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**Non-active surgical implants — Joint  
replacement implants — Specific  
requirements for knee-joint replacement  
implants**

*Implants chirurgicaux non actifs — Implants de remplacement  
d'articulation — Exigences spécifiques relatives aux implants de  
remplacement de l'articulation du genou*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 21536 was prepared by Technical Committee ISO/TC 150, *Implants for surgery*, Subcommittee SC 4, *Bone and joint replacements*.

This second edition cancels and replaces the first edition (ISO 21536:2002), which has been technically revised.

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## Introduction

There are three levels of International Standard dealing with non-active surgical implants. These are as follows, with level 1 being the highest:

- level 1: general requirements for non-active surgical implants and instrumentation used in association with implants;
- level 2: particular requirements for families of non-active surgical implants;
- level 3: specific requirements for types of non-active surgical implant.

This International Standard is a level 3 standard and contains requirements applying specifically to knee joint replacements. The level 1 standard contains requirements that apply to all non-active surgical implants. It also indicates that there are additional requirements in the level 2 and level 3 standards.

The level 2 standards apply to more restricted sets or families of implants such as those designed for use in osteosynthesis, cardiovascular surgery or joint replacement.

To address all requirements, it is recommended that a standard of the lowest available level be consulted first.

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# Non-active surgical implants — Joint replacement implants — Specific requirements for knee-joint replacement implants

## 1 Scope

This International Standard provides specific requirements for knee joint replacement implants. With regard to safety, this International Standard specifies requirements for intended performance, design attributes, materials, design evaluation, manufacture, sterilization, packaging, information supplied by the manufacturer and methods of test.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7207-1, *Implants for surgery — Components for partial and total knee joint prostheses — Part 1: Classification, definitions and designation of dimensions*

ISO 14243-1, *Implants for surgery — Wear of total knee-joint prostheses — Part 1: Loading and displacement parameters for wear-testing machines with load control and corresponding environmental conditions for test*

ISO 14243-2, *Implants for surgery — Wear of total knee-joint prostheses — Part 2: Methods of measurement*

ISO 14243-3, *Implants for surgery — Wear of total knee-joint prostheses — Part 3: Loading and displacement parameters for wear-testing machines with displacement control and corresponding environmental conditions for test*

ISO 14630:—<sup>1)</sup>, *Non-active surgical implants — General requirements*

ISO 14879-1, *Implants for surgery — Total knee joint prostheses — Part 1: Determination of endurance properties of knee tibial trays*

ISO 21534:2007, *Non-active surgical implants — Joint replacement implants — Particular requirements*

## 3 Terms and definitions

For the purposes of this document the terms and definitions of ISO 21534 and ISO 7207-1 together with the following apply.

### 3.1

#### femoral component

component of a total knee joint replacement intended to be secured to the femur to replace its articulating surfaces

NOTE These implants can be manufactured as one component or a set of components to be assembled by the user.

1) To be published. (Revision of ISO 14630:2005)

**3.2 tibial component**  
component of a total knee joint replacement intended to be secured to the tibia to replace its articulating surfaces

NOTE These implants can be manufactured as one component or a set of components to be assembled by the user.

**3.3 tibial tray**  
sub-component used to support and secure the articulating sub-component of a tibial component of a unicompartmental or total knee joint prosthesis

**3.4 patellar component**  
component of a total or partial knee joint replacement which is used to replace the articulating surface of the patella

**3.5 patellar tray**  
sub-component used to support and secure the articulating sub-component of a patellar component

**3.6 unicompartmental knee joint prosthesis**  
knee joint prosthesis designed to replace the femoral and tibial bearing surfaces in one compartment of the knee

NOTE Adapted from ISO 7207-1, definition 3.1.2.

**3.7 meniscal component**  
component of certain total knee joint prostheses which is intended to transmit tibio-femoral load and which moves relative to both the tibial and femoral components

## 4 Intended performance

The requirements of Clause 4 of ISO 21534:2007 shall apply together with the following.

The intended range of angular movement between the skeletal parts referred to in 4 a) of ISO 21534:2007 shall be determined. Annex A gives a suitable method for measurement of the range of movement of fully constrained knee joints.

## 5 Design attributes

### 5.1 General

The requirements of Clause 5 of ISO 21534:2007 shall apply together with the following.

### 5.2 Thickness of ultra-high molecular weight polyethylene (UHMWPE) in tibial components and meniscal components

For tibial components and meniscal components made of UHMWPE, the UHMWPE component or sub-component shall have the following minimum thickness in the load bearing area:

- a) 6 mm for components having a tibial tray;
- b) 9 mm for components without a tibial tray.

### 5.3 Finish of non-articulating regions of metallic knee joint components

The surface of the non-articulating regions of metallic knee joint components intended to be exposed to soft tissue shall be smooth and non-abrasive.

NOTE A roughness value  $R_a$  of 1,5  $\mu\text{m}$  has been found to be satisfactory.

## 6 Materials

The requirements of Clause 6 of ISO 21534:2007 shall apply together with the following.

Unalloyed titanium and titanium alloys shall not be used as the articulating surfaces of knee joint replacement components unless an appropriate surface treatment is undertaken and demonstrated to be suitable in clinical use.

## 7 Design evaluation

### 7.1 General

The requirements of Clause 7 of ISO 21534:2007 shall apply together with the following.

One or more of the tests in 7.2 of ISO 21534:2007 might not be required:

- a) for every component within a range of components (product family);
- b) where the required test results already exist for the same or a similar component.

In these cases a justification for omitting any given test on any given component shall be documented.

### 7.2 Preclinical evaluation

#### 7.2.1 Endurance of tibial trays of knee joint components — Cemented and non-cemented

The tibial trays of knee joint components, intended for use with or without bone cement, shall be tested to determine their endurance under cyclic load under appropriate loading conditions according to the test methods of ISO 14879-1. Each of five specimens shall be tested with a maximum load of 900 N for  $10 \times 10^6$  cycles with no failure (as defined in ISO 14879-1). All tibial components designated by this International Standard shall pass this minimum requirement.

NOTE The tibial tray test method of ISO 14879-1 is a simplified means of evaluating performance and addresses some, but not all, clinical failure modes. The minimum performance level of 900 N is based on literature and the experience of several test laboratories. It is recognized that investigators have used other test methods to evaluate tibial components of total knee prostheses for similar and different failure modes.

#### 7.2.2 Wear testing of total knee joint replacements

The wear characteristics of total knee joint replacements comprising a metallic or ceramic femoral component articulating on a tibial component shall be tested in accordance with ISO 14243-1, -2 and -3.

## 8 Manufacture

The requirements of Clause 8 of ISO 21534:2007 shall apply together with the following.

Implants or implant components manufactured from cast cobalt-chromium based alloys shall be solution heat treated if appropriate. Any solution heat treatment undertaken shall be recorded and documented.

NOTE One example of solution heat treatment found to be satisfactory is holding the castings for 4 h at a temperature of 1 200 °C.