

**DCC (Demand Connection Code), articles 3-29**

**Requirements laid down pursuant to EU regulation 2016/1388 – Demand Connection Code (DCC)**

Please note that this is a translation of the original Danish text. In case of inconsistencies, the Danish version shall apply.

TEXT	VERSION	DATE
Amended following the Danish Utility Regulator’s consultation period and approved by the Danish Utility Regulator	0	28.05.2019

Normative requirements – no changes made
Requirements finalised

Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.
<b>Scope of application</b>								
3	1			The connection requirements set out in this Regulation shall apply to:			<u>Facility categories</u> The regulation distinguishes between different connection types, and therefore, a total of 5 different categories of transmission-connected distribution systems and demand facilities have been defined:  <u>Distribution system - category 1</u> A distribution system, which is characterized by one or more POCs to the transmission system and in addition, depending on current operating conditions, has an electric interconnection - or the possibility of an electric interconnection - with one or more distribution systems.	0
3	1	a		new transmission-connected demand facilities;				
3	1	b		new transmission-connected distribution facilities;				
3	1	c		new distribution systems, including new closed distribution systems;				
3	1	d		new demand units used by a demand facility or a closed distribution system to provide demand response services to relevant system operators and relevant TSOs.				
				The relevant system operator shall refuse to allow the connection of a new transmission-connected demand facility, a new transmission-connected distribution facility, or a new distribution system, which does not comply with the requirements set out in this Regulation and which is not covered by a derogation granted by the regulatory authority, or other authority where applicable in a Member State pursuant to Article 50. The relevant system operator shall communicate such refusal, by means of a reasoned statement in writing, to the demand facility owner, DSO, or CDSO and, unless specified otherwise by the regulatory authority, to the regulatory authority.				

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				<p>Based on compliance monitoring in accordance with Title III, the relevant TSO shall refuse demand response services subject to Articles 27 to 30 from new demand units not fulfilling the requirements set out in this Regulation.</p>			<p>The distribution system provides transport of electricity for customers connected to the distribution system's public high-voltage, medium-voltage and low-voltage grids.</p> <p>If the electricity supply undertaking, when reviewing an application for grid connection, determines that there is a risk of significant challenges as regards voltage quality, the electricity supply undertaking must contact Energinet Elsystemansvar A/S, cf. the process in appendix 1F.</p> <p><u>Demand facility - category 3</u>                      A demand facility, which, in connection with the completion of the grid connection process (EON, ION, FON) and issue of an FON, can document its maximum consumption in relation to the assigned maximum power draw.</p> <p>The assigned maximum power draw may, in specific instances, be limited if there is a predictable risk of lack of grid adequacy, lack of generation adequacy, and/or deterioration of the robustness of the transmission system. In such cases, the specific details will be stated in the grid connection agreement.</p> <p><u>Demand facility - category 4</u>                      A demand facility, which, in connection with the completion of the grid</p>		

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							<p>connection process (EON, ION, FON) and issue of an FON, cannot document its maximum consumption in relation to the assigned maximum power draw.</p> <p>The demand facility's consumption may, by agreement with Energinet Elsystemansvar A/S, be increased to the maximum power draw assigned with a step-by-step expansion of the existing demand facility.</p> <p>The assigned maximum power draw may, in specific instances, be limited if there is a predictable risk of lack of grid adequacy, lack of generation adequacy, and/or deterioration of the robustness of the transmission system. In such cases, the specific details will be stated in the grid connection agreement.</p> <p><u>Demand facility - category 5</u> A demand facility, which, in connection with the completion of the grid connection process (EON, ION, FON) and issue of an FON, can document its maximum consumption in relation to the assigned maximum power draw.</p> <p>The demand facility is operational in peak-load situations for a maximum of 500 full-load equivalent hours a year.</p> <p>The assigned maximum power draw may, in specific instances, be limited if there is a predictable risk of lack of grid adequacy, lack of generation adequacy,</p>		

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							<p>and/or deterioration of the robustness of the transmission system. In such cases, the specific details will be stated in the grid connection agreement.</p> <p><u>Demand facility - category 6</u>                      Third rail current supply for electrical railway services, where the facility's supply and substations are connected to the transmission grid.</p> <p>Supply and substations are connected to Banedanmark's overall third rail current system for electrical railway services.</p> <p>This type of demand facility may differ significantly from other transmission-connected demand facilities with regard to connection and consumption characteristics.</p>		
3	2			This Regulation shall not apply to:					
3	2	a		demand facilities and distribution systems connected to the transmission system and distribution systems, or to parts of the transmission system or distribution systems, of islands of Member States of which the systems are not operated synchronously with either the Continental Europe, Great Britain, Nordic, Ireland and Northern Ireland or Baltic synchronous area;					
3	2	b		storage devices except for pump-storage power generating modules in accordance with Article 5(2).					
3	3			In case of demand facilities or closed distribution systems with more than one demand unit, these demand units shall together be considered as one demand unit if they cannot be operated independently from each other or can reasonably be considered in a combined manner.					
<b>Chapter 1 - General requirements</b>									
<b>General frequency requirements</b>									

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
12	1			Transmission-connected demand facilities, transmission-connected distribution facilities and distribution systems shall be capable of remaining connected to the network and operating at the frequency ranges and time periods specified in Annex I.	E		<p><b>CE:</b> 47.5 Hz-48.5 Hz – 30 min. 48.5 Hz-49.0 Hz – 30 min.</p> <p><b>N:</b> 48.5 Hz-49.0 Hz – 30 min.</p> <p>This means minimum 30 minutes in the 48.5 Hz to 49 Hz frequency range and 30 minutes in the 47.5 Hz to 48.5 Hz frequency range. However, total operation time below 49 Hz may not exceed 60 minutes.</p>	0	
12	2			The transmission-connected demand facility owner or the DSO may agree with the relevant TSO on <u>wider frequency ranges or longer minimum times for operation</u> . If wider frequency ranges or longer minimum times for operation are technically feasible, the consent of the transmission-connected demand facility owner or DSO shall not be unreasonably withheld.	O		<p><b>Demand facility:</b> Part of the terms and conditions that Energinet specifies for the specific grid connection based on the location of the point of connection in the transmission system.</p> <p><b>Distribution system:</b> Part of the terms and conditions that Energinet specifies for the specific grid connection based on the location of the point of connection in the transmission system.</p>	0	
<b>General voltage requirements</b>									
13	1			Transmission-connected demand facilities, transmission-connected distribution facilities and transmission-connected distribution systems shall be capable of remaining connected to the network and operating at the voltage ranges and time periods specified in Annex II.	NE		<p><b>CE:</b> 110-300 kV/1.118 – 1.15 p.u. - 60 min. 300-400 kV/1.05 – 1.1 p.u. - 60 min.</p> <p><b>N:</b> 300-400 kV/1.05 – 1.1 p.u. - 60 min.</p>		
13	2			Equipment of distribution systems connected at the same voltage as the voltage of the connection point to the transmission system shall be capable of remaining connected to the network and operating at the voltage ranges and time periods specified in Annex II.	E				

