



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 1 of 30

**OPERATIONAL QUALIFICATION
PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION &
DISTRIBUTION SYSTEM**

EQUIPMENT ID. No.	
LOCATION	
DATE OF QUALIFICATION	
SUPERSEDES PROTOCOL CUM REPORT No.	NIL



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OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT FOR PURE STEAM GENERATION AND DISTRIBUTION SYSTEM

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 2 of 30

CONTENTS

S.No.	TITLE	PAGE No.
1.0	Protocol Pre- Approval	03
2.0	Objective	04
3.0	Scope	04
4.0	Responsibility	05
5.0	Equipment Details	06
6.0	System Description	06
7.0	Pre- qualification Requirement	08
8.0	Critical Variables to be Met	09
9.0	References	29
10.0	Documents to be Attached	29
11.0	Deviation from Pre-defined Specification, if Any	29
12.0	Change Control, if Any	29
13.0	Review (Inclusive of Follow Up Action, If Any)	30
14.0	Conclusion	30
15.0	Recommendation	30
16.0	Abbreviations	31
17.0	Protocol Post- Approval	32



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 3 of 30

1.0 PROTOCOL PRE- APPROVAL:

PREPARED BY:

DESIGNATION	NAME	SIGNATURE	DATE
OFFICER/EXECUTIVE (QUALITY ASSURANCE)			

REVIEWED BY:

DESIGNATION	NAME	SIGNATURE	DATE
OPERATING MANAGER (QUALITY ASSURANCE)			
HEAD (ENGINEERING)			

APPROVED BY:

DESIGNATION	NAME	SIGNATURE	DATE
HEAD (QUALITY ASSURANCE)			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 4 of 30

2.0 OBJECTIVE:

- To prepare Operational Qualification Protocol Cum Report of **Pure Steam Generation & Distribution System**.
- To verify that the **Pure Steam Generation & Distribution System** operates in accordance with the Design and User Requirements as defined by set acceptance criteria and complies with relevant cGMP Requirements.
- To demonstrate that the System will operate reproducibly and consistently within its Operating Range.
- To confirm the Suitability of the Standard Operating Procedures for all routine activities associated with the System.
- Successful completion of this Operational Qualification activity will verify that the **Pure Steam Generation & Distribution System** meets all the acceptance criteria and is ready for PQ.

3.0 SCOPE:

- The Protocol Cum Report covers all aspects of Operational Qualification for the **Pure Steam Generation & Distribution System**.
- This protocol Cum Report will define the methods and documentation used to qualify the **Pure Steam Generation & Distribution System**.



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 5 of 30

4.0 RESPONSIBILITY:

The Validation Group, comprising of a representative from each of the following departments, shall be responsible for the overall compliance of this Protocol:

DEPARTMENTS	RESPONSIBILITIES
Quality Assurance	<ul style="list-style-type: none">• Preparation, Review, Pre Approval, Compilation and Post Approval of the Operational Qualification Protocol cum Report.• Co-ordination with Production and Engineering to execute Operational Qualification Activity.• Monitoring of Operational Qualification Activity.• Verification of Tests & Results.• Compliance of Deficiency (if any) & Corrective Action (if any).
Production	<ul style="list-style-type: none">• Review & Pre-Approval of Operation Qualification Protocol cum Report.• Giving clearance to operate the unit.• Execution of Operational Qualification activity.• Ensure that the equipment operates as per protocol.• Post Approval of Operation Qualification Protocol after Execution.
Engineering	<ul style="list-style-type: none">• Review & Pre-Approval of Operation Qualification Protocol cum Report.• To co-ordinate and support Operational Qualification activity.• Calibration of Process instruments.• Ensure that the equipment is operates as per protocol cum report.• Responsible for Trouble shooting (if occurs during execution).• Post Approval of Operation Qualification Protocol cum report after Execution



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 6 of 30

5.0 EQUIPMENT DETAILS:

PURE STEAM GENERATION & DISTRIBUTION SYSTEM	
Equipment ID. No.	
Manufacturer's Name	
Supplier's Name	
Location of Installation	
Capacity	500 kg/hr.
User Points	07 Nos.

6.0 BRIEF SYSTEM DESCRIPTION:

6.1 PURE STEAM GENERATION & DISTRIBUTION:

Pure Steam Generator capacity 500 kg/cm² produces Pure steam as pyrogen free, Pure Steam. It operates on the Distillation as Unit Process. Sterile steam generation engross with Liquid to Vapor phase change to produce very high purity steam. It removes the impurities at sterile temperature without using any filtration medium.

