

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Live working – Insulating foam-filled tubes and solid rods –
Part 1: Tubes and rods of a circular cross-section**

**Travaux sous tension – Tubes isolants remplis de mousse et tiges isolantes –
Partie 1: Tubes et tiges de section circulaire**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Live working – Insulating foam-filled tubes and solid rods –
Part 1: Tubes and rods of a circular cross-section**

**Travaux sous tension – Tubes isolants remplis de mousse et tiges isolantes –
Partie 1: Tubes et tiges de section circulaire**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX



ICS 13.260; 29.240.20; 29.260

ISBN 2-8318-1064-1

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Requirements	8
4.1 Materials and design	8
4.2 Electrical requirements.....	8
4.3 Mechanical requirements.....	8
4.4 Tolerance requirements on outer diameters.....	8
4.5 Marking	9
4.6 Packaging	9
5 Testing provisions	9
5.1 General.....	9
5.2 Type test conditions	9
5.2.1 General	9
5.2.2 Groups and test pieces.....	10
5.3 Visual and dimensional checks.....	10
5.3.1 General	10
5.3.2 Visual check	10
5.3.3 Dimensional check	10
5.4 Electrical tests.....	11
5.4.1 Dielectric test under dry condition.....	11
5.4.2 Dielectric test after exposure to water.....	12
5.4.3 Wet test.....	19
5.5 Mechanical tests	21
5.5.1 Bending test	21
5.5.2 Torsion test	23
5.5.3 Crushing test on tube	25
5.5.4 Electrical test after mechanical ageing.....	26
5.5.5 Dye penetration test	27
5.5.6 Durability of marking.....	27
6 Conformity assessment of tubes and rods having completed the production phase.....	27
7 Modifications	27
Annex A (informative) Usual outer diameters	28
Annex B (normative) Plan of carrying out of the type tests	29
Annex C (normative) Classification of defects and associated requirements and tests	30
Bibliography.....	31
Figure 1 – Dielectric test under dry condition – Typical test arrangement.....	11
Figure 2 – Dielectric test after exposure to water – Typical test arrangement.....	13
Figure 3 – Dielectric test after exposure to water – Assembly diagram of the test piece to the guard electrodes	14
Figure 4 – Dielectric test after exposure to water – Constructional drawings for guard electrodes and parts	16

Figure 5 – Examples of constructional drawings for guard electrode parts according to some test piece diameters	17
Figure 6 – Wet test	21
Figure 7 – Bending test.....	22
Figure 8 – Torsion test – Examples for fixing tube or rod	24
Figure 9 – Crushing test.....	26
Table 1 – Tolerances on outer diameter d	8
Table 2 – Maximum values for the current I	19
Table 3 – Values of F_d , f and F_r for bending test	23
Table 4 – Values of C_d , a_d and C_r for torsion test	25
Table 5 – Values of F_d and F_r for crushing test	25
Table A.1 – Usual diameters	28
Table B.1 – Chronological order of the type tests	29
Table C.1 – Classification of defects and associated requirements and tests	30

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**LIVE WORKING –
INSULATING FOAM-FILLED TUBES AND SOLID RODS –****Part 1: Tubes and rods of a circular cross-section**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60855-1 has been prepared by technical committee 78: Live working.

This first edition of IEC 60855-1 cancels and replaces the first edition of IEC 60855 published in 1985, and constitutes a technical revision.

It includes the following significant technical changes from the previous IEC 60855:

- the clarification of the limitation of the standard to foam-filled tubes and solid rods of circular cross section;
- the review of the maximum tolerances on the outer diameter;
- the addition of a requirement for the individual packaging of the product;
- the addition of a requirement for the marking of the outer diameter on the product;

- the review of the requirements and test provisions (except for some mechanical test provisions) to permit any diameters of foam-filled tubes and solid rods:
 - the table of electrical tests specifying the limit of current is replaced by a formula;
- the introduction of a subclause for the electrical requirements (4.2) and the clarification of test results (temperature rise, 5.4.1 and 5.4.3.3);
- the dielectric test before exposure to humidity is replaced by a dielectric test under dry condition with different test set-up and different sanction;
- the application of the dye penetration test to the insulating solid rods;
- the introduction of a test for the durability of marking;
- the implementation of the outputs of IEC 61318, focusing on the classification of defects and practicability of test provisions.

Technical committee 78 is considering the preparation of IEC 60855-2, which would cover tubes and rods of cross-section other than circular.

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

FDIS	Report on voting
78/817/FDIS	78/828/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 60855 series, published under the general title *Live working – Insulating foam-filled tubes and solid rods*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

INTRODUCTION

This International Standard is intended to define essential characteristics necessary for the safe use of the tubes and rods, to determine appropriate requirements and to provide testing provisions.

This standard has been prepared in accordance with the requirements of IEC 61477.

The product covered by this standard may have an impact on the environment during some or all stages of its life cycle. These impacts can range from slight to significant, be of short-term or long-term, and occur at the global, regional or local level.

This standard does not include requirements and test provisions for the manufacturers of the product, or recommendations to the users of the product for environmental improvement. However, all parties intervening in its design, manufacture, packaging, distribution, use, maintenance, repair, reuse, recovery and disposal are invited to take account of environmental considerations.