Krav fastsat i henhold til EU-forordning 2016/1388 – Demand Connection Code (DCC)

Relevant forklaring:

Exhaustive = E

Non exhaustive = NE

Optional = O

Normativt krav- behandles ikke						
Krav færdigbehandlet						

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
Scope of application									
3	1			The connection requirements set out in this Regulation shall apply to:			Anlægskategorier Forordningen håndterer forskellige tilslutningstyper forskelligt, hvorfor der defineres tilsammen 6 forskellige kategorier af transmissionstilsluttede distributionssystemer og forbrugsanlæg: Distributionssystem – kategori 1 Et klassisk distributionssystem, som er kendetegnet ved ét eller flere POC til transmissionssystemet og som desuden, afhængigt af aktuelle driftsforhold, har elektrisk sammenkobling - eller mulighed for elektrisk sammenkobling - med et eller flere distributionssystemer. Distributionssystemet leverer transport af elektricitet for kunder tilsluttet på distributionssystemets kollektive højspændings-, mellemspændings- og lavspændingsnet. Hvis elforsyningsvirksomheden ved ansøgning om nettilslutning vurderer, at		
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. 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.					

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							der er risiko for væsentlige udfordringer med spændingskvaliteten, skal elforsyningsvirksomheden rette henvendelse til Energinet Elsystemansvar A/S, og processen fra distributionssystem – kategori 2 anvendes. <u>Distributionssystem – kategori 2</u> Et distributionssystem, som er kendetegnet ved ét POC til transmissionssystemet, og som desuden, afhængigt af aktuelle driftsforhold (unormal drift, nøddrift eller lignende), har mulighed for elektrisk sammenkobling med et eller flere distributionssystemer. Distributionssystemet leverer primært transport af elektricitet for kunder tilsluttet på distributionssystemets kollektive højspændings- eller mellemspændingsnet. Den tildelte maksimale trækningsret kan i konkrete tilfælde være begrænset, såfremt der er forudsigelig risiko for mangel på nettilstrækkelighed, mangel på effekttilstrækkelighed og/eller forringelse af robustheden i transmissionssystemet. Hvis dette er tilfældet, vil de konkrete om-stændigheder være angivet i nettilslutningsaftalen. Overgang fra Distributionssystem – kategori 2 til Distributionssystem – kategori 1 afgøres af Energinet Elsystemansvar A/S efter henvendelse om en væsentlig ændring og ud fra en dialog med den elforsyningsvirksomhed, som har		

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							tilslutningsaftalen omhandlende det aktuelle, transmissionstilsluttede distributionssystem - kategori 2. <u>Forbrugsanlæg - kategori 3</u> Et forbrugsanlæg, som, i forbindelse med afslutning af nettilslutningsprocessen (EON, ION, FON) og tildeling af FON, kan eftervise maksimalt forbrug i forhold til den tildelte maksimale trækningsret. Den tildelte maksimale trækningsret kan i konkrete tilfælde være begrænset, såfremt der er forudsigelig risiko for mangel på nettilstrækkelighed, mangel på effekttilstrækkelighed og/eller forringelse af robustheden i transmissionssystemet. Hvis dette er tilfældet, vil de konkrete om-stændigheder være angivet i nettilslutningsaftalen. <u>Forbrugsanlæg - kategori 4</u> Et forbrugsanlæg, som, i forbindelse med afslutning af nettilslutningsprocessen (EON, ION, FON) og tildeling af FON, ikke kan eftervise maksimalt forbrug i forhold til den tildelte maksimale trækningsret. Forbrugsanlæggets forbrug kan, efter aftale med Energinet Elsystemansvar A/S, øges til den tildelte maksimale trækningsret ved en trinvis udbygning af det eksisterende forbrugsanlæg. Den tildelte maksimale trækningsret kan i konkrete tilfælde være begrænset,		