PSG works on "Falling Film Evaporator" principle. It is most reliable method to produce pure steam. It employs high temperature (Sterile state temperature), which assures constant production with high quality. As unit does not have moving parts, it demands very little maintenance.

Pure Steam is used for steam sterilization in autoclave, pipelines, tanks, fermentors and humidification of sterile area.

The system designed to remove microbial contamination by Three Stage Separation.

PSG has single effect unit. It comprise of a inner most evaporator (Shell & Tube heat exchanger), an intermediate separator and outer columns. Source of energy for the effect is Boiler Steam.

Feed Purified water is preheated by waste recovery method and enters the first effect from tube side.

Specially designed distribution plate ensures the water falls down the tube as a "Thin film". The falling film is heated with plant steam and causing it to a instant flash evaporation. This flash evaporation helps the steam to leave behind the heavier particles or droplets. (First Stage of Separation).This



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 7 of 30

Transformation from water to steam significantly increases the velocity as it approaches the bottom of the column with high pressure.

This vapour as it moves outside the tubes is forced to change its direction to a 180° turn. This directional change induces the separation of large water droplets (Secondary Separation), which fall into the bottom of the column, where they are collected with excess feed water that has not evaporated.

As the steam moves upwards, the spirals provided on the shell of the evaporator force the steam to move in a circular path. The resulting centrifugal action forces the remaining microscopic droplets and impurities including the Endotoxin to the outer surface, which then gets blown down through the windows provided on the separator. (Third Stage Separation) the resulting steam is Pure Pyrogen free sterile Steam.

The Pure Steam Generator consists of:

- One Column Shell
- One Main Heat Exchanger.
- Two Pre-heaters.
- Feed water line with multistage pump.
- NCGR system with sampling arrangement.
- Boiler steam inlet line.
- Pure steam outlet line.
- Boiler steam condensate line with steam trap.
- Excess feed water (un-evaporated) line.
- Automatic control panel with HMI.



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 8 of 30

7.0 PRE –QUALIFICATION REQUIREMENT:

7.1 Verification of Documents:

Verify that the DQ/IQ of the **Pure Steam Generation & Distribution System** have been executed and approved.

Verify that SOP for Operating, Cleaning and Preventive Maintenance of the **Pure Steam Generation & Distribution System** has been prepared.

The following lists all the SOP's and formats, as draft documents that are related to the operation of the **Pure Steam Generation & Distribution System**. The validation team should make necessary amendments to those and record the status on the checklist that will be attached to the report.

S. No.	Document Name	Document/SOP No.	Completed (Yes/No)	Checked By (Engineering) Sign/Date	Verified By (QA) Sign/Date
1.	DQ Protocol Cum Report				
2.	IQ Protocol Cum Report				
3.	Operational qualification protocol cum report of Pure Steam Generator and Distribution				
4.	Cleaning and Sanitization of Pure Steam Generator and Distribution				
5.	Hydro test procedure				
6.	Passivation Procedure				
7.	Slope verification Procedure				
8.	Boroscopy Procedure				
9.	Drainability Procedure				
10.	Welding Procedure				

Check list to be filled by the validation team and attached to the report.



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 9 of 30

8.0 CRITICAL VARIABLES TO BE MET:

8.1 Testing of Main Panel/Control Panel:

To verify the response of the Equipment at the input from various Push Buttons/Switches on control or Main Panel is as per the System Design.

8.1.1 Procedure:

Give inputs from the various push Buttons & Switches on Control Panel/Main Panel and observe the response from the Machine.

8.1.2 Acceptance Criteria:

The Equipment will respond as per the System Design.

Operational Checks	Acceptance Criteria	Observation	Observed By (Engineering) Sign & Date
Main Control Panel Testing:			
Main Panel Main Switch switched on	Indicating Lamp on main Panel Shall Glow		
Press emergency stop button	Display will shows "Emergency Stop" & Feed pump will stop, all valves will get OFF & dumping valve will get ON/OFF as per valve Position		
Release emergency stop button	Feed pump will start valves will get On as per interlocking & dumping valve will get OFF		

Checked By:
(Engineering)
Sign & Date _____

Verified By:
(Quality Assurance)
Sign & Date _____

Inference: _____

Reviewed By:
(Manager QA)
(Sign & Date) _____



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 10 of 30

**8.2 Operational Checks:
Instrument Calibration:**

The validation team will test and record the calibration data for the instruments that are going to be used for the calibration of the various equipment in the **Pure Steam Generation and Distribution system**. In cases where the calibration instruments are calibrated/ certified by an external agency, a certificate for the calibration should be attached to the OQ report.

