

# INTERNATIONAL STANDARD

**IEC**  
**61212-3-2**

Second edition  
2006-05

---

---

**Insulating materials –  
Industrial rigid round laminated tubes  
and rods based on thermosetting resins  
for electrical purposes –**

**Part 3:  
Specifications for individual materials –  
Sheet 2: Round laminated moulded tubes**



Reference number  
IEC 61212-3-2:2006(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

## Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

## Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** ([www.iec.ch](http://www.iec.ch))

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site ([www.iec.ch/searchpub](http://www.iec.ch/searchpub)) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications ([www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: [custserv@iec.ch](mailto:custserv@iec.ch)  
Tel: +41 22 919 02 11  
Fax: +41 22 919 03 00

# INTERNATIONAL STANDARD

# IEC 61212-3-2

Second edition  
2006-05

---

---

## Insulating materials – Industrial rigid round laminated tubes and rods based on thermosetting resins for electrical purposes –

### Part 3: Specifications for individual materials – Sheet 2: Round laminated moulded tubes

© IEC 2006 — Copyright - all rights reserved

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 the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland  
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: [inmail@iec.ch](mailto:inmail@iec.ch) Web: [www.iec.ch](http://www.iec.ch)



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

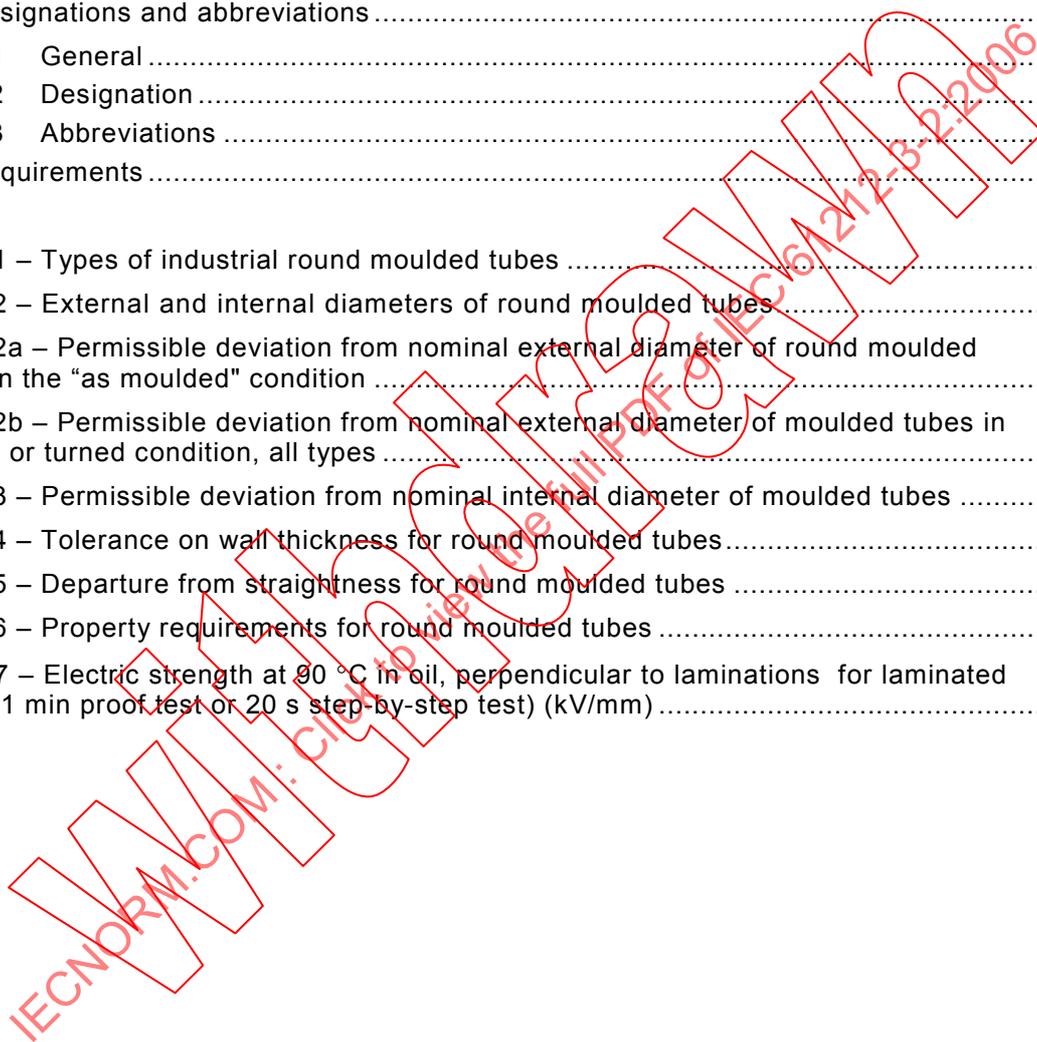
PRICE CODE

**M**

*For price, see current catalogue*

## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	6
4 Designations and abbreviations .....	7
4.1 General .....	7
4.2 Designation .....	7
4.3 Abbreviations .....	7
5 Requirements .....	8
Table 1 – Types of industrial round moulded tubes .....	8
Table 2 – External and internal diameters of round moulded tubes .....	9
Table 2a – Permissible deviation from nominal external diameter of round moulded tubes in the “as moulded” condition .....	9
Table 2b – Permissible deviation from nominal external diameter of moulded tubes in ground or turned condition, all types .....	9
Table 3 – Permissible deviation from nominal internal diameter of moulded tubes .....	10
Table 4 – Tolerance on wall thickness for round moulded tubes .....	10
Table 5 – Departure from straightness for round moulded tubes .....	11
Table 6 – Property requirements for round moulded tubes .....	12
Table 7 – Electric strength at 90 °C in oil, perpendicular to laminations for laminated tubes (1 min proof test or 20 s step-by-step test) (kV/mm) .....	13



