

TECHNICAL REPORT

BASIC EMC PUBLICATION

**Electromagnetic compatibility (EMC) –
Part 3-7: Limits – Assessment of emission limits for the connection of
fluctuating installations to MV, HV and EHV power systems**

[IEC TR 61000-3-7:2008](#)

<https://standards.iteh.ai/catalog/standards/sist/1c27e49e-2630-431d-be19-40d9acc22093/iec-tr-61000-3-7-2008>





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CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
ACKNOWLEDGMENT.....	8
1 Scope.....	9
2 Normative references	10
3 Terms and definitions	10
4 Basic EMC concepts related to voltage fluctuations.....	13
4.1 Compatibility levels	14
4.2 Planning levels.....	14
4.2.1 Indicative values of planning levels.....	14
4.2.2 Assessment procedure for evaluation against planning levels.....	15
4.3 Illustration of EMC concepts.....	16
4.4 Emission levels	17
5 General principles	18
5.1 Stage 1: simplified evaluation of disturbance emission	18
5.2 Stage 2: emission limits relative to actual system characteristics.....	18
5.3 Stage 3: acceptance of higher emission levels on a conditional basis.....	19
5.4 Responsibilities	19
6 General guidelines for the assessment of emission levels.....	19
6.1 Point of evaluation.....	19
6.2 Definition of flicker emission level.....	20
6.3 Assessment of flicker emission levels.....	20
6.4 Declared system short circuit power or impedance	21
6.4.1 Short-circuit power or impedance for pre-connection assessment of emission levels.....	21
6.4.2 Short-circuit power or impedance for assessing actual emission levels.....	21
6.5 General guidelines for assessing the declared system impedance.....	21
7 General summation law	21
8 Emission limits for fluctuating installations connected to MV systems	22
8.1 Stage 1: simplified evaluation of disturbance emission	22
8.2 Stage 2: emission limits relative to actual system characteristics.....	23
8.2.1 Global emission to be shared between the customers.....	23
8.2.2 Individual emission limits.....	24
8.3 Stage 3: acceptance of higher emission levels on a conditional basis.....	25
8.4 Summary diagram of the evaluation procedure.....	26
9 Emission limits for fluctuating installations connected to HV or EHV systems	28
9.1 Stage 1: simplified evaluation of disturbance emission	28
9.2 Stage 2: emission limits relative to actual system characteristics.....	28
9.2.1 Assessment of the total available power	28
9.2.2 Individual emission limits.....	29
9.3 Stage 3: acceptance of higher emission levels on a conditional basis.....	30
10 Rapid voltage changes	31
10.1 General considerations.....	31
10.2 Compatibility level	32

10.3	Planning levels	32
10.4	Emission limits	33
10.5	Assessment procedure for evaluation against planning levels & emission limits	33
Annex A (informative)	$P_{st} = 1$ curves and numerical data for 230 V and 120 V applications	34
Annex B (informative)	Guidelines on the assessment of flicker transfer coefficient.....	36
Annex C (informative)	Example of reallocation of global contributions and planning levels considering transfer coefficients.....	37
Annex D (informative)	The use of the severity indicators A_{st} and A_{lt} to simplify calculations.....	39
Annex E (informative)	Pre-connection and post-connection assessment of emission for P_{st}	40
Annex F (informative)	Addition of P_{st} from different busbars.....	49
Annex G (informative)	Examples of case studies	51
Annex H (informative)	List of symbols and subscripts	62
Bibliography.....		64
Figure 1 – Illustration of basic voltage quality concepts with time/ location statistics covering the whole system.....		17
Figure 2 – Illustration of basic voltage quality concepts with time statistics relevant to one site within the whole system.....		17
Figure 3 – Example of a system for sharing global contributions at MV.....		23
Figure 4 – Diagram of evaluation procedure.....		27
Figure 5 – Determination of S_t for a simple HV or EHV system.....		28
Figure 6 – Determination of S_t for a meshed HV or EHV system		29
Figure 7 – Equivalent circuit and vector diagram for simple assessments		31
Figure 8 – Example rapid voltage change associated with motor starting		31
Figure 9 – Example rapid voltage change associated with capacitor switching		32
Figure A.1 – $P_{st} = 1$ curve for regular rectangular voltage changes [13].....		34
Figure E.1 – Shape factor curve for pulse and ramp changes		41
Figure E.2 – Shape factor curves for double-step and double-ramp changes		42
Figure E.3 – Shape factor curves for sinusoidal and triangular changes.....		42
Figure E.4 – Shape factor curves for aperiodic changes		43
Figure E.5 – Accounting for network loading		45
Figure E.6 – System for flicker emission assessment.....		47
Figure E.7 – Assessment of emission level using current measurements		48
Figure F.1 – Example of two loads fed from different busbars		49
Figure G.1 – Example of effect from a rolling mill		51
Figure G.2 – Example of effect of multiple spot welder load		53
Figure G.3 – Example profile of winder reactive power levels.....		57
Figure G.4 – Normal system configuration		58
Figure G.5 – Busbars coupled.....		59

