TC EC – Decision to
Technical Guideline
TG 3 Rev. 26

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Technical Committee Electrical Characteristics (TC EC) – Decision 1 from 15 October 2024

The Technical Committee Electrical Characteristics (TC EC) decides the amendment of Revision 26 of the Technical Guideline Part 3 (TG 3).

The supplementary sheet 1 to FGW TG 3 Rev. 26 presents the testing method for prioritising the active power in the case of an underfrequency event with simultaneous specification by third parties (e.g. a direct seller) by the grid safety management (German: Netzsicherheitsmanagement (NSM)) of the grid operator. This is a purely functional test that does not involve the determination of dynamic parameters and control accuracies.

In addition, corrections to FGW TG 3 Rev. 26 are listed in Chapter 3.

on behalf of the TC Electrical Characteristics

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Supplementary sheet 1 to FGW TG 3 Rev. 26 Determination of the Electrical Characteristics of Power Generating Units and Systems, Storage Systems as well as for their Components in Medium, High and Extra-High Voltage Grids

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In the interest of easier legibility, a gender-neutral differentiation is not used here. Any gender-specific terminology always refers to both genders.

Supplementary sheet 1 to FGW TG 3 Rev. 26

Contents

1 Introduction

Representatives of the following groups participated in the compilation of this supplementary sheet to the Technical Guidelines for Power Generating Units (PGUs) and Systems, Part 3 Rev. 26 (TG 3) /1/:

- Grid operators.
- Manufacturers of PGUs and their components.
- Recognised institutes and universities.
- Testing institutes.
- Certification bodies.

All parties involved have expressed the desire that this supplementary sheet shall supplement TG 3 Rev. 26 /1/.

The requirements, specifications and explanations described in TG 3 Rev. 26 /1/, in particular Chapter 1 (Introduction), Chapter 2 (Scope) and Chapter 3 (Requirements) also apply to this supplementary sheet.

The abbreviations, symbols and units as well as terms and definitions listed in TG 3 Rev. 26 /1/ apply to this supplementary sheet too.

In Chapter 2, the requirements for a testing method for prioritizing underfrequency events are specified. This testing method supplements the methods in Chapter 4.1, Chapter 6.1 and Chapter 7.2 of TG 3 Rev. 26 /1/. The method described in Chapter 2 can also be used analogously for certifications according to earlier editions of TG 3.

Chapter 3 lists corrections to TG 3 Rev. 26 /1/.

2 Prioritisation of the active power input for underfrequency

2.1 AIM

The testing method shall demonstrate the prioritisation of the active power in the case of an underfrequency event with simultaneous specification by third parties (e.g. a direct seller) or by the grid safety management (German: Netzsicherheitsmanagement (NSM)) of the grid operator. The testing described here is purely a functional test that does not involve the determination of dynamic parameters and control accuracies.

2.2 TESTING METHOD

The following testing method can be carried out either on the PGS controller or on the PGU. For measurements on components, the manipulated variable of the active power can also be used as the output variable instead of the actual active power.

The requirements for prioritising the active power differ between TCR-MV /5/ and TCR-HV /4/ on the one hand and TCR-EHV /3/ on the other hand. Therefore, depending on which connection rule is to be used for certification, the testing method should be carried out with the setting of the PGU or PGS controller in accordance with TCR-MV /5/ and TCR-HV /4/ on the one hand and in accordance with TCR-HV /3/ on the other hand. In the individual verification procedure, the verification must only be provided for the respective valid requirement.

The frequency can be specified using one of the methods for changing the grid frequency in accordance with chapter 4.1.3.2.1 of TG 3 Rev. 26 /1/.

In justified cases, the following specifications for the testing method can be adapted.

The levels shown in Table 1 must be approached and recorded with the given specifications by the grid safety management of the grid operator and by third parties and at the given frequencies and active powers.

The times of each individual level must be selected so that the active power/ manipulated variable is in a stationary state for at least 30 s at the end of each level.

During the test, the available active power must be at least as high as the technical minimum power[1] + 50 % P_n, but not more than 100 % P_n.

