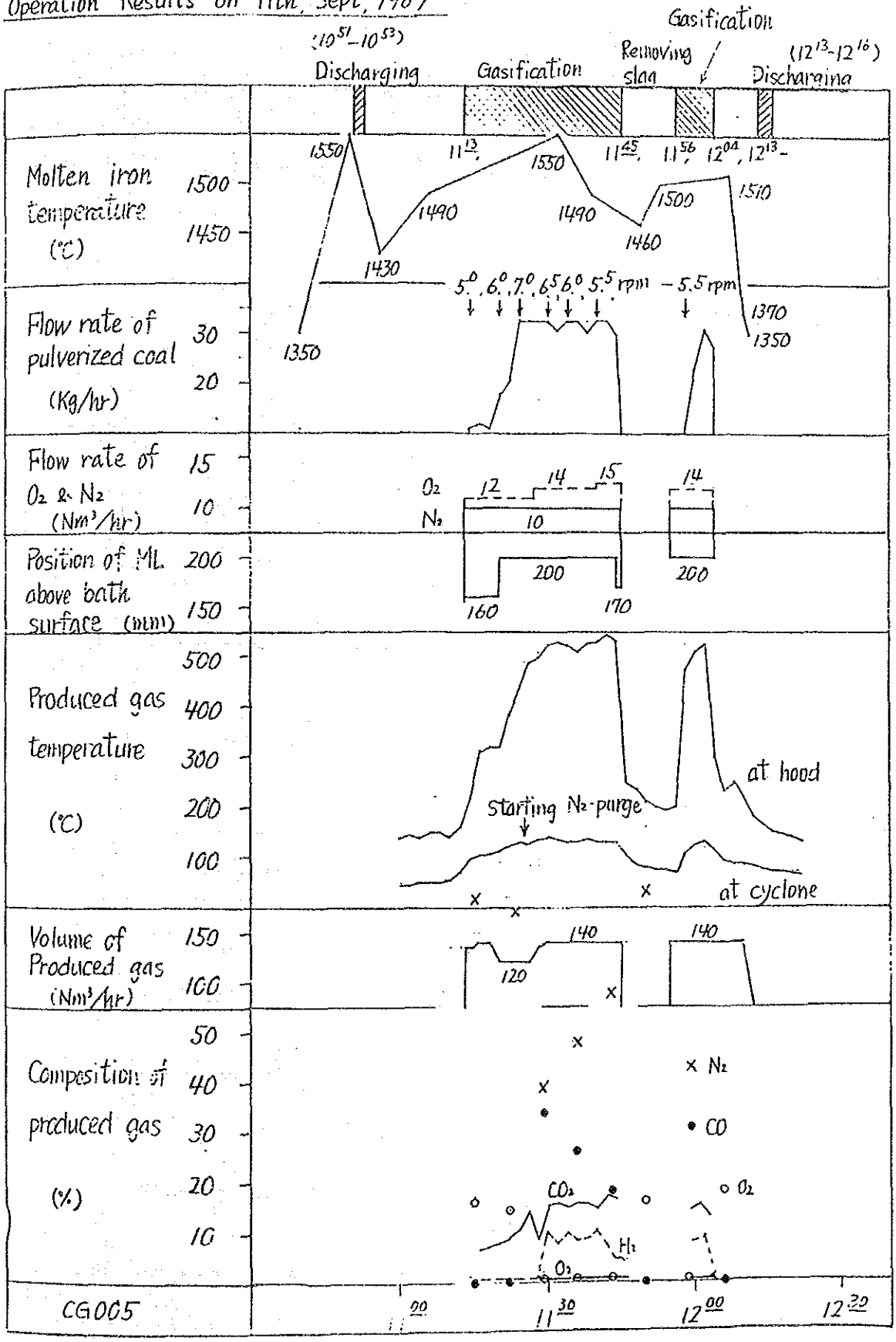


CG004

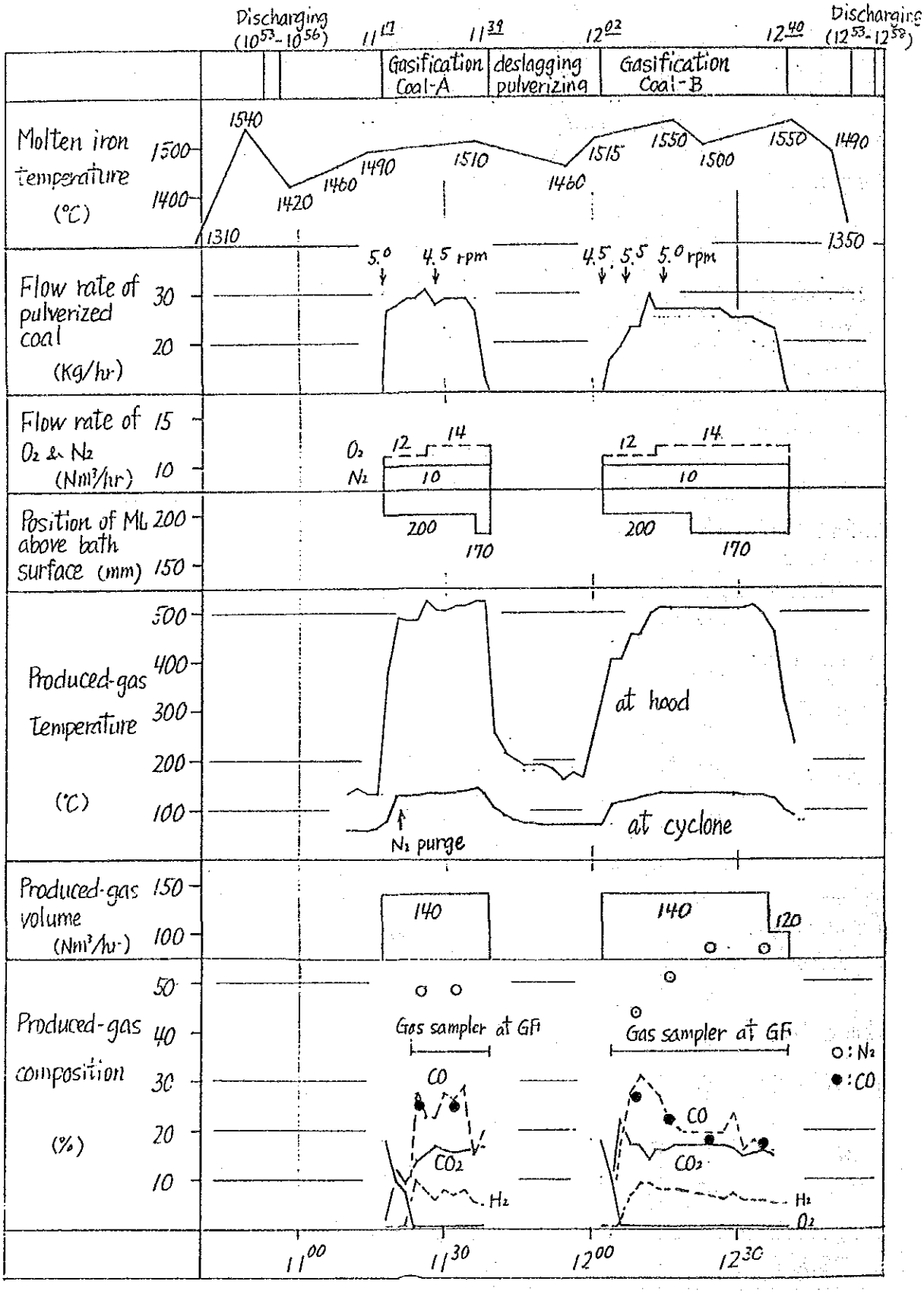
Operation Result on 8th, Sept. 1987



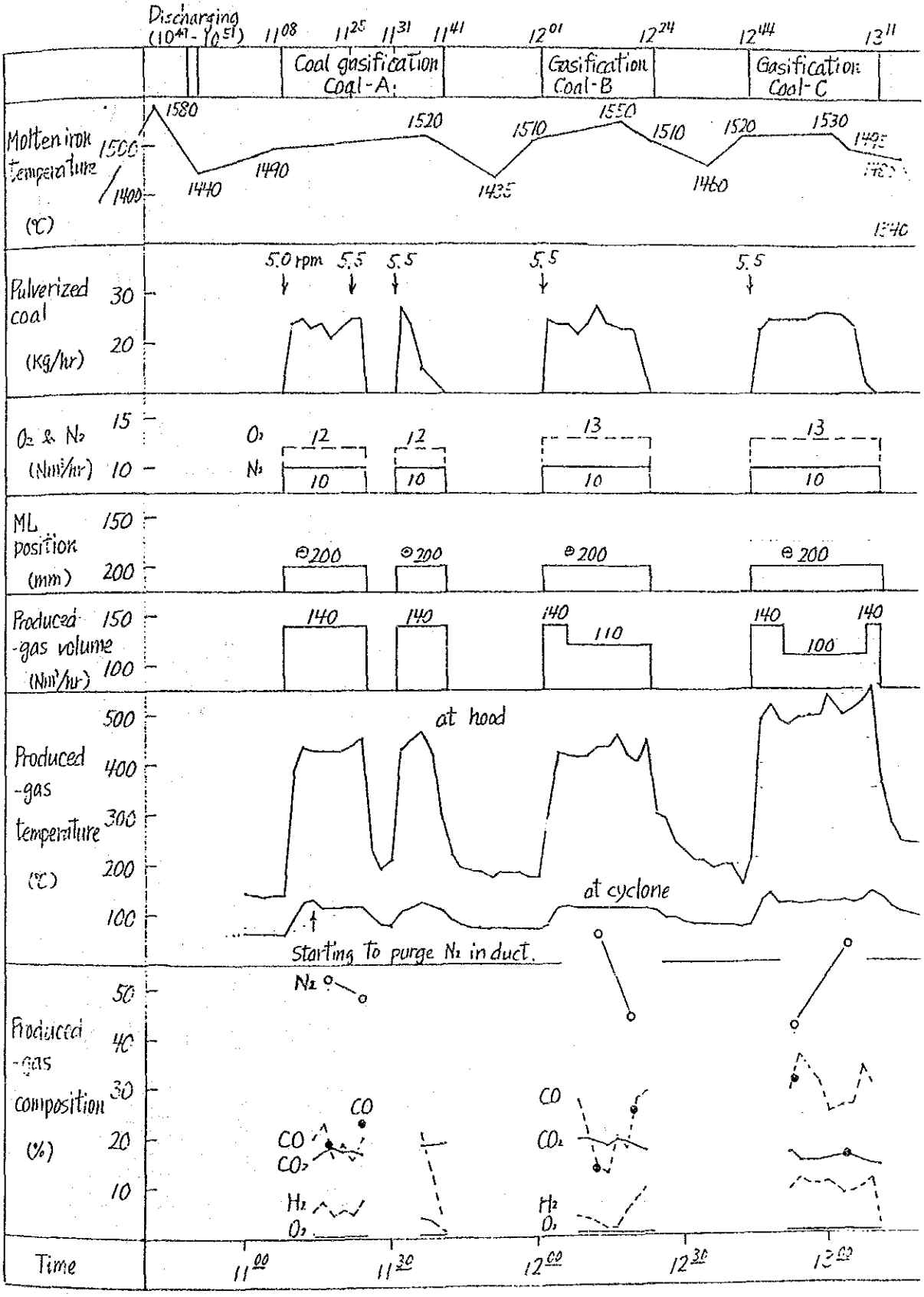
Operation Results on 11th, Sept, 1987



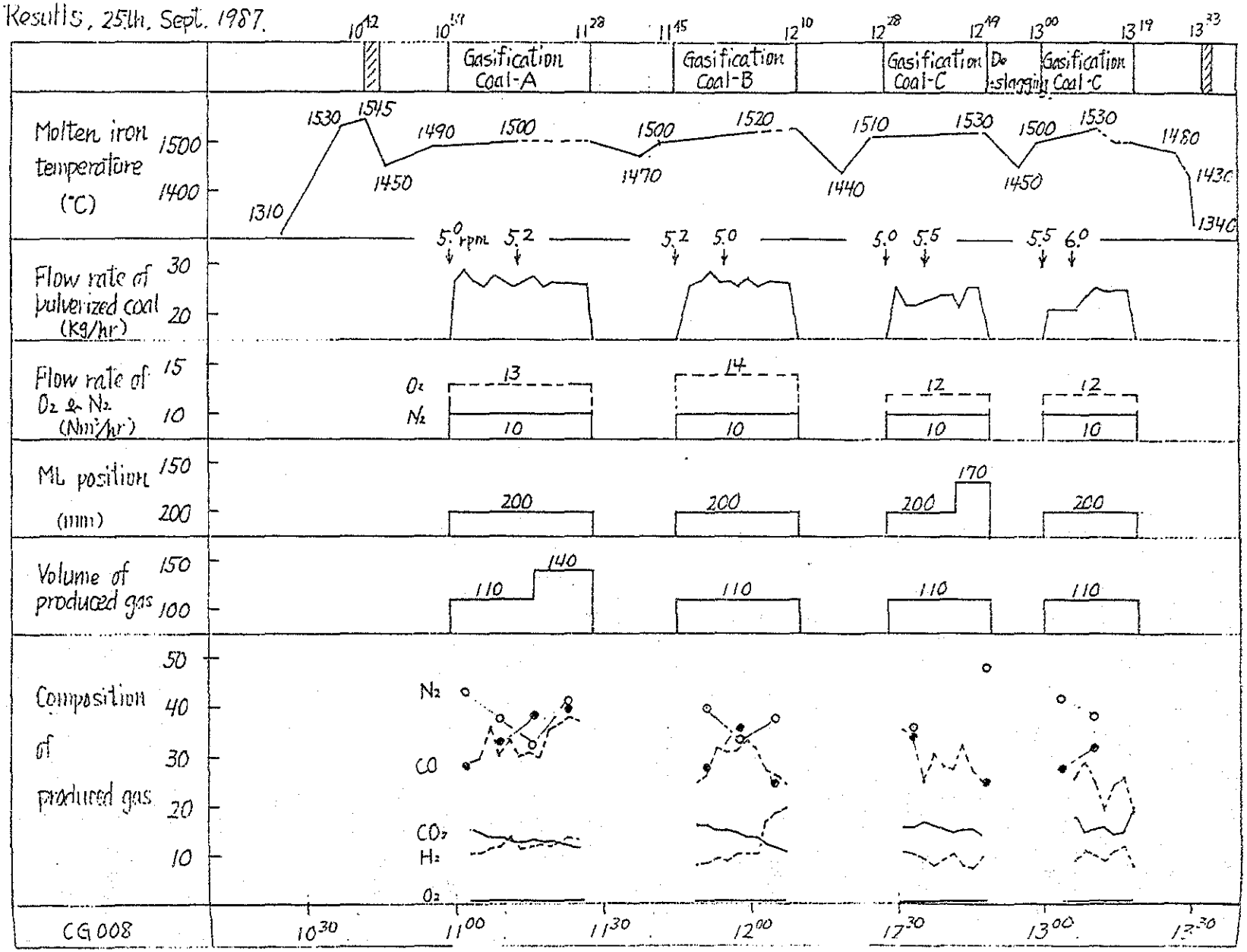
Operation Results on 16th. Sept. (CG006)

