Pulse Oximeters - Premarket Notification Submissions [510(k)s]

Guidance for Industry and Food and Drug Administration Staff

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Food and Drug Administration
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Anesthesiology and Respiratory Devices Branch

Preface

Public Comment

You may submit written comments and suggestions at any time for Agency consideration to the Division of Dockets Management, Food and Drug Administration, 5630 Fishers Lane, rm. 1061, (HFA-305), Rockville, MD, 20852. Submit electronic comments to http://www.regulations.gov. Identify all comments with the docket number listed in the notice of availability that publishes in the *Federal Register*. Comments may not be acted upon by the Agency until the document is next revised or updated.

Additional Copies

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Guidance for Industry and Food and Drug Administration Staff

This guidance represents the Food and Drug Administration's (FDA's) current thinking on this topic. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. You can use an alternative approach if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative approach, contact the FDA staff responsible for implementing this guidance. If you cannot identify the appropriate FDA staff, call the appropriate number listed on the title page of this guidance.

1. Introduction

FDA has developed this guidance document to assist industry in preparing premarket notifications (510(k)s) for pulse oximeters. These devices are intended for non-invasive measurement of the arterial blood oxygen saturation and pulse rate.

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.

2. Scope

The scope of this document is limited to the Class II devices, Oximeter and Ear oximeter, classified under the following regulations:

21 CFR 870.2700 – Oximeter (product codes: DQA (Oximeter) and NLF (Oximeter, Reprocessed))

An oximeter is a device used to transmit radiation at a known wavelength(s) through blood and to measure the blood oxygen saturation based on the amount of reflected or scattered radiation. It may be used alone or in conjunction with a fiberoptic oximeter catheter.

This guidance does not address oximeters in product codes MUD (tissue saturation oximeter), NMD (reprocessed tissue saturation oximeter), or MMA (fetal pulse oximeter).

21 CFR 870.2710 – Ear Oximeter (product code: DPZ (Ear oximeter))

An ear oximeter is an extravascular device used to transmit light at a known wavelength(s) through blood in the ear. The amount of reflected or scattered light as indicated by this device is used to measure the blood oxygen saturation.

These classification regulations group together all oximeters intended to measure blood oxygen saturation. The regulations at 21 CFR 870.2700 and 870.2710 include devices using reflectance, transmittance, and fiber optic technologies, which are collectively referred to as pulse oximeters for the purpose of this guidance. The terms "transmittance" and "reflectance" refer to the sensor geometry and are not related to the principles of pulse oximetry and how the light is absorbed by hemoglobin.

This guidance document pertains to non-invasive pulse oximeters to measure arterial blood oxygen saturation (SpO2) and pulse rate based on the amount of transmitted, reflected and scattered light through various application sites (including, but not limited to finger, ear, foot, hand, forehead, back, and nose). These devices are limited to prescription use. These pulse oximeters may be continuous or spot-checking devices and either stand-alone or multi-parameter modules. These devices are typically labeled with a general indication for non-invasive measurement of blood oxygen saturation. A manufacturer that wishes to seek a specific clinical indication for use of a pulse oximeter, for example to screen for or diagnose a disease or condition, should submit clinical safety and effectiveness data to support the specific indication. A clinical evaluation of a new intended use of a legally marketed device may require an Investigational Device Exemption (IDE) under 21 CFR Part 812 (http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/InvestigationalDeviceExemptionIDE/default.htm) before the clinical study is initiated. Should an IDE be necessary, FDA suggests that manufacturers take advantage of the Pre-Submission Program (see "Draft Guidance for Industry and FDA Staff Medical Devices: The Pre-Submission Program and Meetings with FDA Staff," issued July 13, 2012,[1] which when final will represent FDA's current thinking on this topic) to obtain input from FDA on their study plan.

3. Device Description

We recommend you identify your device by the applicable regulation number and product code indicated in Section 2 above and include the information described below.

