2.2 Installation of economizer inlet check valve in order not to subject Feed Water Heaters to possible backflow of high temperature fluid from the boiler during trip-out.

2.3 Inspection and repair of relief valves on all high pressure pipings.

2.4 Inspection of condition of high pressure pipings and boiler hangers including vibration eliminators.

3.0 TURBINE AND RELATED FACILITIES

3.1 Eddy current test on condenser tubes

3.2 Thickness measurement and possible patch weld repair of circulating water pipe portion found to be below required allowable thickness.

3.3 Inspection and repair of reversing valve if tide level condition permits.

3.4 Installation of feed water heater by-pass line.

3.5 Inspection and repair of condenser baffle plates.

3.6 Inspection and repair of condensate pump inlet strainer. Provide also spare strainers.

3.7 Inspection and repair of feed water pump strainer Provide also spare strainer.

3.8 Provide high pressure pipings and heater drains and vent valves with series valves.

4.0 ELECTRICAL, INSTRUMENT AND CONTROL

4.1 Replacement of mercury-type pressure switches with micro swithch-type.

4.2 Recheck and adjustment of the following valve control systems should be made after completion of mechanical works.

4.2.1 Motor-driven valves

MV-1, MV-2, MV-3, MV-4, MV-5

4.2.2 Control valves

CV-1A/1B, CV-101 A/B, CV-102, CV-103, CV-104, CV-105, CV-107, CV-108, CV-109

4.2.3 Local control valves

* Auxiliary steam pressure control valves
* All deaerator control valve
* HP heater drain level control valves
* LP heater drain level control valves
* Steam air preheater control valves
* Instrument air control
* Station air control
* Fuel oil temperature control valves
* Soot blowing steam pressure control valves
* Turbine extraction steam line drain control valves
* Fuel oil pressure control valve
* Ignitor oil pressure control valve
* SAH control valve
* Boilerexpansion tank temperature control

4.3 Deaerator pegging steam pressure control valve (Not operational)

By-pass valve - - - - - - - - - - - opened

Normal valves (before and after regulator - - - - - - - - - - - - isolated

4.4 Provide adequate support for instrument air piping specially around boiler yard.

4.5 Calibration of fuel flow meters, air flow meters, feed water flow meters and steam flow meters required for satisfactory operation of once-through boiler.

4.6 Operation tests before unit start-up

* Motor-driven valves
* Pneumatic-actuated control valves
* Solenoid valves
* Hydraulic-actuated valves

4.7 Blowing-out/Purging of instrument air line at controller terminals

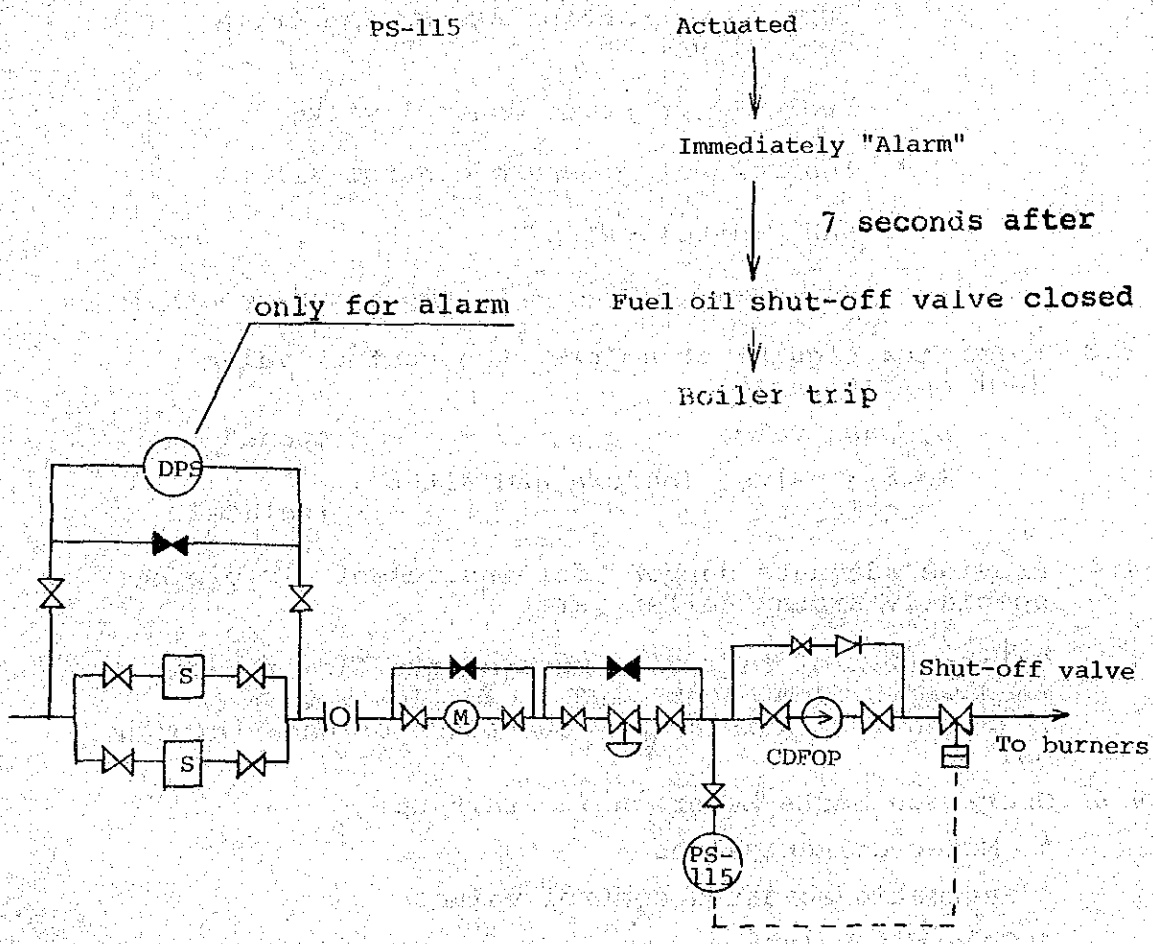
4.8 Boiler, turbine and generator tripping interlock relay tests and re-confirmation of the set points.

