

Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (Text with EEA relevance)

PART IV

LOAD-FREQUENCY CONTROL AND RESERVES

TITLE 3

LOAD-FREQUENCY CONTROL STRUCTURE

Article 139

Basic structure

- 1 All TSOs of [^{F1}the GB synchronous area] shall specify the load-frequency-control structure for the synchronous area in the synchronous area operational agreement. Each TSO shall be responsible for implementing the load-frequency-control structure of [^{F2}the GB synchronous area] and operating in accordance with it.
- 2 The load-frequency control structure of [^{F3}the GB synchronous area] shall include:
 - a a process activation structure in accordance with Article 140; and
 - b a process responsibility structure in accordance with Article 141.

Textual Amendments

- F1** Words in Art. 139(1) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 89(2)(a)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F2** Words in Art. 139(1) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 89(2)(b)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F3** Words in Art. 139(2) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 89(3)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

Article 140

Process activation structure

- 1 The process activation structure shall include:
 - a a FCP pursuant to Article 142;
 - b a FRP pursuant to Article 143 ^{F4}...
 - ^{F4}c

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- 2 The process activation structure may include:
- a a RRP pursuant to Article 144;
 - ^{F5}b
 - ^{F6}c
 - ^{F7}d
 - e ^{F8}... a time control process pursuant to Article 181.

Textual Amendments

- F4** Art. 140(1)(c) and word omitted (E.W.S.) (31.12.2020) by virtue of The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 90(2)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F5** Art. 140(2)(b) omitted (E.W.S.) (31.12.2020) by virtue of The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 90(3)(a)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F6** Art. 140(2)(c) omitted (E.W.S.) (31.12.2020) by virtue of The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 90(3)(a)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F7** Art. 140(2)(d) omitted (E.W.S.) (31.12.2020) by virtue of The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 90(3)(a)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F8** Words in Art. 140(2)(e) omitted (E.W.S.) (31.12.2020) by virtue of The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 90(3)(b)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

Article 141

Process responsibility structure

- 1 When specifying the process responsibility structure, all TSOs of [^{F9}the GB synchronous area] shall take into account at least the following criteria:
- a the size and the total inertia, including synthetic inertia, of the synchronous area;
 - b the grid structure and/or network topology; and
 - c the load, generation and HVDC behaviour.
- 2 By 4 months after entry into force of this Regulation, all TSOs of [^{F10}the GB synchronous area] shall jointly develop a common proposal regarding the determination of the LFC blocks, which shall comply with the following requirements:
- a a monitoring area corresponds to or is part of only one LFC area;
 - b a LFC area corresponds to or is part of only one LFC block;
 - c a LFC block corresponds to or is part of only one synchronous area; and
 - d each network element is part of only one monitoring area, only one LFC area and only one LFC block.

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3 All TSOs of each monitoring area shall continuously calculate and monitor the real-time active power interchange of the monitoring area.

4 All TSOs of each LFC area shall:

- a continuously monitor the FRCE of the LFC area;
- b implement and operate a FRP for the LFC area;
- c endeavour to fulfil the FRCE target parameters of the LFC area as defined in Article 128; and
- d have the right to implement one or several of the processes referred to in Article 140(2).

5 All TSOs of each LFC block shall:

- a endeavour to fulfil the FRCE target parameters of the LFC block as defined in Article 128; and
- b comply with the FRR dimensioning rules in accordance with Article 157 and the RR dimensioning rules in accordance with Article 160.

6 All TSOs of [^{F11}the GB synchronous area] shall:

- a implement and operate a FCP for the synchronous area;
- b comply with FCR dimensioning rules in accordance with Article 153; and
- c endeavour to fulfil the frequency quality target parameters in accordance with Article 127.

7 All TSOs of each monitoring area shall specify in the monitoring area operational agreement the allocation of responsibilities between TSOs in the monitoring area for the implementation of the obligation set out in paragraph 3.

8 All TSOs of each LFC area shall specify in the LFC area operational agreement the allocation of responsibilities between TSOs in the LFC area for the implementation of the obligations set out in paragraph 4.

9 All TSOs of each LFC block shall specify in the LFC block operational agreement the allocation of responsibilities between TSOs in the LFC block for the implementation of the obligations set out paragraph 5.