The following checklist should be completed during the Operational qualification by the validation team and added to the report.

S.No.	Name of the Instrument	Calibration Done on	Calibration Due on	Calibration verified by
1.	Pressure transmitter			
2.	Pressure gauge for boiler steam inlet			
3.	Pressure gauge for feed water			
4.	Pressure gauge for pure steam.			
5.	Pressure switch for operating air pressure			
6.	Pressure switch for feed water			
7.	Pressure switch for loop system			
8.	Temperature sensor for boiler plant steam inlet			
9.	Temperature sensor cum transmitter for pure steam outlet			
10.	Level sensor for column			
11.	Flow meter for feed water			
12.	Conductivity sensor for feed water			
13.	Conductivity sensor for pure steam			

Checked By:
(Engineering)
Sign & Date _____

Verified By:
(Quality Assurance)
Sign & Date _____

Inference:.....
.....
.....
.....
.....

Reviewed By:
(Manager QA)
Sign & Date _____



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 11 of 30

8.3 CRITICAL VARIABLES TO BE MET:

List of Operational Checks on the System.

After starting the system according to the draft SOP, the validation team should perform the following Operational checks to the system according to the specified details that are described in the following checklist.

- **PURE STEAM GENERATION & DISTRIBUTION SYSTEM**

8.3.2 Feed Water Pumps:

Operate the system as specified by SOP with all points of use closed, perform checks, take readings and record them in the present check list. Check that Electrical connection to pump is done.

Fix the flow meter to the discharge end of the pump. Switch on the supply. Start the pump. Check the rotation of pump. Check for abnormal noise.

Check for any leakages. Check the pressure reading at pressure gauge installed at pump discharge. Check the discharge through pump on flow meter.

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Pump	MP1	Direction of rotation	Clockwise from non-driving end			
		Abnormal noise	Absent			
		For leakage	No leakages			
		Abnormal noise	Absent			



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**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 12 of 30

8.3.3 Column Assembly:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Column	CA-301	Column Assembly Pressure	Inlets /Outlets	Not open to atmosphere, no leakages		

8.3.4 First pre heater assembly:

Part involved	Check	Specifications	Results	Checked by	Verified by
First Pre-Heater double tube sheet Assembly	Inlets /Outlets	Not open to atmosphere, no leakages			

8.3.5 Second pre heater assembly:

Second Pre-Heater Assembly	Inlets /Outlets	Not open to atmosphere, no leakages			
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8.3.6 Heat exchanger assembly:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Heat Exchanger Assembly	HA-301	Inlets /Outlets	Not open to atmosphere, no leakages			



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**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 13 of 30

8.3.7 Heat Exchanger Assembly Drain:

Part involved	Check	Specifications	Results	Checked by	Verified by
Heat Exchanger Assembly Drain	Inlets/Outlets	Not open to atmosphere, no leakages			

8.3.8 Rota meter:

Part involved	Check	Specifications	Results	Checked by	Verified by
Tube Rota meter	Flow within specifications	100 -1000 LPH			



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**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 14 of 30

8.3.9 Pneumatic Angle Valve:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Pneumatic Angle Valve	PN-43	Open and close correctly	When closed no leakage observed, no pressure drop			
Pneumatic Angle Valve	PN 2	Open and close correctly	When closed no leakage observed, no pressure drop			
Pneumatic Angle Valve	PN 44	Open and close correctly	When closed no leakage observed, no pressure drop			
Pneumatic Angle Valve	PN-53	Open and close correctly	When closed no leakage observed, no pressure drop			
Pneumatic Angle Valve	PN 61	Open and close correctly	When closed no leakage observed, no pressure drop			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 15 of 30

8.3.10 Diaphragm Valve:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Diaphragm Valve	DP-1	Open and close correctly	When closed no leakage, no pressure drop			

8.3.11 Conductivity Sensor & Transmitter:

After having checked the calibration status of the different conductivity indicators, take the readings during operation and report.