4.9 Insulation test (meggering) of power cables and motor windings before test run.

4.10 Alarm sensor test (sensor to annunciator lamp)

4.11 "Strainer differential pressure high" alarm .

Differential pressure indicator with alarm contacts should be separately provided. (only for pre-alarm)



4.12 Supervisory instrument calibration and signal check mounted on central control panel including transmitter, transducer and modules.

5.0 ADDITIONAL ITEMS TO BE CARRIED OUT
(Refer to Attachment Sheet B)

5.1 Improve ventilation of boiler room

5.2 Provide sufficient auxiliary power for lighting and additional outlets for welding job during overhauling

Caution:

Do not use auxiliary power from load centers of another units under normal operation.

5.3 Preventive measures against scattering the insulation materials removed from pipings.

5.4 Improvement of staircase

5.5 Additional lighting both for overhauling and normal daily inspection.

5.6 Blowing out of instrument air pipings at controller terminals.

5.7 Adoption and religious implementation of tagging system.

R E P O R T E D B Y :

K. ARIYOSHI
Mechanical Engineer
WEST JEC

H. MAEDA
Mechanical Engineer
NEW JEC

J. FUJIMOTO
Electrical Engineer
WEST JEC

M. KOTANI
Electrical Engineer
WEST JEC

ATTACHMENT SHEET - A

ROOT VALVE FOR SAMPLING

a) HP Heater Drip Flow

b) Hot RH Steam

c) Main Steam

d) Condensate Before Deaerator

e) Deaerator Storage Tank

f) Condensate Pump Discharge

g) Water Wall Header

h) House Service Closed Cycle

i) All other sampling valves

j) All sampling tubes should be replaced with SUS materials, including chemical injection lines (water, chemical).

k) SH and RH Spray Control Valves and Stop Valves should be checked, inspected and adjusted.

- ooo Oooo -

ATTACHMENT SHEET B

1. ADEQUATE AND CONTINUOUS VENTILLATING SYSTEM

Inherent in the operation of a power plant are heat emission from various plant systems specially from major equipments. Unwanted gas leaks and soots from boiler casing and ductworks are sometimes encountered. All these factors contributes to the establishment of undesirable working condition which does not only affect the health of plant personnel but also their efficiency and effectiveness in performing operation, preventive maintenance, inspection and overhauling activities. It is therefore suggested that all ventillating fans should be properly maintained and kept continuously runningboth during overhauling and normal operation. Further, a portion of the boiler house sidewall should be removed during overhauling to provide additional ventillation for the boiler room.

2. HOUSEKEEPING AND SAFEGUARDS TO CONTROLS AND EQUIPMENTS.

It was noted during the inspection that removed insulation materials from pipings heaters, boiler casing and ductworks and scraps are left scattered in various work areas specially in the boiler room. This condition affects to a large extent the safety and mobility of plant personnel. Secondly, locally mounted instruments and equipments already repaired are exposed or affected by falling dust. In this connection, it is suggested that removed insulations and scraps be immediately collected/ placed in empty containers and moved to a designated area. Or the gratings where the activity is being performed should be covered with canvass. Fire proof type canvass should be used also to cover gratings just under areas where welding jobs are being done for reasons of safety.

