

PLTU Nagan Raya NAD 2X110MW

Boiler Operation Manual (Startup Boiler Operation Manual)

Vol.1 –4A



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Preface

The CFB Startup Boiler Operation Manual is compiled in accordance with all the descriptions and corresponding drawings provided by Jiangsu Taihu Boiler Co. Ltd and manufacturers from the 2×110MW coal-fired power plant project in Aceh, Indonesia. This version is just applicable to the CFB boiler auxiliaries operation of 2×110MW coal-fired power plant project in Aceh, Indonesia.

The relevant set values and interlock conditions in the operation manual need to be supplemented and modified after the site commissioning.

There may be some mistakes and flaws in the manual as a result of incomplete materials. As the material gradually becomes complete, the manual will be modified and improved continually.

1 Startup Boiler

1.1 General Introduction to Startup Boiler

This startup boiler, structured in D-shaped furnace, is composed of upper and lower steam drum, convective and radiating heating surface, superheaters, economizers, boiler walls, platform escalator, steel frame and other components. It's of compact structure and high thermal efficiency.

1.2 Technical Specifications

Table 1-1 Main Technical Specification of Starting Boiler

Parameter	Unit	Design Data
Boiler Model		SZS10-1.27/270-Y
Boiler Rated Output	t/h	10
Boiler Maximum Continuous Rate	t/h	11
Steam Pressure under Rated Condition	MPa	1.27
Steam Temperature under Rated Condition	°C	270
Feedwater Temperature	°C	20
Economizer Outlet Water Temperature	°C	89
Boiler Fume Discharging Temperature	°C	166
Rated Oil Consumption	t/h	733
Oil Pressure on Burner	MPa	2.8~3.5

1.3 Technical Specification of Boiler Auxiliaries

1.3.1 Specification of FDF

Table 1-2 Technical Specification of FD Fan

Parameter	Unit	Data
Air Volume	m ³ /h	10800
Air Pressure	Pa	6000
Motor Power/Voltage	KW/V	30/400
Current	A	54.1
Protection Grade		IP55

Rotary Speed	rpm	2965
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1.3.2 Technical Specification of IDF

Table 1-3 Technical Specification of Induced Draft Fan

Name	Unit	Data
Air Volume	m ³ /h	31554
Air Pressure	Pa	2041
Motor Power/Voltage	KW/V	37/400
Protection Grade		IP54
Rotary Speed	rpm	1450

1.3.3 Specification of Feedwater Pump

Table 1-4 Technical Specification of Feedwater Pump

Parameter	Unit	Data
Quantity	Set	2
Volume	t/h	12.5
Head	m	175
Motor Power/Voltage	KW/V	15/400
Current	A	27
Protection Grade		IP54
Rotary Speed	rpm	2900

2 Boiler Startup

2.1 Preparation and Inspection before Boiler Startup

2.1.1 Preparation before Boiler Startup

- 2.1.1.1 Check boiler equipment to confirm all auxiliaries are connected with power supplies.
- 2.1.1.2 Contact I&C personnel to run the monitoring devices continuously for 4 hours earlier before ignition.
- 2.1.1.3 Contact I& C personnel to check and calibrate related instruments. If everything is good, run them and put boiler protection interlocks into operation.
- 2.1.1.4 Put compressed air system into operation.
- 2.1.1.5 Contact chemical personnel to prepare abundant and standard demineralized water and test boiler water quality. Boiler cannot be started unless the water

