

HPrüfbericht-Nr.: <i>Test report no.:</i>	CN25HVW8 001	Auftrags-Nr.: <i>Order no.:</i>	326060242	Seite 1 von 31 <i>Page 1 of 31</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	2513995	Auftragsdatum: <i>Order date:</i>	2024-10-29	
Auftraggeber: <i>Client:</i>	Suzhou RCT Power Energy Technology Co., Ltd. 5.1.2e China			
Prüfgegenstand: <i>Test item:</i>	C&I Energy Storage System			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	CESS932-500-01D, CESS699-375-01D, CESS466-250-01D			
Auftrags-Inhalt: <i>Order content:</i>	A3 Certificate			
Prüfgrundlage: <i>Test specification:</i>	EN 50549-1: 2019+A1 EN 50549-10:2022			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2024-11-15			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003869340-001			
Prüfzeitraum: <i>Testing period:</i>	2024-11-15 - 2025-03-17			
Ort der Prüfung: <i>Place of testing:</i>	Suzhou RCT Power Energy Technology Co., Ltd. 5.1.2e 5.1.2e 5.1.2e China			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	5.1.2e	genehmigt von: <i>authorized by:</i>	5.1.2e	
Datum: <i>Date:</i>	2025-03-20	Ausstellungsdatum: <i>Issue date:</i>	2025-03-20	
Stellung / Position:	Project Engineer	Stellung / Position:	Authorizer	
Sonstiges / <i>Other:</i>	This report does not evidence compliance of the provided sample with the relevant standards but only with the referred tests. This test report documents the findings of examination conducted on the delivered product mentioned above only. This report does not entitle the applicant to carry any safety mark on this or similar products. Further for sales or other application purposes of the tested product, any reference to TÜV Rheinland or a test through TÜV Rheinland is only permissible with prior written consent of TÜV Rheinland.			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Prüfbericht-Nr.: CN25HVW8 001
Test report no.:

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Page 2 of 31

Anmerkungen Remarks

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüflabors kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>
2	Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben. Informationen zur Verifizierung der Authentizität unserer Dokumente erhalten Sie auf folgender Webseite: go.tuv.com/digital-signature <i>As contractually agreed, this document has been signed digitally only. TÜV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TÜV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged. For information on verifying the authenticity of our documents, please visit the following website: go.tuv.com/digital-signature</i>
3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>
4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. <i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i>

TEST REPORT

EN 50549-1:2019+A1

Requirements for generating plants to be connected in parallel with distribution networks –
Part 1: Connection to a LV distribution network - Generating plants up to and including Type B

EN 50549-10:2022

Requirements for generating plants to be connected in parallel with distribution networks - Part 10:
Tests for conformity assessment of

Report Reference No.....: **CN25HVW8 001**

Tested by (name + signature): See cover page

Witnessed by (name + signature) ...: See coverpage

Supervised by (name + signature) ..: See coverpage

Approved by (name + signature): See cover page

Date of issue.....: See cover page

Testing Laboratory: TÜV Rheinland (Shanghai) Co., Ltd.

Address.....: 5.1.2e 5.1.2e 5.1.2e 5.1.2e
5.1.2e China
Testing location/ procedure: CBTL ☐ TMP ☐ WMT ☐ SMT ☐ RMT ☐ CCATL ☐
Testing location/ address: No. 177, 178, Lane 777, 5.1.2e 5.1.2e
5.1.2e China

Applicant's name: See cover page

Address.....: See cover page

Test specification:

Standard: EN 50549-1: 2019+A1
EN 50549-10:2022

Test procedure.....: A3 certificate

Non-standard test method.....: N/A

Test Report Form No.....: EN 50549-1: 2019+A1 & EN 50549-10:2022

Master TRF: 2024-08

Test Report Form(s) Originator: TÜV Rheinland Group

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Test item description: C&I Energy storage system

Trade Mark:



License Holder.....: Same as applicant.

Model/Type reference.....: See cover page

Ratings.....: See model list and marking label on following pages.

Testing procedure and testing location:
☐ **CB Testing Laboratory:** See cover page

Testing location/ address..... : See cover page

☐ **Associated CB Test Laboratory:**

Testing location/ address..... :

Tested by (name + signature)..... : See cover page

Approved by (+ signature)..... : See cover page

☐ Testing procedure: TMP

Tested by (name + signature)..... :

Approved by (+ signature)..... :

Testing location/ address..... :

☐ Testing procedure: WMT

Tested by (name + signature)..... :

Witnessed by (+ signature)..... :

Approved by (+ signature)..... :

Testing location/ address..... :

☐ Testing procedure: SMT

Tested by (name + signature)..... :

Approved by (+ signature)..... :

Supervised by (+ signature)..... :

Testing location/ address..... :

☐ Testing procedure: RMT

Tested by (name + signature)..... :

Approved by (+ signature)..... :

Supervised by (+ signature)..... :

Testing location/ address..... :

Possible test case verdicts:

- test case does not apply to the test object..... : N/A
- test object was not evaluated for the requirement.... : N/E
- test object does meet the requirement : Pass (P)
- test object does not meet the requirement : Fail (F)

Testing:

Date of receipt of test items..... : See cover page

Date(s) of performance of tests..... : See cover page

General remarks:

"(see Attachment #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

The tests results presented in this report relate only to the object tested.

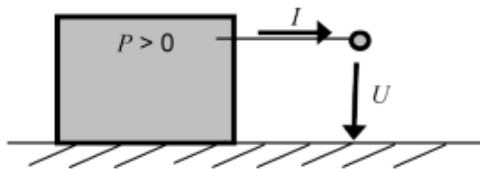
This report shall not be reproduced except in full without the written approval of the testing laboratory.

List of test equipment must be kept on file and available for review.

Additional test data and/or information provided in the attachments to this report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Generator reference system:


Manufacturer's Declaration per sub-clause 6.2.5 of IEC 60335-1:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided:

☐ Yes

☒ Not applicable

Manufacturer's Declaration per sub-clause 6.2.5 of IEC 60335-1:

When differences exist; they shall be identified in the General product information section.

List of Attachments (including a total number of pages in each attachment):

Attachment 1 - Test Plan 418 pages

Attachment 2 - Photo Documentation 9 pages

Copy of marking plate:

 Suzhou RCT Power Energy Technology Co.,Ltd Email: info@rct-power.com.cn Add: Unit01 and 02, Building B, No.28, Yongchang Road, Caohu Street, Suzhou, Jiangsu, P.R.China	
Model	CESS466-250-01D
Manufacturer/Date	RCT Power / (xx/2024)
Serial Number of Unit	
Battery Chemistry	LiFePO ₄
DC Voltage Range	715~928.2Vd. c.
Max.Storage Capacity/Nominal Voltage	466kWh / 832Vd. c.
PCS AC Rate Power/Current/Max Current	250kW/360A/396A
Nominal Grid/Load/Voltage/Frequency	400Va. c. (3P+N+PE) / 50/60Hz
AUX. Power/Voltage/Frequency	9.6kW / 230Va. c. Max / 50/60Hz
Rated Short-Time Withstand Current	20kA/1s
Rated Operating Short-Circuit Breaking Capacity	50kA
Protection Class	I
Ingress Protection	IP54 (Battery Room IP55)
Dimensions(mm)/Weight	W2991*D2438*H2591(mm) /
Operating Temperature Range	-20 to 45°C



 Suzhou RCT Power Energy Technology Co.,Ltd Email: info@rct-power.com.cn Add: Unit01 and 02, Building B, No.28, Yongchang Road, Caohu Street, Suzhou, Jiangsu, P.R.China	
Model	CESS699-375-01D
Manufacturer/Date	RCT Power / (xx/2024)
Serial Number of Unit	
Battery Chemistry	LiFePO ₄
DC Voltage Range	715~928.2Vd. c.
Max.Storage Capacity/Nominal Voltage	699kWh / 832Vd. c.
PCS AC Rate Power/Current/Max Current	375kW/540A/594A
Nominal Grid/Load/Voltage/Frequency	400Va. c. (3P+N+PE) / 50/60Hz
AUX. Power/Voltage/Frequency	9.6kW / 230Va. c. Max / 50/60Hz
Rated Short-Time Withstand Current	20kA/1s
Rated Operating Short-Circuit Breaking Capacity	50kA
Protection Class	I
Ingress Protection	IP54 (Battery Room IP55)
Dimensions(mm)/Weight	W2991*D2438*H2591(mm) /
Operating Temperature Range	-20 to 45°C



 Suzhou RCT Power Energy Technology Co.,Ltd Email: info@rct-power.com.cn Add: Unit01 and 02, Building B, No.28, Yongchang Road, Caohu Street, Suzhou, Jiangsu, P.R.China	
Model	CESS932-500-01D
Manufacturer/Date	RCT Power / (xx/2024)
Serial Number of Unit	
Battery Chemistry	LiFePO ₄
DC Voltage Range	715~928.2Vd.c.
Max.Storage Capacity/Nominal Voltage	932kWh / 832Vd.c.
PCS AC Rate Power/Current/Max Current	500kW/720A/792A
Nominal Grid/Load/Voltage/Frequency	400Va.c. (3P+N+PE) / 50/60Hz
AUX.Power/Voltage/Frequency	9.6kW / 230Va.c. Max / 50/60Hz
Rated Short-Time Withstand Current	20kA/1s
Rated Operating Short-Circuit Breaking Capacity	50kA
Protection Class	I
Ingress Protection	IP54 (Battery Room IP55)
Dimensions (mm) /Weight	W2991*D2438*H2591 (mm) /
Operating Temperature Range	-20 to 45℃











Warning label:



DANGER

NOTES:

- Disassembly or modification is prohibited without the maintenance personnel;
- Do not drop, impact, cut, deform or spearing with a sharp object;
- Do not place at a children or pet touchable area;
- Keeping away from the source of fire to avoid fire or explosion;
- Prohibit spraying, trampling, hitting and destroying, so as not to cause corrosive chemical leakage, fire or explosion;
- Please read the maintenance manual or instructions carefully before maintenance;
- Please wear protective equipment as required before maintenance or replacement

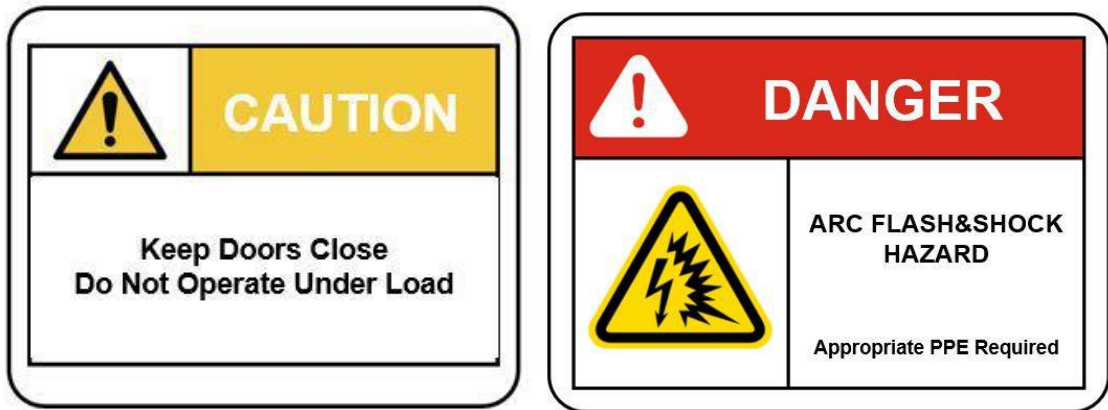












Arc Flash and Shock Hazard Present

Appropriate PPE Required

Arc Flash Boundary	1.20 m	Level A
Incident Energy in cal/cm ²	5.2	
Working Distance	46 cm	Minimum PPE Requirements
Shock Hazard Exposure	1000Vdc	Arc-rated long-sleeve shirt and arc-rated pants or arc-rated coverall and/or arc flash suit,
Insulating Gloves Class	0	Arc-rated face shield, Arc-rated jacket, Hard hat, Arc-rated hard hat liner, Safety glasses,
Shock Hazard when covers removed		Hearing protection, Leather gloves and Leather footwear.
Limited Approach Boundary	1.07 m	
Restricted Approach Boundary	0.30 m	



Importer:

Telephone:

Address:

Eu importer information will be provided prior to marketing in the EU.

General product information and other remarks:Product Description:

The system is mainly applied in industrial and commercial scenarios.

1. The system described in this report are one series of AC Energy Storage System which include two to four battery racks with PCSs, auxiliary power system, liquid-cooling system for battery racks and PCS, air conditioner for dehumidification, and fire suppression system.
 - a) The auxiliary power box is for providing the auxiliary power for whole BMS control system, liquid-cooling system.
 - b) Each battery rack connected to one PCS which converts the DC power generated by the energy storage batteries into AC power. The battery rack can also store energy from AC grid. The AC branches converge through busbar.
 - c) The difference between each model is the number of battery racks and PCSs, details refer to the model list.
2. The insulation between the DC circuit and the metal enclosure is basic insulation. And the insulation between the DC circuit and communication ports is reinforced insulation or double insulation. OVC II considered for the battery rack, OVC III for PCS, Mains, and auxiliary power.
3. The IP rating of the EUT is IP54(IP55 for Battery room), PD 2 inside and PD 3 outside evaluated.
4. The BMS functional safety was evaluated according to IEC 60730-1 Annex H.
5. The battery racks were certified to EN IEC 62619, IEC 63056, refer to report no. CN24VXEB 001 and EN 62477-1, refer to report no. CN24DRLH 001. The Energy Storage System has been certified to EN 62477-1, refer to CN24MAWD 001.
6. The PCS (JTES-PCS125K-1000/400-L05C1) was certified individually by TÜ V Rheinland Co., Ltd.

Insulation structure description of the Energy Storage System

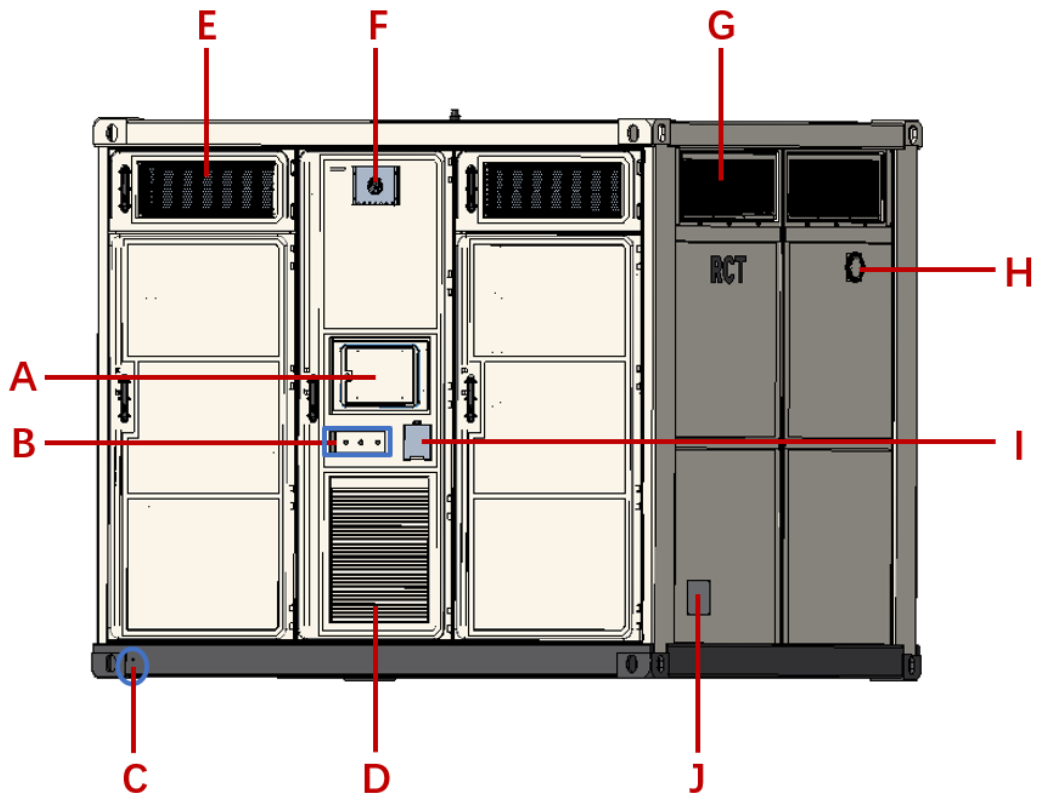
The Battery container is designed as isolation type. Please see the classification of circuit as below

- Primary circuit: Battery input/output, AC input/output, Auxiliary power input
- SELV circuit: External communication circuit of BMS control box and battery packs

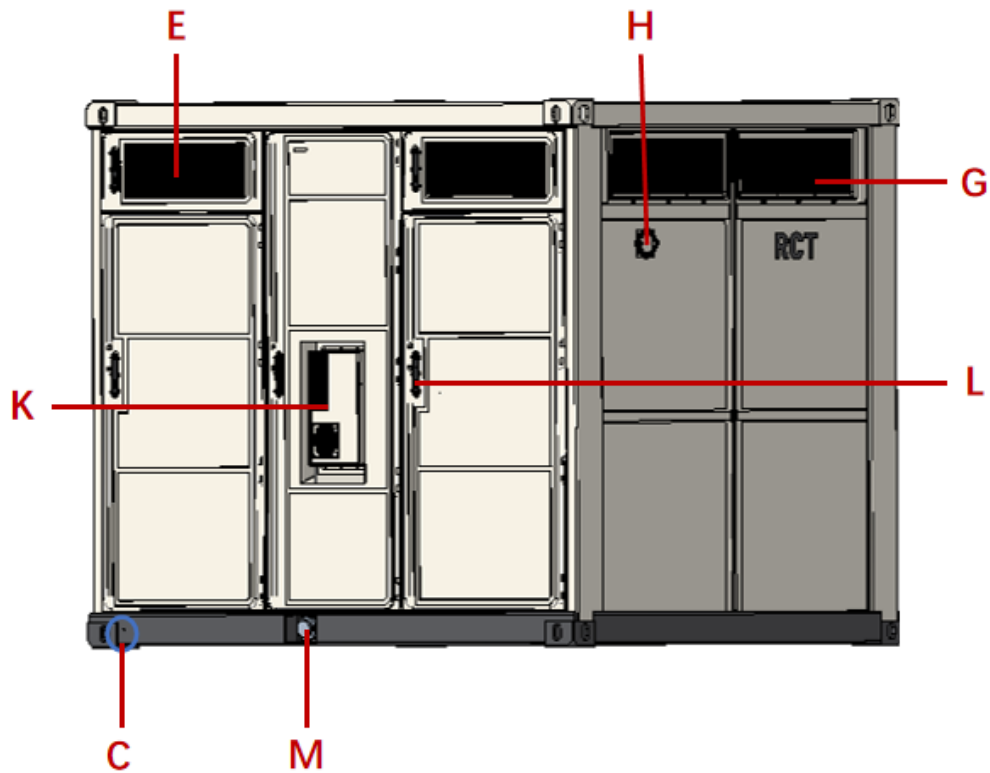
Therefore

- Basic insulation between Primary circuit and earthed metal chassis
- Double/reinforced insulation between Primary circuit and SELV circuit, details see below table

The main electrical equipment:

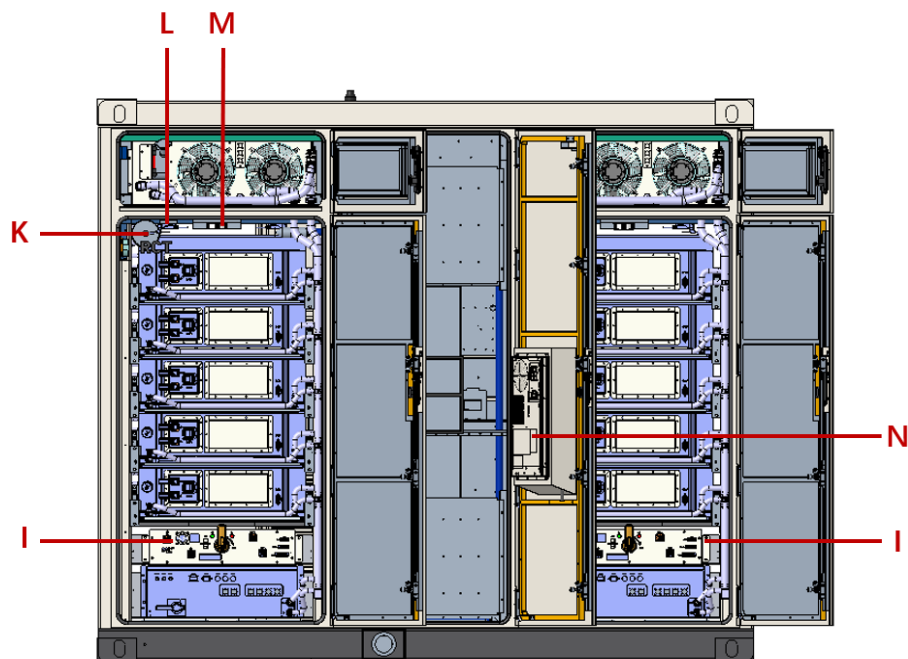
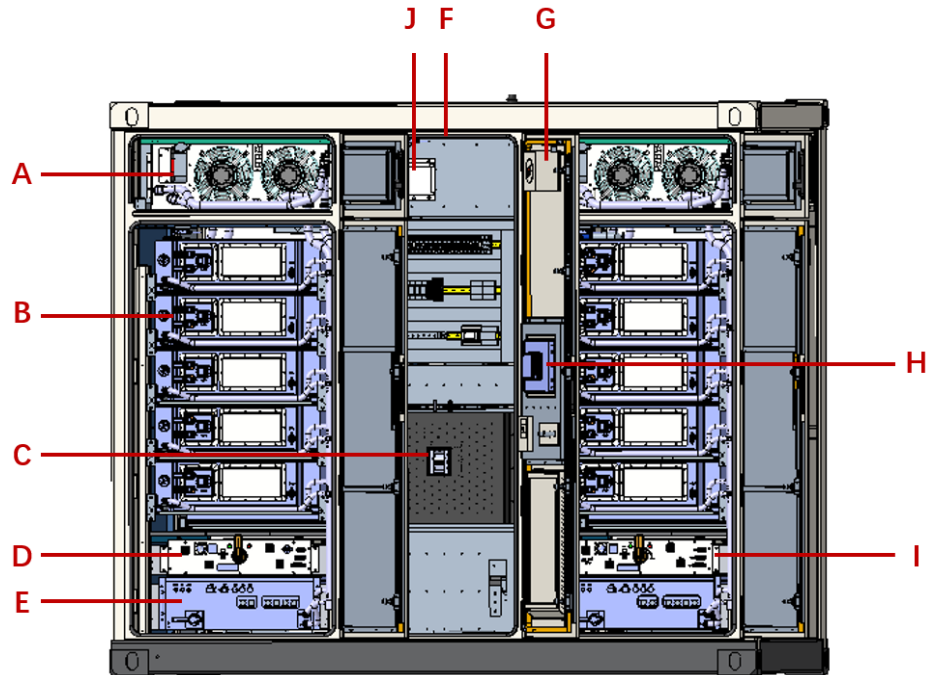


Front and left side with door open view



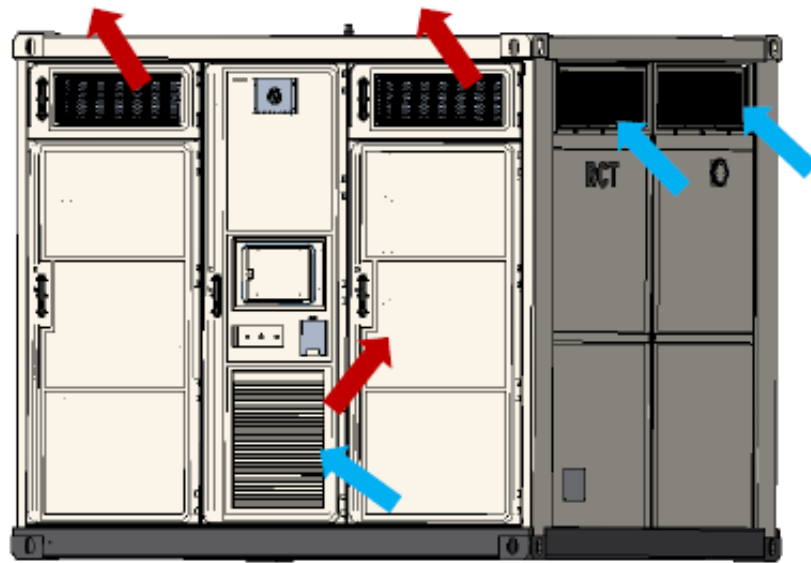
Back and Left View

A. Touch panel cover; B. Indicator Light & Emergency stop button; C. Grounding point; D. Air grill; E. Chiller air outlet grill; F. Strobe and siren; G. Chiller air intake grill; H. Explosion proof valve. I. Fire switch; J. Name plate; K. Air conditioner; L. Door lock; M. Water inlet

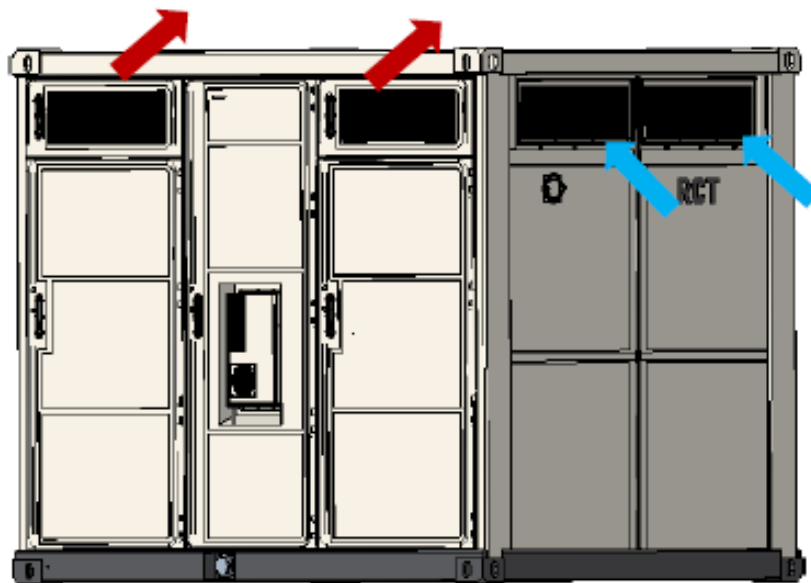


A. Chiller; B. Battery pack; C. Grid connection MCCB; D. Switch gear; E. AC/DC inverter; F. Illumination; G. Strobe and siren; H. Touch panel; I. Switch gear; J. Fire control unit; K. Aerosol fire suppression; L. Door switch; M. Composite detector; N. Air conditioner

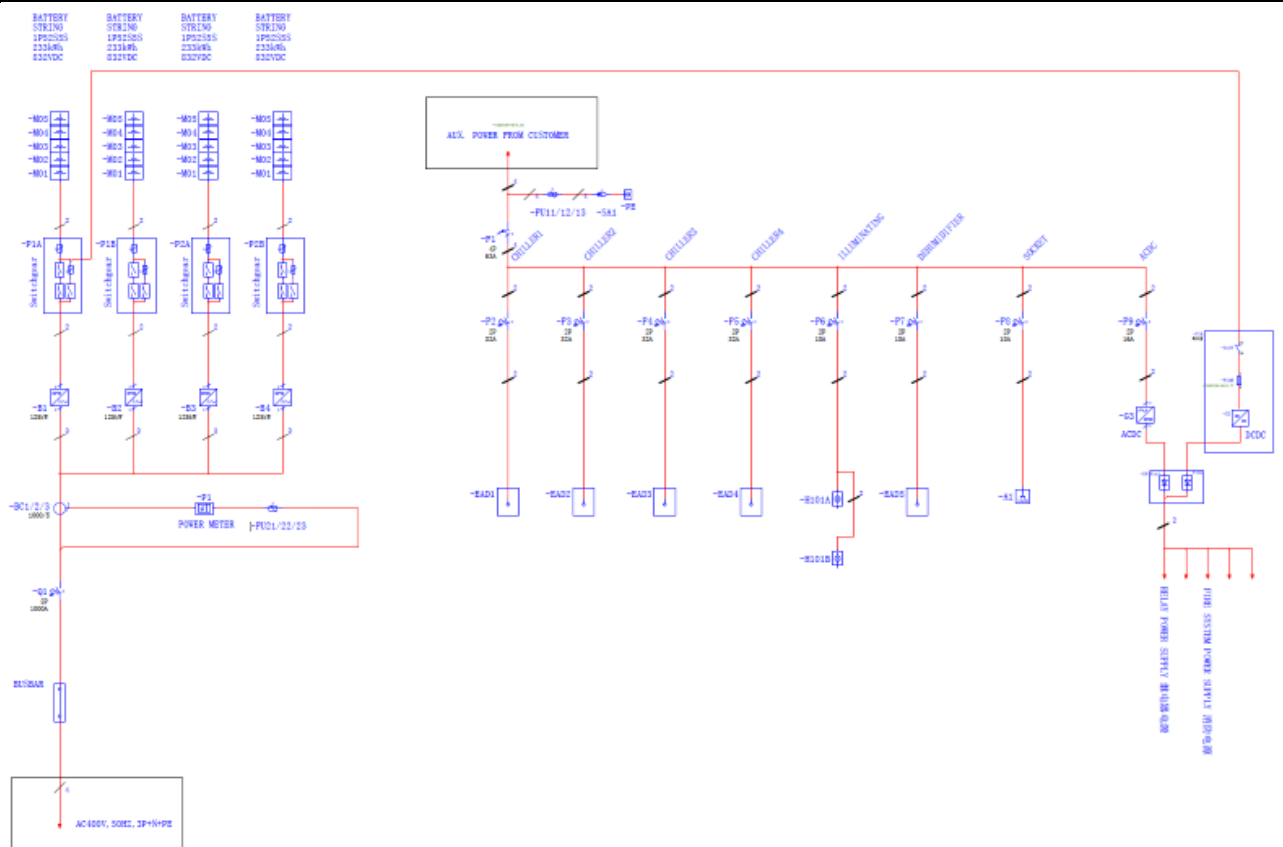
Air inlet and outlet



Front and Right View



Back and Left View



System diagram block for CESS932-500-01D

Model list:

MODELS LIST		CESS932-500-01D	CESS699-375-01D	CESS466-250-01D
DC side	Operating voltage range [Vd.c.]	715-928.2		
	Battery Nominal Voltage [Vd.c.]	832		
	Rated capacity	931840Wh	698880Wh	465920Wh
	Maximum charging and discharging current [A]	175.7*4	175.7*3	175.7*2
	Maximum charging and discharging power [kW]	116.48*4	116.48*3	116.48*2
	Structure	RACK-233L1D-IEC-21*1+ RACK-233L1D-IEC-20*3	RACK-233L1D-IEC-21*1+ RACK-233L1D-IEC-20*2	RACK-233L1D-IEC-21*1+ RACK-233L1D-IEC-20*1
AC side	PCS Model	JTES-PCS125K-1000/400-L05C1*4	JTES-PCS125K-1000/400-L05C1*3	JTES-PCS125K-1000/400-L05C1*2
	Rated H.V. voltage [Va.c.]	400(3P+N+PE)		
	Rated H.V. current [A a.c.]	720	540	360
	Rated grid frequency [Hz]	50/60		
	Max. Current [A.a.c.]	792	594	396
	Rated AC power [kVA]	500	375	250
	Overvoltage Category (OVC)	III		
AUX power	Rated voltage [Va.c.]	3x230, 400 Va.c., 3P+N		
	Max Power[kVA]	9.6		
	Rated frequency [Hz]	50/60		
	Overvoltage Category (OVC)	III		
Battery Energy Storage System	IP rating/ Enclosure index / type	IP 54(Battery Room IP55)		
	Protective Class	I		
	Operating Temperature Range [°C]	-20°C to +45 °C		
	Pollution degree (PD)	External PD3/Internal PD 2	External PD3/Internal PD 2	External PD3/Internal PD 2
	Altitude [m]	2000		
	Weight [kg]	11600	9700	7800
	Size (W x D x H) [mm]	W2991*D2438*H2591		

Test conditions:

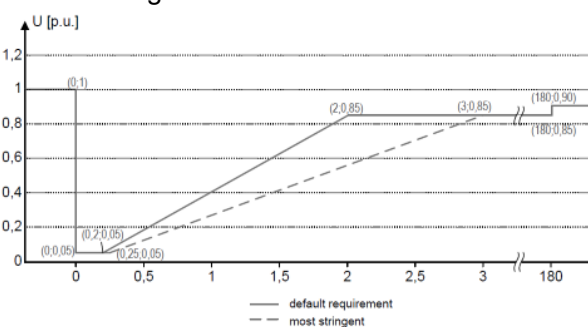
Temperature: 25°C Relative humidity: 65%

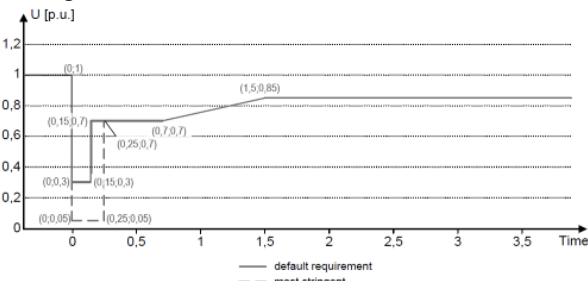
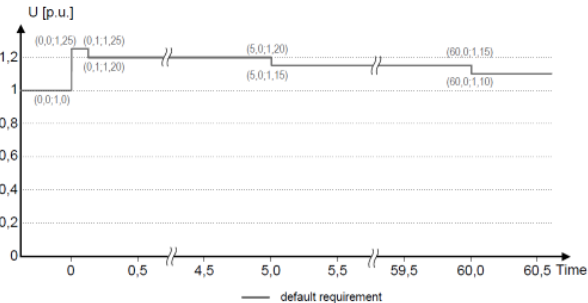
Serial number: 1040016947240002

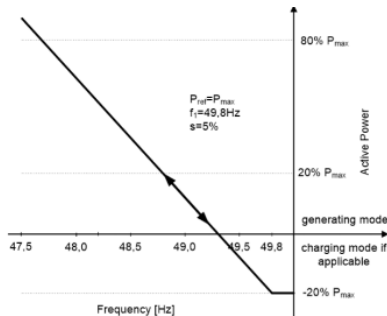
Firmware version: EMS3.0

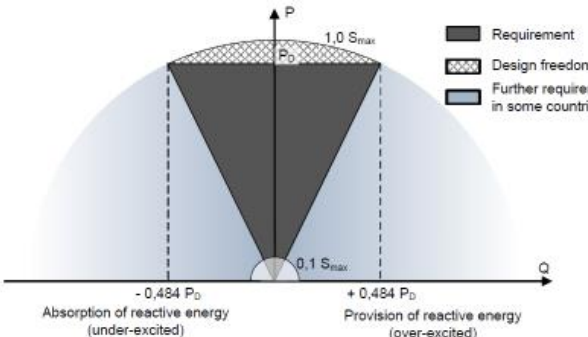
EN 50549-1: 2019+A1			
Clause	Requirement – Test	Result - Remark	Verdict
4	Requirements on generating plants		P
4.1	General		P
	This clause defines the requirements on generating plants to be operated in parallel with the distribution network. Where settings or a range of configurability is provided and respecting the legal framework the configurations and settings may be provided by the DSO. Where no settings are provided by the DSO, the specified default settings shall be used; if no default settings are provided, the producer shall propose settings and inform the DSO.	Noticed.	P
4.2	Connection scheme		P
	The generating plant shall be in compliance with the requirements of the DSO. Different requirements may be subject to agreement between the producer and the DSO depending on the power system needs.	Considered.	P
4.3	Choice of switchgear		P
4.3.1	General		N/A
	Switches shall be chosen based on the characteristics of the power system in which they are intended to be installed.	Disconnecting device is not integral part of the unit. The installation instructions specify a disconnection device for the final installation. The correct assembling is part of the installer.	N/A
4.3.2	Interface switch		P
	Switches shall be power relays, contactors or mechanical circuit breakers each having a breaking and making capacity corresponding to the rated current of the generating plant and corresponding to the short circuit contribution of the generating plant. NOTE For PV-inverters further requirements are stated in EN 62109-1 and -2 with respect to the interface switch.	The unit provides two integrated relays in series for phase. Each device can be switched.	P
4.4	Normal operating range		P
4.4.1	General		P
	Generating plants when generating power shall have the capability to operate in the operating ranges specified below regardless the topology and the settings of the interface protection.	See 4.4.2 to 4.4.4.	P
4.4.2	Operating frequency range		P