3. POWER SUPPLY AND LIGHTING FOR OVERHAULING WORKS.

Adequate outlets should be provided at various portions and/or different locations of boiler. In case of overhauling, low voltage lighting power (about 20 to 40 V AC) is required for safety.

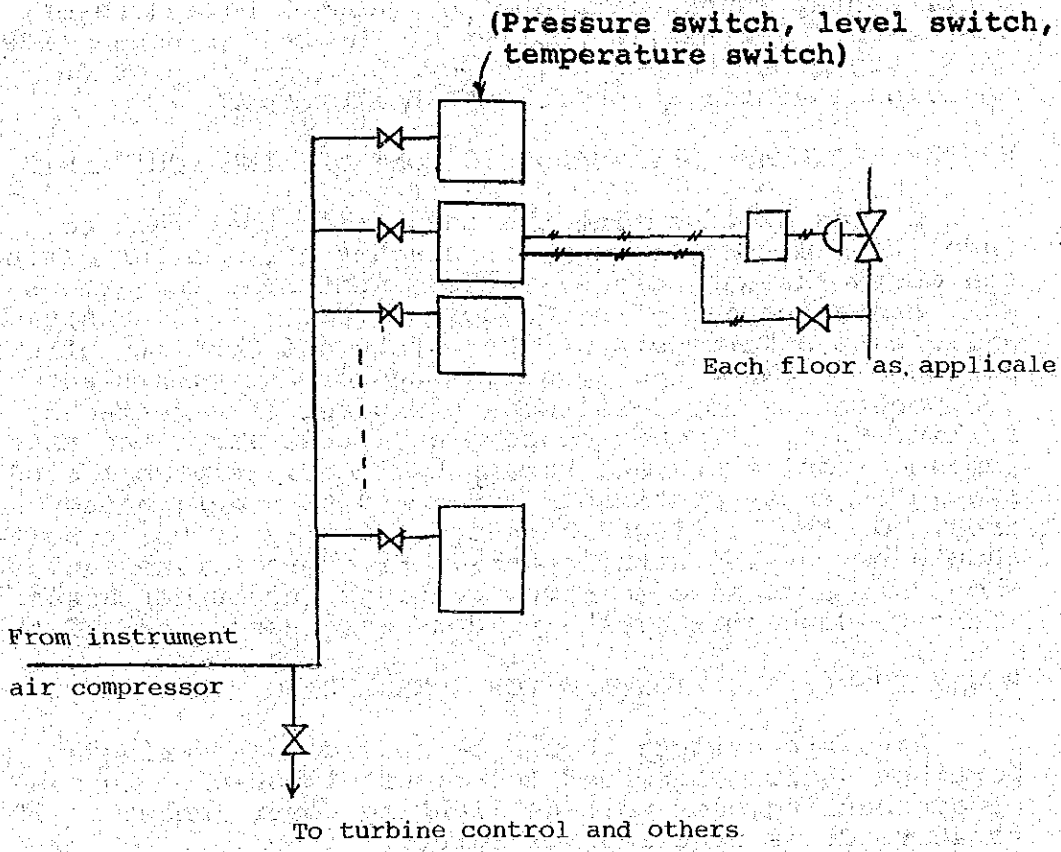
It is recommended that auxiliary power supply for overhauling works such as welding jobs, lighting, etc. should be taken only from auxiliary power load centers of unit undergoing overhaul, not from other units under normal operation. Short circuited or grounding of power cables or electric welding equipment may lead to serious

troubles of other running units, thus causing unit tripout. Control center of units under normal operation adjacent to unit being overhauled should be covered for prevention against dust and damage from possible falling objects.

4. CONTROL INSTRUMENT AIR PIPING

Blowing out/purging of instrument air pipings for control units including locally mounted control units is required for satisfactory operation of automatic controls.

For long term rehabilitation, instrument air piping should be modified as follows:



5. ADOPTION OF APPROPRIATE TAGGING SYSTEM

Each detailed overhauling work such as replacement of valve packing, calibration of instruments, adjustment of valve opening and test run should be confirmed by tagging system.