-
- quality is good.
- 2.1.1.6 Confirm one oil supply pump is in service and circulating state. Oil pressure must be greater than 2.5MPa.
- 2.1.1.7 Inform shift operators to make records in order to start boiler operation permit.
- 2.1.2 **Inspection before Boiler Startup**
- 2.1.2.1 Boiler Proper Inspection
- 1) Check all heating surface is proper in appearance and clean.
 - 2) Check boiler periphery is clean and nobody is on work.
 - 3) Check every manhole, observation port and fire inspection port is tightly closed.
 - 4) Check boiler roof, all channels of operation floor, ground and operation periphery is clean and without foreign matters.
 - 5) Check boiler house is in good illumination and emergency illumination is reliable.
 - 6) Check all platforms, stairs, fences, coverplates inside boiler house are well-equipped.
 - 7) Check compressed air system pressure is proper (fixed value after operation)
 - 8) Check pipe supporters are under good condition, every flue gas duct is without crack and every air
- 2.1.2.2 Steam Water System Inspection
- 1) Check steam and water connector of water level gauge is clear and proper in insulation.
 - 2) Check water level gauge indication is clear, steam valve, water valve and water discharge valve are in zero leakage and switch is working freely.
 - 3) Check to ensure every steam and water valves, flanges and bonnet bolts are tight and secure, pilot wheel is well-equipped, valve stem is clean and without bend and rust, and switch is working freely.
 - 4) Check rod joints on adjusting devices is well-equipped, pins are tight and secure and motor-driven devices are under good condition.
 - 5) Check steam drum and all pressure parts are in zero leakage.
- 2.1.2.3 Boiler Air Fan Inspection
- damper works smoothly with high sensitivity.
- 9) Check control panel is clean.
 - 10) Check and confirm every indication signal from control panel is in line with the real condition.
 - 11) Check every damper, valve and pin in every part is not only tight and secure, but also in appropriate control and flexible motion.
 - 12) Check rods and joints for each transmission device are not only tight and secure, but also in appropriate control and flexible motion.

- 1) Check all protection houses are well-equipped and tight, coupling is in good connection, foundation and base bolts are tight and secure, coupling is in flexible rotation.
- 2) Check air fan dampers and its actuators are working freely, switches are in proper direction and zero leakage.
- 3) Check junction boxes on motor is tight and secure and earthing wire is under good condition (convenient for electrical personnel to check).
- 4) Check motor periphery is in good illumination and without scaffolding and other

foreign matters.

2.1.2.4 Feedwater Pump Inspection

- 1) Check all protection houses are well-equipped and tight, coupling is in good connection, foundation and base bolts are tight and secure, coupling is in flexible rotation.
- 2) Check junction boxes on motor is tight and secure and earthing wire is under good condition (convenient for electric personnel to check).
- 3) Check feedwater inlet and outlet valves, flanges and bonnet bolts are tight and secure, pilot wheel is well-equipped, valve stem is clean and is without bend and rust, and switch is flexible.

2.1.2.5 Fuel Oil System Inspection

- 1) Check oil supply pump motor, base bolts on pump and protection house are tight and secure.
- 2) Check and confirm fuel oil pump has been started and in circulating state.
- 3) Check oil is abundantly reserved.
- 4) Check burner is properly installed.
- 5) Check each oil pipeline, blowing pipeline, compressed air pipeline and valves are in zero leakage.
- 6) Check igniter is under good condition and without jam.
- 7) Check to make sure motor-driven valves and control valves work freely while being closed and opened, and remote actuator work smoothly and at REMOTE position.
- 8) Check compressed air pressure is proper (determine the set value after commissioning)

Table 2-1 Inspection of Boiler Valves

Items	Before Ignition	During Ignition	During Operation
Water makeup valve of feedwater tank	Closed	Open	Open
A Inlet valve of feedwater pump	Closed	Open	Open
B Inlet valve of feedwater pump	Closed	Open	Open
A outlet valve of feedwater pump	Closed	Open	Open
B outlet valve of feedwater pump	Closed	Open	Open
The manual stop valve before main feedwater valve (motor driven)	Closed	Open	Open
The manual stop valve after main feedwater valve (motor driven)	Closed	Open	Open
Main feedwater valve	Closed	Regulating	Regulating
Main feedwater bypass valve	Closed	Open	Closed
Air valve of feedwater pipe	Closed	Closed	Closed
Inlet valve of economizer	Closed	Open	Open

