

INTERNATIONAL STANDARD

IEC
61212-3-3

Second edition
2006-08

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

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



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

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site (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 On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.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) 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
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC 61212-3-3

Second edition
2006-08

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

Part 3: Specifications for individual materials – Sheet 3: Round laminated moulded rods

© 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 Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

J

For price, see current catalogue

CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	5
3 Terms and definitions	5
4 Designations and abbreviations	6
4.1 General	6
4.2 Designation	6
4.3 Abbreviations	6
5 Requirements	6
Table 1 – Types of round moulded rods	7
Table 2 – Permissible deviation from nominal diameter of round moulded rods	8
Table 3 – Departure from straightness for round moulded rods	8
Table 4 – Properties of round moulded rods.....	9

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 3: Round laminated moulded rods**

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 61212-3-3 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. Type EP GC 43 has been added.

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

FDIS	Report on voting
15/329/FDIS	15/344/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.

A list of all parts of 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 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.

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

Part 3: Specifications for individual materials – Sheet 3: Round laminated moulded rods

1 Scope

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

round laminated moulded rod (as applied to thermosets)

rod formed by rolling impregnated layers of material on a mandrel, removing the mandrel, curing in a cylindrical mould under heat and pressure, and grinding to size

[ISO 472, MOD]

4 Designations and abbreviations

4.1 General

The moulded rods covered by this standard 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 “4” indicates moulded rods, and, a second digit denoting sub-grades of the same type.

The abbreviations are given in 4.3.

The complete designation of the moulded rod is denoted by:

- description: Moulded rod;
- number of the IEC standard: IEC 61212–3–3;
- designation of the individual type;
- dimensions (in millimetres of the moulded rod: diameter x length)
- a letter designating the finish on the external diameter of the moulded rod:
 - “A” designating rods in the “as produced” condition;
 - “B” designating rods in ground or turned condition.

EXAMPLE:

Moulded rod, IEC 61212-3-3 – EP CC 41 – 25x1000 – A

4.3 Abbreviations

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

5 Requirements

In addition to the general requirements given in IEC 61212-1, the moulded rods shall comply with the additional requirements given in Tables 2a, 2b, 3, and 4, with the exception of the length of rod supplied, which shall be subject to agreement between buyer and seller.

Table 1 – Types of round moulded rods

Resin	Reinforce- ment	Serial number	Applications and distinguishing characteristics ^a
EP	CC	41	Mechanical, electrical and electronic applications. Good resistance to tracking. Fine weave ^b .
	GC	41	Mechanical and electrical applications. High mechanical strength at moderate temperatures. Good stability of electrical properties when exposed to high relative humidity.
		42	Similar to EP GC 41, but with high mechanical strength at elevated temperature.
		43	Similar to EP GC 41, but with improved flame resistance.
PF	CC	41	Mechanical and electrical applications. Fine weave ^b .
		42	Mechanical and electrical applications. Coarse weave ^b .
		43	Mechanical and electrical applications. Very coarse weave ^b .
	CP	41	Mechanical and electrical applications. Good stability of electrical properties when exposed to high relative humidity.
		42	Similar to PF CP 41, but with lower mechanical and electrical properties.
		43	Mechanical applications and low voltage electrical applications.
SI	GC	41	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 moulded rods of any particular type are necessarily unsuitable for applications other than those listed for them, or that specific moulded rods will be suitable for all applications within the wide description given.

^b Fabric weaves of type CC reinforcements:

	Mass per unit area	Thread count
	g/m ²	cm ⁻¹
Very coarse weave	> 200	< 18
Coarse weave	> 130	18 to 29
Fine weave	≤ 130	≥ 30

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.

Tables 2 – Permissible deviation from nominal diameter of round moulded rods

Table 2a – Permissible deviation from nominal diameter of round moulded rods in the "as moulded" condition

Nominal diameter <i>D</i> mm	Maximum deviation ^a ± mm	
	Type	
	PF CP EP CC	All other types
≤ 10	0,3	0,4
10 < <i>D</i> ≤ 20	0,3	0,4
20 < <i>D</i> ≤ 30	0,4	0,5
30 < <i>D</i> ≤ 50	0,4	0,5
50 < <i>D</i> ≤ 75	0,4	0,7
75 < <i>D</i> ≤ 100	0,5	1,0
100 < <i>D</i> ≤ 150	0,6	1,5
150 < <i>D</i> ≤ 200	0,7	1,7
200 < <i>D</i> ≤ 300	0,75	2,0
300 < <i>D</i> ≤ 500	0,8	2,2
> 500	1,0	2,5
Test method: see 4.2 of IEC 61212-2.		
^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 2b – Permissible deviation from nominal diameter of round moulded rods in ground or turned condition

Nominal diameter <i>D</i> mm	Maximum deviation ± mm
≤ 25	0,15
25 < <i>D</i> ≤ 50	0,25
50 < <i>D</i> ≤ 75	0,30
75 < <i>D</i> ≤ 100	0,35
100 < <i>D</i> ≤ 125	0,45
> 125	0,50
Test method: see 4.2 of IEC 61212-2.	

Table 3 – Departure from straightness for round moulded rods

For all rods	3,5 L^2 mm
When measured in accordance with 4.5 of IEC 61212-2, the departure from straightness of any rod shall not exceed the appropriate limiting value given above, where <i>L</i> is the length of the rod in metres.	

Table 4 – Properties of round moulded rods

Property	Method of test (sub-clause No. in IEC 61212-2)	Unit	Maxi- mum or minimum	Type										Remarks	
				EP CC 41	EP GC 42	EP GC 43	PF CC 41	PF CC 42	PF CC 43	PF CP 41	PF CP 42	PF CP 43	SI GC 41		
Flexural strength perpendicular to laminations	5.1	MPa	Minimum	125	220 ^a	220	125	90	90	90	120	110	100	180	^a Flexural strength measured at 150 °C ± 3 K after 1 h at 150 °C ± 3 K not to be less than 50 % of the specified value
Axial compressive strength	5.2	MPa	Minimum	80	175	175	90	80	80	80	80	80	80	40	
Breakdown voltage at 90°C in oil parallel to laminations	6.1	kV	Minimum	30	40	40	5	5	1	1	13	10	10	30	The 20 s step-by-step test and the 1 min proof test for breakdown voltage at 90 °C in oil, parallel to laminations, are alternatives.
Insulation resistance after immersion in water	6.2	MΩ	Minimum	50	1000	150	5,0	1,0	0,1	0,1	75	30	0,1	150	
Thermal endurance	7.1	TI	Minimum	(130)	(130)	(155)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(180)	
Water absorption	7.2	mg/cm ²	Maximum	2	3	5	5	8	8	8	3	5	8	2	
Density	7.3	g/cm ³	Range	(1,2 – 1,4)	(1,7 – 1,9)	(1,7 – 1,9)	1,2 – 1,4	(1,2 – 1,4)	(1,2 – 1,4)	(1,2 – 1,4)	(1,2 – 1,4)	(1,2 – 1,4)	(1,2 – 1,4)	(1,6 – 1,8)	
Flammability	7.4	Cate- gory	-	--	--	--	--	--	--	--	--	--	--	V-0	The small-scale laboratory test used in this standard for assigning a flammability category is primarily for monitoring consistency of production of products. The results so obtained should not in any circumstances be considered as an overall indication of the potential fire hazards presented by these products under actual conditions of use.
Values in brackets “()” are typical values intended to give only general guidance and are not to be considered as requirement of this standard.															
NOTE A double dash “--” signifies that there is no requirement.															

ISBN 2-8318-8765-8



ICS 29.035.01