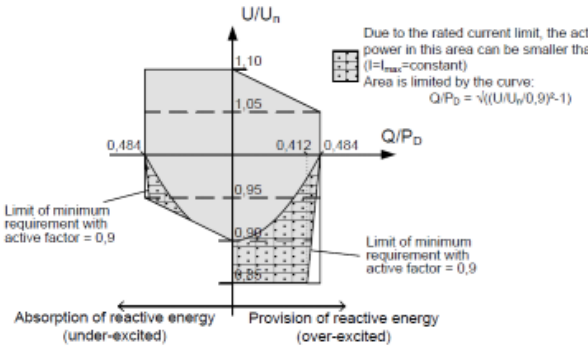
EN 50549-1: 2019+A1																										
Clause	Requirement – Test	Result - Remark	Verdict																							
	The generating plant shall be capable to operate continuously when the frequency at the point of connection stays within the range of 49 Hz to 51 Hz. In the frequency range from 47 Hz to 52 Hz the generating plant should be capable to operate until the interface protection trips. Therefore, the generating plant shall at least be capable to operate in the frequency ranges and for the duration as for the minimum requirement indicated in Table 1. Table 1 — Minimum time periods for operation in under-frequency situation <table><tr><th rowspan="2">Frequency Range</th><th>Time period for operation</th><th>Time period for operation</th></tr><tr><th>Minimum requirement</th><th>Most stringent requirement</th></tr><tr><td>47,0 Hz – 47,5 Hz</td><td>not required</td><td>20 s</td></tr><tr><td>47,5 Hz – 48,5 Hz</td><td>30 min *</td><td>90 min</td></tr><tr><td>48,5 Hz – 49,0 Hz</td><td>30 min *</td><td>90 min *</td></tr><tr><td>49,0 Hz – 51,0 Hz</td><td>Unlimited</td><td>Unlimited</td></tr><tr><td>51,0 Hz – 51,5 Hz</td><td>30 min *</td><td>90 min</td></tr><tr><td>51,5 Hz – 52,0 Hz</td><td>not required</td><td>15 min</td></tr></table> *: Respecting the legal framework, it is possible that longer time periods are required by the relevant authority in some synchronous areas.	Frequency Range	Time period for operation	Time period for operation	Minimum requirement	Most stringent requirement	47,0 Hz – 47,5 Hz	not required	20 s	47,5 Hz – 48,5 Hz	30 min *	90 min	48,5 Hz – 49,0 Hz	30 min *	90 min *	49,0 Hz – 51,0 Hz	Unlimited	Unlimited	51,0 Hz – 51,5 Hz	30 min *	90 min	51,5 Hz – 52,0 Hz	not required	15 min	See appended table.	P
Frequency Range	Time period for operation		Time period for operation																							
	Minimum requirement	Most stringent requirement																								
47,0 Hz – 47,5 Hz	not required	20 s																								
47,5 Hz – 48,5 Hz	30 min *	90 min																								
48,5 Hz – 49,0 Hz	30 min *	90 min *																								
49,0 Hz – 51,0 Hz	Unlimited	Unlimited																								
51,0 Hz – 51,5 Hz	30 min *	90 min																								
51,5 Hz – 52,0 Hz	not required	15 min																								
4.4.3	Minimal requirement for active power delivery at under-frequencies		P																							
	A generating plant shall be resilient to reductions of frequency at the point of connection while reducing the maximum active power as little as possible. The admissible active power reduction due to under-frequency below 49,5 Hz is limited by a reduction rate of 10 % of the momentary power P_M per 1 Hz frequency drop as given by the full line in Figure 3. Figure 3 — Maximum allowable power reduction in case of under-frequency	See appended table.	P																							
4.4.4	Continuous operating voltage range		P																							
	The generating plant when generating power shall be capable to operate continuously when the voltage at the point of connection stays within the range of 85 % U_n to 110 % U_n. In case of voltages below U_n, it is allowed to reduce the apparent power to maintain the current limits of the generating plant. The reduction shall be as small as technically feasible.	See appended table.	P																							
4.5	Immunity to disturbances		P																							

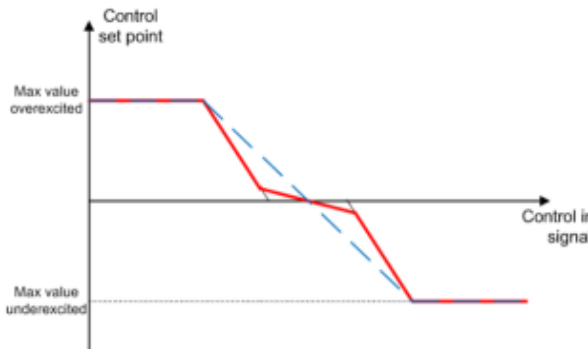
EN 50549-1: 2019+A1			
Clause	Requirement – Test	Result - Remark	Verdict
4.5.1	General		P
	The following withstand capabilities shall be fulfilled regardless the topology and the settings of the interface protection.	See 4.5.2 to 4.5.4.	P
4.5.2	Rate of change of frequency (ROCOF) immunity		P
	The generating modules in a generating plant shall have ROCOF immunity for a ROCOF equal or exceeding the value specified by the responsible party. If no ROCOF immunity value is specified, the following ROCOF immunity shall apply, making distinction between generating technologies: • Non-synchronous generating technology: at least 2 Hz/s • Synchronous generating technology: at least 1 Hz/s	See appended table.	P
4.5.3	Unde-voltage ride through (UVRT)		P
4.5.3.1	General		P
	Generating plants shall contribute to overall power system stability by providing also immunity towards dynamic voltage changes.		P
4.5.3.2	Generating plant with non-synchronous generating technology		P
	Generating modules shall be capable of remaining connected to the distribution network as long as the voltage at the point of connection remains above the voltage-time curve of Figure 6. The voltage is relative to U_n.  Figure 6 — Under-voltage ride through capability for non-synchronous generating technology	See appended table.	P
4.5.3	Generating plant with synchronous generating technology	Not such type of unit.	N/A

EN 50549-1: 2019+A1			
Clause	Requirement – Test	Result - Remark	Verdict
	Generating modules shall be capable of staying connected to the distribution network as long as the voltage at the point of connection remains above the voltage-time curve of Figure 7. The voltage is relative to U_n.  Figure 7 — Under-voltage ride through capability for synchronous generating technology		N/A
4.5.4	Over-voltage ride through (OVRT)		P
	Generating modules, except for micro-generating plants, shall be capable of staying connected to the distribution network as long as the voltage at the point of connection remains below the voltage-time curve of Figure 8.  Figure 8 — Over-voltage ride through capability	See appended table.	P
4.6	Active response to frequency deviation		P
4.6.1	Power response to over-frequency		P

EN 50549-1: 2019+A1			
Clause	Requirement – Test	Result - Remark	Verdict
	The generating unit shall be capable of activating active power response to over-frequency at a programmable frequency threshold f_1 at least between and including 50.2 Hz and 52 Hz with a programmable droop in a range of at least 2 % to 12 %. The droop reference is P_{ref}. Unless defined differently by the responsible party: • $P_{ref}=P_{max}$, in the case of synchronous generating technology and electrical energy storage systems. • $P_{ref}=P_M$, the actual AC output power at the instant when the frequency reaches the threshold f_1, in the case of all other non-synchronous generating technology The resolution of the frequency measurement shall be ± 10 mHz or less. After activation, the active power frequency response shall be delivered with an accuracy of ± 10 % of the nominal power.	See appended table.	P
4.6.2	Power response to underfrequency		P
	The active power response to underfrequency shall be delivered at a programmable frequency threshold f_1 at least between and including 49.8 Hz and 46.0 Hz with a programmable droop in a range of at least 2 % to 12 %. The generating unit shall be capable of activating active power response to underfrequency as fast as technically feasible with an intrinsic dead time that shall be as short as possible with a maximum of 2 s and with a step response time of maximum 30 s unless another value is defined by the relevant party. After activation, the programmed droop with an accuracy of ± 10 % of the nominal power. The resolution of the frequency measurement shall be ± 10 mHz or less.  Figure 11 — Example of active power frequency response to underfrequency in case of storage device with 20 % power charging at passing of threshold frequency f_1	See appended table.	P
4.7	Power response to voltage changes		P
4.7.1	General		P

EN 50549-1: 2019+A1			
Clause	Requirement – Test	Result - Remark	Verdict
	The capability to contribute to voltage support by means of management of reactive and/or active power by the generating plant may be required by the DSO.	See appended table.	P
4.7.2	Voltage support by reactive power		P
4.7.2.1	General		P
	Generating plants shall not lead to voltage variations out of acceptable limits. These limits should be defined by national regulation. Generating units and plants shall be able to contribute to meet this requirement during normal network operation.	See 4.7.2.2 to 4.7.2.3.	P
4.7.2.2	Capabilities	See below.	P
	Unless specified differently below, for specific generating technologies, generating plants shall be able to operate with active factors as defined by the DSO and the responsible party from active factor = $0.90_{\text{underexcited}}$ to active factor = $0.90_{\text{overexcited}}$  Figure 12 — Reactive power capability at nominal voltage	See appended table.	P
	The reactive power capability shall be evaluated at the terminals of the/each generating unit CHP generating units with a capacity ≤ 150 kVA shall be able to operate with active factors as defined by the DSO from $\cos \varphi = 0.95_{\text{under-excited}}$ to $\cos \varphi = 0.95_{\text{over-excited}}$.	Not such type of unit.	N/A
	Generating units with an induction generator coupled directly to the grid and used in generating plants above micro generating level, shall be able to operate with active factors as defined by the DSO from $\cos \varphi = 0.95_{\text{under-excited}}$ to $\cos \varphi = 1$ at the terminals of the unit. Deviating from 4.7.2.3 only the $\cos \varphi$ set point mode is required. Deviating from the accuracy requirements below, the accuracy is only required at active power P_D .	Not such type of unit.	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	Generating units with an induction generator coupled directly to the grid and used in micro generating plants shall operate with an active factor above 0,95 at the terminals of the generating unit. A controlled voltage support by reactive power is not required from this technology.	Not such type of unit.	N/A
	Generating units with linear generators, coupled directly and synchronously to the grid shall operate with an active factor above 0,95 at the terminals of the generating unit, and therefore a controlled voltage support by reactive power is not required from this technology.	Not such type of unit.	N/A
	When operating above the apparent power threshold S_{min} equal to 10 % of the maximum apparent power S_{max} or the minimum regulating level of the generating plant, whichever is the higher value, the reactive power capability shall be provided with an accuracy of $\pm 2 \% S_{max}$. Up to this apparent power threshold S_{min}, deviations above 2 % are permissible. For generating units with a reactive power capability according Figure 12 the reactive power capability at active power P_D shall be at least according Figure 13. For generating units with a reduced reactive power capability Figure 13 is only applicable up to the maximum reactive power capability.  Figure 13 — Reactive power capability at active power P_D in the voltage range (positive sequence component of the fundamental)	See appended table.	P
4.7.2.3	Control modes.		P
4.7.2.3.1	General		P
	If actually required, the form of the contribution to voltage control shall be specified by the DSO. The control modes are exclusive; only one mode may be active at a time. • Q setpoint mode • Q (U) • Cos ϕ setpoint mode • Cos ϕ (P)	See 4.7.2.3.2 to 4.7.3.	P

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Clause	Requirement – Test	Result - Remark	Verdict
4.7.2.3.2	Setpoint control modes (Cos ϕ setpoint mode)		P
	Q setpoint mode and cos ϕ setpoint mode control the reactive power output and the cos ϕ of the output respectively, according to a set point set in the control of the generating plant/unit. In the case of change of the set point local or by remote control the settling time for the new set point shall be less than one minute.	See appended table.	P
4.7.2.3.3	Voltage related control modes (Q (U))		P
	The voltage related control mode Q (U) controls the reactive power output as a function of the voltage. There is no preferred state of the art for evaluating the voltage. Therefore it is the responsibility of the generating plant designer to choose a method. One of the following methods should be used: - the positive sequence component of the fundamental; - the average of the voltages measured independently for each phase to neutral or phase to phase; - phase independently the voltage of every phase to determine the reactive power for every phase. For voltage related control modes, a characteristic with a minimum and maximum value and three connected lines according to Figure 16 shall be configurable.	See appended table.	P
4.7.2.3.4	Power related Control mode:		P
	The power related control modes Q (P) and cos ϕ (P) control the reactive power output and the cos ϕ of the output respectively as a function of the active power output. For power related control modes, a characteristic with a minimum and maximum value and three connected lines shall be configurable in accordance with Figure 16.  Figure 16 — Example characteristics for Q respectively cos ϕ control mode	See appended table.	P

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Clause	Requirement – Test	Result - Remark	Verdict
4.7.3	Voltage related active power reduction		P
	In order to avoid disconnection due to a maximum voltage protection (see 4.9.3.3 and 4.9.3.4), generating plants/units are allowed to reduce active power output as a function of this rising voltage. The final implemented logic can be chosen by the manufacturer. Nevertheless, this logic shall not cause steps or oscillations in the output power.	The interface protection device was incorporated into the microgenerator control system. See appended table.	P
4.7.4	Short circuit current requirements on generating plants		P
4.7.4.1	General	Type A of unit.	N/A
	Generating modules classified as type B modules according to COMMISSION REGULATION 2016/631 shall comply with the requirements of 4.7.4.2 and 4.7.4.3. Generating modules classified as type A according to COMMISSION REGULATION 2016/631 should comply with these requirements. The actual behaviour of type A modules shall be specified in the connection agreement.		N/A
4.7.4.2	Generating plant with non-synchronous generating technology		P
4.7.4.2.1	Voltage support during faults and voltage steps		P
	In general no voltage support during faults and voltage steps is required from generating plants connected in LV distribution networks as the additional reactive current is expected to interfere with grid protection equipment. If the responsible party requires voltage support during faults and voltage steps for generating plants of type B connected to LV distribution grids, the clause 4.7.4 of EN 50549-2 applies.	Considered to type A of unit.	P
4.7.4.2.2	Zero current mode for converter connected generating technology		P
	If UVRT capability (see 4.5.3) is provided additional to the requirements of 4.5, generating units connected to the grid by a converter shall have the capability to reduce their current as fast as technically feasible down to or below 10 % of the rated current when the voltage is outside of a static voltage range. Generating units based on a doubly fed induction machine can only reduce the positive sequence current below 10 % of the rated current. Negative sequence current shall be tolerated during unbalanced faults. In case this current reduction is not sufficient, the DSO should choose suitable interface protection settings.	See appended table.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	The static voltage range shall be adjustable from 20 % to 100 % of U_n for the undervoltage boundary and from 100 % to 130 % of U_n for the overvoltage boundary. The default setting shall be 50% of U_n for the undervoltage boundary and 120% of U_n for the overvoltage boundary. Each phase to neutral voltage or if no neutral is present each phase to phase voltage shall be evaluated. At voltage re-entry into the voltage range, 90% of pre-fault power or available power, whichever is the smallest, shall be resumed as fast as possible, but at the latest according to 4.5.3 and 4.5.4.	See appended table.	P
4.7.4.2.3	Induction generator based units	Not such type of unit.	N/A
	In general no voltage support during faults and voltage steps is required from generating plants connected in LV distribution networks as the additional reactive current is expected to interfere with grid protection equipment. If the responsible party requires voltage support during faults and voltage steps for generating plants of type B connected to LV distribution grids, the clause 4.7.4 of EN50549-2 applies.		N/A
4.7.4.3	Generating plant with synchronous generating technology - Synchronous generator based units	Not such type of unit.	N/A
	In general no voltage support during faults and voltage steps is required from generating plants connected in LV distribution networks as the additional reactive current is expected to interfere with grid protection equipment. If the responsible party requires voltage support during faults and voltage steps for generating plants of type B connected to LV distribution grids, the clause 4.7.4 of EN50549-2 applies.		N/A
4.8	EMC and power quality		P
	Similar to any other apparatus or fixed installation, generating units shall comply with the requirements on electromagnetic compatibility established in Directive 2014/30/EU or 2014/53/EU, whichever applies. EMC limits and tests, described in EN 61000 series, have been traditionally developed for loads, without taking into account the particularities of generating units, such as their capability to create overvoltages or high frequency disturbances due to the presence of power converters, which were either impossible or less frequent in case of loads.	See EMC report	P
	• Harmonic emissions;	See appended table.	P
	• Flicker and voltage fluctuations;	See appended table.	P
	• DC injection;	See appended table.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	Short and long duration overvoltages emission;		N/A
	Switching frequency emission;		N/A
	Immunity to voltage dips and short interruptions;		N/A
	Immunity to frequency variation		N/A
	Immunity to harmonics and inter-harmonics;	See appended table.	P
	Unbalance.	See appended table.	P
4.9	Interface protection		P
4.9.1	General		P
	This automatic means of disconnection has following main objectives: - prevent the power production of the generating plant to cause an overvoltage situation in the distribution network it is connected to. Such overvoltages could result in damages to the equipment connected to the distribution network as well as the distribution network itself; - detect unintentional island situations and disconnect the generating plant in this case. This is contributing to prevent damage to other equipment, both in the producers' installations and the distribution network due to out of phase re-closing and to allow for maintenance work after an intentional disconnection of a section of the distribution network; - assist in bringing the distribution network to a controlled state in case of voltage or frequency deviations beyond corresponding regulation values.	The integrated protection provided to detect abnormal condition (Out of range for AC voltage, frequency, and unintentional island). It can disconnect from grid while abnormal condition is happened.	P
	It is not the purpose of the interface protection system to: - disconnect the generating plant from the distribution network in case of faults internal to the power generating plant. Protection against internal faults (short-circuits) shall be coordinated with network protection, according to DSO protection criteria. Protection against e.g. overload, electric shock and against fire hazards shall be implemented additionally according to HD 60364-1 and local requirements; - prevent damages to the generating unit due to incidents (e.g. short circuits) on the distribution network	See above.	P

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Clause	Requirement – Test	Result - Remark	Verdict
4.9.2	Void		N/A
4.9.3	Requirements on voltage and frequency protection	.	P
4.9.3.1	General		P
	Part or all of the following described functions may be required by the DSO. The protection functions shall evaluate at least all phases where generating units, covered by this protection system, are connected to. In case of three phase generating units/plants and in all cases when the protection system is implemented as an external protection system in a three phase power supply system, all phase to phase voltages and, if a neutral conductor is present, all phase to neutral voltages shall be evaluated. The minimum required accuracy for protection is: ● for frequency measurement ± 0.05 Hz; ● for voltage measurement $\pm 1\%$ of U_n.	The frequency range, voltage range, observation time, and power gradient can be adjustable in display panel. It can be protected by password, and adjusted by local distributor.	P
4.9.3.2	Undervoltage protection [27]		P
	The protection shall comply with EN 60255-127. The evaluation of the r.m.s. or the fundamental value is allowed.	See appended table.	P
4.9.3.3	Overvoltage protection [59]		P
	The protection shall comply with EN 60255-127. The evaluation of the r.m.s. or the fundamental value is allowed.	See appended table.	P
4.9.3.4	Overvoltage 10 min mean protection		P
	The calculation of the 10 min value shall comply with the 10 min aggregation of EN 61000-4-30 Class S, but deviating from EN 61000-4-30 as a moving window is used. Therefore the function shall be based on the calculation of the square root of the arithmetic mean of the squared input values over 10 min. The calculation of a new 10 min value at least every 3 s is sufficient, which is then to be compared with the threshold value.	See appended table.	P
4.9.3.5	Underfrequency protection [81<]		P
	Underfrequency protection may be implemented with two completely independent protection thresholds, each one able to be activated or not.	See appended table.	P
4.9.3.6	Overfrequency protection [81>]		P
	Underfrequency protection may be implemented with two completely independent protection thresholds, each one able to be activated or not.	See appended table.	P
4.9.4	Means to detect island situation		P

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Clause	Requirement – Test	Result - Remark	Verdict
4.9.4.1	General		P
	Besides the passive observation of voltage and frequency further means to detect an island might be required by the DSO. Detecting islanding situations shall not be contradictory to the immunity requirements of 4.5.	Considered. Active method of anti-islanding detection is AFD.	P
4.9.3.2	Active methods tested with a resonant circuit		P
	These are methods which pass the resonant circuit test according to Clause 5 or for PV inverters according to EN 62116.	See appended table.	P
4.9.4.3	Switch to narrow frequency band (see Annex E and Annex F)		P
	In case of local phenomena (e.g. a fault or the opening of circuit breaker along the line) the DSO in coordination with the responsible party may require a switch to a narrow frequency band to increase the interface protection relay sensitivity. In the event of a local fault it is possible to enable activation of the restrictive frequency window (using the two underfrequency/overfrequency thresholds described in 4.9.2.5 and 4.9.2.6) correlating its activation with another additional protection function.	The settings of field can be readable on the display panel. See instruction manual.	P
4.9.5	Digital input to the interface protection		N/A
	If required by the DSO, the interface protection shall have at least two configurable digital inputs. These inputs can for example be used to allow transfer trip or the switching to the narrow frequency band.	Must be taken under consideration for the installation.	N/A
4.10	Connection and starting to generate electrical power		P
4.10.1	General		P
	Connection and starting to generate electrical power is only allowed after voltage and frequency is within the allowed voltage range and the allowed frequency range for at least the specified observation time. It shall be impossible to overrule these conditions. The setting of the conditions depends on whether the connection is due to a normal operational start-up or an automatic reconnection after tripping of the interface protection.	Considered.	P
4.10.2	Automatic reconnection after tripping		P

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Clause	Requirement – Test	Result - Remark	Verdict																					
	The frequency range, the voltage range, the observation time shall be adjustable in the range according to Table 3 column 2. If no settings are specified by the DSO and the responsible party, the default settings for the reconnection after tripping of the interface protection are according to Table 3 column 3. Table 3 — Automatic reconnection after tripping <table><tr><th>Parameter</th><th>Range</th><th>Default setting</th></tr><tr><td>Lower frequency</td><td>47,0Hz – 50,0Hz</td><td>49,5Hz</td></tr><tr><td>Upper frequency</td><td>50,0Hz – 52,0Hz</td><td>50,2Hz</td></tr><tr><td>Lower voltage</td><td>50% – 100% U_n</td><td>85 % U_n</td></tr><tr><td>Upper voltage</td><td>100% – 120% U_n</td><td>110 % U_n</td></tr><tr><td>Observation time</td><td>10s – 600s</td><td>60s</td></tr><tr><td>Active power increase gradient</td><td>6% – 3000%/min</td><td>10%/min</td></tr></table>	Parameter	Range	Default setting	Lower frequency	47,0Hz – 50,0Hz	49,5Hz	Upper frequency	50,0Hz – 52,0Hz	50,2Hz	Lower voltage	50% – 100% U_n	85 % U_n	Upper voltage	100% – 120% U_n	110 % U_n	Observation time	10s – 600s	60s	Active power increase gradient	6% – 3000%/min	10%/min	See appended table.	P
Parameter	Range	Default setting																						
Lower frequency	47,0Hz – 50,0Hz	49,5Hz																						
Upper frequency	50,0Hz – 52,0Hz	50,2Hz																						
Lower voltage	50% – 100% U_n	85 % U_n																						
Upper voltage	100% – 120% U_n	110 % U_n																						
Observation time	10s – 600s	60s																						
Active power increase gradient	6% – 3000%/min	10%/min																						
4.10.3	Starting to generate electrical power		P																					
	The frequency range, the voltage range, the observation time shall be adjustable in the range according to Table 4 column 2. If no settings are specified by the DSO and the responsible party, the default settings for connection or starting to generate electrical power due to normal operational start-up or activity are according to Table 4 column 3. Table 4 — Starting to generate electrical power <table><tr><th>Parameter</th><th>Range</th><th>Default setting</th></tr><tr><td>Lower frequency</td><td>47,0Hz – 50,0Hz</td><td>49,5Hz</td></tr><tr><td>Upper frequency</td><td>50,0Hz – 52,0Hz</td><td>50,1Hz</td></tr><tr><td>Lower voltage</td><td>50% – 100% U_n</td><td>85 % U_n</td></tr><tr><td>Upper voltage</td><td>100% – 120% U_n</td><td>110 % U_n</td></tr><tr><td>Observation time</td><td>10s – 600s</td><td>60s</td></tr><tr><td>Active power increase gradient</td><td>6% – 3000%/min</td><td>disabled</td></tr></table>	Parameter	Range	Default setting	Lower frequency	47,0Hz – 50,0Hz	49,5Hz	Upper frequency	50,0Hz – 52,0Hz	50,1Hz	Lower voltage	50% – 100% U_n	85 % U_n	Upper voltage	100% – 120% U_n	110 % U_n	Observation time	10s – 600s	60s	Active power increase gradient	6% – 3000%/min	disabled	See appended table.	P
Parameter	Range	Default setting																						
Lower frequency	47,0Hz – 50,0Hz	49,5Hz																						
Upper frequency	50,0Hz – 52,0Hz	50,1Hz																						
Lower voltage	50% – 100% U_n	85 % U_n																						
Upper voltage	100% – 120% U_n	110 % U_n																						
Observation time	10s – 600s	60s																						
Active power increase gradient	6% – 3000%/min	disabled																						
4.10.4	Synchronisation		P																					
	Synchronizing a generating plant/unit with the distribution network shall be fully automatic i.e. it shall not be possible to manually close the switch between the two systems to carry out synchronization.	Complied. See appended table.	P																					
4.11	Ceasing and reduction of active power on set point		P																					
4.11.1	Ceasing active power		P																					
	Generating plants with a maximum capacity of 0.8 kW or more shall be equipped with a logic interface (input port) in order to cease active power output within five seconds following an instruction being received at the input port.	See appended table.	P																					
4.11.2	Reduction of active power on set point		P																					

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Clause	Requirement – Test	Result - Remark	Verdict
	A generation unit/plant shall be capable of carrying out the power output reduction to the respective limit within an envelope of not faster than 0.66% P_n/s and not slower than 0.33% P_n/s with an accuracy of 5 % of nominal power. Generating plants are permitted to disconnect from the network at a limit value below it minimum regulating level. If required by the DSO, this includes remote operation.	See appended table.	P
4.12	Remote information exchange		P
	Generating plants whose power is above a threshold to be determined by the DSO and the responsible party shall have the capacity to be monitored by the DSO or TSO control centre or control centres as well as receive operation parameter settings for the functions specified in this European Standard from the DSO or TSO control centre or control centres. This information exchange is aimed at allowing the DSO and/or the TSO to improve, optimize and make safer the operation of their respective networks.	Considered.	P
4.13	Requirements regarding single fault tolerance of interface protection system and interface switch		P
	If required in 4.3.2, the interface protection system and the interface switch shall meet the requirements of single fault tolerance. A single fault shall not lead to a loss of the safety functions. Faults of common cause shall be taken into account if the probability for the occurrence of such a fault is significant. Whenever reasonably practical, the individual fault shall be displayed and lead to the disconnection of the power generating unit or system.	See appended table.	P
Annex A (informative)	Interconnection guidance	Must be taken under consideration for the installation.	N/A
Annex B (informative)	Void		N/A
Annex C (informative)	Parameter Table	Considered, see 4.3 to 4.13.	P
Annex D (informative)	List of national requirements applicable for generating plants	Must be taken under consideration for the installation.	N/A
Annex E (informative)	Loss of Mains and overall power system security	Noticed.	P
Annex F (informative)	Examples of protection strategies	Noticed.	P

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Clause	Requirement – Test	Result - Remark	Verdict
Annex G (normative)	Abbreviations	Noticed.	P
Annex H (informative)	Relationship between this European standard and the COMMISSION REGULATION (EU) 2016/631	Noticed.	P

- End of test report -

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Liste der verwendeten Prüfmittel
List of used test equipment

Measurement and Test Equipment	MTE Type / model / Equipment No. / Internal ID	Next Calibration Date (yyyy.mm.dd)
Power analyzer	ESR-TC-054	2025.03.26
Power analyzer	ESR-TC-055	2025.03.26
Power analyzer	ESR-TC-250	2025.11.19
2000A current transformer	ESR-TC-086	2025.4.6
2000A current transformer	ESR-TC-087	2025.4.6
1000A current transformer	ESR-TC-066	2025.3.26
1000A current transformer	ESR-TC-067	2025.3.26
1000A current transformer	ESR-TC-068	2025.3.26
1000A current transformer	ESR-TC-069	2025.3.26
1000A current transformer	ESR-TC-070	2025.3.26
1000A current transformer	ESR-TC-071	2025.3.26
200A current transformer	ESR-TC-056	2025.3.26
200A current transformer	ESR-TC-064	2025.3.26
200A current transformer	ESR-TC-065	2025.3.26
200A current transformer	ESR-TC-057	2025.3.26
200A current transformer	ESR-TC-058	2025.3.26
200A current transformer	ESR-TC-059	2025.3.26
200A current transformer	ESR-TC-060	2025.3.26
200A current transformer	ESR-TC-061	2025.3.26
Datalogger	ESR-TC-247	2025.11.17
Datalogger	ESR-TC-248	2025.11.17
steel measuring tape	ESR-TC-245	2025.10.8
Leakage current test kit	ESR-TC-052	2025.3.26
Impulse tester	ESR-TC-074	2025.3.26
Safety tester	ESR-TC-053	2025.3.26
Digital display remote pressure gauge	ESR-ENG-001	2025.5.14
Digital push tension meter	ESR-TC-226	2025.8.11

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Produktbeschreibung
Product description

See test report CN25HVV8 001 for detail.

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ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

5	Testing	
5.1	General	P
5.2	Normal operating range	P
5.3	Immunity to disturbances	P
5.4	Active response to frequency deviation	P
5.5	Power specification and response to voltage variations	P
5.6	Voltage related active power reduction - $P(U)$	P
5.7	EMC and power quality	P
5.8	Interface protection	P
5.9	Connection and starting	P
5.10	Active power reduction on set point	P
5.11	Remote information exchange	P
5.12	Requirements regarding single fault tolerance of interface protection system and interface switch	P
5.13	Model definition and model validation for generating units of synchronous generating technology	N/A

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ZUSATZ-DOKUMENTATION
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See following data for details.

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Test Engineer:	5.1.2e	Reviewer:	5.1.2e
Signature:	5.1.2e	Signature:	5.1.2e

Testing Location:	
Name:	See Cover Page
Address:	See Cover Page

Test Sample No.:	See Cover Page
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Test Condition:	See Cover Page
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Test Date:	See Cover Page
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Clause	Test items	Remark
5.2.1, 5.2.2	Normal operating range (Operation range)	P
5.3.1	Immunity to disturbances - Rate of change of frequency (ROCOF)	P
5.3.2	Phase jump	P
5.3.3	Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	P
5.4.3	Active response to frequency deviation	P
5.5.1	Power capabilities assessment	P
5.5.2	Voltage support by reactive power - test to determine the reactive power control modes	P
5.5.2.3	Verification procedure for Set point control	P
5.5.2.4	Verification procedure for voltage related control mode for reactive power Q(U)	P
5.5.2.5	Verification procedure for power related control modes for reactive power	P
5.6	Voltage related active power reduction - P(U)	P
5.7.2	Power Quality	P
5.8.3	Verification procedure for generating plants to be connected to a LV distribution network with Interface protection as internal device	P
5.8.5	Verification procedure for generating plants to be connected to a MV distribution network	N/A
5.8.6	Islanding detection	P
5.9.3	Automatic reconnection after tripping	P
5.9.4	Starting to generate electrical power	P
5.10	Active power reduction on set point	P
5.11	Remote information exchange	P
5.12	Requirements regarding single fault tolerance of interface protection system and interface switch	P
5.13	Model definition and model validation for generating units of synchronous generating technology	N/A

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5.2.1, 5.2.2	TABLE: Normal operating range (Operation range)				
Test Conditions			Measurements	Target value	Limit
U/Un	f [Hz]	Time	Pmax/Pn	Pmax/Pn	Pmax/Pn
100%	47.5	5min	99.80%	100%	≥80%
100%	51.5	5min	99.75%	100%	100%±5%
100%	47.0	20s	99.75%	100%	≥75%
100%	52.0	5min	99.77%	100%	100%±5%
85%**	50.0	10min	99.87%	100%	80%-105%
90%***	50.0	10min	99.85%	100%	85%-105%
100%	50.0	10min	99.92%	100%	100%±5%
110%	50.0	10min	99.72%	100%	100%±5%

Note(s):

* Function of interface protection and activating active power response to over/under frequency and voltage shall be disable.

** For 50549-1:85%

*** For 50549-2:90%

5.3.1	TABLE: Immunity to disturbances - Rate of change of frequency (ROCOF)		P
Test Condition		Measurement	Limit
f [Hz]	Time [s]		Connect
50	3	No Disconnection	Connect
51	3	No Disconnection	Connect
49	3	No Disconnection	Connect
50	6	No Disconnection	Connect

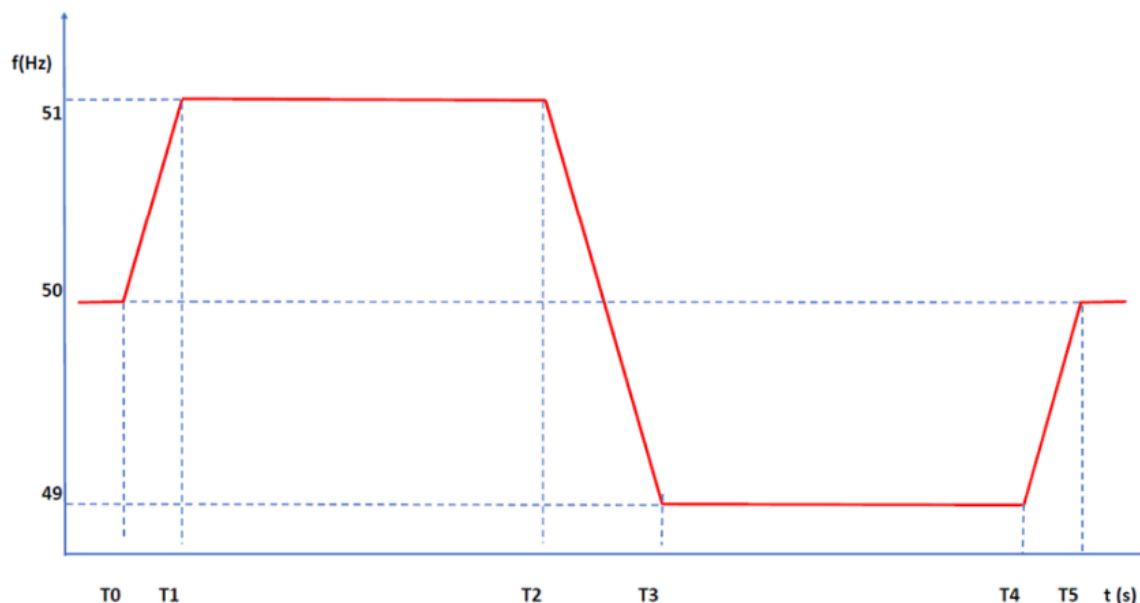
Note(s):

☒ Non-synchronous generating technology: at least 2 Hz/s

☐ Synchronous generating technology: at least 1 Hz/s

* Function of interface protection and activating active power response to over/under frequency shall be disable.