Drain valve of economizer inlet header	Closed	Closed	Closed
economizer Outlet valve	Closed	Open	Open
Vent valve of economizer outlet header	Open	Closed	Closed
Vent valve of upper steam drum inlet pipe	Open	Closed	Closed
manual stop valve before desuperheating water valve	Closed	Open	Open
manual stop valve After desuperheating water valve	Closed	Open	Open
Desuperheating water valve	Closed	Regulating	Regulating
Air valve of desuperheating water pipe	Closed	Closed	Closed
Primary valve of upper steam drum local pressure gauge	Closed	Open	Open
Air valve of upper steam drum	Closed	Open	Closed
Steam side valve of upper steam drum local water level meter	Closed	Open	Open
Water side valve of steam drum local water level meter	Closed	Open	Open
Discharging valve of upper steam drum local water level meter	Closed	Closed	Closed
Chemical dosing stop valve of upper steam drum	Closed	Open	Open
Blowdown valve of lower steam drum	Closed	Closed	Closed
Drain valve of superheater inlet header	Closed	Open	Closed
Drain valve of superheater outlet header	Closed	Open	Closed
Air valve of superheater outlet header	Closed	Open	Closed
Superheater outlet valve	Closed	Closed	Open
Outlet manual isolating valve of superheater	Closed	Open	Open
Superheat steam sampling valve	Closed	Open	Open
Feedwater sampling valve	Closed	Open	Closed
Boiler water sampling valve	Closed	Open	Open
Saturated steam sampling valve	Closed	Open	Open
Inlet motor-driven damper of Induced Draft Fan(IDF)	Closed	Regulating	Regulating
Outlet damper of Forced Draft Fan(FDF)	Closed	Open	Open

2.2

Boiler Cold State Startup

2.2.1

Open primary and secondary saturated steam vent valve, primary and secondary

		2.2.9	Close FD Fan outlet damper and press the Start button to start it. Then, open the outlet damper after confirming that the FD Fan is running normally.
2.2.2	valve of superheater inlet and outlet header, and air valve of feed water pipe.		
	Open atmospheric relief valve and drain valve of superheater.	2.2.10	Switch air volume control damper of burner to AUTO position.
2.2.3	Open inlet valve of feedwater pump and close outlet valve. Press feedwater pump Startup button in the control panel and slowly open outlet valve after checking and making sure that the pump operates normally (value set after regulation).	2.2.11	Switch IDF inlet damper to AUTO position.
		2.2.12	Check and make sure front oil pressure in oil regulating valve of boiler front oil system at 2.5MPa (value set after regulation).
		2.2.13	Adjust to ensure intake air > 30%total air (the value is to be determined after testing and commissioning) and keep the negative pressure of furnace at -100Pa.
2.2.4	Open manual valve and control valve of feedwater pipe and inlet valve of economizer. Open manual valve of economizer outlet header to upper steam drum. Inject dematerialized water into boiler. The temperature of inlet water should be within 90℃.	2.2.14	Check and make sure program control operates normally and then start boiler purging. The purging time is 60s. Ignite after purging.
		2.2.14.1	Move forward the igniter.
2.2.5	Close air valve of feedwater pipe when there is water.	2.2.14.2	Burner nozzle will be opened after the solenoid valve is energized.
2.2.6	Close control valve of feed water pipe and economizer inlet valve, shut down feed water pump, and switch the control button of feedwater pump to AUTO position.	2.2.14.3	When flame is detected by flame detector
		2.2.14.4	Withdraw the igniter.
		2.2.14.5	Switch burner to automatic mode.
		2.2.15	If boiler ignites successfully, it will operate with minimum load. If boiler fails to ignite, do not ignite compulsively. Ascertain the causes, eliminate problems and then reignite after purging furnace.
2.2.7	Record expansion value of boiler's every part once.		
2.2.8	Close inlet damper of Induced Draft Fan (IDF) and press IDF Startup button in the control panel. Regulate inlet damper of IDF after checking and making sure that IDF operates normally and keep negative pressure of	2.2.16	Automatically start up feedwater pump according to water level (value set is determined after testing) during boiler heating and boosting.

- 2.2.17 Use AUTO regulation mode to increase load. It is required that a minimum time of 2 hours is needed to increase boiler pressure to the rated operating pressure (1.27MPa).
- 2.2.18 Flush water level meter of upper drum once as follows when the pressure of upper steam drum is 0.05 ~ 0.1Mpa:
- 2.2.18.1 Water flushing
- 1) Close water level meter steam side valve.
 - 2) Open water level meter drain valve to fully open.
 - 3) Close water level meter drain valve.

