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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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UK Vote

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



22E/268/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER: IEC 63497 ED1	
DATE OF CIRCULATION: 2024-04-19	CLOSING DATE FOR COMMENTS: 2024-06-14
SUPERSEDES DOCUMENTS: 22E/248/NP, 22E/251A/RVN	

IEC SC 22E : STABILIZED POWER SUPPLIES	
SECRETARIAT: Germany	SECRETARY: Mr Clemens Klemm
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 22,SC 22H,TC 33,TC 77	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☒ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

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Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE [AC/22/2007](#) OR [NEW GUIDANCE DOC](#)).

TITLE: Parallel Connected Active Correction Devices (ACD)

NOTE FROM TC/SC OFFICERS: Note that to be more specific and in accordance with the scope of the the title has been changed from "Active Correction Devices (ACD)" to "Parallel Connected Active Correction Devices (ACD)".

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PARALLEL CONNECTED ACTIVE CORRECTION DEVICES (ACD)

FOREWORD

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IEC 6xxxx has been prepared by IEC technical committee 22E: Stabilized power supplies

The text is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/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 Technical Report 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 <http://www.iec.ch/standardsdev/publications>.

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

- 155 • reconfirmed,
- 156 • withdrawn,
- 157 • replaced by a revised edition, or
- 158 • amended.

159

INTRODUCTION

Equipment comprising power electronics circuits are typically non-linear loads. Such loads are increasingly frequent in all industrial, commercial and residential installations and their percentage in overall electrical consumption is growing steadily.

Examples include:

- Industrial equipment (welding machines, arc and induction furnaces, battery chargers, rectifiers like electrolyzers, etc.),
- Variable Speed Drives for AC or DC motors,
- some Uninterruptible Power Supplies.
- Electric Vehicle charging system

In power systems, non-linear loads are permanently connected, they generate permanent harmonics, whose effects are described in IEC TS 63191. The major consequences of harmonics are the increase of the r.m.s. current in the different circuits and the deterioration of the supply voltage quality. The negative impact may remain un-noticed, but economical results may be compromised:

- increased overloading on the electrical system, thereby limiting useable capacity,
- increased energy losses and demand power, reduction of Energy Efficiency,
- increased risks of outage,
- Overheating of equipment and cables in installation leading to reduction of equipment lifetime.
- Perturbation of some electronic systems

The following pictures present typical current waveforms for single-phase (Figure 1) and three-phase non-linear loads (Figure 2), measured by devices such as PMD compliant to IEC 61557-12 or PQI compliant to IEC 62586-1.

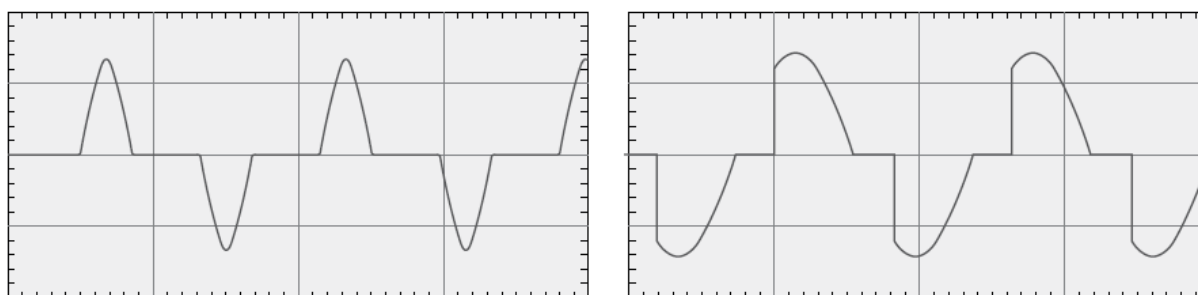


Figure 1 – Typical current waveforms for single-phase non-linear loads

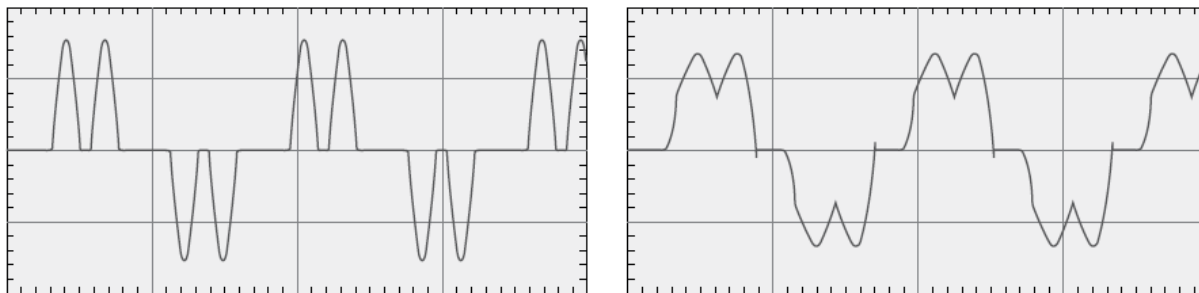


Figure 2 – Typical current waveforms for 3-phases non-linear loads

Active parallel connected filter is used in parallel with the load to minimize these distortions, in order to obtain a pure sinusoidal waveform.