During the test, the frequency, RMS voltage, RMS current and active and reactive power measured at the output terminals of the generating unit shall be recorded as 10 cycle average values..



5.3.2	TABLE: Phase jump						P
Test Condition		Measurements			Limitation		
		After phase jump ride through			After phase jump ride through		
P/Pn	Phase displacement [°]	Result	P/Pn	T _{an,90%} [s]	Result	P/Pn	T _{an,90%} [s]
100%	+90°	No damage, inverter connected	100.32%	0.3	No damage inverter connected	≥ 90%	≤ 1 s
100%	-90°	No damage, inverter connected	99.71%	0.2			
100%	+180°	No damage, inverter connected	100.66%	0.3			
100%	-180°	No damage, inverter connected	100.66%	0.3			
100%	+50°	No damage, inverter connected	100.31%	0.2			
100%	-50°	No damage, inverter connected	100.56%	0.2			

Note:
Before phase jump ride through, the test the EUT is operating to Un, more than 90%, and active factor (cosφ) =1 at least for 5 min.

5.3.3

TABLE: Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)

P

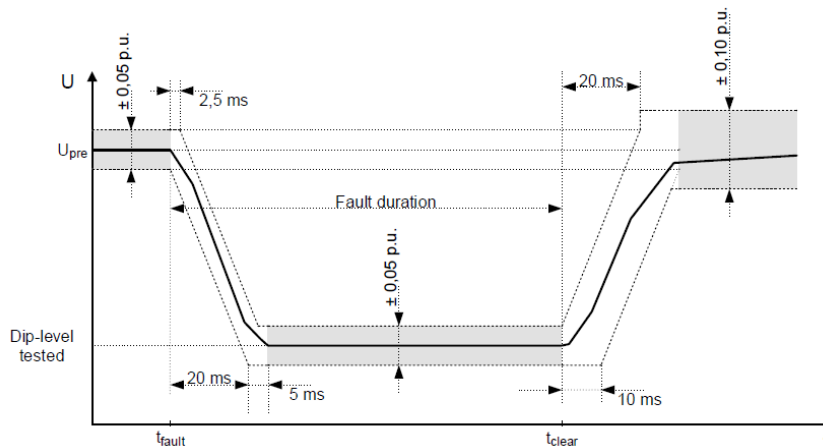


Figure 5 — Tolerances of the positive sequence voltage for the undervoltage event

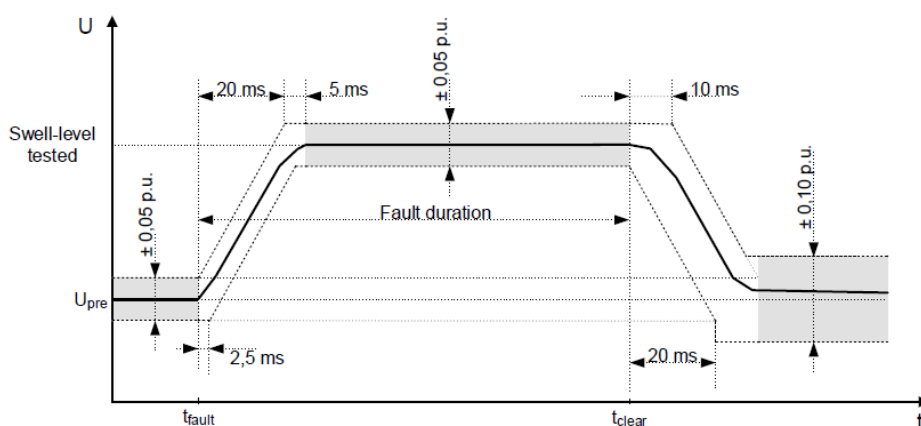
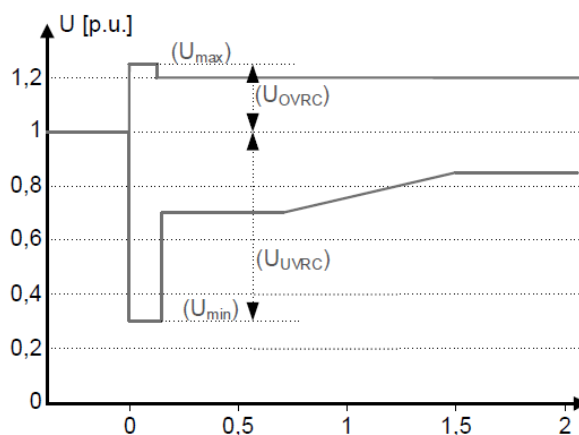


Figure 6 — Tolerances of the positive sequence voltage for the overvoltage event

Figure 7 — U_{UVRT} and U_{OVRT} for the default requirement of a generating plant of synchronous generating technology

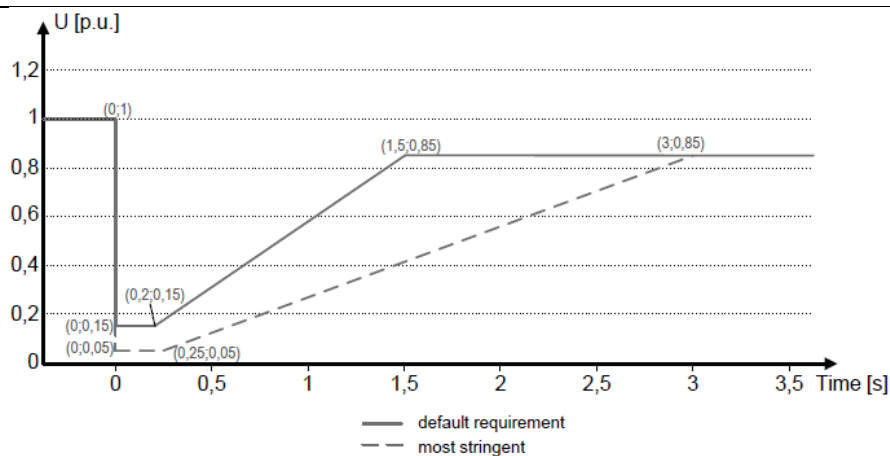


Figure 6 — Under-voltage ride through capability for non-synchronous generating technology (EN 50549-1)

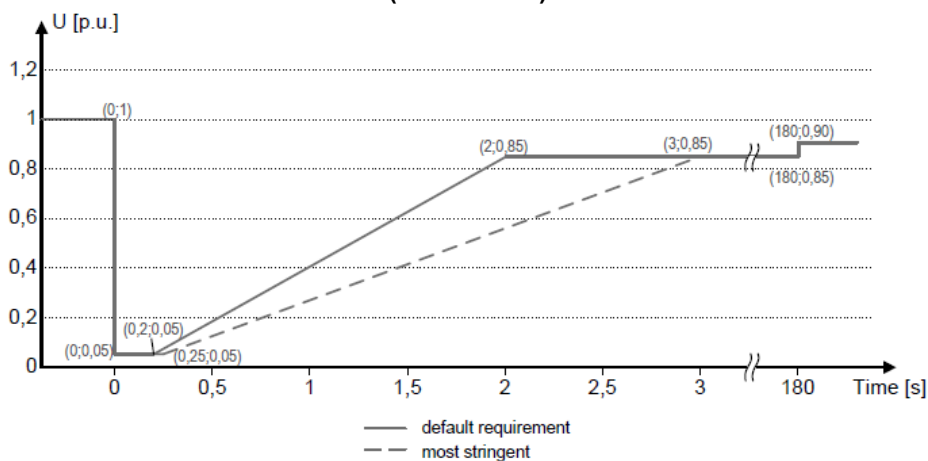


Figure 6 — Under-voltage ride through capability for non-synchronous generating technology (EN 50549-2)

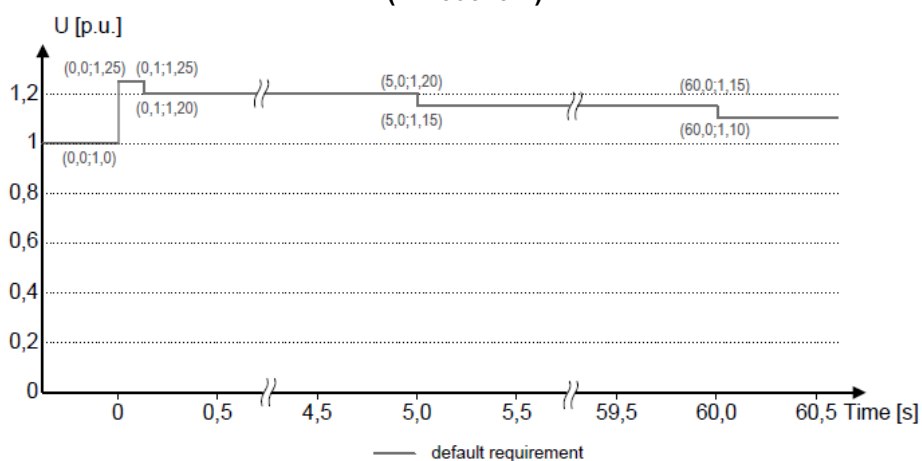


Figure 8 — Over-voltage ride through capability (EN 50549-1, EN 50549-2)

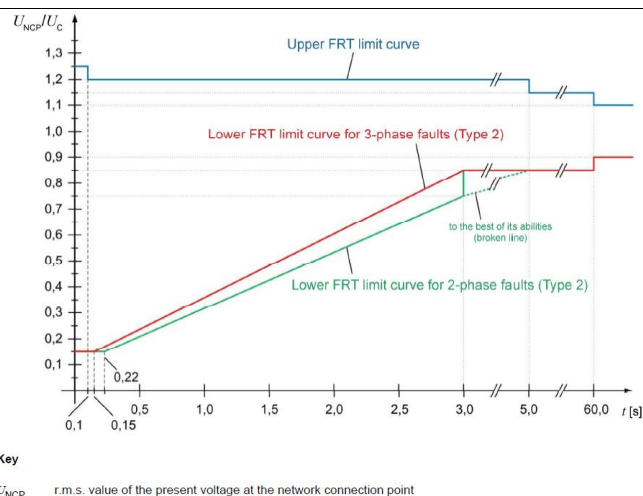


Figure 14 – Fault Ride-Through (FRT) limit curve for the voltage curve at the network connection point for a Type 2 power generating plant (VDE-AR-N 4110)

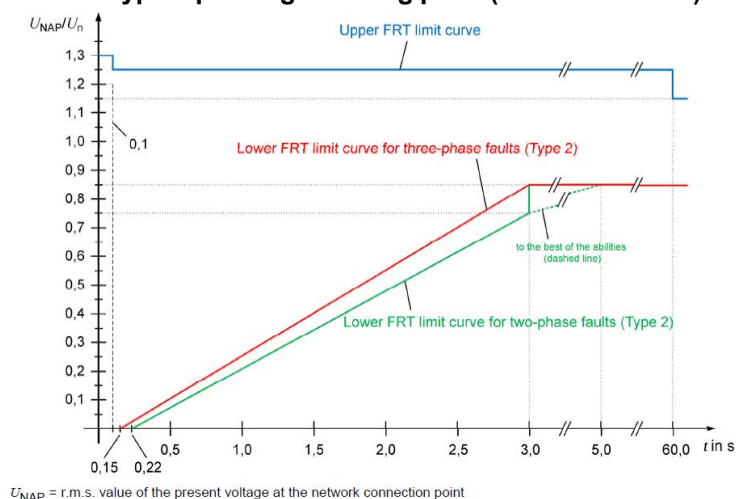


Figure 12 – Fault Ride-Through (FRT) limit curve for the voltage curve at the network connection point for a Type 2 power generating plant (VDE-AR-N 4110)

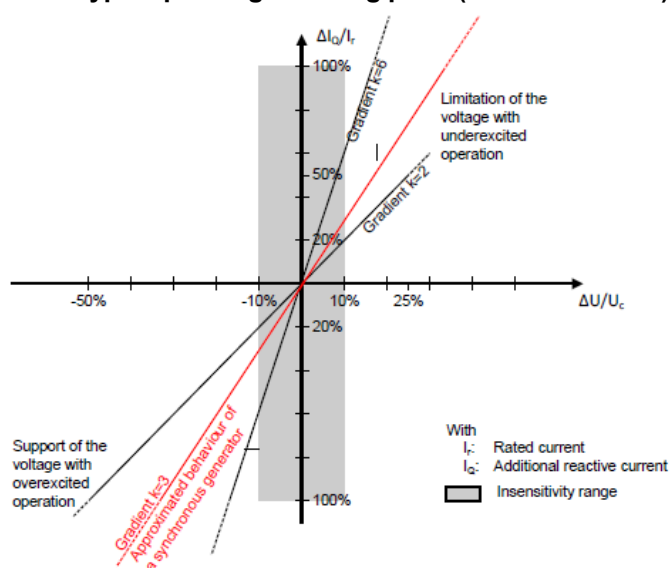
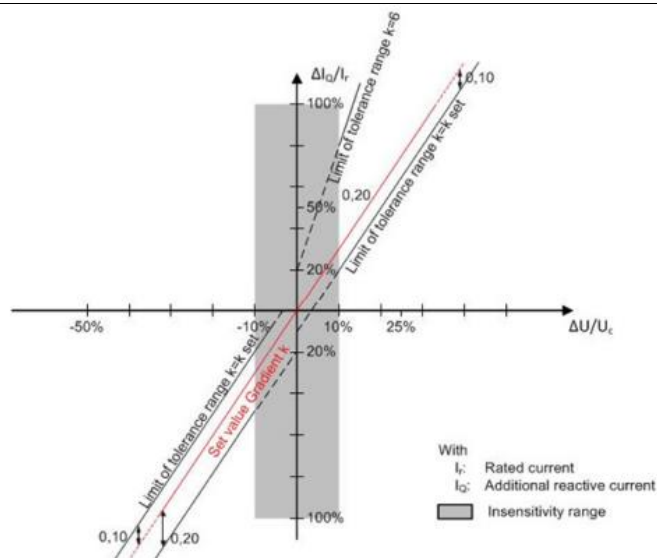
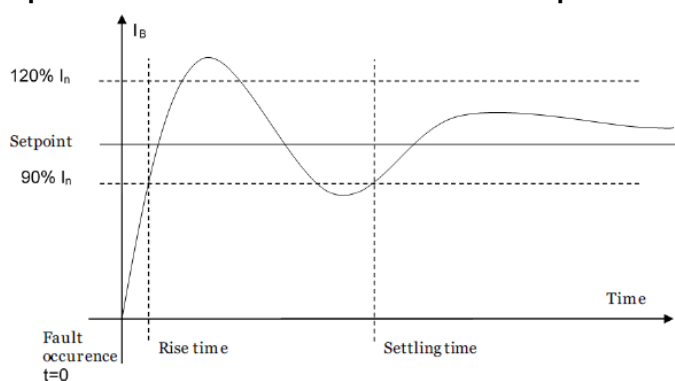


Figure 17 — Principle of voltage support during faults and voltage steps (EN 50549-2)


Figure 18 — Accuracy requirement for additional reactive current in positive and negative sequence

Fig. 4-30: Determination of the rise and settling times for setpoint value $I_Q = 100\% I_n$ (BDEW TG3)

$U \leq 15\% U_c$, No current supply is required. $T_{sr} \leq 30\text{ms}$; $T_s \leq 60\text{ms}$; $T_{an_90\%} \leq 1\text{s}$

$I \leq 10\% I_n$ during FRT for Zero current mode

$|I_{Q1}| + |I_{Q2}| \geq I_n$

I_{Q1} – Positive sequence reactive current

I_{Q2} – Negative sequence reactive current

I_n – Rated current of the PGU

Test condition:

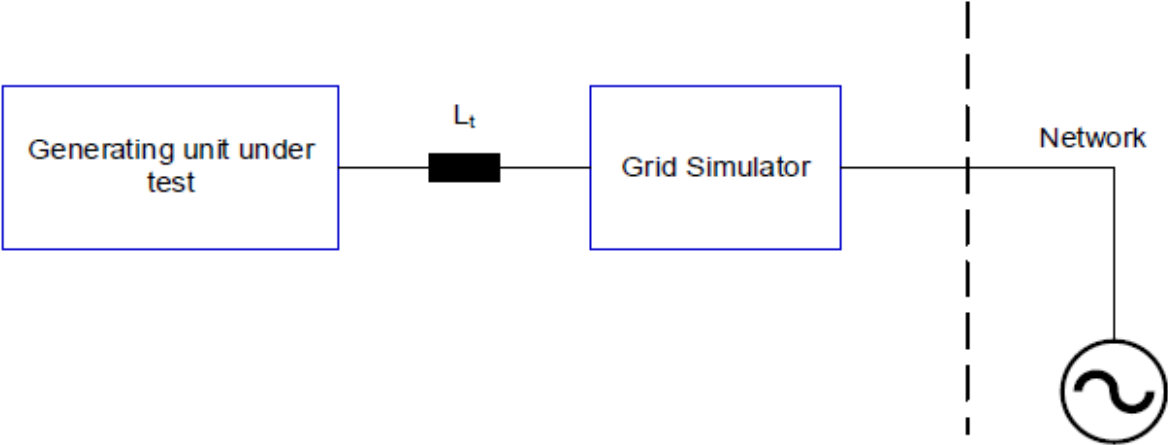


Figure A.3 — Example test setup with AC grid simulator

The short circuit power of the test setup shall be in the range of 2 times to 40 times the nominal power of the generating unit. The X/R ratio of the test impedance shall be at least 3.

FRT fault type A and D	Test equipment (AC grid simulator)	Test sample
Connection terminal	U	L1
	V	L2
	W	L3 (L for single phase)

Regarding phase relationship in the test event:

- 1) Symmetrical three-phase fault (Table 4, tests VD1, 2, 3, 4, 5), see Figure A.4.

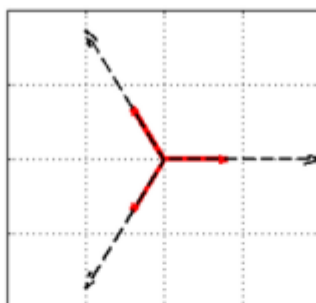


Figure A.4 — Vectorial representation of a symmetrical three-phase fault

- 2) asymmetric two-phase fault (Table 3, Tests VD 6, 7, 8, 9, 10), see Figure A.5.

A fault in the medium voltage or high voltage grid is causing a variation in LV in voltage amplitude as well as phase relationship (the case considered envisages a Dy transformer to connect the generator to the MV line or secondary station).

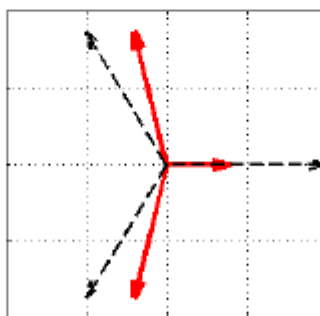


Figure A.5 — vectorial representation of an asymmetric two-phase fault

During the asymmetric two-phase fault, the residual amplitude of the 3 voltages and phase shifts shall conform to the values given in the following Table A.1 and Table A.2.

Table A.1 — Phase vectors on the LV side of a Dy transformer in the presence of asymmetric two-phase fault on the primary MV side

	U/U _n (MV side)	Phase-earth voltages (LV side)			Phase angles		
		U ₁ / U _{1,n}	U ₂ / U _{2,n}	U ₃ / U _{3,n}	φ _{U1}	φ _{U2}	φ _{U3}
VD6	0.05 ± 0.05	0.05 ± 0.05	0.87 ± 0.05	0.87 ± 0.05	0°	268°	92°
VD7	0.25 ± 0.05	0.25 ± 0.05	0.88 ± 0.05	0.88 ± 0.05	0°	262°	98°
VD8	0.50 ± 0.05	0.50 ± 0.05	0.90 ± 0.05	0.90 ± 0.05	0°	254°	106°
VD9	0.75 ± 0.05	0.75 ± 0.05	0.94 ± 0.05	0.94 ± 0.05	0°	247°	113°
VD10	0.90 ± 0.05	0.90 ± 0.05	0.98 ± 0.05	0.98 ± 0.05	0°	243°	117°
normal conditions	1	1	1	1	0°	240°	120°

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Table A.2 — Phase vectors on the LV side of a Dy transformer in the presence of asymmetric two-phase overvoltage event on the primary MV side

	U/U _n (MV side)	Phase-earth voltages (LV side)			Phase angles		
		U ₁ / U _{1,n}	U ₂ / U _{2,n}	U ₃ / U _{3,n}	φ _{U1}	φ _{U2}	φ _{U3}
VS3	1.25 ±0.05	1.25 ±0.05	1.07 ±0.05	1.07 ±0.05	0°	234°	126°
VS4.1	1.20 ±0.05	1.20 ±0.05	1.05 ±0.05	1.05 ±0.05	0°	235°	125°
VS4.2	1.15 ±0.05	1.15 ±0.05	1.04 ±0.05	1.04 ±0.05	0°	236°	124°
normal conditions	1	1	1	1	0°	240°	120°

Note(s):

FRT Fault for Type A: Three phase symmetrical fault

FRT Fault for Type D: Two phase asymmetrical fault

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Test	Voltage dip/swell U/Un [p.u.]	VRT fault type	Fault duration (t2-t1) [ms]	Pmax/Pn [p.u.]	Q/Pmax [p.u.]	Test No.
1	0.05	VD1	≥200	0.98 to 1.02	0 to ±0.1	1.1
				0.1 to 0.5		1.2
		VD6		0.98 to 1.02		1.3
				0.1 to 0.5		1.4
2	0.25	VD2	≥630	0.98 to 1.02	0 to ±0.1	2.1
				0.1 to 0.5		2.2
		VD7		0.98 to 1.02		2.3
				0.1 to 0.5		2.4
3	0.50	VD3	≥1260	0.98 to 1.02	0 to ±0.1	3.1
				0.1 to 0.5		3.2
		VD8		0.98 to 1.02		3.3
				0.1 to 0.5		3.4
4	0.75	VD4	≥1800	0.98 to 1.02	0 to ±0.1	4.1
				0.1 to 0.5		4.2
		VD9		0.98 to 1.02		4.3
				0.1 to 0.5		4.4
5	0.92	VD5	≥6000	0.98 to 1.02	0 to ±0.1	5.1
				0.1 to 0.5		5.2
		VD10		0.98 to 1.02		5.3
				0.1 to 0.5		5.4
6	1.15	VS2.2	≥60000	0.98 to 1.02	0 to ±0.1	6.1
				0.1 to 0.5		6.2
		VS4.2		0.98 to 1.02		6.3
				0.1 to 0.5		6.4
7	1.20	VS2.1	≥5000	0.98 to 1.02	0 to ±0.1	7.1
				0.1 to 0.5		7.2
		VS4.1		0.98 to 1.02		7.3
				0.1 to 0.5		7.4
8	1.25	VS1	≥100	0.98 to 1.02	0 to ±0.1	8.1
				0.1 to 0.5		8.2
		VS3		0.98 to 1.02		8.3
				0.1 to 0.5		8.4

Note(s): The two consecutive tests as specified in 5.3.3.3 shall be conducted with different DC input voltages:

- One test near the minimum DC input voltage, between 0 % – 20 % of the voltage range;
- One test near the maximum DC input voltage, between 80 % – 100 % of the voltage range.

EXAMPLE If voltage range is 300 V – 900 V: 300 V = 0 %; 900 V = 100 %, Utestmin = 300 V – 420 V as 300 V+0,2*600 V = 420 V; Utestmax = 780 V – 900 V as 300+0,8*600 V = 780 V)

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Test	Voltage dip/swell U/Un [p.u.]	VRT fault type	Fault duration (t2-t1) [ms]	Pmax/Pn [p.u.]	Q/Pmax [p.u.]	Test No.
For PV inverter the maximum and minimum DC input voltage shall be the minimum and maximum MPP voltage according to EN 50524.						

5.3.3	TABLE: Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	P
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DC Input:757V

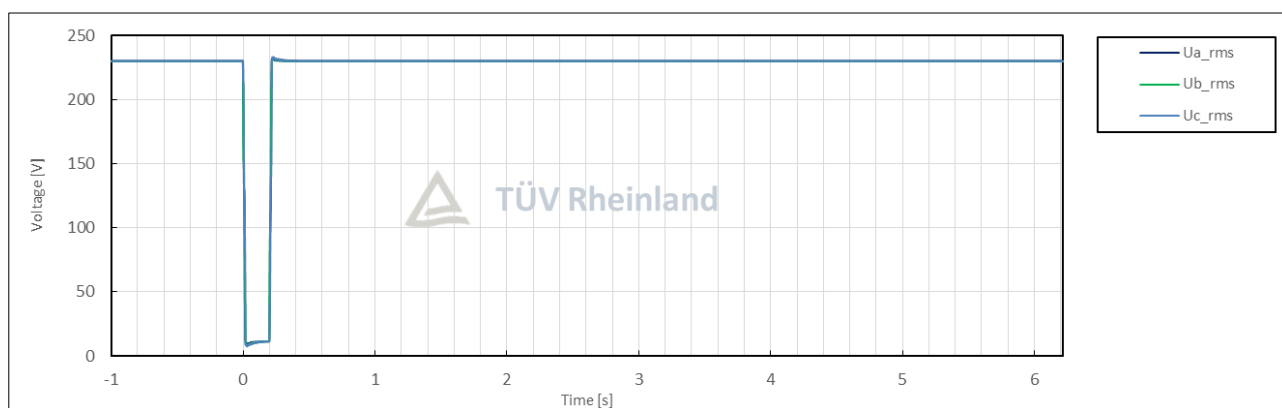
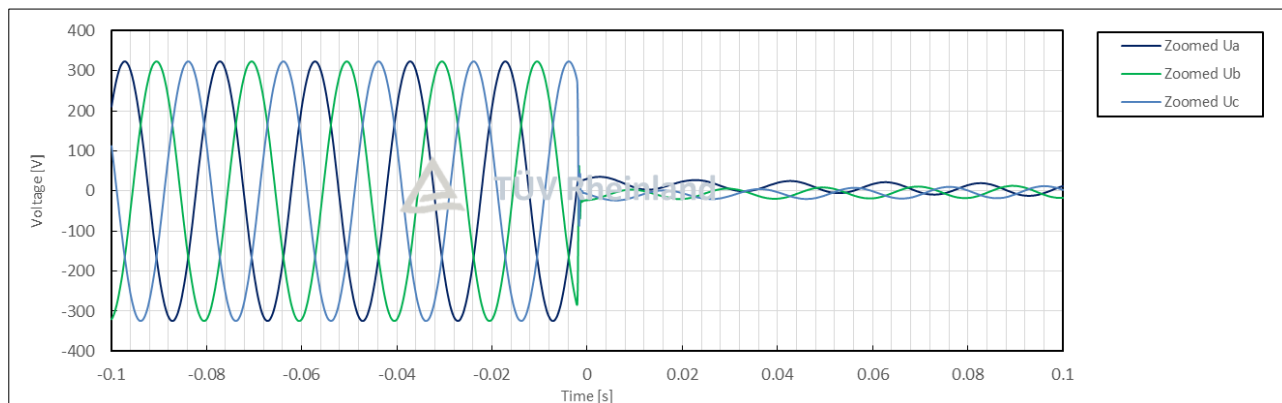
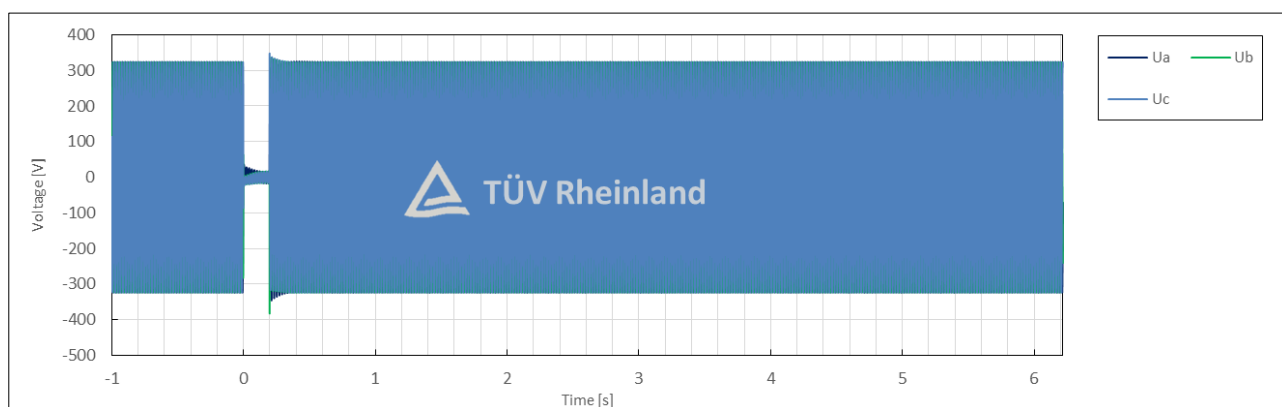
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	1.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:13:21
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.05
	5	Setting dip duration		--		217
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	217
	8	Fault duration in empty load test	Total	--	ms	217
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.05
	10		Pos.		p.u.	0.05
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.01
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.05
	19	Line current	Phase 1	t1+50ms	p.u.	0.07
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.04
	23		Phase 2			0.05
	24		Phase 3			0.04
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to	p.u.	1.01

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	29		Pos.	t2+10s		1.01
	39	Active power rising time	Pos.	--	s	0.032
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

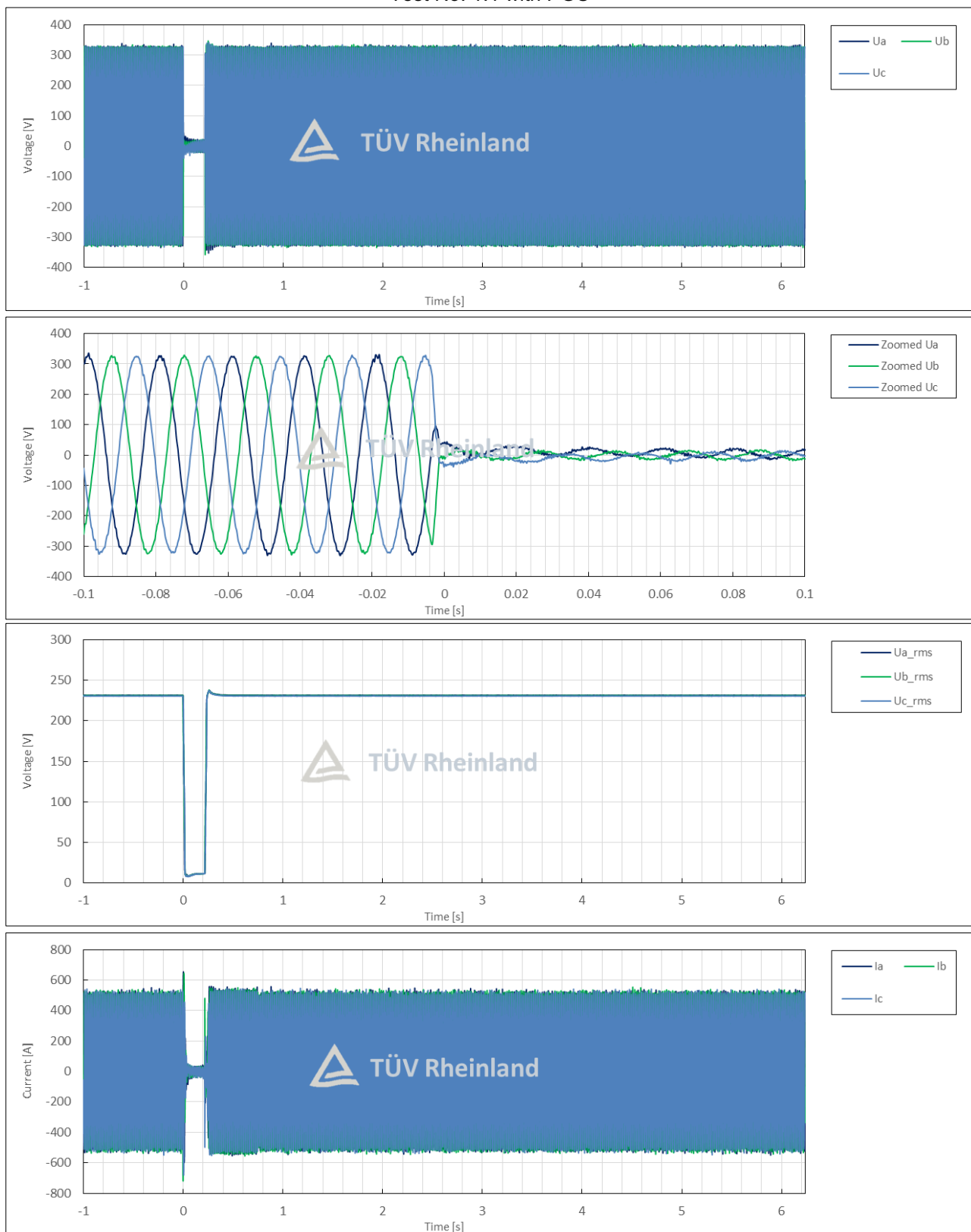
Test No. 1.1 idle test

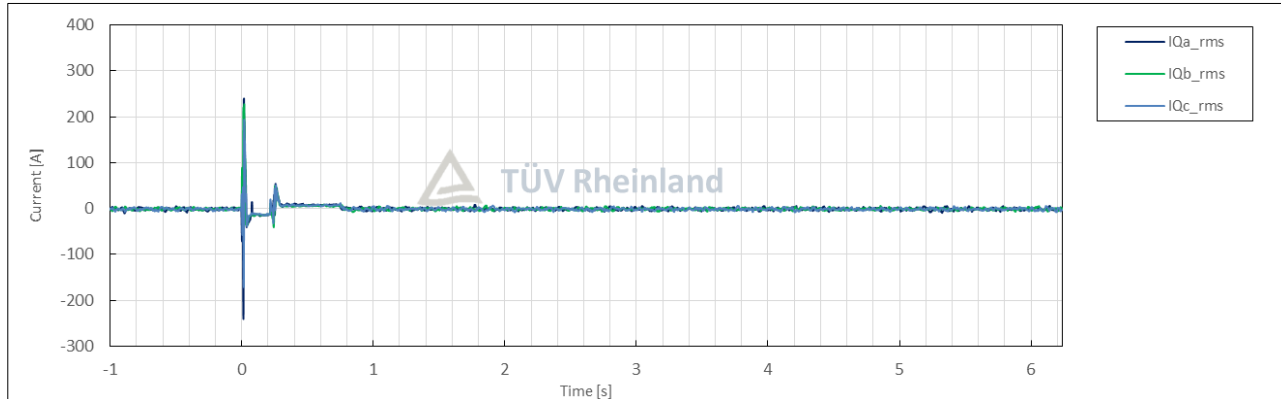
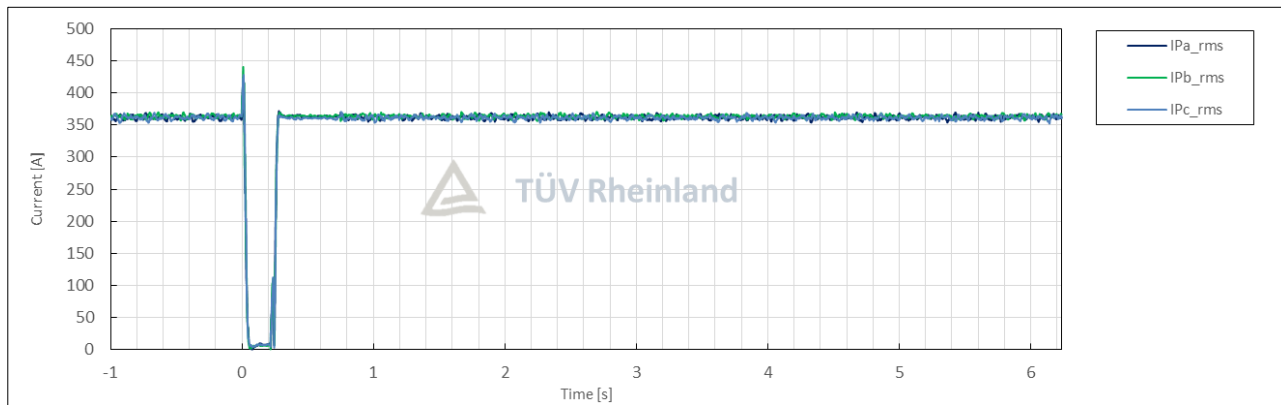
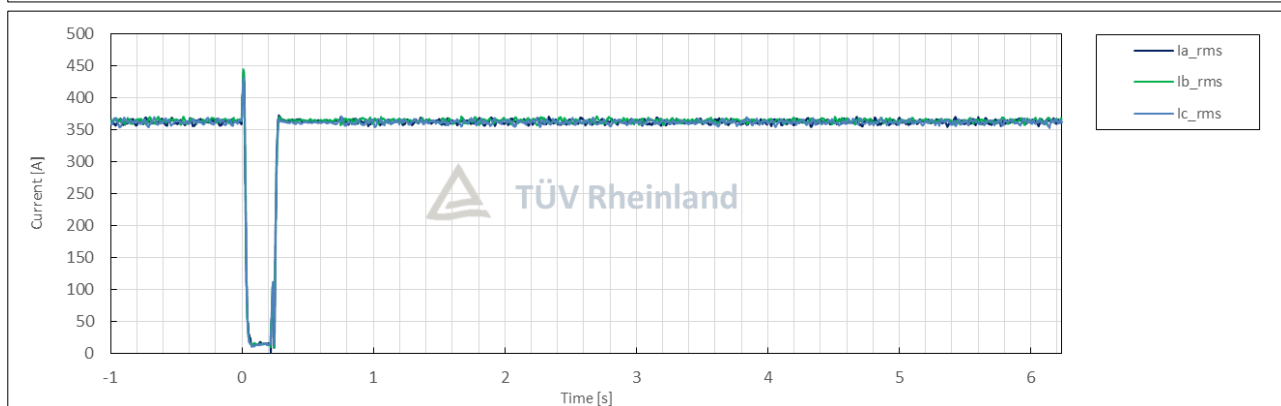
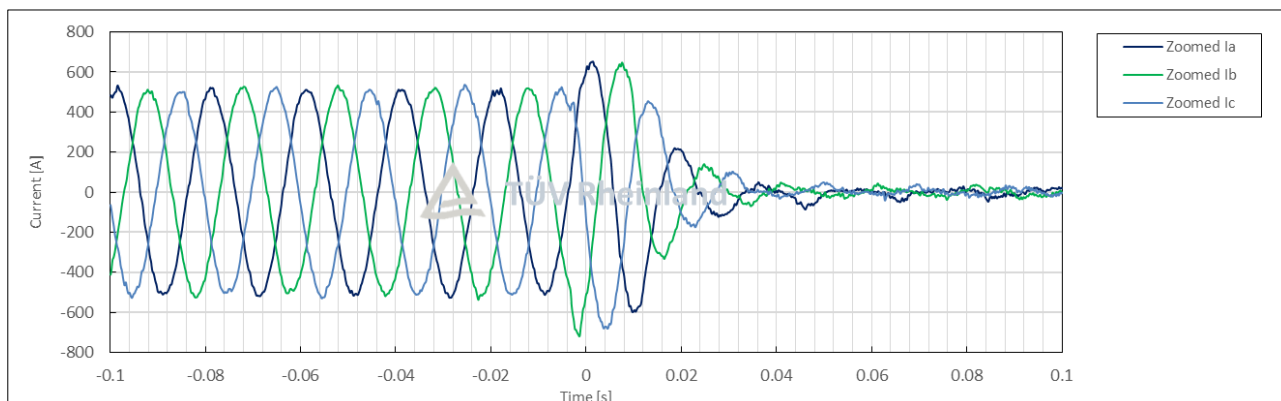


