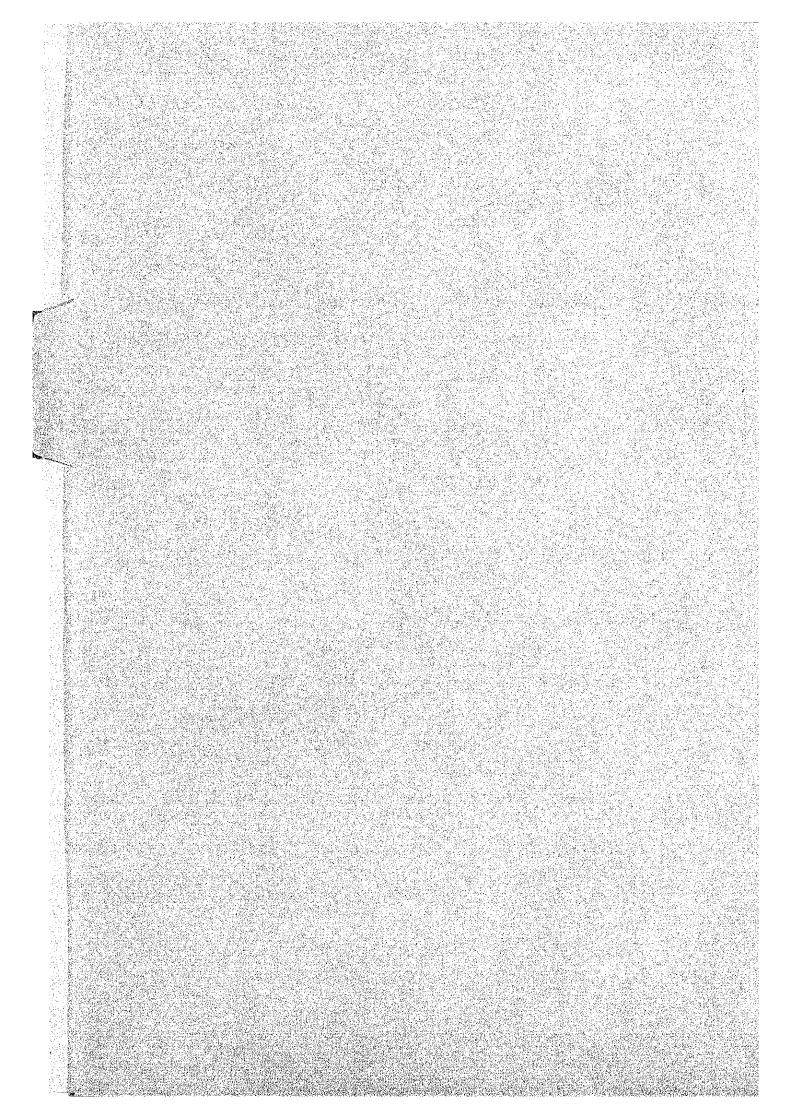
APPENDIX-7 TESTING ITEMS AND PROCEDURES



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'보이고 있는데 보이고 있는데, 스토팅 그는데 보는 보이고 있는데 그렇게 되고 있는데 보이고 말했다. 이 후에 되는데 보이고 말했다. 그런데 그렇게 되었다. 그 보다. - 이 후에 대한 경우는 그렇게 그리고 있다. 이 그렇게 되었는데 이 그는데 보고 있는데, 그는데 그렇게 하는데, 나를 되었다. 그 보다.
<u> 프로젝트에 보다는 토막으로 하는 것은 네트로 되고 있는데 나는 통상 연락이 중요.</u>
에 가는 사람들은 사이들은 마음에 보는 그들에 이 것을 하여 한국을 받았다. 그 그들을 하는 이 것은 사람들이 하는 사람들이 가장 없는 사람들이 하였다. 그는 것이 사용적 회에 가는 사람들이 하는 사람들은 사람들이 되는 사람들이 되었다. 하는 사람들이 하는 것을 받아 있습니다.
고기 교통으로 가게 되었고 있다. 그는 문제가 되는 그들은 가게 되었다. 그는 그리고 하는 것이 되었다. 그는 사람들은 그들은 사람들은 사람들은 사람들은 사람들이 되었다. 그는 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은
는 하늘 마음 마음이 많은 이 사람들은 마음이 발표를 들었다. 그렇게 되었는데 모르게 보고 있는데 모르게 되었는데 다른데 다른데 되었다. 그 마음에 마음에 되는데 말이 되었다. 그들은 이 사람들은 사람들은 사람들은 사람들이 하는데 모르는데 모르는데 그렇게 되었다. 그렇게 되었다.
불로, 하고 병을 하는 하는 후를 만든다. 불물로 몰로는 이불물 먹는 한 본 일본 살이다.
고 있는 경기로 발표되는 경기로 보는 그는 그는 그는 그는 그 그리고 그리고 있다.
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요. 하면 없는 물 하는 사이를 보고 있다. 그런 하는 것으로 보고 있다. 그런 사람들이 되는 것으로 보고 되었다. 그런 그런 그런 그런 그런 그런 그는 것을 했다. 그런 사람들이 보고 있는 것으로 보는 것으로 하는 것이 되었다. 그런 그런 그는 것으로 보고 있는 것은 것을 하는 것으로 보고 있다. 그런 그런 그런 그런 것으로 보고 있다.
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마을 작용하는 생산 등학에 가장 등 중심한 장면 가능하여 한 경기를 보고 있다. 그는 사람들이 되었다. 100년 1일 12년 1일 12년 12년 12년 12년 12년 12년 12년 12년 12년 1 1일 10년 12년 1일 1일 12년
보면 보고 1980년 1일 대한 교육 1일 22 12 12 12 13 13 14 15 15 16 16 16 16 16 16 16 16 16 16 16 16 16
용 보다를 지내고 하는 그는 폭력 고객들은 경험을 하면 하게 되었다. 한 경험을 하는 것이 되는 것이 되는 것이 되었다. 하는 성도 하나 중에 되는 것을 된 것 같아 그들을 것 같아. 그렇게 되어 보다는 것을 것 같아 되는 것을 하는 것이 되었다.
중에 하면 하는 가장하는 것, 당한한 강한 강력을 하면 하는 사람들이 함께 당면 물론 생생물의 경험이 가장 보다는 다음이다. 그는 사람이 되었다. 그는 사람이 되었다. 참 하는 통령한 경험이 하는 것이 되었다. 그는 사람들은 전략 기를 가려 있다. 그는 것이 되었다. 그는 것은 것은 것은 것은 것이 되었다. 그는 사람들이 되었다. 그는 것이 되었다.
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등하는 일반 이 경에서 한 시간을 보고 하는데 하는 것은 사람들이 들어들은 그리고 있다면 하는데
마음 사용 경기 기업이 되고 있었다. 그런 가는 이 이 경기를 보고 있는 것이 없는데 보고 있다. 그런
는 사람들이 살려면 가는 것을 것을 했다. 그런 사람들이 살려면 함께 함께 함께 함께 함께 되었다. 그런