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
13	3			The voltage range at the connection point shall be expressed by the voltage at the connection point related to reference 1 per unit (p.u.) voltage. For the 400 kV grid voltage level (or alternatively commonly referred to as 380 kV level), the reference 1 p.u. value is 400 kV, for other grid voltage levels the reference 1 p.u. voltage may differ for each system operator in the same synchronous area.	E				
13	4			Where the voltage base for p.u. values is from 300kV to 400kV included, the relevant TSO in Spain may require transmission-connected demand facilities, transmission-connected distribution facilities and transmission-connected distribution systems to remain connected in the voltage range between 1.05 p.u. –1.0875 p.u. for an unlimited period.	E	n/a	n/a		
13	5			Where the voltage base for p.u. values is 400kV, the relevant TSOs in the Baltic synchronous area may require transmission-connected demand facilities, transmission-connected distribution facilities and transmission-connected distribution systems to remain connected to the 400 kV network in the voltage ranges and for time periods that apply to the Continental Europe synchronous area.	E		n/a		
13	6			<u>If required by the relevant TSO</u> , a transmission-connected demand facility, a transmission-connected distribution facility, or a transmission-connected distribution system shall be capable of automatic disconnection at specified voltages. The terms and settings for automatic disconnection shall be agreed between the relevant TSO and the transmission-connected demand facility owner or the DSO.	NE	R-TSO	<b>Demand facility:</b> No requirement for automatic disconnection from the transmission system at a predetermined voltage. <b>Distribution system:</b> No requirement for automatic disconnection from the transmission system at a predetermined voltage.		
13	7			With regard to transmission-connected distribution systems with a voltage below 110kV at the connection point, <u>the relevant TSO shall specify</u> the voltage range at the connection point that the distribution systems connected to that transmission system shall be designed to withstand. DSOs shall design the capability of their equipment, connected at the same voltage as the voltage of the connection point to the transmission system, to comply with this voltage range.	NE	R-TSO	<b>Distribution system:</b> (Information: Distribution systems are connected below 110 kV) Voltage range must be specified per connection as part of the connection terms and conditions.		
<b>Short-circuit requirements</b>									
14	1			Based on the rated short-circuit withstand capability of its transmission network elements, <u>the relevant TSO shall specify</u> the maximum short-circuit current at the connection point that the transmission-connected demand facility or the transmission-connected distribution system shall be capable of withstanding.	E				

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14	2			The relevant TSO shall deliver to the transmission-connected demand facility owner or the transmission-connected distribution system operator an estimate of the minimum and maximum short-circuit currents to be expected at the connection point as an equivalent of the network.	NE	R-TSO	A short-circuit catalogue specifies the method for calculating short-circuit power and calculates conditions in known connection points.		
14	3			After an <u>unplanned event</u> , the relevant TSO shall inform the affected transmission-connected demand facility owner or the affected transmission-connected distribution system operator as soon as possible and no later than one week after the unplanned event, of the changes <u>above</u> a threshold for the maximum short-circuit current that the affected transmission-connected demand facility or the affected transmission-connected distribution system shall be able to withstand from the relevant TSO's network in accordance with paragraph 1.	E	R-TSO			
14	4			The threshold set in paragraph 3 shall either be specified by the transmission-connected demand facility owner for its facility, or by the transmission-connected distribution system operator for its network.	E				
14	5			Before a <u>planned event</u> , the relevant TSO shall inform the affected transmission-connected demand facility owner or the affected transmission-connected distribution system operator, as soon as possible and no later than one week before the planned event, of the changes <u>above</u> a threshold for the maximum short-circuit current that the affected transmission-connected demand facility or the affected transmission-connected distribution system shall be able to withstand from the relevant TSO's network, in accordance with paragraph 1.	E	R-TSO			
14	6			The threshold set in paragraph 5 shall either be specified by the transmission-connected demand facility owner for its facility, or by the transmission-connected distribution system operator for its network.	E	TxDF DSO			
14	7			The relevant TSO shall request information from a transmission-connected demand facility owner or a transmission-connected distribution system operator concerning the contribution in terms of short-circuit current from that facility or network. As a minimum, the equivalent modules of the network shall be delivered and demonstrated for zero, positive and negative sequences.	NE	R-TSO	Included in simulation model requirements.		
14	8			After an <u>unplanned event</u> , the transmission-connected demand facility owner or the transmission-connected distribution system operator shall inform the relevant TSO, as soon as possible and no later than one week after the unplanned event, of the changes in short-circuit contribution above the threshold set by the relevant TSO.	E	TxDF DSO			

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14	9			Before a <u>planned event</u> , the transmission-connected demand facility owner or the transmission-connected distribution system operator shall inform the relevant TSO, as soon as possible and no later than one week before the planned event, of the changes in short-circuit contribution above the threshold set by the relevant TSO.		TxDF DSO			
<b>Reactive power requirements</b>									
15	1			Transmission-connected demand facilities and transmission-connected distribution systems shall be capable of maintaining their steady-state operation at their connection point within a reactive power range specified by the relevant TSO, according to the following conditions:	E	R-TSO			
15	1	a		for transmission-connected demand facilities, the actual reactive power range specified by the relevant TSO for importing and exporting reactive power shall not be wider than 48 percent of the larger of the maximum import capacity or maximum export capacity (0.9 power factor import or export of active power), except in situations where either technical or financial system benefits are demonstrated, for transmission-connected demand facilities, by the transmission-connected demand facility owner and accepted by the relevant TSO;	NE	R-TSO	<b>Demand facility:</b> cos phi > 0.99, however, maximum +/-15 MVAR.		
15	1	b		for transmission-connected distribution systems, the actual reactive power range specified by the relevant TSO for importing and exporting reactive power shall not be wider than:	E	R-TSO			
15	1	b	in	48 percent (i.e. 0.9 power factor) of the larger of the maximum import capability or maximum export capability during reactive power import (consumption); and	NE	R-TSO	<b>Distribution system:</b> 15 MVAR, cf. note 1.	0	
15	1	b	ii	48 percent (i.e. 0.9 power factor) of the larger of the maximum import capability or maximum export capability during reactive power export (production); except in situations where either technical or financial system benefits are proved by the relevant TSO and the transmission-connected distribution system operator through joint analysis;	NE	R-TSO	<b>Distribution system:</b> 15 MVAR, cf. note 1.	0	
15	1	c		the relevant TSO and the transmission-connected distribution system operator shall agree on the scope of the analysis, which shall address the possible solutions, and determine the optimal solution for reactive power exchange between their systems, taking adequately into consideration the specific system characteristics, variable structure of power exchange, bidirectional flows and the reactive power capabilities in the distribution system;	E	R-TSO			



