

BS EN 60252-2:2011+A1:2013



BSI Standards Publication

AC motor capacitors

Part 2: Motor start capacitors

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National foreword

This British Standard is the UK implementation of EN 60252-2:2011+A1:2013. It is identical to IEC 60252-2:2010, incorporating amendment 1:2013. It supersedes BS EN 60252-2:2011, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee PEL/33, Power capacitors.

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

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Date	Text affected
31 December 2013	Implementation of IEC amendment 1:2013 with CENELEC endorsement A1:2013. Annex ZA updated

**AC motor capacitors -
Part 2: Motor start capacitors
(IEC 60252-2:2010)**

Condensateurs des moteurs à courant
alternatif -
Partie 2: Condensateurs de démarrage de
moteurs
(CEI 60252-2:2010)

Wechselspannungsmotorkondensatoren -
Teil 2: Motoranlaufkondensatoren
(IEC 60252-2:2010)

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CENELEC

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

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Foreword

The text of document 33/476/FDIS, future edition 2 of IEC 60252-2, prepared by IEC TC 33, Power capacitors, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60252-2 on 2011-01-19.

This European Standard supersedes EN 60252-2:2003.

The main changes with respect to EN 60252-2:2003 are listed below:

- definition of segmented film capacitors;
- clearer definition of the purpose of d.c. conditioning in destruction test.

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

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2011-10-19
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2014-01-19

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60252-2:2010 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 33/533/FDIS, future IEC 60252-2:2010/A1, prepared by IEC/TC 33, "Power capacitors and their applications" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60252-2:2011/A1:2013.

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- latest date by which the national (dow) 2016-10-03
standards conflicting with the
document have to be withdrawn

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.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60252-2:2010/A1:2013 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60062	-	Marking codes for resistors and capacitors	EN 60062	-
IEC 60068-2	Series	Environmental testing - Part 2: Tests	EN 60068-2	Series
IEC 60068-2-6	-	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-14	-	Environmental testing - Part 2-14: Tests - Test N: Change of temperature	EN 60068-2-14	-
IEC 60068-2-20	-	Environmental testing - Part 2-20: Tests - Test T: Test methods for solderability and resistance to soldering heat of devices with leads	EN 60068-2-20	-
IEC 60068-2-21	-	Environmental testing - Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices	EN 60068-2-21	-
IEC 60068-2-78	2001	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2001
IEC 60112	-	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	-
IEC 60309-1	1999	Plugs, socket-outlets and couplers for industrial purposes - Part 1: General requirements	EN 60309-1	1999
IEC 60529	2001	Degrees of protection provided by enclosures - (IP Code)	-	-
IEC 60695-2-10	2000	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10	2001
IEC 60695-2-11	2000	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products	EN 60695-2-11	2001

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 4046	2002	Paper, board, pulp and related terms - Vocabulary	-	-

CONTENTS

1	Scope.....	6
2	Normative references.....	6
3	Terms and definitions.....	7
4	Service conditions	10
4.1	Normal service conditions	10
4.2	Preferred tolerances on capacitance	10
5	Self-healing motor start capacitors	11
5.1	Quality requirements and tests	11
5.1.1	Test requirements	11
5.1.2	Nature of tests	11
5.1.3	Type tests	11
5.1.4	Routine tests	13
5.1.5	Tangent of the loss-angle measurement	13
5.1.6	Visual examination	13
5.1.7	Voltage test between the terminals	14
5.1.8	Voltage test between terminals and case	14
5.1.9	Capacitance measurement	14
5.1.10	Check of dimensions	14
5.1.11	Mechanical tests	15
5.1.12	Sealing test	17
5.1.13	Endurance test	17
5.1.14	Damp heat test	19
5.1.15	Self-healing test.....	19
5.1.16	Destruction test.....	19
5.1.17	Resistance to heat, fire and tracking	24
5.2	Overloads	25
5.2.1	Maximum permissible voltage.....	25
5.2.2	Maximum permissible current	25
5.2.3	Maximum permissible reactive output	25
5.3	Safety requirements	25
5.3.1	Creepage distances and clearances.....	25
5.3.2	Terminals and connecting cables.....	26
5.3.3	Earth connections	26
5.3.4	Discharge devices.....	27
5.3.5	Pollution.....	27
5.4	Marking.....	27
6	Electrolytic motor start capacitors.....	28
6.1	Quality requirements and tests	28
6.1.1	Test requirements	28
6.1.2	Nature of tests	28
6.1.3	Type tests	31
6.1.4	Routine tests	31
6.1.5	Visual examination	31
6.1.6	Voltage test between the terminals	31
6.1.7	Voltage test between terminals and case	31

