

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Electrostatics –**

**Part 4-4: Standard test methods for specific applications – Electrostatic classification of flexible intermediate bulk containers (FIBC)**

**Électrostatique –**

**Partie 4-4: Méthodes d'essai normalisées pour des applications spécifiques – Classification électrostatique des grands récipients pour vrac souples (GRVS)**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 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 Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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 corrigenda or an amendment might have been published.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://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](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://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](mailto:sales@iec.ch).

---

### 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.

#### Catalogue IEC - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

#### Recherche de publications IEC - [webstore.iec.ch/advsearchform](http://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](http://webstore.iec.ch/justpublished)

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

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

#### Service Clients - [webstore.iec.ch/csc](http://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](mailto:sales@iec.ch).

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



---

**Electrostatics –  
Part 4-4: Standard test methods for specific applications – Electrostatic  
classification of flexible intermediate bulk containers (FIBC)**

**Électrostatique –  
Partie 4-4: Méthodes d'essai normalisées pour des applications spécifiques –  
Classification électrostatique des grands récipients pour vrac souples (GRVS)**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

---

ICS 17.220.99; 29.020; 55.080

ISBN 978-2-8322-5264-2

**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 .....	9
3 Terms and definitions .....	10
4 Classification.....	12
4.1 Classification for FIBC .....	12
4.1.1 Principles of classification.....	12
4.1.2 Type A.....	12
4.1.3 Type B.....	12
4.1.4 Type C.....	12
4.1.5 Type D.....	12
4.2 Principles of classification and requirements for inner liners .....	12
4.2.1 Components of inner liners.....	12
4.2.2 Surface resistivity measurements for inner liners .....	13
4.2.3 Breakdown voltage measurements for inner liners .....	13
4.2.4 Type L1 .....	14
4.2.5 Type L1C.....	15
4.2.6 Type L2 .....	15
4.2.7 Type L3 .....	16
4.3 Combination of FIBC and inner liners.....	17
5 Safe use of FIBC .....	17
6 Labelling.....	19
7 Requirements for FIBC .....	22
7.1 General remarks .....	22
7.2 Requirements for dust environments with ignition energies greater than 3 mJ (apply to Type B FIBC, Type C FIBC and Type D FIBC).....	22
7.3 Requirements for vapour and gas atmospheres and for dust environments with ignition energies of 3 mJ or less .....	23
7.3.1 Type C FIBC.....	23
7.3.2 Type D FIBC.....	23
8 Atmosphere for conditioning, calibrating and testing .....	24
8.1 Conditioning time .....	24
8.2 Electrical breakdown voltage, surface resistivity and resistance to groundable point testing.....	24
8.3 Surface resistivity testing .....	24
8.4 Ignition testing .....	24
9 Test procedures .....	24
9.1 Sampling.....	24
9.2 Electrical breakdown voltage.....	24
9.3 Ignition testing .....	25
9.3.1 Apparatus.....	25
9.3.2 Establishing correct charging current.....	32
9.3.3 Ignition tests.....	32
9.4 Resistance to groundable point.....	35
9.4.1 Apparatus.....	35

