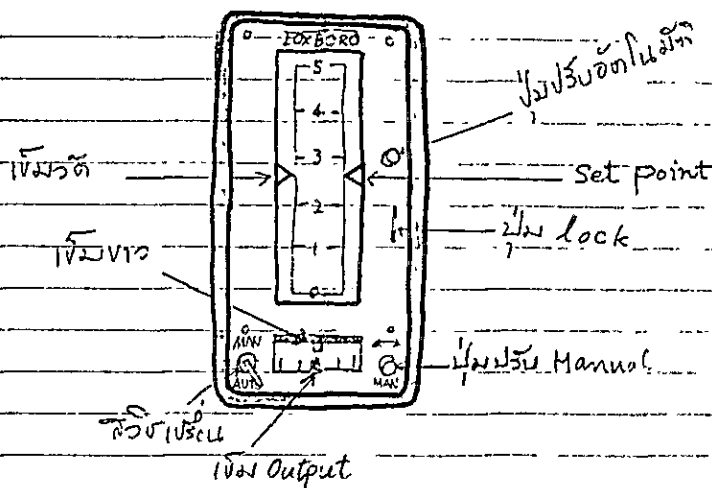


Operation Manual for Operator, provided by Mae Moh Factory

Type 52A Controller (YEW)

(FEED WATER PLANT)



การปรับ Manual ให้เป็นอัตโนมัติ

ในการปรับ Manual ให้เป็นอัตโนมัติ จะต้องปรับ smooth ตามที่ปรับไว้ และปรับ set point ให้ตรงกับความต้องการใช้งาน

1. ปรับค่าปรับอัตโนมัติให้เท่ากับ 1 แล้วปรับ error indicator ให้เป็น Manual แล้วปรับค่าปรับอัตโนมัติให้เท่ากับ 1 แล้วปรับ error indicator ให้เป็น Manual แล้วปรับค่าปรับอัตโนมัติให้เท่ากับ 1

การปรับ Manual ให้เป็น Manual

ในการปรับ Manual ให้เป็น Manual จะต้องปรับ Manual ให้เป็น Manual แล้วปรับค่าปรับอัตโนมัติให้เท่ากับ 1

1. ปรับค่าปรับ Manual ให้เป็น Manual แล้วปรับ error indicator ให้เป็น Manual แล้วปรับค่าปรับอัตโนมัติให้เท่ากับ 1

2. ปรับค่าปรับ Manual ให้เป็น Manual แล้วปรับ (Process) ให้เป็น Manual แล้วปรับค่าปรับอัตโนมัติให้เท่ากับ 1

7-3-9 Modification Work of N₂ Line

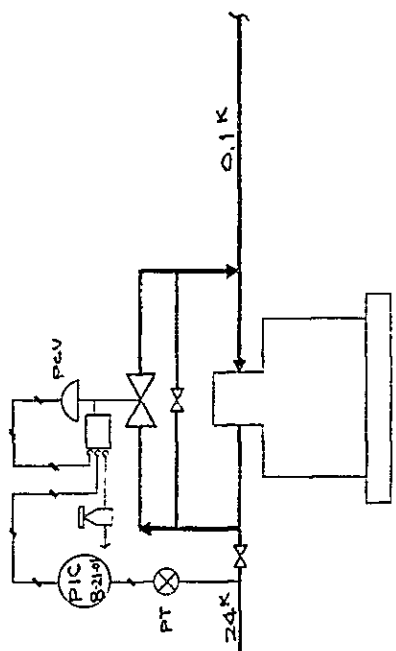
It was revealed at the time of the First Survey that the ratio control of N₂ and H₂ is quite difficult due to the manual control of N₂ Valve. During this stage, improvement of efficiency has been achieved considerably after modifying the operation into automatic system by newly providing control valve and pneumatic controller. Details of the modification work are shown on the pages hereinafter.

Contents

N ₂ LINE (AIR SEP to AMMONIA) Modified FLOW DIAGRAM	
LOOP DRAWING	FRC-3-31-03, PIC-8-21-01
SPECIFICATION	FRC-3-31-03, PVC-8-21-01, PIC-8-21-01 FCV-3-31-03

NO	ITEM	S.P.I.C.
1	FIC	PNEUMATIC CONTROLLER PREFER BY MTC SCALE 0-3000 N ₂ /H TYPE Y/130A EXISTING RECORDER EXISTING TRANSMITTER EXISTING ORIFICE CONTROL VALVE AMMONIA PLANT PCV-3-29-01 BE CONVERTED 2 1/2 J15 40° RF
2	FR	
3	FT	
4	FE	
5	FCV	
1.	PIC	PNEUMATIC CONTROLLER AMMONIA PLANT PIC-3-29-01 BE CONVERTED TYPE Y/130A SCALE 0-40° PNEUMATIC TRANSMITTER AMMONIA PLANT PT-3-29-01 USE TYPE Y/116M RANGE 0-40° CONTROL VALVE EGAT BOILER PLANT PCV-3-65-01 BE CONVERTED J15 40° 1 1/2 CV-11
2	PT	
3	PCV	

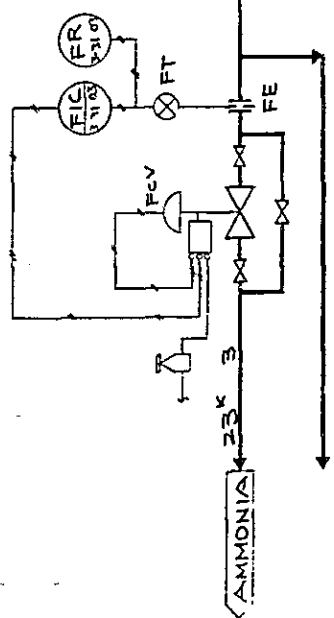
PIC-3-21-01



N₂ COMPRESSOR

AIR SEPARATION PLANT

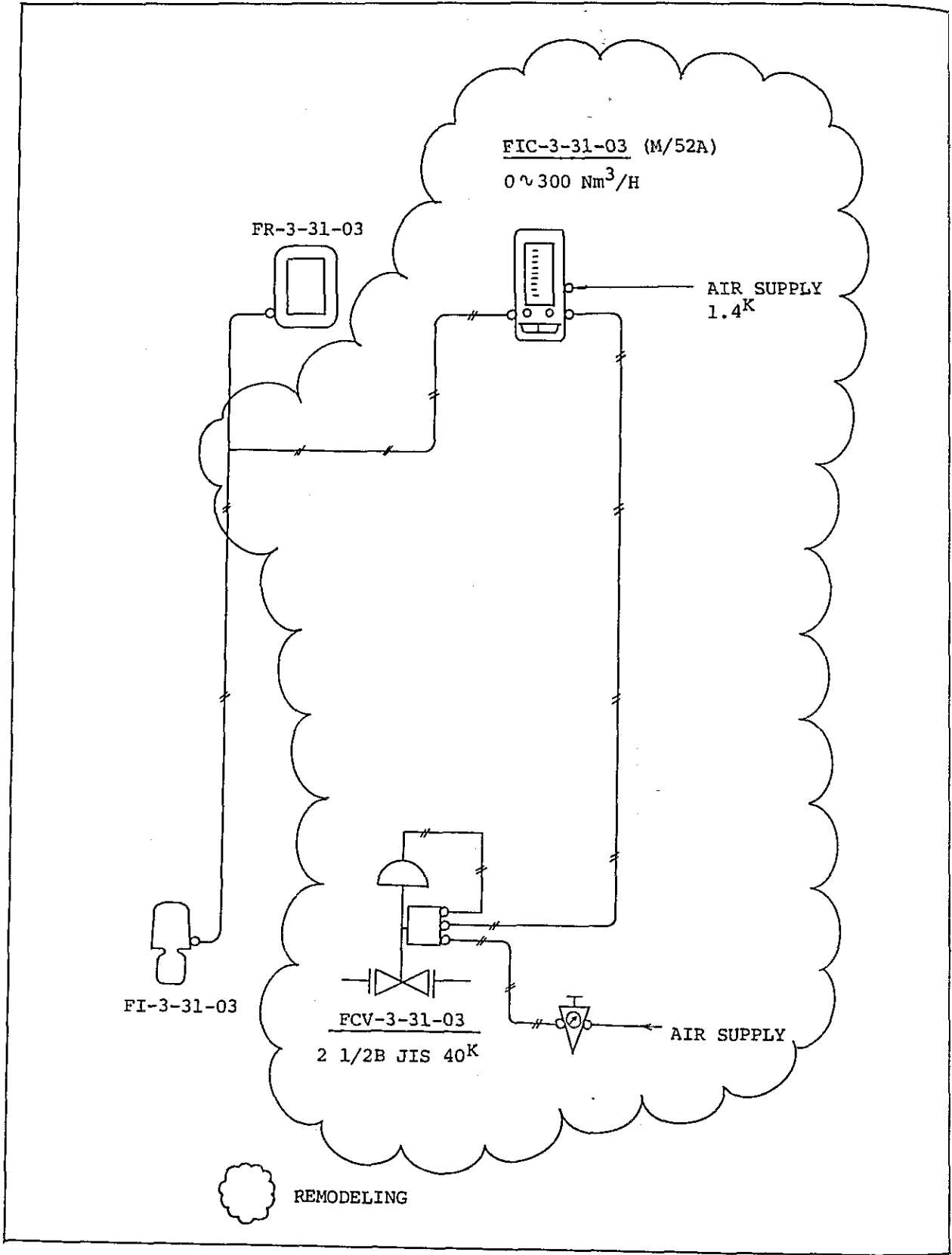
FIC-3-31-03



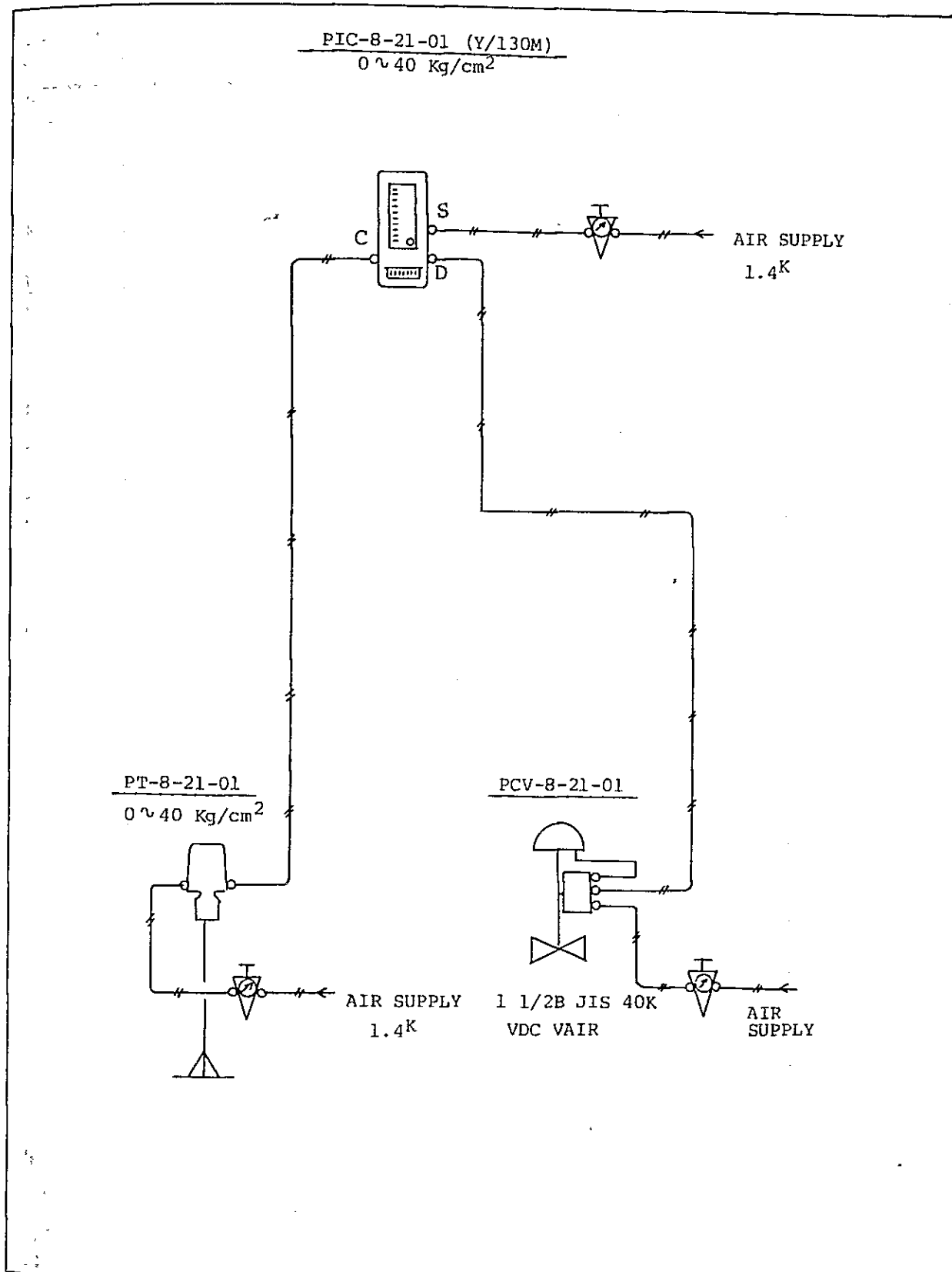
AMMONIA PLANT

MAE MOH FACTORY
N ₂ LINE
= AIR SEP TO AMMONIA
DWG NO.

AMMONIA PLANT FRC-3-31-03 LOOP DRAWING



AIR SEP PLANT PIC-8-21-01 (N₂ line)



AMMONIA PLANT

TAG NO.		FRC-3-31-03		
LOCATION		N ₂ INLET		
CONTROLLER	MANUFACTOR	YEW		
	TYPE	52A		
	SCALE RANGE	0 ~ 3000 Nm ³ /H		
	NORMAL	1500 Nm ³ /H		
	CONTROL ACTION	P + I DEC		
	ALARM TYPE			
	RECORDER	YES		
TRANSMITTER	MANUFACTOR	YEW		
	TYPE	13A		
	MEASURING RANGE	0 ~ 1296 mmH ₂ O		
	OUT PUT	0.2 ~ 1.0 kg/cm ²		
	SEALING METHOD			
	SEAL SIZE			
	CONNECTION	PT 1/2 B		
DETECTOR	TYPE	YEW		
	TEMPERATURE			
	MOISTURE			
	TYPE OF DETECT- ING ELEMENT	SUS 316		
	MATERIAL OF THE BODY	S25C		
	MATERIAL OF THE IMPORTANT PART	SUS 316		
	CONNECTION	PT 1/2 B		

AIR SEPARATION PLANT

TAG NO.		PCV-8-21-01		
LOCATION		N ₂ Comper-By-Pass		
CONTROL VALVE	MANUFACTOR	Y.H		
	MODEL	VDC		
	ACTUATOR	VAIR		
	SEAT TYPE	CAGE		
	CHARACTERISTIC	%V		
	VALVE ACTION	AIR TO OPEN		
	MAX CV	11		
	STANDARD OF CONNECTION	1 1/2 JIS40K.RF		
	FACE TO FACE LENGTH	251 mm		
	POWER	AIR 2.8 k		
	MATERIAL OF THE BODY	SCS 13		
	MATERIAL OF THE TRIM	SCS 14 ST		
	GASKET	V-543		
	GRAND PACKING	JM-397		
	GREASE	G-23		
SPRING RANGE	0.8 ~ 2.4 k			
HAND WHEEL	YES			
HEAT & COLD EQUIPMENT BONNET	YES			
POSITIONER	MANUFACTOR	YAMATAKE		
	TYPE	HTP		
	INPUT SIGNAL	0.2 ~ 1.0 kg/cm ²		
	OUTPUT SIGNAL	0.8 ~ 2.4 kg/cm ²		
AIR SET	2.8 kg/cm ²			
FLUID	COMPOSITION	N ₂ GAS		
	NORMAL FLOW	0 Nm ³ /H		
	MAXMUM FLOW			
	UPSTREAM PRESSER	21 kg/cm ²		
	PRESSURE DROP	21 kg/cm ²		
TEMPERATURE				

AIR SEPARATION PLANT

TAG NO.		PIC-8-21-01		
LOCATION		N ₂ Comper-By-Pass		
CONTROLLER	MANUFACTOR	YEW		
	TYPE	Y/130M-N4-MTP		
	SCALE RANGE	0 ~ 40 kg/cm ²		
	NORMAL	21 kg/cm ²		
	CONTROL ACTION	P + I INC		
	ALARM TYPE	NO.		
	RECORDER	NO.		
TRANSMITTER	MANUFACTOR	YEW		
	TYPE	Y/11GM-DS2		
	MEASURING RANGE	0 ~ 40 kg/cm ²		
	OUT PUT	0.2 ~ 1.0 kg/cm ²		
	SEALING METHOD			
	SEAL SIZE			
	CONNECTION	PT 1/2		
DETECTOR	TYPE	YEW		
	TEMPERATURE	50°C		
	MOISTURE			
	TYPE OF DETECT- ING ELEMENT	SUS 316		
	MATERIAL OF THE BODY	SUS 316		
	MATERIAL OF THE IMPORTANT PART	SUS 316		
	CONNECTION	PT 1/2		

