

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Resin based reactive compounds used for electrical insulation –
Part 2: Methods of test**

**Composés réactifs à base de résines utilisés comme isolants électriques –
Partie 2: Méthodes d'essai**

[IEC 60455-2:2023](#)

<https://standards.iteh.ai/catalog/standards/sist/3b064347-5ef5-4d96-9569-4a22f9726f31/iec-60455-2-2023>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, 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 either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables 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 It also gives information on projects, replaced and withdrawn publications.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 online and once a month by email.

IEC 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: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) 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 IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC 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.

IEC Just Published - webstore.iec.ch/justpublished

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

Service Clients - webstore.iec.ch/csc

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

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Resin based reactive compounds used for electrical insulation –
Part 2: Methods of test**

**Composés réactifs à base de résines utilisés comme isolants électriques –
Partie 2: Méthodes d'essai**

[IEC 60455-2:2023](#)

<https://standards.iteh.ai/catalog/standards/sist/3b064347-5ef5-4d96-9569-4a22f9726f31/iec-60455-2-2023>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.220.99, 29.035.01

ISBN 978-2-8322-7283-1

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	11
4 General notes on methods of test	11
4.1 Preparation and conditioning.....	11
4.2 Sequence of tests	12
4.3 Test report	12
5 Methods of test for reactive compounds and their components	12
5.1 Flash point.....	12
5.2 Density	12
5.3 Viscosity	12
5.4 Viscosity after storing at elevated temperature.....	12
5.5 Content of volatile organic components.....	13
5.6 Isothermal increase of viscosity (processing time)	13
5.7 Shelf life	13
5.8 Colour.....	13
5.9 Softening temperature	14
5.10 Ash content.....	14
5.11 Filler content.....	14
5.12 Chlorine content.....	14
5.12.1 Total chlorine content of unsaturated polyesters and epoxide resins.....	14
5.12.2 Inorganic chlorine content of epoxide resins and glycidyl esters	14
5.12.3 Easily saponifiable chlorine content of epoxide resins and related materials	14
5.13 Tendency of crystallisation.....	14
5.14 Epoxide equivalent of epoxide resins	14
5.15 Content of isocyanate	14
5.16 Water content (Karl Fischer method).....	14
5.17 Hydroxyl value	15
5.17.1 Polyester resins.....	15
5.17.2 Resins other than polyester	15
5.18 Acid value of polyester resins	15
5.19 Amount of double bonds of unsaturated polyester and acrylate resins	15
5.20 Acid and acid-anhydride content of acid-anhydride hardeners.....	15
5.21 Amine value	15
5.22 Pot life	15
5.22.1 General	15
5.22.2 Resinous compounds for cable accessories.....	15
5.23 Gel time	16
5.23.1 Unsaturated polyester based compounds	16
5.23.2 Phenolic resin based compounds.....	16
5.23.3 Other compounds	16
5.24 Exothermic temperature rise	16
5.24.1 Unsaturated polyester based compounds	16
5.24.2 Resinous compounds for cable accessories.....	16

