

Draft Guidance for Industry and FDA Staff

Processing/Reprocessing Medical Devices in Health Care Settings: Validation Methods and Labeling

DRAFT GUIDANCE

This guidance document is being distributed for comment purposes only.

Document issued on: May 2, 2011

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When final, this document will supersede “Labeling Reusable Medical Devices for Reprocessing in Health Care Facilities: FDA Reviewer Guidance” dated April 1996.



**U.S. Department of Health and Human Services
Food and Drug Administration
Center for Devices and Radiological Health
Office of Office of Device Evaluation
Center for Biologics Evaluation and Research**

Preface

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I. Introduction

When final, this guidance will supersede Labeling Reusable Medical Devices for Reprocessing in Health Care Facilities: FDA Reviewer Guidance. This draft guidance document updates and clarifies the recommended content of, and review procedures for, premarket notification submissions [510(k)], premarket approval (PMA) applications, humanitarian device exemption (HDE) applications, and investigational device exemptions applications (IDE), concerning the labeling instructions for reprocessing reusable medical devices. In addition, this draft document provides more detail about FDA's recommendations for the validation of processes intended to support reprocessing.

FDA's guidance documents, including this guidance, do not establish legally enforceable responsibilities. Instead, guidances describe the Agency's current thinking on a topic and should be viewed only as recommendations, unless specific regulatory or statutory requirements are cited. The use of the word *should* in Agency guidances means that something is suggested or recommended, but not required.

II. Background

In recent years, there has been a significant advance in knowledge and technology involved in reprocessing reusable medical devices. Additionally, there has been an

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evolution towards more complex reusable medical device designs that are more difficult to clean and disinfect or sterilize. The revision of this guidance reflects scientific advances in this area. Under FDA labeling regulations, 21 CFR Part 801, a device must have adequate directions for use, which include instructions on preparing a device for use. Instructions on how to reprocess (i.e., clean and disinfect or sterilize) a reusable device are critical to ensuring a reusable device is appropriately prepared for its next use.

III. Scope

This guidance provides recommendations regarding reuse instructions in labeling for reusable medical devices and the validation of the recommended reprocessing process in the instructions. The recommendations are applicable to the three device reprocessing situations below.

1. Reusable medical devices initially supplied as sterile to the end user and requiring the end user to process the device after initial use (i.e., cleaning and disinfection or sterilization) prior to the subsequent patient use.
2. Reusable medical devices initially supplied as non-sterile to the end user, and requiring the end user to disinfect or sterilize the initial packaged device and to subsequently reprocess the device after initial use (i.e., cleaning and disinfection or sterilization).
3. Single use medical devices initially supplied as non-sterile to the end user, and requiring the end user to sterilize the device prior to its use.

Please note that while this guidance addresses all 3 of the above categories, the majority of devices addressed by this guidance are reusable devices. Accordingly, for editorial convenience, this document identifies “reusable devices” as the primary subject.

Some sections of the guidance are not applicable to single use devices initially supplied non-sterile. These sections are the establishment of the use life criteria for reusable devices (Criteria 6.I), as well as those that address cleaning instructions related to the removal of organic soil due to previous patient exposure.

Exclusions

The three processes listed below are not within the scope of this guidance, because they are not used on reusable medical devices or because they focus on the reprocessing of single use devices.

1. Processes that are used in industrial settings for the manufacture of single use medical devices that are intended to be sold sterile (See “Updated 510(k) Sterility Review Guidance K90-1”¹).

¹ Updated 510(k) Sterility Review Guidance K90-1; Final Guidance for Industry and FDA (available at <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm072783.htm>) issued August 30, 2002

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2. Processes intended to be used by reproducers of single-use devices (See “Medical Device User Fee and Modernization Act of 2002, Validation Data in Premarket Notification Submissions (510(k)s) for Reprocessed Single-Use Medical Devices.”²)
3. Any process used for a sterile device provided without any reprocessing instructions from the original equipment manufacturer to permit use after the package has been opened. Single use sterile device that do not have reprocessing instructions should not be reprocessed and should not be used if the sterile packaging has been compromised. The device should be appropriately discarded or returned to the manufacturer.

The scope of this guidance does not include recommendations regarding the removal or inactivation of transmissible spongiform encephalopathy (TSE) agents (prions) from contaminated medical devices. As of the date of this guidance, no medical devices including sterilizers, have received FDA-clearance for the claim of reducing the infectivity of TSE agents.

This document is not intended to be an in-depth guidance on device design and testing factors related to infection control. Manufacturers should take infection control recommendations and practices into account during the design of reusable devices to facilitate cleaning and any necessary disinfection or sterilization. Design and testing factors are addressed in device-specific FDA guidance documents, when available for a particular device type.

IV. Reusable Medical Devices

A. Introduction

Under FDA labeling regulations, 21 CFR Part 801, a device must have adequate directions for use, which include instructions on preparing a device for clinical use. Instructions on how to process (i.e., sterilize) a single use device intended to be sterilized prior to usage and provided non-sterile to the end user and reprocess (i.e., clean and disinfect or sterilize) a reusable device are necessary for ensuring that a device is effectively prepared for its clinical use.

B. Ensuring the Safety of Reusable Medical Devices

Both the manufacturer of the reusable medical device and the user of the device have roles to play in ensuring the safe and effective reprocessing of medical devices.

² Medical Device User Fee and Modernization Act of 2002, Validation Data in Premarket Notification Submissions (510(k)s) for Reprocessed Single-Use Medical Devices (available at <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm071434.htm>) issued September 25, 2006

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Manufacturers of reusable medical devices should provide adequate labeling that includes instructions for reprocessing and reusing devices safely. The labeling should provide sufficient instructions on how to prepare the device for the next patient use. The user should be able to follow these instructions because they should refer to materials and equipment available to device users. The manufacturer should maintain in the Device Master Record and/or design history file as appropriate, documentation of tests that were performed to demonstrate that the instructions are complete and understandable and can reasonably be executed by the user. (The device master record must comply with the requirements of 21 CFR 820.181; the design history file must comply with requirements of 21 CFR 820.30(j).) The users should ensure that they have the facilities, equipment, and easy access to manufacturer-specified sterilization/disinfection agents to execute the instructions, and that the instructions are followed for every patient use of the device.

C. Process Overview

In general, reprocessing reusable medical devices involves three steps.

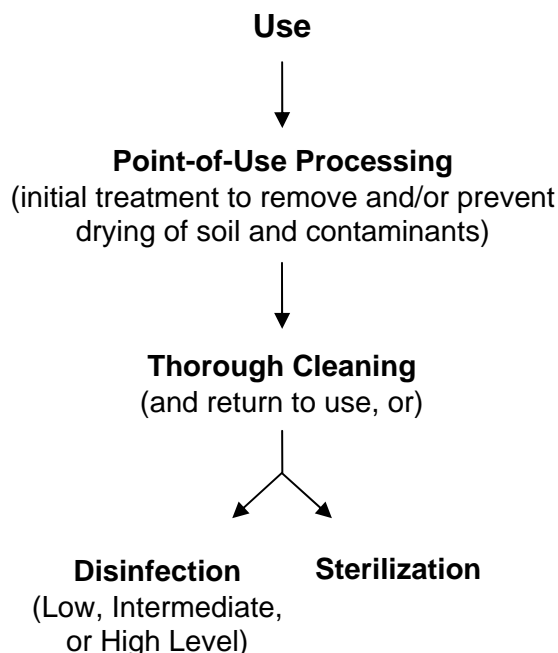
First, reprocessing begins at the point of use, which includes initial cleaning and measures to prevent drying of soil and contaminants in and on the device.

Second, the device is thoroughly cleaned in the dedicated cleaning area.

Third, depending on the intended use of the device, the device will be disinfected or sterilized, and routed back into use.

A more detailed overview of each reprocessing step is provided in Appendix A. In Section VI, this guidance provides FDA's recommendations for developing reprocessing instructions that help users avoid errors during reprocessing. Instructions that are clear and easy to follow help assure devices are properly reprocessed and safe for reuse. In Sections VII to IX, this guidance describes FDA's recommendations for testing your reprocessing methods to validate that both the instructions and the method can assure proper reprocessing and safe reuse. A simple process overview is presented below as Figure 1.