AMMONIA PLANT

TAG NO.		FCV-3-31-03		
LOCATION		N ₂ INLET		
CONTROL VALVE	MANUFACTOR	Y.H		
	MODEL	V.D.C.		
	ACTUATOR	VA2R		
	SEAT TYPE	CAGE		
	CHARACTERISTIC	%V		
	VALVE ACTION	AIR TO OPEN		
	MAX CV	68		
	STANDARD OF CONNECTION	2 1/2 JIS40K.RF		
	FACE TO FACE LENGTH	311 mm		
	POWER	AIR 2.8 k		
	MATERIAL OF THE BODY	SCPH 21		
	MATERIAL OF THE TRIM	SCS 14		
	GASKET	V-543, V-595		
	GRAND PACKING	TEFLON, Y-7132Y		
	GREASE	G-33		
	SPRING RANGE	0.8 ~ 2.4 kg/cm ²		
HAND WHEEL	YES			
HEAT & COLD EQUIPMENT BONNET	STANDARD			
POSITIONER	MANUFACTOR	Y.H		
	TYPE	HTP		
	INPUT SIGNAL	0.2 ~ 1.0 kg/cm ²		
	OUTPUT SIGNAL	0.8 ~ 2.4 kg/cm ²		
	AIR SET	2.8 kg/cm ²		
FLUID	COMPOSITION	N ₂ GAS		
	NORMAL FLOW	1500 Nm ³ /H		
	MAXIMUM FLOW	3000 Nm ³ /H		
	UPSTREAM PRESSER	21.0 kg/cm ² .G		
	PRESSURE DROP			
	TEMPERATURE			

7-3-10 TRIP SYSTEM

Investigations were made for the functions of trip systems of SYN-GAS COMPRESSOR at AMMONIA PLANTS, N₂ Compressor at Air Separation Plant and CO₂-Compressor at UREA Plant, and for the functions of emergency system of Gasification Plant, by carrying out the relative operation tests. Those systems mentioned the above, are shown on the pages hereinafter. Further, as a safety instrumentation, trip system was set up, under our supervision, at CO₂ Drying Unit, which caused the burst of CO₂ Compressor. Flow and sequence of this trip system are shown on the pages hereinafter.

Contents

DIAGRAM OF AUTOMATIC INSTRUMENT FOR
SYN-GAS COMPRESSOR OF AMMONIA PLANT
N ₂ COMPRESSOR OF AIR SEP PLANT
CO ₂ -COMPRESSOR OF UREA PLANT
CO ₂ DRYING UNIT OF UREA PLANT
GASIFICATION PLANT

DIAGRAM OF AUTOMATIC INSTRUMENT FOR
 SYN-GAS COMPRESSOR OF AMMONIA PLANT

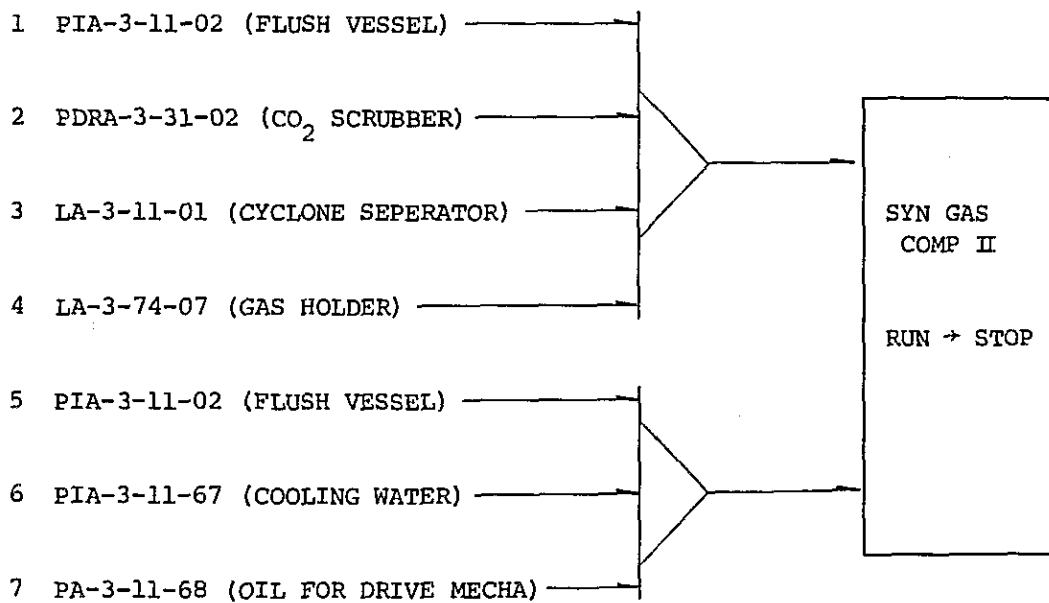
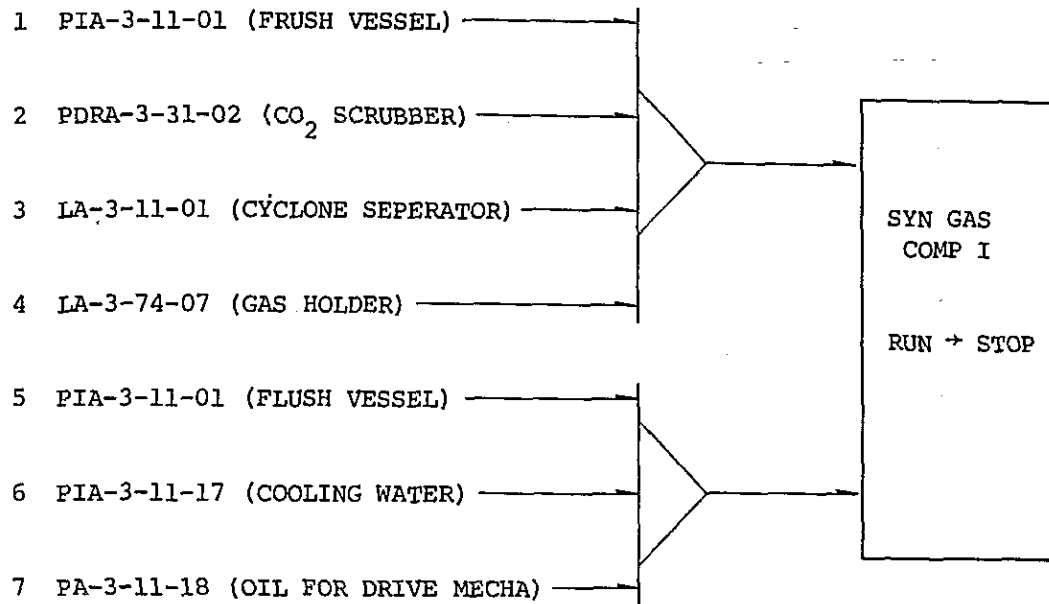


DIAGRAM OF AUTOMATIC INSTRUMENT FOR
N₂ COMPRESSOR OF AIR SEP PLANT

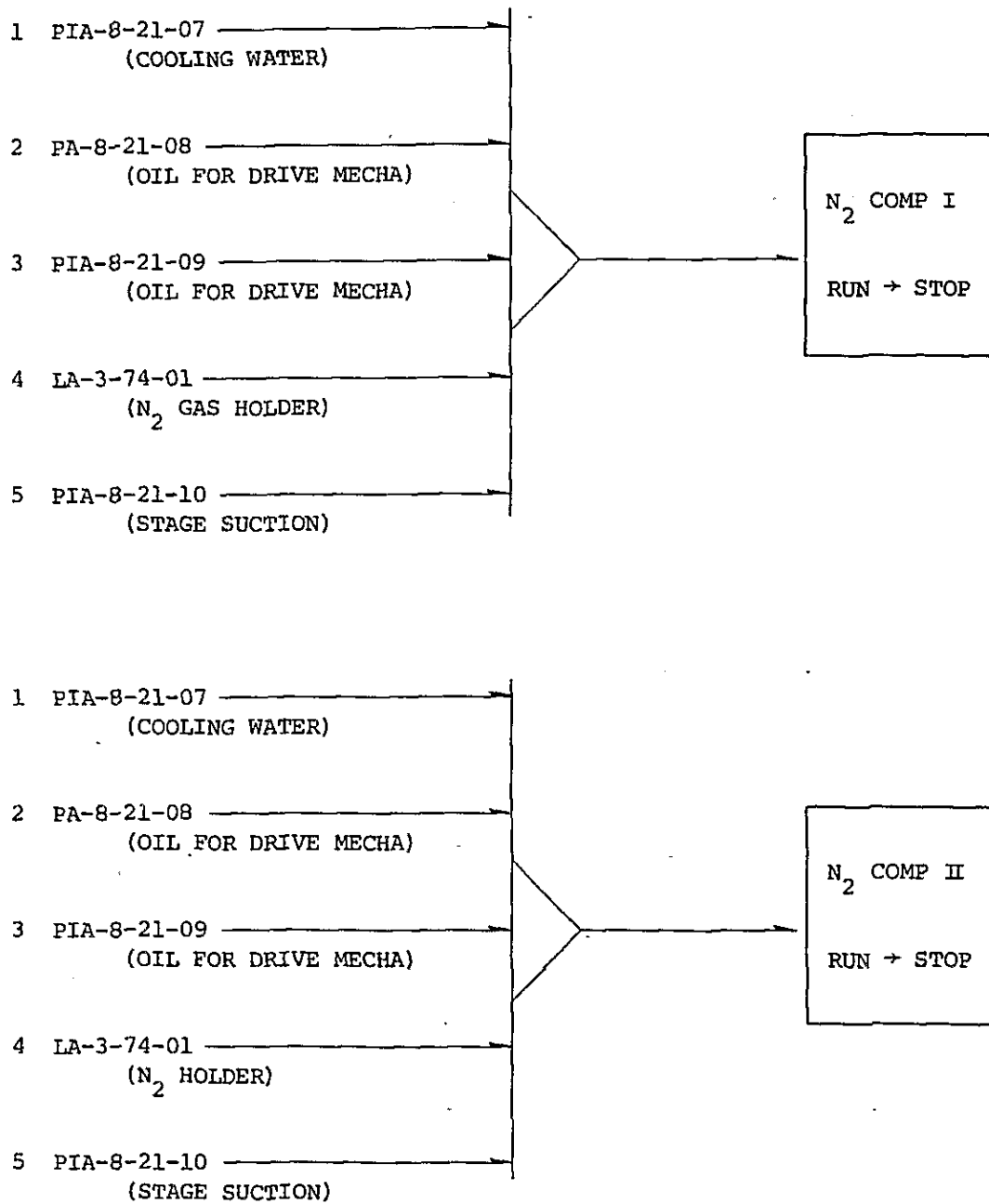
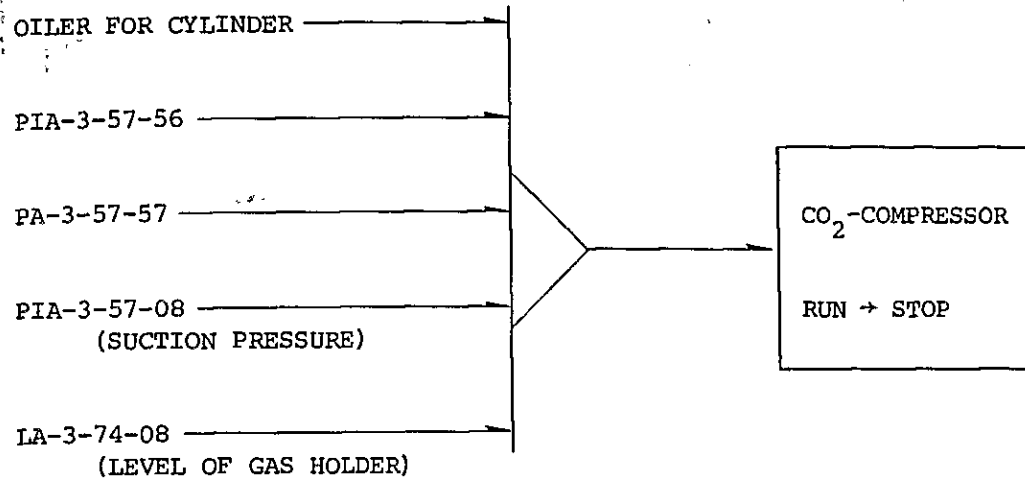
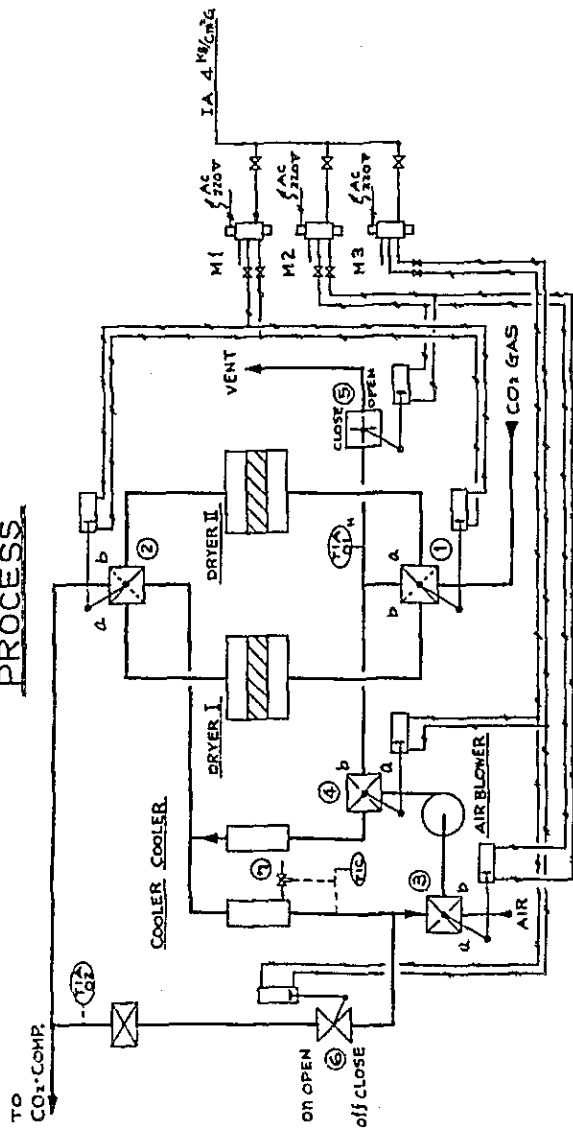


DIAGRAM OF AUTOMATIC INSTRUMENT FOR
CO₂-COMPRESSOR OF UREA PLANT

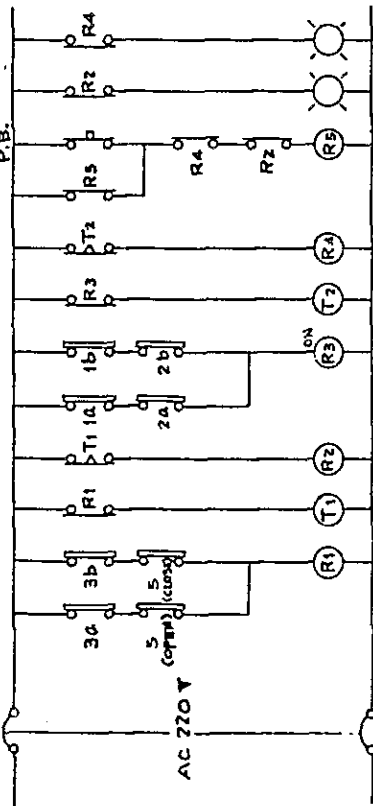


PROCESS



SEQUENCE

When Butterfly Valve "3" is "a" position, the limit SW 3a be closed.
 When Butterfly Valve "5" is opened, the limit SW 5(open) be closed.
 RESET P.B.



