ADVANCED STERILIZATION PRODUCTS
Division of Ethicon, Inc.
a Johnson & Johnson company

QUALITY ASSURANCE IN STERILIZATION

VALIDATION OF GAS PLASMA LOW TEMPERATURE STERILIZERS

in compliance with the ISO 14937

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ASP17-002

What will we discuss today ?

1. Review of the ISO 14937 standard.

   Defining compliance to ISO 14937 ?

2. The importance of validation in gas plasma sterilizers according to ISO 14937

3. Routine Monitoring and control for low temperature sterilizers. What can be used?

4. Parametric release of the loads in Europe. Why and How ?

Section 1 - ISO 14937 review

Introduction

In the 90’s, we started to see coming on the market a new generation of low temperature sterilizers.

This was driven by the fact that we had more and more « high tech » instruments to be reprocessed.

While there were specific standards for steam, ETO and FO sterilizers, there was no standard for this new generation of sterilizers.

For this reason, the ISO committee decided to release one standard which is not specific to one technology.

Section 1 - ISO 14937 review

Definition

Sterilization of healthcare products

General requirements for characterization of a sterilizing agent and the development, validation and routine control of a sterilization process for medical devices.

The ISO 14937 is a generic standard about the requirements to achieve the sterility of medical devices based on a quality management system.

It doesn’t give details about what parameter to measure and how to proceed like other standard for steam for example.

Section 1 - ISO 14937 review (cont.)

Objectives

- **Identify requirements for sterilization processes without a specific standard**
- **Provide common understanding between manufacturers, regulators and users**
- **Outline responsibilities of manufacturers of sterilizing equipment, device manufacturers and users**
- **Provide a framework for revision of existing sterilization standards**
- **Harmonize terminology**

Note : The ISO committee is in discussion regarding a standard for the validation of sterilizers using Vapour Hydrogen Peroxide.

Section 1 - ISO 14937 review (cont.)

Like any ISO standard, the ISO 14937 is a ***voluntary*** standard.

ISO 14937 refers to other harmonized standards.

ISO 13485:2016
Medical devices -- Quality management systems -- Requirements for regulatory purposes

ISO 13488:2001
Quality systems -- Medical devices -- Particular requirements for the application of ISO 9002

EN 61010-1:2001
Safety requirements for electrical equipment for measurement, control and laboratory use.

Section 1 - ISO 14937 review (cont.)

ISO 10012:2003
Measurement management systems -- Requirements for measurement processes and measuring equipment -- Part 1: Metrological confirmation system for measuring equipment

ISO 10993-1:2003
Biological evaluation of medical devices -- Part 1: Evaluation and testing

ISO 10993-17:2002
Biological evaluation of medical devices -- Part 17: Establishment of allowable limits for leachable substances

ISO 11737-2:1998
Sterilization of medical devices -- Microbiological methods -- Part 2: Tests of sterility performed in the validation of a sterilization process

ISO 11138-1:2006
Sterilization of health care products -- Biological indicators -- Part 1: General requirements

ISO 11140-1:2005
Sterilization of health care products -- Chemical indicators -- Part 1: General requirements

ISO 11737-1:2006
Sterilization of medical devices -- Microbiological methods -- Part 1: Determination of a population of microorganisms on products

Section 1 - ISO 14937 review (cont.)

Compliance to this standard is a <u>process</u>.

This process involves

a) the manufacturer of the sterilizer,
b) the manufacturer of the medical devices to be sterilized and
c) the health care facility (user).

Too many times we see in the tenders :

« the sterilizer should be compliant to the ISO 14937 ».

- A model of <u>sterilizer and associated consumables</u> can be developped and designed according to the ISO 14937, however, only a specific machine installed and validated on a specific site will be compliant after different actions have been completed by the different parties.

Section 1 - ISO 14937 review (cont.)

Compliance is not a one time event.

The compliance of the sterilizer is not limited to the installation and validation of the machine.

It's a daily process.

As part of the compliance, different procedures should be defined and applied by the health care facility.

- *procedure to release the load.*
- *procedure for the routine control and monitoring of the sterilization process.*
- *procedure to maintain the effectiveness of the sterilization process.*
- *procedure for the re-qualification of the sterilizer.*
  - periodic re-qualification or after a major repair.

The healthcare facility needs to take ownership of the process!

Section 1 - ISO 14937 review (cont.)

Compliance and validation of the sterilizer may involve the validation of other systems associated to the process.

- Biological Indicators (BI) are used for the validation of the sterilizer, and /or for the release of the load, we have to validate the incubator for the BIs.

- Sealing of the packaging of the load could have an impact on the expected result, the heat sealer should be validated as well.

Section 1 - ISO 14937 review (cont.)

Structure and responsibility

1. Application field
2. Normative reprimands
3. Definitions
4. **Quality system**
5. **Sterilizing agent characterization**
6. **Process / equipment characterization**
7. **Product definition**
8. **Process definition**
9. **Validation**
10. **Routine control and monitoring**
11. **Product release from sterilization**
12. **Maintaining process effectiveness**