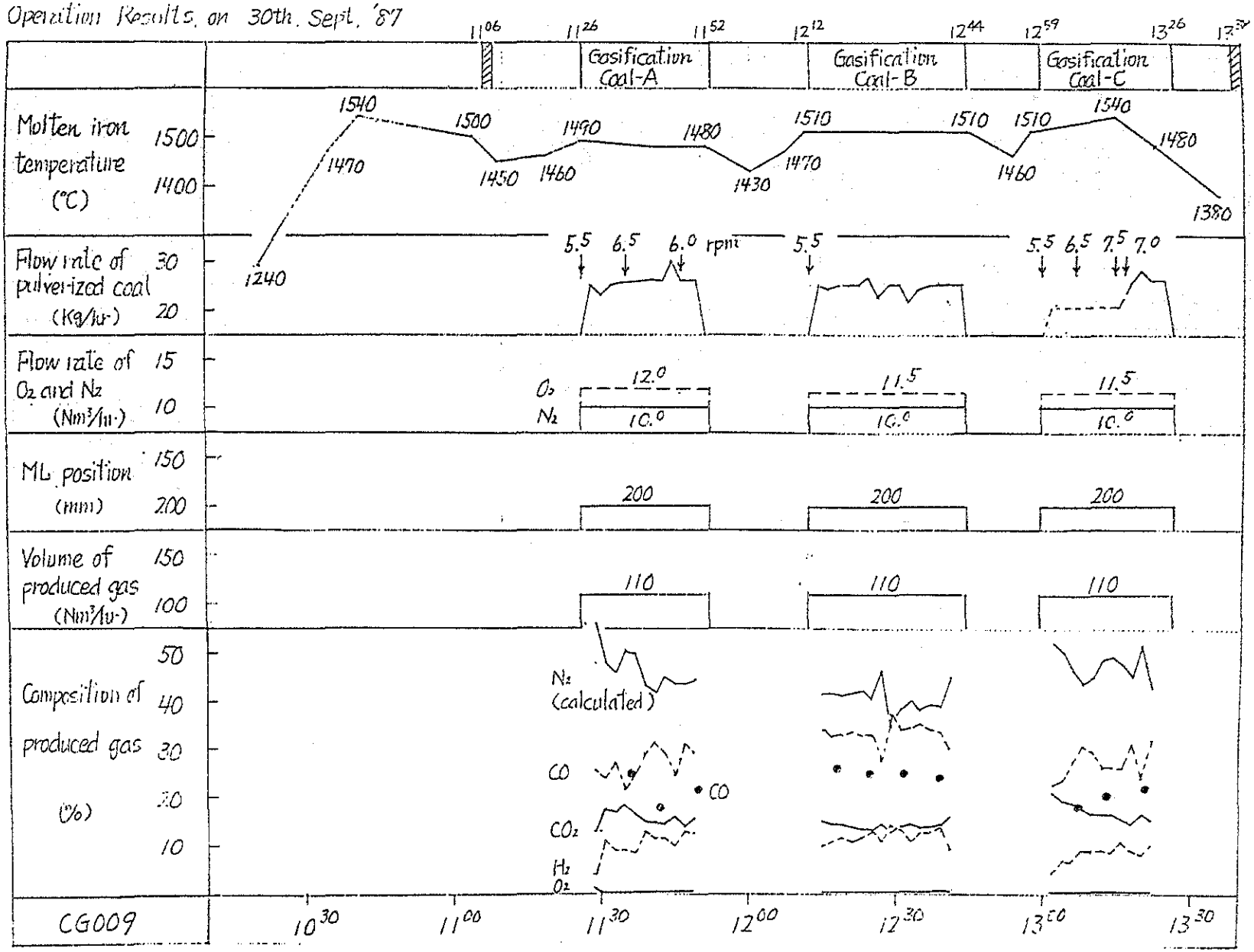


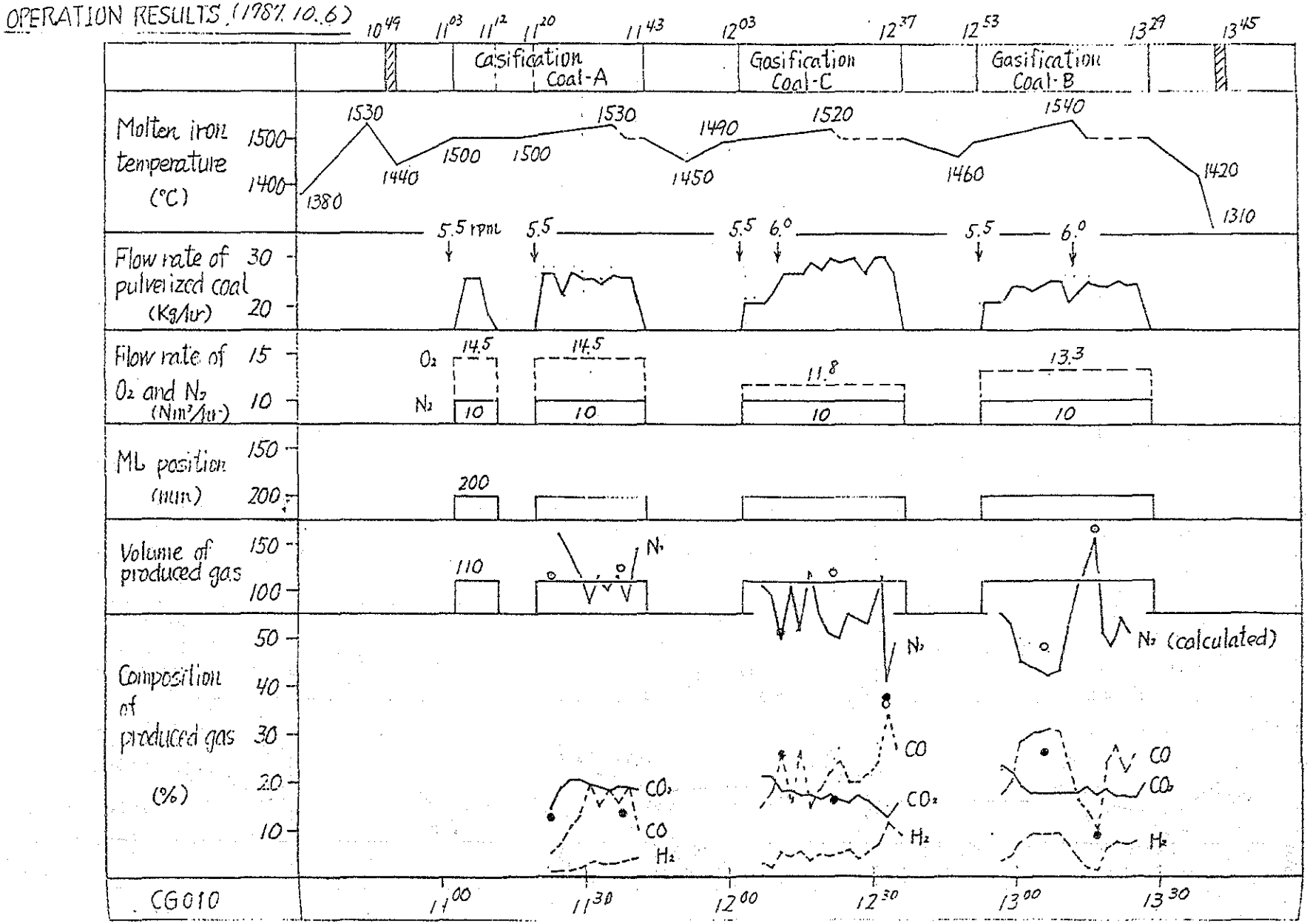
Operation Results on 22nd. Oct. (CG007)



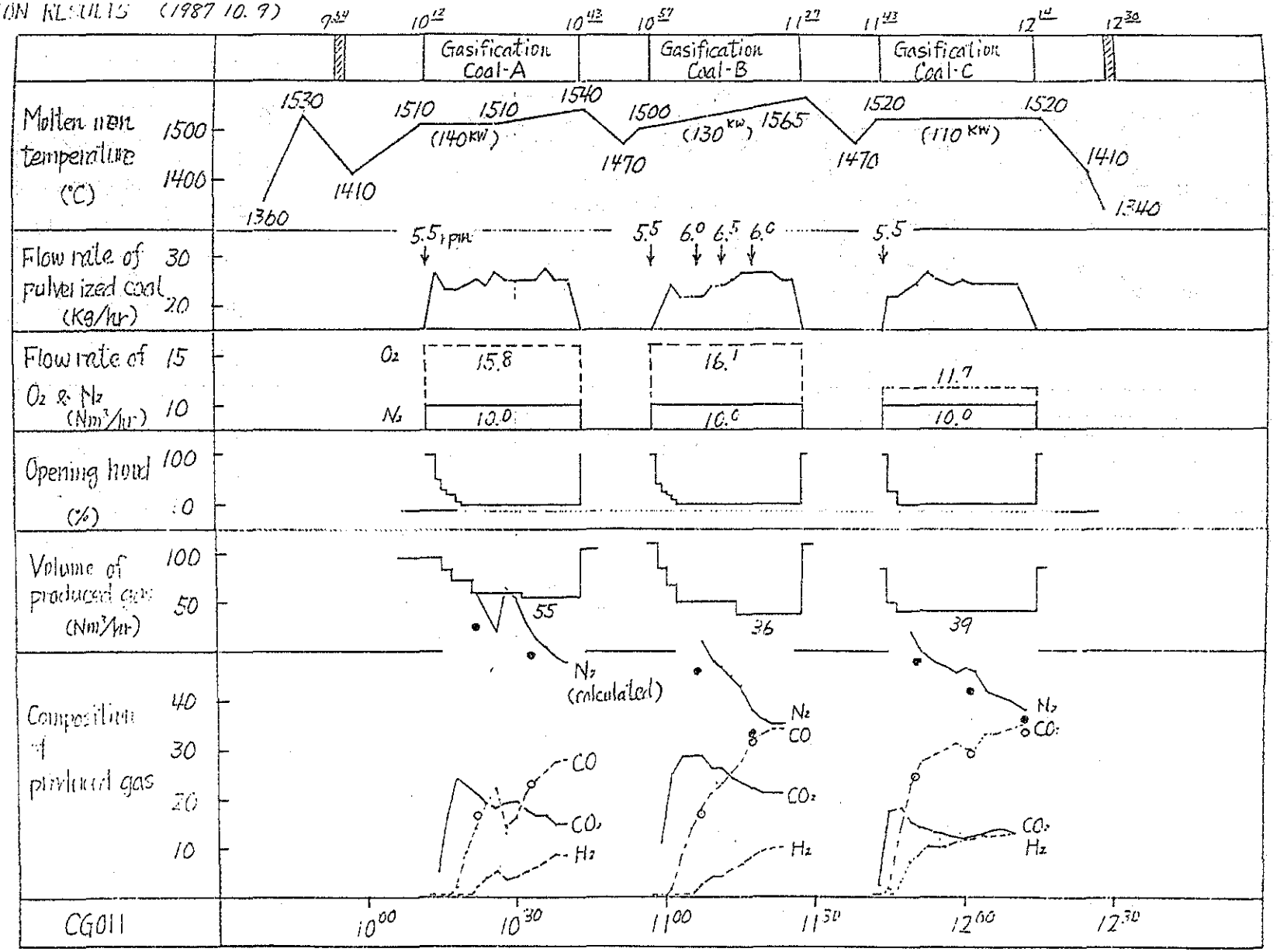
Operation Results, 25th. Sept. 1987.



