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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Static transfer systems (STS) –
Part 3: Method for specifying performance and test requirements

Systèmes de transfert statique (STS) –
Partie 3: Méthode de spécification des performances et exigences d'essai

IEC 62310-3:2008

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

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Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

STATIC TRANSFER SYSTEMS (STS) –

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FOREWORD

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International Standard IEC 62310-3 has been prepared by subcommittee 22H: Uninterruptible power systems (UPS), of IEC technical committee 22: Power electronic systems and equipment.

The text of this standard is based on the following documents:

FDIS	Report on voting
22H/105/FDIS	22H/107/RVD

Full information on the voting for the approval of this standard 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 the IEC 62310 series, under the general title: *Static transfer systems (STS)*, can be found on the IEC website.

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

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- withdrawn,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

STATIC TRANSFER SYSTEMS (STS) –

Part 3: Method for specifying performance and test requirements

1 Scope

The IEC 62310 series of three standards applies to stand-alone operating a.c. static transfer systems (STS) intended to ensure the continuity of load supply through controlled transfer, with or without interruption of power, from two or more independent a.c. sources.

This series of standards includes information for the overall integration of the STS and its accessories into the a.c. power network and includes requirements for the switching elements, their control and protective elements, where applicable.

Part 1 of the series concerns general and safety requirements.

Part 2 of the series concerns electromagnetic compatibility (EMC) requirements.

This Part 3 of the series concerns methods for specifying performance and test requirements including applicable safety tests referenced in standard IEC 62310-1 for general and safety requirements.

This standard applies for single-phase, phase-phase and three-phase static transfers in a. c. systems up to 1 000 V. It takes precedence over all aspects of generic performance standards, and no additional performance testing is necessary.

The requirements have been selected so as to be consistent with compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems (see IEC 61000-2-2) as well as to ensure an adequate level of performance when the STS is applied in diverse critical load situations. The requirements take into account the differing test conditions necessary to encompass the range of physical sizes and power ratings of STS. This standard applies to STS as a stand-alone product, whether presented as a unit or an assembly of units. This standard does not apply to:

– devices for d.c. source switching;
– single source systems;
– transfer systems using only electromechanical switching devices with interruption of the supply to the load during transfer and intended to be used in emergency power systems or covered by IEC 60947-6-1;
– automatic switching devices integrated into UPS covered by the IEC 62040 series of UPS product standards.

NOTE Additional or different requirements may apply to STS intended for use on board of vehicles including ships and aircrafts, in emergency power systems subject to a particular regulation e.g. health care facilities, fire fighting or emergency rescue, in tropical countries or where elevations are greater than 1 000 m.

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 60068 (all parts), *Environmental testing*

IEC 60146-1-1, *Semiconductor convertors – General requirements and line commutated convertors – Part 1-1: Specifications of basic requirements*

IEC 60439-1, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*

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

IEC 60947-6-1, *Low-voltage switchgear and controlgear – Part 6-1: Multiple function equipment – Transfer switching equipment*

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

IEC 61000-2-2, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 62040-3, *Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements*

IEC 62310-1, *Static Transfer Systems (STS) – Part 1: General and safety requirements*

IEC 62310-2, *Static Transfer Systems (STS) – Part 2: Electromagnetic Compatibility (EMC) requirements*

ISO 7779, *Measurement of airborne noise emitted by information technology and telecommunications equipment*

3 Terms and definitions

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

3.1 General definitions

3.1.1
static transfer system (STS)
system that transfers a load, by static means, between a preferred source and an alternate source

NOTE 1 The transfer may be automatic and/or manual.

NOTE 2 The transfer may be with or without interruption.

3.1.2
power pole or electronic power switch
in the context of this standard, an operative unit for electronic power switching comprising at least one controlled electronic valve device

[IEV 551-13-01, modified]

3.1.3
primary circuit
internal circuit which is directly connected to the external supply source which supplies the electric power to the load. It includes the primary windings of transformers, motors, other loading devices and the means of connection to the supply source.

3.1.4
input power
power derived either from the preferred or from the alternate source or from both and supplied to the STS (and maintenance bypass if any)

3.1.5
SELV circuit
secondary circuit which is so designed and protected that under normal operating conditions and single fault conditions, its voltages do not exceed a safe value

NOTE 1 The limit values of voltages under normal operating conditions and single fault conditions are specified in 2.2 of IEC 60950-1, see also Table 1A of IEC 60950-1.

NOTE 2 This definition of an SELV CIRCUIT differs from the term "SELV system" as used in IEC 61140.