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							såfremt der er forudsigelig risiko for mangel på nettilstrækkelighed, mangel på effekttilstrækkelighed og/eller forringelse af robustheden i transmissionssystemet. Hvis dette er tilfældet, vil de konkrete omstændigheder være angivet i nettilslutningsaftalen. <u>Forbrugsanlæg - kategori 5</u> Et forbrugsanlæg, som, i forbindelse med afslutning af nettilslutningsprocessen (EON, ION, FON) og tildeling af FON, kan eftervise maksimalt forbrug i forhold til den tildelte maksimale trækningsret. Forbrugsanlægget er anvendt i spidslastsituationer med maksimalt 500 fuldlastækvivalens-timer årligt. Den tildelte maksimale trækningsret kan i konkrete tilfælde være begrænset, såfremt der er forudsigelig risiko for mangel på nettilstrækkelighed, mangel på effekttilstrækkelighed og/eller forringelse af robustheden i transmissionssystemet. Hvis dette er tilfældet, vil de konkrete omstændigheder være angivet i nettilslutningsaftalen. <u>Forbrugsanlæg - kategori 6</u> Kørestrømsforsyning for elektrisk togdrift, hvor anlæggets forsynings- og fordelingsstationer er tilsluttet transmissionsnettet. Forsynings- og fordelingsstationerne er sammenkoblet med Banedanmarks øv-		

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							rige kørestrømssystem for elektrisk togdrift. Denne type af forbrugsanlæg kan adskille sig væsentligt fra de øvrige transmissionstilsluttede forbrugsanlæg med hensyn til tilslutnings- og forbrugskarakteristika.		
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.					
Chapter 1 - General requirements									
General frequency requirements									
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		**CE:** 47,5 Hz-48,5 Hz – 30 min 48,5 Hz-49,0 Hz – 30 min **N:** 48,5 Hz-49,0 Hz– 30 min		
12	2			The transmission-connected demand facility owner or the DSO may agree with the relevant TSO on wider frequency ranges or longer minimum times for operation. 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		**Forbrugsanlæg:** Del af tilslutnings- vilkår og betingelser. **Distributionssystem:** Del af tilslutnings- vilkår og betingelser.		
General voltage requirements									

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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		**CE:** 110 -300 kV/1,118 – 1,15 pu - 60 min 300 – 400 kV/1,05 – 1,1 pu - 60 min **N:** 300 – 400 kV/1,05 – 1,1 pu - 60 min		
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				
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 (pu) voltage. For the 400 kV grid voltage level (or alternatively commonly referred to as 380 kV level), the reference 1 pu value is 400 kV, for other grid voltage levels the reference 1 pu voltage may differ for each system operator in the same synchronous area.	E				
13	4			Where the voltage base for pu 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 pu –1.0875 pu for an unlimited period.	E	n/a	n/a		
13	5			Where the voltage base for pu 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			If required by the relevant TSO, 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	**Forbrugsanlæg:** Ingen krav om automatisk frakobling transmissionssystemet ved en forud defineret spænding. **Distributionssystem:** Ingen krav om automatisk frakobling transmissionssystemet ved en forud defineret spænding.		

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13	7			With regard to transmission-connected distribution systems with a voltage below 110kV at the connection point, the relevant TSO shall specify 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	**Distributionssystem:** (information: Distributionssystemer er tilsluttet under 110 kV.) Spændingsinterval specificeres per tilslutning som del af tilslutnings- vilkår og betingelser.		
Short-circuit requirements									
14	1			Based on the rated short-circuit withstand capability of its transmission network elements, the relevant TSO shall specify 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				
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	Kortslutningskatalog fastlægger metode for beregning af kortslutningseffekt samt beregner konditioner i kendte tilslutningspunkter.		
14	3			After an unplanned event, 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 above 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 planned event, 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 above 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			

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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	Inkluderet i krav til simuleringsmodeller.		
14	8			After an unplanned event, 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			
14	9			Before a planned event, 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			
Reactive power requirements									
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	**Forbrugsanlæg:** cos phi > 0,99, dog maksimalt +/- 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	i	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	**Distributionssystem:** 15 MVAr samt krav jf. note 1.		
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	**Distributionssystem:** 15 MVAr samt krav jf. note 1.		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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			
15	1	d		the relevant TSO may establish the use of metrics other than power factor in order to set out equivalent reactive power capability ranges;	O	R-TSO	**Distributionssystem:** En absolut MVAr værdi anvendes. Årsvarighedskurvens 50 % fraktil anvendes i forbindelse med overholdelse af krav til udveksling. Krav jf. note 1. **Forbrugsanlæg:** En absolut MVAr værdi anvendes sammen med cos phi.		
15	1	e		the reactive power range requirement values shall be met at the connection point;	E		- Krav/definition jf. note 2.		
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 require that transmission-connected distribution systems have the capability at the connection point to not export reactive power (at reference 1 pu 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	**Distributionssystem:** Med udgangspunkt i nationalt koncept for regulering af reaktiv effekt i snitfladen mellem transmissionssystemet og distributionssystemet og aftale anvendes artikel 15 stk. 2 ikke.		
15	3			Without prejudice to point (b) of paragraph 1, the relevant TSO may require 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	**Distributionssystem:** Med udgangspunkt i nationalt koncept for regulering af reaktiv effekt i snitfladen mellem transmissionssystemet og distributionssystemet og aftale anvendes artikel 15 stk. 3 ikke.		