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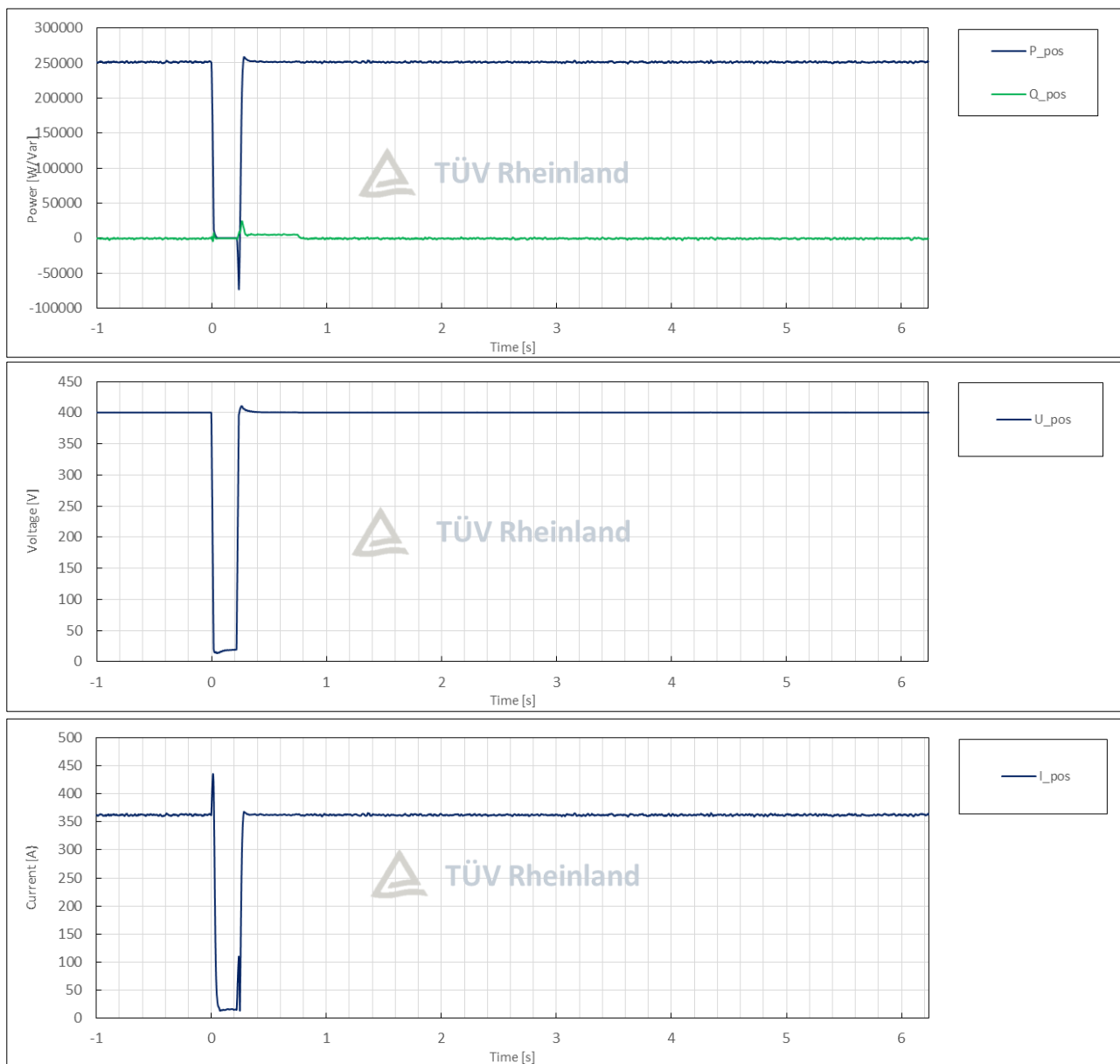
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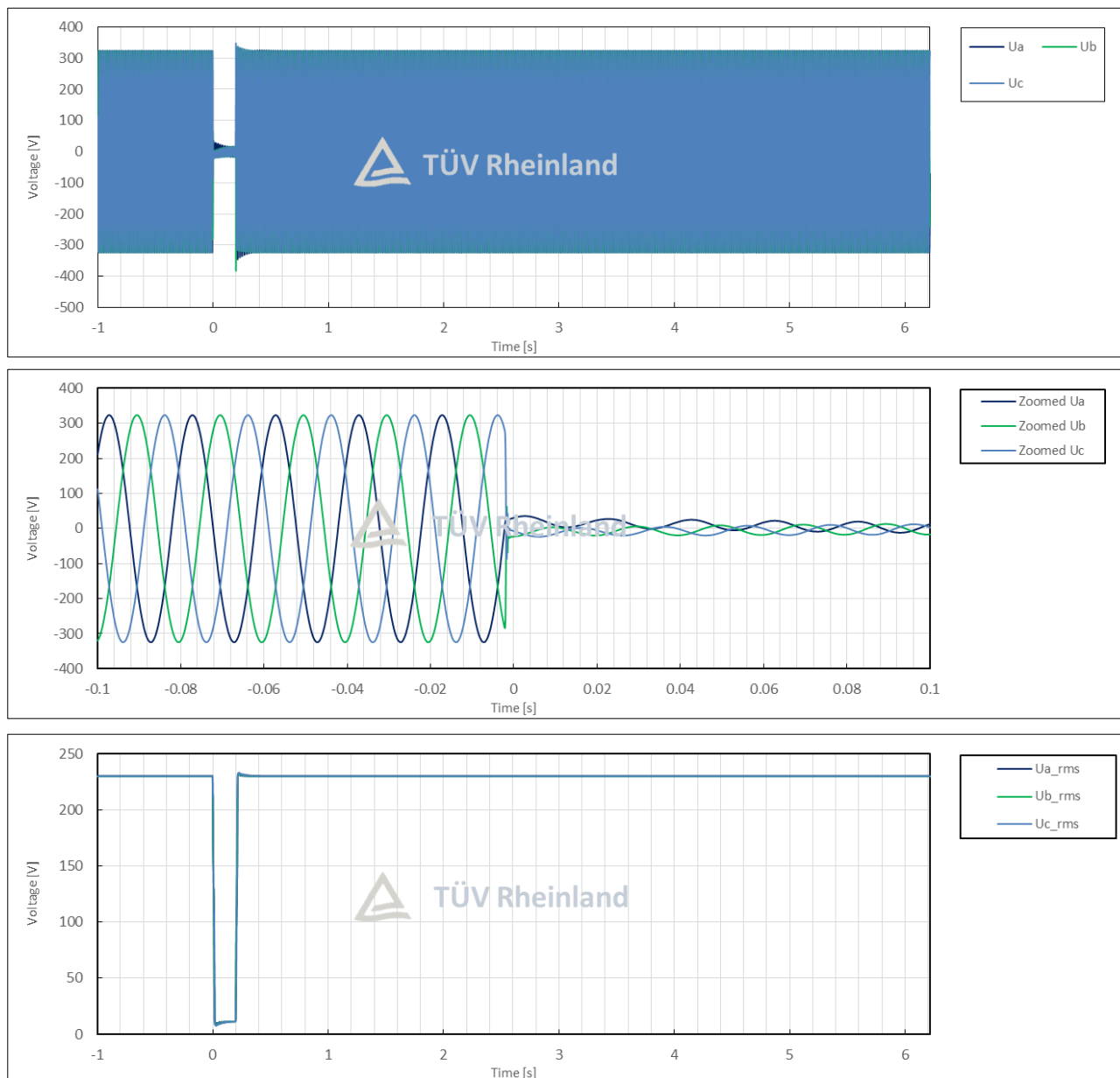


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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	1.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:14:10
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.05
	5	Setting dip duration		--		217
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	217
	8	Fault duration in empty load test	Total	--	ms	217
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.05
	10		Pos.		p.u.	0.05
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.05
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.04
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.031
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

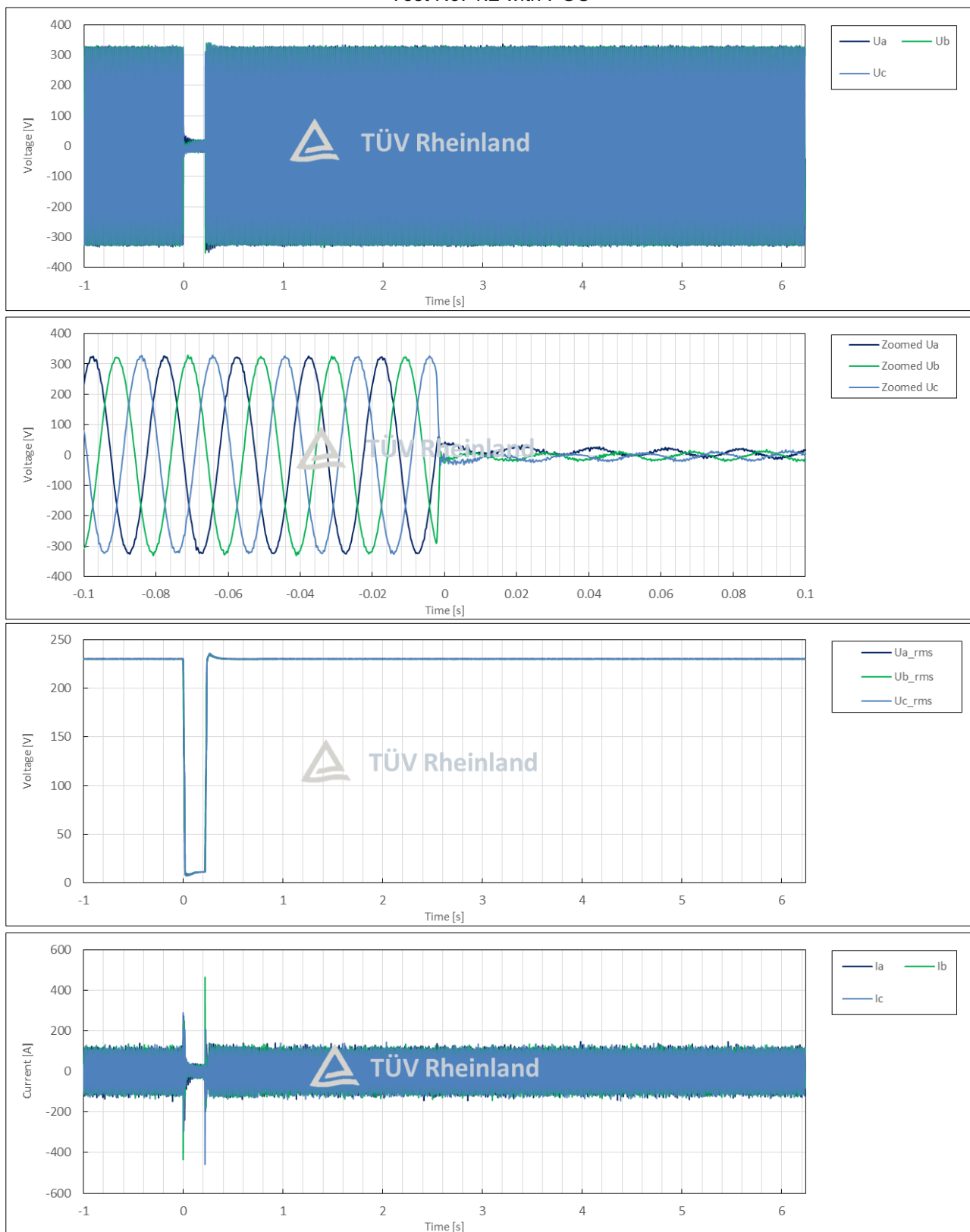
Test No. 1.2 idle test



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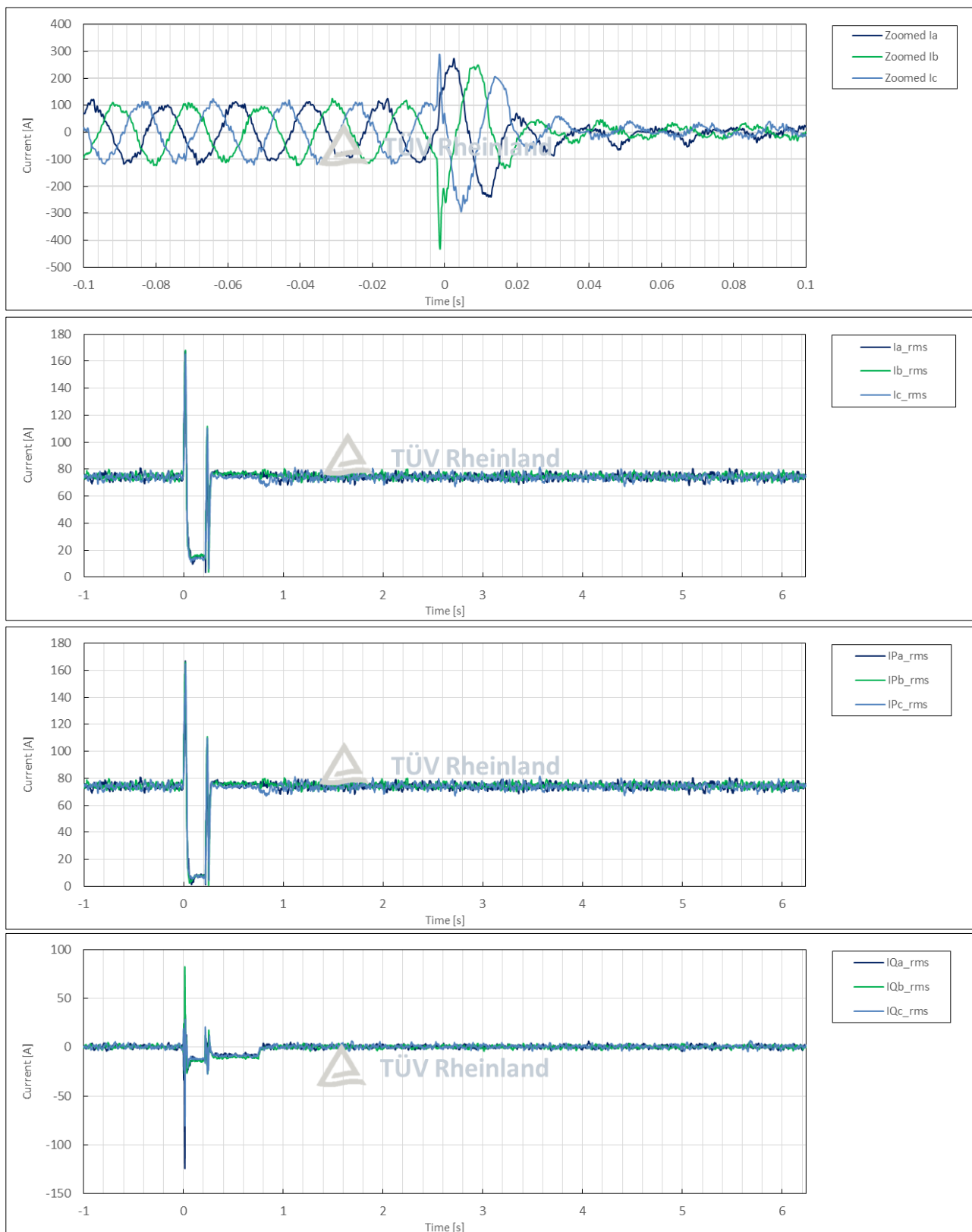
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Test No. 1.2 with PGU



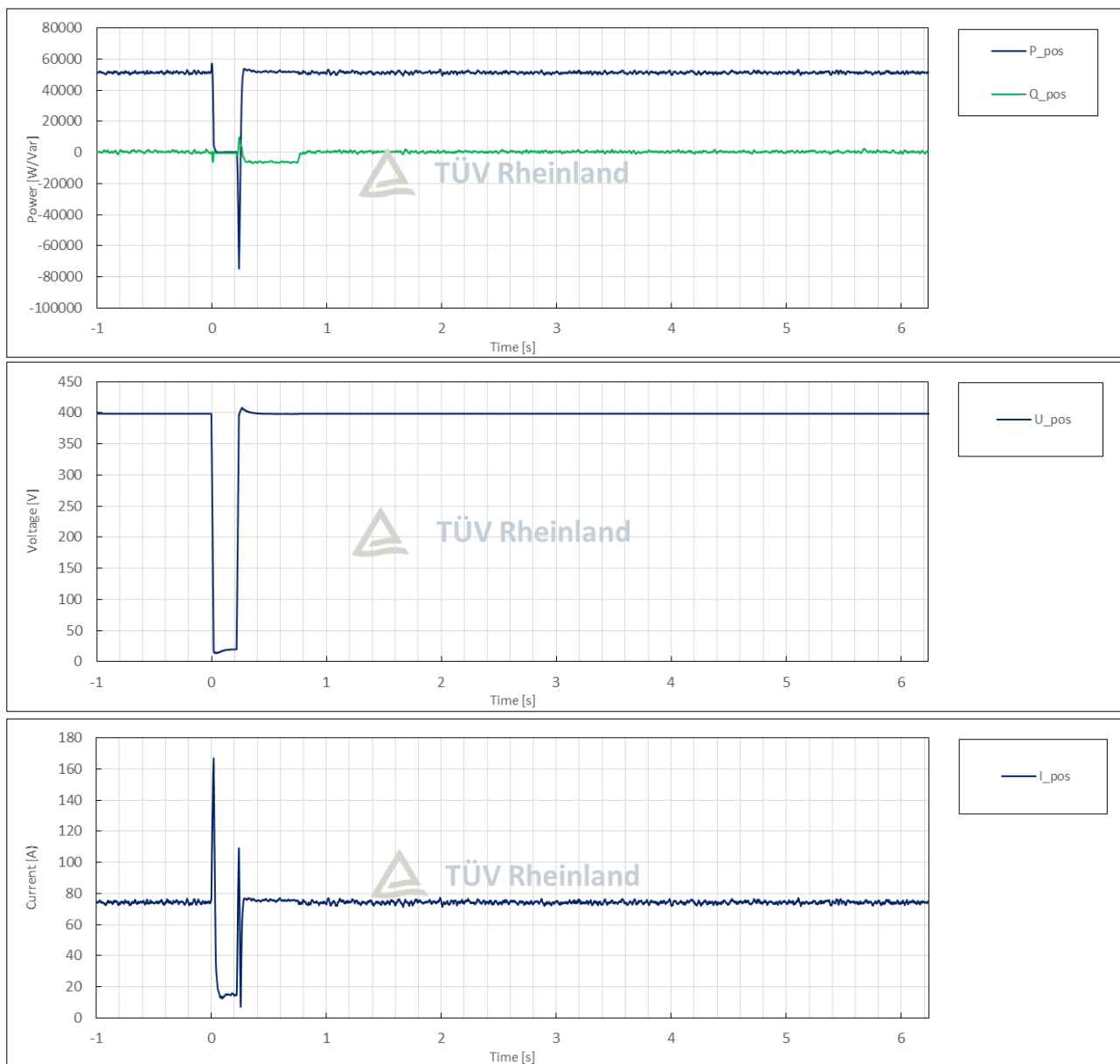
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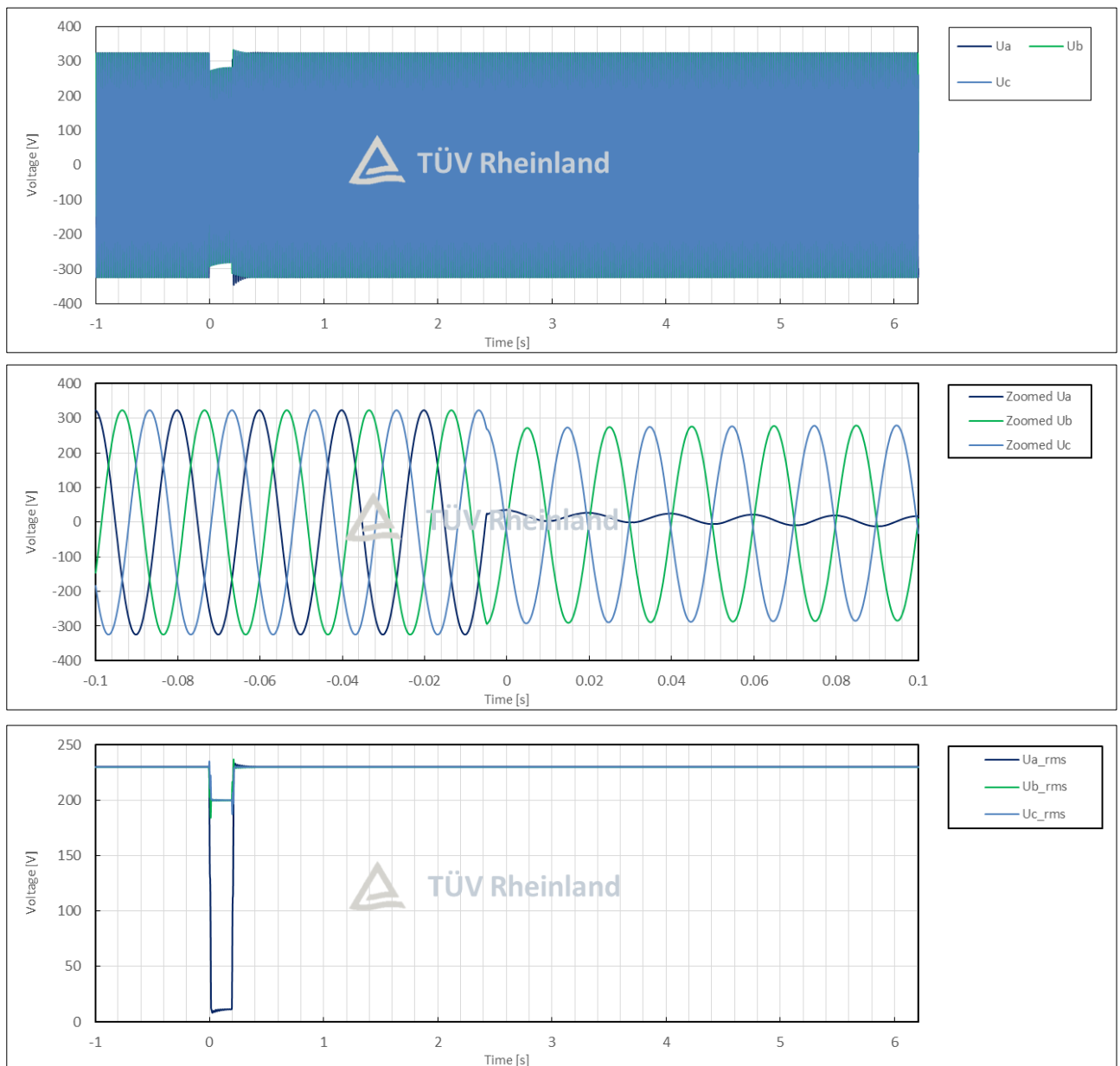


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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	1.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:14:53
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.05
	5	Setting dip duration		--		211
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	211
	8	Fault duration in empty load test	Total	--	ms	211
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.05
	10		Pos.		p.u.	0.53
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.05
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.02
	23		Phase 2			0.06
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

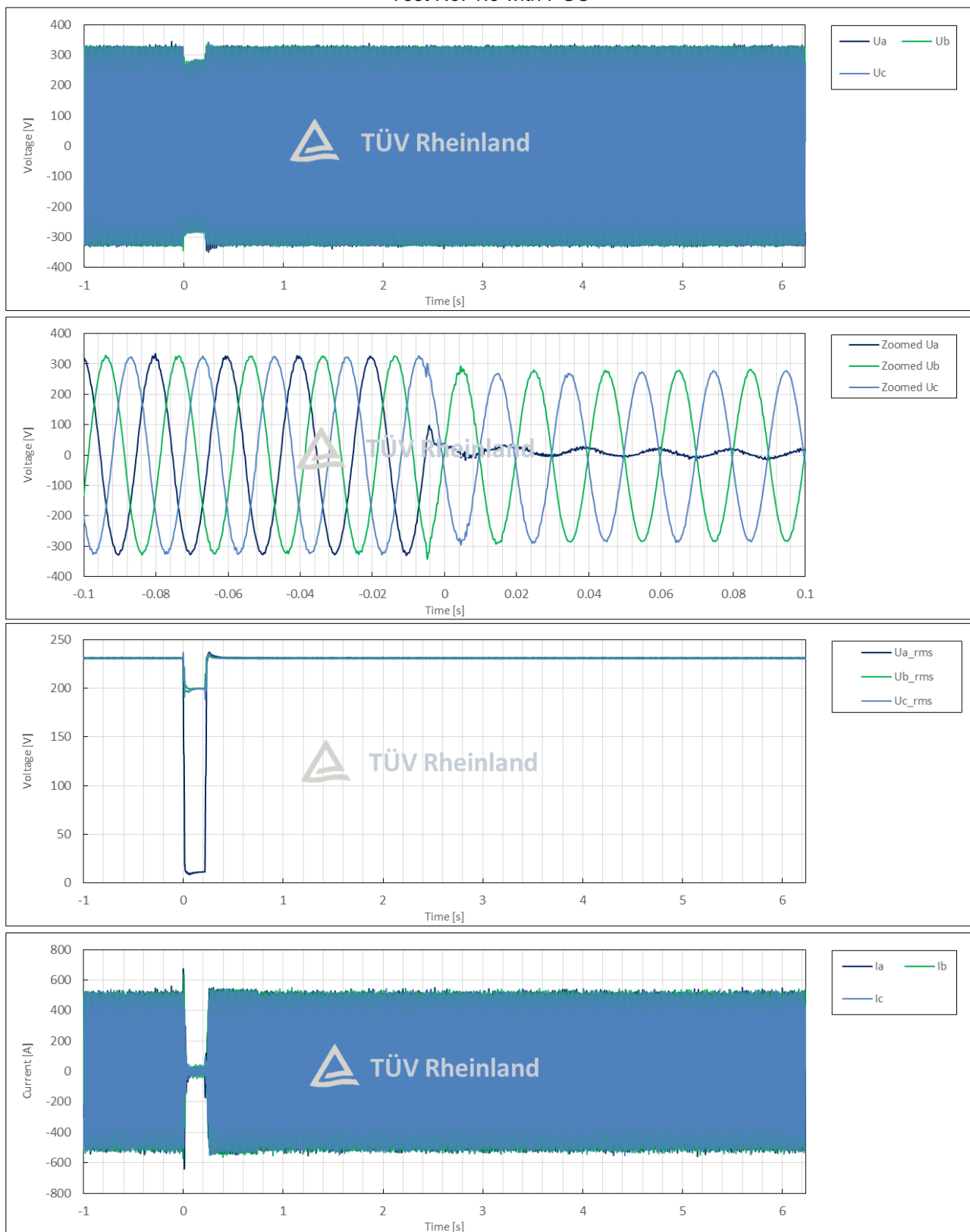
Test No. 1.3 idle test



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Test No. 1.3 with PGU



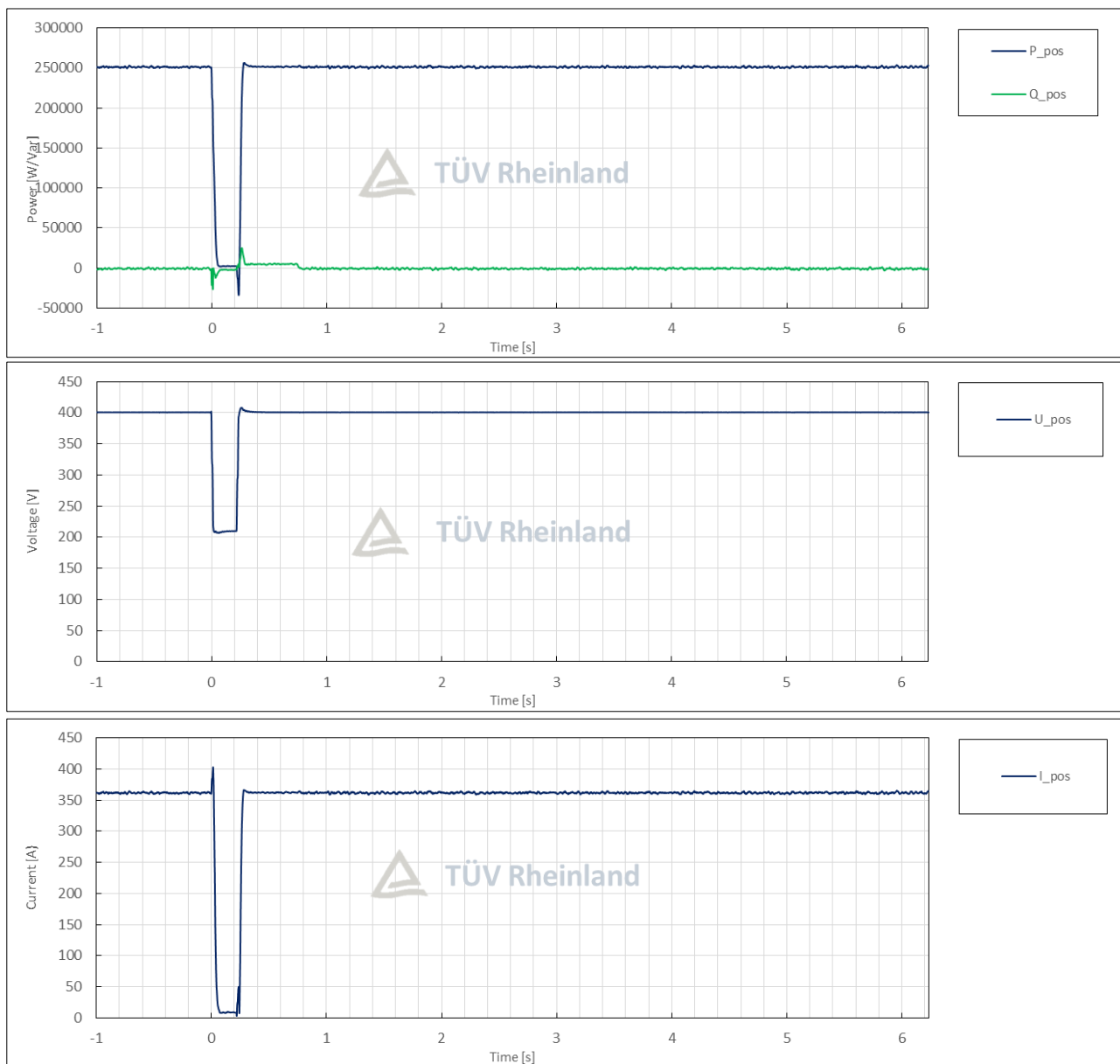
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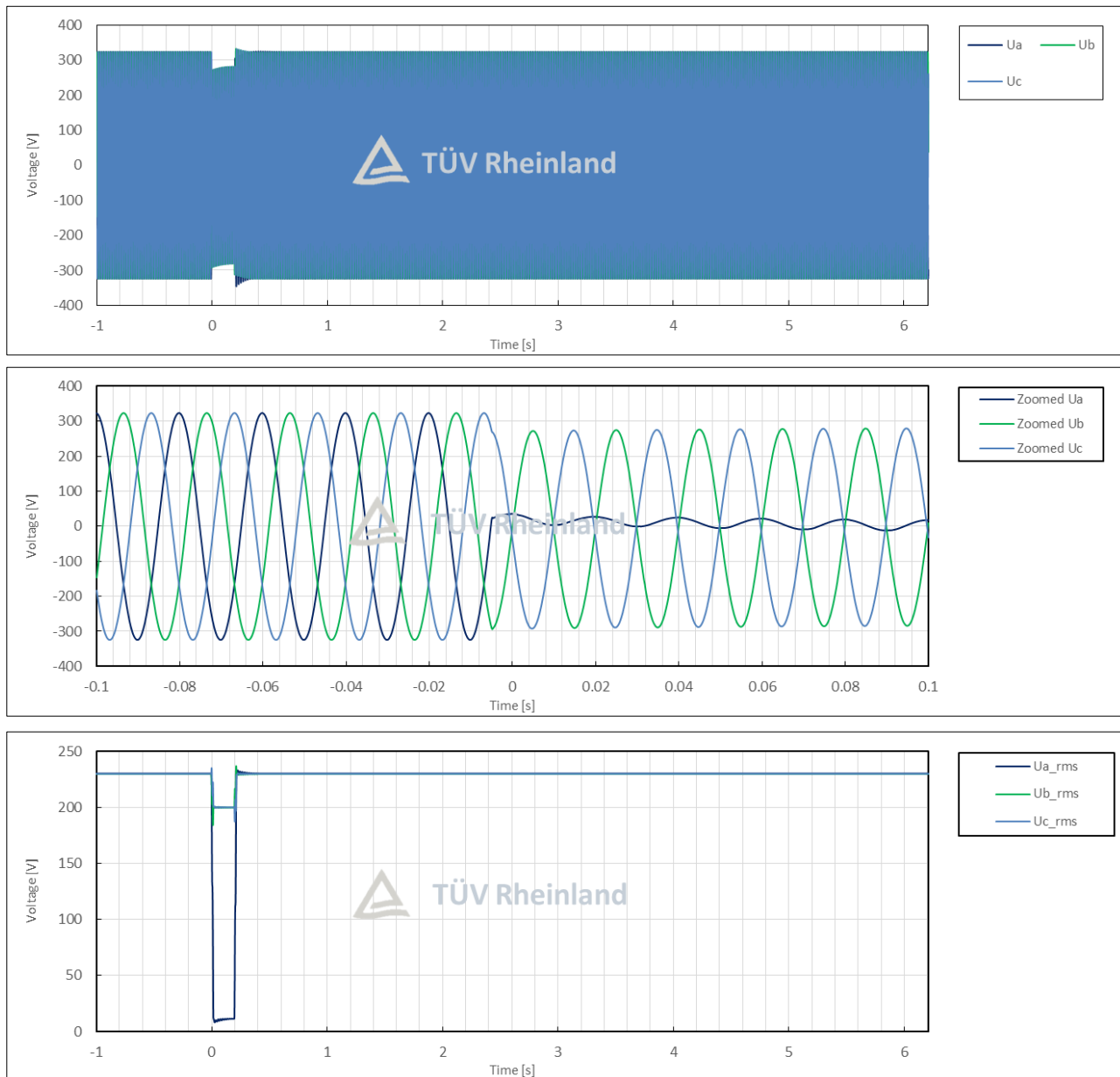


