Annex C Blank forms, questionnaires for new systems

This annex is split into:

- C.1 (Part A): The operator questionnaire and
- C.2 (Part B): The grid operator questionnaire.

C.1 PART A: OPERATOR QUESTIONNAIRE FOR THE SYSTEM CERTIFICATE

See BDEW MV guideline, Annex F.1.

See TCC High-Voltage, Annexes E.1, E.4 and E.6.

Part A and the extract from the test report 'Power quality' in accordance with TG 3 must be handed over to the grid operator as requested by Part B.

The table below should also be filled out.

No.	Manufacturer	Type name	Rated power in kW		Commissioning date for existing systems at the GCP	Planned commissioning date	Project ID / serial number	List of the constituent PGUs in the PGS (all the PGUs in the PGS of the applicant; existing system PGUs are to be marked with a (*)).	Data questionnaire for WT operators
Example	XYZ	ABCxxxxx	2000		1XXXX1*	20/09/2013	xxxxx1	TO BE COMPLETED AFTER THE FIRST TABLE. PART A	
1									
2									
3									
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12									
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14									
15									

C.2 PART B: GRID OPERATOR QUESTIONNAIRE

TCC High-Voltage, Annex E.7, can also be applied for high-voltage connections

Data questionnaire for grid operators of new systems **Certification of a power generating system** Connection/modification of a power generating system		**TG 8, Annex C, Part B** **1 (9)**
Name of power generating system		
Agreed connected active power P_{AV} and apparent power S_{AV}		
Grid operator including contact person and contact details		
Registration number of grid operator		
Name of substation		
Name of grid connection point		
Project data: See checklist TG 8, Annex C, Part A (F1) ☐ **Document attached** ☐ **Document not attached**		
Other remarks		

Data questionnaire for grid operators of new systems **Certification of a power generating system**	**TG 8, Annex C, Part B** **2 (9)**

1. The setting values of the protective devices at the grid connection point
Basis: BDEW MV guideline, and TCC High-Voltage

1.1 Short-circuit protective devices
(mark with a cross where applicable)

☐ **Distance protection; type:**

Setting parameter		Prescribed setting values		
		Old (actual)	New (setpoint)	
Overcurrent excitation I >> [A]				☐ separate settings sheet attached Remarks:
Undervoltage excitation	I > [A]			
	U < [V]			
Zero phase sequence system excitation	I_E > [A]			
	U_{NE}> [V]			

☐ **Time overcurrent protection; type:**

Setting parameter	Prescribed setting values		
	Old (actual)	New (setpoint)	
I >> [A]			☐ separate settings sheet attached Remarks:
$t_{I>>}$ [ms]			
I > [A]			
$t_{I>}$ [ms]			

☐ **Earth fault protection; type:**

Setting parameter	Prescribed setting values		
	Old (actual)	New (setpoint)	
I_E >> [A]			☐ integrated in distance protection or time overcurrent protection ☐ separate settings sheet attached Remarks:
$t_{IE>>}$ [ms]			
I_E > [A]			
$t_{IE>}$ [ms]			
U_E > [V]			
$t_{UE>}$ [ms]			

NOTE: For all physical variables, PRIMARY VALUES are to be given. (e. g. I>> 360 A instead of I>> 1.2 I_n; U< 16 kV instead of U< 0.8 U_n).

Data questionnaire for grid operators of new systems **Certification of a power generating system**				**TG 8, Annex C, Part B** **3 (9)**
1.2 PGS grid protection				
☐ **Connection to the EHV/HV grid** ☐ **to be taken from TCC .....of .....**				
Function	Setting parameter	Recommendation from TCC High-Voltage	Grid operator setting specifications	
High voltage side				
Overvoltage protection	U> [kV]	1.25 U_n		U_n=rated voltage of the HV grid
	$t_{U>}$ [ms]	500 ms		
Undervoltage protection	U< [kV]	0.8 U_n		
	$t_{U<}$ [s]	5.0 s		
Overfrequency protection	f> [Hz]	51.5 Hz		
	$t_{f>}$ [ms]	≤ 100 ms		
Underfrequency protection	f< [Hz]	47.5 Hz		
	$t_{f<}$ [ms]	≤ 100 ms		
Low voltage side				
Overvoltage protection	U>> [kV]	1.20 U_{MV}		U_{MV}=Controller setpoint voltage [1]
	$t_{U>>}$ [ms]	300 ms		
	U> [kV]	1.1 U_{MV}		
	$t_{U>}$ [s]	180s		
Other remarks				

NOTE: For all physical variables, PRIMARY VALUES are to be given (e. g. I>> 360 A instead of I>> 1.2 I_n; U< 16 kV instead of U< 0.8 U_n).