10 All TSOs of [^{F12}the GB synchronous area] shall specify in the synchronous area operational agreement the allocation of responsibilities between TSOs in the synchronous area for the implementation of the obligations set out in paragraph 6.

^{F13}11

Textual Amendments

- F9** Words in Art. 141(1) substituted (E.W.S.) (31.12.2020) by The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 91(2)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F10** Words in Art. 141(2) substituted (E.W.S.) (31.12.2020) by The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 91(3)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F11** Words in Art. 141(6) substituted (E.W.S.) (31.12.2020) by The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 91(4)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

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- F12** Words in Art. 141(10) substituted (E.W.S.) (31.12.2020) by The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 91(4)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F13** Art. 141(11) omitted (E.W.S.) (31.12.2020) by virtue of The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 91(5)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

Article 142

Frequency containment process

- 1 The control target of FCP shall be the stabilization of the system frequency by activation of FCR.
- 2 The overall characteristic for FCR activation in [^{F14}the GB synchronous area] shall reflect a monotonic decrease of the FCR activation as a function of the frequency deviation.

Textual Amendments

F14 Words in Art. 142(2) substituted (E.W.S.) (31.12.2020) by The Electricity Network Codes and Guidelines (System Operation and Connection) (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 92** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

Article 143

Frequency restoration process

- [^{F15}1 The control target of the FRP shall be to regulate the FRCE towards zero within the time to restore frequency.]
- 2 The FRCE is:
 - a the ACE of an LFC area, where there is more than one LFC area in a synchronous area; or
 - b the frequency deviation, where one LFC area corresponds to the LFC block and the synchronous area.
 - 3 The ACE of a LFC area shall be calculated as the sum of the product of the K-Factor of the LFC area with the frequency deviation plus de subtraction of:
 - a the total interconnector and virtual tie-line active power flow; and
 - b the control program in accordance with Article 136.

^{F16}4

^{F17}5

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Textual Amendments

- F15** Art. 143(1) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019 \(S.I. 2019/533\)](#), reg. 1(2), **Sch. 1 para. 93(2)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F16** Art. 143(4) omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019 \(S.I. 2019/533\)](#), reg. 1(2), **Sch. 1 para. 93(3)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F17** Art. 143(5) omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019 \(S.I. 2019/533\)](#), reg. 1(2), **Sch. 1 para. 93(3)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

Article 144

Reserve replacement process

- 1 The control target of the RRP shall be to fulfil at least one of the following goals by activation of RR:
 - a progressively restore the activated FRR;
 - b support FRR activation;
 - c ^{F18}... to progressively restore the activated FCR and FRR.
- 2 The RRP shall be operated through instructions for manual RR activation in order to fulfil the control target in accordance with paragraph 1.

Textual Amendments

- F18** Words in Art. 144(1)(c) omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019 \(S.I. 2019/533\)](#), reg. 1(2), **Sch. 1 para. 94** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

Article 145

Automatic and manual frequency restoration process

- 1 Each TSO of each LFC area shall implement an automatic frequency restoration process ('aFRP') and a manual frequency restoration process ('mFRP').
- 2 By 2 years after entry into force of this regulation, the TSOs of GB [^{F19}synchronous area] may each submit a proposal to [^{F20}the regulatory authority] requesting not to implement an aFRP. Those proposals shall include a cost-benefit analysis demonstrating that implementation of an aFRP would lead to higher costs than benefits. In case the proposal is approved by the [^{F21}regulatory authority], the respective TSOs and [^{F22}the regulatory authority] shall re-evaluate such decision at least every 4 years.

^{F23}

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4 The aFRP shall be operated in a closed-loop manner where the FRCE is an input and the setpoint for automatic FRR activation is an output. The setpoint for automatic FRR activation shall be calculated by a single frequency restoration controller operated by a TSO within its LFC area. ^{F24}...

- a be an automatic control device designed to reduce the FRCE to zero;
- b have proportional-integral behaviour;
- c have a control algorithm which prevents the integral term of a proportional-integral controller from accumulating the control error and overshooting; and
- d have functionalities for extraordinary operational modes for the alert and emergency states.