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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	**Distributionssystem:** Med udgangspunkt i nationalt koncept for regulering af reaktiv effekt i snitfladen mellem transmissionssystemet og distributionssystemet og aftale anvendes artikel 15 stk. 4 ikke.		
Protection requirements									
16	1			The relevant TSO shall specify 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	RSO anvender: -Linjebeskyttelse -Transformerbeskyttelse -Reaktorbeskyttelse -Hjælpekrafttransformerbeskyttelse -Samleskinnebeskyttelse Alle relevante indstillinger specificeres individuelt med udgangspunkt i relevant net- og anlægsanalyse. Anlægsejer anvender som minimum: -Anlægget sikres mod skader fra fejl og hændelser i nettet -Anlægget sikres mod interne kortslutninger -Anlægget sikres mod udkoblinger i ukritiske situationer - Det kollektive elforsyningsnet sikres i videst mulig omfang mod uønskede påvirkninger fra anlægget		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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		Jf. A16(1)		
16	3	a		external and internal short circuit;			Del af vilkår og betingelser		
16	3	b		over- and under-voltage at the connection point to the transmission system;			Del af vilkår og betingelser		
16	3	c		over- and under-frequency;			Del af vilkår og betingelser		
16	3	d		demand circuit protection;			Del af vilkår og betingelser		
16	3	e		unit transformer protection;			Del af vilkår og betingelser		
16	3	f		back-up against protection and switchgear malfunction.			Del af vilkår og betingelser		
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		Del af vilkår og betingelser Proces		
Control requirements									
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		Del af vilkår og betingelser		
17	2			The agreement shall cover at least the following elements:	E				
17	2	a		isolated (network) operation;	E		**(tilladt)** **Forbrugsanlæg:** Del af vilkår og betingelser **Distributionssystem:** Del af vilkår og betingelser		

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17	2	b		damping of oscillations;	E		**Forbrugsanlæg:** Del af vilkår og betingelser **Distributionssystem:** Del af vilkår og betingelser		
17	2	c		disturbances to the transmission network;	E		**Forbrugsanlæg:** Del af vilkår og betingelser **Distributionssystem:** Del af vilkår og betingelser		
17	2	d		automatic switching to emergency supply and restoration to normal topology;	E		**(tilladt)** **Forbrugsanlæg:** Del af vilkår og betingelser **Distributionssystem:** Del af vilkår og betingelser		
17	2	e		automatic circuit-breaker re-closure (on 1-phase faults).	E		**(tilladt)** **Forbrugsanlæg:** Del af vilkår og betingelser **Distributionssystem:** Del af vilkår og betingelser		
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	Del af vilkår og betingelser		
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				