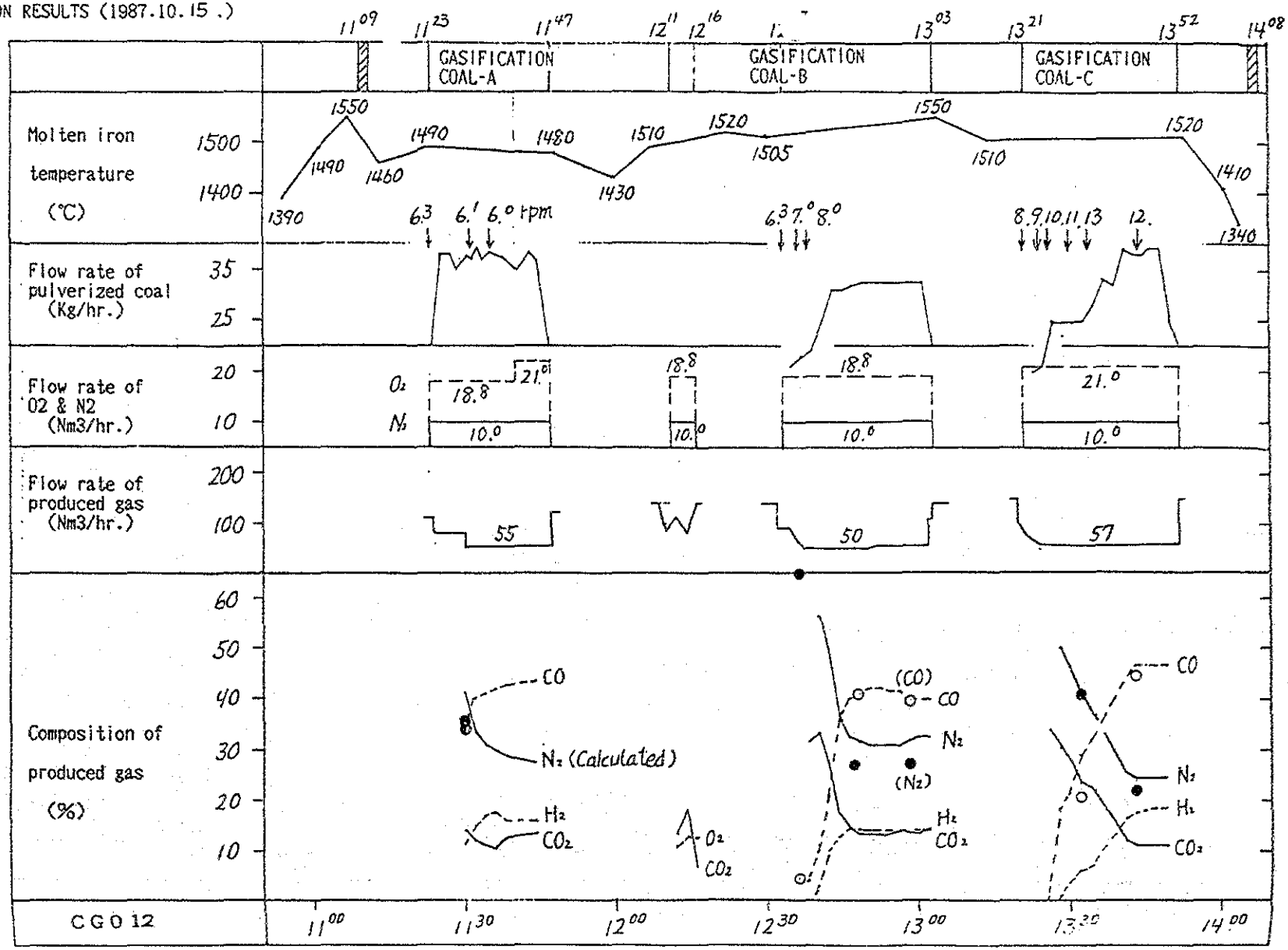

Operation Results on 30th. Sept. '87
11^06
11^26
11^52
12^12
12^44
12^59
13^26
Gasification Coal-A
Gasification Coal-B
Gasification Coal-C
Molten iron temperature (°C)
1500
1400
1540
1470
1500
1450
1490
1460
1480
1430
1510
1470
1510
1460
1510
1540
1480
1380
Flow rate of pulverized coal (Kg/hr)
30
20
1240
5.5
6.5
6.0 rpm
5.5
5.5
6.5
7.5
7.0
Flow rate of O2 and N2 (Nm³/hr)
15
10
O2
N2
12.0
10.0
11.5
10.0
11.5
10.0
ML position (mm)
150
200
200
200
200
Volume of produced gas (Nm³/hr)
150
100
110
110
110
Composition of produced gas (%)
50
40
30
20
10
N2 (calculated)
CO
CO
CO2
H2
O2
CG009
10^30
11^00
11^30
12^00
12^30
13^00
13^30


OPERATION RESULTS (1987. 10. 6)
10^49
11^03
11^12
11^20
11^43
12^03
12^37
12^53
13^29
13^45
Gasification Coal-A
Gasification Coal-C
Gasification Coal-B
Molten iron temperature (°C)
1500
1400
1530
1380
1440
1500
1500
1530
1450
1490
1520
1460
1540
1420
1310
Flow rate of pulverized coal (Kg/hr)
30
20
5.5 rpm
5.5
5.5
6.0
5.5
6.0
Flow rate of O2 and N2 (Nm³/hr)
15
10
O2
N2
14.5
14.5
11.8
13.3
10
10
10
10
ML position (mm)
150
200
200
Volume of produced gas
150
100
110
N2
N2
N2 (calculated)
Composition of produced gas (%)
50
40
30
20
10
CO2
CO
H2
CO
CO2
H2
CO
CO2
H2
CG010
11^00
11^30
12^00
12^30
13^00
13^30

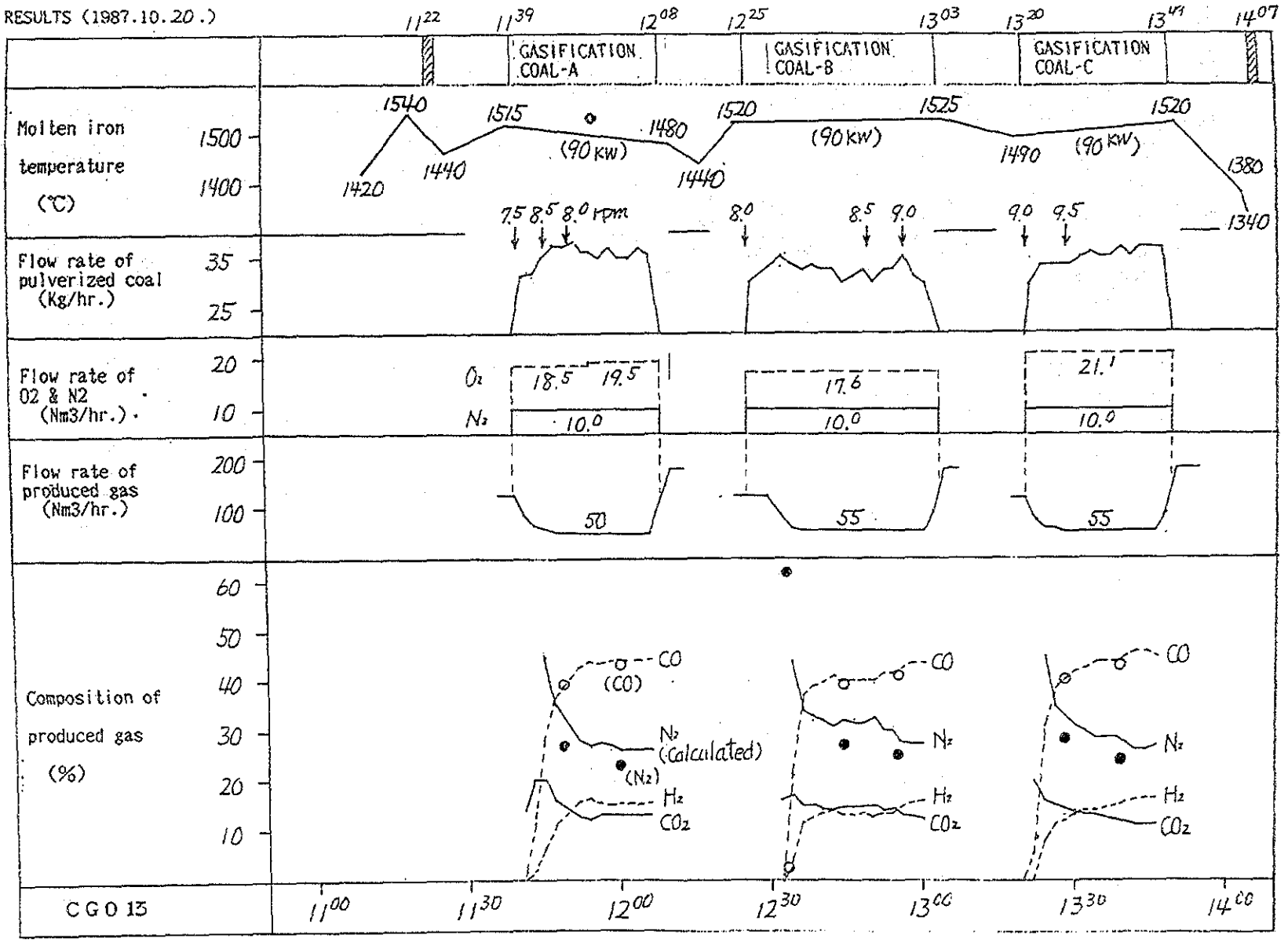
OPERATION RESULTS (1987 10. 9)



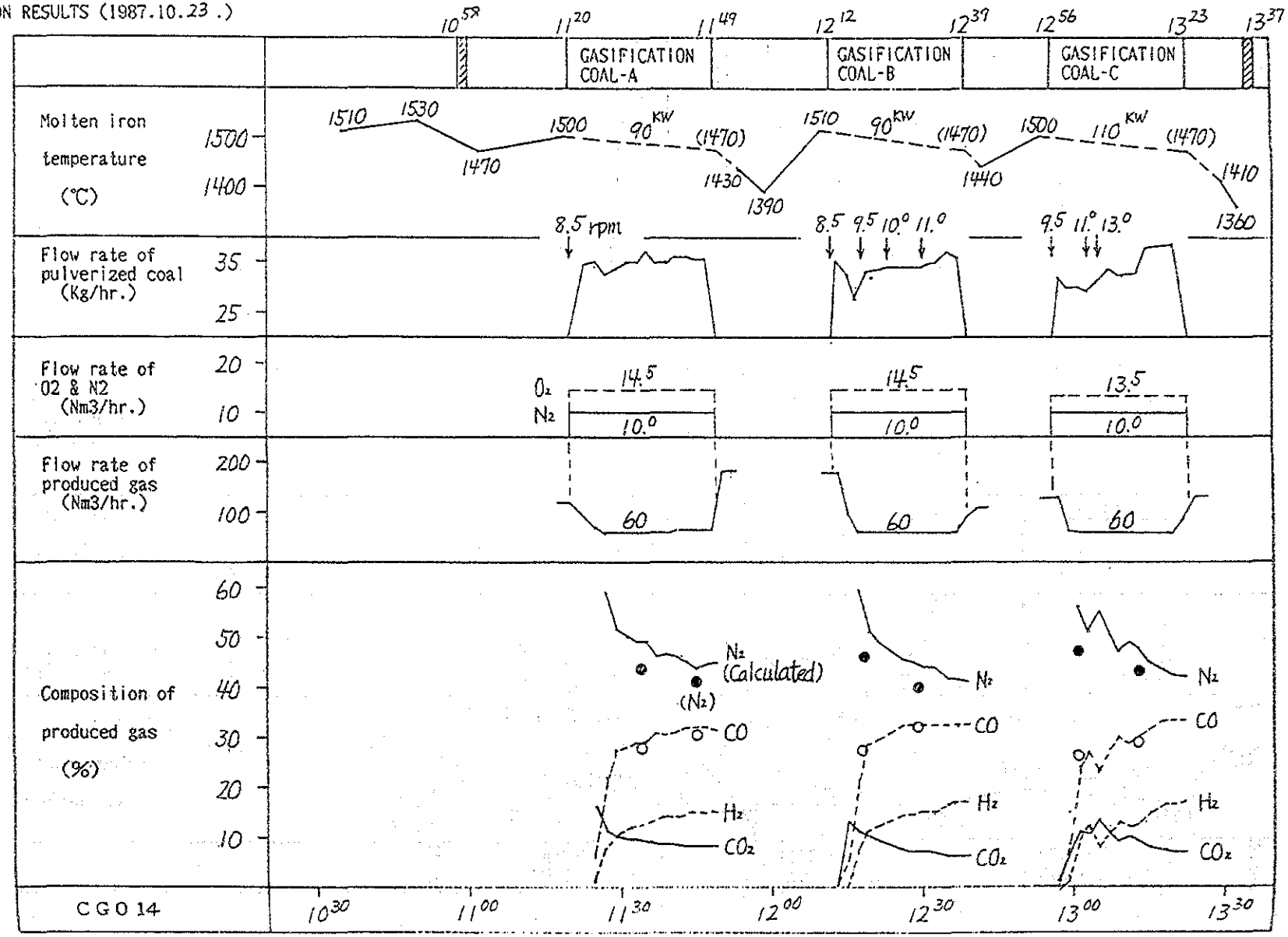
OPERATION RESULTS (1987.10.15 .)



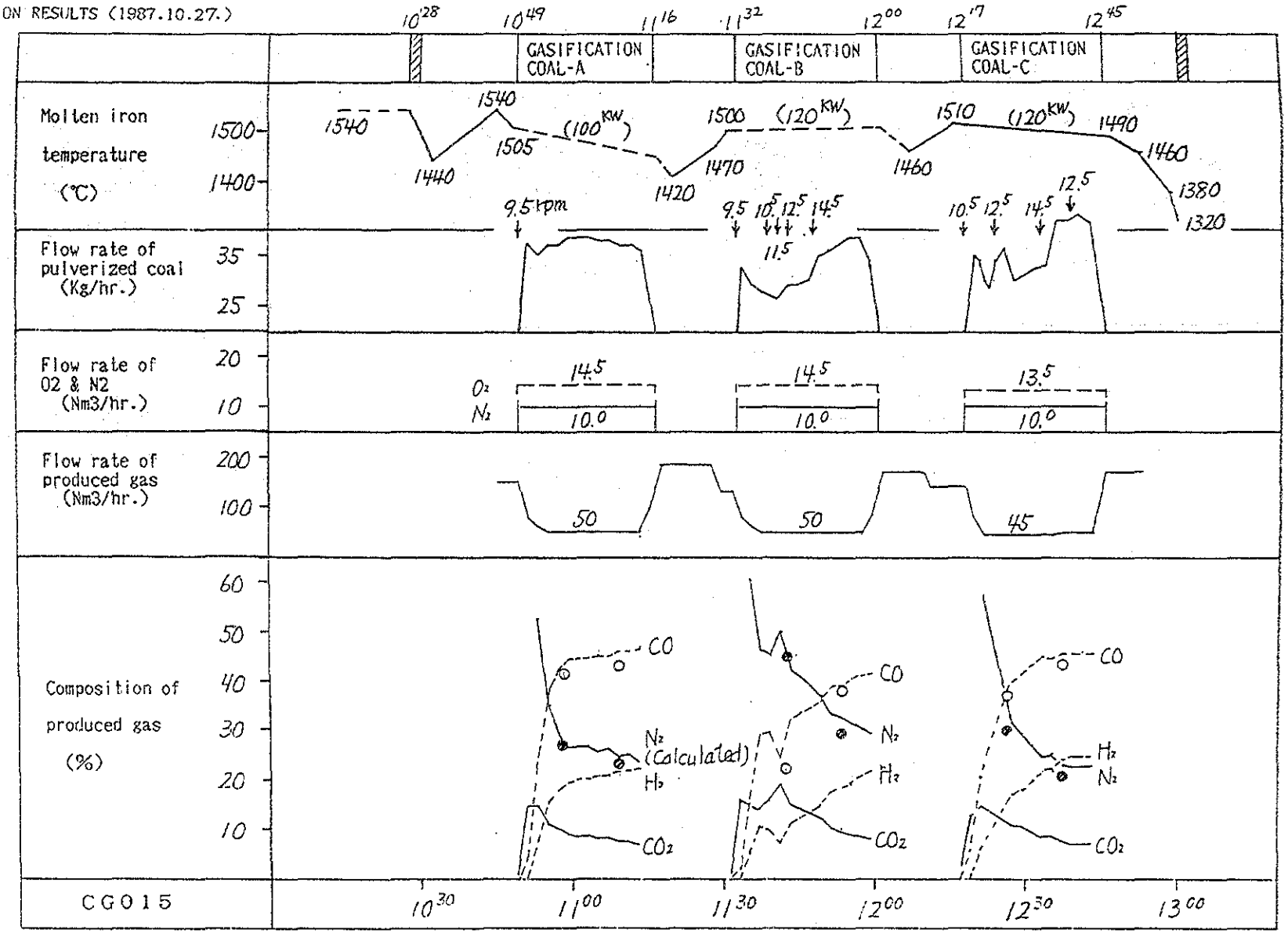
OPERATION RESULTS (1987.10.20.)