Valve
 3,5 or 1,2
 Trouble
 Annunciator

Explanation of SEQUENCE

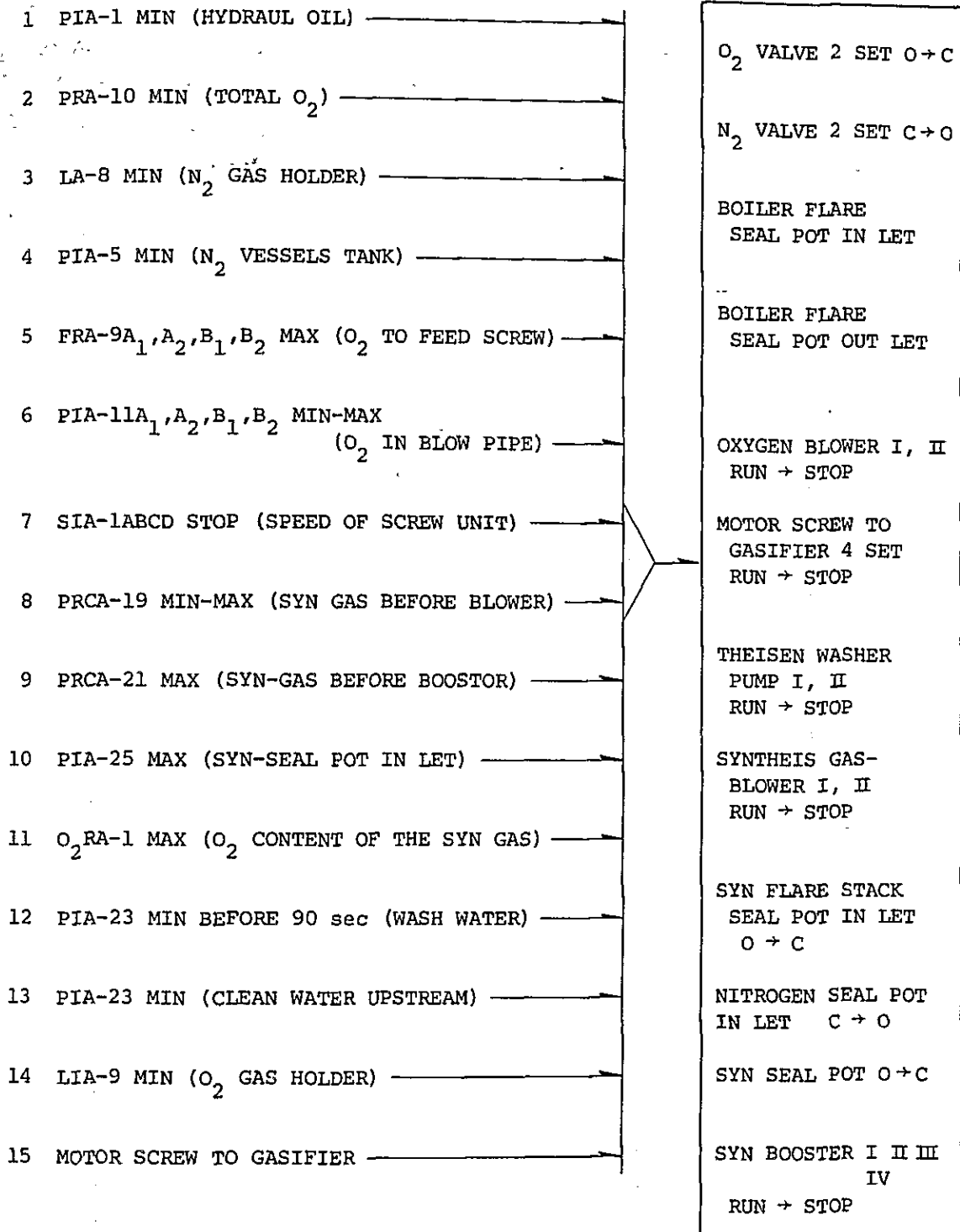
Purpose Prevent the AIR penetration into CO₂ line by the mal-action of Butterfly Valves.

Action When the Butterfly Valves positions are not followed to line changing sequence. The failure are checked by limit SW, which are newly mounted on valve side, the AIR blower shall be stopped.

Butterfly Valve	A	B	C	D
1	a	a	a	b
2	a	a	a	b
3	a	b	a	a
4	a	b	b	a
5	OPEN	CLOSE	OPEN	OPEN
6	CLOSE	OPEN	OPEN	CLOSE
7	CLOSE	OPEN	OPEN	CLOSE
AIR BLOWER	RUN	RUN	STOP	RUN

THAI MAE MOH FACTORY
 UREA PLANT
 CO₂ DRYING UNIT

DIAGRAM OF AUTOMATIC INSTRUMENT
OF GASIFICATION PLANT



7-3-11 Alarm System

Signal lamp lighting and buzzing were checked on the alarm system provided for indicating the trouble of process to operators. However, the functions thereof were almost unsatisfactory. Especially, the system at Gasification Plant has to be replaced for its entirety. For Urea Plant, it was repaired to good condition in general. Further, the immediate repair is required for Ammonia Plant, etc.

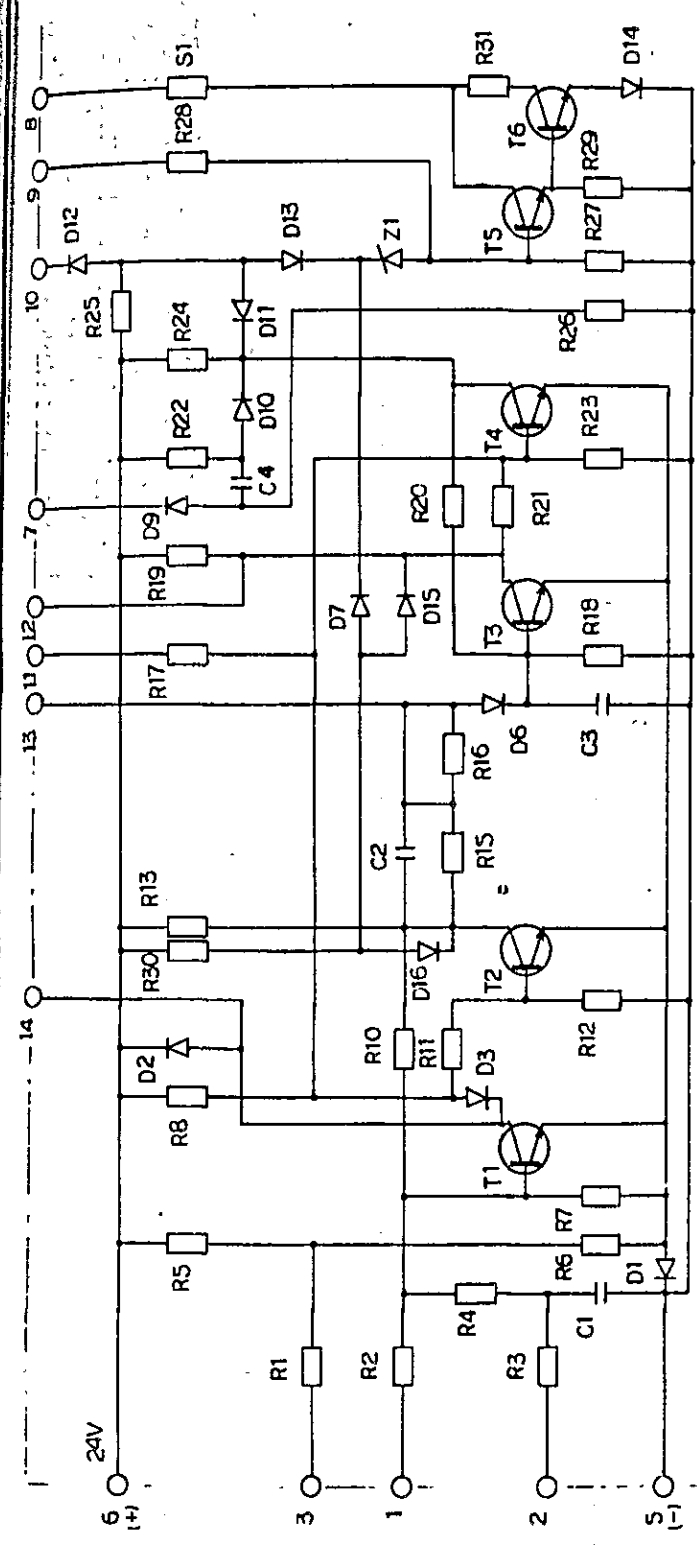
Repairing of print plate of alarm circuit was supervised using parts materials provided by us, but not extended to the entire repair.

For the future repair or new assembly of printed circuit plate, alarm circuit drawings are provided.

Since these circuit drawings are applicable to all plants of Mae Moh Factory, future replacements or repairs by means of those drawings are expected.

Contents

ANNUNCIATOR UNIT (1)	MAIN AMP CIRCUIT
" (2)	ANN FLUSHING FUNCTION CIRCUIT
" (3)	ALARM AND BUZZER RESET CIRCUIT

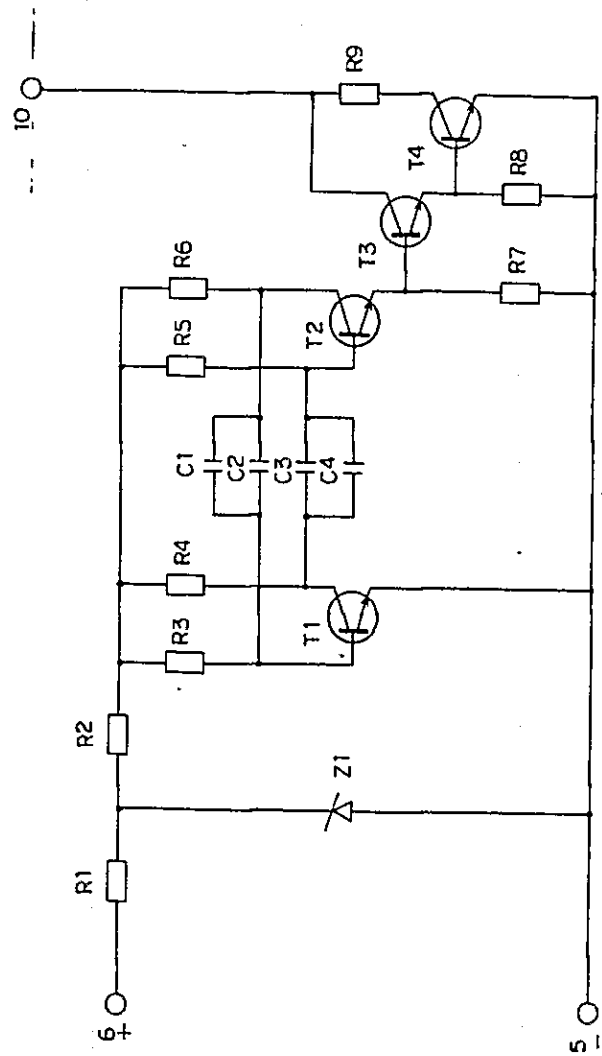


PARTS LIST			PARTS LIST			PARTS LIST		
SYMBOL	MULTIPLIER	PART NAME	SYMBOL	MULTIPLIER	PART NAME	SYMBOL	MULTIPLIER	PART NAME
R31	0.47 OHM	RESISTOR	R30	5.6 K OHM	RESISTOR	D6, D9		ZENER DIODE
R1	27		R16	8.2		B15, D13		
R29	1.2 K OHM		R17	12		D15		
R6	1.5		R28	8.2		D16		
R3	1.8		R2	18		T1~T5		TOSHIBA 2SC 497 SONY 756 NEC 969 NATIONAL 696
R4	1.8		R20	18		D2		DIODE
R27	27		R25	33				
R5	5.3		R15	220				
R7	4.7		R10	470				
R8	4.7		C1	4.7 μF 15/18V	CAPACITOR			
R12	4.7		C4	4.7				
R18	4.7		C2	0.1				
R23	4.7		C3	0.022				
R25	5.6		T6	BSX25	TRANSISTOR			
R13	6.8		Z1	Z5	ZENER DIODE			
R22	6.8		D1	SIG 1/100	ZENER DIODE			
R19	6.8		D14	SIG 1/200	ZENER DIODE			
R24	6.8		D3	BA 10C	ZENER DIODE			
R11	8.2							

ANNUNCIATOR			MAE MOH FACTORY		
UNIT (1)			MAR. 1973		
MAIN AMP CIRCUIT					

PARTS LIST

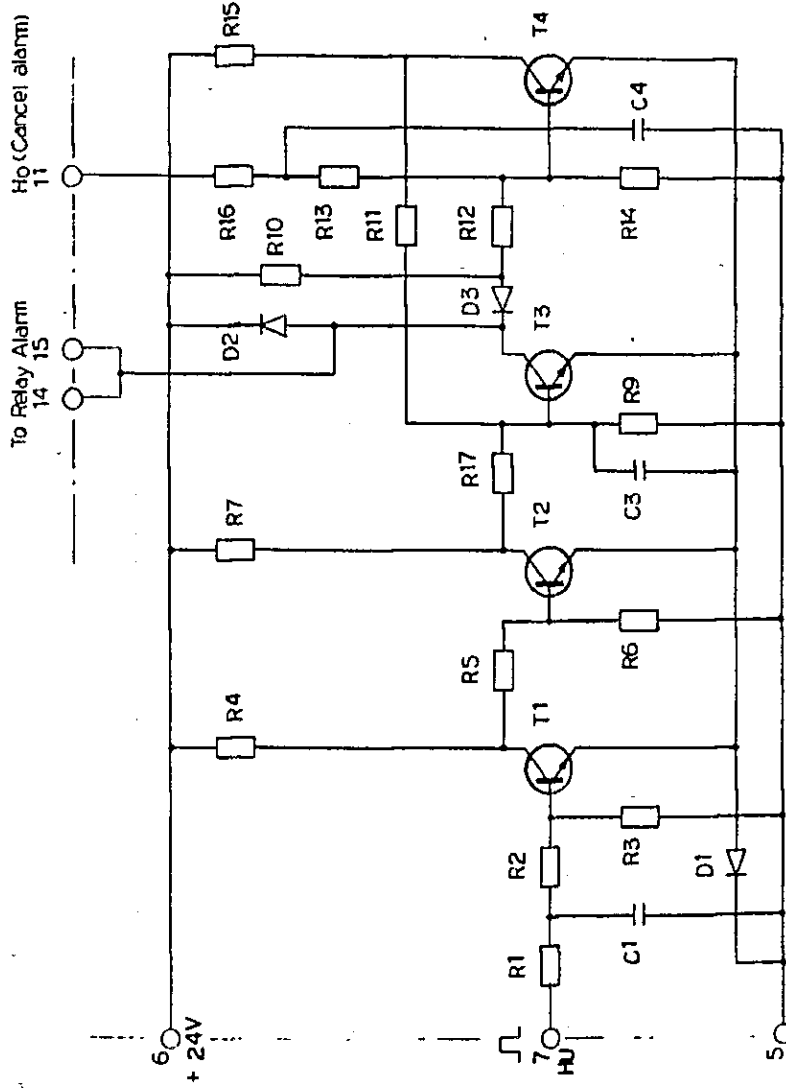
SYMBOL	MULTIPLIER	PART NAME
R8	4.7 OHM	RESISTOR
R1	1.8 K.OHM	
R2	2.7	
R4	2.2	
R6	3.9	
R7	0.15 OHM	
R9	6.8 KOHM	
R3	6.8	
R5		
C1	4.7 μF 18V	CAPASITOR
C2	4.7	
C3	4.7	
C4	4.7	
T1	BFY40	TRANSISTOR
T2	BFY40	
T3	BFY40	
T4	ESY 85	
Z2	Z 12	ZENER DIODE



ANNUNCIATOR UNIT (2)	MAE MOH FACTORY
	MAR. 1978
ANN FLUSHING FUNCTION CIRCUIT	

PARTS LIST

SYMBOL	MULTIPLIER	PART NAME
R1	1	KOHM
R2	1	RESISTOR
R3	3.9	
R4	4.7	
R5	4.7	
R6	4.7	
R7	4.7	
R8	4.7	
R9	4.7	
R10	4.7	
R11	4.7	
R12	6.8	
R13	6.8	
R14	6.8	
R15	8.2	
R16	8.2	
R17	15	
R18	15	
C1	4.7	µF
C2	0.1	160V
C3	0.22	250V
D1	SER 1S1	SI DIODE
D2	BA 100	TRANSISTOR
D3	BFY 40	TRANSISTOR
D4	BFY 40	TRANSISTOR
D5	BFY 40	TRANSISTOR
D6	BFY 40	TRANSISTOR
D7	Kd	DIODE



ANNUNCIATOR	MAE MOH FACTORY
UNIT (3)	MAR. 1978
ALARM & Buzzer RESET FUNCTION CIRCUIT	

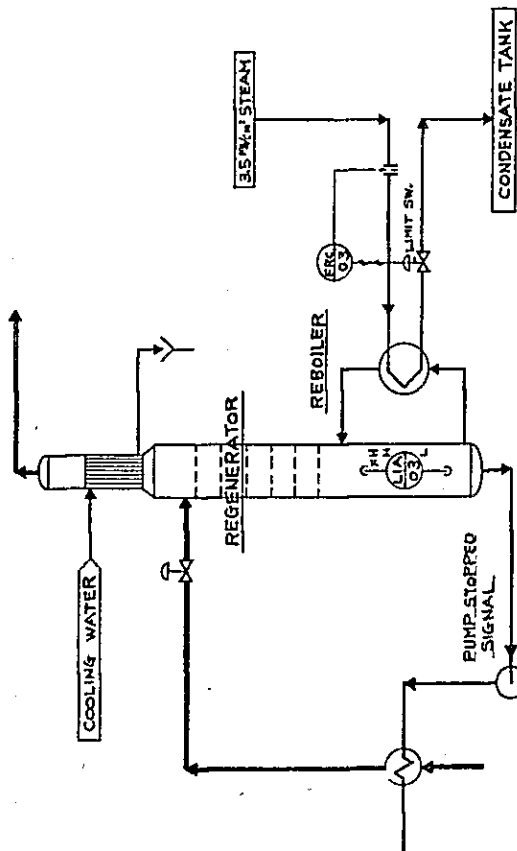
7-4 Future Modification Plan

Modification plan is provided for the following 4 items in accordance with the request by Process Side.