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
17	4	d		power restriction.	E				
Information exchange									
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			
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	Krav jf. Generisk signalliste, bilag 1.B **Opdeling pr. kategori:** Distribution – kat.1: Distribution – kat.2: Forbrug – kat.3: Forbrug – kat.4: Forbrug – kat.5: Forbrug – kat.6		
Demand disconnection and demand reconnection									
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	**LFDD - Distributionssystem:** **CE:** **6 automatiske trin a 8 %.** Trin 1: f < 49,0 Hz Trin 2: f < 48,8 Hz Trin 3: f < 48,6 Hz Trin 4: f < 48,4 Hz Trin 5: f < 48,2 Hz Trin 6: f < 48,0 Hz (frekvensangivelser er informative) **N:**		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
							5 automatiske trin a 10 % Trin 1: f < 48,5 Hz Trin 2: f < 48,3 Hz Trin 3: f < 48,1 Hz Trin 4: f < 47,9 Hz Trin 5: f < 47,7 Hz (frekvensangivelser er informative) **LFDD Forbrugsanlæg:** Forbrug – kat.3: Forbrug – kat.4: Jf. bilag 1.C. Forbrug – kat.5: **CE:** **6 automatiske trin a 8 %.** Trin 1: f < 49,0 Hz Trin 2: f < 48,8 Hz Trin 3: f < 48,6 Hz Trin 4: f < 48,4 Hz Trin 5: f < 48,2 Hz Trin 6: f < 48,0 Hz **N:** **5 automatiske trin a 10 %.** Trin 1: f < 48,5 Hz Trin 2: f < 48,3 Hz Trin 3: f < 48,1 Hz Trin 4: f < 47,9 Hz Trin 5: f < 47,7 Hz Alternativt: Transmissionsregion med bilateral aftale mellem forbrugsanlæg og TSO. **LFDD Forbrugsanlæg:** Forbrug – kat.6: Indgået aftale om manuel aflastning ved aftalt frekvensværdi. Værdi indgår i vilkår og betingelser.		

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19	1	b		the low frequency demand disconnection functional capabilities shall allow for discon-necting 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	i	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 pu 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		the relevant TSO may specify, in coordination with the transmission-connected distribu-tion system operators, low voltage demand disconnection functional capabilities for the transmission-connected distribution facilities;	O	R-TSO icw RSO	**LVDD - Distributionssystem:** Ingen krav om LVDD.		
19	2	b		the relevant TSO may specify, in coordination with the transmission-connected demand facility owners, low voltage demand disconnection functional capabilities for the trans-mission-connected demand facilities;	O	R-TSO	**LVDD - Forbrugsanlæg:** Ingen krav om LVDD.		
19	2	c		based on the TSO's assessment concerning system security, the implementation of on load tap changer blocking and low voltage demand disconnection shall be binding for the transmission-connected distribution system operators;	NE	R-TSO	**LTCB – Distributionssystem: CE + N.** TF 5.3.4.1/NTO 9 – Kritisk spænding I transmissionsnettet. Viklingskobler sættes i ”manuel”.		
19	2	d		if the relevant TSO decides to implement a low voltage demand disconnection 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	-		
19	2	e		the method for low voltage demand disconnection shall be implemented by relay or con-trol room initiation;	E		-		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
19	2	f		the low voltage demand disconnection functional capabilities shall have the following features:	E		-		
19	2	f	i	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		if required by the relevant TSO, the transformer at the transmission-connected distribution facility shall be capable of automatic or manual on load tap changer blocking;	NE		Specificeret jf. artikel 19(2)(c) Funktionalitet: manuel eller automatisk blokering af viklingskobler. Begge funktioner.		
19	3	b		the relevant TSO shall specify the automatic on load tap changer blocking functional capability.	NE		Fremgår af vilkår og betingelser.		
19	4			All transmission-connected demand facilities and transmission-connected distribution systems shall fulfil the following requirements related to disconnection or reconnection of a transmission-connected demand facility or a transmission-connected distribution system:	E		-		
19	4	a		with regard to the capability of reconnection after a disconnection, 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	**Forbrugsanlæg - reconnection:** Reconnection/synkronisering og forbrug må ikke genoptages inden tilladelse er givet fra EL-Kontrolcenter: (Information: Der kan dog kobles med eget materiel i normaldrift.) **Distributionssystem - reconnection:** Reconnection og forbrug må ikke genoptages inden tilladelse er givet fra EL-Kontrolcenter		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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	**Normativt krav om synkroniseringsevne.** **Forbrugsanlæg:** Frekvenser jf. A12 Indstillinger specificeres i betingelser og vilkår. **Distributionssystem:** Indstillinger og krav specificeres ikke til transmissionstilsluttede distributionssystemer, da gensynkronisering og ø-drift af distributionssystemer ikke indgår i den danske strategi for forsyningssikkerhed.		
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	**Disconnection** **Forbrugsanlæg:** Der er krav om udstyr til automatisk fjernbetjent frakobling. **Distributionssystem:** Der er krav om udstyr til automatisk fjernbetjent frakobling. **Reconfiguration** **Forbrugsanlæg:** Med udgangspunkt i anlægsegenskaber indgår "Block loading" som bilateral aftale i forbindelse med betingelser og vilkår **Distributionssystem:** Tillastning skal kunne ske trinvis, på samme måde som gælder for manuel aflastning		
Power quality									