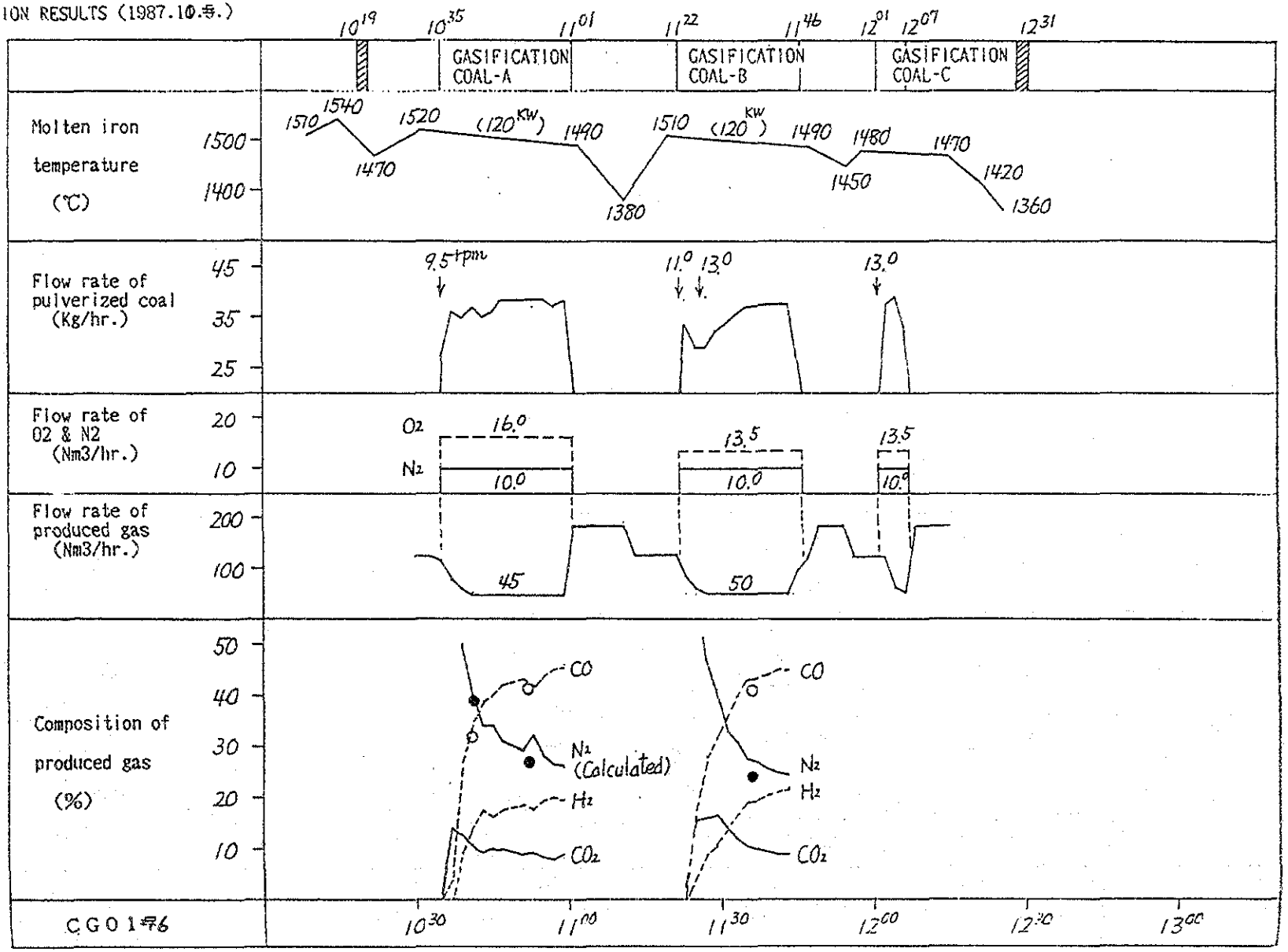
OPERATION RESULTS (1987.10.23 .)



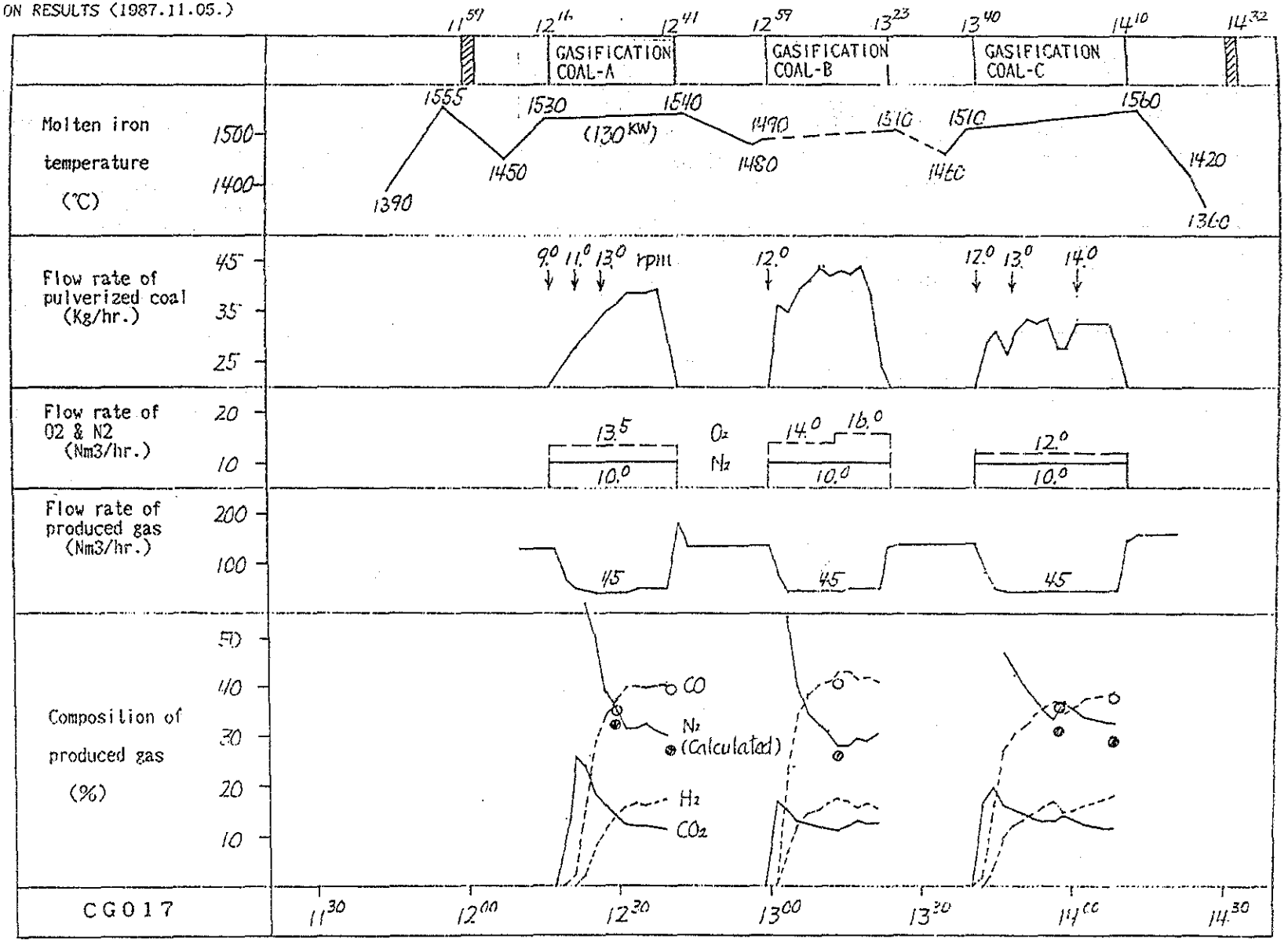
OPERATION RESULTS (1987.10.27.)



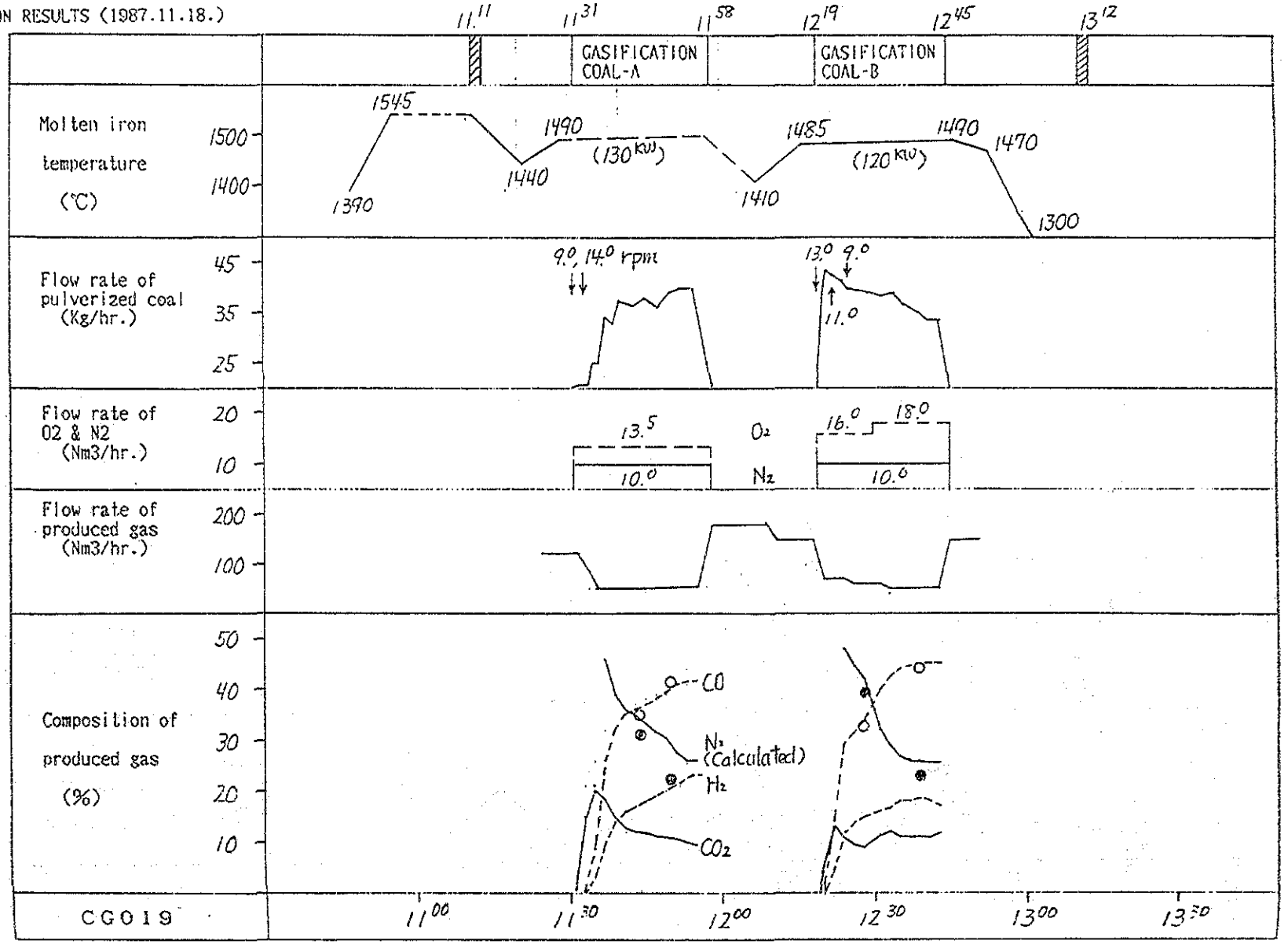
OPERATION RESULTS (1987.10.5.)