3.1.6
preferred source
source used as normal power supply to the load, usually set by the operator

3.1.7
alternate source
source used as alternate power supply to the load when the preferred source fails or is out of tolerance or is switched off for maintenance

3.1.8
normal mode of STS operation
condition where the load is supplied via the electronic (power) switches by either the preferred source or by the alternate source

3.1.9
maintenance bypass
power path designed to allow isolation of an appropriate section or sections of an STS for safety during maintenance and/or to maintain continuity of load power

3.1.10
transfer
act of altering the supply path to the load from one source to another

3.1.11
automatic transfer
transfer without human intervention as a result of the supplying source being outside specified conditions

3.1.12
automatic retransfer
transfer without human intervention from an alternate to the preferred source once the preferred source has returned to specified conditions

3.1.13
manual transfer
transfer that occurs as a result of local or remote operator intervention

3.1.14
normal transfer
transfer of load power between two sources while their voltage phase angle difference is within a tolerance band as declared by the manufacturer

3.1.15
synchronous (or synchronised) transfer
transfer within a limited voltage phase angle difference specified by the user

3.1.16
asynchronous (or non-synchronised) transfer
transfer of load power between two sources while their voltage phase angle difference, when transfer occurs, is out of a tolerance band as declared by the manufacturer

3.1.17
transfer time
time interval between initiation of transfer and the instant when the output quantities have been transferred

3.1.18
cross-current
current due to conduction from a phase of one source through electronic power switches to the corresponding phase of another source

3.1.19
objectionable current
load current that, during normal operation and/or transfers, flows in paths other than those intended and that contributes to any of the following:

– interference with the proper sensing and operation of ground-fault residual current devices (RCDs)

– arcing of sufficient energy to ignite flammable materials

– electromagnetic emission in excess of levels prescribed in IEC 62310-2 for STSs

3.1.20
linear load
load where the current drawn from the supply is defined by the relationship:

$$I = U/Z$$

where

I is the load current;

U is the supply voltage;

Z is a constant impedance

3.1.21
non-linear load
load where the parameter Z (load impedance) is no longer a constant but is a variable dependent on other parameters, such as voltage or time

3.1.22
active power
under periodic conditions, mean value, taken over one period T, of the instantaneous power p:

$$P = \frac{1}{T} \cdot \int_0^T p \cdot dt$$

[IEV 131-11-42]

NOTE 1 Under sinusoidal conditions, the active power is the real part of the complex power.

NOTE 2 The SI unit for active power is the watt.

NOTE 3 DC, fundamental and harmonic voltages contribute directly to the magnitude of the active power. Where applicable, instruments used to measure active power should therefore present sufficient bandwidth and be capable of measuring any significant non-symmetrical and harmonic power components.

3.1.23
power factor, (λ)
ratio of the active power to the apparent power

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

[IEV 131-11-46, modified]

NOTE For the purpose of this standard, the load power factor is determined assuming an ideal sinusoidal supply voltage, where the load is non-linear; the load power factor includes harmonic power components.

3.1.24
apparent power, (S)
product of the r.m.s. values of voltage and current at a port

[IEV 133-11-41, modified]

$$S = UxI$$

3.1.25
ambient temperature
temperature of the air or other medium where the equipment is to be used

[IEV 826-01-04]

3.2 Specified values

3.2.1
rated value
quantity value assigned, generally by a manufacturer, for a specified operating condition of a component, device or equipment

[IEV 151-16-08, modified]

3.2.2
rating
set of rated values and operating conditions of a machine or a device or equipment

[IEV 151-16-11]

3.2.3
tolerance (band)
range of values of a quantity within specified limits

3.2.4
deviation
difference between the desired value and the actual value of a variable at a given instant

[IEV 351-12-15, modified]

3.2.5
transient
behaviour of a variable during transition between two steady states

[IEV 351-14-04]

3.2.6
rated voltage
input or output voltage (for three-phase supply, the phase-to-phase and phase-to-neutral voltage when the STS supports neutral connection) as declared by the manufacturer

3.2.7
voltage variation
difference between the r.m.s. voltage and the corresponding previously undisturbed r.m.s. voltage

NOTE For the purposes of this standard, the term "variation" has the following meaning: the difference of the value of a quantity before and after a change of an influence quantity.

3.2.8
rated current
r.m.s. input or output phase current of the equipment as declared by the manufacturer

3.2.9
rated frequency
operating frequency as declared by the manufacturer

3.2.10
total harmonic distortion (THD)
ratio in percent of the r.m.s. value of the harmonic content to the r.m.s. value of the fundamental component of the alternating quantity

3.2.11
harmonic components
components of the harmonic content as expressed in terms of the order and r.m.s. values of the Fourier series terms describing the periodic function

3.2.12
harmonic content
quantity obtained by subtracting from an alternating quantity its fundamental component

NOTE The harmonic content may be given as a time-function or as an r.m.s. value.