FIGURE 1. PROCESS OVERVIEW



We recommend that you also refer to the following Technical Information Reports (TIR) developed by the Association for the Advancement of Medical Instrumentation (AAMI) when developing labeling instructions for reusable medical devices:

- AAMI TIR 12:2010, Designing, testing and labeling reusable medical devices for reprocessing in health care facilities: A guide for medical device manufacturers.³
- AAMI TIR 30:2003, A compendium of processes, materials, test methods, and acceptance criteria for cleaning reusable medical devices.⁴

These AAMI TIRs provide comprehensive technical information for manufacturers, and user perspectives on this topic.

³ Association for the Advancement of Medical Instrumentation, Designing, testing, and labeling reusable medical devices for reprocessing in health care facilities: A guide for medical device manufacturers, AAMI TIR12:2004, Arlington, VA: AAMI, 2004. Technical Information Report.

⁴ Association for the Advancement of Medical Instrumentation, A compendium of processes, materials, test methods, and acceptance criteria for cleaning reusable medical devices, AAMI TIR30:2003, Arlington, VA: AAMI, 2003. Technical Information Report.

V. Overview of Labeling for Reusable Devices

A. Introduction

In accordance with 21 CFR Part 801, a device must have adequate directions for use, which for a reusable device should include reprocessing instructions. There are two components to establishing safe and effective reprocessing instructions:

1. developing the cleaning process and disinfection or sterilization method; and
2. validating the cleaning process, disinfection or sterilization method, and the reprocessing instructions to demonstrate that they are complete and understandable to allow the device to be reused.

Cleaning, disinfection, and sterilization are understood to be distinctly different processes.

Cleaning is the physical removal of organic soil, and the methods used for cleaning should be designed to remove such contamination effectively. Effective cleaning should:

- minimize the organic soil transfer from one patient to another;
- prevent accumulation of residual soil throughout the product's use life; and
- allow for successful, subsequent disinfection/sterilization steps.

In comparison, disinfection and sterilization processes are intended to kill microorganisms, and the agents employed for disinfection and sterilization should possess microbicidal properties. Accordingly, cleaning, disinfection, and sterilization steps should be validated separately and independently of each other since the purpose of each process differs.

An overview of reusable medical device processing is found in Appendix A of this document. Appendix C provides additional information on the definitions of common terms used. Appendix E provides additional resources, such as FDA labeling guidance documents, that may be useful when developing user instructions.

B. FDA Review of Reprocessing Instructions

FDA will review the labeling containing reprocessing instructions when we review premarket submissions for reusable medical devices. If the proposed labeling is deficient based on any of the criteria described within this guidance document, then FDA will inform you of the deficiency. In response, you may submit revised labeling, or alternatively, provide your rationale why the labeling is adequate. In the latter case, we recommend you include supporting documentation.

All cleaning, disinfection, and sterilization procedures should be validated, and validations should be completed prior to submission of your pre-market application to

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ensure that they meet the parameters you have indicated in your labeling. You may use current FDA recognized test methods available from standards organizations. (A searchable data base of FDA recognized consensus standards is available at: <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfStandards/search.cfm>).

When evaluating a 510(k), FDA generally compares the labeling for the legally marketed predicate device to the labeling for the new device. As part of the review process, FDA identifies differences and assesses the impact of the differences on substantial equivalence. However, reprocessing instructions for some older, predicate legally-marketed, reusable devices may not be consistent with state-of-the-art infection control procedures, so a labeling comparison alone will not be sufficient to demonstrate that a device is clean, disinfected, or sterile. If post-market experience indicates potentially unsafe reprocessing due to inadequate instructions, FDA may recommend that instructions be changed to address the need for improved reprocessing procedures to resolve reported adverse events. Reprocessing instructions should be tested to assure user needs and intended uses are met.

C. Resources for Developing Reprocessing Instructions

You should consult the resources listed below before developing reprocessing instructions for reprocessing reusable medical devices.

1. Labeling must comply with 21 CFR Part 801 and any applicable device-specific requirements given in Part 801.
2. You should follow labeling recommendations for the type of device given in FDA guidance relevant to your device. (Device guidance may be found using the Good Guidance Practices (GGP) Database Search engine available at <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfggp/search.cfm>)
3. You should also consult any relevant clinical practice guidelines and standards for infection control published by professional societies and associations, government agencies such as the CDC, and standards organizations. Clinical practice guidelines, however, do not always consider or correctly address all regulatory requirements. As an example, some professional organizations may recommend using disinfectants in ways that may not necessarily comply with FDA or Environmental Protection Agency (EPA) regulations. In instances where the recommendations of professional organizations are inconsistent with FDA and EPA regulatory requirements, compliance with regulations should take priority.

D. Human Factors in Developing Reprocessing Instructions

1. We recommend that you develop consistent reprocessing instructions across each of your product lines. Labeling that provides consistent instructions and terminology, and utilizes the same layout for all devices of a type, may help improve the user's comprehension and adherence to the instructions.
2. You should address any known post-market human factors issues with your device or similar devices. Information on post-market issues may be found by reviewing your internal user complaint files, the published literature, the FDA's Medical Device Reporting (MDR) system, the literature, and FDA Safety Alerts and Public Health Notifications. Please refer to FDA's guidance "Medical Device Use-Safety: Incorporating Human Factors Engineering into Risk Management"⁵ for additional guidance on human factors.
3. As part of your design controls, you should validate your reprocessing instructions to ensure that the end users will be able to successfully understand and follow them. Participants may use the instructions to perform an actual or simulated reprocessing procedure or verbally describe what they would do as they read the instructions. If attributes of the use environment might affect use of the instructions and reprocessing of the device, they should be represented in the testing activity. Observing participant behavior during testing will allow you to assess the participants' adherence to the instructions and to identify and understand the nature of any errors or problems that occur. After using the instructions independently, you should ask the participants if they had any difficulty and allow them to describe their experience. You should then ask specifically about any errors, problems or hesitations that were observed. The participants should provide subjective feedback regarding any wording in the instructions that they found confusing, misleading or incomplete. If you make significant changes to the instructions after testing them, you should validate the success of the changes at eliminating or reducing the problems previously identified.

VI. FDA's Seven Criteria for Reprocessing Instructions

Your labeling should address the seven criteria below for clear reprocessing instructions to help ensure users understand and correctly follow the instructions.

⁵ Medical Device Use-Safety: Incorporating Human Factors Engineering into Risk Management" (available at <http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm094461.pdf>) issued July 18, 2000.

Criterion 1. Labeling should reflect the intended use of the device.

Your labeling should include instructions for a reprocessing method that reflects the physical design of the device, its intended use, and the soiling and contamination to which the device is subject during clinical use. Appropriate reprocessing instructions depend on whether the device will:

- contact only intact skin;
- contact intact mucosal surface;
- contact normally sterile tissues, blood, or bodily fluids such as cerebrospinal fluid, peritoneal fluid, etc;
- be subject to splatter or splash of body fluids or blood because of proximity to the patient, although it is not in direct contact with the patient;
- be subject to microbial contamination during use from contact with soiled hands of patient caregivers or patients (both unwashed and gloved hands can carry both organic soil and microorganisms to the surfaces they touch);
- be subjected to contamination by unexpected or accidental events (e.g., patient bleeding, incontinence, vomiting, wounds leaking through dressings);
- be subject to reprocessing with disinfectants or other chemicals that might leave harmful residues, or adversely affect device materials or performance, if inadequately rinsed; and
- present specific or unique risks to the patient or user.

When likely contamination may include human blood or body fluids capable of transmitting bloodborne pathogens, the requirements of the OSHA Standard 29 CFR 1910.1030 Occupational Exposure to Bloodborne Pathogens must be included in labeling.⁶

Criterion 2. All reprocessing instructions for reusable devices should advise users to thoroughly clean the device.

In general, the effectiveness of each step in the reprocessing of a reusable medical device will influence the effectiveness of subsequent steps. The fact that adequate reprocessing depends upon the thoroughness of cleaning emphasizes the importance of ensuring the instructions to the user result in thorough cleaning.