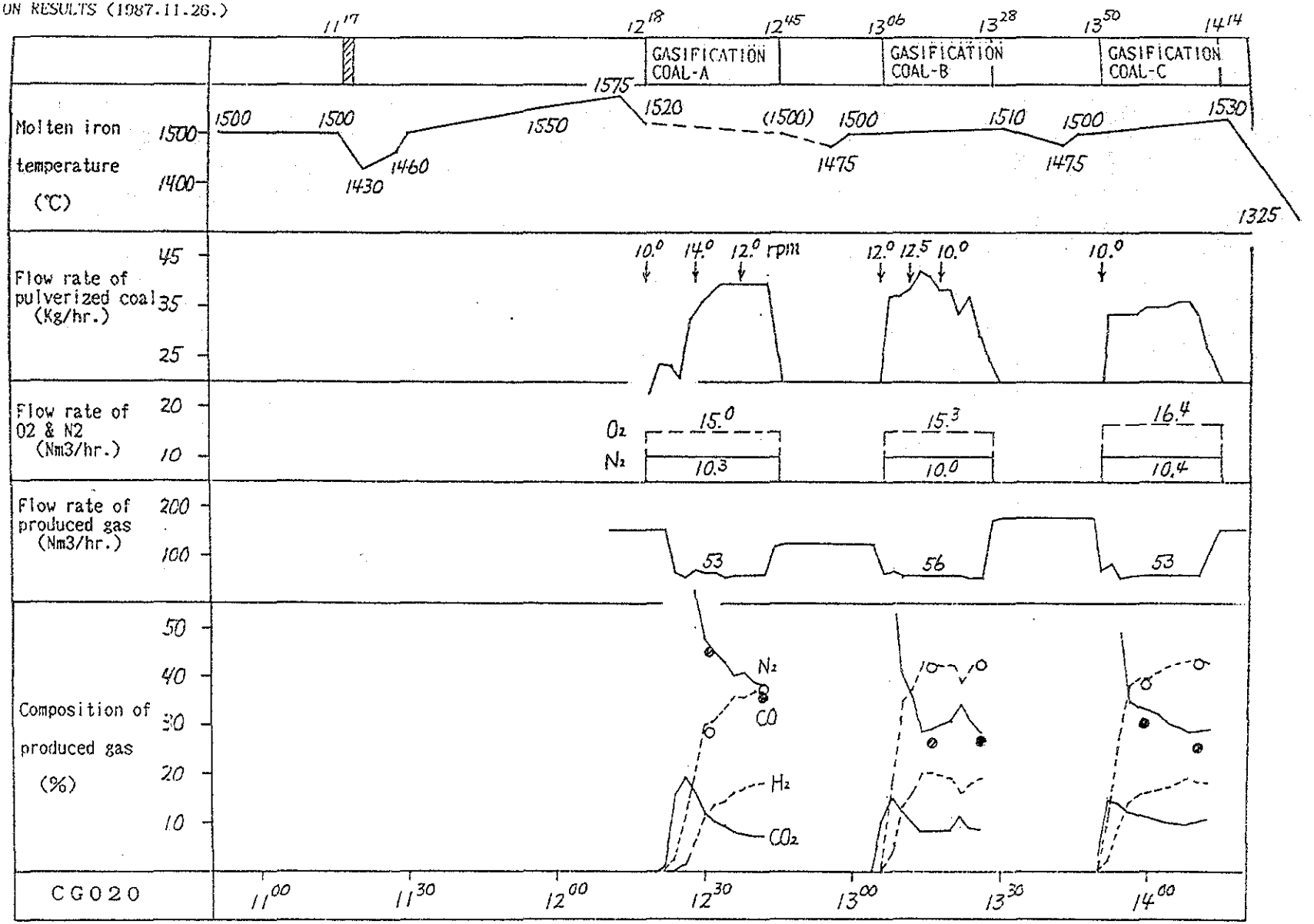
OPERATION RESULTS (1987.11.05.)



OPERATION RESULTS (1987.11.18.)



OPERATION RESULTS (1987.11.26.)

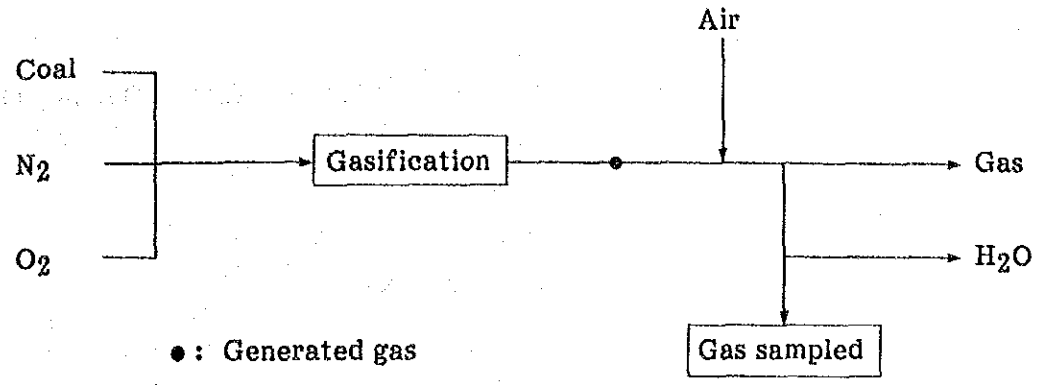


ATTACHMENT 8-4

		Page
1.	Material Balance Based on Gas Sampled from Inside of Gasifier	179
2.	Material Balance Based on Gas Sampled from Position just before IDF	183

1. Material Balance Based on Gas Sampled from Inside of Gasifier

1. Material Flow



As shown in material flow, coal, N_2 and O_2 become generated gas by gasification. We want to know an information of generated gas, however air from the atmosphere mixes and reacts with generated gas before we get gas sample.
Furthermore we analyzed gas component as dry.
Therefore we should estimate real gas component by material balance calculation.

2. Assumption

1 Oxygen in the air from the atmosphere reacts with CO and H_2 in the generated gas, generating CO_2 and H_2O.

2 If summation of each content of gas components such as CO, CO_2, H_2, H_2O, N_2 and so on would not be 100%, N_2 content would be modified to make the summation 100%.

3. Calculation Method

By making material balance for H_2, O_2 and N_2 around gasifier we can know the following unknown values.

Unknown values:
1) gas components in generated gas (CO, CO_2, H_2, O_2, N_2, H_2O, H_2S, COS)
2) amount of generated gas
3) amount of air from the atmosphere
4) H_2O content in sampled gas

Known values:
1) property of coal (ash, moisture, C, H, O, N, S)
2) operation conditions (coal feed rate, carrier gas flow rate, oxygen flow rate)
3) gas components in sampled gas (CO, CO_2, H_2, O_2, N_2, H_2S, COS)

(1) Hydrogen balance

$$HSUI + HGEN = HGAS + HJO$$

$$HSUI = \frac{22.4}{18} \times CFR \times Moi/100$$

$$HGEN = \frac{22.4}{2} \times CFR \times (100 - Ash - Moi)/100 \times H/100$$

$$HGAS = (Y + 0.79Z - X) \times (H_2GS + H_2SGS)/100$$

$$HJO = X$$

(2) Nitrogen balance

$$NGEN + 0.79Z + CGFR = NGAS$$

$$NGEN = \frac{22.4}{28} \times CFR \times (100 - Ash - Moi)/100 \times N/100$$

$$NGAS = (Y + 0.79Z - X) \times N2GSD/100$$

(3) Oxygen balance

$$OSUI + OGEN + OFR + 0.21Z = OGAS + OJO$$

$$OSUI = \frac{11.2}{18} \times CFR \times Moi/100$$

$$OGEN = \frac{22.4}{32} \times CFR \times (100 - Ash - Moi)/100 \times O/100$$

$$OGAS = (Y + 0.79Z - X) \times (COGS/2 + CO2GS + O2GS + COSGS/2)/100$$

$$OJO = X/2$$

(4) Gas compositions in generated gas

CO : $Y\times CO/100 - 0.21Z\times\eta co\times 2 = (Y + 0.79Z - X)\times COGS/100$

CO_2 : $Y\times CO_2/100 + 0.21Z\times\eta co\times 2 = (Y + 0.79Z - X)\times CO_2GS/100$

H_2 : $Y\times H_2/100 - 0.21Z\times(1 - \eta co)\times 2 = (Y + 0.79Z - X)\times H_2GS/100$

O_2 : $Y\times O_2/100 = (Y + 0.79Z - X)\times O2GS/100$

N_2 : $Y\times N_2/100 + 0.79Z = (Y + 0.79Z - X)\times N_2GS/100$

H_2S : $Y\times H_2S/100 = (Y + 0.79Z - X)\times H_2SGS/100$

COS : $Y\times COS/100 = (Y + 0.79Z - X)\times COSGS/100$

H_2O : $Y\times H_2O/100 + 0.21Z\times(1-\eta co)\times 2 = X$

Assumption: ηco is given under the following assumption

$$K = \frac{CO\times H_2O}{CO_2\times H_2} = \frac{COGS\times X}{CO_2GS\times(Y+0.79Z-X)\times H_2GS/100}$$

X, Y and Z can be calculated by three simultaneous equations of (1), (2) and (3).

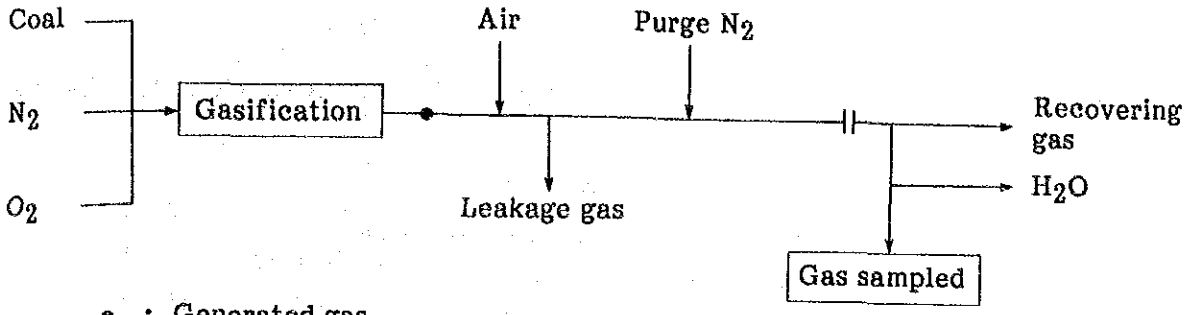
Therefore gas composition in generated gas can be also calculated by the upper equation (4).

Ash	Ash in coal (%)
Moi	Moisture in coal (%)
C	Carbon in coal (%) (d.a.f.)
H	Hydrogen in coal (%) (d.a.f.)
O	Oxygen in coal (%) (d.a.f.)
N	Nitrogen in coal (%) (d.a.f.)
S	Sulfur in coal (%) (d.a.f.)
CFR	Coal feed rate (kg/h)
CGFR	Carrier gas flow rate (Nm^3/h)
OFR	Oxygen flow rate (Nm^3/h)
COGS	CO content in sampled gas (%)
CO_2GS	CO_2 content in sampled gas (%)
H_2GS	H_2 content in sampled gas (%)
O_2GS	O_2 content in sampled gas (%)
N_2GS	N_2 content in sampled gas (%)
H_2SGS	H_2S content in sampled gas (%)
COSGS	COS content in sampled gas (%)

CO	CO content in generated gas (%)
CO_2	CO_2 content in generated gas (%)
H_2	H_2 content in generated gas (%)
O_2	O_2 content in generated gas (%)
N_2	N_2 content in generated gas (%)
H_2S	H_2S content in generated gas (%)
COS	COS content in generated gas (%)
H_2O	H_2O content in generated gas (%)
Y	Amount of generated gas (Nm^3/h)
Z	Amount of air (Nm^3/h)
X	Amount of H_2O in sampled gas (Nm^3/h)
AA	Summation of gas components in sampled gas (%)
N_2GSD	N_2 content in sampled gas after modification ($N_2GSD = N_2GS + 100 - AA$)
Y_2	Amount of leakage gas (Nm^3/h)
N_2P	Amount of purge N_2 (Nm^3/h)
HSUI	Hydrogen amount in moisture in coal (Nm^3/h)
HGEN	Hydrogen amount in coal (Nm^3/h)
HGAS	Hydrogen amount in sampled gas (Nm^3/h)
HJO	Hydrogen amount in H_2O in sampled gas (Nm^3/h)
NGEN	Nitrogen amount in coal (Nm^3/h)
NGAS	Nitrogen amount in sampled gas (Nm^3/h)
OSUI	Oxygen amount in moisture in coal (Nm^3/h)
OGEN	Oxygen amount in coal (Nm^3/h)
OGAS	Oxygen amount in sampled gas (Nm^3/h)
OJO	Oxygen amount in H_2O in sampled gas (Nm^3/h)
ηco	Utilization ratio of oxygen in air to burn CO
FI	Recovering gas flow rate (m^3/h)
ρo	Design value of density of recovering gas (kg/m^3)
ρ	Actual density of recovering gas (kg/m^3)
To	Design value of temperature of recovering gas (^oC)
T	Actual temperature of recovering gas (^oC)
PPI	Pressure difference in bag filter (mmH_2O)
Po	Design value of pressure of recovering gas (mmH_2O)

2. Material Balance Based on Gas Sampled from Position just before IDF

1. Material Flow



• : Generated gas

|| : Gas flow meter

As shown in material flow, coal, N_2 and O_2 become generated gas by gasification. After that, air from the atmosphere mixes and reacts with generated gas and then a part of gas leaks from the space between hood and gasifier. Furthermore purge N_2 comes in from main lance hole and bag filter. After taking these change, gas passes through gas flow meter and is sampled at the position just before IDF in gas recovering duct.

In this material flow, we would know about an information of real generated gas.

2. Assumption

(1) Oxygen in the air from the atmosphere reacts with CO and H_2 in the generated gas, generating CO_2 and H_2O.

(2) If summation of each content of gas components such as CO, CO_2, H_2, H_2O, N_2 and so on would not be 100%, N_2 content would be modified to make the summation 100%.

3. Calculation Method

By making material balance for H_2, O_2 and N_2 around gasifier we can know the following unknown values.

Unknown values:
1) gas components in generated gas (CO, CO_2, H_2, O_2, N_2, H_2O, H_2S, COS)
2) amount of generated gas
3) amount of air from the atmosphere
4) amount of leakage gas
5) H_2O content in sampled gas

Known values:
1) property of coal (ash, moisture, C, H, O, N, S)
2) operation conditions (coal feed rate, carrier gas flow rate, oxygen flow rate, recovering gas flow rate)
3) gas components in sampled gas (CO, CO_2, H_2, O_2, N_2, H_2S, COS)

		Generated gas	After gasifier	Gas flow meter	Gas sampled
Gas amount	(Nm^3/h)	Y	Y+0.79Z	Y+0.79Z-Y_2+N_2P	/
CO	(%)	CO	COI	COII	COGS
CO_2	(%)	CO_2	CO_2I	CO_2II	CO_2GS
H_2	(%)	H_2	H_2I	H_2II	H_2GS
H_2O	(%)	H_2O	H_2OI	H_2OII	/
O_2	(%)	O_2	O_2I	O_2II	O_2GS
N_2	(%)	N_2	N_2I	N_2II	N_2GS
H_2S	(%)	N_2S	H_2SI	H_2SII	H_2SGS
COS	(%)	COS	COSI	COSII	COSGS

↑ Air Z Nm^3/h ↓ Leakage Y_2 Nm^3/h ↑ Purge N_2 N_2P Nm^3/h

(1) Hydrogen balance

$$HSUI + HGEN = Y\times(H_2 + H_2O + H_2S)/100$$
$$= (Y + 0.79Z)\times(H_2I + H_2OI + H_2SI)/100$$
$$= Y_2\times(H_2I + H_2OI + H_2SI)/100$$
$$+ (Y + 0.79Z - Y_2 + N_2P)\times(H_2II + H_2OII + H_2SII)/100$$

H_2 : $Y\times H_2/100 - Z\times 0.21\times 2\times(1 - \eta co) = (Y + 0.79Z)\times H_2GS\times A\times B/100$

H_2O : $Y\times H_2O/100 + Z\times 0.21\times 2\times(1 - \eta co) = (Y + 0.79Z)\times H_2OII\times B/100$

H_2S : $Y\times H_2S/100 = (Y + 0.79Z)\times H_2SGS\times A\times B/100$

$$Y\times(H_2 + H_2O + H_2S)/100 = (Y + 0.79Z)\times B\times(H_2OII + A\times(H_2GS + H_2SGS))/100 \quad \cdots\cdots (1)$$

$$Y + 0.79Z - Y_2 + N_2P = FI\times D$$

$$D = SQRT\ (\frac{\rho o}{\rho})\times(\frac{To+273}{T+273})\times(\frac{10^4-PDI}{Po})$$

$$A = (100 - H_2OII)/100$$

$$B = (Y + 0.79Z - Y_2 + N_2P)/(Y + 0.79Z - Y_2)$$

(2) Oxygen balance

$$OSUI + OGEN + OFR = Y\times(CO/2 + CO_2 + H_2O/2 + O_2 + COS/2)/100$$
$$OSUI + OGEN + OFR + 0.21Z = (Y + 0.79Z)\times(COI/2 + CO_2I + H_2OI/2$$
$$+ O_2I + COSI/2)$$
$$= Y_2\times(COI/2 + CO_2I + H_2OI/2 + O_2I + COSI/2,$$
$$+ (Y + 0.79Z - Y_2 + N_2P)\times(COII/2 + CO_2II$$
$$+ H_2OII/2 + O_2II + COSII/2)/100$$

CO : $COI = COGS\times A\times B$

CO_2 : $CO_2I = CO_2GS\times A\times B$

H_2O : $H_2OI = H_2OII\times B$

O_2 : $O_2I = O_2GS\times A\times B$

COS : $COSI = COSGS\times A\times B$

$\times$ $OSUI + OGEN + OFR + 0.21Z = (Y + 0.79Z)\times B\times(A\times(COS/2 + CO_2GS$
$+ O_2GS + COSGS/2) + H_2OII/2)/100$

$\cdots\cdots$ (2)

(3) Nitrogen balance

$$NGEN + CGFR = Y \times N_2/100$$

$$NGEN + CGFR + 0.79Z = (Y + 0.79Z) \times N_2I/100$$

$$NGEN + CGFR + 0.79Z - Y_2 \times N_2I/100 + N_2P = (Y + 0.79Z - Y_2 + N_2P) \times N_2II/100$$

$$(Y + 0.79Z - Y_2) \times N_2I/100 = (Y + 0.79Z - Y_2 + N_2P) \times N_2II/100 - N_2P$$

$$N_2II = N_2GS \times A$$

$$NGEN + CGFR + 0.79Z = (Y + 0.79Z) \times B \times (A \times N_2GS/100 - N_2P/(Y + 0.79Z - Y_2 + N_2P)) \quad \ldots\ldots (3)$$

From equation (1) and (2), Y and Z can be calculated, if H_2OII could be assumed a certain value.

After that we check whether both sides in equation (3) are equal or not, if they are OK, we can have all components in generated gas.

Ash	Ash in coal (%)
Moi	Moisture in coal (%)
C	Carbon in coal (%) (d.a.f.)
H	Hydrogen in coal (%) (d.a.f.)
O	Oxygen in coal (%) (d.a.f.)
N	Nitrogen in coal (%) (d.a.f.)
S	Sulfur in coal (%) (d.a.f.)
CFR	Coal feed rate (kg/h)
CGFR	Carrier gas flow rate (Nm^3/h)
OFR	Oxygen flow rate (Nm^3/h)
COGS	CO content in sampled gaas (%)
CO_2GS	CO_2 content in sampled gas (%)
H_2GS	H_2 content in sampled gas (%)
O_2GS	O_2 content in sampled gas (%)
N_2GS	N_2 content in sampled gas (%)
H_2SGS	H_2S content in sampled gas (%)
COSGS	COS content in sampled gas (%)
CO	CO content in generated gas (%)

CO_2	CO_2 content in generated gas (%)
H_2	H_2 content in generated gas (%)
O_2	O_2 content in generated gas (%)
N_2	N_2 content in generated gas (%)
H_2S	H_2S content in generated gas (%)
COS	COS content in generated gas (%)
H_2O	H_2O content in generated gas (%)
Y	Amount of generated gas (Nm^3/h)
Z	Amount of air (Nm^3/h)
X	Amount of H_2O in sampled gas (Nm^3/h)
AA	Summation of gas components in sampled gas (%)
N_2GSD	N_2 content in sampled gas after modification ($N_2GSD = N_2GS + 100 - AA$)
Y_2	Amount of leakage gas (Nm^3/h)
N_2P	Amount of purge N_2 (Nm^3/h)
HSUI	Hydrogen amount in moisture in coal (Nm^3/h)
HGEN	Hydrogen amount in coal (Nm^3/h)
HGAS	Hydrogen amount in sampled gas (Nm^3/h)
HJO	Hydrogen amount in H_2O in sampled gas (Nm^3/h)
NGEN	Nitrogen amount in coal (Nm^3/h)
NGAS	Nitrogen amount in sampled gas (Nm^3/h)
OSUI	Oxygen amount in moisture in coal (Nm^3/h)
OGEN	Oxygen amount in coal (Nm^3/h)
OGAS	Oxygen amount in sampled gas (Nm^3/h)
OJO	Oxygen amount in H_2O in sampled gas (Nm^3/h)
ηco	Utilization ratio of oxygen in air to burn CO
FI	Recovering gas flow rate (Nm^3/h)
ρo	Design value of density of recovering gas (kg/m^3)
ρ	Actual density of recovering gas (kg/m^3)
To	Design value of temperature of recovering gas (^oC)
T	Actual temperature of recovering gas (^oC)
PPI	Pressure difference in bag filter (mmH_2O)
Po	Design value of pressure of recovering gas (mmH_2O)

ATTACHMENT 11-3

1. Electricity Generation Cost by Coal Firing Power Plant with Fluidized-bed Boiler

2. Computer Printout (Electricity Generation Cost, Case E-9)

1. Electricity Generation Cost by Coal Firing Power Plant with Fluidized-bed Boiler

Electricity Generation Cost by Coal Firing Power Plant with Fluidized-bed Boiler

1. Objective of the Study

This study has been carried out for the purpose of preliminary evaluation of economic feasibility on the case of electricity generation from Banko coal by using the fluidized-bed boiler in order to compare with the economic evaluation of coal gasification combined-cycle (CGCC) power generation studied in FY1986.

As a matter of convenience between this plant and CGCC power plant in FY1986, the same gross generating capacity (900 MW) was selected in this study.

Assumption of economic factors such as electricity generation schedule, finance, sales price and raw material cost is same as those in the study in FY1986.

2. Outline of Power Plant

2-1 Design Basis

(1)	Type of Power Plant	:	Thermal Power Plant with Fluidized-bed Boiler
(2)	Generating Power		
	Gross Generating Power	:	900 MW
	Net Generating Power	:	818 MW
	(For Home Consumption	:	82 MW)
(3)	Annual Operation Days	:	320 days/year
(4)	Plant Location	:	Tanjung Priok
(5)	Electricity Transmission	:	Switchyard of Power Plant

(Note): Electricity will be sold to PLN.

(6) Feed Coal Specification :

C, %	:	27.4
V.M., %	:	32.8
Ash, %	:	4.8
Mo., %	:	35.0
Total, %	:	100.0
HV, Kcal/kg	:	4,430

(7) Coal Receiving : Bunker Hopper at Mine Site

(8) Utilities

All the utilities except raw water and coal are generated inside the plant.
Drying of coal is carried out by utilizing the heat of boiler flue gas.
Cooling water for main condenser is supplied at 30°C and returned at 37°C.

2-2 Plant Configuration

Fig. 1 shows the scope of power plant devided into five blockes each of which has its individual function.

The component facilities in each block are listed in Table 1. The main processes and systems are described in the following pages.

2-3 Belt Conveyor System

See the Interim Report II (FY 1985), page 192-197.

2-4 Electricity Generation

(1) Process Flow Diagram

See Fig. 2.

(2) Process Description (Fig. 2 & Fig. 3)

1) The plant comprises three trains. Each train consists of 300 MW single reheat steam turbine generator set and 3 units of fluidized bed boiler.

2) The fluidized bed boiler is especially suitable for burning the difficult-burn coal such as lignite with water high content and anthracite.

3) The feedwater is heated by 3 units of LP feedwater heaters, deaerator, and 4 units of HP feedwater heaters. The steam for heating of each feedwater is extracted from the respective steam turbine bleeding point.

(3) Major Equipment

Specifications and the number of units of major equipment are listed in Table 2.

2-5 Utility Requirement

See Table 3 and Fig. 4.

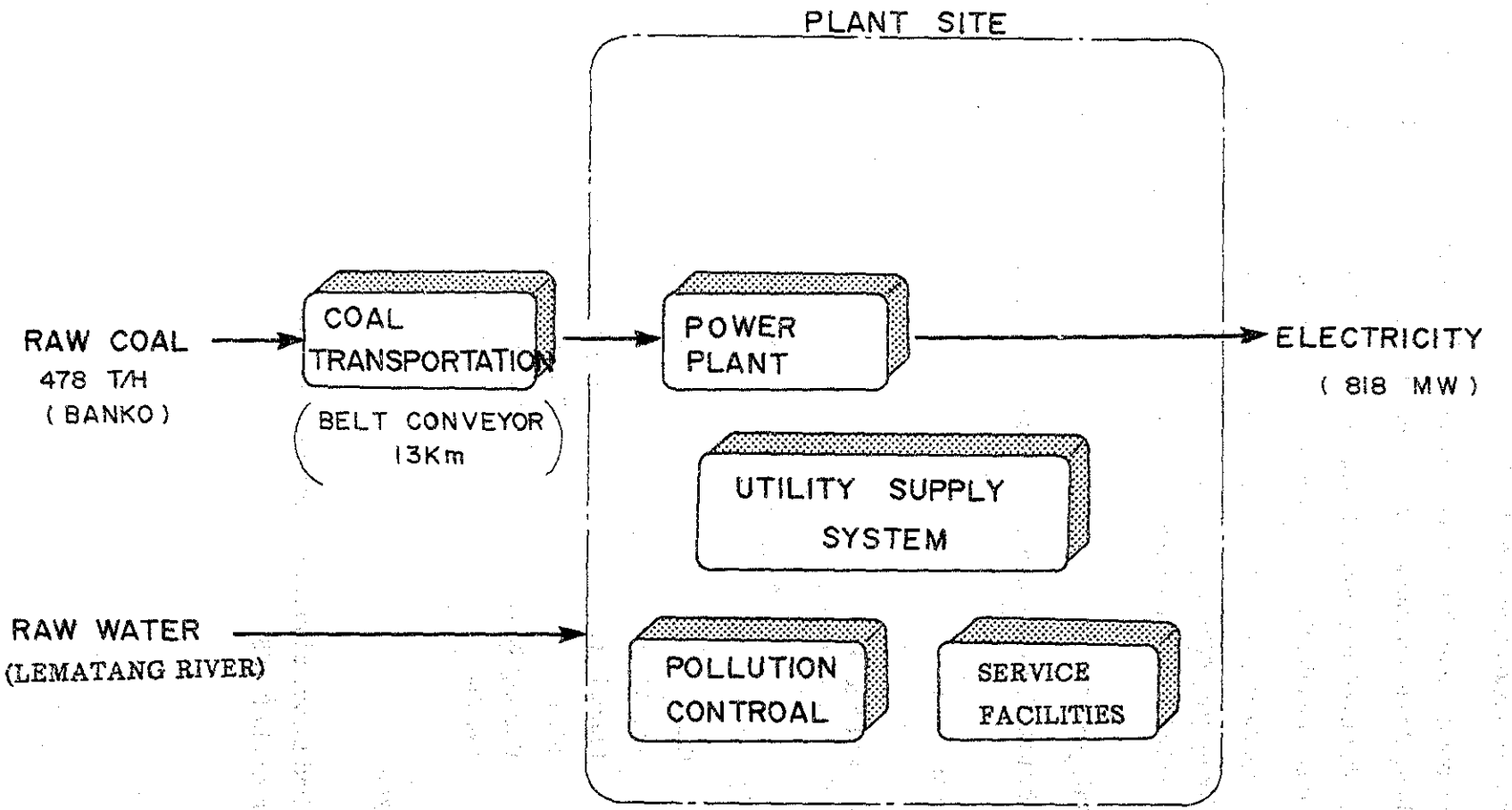
Table 3 Utility Requirement

Coal	478 T/h (external supply)
Raw Water	1,680 T/h (ditto)
Electricity	818,000 kW (outside supply)
ditto	82,000 kW (internal supply)
Cooling Water	155,000 T/h (ditto)
$CaCO_3$	15 T/h

2-6 Plant Layout

The detailed layout cannot be determined in this stage but the image of it is roughly estimated as shown in Fig. 5.

Fig. 1 Overall Block Flow Diagram



* Component facilities consisting each block are listed in Table 1.