FOR EXAMPLE:

_____ Tag		
	Date	Signature
Valve No.	(CV-101) Aug. 1. 1982	
Valve Seat	(Replaced)	
Packing	(O K)	
Positioner	(Adjusted)	
Actuator	(O K)	
Controller	(Calibrated)	

Checked by: _____

Approved by: _____

6. PROVIDE NAME PLATE FOR EACH VALVES (VALVE NO. OR VALVE NAME

K. ARIYOSHI
Mechanical Engineer
WEST JEC

H. MAEDA
Mechanical Engineer
NEW JEC

J. FUJIMOTO
Electrical Engineer
WEST JEC

M. KOTANI
Electrical Engineer
WEST JEC

APPENDIX-14 S-1 ANNUAL OVERHAULING ACTIVITIES

S-1 ANNUAL OVERHAULING ACTIVITIES

QAG-82-0174
August 27, 1982

Mr. J. C. Villanueva
Manager
Sucat Thermal Plant

SUBJECT: JICA Mission Recommendation/Comments on Forthcoming 4 - 1 Overhauling

As agreed during our meeting with Mr. T. N. Calasanz last August 16, 1982, the JICA Group member assigned at your station were requested to conduct an independent review/study on the activities to be performed during the annual overhauling of the above subject unit.

Supplemental to the above, they also conducted actual survey on the present operating conditions and consequently came up with some comments/recommendations, a copy of which is herewith attached for your information and possible consideration/inclusion in your work program.

L. F. OBILLA
Manager
Quality Assurance Group
Office of the President

Encl.: a/s

cc.:
Gen. M. S. Aguinaga
Mr. J. U. Jovellanos
Mr. T. N. Calasanz
Mr. T. Oga
Mr. A. F. Katandian
Mr. R. Padron
Mr. A. Tatlonghari
QA File

August 23, 1982

MEMORANDUM -

FOR : Mr. L. F. Osilla
Manager
Quality Assurance Group

FROM : JICA Mission Group Member
Gardner/Snyder Thermal Plant

SUBJECT : S - 1 Annual Overhauling Activities

We were notified that the above subject unit will be overhauled as soon as G-2 is synchronized and stabilized in the grid. In this connection and upon NPC's request, the JICA Mission Group members assigned at Gardner/Snyder station gave priority to the immediate ocular inspection of the units' systems and components afterwhich reviewed the overhauling activities prepared and provided us by plant personnel.

As a result thereof, we are submitting herewith our recommendation/comments for possible adoption by NPC plant management. The duration of the overhauling schedule, however, will have to be decided/resolved by NPC considering system power demand and various resources needed in the forthcoming overhauling of the unit.

We hope that you will find the attached report in order, but should you need further clarification on the matter, please feel free to contact us.

K. Ariyoshi

K. ARIYOSHI
Mechanical Engineer
JICA Mission

Attached: a/s

cc.: Mr. T. Oga
NPC Counterpart
JICA File

JICA MISSION RECOMMENDATION/COMMENTS
ON S-1 OVERHAULING ACTIVITIES

I GENERAL

1) Re-check of all spare parts required for replacement of defective equipment. Purchase spare parts if not available.

2) Installation of additional temporary lifting equipment for smooth and quick transfer/movement of materials and tools during overhauling.

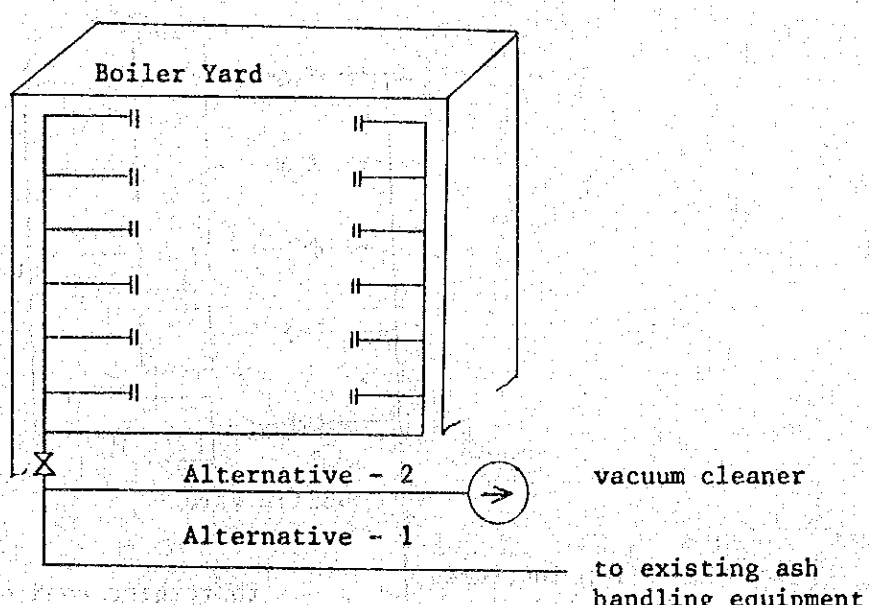
3) Permanent installation of vacuum cleaner connection on each floor of boiler (yard) area to clean all equipment.

ALTERNATIVE - 1

Utilization of existing ash handling vacuum line.
Repair the existing ash handling equipment and connect the cleaning line to be additionally installed with the existing vacuum piping as shown in Figure I.