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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
15	1	d		the relevant TSO may <u>establish</u> the use of metrics other than power factor in order to set out equivalent reactive power capability ranges;	O	R-TSO	<p><b>Distribution system:</b> An absolute MVAR value is used. The annual duration curve's 50% quantile is used in connection with compliance with exchange requirements. Requirements, cf. note 1.</p> <p><b>Demand facility:</b> An absolute MVAR value is used in combination with cos phi.</p>	0	
15	1	e		the reactive power range requirement values shall be met at the connection point;	E		- Requirements/definition cf. note 2.	0	
15	1	f		by way of derogation from point (e), where a connection point is shared between a power generating module and a demand facility, equivalent requirements shall be met at the point defined in relevant agreements or national law.			-		
15	2			The relevant TSO may <u>require</u> that transmission-connected distribution systems have the capability at the connection point to not export reactive power (at reference 1 p.u. voltage) at an active power flow of less than 25% of the maximum import capability. Where applicable, Member States may require the relevant TSO to justify its request through a joint analysis with the transmission-connected distribution system operator. If this requirement is not justified based on the joint analysis, the relevant TSO and the transmission-connected distribution system operator shall agree on necessary requirements according to the outcomes of a joint analysis.	O	R-TSO	<p><b>Distribution system:</b> Owing to the existence of a national concept for reactive power regulation in the interface between transmission system and distribution system and an agreement made, article 15 (2) is not applicable.</p>		
15	3			Without prejudice to point (b) of paragraph 1, <u>the relevant TSO may require</u> the transmission-connected distribution system to actively control the exchange of reactive power at the connection point for the benefit of the entire system. The relevant TSO and the transmission-connected distribution system operator shall agree on a method to carry out this control, to ensure the justified level of security of supply for both parties. The justification shall include a roadmap in which the steps and the timeline for fulfilling the requirement are specified.	O	R-TSO	<p><b>Distribution system:</b> Owing to the existence of a national concept for reactive power regulation in the interface between transmission system and distribution system and an agreement made, article 15 (3) is not applicable.</p>		
15	4			In accordance with paragraph 3, the transmission-connected distribution system operator may require the relevant TSO to consider its transmission-connected distribution system for reactive power management.	O	TxDF DSO	<p><b>Distribution system:</b> Owing to the existence of a national concept for reactive power regulation in the interface between transmission system and distribution system and an agreement made, article 15 (4) is not applicable.</p>		
Protection requirements									

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
16	1			The relevant TSO shall <u>specify</u> the devices and settings required to protect the transmission network in accordance with the characteristics of the transmission-connected demand facility or the transmission-connected distribution system. The relevant TSO and the transmission-connected demand facility owner or the transmission-connected distribution system operator shall agree on protection schemes and settings relevant for the transmission-connected demand facility or the transmission-connected distribution system.	NE	R-TSO	<p>Distribution system uses:</p> <ul style="list-style-type: none"> <li>- Line protection</li> <li>- Transformer protection</li> <li>- Reactor protection</li> <li>- Auxiliary power transformer protection</li> <li>- Busbar protection</li> </ul> <p>All applicable settings are specified individually based on the relevant grid and facility analyses.</p> <p>Demand facility – categories 3, 4 and 5 use as a minimum:</p> <ul style="list-style-type: none"> <li>- The facility must be protected against damage resulting from faults and incidents in the grid.</li> <li>- The facility must be protected against internal short circuits</li> <li>- The facility must be protected against disconnection in non-critical situations.</li> <li>- Wherever possible, the <i>public electricity supply grid</i> must be protected against any unwanted impact from the facility.</li> </ul>	0	
16	2			Electrical protection of the transmission-connected demand facility or the transmission-connected distribution system shall take precedence over operational controls while respecting system security, health and safety of staff and the public.	E				
16	3			Protection scheme devices may cover the following elements:	E		See A16(1)		

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16	3	a		external and internal short circuit;			Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
16	3	b		over- and under-voltage at the connection point to the transmission system;			Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
16	3	c		over- and under-frequency;			Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
16	3	d		demand circuit protection;			Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
16	3	e		unit transformer protection;			Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
16	3	f		back-up against protection and switchgear malfunction.			Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
16	4			The relevant TSO and the transmission-connected demand facility owner or the transmission-connected distribution system operator shall agree on any changes to the protection schemes relevant for the transmission-connected demand facility or the transmission-connected distribution system, and on the arrangements for the protection schemes of the transmission-connected demand facility or the transmission-connected distribution system.	E		Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
<b>Control requirements</b>									
17	1			The relevant TSO and the transmission-connected demand facility owner or the transmission-connected distribution system operator shall agree on the schemes and settings of the different control devices of the transmission-connected demand facility or the transmission-connected distribution system relevant for system security.	E		Part of the terms and conditions		
17	2			The agreement shall cover at least the following elements:	E				

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17	2	a		isolated (network) operation;	E		<p><b>(permitted)</b></p> <p><b>Demand facility:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.</p> <p><b>Distribution system:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.</p>	0	
17	2	b		damping of oscillations;	E		<p><b>Demand facility:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.</p> <p><b>Distribution system:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.</p>	0	
17	2	c		disturbances to the transmission network;	E		<p><b>Demand facility:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.</p> <p><b>Distribution system:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.</p>	0	
17	2	d		automatic switching to emergency supply and restoration to normal topology;	E		<p><b>(permitted)</b></p> <p><b>Demand facility:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.</p> <p><b>Distribution system:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.</p>	0	

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
17	2	e		automatic circuit-breaker re-closure (on 1-phase faults).	E		<b>(permitted)</b> <b>Demand facility:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement. <b>Distribution system:</b> Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
17	3			The relevant TSO and the transmission-connected demand facility owner or the transmission-connected distribution system operator shall agree on any changes to the schemes and settings of the different control devices of the transmission-connected demand facility or the transmission-connected distribution system relevant for system security.	E	R-TSO	Part of the terms and conditions laid down in connection with the conclusion of an agreement.	0	
17	4			With regard to priority ranking of protection and control, the transmission-connected demand facility owner or the transmission-connected distribution system operator shall set the protection and control devices of its transmission-connected demand facility or its transmission-connected distribution system respectively, in compliance with the following priority ranking, organised in decreasing order of importance:	E				
17	4	a		transmission network protection;	E				
17	4	b		transmission-connected demand facility or transmission-connected distribution system protection;	E				
17	4	c		frequency control (active power adjustment);	E				
17	4	d		power restriction.	E				
<b>Information exchange</b>									
18	1			Transmission-connected demand facilities shall be equipped according to the standards specified by the relevant TSO in order to exchange information between the relevant TSO and the transmission-connected demand facility with the specified time stamping. The relevant TSO shall make the specified standards publicly available.	E	R-TSO			
18	2			Transmission-connected distribution system shall be equipped according to the standards specified by the relevant TSO in order to exchange information between the relevant TSO and the transmission-connected distribution system with the specified time stamping. The relevant TSO shall make the specified standards publicly available.	E	R-TSO			

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18	3			The relevant TSO shall specify the information exchange standards. The relevant TSO shall make publicly available the precise list of data required.	NE	R-TSO	Requirements, cf. generic signal list, appendix 1.B  <b>Requirements by category:</b> Distribution – cat.1: Demand – cat 3: Demand – cat 4: Demand – cat 5: Demand – cat 6	0	
<b>Demand disconnection and demand reconnection</b>									
19	1			All transmission-connected demand facilities and transmission-connected distribution systems shall fulfil the following requirements related to low frequency demand disconnection functional capabilities:	E				
19	1	a		each transmission-connected distribution system operator and, where specified by the TSO, transmission-connected demand facility owner, shall provide capabilities that enable automatic 'low frequency' disconnection of a specified proportion of their demand. The relevant TSO may specify a disconnection trigger based on a combination of low frequency and rate-of-change-of-frequency;	NE	R-TSO	<b>For facility categories 1-5:</b>  CE: Facilities must be able to disconnect load in 6 automatic steps in CE  Nordic countries: Facilities must be able to disconnect load in 5 automatic steps in the Nordic countries.  <b>The following applies to facility category 6:</b>  CE: Agreement made on manual disconnection of load at agreed frequency value.  Nordic countries: Agreement made on manual disconnection of load at agreed frequency value.		