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Conductivity Sensor	CS-1	Conductivity within specifications	0 to 10 $\mu\text{s}/\text{cm}$			
Conductivity Sensor	CS-2	Conductivity within specifications	0 to 10 $\mu\text{s}/\text{cm}$			

8.3.12 Safety Valve:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Safety Valve	SV-1	Open and close correctly.	When closed no leakage			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 16 of 30

8.3.13 Pressure Gauges.

Operate the system as specified by SOP with all points of use closed, after checking that the different pressure gauges are correctly calibrated take readings and record them in the present check list.

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Pressure Gauge	PG-1	Pressure within specifications.	0 to 16 kg/cm ²			
Pressure Gauge	PG-2	Pressure within specifications.	0 to 16 kg/cm ²			
Pressure Gauge	PG-3	Pressure within specifications.	0 to 7 kg/cm ²			

8.3.14 Pressure Transmitter:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Pressure Transmitter	PT-1	Pressure within specifications -1to 5 bar	Temperature within specifications			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 17 of 30

8.3.15 Pressure Switch:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Pressure Switch	PS-1	Trip entire system as per Interlocking	Set value within specifications			
Pressure Switch	PS-2	Trip entire system as per Interlocking	Set value within specifications			
Pressure Switch	PS-3	Trip entire system as per Interlocking.	Set value within specifications			
Pressure Switch	PS-4	Trip entire system as per Interlocking	Set value within specifications			

8.3.16 Level Sensor:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Level Sensor	LS-1	Work Effectively	Level within specification			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 18 of 30

8.3.17 Temperature Sensors & Transmitter:

Operate the system as specified by SOP, after checking that the different temperature probes are correctly calibrated take readings and record them in the present check list.

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Temperature Sensor	TS-1	Temperature within specifications	0-200°C			
Temperature Sensor cum	TS-2	Temperature within specifications	0-200°C			
Temperature Sensor cum Transmitter	TS-3	Temperature within specifications	0-200°C			

8.3.18 Ball Valve:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Ball Valve	BV-1	Open and close correctly.	When closed no leakage observed.			
Ball Valve	BV-2	Open and close correctly.	When closed no leakage observed.			
Ball Valve	BV-3	Open and close correctly.	When closed no leakage observed.			
Ball Valve	BV-4	Open and close correctly.	When closed no leakage observed.			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 19 of 30

8.3.19 AIR FILTER REGULATOR:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Air filter regulator	APR-1	Open and close correctly no leakage.	Air Pressure within specification			

8.3.20 Non Returnable Valve:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Non- Returnable Valve	NRV-1	Valve effectively open	When closed no leakage observed,			
Non- Returnable Valve	NRV-2	Valve effectively open	When closed no leakage observed			
Non- Returnable Valve	NRV-3	Valve effectively open	When closed no leakage observed.			

8.3.21 Steam Trap:

Part involved	Tag	Check	Specifications	Results	Checked by	Verified by
Steam Trap	ST-1	Tightness	When closed no leakage observed			
Steam Trap	ST-2	Tightness	When closed no leakage observed			
Steam Trap	ST-3	Tightness	When closed no leakage observed			
Steam Trap	ST-4	Tightness	When closed no leakage observed			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 20 of 30

8.3.22 Sampling Valves .

Observe every sample valve for leakage when closed. Open one by one completely and with the aid of a Class A measuring cylinder check the volume delivered in 5 min.

Part involved	Tag	Check	Specifications	Results Open condition	Results Closed Condition	Checked by	Verified by
Sampling Valve	SP-301	Open and close correctly.	When closed no leakage observed,				

8.3.23 Electric Control Panel

To conduct this operational check proceed as follows: Switch ON main supply with the PLC, select manual mode with SW1 switch and release the emergency Stop button. Fill the Storage tank to High Level.

Part involved	Tag	Check	Specifications	observation	Checked by	Verified by
PLC	PLC-101	Emergency push Button	Work as per given system			
		Main supply switch	Work as per given system			
		Light indicator	Work as per given system			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 21 of 30

8.4 OPERATIONAL CHECKS ON ALARMS:

Provoke the following alarms and check for the result of the action and the signaling:

