TRANSMISSION INVESTMENT

Application of P28 in Operational Timescales

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Circuit Energisation Versus CC6.1.7

- OTSDUW in designing the OFTO network typically performs energisation studies against **CC6.1.7** as required by the Grid Code/BCA. **CC6.1.7** for infrequent events, which includes export circuit energisation is illustrated in the diagram.
- The studies in the case TCP have recently encountered are performed with no dynamic MVAr response from either onshore TO or OFTO dynamic voltage control equipment. The most onerous switching event is the energisation of an offshore export cable circuit.
- An example of “non-compliance” versus **CC6.1.7** is shown in the diagram for a low fault level. The exceedance of **+6%** is a very short time and response from Dynamic Onshore TO and OFTO voltage control equipment is not modelled.

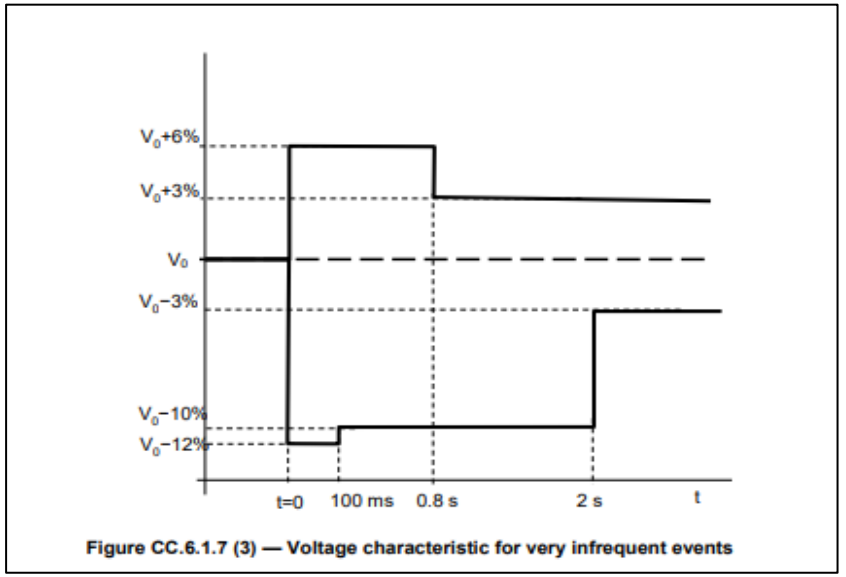
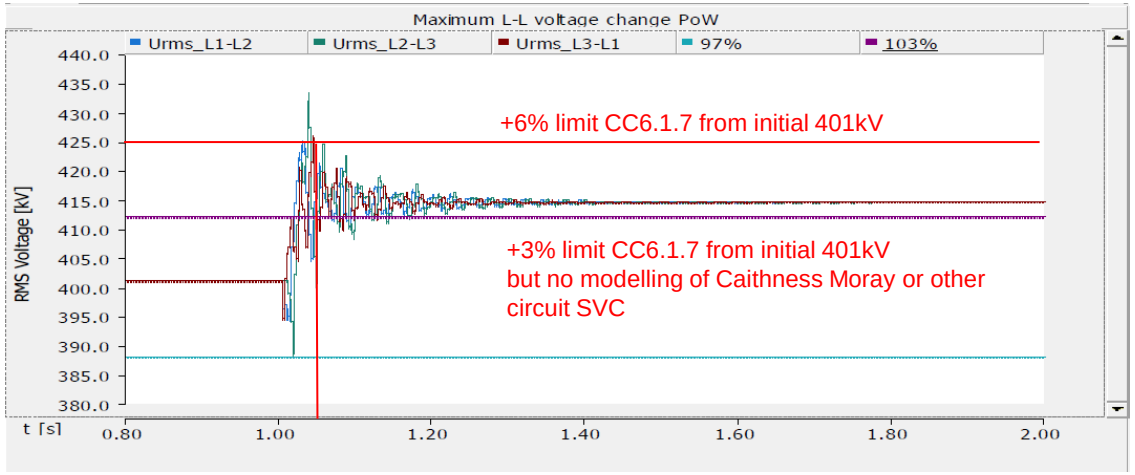
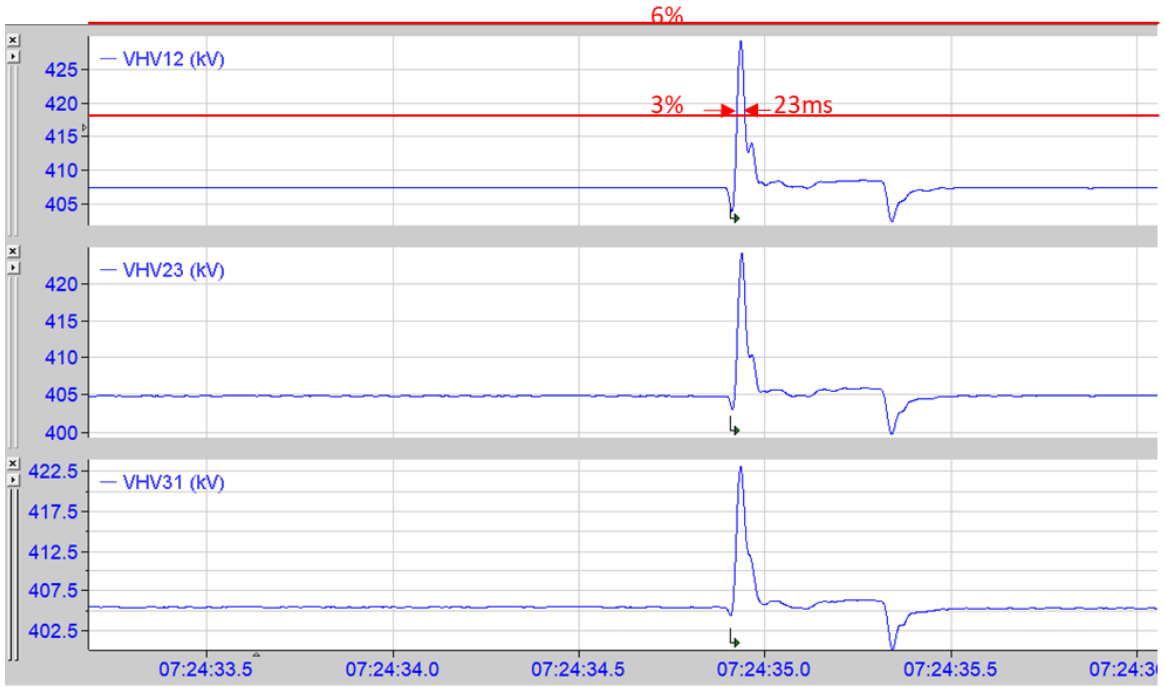


