

**IEC 62310 FOR STATIC
TRANSFER SYSTEMS:
NEW STANDARDS TO
GUARANTEE PERFORMANCES
AND SAFETY**

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Before the IEC 62310¹, prior to 2008, there was no product standard for the STS. The closest standard used by manufacturers was the IEC 62040 (Uninterruptible power systems (UPS)). Indeed It is a good reference, but the weak points are definitions and tests.

In fact in UPS standard IEC 62040 there is no definition for “Static Transfer System”, or of the following:

- Preferred and alternate source
- Normal mode of operation
- Transfer and retransfer
- Switching mode
- Synchronous and asynchronous transfer
- Sensitivity
- Protection class

Nevertheless the performances and the test procedures are clearly defined. First among all the size is defined with the Current (I) and not as the UPS with the Apparent Power (S).

WHY THE USERS SHOULD ASK FOR STS IEC 62310 COMPLIANT?

First of all to have a high quality Static Transfer Switch built in line with its own specific standards.

Secondly to have an appropriate warranty on the product. In fact, before IEC 62310, there was no definition of test and performances for STS.

PERFORMANCES

First of all the performances are defined by a code structured as “XX YY B TS”.

XX defines the fault currents management and it can be:

- CB, STS: with integrated breakers or fuses capable of bearing and of breaking specified short-circuit currents, or
- PC, STS: without integrated breakers or fuses capable of withstanding specified short-circuit currents but not intended for breaking short-circuit currents.

YY defines the Neutral management and it can be:

- 00 - Neutral not supported
- NC - Neutral common
- NS - Neutral separation by switching
- NI - Neutral separation by galvanic isolation

The galvanic isolation can, be achieved by means of NS STS and combined with an external transformer.

B defines the type of the transfer and it can be:

- B - Break before make (no sources overlap)
- M - Make before break (sources overlap during the transfer)

To avoid high transient currents between the sources the angle shift between them must be limited and settable. The transfers between sources within these limits are defined either as Synchronous or Asynchronous. Make Before Break transfers must be Synchronous.

TS defines the tolerable voltage drop characteristic by the load and it can be:

- T - total transient introduced to the load by the STS throughout an automatic transfer, or

¹ (issues: part 1 March 2005, part 2 January 2006, part 3 June 2008)

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

More details of T and S must be the numbers 1, 2, 3 and 4. They identify the curves that relate the voltage variation with the admissible time the load is able to work with.