I. Testing Items

Generally, testing items to be carried out during overhauling should include at least boiler safety valve, steam turbine emergency shut-down device, auxiliary oil pump and emergency oil pump for steam turbine, condenser, feed water pumps, forced draft fans, gas recirculation fan, air preheaters and feed water heaters.

Overhauling records should be reported in detail, and covers dismantling, reassembling records and its method, scope of repair works, calibration and adjusting records including data and information and test records.

Testing items to be carried out during overhauling are as follows:

- 1) Hydraulic test
 - 2) Safety valve test
 - 3) Boiler tripping interlock test
 - 4) Feed water pump test
 - 5) Fuel oil pump test
- 6) Air preheater test
 - 7) Soot blower test
 - 8) Light off and pressurization test
 - 9) Turbine major valve test
 - 10) Turbine tripping interlock test
 - 11) Vacuum up test
- 12) Turbine stretch out test
 - 13) Turbine acceleration test

- 14) Lubricating oil system test
- 15) Feed water heater leak test
- 16) Condensate pump test
- 17) Circulating water pump test
- 18) Generator
- 19) Transformer

II. Testing Procedures

II - 1. <u>Hydraulic test</u>

 a) Apply pressure to boiler with the aid of boiler feed water pump.

and the property of the street of the street

- b) Use pure water of temperature at about 40°C.
- c) Pressure increase and decrease rates should be 3~5 kg/cm²/minute, and pressurize at the slower rate in proximity to maximum working pressure.
- d) Safety valve should be mechanically locked with the aid of gag at pressure of about 80% of maximum working pressure.
- e) 1.15 times of maximum working pressure should be kept for about 30 minutes to 1 hour.

Check items Leak from any portion of boiler Distortion and deformation of tubes, headers,

II - 2. Safety valve test

 a) Pressurize boiler up to spouting pressure setting with small capacity burner.

- b) In case of drum type boiler, keep the drum level low since the level increases after spouting of safety valve.
- c) Another safety valve except testing safety valve should be mechanically locked with gag so as not to be spouted.
- d) After safety valve spouting, decrease firing rate and open the drain valves so that the boiler pressure decreases.
- e) Close the drain valves at adequate pressure for next safety valve tests.
- f) Use precise pressure gauge temporarily installed for safety valve test.
- g) Safety valve test can be carried out with use of hydraulic jack.

Check items

Popping pressure Reset pressure Blowing down pressure Safety valve lift

Working condition

II - 3. Boiler tripping interlock test

All of actual unit trip may not be carried out in accordance with the test items described below, some of them can be tested only by relay.

- a) Both FDFs trip test:
 - Trip the FDF by manual operation. FDF should be tripped one by one.

	2) When one FDF tripped, confirm the damper condi-
	tions (opened or closed).
and the second s	3) Trip another FDF by manual operation. Confirm
	the damper conditions.
	<u>Check items</u>
	Alarm annunciation
	Damper interlock
	b) Reheater protection interlock test:
	1) Decrease fuel flow gradually up to interlock set-
	ting.
	2) Confirm setting point and alarm annunciation.
	<u>Check items</u>
	Alarm annunciation
	Fuel flow setting and timer setting
	Air flow
	c) Furnace draft high interlock test:
	1) Increase furnace draft gradually by closing gas
	side damper.
	2) Confirm pressure setting and alarm annunciation.
	Check items
	Alarm annunciation
	Pressure setting point
	d) Fuel oil low pressure interlock test:
	1) Decrease fuel oil header pressure by gradual
	closing fuel oil flow control valve.
	2) Confirm pressure setting point.

	OTTOW 1 DEMO
	Alarm annunciation
	Confirm the pressure setting point and timer setting point
	Fuel oil pumps stoppage
and the second s	Fuel oil shut-off valve closed
e) Purge inter	lock test:
1) Operate	FDFs.
2) Confirm	the damper conditions.
3) Purge t	he furnace for about 5 minutes at about
30% air	flow up to MFT reset.
	Check items
	Air flow
	Purge timer setting
	Alarm annunciation reset
	Fuel oil system interlock after MFT reset
	Fuel oil shut-off valve Light oil shut-off valve Fuel oil pump Light oil pump Fuel oil burner valve Light oil burner valve

Feed water pump test (motor-driven)

- a) Auxiliary oil pump auto start test.
- b) Start BFP-M keeping discharge valve fully closed.
- c) Open the discharge valve gradually.
- d) Adjust the feed water flow until the minimum flow control valve closes.

in the second control of the second control	
	Check items
	Abnormal sound and vibration
	경우 등 경우 경우 경우 이 경우 이 경우 이 경우 이 경우 이 경우 이
	Bearing lubricating oil temperature and pressure
	Auxiliary oil pump auto-start pressure set point
	Cooling water flow
	Motor current
	Inlet and outlet feed water pressure
	Minimum flow control flow set point
	Leakage from pump gland
II - 5. Fuel oil pu	mp test
a) Start f	uel oil pump after formation of fuel oil line
from pu	mp discharge to fuel oil storage tank.
	Check items
	Abnormal sound, vibration
	Bearing temperature
	Motor current
	Fuel oil temperature
	Differential pressure between inlet and outlet of oil strainer
	Operating condition of pump discharge relief valve
	Oil leakage from the pump and pipings
II - 6. <u>Air preheat</u>	en test
a) Operate	the AH with motor or air motor.
	Check items
	Abnormal sound, vibration
	Bearing temperature