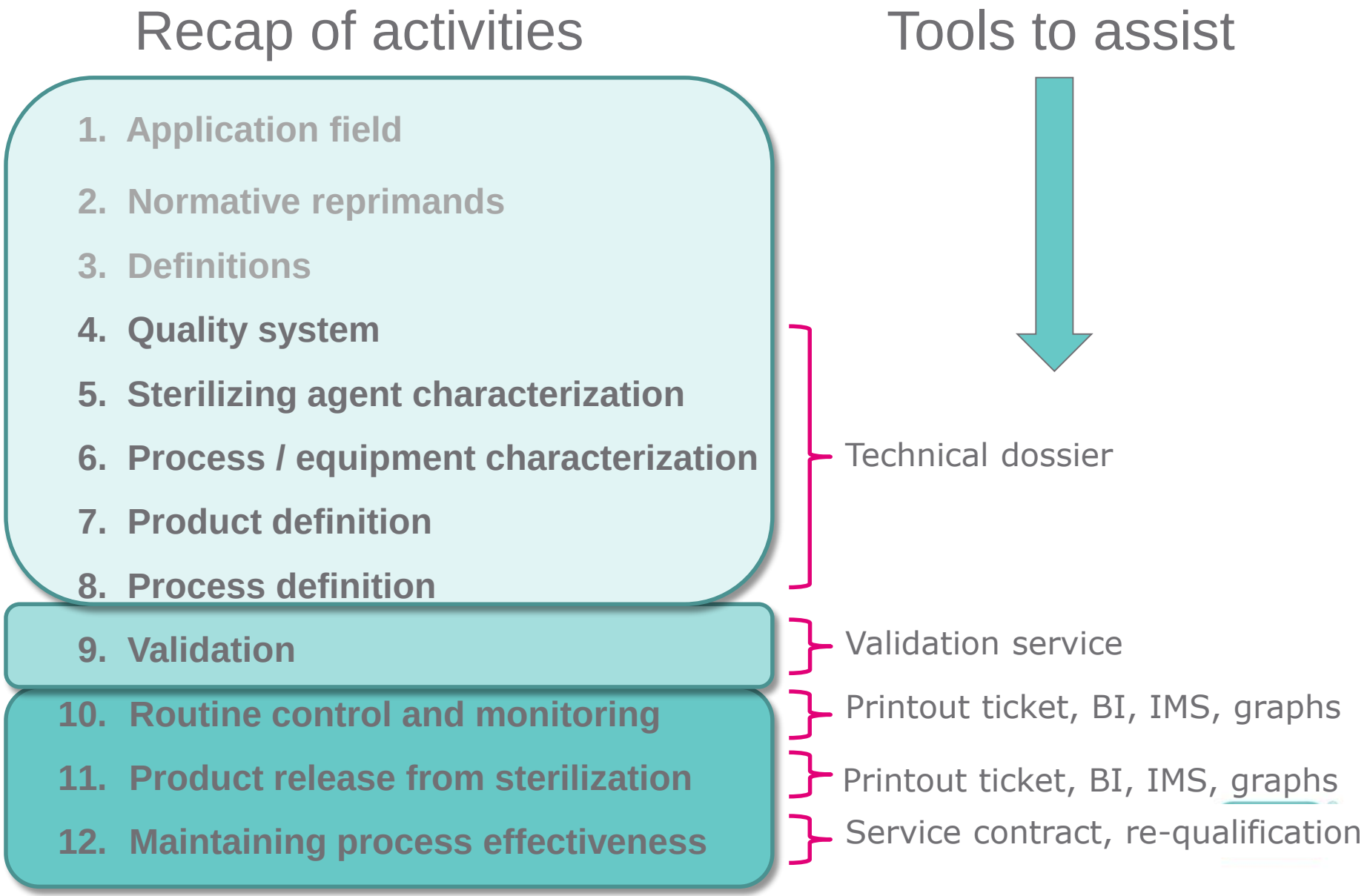
Under the responsibility of the **manufacturers**

Under the responsibility of the **health care facility** with support from MDMs

Section 2 - The importance of the validation (cont.)

- As part of the quality assurance, our customers want to have a guarantee that the process delivered by the sterilizer to the surgical instruments is effective, documented, safe and reproducible.
- As part of the quality label from JCI/NIAZ-QMentum
- For this reason, users adhere and comply with ISO14937 even if there is no obligation in their country.
- Patient care and safety are the key drivers for this decision.

Section 2 - The importance of the validation (cont.)



Section 2 – Installation Qualification

9.2 Installation qualification

9.2.1 Equipment

9.2.1.1 Equipment to be used in the sterilization process, including any ancillary items, shall be specified.

9.2.1.2 Sterilization equipment shall comply with IEC 61010-2-040.

9.2.1.3 The operating procedures for the equipment shall be specified. These operating procedures shall include, but are not limited to:

a) step-by-step operating instructions;

b) fault conditions, the manner in which they are indicated, and actions to be taken;

c) instructions for maintenance and calibration;

d) details of contacts for technical support.

9.2.2 Installation

9.2.2.1 The location in which the equipment is to be installed, including any services required, shall be specified. Any special precautions and provisions shall be identified (for example, safety equipment).

9.2.2.2 Instructions for installation shall be specified and shall include instructions pertinent to the health and safety of personnel.

9.2.2.3 If applicable, conditions for the safe storage of the sterilizing agent to ensure that its quality and composition remain within specification shall be specified.

9.2.2.4 Prior to IQ, the calibration status of all instrumentation (including any test instruments) used for monitoring, controlling, indicating or recording shall be confirmed (see 4.3.3).

9.2.2.5 It shall be demonstrated that the equipment, any ancillary items and storage conditions, as installed, operate as intended.

Section 2.1 – Installation Qualification (cont.)