		manufacturer's references
	4) Flushing is finished. Open water level meter steam side valve and operate water level meter.	available, we can not ascertain boiler temperature and pressure. Here we only provide the procedures on hot state startup. Open atmospheric relief valve and drain valve of superheater. Close inlet regulating damper of IDF. Press the START button to start it. Open inlet regulating damper after checking and making sure IDF operates normally. Close outlet damper of Forced Draft Fan (FDF). Press FDF STARTUP button to start up FDF. Adjust to allow intake air > 30% total air (value set will be determined after testing and commissioning) and keep the negative pressure of furnace at -100Pa. Feedwater pump should be at automatic position. The outlet valve of feedwater pump A should be closed. The valve of the feedwater pipeline should also be closed. The feedwater pump should be started according to the boiler water level automatically. After program control mode runs normally, you can start boiler purging. The time of purging is determined by the boiler control system. After purging, perform boiler ignition. Press the START BURNER button to ignite the boiler. Operate with lowest load after successful ignition. Cannot conduct forced ignition if the boiler ignition failed. Re-ignite the boiler after checking and solving the problems. Re-ignition should be followed by furnace purging. The adjustment of the load in
2.2.18.2	Steam flushing 1) Close water level meter water side valve. 2) Open water level meter drain valve to fully open. 3) Close water level meter drain valve. 4) Flushing is finished. Open water level meter water side valve and operate water level meter.	2.3.1 2.3.2 2.3.3
2.2.19	Close primary and secondary vent valve of saturated steam when the pressure of upper steam drum is 0.15 ~ 0.2MPa.	2.3.4
2.2.20	Close primary and secondary vent valve of superheater inlet and outlet header, and drain valve of superheater when the pressure of upper steam drum is 0.15 ~ 0.2MPa.	2.3.5
2.2.21	Slowly open main steam valve when the pressure of steam raise to 0.4 ~ 0.5MPa. Close atmospheric relief valve of superheater after opening main steam valve.	2.3.6
2.2.22	Open desuperheating water valve according to the temperature change of main steam.	
2.3	Boiler Hot State Startup Because there is no boiler	2.3.7

boiler should be automatic.
The load of boiler should increase and the pressure 2.3.9 of it should increase to the set pressure (1.27Mpa), and which should be not less than 1 hour.

2.3.8

The drain valve of superheater should be closed when the pressure

of the drum reaches 0.15~0.2Mpa.

The main steam MOV should be opened slowly when the main steam pressure increases to 0.4~0.5Mpa. The atmospheric relief valve of the superheater should be closed when the MOV of the main steam is opened.

- 2.3.10 The superheating water valve should be opened to let the superheating water enter the boiler according to the main steam temperature.

3 Inspection and Adjustment During Normal Operation

3.1 Inspection During Operation

- 3.1.1 Check the boiler observation hole and inspection hole closed tightly. Take immediate methods once there's air leakage.
- 3.1.2 Check the operation of fans, water pumps and oil pumps whether stable or not. Check the sound of the equipment whether normal or not. The boiler should be shutdown to find out the cause if there's any abnormality.
- 3.1.3 Check the bolts for fans, feedwater pump and anchor bolts for oil pumps for looseness.
- 3.1.4 Check the temperature and vibration of fans and bearing of makeup water pump whether within the specified scope.
- 3.1.5 Check the dial of the oil pressure gauge whether stable or not. The boiler should be shutdown to find out the cause in time if the pressure is abnormal. Special attention should be paid if there's any fuel leakage.
- 3.1.6 Check the dial of the steam pressure gauge and makeup water pressure gauge whether stable or not. Immediate shutdown should be carried out if the pressure is abnormal.
- 3.1.7 Check the water level gauge, valves, pipes and flange of the steam drum whether there's any leakage
- 3.1.8 Monitor the water level of the water level gauge whether there's huge fluctuation. Immediate shutdown should be implemented to find out the cause if there's any abnormality.
- 3.1.9 Monitor the water level of boiler to be normal($0\pm 50\text{mm}$). The water level is neither allowed to be lower than the lowest water level (-50mm) nor higher than the highest water level ($+50\text{mm}$). Meanwhile, amount of water and steam flow must be observed to make sure they are as required. In addition, changes of the water flow should be steady and without sudden fluctuation.
- 3.1.10 Water level in steam drum should be calibrated every shift, and the water level gauge should be cleaned every day.