- 7 -
Lubricating oil temperature
Lubricating oil flow
Cooling water flow
AH balancing
Motor current
Gas side differential pressure
Air side differential pressure
Inlet and outlet temperature of AH
II - 7. Soot blower test
a) Confirm normal operation of auxiliary steam pressure
control valve.
b) Confirm the drainage before blowing test.
c) Blowing test from remote control panel in the central
control room.
Check items
Abnormal sound, vibration
Blowing steam pressure
Travelling speed, blowing time
Emergency extraction
Steam leakage from head valve and pipings
II - 8. <u>Light off and pressurization test</u>
a) After the confirmation of boiler protection device
functions, operate the equipments necessary for unit
start-up.
<u>Check items</u>
Burner operating condition
Burning condition

	en de la companya de La companya de la co
	Water, steam and gas temperature
	Temperature increase rate
	Steam quality
	Furnace expansion
	Expansion of pipe hanger
	Gas, water, drain and steam leakage
II - 9.	Turbine major valve test
	a) Main stop valve:
	This valve should be tested at turbine start-up, unit
	loading and unit shut-down.
기 시청 사이 중요 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등 등	Check items
	Stroke of valve lift
	Full stroke operating time
	Operating condition
	Interlock
	Indicating lamps and positioner
	Limit switches
	b) Governing valve:
	This valve should be tested at turbine start-up, unit
	loading and unit shut-down.
	<u>Check items</u>
	Oil cylinder stroke and opening
	Operating condition
	Indicating lamps and positioner
가입니다. 남자 전 기계 유럽하고 있는 경우에 있다.	Balancing valve
	Lead pipe, drain valve

	Valve lift
	Limit switches
c)	Reheat stop valve:
	This valve should be tested at turbine start-up, unit
	loading and unit shut-down.
	Check items
A Section	Valve stroke
	Operating condition
	Interlock
	Indicator and positioner
	Limit switches
d)	Intercept valve:
	This valve should be tested at turbine start-up, unit
	loading and unit shut-down.
	<u>Check items</u>
	Valve stroke
	Full stroke operating time
	Operating condition
	Interlock
	Balancing valve
	Limit switches
	Indicator and positioner
II - 10. <u>Tu</u> r	bine tripping interlock test
A1 1	of actual unit trip may not be carried out in accordance

with the test items described below, some of them can be

tested only by relay.

	~ 10 ~
a)	Manual trip lever test:
	This test should be carried out before turbine start-up.
	<u>Check items</u>
ing kalanggan belagi dalam dalam belagi dalam belagi dalam belagi dalam belagi dalam belagi dalam belagi dalam Belagi belagi dalam	Operating condition
	Alarm annunciation
	Indicating lamps
	Interlock with turbine major valves
b)	Vacuum trip test:
	1) Operate air ejector, and vacuum up to about 700mmHg.
	2) Open gradually vacuum break valve.
	<u>Check items</u>
	Confirmation of low vacuum set point
	Alarm annunciation
	Interlock with turbine major valves
II - 11. <u>Vac</u>	uum up test
	Operate gland steam regulator and air ejectors, and
	vacuum up. If the vacuum up rate will be slow, check
	the leakage.
	<u>Check items</u>
	Vacuum up rate
	Leakage and extraction air
	Gland steam regulator
II - 12. <u>Tu</u>	bine stretch out test
	After steam admission to turbine, turbine casing should
	be heated uniformly changing condenser vacuum.

		Chook stame
		Check items
		Casing expansion
	***************************************	Uniform expansion
		Eccentricity
		Bearing oil temperature and pressure
		LP turbine exhaust steam temperature
	i serie 65 ûni. Volumente	Vacuum Teelisesse een en terrete en terrete en de la dela de
		Abnormal sound
		Chest metal temperature
II - 13. 1	Turbine accel	eration test
		ing gear is disengaged, stop the steam
		turbine and carry out rub check. Confirm
	and the second section of	no abnormality, then accelerate turbine
1	revolution.	Pay attention to bearing oil temperature and
•	adjust the o	il cooler.
		Check items
	ter ben frankling <u> </u>	Turbine speed
		Eccentricity
		Expansion
		Differential thermal expansion
		Vibration
		Abnormal sound
		Bearing oil temperature and pressure
		Governing oil pressure and control oil pressure
		Metal temperature inside and outside of chest
		Oil pressure set point of auxiliary oil pump stop
		Operating conditions of governor

	12 -
11 - 14.	Lubricating oil system test
	(Turning oil pump, auxiliary oil pump and emergency oil
	pump)
	a) Automatic start-up of the oil pumps should be tested
	after reassembling of the oil units.
	b) Confirm that the oil pumps start at the normal set
	point pressure.
	Check items
	Abnormal sound
	Vibration
	0il pressure
	그는 인팅원이 타양분이 발달한 취약하는 하면 없는 것이 그런 생생했다. 그는 네가 있는 것이 없는 것이 없는 것이다.
	Set point of automatic start-up
II - 15.	Leakage from oil pipings and flanges Feed water heater leak test
11 - 15.	
	Apply pressure to water chamber of feed water heater, and
	confirm that there is no leakage from heating tube.
	Check items
	Leakages
	Test pressure
11 - 16.	Condensate pump test
	Check items
	Abnormal sound
	Vibration
	Bearing temperature
	Motor current
	Suction and discharge pressures
	Leakage from pump gland
	[현실] 등 기본 (기본 기본 기

I - 17. Circulat	ing water pump test
	<u>Check items</u>
	Abnormal sound
	Vibration
	Bearing temperature
	Motor current
	Suction and discharge pressure
	Bearing cooling water flow
	Lubricating water flow
la politica i Navy estale. Politica i Pierra	Cooling water solenoid valve
	Interlock

II - 18. Generator

a) Leak test of generator:

Leak test should be carried out after reassembly of generator and seal oil unit.

- Operate seal oil unit including stand-by of back-up system.
- 2) Supply the generator with freon gas by 0.5 or 1.0% of generator capacity and with air up to specified pressure.
- 3) Check leakage at valve flange and other places completely by soap method and freon gas detector.
- 4) After leak check, pressurize up to specified pressure then close the air supply valve.
- 5) Read the generator pressure by mercury manométer and temperature.

