BS EN 60384-14:2013
Incorporating corrigendum April 2016



BSI Standards Publication

Fixed capacitors for use in electronic equipment

Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains

bsi.

National foreword

This British Standard is the UK implementation of EN 60384-14:2013. It is identical to IEC 60384-14:2013, incorporating corrigendum April 2016. It supersedes BS EN 60384-14:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/40X, Capacitors and resistors for electronic equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2016.
Published by BSI Standards Limited 2016

ISBN 978 0 580 94233 4
ICS 31.060.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2013.

Amendments/corrigenda issued since publication

Date	Text affected
31 May 2016	Implementation of IEC corrigendum April 2016: Table 11 and Table 12 modified

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60384-14

August 2013

ICS 31.060.10

Supersedes EN 60384-14:2005

English version

Fixed capacitors for use in electronic equipment - Part 14: Sectional specification - Fixed capacitors for electromagnetic interference suppression and connection to the supply mains

(IEC 60384-14:2013)

Condensateurs fixes utilisés dans les équipements électroniques - Partie 14: Spécification intermédiaire - Condensateurs fixes d'antiparasitage et raccordement à l'alimentation
(CEI 60384-14:2013)

Festkondensatoren zur Verwendung in Geräten der Elektronik - Teil 14: Rahmenspezifikation - Festkondensatoren zur Unterdrückung elektromagnetischer Störungen, geeignet für Netzbetrieb
(IEC 60384-14:2013)

This European Standard was approved by CENELEC on 2013-07-10. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels

© 2013 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Ref. No. EN 60384-14:2013 E

Foreword

The text of document 40/2199/FDIS, future edition 4 of IEC 60384-14, prepared by IEC/TC 40 "Capacitors and resistors for electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60384-14:2013.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2014-04-10
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-07-10

This document supersedes EN 60384-14:2005.

EN 60384-14:2013 includes the following significant technical changes with respect to EN 60384-14:2005:

All changes that have been agreed upon can be categorized as minor revisions.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60384-14:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60335-1	NOTE	Harmonised as EN 60335-1.
IEC 60384-14-3	NOTE	Harmonised as EN 60384-14-3.
IEC 60950-1	NOTE	Harmonised as EN 60950-1.
IEC 61140	NOTE	Harmonised as EN 61140.

Annex ZA
(normative)
Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60060-1	2010	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	2010
IEC 60063		Preferred number series for resistors and capacitors	-	-
IEC 60065 (mod) + corr. August + A1 (mod) + A2 (mod) - -	2001 2002 2005 2010 - -	Audio, video and similar electronic apparatus - Safety requirements	EN 60065 + corr. August + A1 + A2 + A11 + A12	2002 2007 2006 2010
IEC 60068-1 + corr. October	1988 1988	Environmental testing - Part 1: General and guidance	EN 60068-1 [1)]	1994
IEC 60068-2-17		Environmental testing - Part 2: Tests - Test Q: Sealing	EN 60068-2-17	
IEC 60384-1 + corr. November	2008 2008	Fixed capacitors for use in electronic equipment - Part 1: Generic specification	EN 60384-1	2009
IEC 60417	Data base	Graphical symbols for use on equipment	HD 243 S12 [2) 3)]	
IEC 60664-1		Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1 [4) 5)]	
IEC 60695-11-10		Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	
IEC 60940		Guidance information on the application of capacitors, resistors, inductors and complete filter units for radio interference suppression	-	-
IEC 61193-2		Quality assessment systems - Part 2: Selection and use of sampling plans for inspection of electronic components and packages	EN 61193-2	

[1)] EN 60068-1 includes A1 to IEC 60068-1 + corr. October .
[2)] HD 243 S12 includes supplement(s) M to K to IEC 60417.
[3)] HD 243 S12 is superseded by EN 60417-2:1999, which is based on IEC 60417-2:1998.
[4)] EN 60664-1 includes A1 + A2 to IEC 60664-1.
[5)] EN 60664-1 is superseded by EN 60664-1:2007, which is based on IEC 60664-1:2007.