Figure G.6 – "n-1" system configuration 60

Figure G.7 – Operation without SVC 61

Table 1 – Compatibility levels for flicker in low voltage systems reproduced from IEC 61000-2-2 14

Table 2 – Indicative values of planning levels for flicker in MV, HV and EHV power systems 15

Table 3 – Stage 1 limits for the relative changes in power as a function of the number of changes per minute 22

Table 4 – Minimum emission limits at MV 25

Table 5 – Minimum emission limits at HV-EHV 30

Table 6 – Indicative planning levels for rapid voltage changes as a function of the number of such changes in a given period 33

Table A.1 – Input relative voltage fluctuation $\Delta V/V$ for $P_{St}=1,0$ at output [13] 34

Table B.1 – Example of flicker transfer coefficients 36

Table D.1 – Compatibility levels for A_{St} and A_{It} in LV and MV power systems 39

Table D.2 – Indicative values of planning levels for A_{St} and A_{It} in MV, HV and EHV power systems 39

Table G.1 – Flicker measurements for example G.3, flicker effects, normal operation 56

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –**Part 3-7: Limits –
Assessment of emission limits for the connection of fluctuating
installations to MV, HV and EHV power systems**

FOREWORD

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IEC/TR 61000-3-7, which is a technical report, has been prepared by subcommittee 77A: Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

This Technical Report forms Part 3-7 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107 [17].¹

This second edition cancels and replaces the first edition published in 1996 and constitutes a technical revision.

¹ Figures in square brackets refer to the bibliography.

This new edition is significantly more streamlined than the original technical report (Edition 1), and reflects the experiences gained in the application of the first edition. This technical report has also been harmonised with IEC/TR 61000-3-6 [18] and IEC/TR 61000-3-13 [19].

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

Enquiry draft	Report on voting
77A/576/DTR	77A/615/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.

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

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

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

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- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

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 of the environment

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 product committees)

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

[IEC TR 61000-3-7:2008](#)

Mitigation methods and devices

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Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts published either as International Standards or as technical specifications or technical reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

ACKNOWLEDGMENT

In 2002, the IEC subcommittee 77A made a request to CIGRE Study Committee C4 and CIRED Study Committee S2, to organize an appropriate technical forum (joint working group) whose scope was to prepare, among other tasks, the revision of the Technical Report IEC 61000-3-7 concerning emission limits for the connection of fluctuating installations to public supply systems at MV, HV and EHV.

To this effect, Joint Working Group CIGRE C4.103/ CIRED entitled "*Emission Limits for Disturbing Installations*" was appointed in 2003. Some previous work produced by CIGRE JWG C4.07-CIRED has been used as an input to the revision, in particular the planning levels and associated indices, along with the experience since the technical report IEC 61000-3-7 was initially published in 1996.

Subsequent endorsement of the document by IEC was the responsibility of SC 77A.

It may also be worthwhile mentioning that another CIGRE Working Group is currently preparing a Technical Report for reviewing the flicker measurement results available internationally along with the flicker propagation characteristics in systems and the related objectives (flicker levels).

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-7: Limits – Assessment of emission limits for the connection of fluctuating installations to MV, HV and EHV power systems

1 Scope

This part of IEC 61000 provides guidance on principles which can be used as the basis for determining the requirements for the connection of fluctuating installations to MV, HV and EHV public power systems (LV installations are covered in other IEC documents). For the purposes of this report, a fluctuating installation means an installation (which may be a load or a generator) that produces voltage flicker and / or rapid voltage changes. The primary objective is to provide guidance to system operators or owners on engineering practices which will facilitate the provision of adequate service quality for all connected customers. In addressing installations, this document is not intended to replace equipment standards for emission limits.

This report addresses the allocation of the capacity of the system to absorb disturbances. It does not address how to mitigate disturbances, nor does it address how the capacity of the system can be increased.

