POLITECNICO DI MILANO

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EN 50160:2010 IMPROVEMENTS OF THE REVISED VERSION

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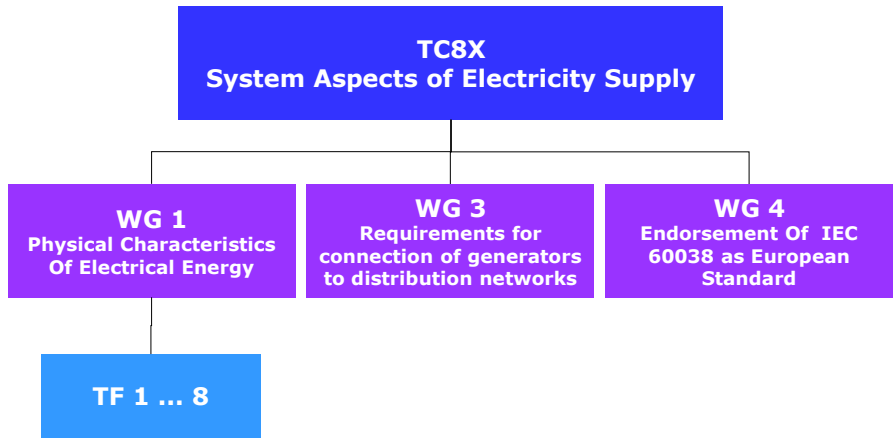
TC8X Organization



Editions of EN 50160

- **First edition: November 1994**

  EN 50160: Voltage characteristics of electricity supplied by public distribution systems.

  Subjects: LV and MV distribution networks

- **Following Editions: 1999, 2007**

- **Current edition**

  EN 50160: 2010 Voltage characteristics of electricity supplied by public electricity networks

  Voted positively on May, 2009; Ratified postponed by CLC BT due to comments received

  Finally ratified by BT on March 2010 and dispatched on July 2010

  Subjects: LV; MV; HV networks

New edition of EN 50160: continuous phenomena / voltage events

In the following, a distinction is made between:

- continuous phenomena, i.e. small deviations from the nominal value that occur continuously over time - such phenomena are mainly due to load pattern, changes of load or nonlinear loads;

- voltage events, sudden and significant deviations from normal or desired wave shape.

Voltage events are typically due to unpredictable events (e.g., faults) or to external causes (e.g., weather, third party actions)

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Continuous phenomena

Continuous phenomena, i.e. small deviations…

- Power frequency
- Supply voltage variations
- Rapid voltage changes
  - Single rapid voltage change
  - Flicker
- Supply voltage unbalance
- Harmonic voltages
- Interharmonic voltage
- Mains signalling voltage on the supply voltage

It il possible to set limits (n.a. to RVCs): consolidated knowledge, probabilistic approach (time %)

Supply voltage variations: new edition *(LV limits)*

4.2.2.1 Requirements

Under normal operating conditions, voltage variations should not exceed ± 10 % of the nominal voltage Un.
In cases of electricity supplies in networks not interconnected to transmission systems or for special remote network users, voltage variations should not exceed + 10 % / - 15 % of Un.

Network users should be informed of the conditions.

Supply voltage variations: new edition *(LV limits)*

4.2.2.2 Test method

When voltage measurements are required, they will be done in accordance with 5.2 of EN 61000-4-30 with a measurement period of at least one week.

Under conditions of 4.2.2.1 the following limits apply:

- at least **95%** of the 10 min mean r.m.s. values of the supply voltage shall be above the lower limit given in 4.2.2.1. (90%)
- **none** of the 10 min mean r.m.s. values of the supply voltage shall be outside the limits +10% / - 15 % of Un**.**

Supply voltage variations: new edition *(LV limits)*

Requirements, note 1

The actual power consumption required by individual network users is not fully predictable, in terms of amount and of contemporaneity. As a consequence, networks are generally designed on a probabilistic basis.