Cleaning is only the first step in reprocessing. Details of the cleaning procedure will vary depending on the complexity of the device. See Section VIII for recommendations about the validation of cleaning processes. Devices with features which may result in soil retention, or have features that make them difficult to clean, will need to be disassembled in order to be completely cleaned. The

⁶ Occupational Safety & Health Administration 29 CFR 1910.1030: Bloodborne Pathogens (available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051)

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instructions/diagrams for adequate disassembly should be included in the cleaning instructions.

The cleaning step should be described in the labeling as part of an overall reprocessing regimen. You should evaluate the rigor of the cleaning step in terms of its ability to eliminate organic soil from the device. The effectiveness of the cleaning step in making the device ready for the next patient will influence the effectiveness of subsequent processes, including any terminal processing.

Directions may include the use of protective covers on the device, to try to reduce the extent of cleaning needed before the device can be reused (e.g., bronchoscopes). If you recommend the use of protective covers, your labeling should include the recommendation to use only legally marketed protective covers. However, the cleaning and disinfection instructions for your device should assume the device is used uncovered, because of the potential for loss of cover integrity during use. Unnoticed loss of cover integrity may result in degrees of soiling that are difficult to see but will present a risk to the health of the next patient unless the device is properly reprocessed.

Criterion 3. The instructions should indicate the appropriate microbicidal process for the device.

Your instructions should be consistent with current infection control practice. The microbicidal process recommended should be sterilization, or high, intermediate, or low level disinfection, depending upon the intended use of the device.

FDA uses the Spaulding Classification⁷ scheme described below for critical, semi-critical and non-critical devices to describe the effect of microbicidal processes on the potential risk of infection caused by the device. Because the Spaulding classification does not address all clinical device uses and reprocessing needs in detail, it has been modified as needed.

a. Critical Devices

Critical devices are devices that are introduced directly into the bloodstream or which contact a normally sterile tissue or body space during use. FDA recommends that you instruct end users to thoroughly clean and sterilize critical devices after each use. There is a likelihood of microbial transmission and risk of infection (subclinical or clinical) if the device is not sterile.

Examples of critical devices are surgical instruments and endoscopes used in sterile body cavities (such as laparoscopes, arthroscopes, intravascular endoscopes), and all endoscope biopsy accessories.

⁷ Spaulding, EH The role of chemical disinfection in the prevention of nosocomial infections. In: Brachman PS, Eickoff TC, eds Proceedings of the International Conference on Nosocomial Infections, 1970. Chicago: American Hospital Association, 1971:254-274

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b. Semi-Critical Devices

Semi-critical devices are devices that contact intact mucous membranes or non-intact skin. They do not ordinarily penetrate tissues or otherwise enter normally sterile areas of the body. These devices should be reprocessed to be free from all microorganisms. However, intact mucosal surfaces are relatively resistant to small numbers of spores. FDA recommends that you instruct end users to thoroughly clean these devices and then reprocess them by high level disinfection or, if feasible, by sterilization.

Examples of semi-critical devices include endotracheal tubes, laryngoscope blades and other respiratory equipment, esophageal manometry probes, diaphragm fitting rings, etc. Means of high-level disinfection used in health care facilities include liquid chemical sterilants used at high level disinfection conditions and hot water pasteurization (often used for respiratory and anesthesia equipment reprocessing).

Endoscopes which contact intact mucosal surfaces may be used with invasive devices such as biopsy forceps. Therefore, sterilization may be preferable to high level disinfection if feasible. Heat-stable endoscopes (mostly rigid endoscopes) should be processed by steam sterilization. For heat-labile endoscopes, available "low temperature" reprocessing technologies include hydrogen peroxide gas plasma sterilization, ozone sterilization, ethylene oxide (EO) sterilization (the need for device aeration should be considered) and liquid chemical sterilant/high level disinfectant chemical systems used to provide either liquid chemical sterilization or high level disinfection. Note that whichever endoscope reprocessing method(s) is/are recommended, the compatibility of the endoscope with the method(s) and the ability of the method(s) to successfully reprocess the endoscope's lumen length and diameter should be validated and then stated in the Instructions for Use.

c. Non-Critical Devices

Non-critical devices are instruments and other devices whose surfaces contact only intact skin and do not penetrate it. Non-critical devices also include devices that do not directly contact the patient but may become contaminated with microorganisms and organic soil during patient care. FDA recommends thorough cleaning and then intermediate or low level disinfection for non-critical devices depending on the nature and extent of contamination. Items contaminated with blood or body fluids which may contain bloodborne pathogens should receive intermediate level disinfection with a product having an EPA-registered claim for activity against hepatitis B after cleaning.⁸ Blood glucose meters are an example

⁸ Center for Disease Control and Prevention (CDC), "Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008.

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of a blood-contaminated device which has been a source of hepatitis B transmission during patient to patient use when not properly cleaned and disinfected and used with strict compliance with glove use and hand washing after glove removal.

Devices in contact with intact patient skin, or devices used in patient care which may become contaminated with patient microorganisms during use but are not visibly contaminated with blood or body fluids can usually be effectively prepared for safe reuse by cleaning and low level disinfection. Note that some disinfectants are also fairly effective cleaning agents while others are not. Consider the worst case microbes to which the device may be exposed during clinical use, the likelihood of significant organic soiling of the device during use and the ability of the device material to repeatedly withstand disinfectant contact when selecting a disinfectant to validate and then recommend for use with your device. Consider the products which are frequently used in health care settings when selecting a disinfectant to study and validate. If a product/product class can damage the materials in your device, your device label should include a warning not to use that product/class of products to reprocess your device. Be aware that in some clinical situations, isolation precautions recommended for use by CDC may include the use of specific disinfectants (i.e., patients with Norovirus infection, patients with *Clostridium difficile* infection). Always recommend that the user follow the specific EPA label disinfectant contact times when using the disinfectant. If your device has unsealed seams/crevices through which excessive liquid disinfectant could reach the interior of your device and damage it, you should caution users about this potential hazard and provide specific use instructions which can prevent it, such as avoiding the application of excess liquid to your device.

Examples of devices that contact only intact skin are blood pressure cuffs, stethoscopes, and skin electrodes. Examples of devices that have no direct patient contact, yet may become contaminated during patient care are infusion pumps and ventilators.

Other devices may not become contaminated with pathogens during use, may not require disinfection, and therefore may be suitable for use after cleaning only (e.g., room vital signs monitor).

Criterion 4. Reprocessing recommendations should be technically feasible.

Reprocessing recommendations should be technically feasible in the intended location (e.g., health care facility or home use). The equipment and accessories needed to implement the instructions should also be available in the intended location.

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Users reprocessing reusable devices should have the ability to carry out the reprocessing steps. The type of sterilizer, and the manufacturer-validated sterilization cycle parameters and accessories should be available to the users. For example, radiation sterilization is generally only used in manufacturing facilities. Steam sterilization is the most common method of sterilization used in health care facilities. EO, gas/plasma, and liquid chemical sterilization processes are also available in many health care facilities. Dry heat and chemical vapor sterilization are less common.

FDA recommends that the instructions specify sterilization parameters that are technically feasible for the user. That is, sterilization cycle parameters in the labeling should be consistent with cycle parameters found on commonly available, legally marketed, sterilizers used in health care facilities. For examples of cycle parameters commonly found on health care steam and EO sterilizers at the time of this guidance, please see Appendix B.

FDA also recommends that, where possible, your validation data be generated in FDA-cleared sterilizers and with FDA-cleared accessories. Designing validation protocols in accordance with the conventional parameters represented in Appendix B provides assurance that your device is compatible with essential existing FDA-cleared equipment. Alternatively, you should address issues such as the chamber size and chamber load differences that may exist between "industrial" and "health care facility" sterilizer models, and you should address whether or not health care facility sterilizer cycles can actually replicate the cycle conditions achievable in larger industrial sterilizer models.

The expression "extended cycle" has gained common usage to describe any sterilization cycle that includes specifications that deviate from those found on commonly used, FDA-cleared sterilizers, and for which there are no FDA-cleared sterilization accessories. These extended cycles typically include longer exposure times and/or higher temperatures, but may also otherwise deviate from more conventional sterilization cycles. Implementation of such cycles poses serious technical challenges in health care facilities.