The following parameters are suggested for the test:

- Gradient $\Delta P/\Delta f$: 40 % P_{ref} per Hertz, only for storage of type 2: 100 % P_{ref} per Hertz, whereby the following applies to all PGU types: $P_{ref} = P_{rE}$
- Setting value at the beginning of the underfrequency range: 49.8 Hz
- Active power gradient according to the requirements of TCR MV /5/, TCR HV /4/, or TCR EHV /3/ or according to grid operator specifications
- Rise times and settling times for the $P(f)$ control according to Table 9 of TCR MV /5/, considering the exceptions below Table 9.

[1] For the definition of 'technical minimum power', please reference to /3/, /4/ and /5/ Chapter 3.1. The term technical minimum power is also used for type 2 units and can be set to 0 unless the manufacturer specifies otherwise.

For the individual verification procedure, the specifications defined in the network operator questionnaire can also be used as well.

Test level	Frequency	Active power limitation through grid safety management	Active power specification by third parties	Informative: Expected active power after	
				TCR MV /5/ and TCR HV /4/	TCR EHV /3/
1	50 Hz	None	None	Available active power	
2	50 Hz	None	Technical minimum power, at least 10 % P_n	Technical minimum power, at least 10 % P_n	
3	49.7 Hz	None	Technical minimum power, at least 10 % P_n	According to Gradient $\Delta P/\Delta f$	
4	f1*	None	Technical minimum power, at least 10 % P_n	According to Gradient $\Delta P/\Delta f$	
5	f1*	Technical minimum power + 20 % P_n	Technical minimum power, at least 10 % P_n	Technical minimum power + 20 % P_n	According to Gradient $\Delta P/\Delta f$
6	f1*	Technical minimum power + 20 % P_n	None	Technical minimum power + 20 % P_n	According to Gradient $\Delta P/\Delta f$
7	f1*	None	None	According to Gradient $\Delta P/\Delta f$	
8	50 Hz	None	None	Increase to available active power with a gradient of max. 10 % $P_{b\,inst}$/min.	

*f1: The frequency f1 must be selected so that the active power setpoint value resulting from the frequency change is greater than or equal to the technical minimum power + 30 % P_n.

Table 1: Operating points to be approached as part of the testing method

Special WT features

None.

Special PV and storage features

None.

Special CE features

None.

2.3 ANALYSIS

The setpoint value of the active power must be calculated from the characteristic curve of the active power adaptation for overfrequency and underfrequency and the simulated frequency.

Special WT features

None.

Special PV and storage features

None.

Special CE features

None.

2.4 DOCUMENTATION

The following signals must be displayed graphically over time for the entire duration of the testing method:

- The setpoint specification of the active power by the grid safety management of the grid operator
- The setpoint specification of the active power by third parties.
- The simulated or specified frequency.
- The active power setpoint calculated on the basis of the characteristic curve of the active power adaptation for overfrequency and underfrequency and the simulated or specified frequency.
- The measured active power.

All time sequences are to be displayed as 0.2-second mean values.

Special WT features

None.

Special PV and storage features

None.

Special CE features

None.

3 Corrections to TG 3 Rev. 26

Corrections to TG 3 Rev. 26 are listed in the following.

3.1 TABLE 4-76 OF TG 3 REV. 26

Correction: In Table 4-76 of TG 3 Rev. 26 /1/, the test labelled '110.3_FL_Long' should correctly be labelled '110.3_PL_Long'.

3.2 FOOTNOTE 6 TO TABLE 4-76 OF TG 3 REV. 26

In footnote 6 to Table 4-76 of TG 3 Rev. 26 /1/, the reference to the tests 110.2 FL and 110.2 PL must be replaced by 110_3_PL-Long.

Correction: Footnote 6 of TG 3 Rev. 26 /1/ must read as follows:

[6]In accordance with VDE 4110/20/30 ([4] [3] [2]) Chapter 11.2.5.3: These test points are an alternative to verification via a manufacturer's declaration. If the three tests 115.3.FL, 115.3.PL and 115_3_PL_Long are carried out, the corresponding three-phase tests 110.3.FL, 110.3.PL and 110.3_PL_Long are no longer required.