Intended Use

We recommend you clarify if the device [and accessories] is intended:

[1] Web addresses for all guidance documents referenced within can be found in the "List of References" at the end of this document.

- as a stand-alone device or a multi-parameter module;
- for use in spot-checking or continuous monitoring;
- for single use or multi-use;
- for out-of-hospital transport; or
- for home use.

Device Design

We recommend you identify and describe:

- scientific principles underlying how the device achieves its intended use, i.e., the theory of operation (e.g. functional oxygen saturation or fractional oxyhemoglobin);
- sensor configuration/geometry and recommended application sites;
- design features; e.g., functions, alarms. In general, pulse oximeters intended for continuous monitoring should include high and low SpO2 and pulse rate alarms;
- all patient interface accessories; e.g., patient cable, extender cables, sensors, bandages;
- whether the device will be provided sterile; and
- whether the device is a reprocessed single-use device.

We recommend you include high-level drawings, diagrams, or photographs of your device that can help explain the function or highlight new features that may affect safety and effectiveness, for example, changes to a sensor.

We recommend that you compare your device with a legally marketed predicate device (include the 510(k) number, if available) and provide information to show how your device is similar to and different from the predicate. Side by side comparisons, whenever possible, are desirable, for example, using a tabular format as shown below. For each identified difference, please provide further discussion of the difference compared to the predicate and why this difference will not significantly affect safety or effectiveness.

Table 1. Example Comparison of New and Predicate Devices

Description	Your Device	Predicate Device
Intended patient population, such as neonate, infant, pediatric, adult		
Intended application site, such as finger, ear, foot, hand, forehead, back, nose		
Performance Specifications (including use under motion and low perfusion conditions, if applicable, and any indices or signals provided to the user)		

Safety Specifications (e.g., electrical, mechanical, environmental)		
Features (e.g., alarms, display and indicators, modes)		

4. Device Performance

We recommend the device undergo performance testing as described in ISO 80601-2-61:2011 *Medical Electrical Equipment — Part 2-61: Particular requirements for basic safety and essential performance of pulse oximeter equipment* or equivalent method. This should include, but not be limited to, testing identified in Sections 4.1 – 4.4 below.

4.1 Accuracy of Pulse Oximeters

We recommend that you conduct the testing described in Clause 201.12.1 of ISO 80601-2-61:2011 or equivalent methods.

An oximeter operates as a system composed of a sensor, any extender or interface cable, and a specific oximeter monitor or module. We recommend you validate each system through appropriate testing, inspection, or analysis.

Grouping Sensors for Testing

It may be appropriate to group certain sensors for testing if they are of similar design or equivalent performance. We consider sensors to be of similar design if they contain identical materials and electro-optical components and have equivalent sensor characteristics (e.g., location of use). If you choose to group sensors for testing based on their similar design, we recommend you indicate that all sensors within each group contain identical materials and electro-optical components and describe the rationale for grouping. Generally, we believe that clip and adhesive sensors should not be grouped based on similar design because they differ in form, fit, and functional specifications. If you choose to group sensors for testing based on equivalent performance, we recommend you provide valid scientific evidence and statistical analysis to demonstrate that the results of testing are poolable.

Incorporating an Original Equipment Manufacturer's Cleared Technology

If your device incorporates an Original Equipment Manufacturer's (OEM) oximeter that is legally marketed for the same intended use, we recommend you provide the following in lieu of accuracy studies:

- the 510(k) numbers for the submissions where each combination of oximeter, sensor, and cable were cleared for use together; and
- testing that demonstrates that SpO2 and pulse rate values calculated by the OEM system are not corrupted during communication to your host device.

We recommend you conduct the above verification on the bench using a functional tester (see ISO 80601-2-61:2011 Section 201.3.209 for the definition and appropriate uses of a

functional tester) to span the range of saturation and pulse rate values to assure communication between the component and the host module.

