ECC.6.3.15.9.2.1 (FAULT RIDE THROUGH)

(b) Requirements applicable to Type C and Type D Power Park Modules and OTSDUW Plant and Apparatus (excluding OTSDUW DC Converters) subject to Supergrid Voltage dips on the Onshore Transmission System greater than 140ms in duration.

In addition to the requirements of ECC.6.3.15.5, ECC.6.3.15.6 and ECC.6.3.15.8 (as applicable) each OTSDUW Plant and Apparatus or each Power Park Module and / or any constituent Power Park Unit, shall:

(i) remain transiently stable and connected to the System without tripping of any OTSDUW Plant and Apparatus, or Power Park Module and / or any constituent Power Park Unit, for balanced Supergrid Voltage dips and associated durations on the Onshore Transmission System (which could be at the Interface Point) anywhere on or above the heavy black line shown in Figure ECC.6.3.15.9(b), Appendix 4 and Figures EA.4.3.4 (a), (b) and (c) provide an explanation and illustrations of Figure ECC.6.3.15.9(b); and,

(ii) be required to satisfy the requirements of ECC.6.3.16, in the case of a Non-Synchronous Generating Unit or OTSDUW Plant and Apparatus or Power Park Module where there has been a reduction in the Intermittent Power Source or in the case of OTSDUW Active Power transfer capability in the time range in Figure ECC.6.3.15.9(b) an allowance shall be made for the fall in power and the corresponding injection of real and reactive current.

(iii) restore Active Power output (or, in the case of OTSDUW, Active Power transfer capability), following Supergrid Voltage dips on the Onshore Transmission System as described in Figure ECC.6.3.15.9(b), within 1 second of restoration of the voltage at the:

- Onshore Grid Entry Point for directly connected Onshore Power Park Modules or,
- Interface Point for OTSDUW Plant and Apparatus and Offshore Power Park Modules or,
- User System Entry Point for Embedded Onshore Power Park Modules or,
User System Entry Point for Embedded Medium Power Stations which comprise Power Park Modules not subject to a Bilateral Agreement and with an Onshore User System Entry Point (irrespective of whether they are located Onshore or Offshore) to the minimum levels specified in ECC.6.1.4 to at least 90% of the level available immediately before the occurrence of the dip except in the case of a Non-Synchronous Generating Unit, OTSDUW Plant and Apparatus or Power Park Module where there has been a reduction in the Intermittent Power Source in the time range in Figure ECC.6.3.15.9(b) that restricts the Active Power output or, in the case of OTSDUW, Active Power transfer capability below this level. Once the Active Power output or, in the case of OTSDUW, Active Power transfer capability has been restored to the required level, Active Power oscillations shall be acceptable provided that:

- the total Active Energy delivered during the period of the oscillations is at least that which would have been delivered if the Active Power was constant
- the oscillations are adequately damped.

For the avoidance of doubt a balanced Onshore Transmission System Supergrid Voltage meets the requirements of ECC.6.1.5(b) and ECC.6.1.6.

ECC.6.3.16 FAST FAULT CURRENT INJECTION

ECC.6.3.16.1 General Fast Fault Current injection, principles and concepts applicable to Type B, Type C and Type D Power Park Modules and HVDC Equipment

ECC.6.3.16.1.1 Each Type B, Type C and Type D Power Park Module or HVDC Equipment shall be required to satisfy the following requirements. For the purposes of this requirement, current and voltage are assumed to be positive phase sequence RMS values.

ECC.6.3.16.1.2 For any balanced or unbalanced fault which results in the positive phase sequence RMS voltage falling below the nominal voltage levels specified in ECC.6.1.4 at the Grid Entry Point or User System Entry Point, each Type B, Type C and Type D Power Park Module or HVDC Equipment shall, as a minimum, be required to inject a reactive current in accordance with the requirements of Figure ECC.16.3.16(a) and Figure ECC.6.3.16(b) and Figure ECC.6.3.16(c), with any residual capability being supplied as active current without exceeding the transient rating of the Power Park Module and / or constituent element or HVDC Equipment.
Notes
\( V_o \) – Nominal Voltage
\( V \) – Voltage at Grid Entry Point or User System Entry Point
\( \Delta V = V_o - V \)
\( I_{\text{dead}} \) – The maximum injected Reactive Current as defined in Figure ECC.16.3.16(b) and Figure ECC.16.3.16(c)
Within the deadband (\( \pm 10\% \) of \( V_o \)) voltage control is required as specified in ECC.6.3.8 over the reactive capability range defined in ECC.6.3.2.