ALTERNATIVE - 2

New, additional installation of vacuum cleaner.



F I G I

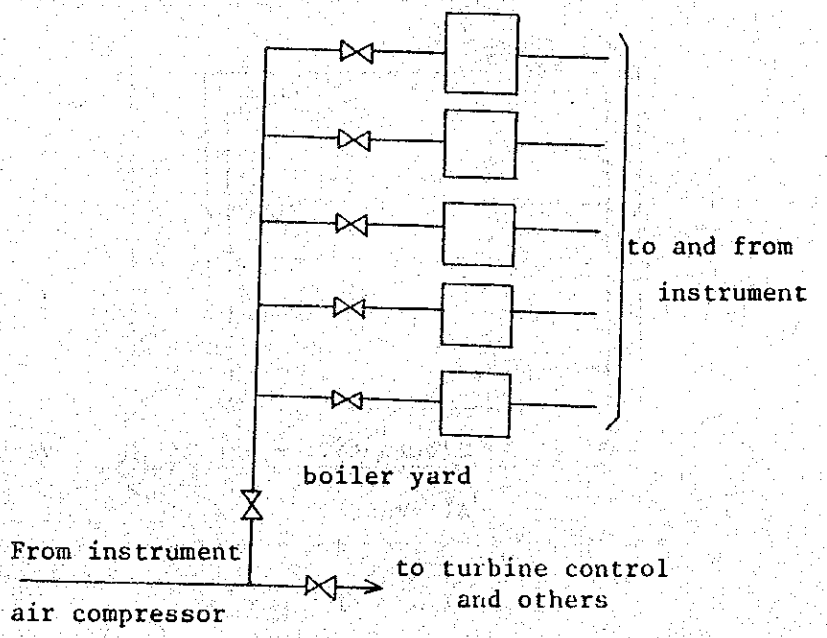
4) A large volume of gas leak from the boiler casing particularly on the 10th and 11th floor.
The ambient temperature is very high (about 50°C)and nobody can withstand the heat for a minimum period of 10 minutes. One factor causing this condition is the insufficient ventilation in this area. Boiler casing should be perfectly repaired for the health of plant personnel and effectiveness in performing operation, preventive maintenance, inspection and overhauling activities.

5) Power supply and lighting for overhauling works

Adequate electric outlets should be provided at each floor of boiler (yard) area for temporary lighting and welding.

6) Control instrument air piping

Blowing out/purging of instrument air pipings for control units including locally mounted control units is required for satisfactory operation of automatic controls. For long-term rehabilitation, instrument air piping should be modified as follows:



7) The constant differential fuel oil pump is not placed into service (out of order). Main fuel oil burners are designed as return flow atomizers not as straight mechanical atomizers. Using this type of burner without constant differential fuel oil pump will possibly cause a long flame and incomplete combustion in the furnace, resulting in AH burning out in the worst case due to unburnt carbon adhesion on the AH elements, and also clogging of the element. Place constant fuel oil pump into operation immediately.

8) Complete heat insulation of pipings and equipment requiring insulation

9) Clean up of condenser internals to remove all rust and deposits on throat expansion parts before condensate line clean up.

10) <u>TESTS AND TRIAL OPERATION TO BE CARRIED OUT DURING AND AFTER OVERHAULING</u>

I BOILER AND AUXILIARIES

1) Hydraulic Test
2) Boiler air leak test
3) Boiler tripping interlock test
   a) Both forced draft fans trip including air dampers interlock
   b) Reheater Protection test
   c) Furnace draft high trip test including FDF tripping interlock
   d) Fuel oil pressure low trip including fuel oil shut-off valve interlock
   e) Feed water flow low trip test including BFP trip interlock
   f) Furnace purge and MFT reset
4) Burner light-off and pressurization for safety valve test

5) Other valves test including motor-driven, air actuated, etc.

6) Boiler feed water pump test
   a) Minimum flow control valve test
   b) Auxiliary oil pump auto-start test

7) Fuel oil pump test including diesel oil pump test

8) Air preheater test including air motor back-up start test

9) Soot blower test

II TURBINE AND AUXILIARIES

1) Major valve test
   a) Main stop valve test
   b) Governing valve test
   c) Reheat stop valve
   d) Intercept valve

2) Turbine tripping interlock test
   a) Manual trip lever test
   b) Solenoid trip test
   c) Thrust movement
   d) Bearing oil pressure low trip test
   e) Vacuum low trip test
   f) Both MSV closed
   g) No load trip

3) Leak test
   a) MSV
   b) Turbine control valves test

4) Vacuum up test including ejector and gland steam regulator

5) Turbine speed up test

6) Condenser test

7) Major valve test including extraction steam non-return valves.