Information regarding the equipment

- Identification of equipment and control Instrumentation, IMS (hardware, part nr, ser nr)
- Materials and Test Instruments (thermom., voltmeter, plasma verif box,…)
- Documentation (techn doss, user guide)
- Personnel and contacts

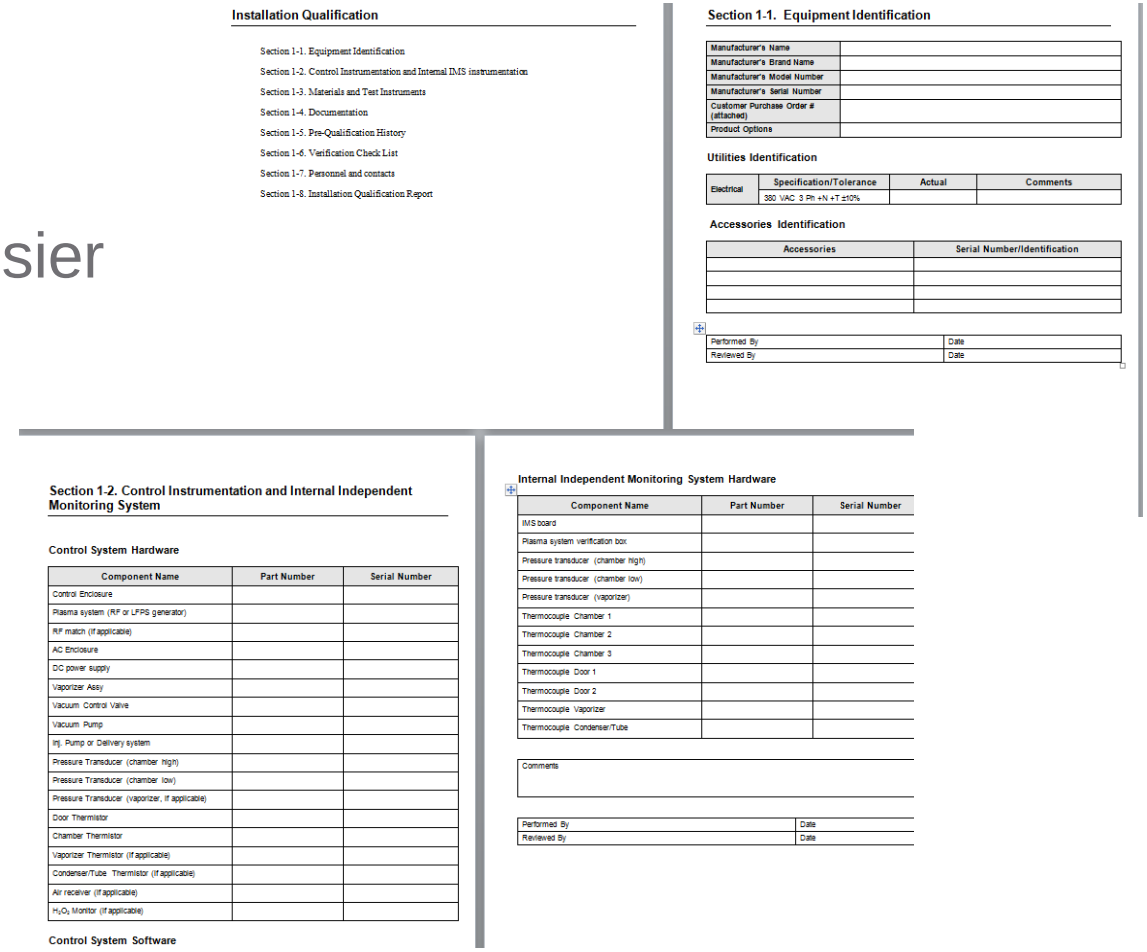
= Installation Qualification Report

Section 2.1 – Installation Qualification (cont.)

Report

Control report

- Completion of dossier
- Signatures
- Dates
- Serial nr machine
- Certificates



Installation Qualification

Section 1-1. Equipment Identification
Section 1-2. Control Instrumentation and Internal IMS instrumentation
Section 1-3. Materials and Test Instruments
Section 1-4. Documentation
Section 1-5. Pre-Qualification History
Section 1-6. Verification Check List
Section 1-7. Personnel and contacts
Section 1-8. Installation Qualification Report

Section 1-1. Equipment Identification

Manufacturer's Name	
Manufacturer's Brand Name	
Manufacturer's Model Number	
Manufacturer's Serial Number	
Customer Purchase Order # (attached)	
Product Options	

Utilities Identification

	Specification/Tolerance	Actual	Comments
Electrical	380 VAC, 3 Ph +N +T ±10%		

Accessories Identification

Accessories	Serial Number/Identification

Performed By	Date
Reviewed By	Date

Section 1-2. Control Instrumentation and Internal Independent Monitoring System

Control System Hardware

Component Name	Part Number	Serial Number
Control Enclosure		
Plasma system (RF or LFPS generator)		
RF match (if applicable)		
AC Enclosure		
DC power supply		
Vaporizer Assy		
Vacuum Control Valve		
Vacuum Pump		
Inj. Pump or Delivery system		
Pressure Transducer (chamber high)		
Pressure Transducer (chamber low)		
Pressure Transducer (vaporizer, if applicable)		
Door Thermistor		
Chamber Thermistor		
Vaporizer Thermistor (if applicable)		
Condenser/Tube Thermistor (if applicable)		
Air receiver (if applicable)		
H_2O_2 Monitor (if applicable)		

Control System Software

Internal Independent Monitoring System Hardware

Component Name	Part Number	Serial Number
IMS board		
Plasma system verification box		
Pressure transducer (chamber high)		
Pressure transducer (chamber low)		
Pressure transducer (vaporizer)		
Thermocouple Chamber 1		
Thermocouple Chamber 2		
Thermocouple Chamber 3		
Thermocouple Door 1		
Thermocouple Door 2		
Thermocouple Vaporizer		
Thermocouple Condenser/Tube		

Comments

Performed By	Date
Reviewed By	Date

Section 2.2 – Operational Qualification

9.3 Operational qualification

9.3.1 Prior to OQ, the calibration status of all instrumentation (including any test instruments) used for monitoring, controlling, indicating, or recording shall be confirmed (see 4.3.3).

9.3.2 OQ shall demonstrate that the installed equipment is capable of delivering the specified process (see 8.11) within defined tolerances.

Section 2.2 – Operational Qualification (cont.)