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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	Krav jf. bilag 1.E. **Opdeling pr. kategori:** Distribution – kat.1: Distribution – kat.2: Forbrug – kat.3: Forbrug – kat.4: Forbrug – kat.5: Forbrug – kat.6		
Simulation models									
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			Each TSO may require simulation models or equivalent information showing the behaviour of the transmission-connected demand facility, or the transmission-connected distribution system, or both, in steady and dynamic states.	O		Krav jf. bilag 1.D. **Opdeling pr. kategori:** Distribution – kat.1: Distribution – kat.2: Forbrug – kat.3: Forbrug – kat.4: Forbrug – kat.5: Forbrug – kat.6:		
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) shall contain the following sub-models or equivalent information:					

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
21	4	a		power control;	E				
21	4	b		voltage control;	E				
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				

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav	
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	Logning skal realiseres via et elektronisk udstyr, der kan opsattes til, som minimum, at logge relevante hændelser for nedenævnte signaler i nettilslutningspunktet ved fejl i det kollektive elforsyningsnet. Anlægsejer installerer i nettilslutningspunktet et logningsudstyr(fejlskriver), der som minimum registrerer: -Spænding for hver fase for anlægget -Strøm for hver fase for anlægget -Aktiv effekt for anlægget (kan vare beregnede størrelser) -Reaktiv effekt for anlægget (kan vare beregnede størrelser) -Frekvens i POC/anlæg -Aktivering af interne beskyttelsesfunktioner Specifikke krav til målinger beskrives i nettilslutningsaftalen. Logning skal udføres som sammenhangende tidsserier af måleværdier fra 10 sekunder for hændelse til 60 sekunder efter hændelsestidspunktet. Minimum samplefrekvens for alle fejllogninger skal vare 1 kHz. De specifikke opsætninger af hændelsesbaseret logning aftales med Energinet Elsystemansvar A/S ved opstart af anlægget. Alle målinger og data, der skal opsamles iht. TF 5.8.1 skal logges med en tidsstempling og en nøjagtighed, som sikrer, at disse kan korreleres med hinanden og med tilsvarende registreringer i det kollektive elforsyningsnet. Logninger skal arkiveres i minimum tre måneder fra fejlsituationen, dog maksimalt op til 100 hændelser. Energient Elsystemansvar A/S skal på forlangende have adgang til loggede og relevante registrerede informationer.	

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
Chapter 2 - Operational notification procedure									
General provisions									
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				
Energisation operational notification									
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				
Interim operational notification									
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				

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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.					
Final operational notification									

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
25	1			A 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			A 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			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. A 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. 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. 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.					
Limited operational notification									

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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			A 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.					

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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.					
General requirements									
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	i	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	i	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.					
Specific provisions for demand units with demand response active power control, reactive power control and transmission constraint management									
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.					

