Standard Operating Procedure

Title: Validation of Autoclaves, Autoclave Cycles and Loads

Department	Validation/Technical Services		Document no	VAL-175	
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A PURPOSE

This standard operating procedure outlines the validation approach for autoclaves, autoclave loads and autoclave cycles a GMP site.

B SCOPE

This document describes the validation and re-validation approach to sterilisation activities conducted utilising autoclaves a GMP site.

C RESPONSIBILITIES

The department responsibilities in regards to validation of the autoclave, cycle and loads are outlined below.

1 Validation

1.1 Prepare, approve and execute protocols in accordance with this SOP.

1.2 Develop validation program and re-validation plans.

1.3 Review and approve validation test results.

1.4 Ensure only fully validated load configurations and cycle parameters are documented in the relevant operational SOPs.

2 Quality Assurance

2.1 Ensure compliance with this SOP with specific regard to Installation, Operational and Performance Qualification and Re-validation activities.

2.2 Ensure compliance with current corporate policy and regulatory requirements.

2.3 Ensure operational compliance to local Department of Agriculture requirements.

3 Quality Control

3.1 Review and approve validation protocols and test documentation.

3.2 Provide access to equipment and resources to allow for validation work to be carried out.

3.3 To ensure SOPs contain only current and accurate load patterns and associated autoclave cycles

3.4 To generate change controls for autoclave cycle/load additions/changes

3.5 Perform Biological Indicator (BI) analysis.

4 Engineering

4.1 Review and approve validation protocols and test documentation.

4.2 Ensure compliance with this SOP with specific regards to Maintenance, Calibration and Change Controls.

4.3 Ensure that autoclave equipment utilities and sensors are compliant with operating limits

4.4 Ensure autoclave cycle programs, PLCs and chart recorders are up to date, correct and operational

5 Production / Development

5.1 Review and approve validation protocols and test documentation

5.2 Provide access to equipment and resources to allow for validation work to be carried out

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1.4 The F_0 values calculated for each cell are added together over the duration of the SIP time period to give the total F_0 value for that particular location.

1.5 Example (Assumption of 1 second sampling interval):

	A	B	C
1	**Time**	**Temperature (°C)**	**Calculated F_0 value**
2	13:50:00	122.4	=0.0167*10^((B2-121)/10)
3	13:50:10	122.6	=0.0167*10^((B3-121)/10)
4	13:50:20	122.5	=0.0167*10^((B4-121)/10)
5	**Accumulated F_0**		=SUM(C2:C4)

1.6 The equation entered must be verified to be correct by a second validation engineer or delegate. The verification signature must be on the results sheet of each run in the validation report.

G PROCEDURE – VALIDATION OF AN AUTOCLAVE AND/OR AUTOCLAVE INSTALLATION

1 Prerequisites

1.1 A user requirement specification (URS) document containing the equipment requirements shall be referenced if available.

1.2 An Equipment Verification (EV) shall be executed prior to Performance Qualification (PQ). Any deviations or failures to meet acceptance criteria shall be resolved.

1.3 All critical instruments shall be calibrated and maintained in accordance with site procedures.

2 Equipment Verification (EV) Protocol

2.1 The EV protocol should include the following:

2.1.1 Utility connection and supply checks;

2.1.2 Instrumentation verification (as per BS EN 285 sections 6.1 and 6.2);

2.1.3 Alarms, Interlocks, Controls and Indicators are functioning as specified by the manufacturer, as directed in the URS and/or required by the owner.

2.1.4 An empty chamber temperature distribution study

3 Acceptance Criteria

3.1 The chamber is capable of maintaining a temperature within ±1°C (Celsius) of the mean chamber temperature at each time point.

3.2 All temperatures are within the sterilisation band.

3.3 All cycle parameters match the programmed parameters

3.4 Prior to use, the thermocouples meet the required calibration tolerance of at least ±0.1°C. (BS EN285) Averaged over the number of thermocouple channels.

3.5 Post Use calibration verification check – 80% thermocouples within ±0.8°C of the heat source.

3.6 Recorded temperatures measured by the control system must be within ±2°C of the temperature recorded by the thermocouple(s) at the same tested location.

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1.1 The chamber thermocouples are capable of maintaining a temperature within ±1°C (Celsius) of the mean chamber temperature at each time point. Instantaneous variations are permitted provided they do not exceed more than 5 seconds.

1.2 All temperatures are within the sterilisation band (-1°C and + 2 °C of the set point).

1.3 All cycle parameters on the report match the programmed parameters shown on the parameters list.

1.4 Prior to use, the thermocouples meet the required calibration tolerance of at least ±0.5°C. (BS EN285) Averaged over the number of thermocouple channels.

1.5 Post Use calibration verification check – 80% thermocouples within ±0.8°C of the heat source.

1.6 Recorded temperatures measured by the control system must be within ±2°C of the temperature recorded by the thermocouple(s) at the same tested location.

1.7 Recorded pressure indication measured by the control system must be within ± 2kPa (or 0.5% if range different to 0 – 400kPa) of the pressure recorded by the external pressure transmitter

1.8 Calculated F_0 values for each location within the load must be greater than 22 minutes

1.9 Some regulatory agency requires waste cycles must have calculated F_0 value equal to or greater than 30 minutes.

1.10 The measured value for the chamber temperature is within ±2°C of the corresponding saturated temperature at the pressure measured by the pressure transducer. This is assessed by taking the readings at the mid-point of the steam sterilising stage for a 1 minute time period and averaging the chamber load temperatures for the comparison.

1.11 The Autoclave Load should be visibly dry (free of pooled liquid condensate) on cycle completion

2 Wet Cycle Acceptance Criteria (Liquid Containing Loads)

2.1 The chamber thermocouples are capable of maintaining a temperature within ±1°C (Celsius) of the mean chamber temperature at each time point. Instantaneous variations are permitted provided they do not exceed more than 5 seconds.

2.2 All chamber temperatures are within the programmed parameters for Temperature regulated cycles (-1°C and + 2 °C of the set point). This does not apply to F_0 or Pressure regulated cycles.

2.3 All cycle parameters on the report match the programmed parameters shown on the parameters list.

2.4 Prior to use, the thermocouples meet the required calibration tolerance of at least ±0.5°C. (BS EN285) Averaged over the number of thermocouple channels.

2.5 Post Use calibration verification check – 80% thermocouples within ±0.8°C of the heat source.

2.6 Recorded temperatures measured by the control system must be within ±2°C of the temperature recorded by the thermocouple(s) at the same tested location.

2.7 Recorded pressure indication measured by the control system must be within ± 2kPa (or 0.5% if range different to 0 – 400kPa) of the pressure recorded by the external pressure transmitter

2.8 Calculated F_0 values for each location within the load should be greater than 22 minutes for a standard load and F_0 greater 30 minutes for any cycles requiring compliance to some other regulations where the load “core” temperature is not measured and $F_0 \geq$ 15min where the load “core” temperature is evaluated.

2.9 Where the load is heat sensitive, an accumulated F_0 value of ≤15 minutes is permitted with appropriate justification.

2.10 For loads with temperature sensitive cycles, the core temperature must be measured if a F_0 of 15 minutes is to be utilised.

2.11 The measured value for the chamber temperature is within ±2°C of the corresponding saturated temperature at the pressure measured by the pressure transducer. This is assessed by taking the readings at the mid-point of the steam sterilising stage for a 1 minute time period and averaging the chamber load temperatures for the comparison.

2.12 All liquid temperatures at the end of the cycle are below or equal to 90°C.

J PROCEDURE – AUTOCLAVE AND LOAD CYCLE EVALUATION – EMPTY CHAMBER PERFORMANCE CHECK

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2.9 Start the collection of data on the data logger. Where the unit permits, enter run details into the file names.

2.10 Ensure the chart recorder is in the operating position (where applicable)

2.11 Start the autoclave cycle on the controlling PLC/SCADA or via manual valves depending on the autoclave type.

2.12 On completion of the cycle, collect the report and charting data from the data recorder. Also stop the data logger from collecting data and copy / archive the file to removable media (USB/Flash Card). Copy the file into the project folder.

2.13 Complete activities as per VAL-180 "Heat Penetration Heat Distribution Study" and submit biological indicators to QC for testing.

2.14 On completion of the final trial, conduct calibration verification of the thermocouples using a certified temperature source.

L PROCEDURE – AUTOCLAVE AND LOAD CYCLE EVALUATION – REPORTING

1 Deviation Reports

1.1 If any of the autoclave trials or tests fails to meet the acceptance criteria, complete a deviation report. Trials should not continue until an agreed course of action has been obtained. Upon resolving the cause of any failure(s) the test can be repeated if the nature of the failure does not warrant the closure of the study and the re-issuing or amendment of the protocol. Deviation reports should be completed utilising VAL-075 'Validation Deviation Management' and Form-745 'Validation Protocol Deviation Reporting Form'.

2 Conditional Release

2.1 A cycle may be released for the use of production prior to final approval of the validation report where a conditional release is granted.

2.2 Conditional Release may be granted only when thermometric and barometric data has been evaluated and considered acceptable and BI tests have passed. Conditional release may also occur only when any outstanding deviation reports have been completed and accepted.

2.3 The Validation Department is responsible for issuing the conditional release document Form-750 "Conditional Release Form" for QA approval.

3 Cycle Reporting

3.1 Following receipt of all test results and completion of data analysis, for review of performance of each trial evaluation, complete Form-755 'Autoclave Cycle Acceptance Review' Sheet.

4 Summary Reporting

4.1 A summary validation report shall be prepared on completion of trial execution, and contain the following:

4.2 An evaluation of the data (This may include a graph of the chamber and load temperature performance and chamber pressure).

4.3 A copy of the data generated from the cycle evaluation.

4.4 A comparison of the results to the procedural steps and parameters utilised.

4.5 Documentation of the maximum and minimum temperatures, pressures and F_0 values, where appropriate, from the exposure period of each run.

4.6 Comparison of the values between the trial cycle evaluations.

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Form-780	Autoclave Validation Protocol
Form-785	Autoclave Validation Documents Checklist
Form-790	Steam Penetration Air Removal (Bowie Dick) Test
Form-795	Pressure Regulator Test for Autoclaves
Form-800	Empty Chamber Test for Autoclaves
Form-805	Vacuum Leak Test
Form-810	Equipment Calibration Verification
Form 815	Autoclave Cycle Parameters Recording Sheet Template - Dry Cycle
Form-820	Autoclave Cycle Parameters Recording Sheet Template - Wet Cycle
Form-825	Autoclave Calibration Verification Record
Form-830	Biological Indicator Test Results Sheet
Form-835	Autoclave Dry Cycle Acceptance Review Criteria

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