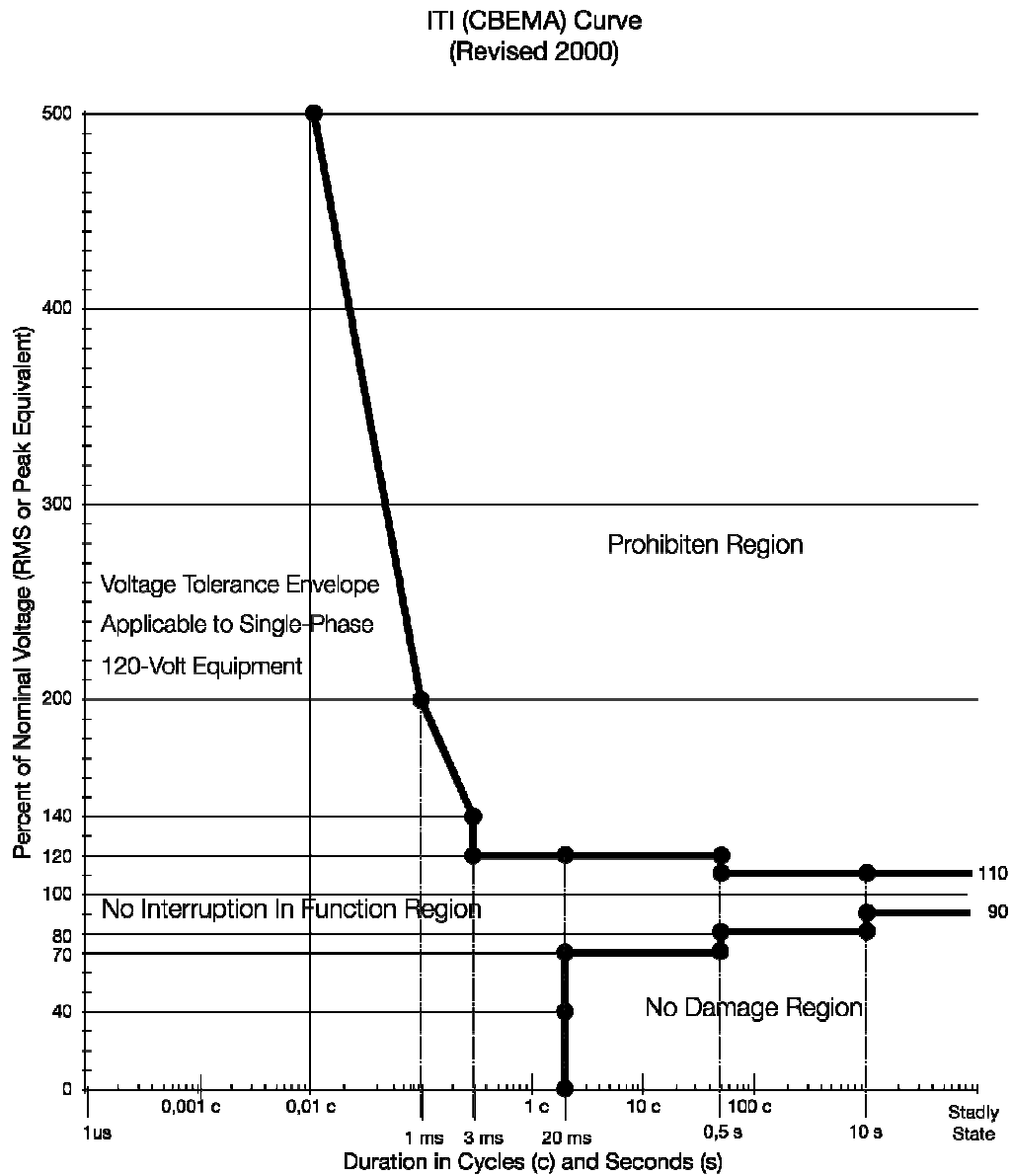


Figure 1 – ITIC curve

Longer values are admissible depending on the voltage variation value.

TEST DEFINITIONS

IEC 62310-3 clearly states which test are type tests, performed on a STS that represents a series of substantially identical products, and which are routine tests, generally performed in the factory (Table 1).

Test description	Routine test	Type test
Insulation (to ground)	X	X
Insulation (input to output)		X
Light load	X	X
Functional & Interconnection cable check	X	X
Control device(s)	X	X
Protective device(s)	X	X
Auxiliary device(s)	X	X
Supervisory, measuring, signalling device(s)	X	X
Automatic transfer	X	X
Manual transfer	X	X
No load	X	X
Rated load	X	X
Cross-current		X
Source tolerance (voltage and frequency)		X
Overload		X
Overcurrent clearing capability		X
Short-circuit withstand current		X
Operating losses		X
Backfeed		X
Abnormal operating conditions		X
Transportation and environment		X
Impact and shock		X
Free fall		X
Storage		X
Temperature and humidity		X
Acoustic noise		X
Safety		X
Electromagnetic compatibility		X

Table 1 – Test Types

This avoids misunderstanding or surprises once the device is installed and working. The former standard improperly used IEC 62040 does not define proper tests for typical STS behaviours, it focuses on UPSs.

E.g. IEC 62040-3 does not mention the tests for:

- Overcurrent clearing capability
- Forced ventilation.

Overcurrent clearing capability

The test consists on the measurement of the over current will be supplied for a minimum of 100 ms without damaging the STS. An alternate method considers the chosen S curve.

Forced ventilation

The text consists on verification of two working conditions normal and fault. During normal operating mode with the minimum rated frequency the component temperature rise is measured. Fault condition is simulated locking the fan rotor measuring how long the device continues to operate properly before the automatic shutdown.

MARKINGS

The markings shall include as minimum:

- rated operational voltage(s); or rated voltage range(s), in volts
- rated frequency or rated frequency range, in hertz
- rated current, in amperes
- number of output phases (1ph – 3ph) with or without neutral
- number of poles switched

WHY FULL NEUTRAL MANAGEMENT IS IMPORTANT?