1 Scope

This document specifies product performance, classification, and testing requirements related to Low Voltage (with rated system voltages not exceeding 1 000 V AC or 1 500 V DC) parallel-connected Active Correction Devices (ACD), except product safety requirements already covered by group safety publication IEC 62477-1:2022.

These devices can be single phase or multi-phases devices.

ACD includes both SVG (Static VAR Generator) and AHF (Active Harmonic Filter).

These devices can achieve the below functions:

- Active harmonics filtering;
- Reactive power compensation;
- Unbalanced Load compensation;
- Flicker compensation;
- Any combination of the above functions;

This document does not cover:

- Active mitigation functions part of another device (Variable Speed Drive, UPS, DVR, ...)
- Switched power capacitors
- Switched inductors
- Passive harmonic filters
- Energy storage converters
- Series-connected active correction devices

In case of hybrid devices, combining a passive harmonic filter and an ACD, the standard covers only the active part.

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 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-30, *Environmental testing – Part 2-30 – Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

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 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-57, *Environmental testing – Part 2-57: Tests – Test Ff: Vibration – Time-history method*

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

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61000-6-2:2016, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity for industrial environments*

IEC 61000-6-4:2018, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards - Emission standard for industrial environments*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62477-1:2022, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

3 Terms and definitions

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

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

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

3.1 Terms related to devices

3.1.1

SVG (Static Var Generator)

active device used for stepless reactive power compensation

Note to entry - SVG can be called EVC (Electronic VAR Compensator) or STATCOM (static Compensator)

3.1.2

AHF (Active Harmonics Filter)

Active device used for fundamental compensation and harmonic filtering

3.1.3

DVR

Dynamic Voltage Restorer

A system to mitigate the sags and swells in supply voltage

3.2 Terms related to device electrical parameters

3.2.1

Rated voltage

rated value of the voltage assigned by the manufacturer to a component, device or equipment and to which operation and performance characteristics are referred

Note 1 to entry: Equipment may have more than one rated voltage value or may have a rated voltage range.

Note 2 to entry: For three-phase power supply, the line-to-line voltage applies.

[SOURCE: IEC 442-09-10]

3.2.2

rated current

the current assigned by the manufacturer for a specified operating condition of an accessory

[SOURCE: IEC 442-01-02]

3.2.3

rated frequency

the frequency at which the device is designed to operate

3.2.4

harmonic Attenuation Factor

Ratio of amplitude of load harmonic current to grid harmonic current for a given harmonic order after application of ACD

3.2.5**operating range**

environmental conditions (temperature range, EMC environment, ...) and use conditions (voltage range, current range, ...) for which a device is able to perform its intended function(s)

3.3 Terms related to electrical phenomena**3.3.1****total harmonic ratio****total harmonic distortion****THD (abbreviation)THD**

ratio of the r.m.s. value of the harmonic content to the r.m.s. value of the fundamental component or the reference fundamental component of an alternating quantity

Note 1 to entry – The total harmonic ratio depends on the choice of the fundamental component. If it is not clear from the context which one is used an indication should be given.

Note 2 to entry – The total harmonic ratio may be restricted to a certain harmonic order. This is to be stated.

[SOURCE: IEC 551-20-13]

3.3.2**commutation notch**

a periodic voltage transient that may appear in the AC side voltage of a line or machine commutated converter due to the commutation

[SOURCE: IEC 551-16-06]

3.3.3**fundamental frequency**

frequency, in the spectrum obtained from a Fourier transform of a time function, to which all the frequencies of the spectrum are referred. For the purposes of this standard, the fundamental frequency is the same as the power supply frequency

Note 1 to entry – In the case of a periodic function, the fundamental frequency is generally equal to the frequency of the function itself.

Note 2 to entry – In case of any remaining risk of ambiguity, the power supply frequency should be referred to the polarity and speed of rotation of the synchronous generator(s) feeding the system.

Note 3 to entry – This definition may be applied to any industrial power supply network, without regard to the load it supplies (a single load or a combination of loads, rotating machines or other loads), and even if the generator feeding the network is a semiconductor converter.

