IEC 61212-3-1

Edition 3.0 2013-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Insulating materials – Industrial rigid round laminated tubes and rods based on thermosetting resins for electrical purposes –
Part 3: Specifications for individual materials – Sheet 1: Round laminated rolled tubes

Matériaux isolants – Tubes et barres industriels rigides, ronds, stratifiés, à base de résines thermodurcissables, à usages électriques –
Partie 3: Spécifications pour matériaux particuliers – Feuille 1: Tubes ronds stratifiés enroulés

IEC 61212-3-1:2013

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

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

Useful links:

IEC publications search - www.iec.ch/searchpub

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It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

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

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

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.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,…).
Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

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

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC 61212-3-1

Edition 3.0 2013-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Insulating materials – Industrial rigid round laminated tubes and rods based on thermosetting resins for electrical purposes –
Part 3: Specifications for individual materials – Sheet 1: Round laminated rolled tubes**

**Matériaux isolants – Tubes et barres industriels rigides, ronds, stratifiés, à base de résines thermodurcissables, à usages électriques –
Partie 3: Spécifications pour matériaux particuliers – Feuille 1: Tubes ronds stratifiés enroulés**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

P

ICS 29.035.01

ISBN 978-2-83220-760-4

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

INSULATING MATERIALS – INDUSTRIAL RIGID ROUND LAMINATED TUBES AND RODS BASED ON THERMOSETTING RESINS FOR ELECTRICAL PURPOSES –

Part 3: Specifications for individual materials – Sheet 1: Round laminated rolled tubes

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 61212-3-1 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This third edition cancels and replaces the second edition published in 2006. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

Details of test for insulation resistance after immersion in water and values for permissible deviation from nominal external diameter of round rolled tubes in the "as rolled and cured" condition are changed.

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

FDIS	Report on voting
15/699/FDIS	15/709/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 the parts in the IEC 61212 series, under the general title *Insulating materials – Industrial rigid round laminated tubes and rods based on thermosetting resins for electrical purposes*, 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.

INTRODUCTION

This part of IEC 61212 is one of a series which deals with industrial rigid round laminated tubes and rods based on thermosetting resins for electrical purposes.

This series consists of three parts:

Part 1: Definitions, designations and general requirements (IEC 61212-1)

Part 2: Methods of test (IEC 61212-2)

Part 3: Specifications for individual materials (IEC 61212-3)

IEC 61212-3-1 contains one of the specification sheets comprising Part 3, as follows:

Sheet 1: Round laminated rolled tubes.

INSULATING MATERIALS – INDUSTRIAL RIGID ROUND LAMINATED TUBES AND RODS BASED ON THERMOSETTING RESINS FOR ELECTRICAL PURPOSES –

Part 3: Specifications for individual materials – Sheet 1: Round laminated rolled tubes

1 Scope

This part of IEC 61212 gives requirements for industrial rigid round laminated rolled tubes for electrical purposes, based on different resins and different reinforcements.

Applications and distinguishing properties are given in Table 1.

Materials which conform to this specification meet established levels of performance. However, the selection of a material by a user for a specific application should be based on the actual requirements necessary for adequate performance in that application and not based on this specification alone.

Safety warning:

It is the responsibility of the user of the methods contained or referred to in this document to ensure that they are used in a safe manner.

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 61212-1, *Insulating materials – Industrial rigid round laminated tubes and rods based on thermosetting resins for electrical purposes – Part 1: Definitions, designations and general requirements*

IEC 61212-2:2006, *Insulating materials – Industrial rigid round laminated tubes and rods based on thermosetting resins for electrical purposes – Part 2: Methods of test*

3 Terms and definitions

For the purposes of this document, the following term and definition apply.

3.1
round laminated rolled tube
<thermosets> tube formed by rolling impregnated layers of material on a mandrel between heated pressure rolls, curing in an oven, then removing the mandrel

[SOURCE: ISO 472:1999, modified – The word “round” has been added to the term.]

4 Designations and abbreviations

4.1 General

The round laminated rolled tubes covered by this Part 3 sheet are classified into types which differ in the resin and reinforcement used, the method of manufacture and their distinguishing properties.

4.2 Designation

Individual types are designated by

– a two-letter abbreviation denoting the resin;
– a second two-letter abbreviation, denoting the reinforcement;
– a serial number of two digits, the first digit denoting the form of the material,
– a “2” indicates rolled tubes, and
– a second digit denoting sub-grades of the same type.

The abbreviations are given in 4.3.

The complete designation of the rolled tube is denoted by

– description: rolled tube;
– number of the IEC standard: IEC 61212-3-1;
– designation of the individual type;
– dimensions (in millimetres) of the rolled tube:
  internal diameter × external diameter × length;
– a letter designating the finish on the external diameter of the rolled tube:
  "A" designating tubes in the "as produced" condition;
  "B" designating tubes in ground or turned condition.

EXAMPLE Rolled tube, IEC 61212-3-1 – EP GC 21 – 25 × 30 × 1 000 – A.

4.3 Abbreviations

Types of resin		Types of reinforcement	
EP	Epoxy (epoxide)	CC	Woven cotton cloth
MF	Melamine	CP	Cellulosic paper
PF	Phenolic	GC	Woven glass cloth
SI	Silicone	MP	Mica paper

5 Requirements

In addition to the general requirements given in IEC 61212-1, the rolled tubes shall comply with the additional requirements given in Tables 2, 3, 4, 5, 6, 7, and 8, with the exception of the length of tube supplied, which shall be subject to agreement between buyer and seller.