- 6) Keep the above condition for 6 hours at least.
- 7) Compute leakage quantity by the following formula:

L=0.0316
$$\frac{V}{H}$$
 [(M1-M2) - $\frac{T1-T2}{273+T1}$ (M1+B1) + (B1-B2)]

L: Leakage quantity at 760mHg and T1 $[m^3/day]$

H: Time (hour)

V: Capacity of generator and pipeline (m^3)

B1, B2: Atmospheric pressure before/after test [mmHg]

M1, M2: Generator pressure before/after testing [mmHg]

T1, T2: Generator air temp. before/after testing $\binom{0}{C}$

Air quantity dissolved into oil:

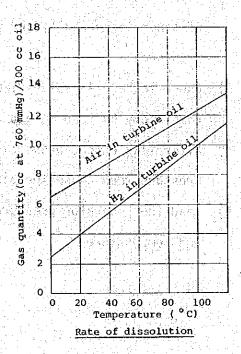
a = 1.44 QAP

as dissolved air into air $\left(m^3/day\right)$

Q: return flow of oil [1/min]

A: rate of dissolution (See Figure shown below)

P: Absolute gas pressure atm



Actual gas leak:

$$Lair = L-a$$

$$Lh = 3.75 \times \sqrt{\frac{Ph}{Pair}} \cdot Lair$$

Lair: Leakage quantity at Pair m³/day of air (760 mmHg at T1)

Lh: Leakage quantity at Ph of hydrogen (760 mmHg at T1) m³/day

Pair: Air press. (kg/m²abs)

Ph : H₂ press. (kg/m²abs)

- 8) Compare data with past record and guaranteed figure by manufacturer.
- b) Test of seal oil unit:
 - 1) Alarm test
 - 2) Back-up test
 - 3) Adjustment of seal oil pressure
- c) Stator coil cooling water system:
 - i) Megger test before filling water
 - 2) Performance check of ion exchanger
 - Leak test of stator cooling water system
 - 4) Characteristic test of cooling water pump
 - 5) Performance test of temperature control valve and pressure reducing valve
 - 6) Check of thermocouple and conductivity meter
 - 7) Measurement of flow rate and pressure of each part
 - 8) Annunciator and interlock test

II - 19. Transformer

- a) Megger test
- b) Operation test of cooling fan and cooling oil pump
- c) Automatic start-stop test of cooling fan
 - d) Annunciator test
 - e) Insulation oil breakdown test

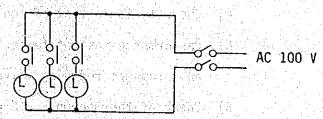
Circuit breaker (230 KV and 115 KV):

- a) Operation test
- b) Megger test
- c) Alarm test
- d) Insulation oil test (115 KV)(breakdown test and measurement of neutralization number)
- e) Open-close test