Description of alarm	Action	Observation	Observed By (Engineering) Sign& Date
PURE STEAM GENERATION & DISTRIBUTION SYSTEM			
Emergency stop:			
EMERGENCY STOP	Emergency stop & check the display & print will show fault “EMERGENCY STOP” and feed pump will stop & valve will OFF		
Release emergency stop button.	Release emergency stop check display it shows PROCESS OK” and feed pump & all valve will on		
Air Pressure Low:			
Air Pressure switch is set at higher value than Actual air Pressure from pressure switch value,	Display will show “AIR PRESSURE LOW” & all valve will close & Feed pump stop.		
Air Pressure switch is set at Lower value than Actual air Pressure from switch value.	Display will show “PROCESS OK” & all valve will open Feed pump start.		
GRC Water Level Low			
Stop air supply given to feed water to GC valve, after some time check on the display	“GRC WATER LEVEL LOW ” & feed pump will be OFF print will show fault		
Give air supply to feed water to GC valve, after some time check on the display	after some time check on the display which show “PROCESS OK” & feed pump will be ON as per logic		
Boiler Steam Temperature Low			
Close boiler steam valve & wait till the boiler steam temperature decrease below set temperature check on display	Check on display & print will show fault “BOILER STEAM TEMP.LOW” & feed pump will be stop & purging valve become ON.		



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 22 of 30

Description of alarm	Action	Observation	Observed By (Engineering) Sign& Date
Open the boiler steam valve & wait till the boiler steam temperature increase up to set temperature check on it display	Check on display it will show "PROCESS OK" & feed pump will be ON & purging valve become OFF.		
Feed Water Conductivity High			
Decrease the set parameter value than existing conductivity	Display will shows "F. W. conductivity High" & Feed pump will stop. & GRC to drain valve will open.		
Increase the set parameter value than existing conductivity	Display will shows "Process ok" & Feed pump will start. & GRC to drain valve will close		
Pure Steam Conductivity High			
Decrease the set parameter value than existing conductivity	Display & print will shows fault " PURE STEAM CONDUCTIVITY HIGH "		
Increase the set parameter value than existing conductivity check on display	Display which will shows "Process OK"		
Pure Steam Pressure High			
Close the pure steam out let valve & let the pure steam pressure be increase higher than the set pressure for pure steam pressure high & check on display & print will shows fault	check on display & print will shows fault "PURE STEAM PRESSURE HIGH"		
Pure Steam Pressure Low			
open the pure steam outlet valve to release the pure steam pressure	Display shows "PROCESS OK"		
Boiler steam temp. Low			



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 23 of 30

Description of alarm	Action	Observation	Observed By (Engineering) Sign& Date
Close the Boiler Steam Valve & Wait till the boiler steam temp. decrease below set temp.	Display shows “ BOILER STEAM TEMP. LOW ” & Feed pump will stop.		
Open the Boiler Steam Valve & Wait till the boiler steam temp. Increased up to set temp	Display shows “ PROCESS OK ” & Feed pump will start.		
Feed Water Pressure Low			
Turn pressure setting knob clock wise to set pressure more than actual pressure till relay of pressure switch gets OFF	Display shows “ F.W. PRESSURE LOW ”		
Turn pressure setting knob anti clock wise to set pressure less than actual pressure till relay of pressure switch gets ON	Display shows “ Process OK ”		
Insufficient Feed Water			
Decrease Feed water inlet pressure less than required pressure as soon as water pressure become less than required	Display shows “ INSUFF.FEED WATER ” & Feed Pump will stop		
Increase the feed water inlet pressure so that pressure is maintained	Display which shows “ PROCESS OK ” & Feed pump will start		
Purging on problem			
Stop Air supply given to Pneumatic Purging Valve. Increase Feed water flow rate. Allow water to accumulate in Last column till it reaches float switch high level. Wait for set parameter (Ensure that this stage will remain continuously for set value)	Display will show “ PURGING PROBLEM ” & Feed pump will stop.		



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 24 of 30

Description of alarm	Action	Observation	Observed By (Engineering) Sign& Date
Give Air supply to pneumatic purging valve. Now water will be drained out	Display shows “PROCESS OK” & feed pump will start		
Purging Off problems			
Decrease Feed water Flow rates. Also Keep pneumatic purging valve open manually by turning manual operating screw of solenoid valve wait for purging fault off time	Display shows “PURGING PROBLEM” with buzzer and feed pump will stop		
Increased feed water flow rate & keep pneumatic purging valve in auto operation. Ensure that water should reach up to level sensor. Purging valve will close after purging time	Display shows “PROCESS OK” & feed pump will start.		
Feed Pump outlet Pressure Low			
Setting knob clock wise to set pressure more than actual pressure till relay of pressure switch gets OFF 10 sec.	Check on display will shows fault “F.P OUT LET PRESSURE LOW” & feed pump will stop.		
Setting knob anti clock wise to set pressure less than actual pressure till relay of pressure switch gets ON.	Check on display will shows “PROCESS OK”		
Feed Pump Over Load			
While pump running give link between 24VDC & feed pump O/L i/p, immediately feed pump will stop automatically	Check display which shows the “FEED PUMP O/L”		
Remove link between 24VDC & feed pump O/L i/p, immediately feed pump will start automatically	Check display which shows the “PROCESS OK”		
Power Failure			