Information regarding the process

Instrumentation calibration verified and documented (Include BI incubator)

Functioning test

Alarm Conditions Tested

Equipment running cycles

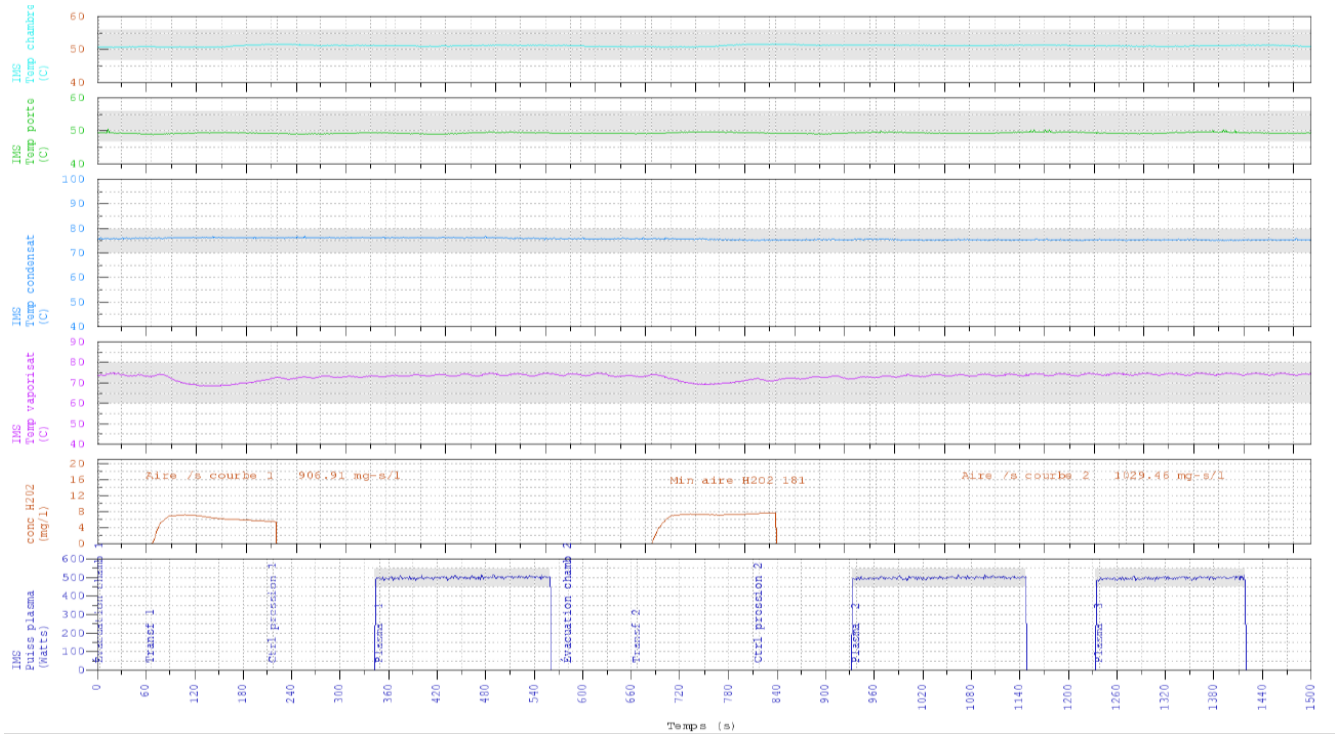
- Delivering the specified process :
  - Within defined tolerances
    - Preparation to be able to release the load based on parameters
      - Pressure, temp, plasma, time
    - 3 consecutive cycles
    - each type of cycle : each available program

= OQ report completed (ticket STERRAD®, graph IMS,…)

Section 2.2 – Operational Qualification (cont.)

Report

- Each cycle run during validation is documented
- The 4 critical parameters are monitored
  - Pressure
  - Plasma Power
  - Time
  - Temperature



Section 2.3 – Performance Qualification

9.3 Operational qualification

9.3.1 Prior to OQ, the calibration status of all instrumentation (including any test instruments) used for monitoring, controlling, indicating, or recording shall be confirmed (see 4.3.3).

9.3.2 OQ shall demonstrate that the installed equipment is capable of delivering the specified process (see 8.11) within defined tolerances.

9.4 Performance qualification

9.4.1 Calibration activities (see 4.3.3) shall be completed for instruments used in PQ.

9.4.2 The manner of presenting the product for sterilization, including the orientation of product, shall be specified.

9.4.3 Product used in PQ shall be packaged identically to that to be sterilized routinely.

9.4.4 Data shall be generated to demonstrate the attainment of the defined physical and/or chemical conditions, within specified tolerances, throughout the sterilization load. Relationship(s) between the conditions occurring at positions used routinely to monitor the sterilization process and those conditions occurring throughout the sterilization load shall be established. This is achieved by determining the attainment of the specified condition(s) at predetermined positions throughout the sterilization load.

9.4.5 Microbiological performance qualification studies shall comprise delivery of the sterilizing agent under conditions so designed that the extent of treatment is reduced relative to that in the sterilization process. Extrapolation of the outcomes of such reduced treatment(s) shall be used to predict that, on application of the sterilization process, the specified requirements for sterility are met. The approaches to process definition described in Annexes B, C or D may also be employed in microbiological performance qualification studies.

9.4.6 Biological indicators employed during microbiological performance qualification shall comply with 8.3.

9.4.7 If tests of sterility are performed on product subjected to conditions as specified in 9.4.5, such tests shall be performed in accordance with ISO 11737-2.

9.4.8 If chemical indicators are used in PQ, they shall comply with 8.4.

9.4.9 If PCDs are used in PQ, they shall comply with 8.6.

9.4.10 PQ shall include a series of at least three successful exposures of product to the sterilization process, within defined tolerances, in order to demonstrate the reproducibility of the process. Results from PQ outside of defined tolerances shall be reviewed and corrective actions determined and instituted before initiating a new series of exposures.