8) Turning device test

9) Oil pump auto-start test
   a) Auxiliary oil pump
   b) Emergency oil pump
   c) Turning oil pump

10) HP/LP heater leak test

11) Gland steam exhauster test

12) Major pump test
   a) Condensate pump
   b) Circulating water pump

13) Re-consideration of plant efficiency (for reference)

Checks of over-all plant performance on the basis of daily operating summary records indicated that there is a considerable decrease on plant efficiency. For purposes of restoring decreased power plant output, taking into consideration the present operating condition, we suggest that the following items be taken cared of immediately.

According to operating summary dated July 31 to August 2, 1982, gross heat rates of S-1 and S-2 at generator end are very high and are as follows:

	S-1	S-2
Daily verage heat rate (BTU/KWH)	12,228	12,762

These values are equivalent to plant efficiency of 27% and 29%, respectively. Plant efficiency of similar power plant in Japan is about 34 to 35% at present.

Low plant efficiency may be caused by the following causes:

a) Excessive spray water flow due to SH/RH spray control valves leakage.

Spray flow rates on August 23, 1982

	S - 1	S - 2
Output	140 MW	200 MW
SH Spray	14,000 lb/h (6.35 t/h)	80,000 lb/h (36.3 t/h)
RH Spray	38,000 lb/h (17.2 t/h)	40,000 lb/h (18.1 t/h)

b) Inadequate combustion air temperature

Combustion air temperature is not controlled automatically due to defective control valves. It is controlled manually with the aid of by-pass valves of SAH temperature control valves.

c) Main steam leak to turbine by-pass line

Flash tank pressure on August 23, 1982

S - 1	S - 2
250 lb/in^2	300 lb/in^2
(17.5 kg/cm^2)	(21.0 kg/cm^2)

d) Increase in radiation loss due to poor heat insulation

e) High auxiliary power ratio

Gas leak will require more power of FDF, and increase auxiliary power ratio. Operation of feedwater pump keeping minimum flow valve opened at a load condition when it is suppose to be close causes also high auxiliary power rate.

f) In adequate vacuum operation

Recorded turbine back pressure ranges from 2.7" Hg - 3.3" Hg (guaranteed value 2.0" Hg)

II BOILER AND AUXILIARIES

1) Inspection and repair of relief valves on all high pressure pipings.
2) Inspection of condition of high pressure pipings and boiler hangers including vibration eleminator.
3) Replacement of Gas O_2 analyzer at Economizer outlet.
4) Repair of ash handling equipment
5) Check and repair of the safety valve on secondary superheater inlet.
6) Check of pressure reducing valve inlet stop valve (MV-3)
7) Repacking of major valves including air vent valves, sampling root valves, instrument root valves, etc.

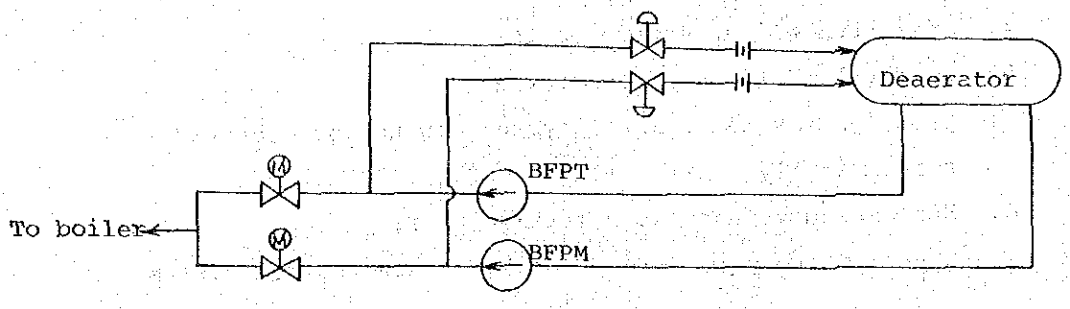
8) Retightening of gland packings after start-up.

9) Provide identification on piping, and/or name plate of valves including instrument to avoid misoperation.

III TURBINE AND AUXILIARIES

1) Check and repair of feed water control valve and the by-pass valve, minimum flow control valve and BFP-T/M discharge motor-driven valves.

2) Minimum flow pipings of BFP-M and BFP-T should be separately arranged, and the orifice should be added to the line respectively.



3) Carry out eddy current test on condenser tube after clean-up of respective tubes with the aid of brush designed for cleaning tube internals.

4) Thickness measurement and possible patch weld repair of circulating water pipe portion found to be below required allowable thickness.

5) Inspection and repair of reversing valve.