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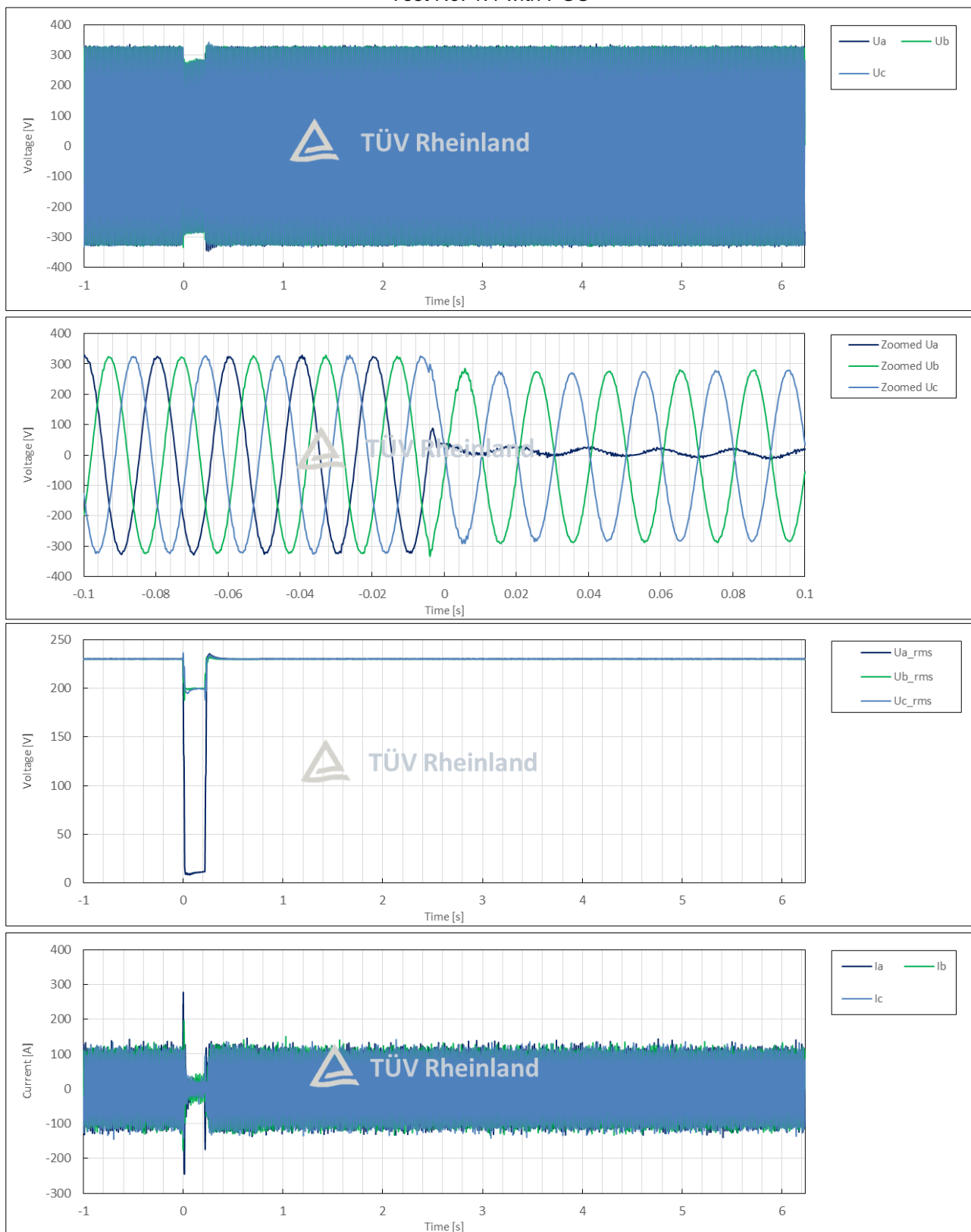
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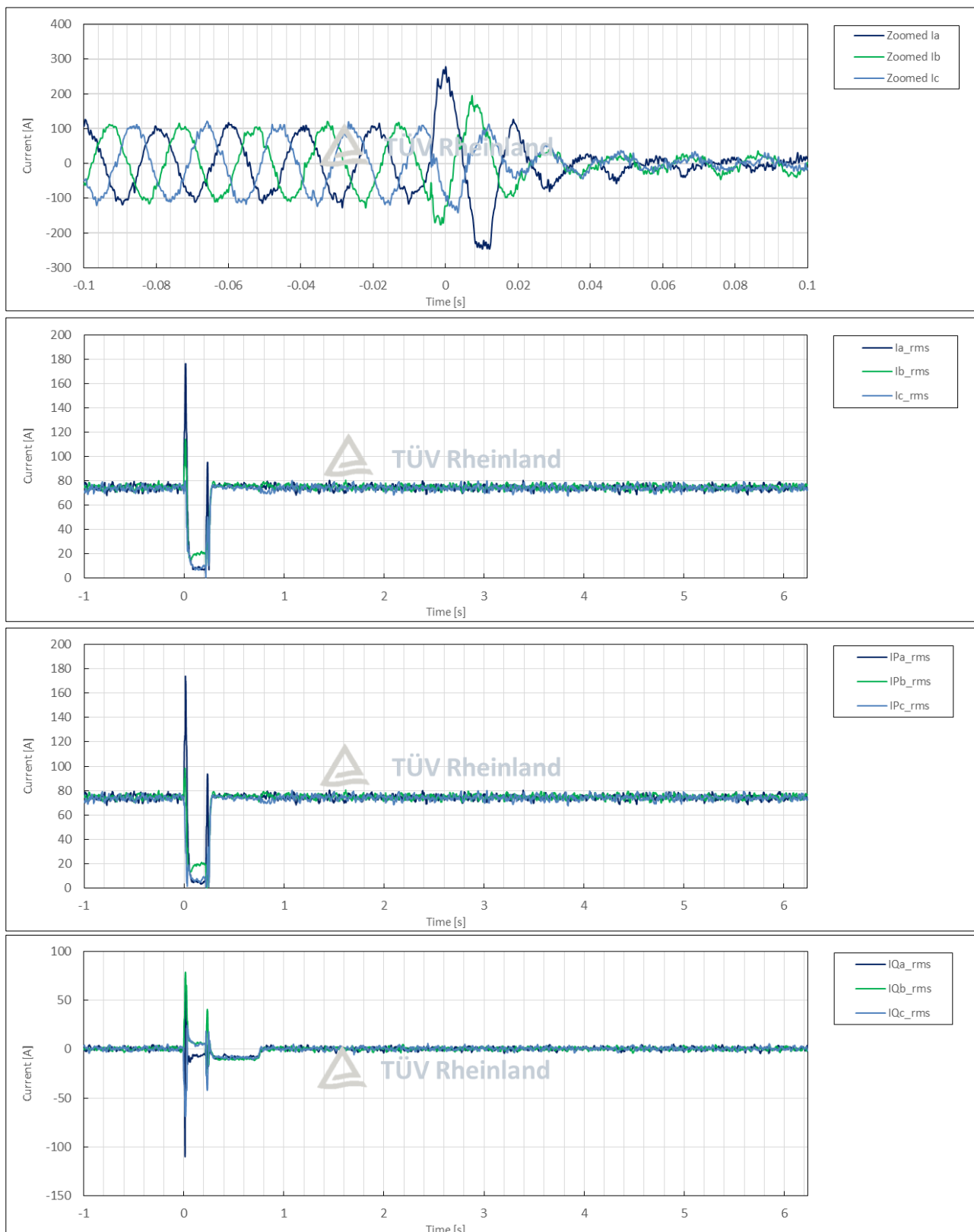
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	1.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:16:04
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.05
	5	Setting dip duration		--		211
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	211
	8	Fault duration in empty load test	Total	--	ms	211
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.05
	10		Pos.		p.u.	0.53
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.05
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.02
	23		Phase 2			0.05
	24		Phase 3			0.02
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 1.4 idle test



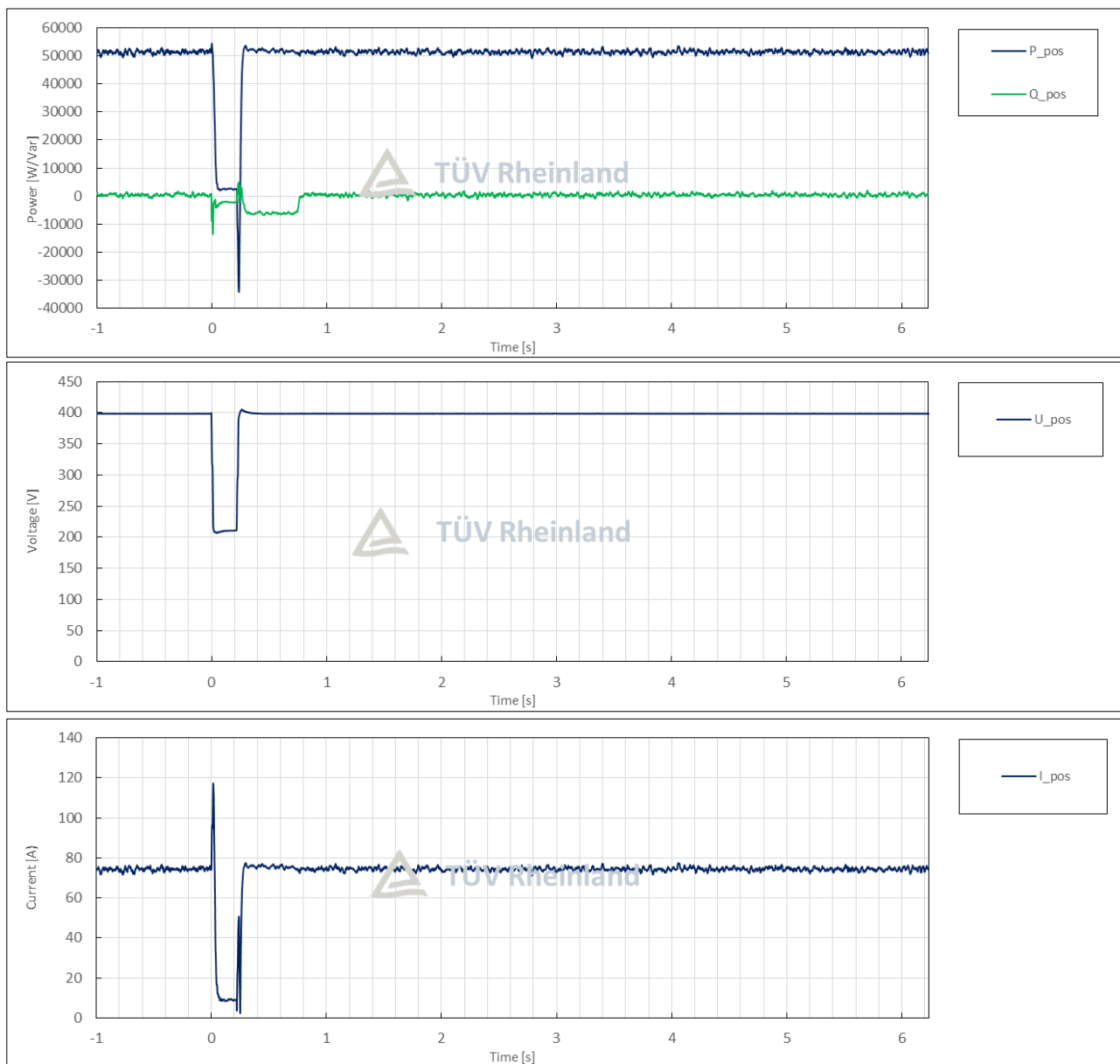
Test No. 1.4 with PGU





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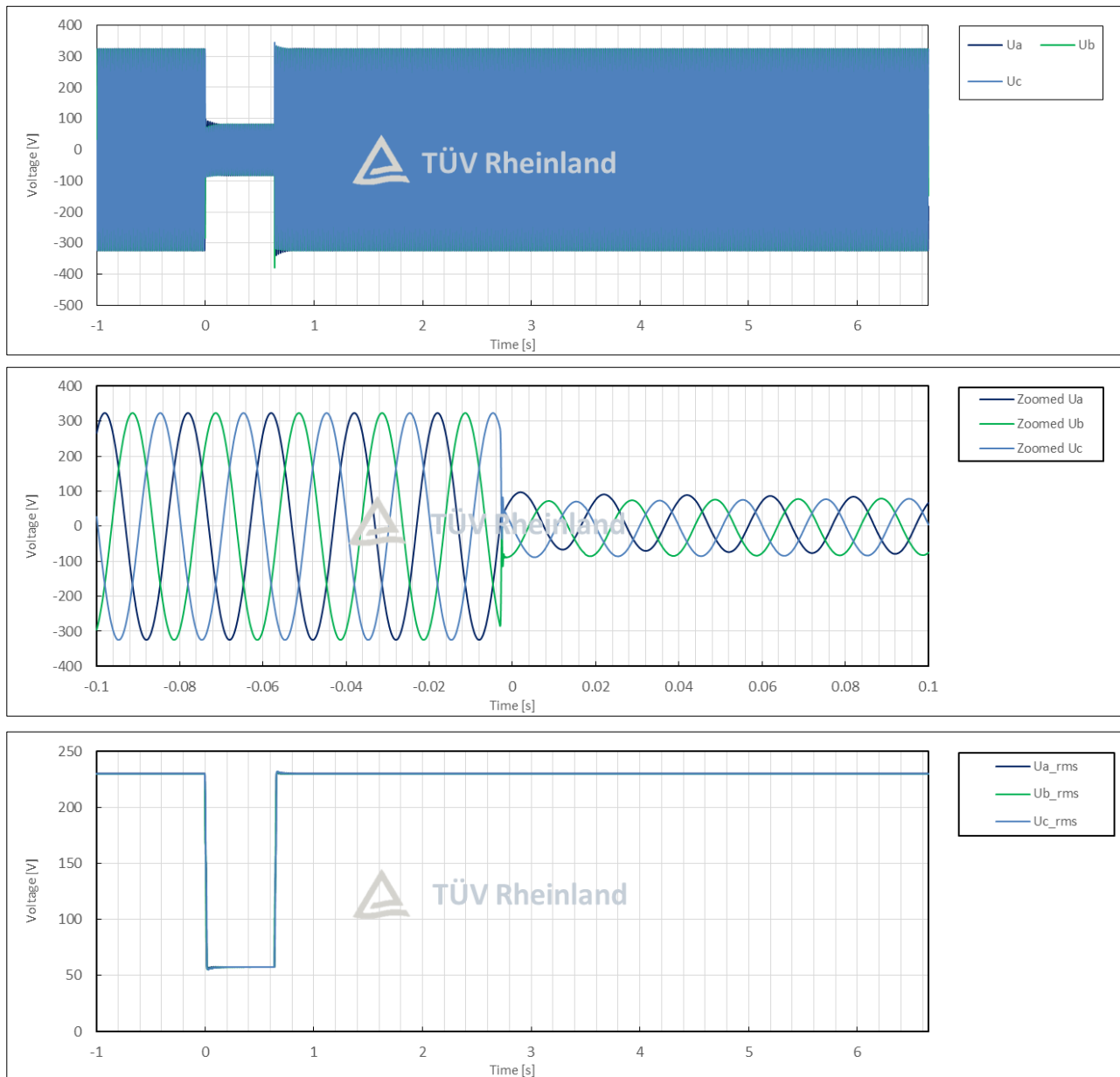


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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	2.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:21:45
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		655
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	655
	8	Fault duration in empty load test	Total	--	ms	655
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.25
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.01
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.04
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	0.032
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

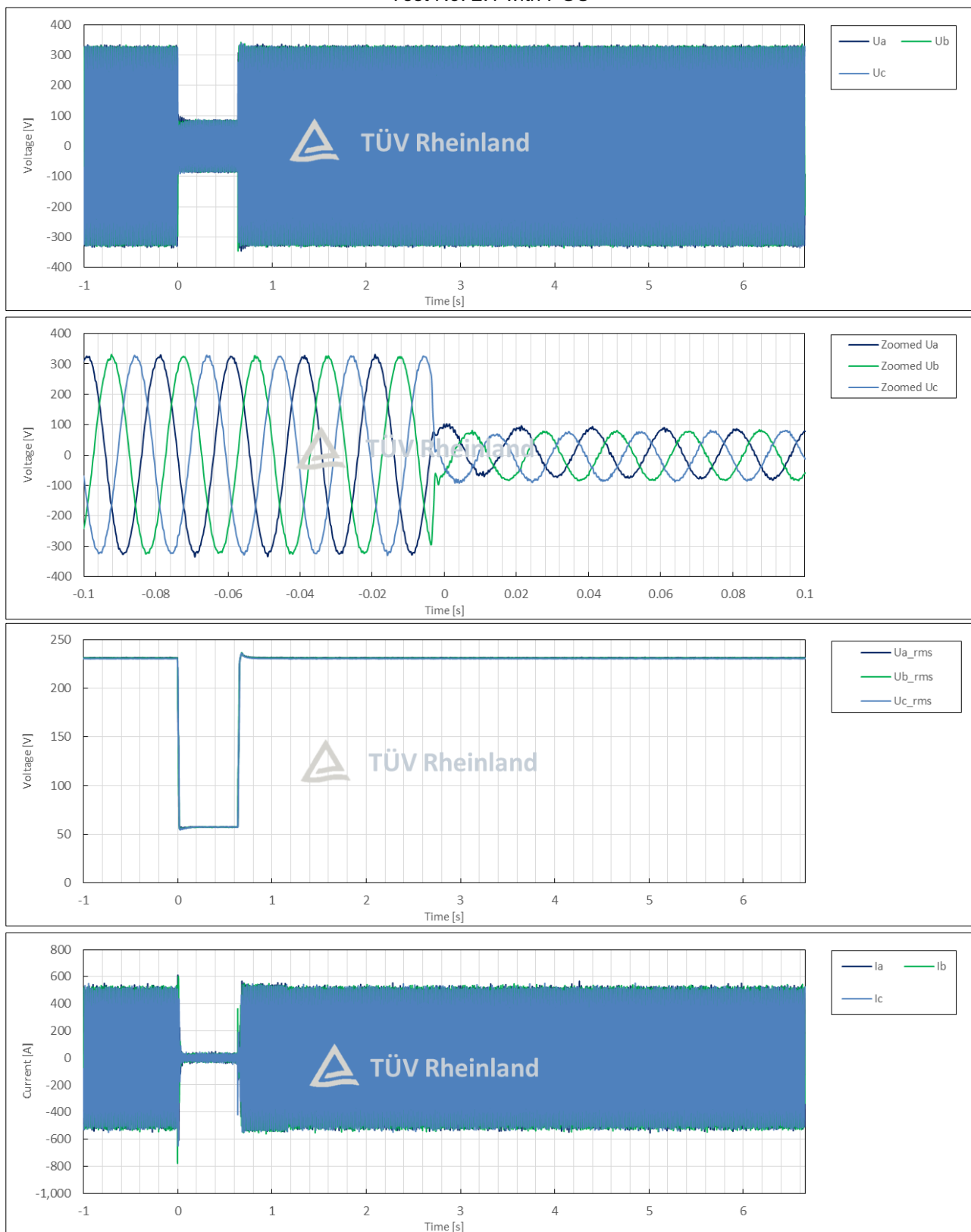
Test No. 2.1 idle test



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Test No. 2.1 with PGU



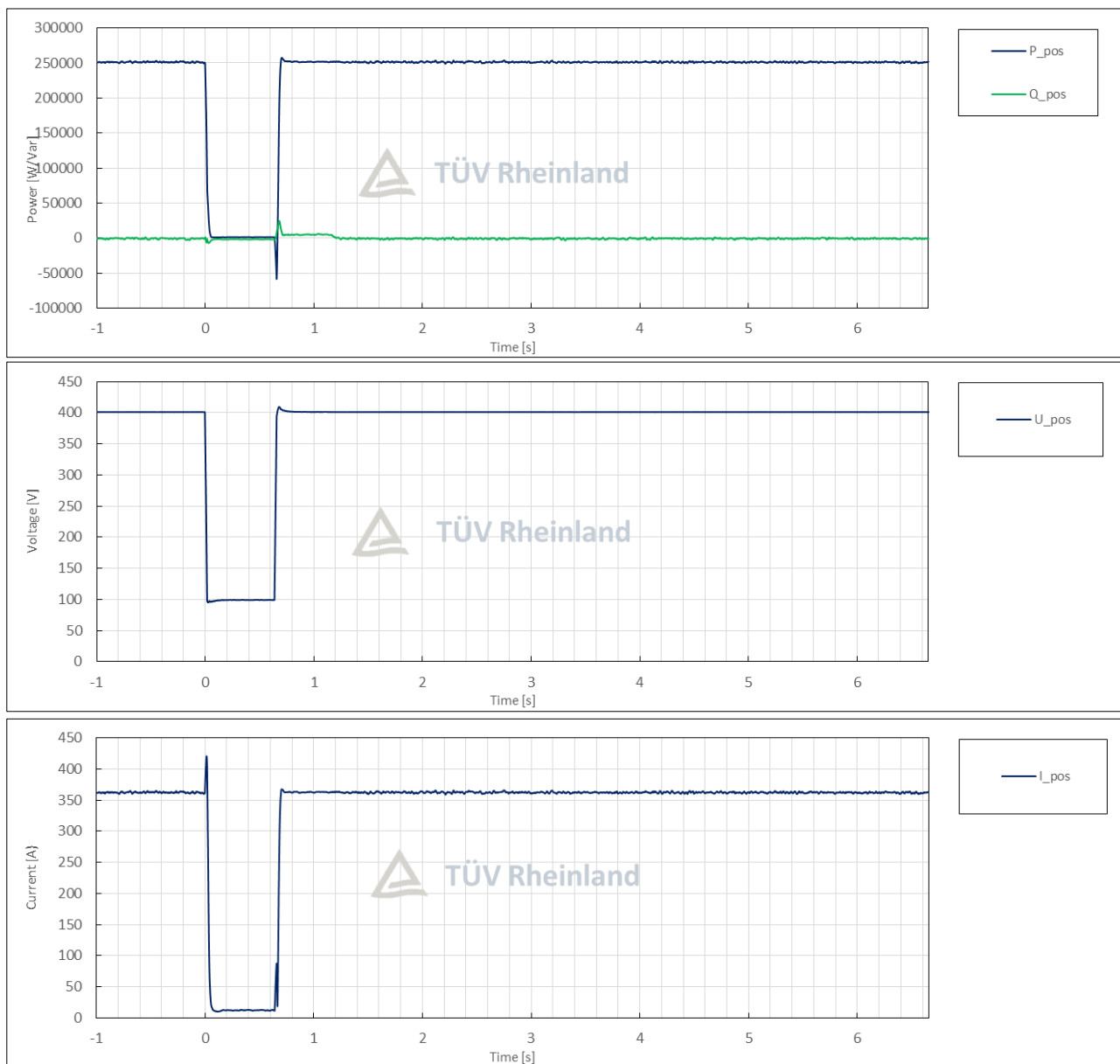
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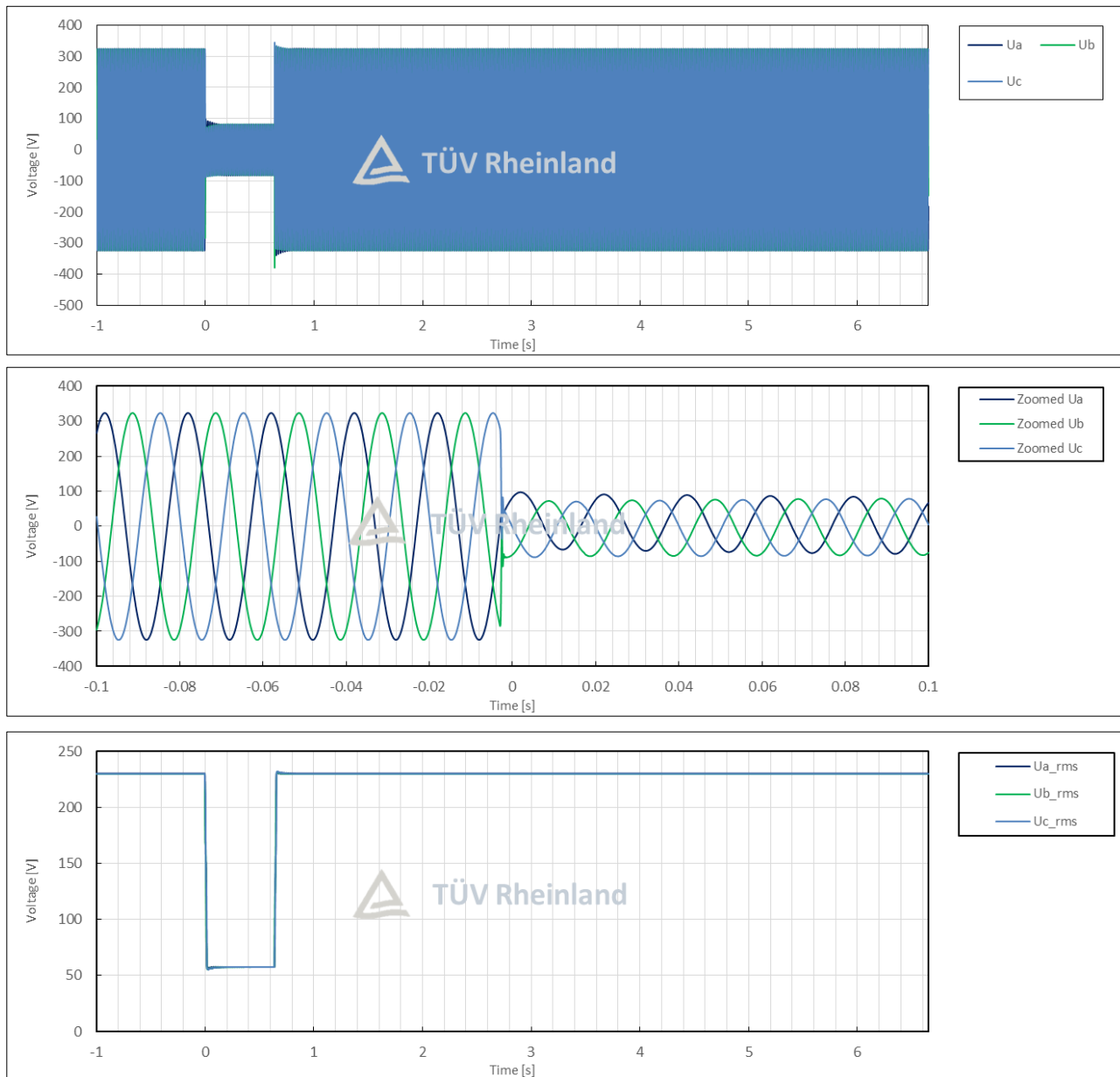


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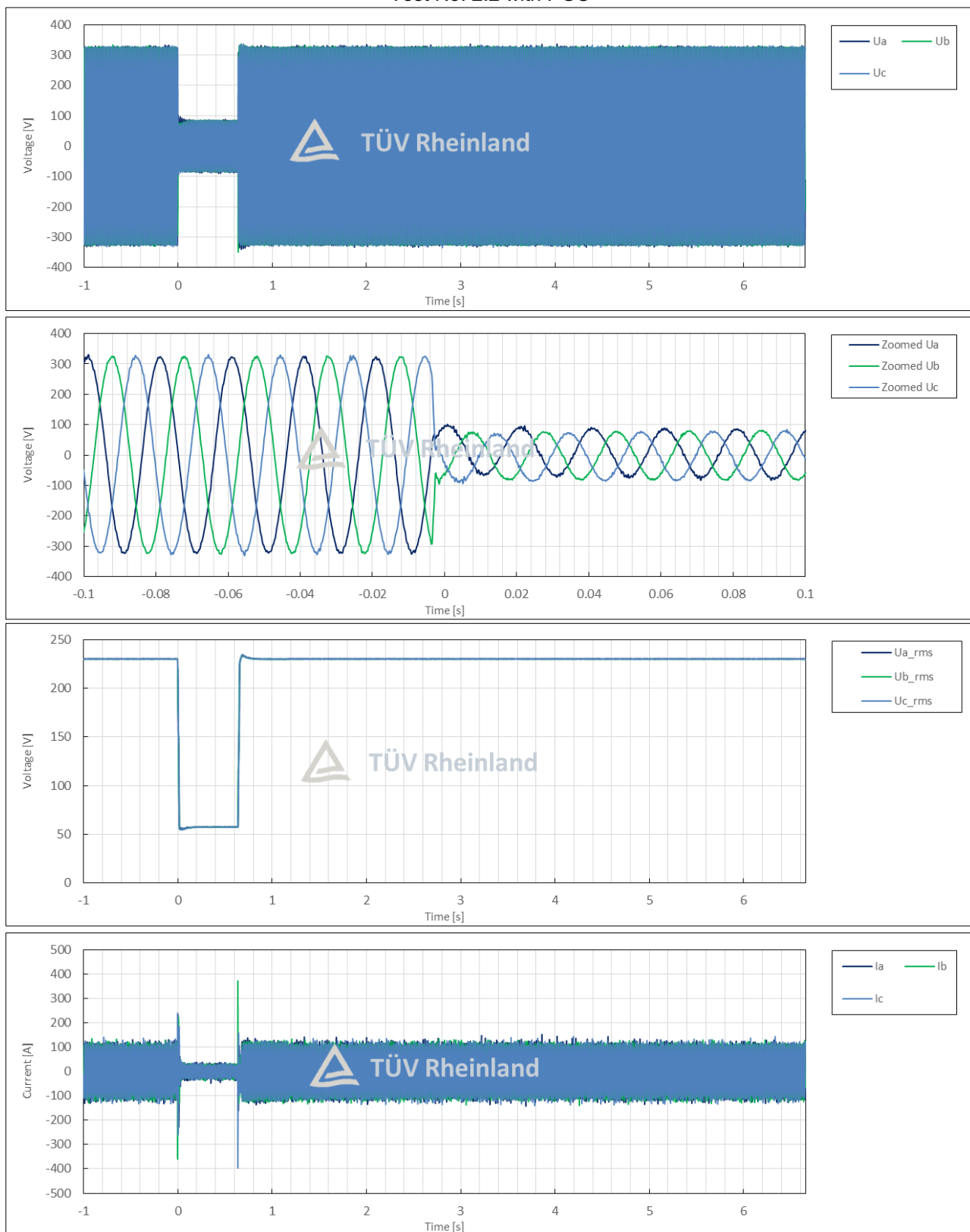
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	2.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:22:29
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		655
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	655
	8	Fault duration in empty load test	Total	--	ms	655
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.25
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.04
	20		Phase 2			0.04
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.04
	23		Phase 2			0.04
	24		Phase 3			0.04
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.035
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 2.2 idle test