3.3 TABLE 4-77 OF TG 3 REV. 26, ACTUAL VALUE VOLTAGE DROP DEPTH

In Table 4-77 of TG 3 Rev. 26 /1, the actual value voltage drop depth / voltage increase is determined in lines 16 and 17 for a time period up to t2', but this t2' is determined from precisely this actual value voltage drop depth / voltage increase in accordance with Chapter 4.6.1.2, which is not possible.

Correction:

In Table 4-77 of TG 3 Rev. 26 /1/, the reference time of row 16 and 17 is amended as follows:

t1+100 ms to t1 + setpoint fault duration (row 6) – 20 ms for fault times ≥ 200 ms

t1+60 ms to t1 + setpoint fault duration (row 6) – 20 ms for fault times < 200 ms

3.4 TABLE 4-79, FOOTNOTE 8 OF TG 3 REV. 26

In footnote 8 to Table 4-79 of TG 3 Rev. 26 /1/, the reference to the tests 110.2 FL and 110.2 PL must be replaced by 110_3_PL-Long.

Correction: Footnote 8 of TG 3 Rev. 26 /1/ must read as follows:

[8] In accordance with VDE 4110/20/30 ([4] [3] [2]) Chapter 11.2.5.5: These test points are an alternative to verification via a manufacturer's declaration. If the three tests 115.3.FL, 115.3.PL and 115_3_PL_Long are carried out, the corresponding three-phase tests 110.3.FL, 110.3.PL and 110_3_PL_Long are no longer required.

3.5 TABLE 4-82 OF TG 3 REV. 26

In Table 4-82 of TG 3 Rev. 26 /1/ , the actual value voltage drop depth / voltage increase is determined in lines 16 and 17 for a time period up to t2‘. This t2’ is however determined from precisely this actual value voltage drop depth / voltage increase in accordance with Chapter 4.6.1.2, which is not possible.

Correction:

In Table 4-82 of TG 3 Rev. 26 /1/, the reference time of row 16 and 17 is amended as follows:

t1+100 ms until the end of the defined setpoint fault duration (row 6) – 20 ms for fault times ≥ 200 ms

t1+60 ms until the end of the defined setpoint fault duration (row 6) – 20 ms for fault times < 200 ms

3.6 TABLE 4-82 FOOTNOTE OF TG 3 REV. 26, VOLTAGE DROPS ≤ 5 %, ENGLISH VERSION

In the English version of TG 3 Rev. 26 /1/, the footnote below Table 4-82 should read ‘48 to 51’ instead of ‘48 and 51’.

Correction:

* For 3-pole voltage drops <= 5% the parameters no. 18 and 19 (phase step), no. 43 to 48 (k-factor (k_{meas}) and reactive current rise and settling times) as well as no. 48 to 51 (phase angle and reactive current) as well as no. 54 and 55 (active power) do not need to be provided.

3.7 CHAPTER D.6.1, SECTION C OF TG 3 REV. 26

In Section C. Voltage splitting autotransformer of TG 3 Rev. 26 /1/, the minus sign in the formula for calculating Z_{length} must be replaced by a plus sign as follows:

Correction:

$\underline{Z}_{length} = \underline{Z}_{Grid} - \underline{Z}_{IO}$

should read correctly:

$\underline{Z}_{length} = \underline{Z}_{Grid} + \underline{Z}_{IO}$

4 Bibliography

/1/ Technical Guidelines for Power Generating Units and Systems, Part 3: Determination of the Electrical Characteristics of Power Generating Units and Systems, Storage Systems as well as for their Components in Medium, High and Extra-High Voltage, Rev. 26, 05.04.2022

/2/ Technical Guidelines for Power Generating Units, Systems and Storage Systems as well as for their Components, Part 8: Certification of the Electrical Characteristics of Power Generating Units, Systems and Storage Systems as well as their Components on the Grid, Rev. 09, 01.02.2019.

/3/ VDE (FNN), VDE-AR-N 4130 Technical requirements for the connection and operation of customer installations to the extra high voltage network (TCR extra high voltage, Berlin, November 2018.

/4/ VDE (FNN), VDE-AR-N 4120 Technical requirements for the connection and operation of customer installations to the high voltage network (TCR high voltage), Berlin, November 2018.

/5/ VDE (FNN), VDE-AR-N 4110 Technical requirements for the connection and operation of customer installations to the medium voltage network (TCR medium voltage), Berlin, September 2023.