[1] UCUCMV is the controller setpoint voltage of the tap changer on the HV/MV transformer. If the defined controller setpoint voltage deviates from the given value, the overvoltage protection setting values must be converted correspondingly. The defined controller setpoint voltage must be given in the conformity declaration.

Data questionnaire for grid operators of new systems **Certification of a power generating system**	**TG 8, Annex C, Part B** **4 (9)**

☐ **Connection to the MV grid**

☐ **to be taken from TCC .....of .....**

Function	**Setting parameter**	**Setting values in accordance with BDEW MV guideline**	**Grid operator setting specifications**	
Overvoltage protection	U>> [kV]	1.15 U_c		U_c= agreed supply voltage
	$t_{U>>}$ [ms]	≤ 100 ms		
	U> [kV]	1.08 U_c		
	$t_{U>}$ [s]	1 min		
Undervoltage protection	U< [kV]	0.8 U_c		
	$t_{U<}$ [s]	2.7 s		
	U<< [kV]			
	$t_{U<<}$ [s]			
Overfrequency protection	f> [Hz]	51.5 Hz		
	$t_{f>}$ [ms]	≤ 100 ms		
Underfrequency protection	f< [Hz]	47.5 Hz		
	$t_{f<}$ [ms]	≤ 100 ms		

Other remarks

NOTE: For all physical variables, PRIMARY VALUES are to be given (e. g. I>> 360 A instead of I>> 1.2 I_n; U< 16 kV instead of U< 0.8 U_n).

Data questionnaire for grid operators of new systems **Certification of a power generating system**				**TG 8, Annex C, Part B** **5 (9)**
1.3 System protection				
☐ **Connection to the EHV/HV grid** ☐ **to be taken from TCC .....of .....**				
Function	Setting parameter	Recommendation from VDE TCC High-Voltage	Grid operator setting specifications[2]	
Reactive power direction undervoltage protection[3]	$U_{Q\rightarrow\&U<}$ [kV]	0.85 U_n		U_n=rated voltage of the HV grid Excitation voltage
	U_{LL} > FG	0.95 U_n		Reconnection enabling voltage
	$t1_{Q\rightarrow\&U<}$ [ms]	500 ms		1st step - trigger at GCP
	φ	3°		Excitation angle[4]
	I_{min} Q(U)	0.1 $I_{transformer}$		Minimum current[5]
	Q_{min} Q(U)	0.05 S_{Amax}		Reactive power discrimination threshold[6]
Other remarks				
☐ **Connection to the MV grid** ☐ **to be taken from TCC .....of .....**				
Function	Setting parameter	Setting values in accordance with BDEW MV guideline	Grid operator setting specifications	
Reactive power undervoltage protection	$U_{Q\rightarrow\&U<}$ [kV]	0.85 U_C		U_c of the MV grid
	$t1_{Q\rightarrow\&U<}$ [ms]	500 ms		Trigger power circuit breaker at the GCP or PGU
Other remarks				

NOTE: For all physical variables, PRIMARY VALUES are to be given (e. g. I>> 360 A instead of I>> 1.2 I_n; U< 16 kV instead of U< 0.8 U_n).

[2] Settings on the basis of the FNN specifications 'Blindleistungsrichtung-Unterspannungsschutz (Q(U)-Schutz)'

[3] With regard to system protection for new systems, the TC 2007 requirements apply. In this respect, the first step must have an effect on the individual PGUs. For this, active connections to the individual PGUs are necessary. Remote connections do not meet the requirements with regard to speed of signal transfer. The voltage at the GCP is to be analysed for reconnection.

[4] Depending on protection device used.

[5] Depending on protection device used; setting recommendation 0.1 I transformer, but max. 0.15 I_N of the installed power generating units.

[6] Depending on protection device used.

Data questionnaire for grid operators of new systems **Certification of a power generating system**	**TG 8, Annex C, Part B** **6 (9)**

2. Setting values of the grid protection device on the power generating unit

Basis: BDEW MV guideline and TCC High-Voltage

2.1 Grid protection

☐ **A) Connection to the EHV/HV grid**
☐ **B) Connection to the MV grid or MV grid with direct substation connection**
☐ **to be taken from TCC .....of .....**

Function	Setting parameter	For **A)** Recommendation in accordance with TCC High-Voltage	For **B)** recommended Setting values in accordance with BDEW MV guideline	Prescribed setting values[7] by grid operator
Overvoltage protection	U>>	1.25[8] U_{LV}	1.15 U_{LV}/1.20 U_{LV} [7]	
	$t_{U>>}$	100 ms	≤ 100 ms	
Undervoltage protection	U<	0.8 U_{LV}	0.8 U_{LV}	
	$t_{U<}$	Staggered, see below	0.3/1.5 ...2.4 s[9]	
	U<<	0.3 U_{LV}	0.45 U_{LV}	
	$t_{U<<}$	800 ms	0 ...300 ms[6]	
Overfrequency protection	f>	51.5 Hz	51.5 Hz	
	$t_{f>}$	≤ 100 ms	≤ 100 ms	
Underfrequency protection	f<	47.5 Hz	47.5 Hz[10]	
	$t_{f<}$	≤ 100 ms	≤ 100 ms	