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19	1	b		the <u>low frequency demand disconnection functional capabilities</u> shall allow for disconnecting demand in stages for a range of operational frequencies;	E		-		
19	1	c		the low frequency demand disconnection functional capabilities shall allow for operation from a nominal Alternating Current ("AC") input to be specified by the relevant system operator, and shall meet the following requirements:	E		-		
19	1	c	in	frequency range: at least between 47-50 Hz, adjustable in steps of 0.05Hz;	E		-		
19	1	c	ii	operating time: no more than 150 ms after triggering the frequency setpoint;	E		-		
19	1	c	iii	voltage lock-out: blocking of the functional capability shall be possible when the voltage is within a range of 30 to 90% of reference 1 p.u. voltage;	E		-		
19	1	c	iv	provide the direction of active power flow at the point of disconnection;	E		-		
19	1	d		the AC voltage supply used in providing low frequency demand disconnection functional capabilities, shall be provided from the network at the frequency signal measuring point, as used in providing functional capabilities in accordance with paragraph 1(c), so that the frequency of the low frequency demand disconnection functional capabilities supply voltage is the same as the one of the network.	E		-		
19	2			With regard to low voltage demand disconnection functional capabilities, the following requirements shall apply:	E		-		
19	2	a		<u>the relevant TSO may specify</u> , in coordination with the transmission-connected distribution system operators, low voltage demand disconnection functional capabilities for the transmission-connected distribution facilities;	O	R-TSO icw RSO	<b>LVDD - Distribution system:</b> No LVDD requirements.		
19	2	b		<u>the relevant TSO may specify</u> , in coordination with the transmission-connected demand facility owners, low voltage demand disconnection functional capabilities for the transmission-connected demand facilities;	O	R-TSO	<b>LVDD – Demand Facility:</b> No LVDD requirements.		
19	2	c		<u>based on the TSO's assessment</u> concerning system security, the implementation of on <u>load tap changer blocking and low voltage demand disconnection</u> shall be binding for the transmission-connected <u>distribution system operators</u> ;	NE	R-TSO	<b>LTCCB – Distribution system: CE + N.</b> TR 5.3.4.1/NTO 9 – Critical voltages in the transmission grid. Tap changer is set to "manual".		
19	2	d		<u>if the relevant TSO decides to implement a low voltage demand disconnection</u> functional capability, the equipment for both on load tap changer blocking and low voltage demand disconnection shall be installed in coordination with the relevant TSO;	E	R-TSO	-		

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19	2	e		the method for low voltage demand disconnection shall be implemented by relay or control room initiation;	E		-		
19	2	f		the low voltage demand disconnection functional capabilities shall have the following features:	E		-		
19	2	f	in	the low voltage demand disconnection functional capability shall monitor the voltage by measuring all three phases;	E		-		
19	2	f	ii	blocking of the relays' operation shall be based on direction of either active power or reactive power flow.	E		-		
19	3			With regard to blocking of on load tap changers, the following requirements shall apply:	E		-		
19	3	a		<u>if required by the relevant TSO</u> , the transformer at the transmission-connected distribution facility shall be capable of automatic or manual on load tap changer blocking;	NE		Specified, cf. article 19(2)(c) Functionality: manual blocking of tap changer.	0	
19	3	b		the relevant TSO shall specify the automatic on load tap changer blocking functional capability.	NE		Part of the terms and conditions that Energinet specifies for the specific grid connection based on the location of the point of connection in the transmission system.	0	
19	4			All transmission-connected demand facilities and transmission-connected distribution systems <u>shall fulfil</u> the following <u>requirements related to disconnection or reconnection</u> of a transmission-connected demand facility or a transmission-connected distribution system:	E		-		
19	4	a		with regard to the <u>capability of reconnection after a disconnection</u> , the relevant TSO shall specify the conditions under which a transmission-connected demand facility or a transmission-connected distribution system is entitled to reconnect to the transmission system. Installation of automatic reconnection systems shall be subject to prior authorisation by the relevant TSO;	NE	R-TSO	<b>Demand facility - reconnection:</b> Reconnection/synchronisation and demand must not be resumed before permission is given by Control Centre Electricity: (Information: However, switching with own equipment in normal operation is possible.)  <b>Distribution system - reconnection:</b> Reconnection and demand must not be resumed before permission is given by Control Centre Electricity.		



DCC (Demand Connection Code), articles 3-29

Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
19	4	b		with regard to reconnection of a transmission-connected demand facility or a transmission-connected distribution system, the transmission-connected demand facility or the transmission-connected distribution system shall be capable of synchronisation for frequencies within the ranges set out in Article 12. The relevant TSO and the transmission-connected demand facility owner or the transmission-connected distribution system operator shall agree on the settings of synchronisation devices prior to connection of the transmission-connected demand facility or the transmission-connected distribution system, including voltage, frequency, phase angle range and deviation of voltage and frequency;	NE	R-TSO	<p><b>Normative requirements for synchronization abilities.</b></p> <p><b>Demand facility:</b> Frequencies, cf. A12 Settings are specified in the terms and conditions.</p> <p><b>Distribution system:</b> Settings and requirements are not specified for transmission-connected distribution systems as re-synchronisation and island operation of distribution systems do not form part of the Danish security of supply strategy.</p>		
19	4	c		a transmission-connected demand facility or a transmission-connected distribution facility shall be capable of being remotely disconnected from the transmission system when required by the relevant TSO. If required, the automated disconnection equipment for reconfiguration of the system in preparation for block loading shall be specified by the relevant TSO. The relevant TSO shall specify the time required for remote disconnection.	NE	R-TSO	<p><b>Disconnection</b></p> <p><b>Demand facility:</b> Equipment for remote disconnection is required.</p> <p><b>Distribution system:</b> Equipment for remote disconnection is required.</p> <p><b>Reconfiguration</b></p> <p><b>Demand facility:</b> Based on facility properties, a bilateral “block loading” agreement is included with the terms and conditions.</p> <p><b>Distribution system:</b> Build-up of load must be in steps, similar to the manual disconnection procedure.</p>	0	
Power quality									

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
20				Transmission-connected demand facility owners and transmission-connected distribution system operators shall ensure that their connection to the network does not result in a determined level of distortion or fluctuation of the supply voltage on the network, at the connection point. The level of distortion shall not exceed that allocated to them by the relevant TSO. TSOs shall coordinate their power quality requirements with the requirements of adjacent TSOs.	NE	R-TSO	<b>All categories:</b> Requirements, cf. appendix 1.E.  <b>Distribution – cat. 1:</b> Process, cf. appendix 1.F.	0	
<b>Simulation models</b>									
21	1			Transmission-connected demand facilities and transmission-connected distribution systems shall fulfil the requirements set out in paragraphs 3 and 4 related to the simulation models or equivalent information.	E		-		
21	2			<u>Each TSO may require simulation models or equivalent information</u> showing the behaviour of the transmission-connected demand facility, or the transmission-connected distribution system, or both, in steady and dynamic states.	O		Requirements, cf. appendix 1.D.  <b>Requirements by category:</b> Distribution – cat.1: Demand – cat. 3: Demand – cat. 4: Demand – cat. 5: Demand – cat. 6:	0	
21	3			Each TSO shall specify the content and format of those simulation models or equivalent information. The content and format shall include:	E				
21	3	a		steady and dynamic states, including 50 Hz component;	E				
21	3	b		electromagnetic transient simulations at the connection point;	E				
21	3	c		structure and block diagrams.	E				
21	4			For the purpose of dynamic simulations, the simulation model or equivalent information referred to in paragraph 3(a) <u>shall</u> contain the following sub-models or equivalent information:					
21	4	a		power control;	E				
21	4	b		voltage control;	E				

