PERFORMANCE QUALIFICATION PROTOCOL FOR PURE STEAM GENERATION & DISTRIBUTION SYSTEM

EQUIPMENT ID No.	
LOCATION	
DATE OF QUALIFICATION	
SUPERSEDES PROTOCOL No.	**NIL**

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1.0 PROTOCOL APPROVAL:

INITIATED BY:

DESIGNATION	NAME	SIGNATURE	DATE
OFFICER/EXECUTIVE (QUALITY ASSURANCE)			

REVIEWED BY:

DESIGNATION	NAME	SIGNATURE	DATE
HEAD (PRODUCTION)			
HEAD (QUALITY CONTROL)			
HEAD (ENGINEERING)			

APPROVED BY:

DESIGNATION	NAME	SIGNATURE	DATE
HEAD (QUALITY ASSURANCE)			

2.0 OBJECTIVE:

- To provide documented evidence that the **Pure Steam Generation & Distribution System** is capable to continuously supply the required quantity of WFI with the specified quality attributes thereby establishing its dependability.
- To ensure that system are continuously followed during the Performance qualification study so that adequate experimental data are obtained to support their effectiveness.

3.0 SCOPE:

The Protocol covers all aspects of Performance Qualification for the **Pure Steam Generation & Distribution System** installed in …….

. 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	• Preparation, Review, Approval, Authorization and Compilation of the Performance Qualification Protocol. • Protocol Training Record. • Co-ordination with Quality Control, Production and Engineering to carryout Performance Qualification Activity. • Monitoring of Performance Qualification.
Production	• Review of Performance Qualification Protocol. • To co-ordinate and support Performance Qualification Activity.
Quality Control	• Review of Performance Qualification Protocol. • Analytical Support (Microbiological Testing/Analysis)
Engineering	• Review of Performance Qualification Protocol. • Co-ordination, Execution and technical support in Area Qualification activity. • Calibration of Process Instruments. • Responsible for Trouble shooting (if occurs during execution).

5.0 EQUIPMENT DETAILS:

PURE STEAM GENERATION & DISTRIBUTION SYSTEM	
Equipment ID. No.	
Manufacturer's Name	
Supplier's Name	
Location of Installation	
Capacity	300 kg/hr.
User Points	One

6.0 SYSTEM DESCRIPTION:

6.1 PURE STEAM GENERATION & DISTRIBUTION:

Pure Steam Generator (300 PSG) produces 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" principal. 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. PSG has single effect unit. It comprise of a innermost evaporator (Shell & Tube heat exchanger), an intermediate separator and outer columns. Source of energy for the effect is Boiler Steam.

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

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 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° urn. This directional changes 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.

7.0 REASON FOR QUALIFICATION:

The study will establish that the parameters are followed, critical variables are under control and the quality of the output is as desired.

After completion of the Operation Qualification of the equipments, it is imperative to perform the Performance Qualification. The study will establish that the parameters are followed, critical variables are under control and the quality of the output is, as desired.

- Installation of New System. □
- Any major modification in the existing system. □
- If the system is found to be malfunctioning. □
- Change of Location.

8.0 SITE OF STUDY:

I Block

9.0 FREQUENCY OF QUALIFICATION:

- Yearly as per Validation Master Plan.
- Addition of user points.
- Substitution of existing system or its component with a new one or any change in loop line.
- After any major breakdown or any major modification in the existing system design since purpose which potentially could affect flow rates, delivery, sampling or water quality, or a signification change to the Operational parameters.
- The frequent surpassing of alert and action limits.

- If the system is found to be malfunctioning.
- Shifting of the system from one location to another

  However, magnitude of re-qualification shall depend upon nature of change and its impact on water quality. Such changes pertaining to design and operational aspects shall be evaluated through change control system. **Periodic re-qualification shall be once in Year.**

10.0 PRE – QUALIFICATION REQUIREMENTS:

10.1 VERIFICATION OF DOCUMENTS:

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

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

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.	OQ Protocol Cum Report				

10.2 VALIDATION PROCEDURE

After satisfactory completion of Operational Qualification, Performance Checks shall be carried out for **Pure Steam Generation & Distribution System**. Validation of Pure Steam Generation Distribution system.

