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I.S. EN 61788-6:2011

# Superconductivity -- Part 6: Mechanical properties measurement - Room temperature tensile test of Cu/Nb-Ti composite superconductors (IEC 61788-6:2011 (EQV))

## I.S. EN 61788-6:2011

*Incorporating amendments/corrigenda issued since publication:*

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**EN 61788-6**

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English version

**Superconductivity -  
Part 6: Mechanical properties measurement -  
Room temperature tensile test of Cu/Nb-Ti composite superconductors  
(IEC 61788-6:2011)**

Supraconductivité -  
Partie 6: Mesure des propriétés  
mécaniques -  
Essai de traction à température ambiante  
des supraconducteurs composites de  
Cu/Nb-Ti  
(CEI 61788-6:2011)

Supraleitfähigkeit -  
Teil 6: Messung der mechanischen  
Eigenschaften -  
Messung der Zugfestigkeit von Cu/Nb-Ti-  
Verbundsupraleitern bei Raumtemperatur  
(IEC 61788-6:2011)

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## **I.S. EN 61788-6:2011**

EN 61788-6:2011

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### **Foreword**

The text of document 90/267/FDIS, future edition 3 of IEC 61788-6, prepared by IEC TC 90, Superconductivity was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61788-6:2011.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2012-05-15
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2014-08-15

This document supersedes EN 61788-6:2008.

EN 61788-6:2011 includes the following significant technical changes with respect to EN 61788-6:2008:

– specific example of uncertainty estimation related to mechanical tests was supplemented as Annex C.

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### **Endorsement notice**

The text of the International Standard IEC 61788-6:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61788-5	NOTE	Harmonized as EN 61788-5.
ISO 3611:2010	NOTE	Harmonized as EN ISO 3611:2010 (not modified).

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-815	-	International Electrotechnical Vocabulary - Part 815: Superconductivity	-	-
ISO 376	-	Metallic materials - Calibration of force-proving instruments used for the verification of uniaxial testing machines	EN ISO 376	-
ISO 6892-1	-	Metallic materials - Tensile testing - Part 1: Method of test at room temperature	EN ISO 6892-1	-
ISO 7500-1	-	Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system	EN ISO 7500-1	-
ISO 9513	-	Metallic materials - Calibration of extensometers used in uniaxial testing	EN ISO 9513	-

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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### SUPERCONDUCTIVITY –

#### **Part 6: Mechanical properties measurement – Room temperature tensile test of Cu/Nb-Ti composite superconductors**

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International Standard IEC 61788-6 has been prepared by IEC technical committee 90: Superconductivity.

This third edition cancels and replaces the second edition published in 2008. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- specific example of uncertainty estimation related to mechanical tests was supplemented as Annex C.

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The text of this standard is based on the following documents:

FDIS	Report on voting
90/267/FDIS	90/278/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61788 series, published under the general title *Superconductivity*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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## INTRODUCTION

The Cu/Nb-Ti superconductive composite wires currently in use are multifilamentary composite material with a matrix that functions as a stabilizer and supporter, in which ultrafine superconductor filaments are embedded. A Nb-40~55 mass % Ti alloy is used as the superconductive material, while oxygen-free copper and aluminium of high purity are employed as the matrix material. Commercial composite superconductors have a high current density and a small cross-sectional area. The major application of the composite superconductors is to build superconducting magnets. While the magnet is being manufactured, complicated stresses are applied to its windings and, while it is being energized, a large electromagnetic force is applied to the superconducting wires because of its high current density. It is therefore indispensable to determine the mechanical properties of the superconductive wires, of which the windings are made.

## **SUPERCONDUCTIVITY –**

### **Part 6: Mechanical properties measurement – Room temperature tensile test of Cu/Nb-Ti composite superconductors**

#### **1 Scope**

This part of IEC 61788 covers a test method detailing the tensile test procedures to be carried out on Cu/Nb-Ti superconductive composite wires at room temperature.

This test is used to measure modulus of elasticity, 0,2 % proof strength of the composite due to yielding of the copper component, and tensile strength.

The value for percentage elongation after fracture and the second type of 0,2 % proof strength due to yielding of the Nb-Ti component serves only as a reference (see Clauses A.1 and A.2).

The sample covered by this test procedure has a round or rectangular cross-section with an area of 0,15 mm<sup>2</sup> to 2 mm<sup>2</sup> and a copper to superconductor volume ratio of 1,0 to 8,0 and without the insulating coating.

#### **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.

IEC 60050-815, *International Electrotechnical Vocabulary – Part 815: Superconductivity*

ISO 376, *Metallic materials – Calibration of force-proving instruments used for the verification of uniaxial testing machines*

ISO 6892-1, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature*

ISO 7500-1, *Metallic materials – Verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Verification and calibration of the force-measuring system*

ISO 9513, *Metallic materials – Calibration of extensometers used in uniaxial testing*

#### **3 Terms and definitions**

For the purposes of this document, the definitions given in IEC 60050-815 and ISO 6892-1, as well as the following, apply.

##### **3.1**

##### **tensile stress**

tensile force divided by the original cross-sectional area at any moment during the test

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