Modifications to Oximeter Systems that Require a New 510(k)

In accordance with 21 CFR 807.87(g), a pulse oximeter system "that has undergone a significant change or modification *(from its currently cleared configuration)* that could significantly affect the safety or effectiveness of the device" requires a new 510(k). To decide when to submit a new 510(k) for a change to an existing device, we recommend you refer to the FDA guidance titled "Deciding When to Submit a 510(k) for a Change to an Existing Device (K97-1)," issued January 10, 1997. FDA generally considers any one of the following modifications to be significant as they may have the potential to affect safety or effectiveness:

- significant electro-optical sensor modifications (e.g., component or bandage material in the light path, extensive re-design where a device is miniaturized); or
- significant SpO_2 algorithm modifications.

We recommend you conduct *in vivo* (i.e., clinical) studies to determine the accuracy of SpO_2 (under laboratory and any labeled operating conditions (e.g., motion)) for new and modified systems. FDA will always consider alternatives to *in vivo* testing when the proposed alternatives are supported by an adequate scientific rationale. For example, when changes or modifications made do not affect the optical chain or signal processing path, then additional clinical studies may not be needed.

If a clinical study is needed to demonstrate substantial equivalence, i.e., conducted prior to obtaining 510(k) clearance of the device, the study must be conducted under the Investigational Device Exemptions (IDE) regulation, 21 CFR Part 812. Generally, FDA believes pulse oximeters addressed by this guidance document are non-significant risk devices; therefore, the study would be subject to the abbreviated requirements of 21 CFR 812.2(b). Please see the FDA Guidance titled, "Significant Risk and Nonsignificant Risk Medical Device Studies," issued January 2006. In addition to the requirements of Section 21 CFR 812.2(b), sponsors of such trials must comply with the regulations governing institutional review boards (21 CFR Part 56) and informed consent (21 CFR Part 50).

4.1.1 *In vivo* testing for SpO_2 accuracy under laboratory conditions

We recommend you follow Clause 201.12.1.101.2 and Annex EE.2 of ISO 80601-2-61:2011 *Procedure for invasive laboratory testing on healthy volunteers*, or equivalent method to validate the SpO_2 accuracy specifications of your pulse oximeter system by comparing each value from your system and a simultaneous value from co-oximetry of an arterial blood sample. We recommend you submit a detailed clinical report for this testing. Your report should describe the device configuration tested and include the following:

- test apparatus used, including means for arterial catheterization and blood sampling, means for recording SpO_2 values, and means for delivering medical

grade oxygen-nitrogen mixtures of varying fractional inspired oxygen (FiO_2) levels;

- inclusion and exclusion criteria;
- number of subjects;
- number of samples taken per subject;
- specific conditions of testing, including laboratory conditions, subject motion, low pulse amplitude;
- type and frequency of motion for testing under motion conditions, if applicable;
- criteria and methods for determining stability of reference arterial blood oxygen saturation (SaO_2) at the pulse oximeter sensor site;
- desaturation profile, including target saturation plateaus and ranges; and
- formula used for determination of root mean square difference (A_{rms}). (See Clause 201.12.1.101.2.2 of ISO 80601-2-61:2011 for recommended formula.)

We recommend you conduct the study described in Clause 201.12.1.101.2 and Annex EE.2 of ISO 80601-2-61:2011 on 10 or more healthy subjects that vary in age and gender. Your data should include 200 or more data points (paired observations: pulse oximeter, co-oximeter). These data should be distributed as described in Annex EE.2.3.4(g).

Your study should have subjects with a range of skin pigmentations, including at least 2 darkly pigmented subjects or 15% of your subject pool, whichever is larger.

We recommend you provide a line listing, a Bland-Altman plot, error plots (i.e., SaO_2 versus (SpO_2-SaO_2) for both individual test subjects and all subjects pooled), and rationale for any points excluded from analysis. Please include population mean bias (μ_0), between-subject variance (σ_μ^2), within-subject variance (σ^2), and upper 95% and lower 95% limits of agreement. Please provide this information as outlined in Section 3 of "Agreement Between Methods Of Measurement With Multiple Observations Per Individual" by Bland and Altman.[2] If you note that the plots show noticeable outliers, please provide the following:

- a discussion of the state of health, subject characteristics, test setup, test procedure, and any other factors that may have affected these data points; and
- a discussion of how the outlier(s) do not raise safety and performance concerns regarding the accuracy of the device.