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
21	4	c		transmission-connected demand facility and transmission-connected distribution system protection models;	E				
21	4	d		the different types of demand, that is to say electro technical characteristics of the demand; and	E				
21	4	e		converter models.	E				

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
21	5			Each relevant system operator or relevant TSO shall specify the requirements of the performance of the recordings of transmission-connected demand facilities or transmission-connected distribution facilities, or both, in order to compare the response of the model with these recordings.		R-TSO	<p>Logging must be performed with electronic equipment that, as a minimum, can be configured to log relevant incidents in the Point of Connection for the signals listed below in case of faults in the public electricity supply grid.</p> <p>In the Point of Connection, the facility owner must install logging equipment which records, as a minimum:</p> <ul style="list-style-type: none"> <li>- Voltage for each phase for the facility</li> <li>- Current for each phase for the facility</li> <li>- Active power for the facility (may be computed values)</li> <li>- Reactive power for the facility (may be computed values)</li> <li>- Frequency in the POC/facility</li> <li>- Activation of internal protective functions</li> </ul> <p>Specific measurement requirements are described in the grid connection agreement.</p> <p>Logging must be performed as consecutive time series of measuring values from 10 seconds before the incident until 60 seconds after the time of the incident. Minimum sample frequency for all fault logs must be 1 kHz. The specific settings for incident-based logging must be agreed with Energinet Elsystemansvar A/S upon commissioning of the facility. All measurements and data to be collected in accordance with TR 5.8.1 must be logged with a time stamp and an accuracy ensuring that such measurements and data can be correlated with each other and with similar recordings in the public electricity supply grid.</p> <p>Logs must be filed for at least three months from the time of the fault situation. However, the maximum number of incidents to be recorded is 100. Energinet Elsystemansvar A/S must be given access to logged and relevant recorded information on request.</p>	0	

## DCC (Demand Connection Code), articles 3-29

Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
<b>Chapter 2 - Operational notification procedure</b>									
<b>General provisions</b>									
22	1			The operational notification procedure for the connection of each new transmission-connected demand facility, each new transmission-connected distribution facility and each new transmission-connected distribution system, shall comprise:	E				
22	1	a		an energisation operational notification (EON);	E				
22	1	b		an interim operational notification (ION);	E				
22	1	c		a final operational notification (FON).	E				
22	2			Each transmission-connected demand facility owner or transmission-connected distribution system operator to which one or more of the requirements in Title II apply shall demonstrate to the relevant TSO that it has complied with the requirements set out in Title II of this Regulation by completing successfully the operational notification procedure for connection of each transmission-connected demand facility, each transmission-connected distribution facility and each transmission-connected distribution system described in Articles 23 to 26.	E				
22	3			The relevant TSO shall specify and make publicly available further details concerning the operational notification procedure.	NE				
<b>Energisation operational notification</b>									
23	1			An EON shall entitle the transmission-connected demand facility owner or transmission-connected distribution system operator to energise its internal network and auxiliaries by using the grid connection that is specified for the connection point.	E				
23	2			An EON shall be issued by the relevant TSO, subject to completion of preparations including agreement on the protection and control settings relevant to the connection point between the relevant TSO and the transmission-connected demand facility owner or transmission-connected distribution system operator.	E				
<b>Interim operational notification</b>									
24	1			An ION shall entitle the transmission-connected demand facility owner or transmission-connected distribution system operator to operate the transmission-connected demand facility, the transmission-connected distribution facility, or the transmission-connected distribution system by using the grid connection for a limited period of time.	E				

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Art. no.	Art. sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
24	2			An ION shall be issued by the relevant TSO, subject to completion of the data and study review process as required by this Article.	E				
24	3			With regard to the data and study review, the relevant TSO shall have the right to request that the transmission-connected demand facility owner or transmission-connected distribution system operator provide the following:	E				
24	3	a		an itemised statement of compliance;	E				
24	3	b		detailed technical data of the transmission-connected demand facility, the transmission-connected distribution facility or the transmission-connected distribution system relevant to the grid connection as specified by the relevant TSO;					
24	3	c		equipment certificates issued by an authorised certifier in respect of transmission-connected demand facilities, transmission-connected distribution facilities and transmission-connected distribution systems, where these are relied upon as part of the evidence of compliance;					
24	3	d		simulation models, as specified in Article 21 and required by the TSO;					
24	3	e		studies demonstrating expected steady-state and dynamic performance as required in Articles 43, 46 and 47;					
24	3	f		details of intended practical method of completing compliance tests according to Chapter 2 of Title IV.					
24	4			The maximum period during which the transmission-connected demand facility owner or transmission-connected distribution system operator may maintain ION status shall be 24 months. The relevant TSO is entitled to specify a shorter ION validity period. An extension of the ION shall be granted only if the transmission-connected demand facility owner or transmission-connected distribution system operator has made substantial progress towards full compliance. Outstanding issues shall be clearly identified at the time of requesting extension.					
24	5			An extension of the period during which the transmission-connected demand facility owner or transmission-connected distribution system operator may maintain ION status, beyond the period established in paragraph 4, may be granted if a request for a derogation is made to the relevant TSO before the expiry of that period in accordance with the derogation procedure laid down in Article 50.					
<b>Final operational notification</b>									

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
25	1			An FON shall entitle the transmission-connected demand facility owner or transmission-connected distribution system operator to operate the transmission-connected demand facility, the transmission-connected distribution facility or the transmission-connected distribution system by using the grid connection.					
25	2			An FON shall be issued by the relevant TSO, upon prior removal of all incompatibilities identified for the purposes of the ION status and subject to the completion of the data and study review process as required by this Article.					
25	3			For the purposes of the data and study review, the transmission-connected demand facility owner or transmission-connected distribution system operator must submit the following to the relevant TSO:					
25	3	a		an itemised statement of compliance; and					
25	3	b		an update of the applicable technical data, simulation models and studies as referred to in points (b), (d) and (e) of Article 24(3), including the use of actual measured values during testing.					
25	4			<p>If incompatibility is identified in connection with the issuing of the FON, a derogation may be granted upon a request made to the relevant TSO, in accordance with the derogation procedure described in Chapter 2 of Title V. An FON shall be issued by the relevant TSO if the transmission-connected demand facility, the transmission-connected distribution facility, or the transmission-connected distribution system complies with the provisions of the derogation.</p> <p>Where a request for a derogation is rejected, the relevant TSO shall have the right to refuse to allow the operation of the transmission-connected demand facility, the transmission-connected distribution facility, or the transmission-connected distribution system until the transmission-connected demand facility owner or transmission-connected distribution system operator and the relevant TSO resolve the incompatibility and the relevant TSO considers that the transmission-connected demand facility, the transmission-connected distribution facility, or the transmission-connected distribution system complies with the provisions of this Regulation.</p> <p>If the relevant TSO and the transmission-connected demand facility owner or transmission-connected distribution system operator do not resolve the incompatibility within a reasonable time frame, but in any case not later than six months after the notification of the rejection of the request for a derogation, each party may refer the issue for decision to the regulatory authority.</p>					
<b>Limited operational notification</b>									