Arabes est

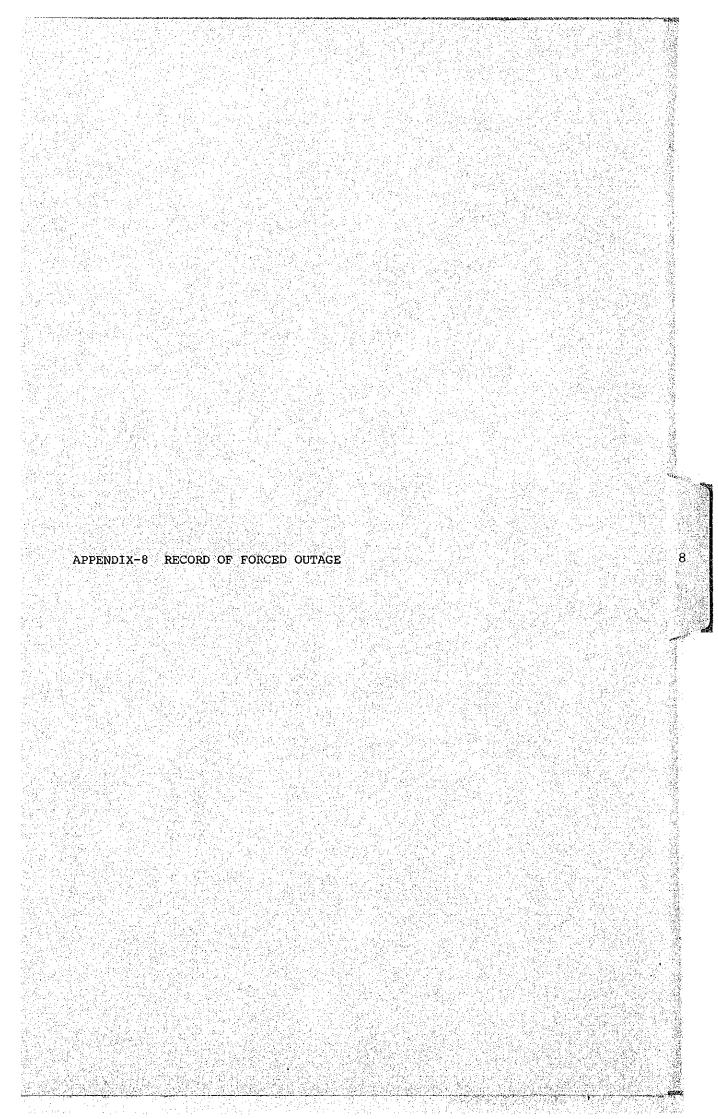
- Measurement of contact timing

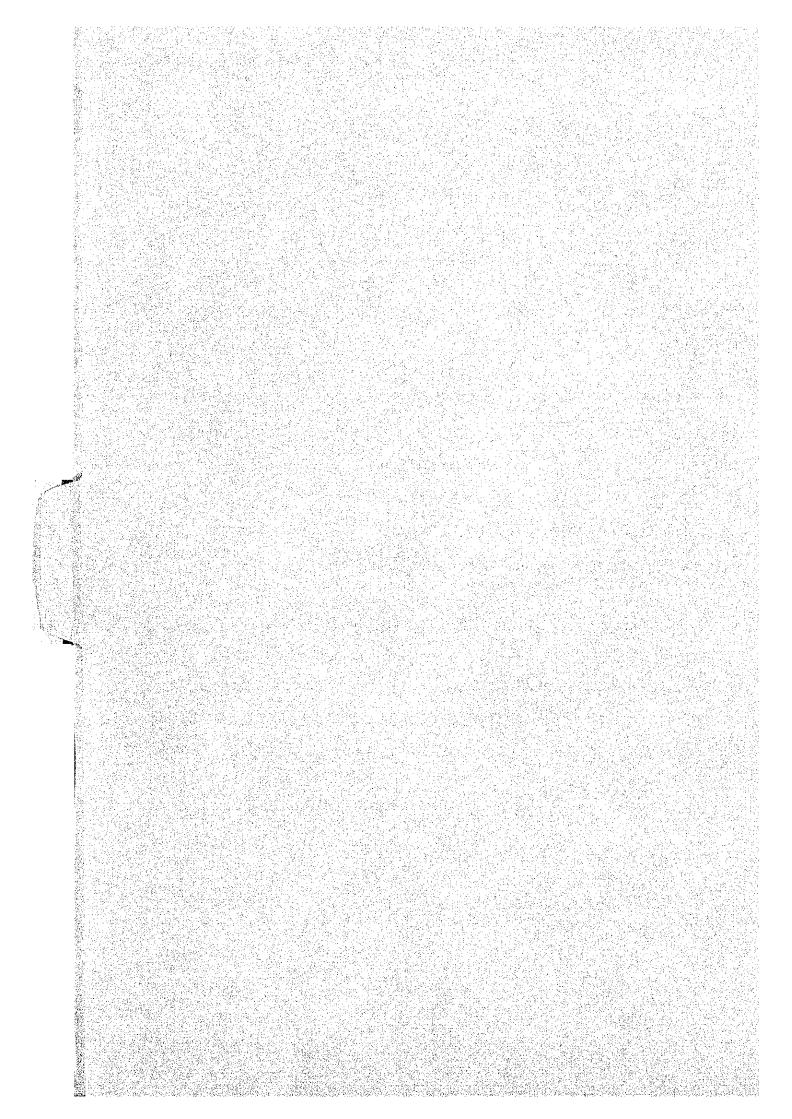
All contacts to be closed simultaneously should be confirmed by lamp test method while moving contact slowly by hand.



₹ Measurement of switching time

Time for open and close can be measured by oscillograph.





		TI	T L	<u>E</u>						PAGE
I.	HISTORICAL RECORD) OF	TROU	BLE	FOR	EACH	UNIT			1
II.	GARDNER UNIT NO.	1 -							~ ~	3
III.	GARDNER UNIT NO.	2 -								5
IV.	SNYDER UNIT NO.	1		• •• •• «	: 			·		8
٧.	SNYDER UNIT NO. 2	2 - -					~			11
VI.	MALAYA UNIT NO.]								14
VII.	MALAYA UNIT NO. 2	2						- 1		17

Attached sheets indicate the actual trouble records for each unit and these will be understood as reference data to grasp actual situation, tendency and cause of trouble.

I. <u>Historical Record of Trouble for Each Unit</u>

	Gardner Unit 1	Gardner Unit 2	Snyder Unit 1	Snyder Unit 2	Malaya Unit 1	Malaya Unit 2
Commercial Operation	8/91/68	1/15/70	07/01/71	07/31/72	09/04/75	06/26/79
1968	10					
1969	10					
1970	8	1				
1971	10	9	8			
1972	23	15	23	9		
1973	9	16	17	24		
1974	7	18	25	22		
1975	1	24	13	20		
1976	4	22	23	18	18	
1977	9	21	21	15	19	
1978	16	34	20	28	36	
1979	14	29	23	33	14	10
1980	16	23	25	26	21	16
1981	12	19	28	23	24	21
1982	3	13	6	4	9,	7
Total Record of Forced Outage	158 147	254 243	232 229	222 222	152 128	54 54

- 2 -SUMMARY RECORD OF FORCED OUTAGES

	Gardner Unit 1	Gardner Unit 2	Snyder Unit I	Snyder Unit 2	Malaya Unit l	Malaya Unit2	Total
1. Boiler and Auxiliary	84	102	72	106	32	16	412
1) Boiler	17	49	25	39	23	4	157
2) Fuel oil System	3	3	5	7	4	5	27
3) Air heater	45	33	30	43	0.	0	151
4) Forced draft fan	9	3	0	3	0	0	15_
5) Gas recirculation fa	n 2	0	1.50	0	0	0	3
6) Valve and piping	7	14	9	14	4	0	47
7) Control system	1	0	2	0	1	7	11
2. Turbine and Auxiliary	31	45	66	60	39	12	253
1) Main turbine	2	14	39	22	27	7	111
2) Condenser	14	6	9	17	7	2	55
3) Circulating H ₂ Opump	5	2	3	0	- 40° 1	3	14
4) Control system	10	23	15	21	4	0	.73
3. Condensate and feed 3. water system	2	59	54	45	25	3	188
1) Condensate and make-up system	0	2	6	3	0	1	12
2) Motor driven BFP		23	12	3	1		41
3) Turbine driven BFP		24	15	7,	7	0	53
4) Low press. heater	0	θ	-6	2	1		10
5) High press. heater		8	15	28	15	0	67
6) Control system	0	2	0	2	1	0	5
4. Electrical Equipment	21	15	15	4	9	15	79
1) Generator & Exciter	4	7	3	3	2	5	24
2) Transformer and Substation	10	6	6	. 0	4	5	31
3) Station service	0		4	0	0	5	10
4) Control system	7	1	2	1	3	0	14
5. Others	9	22	22	7	23	8	91
1) B-T interlock	0	7		\$4.554 ds	of Kaylowatin	2	22
2) Generator Back-up	0	4	6 6	0 3	7/	15	22 15
3) Outside trouble	9	11	10	4	15	5	15 91
TOTAL	147	243	229	222	128	54	1023

