

Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (Text with EEA relevance)

TITLE II

REQUIREMENTS

CHAPTER 3

Requirements for power park modules

Article 21

Requirements for type C power park modules

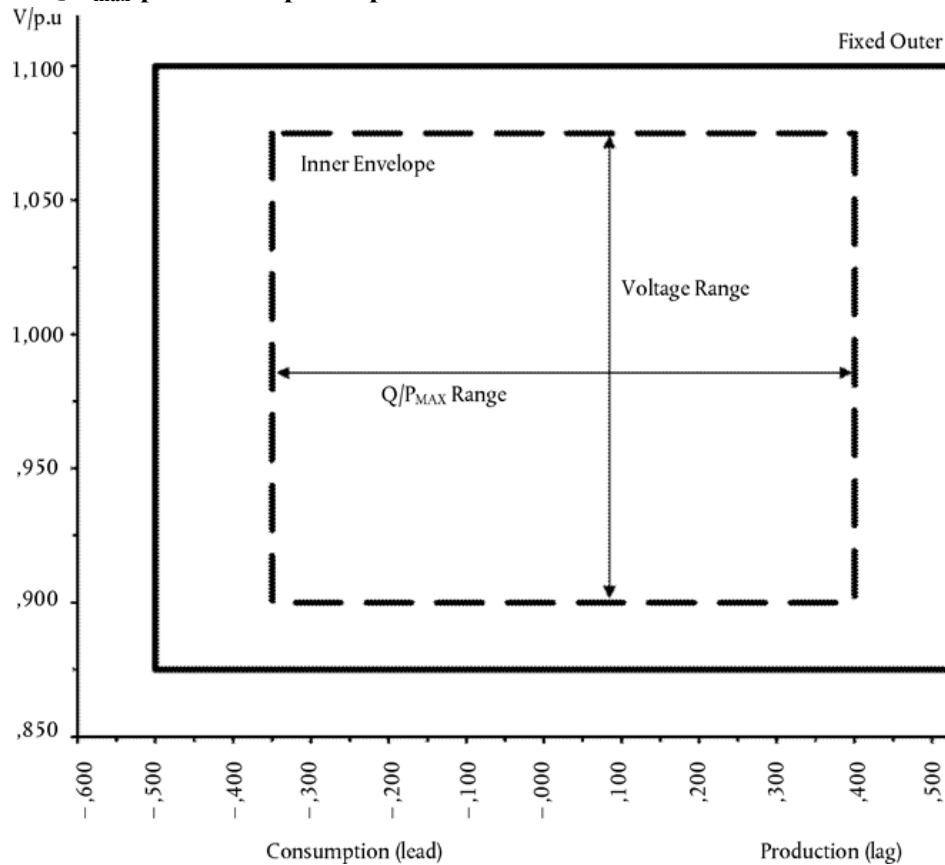
- 1 Type C power park modules shall fulfil the requirements listed in Articles 13, except for Article 13(2)(b) and (6), Article 14, except for Article 14(2), Article 15 and Article 20, except for Article 20(2)(a), unless referred to otherwise in point (v) of paragraph 3(d).
- 2 Type C power park modules shall fulfil the following additional requirements in relation to frequency stability:
 - a the relevant TSO shall have the right to specify that power park modules be capable of providing synthetic inertia during very fast frequency deviations;
 - b the operating principle of control systems installed to provide synthetic inertia and the associated performance parameters shall be specified by the relevant TSO.
- 3 Type C power park modules shall fulfil the following additional requirements in relation to voltage stability:
 - a with regard to reactive power capability, the relevant system operator may specify supplementary reactive power to be provided if the connection point of a power park module is neither located at the high-voltage terminals of the step-up transformer to the voltage level of the connection point nor at the convertor terminals, if no step-up transformer exists. This supplementary reactive power shall compensate the reactive power demand of the high-voltage line or cable between the high-voltage terminals of the step-up transformer of the power park module or its convertor terminals, if no step-up transformer exists, and the connection point and shall be provided by the responsible owner of that line or cable.
 - b with regard to reactive power capability at maximum capacity:
 - (i) the relevant system operator in coordination with the relevant TSO shall specify the reactive power provision capability requirements in the context of varying voltage. To that end, it shall specify a U-Q/P_{max}-profile that may take any shape within the boundaries of which the power park module shall be capable of providing reactive power at its maximum capacity;
 - (ii) the U-Q/P_{max}-profile shall be specified by each relevant system operator in coordination with the relevant TSO in conformity with the following principles:

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- the $U-Q/P_{\max}$ -profile shall not exceed the $U-Q/P_{\max}$ -profile envelope, represented by the inner envelope in Figure 8,
- the dimensions of the $U-Q/P_{\max}$ -profile envelope (Q/P_{\max} range and voltage range) shall be within the values specified for each synchronous area in Table 9,
- the position of the $U-Q/P_{\max}$ -profile envelope shall be within the limits of the fixed outer envelope set out in Figure 8, and
- the specified $U-Q/P_{\max}$ profile may take any shape, having regard to the potential costs of delivering the capability to provide reactive power production at high voltages and reactive power consumption at low voltages;

^{F1} Figure 8

$U-Q/P_{\max}$ -profile of a power park module



The diagram represents boundaries of a $U-Q/P_{\max}$ -profile by the voltage at the connection point, expressed by the ratio of its actual value and its reference 1 pu value, against the ratio of the reactive power (Q) and the maximum capacity (P_{\max}). The position, size and shape of the inner envelope are indicative.

TABLE 9

Parameters for the inner envelope in Figure 8

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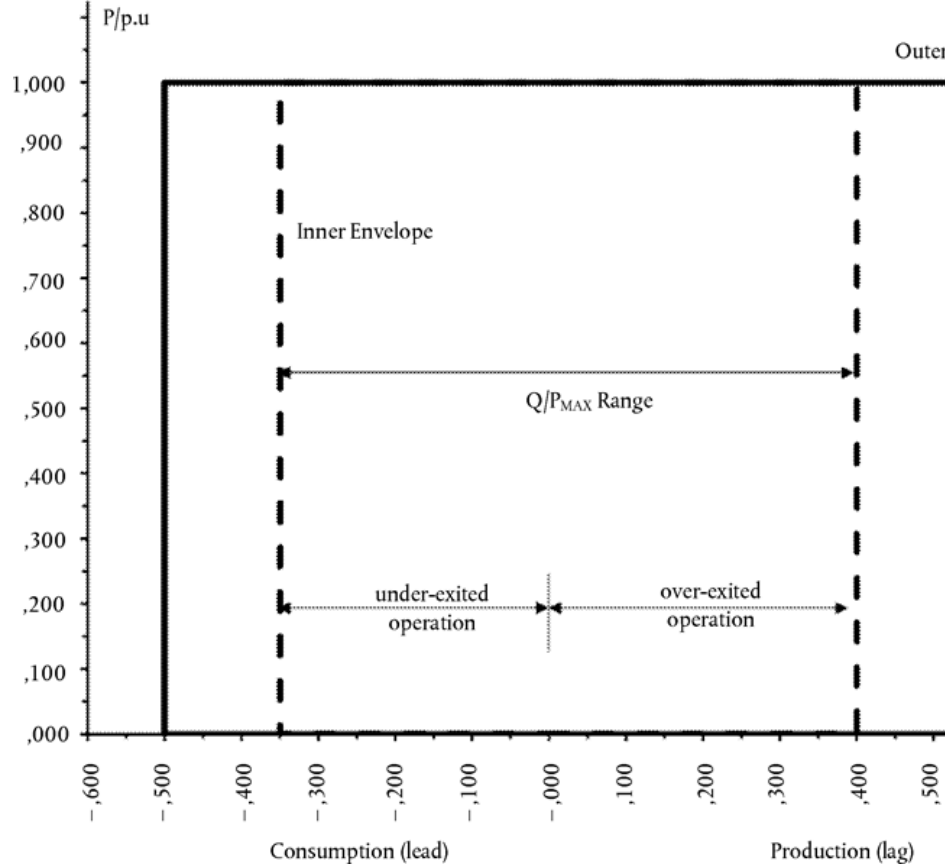
Synchronous area	Maximum range of Q/ P_{\max}	Maximum range of steady-state voltage level in PU
F2	F2	F2
...
F3	F3	F3
...
Great Britain	[^{F4} 0.66]	[^{F5} 0.225]
F6	F6	F6
...
F7	F7	F7
...