5.25	Total volume shrinkage of epoxide and unsaturated polyester based compounds	17
5.26	Curing in presence of water	17
5.26.1	General	17
5.26.2	Apparatus and materials	17
5.26.3	Pouring device	17
5.26.4	Procedure	17
5.26.5	Test report	18
5.27	Determination of the degree of curing	19
5.28	Curing in thick layer and emissions during curing	19
5.28.1	General	19
5.28.2	Equipment	20
5.28.3	Test specimen	20
5.28.4	Procedure	20
6	Methods of test for cured reactive compounds	21
6.1	General	21
6.2	Test specimens	21
6.2.1	General	21
6.2.2	Preparation of the reactive compound	21
6.2.3	Preparation of test specimens	22
6.2.4	Type and number of test specimens	22
6.3	Density	22
6.4	Mechanical properties	22
6.4.1	Tensile properties	22
6.4.2	Compressive properties	22
6.4.3	Flexural properties	23
6.4.4	Impact strength	23
6.4.5	Hardness	23
6.5	Thermal properties	23
6.5.1	Bond strength at elevated temperature	23
6.5.2	Linear thermal expansion	23
6.5.3	Thermal conductivity	23
6.5.4	Glass transition	24
6.5.5	Flammability	24
6.5.6	Thermal shock	24
6.5.7	Dry heat resistance of resins for cable accessories – Method of test	24
6.5.8	Wet heat resistance of resins for cable accessories	25
6.5.9	Loss of mass	27
6.5.10	Temperature index	28
6.6	Chemical properties	29
6.6.1	Water absorption	29
6.6.2	Effect of liquid chemicals	29
6.6.3	Resistance to mould growth	29
6.6.4	Water vapour permeability	29
6.7	Electrical properties	29
6.7.1	Effect of water immersion on volume resistivity	29
6.7.2	Dielectric dissipation factor ($\tan \delta$) and relative permittivity	29
6.7.3	Break down voltage and electric strength	29
6.7.4	Proof tracking index (PTI)	31

6.7.5 Electrolytic corrosion 31

Annex A (informative) Health and safety 34

Bibliography..... 35

Figure 1 – Examination grid 18

Figure 2 – Position of examination grid on the specimen..... 19

Figure 3 – Example of electrode arrangement for flexible cured compound 32

Figure 4 – Example of electrode arrangement for rigid cured compound 33

Table 1 – Condition of the top side..... 20

Table 2 – Condition of the bottom side..... 20

Table 3 – Condition of the interior 20

Table 4 – Voids..... 21

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 60455-2:2023](https://standards.iteh.ai/catalog/standards/sist/3b064347-5ef5-4d96-9569-4a22f9726f31/iec-60455-2-2023)

<https://standards.iteh.ai/catalog/standards/sist/3b064347-5ef5-4d96-9569-4a22f9726f31/iec-60455-2-2023>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RESIN BASED REACTIVE COMPOUNDS USED
FOR ELECTRICAL INSULATION –****Part 2: Methods of test****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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60455-2 has been prepared by IEC technical committee 15: Solid electrical insulating materials. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2015. This edition constitutes a technical revision.

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

- a) Introduction of test methods related to IEC 60455-3-8;
- b) Additional and updated test methods for resins.

The text of this International Standard is based on the following documents:

Draft	Report on voting
15/1006/FDIS	15/1015/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60455 series, published under the general title *Resin based reactive compounds used for electrical insulation*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

[IEC 60455-2:2023](https://standards.iteh.ai/catalog/standards/sist/3b064347-5ef5-4d96-9569-4a22f9726f31/iec-60455-2-2023)

<https://standards.iteh.ai/catalog/standards/sist/3b064347-5ef5-4d96-9569-4a22f9726f31/iec-60455-2-2023>

INTRODUCTION

This part of IEC 60455 is one of a series which deals with solvent-free resin based reactive compounds and their components used for electrical insulation.

The series consists of three parts:

- Part 1: Definitions and general requirements;
- Part 2: Methods of test;
- Part 3: Specifications for individual materials.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 60455-2:2023](https://standards.iteh.ai/catalog/standards/sist/3b064347-5ef5-4d96-9569-4a22f9726f31/iec-60455-2-2023)

<https://standards.iteh.ai/catalog/standards/sist/3b064347-5ef5-4d96-9569-4a22f9726f31/iec-60455-2-2023>

RESIN BASED REACTIVE COMPOUNDS USED FOR ELECTRICAL INSULATION –

Part 2: Methods of test

1 Scope

This part of IEC 60455 specifies methods of test to be used for testing resin based reactive compounds, their components and cured compounds used for electrical insulation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

IEC 60068-2-10:2005, *Environmental testing – Part 2-10: Tests – Test J and guidance: Mould growth*