6.1.8	Capacitance and power factor measurement	32
6.1.9	Check of dimensions	33
6.1.10	Mechanical tests	33
6.1.11	Sealing test	35
6.1.12	Endurance test	35
6.1.13	Damp heat test	37
6.1.14	Pressure relief test	37
6.1.15	Resistance to heat, fire and tracking	38
6.2	Overloads	38
6.2.1	Maximum permissible voltage	38
6.2.2	Maximum permissible current	38
6.2.3	Maximum permissible reactive output	39
6.3	Safety requirements	39
6.3.1	Creepage distances and clearances	39
6.3.2	Terminals and connecting cables	39
6.3.3	Earth connections	39
6.3.4	Discharge devices	40
6.3.5	Pollution	40
6.4	Marking	40
7	Guidance for installation and operation	41
7.1	General	41
7.2	Choice of rated voltage	41
7.2.1	Measurement of working voltage	41
7.2.2	Influence of capacitance	42
7.3	Checking capacitor temperature	42
7.3.1	Choice of maximum permissible capacitor operating temperature	42
7.3.2	Choice of minimum permissible capacitor operating temperature	42
7.4	Checking transients	42
7.5	Storage of electrolytic capacitors	43
Annex A (normative)	Test voltage	44
Figure 1	– Test apparatus for d.c. conditioning	20
Figure 2	– Test apparatus for a.c. destruction test	20
Figure 3	– Arrangement to produce the variable inductor L in Figure 2	21
Figure 4	– Test circuit for measurement of capacitance and power factor	32
Table 1	– Type test schedule	12
Table 2	– Test voltages	14
Table 3	– Torque	15
Table 4	– Minimum creepage distances and clearances	27
Table 5	– Type test schedule	30
Table 6	– Test voltages	31
Table 7	– Torque	34
Table 8	– Minimum creepage distances and clearances	40

AC MOTOR CAPACITORS –

Part 2: Motor start capacitors

1 Scope

This part of IEC 60252 applies to motor start capacitors intended for connection to windings of asynchronous motors supplied from a single-phase system having the frequency of the mains.

This standard covers impregnated or unimpregnated metallized motor start capacitors having a dielectric of paper or plastic film, or a combination of both and electrolytic motor start capacitors with non-solid electrolyte, with rated voltages up to and including 660 V.

2 Normative references

The following referenced documents are indispensable for the application 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 60062, *Marking codes for resistors and capacitors*

IEC 60068-2 (all parts), *Environmental testing – Part 2: Tests*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-20, *Environmental testing – Part 2-20: Tests – Test T: Soldering*

IEC 60068-2-21, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60112, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*

IEC 60309-1:1999, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*

☐A1 IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)* ☐A1

IEC 60695-2-10:2000, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

☐A1 ISO 4046:2002, *Paper, board, pulps and related terms – Vocabulary* ☐A1

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

motor running capacitor

power capacitor which, when used in conjunction with an auxiliary winding of a motor, assists the motor to start and improves the torque under running conditions

NOTE The running capacitor is usually connected permanently to the motor winding and remains in circuit throughout the running period of the motor. During the starting period, if it is in parallel with the starting capacitor, it helps to start the motor.