Table 1 Plant Configuration

1) Belt Conveyor System

- Primary Crusher/Feeder
- Overland Coal Conveyor

2) Coal and Limestone Handling

- Coal Storage and Handling
- Coal Pretreatment
- Limestone Storage and Handling

3) Power Plant & Utility System

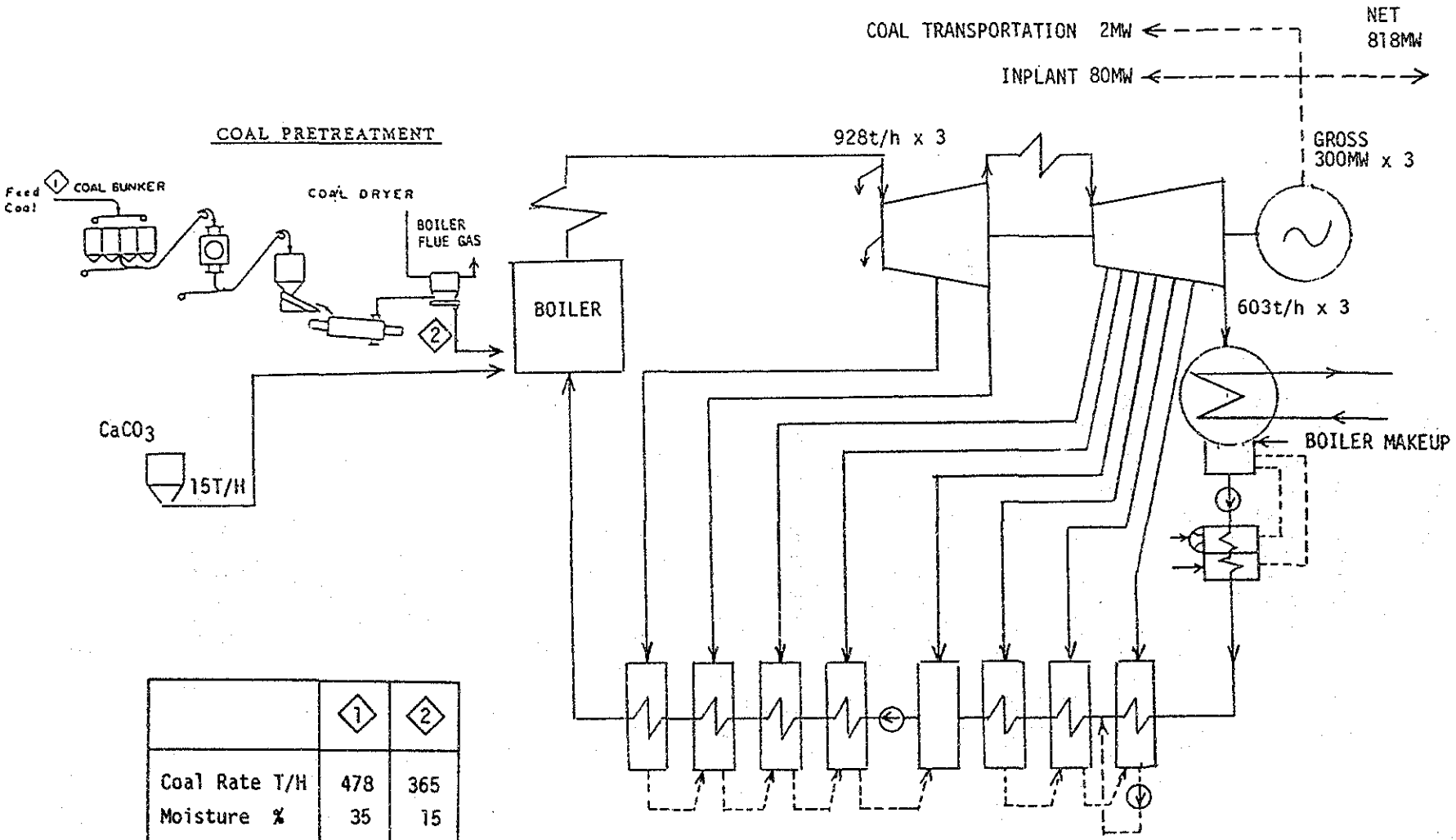
- Gas Turbine/Generator
- Steam Turbine/Generator
- Coal Fired Fluidized Bed Boiler
- Power Distribution
- Water Cooling
- Raw Water Intake/Pretreatment
- Instrument/Plant Air Supply

4) Pollution Control/Safety System

- Waste Water Treatment
- Solid Waste Disposal
- Flare/Blowdown
- Fire Fighting

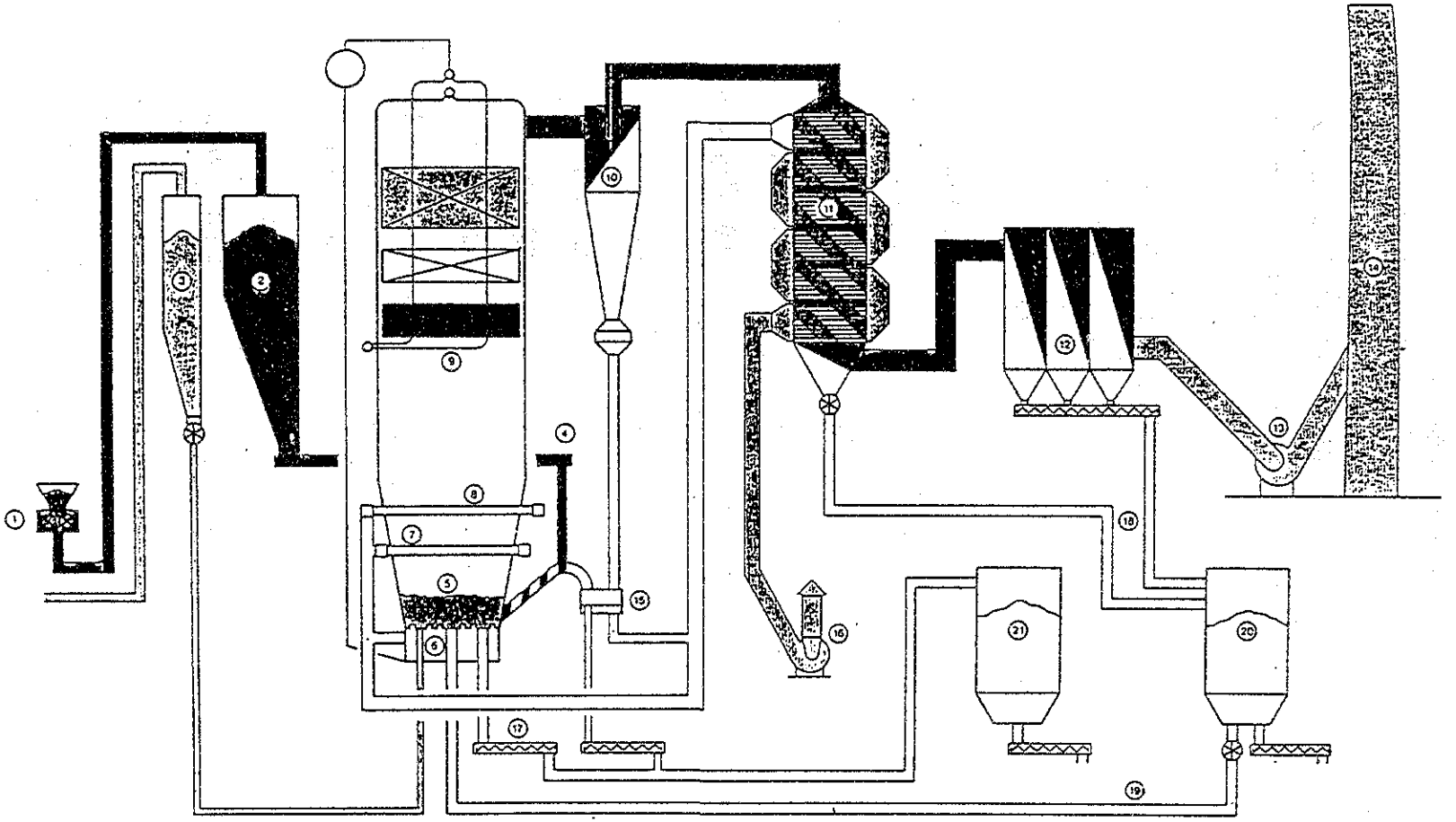
5) Service Facilities

- Administration Office
- Laboratory
- Warehouse
- Accommodation
- Canteen
- Cafeteria
- Leisure Center
- Mosque
- Communication System
- Maintenance Shop
- Portable Water Supply



	①	②
Coal Rate T/H	478	365
Moisture %	35	15
Size mm	<40	<10

Fig. 2 Power Plant Flow Diagram



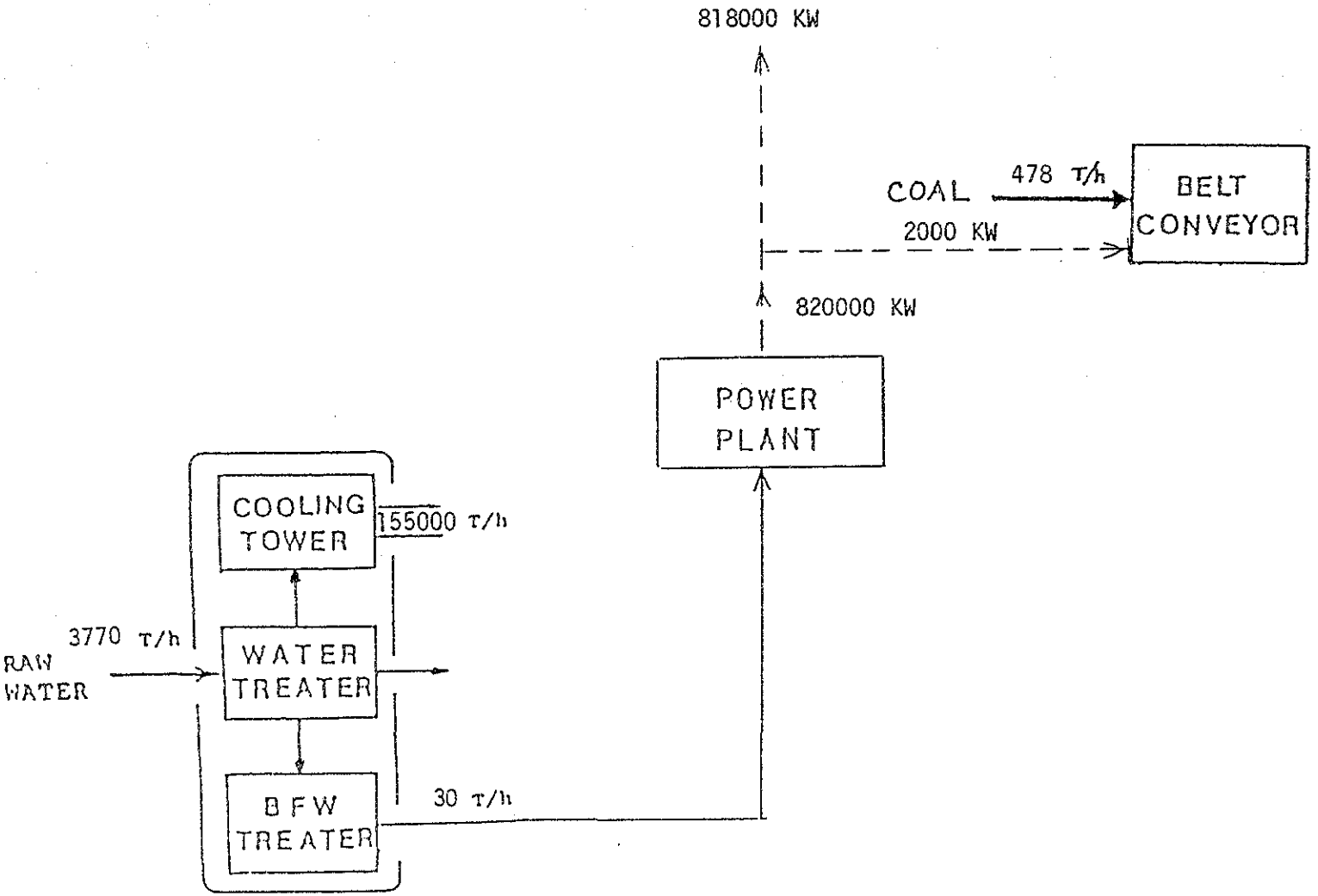
1 Coal Crusher
2 Coal Bunker
3 Limestone Bunker
4 Coal Feed
5 Fluidized Bed
6 Primary Air
7 Secondary Air
8 Tertiary Air
9 Steam Generator
10 Cyclone
11 Air Preheater
12 Bag Filter
13 IDF
14 Stack
15 Ash Siphon
16 FDF
17 Bed Ash
18 Fly Ash
19 Fly Ash Recycle
20 Fly Ash Silo
21 Bed Ash Silo

Fig. 3 Scheme of Fluidized Bed Boiler

Table 2 Major Equipment

Description	Q'ty	Capacity
1. Coal Handling Section		
1.1 Primary Crusher	3	200 t/h
1.2 Dewatering Drum	3	160 t/h
2. Thermal Power Plant Section		
Fluidized bed boiler	9	310 t/h
Steam turbine/generator unit	3	300 MW
Steam condenser	3	603 t/h x 700 mmHgV
Vacuum pump	3	700 mmHgV
Condensate pump	9 (3 standby)	360 m^3/h x 200 m
Feedwater tank	3	10 m^3
HP feedwater heaters	12	928 t/h
Deaerators	3	928 t/h
LP feedwater heaters	9	702 t/h
Boiler feed pumps	9 (3 standby)	510 t/h x 198 at
Cooling tower	1	155,000 t/h
Demineralized water plant	3	35 t/h
Raw water pump	2 (1 standby)	1,900 t/h x 30m