	RECORD OF FORCED OUTAGES	
Eguipment/System	Nature of Trouble No.	of Time
1. Boiler and Auxiliary		84
1) Böiler	a) Tube leakb) Fire at burnerc) Leak at burner flex hose	14 2 1
2) Fuel oil system	a) CDFOP leakage b) MFOP discharge line leakage	1 2
3) Air heater	 a) AH burned elements b) AH drive mechanism trouble c) AH clogging d) SAH clogging e) Replacement of G1 AH elements 	3 2 29 8 3
4) Forced draft fan	a) Excessive vibrationb) Defective discharge damper	7 2
5) Gas recirculation fan	a) Overload and heating up of motor	2
6) Valve and piping	a) Valve leakb) Main stop valve leakage at sealring	6 1
7) Control system	a) Control air contamination with oil	1
2. Turbine and Auxiliary		31
1) Main turbine	a) Burned turbine asbestos insulationb) Crossover pipe leak]]
2) Condenser	a) Condenser tube leakb) Hotwell recirculation valve malfunctionc) Air ejector leakage	11 1 2 1
3) Criculating water pump	a) Defective of rubber expansion jointb) Leakage at discharge pipe	2 3
4) Contro system	a) Main trubine control valve troubleb) Main turbine control mechanism trouble	2 8

Equipment/System	Nature of Trouble	No. of Tim
3. Condensate and Feedwater		<u>2</u>
System		
1) Condensate and make-up system		0.
2) Motor driven BFP	a) Suction strainer clogging	1
3) Turbine driven BFP	요한 사용되고 사용되는 한 것이 있는 안내보는 호텔트 등의 사용 기계의 기계 전환 기계 전환 기계 등을 받는 것 같습니다.	
4) Low Press, Heaters		0 0
5) High Press. heaters	a) Tube leak	
6) Control system		0
4. Electrical Equipment		<u>21</u>
1) Generator and Exciter	a) Loss of excitation	4
2) Transformer & Substation	a) Main transformer, defective jumper	• 3
	b) Main transformer, oil leak	1
	c) Bank tapping	2
가용됐다. 그 타스 이를 동생하고 하십을 때 모 두 하일 등이 다 나는 이 중요, 저는 이를 통했다.	d) Power cable trouble	2
에 가장하다는 그리라는 이 생활으로만을 생각한다. 기계로 생물이 소리되다는 사용한 사람들으로 기사하는	e) Disconnect switch failure	2
3) Station service system		0
4) Control system	a) Voltage regulator trouble	4
	b) Over exictation relay trouble	3
5. Others		9
		0
1) B-T, interlock		0
2) Generator back-up	a) Tripping of 115 KV line	2
3) Outside trouble	b) Frequency disturbance	6
	c) Typhoon	
에 아니라이 전 하다. 하나 하는데 사람은 분석을 되었다. 하는 사용 하는 사람들은 하는데 하는데 하는 것이다.		
요하는데 이번 화학생님은 하는 하는 이번 가는 그는 바이트를 받는다.		
[문화점 : 18. 10년 : 18. 2017년 - 18. 18. 18. 18. 18. 18. 18. 18. 18. 18.		
	가입하다면 많이 즐겁게 되었다. 기업은 교통적 20차 등학교 중에 기자 사람이 되는 사용하는 통증을	

III. Gardner Unit No. 2 October 11, 1969 - June 30, 1982

Equipment/Sys	ten	Nautre of Trouble	No. of Times
1. Boiler and Aux	<u>iliary</u>		102
1) Boiler		a) Tube leak	36
		b) Reheater flushing	1
	o tora del a se <mark>l soldicione di la</mark> Calcinata	c) Burner trouble	2
		d) Uncontrollable steam & metal temp.	10
2) Fuel oil sy	/stem	a) MFOP seal leakage	3
3) Air Heater		a) Clogging	27
		b) Burned element	10 Kara (1 5 1) (2 5 1) (3 5 1) (3 1)
		c) Damaged parts	
4) Forced draf	ft fan	a) Excessive vibration	3
5) Gas recircu	lation fan		0
6) Valve and p	oiping	a) Valve leak	14
7) Control sys	s tem		0
2. Turbine and Au	ıxiliary		45
1) Main turbi	1 е	a) Auxiliary oil failure	9
		b) Bearing damage	3
		c) Excessive vibration	
		d) Turbine blade failure	
2) Condenser	소설 등 1일 전혀 소환했습 전 설립 기를 하는 것 같습니다.	a) Tube leak	5
		b) Damaged condenser diaphragm	
3) Circulating	g water pump	a) Planetary gear failure	2
4) Control sy	stem	a) Main turbine control mechanism failure	16
		b) Main turbine control valves failur	e 7
3. Condensate an System	d Feedwater		<u>56</u>
1) Condensate	and make-up		
system		a) Contamination of CST	
	the control of the second second	h) low Dem water reserve	

<u>Eguipment/System</u>	Nature of Trouble No.	of Time
2) Motor driven BFP	a) Pump leakage	4
	b) Temperature, equalizing line leakage	7
	c) Main flow line trouble	9
	c) Leakage at suction valve	3
3) Turbine driven BFP	a) Balancing leak-off line trouble	. 5 2
	b) Defective vacuum trip devicec) Main flow line trouble	5 5
	d) Clogging of suction strainer	1
	e) Damaged internal parts	- 5
. 전환 회원 (1980년) 등 1일 등 1	f) Leakage of steam/water pipe	2
4) Low Pressure Heaters	도 발생 보는 경험에 있는 것이 되었다. 그는 것이 되었다. 그를 보고 있다. 사용하는 것들이 발생하는 것이 되었다. 그는 것이 되었다. 그는 것이다.	0
5) High Pressure Heaters	a) Tube leak	2
	b) Drip line leak	3
	c) Isolating valve leak	3
6) Control system	a) Malfunction of T-BFP control valve	
	b) Trouble at feed water flow	
4. Electrical Equipment		<u>15</u>
1) Generator and Exciter	a) Hydrogen leak	2
	b) Main exciter failure	3
	c) Oil circuit breaker failure	
2) Fransformer and Substation	a) Main transformer jumper wire heating ub) Tripping of differential lockout rela	
3) Station service system	a) M_BFP trip-out breaker failure	
4) Control system	a) Voltage regulator failure	
5. <u>Others</u>		<u>22</u>
1) B-T interlock	a) MFO shut+off valve malfunction	1
	b) Malfunction of controls	6
2) Generator back-up	a) Back-up lockout switch	2
	b) Reverse power relay	2
마다 살아들은 사이가 하는 사람들은 사람이 되었다. 집에 사이를		

	. 7	
Equipment/System	Nature of Trouble	No. of Times
3) Outside trouble	a) Tripping of 115 KV switch	2
	b) Frequency disturbance	8
	c) Typhoon	
	하는 경우 보고 말하는 말이었는 가 잘 보고 있다. 보고 있는 사람들들이 모르는 것을 보고 있다.	