Table 3-1 Monitoring data during operation

Items	Set Value	Notes
Main steam flow	Set 10t/h, Max 11t/h	
Main steam temperature	270℃	
Main steam pressure	1.27Mpa	
Steam drum water level	$0\pm 50\text{mm}$	

oil pressure	$\geq 2.5\text{Mpa}$	
Furnace pressure	- 50 ~ - 100 Pa	
Exhaust Temperature		To be determined after testing
I.D. fan current	$< 66.7\text{A}$	
I.D. fan motor bearing temperature	$< 90^{\circ}\text{C}$	To be determined after testing
I.D. fan bearing vibration	$< 6.3\text{mm/s}$	To be confirmed after testing
F.D. fan current	$< 54.1\text{A}$	
F.D. fan motor bearing temperature	$< 90^{\circ}\text{C}$	To be determined after testing
F.D. fan motor vibration	$< \text{xmm/s}$	To be determined after testing
Feedwater pump current A,B	$< 27\text{A}$	
Feedwater pump motor bearing temperature	$< 90^{\circ}\text{C}$	To be determined after testing
leakage in packing chest	$< 15\text{ml/min}$	

3.2 Boiler Operational Tune-up

3.2.1 Boiler Operation Tune-up Items

- 3.2.1.1 Keep the evaporation of the boiler less than 10t/h, no more than 11t/h at most
- 3.2.1.2 Ensure the steam pressure and temperature are less than 1.27Mpa and 270℃ respectively
- 3.2.1.3 Balance the inlet water and keep it fluctuating within the scope of 0±50mm.
- 3.2.1.4 Guarantee the quality of the saturated steam and the superheated steam.
- 3.2.1.5 Ensure the safe and economical operation of the boiler

3.2.2 Adjustment of Boiler Water Level

- 3.2.2.1 Boiler feedwater should be well distributed. The fluctuation scope of the steam drum water level is ±50mm. Boiler feedwater disruption is forbidden during the operation.
- 3.2.2.2 The feedwater control valve should be switched to Automatic after water level is settled when the steam drum pressure is higher than 1MPa (the final value will be determined after testing).
- 3.2.2.3 The fluctuation of boiler water level should be monitored to make sure that the water level change is steady avoiding severe regulation. Moreover, check the flow of feedwater whether meets up with the flow of steam or not.
- 3.2.2.4 The fluctuation of feedwater pressure and temperature should be monitored during operation.
- 3.2.2.5 The steam drum water level should be calibrated at least twice every shift during operation. Maintenance personnel should be informed immediately once the level gauge indicates incorrectly.
- 3.2.2.6 The water level in steam drum should be working properly and easy to read. The lighting should be adequate. The water level gauge should be cleaned once a

Regulation

3.2.3	Steam Pressure and Temperature Adjustment	3.2.4.1	The combustion status should be observed. Complete combustion depends on the proper ratio of fuel and air, which should follow the criteria below:
3.2.3.1	The amount of evaporation of the boiler should be adjusted according to the demands. The evaporation should not be less than the minimum permissible value (value set after regulation) to ensure the steady combustion of the boiler and normal water circulation.		1) Flame with dark smoke and emitting from stack means inadequate air. Widely open the forced air valve.
3.2.3.2	The permissible fluctuation scope of the steam pressure in boiler: steam pressure 0.05Mpa. And the permissible fluctuation scope of the steam temperature in boiler: steam temperature $\pm 5^{\circ}\text{C}$.	3.2.4.2	2) Flame appearing orange color, furnace full of flames and colorless and transparent smoke mean complete combustion
3.2.3.3	The flow of superheating water should be regulated according to the variation of boiler temperature to ensure a constant temperature of superheated steam.	3.2.4.3	3) Flame appearing white, splashing sparks and white smoke emitting from stack means excessive air flow. Close the forced air valve according to the demands.
3.2.3.4	The duration of boiler operation with excessive load should not be over 2 hours and the main steam flow is less than 11t/h.	3.2.5	The pressure in combustion chamber should be within - 50 ~ - 100 Pa during operation. Operation with positive pressure is forbidden.
3.2.3.5	The pressure gauge and thermometer of steam should be checked once in every shift to make sure that the parameter of steam supply is normal. I&C personnel should be informed instantly if there's any irregular action taking place.	3.2.5.1	Adjust fuel quantity timely according to the variation of boiler load to make sure that the steam pressure and temperature in boiler is constant.
3.2.4	Boiler Combustion	3.2.5.2	Boiler Blowdown Carry out the blowdown once a day during operation. Boiler operates with low load and high water level when blowdown. The blowdown time for each circulation loop cannot exceed 30 seconds. Two or more valves cannot be opened at the same time. This boiler is designed with manual blowdown operation mode. Monitor the variable of feedwater pressure and drum

