

# Definitions of Abnormal Voltage Conditions



Definitions of Abnormal Voltage Conditions (Sag, Swell, Surge and Interruption)

## Sag

A **sag** is a temporary **reduction in the normal AC voltage**.

A momentary sag is a variation, which lasts for a period of 0.5 cycle to about 2 s usually the result of a short circuit somewhere in the power system. Instances of longer duration of low voltage are called sustained sags (**see Figure 1**).

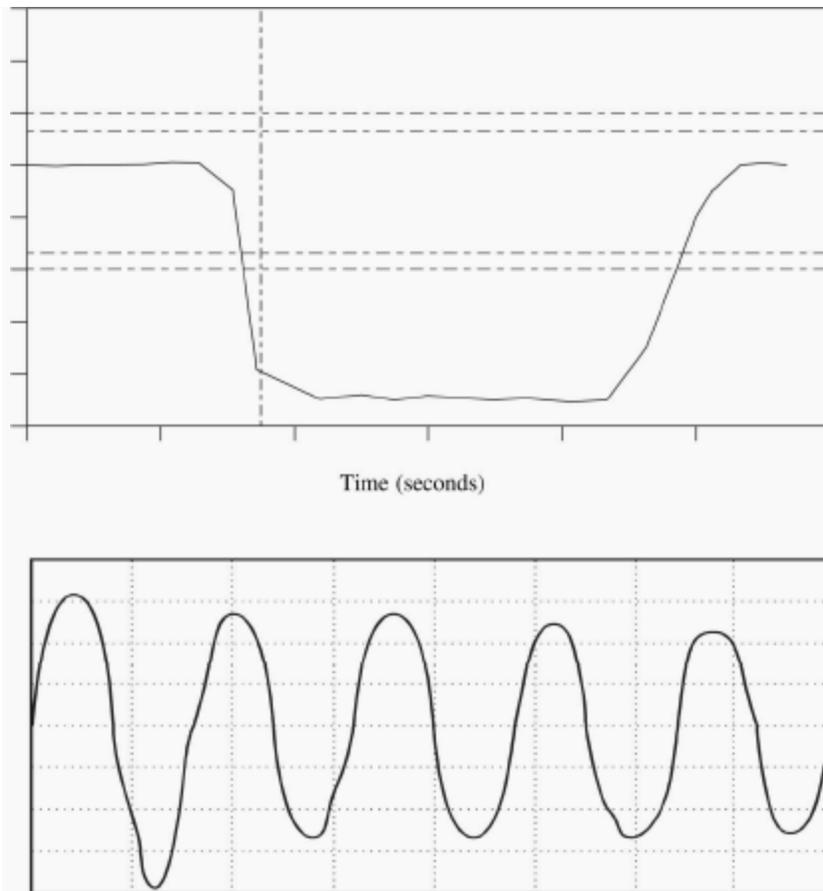


Figure 1 - Sag - momentary and sustained

## Swell

Swell is the **opposite of sag** and refers to the **increase of power frequency voltage**. A momentary swell lasts from 0.5 cycles to 2 s. A sustained swell lasts for longer periods (**see Figure 2**).

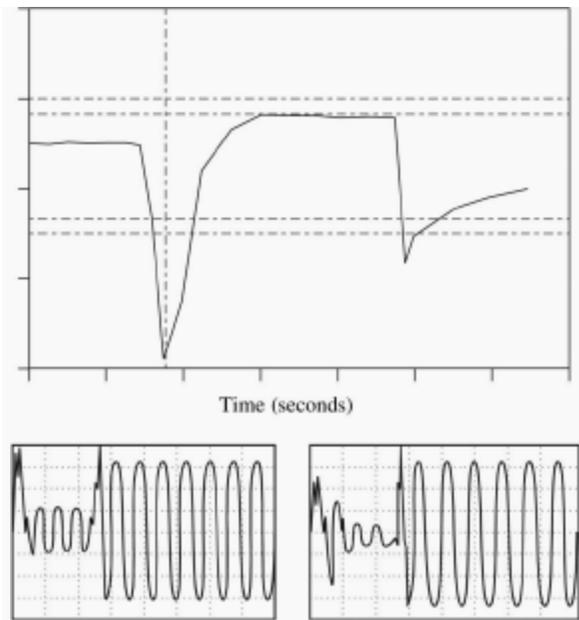


Figure 2 - Swell - momentary and sustained

## Surge

**Surge** is a **sub-cycle disturbance** lasting for a duration of less than half a cycle and mostly less than a millisecond. The earlier terminology was transient or spikes.