IV. Snyder Unit No. 1 April 30, 1971 0 June 30, 1982

Equipment/System	Nature of Trouble	No. of Times
1. Boiler and Auxiliary		<u>72</u>
I) Boiler	a) Tube Leak	14
	b) Burner failure	2
	c) Burner windbox burned	2
	d) Uncontrollable steam temperature	6
	e) Gas leak	1
2) Fuel oil system	a) Leakage of F.O. Heater & pipe	2
	b) MFOP mechanical trouble	3
3) Air heater	a) Clogging	25
	b) Drive mechanism trouble	9
	c) Damaged main parts	2
4) Forced draft fan		0
5) Gas recirculation fan	a) Motor overload	
6) Valve and piping	a) Boiler valve leak	g
7) Control system	a) F.O. Heater press, regulator trou	ble 2
2. Turbine and Auxiliary	기가 있다면 하는 기가 있는 것이 되었다. 그는 사람들은 기상이 되는 기가 있다는 것이다.	<u>66</u>
1) Main turbine	a) Blade failure	7
	b) Excessive vibration	11
	c) Inspection internals and parts	3
	d) Tripping device trouble	11
	e) Blade washing	2
	f) Cross-over pipe & expansion bello leakage	ws 4
	g) Fire accident	
2) Condenser	a) Tube leak	9
3) Circulating water pump	a) Planetary gear failure	3

Equipment/System	Nature of Trouble No.	of Time
4) Control system	a) Main turbine control valve trouble	5
	b) Hydraulic control system trouble	10
Condensate and Feedwater System		<u>54</u>
 Condensate & make-up system 	a) Leakage at condensate pump suction expansion joint	1
	b) Leakage at raw water	3
	c) Low demineralizing water reserve	1
	d) Busted condensate line	1
2) Motor driven BFP	a) Temp. Equalizing line trouble	2
	b) Tripping device trouble	2
	c) Leakage at discharge & suction of pump	4
	d) Motor overload	1
	e) Clogging of suction strainer	3
3) Turbine driven BFP	a) Balancing leak-off system trouble	3
	b) Clogging of suction strainer	1
	c) Temp. equalizing recirculation trouble	2 7
	d) Damage on pump parts	2
	e) Main flow system trouble	¥ 1_:
4) Low Pressure heaters	a) Tube leak	⁹ 6
5) High Pressure Heaters	a) Tube leak	5
	b) Drip lines trouble	10
6) Control system		0
Electrical Equipment		<u>15</u>
1) Generator & Exciter	a) Oil circuit breaker (G3GG8) trouble	2
i) denerator a exerter	b) Oil circuit breaker malfunction	1
Ol Tunnafauman & Culhatatian	a) Main transformer jumper line faults	4
2) Transformer & Substation	b) Bursting of lightning arrester	
	c) Differential lockout trouble	
2) Station convice custom	a) Loss of 4160 V power supply	1
3) Station service system	b) 4160 V bus grounded	3

<u>Equipment/System</u>	Nature of Trouble	No. of Times
4) Control system	a) Wet generator control cubicle	1
	b) Voltage regulator trouble	
5. <u>Others</u>		<u>20</u>
1) B-T interlock	a) Feedwater regulator malfunction	5
	b) Poor conbustion, drop in air flow	
2) Generator Back-up	a) Shorted emergency trip relay and back-up relay	3
	b) Reverse power relay	3
3) Outside trouble	a) Tripping of 115 KV lines due to he down power	avy 2
	b) Frequency disturbance	7
	c) Typhoon	1

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V. Snyder Unit No. 2 June 2, 1972 - June 30, 1982

	Eguipment/System		Nature of Trouble	No. of Times
1.	Boiler and Auxiliary			106
	1) Boiler	a)	Tube leak	21
		b)	Gas leak at casing	
		c)	Burner damage	1
		d)	Uncontrollable temperature/pressure/flow condition	10
,	2) Fuel oil system	a)	Leakage of CDFOP pipe flange	1
		b)	Header pressure regulator line leaka	ge 5
		c)	Fire accident at MFOP area	1.
	3) Air Heater	a)	Clogging	37
		b)	Replaced burned elements	3
		c)	Damaged bearing and parts	2
· .		d)	Sootblower failure	1
<i>i</i> .	4) Forced draft fan	a)	Excessive vibration	3
	5) Gas recircualtion fan			0
	6) Valve and piping	a)	Boiler valve leak	9
		b)	Leakage at auxiliary steam header	1
		c)	Leakage at CRH end flange	2
		d)	Leakage at extraction A-4 flange	2
	7) Control system			0
2.	Turbine and Auxiliary			_59
	I) Main turbine	a)	Excessive vibration	13
			Broken blades	3
		c)	Damaged bearing & turbine rotating parts	5
		d)	Exhaust flange leakage	
	2) Condenser	a,	Tube Teak	15
100		b'	Leakage at drain line to condenser	2

Equipment/System	Nature of Trouble No.	of Tim
3) Circulating water pump		0
4) Control System	a) Electro-Hydraulic governor failure	9
	b) Turbine control valve failure	11
	c) Hotwell level regulator failure	
Condensate and Feedwater System		<u>45</u>
1) Condensate and make-up	a) Ammonex exhaustion	2
system	b) Low demineralized water reserve	1
2) Motor driven BFP	a) Clogging of suction strainer	1
	b) Temperature equalizing pump line leakage	e 2
3) Turbine driven BFP	a) Minimum Flow system trouble	3
	b) Low vacuum at auxiliary condenserc) Leakage at turbine gland steam	3 1
4) Low pressure heater	a) Tube leak	2
	a) Tube leak	16
5) High pressure heater	b) Drip lineleakage	8
	c) Leakage at isolating valve	4
6) Control system	a) Hotwell level regulator failure	1
	b) T-BFP control mechanism failure	1
Electrical Equipment		4
1) Generator and Exciter	a) Generator breaker control cable grounde	d 1
	b) DC Hi-pot test of stator	
	c) Excitation loss	0
2) Transformer & Substation		
3) Station service system		0
4) Control system	a) Voltage regulator trouble	1
<u>Others</u>		<u>6</u>
1) B-T interlock		. 0
2) Generator Back-up	a) Reverse power relay	2