Every neutral system has its own requirements due to safety and power quality reasons.

IT SYSTEMS

Typically used in medical environment the IT system (Figure 2) is used because it is tolerant to the first fault to ground.

The STS must be capable to switch the neutral to avoid the connection between the Neutrals of the two sources. In case of common Neutral the IMD could measure wrong values and in case of Phase-Earth or Neutral-Earth short circuit of one source it would affect the other source.

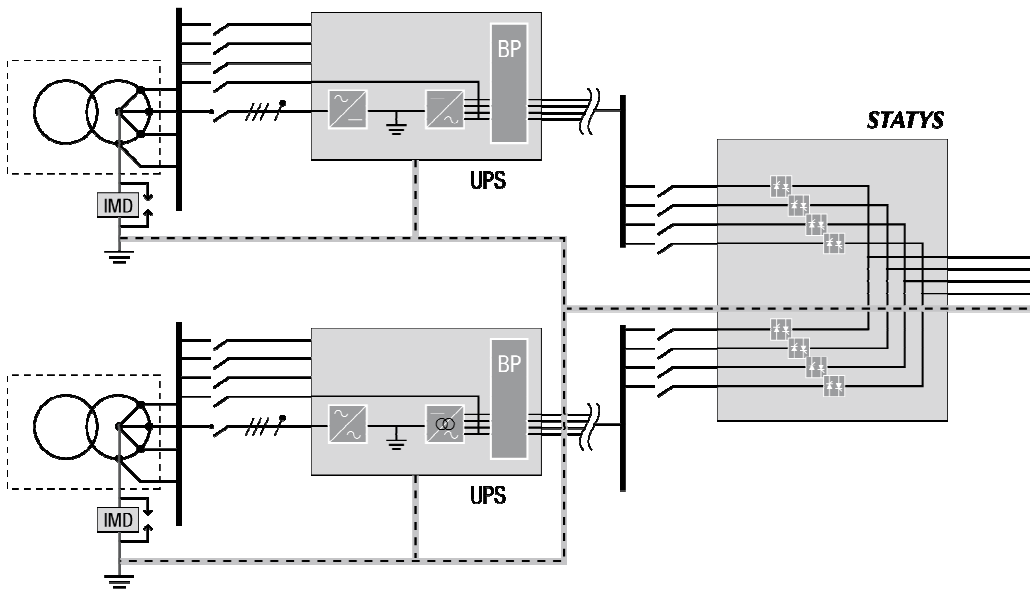


Figure 2 – IT systems scheme

TT SYSTEMS

Typically used when the electrical cabin is not available the TT system (Figure 3) is used because it is necessary to recreate a local earthing. This is typical of domestic plants.

The STS must be able to switch the neutral to avoid the connection between the Neutrals of the two sources.