Where staggering is to be completed within a power generating system, please define the following staggered values:	Setting parameter of the staggering		Setting values
	$t_{U<,1}$	**1.5 s**	
	$t_{U<,2}$	**1.8 s**	
	$t_{U<,3}$	**2.1 s**	
	$t_{U<,4}$	**2.4 s**	

[7] Settings will follow the prescribed values, provided that these do not impair the self-protection of the PGU. Where prescribed setting values are not compatible with the self-protection of the PGU, further consultation with the GO will be required.

[8] U_{LV} is the voltage on the low-voltage side of the generator transformer. It is given by $U_{LV} = U_{MV} \cdot ü$. U_{MV} corresponds to U_c for a medium-voltage connection

[9] Observe the information in BDEW MV guideline.

[10] If specified it must be taken into consideration whether the PGS is connected in a zone with automatic frequency-actuated load shedding.

Data questionnaire for grid operators of new systems **Certification of a power generating system**	**TG 8, Annex C, Part B** **7 (9)**

2.2 Dynamic grid support - low voltage ride-through (LVRT) mode

Function	Prescribed setting values by grid operator	Location at which the k factor must be adhered to
LVRT mode: reactive current feed-in dependent upon the depth of the voltage dip, with a specific k factor[11] [12] ☐ k factor in accordance with SDLWindV – setting range: k = 0-10 ☐ k factor in accordance with BDEW MV guideline– k ≥ 2 ☐ k factor in accordance with TCC High-Voltage 2<k<6	Where k= …	☐ GCP ☐ PGU

Other remarks

As an alternative, the following LVRT mode may be selected:

LVRT mode:
no reactive current feed-in, zero active power feed-in in case of a fault ☐ activate

This LVRT mode is not a requirement from SDLWindV, BDEW MV guideline and TCC High-Voltage. This mode can only be fulfilled by certain PGUs.

If this option cannot be fulfilled by the PGU, then this point must be agreed upon with the grid operator.

[11] It must be indicated whether the k factor has been selected in accordance with TCC High-Voltage, BDEW MV guideline or SDLWindV. The SDLWindV mode is intended for WTs and is not a requirement for all other PGUs.

[12] If the dynamic grid support is deactivated the grid protection settings must be adapted accordingly.

Data questionnaire for grid operators of new systems **Certification of a power generating system**	**TG 8, Annex C, Part B** **8 (9)**
3. Static reactive power behaviour	
☐ **EHV / HV grid**	☐ Version 1 in accordance with Section 10.2.2 of TCC High-Voltage ☐ Version 2 in accordance with Section 10.2.2 of TCC High-Voltage ☐ Version 3 in accordance with Section 10.2.2 of TCC High-Voltage ☐ …… underexcited to …… overexcited (separate regulation)
☐ **MV grid**	☐ 0.95 underexcited to 0.95 overexcited in accordance with BDEW MV guideline ☐ …… underexcited to …… overexcited (separate regulation)
Requirements with regard to reactive power behaviour of existing units on mixed farms [13],[14]	☐ cos φ = …… at the grid connection point ☐ overexcited ☐ underexcited ☐ cos φ = …… at the PGUs ☐ overexcited ☐ underexcited ☐ …… underexcited to …… overexcited ☐ ……
Defined reactive power setpoint and procedure ☐ **to be taken from TCC ……of ……**	
1) Fixed displacement factor cos φ	☐ activate with ……. cos φ = …… ☐ overexcited ☐ underexcited ☐ variable via telecontrol system[15] ☐ schedule
2) Displacement factor cos φ (P)[16]	☐ activate with cos φ = f(x) where f(x) = _____ and x := _____ *Example: f(x)= -0.05 x + 1 mit x := P/P_n*
3) Fixed reactive power	☐ activate with Q = _____ kvar ☐ variable via telecontrol system[17] ☐ schedule[18]
4) Reactive power/voltage characteristic Q(U)[19][20]	Gradient m = …… kvar/kV Voltage dead band = ……kV Upper voltage boundary U (Q_{max}) = ……kV Lower voltage boundary U (Q_{min}) = ……kV Reference voltage: U_o = ……kV variable via telecontrol system Rise time T_{an} = …..s (standard: T_{an} = 5 s)
5) Adjusting time	☐ activate with 1 min ☐ activate with 10 s ☐ activate with ……. (at least 10 s)
6) Q (P) characteristic[21]	*P_{mom}/P_{AV}[%]* | | | | | | *$Q_{EA,soll}/P_{AV}$[%]* | | | | | |
Behaviour on telecontrol system failure[22]	☐ Continued operation using the last received value ☐ U_0 = ……kV; Q = …… kvar; cos φ = …… (depending on method selected)
Other remarks	

[13] If several existing systems exist with different reactive power responses or agreements with the grid operator, please attach detailed information on a separate sheet.