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**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 25 of 30

Description of alarm	Action	Observation	Observed By (Engineering) Sign & Date
Incase of non UPS supply switch off main panel entire panel will off OR remove physical power fail input, & cycle will stop	POWER FAILURE		
Incase of non UPS supply switch ON main panel entire panel will ON OR connect power fail input again , & cycle will stop	Power fail after power ON process will start		
GRC Temperature Low			
Close boiler steam in valve & wait till the GRC temperature decrease below set temperature.	check on the display it will shows fault on display & print "GRC TEMP.LOW"		
Open the boiler steam in PSG valve & wait the GRC temperature increases up to set temperature.	Display shows "PROCESS OK" & feed pump will ON GRC drain valve become OFF		

Checked By:
(Engineering)
Sign & Date _____

Verified By:
(Quality Assurance)
Sign & Date _____

Inference.....
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Reviewed By:
(Manager QA)
Sign & Date _____



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 26 of 30

8.5 Safety Features Verification:

To avoid damage to the operator or **Pure Steam Generation & Distribution System** while operating the Equipment.

8.5.1 Procedure:

- Operate the Equipment in Manual Mode as directed in the User Manual.
- While the Equipment is operating, shutdown the power to the main Control Panel. Record if the equipment stops in a Safe and Secure Condition.
- Perform same Test for three times.

8.5.2 Acceptance Criteria:

Operational Checks	Acceptance Criteria	Observation	Observed By (Engineering) Sign & Date
PURE STEAM GENERATION & DISTRIBUTION SYSTEM			
Pure Steam Safety Valve	Safety valve should open at 7 .0 Kg /cm ² Pressure		
Purging Valve	Purging valve should open when column water level is high		
	Purging valve should open when Boiler Steam temp. Low		
Boiler Steam Safety Valve	Safety Valve should open at 6.1Kg /cm ² Pressure.		
Earthing	Proper Earthing should be provided.		

Checked By:
(Engineering)
Sign & Date _____

Verified By:
(Quality Assurance)
Sign & Date _____

Inference: _____

Reviewed By:
(Manager QA)
Sign & Date _____



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 27 of 30

9.0 REFERENCES

- Design Qualification Protocol Cum Report
- GA and P&ID Drawings
- Approved Design & Specification.
- Any Other Relevant documents.

10.0 DOCUMENTS TO BE ATTACHED:

- Operational and Maintenance Manual
- Copy of Draft SOPs
- Any other Relevant Documents

11.0 DEVIATION FROM PRE-DEFINED SPECIFICATIONS, IF ANY:

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12.0 CHANGE CONTROL, IF ANY:

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**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 28 of 30

13.0 REVIEW (INCLUSIVE OF FOLLOW UP ACTION, IF ANY):

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14.0 CONCLUSION:

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15.0 RECOMMENDATION:

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**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:

EFFECTIVE DATE:

PAGE No.: 29 of 30

16.0 BBREVIATIONS:

- PQ : Performance Qualification.
LPH : Liter per Hour.
PSG : Pure Steam Generator.
P &ID : Piping & Instrumentation Diagram.
SOP : Standard Operating Procedure.



**OPERATIONAL QUALIFICATION PROTOCOL CUM REPORT
FOR
PURE STEAM GENERATION AND DISTRIBUTION SYSTEM**

PROTOCOL No.:
EFFECTIVE DATE:
PAGE No.: 30 of 30

17.0 PROTOCOL POST- APPROVAL:

PREPARED BY:

DESIGNATION	NAME	SIGNATURE	DATE
OFFICER/EXECUTIVE (QUALITY ASSURANCE)			

REVIEWED BY:

DESIGNATION	NAME	SIGNATURE	DATE
OPERATING MANAGER (QUALITY ASSURANCE)			
HEAD (ENGINEERING)			

APPROVED BY:

DESIGNATION	NAME	SIGNATURE	DATE
HEAD (QUALITY ASSURANCE)			