The series of three successful exposures shall be performed consecutively, unless finding outside defined tolerances can be attributed to factors not relevant to the effectiveness of the process being validated. Such findings shall be documented as unrelated to performance of the sterilization process.

EXAMPLES The finding might be attributed, but not limited to, power failures, loss of services or failure of external monitoring equipment.

9.4.11 The levels of any process residues following exposure to the upper tolerances of the process parameters shall be demonstrated as being below the specified limits identified in the health-based risk assessment (see 8.8).

9.4.12 It shall be confirmed that the product meets its specified requirements for safety, quality and performance following application of the defined process at the upper tolerances of the process parameters.

NOTE Information gathered in accordance with 8.9 can be used to meet this requirement.

Section 2.3 – Performance Qualification (cont.)

Information regarding the reproducable process with load

Materials :

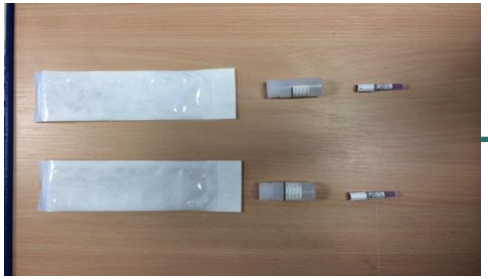
- Independent Monitoring System
- Validation Kit :
  - Challenge Pack
  - Biological indicators
- Per program : 3 reduced parameter consecutive cycles (half cycles)

= Physical and microbiological report
(STERRAD® and IMS, ticket, graph, Paramprint, BI)

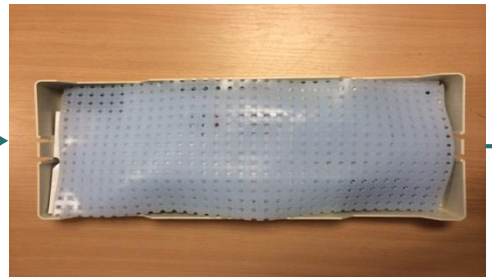
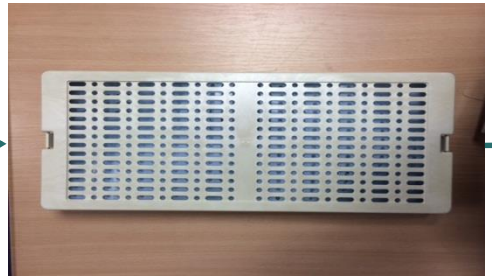
Section 2.3 – Performance Qualification (cont.)

Validation load

❖ **STERRAD® 100S validation load preparation**





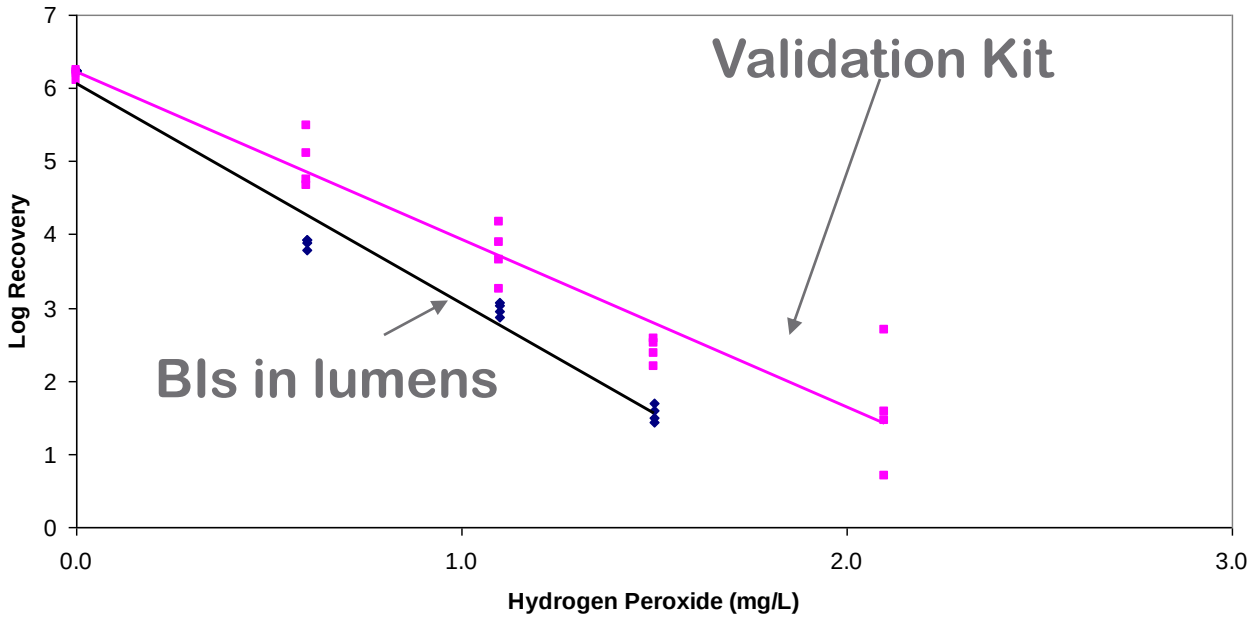





BI handling after cycle

Section 2.3 – Performance Qualification (cont.)