3.2

motor starting capacitor

power capacitor which provides a leading current to an auxiliary winding of a motor and which is switched out of circuit once the motor is running

3.3

metal foil capacitor

capacitor, whose electrodes consist of metal foils or strips separated by a dielectric

3.4

metallized capacitor

capacitor, in which the electrodes consist of a metallic deposit on the dielectric

3.5

self-healing capacitor

capacitor, whose electrical properties, after local breakdown of the dielectric, are rapidly and essentially self-restored

3.6

segmented film capacitor

metallised capacitor with a repeating pattern on the metallic deposit on at least one layer, designed to isolate sections of the capacitor in the event of localised faults occurring in the dielectric

3.7

discharge device of a capacitor

device which may be incorporated in a capacitor, capable of reducing the voltage between the terminals effectively to zero, within a given time, after the capacitor has been disconnected from a network

3.8

continuous operation

operation with no time limit within the normal life of the capacitor

3.9

intermittent operation

operation in which periods with the capacitor energized are followed by intervals during which the capacitor is unenergized

3.10

starting operation

special type of intermittent operation in which the capacitor is energized for only a very short period while the motor is accelerating to rated speed

3.11

rated duty cycle

rated value indicating the rate of intermittent or starting duty for which a capacitor is suitable

NOTE It is specified by the duty cycle duration, in minutes, and the percentage of the time during which the capacitor is energized.

3.12

duty cycle duration

total time of one energized and one unenergized interval during the intermittent operation

3.13

relative operation time

percentage of the cycle duration in which the capacitor is energized

3.14

capacitor for continuous and starting operation

capacitor designed to operate at one voltage when in continuous operation and at a different (usually higher) voltage when in starting operation

3.15

minimum permissible capacitor operating temperature

minimum permissible temperature on the outside of the case at the moment of switching on the capacitor

3.16

maximum permissible capacitor operating temperature

t_c
maximum permissible temperature of the hottest area of the outside of the capacitor case during operation

3.17

rated voltage of a capacitor

U_N
r.m.s. value of the alternating voltage for which the capacitor has been designed

3.18

maximum voltage

maximum r.m.s. voltage permissible at the starting capacitor terminals between the point of starting and the instant at which the capacitor is disconnected

3.19

rated frequency of a capacitor

f_N
highest frequency for which the capacitor has been designed

3.20

rated capacitance of a capacitor

C_N
capacitance value for which the capacitor has been designed

3.21

rated current of a capacitor

I_N
r.m.s. value of the alternating current at the rated voltage and frequency

3.22

rated output of a capacitor

Q_N
reactive power derived from the rated values of capacitance, frequency and voltage (or current)

3.23

capacitor losses

active power dissipated by a capacitor

NOTE Unless otherwise stated, the capacitor losses will be understood to include losses in fuses and discharge resistors forming an integral part of the capacitor.

3.24

tangent of loss angle (tan delta) of a capacitor

ratio between the equivalent series resistance and the capacitive reactance of a capacitor at specified sinusoidal alternating voltage and frequency

3.25

power factor

ratio between the active power and the apparent power of a capacitor

3.26

capacitive leakage current (only for capacitors with a metal case)

current flowing through a conductor connecting the metallic case to earth, when the capacitor is energized from an a.c. supply system with an earthed neutral

3.27

type of capacitor

capacitors are considered to be of the same type when of similar constructional form, the same constructional technology, same rated voltage, same climatic category and same kind of operation

NOTE 1 Capacitors of the same type can differ only in rated capacitance and size; minor differences between terminations and mounting devices are permitted.

NOTE 2 The same construction includes, for example, the same dielectric material, dielectric thickness and type of case (metal or plastic).

3.28

model of capacitor

capacitors are considered to be of the same model when they are of the same construction and have the same functional and dimensional characteristics within the tolerance limits and are consequently interchangeable

A1 3.29

class of safety protection

degree of safety protection identified by one of four codes to be marked on the capacitor

Note 1 to entry: This definition does not apply to electrolytic capacitors.