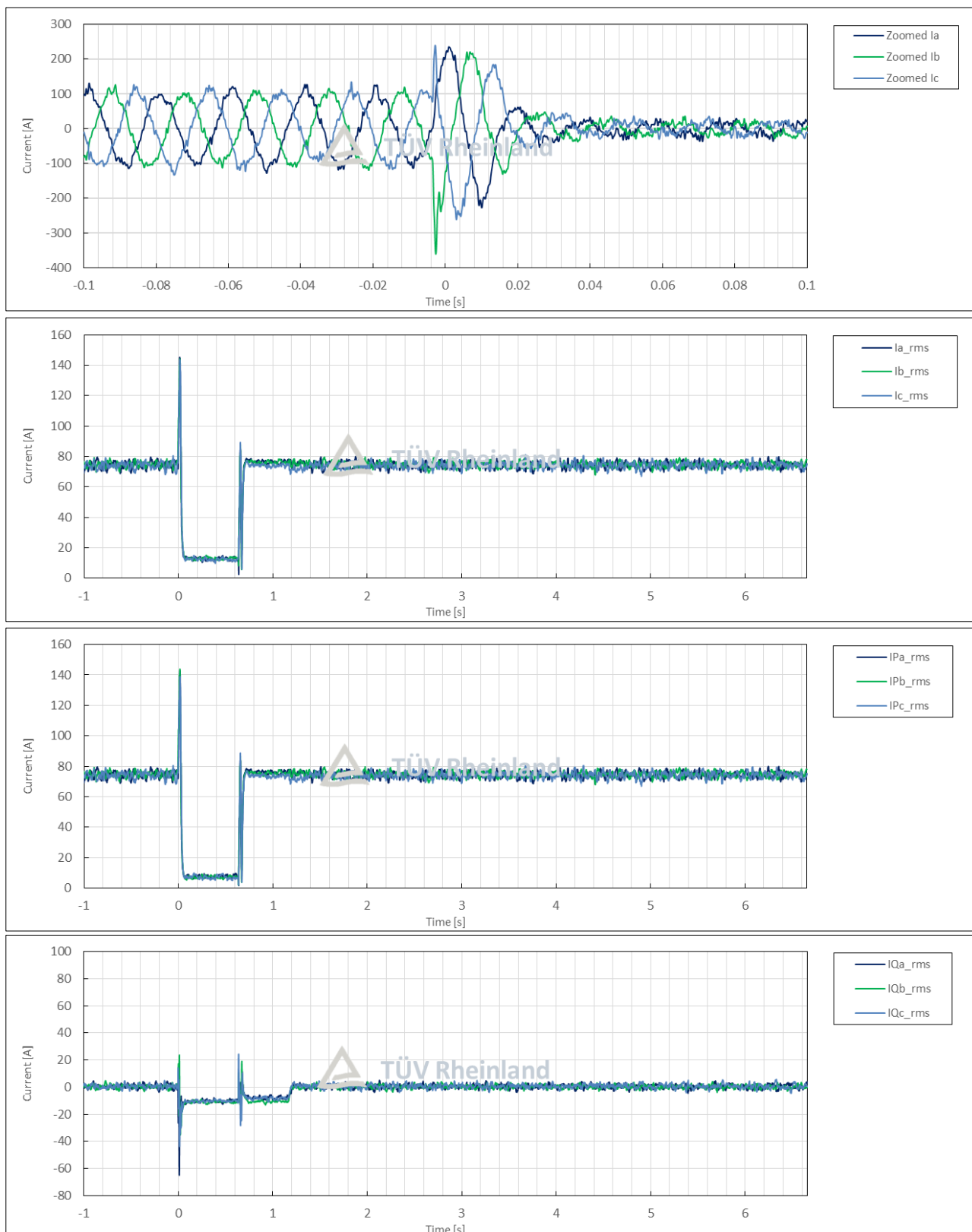


Test No. 2.2 with PGU



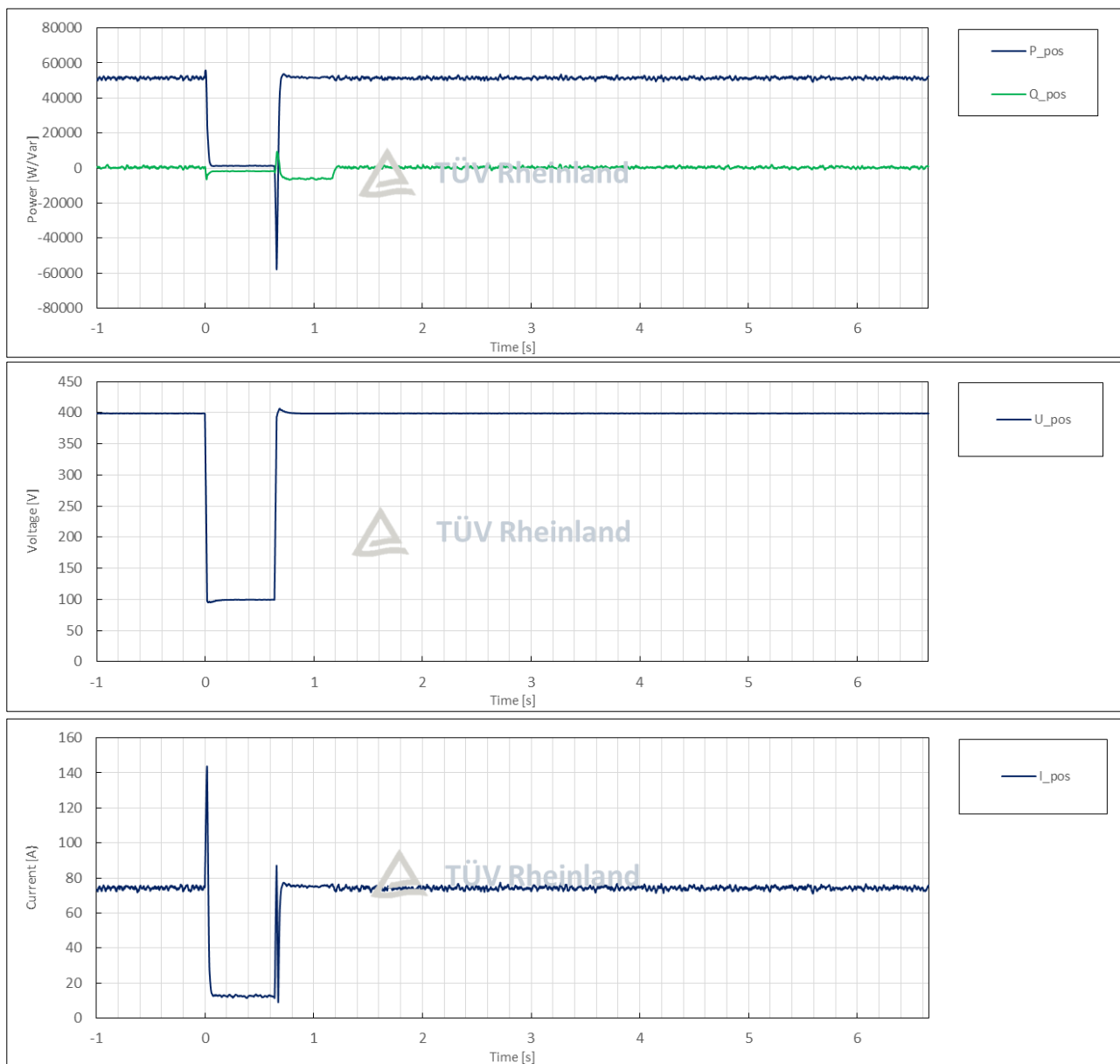
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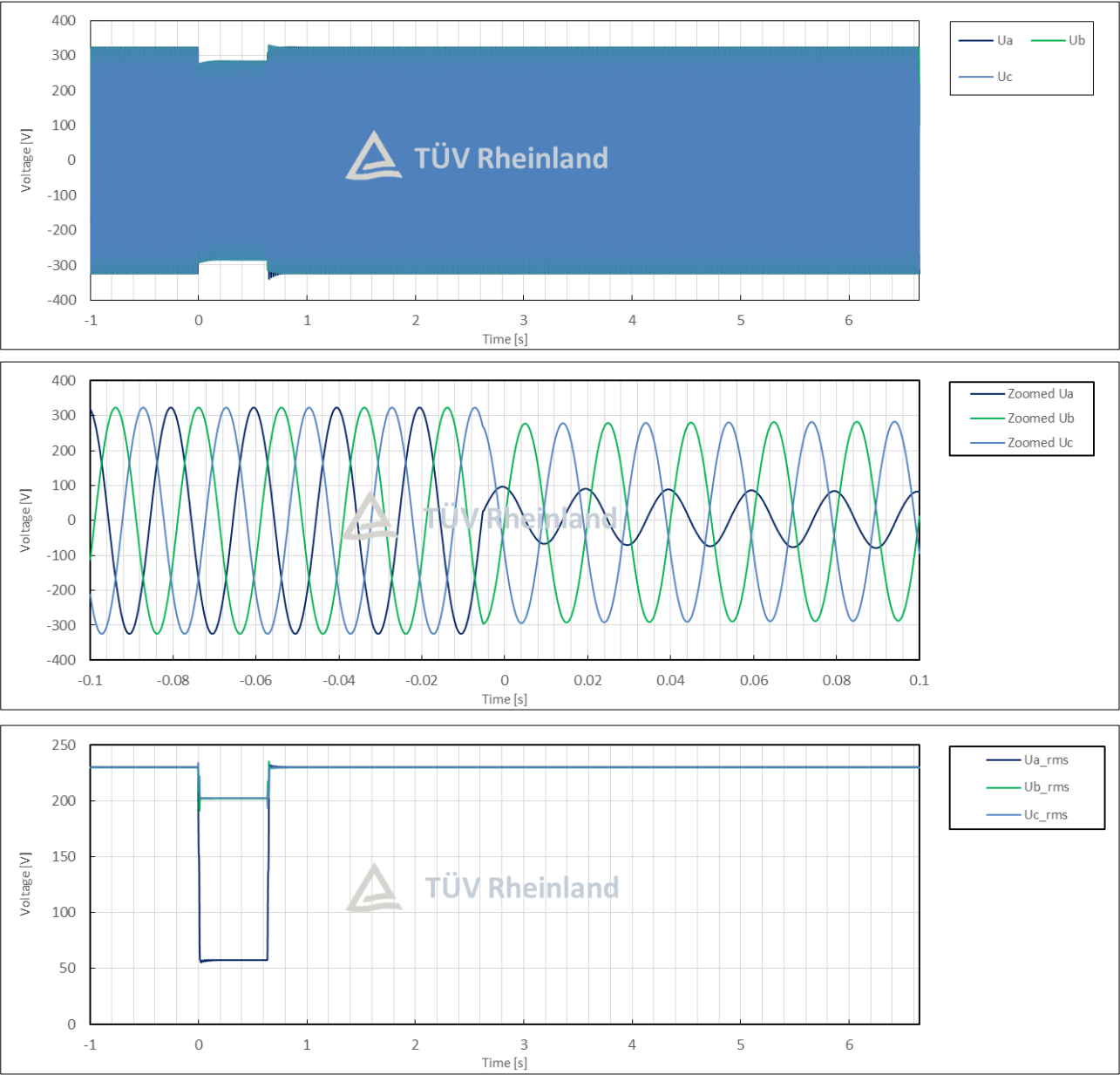


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Test report no.:

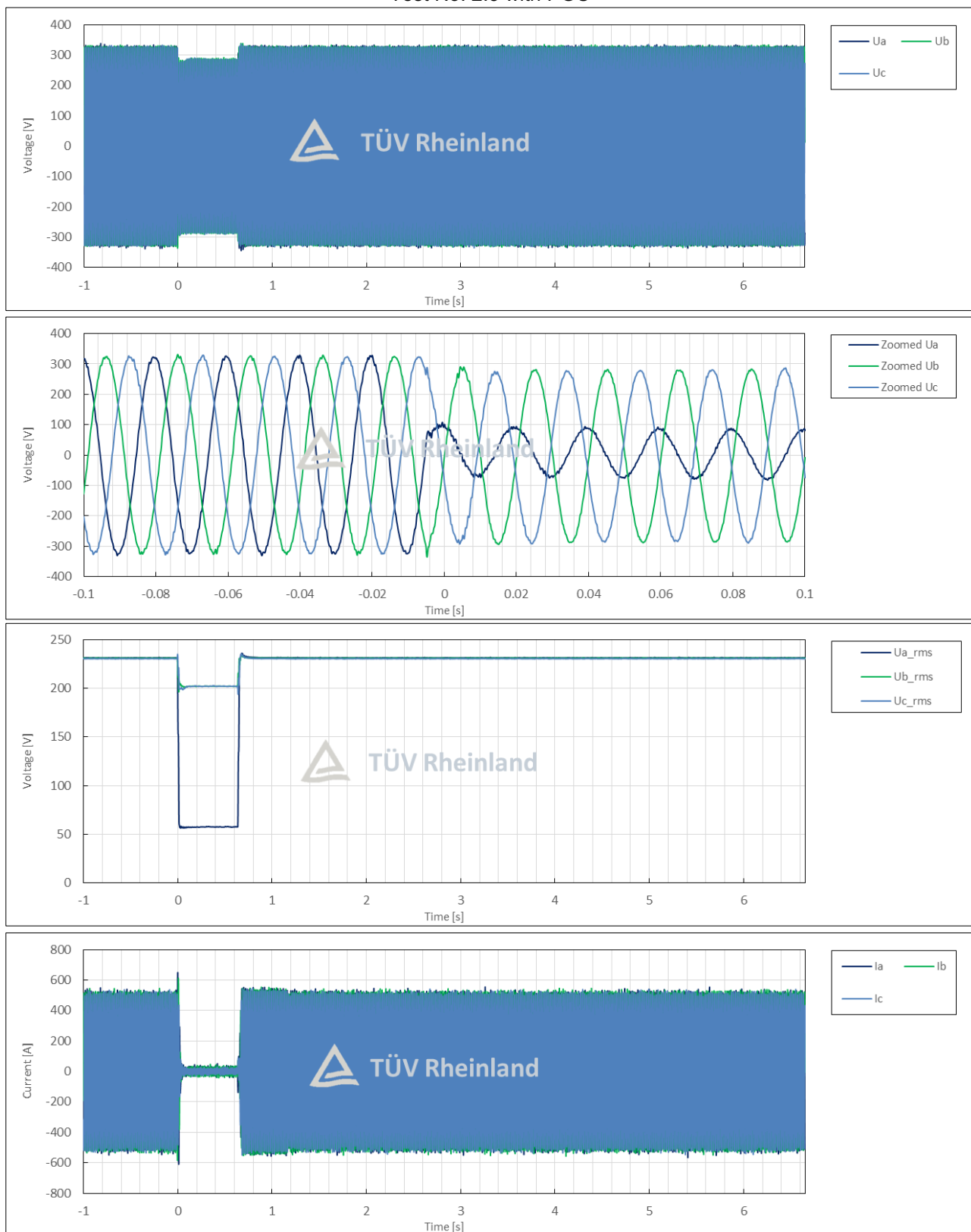
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	2.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:23:24
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		650
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	650
	8	Fault duration in empty load test	Total	--	ms	650
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.63
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.06
	20		Phase 2			0.05
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.03
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

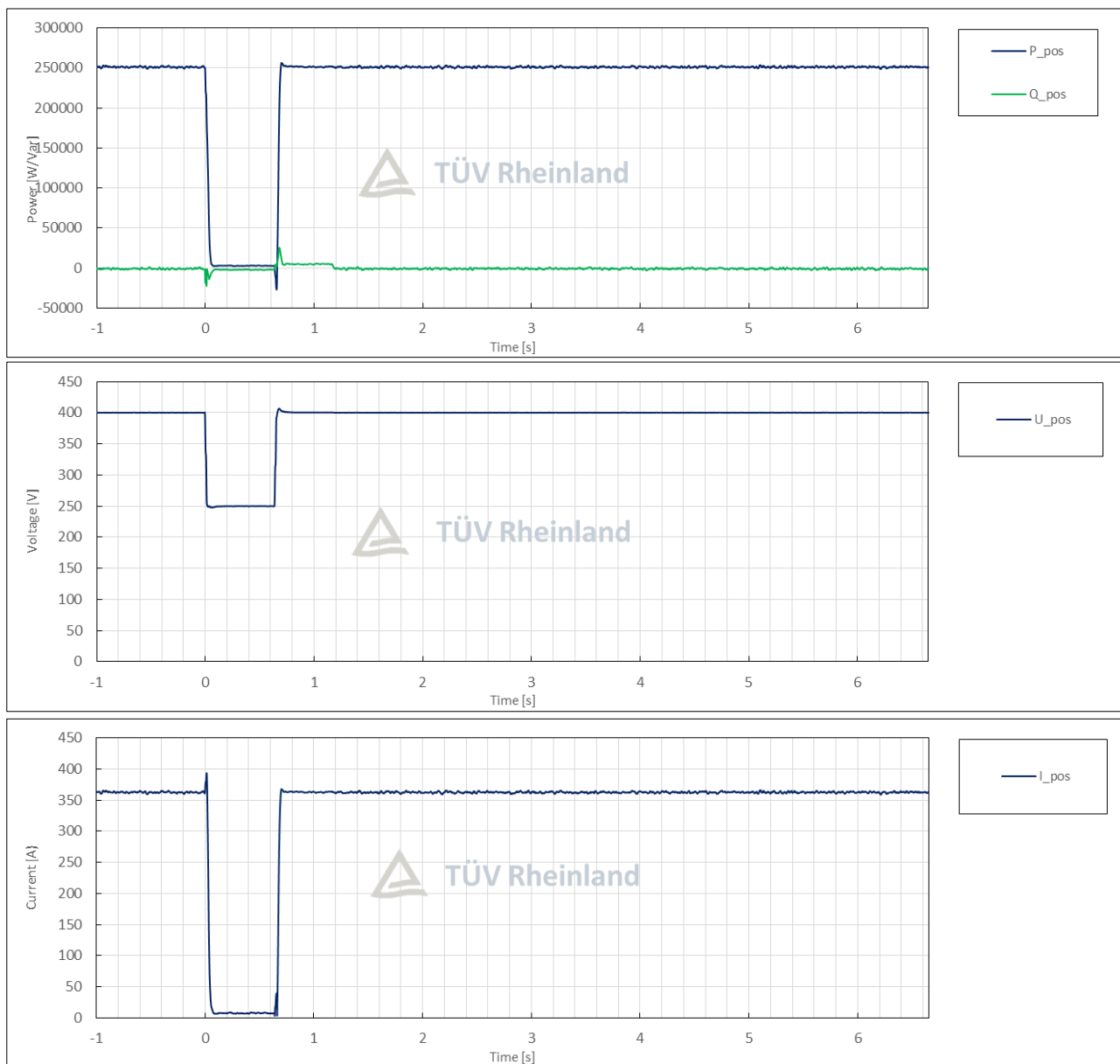
Test No. 2.3 idle test



Test No. 2.3 with PGU





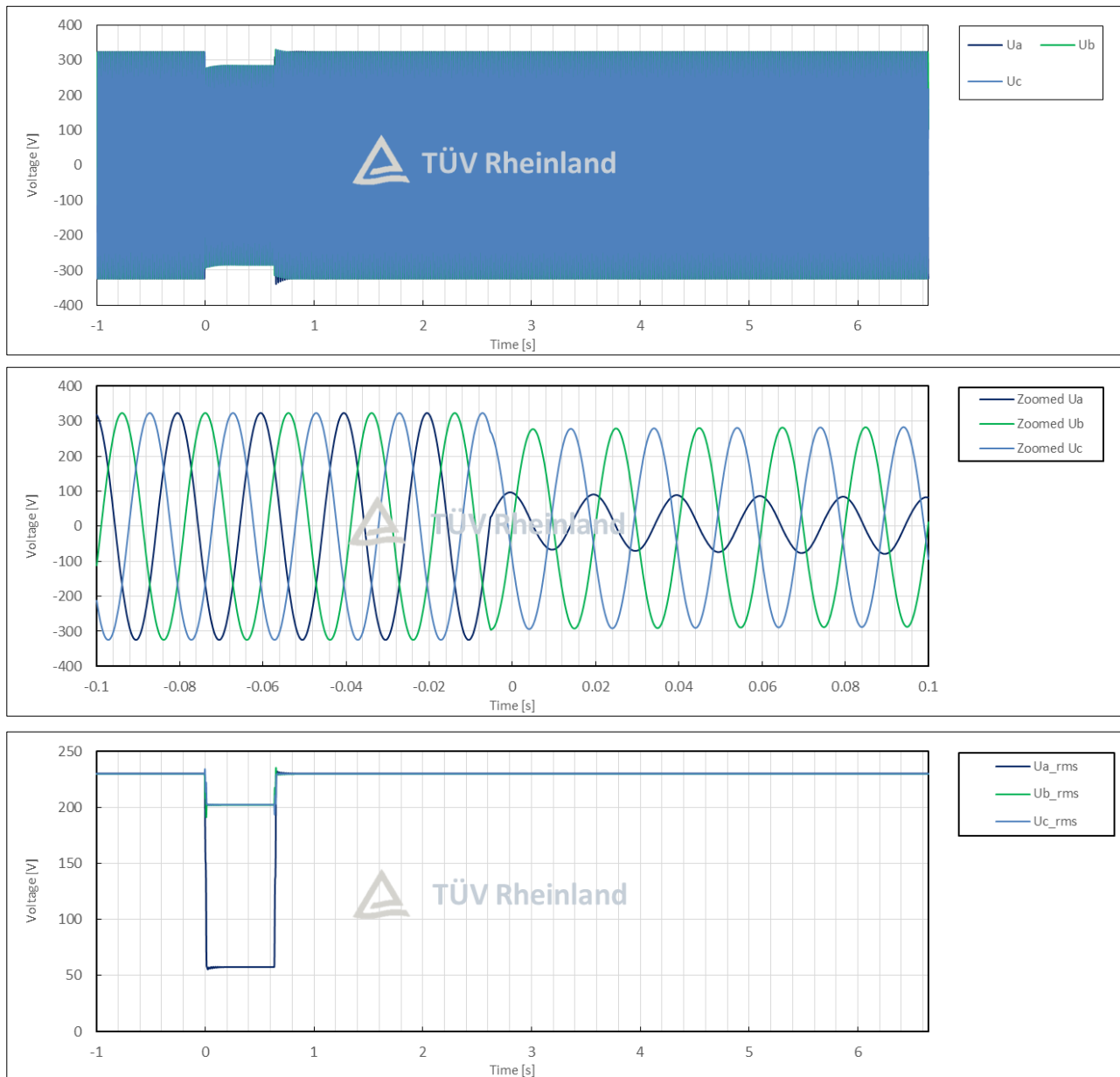


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Test report no.:

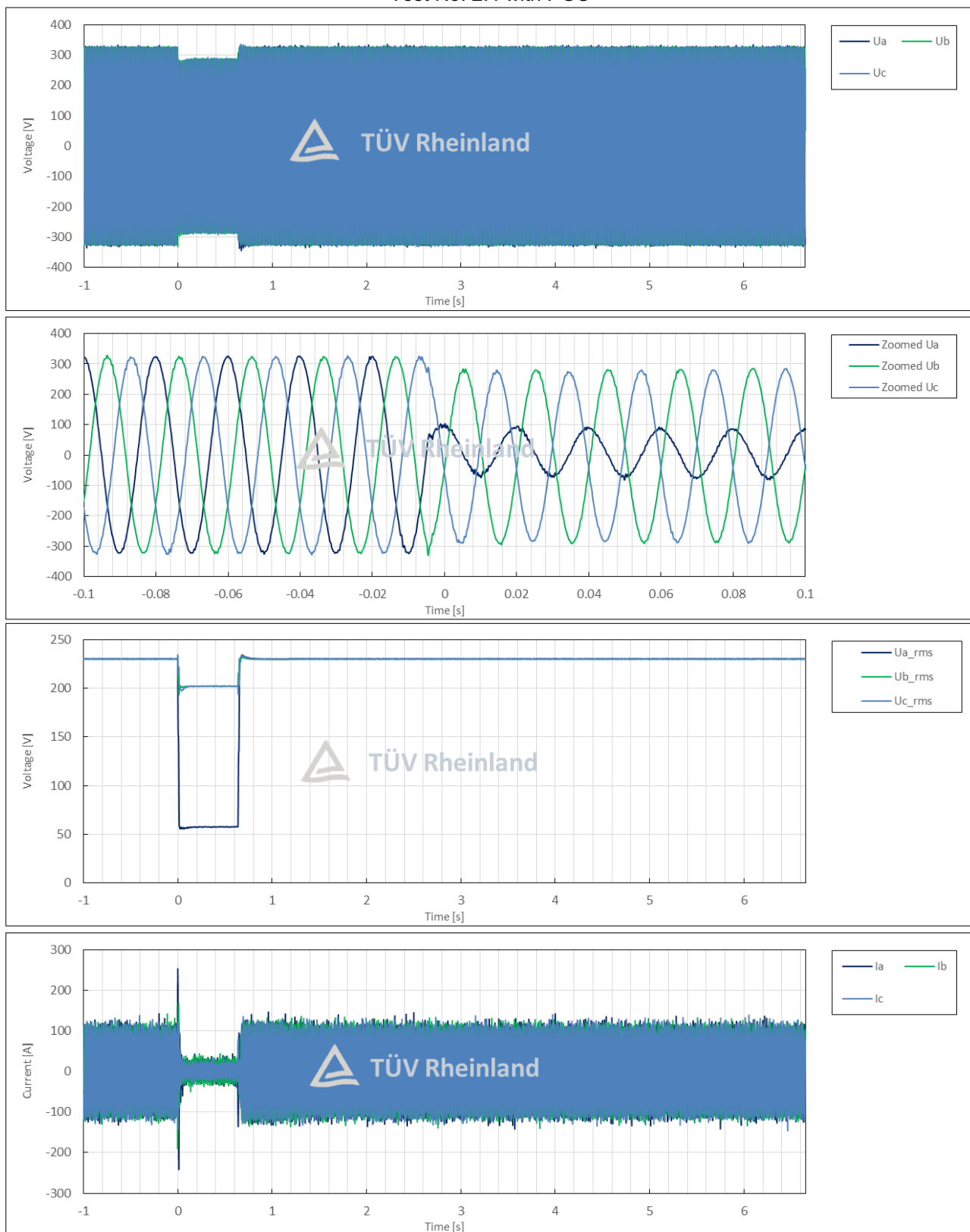
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	2.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:24:10
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		650
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	650
	8	Fault duration in empty load test	Total	--	ms	650
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.63
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.03
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.04
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 2.4 idle test



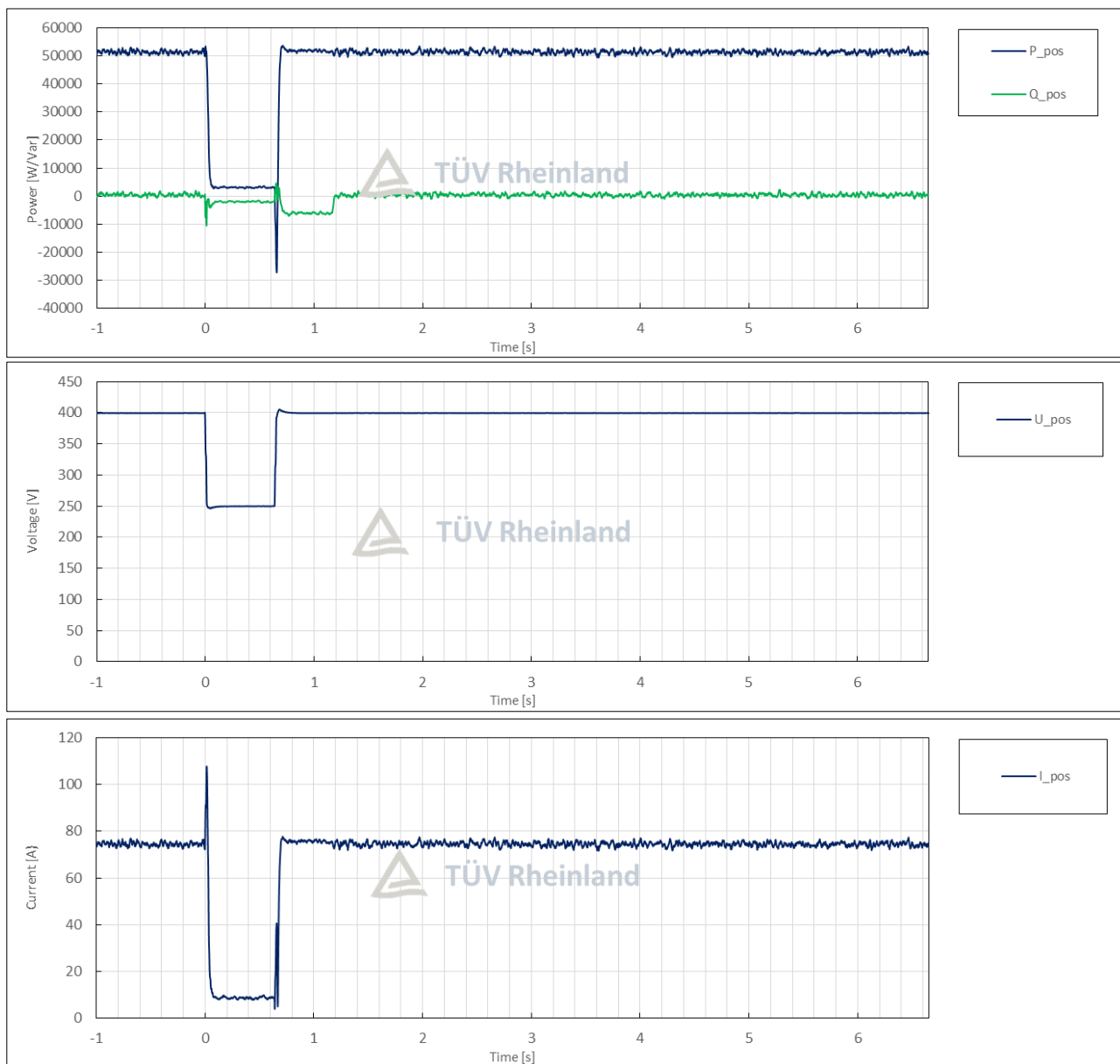
Test No. 2.4 with PGU





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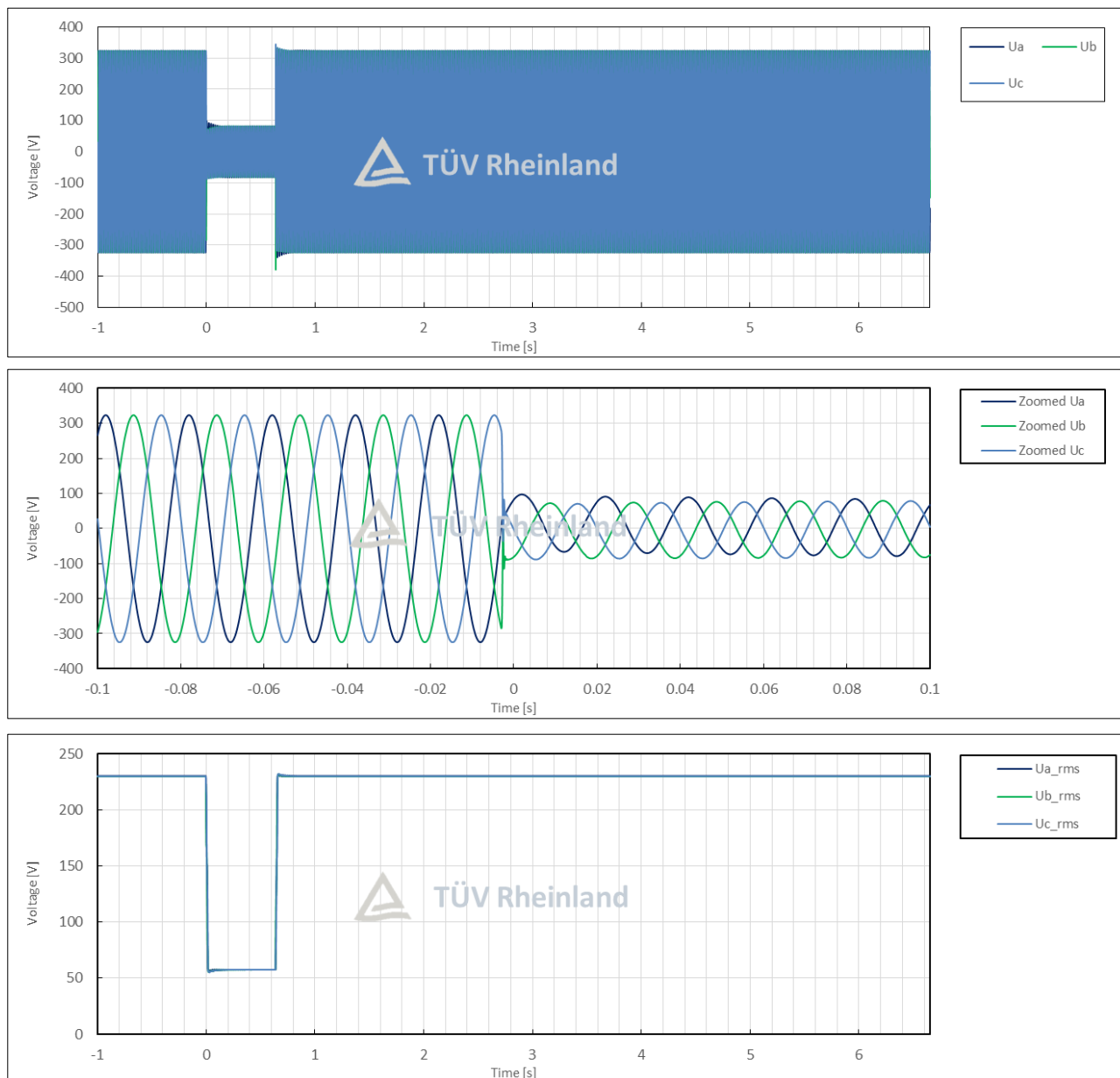


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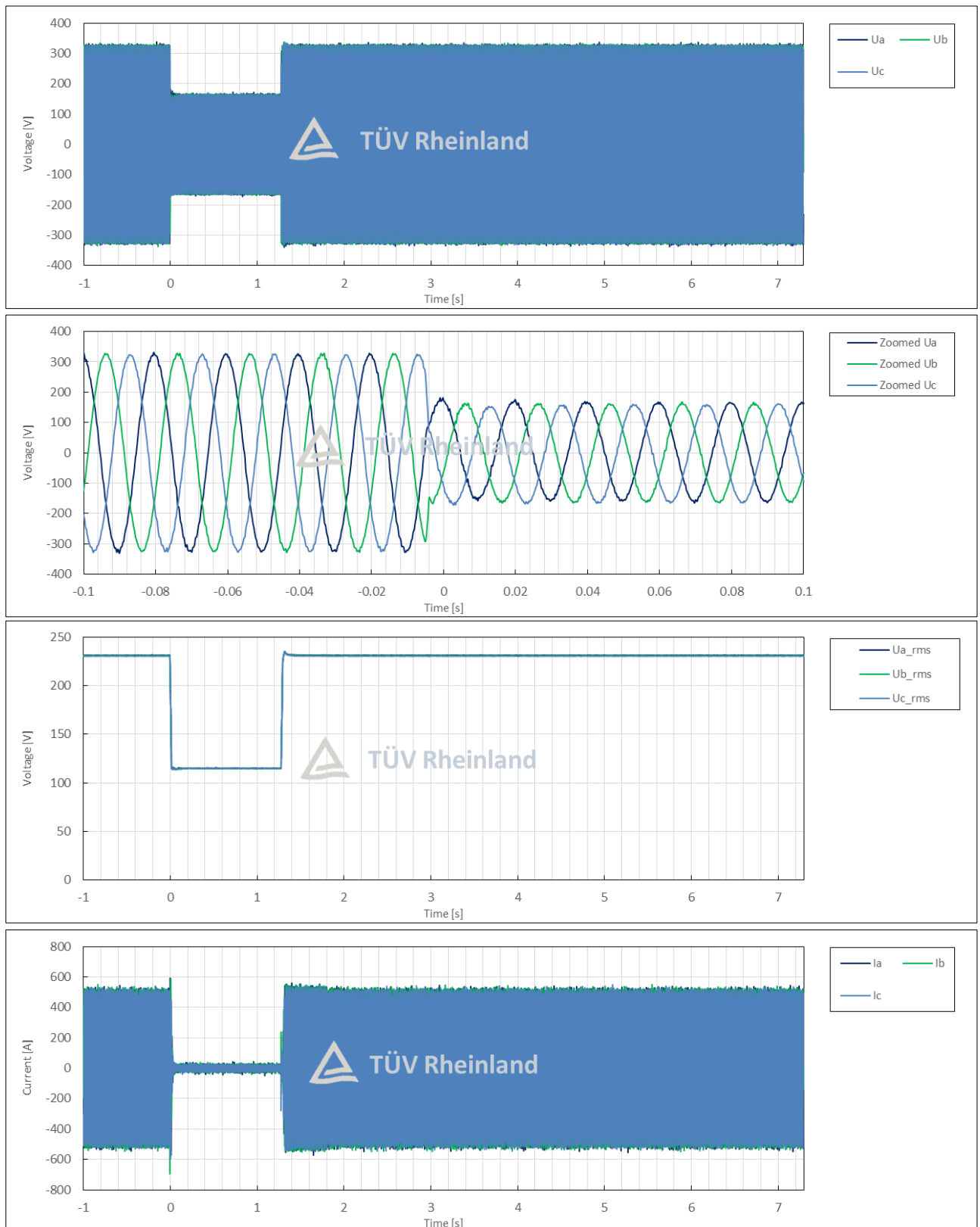
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	3.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:25:04
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		655
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	655
	8	Fault duration in empty load test	Total	--	ms	655
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.25
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.50
	19	Line current	Phase 1	t1+50ms	p.u.	0.04
	20		Phase 2			0.04
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.03
	24		Phase 3			0.02
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 3.1 idle test



