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TECHNICAL SPECIFICATION

colour inside

Adjustable speed electrical power drive systems – Part 8: Specification of voltage on the power interface

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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Adjustable speed electrical power drive systems – Part 8: Specification of voltage on the power interface

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

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FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 61800-8, is a technical specification, which has been prepared by subcommittee SC 22G: Adjustable speed electric drive systems incorporating semiconductor power converters, of IEC technical committee TC 22: Power electronic systems and equipment.

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

Enquiry draft	Report on voting
22G/207/DTS	22G/215/RVC

Full information on the voting for the approval of this technical specification 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 of IEC 61800 series, under the general title *Adjustable speed electrical power drive systems* 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 web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

ADJUSTABLE SPEED ELECTRICAL POWER DRIVE SYSTEMS –

Part 8: Specification of voltage on the power interface

1 Scope

This part of IEC 61800 gives the guidelines for the determination of voltage on the power interface of power drive systems (PDS's).

NOTE The power interface, as defined in the IEC 61800 series, is the electrical connection used for the transmission of the electrical power between the converter and the motor(s) of the PDS.

The guidelines are established for the determination of the phase to phase voltages and the phase to ground voltages at the converter and at the motor terminals.

These guidelines are limited in the first issue of this document to the following topologies with three phase output

- indirect converter of the voltage source type, with single phase diode rectifier as line side converter;
- indirect converter of the voltage source type, with three phase diode rectifier as line side converter;
- indirect converter of the voltage source type, with three phase active line side converter.

All specified inverters in this issue are of the pulse width modulation type, where the individual output voltage pulses are varied according to the actual demand of voltage versus time integral.

Other topologies are excluded of the scope of this International Specification.

Safety aspects are excluded from this Specification and are stated in IEC 61800-5 series. EMC aspects are excluded from this Specification and are stated in IEC 61800-3.

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 61000-2-4, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

3 Overview and terms and definitions

3.1 Overview of the system

A power drive system (PDS) consists of a motor and a complete drive module (CDM). It does not include the equipment driven by the motor. The CDM consists of a basic drive module (BDM) and its possible extensions such as the feeding section or some auxiliaries (e.g. ventilation). The BDM contains converter, control and self-protection functions. Figure 1 shows the boundary between the PDS and the rest of the installation and/or manufacturing process. If the PDS has its own dedicated transformer, this transformer is included as a part of the CDM.

For this document the following agreement for all symbols is set, that:

- the index "head" means the peak value and
- the index "star" means bipolar value.

For a given drive topology, the voltage waveform patterns between the later defined sections are in principal constant as shape (including peak values), while their amplitudes depend on the suited operating voltages, assumed as reference values in each section.

Depending on the considered section interface and on the nature of the examined voltages (differential or common mode quantities), the reference voltages between sections are average DC or RMS fundamental AC quantities.

The actual voltage values shown between sections in the differential mode model and in the common mode model are evaluated as peak values: they are obtained starting from the corresponding reference values, multiplied by suited factors including the effect of the overvoltage phenomena.