3.29.1

(S0) class of safety protection

degree of safety protection indicating that the capacitor type has no specific failure protection

Note 1 to entry: Formerly referred to as P0.

3.29.2

(S1) class of safety protection

degree of safety protection indicating that the capacitor type may fail in the open-circuit or short-circuit mode and is protected against fire or shock hazard

Note 1 to entry: Compliance is verified by the test described in 5.1.16.3 and 5.1.16.5.

Note 2 to entry: Formerly referred to as P1. **A1**

A1 3.29.3

(S2) class of safety protection

degree of safety protection indicating that the capacitor type has been designed to fail in the open-circuit mode only and is protected against fire or shock hazard.

Note 1 to entry: Compliance is verified by the test described in 5.1.16.3 and 5.1.16.5.

Note 2 to entry: Formerly referred to as P2.

3.29.4

(S3) class of safety protection

degree of safety protection indicating that the capacitor is of segmented film construction as defined in 3.6

Note 1 to entry: This capacitor type is required to fail with low residual capacitance ($<1\% C_N$) and has protection against fire and shock hazard. Compliance is verified by the test described in 5.1.16.4 and 5.1.16.6. **A1**

4 Service conditions

4.1 Normal service conditions

This standard gives requirements for capacitors intended for use under the following conditions:

- a) altitude: not exceeding 2 000 m;
- b) residual voltage at energization: shall not exceed 10 % rated voltage (see notes to 5.3.4 and 6.3.4);
- c) pollution: capacitors included in the scope of this standard are designed for operation in lightly polluted atmospheres;

NOTE The IEC has not yet established a definition for "lightly polluted". When this definition is established by the IEC, it will be incorporated in this standard.

- d) operating temperature: between $-40\text{ }^{\circ}\text{C}$ and $+100\text{ }^{\circ}\text{C}$ (see 3.15 and 3.16).

The preferred minimum and maximum permissible capacitor operating temperatures are as follows:

- minimum temperatures: $-40\text{ }^{\circ}\text{C}$, $-25\text{ }^{\circ}\text{C}$, $-10\text{ }^{\circ}\text{C}$ and $0\text{ }^{\circ}\text{C}$;
- maximum temperatures: $55\text{ }^{\circ}\text{C}$, $70\text{ }^{\circ}\text{C}$, $85\text{ }^{\circ}\text{C}$ and $100\text{ }^{\circ}\text{C}$.

Capacitors shall be suitable for transport and storage at temperatures down to $-25\text{ }^{\circ}\text{C}$, or the minimum operating temperature, whichever is the lower, without adverse effect on their quality;

- e) damp heat severity: between 4 days and 56 days. The preferred severity is 21 days.

(The damp heat severity shall be selected from the values indicated by IEC 60068-2-78, i.e.: 4 days, 10 days, 21 days and 56 days.)

Capacitors are classified in climatic categories defined by the minimum and maximum permissible capacitor operating temperatures and damp heat severity: i.e. 10/70/21 indicates that the minimum and the maximum permissible capacitor operating temperatures are $-10\text{ }^{\circ}\text{C}$ and $70\text{ }^{\circ}\text{C}$ and the damp heat severity is 21 days.

4.2 Preferred tolerances on capacitance

Preferred tolerances are as follows: $\pm 5\%$, $\pm 10\%$ and $\pm 15\%$.

Asymmetric tolerances are permitted but no tolerance shall exceed 15 %.

5 Self-healing motor start capacitors

5.1 Quality requirements and tests

5.1.1 Test requirements

5.1.1.1 General

This clause gives the test requirements for self-healing motor start capacitors.

5.1.1.2 Test conditions

Unless otherwise specified for a particular test or measurement, the temperature of the capacitor dielectric shall be in the range +15 °C to +35 °C and shall be recorded.

If corrections are necessary, the reference temperature shall be +20 °C.

NOTE It may be assumed that the dielectric temperature is the same as the ambient temperature, provided that the capacitor has been left in an unenergized state at this ambient temperature for an adequate period, depending on the size of the capacitor.