Figure CC.6.1.7 (3) — Voltage characteristic for very infrequent events



Circuit Energisation Versus CC6.1.7

- The previous slide showed above 6% CC6.1.7 for a short period but CC6.1.7 has no allowance for automatic action.
- Looking at the trace from an **actual** energisation (meeting CC 6.1.7 limits in this case as the fault levels were sufficiently high) one can see the mitigating effect that the OFTO's own SVCs and Onshore TOs voltage control equipment have on the voltage rise.
- Here the instantaneous step is 5.43% but it is only above 3% for about 23ms. And within about 40ms the voltage trace is very close to the original switching level.
- One can predict that for lower fault level cases then the spike would exceed 6% but that it would only be for circa 20ms before dynamic response from dynamic voltage control returned volts to near original levels.



Circuit Energisation Versus SQSS

- SQSS step change allowance for infrequent operational switching is +6% onshore at an interface with a User.
- At the substation TCP have encountered this issue there will be no User connected post OFTO transfer and the step change limit wouldn't apply.
- Should a User connect in future, Step Change is defined as after the transient time phase.
- Against SQSS lower fault level cases, are expected to be compliant due to the argument in the previous slide.
- GSR0025 is anticipated to implement in SQSS (Go-live April 2021) some alignment with P2/8 and CC6.1.7 but not no change on the allowable step change is proposed.

Table 6.5 Voltage Step Change Limits in Planning and Operational Timescales

Type of Event	Voltage Fall	Voltage Rise
(a) At substations supplying *User Systems* at any voltage		
1. Following *operational switching* at intervals of less than 10 minutes	In accordance with Figure 6.1	
2. Following *operational switching* at intervals of more than 10 minutes, 3. except for *infrequent operational switching* events as described below	-3%	+3%
4. Following *infrequent operational switching* ***(Notes 8, 9)***	-6%	+6%
5. In planning timescales, following a *fault outage of a double circuit supergrid* overhead line ***(Note 10)***	-6%	+6%

Voltage Step Change	The difference in voltage between that immediately before a *secured event* or operational switching and that at the end of the *transient time phase* after the event.

Transient Time Phase	The time within which fault clearance or initial system switching, the transient decay and recovery, auto switching schemes, *generator* inter-tripping, and fast, automatic responses of controls such as *generator* AVR and SVC take place. Load response may be assumed to have taken place. Typically 0 to 5 seconds after an initiating event.

Summary of Anomalies Between Codes and Operational Practice Elsewhere

- NGESO wish to implement an enduring operational restriction for energizing the offshore transmission system against CC6.1.7.
- CC6.1.7 is linked through to OFTOs via STC section D which is **design** part of the STC.
- Section D Part One, clause 2.2.6 of the STC specifies *"in planning and developing its Transmission System, each Transmission Owner (which includes Offshore Transmission Owners) shall ensure that its Transmission System complies with……."*
- CC6.1.7 defines this as applying at a PCC i.e. where "either Demands or Loads are, or may be, connected." At sites where there is no other User at present a CC6.1.7 operational restriction could potentially be implemented **now** in anticipation of a User connecting!
- The long standing definition of step change in the SQSS has been **after the transient period** (5 seconds**)** and historically has always been the measure by which step change was managed operationally. The intent of allowing for this time is clearly stated in the SQSS i.e. automatic fast action from generators, SVCs etc.