STN	Supravodivosť. Časť 19: Meranie mechanických vlastností. Skúška ťahom kompozitných supravodičov Nb3Sn pri teplote prostredia.	STN EN 61788-19 34 5685

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 07/14

Obsahuje: EN 61788-19:2014, IEC 61788-19:2013

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EN 61788-19

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English version

Superconductivity - Part 19: Mechanical properties measurement - Room temperature tensile test of reacted Nb_3Sn composite superconductors (IEC 61788-19:2013)

Supraconductivité -
Partie 19: Mesure des propriétés mécaniques -
Essai de traction à température ambiante des supraconducteurs composites de Nb_3Sn mis en réaction
(CEI 61788-19:2013)

Supraleitfähigkeit -
Teil 19: Messung der mechanischen Eigenschaften - Zugversuch von reagierten Nb_3Sn-Verbundsupraleitern bei Raumtemperatur
(IEC 61788-19:2013)

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CENELEC

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 61788-19:2014 E

Foreword

The text of document 90/328/FDIS, future edition 1 of IEC 61788-19, prepared by IEC/TC 90 "Superconductivity" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61788-19:2014.

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)	2014-09-24
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-12-24

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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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	series	International Electrotechnical Vocabulary	-	-
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 extensometer systems used in uniaxial testing	EN ISO 9513	-

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Part 19: Mechanical properties measurement – Room temperature tensile test of reacted Nb_3Sn composite superconductors

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Partie 19: Mesure des propriétés mécaniques – Essai de traction à température ambiante des supraconducteurs composites de Nb_3Sn mis en réaction

IEC 61788-19:2013

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INTERNATIONAL STANDARD

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Part 19: Mechanical properties measurement – Room temperature tensile test of reacted Nb_3Sn composite superconductors

FOREWORD

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

FDIS	Report on voting
90/328/FDIS	90/330/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_3Sn superconductive composite wires are multifilamentary composite materials. They are manufactured in different ways. The first method is the bronze route, where fine Nb / Nb alloy filaments are embedded in a bronze matrix, a barrier and a copper stabilizer. The second is the internal-tin method, where fine multifilaments are composed with copper matrix including Sn reservoirs, a barrier, and a copper stabilizer. The third is the powder-in-tube method, where Nb / Nb alloy tubes are filled with Sn rich powders and are embedded in a Cu stabilizing matrix.

Common to all types of Nb_3Sn composite wires is that the superconducting A15 phase Nb_3Sn has been formed at final wire dimension by applying one or more heat treatments for several days with a temperature at the last heat treatment step of around 640 °C or above. This superconducting phase is very brittle and failure of filaments occurs – accompanied by the degradation of the superconducting properties.

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. This can be done either by winding the superconductor on a spool and applying the heat treatment together with the spool afterwards (wind and react) or by heat treatment of the conductor before winding the magnet (react and wind). While the magnet is being manufactured, complicated stresses are applied to its windings. Therefore the react and wind method is the minority compared to the wind and react manufacturing process.

In the case that the mechanical properties should be determined in the unreacted, non-superconducting stage of the composite, one should also apply this standard or alternatively IEC 61788-6 (*Superconductivity– Part 6: Mechanical properties measurement – Room temperature tensile test of Cu/Nb-Ti composite superconductors*).

While the magnet is being energized, a large electromagnetic force is applied to the superconducting wires because of their high current density. In the case of the react and wind manufacturing technique, the winding strain and stress levels are very restricted.

It is therefore a prerequisite to determine the mechanical properties of the superconductive reacted Nb_3Sn composite wires of which the windings are manufactured.

SUPERCONDUCTIVITY –

Part 19: Mechanical properties measurement – Room temperature tensile test of reacted Nb_3Sn composite superconductors

1 Scope

This part of IEC61788 covers a test method detailing the tensile test procedures to be carried out on reacted Cu/Nb_3Sn composite superconducting wires at room temperature.

The object of this test is to measure the modulus of elasticity and to determine the proof strength of the composite due to yielding of the copper and the copper tin components from the stress versus strain curve.

Furthermore, the elastic limit, the tensile strength, and the elongation after fracture can be determined by means of the present method, but they are treated as optional quantities because the measured quantities of the elastic limit and the elongation after fracture have been reported to be subject to significant uncertainties according to the international round robin test.

The sample covered by this test procedure should have a bare round or rectangular cross-section with an area between 0,15 mm^2 and 2,0 mm^2 and a copper to non-copper volume ratio of 0,2 to 1,5 and should have no insulation.

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 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

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 extensometer systems used in uniaxial testing*