We recommend an A_{rms} specification in conformance with Clause 201.12.1.101.1 of ISO 80601-2-61:2011. We recognize that accuracy is, among other things, a function of patient characteristics, application site and sensor geometry. The table below outlines the typical A_{rms} between measured values (SpO_2) and reference values (SaO_2) under normal conditions ranging from 70% to 100% SpO_2.

[2] See Bland and Altman. Agreement between methods of measurement with multiple observations per individual. Journal of Biopharmaceutical Statistics (2007) vol. 17 pp. 571-582.

Table 3. Typical Arms Specification by Sensor Type

Sensor Type	A_{rms}
Transmittance, wrap and clip	≤ 3.0 %
Ear clip	≤ 3.5 %
Reflectance	≤ 3.5 %

4.1.2 *In vivo* testing for SpO_2 accuracy for neonates

If your device is intended for use with neonates, we recommend you report performance of neonatal sensors on adult subjects as described in Section 4.1.1. Adult subjects are acceptable in this case due to the uncertainty of determining the accuracy of sensors intended for use in neonates. If the neonatal sensor is new or significantly changed compared to the predicate device, we recommend you provide testing on additional convenience arterial samples (See Annex EE.4.1, *Invasive testing on patients*, of ISO 80601-2-61:2011) collected on neonates to verify safe form, fit, and function (clinical performance).

We recognize that neonatal clinical studies are more representative of the intended use than controlled laboratory studies in adults, that there will be inherently greater noise in the measurement of neonatal oxygen saturation values, and that convenience samples in this population may be clustered around 90% SaO_2. Nonetheless, we recommend you provide data on a sufficient number of neonatal subjects and samples. We recommend that you justify the sample size and SaO_2 range of data collected.

4.1.3 Testing for SpO_2 accuracy for oximeters making motion performance claims

We recommend testing in accordance with Clause 201.12.1.102 of ISO 80601-2-61:2011. One recommended approach is to use the methods described in Section 4.1.1 incorporating subject motion. We recommend including a description of the characteristics of each motion including amplitudes, types, and frequencies of motion selected for testing in your test report.

4.1.4 Testing for SpO_2 accuracy under low perfusion for oximeters making low perfusion performance claims

We recommend testing in accordance with Clause 201.12.1.103 of ISO 80601-2-61:2011. One recommended method is to verify the SpO_2 accuracy under low perfusion conditions in vitro using a functional tester, set to the signal amplitude defined as low perfusion for the system (e.g., 0.3% modulation).

4.1.5 Testing for Pulse Rate Accuracy claims

We recommend testing in accordance with Clause 201.12.1.104 of ISO 80601-2-61:2011. One recommended method is to test your system on the bench (using a functional tester) at the lowest pulse amplitude that the oximeter specifies as "normal."

4.1.6 Testing for Pulse Rate Accuracy for oximeters labeled with motion performance claims

We recommend testing in accordance with Clause 201.12.1.102 of ISO 80601-2-61:2011. One potential approach is to use the methods described in Section 4.1.5 incorporating motion. We recommend including a description of the characteristics of each motion including amplitudes, types, and frequencies selected for testing.

4.1.7 Testing for Pulse Rate Accuracy for oximeters labeled with low perfusion performance claims

We recommend testing in accordance with Clause 201.12.1.103 of ISO 80601-2-61:2011. A recommended approach is to use the methods described in Section 4.1.5 with a functional tester, set to the signal amplitude defined as low perfusion for the system (e.g., 0.3% modulation).

4.2 Alarms

We recommend you address the requirements of Clause 208 of ISO 80601-2-61:2011 or an equivalent method for visual and audible indicators and alarms of the monitor and any remote alarm unit.

