SLOVENSKI STANDARD

SIST EN 61788-4:2002

prva izdaja
maj 2002

Superconductivity - Part 4: Residual resistance ratio measurement - Residual resistance ratio of Nb-Ti composite superconductors

ICS 17.220.20; 29.050

Referenčna številka
SIST EN 61788-4:2002(en)

EUROPEAN STANDARD **EN 61788-4**

NORME EUROPÉENNE

EUROPÄISCHE NORM September 2001

ICS 17.220.20;29.050

English version

Superconductivity
Part 4: Residual resistance ratio measurement – Residual resistance ratio of Nb-Ti composite superconductors
(IEC 61788-4:2001)

Supraconductivité
Partie 4: Mesure de la résistivité résiduelle - Taux de résistivité résiduelle des supraconducteurs composites au Nb-Ti
(CEI 61788-4:2001)

Supraleitfähigkeit
Teil 4: Messungen des verbleibenden spezifischen Widerstandes - Verbleibender spezifischer Widerstand von Nb Ti-Verbundsupraleitern
(IEC 61788-4:2001)

This European Standard was approved by CENELEC on 2001-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 61788-4:2001 E

Foreword

The text of document 90/96/FDIS, future edition 1 of IEC 61788-4, prepared by IEC TC 90, Superconductivity, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61788-4 on 2001-09-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2002-06-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2004-09-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annex A is informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61788-4:2001 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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	2000	International Electrotechnical Vocabulary (IEV) Chapter 815: Superconductivity	-	-

INTERNATIONAL STANDARD

IEC 61788-4

First edition
2001-07

Superconductivity –

Part 4: Residual resistance ratio measurement – Residual resistance ratio of Nb-Ti composite superconductors

Supraconductivité –

Partie 4:
Mesure de la résistivité résiduelle –
Taux de résistivité résiduelle des supraconducteurs composites au Nb-Ti

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE K

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SUPERCONDUCTIVITY –

Part 4: Residual resistance ratio measurement – Residual resistance ratio of Nb-Ti composite superconductors

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61788-4 has been prepared by IEC technical committee 90: Superconductivity.

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

FDIS	Report on voting
90/96/FDIS	90/104/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 3.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

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

A bilingual version of this standard may be issued at a later date.

INTRODUCTION

Copper is used as a matrix material in multifilamentary superconductors and works as an electrical shunt when the superconductivity is interrupted. It also contributes to recovery of the superconductivity by conducting heat generated in the superconductor to the surrounding coolant. The cryogenic-temperature resistivity of copper is an important quantity, which influences the stability of the superconductor. The residual resistance ratio is defined as a ratio of the resistance of the superconductor at room temperature to that just above the superconducting transition.

In this International Standard the test method of residual resistance ratio of Nb-Ti composite superconductors is described. The curve method is employed for the measurement of the resistance just above the superconducting transition. Other methods are described in clause A.4.

SUPERCONDUCTIVITY –

Part 4: Residual resistance ratio measurement – Residual resistance ratio of Nb-Ti composite superconductors

1 Scope

This part of IEC 61788 covers a test method for the determination of the residual resistance ratio (*RRR*) of a composite superconductor comprised of Nb-Ti filaments and Cu, Cu-Ni or Cu/Cu-Ni matrix. This method is intended for use with superconductors that have a rectangular or round cross-section, *RRR* less than 350, and cross-sectional area less than 3 mm^2. All measurements shall be done without an applied magnetic field.

The method described in the body of this standard is the "reference" method and optional acquisition methods are outlined in annex A.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050-815:2000, *International Electrotechnical Vocabulary – Part 815: Superconductivity*

3 Terminology

For the purpose of this part of IEC 61788, the definitions given in IEC 60050-815 and the following definition apply.

3.1
residual resistance ratio
the ratio of resistance at room temperature to the resistance just above the superconducting transition

4 Definition

The residual resistance ratio of the composite wire shall be obtained in equation (1) below where the resistance (R_1) at room temperature (20 °C) is divided by the resistance (R_2) just above the superconducting transition.

$$RRR = \frac{R_1}{R_2} \quad (1)$$

Figure 1 shows schematically a voltage versus temperature curve acquired on a specimen while measuring the cryogenic resistance. Draw a line in figure 1 where the voltage sharply increases (a), and draw also a line in figure 1 where the temperature increases but the resistance remains almost the same (b). The value of resistance at the intersection of these two lines, A, is defined as resistance (R_2) just above the superconducting transition.