[SOURCE: IEC 101-14-50]

3.3.4**fundamental component (or fundamental)**

component whose frequency is the fundamental frequency

[SOURCE: IEC 61000-2-4:2002]

3.3.5**harmonic frequency**

frequency which is an integer multiple of the fundamental frequency. The ratio of the harmonic frequency to the fundamental frequency is named harmonic order. (Recommended notation "h")

[SOURCE: IEC 61000-2-4:2002]

3.3.6**harmonic component**

any of the components having a harmonic frequency. Its value is normally expressed as an r.m.s. value

Note to entry - For brevity, such a component may be referred to simply as a harmonic

[SOURCE: IEC 61000-2-4:2002, modified, note to entry added]

3.3.7**interharmonic frequency**

any frequency which is not an integer multiple of the fundamental frequency

Note 1 to entry – By extension from harmonic order, the interharmonic order is the ratio of interharmonic frequency to the fundamental frequency. This ratio is not an integer. (Recommended notation "*m*")

Note 2 to entry – In the case where $m < 1$, the term sub-harmonic frequency may also be used.

[SOURCE: IEC 61000-2-4:2002]

3.3.8**interharmonic component**

component having an interharmonic frequency. Its value is normally expressed as an r.m.s. value.

Note 1 to entry – For the purpose of this standard, and as stated in IEC 61000-4-7, the time window has a width of 10 fundamental periods (for 50 Hz systems) or 12 fundamental periods (for 60 Hz systems), i.e. approximately 200 ms. The difference in frequency between two consecutive interharmonic components is, therefore, approximately 5 Hz.

Note 2 to entry - For brevity, such a component may be referred to simply as an interharmonic

[SOURCE: IEC 61000-2-4:2002, modified, note to entry added]

3.3.9**power factor**

under periodic conditions, ratio of the absolute value of the active power *P* to the apparent power *S*:

$$\lambda = |P|/S$$

$$\lambda = \frac{|P|}{S}$$

Note 1 to Entry – Under sinusoidal conditions, the power factor is the absolute value of the active factor.

[SOURCE: IEC 61000-2-4:2002, modified, note to entry added]

3.3.10**unbalanced state of a polyphase network**

the condition in which the voltages and/or currents in the phase conductors do not form balanced polyphase sets

[SOURCE: IEC 603-02-19]

3.3.11**flicker voltage range**

voltage fluctuations within a range of frequencies and amplitudes causing flicker to appear in the output of certain lighting equipment

3.3.12**negative (sequence) component (of a three-phase system)**

one of the three symmetrical sequence components which exists only in an unsymmetrical three-phase system of sinusoidal quantities and which is defined by the following complex mathematical expression:

$$X_2 = 1/3(X_{L1} + a^2 X_{L2} + a X_{L3})$$

where a is the 120 degree operator, and X_{L1} , X_{L2} and X_{L3} are the complex expressions of the phase quantities concerned, and where X denotes the system current or voltage phasors

[SOURCE IEC 448 448-11-28]

3.3.13**zero (sequence) component (of a three-phase system)**

one of the three symmetrical sequence components which exists only in an unsymmetrical three-phase system of sinusoidal quantities and which is defined by the following complex mathematical expression:

$$X_0 = 1/3 (X_{L1} + X_{L2} + X_{L3})$$

where X_{L1} , X_{L2} and X_{L3} are the complex expressions of the phase quantities concerned, and where X denotes the system current or voltage phasors

[SOURCE IEC 448-11-29]

3.3.14**positive (sequence) component (of a three-phase system)**

one of the three symmetrical sequence components which exists in symmetrical and unsymmetrical three-phase system(s) of sinusoidal quantities and which is defined by the following complex mathematical expression:

$$X_1 = 1/3(X_{L1} + a X_{L2} + a^2 X_{L3})$$

where a is the 120 degree operator, and X_{L1} , X_{L2} and X_{L3} are the complex expressions of the phase quantities concerned, and where X denotes the system current or voltage phasors

[SOURCE IEC 448-11-27]

3.3.15**Unbalance factor**

in a three-phase system, degree of unbalance expressed by the ratio (in per cent) of the rms values of the negative sequence component (or the zero sequence component) to the positive sequence component of the fundamental component of the voltage or the electric current

[SOURCE IEC 614-01-33]

3.3.16**Attenuation Factor****AF_h**

ratio of the load-side current to the grid-side (filtered) current for a specific harmonic frequency h

3.3.17**Filtering efficiency** **η_h**

ratio of the ACD current to the load-side current for a specific harmonic frequency h , usually expressed in percent