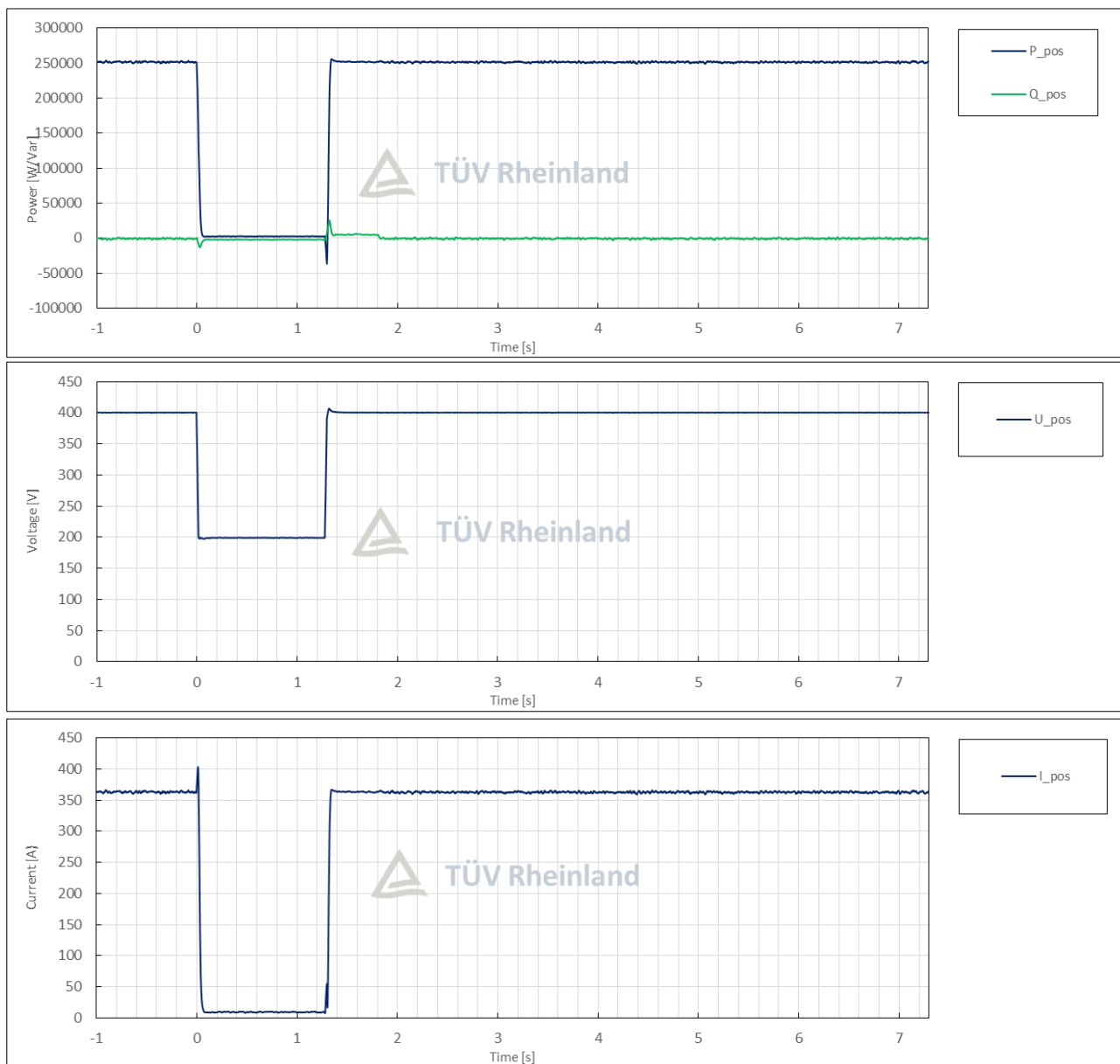
Test No. 3.1 with PGU





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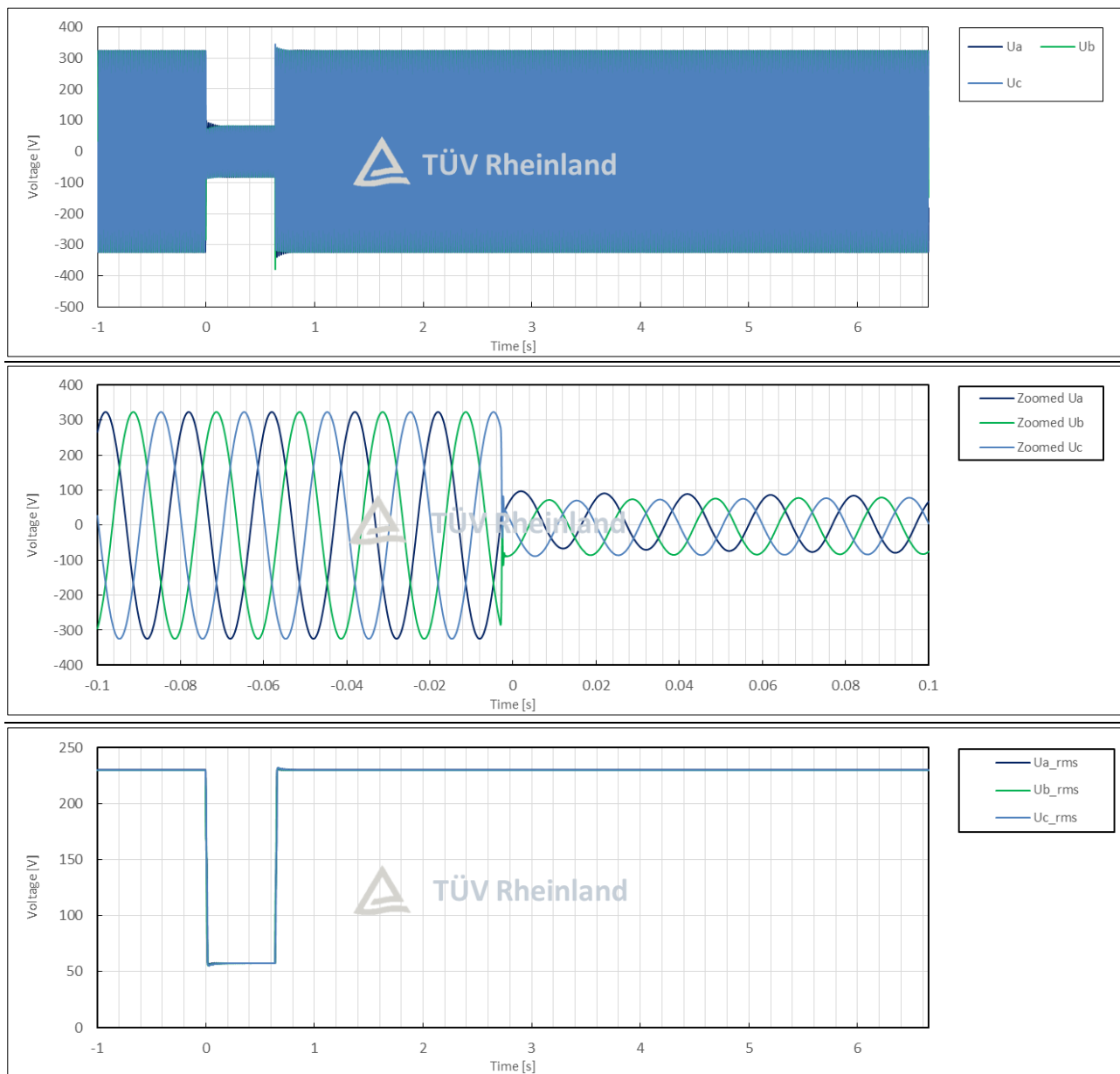


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Test report no.:

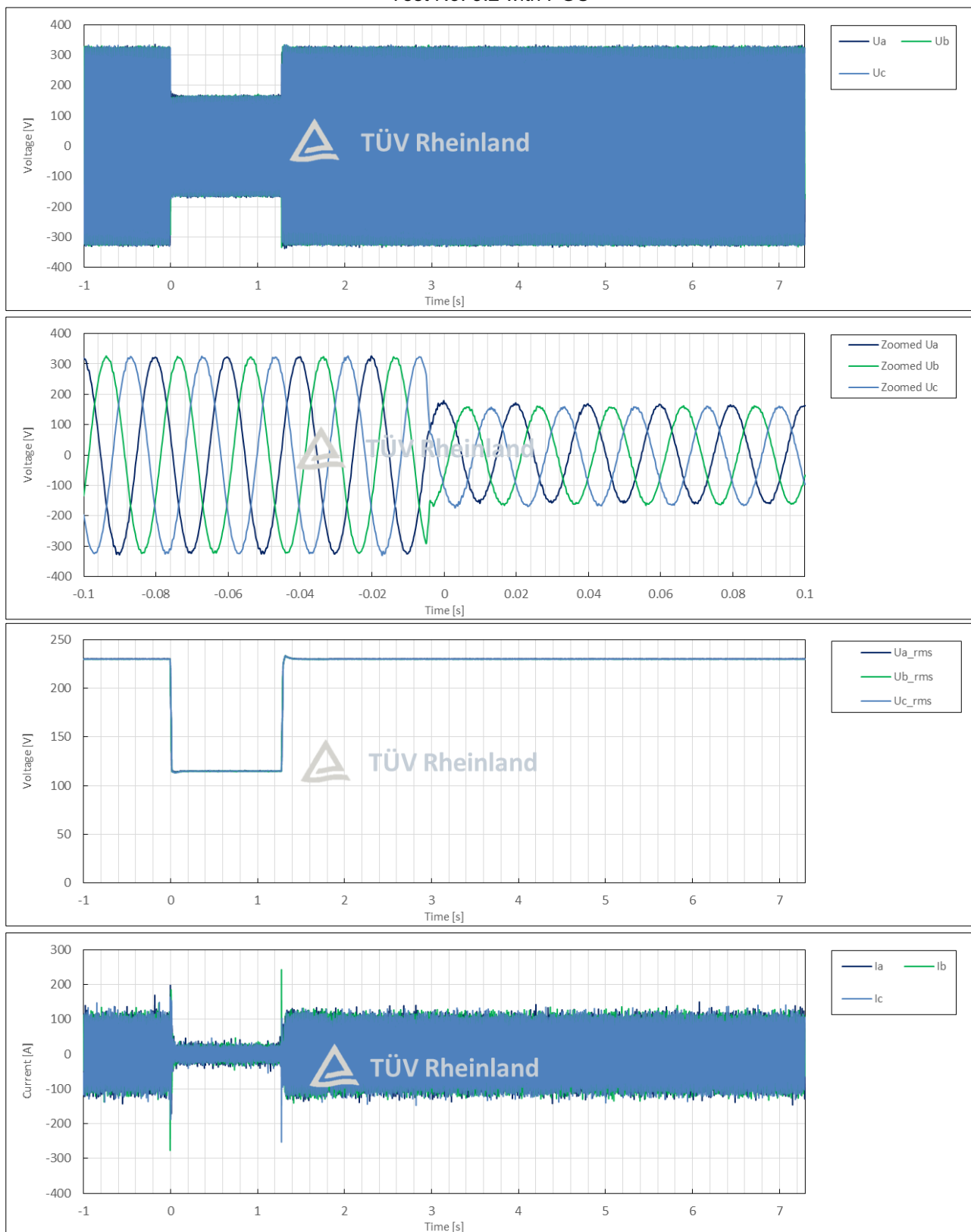
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	3.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:25:47
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		655
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	655
	8	Fault duration in empty load test	Total	--	ms	655
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.25
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.50
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.04
	21		Phase 3			0.03
	22	Line current	Phase 1	t1+80ms	p.u.	0.02
	23		Phase 2			0.03
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 3.2 idle test



Test No. 3.2 with PGU



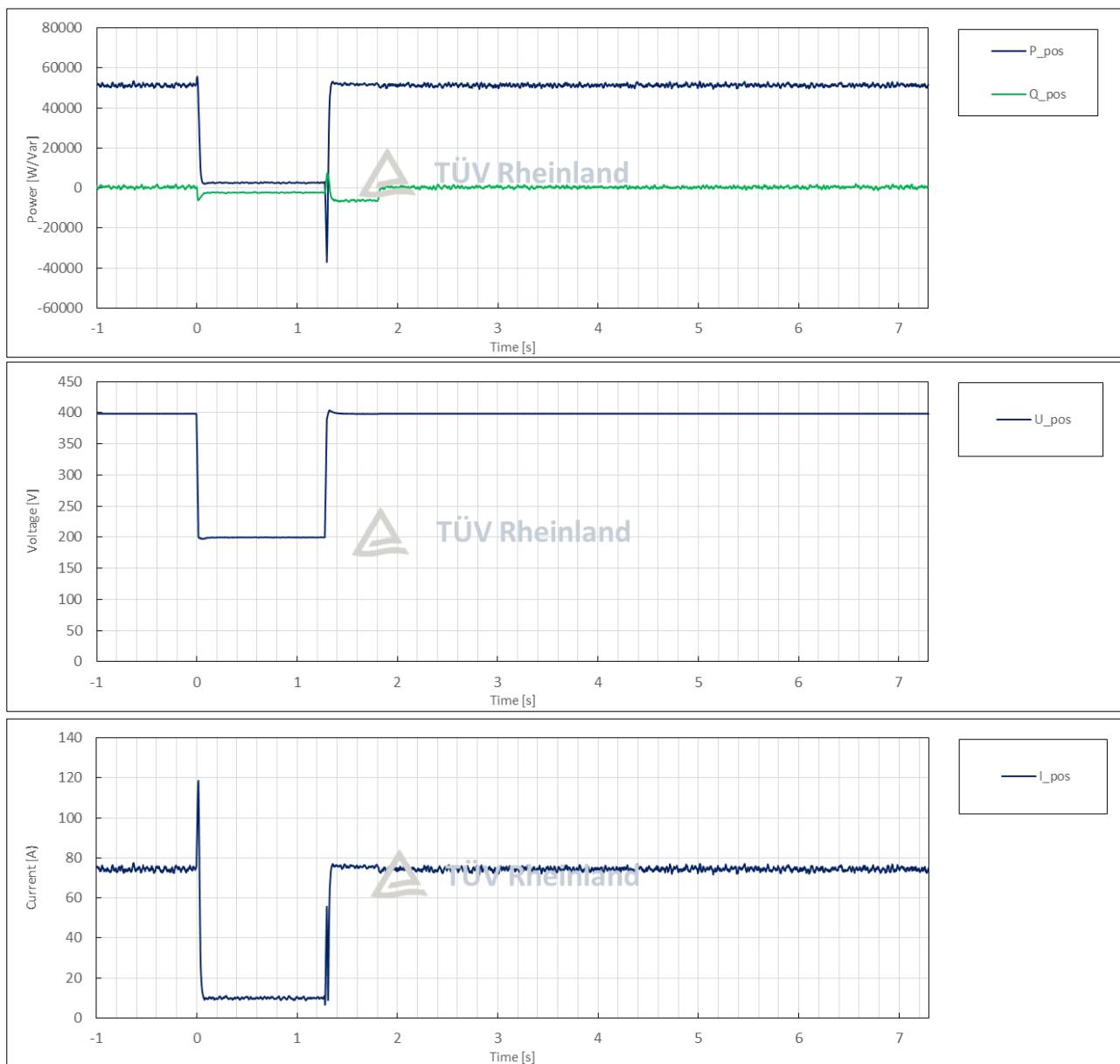
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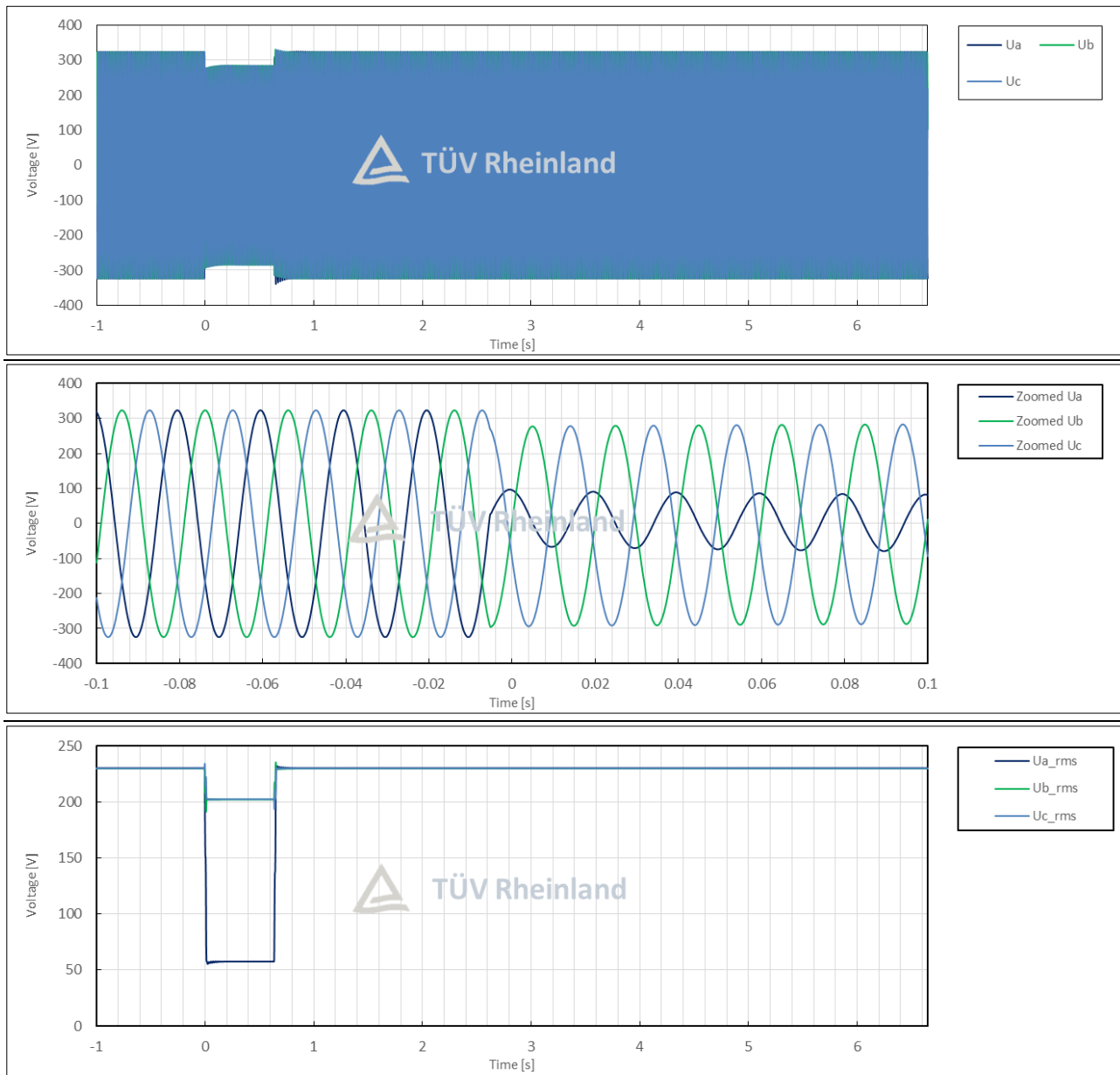


Prüfbericht-Nr.: CN25HVW8 001 Attachment 1
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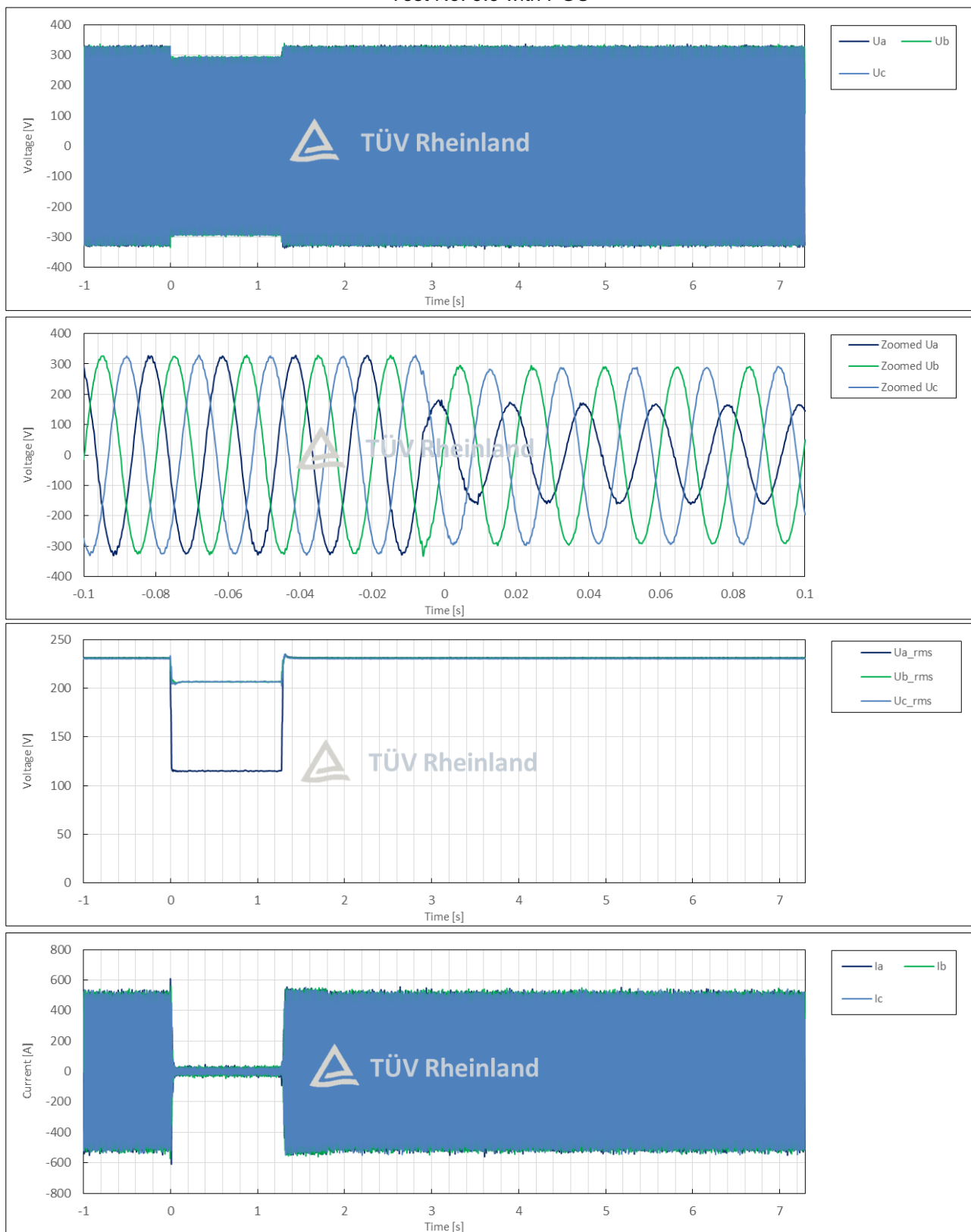
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5.8	TABLE: Verification of dynamic network supporting (FVRT)					P/F
	Condition					Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	3.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:26:29
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		650
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	650
	8	Fault duration in empty load test	Total	--	ms	650
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.63
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.01
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.50
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.02
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.02
	24		Phase 3			0.00
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	30	Active power rising time	Pos.	--	s	0.035
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 3.3 idle test

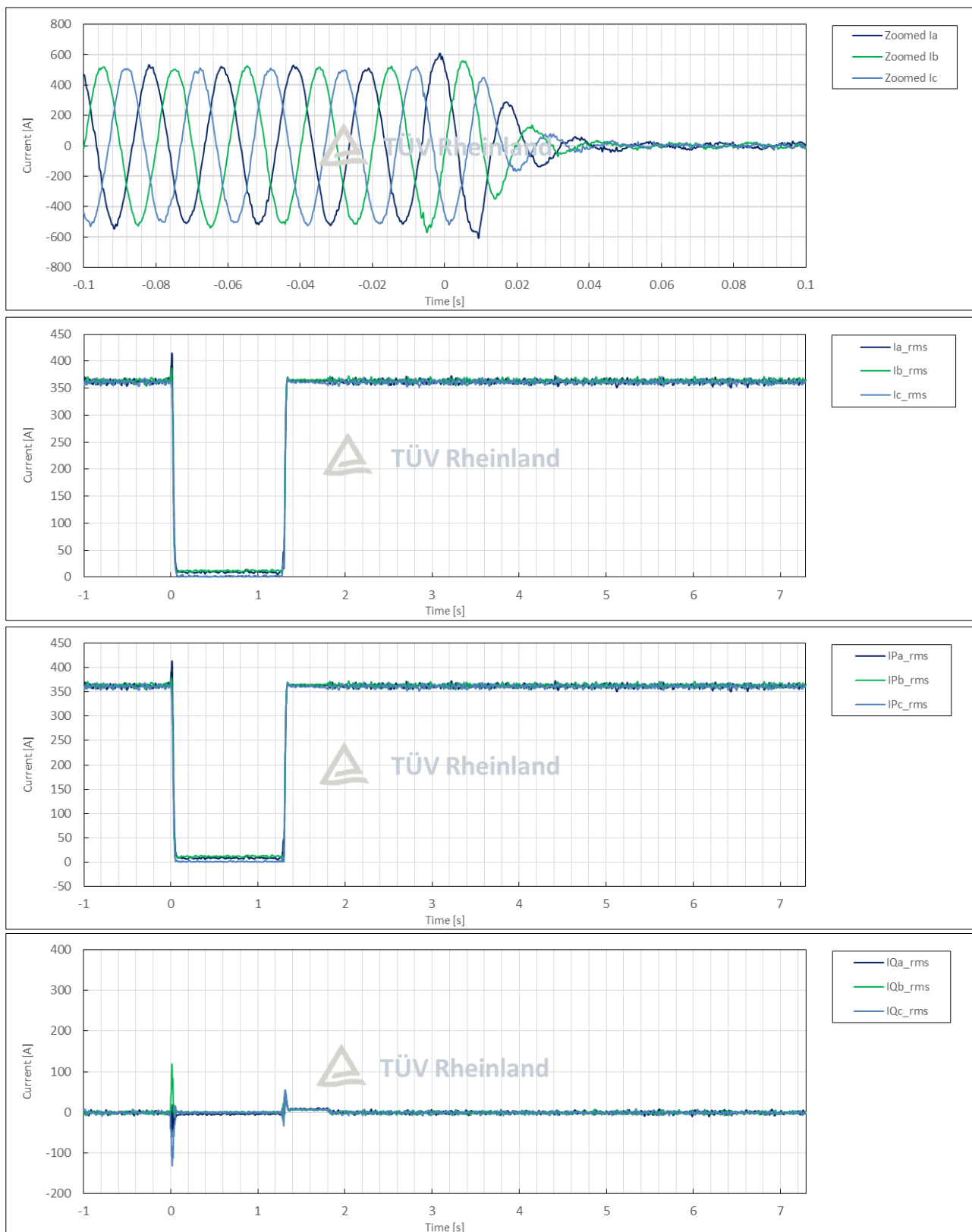


Test No. 3.3 with PGU



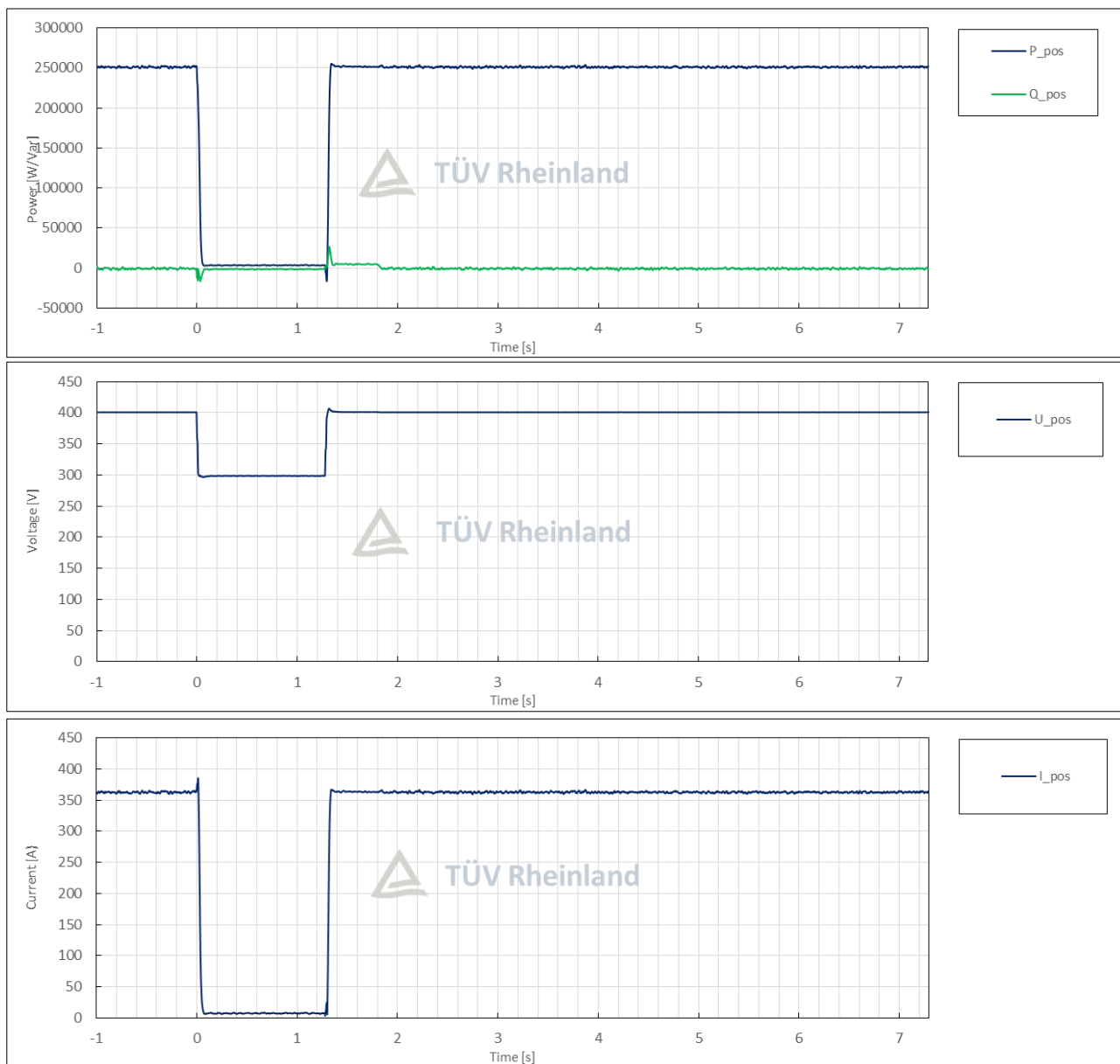
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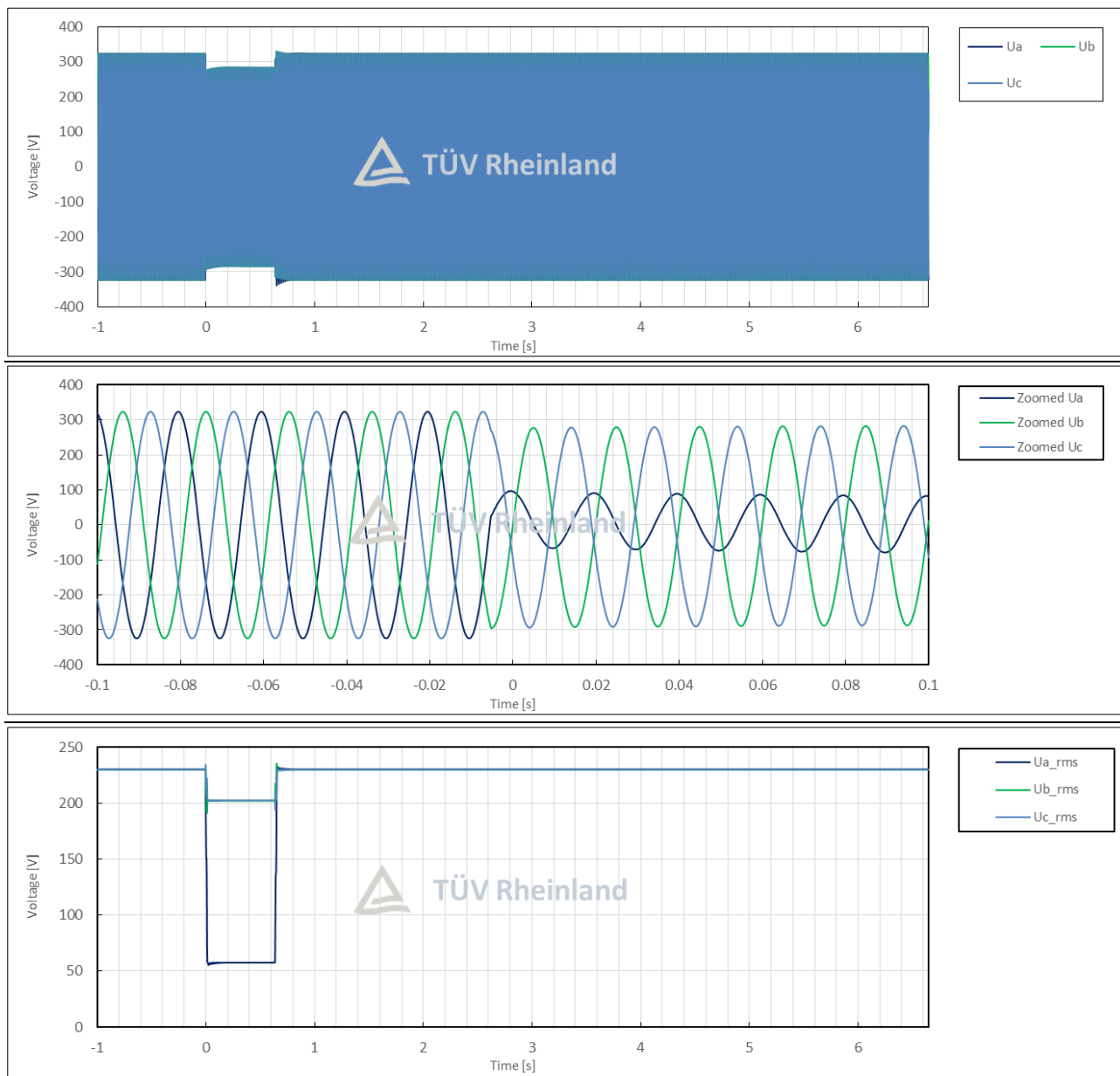


