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BSI Standards Publication

Electromagnetic compatibility (EMC)

Part 1–7: General — Power factor in single-phase systems under non-sinusoidal conditions

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The UK participation in its preparation was entrusted to Technical Committee GEL/210, EMC - Policy committee.

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

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TECHNICAL REPORT

Electromagnetic compatibility (EMC) – Part 1-7: General – Power factor in single-phase systems under non-sinusoidal conditions

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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IEC TR 61000-1-7, which is a Technical Report, has been prepared by subcommittee 77A: *EMC – Low frequency phenomena,* of IEC technical committee 77*: Electromagnetic compatibility*.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
77A/911/DTR	77A/920/RVC

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

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

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

0.1 Series overview

IEC 61000 is published in separate parts, according to the following structure:

Part 1: General

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment

Description levels

Classification of the environment

Compatibility levels

Part 3: Limits

Emission limits

Immunity limits (in so far as they do not fall under the responsibility of the product committees)

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

Mitigation methods and devices

Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into sections which are to be published either as international standards, technical specifications, or as technical reports.

These standards and reports will be published in chronological order and numbered accordingly (for example, 61000-6-1).

0.2 Purpose of this document

The prevalence of loads drawing non-sinusoidal current from power systems requires clarification of such concepts as power and power factor, in order to avoid confusion due to

implied assumptions of sinusoidal voltage and current. This document specifically addresses the terms related to the power factor of equipment that are applicable regardless of the voltage and current waveforms.

When voltages and currents on power supply networks are perfectly sinusoidal, cos φ corresponds to the power factor. But this is not true anymore when electric quantities are distorted. In some existing documents, cos φ is still used as power factor, leading to an incorrect assessment of the equipment impact to supply networks.

The purpose of this Technical Report is to give clear information on both components in the power factor:

- the fundamental power factor, which is due to the phase difference between the voltage and current at the fundamental frequency (cos φ_1), and
- the non-fundamental power factor, which is related to the distortion of the voltage and/or current.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

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1 Scope

This part of IEC 61000, which is a Technical Report, provides definitions of various electrical power quantities and the relationship between them under non-sinusoidal conditions, in order to give clear information on both components in the power factor: the fundamental power factor, which is due to the phase difference between the voltage and current at the fundamental frequency, and the non-fundamental power factor, which is related to the distortion of the voltage and/or current. This Technical Report is applicable only to single-phase systems.

This Technical Report provides definitions for the three following cases:

- the general case where the voltage and current are both distorted (Clause 5),
- the case where the voltage is assumed to be sinusoidal and the current is only distorted with harmonic components (Clause 6),
- the particular case where the voltage and current are both sinusoidal (Annex A).

Annex B gives information on the fundamental active factor, which is used to describe the behaviour of a piece of equipment as a load or a generator.

2 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.

Void.

3 Terms and definitions

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

3.1
root-mean-square value
r.m.s. value
effective value
for a time-dependent quantity, positive square root of the mean value of the square of the quantity taken over a given time interval

Note 1 to entry: The root-mean-square value of a periodic quantity is usually taken over an integration interval the range of which is the period multiplied by a natural number.

Note 2 to entry: For a sinusoidal quantity $a(t) = \hat{A}\cos(\omega t + \vartheta_0)$, the root-mean-square value is $A_{\text{eff}} = \hat{A}/\sqrt{2}$.

Note 3 to entry: The root-mean-square value of a quantity may be denoted by adding one of the subscripts eff or rms to the symbol of the quantity.