- (iii) the reactive power provision capability requirement applies at the connection point. For profile shapes other than rectangular, the voltage range represents the highest and lowest values. The full reactive power range is therefore not expected to be available across the range of steady-state voltages;
- c with regard to reactive power capability below maximum capacity:
 - (i) the relevant system operator in coordination with the relevant TSO shall specify the reactive power provision capability requirements and shall specify a P-Q/ P_{\max} -profile that may take any shape within the boundaries of which the power park module shall be capable of providing reactive power below maximum capacity;
 - (ii) the P-Q/ P_{\max} -profile shall be specified by each relevant system operator in coordination with the relevant TSO, in conformity with the following principles:
 - the P-Q/ P_{\max} -profile shall not exceed the P-Q/ P_{\max} -profile envelope, represented by the inner envelope in Figure 9,
 - the Q/ P_{\max} range of the P-Q/ P_{\max} -profile envelope is specified for each synchronous area in Table 9,
 - the active power range of the P-Q/ P_{\max} -profile envelope at zero reactive power shall be 1 pu,
 - the P-Q/ P_{\max} -profile can be of any shape and shall include conditions for reactive power capability at zero active power, and
 - the position of the P-Q/ P_{\max} -profile envelope shall be within the limits of the fixed outer envelope set out in Figure 9;
 - (iii) when operating at an active power output below maximum capacity ($P < P_{\max}$), the power park module shall be capable of providing reactive power at any operating point inside its P-Q/ P_{\max} -profile, if all units of that power park module which generate power are technically available that is to say they are not out of service due to maintenance or failure, otherwise there may be less reactive power capability, taking into consideration the technical availabilities;

^{F8}Figure 9

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P-Q/ P_{\max} -profile of a power park module



The diagram represents boundaries of a P-Q/ P_{\max} -profile at the connection point by the active power, expressed by the ratio of its actual value and the maximum capacity pu, against the ratio of the reactive power (Q) and the maximum capacity (P_{\max}). The position, size and shape of the inner envelope are indicative.

- (iv) the power park module shall be capable of moving to any operating point within its P-Q/ P_{\max} profile in appropriate timescales to target values requested by the relevant system operator;
- d with regard to reactive power control modes:
 - (i) the power park module shall be capable of providing reactive power automatically by either voltage control mode, reactive power control mode or power factor control mode;
 - (ii) for the purposes of voltage control mode, the power park module shall be capable of contributing to voltage control at the connection point by provision of reactive power exchange with the network with a setpoint voltage covering $[^{F9}0.95]$ to $[^{F10}1.05]$ pu in steps no greater than $[^{F11}0.01]$ pu, with a slope having a range of at least 2 to 7 % in steps no greater than $[^{F12}0.5]$ %. The reactive power output shall be zero when the grid voltage value at the connection point equals the voltage setpoint;

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- (iii) the setpoint may be operated with or without a deadband selectable in a range from zero to $\pm 5\%$ of reference 1 pu network voltage in steps no greater than $[\text{F}^{13}0.5]\%$;
 - (iv) following a step change in voltage, the power park module shall be capable of achieving 90 % of the change in reactive power output within a time t_1 to be specified by the relevant system operator in the range of 1 to 5 seconds, and must settle at the value specified by the slope within a time t_2 to be specified by the relevant system operator in the range of 5 to 60 seconds, with a steady-state reactive tolerance no greater than 5 % of the maximum reactive power. The relevant system operator shall specify the time specifications;
 - (v) for the purpose of reactive power control mode, the power park module shall be capable of setting the reactive power setpoint anywhere in the reactive power range, specified by point (a) of Article 20(2) and by points (a) and (b) of Article 21(3), with setting steps no greater than 5 MVAR or 5 % (whichever is smaller) of full reactive power, controlling the reactive power at the connection point to an accuracy within plus or minus 5 MVAR or plus or minus 5 % (whichever is smaller) of the full reactive power;
 - (vi) for the purpose of power factor control mode, the power park module shall be capable of controlling the power factor at the connection point within the required reactive power range, specified by the relevant system operator according to point (a) of Article 20(2) or specified by points (a) and (b) of Article 21(3), with a target power factor in steps no greater than $[\text{F}^{14}0.01]$. The relevant system operator shall specify the target power factor value, its tolerance and the period of time to achieve the target power factor following a sudden change of active power output. The tolerance of the target power factor shall be expressed through the tolerance of its corresponding reactive power. This reactive power tolerance shall be expressed by either an absolute value or by a percentage of the maximum reactive power of the power park module;
 - (vii) the relevant system operator, in coordination with the relevant TSO and with the power park module owner, shall specify which of the above three reactive power control mode options and associated setpoints is to apply, and what further equipment is needed to make the adjustment of the relevant setpoint operable remotely;
- e with regard to prioritising active or reactive power contribution, the relevant TSO shall specify whether active power contribution or reactive power contribution has priority during faults for which fault-ride-through capability is required. If priority is given to active power contribution, this provision has to be established no later than 150 ms from the fault inception;
- f with regard to power oscillations damping control, if specified by the relevant TSO a power park module shall be capable of contributing to damping power oscillations. The voltage and reactive power control characteristics of power park modules must not adversely affect the damping of power oscillations.