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
26	1			Transmission-connected demand facility owners or transmission-connected distribution system operators to whom a FON has been granted, shall inform the relevant TSO, no later than 24 hours after the incident has occurred, of the following circumstances: A longer time period to inform the relevant TSO can be agreed with the transmission-connected demand facility owner or transmission-connected distribution system operator depending on the nature of the changes.					
26	1	a		the facility is temporarily subject to either significant modification or loss of capability affecting its performance; or					
26	1	b		equipment failure leading to non-compliance with some relevant requirements.					
26	2			The transmission-connected demand facility owner or transmission-connected distribution system operator shall apply to the relevant TSO for a limited operational notification (LON), if the transmission-connected demand facility owner or transmission-connected distribution system operator expects the circumstances described in paragraph 1 to persist for more than three months.					
26	3			An LON shall be issued by the relevant TSO and shall contain the following information which shall be clearly identifiable:					
26	3	a		the unresolved issues justifying the granting of the LON;					
26	3	b		the responsibilities and timescales for expected solution; and					
26	3	c		a maximum period of validity which shall not exceed 12 months. The initial period granted may be shorter with the possibility of an extension if evidence is submitted to the satisfaction of the relevant TSO demonstrating that substantial progress has been made towards achieving full compliance.					
26	4			The FON shall be suspended during the period of validity of the LON with regard to the items for which the LON has been issued.					
26	5			A further extension of the period of validity of the LON may be granted upon a request for a derogation made to the relevant TSO before the expiry of that period, in accordance with the derogation procedure described in Chapter 2 of Title V.					
26	6			The relevant TSO shall have the right to refuse to allow the operation of the transmission-connected demand facility, the transmission-connected distribution facility, or the transmission-connected distribution system once the LON is no longer valid. In such cases, the FON shall automatically become invalid.					



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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
26	7			If the relevant TSO does not grant an extension of the period of validity of the LON in accordance with paragraph 5 or if it refuses to allow the operation of the transmission-connected demand facility, the transmission-connected distribution facility, or the transmission-connected distribution system once the LON is no longer valid in accordance with paragraph 6, the transmission-connected demand facility owner or transmission-connected distribution system operator may refer the issue for decision to the regulatory authority within six months after the notification of the decision of the relevant TSO.					
<b>General requirements</b>									
27	1			Demand response services provided to system operators shall be distinguished based on the following categories:					
27	1	a		remotely controlled:					
27	1	a	in	demand response active power control;					
27	1	a	ii	demand response reactive power control;					
27	1	a	iii	demand response transmission constraint management.					
27	1	b		autonomously controlled:					
27	1	b	in	demand response system frequency control;					
27	1	b	ii	demand response very fast active power control.					
27	2			Demand facilities and closed distribution systems may provide demand response services to relevant system operators and relevant TSOs. Demand response services can include, jointly or separately, upward or downward modification of demand.					
27	3			The categories referred to in paragraph 1 are not exclusive and this Regulation does not prevent other categories from being developed. This Regulation does not apply to demand response services provided to other entities than relevant system operators or relevant TSOs.					
<b>Specific provisions for demand units with demand response active power control, reactive power control and transmission constraint management</b>									
28	1			Demand facilities and closed distribution systems may offer demand response active power control, demand response reactive power control, or demand response transmission constraint management to relevant system operators and relevant TSOs.					

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Art. no.	Art. sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
28	2			Demand units with demand response active power control, demand response reactive power control, or demand response transmission constraint management shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:					
28	2	a		be capable of operating across the frequency ranges specified in Article 12(1) and the extended range specified in Article 12(2);					
28	2	b		be capable of operating across the voltage ranges specified in Article 13 if connected at a voltage level at or above 110kV;					
28	2	c		be capable of operating across the normal operational voltage range of the system at the connection point, specified by the relevant system operator, if connected at a voltage level below 110kV. This range shall take into account existing standards and shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);			Uc +/- 10 %		
28	2	d		be capable of controlling power consumption from the network in a range equal to the range contracted, directly or indirectly through a third party, by the relevant TSO;			DK1 – FCR: ≥ 0.3 MW DK1 + DK2 – aFRR: 1 – 50 MW DK2 – FCR-N: ≥ 0.3 MW DK2 – FCR-D: ≥ 0.3 MW DK1 + DK2 – mFRR: < 5 MW		
28	2	e		be equipped to receive instructions, directly or indirectly through a third party, from the relevant system operator or the relevant TSO to modify their demand and to transfer the necessary information. The relevant system operator shall make publicly available the technical specifications approved to enable this transfer of information. For demand units connected at a voltage level below 110kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);			DK1 – FCR: Frequency measurements must be carried out with a ± 10 mHz accuracy or higher. The control function's sensitivity must be ± 10 mHz or higher.  The resolution of the market participant's SCADA system must be better than 1 second, and selected signals must be able to document the installations' responses to frequency deviations. The service provider must save the signals for at least one week.  DK1 – aFRR: Each individual demand unit that supplies or contributes to the supply of aFRR		

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
							<p>reserves must be connected via information technology to Energinet's Control Centre. For each individual demand unit, the Control Centre must generally have online access to the following information:</p> <ul style="list-style-type: none"> <li>• Status reports, demand unit "out/in".</li> <li>• Online measurements of demand (MW).</li> <li>• Current possible reserve up (MW).</li> <li>• Current max. gradient up (MW/min.).</li> <li>• Current time constant for upward regulation (sec.).</li> <li>• Current possible reserve down (MW).</li> <li>• Current max. gradient down (MW/min.).</li> <li>• Current time constant for downward regulation (sec.).</li> </ul> <p>Requirements and the place of delivery for reports and measurements must be agreed with Energinet Elsystemansvar A/S.</p> <p>DK2 – FCR-N: Frequency measurements must be carried out with a <math>\pm 10</math> mHz accuracy or higher. The control function's sensitivity must be <math>\pm 10</math> mHz or higher.</p> <p>The resolution of the market participant's SCADA system must be better than 1 second, and selected signals must be able to document the installations' responses to frequency deviations. The service provider must save the signals for at least one week.</p>		