Publication	Year	Title	EN/HD	Year
IEC 61210 (mod)		Connecting devices - Flat quick-connect terminations for electrical copper conductors - Safety requirements	EN 61210	
CISPR 17		Methods of measurement of the suppression characteristics of passive EMC filtering devices	EN 55017	
ISO 7000		Graphical symbols for use on equipment - Registered symbols	-	-

CONTENTS

1 General 9
1.1 Scope 9
1.2 Object 9
1.3 Normative references 9
1.4 Information to be given in a detail specification 10
1.4.1 Outline drawing and dimensions 10
1.4.2 Mounting 10
1.4.3 Ratings and characteristics 11
1.4.4 Marking 11
1.5 Terms and definitions 11
1.6 Marking 16
1.6.1 Marking of capacitors 16
1.6.2 Marking of packaging 16
1.6.3 Additional marking 17
1.7 Classification of Class X and Class Y capacitors 17
1.7.1 Classification of X capacitors 17
1.7.2 Classification of Y capacitors 17
2 Preferred ratings and characteristics 18
2.1 Preferred characteristics 18
2.1.1 Preferred climatic categories 18
2.2 Preferred values of ratings 19
2.2.1 Nominal capacitance (C_N) 19
2.2.2 Tolerance on nominal capacitance 19
2.2.3 Rated voltage (U_R) 19
2.2.4 Nominal resistance (R_N) 19
2.2.5 Rated temperature 19
2.2.6 Passive flammability 19
2.3 Requirements for sleeving, tape, tubing and wire insulation 19
3 Assessment procedures 20
3.1 Primary stage of manufacture 20
3.2 Structurally similar components 20
3.3 Certified records of released lots 20
3.4 Approval testing 20
3.4.1 Safety tests only approval 20
3.4.2 Qualification approval 20
3.4.3 Qualification approval on the basis of the fixed sample size procedure 20
3.5 Quality conformance inspection 31
3.5.1 Formation of inspection lots 31
3.5.2 Test schedule 32
3.5.3 Delayed delivery 32
3.5.4 Assessment level 32
4 Test and measurement procedures 33
4.1 Visual examination and check of dimensions 33
4.1.1 Creepage distances and clearances 33

4.2 Electrical tests 34
4.2.1 Voltage proof 34
4.2.2 Capacitance 36
4.2.3 Tangent of loss angle 36
4.2.4 Resistance (Equivalent Series Resistance (ESR)) (for RC units only) 37
4.2.5 Insulation resistance 37
4.3 Robustness of terminations 38
4.4 Resistance to soldering heat 38
4.4.1 Test conditions 38
4.4.2 Final inspection, measurements and requirements 39
4.5 Solderability 39
4.5.1 Test conditions 39
4.5.2 Requirements 39
4.6 Rapid change of temperature 39
4.6.1 Final inspection 39
4.7 Vibration 39
4.7.1 Test conditions 40
4.7.2 Final inspection 40
4.8 Bump 40
4.8.1 Test conditions 40
4.8.2 Final inspection, measurements and requirements 40
4.9 Shock 40
4.9.1 Test conditions 40
4.9.2 Final inspection, measurements and requirements 41
4.10 Container sealing 41
4.10.1 Test conditions 41
4.10.2 Requirements 41
4.11 Climatic sequence 41
4.11.1 Initial measurements 41
4.11.2 Dry heat 42
4.11.3 Damp heat, cyclic, test Db, first cycle 42
4.11.4 Cold 42
4.11.5 Damp heat, cyclic, test Db, remaining cycles 42
4.11.6 Final inspection, measurements and requirements 42
4.12 Damp heat, steady state 42
4.12.1 Initial measurements 43
4.12.2 Test conditions 43
4.12.3 Final inspection, measurements and requirements 43
4.13 Impulse voltage 43
4.13.1 Initial measurements 43
4.13.2 Test conditions 44
4.13.3 Requirements 44
4.14 Endurance 45
4.14.1 Test conditions 45
4.14.2 Initial measurements 45
4.14.3 Endurance for Class X capacitors and RC units containing Class X capacitors 45
4.14.4 Endurance for Class Y capacitors and RC units containing Class Y capacitors 46