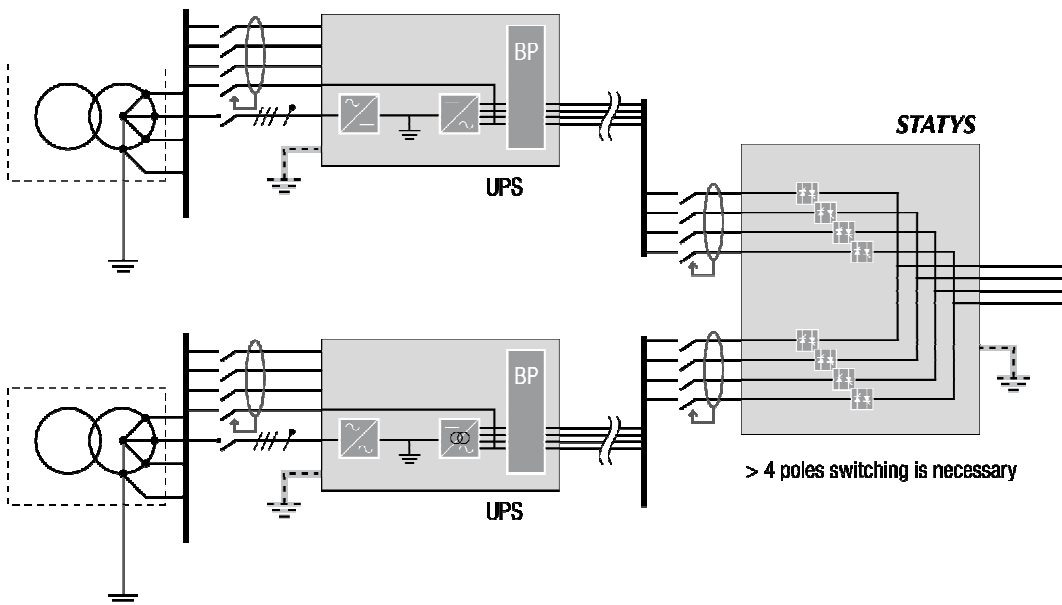


Figure 3 - TT system scheme

In case of common Neutral there are two parallel neutral paths (Figure 4). The non-supplying source neutral is connected via Ground to the conducting source Neutral. This causes the Residual Current Circuit Breaker (RCCB) tripping.

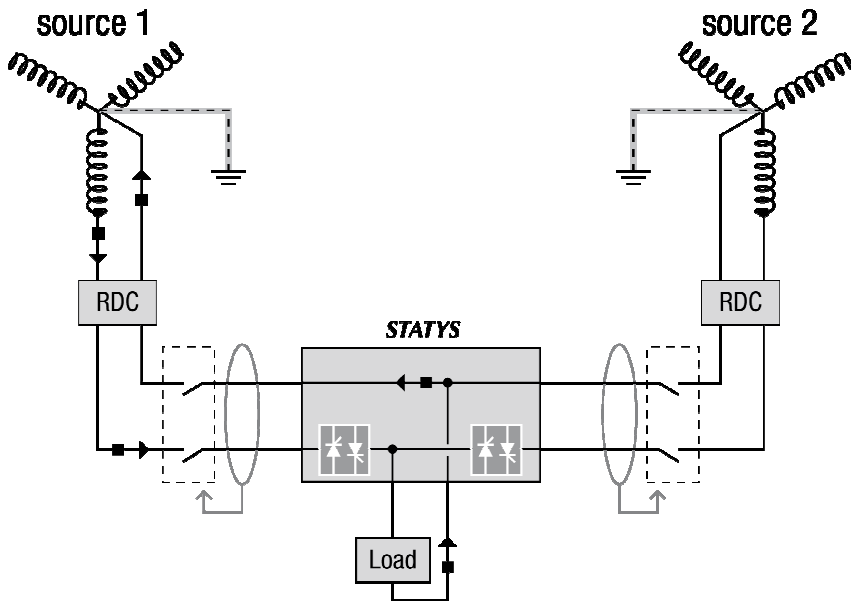


Figure 4 – TT neutral currents without Neutral switching

TNS SYSTEMS

Typically used in a civil environment the TNS system (**Errore. L'origine riferimento non è stata trovata.**) is used because it's a good compromise between safety and maintenance costs.

The STS must be able to switch the neutral to avoid the connection between the Neutrals of the two sources.

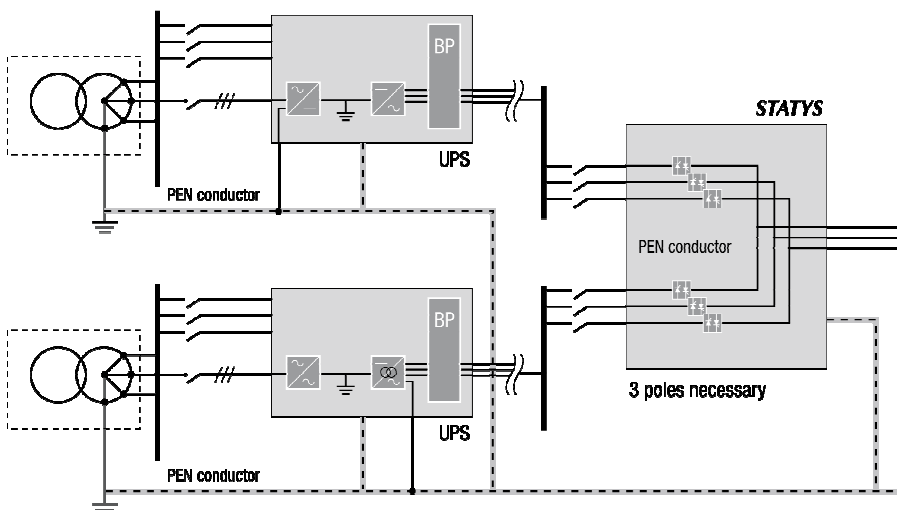


Figure 5 – TNS system scheme

In case of common Neutral there are two parallel neutral paths (**Errore. L'origine riferimento non è stata trovata.**) getting to the analogue situation of TT system.