FDA advises against including extended cycle recommendations in product labeling for a number of reasons. Foremost among these reasons is that FDA evaluates physical and microbiological performance validation data and product labeling claims for discrete cycle parameter specifications as part of the clearance process for sterilizers and accessories. While many sterilizers are designed with manual override controls for time and temperature, sterilizers are cleared only for those discrete cycle specifications for which FDA has received adequate validation data. When a sterilizer is cleared for a 10 minute, 135°C, gravity cycle, there is no assurance that the physical performance of that sterilizer will be the same throughout a 20, 30, or 60 minute cycle. The user of a FDA-cleared sterilization wrap for which the Agency has evaluated physical and microbiological performance data for a 4 minute, 132°C, pre-vacuum cycle, has no assurance that the performance characteristics of this wrap

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apply to a 8, 16, or 24 minute cycle, as it may no longer be able to maintain sterility. A similar rationale applies to the use of biological indicators and other process indicators to monitor cycles for which they have not been validated, or received FDA clearance. Therefore, FDA does not consider such extended cycles to be technically feasible for health care facility users.

Recommendations related to the validation of reprocessing and cleaning instructions are presented in Sections VII, VIII, and IX.

Criterion 5. The processing instructions should include only devices and accessories that are legally marketed.

Many products used in reprocessing reusable devices in health care settings are currently subject to FDA premarket notification as class II devices. These include sterilizers and accessories (e.g., sterilization wraps and containers) used in health care facilities, as well as liquid chemical sterilants and disinfectants intended for use in reprocessing medical devices. Many products used in initial cleaning steps are not “medical devices.”

The Infection Control Devices Branch maintains a list of the legally marketed liquid chemical sterilants and high level disinfectants⁹, available at <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/ReprocessingofSingle-UseDevices/ucm133514.htm>.

Criterion 6. The instructions should be comprehensive.

Comprehensive instructions enable the user reprocessing the device to understand precisely how to implement the entire reprocessing procedure safely and effectively. There may be several acceptable formats for instructions.

Your reprocessing instructions should include the elements below. If any of the elements are not applicable to your type of device, you should state this in your premarket submission.

a. Special Accessories

The instructions should describe any special cleaning and disinfection or sterilization accessories that are needed for safe reprocessing. The instructions should also identify any special tools, sizes and types of brushes, trays, test kits, specific types of sterilization wraps, containers, or protective covers. Custom brushes should be included. The instructions should also provide sufficient detail

⁹ Guidance for Industry and FDA Reviewers: Content and Format of Premarket Notification [510(k)] Submissions for Liquid Chemical Sterilants/High Level Disinfectants (available at <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073773.htm#main>) issued January 3, 2000.

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so that the user can purchase the correct items or identify a source for the purchase of such items.

b. Special Pre-Processing Handling

As needed, labeling should include any instructions for special pre-processing handling. For example, for devices contaminated with protein material, a special pre-processing handling instruction that helps prevent drying of the device surface prior to cleaning may be appropriate as this will facilitate cleaning.

c. Disassembly and Reassembly

If the device consists of more than one removable part, then disassembly and reassembly instructions should be included to facilitate cleaning by the end user. The equipment needed to perform disassembly and reassembly activities should be included. For ease of use, labeling should include step-by-step instructions for disassembly and reassembly. Diagrams and/or illustrations are recommended. In addition, the instructions should indicate the location where the user performs the step, e.g., at the point of use.

Disassembly and reassembly instructions should be explicit, device specific, and should reflect the validation activities. Expressions such as “disassembly, if applicable” leave the determination of “applicability” to the discretion of the end user and such language should not be included. If a device must be disassembled for cleaning, the instructions should be validated to assure that proper reassembly can be performed, and should provide the end user with a method to verify that reassembly has been properly performed, to assure that the device is in operable condition for the next use. Disassembly and reassembly instructions should include information to inspect the device and components for wear and tear.

d. Method of Cleaning

The labeling should recommend a detailed validated method of cleaning. The method may be manual or mechanical (e.g., washer, washer/disinfector, ultrasonic washer). Cleaning instructions should include a list of the appropriate parameters for any recommended method.

For manual cleaning, the labeling should specify the duration of each processing step, temperatures, water quality, and other conditions. Similarly, for automated cleaning, the labeling should specify all processing conditions. The instructions should recommend equipment settings such as time, temperature, and maximum device load size.

Whether the cleaning method is manual or automated, the labeling should contain comprehensive directions for each cleaning, rinsing, and drying step, so that users can accurately follow the steps or program them into the device washer or washer/disinfector.

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Labeling for medical devices that are at risk for becoming contaminated with patient materials through routine handling by health care workers should include instructions for surface cleaning. Even when only simple surface cleaning is recommended, the label should identify the suggested method, any cautions for specific locations or materials, any disassembly needed and any subsequent steps.

When surface cleaning is recommended for a device whose internal components, which are not contaminated during normal use, could be damaged by contact with liquids such as disinfectants, instructions should describe how to adequately clean the device without damaging it. Where appropriate, surface cleaning instructions should provide users with information on how to prevent disinfectant contact with internal device components that are not designed for contact with liquids.

e. Cleaning Agents

The instructions should recommend only cleaning agents or classes of agents (e.g., anionic detergents, surface-active detergent/disinfectants such as quarternary ammonium compounds, and enzymatic detergents) that were used during the cleaning validation studies and that have been demonstrated to be compatible with the device and are effective cleaning agents. Labeling should include instructions for the preparation and use of those agents, or refer to the cleaning agent labeling for preparation and use instructions (e.g., according to the detergent manufacturer's instructions). Labeling should identify the recommended detergents, whether conventional and/or enzymatic, and include mixing instructions for the detergents if needed. Mixing instructions may be specific (e.g., mix 1 ounce of detergent per gallon of water), or may refer to the product instructions for the user (e.g., mix according to the detergent manufacturer's instructions). Labeling for use on specific medical devices should be consistent with the EPA or FDA-cleared labeling for the product recommended for use.

Note: Instructions should be clear regarding the difference between cleaning (removal of soil) and disinfection (reduction of microbes), and labeling recommendations should reflect the distinction between the use of a cleaning agent versus a disinfecting agent.

f. Lubricating Agents

Use of lubricating agents is an effective way of extending the use-life of some medical devices. Lubricants may reduce the friction commonly associated with metal-on-metal movements, and thereby reduce device wear and corrosion, and extend the use-life of some medical devices.

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Lubricants may be water-based or oil-based. If applicable, labeling for the reusable device should refer to the lubricating agent labeling for preparation and use instructions of those agents.

The instructions should recommend lubricating agents, or a class of lubricating agents (e.g., water soluble lubricants) that are compatible with the medical device, its intended use, and with any subsequent processing steps such as sterilization.

If your instructions specify the use of lubricating agents, then you should validate the device reprocessing methods based on the use of the agents under the conditions of use.

Note: Oil-based lubricants may coat and protect surface microorganisms and reduce the effectiveness of certain common sterilization methods, including steam and EO. They may even provide nutrients for microbial growth. Typically oil-based lubricants are limited to the internal mechanisms of powered instruments.

g. Rinsing

The labeling should recommend specific directions for rinsing after cleaning if appropriate and after use of liquid chemical sterilants / high level disinfectants to remove the processing chemical residues. These directions should include the type and quality of rinse water, volume, temperature, and duration of rinse. Rinsing may be manual or mechanical. If the rinsing instructions in the cleaning and disinfecting/sterilizing product's labeling are sufficient, then reusable device labeling may refer to those instructions.

Rinsing instructions should be validated to show that residual cleaning agents are reduced to a level that will not interfere with subsequent reprocessing steps, and that liquid chemical germicides are reduced to a level that is nontoxic.

FDA generally does not recommend saline solutions as the final rinse because saline solutions, when applied or after drying on the device, may interfere with subsequent disinfection or sterilization steps. Saline rinses may also lead to corrosion on certain devices, as well as to the build-up of inorganic residues.

h. Visual Inspection

All routine cleaning instructions should include instructions for visual inspection. The instructions should advise the user that if the device is determined to not be visually clean at the end of processing, the user should repeat the relevant, previous cleaning steps or alternatively, safely dispose of the device. Additionally, labeling should recommend visual inspection along with acceptance or failure criteria related to device performance (e.g., unacceptable deterioration,

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such as corrosion, discoloration, pitting, cracked seals), as well as instructions to properly dispose of devices that fail.

i. Method of Disinfection or Sterilization

For reusable devices intended to be disinfected or sterilized, labeling should specify at least one validated method for disinfection or sterilization.