	water level to maintain normal water level of the steam drum. Thoroughly check after blowdown to make sure every valve is tightly closed.	3.2.5.4	primary one).
3.2.5.3	Open the primary blowdown valve and secondary blowdown valve at the upper steam drum. Close them after 30 seconds (firstly close the secondary valve in prior to	3.2.5.5	Open the primary blowdown valve and secondary blowdown valve at the lower steam drum. Close them after 30 seconds (firstly close the secondary valve in prior to primary one). Slowly perform the blowdown to prevent water impact. Stop blowdown immediately
			1 0

when severe vibration is occurred in pipelines.

- 3.2.5.6 Stop blowdown immediately when emergency events are happened to boiler during blowdown, except that drum water level is too high.

4.1.9

4 Boiler Shutdown

4.1 Boiler Outage to Cold Standby State

- 4.1.1 Boiler blows down once.

4.1.10

- 4.1.2 Gradually lower boiler load.

4.2

- 4.1.3 Set the feedwater control valve for boiler piping at manual mode. Close desuperheating valve for superheater based on the actual temperature of the boiler.

4.2.2

4.2.3

- 4.1.4 Close main steam solenoid valve when the main system does not need steam supply. Open atmospheric relief valve for superheater to maintain normal water level ($0 \pm 50\text{mm}$) in steam drum.

4.2.4

- 4.1.5 When the load of boiler drops to the lowest value, press the Deactivate button for the burner on the control panel to stop firing and close the fuel valves at the corners.

4.2.6

- 4.1.6 Press STOP button for F.D.F on the control panel to stop the forced air and close damper from the F.D.F outlet.

4.2.7

on the control panel to stop the induced air. Close the regulating damper from I.D.F inlet and cut back flue gas system.

Close economizer inlet valve after water gets to the highest water level in the steam drum and close feedwater motor-driven valve to stop supplying water to the boiler.

Press FEEDWATER PUMP STOP to stop operating the feedwater pump when feedwater pump is set to the manual mode and close outlet of feedwater pump.

Close atmospheric relief valve of superheater. The boiler is enclosed.

Boiler Shutdown to Hot Standby State

Lower boiler load gradually and reduce main steam pressure of boiler.

Close desuperheating water valve for superheater gradually and set the feedwater control valve for boiler piping at manual mode.

Close main steam solenoid valve when the main system does not need steam supply. Open atmospheric relief valve for superheater.

Press EXIT THE BURNER button on the control panel and close corner-arranged fuel valve to stop burner operating.

Press F.D.F STOP button on the control panel to stop the forced air and close damper from the F.D.F outlet.

Press I.D.F STOP button on the control panel to stop the induced air. Close the regulating damper from I.D.F inlet and cut back flue gas system.

- 4.2.8 Set feedwater pump at enclosed.
automatic mode and go on
feeding water in the steam
drum until it reaches
normal water
level($0\pm 50\text{mm}$). 5.1

5 Failures and Solutions

Boiler System

- 4.2.10 Close superheater
atmospheric relief valve
gradually. The boiler is

1
1

and accuracy of water level indication.

5.1.1 **Boiler Water Over-limit**

5.1.1.1 Descriptions

- 1) Water level exceeds the normal level 50mm.
- b) High water level signal is on when water level alarming apparatus rings.
- 3) Temperature of superheat steam falls.
- 4) Saltness of steam increases.
- 5) Feedwater flow exceeds steam flow abnormally.
- 6) There would be water attack in steam piping and bubbles in flange when water overflows severely.

5.1.1.2 Causes

- 1) Feedwater automatic regulator is out of order and feedwater regulation device breaks down.
- 2) Operators' misjudging results in mis-operation due to incorrect indication of water meter, steam flow meter or water flow meter.
- 3) Boiler load increases swiftly.
- 4) Feedwater pressure increases suddenly.
- 5) Operators cannot regulate water level in time or mis-operate because of their careless in observing water level.