Table 1 – Types of industrial round rolled tubes

Resin	Reinforcement	Serial number	Applications and distinguishing characteristics[a]
EP	GC	21	Mechanical, electrical and electronic applications. Extremely high mechanical strength at moderate temperatures. Very good stability of electrical properties when exposed to high relative humidity.
		22	Similar to EP GC 21, but with high mechanical strength at elevated temperature.
		23	Similar to EP GC 21, but with improved flame resistance.
	MP	21	Mechanical, electrical and electronic applications. Good stability of electrical properties when exposed to high relative humidity. Good heat resistance.
MF	GC	21	Mechanical and electrical applications. High mechanical strength. Good arc and tracking resistance.
PF	CC	21	Mechanical and electrical applications. Fine weave [b].
		22	Mechanical and electrical applications. Coarse weave [b].
		23	Mechanical applications. Very coarse weave [b].
		24	Similar to PF CC 21. For close tolerance machining applications (very fine weave) [b] .
	CP	21	Mechanical and low voltage electrical applications. Good electrical properties when exposed to normal relative humidity.
		22	High voltage electrical applications at power frequencies. High electric strength in oil.
		23	Similar to type PF CP 21 but with improved electrical properties when exposed to high relative humidity.
	GC	21	Mechanical and electrical applications. Very high mechanical strength at moderate temperatures.
SI	GC	21	Mechanical, electrical and electronic applications when exposed to high relative humidity.
	MP	21	Mechanical, electrical and electronic applications. Good stability of electrical properties at elevated temperatures.

[a] It should not be inferred from the contents of Table 1 that round laminated rolled tubes of any particular type are necessarily unsuitable for applications other than those listed for them, or that specific round laminated rolled tubes will be suitable for all applications within the wide description given.

[b] Fabric weaves of type CC reinforcements:

	Mass per unit area g/m^2	Thread count cm^{-1}
Very coarse weave	> 200	< 18
Coarse weave	> 130	18 to 29
Fine weave	≤ 130	30 to 37
Very fine weave	≤ 125	> 37

These values are only for information. They are not to be considered as specification values. In general, the finer weave materials have better machining characteristics.

Table 2 – Permissible deviation from nominal external diameter of round rolled tubes in the "as rolled and cured" condition

Nominal external diameter *D* mm	Maximum deviation [a] ± mm	
	Type	
	PF CP	All other types
≤ 0	0,3	0,5
10 < *D* ≤ 20	0,4	0,6
20 < *D* ≤ 50	0,4	0,6
50 < *D* ≤ 75	0,5	0,7
75 < *D* ≤ 100	0,7	1,2
100 < *D* ≤ 150	1,0	1,7
150 < *D* ≤ 200	1,2	1,9
200 < *D* ≤ 300	1,4	2,2
300 < *D* ≤ 500	1,6	2,5
> 500	1,8	3,0
Test method: see 4.1 of IEC 61212-2:2006.		
[a] If a unilateral tolerance is agreed between purchaser and supplier, the tolerance shall not exceed twice the value given in the table.		

Table 3 – Permissible deviation from nominal external diameter of round rolled tubes in ground or turned condition, all types

Nominal external diameter *D* mm	Maximum deviation [a] ± mm
≤ 10	0,15
10 < *D* ≤ 25	0,20
25 < *D* ≤ 50	0,25
50 < *D* ≤ 75	0,30
75 < *D* ≤ 100	0,35
100 < *D* ≤ 125	0,45
125 < *D* ≤ 200	0,50
>200	[b]
Test method: see 4.2 of IEC 61212-2:2006.	
[a] If a unilateral tolerance is agreed between purchaser and supplier, the tolerance shall not exceed twice the value given in the table.	
[b] By agreement between purchaser and manufacturer.	

Table 4 – Permissible deviation from nominal internal diameter of round rolled tubes, all types

Nominal internal diameter *d* mm	Maximum deviation [a] ± mm
≤ 3	0,10
3 < *d* ≤ 30	0,15
30 < *d* ≤ 50	0,20
50 < *d* ≤ 75	0,30
75 < *d* ≤ 100	0,40
100 < *d* ≤ 150	0,50
150 < *d* ≤ 200	0,70
200 < *d* ≤ 300	1,00
300 < *d* ≤ 500	1,50
> 500	2,00
Test method: see 4.3 of IEC 61212-2:2006.	

a If a unilateral tolerance is agreed between purchaser and supplier, the tolerance may not be greater than twice the value given in the table.

Table 5 – Tolerance on wall thickness for round rolled tubes

Nominal wall thickness *t* mm	Maximum deviation ± mm	
	All PF CP types	All other types
≤ 1,5	0,25	0,40
1,5 < *t* ≤ 3,0	0,40	0,50
3,0 < *t* ≤ 6,0	0,50	0,50
6,0 < *t* ≤ 12,0	0,80	0,80
12,0 < *t* ≤ 25,0	1,20	1,20
> 25,0	1,60	1,60
Test method: see 4.4 of IEC 61212-2:2006.		