TNC SYSTEMS

Typically used in industrial environment the TNC system (Figure 6) is used because of its simplicity and cheapness.

The STS must not switch to the neutral since the Neutral is also the protection conductor (PEN) that can not be interrupted for safety reasons.

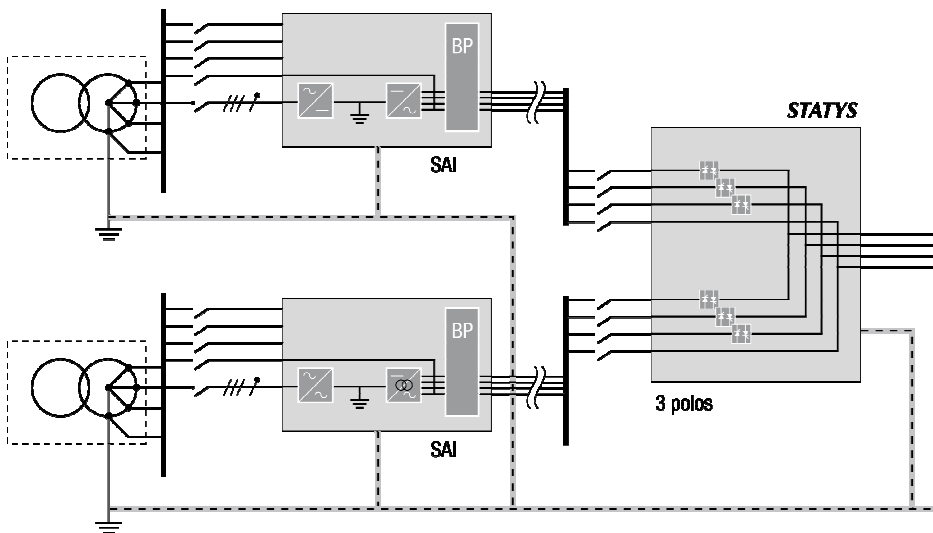


Figure 6 – TNC system scheme

SAFETY IMPROVEMENTS

IEC 62310 introduces some innovation for the human safety during maintenance:

- the backfeed protection, and
- the highlighting of equipment under voltage despite the device switch-off.

What is the backfeed protection for STSs?

The backfeed protection is essentially the command to external breakers to avoid energy flow from one source to the other in case of abnormal conditions like SCR failure. Its aim is to protect the operators from electric shock avoiding hazardous energy or voltages upstream of the isolation device.

The standard IEC 62310-1 states the protection must be embedded into pluggable devices whereas the isolation devices can be installed remotely into the Power Distribution Unit (PDU) for fixed installation. With this last case it is responsibility of the installer and compulsory to connect the isolation device with the triggering command highlighting it with a label.

The embedded isolation device is an advisable characteristic in case of installations with many devices typical of data centres or server farms. When single phase STSs are used in data centres they are installed into the cabinet with the server they protect whereas the breakers are installed into the PDU far from them. Many STSs would require a huge amount of cabling from the racks to the PDUs increasing the plant complexity and reducing the power availability.

The best way to prevent accidents is the preventative information

Again, standard IEC 62310 also defines specification for safety with the requirement to clearly highlight such parts that under voltage even in the event of the device being off. Stickers with dimensions and symbols are defined by the standard, which reduces accidents during maintenance.

THE INSTALLED STS ARE STILL SUITABLE?

Existing and working STS can continue to work until substitution.

CONCLUSIONS

Particular care must be used in choosing the right STS especially in the period of transition between the custom of using UPS standard IEC 62040 and the proper standard IEC 62310. Thanks to introduction of performance definition and safety devices, such as the backfeed protection, the purchase of IEC 62310 compliant STS ensures operation reliability and protection.

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IEC 62310 for Static Transfer Systems: new standards to guarantee performances and safety

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