The decay is usually oscillatory. Surges generally occur due to atmospheric disturbances such as lightning or due to switching of large transformers, inductors or capacitors (**see Figures 3a and b for examples**).

Switching transient

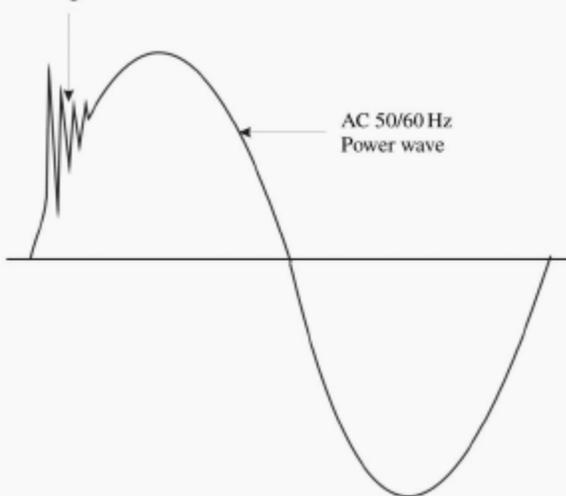


Figure 3a - Surge voltage with oscillatory decay

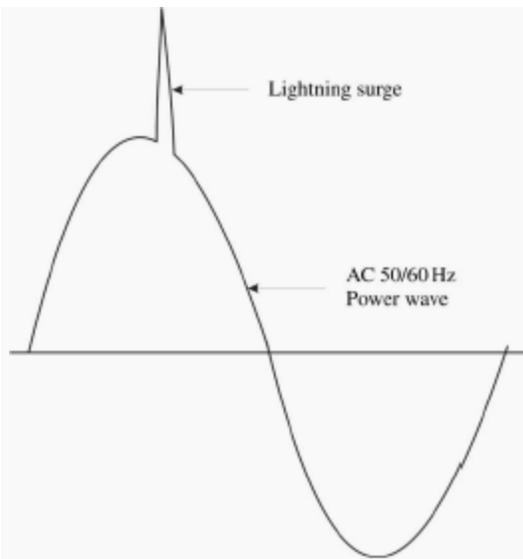


Figure 3b - Surge caused by lightning

## Interruption

**Interruption** means the **complete loss of voltage**. A momentary interruption lasts from half-cycle period to **less than 2 s**. Longer interruptions are called sustained interruption.

Momentary interruption is usually the result of a line outage with the supply being restored automatically from another source or by auto-reclosing operation. Refer **Figure 4** for illustration. An interruption can be instantaneous or of slowly decaying type.

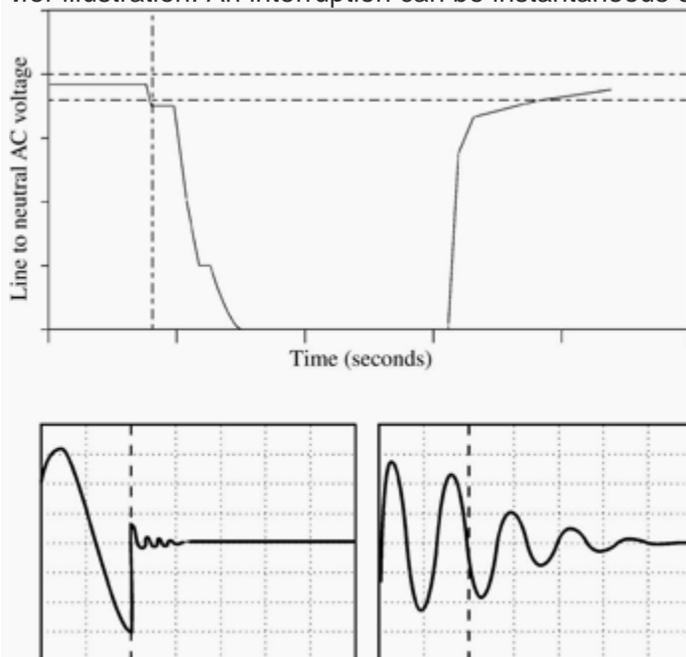


Figure 4 - Examples of supply interruption

In **Figure 4**, the one at the top shows the RMS voltage value during a momentary interruption. The figure on the lower left depicts the waveform of a sustained interruption where the voltage drops to zero almost instantaneously.

The waveform on the lower right shows an interruption where the **voltage decays slowly**.

**Resource:** *Grounding-Bonding-Shielding-and-Surge-Protection* – G. Vijayaraghavan, B.Eng (Hons) Consulting Engineer, Chennai, India

Source:

<http://electrical-engineering-portal.com/definitions-of-abnormal-voltage-conditions>