

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Superconductivity –**

**Part 25: Mechanical properties measurement – Room temperature tensile test on REBCO wires**

**Supraconductivité –**

**Partie 25: Mesure des propriétés mécaniques – Essai de traction à température ambiante des fils REBCO**



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COMMISSION

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**SUPERCONDUCTIVITY –**

**Part 25: Mechanical properties measurement –  
Room temperature tensile test on REBCO wires**

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International Standard IEC 61788-25 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
90/404/FDIS	90/411/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 website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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## INTRODUCTION

Several types of composite superconductors have now been commercialized. The rare-earth-based oxide superconductor (SC) with chemical formula  $\text{REBa}_2\text{Cu}_3\text{O}_7$  is used for practical SC wires, where the rare-earth element RE is typically Y, Dy, Gd, Nd, Ho or Sm, or a combination of two or more among them. This type of practical SC wire is usually called REBCO coated conductors. A typical architecture consists of a substrate of Ni-Cr-Mo based alloy, Ni-W alloy or stainless steel, a buffer layer consisting of a plurality of oxides, a SC layer and a protection layer of Ag. The substrate and buffer layer act as template to facilitate the well-oriented SC layer. In order to resist the large electromagnetic force, the wires are often externally reinforced by laminating thin stainless steel or Cu alloy foils. Commercial composite superconductors have a high current density and a small cross-sectional area. The major application of composite superconductors is to build electrical power devices and superconducting magnets. Complex stresses and strains are applied to the composite superconducting wires when devices are manufactured and energized. In the case of superconducting magnets, large electromagnetic forces are experienced by the winding due to the combination of high magnetic fields and high current density. It is therefore indispensable to determine the mechanical properties of the practical REBCO wires.

## SUPERCONDUCTIVITY –

### Part 25: Mechanical properties measurement – Room temperature tensile test on REBCO wires

#### 1 Scope

This part of IEC 61788 specifies the test method and procedures for testing tensile mechanical properties of REBCO superconductive composite tapes at room temperature. This test is used to measure the modulus of elasticity and 0,2 % proof strength. The values for elastic limit, fracture strength and percentage elongation after fracture serve only as a reference. This document applies to samples having a rectangular cross-section with an area of 12,0 mm<sup>2</sup> to 6,0 mm<sup>2</sup> (corresponding to the tapes with width of 2,0 mm to 12,0 mm and thickness of 0,06 mm to 0,5 mm).

#### 2 Normative references

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.

ISO 376, *Metallic materials – Calibration of force-proving instruments used for the verification of uniaxial testing machines*

ISO 7500-1, *Metallic materials – Calibration and verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Calibration and verification of the force-measuring system*

ISO 9513, *Metallic materials – Calibration of extensometer systems used in uniaxial testing*

#### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

##### **tensile stress**

*R*

tensile force divided by the original cross-sectional area of the test piece at any moment during the test

##### **3.2**

##### **tensile strain**

*A*

displacement increment divided by initial gauge length of extensometers at any moment during the tensile test