SLOVENSKI STANDARD
SIST EN IEC 61788-23:2018

01-december-2018

Superprevodnost - 23. del: Meritve razmerja preostale upornosti - Razmerje preostale upornosti Nb superprevodnikov (IEC 61788-23:2018)

Superconductivity - Part 23: Residual resistance ratio measurement - Residual resistance ratio of Nb superconductors (IEC 61788-23:2018)

Ta slovenski standard je istoveten z: EN IEC 61788-23:2018

ICS:

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities
29.050	Superprevodnost in prevodni materiali	Superconductivity and conducting materials

SIST EN IEC 61788-23:2018 en

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 61788-23

October 2018

ICS 17.220; 29.050

English Version

Superconductivity - Part 23: Residual resistance ratio measurement - Residual resistance ratio of Nb superconductors (IEC 61788-23:2018)

Supraconductivité - Partie 23: Mesurage du rapport de résistance résiduelle - Rapport de résistance résiduelle des supraconducteurs de Nb (IEC 61788-23:2018)

Supraleitfähigkeit - Teil 23: Messung des Restwiderstandsverhältnisses - Restwiderstandsverhältnis von Nb-Supraleitern (IEC 61788-23:2018)

This European Standard was approved by CENELEC on 2018-07-10. 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.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN IEC 61788-23:2018 E

European foreword

The text of document 90/400/FDIS, future edition 1 of IEC 61788-23, prepared by IEC/TC 90 "Superconductivity" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61788-23:2018.

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)	2019-04-10
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2021-07-10

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Endorsement notice

The text of the International Standard IEC 61788-23:2018 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 61788-4:2016 NOTE Harmonized as EN 61788-4:2016 (not modified)

IEC 61788-10:2006 NOTE Harmonized as EN 61788-10:2006 (not modified)

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60050-815	-	International Electrotechnical Vocabulary Part 815: Superconductivity	--	-

IEC 61788-23

Edition 1.0 2018-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

**Superconductivity –
Part 23: Residual resistance ratio measurement – Residual resistance ratio of Nb superconductors**

**Supraconductivité –
Partie 23: Mesurage du rapport de résistance résiduelle – Rapport de résistance résiduelle des supraconducteurs de Nb**

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FOREWORD

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International Standard IEC 61788-23 has been prepared by IEC technical committee 90: Superconductivity.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
90/400/FDIS	90/403/RVD

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

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

A list of all parts in 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 document 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 document. At this date, the document will be

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

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INTRODUCTION

High-purity niobium is the chief material used to make superconducting radio-frequency cavities. Similar grades of niobium may be used in the manufacture of superconducting wire. Procurement of raw materials and quality assurance of delivered products often use the residual resistance ratio (RRR) to specify or assess the purity of a metal. RRR is defined for non-superconducting metals as the ratio of electrical resistance measured at room temperature (293 K) to the resistance measured for the same specimen at low temperature (~4,2 K). The low-temperature value is often called the residual resistance. Higher purity is associated with higher values of RRR.

Niobium presents special problems due to its transformation to a superconducting state at ~9 K, so DC electrical resistance is effectively zero below this temperature. The definition above would then yield an infinite value for RRR. This document describes a test method to determine the residual resistance value by using a plot of the resistance to temperature as the test specimen is gradually warmed through the superconducting transition in the absence of an applied magnetic field. This results in a determination of the residual resistance at just above superconducting transition, ~10 K, from which RRR is subsequently determined.

International standards also exist to determine the residual resistance ratio of superconducting wires. In contrast to superconducting wires, which are usually a composite of a superconducting material and a non-superconducting material and the RRR value is representative of only the non-superconducting component, here the entire specimen is composed of superconducting niobium. Frequently, niobium is procured as a sheet, bar, tube, or rod, and not as a wire. For such forms, test specimens will likely be a few millimeters in the dimensions transverse to electric current flow. This difference is significant when making electrical resistance measurements, since niobium samples will likely be much longer than that for the same length-to-diameter ratio as a wire, and higher electrical current may be required to produce sufficient voltage signals. Guidance for sample dimensions and electrical connections is provided in Annex A. Test apparatus should also take into consideration aspects such as the orientation of a test specimen relative to the liquid helium surface, accessibility through ports on common liquid helium dewars, design of current contacts, and minimization of thermal gradients over long specimen lengths. These aspects distinguish the present document from similar wire standards.

Other test methods have been used to determine RRR. Some methods use a measurement at a temperature other than 293 K for the high resistance value. Some methods use extrapolations at 4,2 K in the absence of an applied magnetic field for the low resistance value. Other methods use an applied magnetic field to suppress superconductivity at 4,2 K. A comparison between this document and some other test methods is presented in Annex A. It should be noted that systematic differences of up to 10 % are produced by these other methods, which is larger than the target uncertainty of this document. Care should therefore be taken to apply this document or the appropriate corrections listed in Annex A according to the test method used.

Whenever possible, this test method should be transferred to vendors and collaborators who also perform RRR measurements. To promote consistency, the results of inter-laboratory comparisons are described in Annex C.