The objective should be to demonstrate that the system is under control. Sampling from, all point daily up to 07 days should be used to satisfy the objective of proving the reliability and robustness of the system in service over an extended period.

10.2.1 CRITICAL CHECK POINT

- Calibration of all measuring instrument.
- Boiler steam temperature 143°C –155°C.
- Boiler steam pressure : 3 – 6 kg /cm^2
- Flow of feed water: 300 lit/hrs.

10.2.2 TEST METHODS AND ACCEPTANCE CRITERIA

10.2.3 PHYSICO-CHEMICAL TEST:

10.3.1 Objective:

To demonstrate that the system is capable of delivering Pure steam Quality as per Physico-Chemical Specification.

10.3.2 Equipments & instruments:

Pure steam Test kit.

10.3.3 Procedure:

Collect Sample from **Pure Steam Generation & Distribution System** following sampling points

PARAMETER	SPECIFICATIONS
Description	Clear Colorless, Odorless & Tasteless Liquid
pH	5.0 - 7.0
Conductivity (at 25°C)	NMT 1.2 µS/cm
Total Organic Carbon (Off line)	NMT 500 ppb
Nitrate	NMT 0.2 ppm
Acidity & Alkalinity	Should Comply

10.3.4 Acceptance criteria:

All the test results should comply the Physico-Chemical test specification.

10.3.5 Observation:

Record the observations in Report.

10.3.6 Evaluation:

After completion of 07 days, all test results shall be compiles and evaluated. Compliance of all test results to the specification shall establish that the Pure Steam Generation & Distribution System is capable to continuously supply the required quality & quantity of Pure steam with the specified quality attributes There by establishing its dependability. In case of out of specification, investigation shall be carried out to find out the cause of failure. Corrective action shall be avoiding reoccurrence of the failures.

Final evaluation of test results shall be carried out after completion of 07 days of qualification study.

10.4 MICROBIOLOGICAL TESTING:

10.4.1 Objective:

To demonstrate that the system is capable of delivering Pure steam Quality as per Microbiological specification.

10.4.2 Equipment and Instrument:

Pure steam test kit

10.4.3 Methodology:

Take pre-sterilized bottles in SS container. Collect the Pure steam from following sampling point as As per sop. Sampling & the Test shall be carried for all the Microbiological parameters given below:

TEST	ACCEPTANCE CRITERIA
Total Aerobic Microbial Count. (TMC)	Total Bacterial Count - NMT 10 CFU/100 ml
Bacterial Endotoxin Test.	NMT 0.25 EU/ml

10.4.4 Acceptance Criteria:

All the test results should Comply the Microbiological specification.

10.4.5 Observation:

Observations are recorded in Report.

10.4.6 Evaluation:

After completion of incubation period, all test results shall be compiles and evaluated. Compliance of all test results to the specification shall establish that the **Pure Steam Generation & Distribution System** is capable to continuously supply the required quality & quantity of **Pure Steam** specified attributes thereby establishing its dependability. In case of out of specification, investigation shall be carried out to find out the cause of failure. Corrective action shall be avoiding reoccurrence of the failures. Final evaluation of test results shall be carried out after completion of incubation period of Qualification study.

10.5 SAMPLING POINT & USER POINT LOCATION OF PURE STEAM GENERATION & DISTRIBUTION SYSTEM

S.No.	SAMPLING POINT	SAMPLING POINT No.
PURE STEAM GENERATION & DISTRIBUTION SYSTEM		
1.	Outlet line of PSG	PSG/SP-301
2.	Inlet line of Bung Processor	PSG/UP-301

10.6 SAMPLING PLAN FOR PURE STEAM GENERATION & DISTRIBUTION SYSTEM

Duration: 07 days.