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
							<p>DK2 – FCR-D: Frequency measurements must be carried out with a ± 10 mHz accuracy or higher. The control function's sensitivity must be ± 10 mHz or higher.</p> <p>The resolution of the market participant's SCADA system must be better than 1 second, and selected signals must be able to document the installations' responses to frequency deviations. The service provider must save the signals for at least one week.</p> <p>DK1 + DK2 – mFRR: Each individual demand unit that supplies manual reserves must be connected via information technology to Energinet's Control Centre. The Control Centre must at least have online access to the following information:</p> <ul style="list-style-type: none"> <li>• Status reports concerning demand unit "out/in".</li> <li>• Measurements of the demand unit's net consumption in the point of connection.</li> </ul> <p>Requirements and the place of delivery for reports and measurements must be agreed with Energinet Elsystemansvar A/S.</p>		
28	2	f		be capable of adjusting its power consumption within a time period specified by the relevant system operator or the relevant TSO. For demand units connected at a voltage level below 110kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);			<p>DK1 – FCR: Power frequency control must be supplied at a frequency deviation of up to +/-200 mHz relative to the reference frequency of 50 Hz. This will normally mean in the 49.8-50.2 Hz range. A deadband of +/-20 mHz is permitted.</p>		

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
							<p>The reserve must as a minimum be supplied linearly at frequency deviations of between 20 and 200 mHz. The first half of the activated reserve must be supplied within 15 seconds, while the last half must be supplied in full within 30 seconds at a frequency deviation of +/-200 mHz.</p> <p>It must be possible to maintain regulation until the automatic and manual reserves can take over; however, minimum 15 minutes.</p> <p>Following completed regulation, the reserve must be re-established after 15 minutes.</p> <p>DK1 – aFRR: Secondary reserve is primarily supplied by plants in operation. It must be possible to supply the reserve requested within 15 minutes.</p> <p>Alternatively, the reserve can be supplied by a combination of plants in operation and fast-start plants. The reserve to be supplied within any coming five-minute period must be provided by plants in operation.</p> <p>It must be possible to maintain regulation continuously.</p> <p>The regulation signal is sent online as a power value from Energinet’s Control Centre to each balance-responsible party/market participant with reference to the bid. In those instances where both production and consumption are used,</p>		

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
							<p>one power rating for production and another for consumption are sent.</p> <p>DK2 – FCR-N: The normal operation reserve must be supplied at a frequency deviation of up to +/-500 mHz relative to the reference frequency of 50 Hz. This means in the 49.5-50.5 Hz range. Deliveries must be made without deadband.</p> <p>The reserve must as a minimum be supplied linearly at frequency deviations of between 0 and 100 mHz. The activated reserve must be supplied within 150 seconds, regardless of the size of the deviation.</p> <p>It must be possible to maintain regulation continuously.</p> <p>DK2 – FCR-D: Frequency-controlled disturbance reserve must be able to:</p> <ul style="list-style-type: none"> <li>• Supply non-inverse power at frequencies between 49.9 and 49.5 Hz.</li> <li>• Supply 50% of the response within 5 seconds.</li> <li>• Supply the remaining 50% of the response within an additional 25 seconds.</li> </ul> <p>DK1 + DK2 – mFRR: The manual reserve must be supplied in full within 15 minutes of activation.</p>		

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
28	2	g		be capable of full execution of an instruction issued by the relevant system operator or the relevant TSO to modify its power consumption to the limits of the electrical protection safeguards, unless a contractually agreed method is in place with the relevant system operator or relevant TSO for the replacement of their contribution (including aggregated demand facilities' contribution through a third party);					
28	2	consultation		once a modification to power consumption has taken place and for the duration of the requested modification, only modify the demand used to provide the service if required by the relevant system operator or relevant TSO to the limits of the electrical protection safeguards, unless a contractually agreed method is in place with the relevant system operator or relevant TSO for the replacement of their contribution (including aggregated demand facilities' contribution through a third party). Instructions to modify power consumption may have immediate or delayed effects;					
28	2	in		notify the relevant system operator or relevant TSO of the modification of demand response capacity. The relevant system operator or relevant TSO shall specify the modalities of the notification;					
28	2	j		where the relevant system operator or the relevant TSO, directly or indirectly through a third party, command the modification of the power consumption, enable the modification of a part of its demand in response to an instruction by the relevant system operator or the relevant TSO, within the limits agreed with the demand facility owner or the CDSO and according to the demand unit settings;					
28	2	k		have the withstand capability to not disconnect from the system due to the rate-of-change-of-frequency up to a value specified by the relevant TSO. With regard to this withstand capability, the value of rate-of-change-of-frequency shall be calculated over a 500 ms time frame. For demand units connected at a voltage level below 110kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);			Rate of change of frequency (ROCOF) = +/- 2 Hz (over 500 milliseconds).  ROCOF [Hz/s] is calculated as the difference between the mean value frequency calculation just done and the mean value frequency calculation done 20 ms ago. (df/dt = mean value 2 – mean value 1/0.020 [Hz/s].)		
28	2	l		where modification to the power consumption is specified via frequency or voltage control, or both, and via pre-alert signal sent by the relevant system operator or the relevant TSO, be equipped to receive, directly or indirectly through a third party, the instructions from the relevant system operator or the relevant TSO, to measure the frequency or voltage value, or both, to command the demand trip and to transfer the information. The relevant system operator shall specify and publish the technical			DK1 – FCR: Energinet does not send signals for the reserve to be activated during the day of operation. Activation of reserves is based on the supplier's own frequency measurements.		

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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
				specifications approved to enable this transfer of information. For demand units connected at a voltage level below 110kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1).			<p>DK1 – aFRR: Activation of reserves is done via online signals from Energinet's Control Centre.</p> <p>DK2 – FCR-N: Energinet does not send signals for the reserve to be activated during the day of operation. Activation of reserves is based on the supplier's own frequency measurements.</p> <p>DK2 – FCR-D: Energinet does not send signals for the reserve to be activated during the day of operation. Activation of reserves is based on the supplier's own frequency measurements.</p> <p>DK1 + DK2 – mFRR: Activation of reserves is done via manual signals from Energinet's Control Centre.</p>		
28	3			For voltage control with disconnection or reconnection of static compensation facilities, each transmission-connected demand facility or transmission-connected closed distribution system shall be able to connect or disconnect its static compensation facilities, directly or indirectly, either individually or commonly as part of demand aggregation through a third party, in response to an instruction transmitted by the relevant TSO, or in the conditions set forth in the contract between the relevant TSO and the demand facility owner or the CDSO.					
<b>Specific provisions for demand units with demand response system frequency control</b>									
29	1			Demand facilities and closed distribution systems may offer demand response system frequency control to relevant system operators and relevant TSOs.					
29	2			Demand units with demand response system frequency control shall comply with the following requirements, either individually or, where it is not part of a transmission-connected demand facility, collectively as part of demand aggregation through a third party:			Energinet has not set requirements for the delivery of these services, as we do not expect to want these types of services.		



