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Superconductivity - Part 8: AC loss measurements - Total AC loss measurement of Cu/Nb-Ti composite superconducting wires exposed to a transverse alternating magnetic field by a pickup coil method

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English version

**Superconductivity**  
**Part 8: AC loss measurements -**  
**Total AC loss measurement of Cu/Nb-Ti composite superconducting wires**  
**exposed to a transverse alternating magnetic field**  
**by a pickup coil method**  
**(IEC 61788-8:2003)**

Supraconductivité  
 Partie 8: Mesure des pertes  
 en courant alternatif -  
 Méthode de mesure par bobines  
 de détection des pertes totales  
 en courant alternatif des fils composites  
 supraconducteurs de Cu/Nb-Ti  
 exposés à un champ magnétique  
 alternatif transverse  
 (CEI 61788-8:2003)

Supraleitfähigkeit  
 Teil 8: Messung der  
 Wechselstromverluste -  
 Messung der gesamten  
 Wechselstromverluste von  
 Cu/NbTi-Verbundsupraleiterdrähten  
 in transversalen magnetischen  
 Wechselfeldern mit Hilfe eines  
 Pickupspulen-Verfahrens  
 (IEC 61788-8:2003)

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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.

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CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, 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**

## Foreword

The text of document 90/135A/FDIS, future edition 1 of IEC 61788-8, prepared by IEC TC 90, Superconductivity, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61788-8 on 2003-05-01.

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) 2004-02-01
- latest date by which the national standards conflicting with the EN have to be withdrawn dow) 2006-05-01

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 annexes A to E are informative.  
Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61788-8:2003 was approved by CENELEC as a European Standard without any modification.

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## 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-815	- <sup>1)</sup>	International Electrotechnical Vocabulary (IEV) Chapter 815: Superconductivity	-	-

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<sup>1)</sup> Undated reference.

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**Supraconductivité –**

**Partie 8:**

**Mesure des pertes en courant alternatif –  
Méthode de mesure par bobines de détection  
des pertes totales en courant alternatif des fils  
composites supraconducteurs de Cu/Nb-Ti  
exposés à un champ magnétique alternatif  
transverse**

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**AC loss measurements –  
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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## SUPERCONDUCTIVITY –

**Part 8: AC loss measurements –  
Total AC loss measurement of Cu/Nb-Ti composite  
superconducting wires exposed to a transverse alternating  
magnetic field by a pickup coil method**

## 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.
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- 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.
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- 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 61788-8 has been prepared by IEC technical committee 90: Superconductivity.

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

FDIS	Report on voting
90/135A/FDIS	90/140/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.

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

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

## INTRODUCTION

Magnetometer and pickup coil methods are proposed for measuring the AC losses of Cu/Nb-Ti composite superconducting wires in transverse time-varying magnetic fields. These represent initial steps in standardization of methods for measuring the various contributions to AC loss in transverse fields, the most frequently encountered configuration.

It was decided to split the initial proposal mentioned above, into two documents covering two standard methods. One of them describes the magnetometer method for hysteresis loss and low frequency (or sweep rate) total AC loss measurement in a slowly varying magnetic field, and the other describes the pickup coil method for total AC loss measurement in higher frequency (or sweep rate) magnetic fields. The frequency range is 0 Hz to 0,06 Hz for the magnetometer method and 0,005 Hz to 1 Hz for the pickup coil method. The overlap between 0,005 Hz and 0,06 Hz is a complementary frequency range for the two methods.

This standard covers the pickup coil method. The test method for standardization of AC loss covered in this standard is partly based on the Versailles Project on Advanced Materials and Standards (VAMAS) pre-standardization work on the AC loss of NbTi composite superconductors [1]<sup>1</sup>.

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<sup>1</sup> Figures in square brackets refer to the Bibliography.

## SUPERCONDUCTIVITY –

### Part 8: AC loss measurements – Total AC loss measurement of Cu/Nb-Ti composite superconducting wires exposed to a transverse alternating magnetic field by a pickup coil method

#### 1 Scope

This part of IEC 61788-8 specifies the measurement method of total AC losses by the pickup coil method in Cu/Nb-Ti composite superconducting wires exposed to a transverse alternating magnetic field. The losses may contain both hysteresis and coupling losses. The standard method to measure only the hysteresis loss in DC or low-sweep-rate magnetic field is specified in IEC 61788-13 [2].

The specimen shall be a multifilamentary round or rectangular wire, expected to be mainly used for pulsed coil applications with relatively higher frequencies or sweep rates up to 1 Hz or 4 T/s, with diameter or average size from 0,2 mm to 1,0 mm, filament diameter from 1  $\mu$ m to around 50  $\mu$ m, and a coupling time constant less than about 40 ms.

The present method can be also extended to the AC loss measurement in a higher range of frequency and sweep rate up to more than 10 Hz or 40 T/s for three-component superconducting wires (IEV 815-04-33) with a shorter coupling time constant down to about 0,1 ms (see Annex E).

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#### 2 Normative references [bdd17eb0d710/sist-en-61788-8-2003](https://standards.iteh.ai/catalog/standards/sist/fab9afcb-5678-455f-81e4-bdd17eb0d710/sist-en-61788-8-2003)

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 (IEV) – Part 815: Superconductivity*

#### 3 Terms and definitions

For the purposes of this part of IEC 61788, the definitions of IEC 60050-815 and the following apply.

##### 3.1

##### AC loss

*P*

power dissipated in a composite superconductor due to application of time-varying magnetic field or current

[IEV 815-04-54]