Fig. 4 Utility Flow Diagram



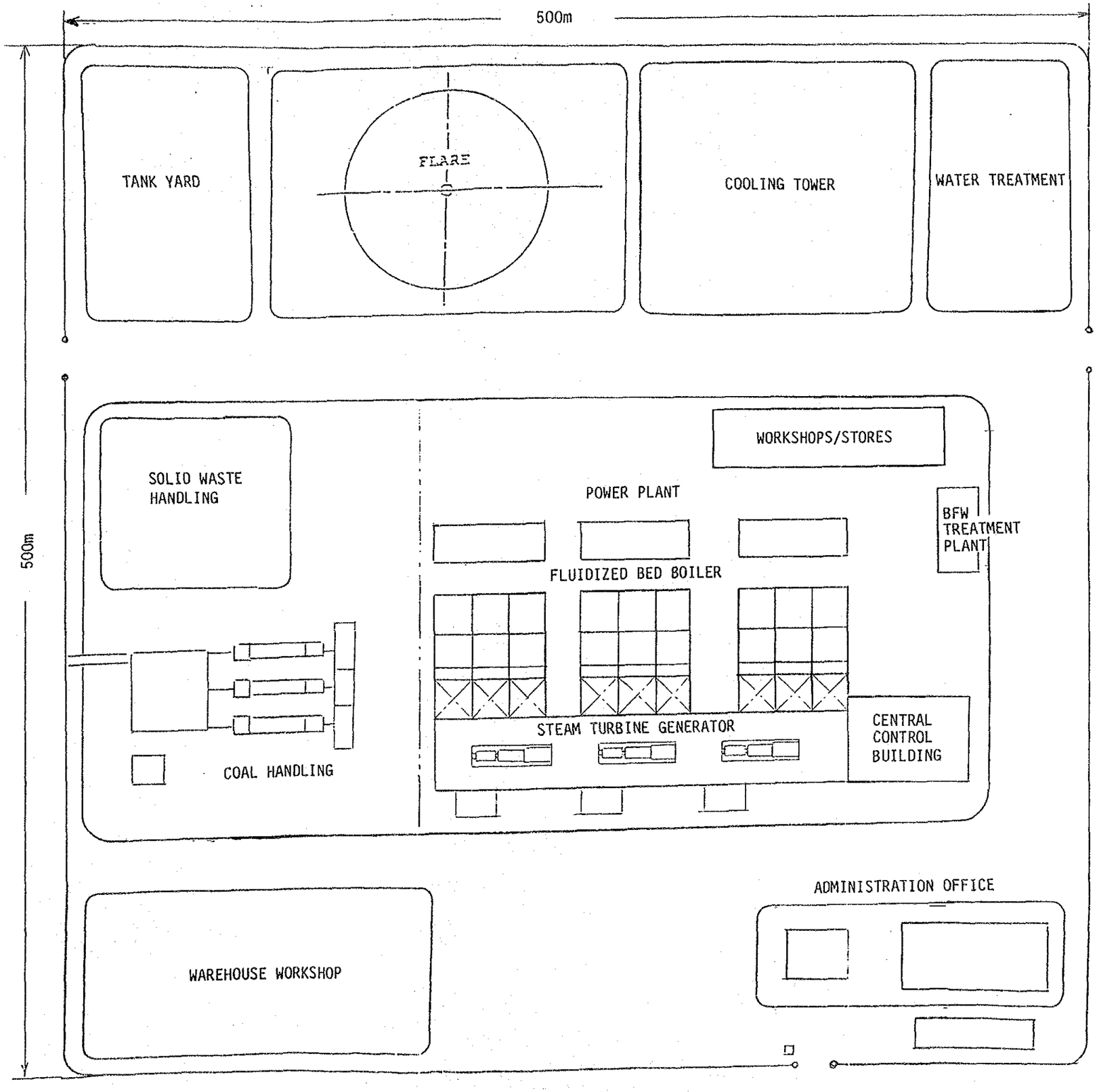


Fig. 5 Plant Layout

3. Financial Analysis

Financial viability and profitability of the project was evaluated by means of financial statements* and internal rate of return (hereafter referred to as IRR) on total project investment.

* Projected Profit & Loss Statement
Projected Cash Flow Statement
Projected Balance Sheet

3-1 Assumptions

(1) Electricity Generation Schedule

1) Net Generating Power : 818 MW

2) Average Load Factor : 66%
(Note): Same as with the case of CGCC in FY1986.

3) Plant Construction Period : 1990 - 1993 (4 years)
where 30% Completion at the end of 1990
60% Completion at the end of 1991
80% Completion at the end of 1992
100% Completion at the end of 1993

4) Project Life : 1994 - 2023 (30 years)
where 70% of full operation in 1994
85% of full operation in 1995
100% of full operation in 1996 and after

5) Annual Operation Days : 320 days

(2) Finance

Same as that in the economic evaluation on methanol production (FY1985) and on CGCC power generation (FY1986).
(For details, see the Interim Report II (FY 1985), page 214-215.)

(3) Escalation

No escalation is assumed.

(4) Price and Costs

1) Ex-Power Plant Price of Electricity

Supply to Jakarta:

Case E-7 : 43 Rp/KWH (7.76 ¥/KWH)
Case E-8 : 53 Rp/KWH (9.57 ¥/KWH)

Supply to Adjacent Area:

Case E-9 : 64 Rp/KWH (11.55 ¥/KWH)
Case E-10 : 78 Rp/KWH (14.08 ¥/KWH)

(Note): Price is same as that in the case of CGCC in FY 1986. For details, see the Interim Report III (FY 1986), page 161 - 166.

2) Capital Investment Costs

i) Fixed-capital Investment:

	10^6 Rupiah	(10^6 Yen)
Coal Transportation	39,900	(7,200)
Power Plant/Support Facilities	736,800	(133,000)
Equipment Transportation	74,200	(13,400)
Contingency	42,700	(7,700)
Total	893,600	(161,300)

ii) Working capital: 33,820 (6,105)

(Note): Working capital is added as cash-inflow at the end of the project.

iii) Start-up Expense: 4,160 (750)

iv) Operator Training Cost: 2,070 (374)

The investment schedule is shown in Table 4.

Table 4 Investment Schedule

	1990	1991	1992	1993
Fixed Capital	30%	30%	20%	20%
Working Capital	-	-	-	100%
Start-up Expense	-	-	-	100%
Operator Training	-	-	-	100%

3) Annual Expense

i) Fixed Costs

a) Depreciation and Amortization[1)*]

	Period	Amount	
	Year	10^6 Rupia/Year	(10^6 Yen/Year)
• Boiler, Power Plant, Cooling Tower, Buildings	15	49,269	(8,893)
• Others	10	29,086	(5,250)
b) Maintenance		20,388	(3,680)
c) Insurance		8,155	(1,472)
ii) Variable Costs			
a) Raw Material (Coal)[2)*]		39,867	(7,196)
b) Superviser & Operating Labor			
• Foreign Staff[3)*]			
• Local Labor		2,166	(391)
c) Chemicals		1,224	(221)
iii) Plant Overhead Costs		8,748	(1,579)
iv) Administration Expenses		4,377	(790)

(Note): 1) Capital investment for the plant construction including expenses and interests during construction period is depreciated and a amortized based on straight line method.

2) In the strategic study in FY1984, mining cost was estimated at $13.88/ton-coal. In this study $14.85/ton-coal is assumed as raw material costs by adding 7% to the mining cost as overhead.

3) Foreign staff decrease in number as the project proceeds. (See Table 5)

Table 5 Costs for Foreign Staffs

Op. Year	1st	2nd	3rd	4th	5th	6th-30th
Year	1994	1995	1996	1997	1998	1999-2023
% on 1st year	100	70	50	30	10	0
Cost, 10^6 Rupiah/year	6,582	4,607	3,291	1,975	658	0
(Cost, 10^6 Yen/year)	(1,188)	(832)	(594)	(356)	(119)	(0)

(5) Evaluation Criteria

1) Financial Statement

i) Profit and Loss Statement

ii) Cash Flow Statement

iii) Balance Sheet

2) IRR on Total Project Cost before Tax
(For details, see the Interim Report II (FY 1985), page 218 - 219.)

3-2 Results and Evaluation

(1) Results

Results are summerized in Table 6.

Profit and loss statement and cash flow statement of Case E-9 which correspond to those of Case E-4 studied in FY1986 are shown in Table 7 and Table 8.

Table 6 Results of Financial Analysis

Case	Supply to Jakarta		Supply to Adjacent Area	
	E-7	E-8	E-9	E-10
Ex-plant Price of Electricity	43 Rp/kwH (7.76 ¥/kwH)	53 Rp/kwH (9.57 ¥/kwH)	64 Rp/kwH (11.55 ¥/kwH)	78 Rp/kwH (14.08 ¥/kwH)
IRR on total Investment	7.4 %	10.8 %	14.0 %	17.5 %
First Year to Have Profit before Tax (Year from Operation Starts)	11th	4th	2nd	1st
Clean off of Accumulated Loss (Year from Operation Starts)	24th	9th	3rd	1st
Pay off of All the Debts (Year from Loan Raised)	23th	14th	12th	12th
Minimum Sales Price (IRR = Interest Rate)	44.7 Rp/kwH (8.08 ¥/kwH)			

Table 7 Profit and Loss Statement of Case E-9

(Unit: 10^9 Rupiah)

Year	OP Year	Revenue	Expenditure					Profit			Retained Earning
			Variable Cost	Fixed Cost	General	Interest Paid	Total	Before Tax	(Tax)	Net Profit	
1994	1	185.7	37.5	106.9	13.1	62.0	219.6	-33.8	0	-33.8	-33.8
1995	2	225.5	41.7	106.9	13.1	56.8	218.6	7.0	0	7.0	-26.9
1996	3	265.3	46.5	106.9	13.1	48.7	215.3	50.0	10.7	39.4	12.5
1997	4	265.3	45.2	106.9	13.1	39.6	204.8	60.5	27.8	32.7	45.2
1998	5	265.3	43.9	106.9	13.1	30.5	194.4	70.9	32.6	38.3	83.5
1999	6	265.3	43.3	106.9	13.1	20.9	184.2	81.1	37.3	43.8	127.3
2000	7	265.3	43.3	106.9	13.1	12.0	175.3	90.1	41.4	48.6	175.9
2001	8	265.3	43.3	106.9	13.1	4.0	167.3	98.1	45.1	53.0	228.9
2002	9	265.3	43.3	106.9	13.1	0	163.3	102.1	47.0	55.1	284.0
2003	10	265.3	43.3	106.9	13.1	0	163.3	102.1	47.0	55.1	339.1
2004	11	265.3	43.3	77.8	13.1	0	134.2	131.1	60.3	70.8	409.9
2005	12	265.3	43.3	77.8	13.1	0	134.2	131.1	60.3	70.8	480.8
2006	13	265.3	43.3	77.8	13.1	0	134.2	131.1	60.3	70.8	551.6
2007	14	265.3	43.3	77.8	13.1	0	134.2	131.1	60.3	70.8	622.4
2008	15	265.3	43.3	77.8	13.1	0	134.2	131.1	60.3	70.8	693.2
2009	16	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	790.7
2010	17	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	888.1
2011	18	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	985.5
2012	19	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,082.9
2013	20	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,180.4
2014	21	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,277.8
2015	22	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,375.2
2016	23	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,472.7
2017	24	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,570.1
2018	25	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,667.5
2019	26	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,764.9
2020	27	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,862.4
2021	28	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	1,959.8
2022	29	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	2,057.2
2023	30	265.3	43.3	28.5	13.1	0	84.9	180.4	83.0	97.4	2,154.6
	Total	7,840.9	1,296.4	1,886.2	393.7	274.6	3,850.8	3,990.1	1,835.5	2,154.6	

Table 8 Cash Flow Statement of Case E-9

(Unit: 10^9 Rupiah)

Year	OP Year	Investment	Profit Before Tax	Depreciation/ Amortization	Interest Paid	Cash Flow	DCF (Base; 1985)
1990		-268.1	-	-	-	-268.1	-139.4
1991		-268.1	-	-	-	-268.1	-122.3
1992		-178.7	-	-	-	-178.7	-71.5
1993		-218.8	-	-	-	-218.8	-76.8
1994	1	-	-33.8	78.4	62.0	106.6	32.8
1995	2	-	7.0	78.4	56.8	142.2	38.4
1996	3	-	50.0	78.4	48.7	177.1	42.0
1997	4	-	60.5	78.4	39.6	178.4	37.1
1998	5	-	70.9	78.4	30.5	179.8	32.8
1999	6	-	81.1	78.4	20.9	180.4	28.9
2000	7	-	90.1	78.4	12.0	180.4	25.3
2001	8	-	98.1	78.4	4.0	180.4	22.2
2002	9	-	102.1	78.4	0	180.4	19.5
2003	10	-	102.1	78.4	0	180.4	17.1
2004	11	-	131.1	49.3	0	180.4	15.0
2005	12	-	131.1	49.3	0	180.4	13.2
2006	13	-	131.1	49.3	0	180.4	11.6
2007	14	-	131.1	49.3	0	180.4	10.1
2008	15	-	131.1	49.3	0	180.4	8.9
2009	16	-	180.4	0	0	180.4	7.8
2010	17	-	180.4	0	0	180.4	6.8
2011	18	-	180.4	0	0	180.4	6.0
2012	19	-	180.4	0	0	180.4	5.3
2013	20	-	180.4	0	0	180.4	4.6
2014	21	-	180.4	0	0	180.4	4.1
2015	22	-	180.4	0	0	180.4	3.6
2016	23	-	180.4	0	0	180.4	3.1
2017	24	-	180.4	0	0	180.4	2.7
2018	25	-	180.4	0	0	180.4	2.4
2019	26	-	180.4	0	0	180.4	2.1
2020	27	-	180.4	0	0	180.4	1.9
2021	28	-	180.4	0	0	180.4	1.6
2022	29	-	180.4	0	0	180.4	1.4
2023	30	-	180.4	0	0	214.2	1.5
	Total	-933.7	3,990.1	1,029.9	274.6	4,394,7	0

(2) Evaluation

1) As far as IRR is concerned, the resulting 14.0% of IRR on Case E-9 is a little better than that of the Base Case of methanol production (13.2%) in FY 1985. When the electricity is distributed to the Banko area, it is evaluated to be viable in view of economic feasibility.

2) IRR on the case of distribution to Jakarta area is estimated to be 7.4 - 10.8%. The economics may be inferior to that of methanol production.

3) As for economic comparison for power generation, generating system by fluidized-bed coal-fired steam cycle is slightly superior to that by CGCC though the difference in IRR between two systems is narrow. The results of financial analysis for CGCC power plant are shown in Table 9.

Table 9(*) Results of Financial Analysis for CGCC Power Plant

Case	Supply to Jakarta		Supply to Adjacent Area		(Reference) Base Case
	E-5	E-6	E-4	E-1	
Ex-plant Price of Electricity	43 Rp/kwH (7.76 ¥/kwH)	53 Rp/kwH (9.57 ¥/kwH)	64 Rp/kwH (11.55 ¥/kwH)	78 Rp/kwH (14.08 ¥/kwH)	Methanol 194 Rp/kg (35 ¥/kg)
IRR on Total Investment	6.9 %	10.3 %	13.5 %	17.0 %	13.5 %
First Year to Have Profit before Tax (Year from Operation Starts)	11th	7th	3rd	2nd	3rd
Clear off of Accumulated Loss (Year from Operation Starts)	28th	13th	5th	2nd	5th
Pay off of All the Debts (Year from Loan Raised)	28th	15th	12th	12th	12th
Minimum Sales Price (IRR = Interest Rate)	46 Rp/kwH (8.31 ¥/kwH)				143 Rp/kg (25.9 ¥/kg)

Note(*): Cited from Interim Report III (FY1986), page 170.