

LEGAL DRAFTING – LOW FREQUENCY DEMAND DISCONNECTION

15 FEBRUARY 2022

Extracts from the Connection Conditions

CC.A.5.1 Low Frequency Relays

CC.A.5.1.1 The **Low Frequency Relays** to be used shall have a setting range of 47.0 to 50Hz and be suitable for operation from a nominal AC input of 63.5, 110 or 240V. The following general parameters specify the requirements of approved **Low Frequency Relays** for automatic installations installed and commissioned after 1st April 2007 and provide an indication, without prejudice to the provisions that may be included in a **Bilateral Agreement**, for those installed and commissioned before 1st April 2007:

- (a) **Frequency** settings: 47-50Hz in steps of 0.05Hz or better, preferably 0.01Hz;
- (b) Operating time: Relay operating time shall not be more than 150 ms;
- (c) Voltage lock-out: Selectable within a range of 55 to 90% of nominal voltage;
- (d) Facility stages: One or two stages of **Frequency** operation;
- (e) Output contacts: Two output contacts per stage to be capable of repetitively making and breaking for 1000 operations:
- (f) Accuracy: 0.01 Hz maximum error under reference environmental and system voltage conditions.
0.05 Hz maximum error at 8% of total harmonic distortion **Electromagnetic Compatibility Level**.

For any **Low Frequency Relay** installed by a **Network Operator** on or after XXXX, the requirements of Appendix E5 of the **European Connection Conditions** shall apply and not the requirements of this appendix. This is to ensure that **Low Frequency Relays** installed on or after XXXX include a directional element which is essential for ensuring discrimination between net Demand and net export from Embedded generation.

Extracts from the European Connection Conditions (ECC's)

APPENDIX E5 - TECHNICAL REQUIREMENTS LOW FREQUENCY RELAYS FOR THE AUTOMATIC DISCONNECTION OF SUPPLIES AT LOW FREQUENCY

ECC.A.5.1 Low Frequency Relays

ECC.A.5.1.1 The **Low Frequency Relays** to be used shall have a setting range of 47.0 to 50Hz and be suitable for operation from a nominal AC input of 63.5, 110 or 240V. The following parameters specify the requirements of approved **Low Frequency Relays**:

- (a) **Frequency** settings: 47-50Hz in steps of 0.05Hz or better, preferably 0.01Hz;
- (b) Operating time: Relay operating time shall not be more than 150 ms;
- (c) Voltage lock-out: Selectable within a range of 55 to 90% of nominal

- voltage;
- (d) Direction Tripping interlock for forward or reverse power flow capable of being set in either position or off
 - (e) Facility stages: One or two stages of **Frequency** operation;
 - (f) Output contacts: Two output contacts per stage to be capable of repetitively making and breaking for 1000 operations:
 - (g) Accuracy: 0.01 Hz maximum error under reference environmental and system voltage conditions.
0.05 Hz maximum error at 8% of total harmonic distortion **Electromagnetic Compatibility Level**.

In the case of **Network Operators** who are **GB Code Users**, the above requirements only apply to a relay (if any) installed at the **EU Grid Supply Point** or where the **Network Operator** installed a **Low Frequency Relay** within its **System** on or after 18th December 2022. ~~**Network Operators** who are also **GB Code Users** should continue to satisfy the requirements for low frequency relays as specified in the **CCs** as applicable to their **System**.~~

ECC.A.5.2 Low Frequency Relay Voltage Supplies

ECC.A.5.2.1 It is essential that the voltage supply to the **Low Frequency Relays** shall be derived from the primary **System** at the supply point concerned so that the **Frequency** of the **Low Frequency Relays** input voltage is the same as that of the primary **System**. This requires either:

- (a) the use of a secure supply obtained from voltage transformers directly associated with the grid transformer(s) concerned, the supply being obtained where necessary via a suitable automatic voltage selection scheme; or
- (b) the use of the substation 240V phase-to-neutral selected auxiliary supply, provided that this supply is always derived at the supply point concerned and is never derived from a standby supply **Power Generating Module** or from another part of the **User System**.

ECC.A.5.3 Scheme Requirements

ECC.A.5.3.1 The tripping facility should be engineered in accordance with the following reliability considerations:

(a) Dependability

Failure to trip at any one particular **Demand** shedding point would not harm the overall operation of the scheme. However, many failures would have the effect of reducing the amount of **Demand** under low **Frequency** control. An overall reasonable minimum requirement for the dependability of the **Demand** shedding scheme is 96%, i.e. the average probability of failure of each **Demand** shedding point should be less than 4%. Thus the **Demand** under low **Frequency** control will not be reduced by more than 4% due to relay failure.

(b) Outages

Low **Frequency Demand** shedding schemes will be engineered such that the amount of **Demand** under control is as specified in Table ECC.A.5.5.1a and is not reduced unacceptably during equipment outage or maintenance conditions.

ECC.A.5.3.2 The total operating time of the scheme, including circuit breakers operating time, shall where reasonably practicable, be less than 200ms. For the avoidance of doubt, the replacement of plant installed prior to October 2009 will not be required in order to achieve lower total scheme operating times.

