# Superconductivity -- Part 5: Matrix to superconductor volume ratio measurement - Copper to superconductor volume ratio of Cu/Nb-Ti composite superconducting wires

EESTI STANDARDIKESKUS
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## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

| | |
|---|---|
| See Eesti standard EVS-EN 61788-5:2013 sisaldab Euroopa standardi EN 61788-5:2013 ingliskeelset teksti. | This Estonian standard EVS-EN 61788-5:2013 consists of the English text of the European standard EN 61788-5:2013. |
| Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. | This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation. |
| Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 06.09.2013. | Date of Availability of the European standard is 06.09.2013. |
| Standard on kättesaadav Eesti Standardikeskusest. | The standard is available from the Estonian Centre for Standardisation. |



Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 17.220.20, 29.050

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 61788-5

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ICS 17.220.20; 29.050

Supersedes EN 61788-5:2001

English version

# Superconductivity - Part 5: Matrix to superconductor volume ratio measurement - Copper to superconductor volume ratio of Cu/Nb-Ti composite superconducting wires

(IEC 61788-5:2013)

Supraconductivité - Partie 5 : Mesure du rapport volumique matrice/supraconducteur - Rapport volumique cuivre/supraconducteur des fils en composite supraconducteur Cu/Nb-Ti (CEI 61788-5:2013)

Supraleitfähigkeit - Teil 5: Messung des Verhältnisses von Matrixvolumen zu Supraleitervolumen - Verhältnis von Kupfervolumen zu Supraleitervolumen von Cu/Nb-Ti Verbundsupraleiterdrähten (IEC 61788-5:2013)



CENELEC

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

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## Foreword

The text of document 90/321/FDIS, future edition 2 of IEC 61788-5, prepared by IEC/TC 90 "Superconductivity" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61788-5:2013.

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) | 2014-04-02 |
| • latest date by which the national standards conflicting with the document have to be withdrawn | (dow) | 2016-07-02 |

This document supersedes EN 61788-5:2001.

EN 61788-5:2013 includes the following significant technical changes with respect to EN 61788-5:2001:

The main revisions are the addition of two new annexes, "Uncertainty considerations" (Annex E) and "Uncertainty evaluation in test method of copper to superconductor volume ratio of Cu/Nb-Ti composite superconductors" (Annex F).

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

## Endorsement notice

The text of the International Standard IEC 61788-5:2013 was approved by CENELEC as a European Standard without any modification.

## Annex ZA
(normative)

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

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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.

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 60050-815 | Series | International Electrotechnical Vocabulary (IEV) | - | - |

# CONTENTS

# INTRODUCTION

The copper to superconductor volume ratio of composite superconductors is used mainly to calculate the critical current density of superconducting wires. The test with the method given in this International Standard may be used to provide part of the information needed to determine the suitability of a specific superconductor. Moreover, this method is useful for quality control, acceptance or research testing if the precautions given in this standard are observed.

The test method given in this International Standard is based on the condition that the specific mass of Nb-Ti is known or the Nb-Ti alloy fraction is known and Annex B can be used to estimate the specific mass. If the specific mass of Nb-Ti is unknown and the Nb-Ti alloy fraction is unknown and/or the fraction of Nb barrier is unknown, another method to determine the copper to superconductor volume ratio of composite superconductors is described in Annex A.

# SUPERCONDUCTIVITY –

## Part 5: Matrix to superconductor volume ratio measurement – Copper to superconductor volume ratio of Cu/Nb-Ti composite superconducting wires



## 1 Scope

This part of IEC 61788 covers a test method for the determination of copper to superconductor volume ratio of Cu/Nb-Ti composite superconducting wires.

This test method and the alternate method in Annex A are intended for use with Cu/Nb-Ti composite superconducting wires with a cross-sectional area of 0,1 $mm^2$ to 3 $mm^2$, a diameter of the Nb-Ti filament(s) of 2 μm to 200 μm, and a copper to superconductor volume ratio of 0,5 or more.

The Cu/Nb-Ti composite test conductor discussed in this method has a monolithic structure with a round or rectangular cross-section. This test method is carried out by dissolving the copper with nitric acid. Deviations from this test method that are allowed for routine tests and other specific restrictions are given in this standard.

Cu/Nb-Ti composite superconducting wires beyond the limits in the cross-sectional area, the filament diameter and the copper to superconductor volume ratio could be measured with this present method with an anticipated reduction of uncertainty. Other, more specialized, specimen test geometries may be more appropriate for conductors beyond the limits and have been omitted from this present standard for simplicity and to retain low uncertainty.

The test method given in this standard is expected to apply to other superconducting composite wires after some appropriate modifications.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

## 3 Terms and definitions

For the purposes of this document, the definitions given in IEC 60050-815 as well as the following definition apply.

**3.1**
**copper to superconductor volume ratio**
ratio of the volume of the copper stabilizing material to the volume without copper consisting of Nb-Ti filaments and their Nb barriers