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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 – 50 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: Frekvensmålinger skal udføres med en nøjagtighed på ± 10 mHz eller bedre. Reguleringsfunktionens følsomhed skal være ± 10 mHz eller bedre. Opløsningen i aktørens SCADA-system skal være bedre end 1 sekund, og udvalgte signaler skal kunne dokumentere anlæggenes respons på frekvensafvigelser. Leverandøren skal lagre signalerne i minimum en uge. DK1 – aFRR: Hver enkelt forbrugsenhed, som leverer eller indgår i levering af aFRR reserver, skal informationsteknisk tilsluttes Energinets Kontrolcenter. Kontrolcenteret skal for		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
							hver enkelt forbrugsenhed som udgangspunkt, online, have følgende oplysninger: • Statusmeldinger, forbrugsenhed "ude/inde". • Online målinger for forbrug (MW). • Aktuel mulig reserve op (MW). • Aktuel maks. gradient op (MW/min). • Aktuel tidskonstant for regulering op (sekunder). • Aktuel mulig reserve ned (MW). • Aktuel maks. gradient ned (MW/min). • Aktuel tidskonstant for regulering ned (sekunder). Krav til og leveringssted for meldinger og målinger aftales med Energinet Elsystemansvar A/S. DK2 – FCR-N: Frekvensmålinger skal udføres med en nøjagtighed på ± 10 mHz eller bedre. Reguleringsfunktionens følsomhed skal være ± 10 mHz eller bedre. Opløsningen i aktørens SCADA-system skal være bedre end 1 sekund, og udvalgte signaler skal kunne dokumentere anlæggenes respons på frekvensafvigelser. Leverandøren skal lagre signalerne i minimum en uge. DK2 – FCR-D: Frekvensmålinger skal udføres med en nøjagtighed på ± 10 mHz eller bedre. Reguleringsfunktionens følsomhed skal være ± 10 mHz eller bedre. Opløsningen i aktørens SCADA-system skal være bedre end 1 sekund, og udvalgte sig-		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
							naler skal kunne dokumentere anlæggenes respons på frekvensafvigelser. Leverandøren skal lagre signalerne i minimum en uge. DK1 + DK2 – mFRR: Hver enkelt forbrugsenhed, som leverer manuel reserve, skal informationsteknisk tilsluttes Energinets Kontrolcenter. Kontrolcenteret skal som minimum, online, have følgende oplysninger: • Statusmeldinger vedrørende forbrugsenhed "ude/inde". • Måling for forbrugsenhedens nettoforbrug i tilslutningspunktet. Krav til og leveringssted for meldinger og målinger aftales med Energinet Elsystemansvar A/S		
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);			DK1 – FCR: Primærreguleringen skal leveres ved en frekvensafvigelse op til +/-200 mHz i forhold til referencefrekvensen på 50 Hz. Det vil normalt betyde i området 49,8-50,2 Hz. Det er tilladt med et dødbånd på +/-20 mHz. Reserven skal som minimum leveres lineært ved frekvensafvigelser mellem 20 og 200 mHz afvigelse. Den første halvdel af den aktiverede reserve skal være leveret inden 15 sekunder, mens den sidste del skal være fuldt leveret inden 30 sekunder ved en frekvensafvigelse på +/-200 mHz. Reguleringen skal kunne opretholdes indtil den automatiske og den manuelle reserve tager over, dog minimum 15 minutter.		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
							Efter afsluttet regulering skal reserven være retableret efter 15 minutter. DK1 – aFRR: Sekundær reserven leveres primært fra "kørende" anlæg. Den tilbudte mængde reserve skal kunne leveres inden for 15 minutter. Som alternativ kan reserven sammensættes af "kørende" anlæg og hurtigt startende anlæg. Ydelsen, der skal leveres inden for en kommende 5-minutters periode, skal være fra "kørende" anlæg. Reguleringen skal kunne opretholdes kontinuerligt. Reguleringssignalet udsendes online som en effektværdi fra Energinets Kontrolcenter til hver PBA/aktør med reference til tilbuddet. I de tilfælde, hvor der anvendes både produktion og forbrug, sendes en effektværdi relateret til produktion og en anden effektværdi relateret til forbrug. DK2 – FCR-N: Normaldriftsreserven skal kunne leveres ved en frekvensafvigelse op til +/-500 mHz i forhold til referencefrekvensen på 50 Hz. Det vil betyde i området 49,5-50,5 Hz. Leverancen skal leveres uden dødbånd. Reserven skal som minimum leveres lineært ved frekvensafvigelser mellem 0 og 100 mHz afvigelse. Den aktiverede reserve skal være leveret efter 150 sekunder uanset afvigelsens størrelse.		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
							Reguleringen skal kunne opretholdes kontinuerligt. DK2 – FCR-D: Frekvensstyret driftsforstyrrelsesreserve skal kunne: • Levere effekt omvendt lineært med frekvensen mellem 49,9 og 49,5 Hz. • Levere 50 pct. af responsen inden for 5 sekunder. • Levere de resterende 50 pct. af responsen inden for yderligere 25 sekunder. DK1 + DK2 – mFRR: Den manuelle reserve skal være fuldt leveret 15 minutter efter aktivering.		
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	h		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	i		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;					