IEC 60112:2020, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60216 (all parts), *Electrical insulating materials – Thermal endurance properties*

IEC 60243-1:2013, *Electric strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60296:2020, *Fluids for electrotechnical applications – Mineral insulating oils for electrical equipment*

IEC 60426:2007, *Electrical insulating materials – Determination of electrolytic corrosion caused by insulating materials – Test methods*

IEC 60455-1:1998, *Resin based reactive compounds used for electrical insulation – Part 1: Definitions and general requirements*

IEC 60455-3 (all parts), *Resin based reactive compounds used for electrical insulation – Part 3: Specifications for individual materials*

IEC 60455-3-8:2021, *Resin based reactive compounds used for electrical insulation – Part 3-8: Specifications for individual materials – Resins for cable accessories*

IEC 60695-11-10:2013, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60814:1997, *Insulating liquids – Oil-impregnated paper and pressboard – Determination of water by automatic coulometric Karl Fischer titration*

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

IEC 61099:2010, *Insulating liquids – Specifications for unused synthetic organic esters for electrical purposes*

ISO 37:2011, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties*

ISO 62:2008, *Plastics – Determination of water absorption*

ISO 75 (all parts), *Plastics and ebonite – Determination of temperature of deflection under load*

ISO 175:2010, *Plastics – Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 178:2010, *Plastics – Determination of flexural properties*

ISO 179-1:2010, *Plastics – Determination of Charpy impact properties – Part 1: Non-instrumented impact test*

ISO 179-2:1997, *Plastics – Determination of Charpy impact properties – Part 2: Instrumented impact test*

ISO 291, *Plastics – Standard atmospheres for conditioning and testing*

ISO 306:2013, *Plastics – Thermoplastic materials – Determination of Vicat softening temperature (VST)*

ISO 527 (all parts), *Plastics – Determination of tensile properties*

ISO 584:1982, *Plastics – Unsaturated polyester resins – Determination of reactivity at 80 degrees C (conventional method)*

ISO 604:2002, *Plastics – Determination of compressive properties*

ISO 868:2003, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 1183-1:2019, *Plastics – Methods for determining the density of non-cellular plastics – Part 1: Immersion method, liquid pycnometer method and titration method*

ISO 1513:2010, *Paints and varnishes – Examination and preparation of test samples*

ISO 1523:2002, *Determination of flash point – Closed cup equilibrium method*

ISO 1675:1985, *Plastics – Liquid resins – Determination of density by the pycnometer method*

ISO 2039-1:1993, *Plastics – Determination of hardness – Part 1: Ball indentation method*

ISO 2114:2000, *Plastics (polyester resins) and paints and varnishes (binders) – Determination of partial acid value and total acid value*

ISO 2431:1993, *Paints and varnishes – Determination of flow time by use of flow cups*

ISO 2535:1997, *Plastics – Unsaturated polyester resins – Measurement of gel time at 25 degrees C*

ISO 2554:1997, *Plastics – Unsaturated polyester resins – Determination of hydroxyl value*

ISO 2555:1989, *Plastics – Resins in the liquid state or as emulsions or dispersions – Determination of apparent viscosity using a single cylinder type rotational viscometer method*

ISO 2592:1973, *Petroleum products – Determination of flash and fire points – Cleveland open cup method*

ISO 3001:1997, *Plastics – Epoxy compounds – Determination of epoxy equivalent*

ISO 3219:1993, *Plastics – Polymers/resins in the liquid state or as emulsions or dispersions – Determination of viscosity using a rotational viscometer with defined shear rate*

ISO 3451-1:1997, *Plastics – Determination of ash – Part 1: General methods*

ISO 3521:1997, *Plastics – Unsaturated polyester and epoxy resins – Determination of overall volume shrinkage*

ISO 3679:1983, *Paints, varnishes, petroleum and related products – Determination of flashpoint – Rapid equilibrium method*

