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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 30137-2024

Power quality - Voltage swell, voltage dips and short interruptions

电能质量 电压暂升、电压暂降与短时中断

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1 Scope

China's national standard on voltage swells, voltage dips and short interruptions in the power system, and the current edition of GB/T 30137, replacing the 2013 edition. It specifies the indexes used to describe these events and the methods by which they are counted, detected, monitored and assessed, and it applies to 50 Hz AC power systems. The three events are the same phenomenon seen from different directions: a sudden departure of the root-mean-square voltage from its normal value, lasting from ten milliseconds to one minute and then returning. A swell is a rise to between 1.1 and 1.8 per unit, a dip a fall to between 0.1 and 0.9 per unit, and a short interruption a fall below 0.1 per unit. They are by far the most common power quality disturbance, and their economic weight is out of proportion to their duration: a dip lasting a tenth of a second can stop a semiconductor fabrication line, a paper machine or a continuous process plant, and the restart takes hours. Their cause is usually a fault somewhere on the network, which is cleared in a few cycles by protection, so the dip is felt across a wide area while the fault itself is remote and brief - which is why a dip cannot be eliminated at source and has to be characterised, measured and managed instead. The main change in the 2024 edition is that voltage swell is brought fully into scope alongside dips and interruptions, the terminology is aligned with GB/T 17626.30-2023, and phase-angle jump, hysteresis voltage, sliding reference voltage and the severity and energy indexes are defined and specified. Issued on 31 December 2024 and in force since 1 April 2025.

This document specifies the indexes and statistical, test, monitoring and assessment methods for voltage swell, voltage dip and short interruption in the electric power system. This document is applicable to

50 Hz AC power systems.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 19862, General requirements for monitoring equipments of power quality

GB/T 17626.30, Electromagnetic compatibility - Testing and measurement techniques - Part

30.Power quality measurement methods

3 Terms and definitions

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

3.1 voltage swell A phenomenon that the r.m.s. voltage at a certain point in the power system suddenly rises to

1.8 p.u. and returns to normal after a short period of 10 ms ~ 1 min.

3.2 magnitude of voltage swell The maximum value of the r.m.s. voltage during a voltage swell.

3.3 voltage dip; voltage sag A phenomenon that the r.m.s. voltage at a certain point in the power system suddenly drops to

0.1 p.u ~

0.9 p.u. and returns to normal after a short period of 10 ms ~ 1 min.

3.4 short interruption A phenomenon that the r.m.s. voltage at a certain point in the power system suddenly drops to below

0.1 p.u. and returns to normal after a short period of 10 ms ~ 1 min.

3.5 threshold The voltage threshold value used to determine the start and end of a voltage swell, voltage dip or short interruption.

3.6 duration The time taken from the start to the end of a voltage swell, voltage dip or short interruption event.

3.7 phase-angle jump The sudden change in the relative position of the voltage and/or

current waveform on the time axis before and after a voltage swell or voltage dip event occurs, expressed in degrees or radians.

3.8 frequency; occurrence frequency The number of voltage swells, voltage dips, or short interruptions that occur within a specified period of time.

3.9 r.m.s. voltage refreshed each half-cycle Urms(1/2) The measured value of r.m.s. voltage whose measurement data window is one cycle, starting from the zero crossing point of the fundamental wave and updated every half cycle.

4 Statistics and indexes of voltage swells, voltage dips and

short interruptions

4.1 Statistics of voltage swells, voltage dips and short interruptions The voltage swell, voltage dip and short interruption statistics table, which can intuitively reflect the occurrence of voltage swells, voltage dips and short interruptions at the monitoring point within a period of time, mainly counts the number of events with different magnitudes and durations. If voltage swell and voltage dip or short interruption occur simultaneously within 1 minute after the start of the event, they shall be counted in Table 1 and Table 2, respectively. Table 1 shows the number of voltage swell events corresponding to the corresponding magnitude and duration of voltage swell; Table 2 shows the number of voltage dips or short interruptions corresponding to the corresponding residual voltage and duration.

4.2 Indexes of voltage swells, voltage dips and short interruptions

4.2.2 Frequency index The frequency index reflects the frequency of voltage swells, voltage dips or short interruptions. Frequency statistics and evaluation can be carried out through monitoring or other means, and the general statistical cycle is 1 year. The event frequency of a node or the total event frequency of a regional power grid can be counted.

4.2.3 Severity index The severity index reflects the impact of voltage swells, voltage dips or short interruptions on equipment and users. The event severity index is calculated in combination with the equipment tolerance curve. The severity index Se of a single voltage swell event is defined as shown in Formula (3), and the severity index Se of a single voltage dip or short interruption event is defined as shown in Formula (4).

4.2.4 Indexes of voltage swell/dip The energy index reflects the degree of energy enhancement/loss caused by swell/dip events.

5.1 Detection algorithm of r.m.s. voltage

5.1.1 r.m.s. voltage refreshed each half-cycle [Urms(1/2)] The calculation method of Urms(1/2) is shown in Formula (6).

5.1.2 r.m.s. voltage refreshed each cycle [Urms(1)] The calculation method of Urms(1) is

shown in Formula (7).

5.2 Event detection

5.2.1 Threshold setting The threshold for voltage swell is generally set at

1.1 p.u.; the threshold for voltage dip is generally set at

0.9 p.u.; the threshold for short interruption is generally set at

0.1 p.u.

5.2.2 Determination of voltage swell In a single-phase system, when Urms(1/2) or Urms(1) is higher than the swell threshold, the voltage swell event begins; when Urms(1/2) or Urms(1) is equal to or lower than the difference between the voltage swell threshold and the hysteresis voltage, the voltage swell ends. In a multi-phase system, when Urms(1/2) or Urms(1) of any phase is higher than the swell threshold, the voltage swell begins; when Urms(1/2) or Urms(1) of all phases is equal to or lower than the difference between the swell threshold and the hysteresis voltage, the voltage swell ends.

5.2.3 Determination of voltage dip In a single-phase system, when Urms(1/2) or Urms(1) is lower than the dip threshold, the voltage dip event begins; when Urms(1/2) or Urms(1) is equal to or higher than the sum of the dip threshold and the hysteresis voltage, the voltage dip ends. In a multi-phase system, when Urms(1/2) or Urms(1) of any phase is lower than the dip threshold, the voltage dip begins; when Urms(1/2) or Urms(1) of all phases is equal to or higher than the sum of the dip threshold and the hysteresis voltage, the voltage dip ends.

5.2.4 Determination of short interruption In a single-phase system, when Urms(1/2) or Urms(1) is lower than the short interruption threshold, the short interruption event begins; when Urms(1/2) or Urms(1) is equal to or higher than the sum of the short interruption threshold and the hysteresis voltage, the short interruption ends. In a multi-phase system, when Urms(1/2) or Urms(1) of any phase is lower than the short interruption threshold, the short interruption begins; when Urms(1/2) or Urms(1) of all phases is equal to or higher than the sum of the short interruption threshold and the hysteresis voltage, the short interruption ends.

5.3 Method for selecting values of characteristic parameters

5.3.2 Voltage dip The characteristic parameters of voltage dip include residual voltage (Ures) or depth, duration, and phase-angle jump; the residual voltage is the lowest Urms value measured on any channel during the dip. The start time of the voltage dip shall be the end time of the Urms measurement data window triggering the event channel; the end time of the voltage dip shall be the end time of the Urms measurement data window terminating the event channel. Urms is determined by the sum of the threshold and the hysteresis