4.14.5 Endurance for the lead-through arrangements 46
4.14.6 Test conditions – Combined voltage/current tests 46
4.14.7 Final inspection, measurements and requirements 47
4.15 Charge and discharge 47
4.15.1 Initial measurements 47
4.15.2 Test conditions 47
4.15.3 Final measurements and requirements 48
4.16 Radiofrequency characteristics 48
4.17 Passive flammability test 48
4.17.1 Testing according to IEC 60384-1 48
4.17.2 Alternative passive flammability test 49
4.18 Active flammability test 50
4.18.3 Adjustment of U_i 51
4.18.4 Requirements 51
4.19 Component solvent resistance (if applicable) 51
4.20 Solvent resistance of the marking 52
Annex A (normative) Circuit for the impulse voltage test 53
Annex B (normative) Circuit for the endurance test 55
Annex C (normative) Circuit for the charge and discharge test 56
Annex D (normative) Declaration of design (confidential to the manufacturer and the certification body) 57
Annex E (informative) Pulse test circuits 58
Annex F (normative) Particular requirements for safety test of surface-mounting capacitors 60
Annex G (informative) Capacitance ageing of fixed capacitors of ceramic dielectric, Class 2 63
Bibliography 65

Figure 1 – Two-terminal EMI suppression capacitor 12
Figure 2 – RC unit 12
Figure 3 – Lead-through capacitor (coaxial) 12
Figure 4 – Lead-through capacitors 13
Figure 5 – By-pass capacitors 14
Figure 6 – Test duration (s) 31
Figure 7 – Impulse wave form 44
Figure 8 – Typical circuit for pulse loading of capacitors under a.c. voltage 50
Figure 9 – Fundamental a.c. wave with randomly, not synchronized, superimposed high-voltage pulse 51
Figure A.1 – Impulse voltage test circuit 53
Figure B.1 – Endurance test circuit 55
Figure C.1 – Charge and discharge test circuit 56
Figure F.1 – Example of test substrate for safety test according to Table F.1 62

Table 1 – Classification of Class X capacitors 17
Table 2 – Classification of Class Y capacitors 18
Table 3 – Sampling plan – Tests concerning safety requirements only 22

Table 4 – Sampling plan – Safety and performance tests qualification approval – Assessment level DZ 23
Table 5 – Test schedule and sampling plan for lot-by-lot tests 24
Table 6 – Test schedule for safety tests only (1 of 2) 25
Table 7 – Test schedule for safety and performance tests qualification approval – Assessment level DZ 27
Table 8 – Assessment level 33
Table 9 – Creepage distances and clearances 34
Table 10 – Voltage proof 36
Table 11 – Insulation resistance – Safety tests only 37
Table 12 – Insulation resistance – Safety and performance tests 38
Table 13 – Resistance to soldering heat – Requirements 39
Table 14 – Climatic sequence – Requirements 42
Table 15 – Damp heat, steady state – Requirements 43
Table 16 – Endurance – Requirements 47
Table 17 – Charge and discharge – Requirements 48
Table A.1 – Values of C_X, C_T, R_P, R_S, C_p 53
Table A.2 – Values and tolerances of C_X, t_r, t_d 54
Table F.1 – Test schedule and sampling plan for safety test of surface mount capacitors 61

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 14: Sectional specification – Fixed capacitors for electromagnetic interference suppression and connection to the supply mains

1 General

1.1 Scope

This part of IEC 60384 applies to capacitors and resistor-capacitor combinations which will be connected to an a.c. mains or other supply with nominal voltage not exceeding 1 000 V a.c. (r.m.s.) or 1 000 V d.c. and with a nominal frequency not exceeding 100 Hz.

1.2 Object

The principal object of this part of IEC 60384 is to prescribe preferred ratings and characteristics and to select from IEC 60384-1, the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of capacitor. Test severities and requirements prescribed in detail specifications referring to this sectional specification will be of equal or higher performance level; lower performance levels are not permitted.

This standard also provides a schedule of safety tests to be used by national testing stations in countries where approval by such stations is required.

The overvoltage categories in combination with the a.c. mains voltages for the capacitors classified in this standard should be taken from IEC 60664-1.

1.3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60063, *Preferred number series for resistors and capacitors*

IEC 60065:2001, *Audio, video and similar electronic apparatus – Safety requirements*
Amendment 1:2005
Amendment 2:2010

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-17, *Environmental testing – Part 2-17: Tests – Test Q: Sealing*

IEC 60384-1:2008, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60417, *Graphical symbols for use on equipment*