The validation of the performance should be done in challenging conditions

- a validation load has been developped



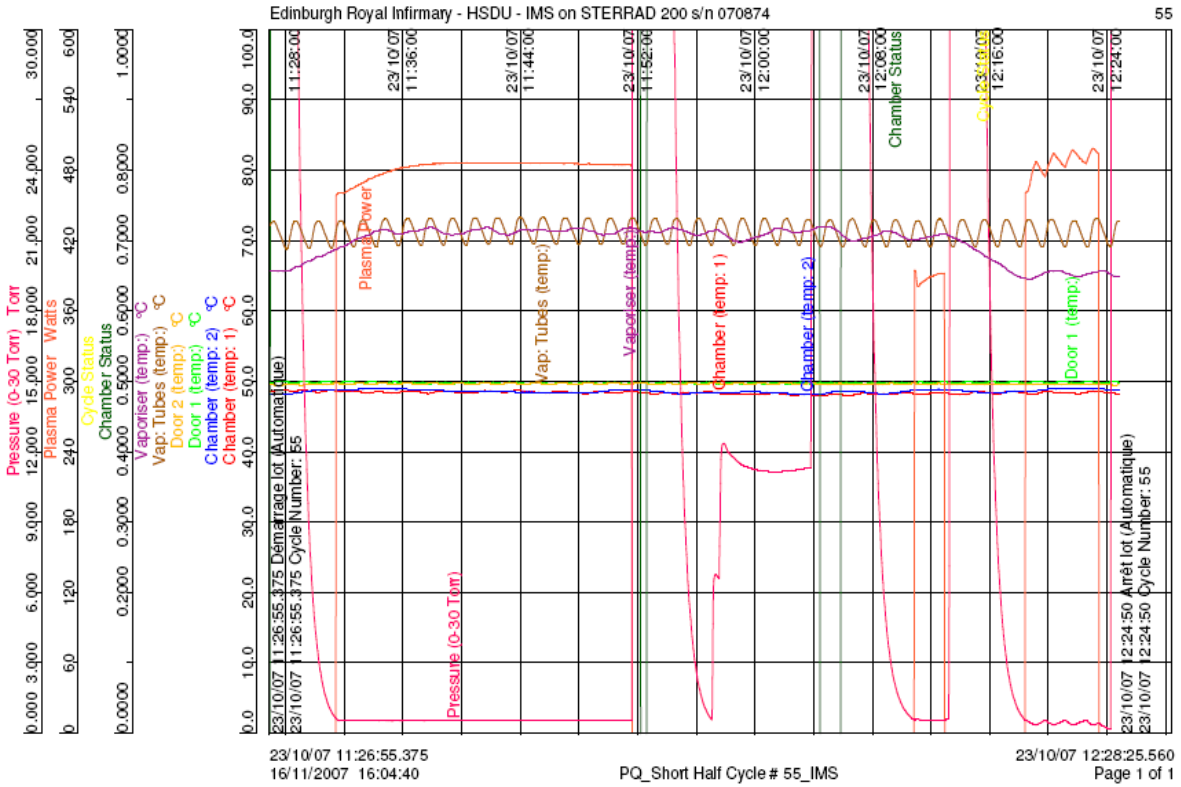
Biological Validation Model: y = -3.0006x + 6.0661
R^2 = 0.9789

CycleSure Validation Kit: y = -2.2905x + 6.2189
R^2 = 0.9347

Section 2.3 – Performance Qualification (cont.)

Documentation of test and measurements

- Each cycle run during validation is documented.
- The critical parameters are monitored.



During the validation the operating conditions of the machine are verified (IQ), calibration and functionality are verified (OQ), and the capability to sterilize in challenging conditions is measured and verified (PQ).

Section 2.3 – Performance Qualification (cont.)

Report

To check :

- BI's
- Printouts
- Cycles

PQ cycles printouts

The curves (pressure, temperature, Plasma power) of the different cycles are available in Appendix D.

Standard Cycle 1	Standard Cycle 2	Standard Cycle 3
		

Performed by	Vanvuchelen Gert	Date	29-11-2016
Reviewed By	Van Hoorde Vincent	Date	29-11-2016

Section 2.3 – Performance Qualification (cont.)

Final Report

To check :

- BI's
- Printouts
- Cycles

Section 5. Final Report

Review And Approval Of Validation Checklist			
ISO 14937 Section Number	**Text**	**STERRAD Sterilization System Compliance Summary**	**Initials**
9.2	Installation Qualification	OK	GV
9.3	Operational Qualification	OK	GV
9.4	Performance Qualification	OK	GV

STERRAD® Sterilizer

Serial Number	1042130117
Model Number	100NX

Conforms to ISO 14937 standard

YES ☒ NO ☐

Check the appropriate box.

Note: The validation of this sterilizer was performed in accordance with the manufacturers instructions and the general principles of EN ISO 14937. All materials used during the course of this validation were manufactured by or on behalf of the sterilizer manufacturer, Advanced Sterilization Products. All such materials have been validated for use with the STERRAD Sterilization process. Any subsequent use of materials not approved by the manufacturer, Advanced Sterilization Products, violates the validation of this sterilizer and may well compromise the sterility of any item thus processed. In all cases of doubt the advice of the sterilizer manufacturer should be sought.

Final product and process review approved and signed off by:

Name and Title :Vanvuchelen Gert / Equipment Service Technician		Comments :/
Signature :	Date 13-12-2013	
Name and Title :Rowies Patrick / Technical Manager FraBeNe		Comments :/
Signature	Date 13-12-2013	
Name and Title :		Comments :
Signature	Date 13/12/13	

Section 3 – Routine Monitoring and control

1. Application field
2. Normative reprimands
3. Definitions
4. **Quality system**
5. **Sterilizing agent characterization**
6. **Process / equipment characterization**
7. **Product definition**
8. **Process definition**
9. **Validation**
10. **Routine control and monitoring**
11. **Product release from sterilization**
12. **Maintaining process effectiveness**

Under the responsibility of the **manufacturers**

Under the responsibility of the **health care facility** with support from MDMs

Section 3 – Routine Monitoring and control

-> Provide evidence through direct measurement that the process was delivered within the defined tolerances

1/ STERRAD® controller and/or IMS printout

2/ Paramprint tables

3/ Change color chemical indicators
(BI, tape, Tyvek®, strips)

4/ Result of the Biological indicator, if used

Section 3 – Routine Monitoring and control (cont.)