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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 millisekunder). ROCOF [Hz/s] beregnes som forskellen mellem den netop udførte middelværdi-frekvensberegning og den middelværdi frekvensberegning, der blev foretaget for 20 ms siden. (df/dt = middelværdi 2 – middelværdi 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 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: Energinet sender ikke signaler til aktivering af reserven i selve driftsdøgnet. Aktivering af reserverne foregår via leverandørens egne målinger af frekvensen. DK1 – aFRR: Aktivering af reserverne foregår via online signal fra Energinets Kontrolcenter. DK2 – FCR-N: Energinet sender ikke signaler til aktivering af reserven i selve driftsdøgnet. Aktivering af reserverne foregår via leverandørens egne målinger af frekvensen. DK2 – FCR-D: Energinet sender ikke signaler til aktivering af reserven i selve driftsdøgnet. Aktivering af reserverne foregår via leverandørens egne målinger af frekvensen. DK1 + DK2 – mFRR: Aktivering af reserverne foregår via manuelt signal fra Energinets Kontrolcenter.		

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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.					
Specific provisions for demand units with demand response system frequency control									
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 fastsætter ikke krav til levering af disse ydelser, da vi ikke forventer at efterspørge denne type af ydelser.		
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.					

Art nr.	Art stk.	Art. afs.	Art. enh.	Artikel emne	Type	Ejer	Krav		
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;					

Note 1
MVAr-model

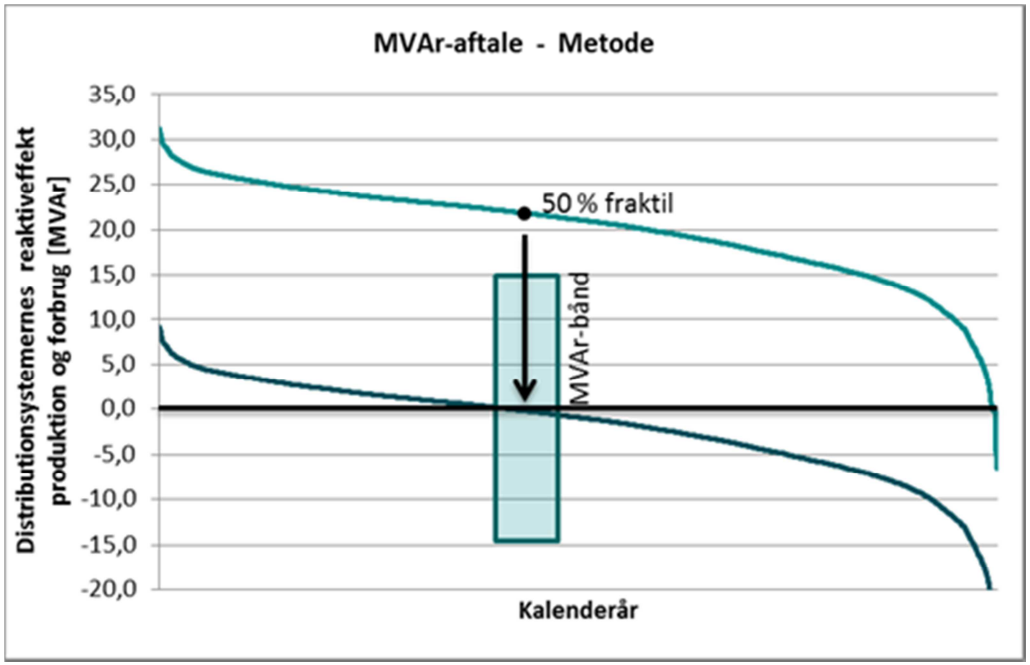
Den maksimalt tilladelige udveksling af reaktiv effekt er gældende per transmissionstilslutningspunkt, det vil sige per 150-132 kV station målt ab 60-10 kV niveau, og udgør således summen af den udvekslede reaktive effekt i nettilslutningspunktet. Summen er uafhængig af antallet af tilsluttede transformatorer eller bevillingshavende netvirksomheder tilsluttet et vilkårligt nettilslutningspunkt.

Metode

MVAr-metoden skal sikre, at 50 % fraktilen af årsvarighedskurven for den tidsmæssigt variable udveksling af reaktiv effekt i et nettilslutningspunkt mellem transmissionssystemet og et distributionssystem er mindre end nedenstående grænseværdier (MVAr-bånd).

- Årsvarighedskurvens 50 % fraktil skal ligge i båndet +/- 15 MVAr.