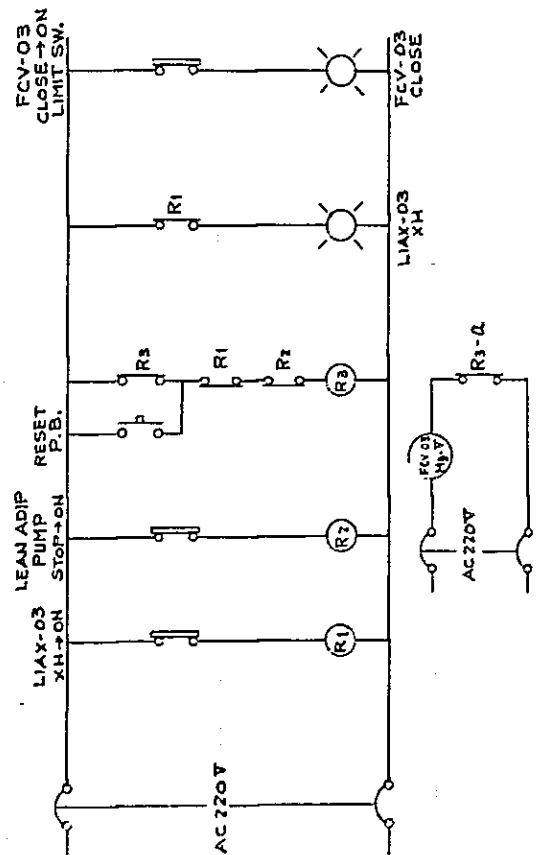
Item	Outline of Modification
1 ADIP PLANT STEAM CUT OFF	Make FCV-4-11-03 Close at LIAX-03XH and Lean Adip Pump Stop.
2 Modification of BOILER STEAM SYSTEM	Loop Drawing, Desk Modification Drawing, P&I, Specification. Modify manual operation to automatic one, by providing 2 sets of LRC, TRC & PRC.
3 GASIFICATION PLANT Pulverized Coal	Automatic Control of relative internal pressure of pulverized coal production device.
4 AMMONIA PLANT Product NH ₃	Detector modified to magnetic Flow type for differential pressure type.

7-4-1 ADIP PLANT STEAM CUT FLOW & SEQUENCE

PROCESS



SEQUENCE (JIS)



SPECIFICATION

ITEM	NAME	TYPE	REMARKS
R1	RELAY	FBV342 6 ¹ /1	Fuji Electric Works (AC220V)
R2	RELAY	FBV342 6 ¹ /1	Fuji Electric Works (AC220V)
R3	RELAY	FBV342 6 ¹ /1	Fuji Electric Works (AC220V)
Mg.V	Solenoid Valve	LB831415	AC200V
RESET	P. B.		
LIAX-03		Displacer	XH (NEWLY SET)
LEAN ADIP PUMP			In the control Room, Running Lump mounted on Panel.

Explanation of Relay Action

When LIAX-03XH or LEAN SOL PUMP STOP has been occurred,

FCV-03 (the discharge valve of 3.5% steam condensate) shall be closed.

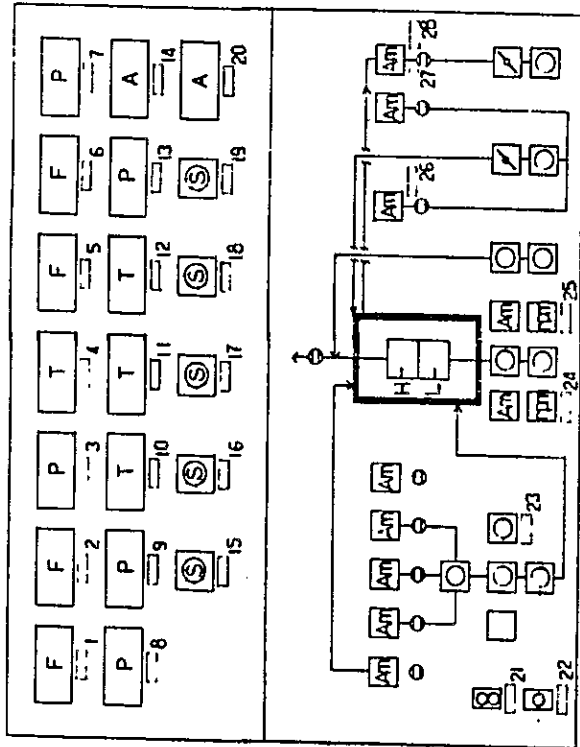
THAI MAE MOH FACTORY

ADIP PLANT

STEAM CUT OFF SEQUENCE

7-4-2 MODIFICATION PLAN FOR BOILER STEAM SYSTEM

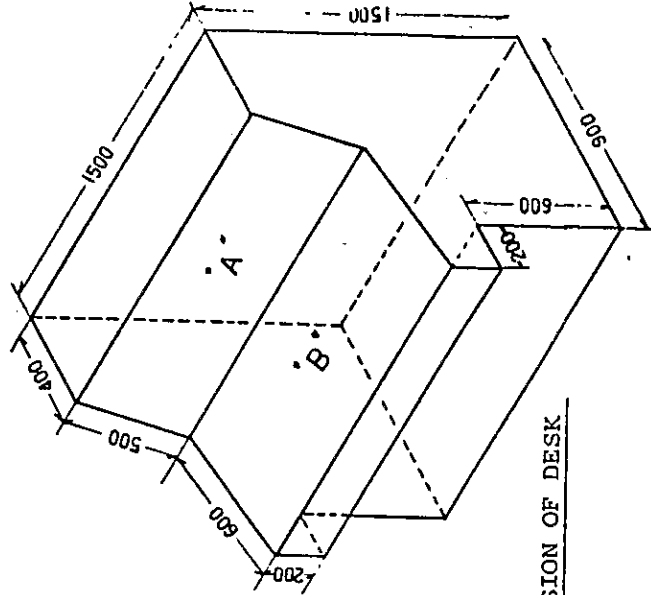
METER LAYOUT



- E : FLOW METER
- P : PRESSURE METER
- T : THERMO METER
- L : LEVEL METER
- A : ANALYSIS METER
- Am : AMMETER
- rpm : REVOLUTION PER MINUTE
- S : CHANGESWITCH

'A' DETAIL

'B' DETAIL



DIMENSION OF DESK

ITEMS

NO	SERVICE	RANGE	NO	SERVICE	RANGE
1	COAL-RATE	0-100%	17	DESUPER HEATER IN LET	200-500 °C
2	COMB AIR	0-100%	18	FLUE GAS ECO IN	50-700 °C
3	HP STEAM	0-100 kg/cm	19	FLUE GAS ECO IN	0-200 mmWG
4	SUPER HEATER OUTLET	200-500 °C	20	CO + H ₂	0-4%
5	HP STEAM FLOW	0-40 T/H	21	ALARM STOP	
6	FW FEED	0-50 T/H	22	TROUBLE OFF	
7	FURNACE DRAFT	-10-0-5 mmWG	23	STEAM AIR RATION	
8	SEC. AIR	0-100 mmWG	24	F.W.P	
9	FD AIR	0-300 °C	25	F.W.P	
10	FD AND FW	0-300 °C	26	F.D.F	
11	DESUPER HEATER	200-500 °C	27	F.D.F	
12	FLUE GAS	50-760 °C	28	I.D.F	
13	FLUE GAS	0-200 mmWG			
14	CO ₂	0-20%			
15	FD AIR	① PREHEAT IN			
		② PREHEAT OUT			
16	FD AND FW	① FW ECO IN			
		② FW ECO OUT			
		③ PREHEAT OUT			

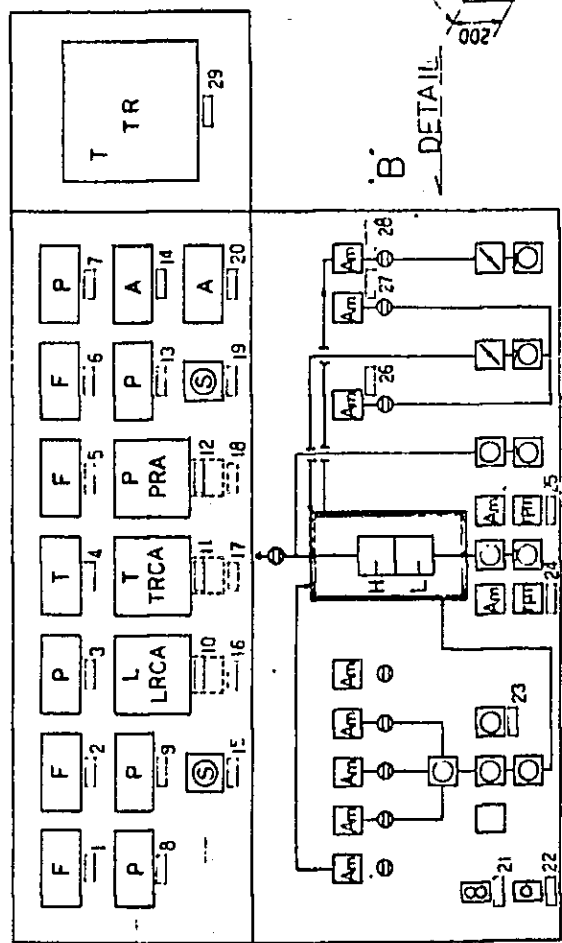
BOILER PLANT
DRAWING OF DESK
(PRESENT)

M&E MOH FACTORY

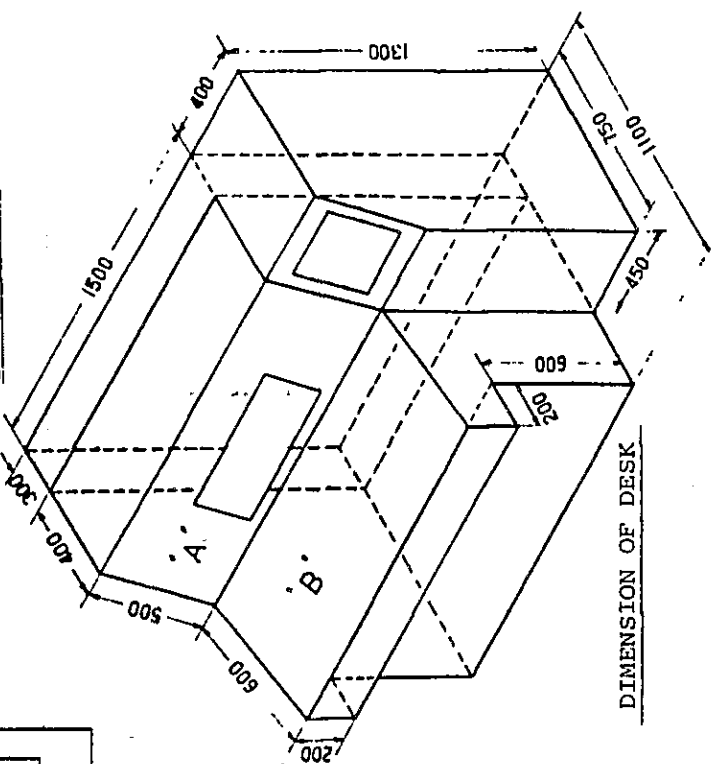
MAR. 1978

Primary plant for modification of 3 factors of boiler control into automatic operation of the plant.

METER LAY OUT



F : FLOW METER
 P : PRESSURE METER
 T : THERMO METER
 L : LEVEL METER
 A : ANALYSIS METER
 Am : AMMETER
 rpm : REVOLUTIONS PER MINUTE
 S : CHANGE SWITCH



DIMENSION OF DESK

ITEMS

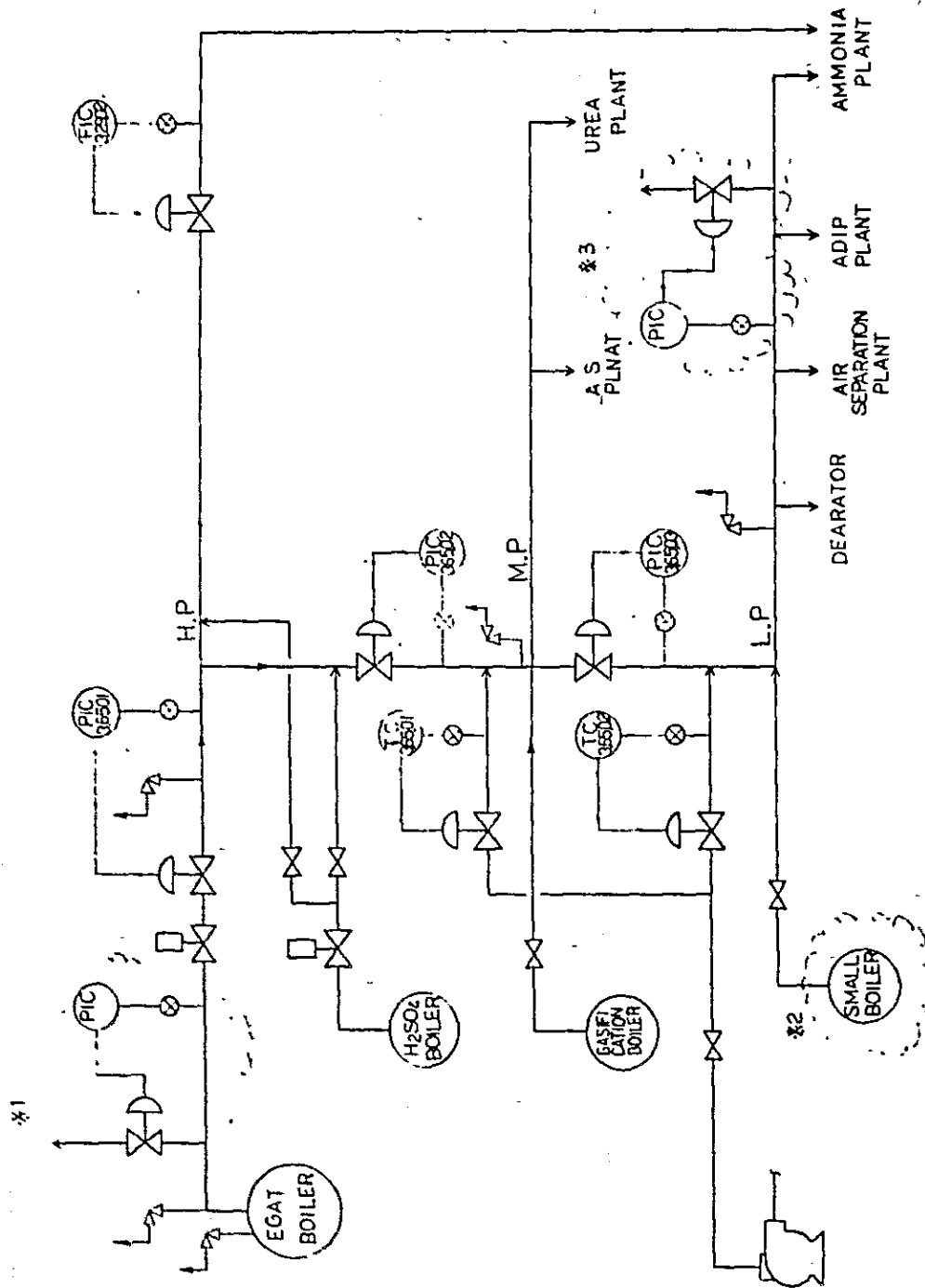
NO	SERVICE	RANGE	NO	SERVICE	RANGE
1	COAL - RATE	0-100 %	16	REMOVE	
2	COMB AIR	0-100 %	17	FLUE GAS ① ECO IN	0-200 mmwG
3	HP STEAM	0-100 kg/cm	18	② ECO OUT	
4	SUPER HEATER OUTLET	200-500 °C	19	③ PREHEAT OUT	
5	HP STEAM FLOW	0-40 T/H	20	CO + H ₂	0-4 %
6	F.W FEED	0-50 T	21	ALARM STOP	
7	FURNACE DRAFT	10-0-5 mmwC	22	TROUBLE OFF	
8	SEC AIR	0-100%	23	STEAM AIR RATION	
9	FD AIR	0-251	24	F.W.P	
10	DRUM LEVEL (NEWLY ADDED)	200-200 mm	25	F.W.F	
11	DESEPER HEATER (NEWLY ADDED)	200-500 °C	26	F.D.F	
12	HP STEAM (NEWLY ADDED)	0-90 kg/cm	27	F.D.F	
13	FLUE GAS	0-200 mmwC	28	I.D.F	
14	CO ₂	0-23 %	29	TRISHO RECORDER (NEWLY ADDED)	0-600 °C
15	FD AIR ① PREHEAT IN	0-25 mmwG			

BOILER PLANT
 DRAWING OF DESK
 (MODIFIED SYSTEM)

MAR. 1978

MAE MOH FACTORY

Primary Plant of Desk Panel Modification for automatic operation of 3 factors of Boiler Control



- *1 Discharging excess of pressure rise through PIC of H.P. Line.
- *2 Prompt correspondence by small boiler to the variation of load at steam line.
- *3 Discharging excess of pressure rise through PIC of L.P. Line.

