

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Varnishes used for electrical insulation –  
Part 1: Definitions and general requirements**

**Vernis utilisés pour l'isolation électrique –  
Partie 1: Définitions et prescriptions générales**

IEC 60464-1:1998

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## VERSION REDLINE



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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

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## VARNISHES USED FOR ELECTRICAL INSULATION –

### Part 1: Definitions and general requirements

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**IEC 60464-1 edition 2.1 contains the second edition (1998) [documents 15C/989/FDIS and 15C/1007/RVD] and its amendment 1 (2006) [documents 15/252/FDIS and 15/279/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 60464-1 has been prepared by subcommittee 15C: Specifications, of IEC technical committee 15: Insulating materials.

The French version of amendment 1 has not been voted upon.

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 International Standard 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)

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# VARNISHES USED FOR ELECTRICAL INSULATION –

## Part 1: Definitions and general requirements

### 1 Scope

This part of IEC 60464 relates to varnishes used for electrical insulation. ~~All varnishes contain solvent.~~ The varnishes may be used for finishing or impregnating applications, and may be dried or dried and cured at ambient or elevated temperatures.

### 2 Normative references

The following normative documents contain provisions which, through reference in the text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 60464-3-1,— *Varnishes used for electrical insulation – Part 3: Specifications for individual materials – Sheet 1: Ambient curing finishing varnishes*<sup>1)</sup>

IEC 60464-3-2,— *Varnishes used for electrical insulation – Part 3: Specifications for individual materials – Sheet 2: Hot curing impregnating varnishes*<sup>1)</sup>

ISO 472:1988, *Plastics – Vocabulary* [IEC 60464-1:1998](https://standards.iteh.ai/catalog/standards/iec/df33b29e-526e-46d9-a3d1-f502ae6d997e/iec-60464-1-1998)

ISO 1043-1:1997, *Plastics – Symbols and abbreviated terms – Part 1: Basic polymers and their characteristics*

### 3 Designation

The commonly used applications are as shown in table 1.

**Table 1 – Application methods**

Application	Code letters
Finishing varnish	FV
Impregnating varnish	IV

The code letters associated with the application may be used as an abbreviation of the application description. Further applications and associated code letters may be added if so required.

<sup>1)</sup> To be published.

Depending on their composition and purpose, these varnishes dry or dry and cure at ambient or at elevated temperature. The designation of a particular varnish is based on the composition of its resin content or of its major reactive portion. The commonly used resins are as shown in table 2. For symbols of resins and polymers and their special characteristics see ISO 1043-1.

**Table 2 – Basic resins**

Resins	Code letters
Acrylic	A
Epoxy (aliphatic or aromatic)	EP
Melamine-formaldehyde	MF
Phenol-formaldehyde	PF
Polyurethane	PUR
Saturated polyester	SP
Silicone	SI
Unsaturated polyester	UP

The designation letter of the varnish type shall follow the resin type letter in brackets

**Table 3 – Varnish types**

Type	Code letter
Organic solvent based	S
Water based	W
Emulsion	E

IEC 60464-1:1998

The code letters associated with the designation may be used as abbreviation of the polymer description. Further designations and associated code letters may be added if so required.

## 4 Terms and definitions

### 4.1 Varnish

A solution or emulsion of one or more resins in a solvent or carrier liquid. Other components may be present, such as driers, catalysts, reactive diluents, dyestuffs, ~~or~~ pigments or co-solvents. The solvents and by-products are released during the drying/curing process and at the same time the active components are polymerized and/or crosslinked forming a solid product. The drying or curing may take place either at ambient temperature or with application of heat.

NOTE – The definitions for resin and different basic resins given hereinafter are in accordance with ISO 472.

### 4.2 Resin

A solid, semi-solid, or pseudo-solid organic material that has an indefinite and often high molecular mass, exhibits a tendency to flow when subjected to stress, usually has a softening or melting range, and usually fractures conchoidally. In a broad sense, the term is used to designate any polymer that is a basic material for plastics.

#### 4.2.1 Acrylic resin (A)

A resin made with acrylic acid or a structural derivative of acrylic acid, or their copolymers with other monomers, the acrylic monomer(s) being in the greatest amount by mass.

#### 4.2.2 Epoxy resin (EP)

A resin containing epoxide groups capable of crosslinking.

#### 4.2.3 Melamine-formaldehyde resin (MF)

An amino resin made by polycondensation of melamine with formaldehyde or a compound that is capable of providing methylene bridges.

#### 4.2.4 Phenol-formaldehyde resin (PF)

A resin of the phenolic type, made by the polycondensation of phenol with formaldehyde.

#### 4.2.5 Polyurethane resin (PUR)

A resin in which, after curing, the repeated structural unit in the chain is of the urethane type.

#### 4.2.6 Saturated polyester resin (SP)

A resin in which the repeated structural unit is of the ester type.

#### 4.2.7 Silicone resin (SI)

A resin in which the main polymer chain consists of alternating silicon and oxygen atoms.

#### 4.2.8 Unsaturated polyester resin (UP)

A polyester resin characterized by carbon-carbon unsaturation in the polymer chain, which permits subsequent crosslinking with an unsaturated monomer or prepolymer. <http://standards.iteh.ai/> <http://iec-60464-1-1998>

#### 4.3 Diluent

A liquid additive, the sole function of which is to reduce the concentration of solids and the viscosity of a varnish composition.

#### 4.4 Cure; curing

The process of converting a prepolymeric or polymeric composition into a more stable, usable condition by polymerization and/or crosslinking.

#### 4.5 Polymerization

The process of converting a monomer or a mixture of monomers into a polymer.

NOTE – The process of converting a prepolymeric or polymeric composition into a polymer is also called polymerization.

#### 4.6 Crosslinking

The process of producing multiple intermolecular covalent or ionic bonding between polymer chains.

#### 4.7 Adherence

The state in which two surfaces are held together by interfacial forces.

#### 4.8 Void

An enclosed cavity of an undefined shape, containing air or some other gas.

NOTE – The term *bubble* refers to a more or less spherical void.

#### 4.9 Shelf life

The storage time under specified conditions during which a material retains its essential properties.

#### 4.10 Finishing varnish (FV)

A varnish which is applied to the surface of equipment or parts of it to enhance the resistance to environmental influences or to improve the appearance of the equipment.

#### 4.11 Impregnating varnish (IV)

A varnish which is capable of penetrating or impregnating windings and coils of electrical components with the purpose to fill interstices and voids and thus protect and bond the winding and coil.

#### 4.12 Ambient curing varnish

A varnish which dries or dries and cures at ambient temperature without application of heat.

#### 4.13 Hot curing varnish

A varnish which cures by application of heat.

#### 4.14 Emulsion

stable, colloidal mixture of two immiscible liquids

#### 4.15 Co-solvent

solvent, usually a polar or hydrophilic liquid, used in small concentrations to bridge between the polymeric resin and the main solvent (usually water) and facilitate emulsification

#### 4.16 Volatile organic compound content

mass of organic material lost from a water or emulsion based varnish during the drying/curing process, expressed in relation to the mass of the resin of the varnish

### 5 General requirements

All material in a consignment shall comply with the requirements of this standard and shall, in addition, comply with the specifications given in IEC 60464-3.

#### 5.1 Colour

The colour of the dried and/or cured material shall match with the colour as agreed between supplier and purchaser.

#### 5.2 Conditions of supply

The varnish shall be supplied in adequate strong, dry and clean containers, which ensure protection during transport, handling and storage. Each container shall be legibly and durably marked with at least the following information: