Power System Stability Requirements Guideline

Transient Stability

1. All generating systems connected to the transmission and distribution systems must maintain continuous uninterrupted operation following a *credible contingency*.
2. Disturbances on the transmission or distribution systems caused by a *credible contingency*, following a *credible fault type*, shall not exceed the generator's performance requirements.

Oscillatory Stability

3. The power system must be *adequately damped* after system oscillation is triggered by a *small disturbance* or a *large disturbance*.
4. A system oscillation triggered by any *small disturbance* or *large disturbance* shall conform to the following criteria:
   i. the damping ratio of the oscillation be at least 0.1;
   ii. the halving time of any oscillation not to exceed 5 seconds; and
   iii. allow generators to maintain continuous uninterrupted operation.

Note:
A *halving time* ≤ 5 seconds is equivalent to a damping coefficient –0.14 nepers per second or less.

Definitions

Adequately Damped

A system oscillation which complies with the requirements of clause 4 above is adequately damped.

Credible Contingency

A contingency which would be considered for the purposes of assessing transmission system security and which must not result in the remaining transmission system being in breach of the stated planning or operational criteria. Credible contingencies are individually specified throughout the text of the Technical Rules. A credible contingency is initiated by a *credible fault type*.

Credible Fault Type

Any of the following fault events can be considered as credible and initiate a credible contingency:

1. for voltages at 66kV or below: three phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service;
2. for voltages above 66kV, either:
   i. a two-phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service; or
   ii. a three-phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection scheme out of service. This criterion is to be applied only to transmission elements where the Network Service Provider can demonstrate that the design type,

environmental conditions, historic performance or operational parameters results in a material increase in the likelihood of a three-phase to earth fault occurring; or

iii. a single-phase to earth fault cleared by the disconnection of the faulted component, with the fastest main protection scheme out of service; or
iv. a single-phase to earth fault cleared after unsuccessful high-speed single-phase auto-reclosure onto a persistent fault; or
v. a single-phase to earth small zone fault or a single-phase to earth fault followed by a circuit breaker failure, in either case cleared by the operation of the fastest available protection scheme; or
vi. the unplanned outage of a system component.

Generating System

A system comprising one or more *generating units*.

Generating Unit

The equipment used to generate electricity and all the related equipment essential to its functioning as a single entity.

Power System

The electric power system constituted by the South West Interconnected Network and its connected generation and loads, operated as an integrated system.

Small Disturbance

A disturbance sufficiently small to permit the linearisation of system equations for the purpose of analysis. The resulting system response results in small excursions of system variables from their pre-disturbance values. A small disturbance is typically caused by routine switching of a power system component such as transmission line or capacitor, transformer tap changes, *generation unit* AVR set point changes or load variations.

Large Disturbance

A disturbance sufficiently large to prevent the linearisation of system equations for the purpose of analysis. The resulting system response involves large excursions of system variables from their pre-disturbance values, influenced by the non-linear power-angle relationship and other non-linear effects in the power system. A large disturbance typically may be caused by a credible fault type occurring on a power system component such as a transmission line, transformer, or a large mismatch in generation load balance. Only faults that result in a *credible contingency* are considered.