

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Varnishes used for electrical insulation –
Part 3: Specifications for individual materials –
Sheet 2: Hot curing impregnating varnishes**

**Vernis utilisés pour l'isolation électrique –
Partie 3: Spécifications pour matériaux particuliers –
Feuille 2: Vernis d'imprégnation durcissant à chaud**

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INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Varnishes used for electrical insulation –
Part 2: Methods of test**

**Vernis utilisés pour l'isolation électrique –
Partie 2: Méthodes d'essai**

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REDLINE VERSION

VERSION REDLINE



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Part 3: Specifications for individual materials –
Sheet 2: Hot curing impregnating varnishes**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

VARNISHES USED FOR ELECTRICAL INSULATION –

**Part 3: Specifications for individual materials –
Sheet 2: Hot curing impregnating varnishes**

FOREWORD

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IEC 60464-3-2 edition 2.1 contains the second edition (2001-07) [documents 15C/1222/FDIS and 15C/1251/RVD] and its amendment 1 (2006-04) [documents 15/299/FDIS and 15/320/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60464-3-2 has been prepared by subcommittee 15C: Specifications, of IEC technical committee 15: Insulating materials.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The committee has decided that the contents of the base publication and its amendment 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

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INTRODUCTION

This part of IEC 60464 is one of a series which deals with varnishes used for electrical insulation. The series consists of three parts:

Part 1: Definitions and general requirements (IEC 60464-1);

Part 2: Methods of test (IEC 60464-2);

Part 3: Specifications for individual materials (IEC 60464-3).

This standard consists of one of the sheets comprising part 3 as follows:

Sheet 2: Hot curing impregnating varnishes.

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VARNISHES USED FOR ELECTRICAL INSULATION –

Part 3: Specifications for individual materials – Sheet 2: Hot curing impregnating varnishes

1 Scope

This sheet of IEC 60464-3 gives the requirements for hot curing impregnating varnishes and includes requirements for certain properties at elevated temperature.

2 Normative references

The following normative documents contain provisions which, through reference in the text, constitute provisions of this part of IEC 60464. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60464 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 60172:1987, *Test procedure for the determination of the temperature index of enamelled winding wires*

IEC 60317-8:1990, *Specifications for particular types of winding wires – Part 8: Polyesterimide enamelled round copper wire, class 180*¹

IEC 60317-13:1990, *Specifications for particular types of winding wires – Part 13: Polyester or polyesterimide overcoated with polyamide-imide enamelled round copper winding wire, class 200*²

IEC 60464-1:1998, *Varnishes used for electrical insulation – Part 1: Definitions and general requirements*

IEC 60464-2, *Varnishes used for electrical insulation – Part 2: Methods of test*³

IEC 61033:1991, *Test methods for the determination of bond strength of impregnating agents to an enamelled wire substrate*

3 Designation

For the purpose of this specification, the varnishes are identified as in table 1.

¹ A consolidated edition 3.2 exists (1997) that includes IEC 60317-8 (1990) its amendment 1 (1997) and amendment 2 (1997).

² A consolidated edition 2.2 exists (1997) that includes IEC 60317-13 (1990) its amendment 1 (1997) and amendment 2 (1997).

³ To be published.

Table 1 – Identification of varnishes

Type	Temperature for which the property levels are specified °C
130	130
155	155
180	180
200	200
220	220

The purchase contract shall contain the material designation, for example:

IEC 60464-3-2 type 130.

4 Definitions and general requirements

For definitions and general requirements, see clauses 4 and 5 of IEC 60464-1.

5 Requirements

All material in a consignment shall comply with the requirements of IEC 60464-1 and shall, in addition, comply with the requirements given in this sheet.

Requirements for properties listed in table 2 are not included in this specification. Where these are required, they should be agreed between supplier and purchaser. All tests, however, shall be carried out in accordance with IEC 60464-2, if not otherwise specified.