Since the guidelines outlined in this report are necessarily based on certain simplifying assumptions, there is no guarantee that this approach will always provide the optimum solution for all flicker situations. The recommended approach should be used with flexibility and engineering judgment as far as engineering is concerned, when applying the given assessment procedures in full or in part.

The system operator or owner is responsible for specifying requirements for the connection of fluctuating installations to the system. The fluctuating installation is to be understood as the customer's complete installation (i.e. including fluctuating and non fluctuating parts).

Problems related to voltage fluctuations fall into two basic categories:

- Flicker effect from light sources as a result of voltage fluctuations;
- Rapid voltage changes even within the normal operational voltage tolerances are considered as a disturbing phenomenon.

The report gives guidance for the coordination of the flicker emissions between different voltage levels in order to meet the compatibility levels at the point of utilisation. This report primarily focuses on controlling or limiting flicker, but a clause is included to address the limitation of rapid voltage changes.

NOTE The boundaries between the various voltage levels may be different for different countries (see IEV 601-01-28) [16]. This report uses the following terms for system voltage:

- low voltage (LV) refers to $U_n \leq 1 \text{ kV}$;
- medium voltage (MV) refers to $1 \text{ kV} < U_n \leq 35 \text{ kV}$;
- high voltage (HV) refers to $35 \text{ kV} < U_n \leq 230 \text{ kV}$;
- extra high voltage (EHV) refers to $230 \text{ kV} < U_n$.

In the context of this report, the function of the system is more important than its nominal voltage. For example, a HV system used for distribution may be given a "planning level" which is situated between those of MV and HV systems.

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 60050(161), *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*

3 Terms and definitions

For the purpose of this part of IEC 61000, the following definitions apply as well as the definitions in IEC 60050(161).

3.1

agreed power

value of the apparent power of the disturbing installation on which the customer and the system operator or owner agree. In the case of several points of connection, a different value may be defined for each connection point

3.2

customer

a person, company or organization that operates an installation connected to, or entitled to be connected to, a supply system by a system operator or owner

3.3

(electromagnetic) disturbance IEC TR 61000-3-7:2008

any electromagnetic phenomenon which, by being present in the electromagnetic environment, can cause electrical equipment to depart from its intended performance

3.4

disturbance level

the amount or magnitude of an electromagnetic disturbance measured and evaluated in a specified way

3.5

electromagnetic compatibility (EMC)

ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

NOTE 1 Electromagnetic compatibility is a condition of the electromagnetic environment such that, for every phenomenon, the disturbance emission level is sufficiently low and immunity levels are sufficiently high so that all devices, equipment and systems operate as intended.

NOTE 2 Electromagnetic compatibility is achieved only if emission and immunity levels are controlled such that the immunity levels of the devices, equipment and systems at any location are not exceeded by the disturbance level at that location resulting from the cumulative emissions of all sources and other factors such as circuit impedances. Conventionally, compatibility is said to exist if the probability of the departure from intended performance is sufficiently low. See Clause 4 of IEC 61000-2-1 [20].

NOTE 3 Where the context requires it, compatibility may be understood to refer to a single disturbance or class of disturbances.

NOTE 4 Electromagnetic compatibility is a term used also to describe the field of study of the adverse electromagnetic effects which devices, equipment and systems undergo from each other or from electromagnetic phenomena.

3.6

(electromagnetic) compatibility level

specified electromagnetic disturbance level used as a reference level in a specified environment for coordination in the setting of emission and immunity limits

NOTE By convention, the compatibility level is chosen so that there is only a small probability (for example 5%) that it will be exceeded by the actual disturbance level.

3.7

emission

phenomenon by which electromagnetic energy emanates from a source of electromagnetic disturbance

[IEV 161-01-08 modified]

NOTE For the purpose of this report, emission refers to phenomena or conducted electromagnetic disturbances that can cause flicker or fluctuations of the supply voltage.

3.8

emission level

level of a given electromagnetic disturbance emitted from a particular device, equipment, system or disturbing installation as a whole, assessed and measured in a specified manner

3.9

emission limit

maximum emission level specified for a particular device, equipment, system or disturbing installation as a whole

3.10

flicker

impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time

NOTE Flicker is the effect on the incandescent lamps while the electromagnetic phenomenon causing it is referred as voltage fluctuations.

3.11

fluctuating installation

an electrical installation as a whole (i.e. including fluctuating and non-fluctuating parts) which is characterized by repeated or sudden power fluctuations, or start-up or inrush currents which can produce flicker or rapid voltage changes on the supply system to which it is connected

NOTE For the purpose of this report, all references to fluctuating installations not only include loads, but also generating plants.