5 The mFRP shall be operated through instructions for manual FRR activation in order to fulfil the control target in accordance with Article 143(1).

6 In addition to the aFRP implementation in the LFC areas, all TSOs of an LFC block which consists of more than one LFC area shall have the right to appoint one TSO of the LFC block in the LFC block operational agreement to:

- a calculate and monitor the FRCE of the whole LFC block; and
- b take the FRCE of the whole LFC block into account for the calculation of the setpoint value for aFRR activation in accordance with Article 143(3) in addition to the FRCE of its LFC area.

Textual Amendments

- F19** Words in Art. 145(2) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 95(2)(a)(i)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F20** Words in Art. 145(2) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 95(2)(a)(ii)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F21** Words in Art. 145(2) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 95(2)(b)(i)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F22** Words in Art. 145(2) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 95(2)(b)(ii)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F23** Art. 145(3) omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 95(3)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)
- F24** Words in Art. 145(4) omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 95(4)** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

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F25 Article 146

Imbalance netting process

Textual Amendments

F25 Arts. 146-150 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 96** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

F25 Article 147

Cross-border FRR activation process

Textual Amendments

F25 Arts. 146-150 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 96** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

F25 Article 148

Cross-border RR activation process

Textual Amendments

F25 Arts. 146-150 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 96** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

F25 Article 149

General requirements for cross-border control processes

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Textual Amendments

F25 Arts. 146-150 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 96** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

^{F25}Article 150

TSO notification

Textual Amendments

F25 Arts. 146-150 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), **Sch. 1 para. 96** (as amended by S.I. 2020/1016, regs. 1(2), 6(2)); 2020 c. 1, Sch. 5 para. 1(1)

Article 151

Infrastructure

1 All TSOs shall assess what technical infrastructure is necessary to implement and operate the processes referred to in Article 140 and considered critical pursuant to the security plan referred to in Article 26.

2 All TSOs of [^{F26}the GB synchronous area] shall specify, in the synchronous area operational agreement, minimum requirements for the availability, reliability and redundancy of the technical infrastructure referred to in paragraph 1 including:

- a the accuracy, resolution, availability and redundancy of active power flow and virtual tie-line measurements;
- b the availability and redundancy of digital control systems;
- c the availability and redundancy of communication infrastructure; and
- d communication protocols.

3 All TSOs of a LFC block shall set out additional requirements for the availability, reliability and redundancy of the technical infrastructure in the LFC block operational agreement.

4 Each TSO of a LFC area shall:

- a ensure a sufficient quality and availability of the FRCE calculation;
- b perform real-time quality monitoring of the FRCE calculation;
- c take action in case of FRCE miscalculation; and
- d where the FRCE is determined by the ACE, perform an *ex-post* quality monitoring of the FRCE calculation by comparing FRCE to reference values at least on an annual basis.

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Textual Amendments

- F26** Words in [Art. 151\(2\)](#) substituted (E.W.S.) (31.12.2020) by [The Electricity Network Codes and Guidelines \(System Operation and Connection\) \(Amendment etc.\) \(EU Exit\) Regulations 2019](#) (S.I. 2019/533), reg. 1(2), [Sch. 1 para. 97](#) (as amended by [S.I. 2020/1016](#), regs. 1(2), 6(2)); 2020 c. 1, [Sch. 5 para. 1\(1\)](#)

Changes to legislation:

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Changes and effects yet to be applied to the whole legislation item and associated provisions

- Art. 2(3A) inserted by [S.I. 2019/533 Sch. 1 para. 3\(5\)](#) (This amendment not applied to legislation.gov.uk. Sch. 1 para. 3(5) omitted (15.9.2020) by virtue of S.I. 2020/1016, regs. 1(2), 6(3)(a))
- Art. 3.2(168) omitted by [S.I. 2024/706 reg. 44\(a\)\(iii\)](#)
- Art. 55(d) words inserted by [S.I. 2019/533 Sch. 1 para. 44\(2\)\(b\)](#) (This amendment not applied to legislation.gov.uk. Sch. 1 para. 44(2)(b) substituted (15.9.2020) by S.I. 2020/1016, regs. 1(2), 6(3)(j))