6) Installation of feed water heater by-pass line.

7) Install the pressure gauges at the inlet and outlet of the condensate pump suction strainer so that the differential pressure can be checked.

8) Provide high pressure pipings and heater drains and vent valves with series valves.

9) Repacking of major valves including air vent valves, sampling root valves, instrument root valves, vacuum valves, etc.

10) Retightening of gland packings after start-up.

11) Provide identification on piping and/or name plate of valves including instruments to avoid misoperation.

12) All valves on vacuum line should be sealed.

IV ELECTRICAL/CONTROL AND INSTRUMENT

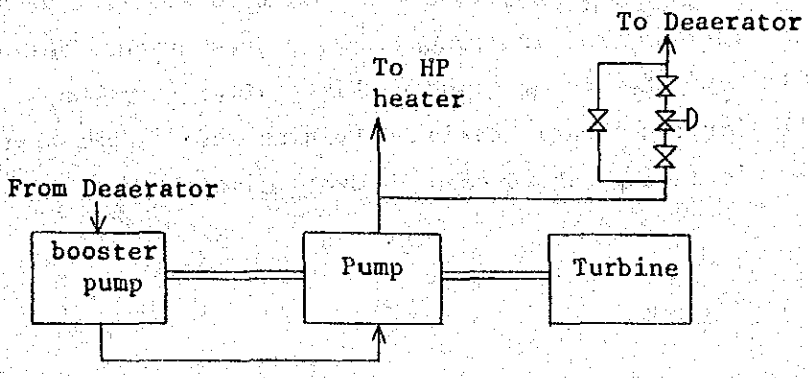
1) Overall check of automatic boiler control system including turbine by-pass control.

   a) List down all defective parts
   b) Re-check of spare parts storage
   c) Study on why the control system can not be operated automatically.
   d) Take measures against defective parts.
   e) Signal matching and loop check of each control system.

2) Pressure switch, PS-134 for BFP-M interlock should be replaced with micro switch type one.

3) Valves handles for root valves of instrument including transmitter, pressure gauge, etc. are not mounted, and some of them defective. Re-check the spare parts for replacement of defective vlave handles, if no spare parts, purchase all kinds of valve handles prior to overhauling.

4) Wire for solenoid valve of turbine-driven BFP minimum flow control valve is not connected, and BFP-T is operated keeping fully opened. This valve should be replaced with hydraulic-actuated valves, and by-pass valve and isolating should be at least installed as follows:



5) Auxiliary steam leaks considerable from auxiliary steam pressure control valve gland, and so the valve gland should be replaced with new one.

6) Auxiliary steam for soot blowing leaks from head valve of 23 L soot blower.
Overall checking of soot blower system should be made.

7) All control valves on turbine by-pass line should be rechecked, repaired and replaced for smooth boiler acid cleaning and unit start-up.

a) High pressure superheater stop valve (MV-1)
b) Resistor tube by-pass valve pressure reducing valve (MV-2)
c) Pressure reducing valve inlet stop valve (MV-3)
d) Low pressure superheater stop valve (MV-4)
e) Flash tank outlet motor operated stop valve (MV-5)
f) Superheater attemperator spray control and shut-off valves (CV-1A/1B)
g) Reheater attemperator spray shut-off valve (CV-2A)
h) Reheater attemperator spray control valve (CV-2B)
i) Superheater by-pass control valves (CV-10VA/B)
j) Turbine by-pass control valve (CV-102)
k) Superheater pressure reducing valve (CV-103)
l) Pressure control valve for dump steam control (CV-104)
m) Pressure control valve for deaerator heating steam control (CV-105)
n) Pressure control valve for HP heater heating steam control (CV-106)
o) Flash tank level control valve (CV-107)
p) Turbine by-pass steam spray water control valve (CV-108)
q) Feed water control valve

Check Item

- Valve stroke, positioner
- Diaphragm for control
- Instrument air piping

- Controller and transmitter
- Valve seat, gland

8) Replacement of all existing mercury-type pressure switches with micro switch type ones.

9) Provide adequate support for instrument air piping especially around boiler yard as a safeguard against vibration and to protect the unit from tripping.