9.4.2	Test procedure .....	35
10	Test report.....	36
10.1	General.....	36
10.2	For all types of testing .....	37
10.3	For electrical breakdown voltage testing .....	37
10.4	For ignition testing .....	37
10.5	For resistance to groundable point testing.....	37
10.6	For surface resistivity testing of inner liners, labels and document pockets .....	37
10.7	For test reports issued by accredited testing authorities.....	37
Annex A (informative)	Electrical breakdown voltage – Typical voltage/time graphs .....	39
Annex B (normative)	Polypropylene pellets for ignition testing .....	40
Annex C (informative)	Guidance on test methods for manufacturing quality control.....	41
C.1	Introductory remarks .....	41
C.2	Test methods .....	41
C.2.1	Resistance measurements.....	41
C.2.2	Charge decay measurements .....	42
C.2.3	Charge transfer measurements.....	42
Annex D (normative)	Classification of hazardous areas and zones.....	43
Annex E (informative)	Risks associated with cone discharges.....	44
Annex F (informative)	Explanation for resistance and resistivity limits, and thickness limits for insulating layers of inner liners .....	45
F.1	Resistance to groundable point limit for Type C FIBC .....	45
F.2	Resistivity of inner liners .....	45
F.3	Thickness of insulating layers of inner liners .....	45
Bibliography	.....	47
Figure 1	– Examples of inner liners in FIBC .....	13
Figure 2	– Example of a label for Type B FIBC .....	20
Figure 3	– Example of a label for Type C FIBC .....	20
Figure 4	– Example of a label for Type D FIBC .....	21
Figure 5	– Example of labels for Type C FIBC designated earth bonding points .....	21
Figure 6	– Ignition probe .....	26
Figure 7	– Perforated metal plate for use in ignition probe .....	27
Figure 8	– Gas control and mixing apparatus (schematic) .....	28
Figure 9	– FIBC filling rig (schematic) .....	30
Figure 10	– Corona charging unit (schematic).....	31
Figure A.1	– Example of voltage/time graph for material showing distinct breakdown.....	39
Figure A.2	– Example of voltage/time graph for material showing reduction in rate of voltage rise because of conduction within the test material .....	39
Table 1	– Permissible configurations and requirements for Type L1 inner liners (without conductive internal layers) .....	14
Table 2	– Permissible configurations and requirements for Type L1C inner liners (with conductive internal layers <sup>a</sup> ) .....	15
Table 3	– Permissible configurations and requirements for Type L2 inner liners.....	16
Table 4	– Permissible configurations and requirements for Type L3 inner liners.....	17

Table 5 – Use of different types of FIBC .....	17
Table 6 – Inner liners and FIBC: combinations that are permissible and not permissible in hazardous explosive atmospheres .....	18
Table 7 – Volume concentrations of flammable gas mixture .....	27
Table 8 – Example of full sample description to be included in the test report .....	38
Table B.1 – Particle size distribution of polypropylene pellets .....	40
Table D.1 – Classification of hazardous areas in IEC 60079-10-1 and IEC 60079-10-2 .....	43
Table D.2 – Classification of zones in IEC 60079-10-1 and IEC 60079-10-2.....	43

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ELECTROSTATICS –

**Part 4-4: Standard test methods for specific applications –  
Electrostatic classification of flexible intermediate bulk containers (FIBC)**

## 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) 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 61340-4-4 has been prepared by IEC technical committee 101: Electrostatics.

This third edition cancels and replaces the second edition, published in 2012, and Amendment 1:2014. This edition constitutes a technical revision.

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

- a) in light of experimental evidence, the maximum resistance to ground limit for Type C FIBC, and corresponding resistance limits for inner liners used in Type C FIBC has been increased from  $1,0 \times 10^7 \Omega$  to  $1,0 \times 10^8 \Omega$ ;
- b) the classification of Type L1 inner liners has been revised and extended to include Type L1C inner liners made from multi-layer materials with a conductive internal layer;

- c) a labelling requirement to include a reference to IEC TS 60079-32-1 for guidance on earthing has been added.

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

FDIS	Report on voting
101/546/FDIS	101/555/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61340 series, published under the general title *Electrostatics*, 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 "<http://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.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

Flexible intermediate bulk containers (FIBC) are widely used for the storage, transportation and handling of powdered, flaked or granular material. Typically, they are constructed from woven polypropylene fabric in the form of cubic bags of about 1 m<sup>3</sup> volume, although they can vary in shape and in size from 0,25 m<sup>3</sup> to 3 m<sup>3</sup>. The fabric used may be a single layer, a multi-layer laminate, or a coated fabric. Untreated polypropylene is an electrical insulator, as is often the case with the products placed in FIBC. There is ample opportunity for the generation of electrostatic charge during filling and emptying operations and in unprotected FIBC high levels of charge can quickly build up. In such cases, electrostatic discharges are inevitable and can be a severe problem when FIBC are used in hazardous explosive atmospheres.