3.12

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 purpose of this technical report, the fundamental frequency is the same as the power supply frequency

NOTE In the case of a periodic function, the fundamental frequency is generally equal to the frequency of the function itself.

3.13

generating plant

any equipment that produces electricity together with any directly connected or associated equipment such as a unit transformer or converter

3.14**immunity (to a disturbance)**

ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

3.15**immunity level**

maximum level of a given electromagnetic disturbance on a particular device, equipment or system for which it remains capable of operating with a declared degree of performance

3.16**interharmonic frequency**

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

NOTE 1 By extension from harmonic order, the interharmonic order is the ratio of the interharmonic frequency to the fundamental frequency. This ratio is not an integer (recommended notation “m”).

NOTE 2 In the case where $m < 1$ the term subharmonic frequency may be used.

3.17**interharmonic component**

component having an interharmonic frequency. For brevity, such a component may be referred to simply as an “interharmonic”

3.18**normal operating conditions**

operating conditions of the system or of the disturbing installation typically including all generation variations, load variations and reactive compensation or filter states (e.g. shunt capacitor states), planned outages and arrangements during maintenance and construction work, non-ideal operating conditions and normal contingencies under which the considered system or disturbing installation has been designed to operate

NOTE Normal system operating conditions typically exclude: conditions arising as a result of a fault or a combination of faults beyond that planned for under the system security standard, exceptional situations and unavoidable circumstances (for example: force majeure, exceptional weather conditions and other natural disasters, acts by public authorities, industrial actions), cases where system users significantly exceed their emission limits or do not comply with the connection requirements, and temporary generation or supply arrangements adopted to maintain supply to customers during maintenance or construction work, where otherwise supply would be interrupted

3.19**planning level**

level of a particular disturbance in a particular environment, adopted as a reference value for the limits to be set for the emissions from the installations in a particular system, in order to coordinate those limits with all the limits adopted for equipment and installations intended to be connected to the power supply system

NOTE Planning levels are considered internal quality objectives to be specified at a local level by those responsible for planning and operating the power supply system in the relevant area.

3.20**point of common coupling (PCC)**

point in the public system which is electrically closest to the installation concerned and to which other installations are or may be connected. The PCC is a point located upstream of the considered installation

NOTE A supply system is considered as being public in relation to its use, and not its ownership.

3.21**point of connection (POC)**

point on a public power supply system where the installation under consideration is, or can be connected

NOTE A supply system is considered as being public in relation to its use, and not its ownership.

3.22

point of evaluation (POE)

point on a public power supply system where the emission levels of a given installation are to be assessed against the emission limits. This point can be the point of common coupling (PCC) or the point of connection (POC) or any other point specified by the system operator or owner or agreed upon

NOTE A supply system is considered as being public in relation to its use, and not its ownership.

3.23

rapid voltage changes

changes in fundamental frequency r.m.s. voltages over several cycles; rapid voltage changes could also be in the form of cyclic changes

NOTE Rapid voltage changes are often caused by start-ups, inrush currents or switching operation of equipment.

3.24

short circuit power

theoretical value expressed in MVA of the initial symmetrical three-phase short-circuit power at a point on the supply system. It is defined as the product of the initial symmetrical short-circuit current, the nominal system voltage and the factor $\sqrt{3}$ with the aperiodic component (DC) being neglected

3.25

spur

a feeder branch off a main feeder (typically applied on MV and LV feeders)

3.26

supply system

all the lines, switchgear and transformers operating at various voltages which make up the transmission systems and distribution systems to which customers' installations are connected

3.27

system operator or owner

entity responsible for making technical connection agreements with customers who are seeking connection of load or generation to a distribution or transmission system

3.28

transfer coefficient (influence coefficient)

the relative level of disturbance that can be transferred between two busbars or two parts of a power system for various operating conditions

3.29

voltage fluctuations

a series of voltage changes or a cyclic variation of the voltage envelope

4 Basic EMC concepts related to voltage fluctuations

The international flickermeter (see IEC 61000-4-15 [1])² provides two quantities to characterize the flicker severity: P_{st} ("st" referring to "short term": one value is obtained for each 10 min period) and P_{lt} ("lt" referring to "long term": one value is obtained for each 2 h period). The flicker related voltage quality criteria are generally expressed in terms of P_{st} and/or P_{lt} , with P_{lt} typically being derived from groups of 12 consecutive P_{st} values.

² Figures in square brackets refer to the bibliography.