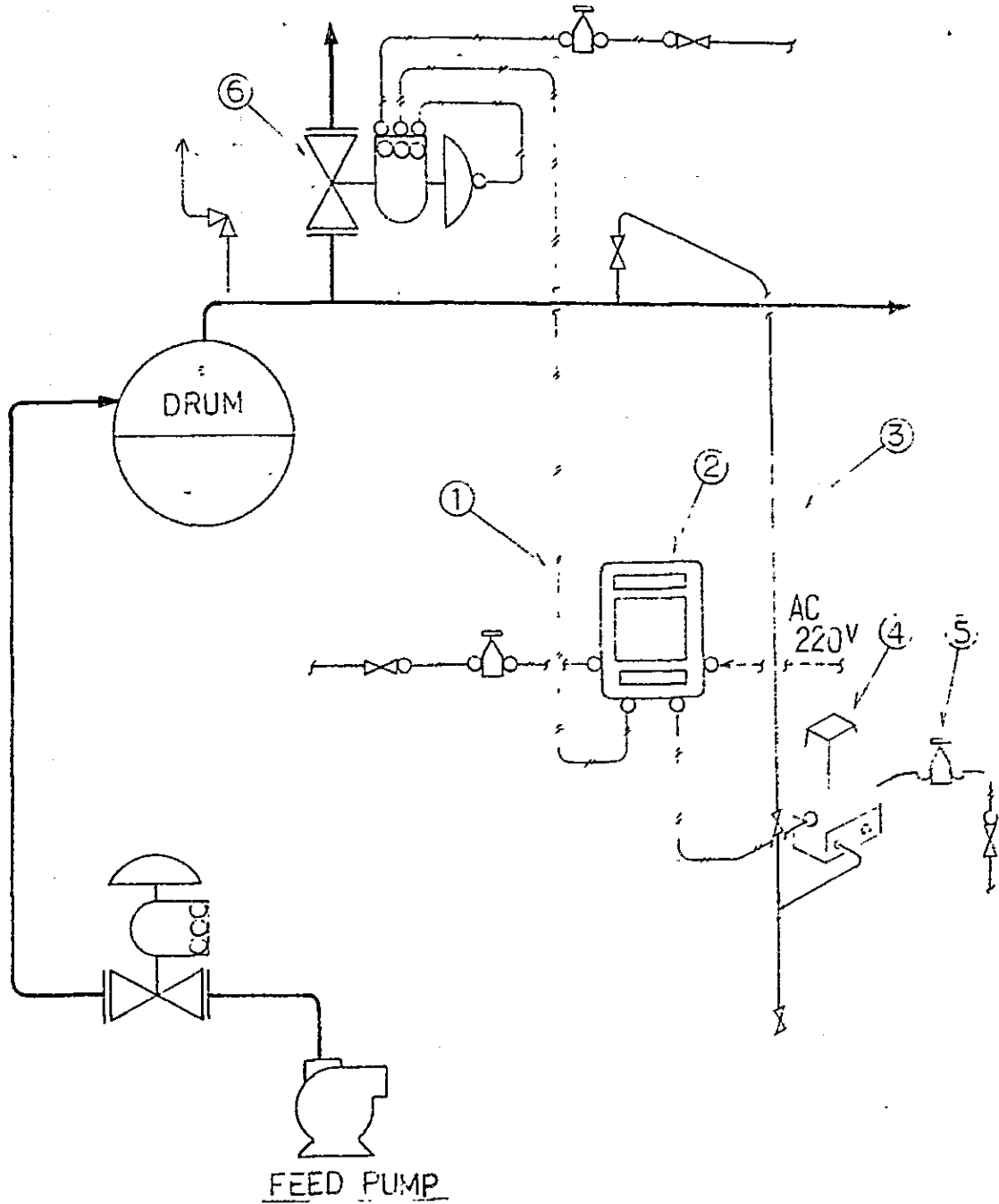
STEAMSYSTEM
PRESSURE CONTROL
CASE STUDY

MAE MOH FACTORY

MAY. 1978

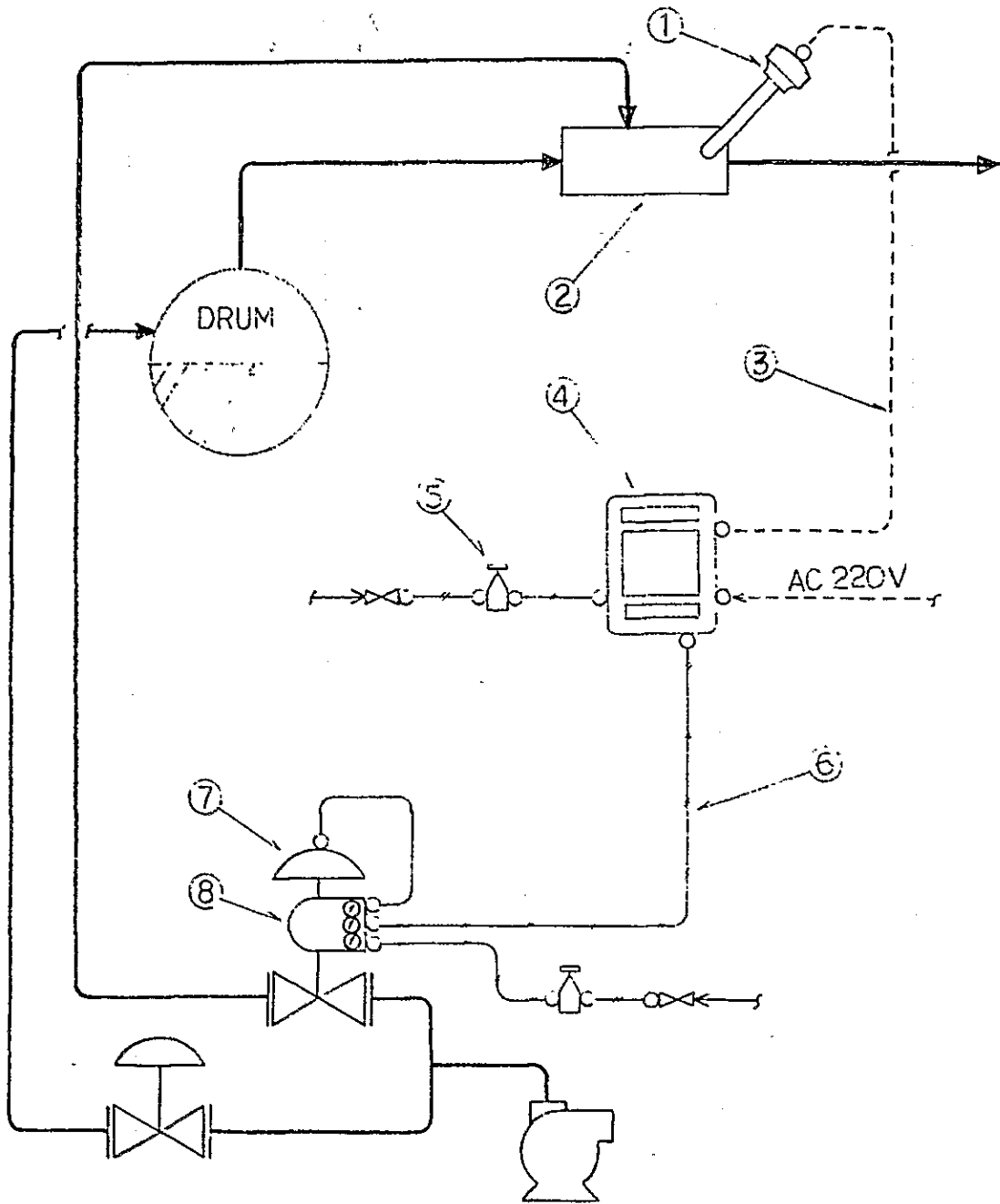
STUDY OF DISCHARGING EXCESS OF PRESSURE
RISE AND PROMPT SUPPLY OF SHORTAGE OF
PRESSURE DOWN UNDER LOAD VARIATION

TAG NO.	SERVICE	REMARK
PRCA -	HIGH PRESSER STEAM VENT	EGAT BOILER



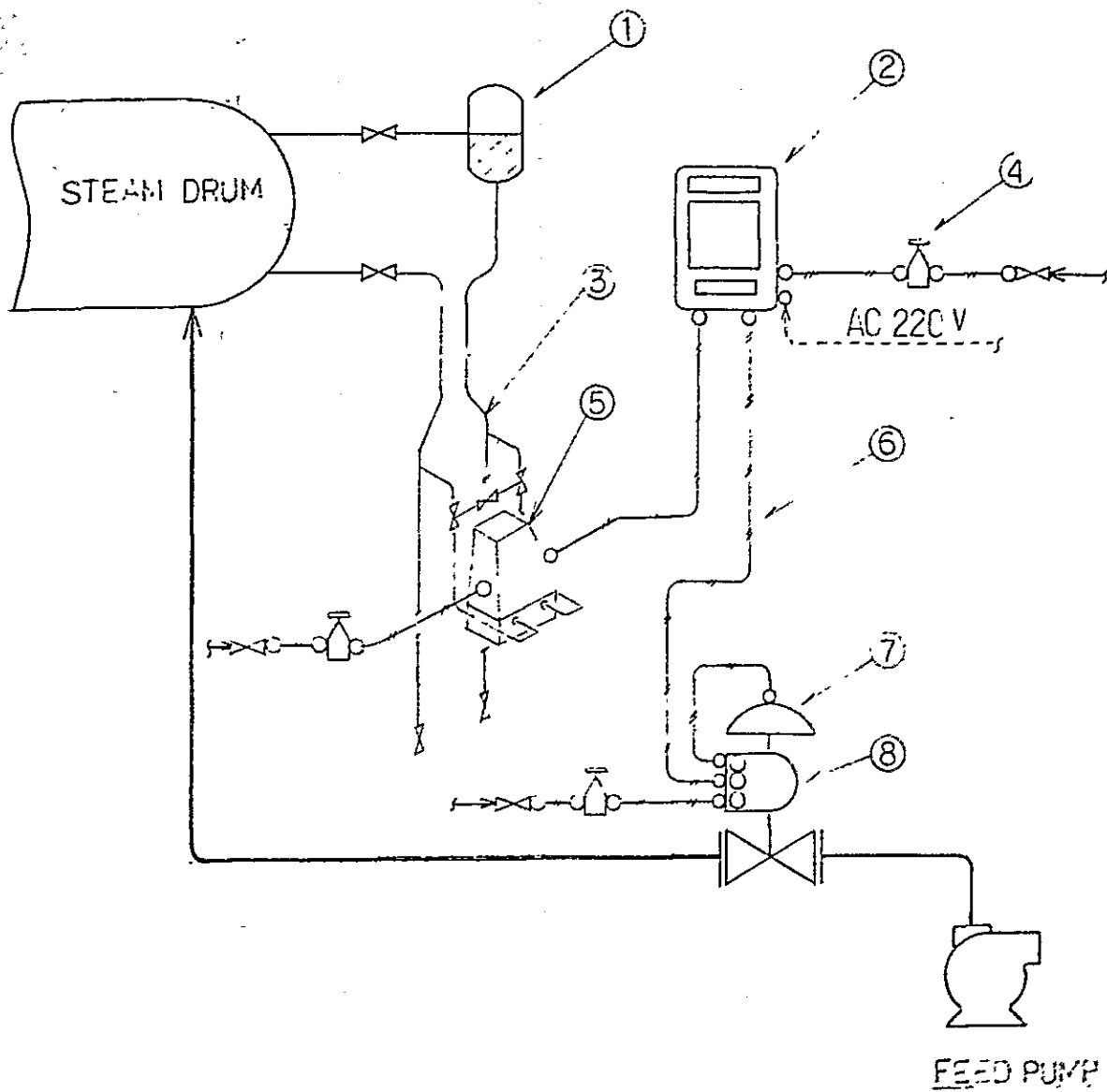
NO	PARTS	SIZE	MAT'L	QTY	PLACE	REMARK
1	COPPER TUBE	6"X4" PVC	CU	100	DRUM SIDE	
2	PRESS CONTROLLER	NRF-1		1	DESK PANEL	
3	LEED PIPE	12"X9"	SUS316	10	FURNACE SIDE	
4	TRANSMITTER	11GH		1	DRUM SIDE	
5	AIR SET	FRF-201		3		
6	CONTROL VALVE	VD1		1	DRUM TOP	

TAG NO	SERVICE	REMARKS
TRCA -	STEAM TEMP CONTROL	EGAT BOILER



NO	PARTS	SIZE	MAT'L	QTY	PLACE	REMARK
1	THERM WELL	CA	SUS	1	DRUM TOP	
2	MIXER			1	//	
3	WIFE	CA		50	FURNACE SIDE	
4	TEMP CONTROLLER	NREA		1	DESK PANEL	
5	AIR SET	PRF-204		2	FURNACE SIDE	
6	COPPER TUBE	6"x4" PVC	Cu	30	//	
7	CONTROL VALVE	VDC	SCA52	1	//	
9	POSITIONER	IITP		1		

TAG NO	SERVICE	REMARK
LRCA -	EGAT BOILER STEAM DRAM	

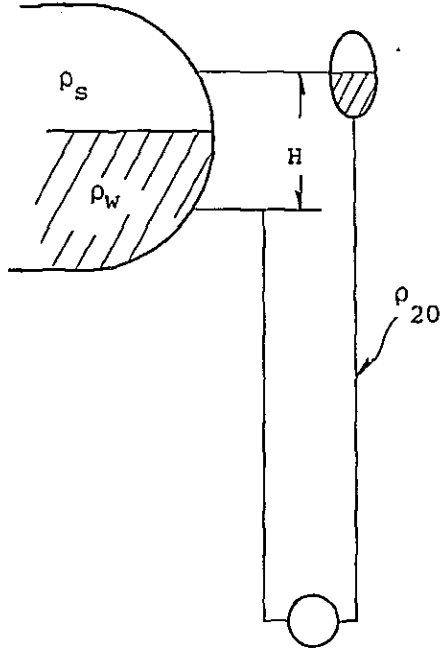


NO	PARTS	SIZE	MAT'L	QTY	PLACE	REMARK
1	DRAIN CONDENSER		S25C	1	DRUM SIDE	
2	LEVEL CONTROLLER	NRPA		1	DESK PANEL	
3	LEED PIPE	12" X 9"	SUS316	10	FURNACE SIDE	
4	AIR SET	PRF-204		3		
5	TRANSMITTER	13A	SUS316	1	FURNACE SIDE	
6	COPPER TUBE	6" X 4" PVC	Cu	50	//	
7	CONTROL VALVE	VDC	SCA52	1	//	
8	POSITIONER	HTP		1		

PRESSURE METER SPECIFICATION

PLANT INDEX	EGAT BOILER STEAM PRESSURE	EGAT BOILER STEAM DRUM
TAG NO.	PRA-	LRCA
INSTRUMENT	4651-04-AC220V-O/All/MTP2	4651-04-AC220V-O/All/MPT2
TYPE	4651-04-AC220V/0/All/MTP2	4651-04-AC220V-O/All/MPT2
SCALE RANGE	0 ~ 80 kg/cm ² G	-200 ~ 0 ~ +200 mm
NORMAL PRESSURE	46 "	P + I
ACTION	DIRECT	
ALARM TYPE	N. OPEN	N. OPEN
TRANSMITTER		
TYPE	Y/11GM-ES2/GAS-FM	Y/13A-MS2/GAS-FM-LD
RANGE	0 ~ 80 kg/cm ² G	-388.72 ~ -77.48 mm
OUT PUT	0.2 ~ 1.0 "	0.2 ~ 1.0 kg/cm ² G
SEALING		
DETECTOR		
TYPE		
TEMPERATURE		50°C
MATERIAL (BODY)		SUS-316
MATERIAL (IMPORTANT)		"
STD of CONNECTION		
PRESS.		46 kg/cm ² G
REMARK	CHART 12 month INK " This instrument can be used as controller. YOKOGAWA	