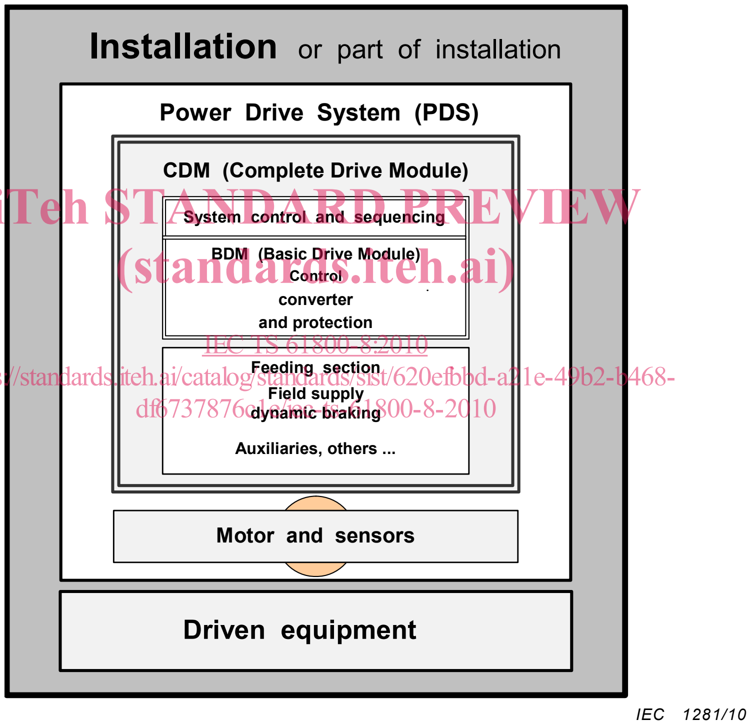

Figure 1 – Definition of the installation and its content

3.2 Terms and definitions

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

3.2.1
power interface
connections needed for the distribution of electrical power within the PDS

[IEC 61800-3:2004, 3.3.11]

3.2.2
two-port network
two-port network (or four-terminal network, or quadripole) is an electrical circuit or device with two pairs of terminals

3.2.3
converter reference point
NP
NP is the reference point of the converter (V_{D+} + V_{D-}) / 2. The converter reference point can be dedicated for the different topologies. The voltage from NP to ground is generally a common mode voltage

3.2.4
DC link
power DC circuit linking the input converter and the output converter of an indirect converter, consisting of capacitors and/or reactors to reduce DC voltage and/or DC current ripple

3.2.5
DC link voltages
V_d, V_{d+}, V_{d-}
DC link voltage of the converter section. V_{d+} means the positive potential; V_{d-} means the negative potential

3.2.6
f_0
filter resonance frequency

3.2.7
f_1
fundamental frequency of the inverter output voltage

3.2.8
f_P
pulse frequency of the phase

3.2.9
f_S
fundamental frequency of the supply voltage system

3.2.10
f_{sw}
switching frequency of each semiconductor active device

3.2.11
ideal ground
ideal ground is the earth reference point of the installation

3.2.12
$k_{C\mu}$
amplifying factors of the related section in the common mode model (peak values)

3.2.13
k_{Dv}
amplifying factors of the related sections in the differential mode model (peak values)

3.2.14
number of levels N
number of levels N is equal to the number of possible voltages of the output phase to NP-Potential

3.2.15
n_{dcmult}
number of DC links per phase of the multi DC link inverter topology

3.2.16
system star point
SP
SP is the reference point of the inverter output. The system star point can be dedicated at different system points. It is used to define the common mode voltage of a three phase system against ideal ground

3.2.17
rise time
$\mathbf{t_r}$
rise time of the voltage is defined between 10 % to 90 % of the voltage transient peak equal to t_{90}-t_{10} (see Figure 2)

3.2.18
overshoot voltage
$\mathbf{V_B}$
amount of voltage that exceeds the steady state value of a voltage step "V_{step}" (see Figure 2)

3.2.19
grounding potential
$\mathbf{V_{Gi}}$
reference potential to ground at the individual section i sometimes the phrase "earth potential" or "earthing" may be used in the same content.

3.2.20
$\mathbf{V_{PP}}$
phase to phase voltage

3.2.21
$\mathbf{V_{PNP}}$
phase to NP voltage at the inverter output

3.2.22
$\mathbf{V_{PSP}}$
phase to star point voltage at the inverter output

3.2.23
$\mathbf{V_{PG,\ motor}}$
phase to ground voltage at the motor terminals.

3.2.24
$V_{PP,\ motor}$
phase to phase voltage at the motor terminals

3.2.25
$\hat{V}_{PP}$
peak value of the phase to phase voltage:

$\hat{V}_{PP} = V_{step} + V_B$ (example for the two level case)

3.2.26
$\hat{V}_{PP^*}$
peak value between two bipolar peak voltages

3.2.27
$\hat{V}_{PP\_fp^*}$
peak value of the phase to phase voltage including two times the over voltage spike

3.2.28
V_S
phase to phase supply voltage (feeding voltage) of the converter. This voltage is used in this document to normalize the peak voltages and the DC link voltage as "per unit values" and includes all tolerances according to IEC 61000-2-4

