Superconductivity - Part 11: Residual resistance ratio measurement - Residualresistance ratio of Nb3Sn composite superconductors

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NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 61788-11:2011 sisaldab Euroopa standardi EN 61788-11:2011 ingliskeelset teksti.	This Estonian standard EVS-EN 61788-11:2011 consists of the English text of the European standard EN 61788-11:2011.
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ICS 17.220, 29.050

EUROPEAN STANDARD

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Superconductivity - Part 11: Residual resistance ratio measurement - Residual resistance ratio of Nb_3Sn composite superconductors

(IEC 61788-11:2011)

Supraconductivité - Partie 11: Mesure du rapport de résistance résiduelle - Rapport de résistance résiduelle des supraconducteurs composites de Nb_3Sn (CEI 61788-11:2011)

Supraleitfähigkeit - Teil 11: Messung des Restwiderstandsverhältnisses - Restwiderstandsverhältnis von Nb_3Sn-Verbundsupraleitern (IEC 61788-11:2011)

CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of document 90/268/FDIS, future edition 2 of IEC 61788-11, prepared by IEC TC 90, Superconductivity was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61788-11:2011.

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• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2014-08-15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 61788-11:2003.

The main revisions are the addition of two new annexes "Uncertainty considerations" (Annex B) and "Uncertainty evaluation in test method of RRR for Nb_3Sn" (Annex C).

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 61788-11:2011 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 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.

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

CONTENTS

INTRODUCTION

Copper or aluminium is used as stabilizer material in multifilamentary Nb_3Sn superconductors and works as an electrical shunt when the superconductivity is interrupted. It also contributes to recovery of the superconductivity by conducting the heat generated in the superconductor to the surrounding coolant. The resistivity of copper used in the composite superconductor in the cryogenic temperature region 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 for the residual resistance ratio of Nb_3Sn 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.3.

SUPERCONDUCTIVITY –

Part 11: Residual resistance ratio measurement – Residual resistance ratio of Nb_3Sn composite superconductors

1 Scope

This part of IEC 61788 covers a test method for the determination of the residual resistance ratio (*RRR*) of Nb_3Sn composite superconductors. This method is intended for use with superconductor specimens that have a monolithic structure with rectangular or round cross-section, *RRR* less than 350 and cross-sectional area less than 3 mm^2, and have received a reaction heat-treatment. Ideally, it is intended that the specimens be as straight as possible; however, this is not always the case, thus care must be taken to measure the specimen in its as received condition. All measurements are 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 Clause A.3.

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-815 and the following apply.

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

NOTE In this standard for Nb_3Sn composite superconductors, the room temperature is defined as 293°K (20°C), and the residual resistance ratio is obtained in Equation (1) below, where the resistance (R_1) at 293°K 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 resistance versus temperature curve acquired on a specimen while measuring cryogenic resistance. Draw a line in Figure 1 where the resistance sharply increases (a), and draw also a line in Figure 1 where the resistance increases gradually (b) with temperature. The value of resistance at the intersection of these two lines at $T=T_c^*$, A, is defined as resistance (R_2) just above the superconducting transition.