If, following a complaint, measurements carried out by the network operator according to 4.2.2.2 indicate that the magnitude of the supply voltage departs beyond the limits given in 4.2.2.2 causing **negative consequences** for the network user, the network operator should take remedial action in collaboration with the network user(s) depending on a risk assessment.

Temporarily, for the time needed to solve the problem, voltage variations should be within the range + 10 % / - 15 % of *Un*, unless otherwise agreed with the network users.

Supply voltage variations: new edition *(MV limits)*

5.2.2.2 Test method

When voltage measurements are required, they will be done in accordance with 5.2 of EN 61000-4-30 with a measurement period of at least one week.

Under conditions of 5.2.2.1 the following limits apply:

- at least **99%** of the 10 min mean r.m.s. values of the supply voltage shall be below the upper limit given in 5.2.2.1. (110%)
- at least **99%** of the 10 min mean r.m.s. values of the supply voltage shall be above the lower limit given in 5.2.2.1. (90%)
- **none** of the 10 min mean r.m.s. values of the supply voltage shall be outside the limits +/- 15 % of Un**.**

Voltage events

Voltage events, sudden and significant deviations from normal or desired wave shape.

- Interruptions of the supply voltage 
- Supply voltage dips/swells 
- Transient overvoltages between live conductors and earth

It is possible to give only indicative values (incl. RVCs):
such phenomena are difficult to predict;
more investigation is needed

Voltage events: voltage dips 

A temporary reduction of the voltage at a point in the electrical supply system below a specified start threshold.
For the purpose of this standard, the dip start threshold is equal to 90 % of the reference voltage.

Nota 1 Typically, a dip is associated with the occurrence and termination of a short circuit or other extreme current increase on the system or installations connected to it.

Nota 2 For the purpose of this standard, a voltage dip is a two dimensional electromagnetic disturbance, the level of which is determined by both voltage and time (duration).

Responsibility sharing curve

- As some standard/national documents (France, South Africa) already foresee, a bound is needed between :
  - events for which appliances have to be immune
  - events that can be limited by the DSO/TSO
- The concept of a "responsibility sharing curve" is much wider and complex (see IEEE paper by M. Bollen, P. Verde)
- In the new edition the concept has been applied only to voltage dips
- It is useful to describe the possible behavior of the network with the same parameters used for testing appliances (Product Standards)

The new disdip table in EN50160:2010

Starting from the test levels given in EN 61000-4-11, a new table has been included.

	Duration [ms]				
Residual voltage u [%]	10 – 200	200 – 500	500 – 1000	1000 – 5000	5000 – 60000
90 > u ≥ 80	CELL A1	CELL A2	CELL A3	CELL A4	CELL A5
80 > u ≥ 70	CELL B1	CELL B2	CELL B3	CELL B4	CELL B5
70 > u ≥ 40	CELL C1	CELL C2	CELL C3	CELL C4	CELL C5
40 > u ≥ 5	CELL D1	CELL D2	CELL D3	CELL D4	CELL D5
5 > u	CELL X1	CELL X2	CELL X3	CELL X4	CELL X5

Although the cells of the table 2,5 and 8 are not exactly coincident with the test levels table, it can be expected that equipment tested according to the relevant product std should cope with voltage dips as indicated in the cells:

- A1, B1, A2, B2 for class 2;
- A1, B1, C1, A2, B2, A3, A4 for class 3.

Annex B: indicative values for voltage events

B.1 General

…Some information is also given about the way of using values given in the standard, and about the way of collecting further measurement data, in order to allow for comparisons between different systems and to have homogeneous data at a EU level.
As many monitoring systems are in place in some countries, further information is available at a national level.

B.3.3 Currently available indicative values (dips)

The data collected should be homogeneous in terms of voltage levels. Within the same voltage level, distinction should be made between networks with prevailing underground cables or aerial lines. To cover all seasonal effects, the observation time should be at least one year.
The following data shall be reported:

- average dips/swells incidence per bus per year;
- 90 % or 95 % dips/swells incidence per bus per year;
- maximum dips/swells incidence per bus per year.

THANKS!

(comments are welcome)

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