5.1.2 Nature of tests

The tests specified are of two sorts:

- a) type tests;
- b) routine tests.

5.1.2.1 Type tests

Type tests are intended to prove the soundness of the design of the capacitor and its suitability for operation under the conditions detailed in this standard.

Type tests are carried out by the manufacturer and/or the test authority if there is need for an approval.

These tests may be carried out under the supervision of a proper authority which will issue a certified record and/or type approval.

5.1.2.2 Routine tests

Routine tests shall be carried out by the manufacturer on every capacitor before delivery.

5.1.3 Type tests

5.1.3.1 Test procedure

The samples of each model selected for the type tests shall be divided into groups, as indicated in Table 1.

Capacitors forming the sample shall have successfully passed the routine tests indicated in 5.1.4.

Each test group shall contain equal numbers of capacitors of the highest capacitance and the lowest capacitance in the range.

The manufacturer shall provide data on the ratio of capacitance per outer total surface area of the case of each capacitance value in the range.

The capacitor with the maximum capacitance per unit surface area shall also be tested if this ratio exceeds that of the maximum capacitance value in the range by 10 % or more.

Similarly, the capacitor with the minimum capacitance per unit area shall also be tested if the ratio is less than that of the minimum capacitance value in the range by 10 % or more.

“Area” denotes total outer surface area of the capacitor case with the exception of small protrusions, terminals and fixing studs.

5.1.3.2 Extent of qualification

5.1.3.2.1 A type test on a single model qualifies only the model tested. When the type test is performed on two models of the same type but of different rated capacitance value, selected under the rules of 5.1.3.1, the qualification is valid for all models of the same type having rated capacitance between the two tested values.

5.1.3.2.2 The qualification tests carried out successfully on a capacitor model having a certain capacitance tolerance are valid also for capacitors of the same model but having a different capacitance tolerance of up to twice the limits of the declared tolerance. For example, $\pm 5\%$ would cover up to $\pm 10\%$, and $\pm 10\%$ would cover up to $\pm 20\%$. A smaller tolerance than the declared tolerance is not permitted. For example, a type approval for $\pm 10\%$ would not cover $\pm 5\%$.

5.1.3.2.3 Occasionally, in current practice, capacitors are required with a capacitance tolerance that is not symmetrical with respect to the rated capacitance value.

When a type test is carried out successfully on a capacitor model having a symmetrical capacitance tolerance, the relevant qualification is valid also for capacitors of the same model having a non-symmetrical capacitance provided that the total range of non-symmetrical tolerance is

- a) within the total range of capacitance allowed in 5.1.3.2.2,
- and
- b) greater than, or equal to, that of the tested capacitor model. For example, qualification for ± 5 would allow values such as $^{+10}_{-5}\%$, $^{+5}_{-10}\%$, $^{+8}_{-2}\%$, $^{+10}_0\%$ but not $^{+15}_{-5}\%$.

Table 1 – Type test schedule

Group	Tests	Subclause	Number of samples to be inspected a	Number of failures allowed in first test b	Number of failures allowed in retest
1	Visual examination Check markings Check of dimensions Mechanical tests (excluding soldering) Sealing tests (if applicable)	5.1.6 5.4 5.1.10 5.1.11 5.1.12	8 [4]	1 ^c	0
2	Endurance test	5.1.13	42 [21]	2 ^d	0
3	Soldering (if applicable) Damp heat test Voltage test between terminals Voltage test between terminals and case	5.1.11.2 5.1.14 5.1.7 5.1.8	12 [6]	1 ^c	0
4	Self-healing test (if applicable)	5.1.15	20 [10]	1 ^c	0
5	Destruction test (if marked on the capacitor)	5.1.16	20 [10] 10 [5]	1 ^e	0
6	Resistance to heat, fire and tracking (not applicable to capacitors with lead terminations)	5.1.17	3 (terminal housing only) ^f	0	