10) Local control valves

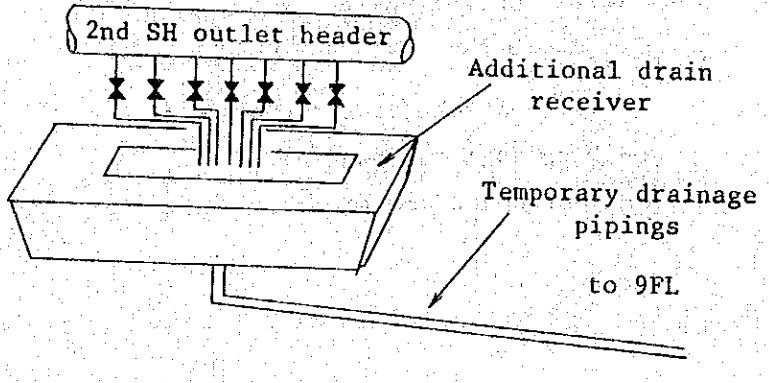
All local control valves should be repaired especially the following valves:

a) Auxiliary steam pressure control valves
b) Control valves around deaerator
c) HP/LP heater drain level control valves
d) SAH temperature control valves
e) Soot blowing steam pressure control valves.
f) Turbine extraction steam line drain control valves
g) Fuel oil pressure control valve
h) Fuel oil temperature control valve

11) Stop immediately steam and drain leakage from secondary superheater outlet header drain and vent valves.

The drain drips on the soot blower motor and terminal block for thermocouple connection on 8th floor.

Temporary drainage should be considered to dispose the drain to outside of boiler yard as shown in sketch below:



12) Fuel oil leak drips on HP heaters, the drain level controllers and pressure gauges should be wiped out clearly. The ambient temperature is very high, fire may occur due to vaporization of this oil leaks in the worst case.

13) Differential pressure switch for strainer pre-alarm

Differential pressure between inlet and outlet of the fuel oil strainer should be separately provided from fuel oil shut-off valve interlock, and additional pre-alarm "Fuel oil strainer Diff. Press. High" should be provided in the central control room.

14) Central Control Room

The following recorders are not placed into service.

a) Economizer outlet O_2 percent recorder
b) Boiler metal temperature recorder

15) Improvement of central control room air conditioning system

Additional air conditioners should be installed in S-1 and S-2 central control room and relay room, furthermore, openings in the central control boards and relay panels should be filled up with iron steel plate so as not to allow the hot air from outside enter into the room.

16) Prevention of excessive vibration of fuel oil integration meter

V. CHEMICAL/WATER TREATMENT

1) Inspection and clean-up

Condenser hotwell, Deaerator, flash tank and steam headers

a) Quantity of sludge, and analysis of sludge contents.

b) Measures against entering foreign matters into the system during overhauling

c) Flushing before starting

d) Recording and keeping of result of inspection

2) Water purifier, condensate demineralizer

a) Check of quantity of resin and performance of the system

b) Inspection of resin tower inside

c) Inspection of resin trap

d) Inspection and clean up of pure water tank and condensate tank, if possible.

3) Sampling rack and chemical inspection

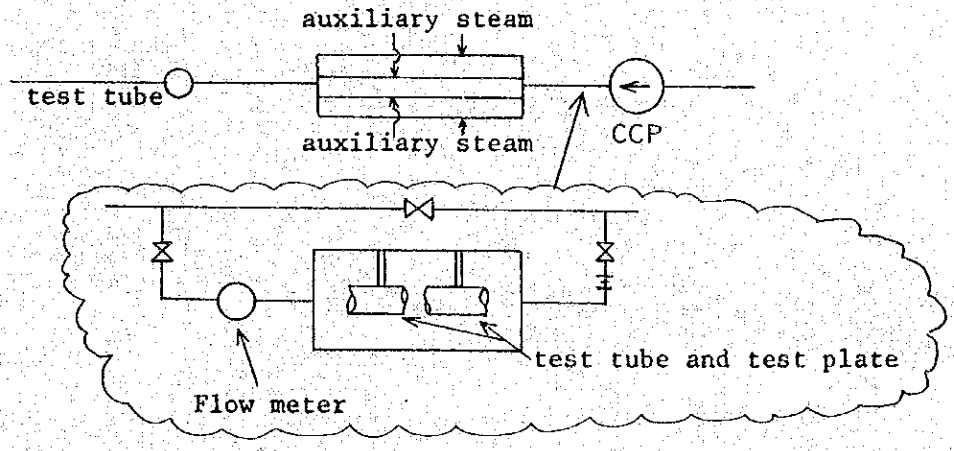
a) Inspection and repair of the root valves

b) Repair of piping steam leak

4) Boiler acid cleaning

a) Review of schedule for acid cleaning taking the unit start-up into consideration

b) Review of location of test tube and test plate



c) Secure all valves leading to Main Condenser that may possibly be affected during acid cleaning to preclude damaging condenser tube in case of acid solution leak, thru valve seat installed along the line.

R E C O M M E N D E D B Y :

K. ARIYOSHI
Mechanical Engineer

H. MAEDA
Mechanical Engineer

J. FJIMOTO
Electrical Engineer

M. KOTANI
Electrical Engineer