5.1.1.3 Solutions

- 1) Confirm the rightness

- 2) Turn down regulation valve to reduce feedwater when feedwater automatic regulator is out of order, influencing water level. Turn down feedwater valve when regulation valve cannot control feedwater.
- 3) Open the blow-off valve for steam drum when water level is rising.
- 4) Go on turning down or close the valves controlling feedwater when the three measures are used but water level is still rising, exceeding 100mm of normal level.
- 5) Shut down the boiler as water level in steam drum exceeds upper visible water level.

Water Loss in Boiler

Descriptions

- 1) Water level is under normal level.
- 2) Low water level signal is on when water level alarm rings.
- 3) Feedwater flow is less than steam flow abnormally.
- 4) Superheat steam temperature rises due to lack of water severely.

Causes

- 1) Malfunction of Feedwater automatic control valve.
- 2) Incorrect indication of water level and steam flowmeter of steam or water, which resulted in an mis-just and misoperation .
- 3) Boiler load decreases suddenly.
- 4) Feedwater pressure decreases.
- 5) Boiler blowdown pipe

overflows. The valve
leaks severely.

- 6) Water wall pipes or
economizer pipes
crack.

- 7) Inadvertently watch against
water level or failure to do
right adjustment or

1
2

mis-operate level.

5.1.2.3 Solutions

- 1) Confirm the rightness and accuracy of water level indication.
- 2) Turn up regulation valve to increase feedwater when feedwater automatic regulator is out of order, influencing water level.
- 3) Go on feeding feedwater when the two measures are used but the water level is lowering, 100mm less than normal level. Close all blow off valves and discharging valves to decrease evaporation capacity properly.
- 4) Shut down boiler immediately and close main steam valve to feed feedwater in the boiler when the water level in steam drum keeps on decreasing and the water level in the level gauge is out of sight.

5.2 Solutions Against Boiler Auxiliary Malfunction

5.2.1 Solutions Against Forced Draft Fan Failures

Table 5-1 Solutions against forced draft fan failures

Malfunction	Causes	Solutions
Severe vibration on bearing box	a) Misalignment between fan bearing and motor bearing; coupling tilt. b) Insufficient foundation rigidity c) Loosening of bolt at the bottom of bearing seat. d) Friction between air inlet and impeller. e) Blade imbalance due to oil scaling and friction.	a) Realign and reassemble. b) Reinforce and repair. c) Inspect and tighten every bolt. d) Adjust space between air inlet and impeller. e) Check, clean and repair. Perform dynamic balance test if necessary.
Overheat of bearing	a) Severe vibration on bearing box. b) Over fastening or loosening of bearing cap. c) Excessive space between bearing raceway or damage in bearing. d) Imbalance of rotor.	a) Adopt the above solutions. b) Check and adjust. c) Check and change bearing. d) Check and rebalance rotor.
Excessive motor current and over heat	a) Excessive conveying gas density. b) Current and voltage in excess to set value. c) Extreme low inlet voltage of motor or single phase power supply outage. d) Coupling misalignment, or uneven clearance. e) Actual operating power exceeds the rated power.	a) Check whether the density exceeds set value. b) Check and restrict operation point. c) Check and adopt solutions. d) Check, align and adjust. e) Adjust control valve or change motor.

5.2.2 Solutions Against Induced Fan Malfunction

Table 5-2 Solutions against induced fan malfunction

Malfunction	Causes	Solutions
Severe vibration on bearing box	a) Misalignment between fan bearing and motor bearing, coupling tilt. b) Insufficient foundation rigidity. c) Loosening of bolt at the bottom of bearing seat. d) Friction between air inlet and impeller. e) Blade imbalance due to oil scaling and friction.	a) Realign and reassemble. b) Reinforce and repair. c) Reinforce and repair every bolt. d) Adjust space between air inlet and impeller. e) Check, clean and repair. Perform dynamic balance test if necessary.
Overheat of bearing	a) Severe vibration on bearing box. b) Over fastening or loosening of bearing cap. c) Excessive space between bearing raceway or damage in bearing. d) Imbalance of rotor.	a) Adopt the above solutions. Check and adjust. c) Check and change bearing. d) Check and change rotor.
Excessive motor current and over heat	a) Excessive conveying gas density. b) Excessive values of current and voltage. c) Extreme low inlet voltage of motor or single phase power supply outage. d) Coupling connection misalignment, space nonuniformity. e) Required power for operation in excess to rated power.	a) Check whether the density exceeds set value. b) Check and restrict operation point. d) Check, align and adjust. e) Adjust control valve or change motor.