Textual Amendments

F1 Figure 8 amended (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(a)** as follows:

- (i) for “1,100” substitute “1.100”;

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- (ii) for “1,050” substitute “1.050”;
- (iii) for “1,000” substitute “1.000”;
- (iv) for “,950” substitute “,950”;
- (v) for “,900” substitute “,900”;
- (vi) for “,850” substitute “,850”;
- (vii) for “-,600” substitute “-.600”;
- (viii) for “-,500” substitute “-.500”;
- (ix) for “-,400” substitute “-.400”;
- (x) for “-,300” substitute “-.300”;
- (xi) for “-,200” substitute “-.200”;
- (xii) for “-,100” substitute “-.100”;
- (xiii) for “-,000” substitute “-.000”;
- (xiv) for “,100” substitute “.100”;
- (xv) for “,200” substitute “.200”;
- (xvi) for “,300” substitute “.300”;
- (xvii) for “,400” substitute “.400”;
- (xviii) for “,500” substitute “.500”;
- (xix) for “,600” substitute “.600”;
- (xx) for “,700” substitute “.700”;

- F2** Words in Art. 21(3) Table 9 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(b)(i)**
- F3** Words in Art. 21(3) Table 9 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(b)(ii)**
- F4** Word in Art. 21(3) Table 9 substituted (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(b)(iii)(aa)**
- F5** Word in Art. 21(3) Table 9 substituted (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(b)(iii)(bb)**
- F6** Words in Art. 21(3) Table 9 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(b)(iv)**
- F7** Words in Art. 21(3) Table 9 omitted (E.W.S.) (31.12.2020) by virtue of [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(b)(v)**
- F8** Figure 9 amended (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(c)** as follows:
 - (i) for “1,000” substitute “1.000”;
 - (ii) for “,900” substitute “,900”;
 - (iii) for “,800” substitute “.800”;
 - (iv) for “,700” (in both places it occurs) substitute “.700”;
 - (v) for “,600” (in both places it occurs) substitute “.600”;
 - (vi) for “,500” (in both places it occurs) substitute “.500”;
 - (vii) for “,400” (in both places it occurs) substitute “.400”;
 - (viii) for “,300” (in both places it occurs) substitute “.300”;
 - (ix) for “,200” (in both places it occurs) substitute “.200”;
 - (x) for “,100” (in both places it occurs) substitute “.100”;
 - (xi) for “,000” substitute “.000”;
 - (xii) for “-,600” substitute “-.600”;
 - (xiii) for “-,500” substitute “-.500”;

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- (xiv) for “-,400” substitute “-,400”;
- (xv) for “-,300” substitute “-,300”;
- (xvi) for “-,200” substitute “-,200”;
- (xvii) for “-,100” substitute “-,100”;
- (xviii) for “-,000” substitute “-,000”;

- F9** Word in Art. 21(3)(d)(ii) substituted (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(d)(aa)**
- F10** Word in Art. 21(3)(d)(ii) substituted (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(d)(bb)**
- F11** Word in Art. 21(3)(d)(ii) substituted (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(d)(cc)**
- F12** Word in Art. 21(3)(d)(ii) substituted (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(d)(dd)**
- F13** Word in Art. 21(3)(d)(iii) substituted (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(e)**
- F14** Word in Art. 21(3)(d)(vi) substituted (E.W.S.) (31.12.2020) by [The Electricity and Gas \(Internal Markets and Network Codes\) \(Amendment etc.\) \(EU Exit\) Regulations 2020 \(S.I. 2020/1006\)](#), reg. 1(2), **Sch. 1 para. 18(f)**

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