Manufacturers of reusable devices should ensure that sterilization processes listed in labeling are compatible with the reusable device. Different microbicidal processes may be effective for different types of devices. Each type of process has its advantages and limitations. For example, heat-labile devices should be sterilized by a non-thermal process (e.g., chemical vapor, gas/plasma, or liquid chemical sterilant).

Specifications for sterilization equipment vary with manufacturers and models. Labeling should identify the particular sterilization method and type, and list the cycle parameters which you have validated.

Traditional sterilization processes, such as steam and EO, are sufficiently well-standardized among sterilizer manufacturers that sterilizer cycle identification may be limited to the critical cycle parameters. (Accessories for these sterilization processes also may be identified using only the critical cycle parameters.) Refer to Appendix B for typical parameters of sterilization cycles currently used in health care facilities.

Sterilization processes using newer low temperature chemical sterilization methods vary in proprietary characteristics from one device manufacturer to another. Therefore, for these sterilization processes (e.g., hydrogen peroxide (H₂O₂), and ozone (O₃)), the manufacturer of the device, the sterilizer model, and the specific cycle identification (name or cycle parameters) should be specifically identified in labeling. (Accessories for these sterilization processes should be labeled by the accessory manufacturer to specify sterilizer manufacturer, sterilizer model, and sterilizer cycle name and/or cycle parameters.)

For all methods, complete cycle specifications should include all critical cycle parameters and other pertinent information that identifies the cycle. For example:

- Steam: type of cycle (dynamic air removal vs gravity), time, temperature, load characteristics (e.g., weight, wrapped/unwrapped, textile, etc.), drying time
- EO: EO concentration (and gas composition), time, relative humidity, temperature, aeration time
- H₂O₂ and O₃: manufacturer, model, specific cycle identification per model either by name or specific cycle parameters
- Dry heat: time, temperature, load characteristics

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j. Special Post-Process Handling

Instructions should include special post-processing procedures, as needed, in order to reduce or eliminate recontamination before use or reuse.

For example, labeling should include instructions for reducing sterilant residuals (e.g., by aeration) during post-process handling after a process that may leave sterilant residuals on the device such as sterilization by EO or vaporized hydrogen peroxide. Labeling should recommend a post-processing aeration time that is consistent with the maximum acceptable levels of residuals.

In the case of EO sterilization, CDRH has accepted EO residuals information based on the recognized standard, ANSI/AAMI/ISO 10993-7:2008 “Biological Evaluation of Medical Devices – Part 7: Ethylene Oxide Sterilization Residuals.”

k. Drying

Active device drying is another post-processing procedure which may reduce or eliminate recontamination of unwrapped devices after high level disinfection/liquid chemical sterilization reprocessing of devices because they will be wet at the end of reprocessing. Labeling should recommend that the user thoroughly dry the device, after processing and before storage, to inhibit any subsequent growth of waterborne microbes.

Labeling should also recommend a validated drying time specification for terminal sterilization methods for wrapped/contained devices. Moisture remaining on wrapped/contained product after sterilization could compromise the package integrity and performance by impairing the sterile barrier properties of the packaging materials and the effectiveness of the seals.

The reprocessing procedure should minimize or eliminate delays between steps. Delays should be avoided because delays may create conditions favorable to microbial growth or colonization, which may increase the challenge to subsequent steps such as cleaning and disinfection/sterilization. For example, delays between point-of-use pre-processing and cleaning may create conditions that promote biofilm formation. Organic contamination, such as biofilms, may increase the challenge to cleaning, and may also inactivate or prevent full penetration of a disinfectant or sterilant. Such time delays should therefore be kept to a minimum.

The time interval between cleaning and sterilization, i.e., complete processing, is also important. If complete processing is delayed, labeling should recommend an intermediate and effective drying step before any delayed sterilization.

l. Reuse Life

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The labeling should inform the user how many times, based on testing, the device can be reused; or provide the user with a mechanism or method to ascertain whether the device has exceeded its use-life.

This may be done by validating the number of times the product can be reprocessed and reused, and providing this specification in the labeling. For example, the labeling for a reusable device may state the maximum number of reuses and provide a specific tracking method.

Alternatively, labeling should provide the user with a method to establish that the device is still within performance specifications and instructions to dispose of devices that fail. Examples include:

- labeling that refers to a device design feature, such as a built-in, automatic pre-check function;
- labeling that identifies a performance test that should be passed prior to reuse; and
- labeling that recommends visual inspection along with acceptance or failure criteria (e.g., unacceptable deterioration, such as corrosion, discoloration, pitting, cracked seals), .

m. Special Label Designations, Warnings, and Precautions

Single use devices that are initially supplied non-sterile to the end user and require the end user to sterilize the device before use, and reusable devices that are initially supplied non-sterile to the end user and require the end user to sterilize the initial packaged device and to subsequently reprocess the device after initial use (i.e., cleaning and sterilization), should be prominently labeled "Non-sterile" in large type directly on the manufacturer's original device package in a manner which precludes separation of "Non-sterile" from the device.

Labeling should include any special warnings or precautions about the reprocessing procedure, when warranted. These may be related to user safety or emphasize conditions that could significantly alter the safety or effectiveness of reprocessing or the performance of the device.

n. Patient or Lay Use

Devices that are intended to be maintained by a patient or lay care provider (e.g., family member or other) should have reprocessing instructions which are understandable to a lay person, and which can be performed at home. The equipment and accessories needed to implement the instructions should also be readily available in the intended location of use.

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See also FDA's "Guidance on Medical Device Patient Labeling."¹⁰

o. Reference to Guidelines or Accessory Labeling

The labeling of the reusable device, in addition to all of the recommendations set forth in this guidance, may also refer the user to professional organization's clinical practice guidelines, the clinical guidelines of the CDC, or the OSHA Standard 29 CFR 1910.1030 Occupational Exposure to Bloodborne Pathogens⁶ for the additional education of users. Please note that such clinical practice guidelines may not always accurately reflect regulatory considerations for medical devices and should not be used in place of the recommendations of this guidance. The regulatory label of a medical device or a disinfectant cleared by EPA or FDA should always be followed when recommending product use.

Referencing the labeling of devices used in reprocessing, for example, an endoscope washer-disinfector, may be acceptable, as long as the referenced labeling is relevant and consistent with the reusable device's labeling. For instance, labeling for an endoscope may refer, in part, to endoscope washer-disinfector labeling for certain details on scope reprocessing (e.g., placement in chamber).

p. Telephone Number to Request Information

The manufacturer of the reusable device is the appropriate contact for user questions about the reprocessing procedures. The instructions for reusable devices should include a telephone number and email address to obtain additional information about reprocessing the device, including questions on infection control procedures for the device. You may also provide your internet address.

Criterion 7. The instructions should be understandable.

Instructions should be clear, grammatically correct, legible, and in logical order from the initial processing step through the terminal processing step (e.g., pre-processing, disassembly, cleaning, rinsing, reassembly, disinfection or sterilization, final rinsing after disinfection or liquid chemical sterilization, and post-process handling). The instructions should be written in simple language to the greatest extent possible, although they should also be sufficiently detailed to explain the correct procedures for all steps.

Instructions should be in grammatically correct English.¹¹ Where applicable, instructions may include technique diagrams or other graphic representations designed to communicate recommended practices. However, any graphics should be accompanied by clarifying text. The instructions should be validated as described in

¹⁰ Guidance on Medical Device Patient Labeling (available at <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm070782.htm>) issued April 19, 2001

¹¹ 21 CFR 801.15(c)(1)

Section V.D. of this guidance to ensure that users will be able to understand and follow them.

VII. Validation of Reprocessing Methods in Accordance with the Quality System Regulation

Manufacturers must validate the design (including reprocessing instructions) of reusable devices and reprocessing procedures associated with reuse in accordance with the Quality System regulation (21 CFR Part 820) to make certain the device can be effectively reprocessed over its use life.

For devices that are subject to design controls under 21 CFR 820.30, labeling (e.g. reprocessing instructions) must be considered during design validation to assure user needs and intended uses are met. The human factors methods used should ensure that the characteristics of the user population and operating environment are considered. (21 CFR 820.30(g)) See Section V.D. of this guidance for more information about human factors in developing reprocessing instructions.

Cleaning and sterilization processes require process validation which provides a high degree of assurance that a device will consistently meet predetermined specifications. (21 CFR 820.75)

VIII. Validation of Cleaning Process

A. Introduction

This section describes FDA's recommendations on the validation of processes designed to clean reusable medical devices. Although many FDA-recognized consensus standards related to medical device sterilization are currently available, no standards and no dedicated guidance is currently available related to medical device cleaning.

FDA recommends that the establishment of cleaning methods include two steps. First, you should develop the cleaning process and instructions, including disassembly if needed. Second, you should conduct validation activities to demonstrate that your methods are adequate to allow the device to undergo further processing and to eventually be reused; and that your reprocessing instructions are effective in conveying the proper reprocessing methods.

Labeling of reusable devices should provide detailed, validated cleaning specifications for routine device processing. This labeling should indicate all parameter specifications for each step of the process, including, for example, time

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and temperature. Where applicable, this may include specific set points and tolerances or ranges.

Time, temperature, concentration, and other specifications for each step of the process should be specific. Ambiguous or incomplete instructions such as “rinse at room temperature,” or “allow device to dry under ambient conditions” are generally inadequate.

B. Validation of the Cleaning Process Using Worst Case Testing

FDA recommends you validate your recommended cleaning process. Your validation activities should be based on comprehensive validation protocols that use soils that are clinically relevant to the type of device. These should include the worst case (least rigorous) implementation of the cleaning process, medical devices that represent worst case (most contaminated) test devices, and chosen test methods that are related to the clinically relevant soil. Specify predetermined cleaning test endpoints. These protocols should be designed to establish that the most inaccessible locations on your devices can be adequately cleaned during routine processing.

For all testing, you should choose a statistically significant number of replicate samples to support the validity of any instructions based on the tests being performed.

1. Artificial Soil, Inoculation Sites, and Simulated Use:

Implementation of a well-established simulated use test protocol should be an integral part of reprocessing validation.

a. Artificial Soil

The manufacturer should select an artificial test soil composed of a formulation that includes or accurately represents all materials that the device would likely be subjected to during an actual clinical use, and would create the greatest (worst case) challenge to the cleaning process.

FDA does not recommend the use of spore log reduction testing as a method to determine the effectiveness of the cleaning methodology. It is unclear whether or not the removal of bacterial spores directly correlates to the removal of clinical organic soil from the devices. Such testing only indicates how well a process reduces spore count, and provides no information on any other component of organic soil.

b. Inoculation Sites

Soil inoculations should mimic worst case clinical use conditions. We recommend you use the artificial soil to inoculate the device in all locations

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likely to contact patient materials, including all locations that are difficult to clean.

c. Simulated Use Conditions

Simulated use conditions for the validation studies should be device specific. You should use a device which has undergone at least some simulated use. In addition, simulated use conditions should account for real world use conditions, to mimic worst case clinical use, for example, the worst case duration of clinical exposure. You should also conduct all functional procedures (articulations, flexures, manipulations) for which the device is intended to soil the device sufficiently to represent worst case conditions. If the device is likely to be repeatedly subjected to "pushing" soil into a hard to reach area during use, validation soiling should include repeated soiling to adequately reproduce the "worst case" use situation. If after use of the device, drying of soil might occur and cleaning might not be performed immediately after use (such as with loaner devices that will be shipped without adequate reprocessing), the validation methods should allow soils to dry for a length of time that simulates worst case (longest duration).

2. Validation Protocols: Methods Designed to Test the Cleaning Process

The cleaning validation protocols should specify the shortest times, lowest temperatures, weakest dilutions, etc., for each step of the cleaning instructions. You should perform a detailed, side-by-side comparison of the text of the cleaning instructions and the text of the validation protocols, to identify and account for all worst case processing conditions.

As with cleaning instructions, validation protocols should be detailed and specific in time, temperature, concentration, and other specifications.

Examples of worst-case scenarios:

- If the cleaning instructions recommend a 10 to 20 minute pre-soak, the validation protocols should specify 10 minutes or less.
- If the cleaning instructions advise the user to manually clean at 45°C ± 5°C, the validation protocols should specify cleaning at 40°C or less.
- If a device consists of several components to be disassembled for adequate cleaning, examine what will result if the device is not disassembled or is incompletely disassembled.
- Enzymatic Detergents: In general, "worst case" implies shortest times, lowest temperatures, etc. A noteworthy exception to validation at lowest temperature would be the enzymatic detergents, which

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- **Medical Washers/Disinfectors:** If your process validation uses automated medical washers/washer disinfectors or ultrasonic cleaners, your worst-case should include the worst extremes of the intended cycle parameters.

3. Testing: Test Types and Protocols

Choice of Test Types

FDA recommends that you use a quantitative test method capable of measuring meaningful levels of clinically relevant soil to meet a related, predetermined cleaning endpoint. Many potential test methods exist for the evaluation of organic soil contamination, and the effectiveness of cleaning processes. The AAMI publication TIR 30:2003,⁴ provides a summary of what is available in the literature.

When choosing a test method, consideration should be given to a number of factors. These should include, but not necessarily be limited to, the chemical constituents that the device is expected to come in contact with during actual clinical use (which should be adequately represented in the artificial soil), the test specificity, and the sensitivity of the test methods in relation to the proposed cleaning endpoints.

a. Methods Validation

We recommend you validate the test methods chosen to measure residual soil. Your documentation of the method should include analytical sensitivity and specificity information and predetermined cleaning endpoints, and describe appropriate controls.

b. Extraction Method

Devices should be subjected to a validated method of extraction for testing. Exhaustive extraction is a commonly used method, and extraction using a known quantity of inoculum is also common (but has some procedural limitations). Extractions and calculations should address all hard to clean internal surfaces (such as lumens), and worst case soiled surfaces (such as mated surfaces that have been soiled repeatedly or under pressure).

c. Destructive Testing

You should perform destructive testing where necessary to validate the effectiveness of cleaning methods. This particularly applies to complex

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device designs with lumens, internal moving parts, or other inaccessible surfaces.

For such devices, you should demonstrate that cleaning solutions, rinse water and/or patient materials will not penetrate into the internal aspects of the devices via incomplete seals, seams, or other internal-external contiguous air spaces. Such openings may result in the ingress of patient materials and cleaning fluids, and these contaminants may compromise subsequent disinfection or sterilization processes, as well as exit these device openings in the future.

Alternatively, if you determine that patient materials and cleaning fluids can not be prevented from entering the devices, you should demonstrate that the cleaning methods meet the cleaning endpoint for all internal surfaces that become contaminated at any time during use or reprocessing. Direct evaluation for residual soil should include complete surface area extraction for hard to clean internal surfaces. Soil assessment and surface area calculations for these areas should be an integral component of the soil reduction calculations.

C. Resources for Establishing Simulated Use Protocols

FDA recommends the use of worst case simulated use protocols throughout the validation of the cleaning process. Where applicable, clinicians should be consulted to determine the physical extent of “real world” worst case device contamination. Also, practicality and human factors issues should be considered when establishing your simulation protocols. In addition, the AAMI publication TIR 30:2003, “A compendium of processes, materials, test methods, and acceptance criteria for cleaning reusable medical devices” provides a summary of soils and soil recipes that is available in the literature.

D. Documentation of Validation of Reprocessing Methods in Submissions

The nature of the documentation to be submitted to FDA for the validation of your reprocessing process and instructions will depend upon the nature of your application or submission. While all cleaning, disinfection, and sterilization procedures should be validated, the documentation recommended for each type of submission or application is described below.

1. Documentation in Premarket Submissions

A **PMA or HDE** should include a complete report of the validation of the reprocessing instructions in the manufacturing and design section.

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FDA intends to review the reprocessing validation in the same manner as the other manufacturing and design data.