EGAT BOILER "ΔP" CALCULATION



SPECIFICATION

H : 400 mm

ρ_s : 20.2 kg/m³ at 40 kg/cm² STEAM

ρ_w : 798.3 kg/m³ at 40 kg/cm² HOT WATER

ρ_{20} : 992.2 kg/m³ at 20°C WATER

LEVEL 100% CASE

$$\Delta P_{100} = H(\rho_{20} - \rho_w) = 400(0.992 - 0.7983) = 77.48 \text{ mm}$$

LEVEL 0% CASE

$$\Delta P_0 = H(\rho_{20} - \rho_s) = 400(0.992 - 0.0202) = 388.72 \text{ mm}$$

P max.

$$\Delta P_0 - \Delta P_{100} = 388.72 - 77.48 = 311.24 \text{ mm}$$

TRANSMITTER ZERO CHECK CASE

$$\frac{4000}{311.24} = \frac{x}{388.72} \quad x = 499.5 \text{ mm}$$

THERMO RECORDER
PANEL INSTRUMENT SPECIFICATION

PLANT INDEX NO.	EGAT BOILER SSH OUT LET TEMP	
TAG NO.	TRA-	
RECORDER		
TYPE	NRM98-2211F-A-B58	
SCALE RANGE	0 ~ 600°C	
RECORDING POINT	12 POINT	
INPUT SIGNAL	I.C (JIS)	
ALARM TYPE	N. OPEN	
SCANNING CYCLE	6 Sec.	
CHART SPEED	20 mm/H	
BALANCE SPEED	3 Sec.	
POWER SUPPLY	AC220V 50 HZ	
COLOR FINISH	Standard	
DIMENSIONS		
ADDITION SPECIFICATION		
CHART	12 month	
INK	"	
	HONEY WELL	

THERMO CONTROLER
PANEL INSTRUMENT SPECIFICATION

PLANT INDEX NO.	EGAT BOILER SSH OUT LET TEMP CONTROLER	
TAG NO.	TRCA-	
CONTROLER		
TYPE	4641-2-5A220V-1/ALL/MTP2	
SCALE RANGE	200 ~ 500°C	
RECORDING POINT	1	
INPUT SIGNAL	C.A (JIS)	
ALARM TYPE	N. OPEN	
SCANNING CYCLE		
CHART SPEED		
BALANCE SPEED		
POWER SUPPLY	AC200V 50 HZ	
COLOR FINISH	Standard	
DIMENSIONS		
CONTROL ACTION	P + I + D (DIRECT)	
ADDITION SPECIFICATION		
CHART	12 month	
INK	"	
	YOKOGAWA	

TERMOMETER SPECIFICATION

INDEX NO.	EGAT BOILER SSH OUT LET, TEMP	
TAG NO.	TRCA-	
DETECTOR MEASURING ELEMENT DIAMETER of WIRE CONNECTION	C.A (JIS) 1.6 ϕ	
THERMOWELL TYPE MATERIAL INSIDE DIA OUTSIDE DIA INSERTION LENGTH TOTAL LENGTH STANDARD of CONNEC- TION	CH21-S-S1-22-300-A60-RF-40-/UN SUS 304 9 ϕ 22 ϕ 300 500 ANSI600RF	
QUANTITY	1	
REMARK	YOKOGAWA	

CONTROL VALVE SPECIFICATION

INDEX NO.	EGAT BOILER FEED WATER	EGAT BOILER SUPER HEATER OUT
TAG NO.	LCV-	TCV-
QUANTITY CONTROL VALVE TOP WORK SEAT TYPE CHARACTERISTIC VALVE ACTION DESIGN CV STD of CONNECTION FACE to FACE LENGTH POWER MATERIAL of BODY MATERIAL of TRIM SEALING METHOD BONNET JACKET SPEC SEAT PACKING GRAND PACKING LIMIT SWITCH	1 VDC VA3D 1 1/2 x 1 1/4 CAGE Eq % DIRECT 14 ANSI900RF 335 mm AIR 2.6 kg/cm ² G SCA52 SUS316ST ASBEST -	1 VST VA3R 1BxCv1.6 SINGLE Eq % DIRECT 1.6 ANSI900RF 290 mm AIR 2.6 kg/cm ² G SCA52 SUS316ST ASBEST -
POSITIONER TYPE INPUT SIGNAL OUTPUT SIGNAL AIR SET	HONEYWELL HTP 0.2 ~ 1.0 kg/cm ² G 0.4 ~ 2.0 " ATTACHED	HONEYWELL HTP 0.2 ~ 1.0 kg/cm ² G 0.4 ~ 2.0 " ATTACHED
FLUID COMPOSITION NORMAL FLOW MAXIMUM FLOW UPSTREAM PRESSURE PRESSURE DROP TEMPERATURE DENSITY (STANDARD) DENSITY (NORMAL) MOISTURE VISCOSITY PIPE SIZE STANDARD of PIPE	HOT WATER 13 T/H 42 T/H 59.5 kg/cm ² G 12.5 " 150 °C 1 1/2 B	HOT WATER 1 T/H 48 T/H 59.5 kg/cm ² G 12.5 " 150 °C 1 B
REMARK HAND WHEEL LUBRICATOR GREASE FLANGE for PIPING	WHEEL at VALVE SIDE YES 12 month ANSI900RF x 2 SHEET HONEYWELL	WHEEL at VALVE SIDE YES 24 month ANSI900RF x 2 SHEET HONEYWELL

THERMO RECORDER
PANEL INSTRUMENT SPECIFICATION

PLANT INDEX NO.	Gasification	Gasification
TAG NO.	TR-20/TR-24	TR-23
RECORDER TYPE SCALE RANGE RECORDING POINT INPUT SIGNAL ALARM TYPE SCANNING CYCLE CHART SPEED BALANCE SPEED POWER SUPPLY COLOR FINISH DIMENSIONS	NRM60-311F-X 0 ~ 150°C 6 point Pt100Ω at 0°C (JIS) — 6 Sec 20. 60. 120 mm/H 3 Sec AC220V 50HZ Standard	NRM60-2513F-X 0 ~ 1600°C 6 point PR (JIS) — 6 Sec 20. 60. 120 mm/H 3 Sec AC220V 50HZ Standard
ADDITION SPECIFICATION CHART INK	12 month " HONEYWELL	12 month " HONEYWELL

THERMO RECORDER
PANEL INSTRUMENT SPECIFICATION

PLANT INDEX NO.	Gasification	Gasification
TAG NO.	TR-1	TR-2/TR-3
RECORDER		
TYPE	NRM60-2413F-X	NRM90-3113F-X
SCALE RANGE	0 ~ 800°C	0 ~ 200°C
RECORDING POINT	6 point	12 point
INPUT SIGNAL	CA (JIS)	Pt100Ω at 0°C(JIS)
ALARM TYPE	-	-
SCANNING CYCLE	6 Sec	6 Sec
CHART SPEED	20. 60. 120 mm/H	20. 60. 120 mm/H
BALANCE SPEED	3 Sec	3 Sec
POWER SUPPLY	AC220V 50HZ	AC220V 50HZ
COLOR FINISH	Standard	Standard
DIMENSIONS		
ADDITION SPECIFICATION		
CHART	12 month	12 month
INK	"	"
	HONEYWELL	HONEYWELL

THERMO RECORDER
PANEL INSTRUMENT SPECIFICATION

PLANT INDEX NO.	Adip Plant	
TAG NO.	TR-4-11-01	
RECORDER		
TYPE	NRM90-3113F-X	
SCALE RANGE	0 ~ 200°C	
RECORDING POINT	12 point	
INPUT SIGNAL	Pt100Ω at 0°C (JIS)	
ALARM TYPE	-	
SCANNING CYCLE	6 Sec	
CHART SPEED	20. 60. 120 mm/H	
BALANCE SPEED	3 Sec	
POWER SUPPLY	AC220V 50HZ	
COLOR FINISH	Stanadard	
DIMENSIONS		
ADDITION SPECIFICATION		
CHART	12 month	
INK	"	
	HONEYWELL	

THERMO RECORDER
PANEL INSTRUMENT SPECIFICATION

PLANT INDEX NO.	Sulfulic acid plant	Sulfic acid plant
TAG NO.	TR-861-2	TR-861-1
RECORDER		
TYPE	NRM90-2113F-X	NRM90-2113F-X
SCALE RANGE	0 ~ 600°C	0 ~ 600°C
RECORDING POINT	12 point	12 point
INPUT SIGNAL	I.C (JIS)	I.C (JIS)
ALARM TYPE	-	-
SCANNING CYCLE	6 Sec	6 Sec
CHART SPEED	20. 60. 120 mm/H	20. 60. 120 mm/H
BALANCE SPEED	3 Sec	3 Sec
POWER SUPPLY	AC220V 50HZ	AC220V 50HZ
COLOR FINISH	Standard	Standard
DIMENSIONS		
ADDITION SPECIFICATION		
CHART	12 month	12 month
INK	"	"
	HONEYWELL	HONEYWELL

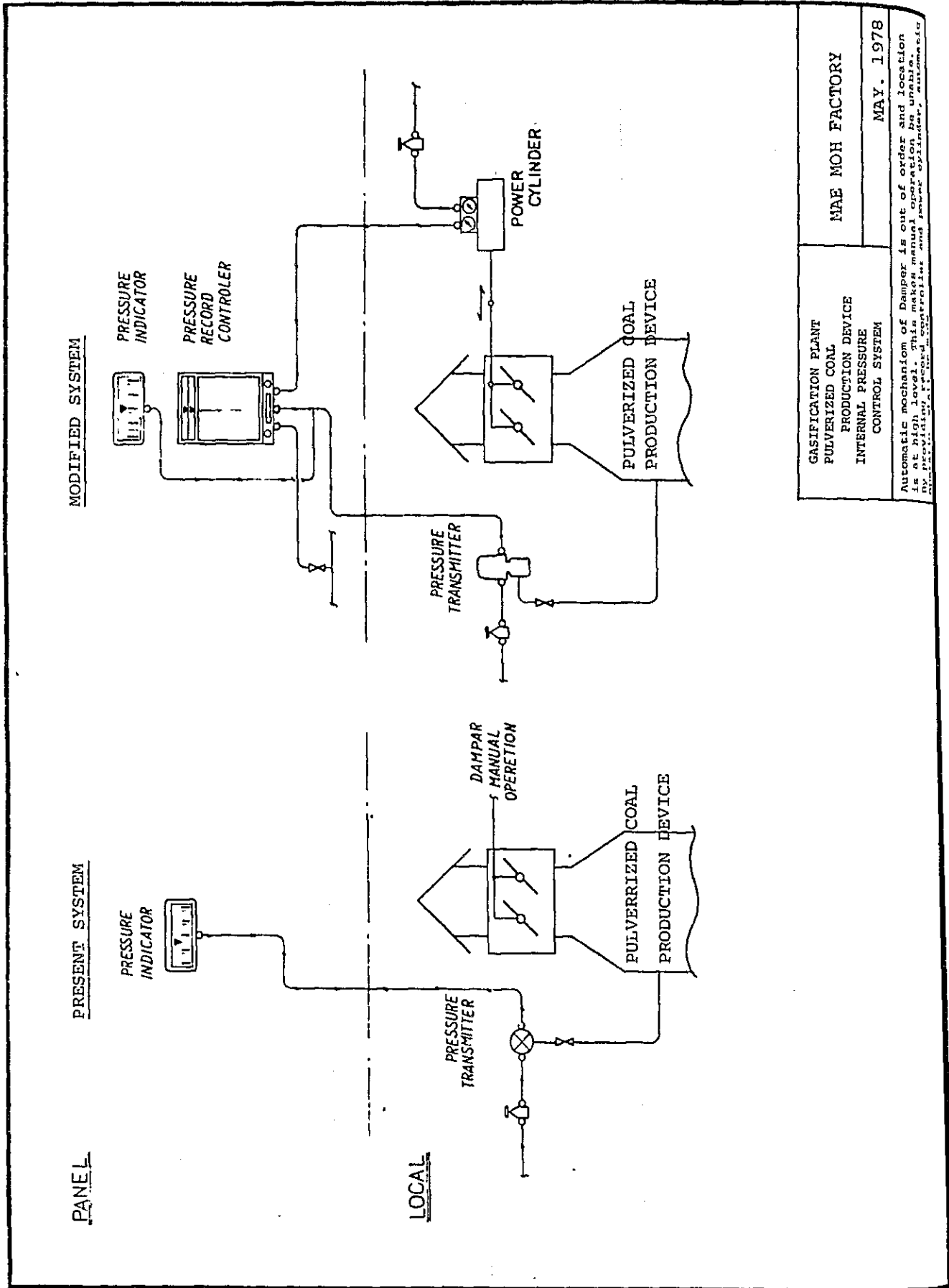
THERMO RECORDER
PANEL INSTRUMENT SPECIFICATION

PLANT INDEX NO.	Urea plant	Urea plant
TAG NO.	TR-3-44	TR-3-57-05
RECORDER		
TYPE	NRM90-3113F-X	NRM90-2213F-X
SCALE RANGE	0 ~ 200°C	0 ~ 250°C
RECORDING POINT	12 point	12 point
INPUT SIGNAL	Pt100Ω at 0°C (JIS)	I.C (JIS)
ALARM TYPE	—	—
SCANNING CYCLE	6 Sec	6 Sec
CHART SPEED	20. 60. 120 mm/H	20. 60. 120 mm/H
BALANCE SPEED	3 Sec	3 Sec
POWER SUPPLY	AC220V 50HZ	AC220V 50HZ
COLOR FINISH	Standard	Standard
DIMENSIONS		
ADDITION SPECIFICATION		
CHART	12 month	12 month
INK	"	"
	HONEYWELL	HONEYWELL

PRESSURE METER PLANT

PLANT INDEX	FEED WATER PLANT	
TAG NO.	PIC-3-65-02	
INSTRUMENT		
TYPE	Y/43AP-Y-A4-C/GAS-FM/P51	
SCALE RANGE	0 ~ 20 kg/cm ² G	
NORMAL PRESSURE	10 "	
ACTION	P + I (DIRECT)	
ALARM TYPE	--	
TRANSMITTER		
TYPE		
RANGE	0 ~ 20 kg/cm ² G	
OUT PUT	0.2 ~ 1.0 "	
SEALING		
DETECTOR		
TYPE		
TEMPERATURE	200°C	
MATERIAL (BODY)	SUS 316	
MATERIAL (IMPORTANT)	"	
STD of CONNECTION	PT Y2	
REMARK	OPTION (1) Bumpless Automatic- manual transfer (2) Air sets YOKOGAWA	

7-4-3 GASIFICATION PULVERIZED COAL PRODUCTION DEVICE



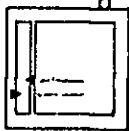
GASIFICATION PLANT PULVERIZED COAL PRODUCTION DEVICE INTERNAL PRESSURE CONTROL SYSTEM	MAE MOH FACTORY
MAY. 1978	

Automatic mechanism of Damper is out of order and location of damper is not known. This makes manual operation be unable. The provided record controller and power cylinder, automatic mechanism is not available.

PRESENT

RECORDER

SCALE 0 - 100 % SQRT
RANGE 0 - 4000 kg/h



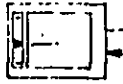
REMODEL

RECORDER

RANGE 0 - 4000 kg/h

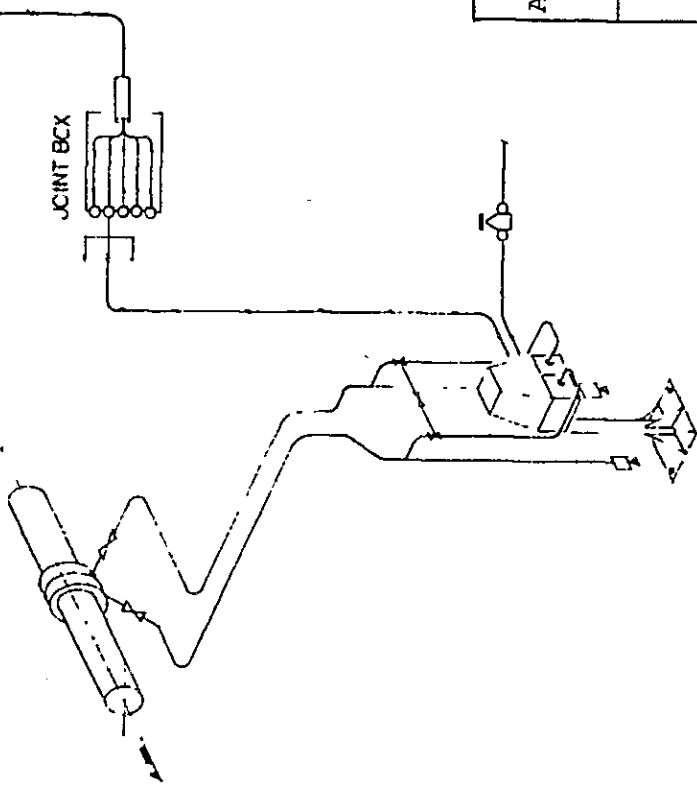
INTEGRATOR

1978



AC220V

LOCAL



AMMONIA PLANT	M&E MOH FACTORY
FRS-3-52-05	MAR. 1978
MODIFICATION OF MEASUREMENT METHOD FOR PRODUCT NH ₃ FLOW	

7-5 Plans for future modification and replacement

1. Cost for modification and replacement

(1000 Baht)

	For the year of 1979	For the year of 1980	Total of years
Modification Cost	825	1,042	1,867
Replacement Cost	5,501	3,355	8,856
Total Cost	6,326	4,397	10,723

For details, please refer to List of Modification Plan and Replacement Plan as indicated hereinafter. (In those lists, Rank-A means work to be performed in 1979 and Rank-B in 1980.)