Table 2 – Property values to be agreed between supplier and purchaser when required

Properties of undried and/or uncured varnish before drying and curing	Properties of dried and/or cured varnish after curing
Density	Tackiness
Dilution ability	Cupping test Bond strength
pH (W and E varnishes)	Bond strength Cupping test
Volatile organic content (W and E varnishes)	Resistance to liquids (inclusive of including water)
Water content (W and E varnishes)	Dissipation factor and relative permittivity
	Breakdown voltage and electric strength
	Resistance to mould growth
	Flash rusting of steel panels (W and E varnishes)

5.1 Flash point

Flash point of the varnish, determined in accordance with 5.1 of IEC 60464-2, shall be not less than agreed between supplier and purchaser. If in a particular country the safety regulations for the application of a material specify a minimum flash point, the material to be used in that country shall comply with that requirement.

5.2 Viscosity

Viscosity of the varnish, determined in accordance with 5.3 of IEC 60464-2, shall be within ± 10 % of the nominal value. The nominal value shall be stated in the purchase contract.

5.3 Content of non-volatile matter

Content of non-volatile matter of the varnish, determined in accordance with 5.4 of IEC 60464-2, shall be within ± 2 % of the nominal value. The nominal value shall be stated in the purchase contract.

5.4 Stability of varnish in an open vessel

Stability of the varnish in an open vessel, determined according to 5.6 of IEC 60464-2, shall show an increase of viscosity of the varnish of not more than four times the nominal value. The nominal value shall be stated in the purchase contract.

5.5 Drying and/or curing in thick layer

After drying and/or curing of the varnish in a thick layer, determined according to 5.7 of IEC 60464-2, the result shall be S 1, U 1 and not worse than I 4.2 and the specimen shall be uniform.

5.6 Effect of varnish on enamelled wires

The effect of the varnish on enamelled wires, determined in accordance with 5.8 of IEC 60464-2, shall not be less than pencil hardness H.

5.7 Bend test (cylindrical mandrel)

After bending around a mandrel of 3 mm diameter, in accordance with 6.2.1 of IEC 60464-2, no cracks shall be detected under normal vision. In the case of certain products, due to their high exothermic enthalpy, specimens may tend to crack. For such products, the requirement for curing in a thick layer is not applicable.

5.8 Temperature index

Temperature index of the varnish, determined in accordance with 6.3.2 of IEC 60464-2, shall be based on any two of the following four criteria as agreed upon between supplier and purchaser:

- bond strength according to IEC 61033, method B, with an end-point criterion of 22 N;
- proof voltage according to IEC 60172 based on enamelled wire substrate of a wire class of not less than 180 according to IEC 60317-8 or IEC 60317-13;

- breakdown voltage in accordance with 6.5.3 of IEC 60464-2 on test specimens based on glass fabric substrate according to 6.1.2 of IEC 60464-2 with an end-point criterion of 3 kV.
- loss of mass on test specimens based on glass fabric substrate according to 6.1.2 of IEC 60464-2 with an end-point criterion of 30 %.

The temperature index shall not be less than stated in table 3 for any of the chosen test criteria.

Table 3 – Minimum temperature index

Type	Temperature index
130	130
155	155
180	180
200	200
220	220

This test is a periodic conformance test and need not be repeated unless the manufacturer has made a significant change in the composition or method of production of the material.

5.9 Resistance to vapour of solvents

Resistance of the varnish to vapour of solvents, according to 6.4.3 of IEC 60464-2, shall show no change in adherence, peeling, blistering, draining and no tackiness.

NOTE This test applies only in countries where legal requirements necessitate its use for materials included in "e" type equipment as defined in IEC 60079-7.

5.10 Effect of water immersion on volume resistivity

Volume resistivity of the varnish, determined in accordance with 6.5.1 of IEC 60464-2, shall not be less than $10^{10} \Omega\text{m}$ before and $10^6 \Omega\text{m}$ after immersion in water.