

INTERNATIONAL STANDARD

Shunt-connected active correction devices (ACD)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Shunt-connected active correction devices (ACD)

FOREWORD

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

Draft	Report on voting
22E/301/FDIS	22E/306/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.

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INTRODUCTION

Loads with non-linear behaviour, causing power quality issues, are increasingly frequent in all industrial, commercial and residential installations, and their percentage in overall electrical consumption is growing steadily.

This type of loads can be found in

- industrial equipment (welding machines, arc and induction furnaces, battery chargers, rectifiers like electrolysers, etc.),
- variable speed drives (VSD) for AC or DC motors,
- uninterruptible power supplies, and
- electric vehicle charging system.

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

- increased overloading on the electrical system, thereby limiting usable capacity;
- increased energy losses;
- increased risks of outage;
- overheating of equipment and cables in installation leading to reduction of equipment lifetime;
- perturbation of some electronic systems.

Figure 1 and Figure 2 present typical current waveforms for single-phase and three-phase non-linear loads respectively, measured by devices such as power metering and monitoring devices (PMD) compliant to IEC 61557-12 or power quality instruments (PQI) compliant to IEC 62586-1.

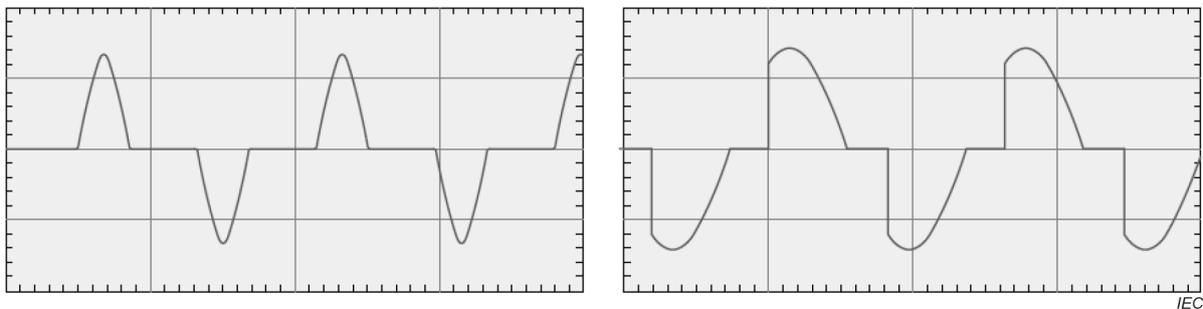


Figure 1 – Typical current waveforms for single-phase non-linear loads

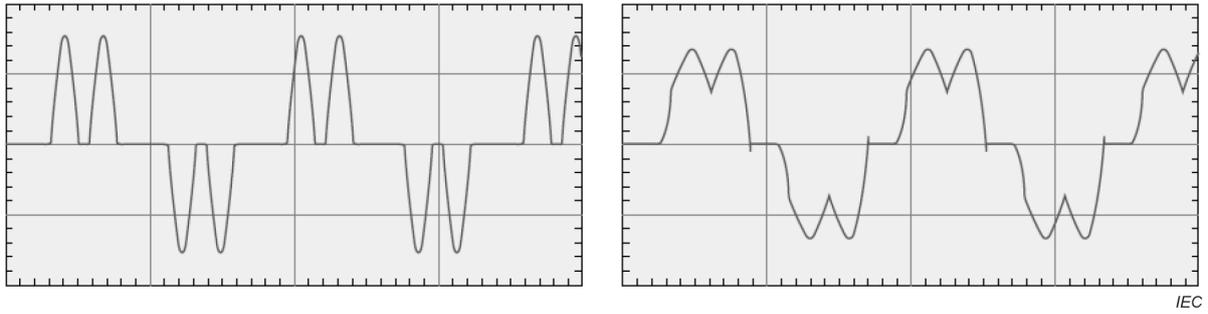


Figure 2 – Typical current waveforms for three-phase non-linear loads

A shunt-connected active correction device is used in parallel with the load to minimize these distortions, in order to obtain an approximately sinusoidal waveform.

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1 Scope

This document, which is a product standard, is intended to specify the EMC, performance and safety requirements of shunt-connected active correction devices (ACD) with rated system voltages not exceeding 1 000 V AC or 1 500 V DC.

These devices can be either cord or permanently connected. They can be movable, stationary, or fixed devices.

An ACD includes both a static VAR generator (SVG) and an active harmonic filter (AHF).

The primary function of a shunt connected ACD is to do one or more of the following:

- active harmonic filtering;
- reactive power compensation;
- unbalanced load compensation.

Additional functions of a shunt-connected ACD, not addressed by this document, can be the following:

- flicker compensation;
- interharmonic component filtering.

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

This document does not cover

- active mitigation functions part of another device (variable speed drive, uninterruptible power supply, dynamic voltage restorer, etc.),
- switched power capacitors,
- switched inductors,
- passive harmonic filters,
- energy storage converters, and
- series-connected active correction devices.

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 60364-1, *Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, and definitions*

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

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests*

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

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

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

3 Terms, definitions and abbreviated terms

3.1 Terms related to devices

For the purposes of this document, the terms and definitions given in IEC 62477-1 and the following 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>

3.1.1

static var generator

SVG

active device mainly used either for stepless reactive power compensation or load balancing, or both

Note 1 to entry: An SVG can be called an EVC (electronic VAR compensator) or a STATCOM (static synchronous compensator).

3.1.2

active harmonics filter

AHF

active device used for harmonic filtering and possibly either stepless reactive power compensation or load balancing, or both

Note 1 to entry: An AHF can be called an APF (active power filter).

3.1.3

dynamic voltage restorer

DVR

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 can have more than one rated voltage value or can have a rated voltage range.

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

[SOURCE: IEC 60050-442:2014, 442-09-10]

3.2.2

rated current

RMS current assigned by the manufacturer for a specified operating condition of a device

[SOURCE: IEC 60050-442:1998, 442-01-02, modified – "RMS" added and "accessory" replaced with "device".]

3.2.3

rated frequency

frequency at which the device is designed to operate

[SOURCE: IEC 60050-421:1990, 421-04-03, modified – "transformer or reactor" replaced with "device".]

3.2.4

operating range

environmental conditions and use conditions for which a device is able to perform its intended function(s)

Note 1 to entry: Environmental conditions can be temperature, range, EMC environment, etc. Use conditions can be voltage range, current range, etc.

3.3 Terms related to electrical phenomena

3.3.1

total harmonic ratio

total harmonic distortion

THD

ratio of the RMS value of the harmonic content to the RMS 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 60050-551:2001, 551-20-13]

3.3.2

commutation notch

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

[SOURCE: IEC 60050-551:1998, 551-16-06]

3.3.3

fundamental frequency

frequency of the fundamental component

[SOURCE: IEC 60050-551:2001, 551-20-03]