S.No	Sample point & User Point No.	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
PURE STEAM GENERATION & DISTRIBUTION SYSTEM								
1.	**PSG/SP-301**	√	√	√	√	√	√	√
2.	**PSG/UP-301**	√	√	√	√	√	√	√

11.0 CHECKLIST OF ALL TEST AND CHECKS:

S.No.	TEST	ACCEPTANCE CRITERIA
CHEMICAL ANALYSIS FOR PURE STEAM GENERATION & DISTRIBUTION SYSTEM		
1.	Appearance	Clear Colorless & Odorless
2.	pH	5.0-7.0
2.	Nitrates	Not more than 0.2 ppm
3.	Conductivity	Not More Than 1.2 µs/cm
4.	Total Organic Compounds	NMT 500 ppb
5.	Acidity & Alkalinity	Should Comply
MICROBIAL ANALYSIS FOR PURE STEAM GENERATION & DISTRIBUTION SYSTEM		
6.	Total Aerobic Microbiological Count	NMT 10 cfu/100 ml
7.	*Escherichia coli*	Should be absent/100 ml
8.	*Pseudomonas aeruginosa*	Should be absent/100 ml
9.	*Salmonella ebony*	Should be absent/100 ml
10.	*Staphylococcus aureus*	Should be absent/100 ml
11.	Bacterial Endotoxin Test	NMT 0.25 EU/ml
TEST METHODS FOR PURE STEAM GENERATION & DISTRIBUTION		
12.	Non Condensable Gas Determination	NLT 3.5 %.
13.	Dryness Fraction Test	Dryness Fraction Value should be NMT 0.9 %
14.	Super Heat Test	Superheat value does NLT 25 %
Opinion: In the opinion of the undersigned, the sample referred to above is **of standard quality** with respect to above specification.		

12.0 ALERT & ACTION LIMITS:

Based on the Microbiological profile observed during appropriate action and alert levels for microbiological aspects. (Total bacterial count and fungus) are established. Establishment of alert & action level is required to indicate a shift in process performance of Water for Injection system. These levels are useful for monitoring and control rather than accept and reject decisions. Alert levels are ranges, when exceeded indicate that process may have drifted from its normal operating conditions. Alert levels constitute a warning and do not necessarily require a corrective action. Action levels are ranges that when exceed, indicate that a process has drifted from its normal operating range. Exceeding

and action levels indicate that corrective actions should be taken to bring the process back into its normal operating range.

13.0 PREVENTIVE MAINTENANCE:

Preventive maintenance of Water for Injection system shall be carried out as per the planned preventive maintenance schedule. This describes the details of maintenance related work and checks to be carried out and monitoring the records.

14.0 TRAINING OF EXECUTION TEAM:

Provide the training to a team for the execution of protocol before execution of the same. Record of Training shall be recorded in Performance Qualification Report.

15.0 REFERENCES:

- Master Validation Plan.
- Schedule – M "Good Manufacturing Practices and Requirements of Premises, Plant and Equipment for Pharmaceutical Products."
- WHO Essential Drugs and Medicines Policy, QA of Pharmaceuticals, Vol-2.Good Manufacturing Practices and Inspection.

16.0 DOCUMENTS TO BE ATTACHED:

- Protocol Training Record
- Operation And Maintenance Manual
- Final SOPs
- Any Other Relevant Documents

17.0 NON COMPLIANCE:

- In case of any deviation observed during PQ, inform to Head QA for necessary action.
- Document the deviation detail in observed deviation section.
- The Head QA will study the impact of deviation. If deviation is acceptable and it does not have an impact on operation as well as on performance of the machine, prepare final conclusion.

18.0 ABBREVIATIONS:

PQ	: Performance Qualification
PSG	: Pure steam Generator
SOP	: Standard operating Procedure
PVT.	: Private
LTD.	: Limited
No.	: Number
ID	: Identification
IPR	: Intellectual Property Rights
Sr.	: Senior
LPH	: Litre per Hour
NMT	: Not More Than
µS/cm	: Micro Siemens per centimeter
kg/cm^2	: Kilogram per centimeter square
IP	: Indian Pharmacopoeia
ppm	: Per part million
ppb	: Per part billion
CFU	: Colony forming unit
EU	: Endo toxin unit
WHO	: World Health Organization
FDA	: Food and Drug Administration
ISPE	: International Society for Pharmaceutical Engineering