A hazardous explosive atmosphere can be generated when handling fine powders that create dust clouds or thin layers of powder, both of which can be ignited by electrostatic discharges. A hazardous explosive atmosphere can also be generated when using gases or volatile solvents. In these industrial situations, there is clearly a need to eliminate incendive electrostatic discharges.

As with any industrial equipment, a thorough risk assessment should always be conducted before using FIBC in potentially hazardous situations. This part of IEC 61340 describes a system of classification, test methods, performance and design requirements and safe use procedures that can be used by manufacturers, specifiers and end-users as part of a risk assessment of any FIBC intended for use within a hazardous explosive atmosphere. However, it does not include procedures for evaluating the specific risks of electrostatic discharges arising from products within FIBC, for example cone discharges, from personnel or from equipment used near FIBC. Information on risks associated with cone discharges is given in Annex E.

**CAUTION:** The test methods specified in this document involve the use of high voltage power supplies and flammable gases that may present hazards if handled incorrectly, particularly by unqualified or inexperienced personnel. Users of this document are encouraged to carry out proper risk assessments and pay due regard to local regulations before undertaking any of the test procedures.

## ELECTROSTATICS –

### Part 4-4: Standard test methods for specific applications – Electrostatic classification of flexible intermediate bulk containers (FIBC)

#### 1 Scope

This part of IEC 61340 specifies requirements for flexible intermediate bulk containers (FIBC) between 0,25 m<sup>3</sup> and 3 m<sup>3</sup> in volume, intended for use in hazardous explosive atmospheres. The explosive atmosphere can be created by the contents in the FIBC or can exist outside the FIBC.

The requirements include:

- classification and labelling of FIBC;
- classification of inner liners;
- specification of test methods for each type of FIBC, inner liner, labels and document pockets;
- design and performance requirements for FIBC, inner liners, labels and document pockets;
- safe use of FIBC (including those with inner liners) within different zones defined for explosion endangered environments, described for areas where combustible dusts are, or can be, present (IEC 60079-10-2), and for explosive gas atmospheres (IEC 60079-10-1);
- procedures for type qualification and certification of FIBC, including the safe use of inner liners.

NOTE 1 Guidance on test methods that can be used for manufacturing quality control is given in Annex C.

The requirements of this document are applicable to all types of FIBC and inner liners, tested as manufactured, prior to use and intended for use in hazardous explosive atmospheres: Zones 1 and 2 (Groups IIA and IIB only) and Zones 21 and 22 (see Annex D for classification of hazardous areas and explosion groups). For some types of FIBC, the requirements of this document apply only to use in hazardous explosive atmospheres with minimum ignition energy of 0,14 mJ or greater and where charging currents do not exceed 3,0 µA.

#### NOTE 2

0,14 mJ represents a realistic minimum ignition energy for a Group IIB gas or vapour atmosphere. Although more sensitive materials exist, 0,14 mJ is the lowest minimum ignition energy of any material that is likely to be present when FIBC are emptied. 3,0 µA is the highest charging current likely to be found in common industrial processes. This combination of minimum ignition energy and charging current represents the most severe conditions that might be expected in practice.

FIBC are not normally used in Zone 0 or Zone 20. If FIBC are used in Zone 0 or Zone 20, the requirements of this document are applicable, together with additional requirements that are beyond the scope of this document to define.

The volume contained within FIBC can be designated as Zone 20, in which case the requirements of this document are applicable.

Solids containing residual solvent can result in a hazardous explosive atmosphere within FIBC, possibly resulting in the volume being designated as Zone 1 or Zone 2; in which case the requirements of this document are applicable.

Compliance with the requirements specified in this document does not necessarily ensure that hazardous electrostatic discharges, for example cone discharges, will not be generated by the