ISO 4573:1978, *Plastics – Epoxide resins and glycidyl esters – Determination of inorganic chlorine*

ISO 4583:1998, *Plastics – Epoxide resins and related materials – Determination of easily saponifiable chlorine*

ISO 4615:1979, *Plastics – Unsaturated polyesters and epoxide resins – Determination of total chlorine content*

ISO 4625:1980, *Binders for paints and varnishes – Determination of softening point – Ring-and-ball method*

ISO 4895, *Plastics – Liquid epoxy resins – Determination of tendency to crystallize*

ISO 7056, *Plastics laboratory ware – Beakers*

ISO 9396:1997, *Plastics – Phenolic resins – Determination of the gel time of resols under specific conditions using automatic apparatus*

ISO 11357-2:1999, *Plastics – Differential scanning calorimetry (DSC) – Part 2: Determination of glass transition temperature and step height*

ISO 11359-2:1999, *Plastics – Thermomechanical analysis (TMA) – Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature*

ISO 11359-3:2002, *Plastics – Thermomechanical analysis (TMA) – Part 3: Determination of penetration temperature*

ISO 14896:2009, *Plastics – Polyurethane raw materials – Determination of isocyanate content*

ISO 15528:2000, *Paints, varnishes and raw materials for paints and varnishes – Sampling*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60455-1 and IEC 60050 and the following shall apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

volume resistance

part of the insulation resistance which is due to conduction through the volume and excluding surface current

3.2

volume resistivity

volume resistance reduced to a cubical unit volume

3.3

dielectric dissipation factor

$\tan \delta$

numerical value of the ratio of the imaginary to the real part of the complex permittivity

3.4

relative permittivity

ϵ_r

ratio of the absolute permittivity to the electric constant

Note 1 to entry: In practical engineering, it is usual to employ the term 'permittivity' when referring to relative permittivity

4 General notes on methods of test

4.1 Preparation and conditioning

Unless otherwise specified in the relevant specification standard or in the method of test, all tests shall be carried out at atmospheric conditions in a temperature range of between 21 °C and 29 °C and a relative humidity range of between 45 % and 70 %. Before measurements are made, the sample or test specimen shall be pre-conditioned under these atmospheric conditions for a time sufficient to allow the sample or the test specimen to reach stability. For taking samples in liquid or paste form, ISO 15528 shall be applied. For preparation of such samples for testing, ISO 1513 shall be applied.

NOTE For definitions of terms for standard atmospheres, see ISO 558. The test atmosphere as specified above does not comply with any of the two standard atmospheres as specified in ISO 291 but covers both ranges inclusive of their tolerances

Normally, all requirements for a method of test are given in the description, and diagrams are intended only to illustrate one possible arrangement for conducting the test. In case of inconsistencies between this document and the specification sheets of the IEC 60455-3 series, the latter shall prevail. When another standard is invoked for a test method, reference to that standard shall be included in the report.

4.2 Sequence of tests

To avoid unnecessary efforts, tests shall be carried out on the samples in the following sequence:

- 1) tests on individual components prior to mixing;
- 2) tests on reactive compound just after mixing (ready to use);
- 3) tests on cured compound;
- 4) tests on cured compound after pre treatment (thermal, humidity, water etc.).

If the sample under test fails a test the following tests may become obsolete.

4.3 Test report

If not otherwise specified, the test report shall include the following data:

- 1) resin designation and identification;
- 2) lot number or other identification;
- 3) confirmation of marking and labelling according to the material safety data sheet (MSDS);
- 4) test results;
- 5) major test parameters, including conditioning and calibration, if any;
- 6) processing conditions used to reactive compound;
- 7) copy of the technical data sheet (TDS) and (MSDS).