A **510(k)** should include validated labeling instructions for reprocessing, based on this guidance. The validation of the reprocessing instructions is part of the QS regulation requirements, 21 CFR Part 820, and may be evaluated during FDA inspections.

A complete report of the validation of the cleaning and reprocessing instructions need not necessarily be included in a 510(k) submission. However, FDA staff may request this data, which the manufacturer should have on file according to 21 CFR Part 820, if submission of validation data is recommended in a specific guidance or on a for cause basis.

2. Documentation in IDEs

An **IDE** should include a summary of the validation of the reprocessing instructions, when completed.

FDA intends to use judgment when considering the extent of the data needed prior to the initiation of clinical studies to document the safety of the recommended reprocessing process for the device. Validation of all reprocessing methods should be completed prior to approval.

IX. Validation of Terminal Reprocessing

A. Disinfection

FDA recommends that you follow the recommendations in product specific FDA Guidance documents, as well as those found in standards that are recognized by the FDA consensus standards program, which can be found in FDA's consensus standards database.¹²

B. Sterilization

FDA recommends that you follow the guidance entitled "Updated 510(k) Sterility Review Guidance K90-1"¹ and any applicable FDA recognized standards.

As stated previously, FDA recommends that, where possible, your validation data be generated in FDA-cleared sterilizers and with FDA-cleared accessories. Alternatively, you should adequately address issues such as the chamber size and chamber load differences that may exist between "industrial" and "health care facility" sterilizer models. In addition, you should address whether or not health

¹² <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfStandards/search.cfm>.

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care facility sterilizers have been validated by their manufacturers for the sterilizer cycle parameters which are recommended and whether FDA-cleared sterilization monitoring accessories such as biological indicators and other process indicators, sterilization wrap, etc. have been labeled for use with the sterilizer cycle parameters and are available to health care facility users.

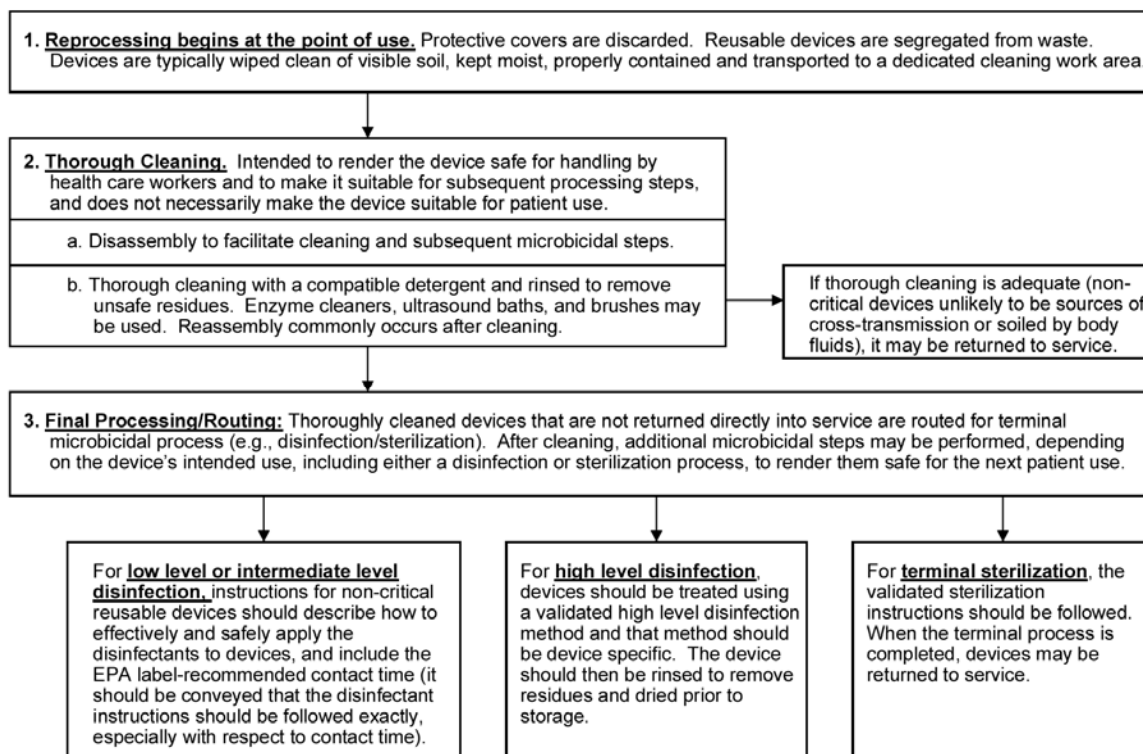
FDA recommends that that you propose and validate sterilization cycle specifications that are in accordance with the conventional parameters represented in Appendix B to provide assurance that your device is compatible with necessary FDA-cleared equipment, and may be validly implemented by end users.

APPENDIX A. Overview of Reusable Medical Device Reprocessing

As it is difficult for the health care workers responsible for reprocessing reusable devices to assess the amount and resistance of microbial contamination on the devices to be reprocessed, product labeling, professional practices, and institutional infection control procedures help guide the persons who are responsible for reprocessing devices.

Proper handling and reprocessing of reusable medical devices for the next patient is done by carefully adhering to general reprocessing steps described in the following detailed overview, presented as Figure 2.

FIGURE 2. DETAILED PROCESS OVERVIEW



We recommend that all reusable medical devices be designed and constructed to allow adequate cleaning, because if a device can not be adequately cleaned, any subsequent disinfection or sterilization process may not be effective.

Additional information on reprocessing for some specific devices, such as endoscopes and ultrasound transducers, is available from FDA in our database of guidance documents and by consulting specific review divisions.

APPENDIX B. Examples of Sterilization Cycles Used in Health Care Facilities

STEAM STERILIZATION CYCLES

Table 1. Cycle Times for Gravity-Displacement Steam Sterilization Cycles

| Item | Exposure Time at 121°C (250°F) | Exposure Time at 132°C (270°F) | Exposure Time at 135°C (275°F) | Drying Times |
|--|--------------------------------|--------------------------------|--------------------------------|-----------------|
| Wrapped Instruments | 30 minutes | 15 minutes | | 15 - 30 minutes |
| | | | 10 minutes | 30 minutes |
| Textile Packs | 30 minutes | 25 minutes | | 15 minutes |
| | | | 10 minutes | 30 minutes |
| Wrapped Utensils | 30 minutes | 15 minutes | | 15 - 30 minutes |
| | | | 10 minutes | 30 minutes |
| Unwrapped nonporous items (e.g., instruments) | | 3 minutes | 3 minutes | 0 - 1 minutes |
| Unwrapped nonporous and porous items in mixed load | | 10 minutes | 10 minutes | 0 - 1 minute |

Table 2. Cycle Times for Dynamic-Air-Removal Steam Sterilization Cycles

| Item | Exposure Time at 132°C (270°F) | Exposure Time at 135°C (275°F) | Drying Times |
|--|--------------------------------|--------------------------------|-----------------|
| Wrapped Instruments | 4 minutes | | 20 - 30 minutes |
| | | 3 minutes | 16 minutes |
| Textile Packs | 4 minutes | | 5 - 20 minutes |
| | | 3 minutes | 3 minutes |
| Wrapped Utensils | 4 minutes | | 20 minutes |
| | | 3 minutes | 16 minutes |
| Unwrapped nonporous items (e.g., instruments) | 3 minutes | 3 minutes | N/A |
| Unwrapped nonporous and porous items in mixed load | 4 minutes | 3 minutes | N/A |

Table 1 and 2 modified and reprinted with permission from ANSI/AAMI ST79:2010 & A1:2010 Comprehensive guide to steam sterilization and sterility assurance in health care facilities. Published by the Association for the Advancement of Medical Instrumentation (AAMI). (C) 2010 AAMI www.aami.org.