Specifications shall be referred to List of Equipments.

3) Basis of Cost Estimation

- a) Cost of Equipment is at F.O.B.
- b) Construction cost is not included.
- c) Cost of specialists to be required for adjustment at site is included.
- d) Import duty and tax into Thailand are not included.

2. Cost for Replacement Plan

(1000 Baht)

Plant	Cost for each rank		Total
	A	B	
EGAT BOILER	71	-	71
FEED WATER	5	206	211
GASIFICATION	1,848	94	1,942
ADIP		52	52
AMMONIA	806	1,913	2,719
UREA	603	351	954
H ₃ SO ₄	767	335	1,102
AMMONIUM SULPHATE	307	404	711
Analyzer Adjustment (14 days 2 Engineers)	400	-	400
Measurement Equipment Cost	694	-	694
Total	5,501	3,355	8,856

4. Cost of Analyzer Adjustment

Plant	Tag No.	Break down of Cost (1000 Baht)
EGAT NO.1	O ₂ R-	Engineers Fee: 8 per man-day
" NO.2	O ₂ R-	Duration: 14 days x 2 Engineers
GASIFICATION	CO ₂ R-2	
"	O ₂ R-1	(1) Engineers Fee 8x14x2 = 240
AMMONIA	ARA-3-29-01	(2) Travelling Expense 50
"	AR-3-29-02	(3) Miscellaneous Expense 26
"	AR-3-31-01	(4) Standard Gas 100
"	ARA-3-43-02	
"	ARA-8-21-01	Total (1)+(2)+(3)+(4) 400
UREA	ARA-3-57-01	

Item	Description of Modification	Rank	Schedule of Modification	Allocation		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
LIC- (No indica- tion of TAG NO.) EGAT BOILER NO.1 STEAM DRUM	1) Newly equip control recorder 2) Newly equip control valve 3) Newly equip level gauge transmitter (Pressure Conduit Pipe be constructed by mechanical division)	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0		Control Recorder 600 Control Valve 1,250 Level Gauge Transmitter 300 Pressure Conduit Pipe 180 Instrumentation Work Material 50 (Cu. P. etc.) Total 2,380
O ₂ R- (No indica- tion of TAG NO.) EGAT BOILER NO.1 INSIDE FURNACE	1) Newly equip O ₂ Analyzer 2) Newly equip recorder 3) Sample piping work 4) Instrumentation work	A	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 2 days	0	0	O ₂ Analyzer 3,600 Recorder 340 Sample Piping Material 60 Instrumentation Work Material 20 Adjustment Fee (See attached Sheet) Total 4,020
LIC- (No indica- tion of TAG NO.) EGAT BOILER NO.2 STEAM DRUM	1) Newly equip control recorder 2) Newly equip control valve 3) Newly equip level gauge transmitter (Pressure Conduit Pipe be constructed by mechanical division)	B	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0		Control Recorder 600 Control Valve 1,250 Level Gauge Transmitter 300 Pressure Conduit Pipe 180 Instrumentation Work Material 50 (Cu. P. etc.) Total 2,380
O ₂ R- (No indica- tion of TAG NO.) EGAT BOILER NO.2 INSIDE FURNACE	1) Newly equip O ₂ analyzer 2) Newly equip recorder 3) Sample piping work 4) Instrumentation work	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 2 days	0	0	O ₂ Analyzer 3,600 Recorder 340 Sample Piping Material 60 Instrumentation Work Material 20 Adjustment Fee (See attached Sheet) Total 4,020

Item	Description of Modification	Rank	Schedule of Modification	Allotment		Estimated Cost
				Mae Moh Factory Staffs	Expat-Riate Staffs	
(GASIFICATION PLANT) HV-1 (O ₂ INLET)	1) Replace control valve (4 sets) 2) Manual Operation Device (4 sets)	B	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0		Control valve (4 sets) 2,690 Manual Operation Device (4 sets) 480 Instrumentation Work Material 60 Total 3,230
(GASIFICATION PLANT) PDI-1 (TUBULAR BOILER)	1) Newly equip differential pressure transmitter 2) Newly equip indicator	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Differential Pressure Transmitter 300 Indicator 100 Pressure Conduit Piping Material 60 Instrumentation Work Material 30 Total 490
(GASIFICATION PLANT) FA-4 (Waste Water Pit)	1) Newly equip fluid level	A	1) Delivery 4 months 2) Construction 7 days 3) Adjustment 1 day	0		Fluid Level Gauge 240 Cable (300 m) 60 Total 300
(ADIP PLANT) FCV-4-11-03 (REBOILER STEAM)	1) Solenoid valve will make FCV close, by rearrangement of Sequence.	A	1) Delivery 4 months 2) Construction 7 days 3) Adjustment 1 day	0		Solenoid Valve 80 Relay 30 Cable 60 Total 170
(H ₂ SO ₄ PLANT) PFC-060-1 (30K STEAM)	1) Newly equip record controller 2) Newly equip control valve 3) " " transmitter	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 1 day	0		Record Controller 600 Control Valve 750 Transmitter 210 Pressure Conduit Piping Material 90 Instrumentation Work Material 30 Total 1,680

7-5-2 LIST OF REPLACEMENT PLAN

EGAT BOILER

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
FI- (No indica- tion of TAG NO.) (HP STEAM FLOW)	1) Replacement of Transmitter 2) Replacement of Indicator	A	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Transmitter 250 Indicator 40 Pressure Conduit Pipe Materials 360 Instrumentation Work Materials 60 Total 710

FEED WATER PLANT

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost
				Mae Moh Factory Staffs	Expat-riate Staffs	
1) FR-3-65-01 (30K STEAM)	1) Orifice Plate replacement	A	1) Delivery 3 months 2) Construction 1 day 3) Adjustment 1 day	0		50 Orifice Plate
2) TIC-3-65-01 (10K STEAM)	1) Replacement of temperature/ Air converter 2) Replacement of Control Valve	B	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 1 day	0		380 Transmitter 410 Control Valve 30 Instrumentation Work Materials 820 Total
3) TIC-3-65-02 (3K STEAM)	1) Replacement of Controller 2) Replacement of Control Valve	B	1) Delivery 6 monthsh 2) Construction 14 days 3) Adjustment 1 day	0		380 Controller 410 Control Valve 30 Instrumentation Work Materials 820 Total
4) TR-3-65-03	1) Replacement of Recorder	B	1) Delivery 6 monthsh 2) Construction 2 days 3) Adjustment 1 day	0		420 Recorder

FASIFICATION PLANT (GRINDING SECTION)

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
1) PRCA-4 (ELECTRO FILTER)	1) Replacement of Record controller 2) Replacement of Transmitter 3) " of Power Cylinder	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 3 days	0		Record Controller 540 Transmitter 310 Power Cylinder 800 Instrumentation Work Material 60 Total 1,710
2) TRA-1 (COAL SHAFT)	1) Replacement of Recorder (6 points)	A	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 2 days	0		Recorder (6 points) 460
3) TRA-2 (GRINDING)	1) Replacement of Recorder (12 points)	A	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 2 days	0		Recorder (12 points) 520
4) TRA-3 (FINISHED DUST BUNKER)	1) To apply spare of TR-2 to recorder	A		0		
5) 1) O ₂ RA-1 (HOT GAS PRODUCER) 2) O ₂ RA-2 (ELECTRO FILTER) 3) O ₂ RA-3 (FINISHED DUST BUNKER)	1) Replacement of Sample Pump	A	1) Delivery 4 months 2) Construction 7 days 3) Adjustment 3 days	0		Pump (3 sets) 570

GASIFICATION PLANT (GRINDING SECTION)

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
6) HV-1,-2,-3,-4 HV-5,-6,-7 HV-8/1,-8/2,-9 HV-10,-11 HSVA-12 (GRINDING)	1) Replacement of Switch	A	1) Delivery 4 months 2) Construction 7 days 3) Adjustment 2 days	0		Switch (15 sets) (including 2 sets as spares) 360
7) LA-3 (FINISHED DUST BUNKER)	1) Replacement of Level Gauge	A	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 2 days	0		Level Gauge (2 sets) Wiring Materials Total 300 20 320

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
1) PRCA-19 (SYN-GAS BLOWER)	1) Replacement of Control Recorder 2) Replacement of Power Cylinder	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0		Control Recorder 540 Power Cylinder (2 sets) 1,100 Total 1,640
2) PRCA-21 (SYN-GAS BOOSTERS)	1) Replacement of Control Recorder 2) Replacement of Power Cylinder	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0		Control Recorder 540 Power Cylinder (4 sets) 2,200 Total 2,740
3) LCV-5 (STEAM DRUM)	1) Replacement of Control Valve	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Control Valve 440 Piping Materials 500 Total 940
4) SIA-1A1, A2, B1, B2 (REVOLUTION OF SCREW)	1) Replacement of Switch	A	1) Delivery 4 months 2) Construction 7 days 3) Adjustment 2 days	0		Switch (4 sets) 100
5) CO ₂ R-2 (THEISEN OUTLET)	1) Replacement of Analyzer 2) " of Recorder	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0	0	Analyzer 3,600 Recorder 340 Sample piping materials 60 Wiring materials 40 Adjustment Fee (see attached sheet) 4,040 Total
6) O ₂ RA-1 (SYN-GAS)	1) Replacement of Analyzer 2) " of Recorder	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0	0	Analyzer 3,600 Recorder 340 Sample Piping Material 60 Wiring Materials 40 Adjustment Fee (see attached Sheet) 4,040 Total

GASIFICATION PLANT

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
7) TR-23 (TUBLER BOILER)	1) Replacement of Recorder 2) " of Compensation conductor cable (PR)	A	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 2 days	0		Recorder (6 point) 460 Compensation Cable 70 Total 530
8) TR-24 (SYN-GAS)	1) Replacement of Recorder (input 6 point)	A	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 2 days	0		Recorder (6 point) 460
9) TR-20/1 (O ₂ MAIN)	1) To apply spares of TR-24 to Recorder	A		0		
10) HV-1A1,1A2,1B1,1B2 HV-2A1,2A2,2B1,2B2 HV-3,-4,-5,-6 HV-7A1,7A2,7B1,7B2 (SYN-GAS)	1) Replacement of Switch	A	1) Delivery 4 months 2) Construction 7 days 3) Adjustment 2 days	0		Switch (6 sets) 390
11) LA-2 (SERVICE BIN)	1) Replacement of Level Gauge	A	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 2 days	0		Level Gauge (4 sets) 580 Wiring Materials 20 Total 600

ADIP PLANT

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
1) TR-4-11-01 (ADIP)	1) Replacement of Recorder	B	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 2 days	0		Recorder (12 point) 520

AMMONIA PLANT

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat-riate Staffs	
1) TIC-3-29-04 (HEAT EXCHANGER I)	1) Replacement of Control Valve 2) " of Compensation Conductor Cable 3) Replacement of Protective Tube	B	1) Delivery 8 months 2) Construction 7 days 3) Adjustment 1 day	0		Control Valve (2 sets) (Butterfly Valve) 3,000 Compensation Cable 40 Protective Tube 50 Total 3,090
2) ARA-3-29-01 (OUTLET CO-CONVERTER) (CO)	1) Replacement of Analyzer 2) " of Recorder	B	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0	0	Analyzer 3,600 Recorder 340 Sample Piping Materials 30 Wiring Materials 60 Adjustment Fee (see attached Sheet) 4,030 Total 4,030
3) AR-3-29-02 (DRAIN WATER) (PH)	1) Replacement of PH meter 2) " of Recorder	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0	0	PH meter 580 Recorder 340 Sample Piping Materials 60 Wiring Materials 60 Adjustment Fee (see attached Sheet) 1,040 Total 1,040
4) AR-3-31-01 (OUTLET CO ₂ -REMOVAL) (CO ₂)	1) Replacement of Analyzer 2) " of Recorder	B	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0	0	Analyzer 3,600 Recorder 340 Sample Piping Materials 30 Wiring Materials 60 Adjustment Fee (see attached Sheet) 4,030 Total 4,030
5) ARA-3-43-02 (SYN-GAS) (CO+CO ₂)	1) Replacement of Analyzer 2) " of Recorder	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0	0	Analyzer 3,600 Recorder 340 Sample Piping Materials 30 Wiring Materials 60 Adjustment Fee (see attached Sheet) 4,030 Total 4,030

AMMONIA PLANT

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
6) ARA-8-21-01 (O ₂)	1) Replacement of Analyzer 2) " of Recorder	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 1 day	o	o	Analyzer 3,600 Recorder 340 Sample Piping Materials 30 Wiring Materials 60 Adjustment Fee (see attached Sheet) Total 4,030
7) TI-3-29-02 TI-3-43-01 TI-3-52-02 (AMMONIA PLANT)	1) Replacement of Thermo Indicator 2) Replacement of Input change- over Switch 3) Replacement of Compensation Conductor Cable	B	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	o		Thermo Indicator 550 Input Change-over Switch (40 point) 200 Compensation Cable (10,000 m) 3,120 Total 3,870
8) TR-3-29-01 (AMMONIA PLANT)	1) Replacement of compensation	B	1) Delivery 6 months 2) Construction 14 days	o		Compensation Cable (3,000 m) 940 Duct Materials 1,000 Total 1,940
9) TR-3-52-01 (NH ₃ CONVERTER)	1) Replacement of compensation	B	1) Delivery 6 months 2) Construction 14 days	o		Compensation Cable (3,600 m) 1,130

UREA PLANT

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
1) PRC-2-8-07 (2ND SEPARATOR)	1) Replacement of Ctrl Recorder	A	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 1 day	0		540 Control Recorder
2) LICA-3-57-08 (STEAM CONDENSATE TANK)	1) Replacement of Controller	B	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 1 day	0		360 Controller
3) LI-2-81-02 (UREA MALTING)	1) Replacement of Transmitter	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		420 Transmitter
4) ARA-3-57-01 (CO ₂ -COMP INLET O ₂)	1) Replacement of Analyzer 2) " of Recorder	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0	0	3,600 Analyzer 340 Recorder 30 Sample Piping Materials 60 Wiring Materials Adjustment Fee (See Attached Sheet) Total 4,030
5) TR-3-57-05 (UREA PLANT)	1) Replacement of Recorder 2) " of Compensation Cable	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 1 day	0		520 Recorder (12 point) 630 Compensation Cable (2,000 m) Total 1,150

UREA PLANT

ITME	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
7) TI-3-57-02 (UREA PLANT)	1) Replacement of Thermo Indicator 2) Replacement of Input Change- over switch 3) Replacement of Compensation Conductor Cable	B	1) Devlivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0		Thermo Indicator 550 Input Change-over Switch (14 point) 90 Compensation Cable 940 Total 1,580

H₂SO₄ PLANT

ITEM	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
1) FR-861-1 (DRYING TOWER OUT)	1) Replacement of Transmitter	B	1) Delivery 6 months	0		Transmitter 330
	2) " of Recorder		2) Construction 7 days			Recorder 240
			3) Adjustment 2 days			Instrumentation Work Materials 120
						Total 690
2) FI-868-1 (INLET FURNACE)	1) Replacement of Transmitter	B	1) Delivery 6 months	0		Transmitter 300
	2) " of Indicator		2) Construction 7 days			Indicator 100
			3) Adjustment 2 days			Instrumentation Work Materials 120
						Total 520
3) TR-868-3.3 (30K STEAM)	1) Replacement of Recorder	A	1) Delivery 6 months	0		Recorder (1 point) 430
	2) " of Compensation Conductor Cable		2) Construction 7 days			Compensation Cable 40
			3) Adjustment 1 day			Total 470
4) FR-868-3.2 (30K STEAM)	1) Replacement of Recorder	A	1) Delivery 6 months	0		Recorder 300
			2) Construction 7 days			Instrumentation Work Materials 60
			3) Adjustment 1 day			Total 360
5) LRC-861-1 (STEAM DRUM)	1) Replacement of Transmitter	B	1) Delivery 6 months	0		Transmitter 310
	2) " of Control Valve		2) Construction 14 days			Control Valve 570
			3) Adjustment 2 days			Total 880
6) DR-861-2 (H ₂ SO ₄)	1) Replacement of Analyzer	A	1) Delivery 6 months	0		Analyzer 2,400
	2) " of Recorder		2) Construction 7 days			Recorder 340
			3) Adjustment 1 day			Wiring Materials 90
						Total 2,830