4.3 Display values, outputs, and indicators

We recommend you provide appropriate (e.g. clinical, bench) testing all of the data outputs, measurement values, and indicators that the device incorporates and displays on the monitor (e.g., perfusion index, signal strength, pulse amplitude). We recommend the test procedure include:

- the test method,
- the objectives of the testing,
- the equipment used, the tests specifications,
- the standards to which conformance is demonstrated,
- the pass/fail criteria, and
- the summary of the results including an analysis explaining the significance of the results.

Please also note Clause 201.12.4 of ISO 80601-2-61:2011 *Protection against hazardous output* for considerations regarding data update period and signal inadequacy.

4.4 Saturation pulse information signal

If your device includes a variable-pitch auditory information signal to indicate the pulse signal, we recommend the pitch change follow Clause 201.103 of ISO 80601-2-61:2011 or equivalent method.

5. Software Information

Please refer to "Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices," issued May 11, 2005, for a discussion of the software documentation that we recommend you provide. Please refer to the guidance "General Principles of Software Validation," issued January 11, 2002, for software development practices. FDA generally considers pulse oximeters to be of "Moderate" level of concern for the purposes of software review.

If the device includes off-the-shelf software, we recommend you provide the additional information as recommended in the guidance, "Off-the-Shelf Software Use in Medical Devices," issued September 9, 1999.

6. Electrical, Mechanical, and Environmental Safety

We recommend you follow safety testing for Type BF or CF applied part as referenced in ISO 80601-2-61:2011. Specifically, we recommend you address the requirements of Clauses 201.4 to 201.11 and 201.13 to 201.16 of ISO 80601-2-61:2011.

7. Electromagnetic Compatibility

Electromagnetic compatibility (EMC) is the ability of a device to operate properly in its intended environment of use without introducing excessive electromagnetic disturbances into that environment. We recommend you address the requirements of Clauses 201.17 and 202 of ISO 80601-2-61:2011.

8. Biocompatibility

We recommend that you provide a list of the patient-contacting materials in your device. You should evaluate the biocompatibility of the patient-contacting materials as described in the FDA guidance on the "Use of International Standard Organization (ISO) Standard ISO-10993, 'Biological Evaluation of Medical Devices Part 1: Evaluation and Testing,'" issued May 1, 1995. We consider pulse oximeters devices with prolonged contact duration due to the potential for cumulative use. We consider the components that contact the patient to be surface contacting components with skin contact. We recommend testing include:

- irritation or intracutaneous reactivity;
- sensitization; and
- cytotoxicity.

Materials are considered identical if they have the identical chemical formulation and identical manufacturing processes. If identical materials are used in a predicate device with the same type and duration of patient contact, you may identify the predicate device in lieu of performing biocompatibility testing.

9. Cleaning, Disinfection, and Sterilization

We recommend you provide information on cleaning, disinfection, and sterilization for all pulse oximeters intended for reuse (both single patient and multi-patient).

9.1 Reuse Instructions and Validation

For pulse oximeter systems and accessories intended for reuse, we recommend you evaluate the instructions for cleaning and, as appropriate, disinfection or sterilization.

If the device is intended to be cleaned, high-level disinfected, or sterilized by the user for multiple use, we recommend you demonstrate that the device can be cleaned, high-level disinfected, or sterilized according to the instructions provided in the device labeling; and that afterwards, the device continues to perform as intended.

In order to demonstrate that the labeled cleaning and disinfection or sterilization methods achieve the desired results, refer to the FDA guidance, "Labeling Reusable Medical Devices for Reprocessing in Healthcare Facilities," issued April 1996, for additional recommendations.

9.2 Sterilization Documentation

If the pulse oximeter system or accessories are provided sterile, we recommend you include the documentation described in "Updated 510(k) Sterility Review Guidance K90-1," issued August 30, 2002.