ECC.A.5.3.3 In addition to the above requirements, each **Low Frequency Relay** installed on or after XXX shall:-

(a) In accordance with the requirements of ECC.A.5.1.1(d), a **directional element** shall be **included and enabled** to inhibit tripping where **Active Power** is exported to the **Total System**.

(b) Be sited **as far as practicable** to minimise the disconnection of **Embedded Type B, Embedded Type C and Embedded Type D Power Generating Modules and HVDC Systems** especially those which have a **Grid Forming Capability**.

(c) Be configured such that operation of the **Low Frequency Relay** does not result in voltage excursions outside the requirements of ECC.6.1.4 and/or power flows which result in greater **Total System** deterioration.

ECC.A.5.3.4 If due to site specific issues, the **Network Operator** is unable to satisfy the requirements of ECC.A.5.3.3(b) and (c) the **Network Operator** shall notify **The Company** and propose which requirement(s) would apply. These requirements would be pursuant to the terms of the **Bilateral Agreement**.

Commented [J(A1): Are we comfortable with this. E&R Art 15(7)(c) states "limit the risk that the scheme leads to power flow deviations and voltage deviations outside operational security limits noting that once the LFDD scheme has triggered we are already outside operational security limits?"

ECC.A.5.4 Low Frequency Relay Testing

ECC.A.5.4.1 **Low Frequency Relays** installed and commissioned after 1st January 2007 shall be type tested in accordance with and comply with the functional test requirements for **Frequency Protection** contained in Energy Networks Association Technical Specification 48-6-5 Issue 1 dated 2005 "ENA **Protection** Assessment Functional Test Requirements – Voltage and Frequency **Protection**".

For the avoidance of doubt, **Low Frequency Relays** installed and commissioned before 1st January 2007 shall comply with the version of ECC.A.5.1.1 applicable at the time such **Low Frequency Relays** were commissioned.

ECC.A.5.4.2 Each **Non-Embedded Customer** shall aim to execute testing on its low frequency demand disconnection relays installed within its network and in service at least once every three years, although this may be extended to no more than every five years if considered to be required for operational purposes.

ECC.A.5.4.3 Each **Network Operator** and **Relevant Transmission Licensee** shall aim to execute testing on its low frequency demand disconnection relays installed within its network and in service at least once every three years, although this may be extended to no more than every five years if considered to be required for operational purposes.

ECC.A.5.5 Scheme Settings

- ECC.A.5.5.1 Table CC.A.5.5.1a shows, for each **Transmission Area**, the percentage of **Demand** (based on **Annual ACS Conditions**) at the time of forecast **National Electricity Transmission System** peak **Demand** that each **Network Operator** whose **System** is connected to the **Onshore Transmission System** within such **Transmission Area** shall disconnect by **Low Frequency Relays** at a range of **Frequencies**. Where a **Network Operator's System** is connected to the **National Electricity Transmission System** in more than one **Transmission Area**, the settings for the **Transmission Area** in which the majority of the **Demand** is connected shall apply.

Frequency Hz	% Demand disconnection for each Network Operator in Transmission Area		
	NGET	SPT	SHTL
48.8	5		
48.75	5		
48.7	10		
48.6	7.5		10
48.5	7.5	10	
48.4	7.5	10	10
48.2	7.5	10	10
48.0	5	10	10
47.8	5		
Total % Demand	60	40	40

Table ECC.A.5.5.1a

Note – the percentages in table ECC.A.5.5.1a are cumulative such that, for example, should the **Frequency** fall to 48.6 Hz in **NGET's Transmission Area**, 27.5% of the total **Demand** connected to the **National Electricity Transmission System** in **NGET's Transmission Area** shall be disconnected by the action of **Low Frequency Relays**.

The percentage **Demand** at each stage shall be allocated as far as reasonably practicable. The cumulative total percentage **Demand** is a minimum.

- ECC.A.5.5.2 In the case of a **Non-Embedded Customer** (who is also an **EU Code User**) the percentage of **Demand** (based on **Annual ACS Conditions**) at the time of forecast **National Electricity Transmission System** peak **Demand** that each **Non-Embedded Customer** whose **System** is connected to the **Onshore Transmission System** which shall be disconnected by **Low Frequency Relays** shall be in accordance with OC6.6 and the **Bilateral Agreement**.
- ECC.A.5.6 Connection and Reconnection
- ECC.A.5.6.1 As defined under OC.6.6 once automatic low **Frequency Demand Disconnection** has taken place, the **Network Operator** on whose **User System** it has occurred, will not reconnect until **The Company** instructs that **Network Operator** to do so in accordance with OC6. The same requirement equally applies to **Non-Embedded Customers**.

- ECC.A.5.6.2 Once **The Company** instructs the **Network Operator** or **Non-Embedded Customer** to reconnect to the **National Electricity Transmission System** following operation of the **Low Frequency Demand Disconnection** scheme it shall do so in accordance with the requirements of ECC.6.2.3.10 and OC6.6.
- ECC.A.5.6.3 **Network Operators** or **Non-Embedded Customers** shall be capable of being remotely disconnected from the **National Electricity Transmission System** when instructed by **The Company**. Any requirement for the automated disconnection equipment for reconfiguration of the **National Electricity Transmission System** in preparation for block loading and the time required for remote disconnection shall be specified by **The Company** in accordance with the terms of the **Bilateral Agreement**.