H₂SO₄ PLANT

ITEM	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
7) DR-861-3 (H ₂ SO ₄)	1) Replacement of Analyzer 2) Replacement of Recorder	A	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 2 days	0		Analyzer 2,400 Recorder 340 Wiring Materials 90 Total 2,830
8) TR-861-1 (H ₂ SO ₄ PLANT)	1) Replacement of Indicator 2) Replacement of Compensation Conductor Cable	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0		Indicator 550 Compensation Cable (1,000 m) 630 Total 1,180
9) TR-861-2 (H ₂ SO ₄ PLANT)	1) Replacement of Recorder 2) Replacement of Compensation Conductor Cable	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Recorder (12 Point) 520 Compensation Cable (1,000 m) 320 Total 840
10) TR-868-2 (H ₂ SO ₄ PLANT)	1) Replacement of Recorder 2) Replacement of Compensation	B	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 1 day	0		Recorder (1 point) 380 Compensation Cable 40 Total 420

AMMONIUM SULPHATE PLANT

ITEM	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
1) FR-2-51-01 (CARBAMATE GAS)	1) Replacement of Transmitter 2) Replacement of Recorder	A	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Transmitter 250 Recorder 240 Pressure Conduit Pipe 80 Instrumentation Work Materials 40 Total 610
2) FI-2-51-02 (INLET SATURATOR)	1) Replacement of Site Indica- tion Flow Meter	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Site Indication Flow Meter 320 Pressure Conduit Pipe 60 Total 380
3) FI-2-51-03 (INLET SATURATOR)	1) Replacement of Site Indica- tion Flow Meter	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Site Indication Flow Meter 320 Pressure Conduit Pipe 60 Total 380
4) FrL-2-51-05 (NH ₃ WATER)	1) Replacement of Rotor Meter	A	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 1 day	0		Rotor Meter 220
5) FrL-2-51-12 (H ₂ SO ₄ 98%)	1) Replacement of Rotor Meter	A	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 1 day	0		Rotor Meter 220
6) FrL-2-51-13 (H ₂ SO ₄ 98%)	1) Replacement of Rotor Meter	A	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 1 day	0		Rotor Meter 220
7) FR-2-51-15 (NH ₃ GAS)	1) Replacement of Recorder	B	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 1 day	0		Recorder 240

AMMONIUM SULPHATE PLANT

ITEM	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat- riate Staffs	
8) PIA-2-51-01 (NH ₃ GAS)	1) Replacement of Transmitter 2) Replacement of Indicator	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Transmitter 210 Indicator 100 Pressure Conduit Pipe 60 Instrumentation Work Materials 60 Total 430
9) PRC-2-51-02 (NH ₃ GAS)	1) Replacement of Control Recorder 2) Replacement of Control Valve	A	1) Delivery 6 months 2) Construction 14 days 3) Adjustment 2 days	0		Control Recorder 540 Control Valve 680 Instrumentation Work Materials 60 Total 1,280
10) PRCA-2-51-09 (COOLING WATER)	1) Replacement of Control Recorder	B	1) Delivery 6 months 2) Construction 2 days 3) Adjustment 1 day	0		Control Recorder 540
11) LIA-2-51-01 (H ₂ SO ₃ HEAD TANK)	1) Replacement of Purge Set 2) Replacement of Transmitter 3) Replacement of Pressure Gauge with Contactor	A	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Purge Set 110 Transmitter 250 Pressure Gauge with Contactor 80 Instrumentation Work Materials 60 Wiring Materials 20 Total 520
12) LIC-2-51-02 (NH ₃ EVAPORATOR)	1) Replacement of Control Valve	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Control Valve 380
13) LIA-2-51-03 (NH ₃ EVAPORATOR)	1) Replacement of Level Gauge	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Level Gauge 190 Wiring Materials 20 Total 210

AMMONIUM SULPHATE PLANT

Item	Description of Replacement	Rank	Schedule of Replacement	Allotment		Estimated Cost (1000 Yen)
				Mae Moh Factory Staffs	Expat-riate Staffs	
14) LIA-2-51-08 (LYE-TANK)	1) Replacement of Purge Set 2) Replacement of Transmitter 3) Replacement of Pressure Gauge with Contactor	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Purge Set 110 Transmitter 250 Pressure Gauge with contactor 80 Instrumentation Work Materials 30 Total 470
15) LI-2-51-10 (SULPHURIC ACID TANK)	1) Replacement of Transmitter	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Transmitter 350 Instrumentation Work Materials 60 Total 410
16) TIC-2-51-09 (NH ₃ SUPER HEATER)	1) Replacement of Controller	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Controller 390
17) TI-2-51-06/1v4 (A.S PLANT)	1) Replacement of Thermo Detector Edge 2) Rewiring In lieu of replacement of Indicator, spare parts of TR-2-51-01 shall be used.	B	1) Delivery 6 months 2) Construction 7 days 3) Adjustment 1 day	0		Thermo Detector Edge 130 Wiring Materials (3W) 80 Total 210

SECTION 8

REPORT FOR ELECTRIC FACILITIES

Section 8 Report for Electric Facilities

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8-1 Summary

Investigation of the electric facilities of Mae Moh Factory could not be carried out to the satisfactory extent during the open-checking periods, since it took more time to perform the investigation and supervision for the instrumentation during our staying periods.

Power interruption has occurred very often and unexpectedly, due to unstable power supply from the thermal power plant of EGAT (Electricity Generation Authority of Thailand). However, it can be expected that this unstable power supply condition will be gradually stabilized, in consideration of a factor of the new power plants just commissioned.

Though whole plant has been overaged, electric facilities such as transformer, small motors, circuit breakers, electric cables, etc., are maintained in good conditions, in general. However, protective relay for safety circuit, provided against the trouble of electric interruption or voltage drop, seem to be overaged. Relays in such conditions actually caused the stop trouble of the large motor due to their mal-function during our stay.

In case they would be left as they are, outbreak of mal-functioning due to overaged relays and damage of relays will be increased gradually. Therefore, immediate replacements of those relays are required, where it is recommendable to start replacement of those relays from such important parts as large synchronous motors.

Furthermore, at each stopping of large synchronous motors, as the electric insulation of main motor has been dropped, cleaning of the motors is required.

Measurement of earth resistance was made for almost all points of each equipment and lightning rod. Earth resistance showed good result, while cables for lightning rod were repaired, as they were disconnected at some point and almost disconnected at underground portion.

For the future maintenance, it is necessary to put in force the appropriate measure for electrical grounding. Especially, for sulphuric acid plant and ammonium sulphate plant, periodical checking is recommendable.

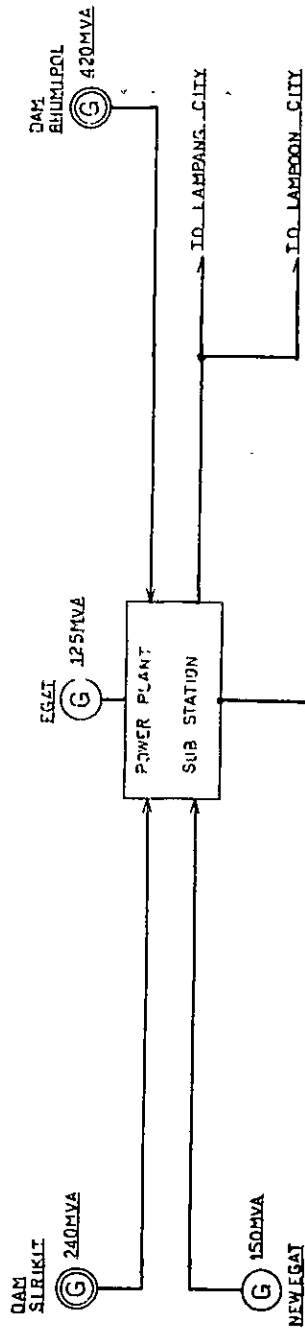
Working organization of electricity workshop is composed of two groups, that is, power distribution and motor repairing which constituent ages are rather high and their workabilities are deligent. Re-winding of coil for small motor or small transformer can be done by themselves.

8-2 Electric Distribution System of Whole Factory

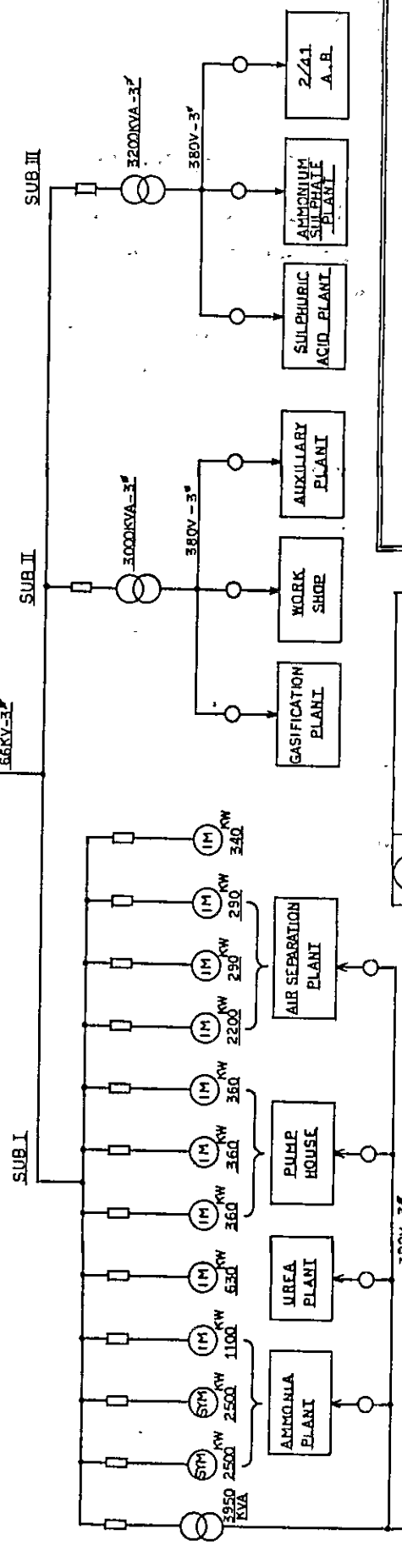
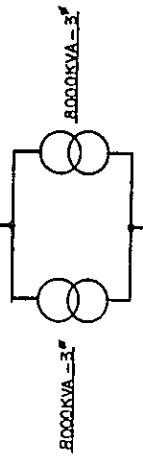
System diagram of electric distribution of Mae Moh Factory is shown on the next page, for alternative current and direct current. Electric power of 11 KV supplied by EGAT, is stepped down by two transformers which has the capacity of 8 MVA respectively I, II & III.

Alternative currents provided are 3 phase 6 KV, 3 phase 380 V and single phase 220 V, and direct currents provided are 220 V and 42 V.

As shown on the diagram, 6 KV is used for large motors and 380 V is used for middle and small motors. A.C 220 V is used for construction work, illumination and temporary facilities, and D.C 220 V and 42 V are used for electricity control circuit. For D.C power, it is supported by battery unit. Rated consumption per day is estimated as 300,000 KWH. Electric power consumption per day under 70% load operation of whole plant is 280,000 KWH at present.












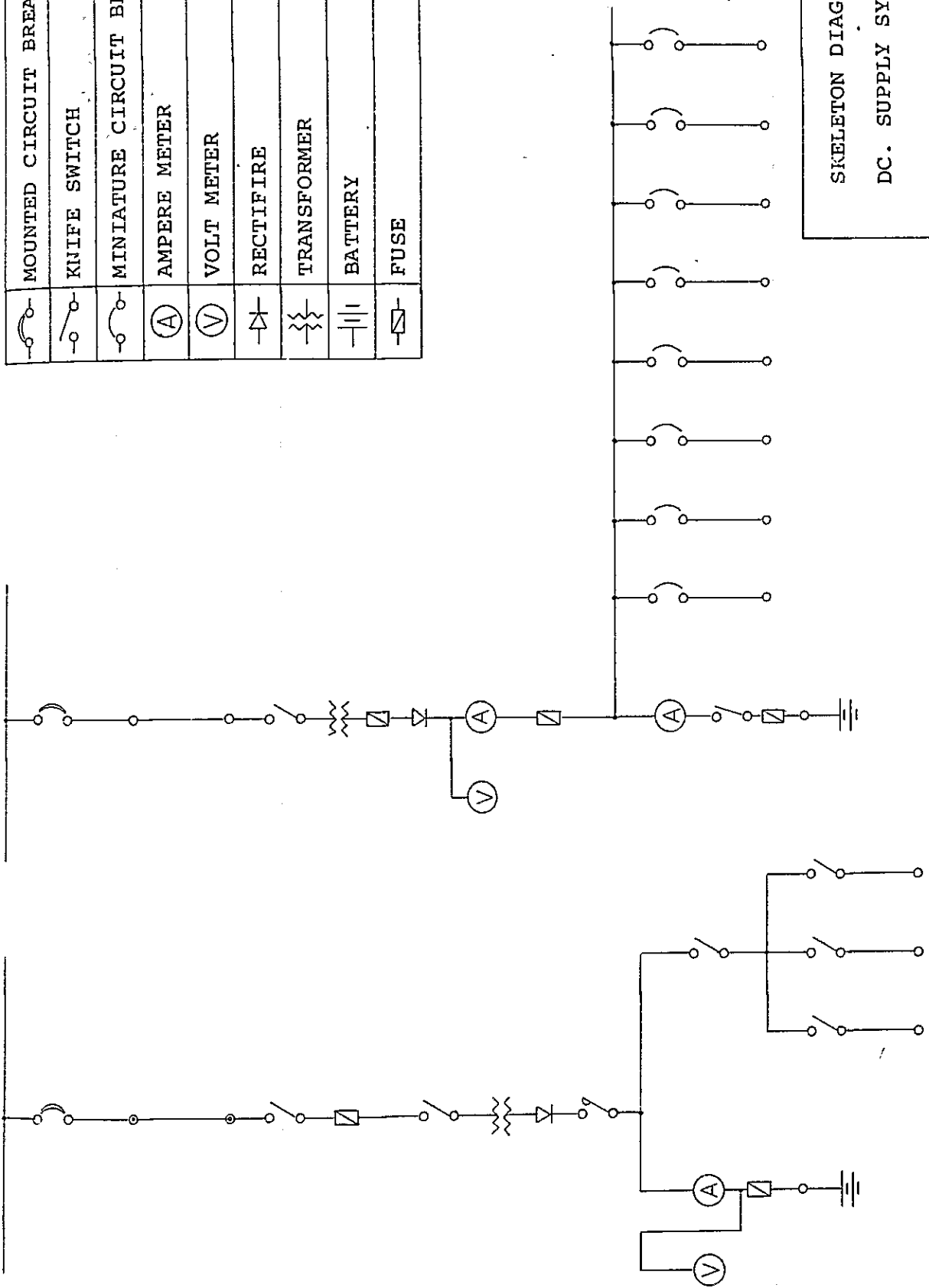
C.F.C.
THREE PHASE SHORT CIRCUIT CAPACITY 345KVA.



	HEAT POWER PLANT
	HYDRAULIC POWER PLANT
	TRANSFORMER
	H.V. CIRCUIT BREAKER
	L.V. CIRCUIT BREAKER

SKELETON DIAGRAM OF DISTRIBUTION SYSTEM

	MOUNTED CIRCUIT BREAKER
	KNIFE SWITCH
	MINIATURE CIRCUIT BREAKER
	AMPERE METER
	VOLT METER
	RECTIFIER
	TRANSFORMER
	BATTERY
	FUSE



SKELTON DIAGRAM OF
DC. SUPPLY SYSTEM

8-3 Electric Power Consumption

Under normal operation of 70% load, electric power consumption per day is a little less than 280,000 KWH, and under maintenance operation, it is 30,000 to 50,000 KWH. Even for 100% load operation, electric power capacity is enough.

On consideration of the convenience for the future electric maintenance work, motor list of whole plant is attached.

8-4 Maintenance for Equipment of High Voltage

Among those electric equipments as transformer, breaker, power-fuse, disconnecter, condensor, reactor, etc., maintenance conditions were investigated for transformer and breaker which usually affect the electrical facilities. Maintenance of the special high voltage, high voltage and other transformer were revealed to have been made in good condition, in general, on their cooling systems, deterioration of oil, N₂ charging, thermometer, etc.

Circuit Breaker for high voltage is Air Circuit Breaker type, utilizing the pneumatic power, the maintenance of which is in good condition on its air supply source portion, breaker portion, movable portion, etc.