	- 13 -	
Equipment/System	Nature of Trouble	No. of Times
3) Outside Trouble	a) Tripping of 115 KV line	
	b) Frequency disturbance	2
	c) Typhoon	

VI. Malaya Unit No. 1 December 21, 1974 - June 30, 1982

Eguipment/System	Nature of Trouble	No. of Times
Boiler and Auxiliary		32
1) Boiler	a) Tube leak	6
	b) Fire at air register assembly	2
	c) Uncontrollable steam temperature	15
2) Fuel oil system	a) Overload of MFOP-1A	1
	b) Tripping of MFOP-1A	2
	c) Leak at MFOP discharge line	1
3) Air heater		0
4) Forced draft fan		0 1
5) Gas recirculation fan		0
6) Valve and piping	a) CV - 101, expansion joint steam leak	2
	b) CV - 104, uncontrollable operation	1
	c) Leak on thermowell economizer inlet	1
7) Control system	a) Oil contamination of pneumatic contr	o1 1
Turbine and Auxiliary		<u>39</u>
1) Turbine	a) Crack turbine blades	1
	b) Excessive vibration	12
	c) Leak at HP admission sensing line	1
	d) Leak at HP, exhaust sensing line	1
	e) Leak at cold reheater flange	2
	f) IPCV, drain line leak	5
	g) Drain station leak	1
	h) Burst rupture diaphragm	
	i) Jacking oil/seal oil leak	3
2) Condenser	a) Low vacuum	2
	b) Chloride contamination	3
	c) High conductivity	

Eguipment/System	Nature of Trouble No	of Ti
	d) Tube leak	1
3) Circulating water pump	a) Tripped of both CWPs as a result of DC failure	1
4) Control	a) EHG control fault	2
	b) Malfunction of remote tripping solenoic valve	1
	c) Failure of thrust bearing safety device to reset	e 1
. Condensate and Feedwater System		25
Condensate and make-up system		0
2) Motor driven BFP	a) Tripped when low deaerator level float control was actuated	1
3) Turbine driven BFP	a) Excessive steam leak	2
	b) Repair of minimum flow valve	2
	c) Trouble at planetary gear of booster pump	1
	d) Malfunction of speed adjuster	1
	e) Busted T-BFP condenser safety device diaphragm	1
4) Low pressure heater	a) Tube leak	1
5) High pressure heater	a) Tube leak	11
	b) Steam/water line leak	2
	c) Leak at drain valve	1
	d) High water level	1
6) Control system	 a) Tripped due to extremely high level of LPH 	1
. Electrical Equipment		<u>9</u>
1) Generator and Exciter	a) Damaged bearings #2 and #8	1
	b) Loss of excitation	1
2) Transformer & Substation		2
wy manarothica a substantibil	b) Explosion of lightning arrester bushing	2

Equipment/System	Nature of Trouble No. of Tim
3) Station service system	0
4) Control system	a) over exictation 2 b) Detachment of voltage regulator 1
<u>Others</u>	146 - 176 -
1) B-T interlock	a) LPH extreme high level 1 b) Low feedwater flow 6
2) Generator back-up	a) Generator reverse power relay
3) Outside trouble	a) Failure of 230 KV line 3 b) Malaya - Dolores 115 KV line 4 c) Line fault at Dolores 4 d) System distrubance 4

VII. Malaya Unit No. 2 March 11, 1979 - June 30, 1982

Equipment/System	Nature of Trouble	No. of Times
1. Boiler and Auxiliary		16
1) Boiler	a) Tube failure	4
2) Fuel oil system	a) Leak one pre-heating discharge linb) Tripping of MFOP 2A	նում և 1
	c) Failure of MFOP 2B	a mino l e is
	d) Low discharge pressuree) Low suction pressure	
3) Air heater		0
4) Forced draft fan		0
5) Gas recirculation fan		0
6) Valve and piping		0
7) Control system	a) Tripped of MFO shut-off valve due low control air supply	to 1
	b) Malfunction of drum level transmit	ter 1
	c) Low boiler drum level	4
	d) Leak at drum level sensing line	
2. Turbine and Auxiliary		<u>12</u>
1) Main trubine	a) Excessive vibration	3
	b) Balancing due to vibration	1
	c) Bearing damage due to DC oil pump failure	
	d) Oil leak at No. 2 bearing	1
	e) Uncontrollable temperature	1
2) Condensing system	a) Condenser low vacuum	2
3) Circulating water pump	a) Tripping of both CWPs due to low vacuum	3
4) Control system		0

	Equipment/System	Nature of Trouble No.	of Time
3.	Condensate and Feedwater System		<u>3</u> .
	1) Condensate and make-up system	 a) Chloride contamination of Deminera- lized water 	1
	2) Motor driven BFP	a) Tripped during change-over	.]
	3) Turbine driven BFP		0
	4) Low pressure heater	a) Leak at deaerator manhole cover	1
	5) High pressure heater		0
	6) Control system		0
4.	Electrical Equipment		15
	1) Generator & Exciter	a) Burnt-out carbon brushes	1
		b) Excitation system failure	2
		c) Malfunction of stator cooling regu- lator	2
	2) Transformer & Substation	a) Tripped due to differential lock out	2
	2,	b) Busting of relief diaphragm	1
		c) Oil pressure drop from relief diaphragm	1
		d) Explosion of lightning arrester	l
	3) Station service system	 a) Loss of station service, emergency feed fails to cut in. 	i 1
		b) Loss of BACC power	3
		c) Failure of DC power supply	1
	4) Control system		:
5.	<u>Others</u>		8
	1) B-T interlock	a) Furnace pressure high	2
	2) Generator back-up	a) Reverse power causedby malfunction of relay on AVR	1
	3) Outside trouble	a) Tripping of Dolores line	3
		b) System disturbance	2