You should also provide a description of the packaging system and the method used to validate that the packaging maintains sterility, but not the validation data itself (for more information on packaging testing, see ANSI/AAMI/ISO 11607-1-2:2006 Packaging for terminally sterilized medical devices – Parts 1 and 2). We recommend you identify the proposed shelf life and provide testing of aged samples to demonstrate that the sterility and device functionality are maintained over the expected shelf life.

10. Labeling

The premarket notification must include labeling in sufficient detail to satisfy the requirements of 21 CFR 807.87(e). Use the following suggestions for assistance in preparing labeling that

satisfies the requirements of 21 CFR 807.87(e).[3] In addition, we recommend you conform to the labeling recommendations in Clause 201.7 of ISO 80601-2-61:2011.

10.1 Intended Use

The intended use should identify:

- patient population(s);
- spot checking or continuous monitoring;
- application sites;
- conditions of use such as motion and low perfusion, if applicable;
- whether the device is intended for single use or reuse; and
- environments of use.

10.2 Instructions for Use

As a prescription device, according to 21 CFR 801.109, the device is exempt from having adequate directions for lay use. Nevertheless, we recommend you provide clear and concise instructions that delineate the technological features of your device and how it is used on patients. Instructions should encourage local/institutional training programs designed to familiarize users with the features of the device and how to use it in a safe and effective manner. We recommend you conform to Clause 201.7 of ISO 80601-2-61:2011 for information to be included in the instructions for use. This includes but is not limited to:

- all applicable safety information, warnings, cautions, and notes;
- a description of your pulse oximeter system including the theory of operation (functional oxygen saturation or fractional oxyhemoglobin, etc.), sensor configuration/geometry, all features, alarms, and accessories;
- an identification of whether the system and accessories are provided sterile or non-sterile;
- device setup and operation information;
- instructions for the frequency of inspection of the application site for skin integrity;
- instructions for the frequency of sensor relocation; and
- device service and maintenance information, including cleaning and disinfection instructions for reusable pulse oximeters and accessories (please also see Section 9.1 above).

10.3 Device Specifications

We recommend you conform to Clauses 201.7.9.2.1.101, 201.7.9.2.14.101, and 201.12.1.101.1 of ISO 80601-2-61:2011 for reporting device specifications in the labeling.

[3] Although final labeling is not required for 510(k) clearance, final labeling must comply with the requirements of 21 CFR 801 before a medical device is introduced into interstate commerce. In addition, final labeling for prescription medical devices must comply with 21 CFR 801.109. Labeling recommendations in this guidance are consistent with the requirements of part 801.

The labeling should include a list of specifications including:

- SpO_2 accuracy specification in the SpO_2 range of 70% to 100%;
- a table with measured SpO_2 accuracy specification in the discrete SpO_2 ranges of 70% to 80%, 80% to 90%, and 90% to 100%;
- graphical plot of all sampled data points;
- pulse rate accuracy specification covering the entire pulse rate display range;
- operating and storage temperature and humidity;
- alarm limits and ranges; and
- default settings.

For the graphical plot, we recommend a plot of SaO_2 versus error ($SpO_2 – SaO_2$) with linear regression fit and upper 95% and lower 95% limits of agreement as discussed in Section 3 of "Agreement Between Methods Of Measurement With Multiple Observations Per Individual" by Bland and Altman.[2] We recommend each sampled data point be identified per individual test subject.

The labeling should identify the specific models of pulse oximeters with which the sensors were clinically validated and intended to be used.

For new systems or major modifications to existing systems intended for use with neonates, we recommend you disclose the SaO_2 range and A_{rms} of the collected convenience samples (see Section 4.1.2 above). The specifications should include:

- patient population characteristics of the neonate population tested;
- number of subjects; and
- number of data samples.

10.4 Package Labeling

We recommend you provide package labeling in your submission in accordance with Clause 201.7.2.101 of ISO 80601-2-61:2011. This includes but is not limited to whether the system is:

- provided sterile or non-sterile; and
- intended for single use or reuse.