Rapport paramétrique de cycle Standard STERRAD® 100NX™

Stérilisat STERRAD® 100NX n°: Numéro cycle 448

Page 1 De 2

Rapport de cycle param STERRAD(R) 100NX

Version logiciel: 10247105A2
Nom établiss:
Nom du service: STERILISATION
Id stérilisat:
N° série
Numéro cycle 448
Nbr cycles quot: 4
Opérat: fg
Charg élém: Néant
Notes cycle: Néant
Sélect cycle: STANDARD

	stérilisat	IMS
Hr démar cycle:	24/01/2012 15:59:12	24/01/2012 15:59:12
Hr fin cycle:	24/01/2012 16:47:55	24/01/2012 16:47:55
Durée écoulée	00:48:43	00:48:43

État cycle: Réussi

Nom étape	Paramètre	Unité	Limite alarme Bas	Limite alarme Haut	stérilisat Min	stérilisat Max	IMS Min	IMS Max
Évacuation vaporisat 1	Pression vaporisat	Torr	5.980	6.420		6.183		6.141
	Temp condensat	C	33.00	37.00	34.56	35.82	35.10	36.60
	Durée étape	mn:ss		≤10:00		05:15		----
Évacuation chamb 1	Pression chambre	Torr	0.000	0.190		0.129		0.138
	Durée étape	mn:ss		≤05:00		00:13		----
Transf 1	Temp condensat	C	65.00	75.00	68.96	70.91	71.00	73.20
	Durée étape	mn:ss		≥08:00		08:02		----
Ctrl pression 1	Pression chambre	Torr	3.900	25.90		19.26		19.19
	Aire H2O2	mg-s/l	≥747.00			5182		----
	Taux constant	1/sec		≤ 0.02		0.002		----
Plasma 1	Pression chambre	Torr	0.200	0.800	0.402	0.519	0.408	0.510
	Puiss fournie	Watts	450.0	550.0	496.0	499.0	482.0	516.0
	Temps plsma	mn:ss		≥07:30		07:30		----
Évacuation vaporisat 2	Pression vaporisat	Torr	5.980	6.420		6.144		6.117
	Temp condensat	C	33.00	37.00	34.49	35.86	35.00	36.60
	Durée étape	mn:ss		≤10:00		05:16		----

Section 3 – Routine Monitoring and control (cont.)

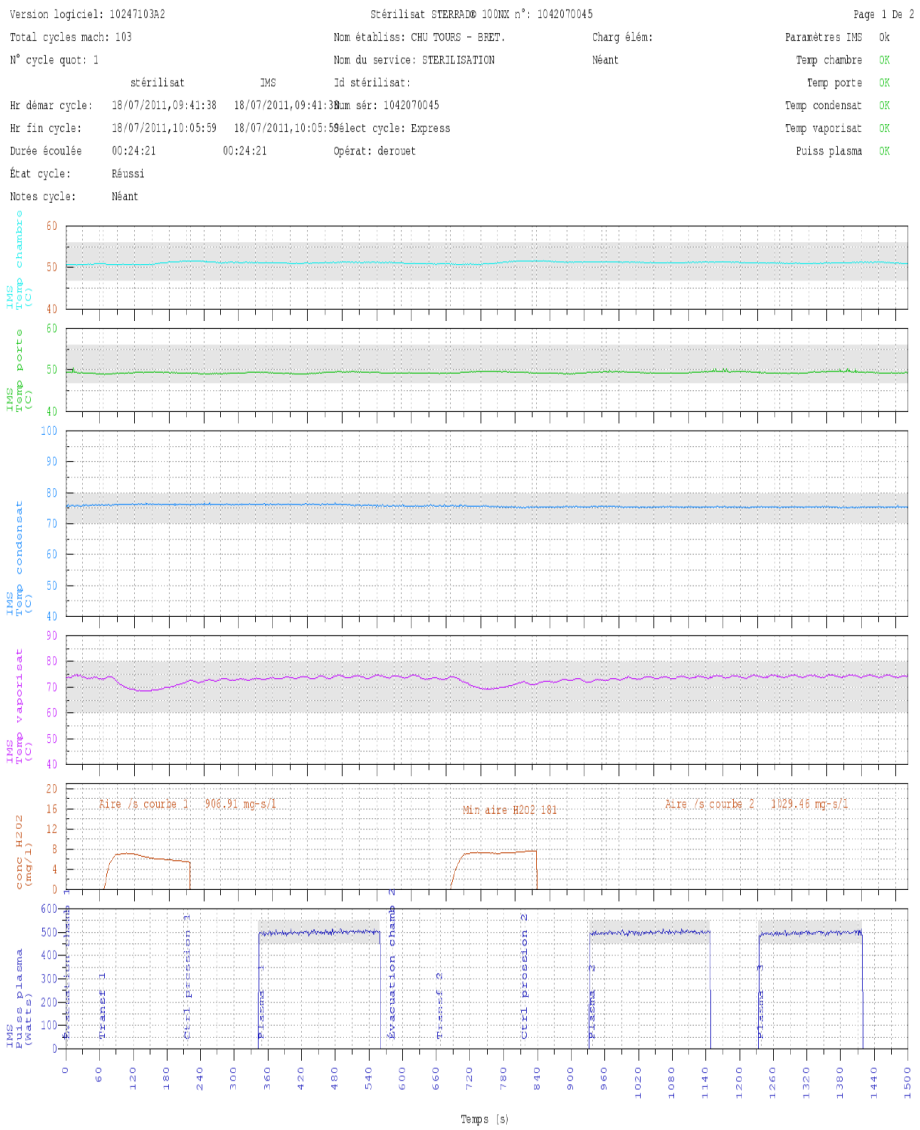
Stérilisat STERRAD® 100NX n°: Numéro cycle 448