## 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 2: Round laminated moulded 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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 61212-3-2 has been prepared by IEC technical committee 15: Standards on specifications for electrical insulating materials.

This second edition cancels and replaces the first edition published in 1995 and constitutes a technical revision. The main changes from the previous edition are as follows: added application use and safety statements. Reformatted document to bring it up to current IEC document format. New types EP GC 23 and PF CC 24 added and type PF CP 24 removed.

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

FDIS	Report on voting
15/303FDIS	15/327/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.

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.

A bilingual version of this publication may be issued at a later date.

IECNORM.COM: Click to view the full PDF of IEC 61212-3-2:2006  
**Withdrawn**

## 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 61212-3-2 contains one of the specification sheets comprising Part 3, as follows:

Sheet 2: Round laminated moulded tubes.

IECNORM.COM: Click to view the full PDF of IEC 61212-3-2:2006  
Withdrawn

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

## Part 3: Specifications for individual materials - Sheet 2: Round laminated moulded tubes

### 1 Scope

This part of IEC 61212-3 gives requirements for industrial rigid round laminated moulded 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 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 61212-1:2006, *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*

ISO 472, *Plastics – Vocabulary*

### 3 Terms and definitions

For the purposes of this document, the following modified definition, which is taken from ISO 472, applies.

#### 3.1

##### **moulded tube (as applied to thermosets)**

tube formed by rolling impregnated layers of material on a mandrel, curing the assembly in a cylindrical mould under heat and pressure, and then removing the mandrel

[ISO 472, MOD]

## 4 Designations and abbreviations

### 4.1 General

The moulded tubes covered by this Part of IEC 61212-3 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 "3" indicates moulded tubes,  
and, a second digit denoting sub-grades of the same type.

The abbreviations are given in 4.3.

The complete designation of the moulded tube is denoted as follows:

- description: moulded tube;
- number of the IEC standard: IEC 61212-3-2;
- designation of the individual type;
- dimensions (in millimetres) of the moulded tube: internal diameter x external diameter x length;
- a letter designating the finish on the external diameter of the moulded tube:  
"A" designating moulded tubes in the "as produced" condition;  
"B" designating moulded tubes in ground or turned condition.