3.2.29
V_{SN}
nominal phase to phase supply voltage (feeding voltage) of the converter, the secondary voltage of the input transformer without tolerances

3.2.30
V_{step}
difference between steady state voltage values before and after a switching transition (see Figure 2)

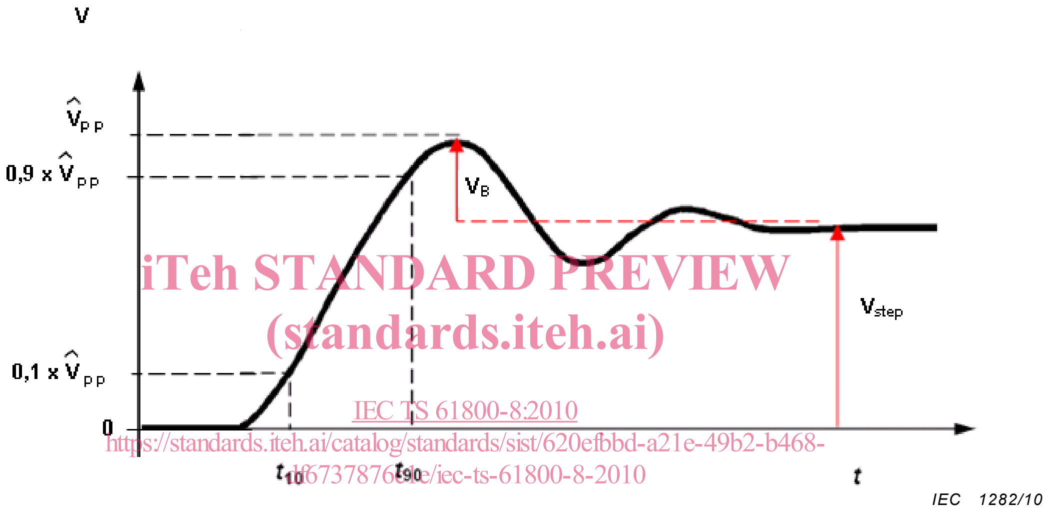

Figure 2 – Voltage impulse wave shape parameters in case of the two level inverter where rise time $t_{ri} = t_{90} - t_{10}$

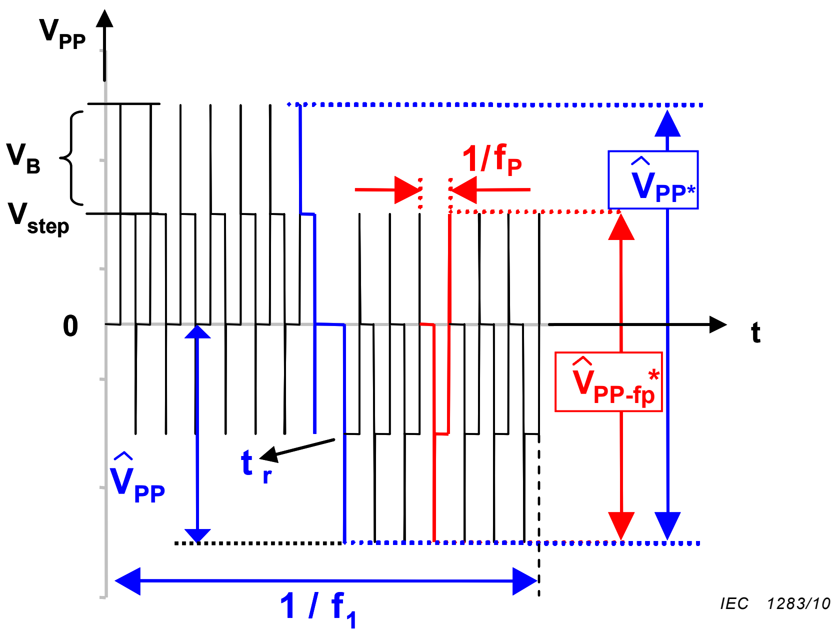

Figure 3 – Example of typical voltage curves and parameters of a two level inverter versus time at the motor terminals (phase to phase voltage)