EO STERILIZATION CYCLES

Table 3. EO Parameter Specification Ranges

| EO Concentration | Exposure Time | Temperature | Relative Humidity |
|--|---------------|------------------------------------|-------------------|
| 450 – 750 mg/L (milligrams per liter) | 1 – 5 hours | 37.8°C to 60°C (100°F to 140°F) | 40% - 80% |

Burgess DJ, Reich RR, Ethylene Oxide Sterilization: Scientific Principles. In Reichert M, Young JH (eds.), Sterilization Technology for the Health Care Facility. 2nd ed. Aspen Publishers, Inc. Gaithersburg, MD. 1997

APPENDIX C. Definition of Terms

The following are common microbiological terms that may be used in reprocessing instructions in device labeling derived from referenced literature.^{6, 7, 13, 14, 15, 16, 17} The list is not exhaustive. Additional definitions of terms can be found in the referenced literature.

- **Biological Indicator (BI):** A test system containing viable microorganisms providing a defined resistance to a specified sterilization process
- **Cleaning:** Physical removal of organic soil from an item to the extent necessary for further processing or for the intended use.
- **Disinfectant:** An agent that destroys pathogenic and other kinds of microorganisms by chemical or physical means. A disinfectant destroys most recognized pathogenic microorganisms, but not necessarily all microbial forms, such as bacterial spores.
- **Disinfection:** A process that destroys pathogens and other microorganisms by physical or chemical means. Disinfection processes do not ensure the same margin of safety associated with sterilization processes. The lethality of the disinfection process may vary, depending on the nature of the disinfectant, which leads to the following subcategories:
 - a. **High Level Disinfection:** A lethal process utilizing a sterilant under less than sterilizing conditions. The process kills all forms of microbial life except for large numbers of bacterial spores.
 - b. **Intermediate Level Disinfection:** A lethal process utilizing an agent that kills viruses, mycobacteria, fungi and vegetative bacteria, but no bacterial spores.
 - c. **Low Level Disinfection:** A lethal process utilizing an agent that kills vegetative forms of bacteria, some fungi, and lipid viruses.
- **Germicide:** An agent that destroys microorganisms, especially pathogenic organisms. Other terms with the suffix *-cide* (e.g., virucide, fungicide, bactericide, sporicide,

¹³ Pflug, I.J., Microbiology and Engineering of sterilization Processes, 7th ed. Minneapolis, Environmental sterilization Laboratory. 1990, Chapters 1-3.

¹⁴ Sehulster LM, Chinn RYW, Arduino MJ et al Guidelines for environmental infection control in health care facilities, 2003.

¹⁵ Occupational Safety & Health Administration, available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051.

¹⁶ Association for the Advancement of Medical Instrumentation (AAMI). Sterilization of health care products-Vocabulary. ANSI/AAMI/ISO TIR11139:2006.

¹⁷ Block SS, Definition of Terms In: Block SS, ed. Disinfection, Sterilization and Preservation, 5th ed. Phila: Lippincott Williams & Wilkins 2001:19-28.

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tuberculocide) indicate an agent that destroys the microorganism identified by the prefix.

- Physical/chemical sterilization process indicator: A physical/chemical sterilization process indicator is a device intended for use by a health care provider to accompany products being sterilized through a sterilization procedure and to monitor one or more parameters of the sterilization process. The adequacy of the sterilization conditions as measured by these parameters is indicated by a visible change in the device. (21CFR 880.2800(b))
- Process Validation: Establishing by objective evidence that a process consistently produces a result or product meeting its predetermined specifications.
- Reprocessing: Validated processes used to render a medical device that has been previously used or contaminated, fit for a subsequent single use on another patient. These processes are designed to remove soil and contaminants by cleaning and to inactivate microorganisms by disinfection or sterilization.
- Reusable Medical Device: A device intended for repeated use either on the same or different patients, with appropriate cleaning and other reprocessing between uses.
- Single Use Device (SUD): A SUD is a device that is intended for one use or on a single patient during a single procedure.¹⁸
- Spore (or endospore): The dormant state of a microorganism, typically a bacterium or fungus, which exhibits a lack of biosynthetic activity, reduced respiratory activity, and has resistance to heat, radiation, desiccation and various chemical agents.
- Sterilant: An agent that destroys all viable forms of microbial life.
- Sterile: State of being free from viable microorganisms.
- Sterilization: A validated process used to render product free from viable microorganisms.

NOTE In a sterilization process, the nature of microbial inactivation is described as exponential and, thus, the survival of a microorganism on an individual item can be expressed in terms of probability. While this probability can be reduced to a very low number, it can never be reduced to zero.¹⁸

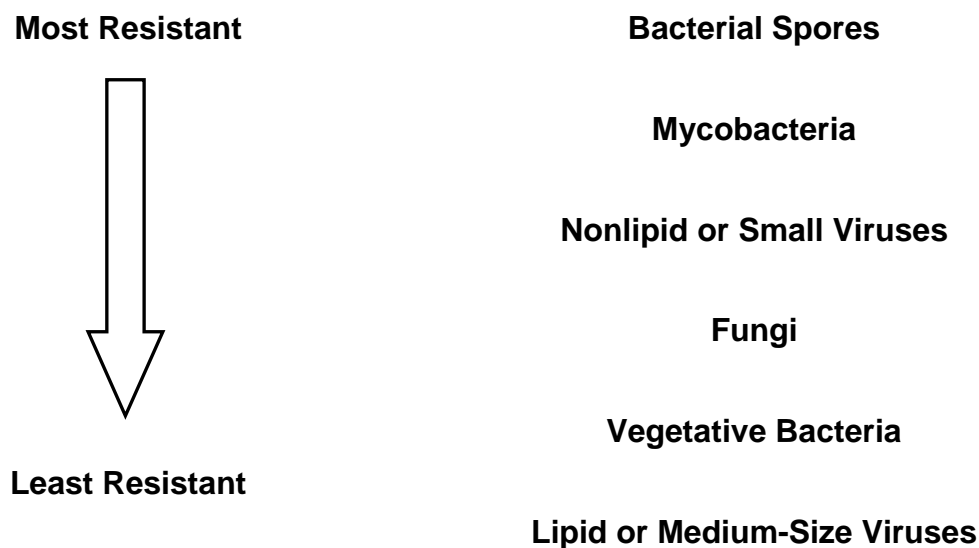
¹⁸ Food and Drug Administration (FDA), Reprocessing of Single Use Devices, Definitions, <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/ReprocessingofSingle-UseDevices/ucm121090.htm> (June 18, 2009).

Contains Nonbinding Recommendations

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- Sterilization wrap: A sterilization wrap (pack, sterilization wrapper, bag, or accessories) is a device intended to be used to enclose another medical device that is to be sterilized by a health care provider. It is intended to allow sterilization of the enclosed medical device and also to maintain sterility of the enclosed device until used. (21 CFR 880.6850)

APPENDIX D. Descending Order of Resistance of Microorganisms to Germicidal Chemicals



Modified from Favero, M.S. and Bond, W.W., Chemical Disinfection of Medical and Surgical Materials. In: Disinfection, Sterilization, and Preservation, 5th Ed Phila: Lippincott Williams & Wilkins 2001: 881-917.

APPENDIX E. Additional Resources

The following additional references may be useful resources:

1. AAMI TIR12:2010, Designing, testing and labeling reusable medical devices for reprocessing in health care facilities: A guide for medical device manufacturers.
2. AAMI TIR 30:2003, A compendium of processes, materials, test methods, and acceptance criteria for cleaning reusable medical devices.
3. ANSI/AAMI ST 79:2006, Comprehensive guide to steam sterilization and sterility assurance in health care facilities.
4. AAMI/ANSI ST 81: 2004/R2010: Sterilization of medical devices - Information to be provided by the manufacturer for the processing of resterilizable medical devices.
5. Burgess DJ, Reich RR, Ethylene Oxide Sterilization: Scientific Principles. In Reichert M, Young JH (eds.), Sterilization Technology for the Health Care Facility. 2nd ed. Aspen Publishers, Inc. Gaithersburg, MD. 1997.
6. Favero, M.S. and Bond, W.W., Chemical Disinfection of Medical and Surgical Materials. In: Block SS, ed. Disinfection, Sterilization, and Preservation, 5th Ed Phila: Lippincott Williams & Wilkins 2001: 881-917.
7. Labeling Regulatory Requirements for Medical Devices (available at <http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM095308.pdf>) issued August 1989.
8. Human Factors Principles For Medical Device Labeling (available at <http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM095300.pdf>) issued September 1993.