3.2.13
crest or peak factor
ratio of peak value to the r.m.s. value of a periodic quantity

NOTE The terms «crest factor» and «peak factor» have the same meaning.

3.3 Input values

3.3.1
input voltage tolerance
maximum variation of steady-state input voltage acceptable by the STS to function

3.3.2
input frequency tolerance
maximum variation of steady-state input frequency acceptable by the STS to function

3.4 Output values

3.4.1
critical load voltage protection limits
maximum variation of steady-state and of transient output voltage of the STS

3.4.2
conditional short-circuit current
prospective current that a STS can withstand when protected by a specified protective device

3.4.3
output voltage tolerance
maximum variation of steady-state output voltage of the STS, generally adjusted to ensure compliance with the critical load protection limits

3.4.4
overload capability
output current capability of the STS in excess of its stated continuous current over a given time, with the output voltage remaining within its rated range

3.4.5
short time withstand current
current that a circuit or a switching device in a closed position can carry during a specified short time and under prescribed conditions of use and behaviour

3.4.6
step load
instantaneous addition or removal of electrical loads to a power source

4 Performance requirements

4.1 Declared electrical characteristics

4.1.1 Performance classification

The manufacturer shall classify STSs complying with this standard in accordance with the following coding.

XX	YY	B	ST

where

XX characterises the management of fault current:
CB: STS capable of making and of breaking specified short-circuit currents and containing integral overcurrent protection.
PC: STS capable of making and of withstanding specified short-circuit currents but not intended for breaking short-circuit currents.

YY characterises the management of input neutrals:
00 – Neutral not supported
NC – Neutral common
NS – Neutral separation by switching
NI – Neutral separation by galvanic isolation

NOTE Galvanic neutral isolation can be achieved through the use of an isolation transformer.

B characterises the nature of the transfer:
B - Break before make (open transition) – no transient cross-conduction during transfer
M - Make before break (closed transition) – possible transient cross-conduction during transfer

ST characterises the sensing and transfer features:

”S” - sensing tolerance prior to automatic transfer being initiated

Voltage in the conducting source, when beyond the specified sensing tolerance, shall cause the STS to initiate an automatic transfer. Figures B.1, B.2, B.3 and B.4 of Annex B define the over and undervoltage limits corresponding to sensing tolerances 1, 2, 3 and 4 respectively. The sensing tolerance (S) shall be agreed on between the manufacturer and the purchaser in accordance with voltage limits deemed acceptable for the critical load - see Annex E – Purchaser specification guidelines

"T" - duration of any power interruption to the load once an automatic transfer is initiated (see Table 1)

Table 1 – Transfer interruption classification "T"

T	Interruption ms
1	≤ 0,1
2	≤ 1
3	≤ 10
4	≤ 20
5	(reserved)

NOTE Transfer classification T = 5 is reserved for particular transfer characteristics if required and agreed upon between the manufacturer/supplier and the purchaser.

Compliance with the STS sensing and transfer features is required when at least one input source is within tolerance under conditions agreed between the purchaser and the manufacturer. For guidance, refer to "Maximum voltage phase difference between sources to enable synchronous transfer" in Table E.1. In the event of all preferred and alternate source(s) being out of tolerance, the manufacturer shall specify the performance.

NOTE Phase to neutral voltage sensing is required in STS where a neutral connection is available to the load.

Example of STS performance classification: "PC NC B 23" characterises a STS that

- can make and withstand specified short-circuit currents but that is not intended for breaking of short-circuit currents
- presents a common input neutral terminal for all sources
- is break before make (open transition), causing no transient cross-conduction during a transfer
- initiates a transfer automatically when the voltage of the conducting source is beyond the limits for source tolerance classification 2 (see Annex B)
- may interrupt supply to the load for up to 10 ms during the transfer

4.1.2 Main electrical characteristics

The STS manufacturer shall specify the following characteristics in the application documentation pertaining to a STS that complies with this standard.

4.1.2.1 Current

- Rated (phase r.m.s. value)

4.1.2.2 Voltage

- rated (phase-phase / phase–neutral as applicable, r.m.s. value)
- input tolerance (refer to 4.2a)
- input unbalance tolerance (for 3-phase STS, refer to 4.2.c)

4.1.2.3 Frequency

- rated
- tolerance (refer to 4.2.b)

4.1.2.4 Input / output wiring

- number of phases (1, 2 or 3) + N (if applicable)