5 Methods of test for reactive compounds and their components

5.1 Flash point

IEC 60455-2:2023

For flash point temperatures of 79 °C and above, the method given in ISO 2592 shall be used. For flash point temperatures below 79 °C, the method given in ISO 1523 shall be used with any of the closed-cup apparatus as described in Annex A of ISO 1523:2002. ISO 1523 shall be read in conjunction with ISO 3679. Two measurements shall be made on two separate samples, and the two results of the flash point shall be reported along with reference to the standards applied.

5.2 Density

The method given in ISO 1675 shall be used. Two measurements shall be made, and the two results of the density shall be reported.

5.3 Viscosity

The viscosity shall be determined with a suitable device at $(23 \pm 0,5)$ °C if not otherwise specified. If a rotating type of device is used, it shall be in accordance with ISO 2555 (Brookfield type) or with ISO 3219 (a type working at a defined shear rate). If an efflux type of equipment is used, the method of test and the flow cup shall be in accordance with ISO 2431. Two measurements shall be made, and the two results of the viscosity shall be reported, along with reference to the standards applied.

5.4 Viscosity after storing at elevated temperature

This method is not applicable to one-component systems or components containing hardener.

If not otherwise specified, a sample of sufficient amount is stored for $(20 \pm 0,5)$ h at a temperature of (100 ± 3) °C in a sealed container. After cooling down to room temperature the viscosity is measured according to 5.3. The increase of viscosity is calculated using the following equation:

Increase of viscosity in % = $(\eta_2 - \eta_1) \times 100 / \eta_1$

where

η_1 dynamic viscosity before storing

η_2 dynamic viscosity after storing

5.5 Content of volatile organic components

This method is not applicable to one-component systems or components containing hardener. If not otherwise specified, the test shall be carried out in the following way:

The mass of an empty weighing bottle (about 80 mm × 30 mm) is taken to 0,001 g (m_1). A mass of 0,4 g to 0,5 g resin (m_2) is weighed to 0,001 g into the weighing bottle (well closed during weighing). Some drops of toluene are added to dilute the resin. The liquid is spread on the floor of the weighing bottle with a slight twist.

The open weighing bottle is placed into an oven with forced air circulation for at least 2 h at $(110 \pm 2) ^\circ\text{C}$. After cooling down to room temperature in a desiccator the weighing bottle is weighed again to 0,001 g (m_3).

Volatile organic components = $100 \times (m_2 - (m_3 - m_1)) / m_2$

where:

m_1 mass of an empty weighing bottle (g)

m_2 mass of resin before heating (g)

m_3 mass of an empty weighing bottle with resin after heating and cooling (g)

5.6 Isothermal increase of viscosity (processing time)

This method is designed for PUR and EP resins. For UP resins gel time shall be used. If not otherwise specified, the test shall be carried out in the following way:

All components and equipment shall be at room temperature. The components of the resin are mixed according to the manufacturer's instructions. The mixing procedure shall not take more than 3 min. The time measurement starts after adding and mixing of the last component. After 10 min the first viscosity measurement is taken as the initial value. The measurement is repeated until the specified maximum viscosity is reached. The time between the initial value and the maximum value is reported as processing time.

5.7 Shelf life

The shelf life shall be determined by measurement of the change in a specified characteristic property after a certain storage time and temperature. Experience has shown that viscosity according to 5.3 and gel time according to 5.23 are appropriate characteristics. To assess shelf life, viscosity and/or gel time shall be determined according to 5.3 and/or 5.23 respectively, at a temperature and with an end-point as agreed upon between supplier and purchaser. Two measurements shall be made on both fresh material and on material stored for a time and at a temperature as agreed between supplier and purchaser. The two results of shelf life shall be reported, along with reference to the standards applied. The results shall contain the viscosity and/or the gel time before and after storing, the storing time and temperature and the test temperature.

5.8 Colour

The method given in ISO 6271 shall be used. Two measurements shall be made, and the two results of colour shall be reported along with reference to the standard applied.