Évacuation chamb 2	Pression chambre	Torr	0.000 0.190	0.138		0.147
	Durée étape	mm:ss	≤05:00	00:12		----
Transf 2	Temp condensat	C	65.00 75.00	68.85	71.02	70.80 73.00
	Durée étape	mm:ss	≥08:00	08:03		----
Ctrl pression 2	Pression chambre	Torr	5.000 25.90	20.55		20.49
	Aire H2O2	mg-s/l	≥747.00	4063		****
	Taux constant	1/sec	≤ 0.02	0.003		----
Plasma 2	Pression chambre	Torr	0.200 0.800	0.402	0.519	0.393 0.510
	Puiss fournie	Watts	450.0 550.0	496.0	499.0	478.0 515.0
	Temps plasma	mm:ss	≥07:30	07:30		****
Cycle de stérilisation:	Temp chambre	C	47.00 56.00	49.88	51.40	49.70 51.60
	Temp porte	C	47.00 56.00	49.84	51.09	49.20 50.40
	Temp vaporisat	C	60.00 80.00	73.29	76.44	71.80 77.30

Proces terminé

Validé par: fg
Numéro lot cassette: 0011E082
Posit cellule : 7

Section 3 – Routine Monitoring and control (cont.)



Section 4 – Product release from sterilization

1. Application field
2. Normative reprimands
3. Definitions
4. **Quality system**
5. **Sterilizing agent characterization**
6. **Process / equipment characterization**
7. **Product definition**
8. **Process definition**
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11. **Product release from sterilization**
12. **Maintaining process effectiveness**

Under the responsibility of the **manufacturers**

Under the responsibility of the **health care facility** with support from MDMs

Section 4 – Product release from sterilization

11.2 Parametric release shall only be used if all process parameters are specified, controlled and directly monitored. Records of process parameters shall be retained (ISO 14937 §11.2 pg 14).

11.3 If biological indicators or chemical indicators are used to monitor the sterilization (ISO 14937 §11.3 pg 14). The results from exposure to these indicators shall be included within the criteria for product release from sterilization.

Section 4 – Product release from sterilization (cont.)

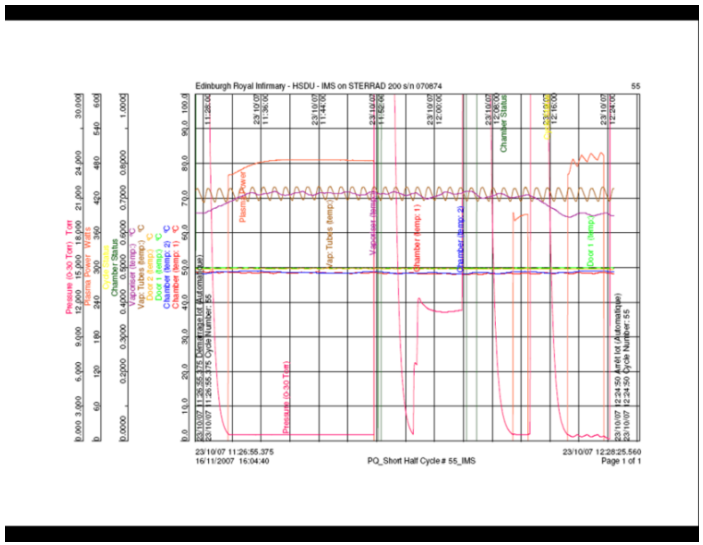
Factors relating to parametric release:

- A major requirement in the CSSD department is 'time' and speed of reprocessing.
- A CSSD has to continually deal with budget cuts and constraints, yet still have the demands to reprocess delicate, sensitive and expensive instruments
- It is not common to have a plentiful supply of these types of instrument sets

For these 3 reasons, in Europe, many health care facilities decided to release the instruments based on the parameters of the cycle without waiting for the result of a Biological Indicator (**parametric release**).

Section 4 – Product release from sterilization (cont.)

The parametric release can be done only after the CSSD facilities has an extensive experience with the process, and through a direct measurement and evaluation of the parameters of the process.



To understand and interpret the parameters of the sterilization process a training is required.

The person who releases the load should be confident in the technology and should trust the system.

For these customers who do a parametric release, complying to the ISO14937 and doing re-qualification of their process every year is a good practice to guarantee their sterilizer is performing correctly.

Section 4 – Product release from sterilization (cont.)

- Chemical indicator
- Biological indicator
- Via Independent Monitor :
  - Measurement of all parameters via paramprint, based on the defined tolerances (paramprint)

Summary

Review about the ISO 14937	•The ISO 14937 is a voluntary standard •It is used for the compliance of the gas plasma sterilizers in absence of any specific standard •The compliance is a process involving different parties •The health care facility is responsible for the validation, the routine control and monitoring, the product release, and to maintain the effectiveness of the process
The importance of the validation	•The validation of a gas plasma sterilizer according to the ISO 14937 is part of the Quality Assurance of the CSSD and can be documented to accreditation
Routine monitoring and control	•Each cycle has the Printout ticket, BI, IMS and or graphs
The parametric release	•To limit the inventory of sensitive instruments, many European users do a parametric release. •The parametric release requests experience with the sterilization process and an evaluation of the measured parameters of each cycle

END

Thank you for your attention

Please refer always to the Instructions for Use / Package Insert that come with the device for the most current and complete instructions.

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References

ISO 14937 Standard : General requirements for characterization of a sterilizing agent and the development, validation and routine control of a sterilization process for medical devices

Technical Dossier Sterrad ® 100S, Sterrad ® 100NX, Sterrad ® NX

White paper Sterrad ® 100S, Sterrad ® 100NX, Sterrad ® NX

Validation Binder 15-12169-A

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