EXAMPLE:

Moulded tube, IEC 61212-3-2 – EP CC 31 – 25x35x1000-A

### 4.3 Abbreviations

Types of resin

EP Epoxy (epoxide)

PF Phenolic

Types of reinforcement

CC Woven cotton cloth

CP Cellulosic paper

## 5 Requirements

In addition to the general requirements given in IEC 61212-1, the moulded tubes shall comply with the additional requirements given in Tables 2a, 2b, 3, 4, 5, 6 and 7, 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 moulded tubes**

Resin	Reinforcement	Serial number	Applications and distinguishing characteristics <sup>a)</sup> .
EP	CC	31	Mechanical, electrical and electronic applications. Good resistance to tracking.
PF	CC	31	Mechanical and electrical applications. fine weave <sup>b)</sup> .
		32	Similar to type PF CC 31, but of coarse weave <sup>b)</sup> .
		33	Similar to type PF CC 31, but of very coarse weave <sup>b)</sup> .
	CP	31	Electrical and mechanical applications. Good electrical properties when exposed to normal relative humidity.
		32	Similar to type PF CP 31, but with improved mechanical and electrical properties.

<sup>a)</sup> 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.

<sup>b)</sup> Fabric weaves of type CC reinforcements:

	Mass per unit area g/m <sup>2</sup>	Thread count cm <sup>-1</sup>
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 – External and internal diameters of round moulded tubes****Table 2a – Permissible deviation from nominal external diameter of round moulded tubes in the “as moulded” condition**

Nominal external diameter $D$ mm	Maximum deviation $\pm$ mm	
	Type	
	PF CP	EP CC PF CC
$\leq 3$	0,08	--
$3 < D \leq 6$	0,1	--
$6 < D \leq 10$	0,15	--
$10 < D \leq 20$	0,2	0,3
$20 < D \leq 30$	0,3	0,4
$30 < D \leq 50$	0,3	0,4
$50 < D \leq 75$	0,4	0,4
$75 < D \leq 100$	0,5	0,5
$100 < D \leq 150$	0,6	0,6
$150 < D \leq 200$	0,7	0,7
$200 < D \leq 300$	0,75	0,75
$300 < D \leq 500$	0,8	0,8
$> 500$	1,0	1,0

Test method: see 4.2 of IEC 61212-2.  
NOTE A double dash "--" signifies that there is no requirement.

**Table 2b – Permissible deviation from nominal external diameter of moulded tubes in ground or turned condition, all types**

Nominal external diameter $D$ mm	Maximum deviation <sup>a</sup> $\pm$ mm
$\leq 25$	0,15
$25 < D \leq 50$	0,25
$50 < D \leq 75$	0,30
$75 < D \leq 100$	0,35
$100 < D \leq 125$	0,45
$> 125$	0,50

Test method: see 4.2 of IEC 61212-2.

<sup>a</sup> 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 3 – Permissible deviation from nominal internal diameter of moulded tubes**

Nominal internal diameter <i>d</i> mm	Maximum deviation <sup>a</sup> ± mm
≤ 3	0,10 <sup>b</sup>
3 < <i>d</i> ≤ 30	0,15
30 < <i>d</i> ≤ 50	0,20
50 < <i>d</i> ≤ 75	0,25
75 < <i>d</i> ≤ 100	0,30
100 < <i>d</i> ≤ 150	0,50
150 < <i>d</i> ≤ 200	0,70
200 < <i>d</i> ≤ 300	1,00
300 < <i>d</i> ≤ 500	1,50
> 500	2,00

Test method: see 4.3 of IEC 61212-2.

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

<sup>b</sup> Applicable to PF CP types only.

**Table 4 – Tolerance on wall thickness for round moulded tubes**

Nominal wall thickness <i>t</i> mm	Maximum deviation ± mm		
	Types		
	PF CP PF CP 32	EP CC PF CC 31	PF CC PF CC 33 PF CC 34
≤ 1,5	0,25	0,28	0,40
1,5 < <i>t</i> ≤ 3,0	0,40	0,45	0,60
3,0 < <i>t</i> ≤ 6,0	0,55	0,60	0,85
6,0 < <i>t</i> ≤ 12,0	0,90	1,00	1,35
12,0 < <i>t</i> ≤ 25,0	1,30	1,40	1,90
> 25,0	2,00	2,00	2,70

Test method: see 4.4 of IEC 61212-2.