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Art. no.	Art sub. art.	Art. sec.	Art. para.	Article subject	Type	Owner	Requirement(s)	Rev.	
29	2	a		be capable of operating across the frequency ranges specified in Article 12(1) and the extended range specified in Article 12(2);					
29	2	b		be capable of operating across the voltage ranges specified in Article 13 if connected at a voltage level at or above 110kV;					
29	2	c		be capable of operating across the normal operational voltage range of the system at the connection point, specified by the relevant system operator, if connected at a voltage level below 110kV. This range shall take into account existing standards, and shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);					
29	2	d		be equipped with a control system that is insensitive within a dead band around the nominal system frequency of 50.00 Hz, of a width to be specified by the relevant TSO in consultation with the TSOs in the synchronous area. For demand units connected at a voltage level below 110kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1);					
29	2	e		be capable of, upon return to frequency within the dead band specified in paragraph 2(d), initiating a random time delay of up to 5 minutes before resuming normal operation.					
29	2	f		The maximum frequency deviation from nominal value of 50.00 Hz to respond to shall be specified by the relevant TSO in coordination with the TSOs in the synchronous area. For demand units connected at a voltage level below 110kV, these specifications shall, prior to approval in accordance with Article 6, be subject to consultation with the relevant stakeholders in accordance with Article 9(1).					
29	2	g		The demand shall be increased or decreased for a system frequency above or below the dead band of nominal (50.00 Hz) respectively;					

**DCC (Demand Connection Code), articles 3-29****Note 1****Requirements concerning the exchange of reactive power**

The maximum permissible exchange of reactive power for transmission-connected distribution systems applies per transmission connection point, i.e. per 150 or 132 kV substation.

In other words:

- If a single distribution system is connected in the transmission-connected 150-132 kV substation, this distribution system may use the specified MVAR headroom for the exchange of reactive power.
- If several distribution systems are connected in the transmission-connected 150-132 kV substation, these distribution systems all share the specified MVAR headroom for the exchange of reactive power.
- The particulars of compliance with the requirements for the exchange of reactive power and establishment of compensation equipment are the responsibility of the grid operator that has entered into an interconnection agreement/operations manager agreement with Energinet Elsystemansvar A/S in the agreed delivery point.

The exchange of reactive power is measured in the delivery point, and the maximum permissible exchange of reactive power is independent of the number of connected transformers or licensed grid enterprises.

The grid operator must ensure a fair MVAR distribution between the transformers owned by Energinet Electricity Transmission A/S in the 150 and 132 kV substations in order to minimise transformer losses.

**Exchange and compensation of reactive power**

Compensation of the distribution system.

The distribution system must be compensated relative to the continuous generation of reactive power stemming from, among other things, underground cabling of the distribution system. This means that a reactive component or an equivalent compensation installed in the distribution system is assumed connected or activated during normal operating conditions.

Compensation of the distribution system is meant to ensure that the 50% quantile of the annual duration curve for the exchange of reactive power between the transmission system and one or more distribution systems in the transmission point of connection is smaller than the limit values in the MVAR headroom.

## DCC (Demand Connection Code), articles 3-29

### Limit values for maximum exchange of reactive power

Limit values for maximum exchange of reactive power is:  $\pm 15$  MVar.

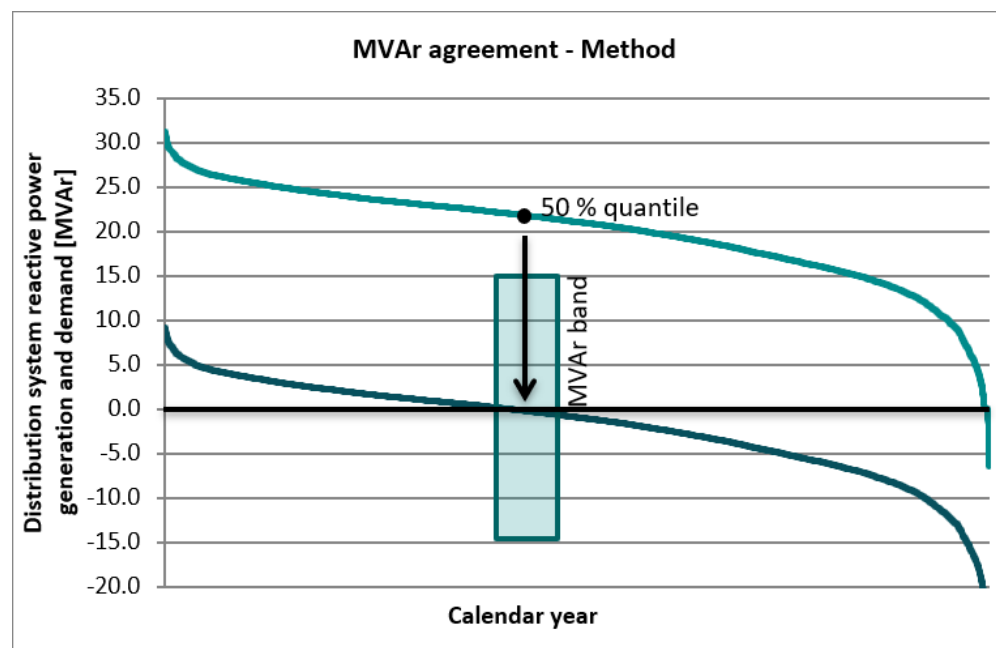


Figure 1: MVar limits illustrated together with the annual duration curve and 50% quantile.

Whether limit values for the exchange of reactive power has been exceeded is established based on the calculated 50% quantile of the annual duration curve for the exchange of reactive power for the previous calendar year.

### Consequences of exceeding limit values

If limit values are exceeded, compensation must be made in the distribution system. Compensation must be designed so that the 50% quantile of the annual duration curve for the exchange of reactive power in the relevant transmission point of connection is subsequently compensated to a value within the limit values, and the aim should be to compensate towards 0 MVar as exemplified in Figure 1.

## **DCC (Demand Connection Code), articles 3-29**

### **Determination of 50% quantile**

The underlying data for regular follow-up on requirements for the exchange of reactive power are prepared based on settlement data for the net exchange of active and reactive power in the delivery point. Consolidated data with a time resolution of 60 minutes are used, meaning that data used represent the mean value of exchanged reactive power (MVAR) in the delivery points for each hour of the year.

### **Redundancy for reactive components in the distribution grids**

Through ongoing planning of the transmission system, Energinet Elsystemansvar A/S ensures the level of reactive components in the transmission system necessary to deal with the consequences for the transmission system that a failure of a reactive component in the distribution system results in, thereby ensuring that the exchange of reactive power in the point of connection to the transmission system can be handled. Therefore, there are no requirements for redundant reactive components in the distribution system to ensure compliance with the MVAR headroom as non-compliance will be accepted until the component is back in operation.

The established redundancy of Energinet Eltransmission A/S at the transmission level does not consider the distribution system's local needs for voltage and MVAR regulation.

Energinet Eltransmission A/S only makes capacity from reactive components at the transmission system level available in the period until the commissioning of a new or replaced reactor in the distribution system (< 2 years).

### **Bilateral agreement on excess compensation**

A grid enterprise may make an application to Energinet Elsystemansvar A/S for the conclusion of a bilateral agreement that states that any excess compensation established in the distribution system can be used in adjacent substations via the transmission system, for the purpose of administratively bringing the exchange of reactive power within the stipulated limit values. The possibility of a bilateral agreement must be based on an assessment of the relevant situation, taking into account, among other things, the specific distribution system's specific circumstances, the geographical location, the distance between substations, as well as both the grid company and Energinet Elsystemansvar A/S' operational conditions in the area in question.

Energinet Elsystemansvar A/S will determine if a bilateral agreement can be made.

## **Note 2**

### **Transmission point of connection**

The transmission point of connection is the point of connection with a system voltage of 150 kV or 132 kV, which is the reference point for transmission-connected distribution systems' exchange of reactive power with the transmission system.