[14] In addition to the agreed operating mode of the existing systems, their true response must also be considered. The calculation method is described in TG 8.

[15] The GO must include specifications of the telecontrol system / they are to be taken from the grid operator's TCC.

[16] Is limited by the setting range given above.

[17] The GO must include specifications of the telecontrol system / they are to be taken from the grid operator's TCC.

[18] If schedules are demanded, they must be provided as a separate sheet or given under Other remarks.

[20] Recommendations to be taken from 10.2.2.4.

[21] Up to 10 value pairs can be specified.

[22] If setpoint input is performed via telecontrol system.

Data questionnaire for grid operators of new systems **Certification of a power generating system**		**TG 8, Annex C, Part B** **9 (9)**
4. Grid data		
Parameter	***Value***	***Unit***
Rated voltage U_n HV: Rated voltage of the grid U_n		kV
Rated short-term current I_k (for T_k = 1 s)[23]		
Agreed supply voltage U_c[24]		kV
Controller setpoint voltage $U_{setpoint}$[25]		kV
Total connectable power at PCC S_{Total}[26] ☐ S_{Total} can be requested from the responsible grid operator in confidential correspondence.		MVA
Min. grid short-circuit power at PCC[27] S_{kV}		MVA
Grid impedance phase angle at PCC ψ_k		°
Grid short-circuit power at grid connection point S_k (If no values are given, the values at the PCC are adopted for the GCP.)		MVA
Grid impedance phase angle at grid connection point ψ_k (If no values are given, the values at the PCC are adopted for the GCP.)		°
Grid cable percentage		% of system length
Neutral point treatment in same grid NOTE: *"The information listed here is required for evaluating asymmetrical faults; if the information is not given only a limited evaluation is possible."*	**☐ solid earthing** **☐ low-resistance neutral point treatment ____Ω** **☐ short-term, low-resistance neutral point treatment ____Ω** **☐ zero phase sequence impedance R_0____Ω, X_o____Ω** **☐ resonance neutral point earthing ____Ω** **☐ isolated**	

[23] For dimensioning the short-circuit resistance of the high-voltage substation.

[24] The generator transformer steps of the PGU are selected based on U_n. U_c is the voltage at the GCP specified by the GO.

[25] The upper and lower boundaries are given for dynamic setpoint input.

[26] If S_{Total} is not given, then S_{Total} = SA.

[27] For the preparation of the system certificate, the GO will supply grid data, the grid short-circuit power S_{kV} and the grid impedance phase angle ψ_k at the grid connection point initially determined. This data will form the basis for the verification of the guideline-compliant response of the PGS. The dimensioning of system components for short-circuit resistance will be governed by more stringent requirements, in accordance with the technical connection conditions of the grid operator.

HV side transformer neutral point wiring (where present)	☐ Free neutral point ☐ Solid earthing Ik1p = ... kA, T_k = ... s ☐ With earthing resistance RME = ... ☐, I_r = ... A, T_k = ... s ☐ With surge voltage protector u_r = ... kV ☐ With neutral earthing reactor I_r = ...A ☐ Fixed ☐ Infinitely variable	
For high-voltage connections: Grid operator's specifications for neutral point handling of connected party's components, which are electrically connected with the grid operator's grid.		
Ripple control frequency		Hz
For MV connections		
Apparent power of the upstream grid transformer[28] S_{Grid}		MVA
R of the upstream grid transformer		Ohm
X of the upstream grid transformer		Ohm
Vector group of the upstream grid transformer		
For HV or EHV connections		
Reference power [29] S_0		
Vector group of the upstream grid transformer, only for HV connections		
Other remarks		

Place, date	Signature of grid operator

[28] The system operator is provided with S_{Grid}, S_{Total} and S_{kV} by the GO. S_{Total} is the total connectable or planned apparent power at the PCC. The share 'owed' to the PGS is determined with the values handed over. If no information is provided, the procedure according to Chapter 4.3.4 is to be used.

[29] If the PGS is connected to a section between two transformer substations, the thermal break-even performance of this section is applied for the reference power S_0. When the PGS is directly connected to a transformer substation, or connected via the customer's own line, the maximum generating power that can be connected to the transformer substation is to be used for S_0.