Where the retained voltage at the Grid Entry Point or User System Entry Point is below 50\%, the full injection of reactive current shall be above the shaded area shown in Figure ECC.16.3.16(b) and Figure ECC.16.3.16(c).

Figure ECC.16.3.16(a)

![Diagram showing reactive current and voltage drop](image)

Figure ECC.16.3.16(b)

Not to Scale

- Forbidden Operating Area
- Blinding Permitted
For the purposes of this requirement, the maximum rated current is taken to be the maximum current each Power Park Module (or constituent Power Park Unit) or HVDC Converter is capable of supplying at the Grid Entry Point (or User System Entry Point if Embedded) when operating at rated Active Power and rated Reactive Power (as required under ECC.6.3.2) at a nominal positive phase sequence RMS voltage of 1.0pu at the Grid Entry Point (or User System Entry Point if Embedded).

For example, in the case of a 100MW Power Park Module the Rated Active Power at the Grid Entry Point (or User System Entry Point if Embedded) would be taken as 100MW and the rated Reactive Power at the Grid Entry Point or User System Entry Point would be taken as 32.8MVA (ie Rated MW output operating at 0.95 Power Factor lead or 0.95 Power Factor lag as required under ECC.6.3.2.4 when the Grid Entry Point or User System Entry Point voltage is set to 1.0pu).

For the avoidance of doubt, the total current of 1.0pu would be assumed to be on the MVA rating of the Power Park Module or HVDC Equipment. Under all normal and abnormal conditions, the transient rating of the Power Park Module or HVDC Equipment would not be required to exceed the locus shown in Figure 16.3.16(c).
**ECC.6.3.16.1.4** Each Type B, Type C and Type D Power Park Module or HVDC Equipment shall be designed to prevent the risk of instability which could arise in the transition between the steady state voltage operating range as defined under ECC.6.1.4 and abnormal conditions where the retained voltage falls below 90% of nominal voltage or above 10% of nominal voltage. Such a requirement is necessary to ensure adequate performance between the pre-fault operating condition of the Power Park Module or HVDC Equipment and its subsequent behaviour under faulted conditions. EU Generators and HVDC System Owners are required to both advise and agree with NGET the control strategy employed to mitigate the risk of such instability.

**ECC.6.3.16.1.5** Each Type B, Type C and Type D Power Park Module or HVDC Equipment shall be designed to reduce the risk of transient over voltage levels arising following clearance of the fault and in order to mitigate the risk of any form of instability which could result. EU Generators or HVDC System Owners shall be permitted to block where the anticipated transient overvoltage would otherwise exceed the maximum permitted values specified in ECC.6.1.7. Figure ECC.16.3.16(b) and Figure ECC.16.3.16(c) shows the impact of variations in fault clearance time which shall be no greater than 140ms. The requirements for the maximum transient overvoltage withstand capability and associated time duration, shall be agreed between the EU Code User and NGET as part of the Bilateral Agreement. Where the EU Code User is able to demonstrate to NGET that blocking is required in order to prevent the risk of transient over voltage excursions as specified in ECC.6.3.16.1.5, EU Generators and HVDC System Owners are required to both advise and agree with NGET the control strategy, which must also include the approach taken to de-blocking. Notwithstanding this requirement, EU Generators and HVDC System Owners should be aware of their requirement to fully satisfy the fault ride through requirements specified in ECC.6.3.15 in respect of Active Power recovery.

**ECC.6.3.16.1.6** In addition to the requirements of ECC.6.3.15, Generators in respect of Type B, Type C and Type D Power Park Modules or HVDC Equipment are required to confirm to NGET, their repeated ability to supply Fast Fault Current to the System each time the voltage at the Grid Entry Point or User System Entry Point falls outside the limits specified in ECC.6.1.4. EU Generators and HVDC Equipment Owners shall inform NGET of the maximum number of repeated operations that can be performed under such conditions and any limiting factors to repeated operation such as protection or thermal rating; and
In the case of a Power Park Module or DC Connected Power Park Module, where it is not practical to demonstrate the compliance requirements of ECC.6.3.16.1 to ECC.6.3.16.1.6 at the Grid Entry Point or User System Entry Point, NGET will accept compliance of the above requirements at the Power Park Unit terminals.

For the avoidance of doubt, Generators in respect of Type C and Type D Power Park Modules and OTSDUW Plant and Apparatus are also required to satisfy the requirements of ECC.6.3.15.9.2.1(b) which specifies the requirements for fault ride through for voltage dips in excess of 140ms. There is no requirement for any change in Reactive Power performance at 140ms.