5.2.3

Solutions Against Feedwater Pump Malfunction

Table 5-3 Solutions against feedwater pump malfunction

Malfunction	Causes	Solutions
Pump not suck water; severe vibration on indicator of pressure gauge and vacuum gauge.	Insufficient water injection to pump; gas leakage on pipe and gauges.	Reinject water into pump; block and stop leakage.
Pump not suck water, extreme vacuum indication on vacuum gauge.	Seat valve closed or clogged; strong resistance to suction pipe; over high suck water height.	Correct or change seat valve condition; change suction pipe; lower suck water height.
Pressure indicated on pressure gauge but no outlet water from pump.	Strong resistance to outlet water pipe; wrong swirling direction; impeller clogged; insufficient pump rotating speed.	Check or shorten pipe; check and clean impeller; increase pump rotating speed.
Water flow under design requirements.	Pump clogged; excessive wear on sealing ring; insufficient pump rotating speed.	Clean pump and pipes; change sealing ring, increase rotating speed of outlet water pump.
Excessive pump consumed power.	Over tightness of packing gland; stuffing box heated; impeller worn; increase in pump water supply.	Loosen packing gland; change impeller; increase outlet water pump resistance to decrease water flow.
Abnormal sound in pump, no water sucked from pump.	Excessive water flow; strong resistance inside suction pipe; air leaked into suction water pipe; overheat of sucked water.	Increase outlet water pipe resistance to increase flow; check pump and pipes; check seat valve; lower suck water height;

		block the leakage.
Vibration on pump.	Misalignment between pump shaft center and motor shaft center.	Align the pump shaft and motor shaft.
Over heat of bearing.	No oil on bearing; misalignment between pump and motor shaft.	Inject oil; align the pump and motor shaft; check or clean bearing body.

5.2.4 Solutions Against Burner Malfunction

Table 5-4 Solutions to burner malfunction

Malfunction	Causes	Solutions
Nozzle: uneven atomization; no oil flow; nozzle leaking.	Loose cyclone plate; Clogging in nozzle; Clogging in filter; Wearing due to use; Clogging in nozzle and malfunction of nozzle shut down device.	Disassemble the nozzle and fasten the cyclone plate; Disassemble and clean; Disassemble and clean; Change; Disassemble, clean or change.
Igniting failure	Air damper unable to turn to full load; Improper cam installation; Wearing or extreme contamination in igniting electrodes and insulation failure; Igniting cable failure; Igniting sensor failure.	Change; Correct; Change or change; Change; Change.
No flame: fan locked shortly after shartup; nozzle stopping injecting oil due to malfunction	Low pressure in oil pump; Clogging or damage in nozzle; Malfunction in solenoid valve; Malfunction in control circuit; Malfunction in solenoid valve; Wear and damage in loops or cable.	Regulate, clean or change; Reinstall; Clean or change; Change; Change the hydraulic solenoid valve; Change the trouble unit.
Unshaped flame	Malfunction in solenoid valve; Malfunction in solenoid valve or damages in loops and cable; Malfunction in module unit; Malfunction in nozzle valve.	Change the faulty parts; Disassemble, clean or change; Change.
Lock occurring after flame formed	Improper burner regulation; Contaminant filter; Clogging in nozzle.	Regulate; Clean; Repair or change.
Oil flowing to combustion chamber	Leakage in nozzle valve; Damage in nozzle;	Clean, repair or change; Change;

	Malfunction in solenoid	Change.
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	valve.	
Flame monitoring malfunction	Improper position of flame detector; Contaminate flame detector; Weak flame; Malfunction in flame detector; Malfunction in control module.	Move the flame detector to proper position; Clean; Check to see if the burner is properly adjusted; Change it; Change it.
Atomizing device burning-out	Improper space between atomizer and nozzle; Improper position of gas regulator or atomizer; Improper nozzle size or type; Damage in nozzle.	Change; Adjust until it is in good condition; Adjust; Replace with a proper nozzle.