11. Submissions for Reprocessed Single-Use Sensors

If your device includes a reprocessed single-use sensor, we recommend you provide the following information in addition to the information previously described in this guidance document:

- electro-optical specifications of the reprocessed sensors;
- means to ensure each reprocessed device meets these specifications; and

- tracking methods used to limit the number of reprocessing cycles.

We recommend you provide complete reprocessing methods and validation data in accordance with the FDA guidance, "Medical Device User Fee and Modernization Act of 2002, Validation Data in Premarket Notification Submissions (510(k)s) for Reprocessed Single-Use Medical Devices," issued September 25, 2006. This should include, but not necessarily be limited to the following information.

11.1 Identification of Components and Uses

We recommend you provide a detailed diagram of all the components of the sensors, and identify each component that will be replaced when the device or system is reprocessed and each component that will be retained. In particular, we recommend you indicate whether the reprocessor will replace or save the laminate that encloses the optical components.

11.2 Performance Testing

We recommend you describe performance testing conducted to validate the performance of the reprocessed device, including:

- clinical validation of SpO_2 accuracy as described in Section 4 above;
- bench testing of pulse rate performance as described in Section 4 above; and
- bench testing of SpO_2 and pulse rate performance as described in Section 4 above in accordance with Clause 5.3 of IEC 60601-1:2005.

We recommend the performance testing for reprocessed sensors be assessed on worst-case basis (i.e., after the maximum number of times the sensor is intended to be reprocessed). In addition, we recommend you simulate use of each sensor after each reprocessing cycle prior to conducting the testing recommended above.

11.3 Cleaning Methods and Validation Information

We recommend you provide point-of-use cleaning instructions for the healthcare facility (if used) in the device labeling.

We recommend you provide incoming inspection instructions for device-cleaning technicians, including:

- detailed acceptance/rejection criteria to control incoming raw materials for devices that are intended to be reprocessed; and
- model sorting.

We recommend you provide cleaning instructions to be used by the device cleaning technicians, including set points and ranges for cleaning methods (e.g., times, temperatures).

We recommend you provide cleaning validation information, including:

- methods that test worst case implementation of set points and ranges described above;

- predetermined cleaning endpoints and their scientific rationale; and
- the adequacy of the proposed cleaning process as measured against the predetermined endpoints.

11.4 Disinfection and/or Sterilization Validation Information

We recommend you provide comprehensive disinfection and sterilization validation protocols and data, consistent with the intended use, indications, and performance characteristics described in your labeling.

11.5 Devices Not Provided Sterile

For devices labeled "non-sterile," we recommend labeling include a general description of how the packaging materials adequately protect the devices during shipping and handling, including packaging validation protocols and data.

11.6 Devices Provided Sterile

For devices labeled "sterile," we recommend you include the documentation described in the guidance "Updated 510(k) Sterility Review Guidance K90-1," issued August 30, 2002.

Appendix – List of References

For the most recent version of a guidance, check the CDRH guidance webpage at http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/default.htm

Draft Guidance for Industry and FDA Staff Medical Devices: The Pre-Submission Program and Meetings with FDA Staff
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm310375.htm

Deciding When to Submit a 510(k) for a Change to an Existing Device (K97-1)
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm080235.htm

Significant Risk and Nonsignificant Risk Medical Device Studies
http://www.fda.gov/downloads/RegulatoryInformation/Guidances/UCM126418.pdf

Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm089543.htm

General Principles of Software Validation; Final Guidance for Industry and FDA Staff
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm085281.htm

Off-the-Shelf Software Use in Medical Devices
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073778.htm

Use of International Standard Organization (ISO) standard ISO-10993, "Biological Evaluation of Medical Devices Part 1: Evaluation and Testing
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm080735.htm

Labeling Reusable Medical Devices for Reprocessing in Healthcare Facilities
http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM080268.htm

Updated 510(k) Sterility Review Guidance K90-1
http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm072783.htm

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