Overskrides disse grænseværdier skal der foretages kompensering i distributionsnettet. Såfremt der installeres en reaktiv komponent skal denne dimensioneres således, at 50 % fraktilen af årsvarighedskurven for den tidsmæssigt variable udveksling af reaktiv effekt i det pågældende nettilslutningspunkt efterfølgende kompenseres til under grænseværdien, og det skal tilstræbes at kompensere mod 0 MVAr som eksemplificeret med Figur 1.



Figur 1 Grundprincip for MVAr-model

Såfremt der sker overkompensering, dvs. 50 % fraktilen af årsvarighedskurven for den tidsmæssigt variable udveksling af reaktiv effekt i et givent nettilslutningspunkt bringes til en værdi mindre end 0 MVAr, kan der indgås aftale om udnyttelse af denne overskydende reaktorkapacitet til kompensering, i henhold til ovenstående princip, af nærtliggende 150-132 kV stationer, såfremt dette ikke medfører driftsmæssige begrænsninger for udnyttelse af transmissionsnettet.

Bestemmelse af 50%-fraktilen

Datagrundlaget for den løbende opfølgning på MVAr-aftalen opstilles på baggrund af afregningsdata for nettoudvekslingen af aktiv og reaktiv energi i et vilkårligt nettilslutningspunkt. Der anvendes konsoliderede data med en tidsopløsning på 60 minutter, og data repræsenterer således middelværdien for den udvekslede reaktive energi (MVArh/h) i nettilslutningspunkterne for hvert af årets timer.

Overskridelse af de aftalte grænseværdier for den tidsmæssigt variable udveksling af reaktiv effekt i et vilkårligt nettilslutningspunkt konstateres på baggrund af beregning af 50 % fraktilen af årsvarighedskurven for det foregående kalender år.

Redundans for komponenter i distributionsnettet

Energinet sikrer gennem den løbende planlægning af transmissionsnettet det nødvendige niveau for reaktive komponenter i transmissionssystemet til håndtering af et havari på en reaktiv komponent i distributionsnettet. Af samme grund stilles der derfor ikke krav om redundante reaktorer i distributionsnettet.

Energinet stiller kun reaktorkapacitet på transmissionssystemniveau til rådighed i perioden frem til idriftsættelsen af en ny reaktor i distributionsnettet (< 2år).

Bilateral aftale omkring overskydende kompensering

Der kan indgås en bilateral aftale mellem Energinet og den pågældende netvirksomhed om, at overskydende kompensering kan anvendes i nærtliggende stationer via transmissionsnettet til administrativt at bringe udvekslingen af reaktiv effekt inden for de fastlagte grænseværdier. Muligheden for en bilateral aftale skal baseres på en vurdering af den konkrete situation, og heri skal bl.a. tages hensyn til det konkrete distributionssystem konkrete forhold, geografiske placering, afstanden mellem stationer samt både netvirksomhedens og Energinets driftsmæssige situation i området.

Note 2
Tilslutningspunkt

Kravspecifikationens udgangspunkt, tager her indledningsvist afsæt i:

- EU 2016/1388 artikel 15, stk. 1, litra (e) - værdierne for kravet om intervallet for reaktiv effekt gælder ved tilslutningspunktet
- Den nuværende fysiske opbygning og anvendt praksis for transmissionstilslutning af distributionssystemer i transmissionssystemet

Som følge heraf og til anvendelse i modellen, fastsættes krav til udveksling af reaktiv effekt per transmissionstilslutningspunkt, her defineret som en 150-132/60-10 kV station, det vil sige i skillefladen mellem transmissionssystemerne (150 - 132 kV) og distributionssystemerne (60 - 10 kV).

Det betyder følgende:

- Er ét enkelt distributionssystem tilsluttet i den transmissionstilsluttede 150-132/60-10 kV station, kan dette distributionssystem anvende det specificerede område for udveksling af reaktiv effekt.
- Er flere distributionssystemer tilsluttet i den transmissionstilsluttede 150-132/60-10 kV station, deler alle distributionssystemerne det specificerede område for udveksling af reaktiv effekt.
- Forholdet omkring efterlevelse af krav for udveksling af reaktiv effekt og etablering af kompenseringsanlæg påhviler det netselskab, som står som stationsansvarlig netselskab på distributionsniveau