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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	3.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:27:08
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		650
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	650
	8	Fault duration in empty load test	Total	--	ms	650
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.63
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.50
	19	Line current	Phase 1	t1+50ms	p.u.	0.04
	20		Phase 2			0.03
	21		Phase 3			0.02
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.03
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

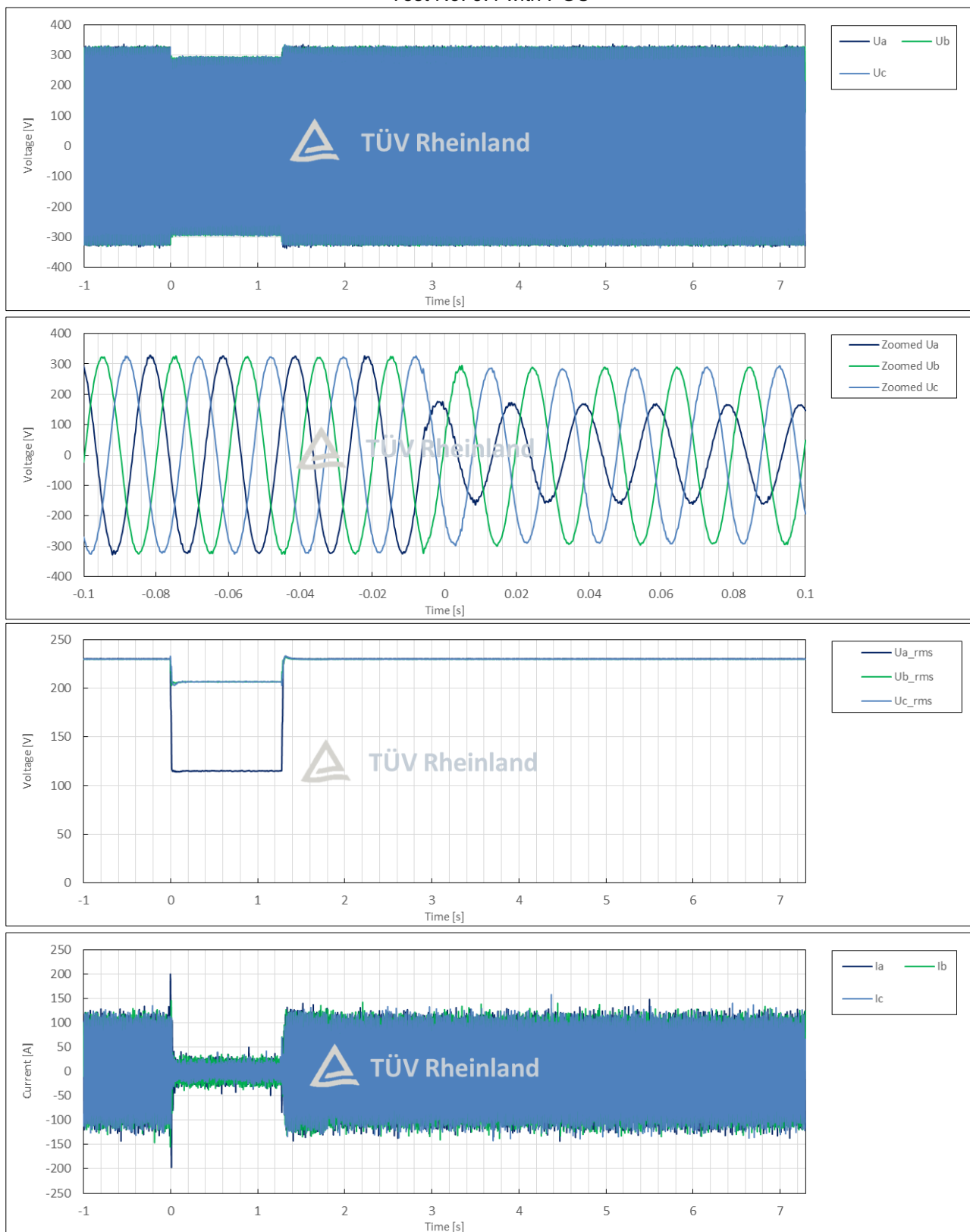
Test No. 3.4 idle test



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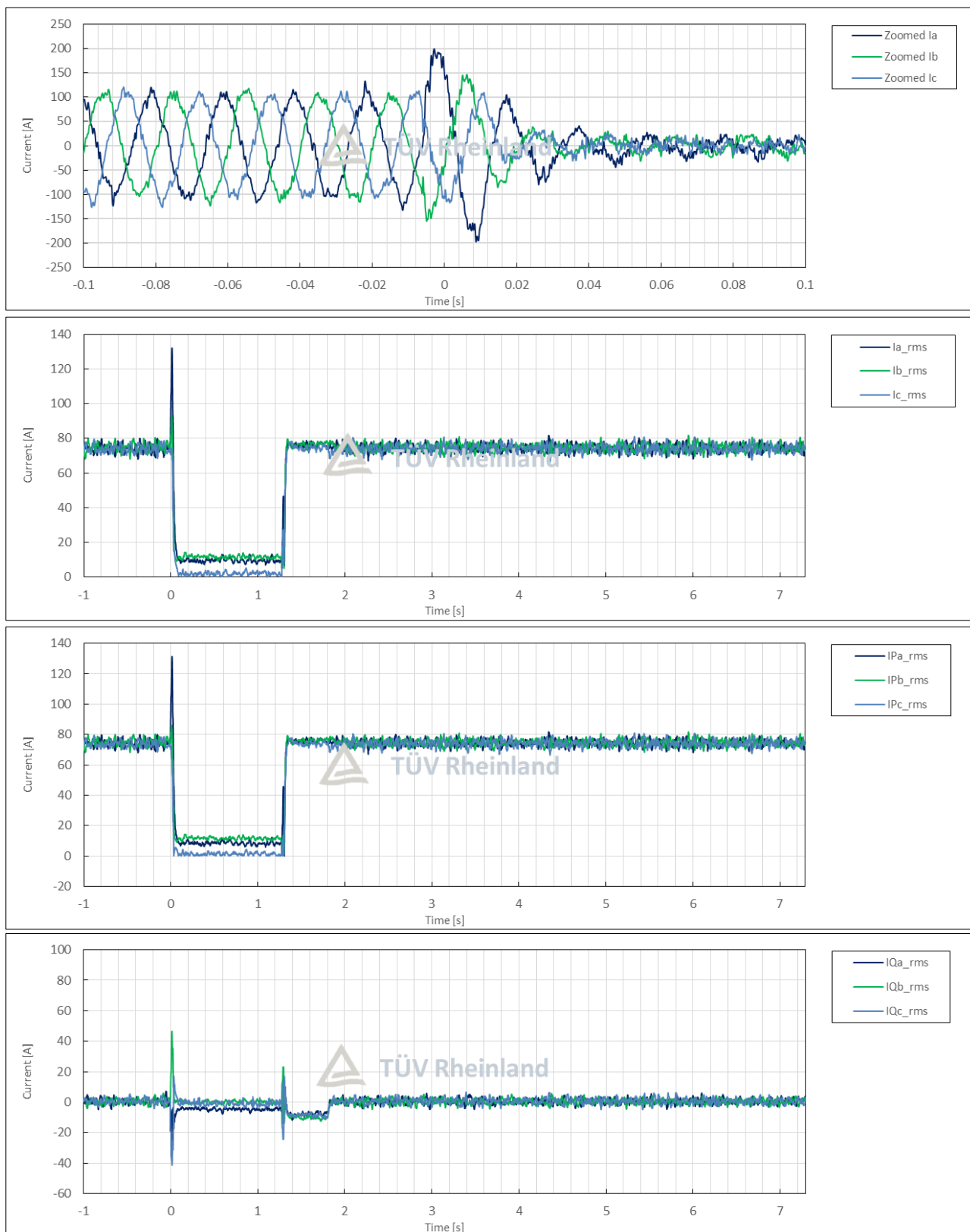
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Test No. 3.4 with PGU



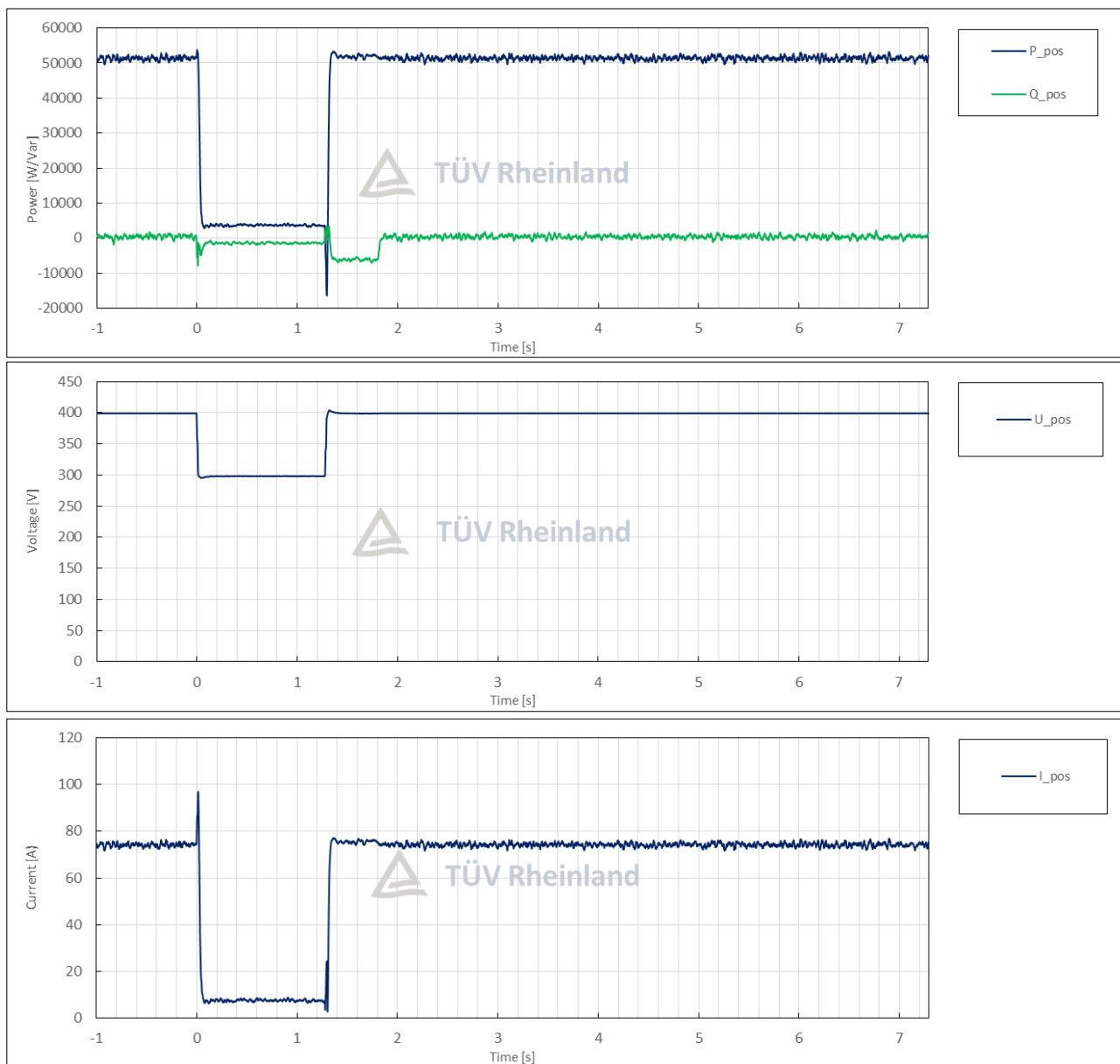
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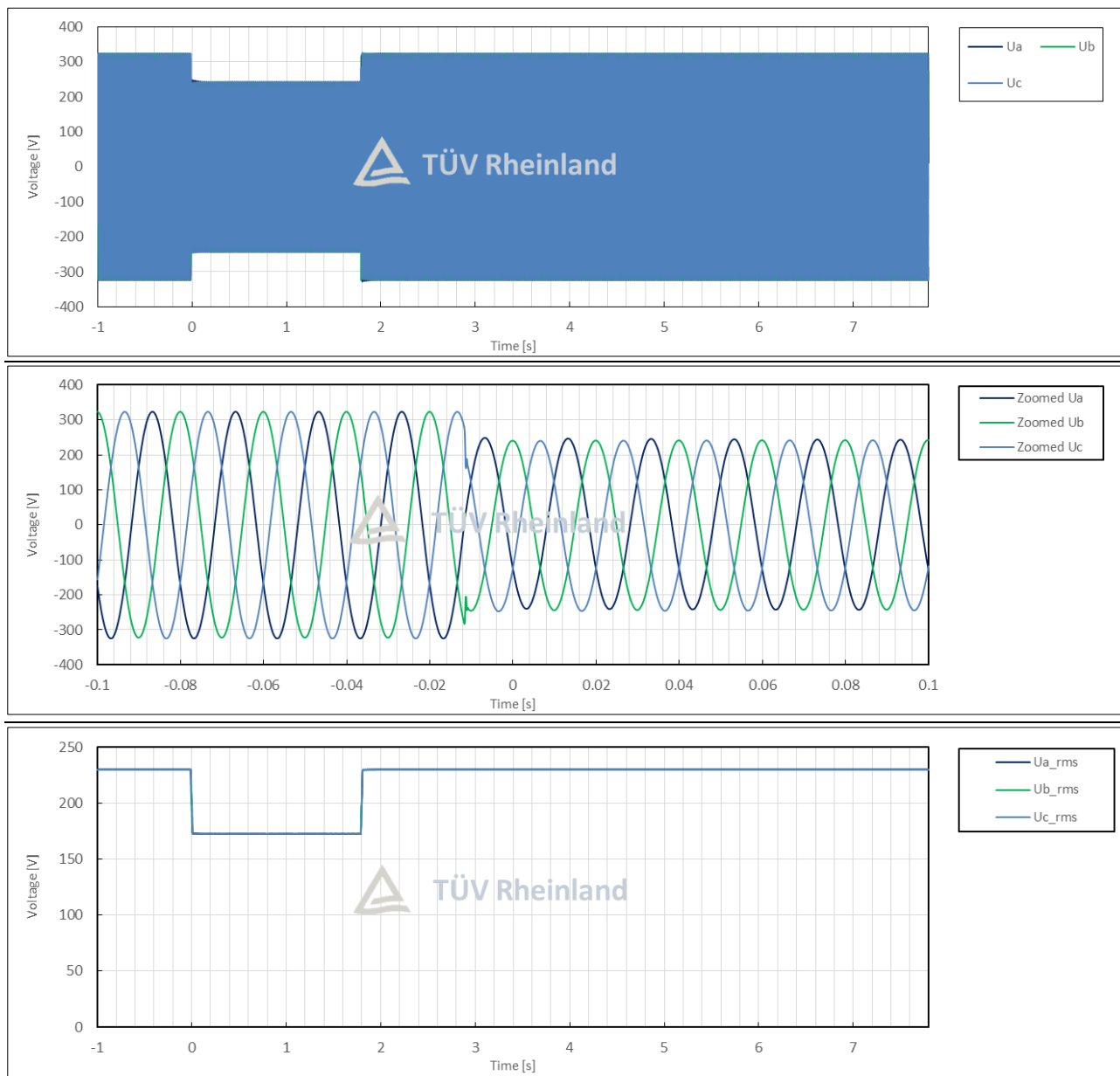


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Test report no.:

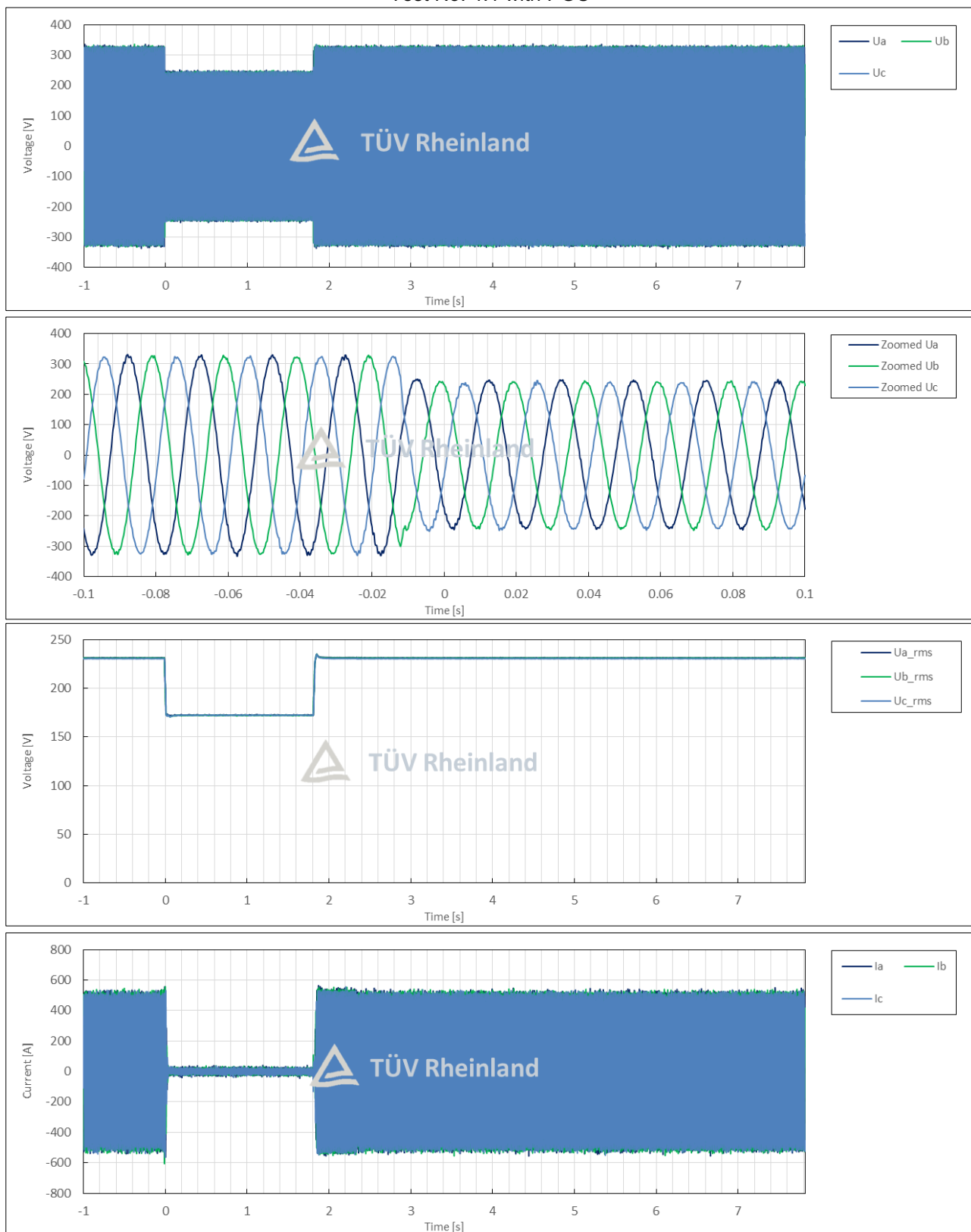
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	4.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:27:47
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.75
	5	Setting dip duration		--		1798
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	1798
	8	Fault duration in empty load test	Total	--	ms	1798
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.75
	10		Pos.		p.u.	0.75
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.01
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.75
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.03
	21		Phase 3			0.01
	22	Line current	Phase 1	t1+80ms	p.u.	0.02
	23		Phase 2			0.02
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	0.041
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 4.1 idle test



Test No. 4.1 with PGU





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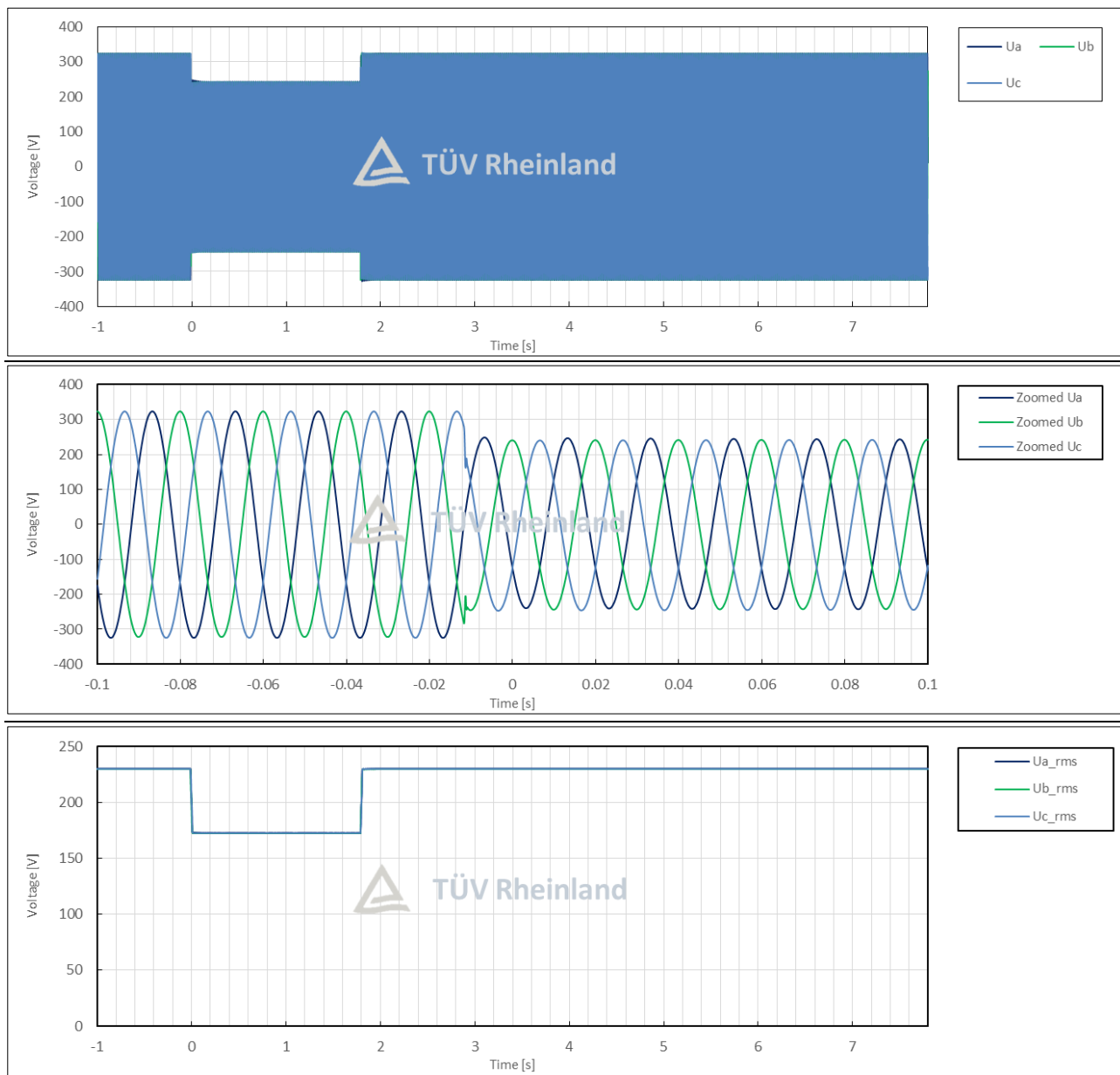


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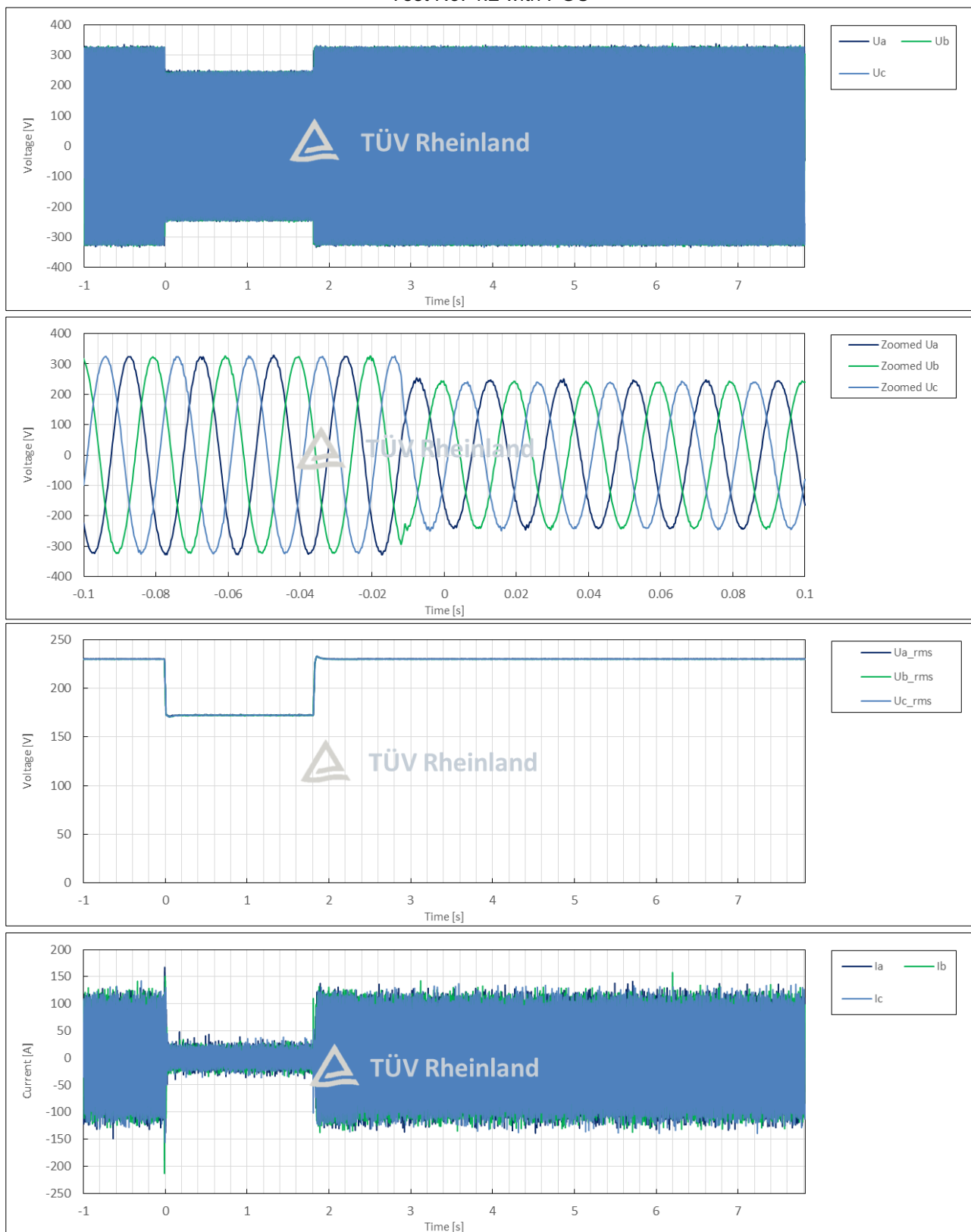
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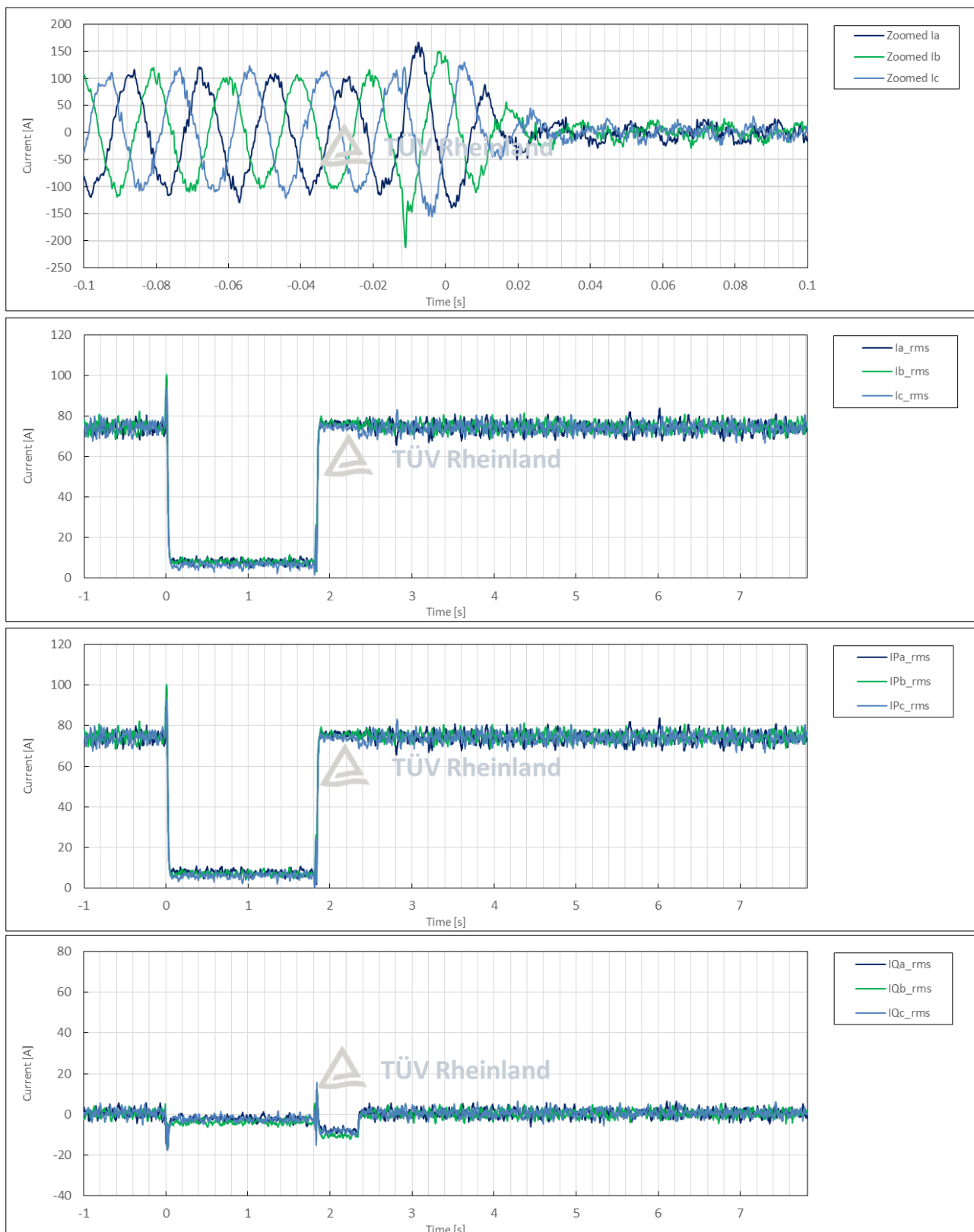
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	4.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:28:27
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.75
	5	Setting dip duration		--		1798
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	1798
	8	Fault duration in empty load test	Total	--	ms	1798
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.75
	10		Pos.		p.u.	0.75
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.75
	19	Line current	Phase 1	t1+50ms	p.u.	0.02
	20		Phase 2			0.02
	21		Phase 3			0.02
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.02
	24		Phase 3			0.02
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.039
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 4.2 idle test



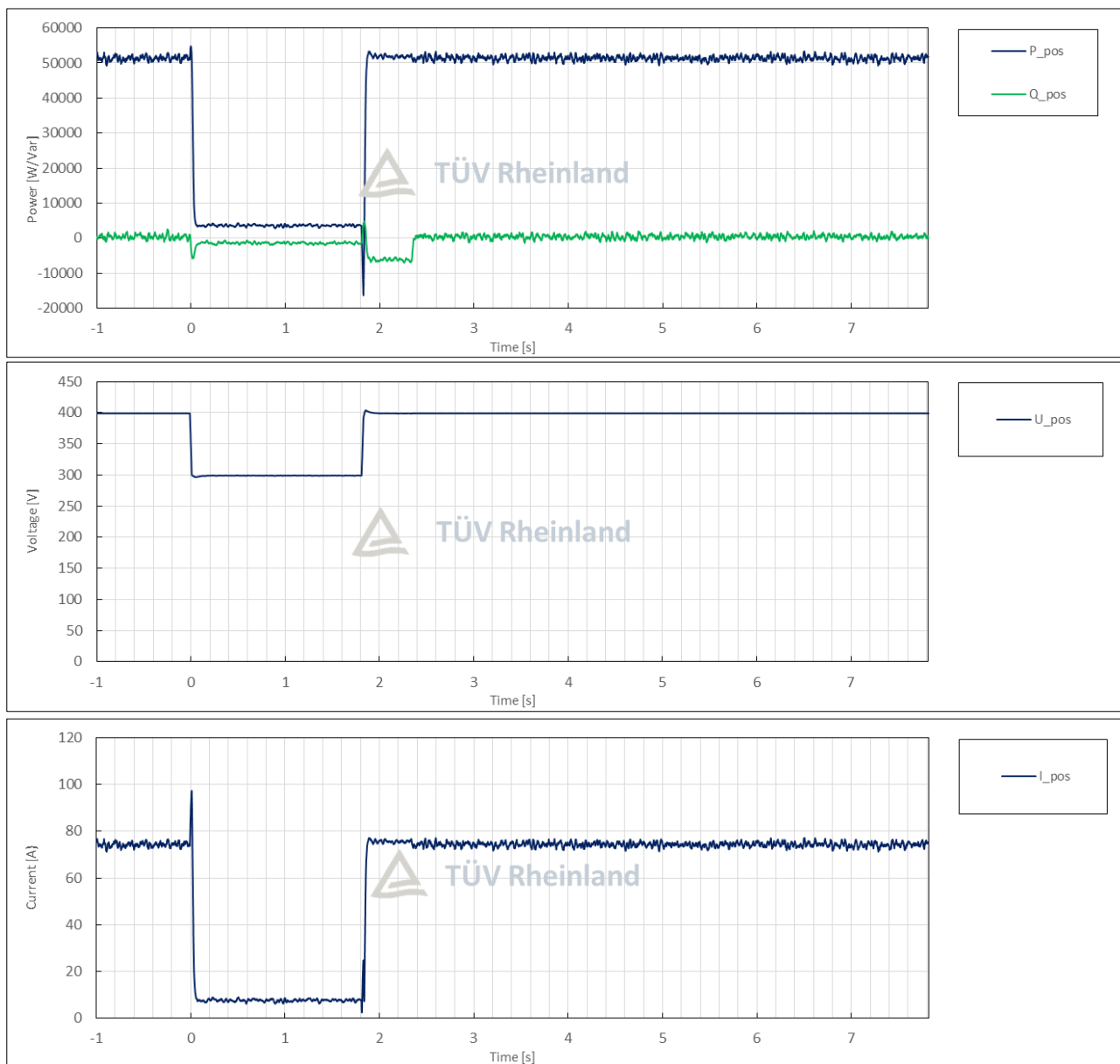
Test No. 4.2 with PGU





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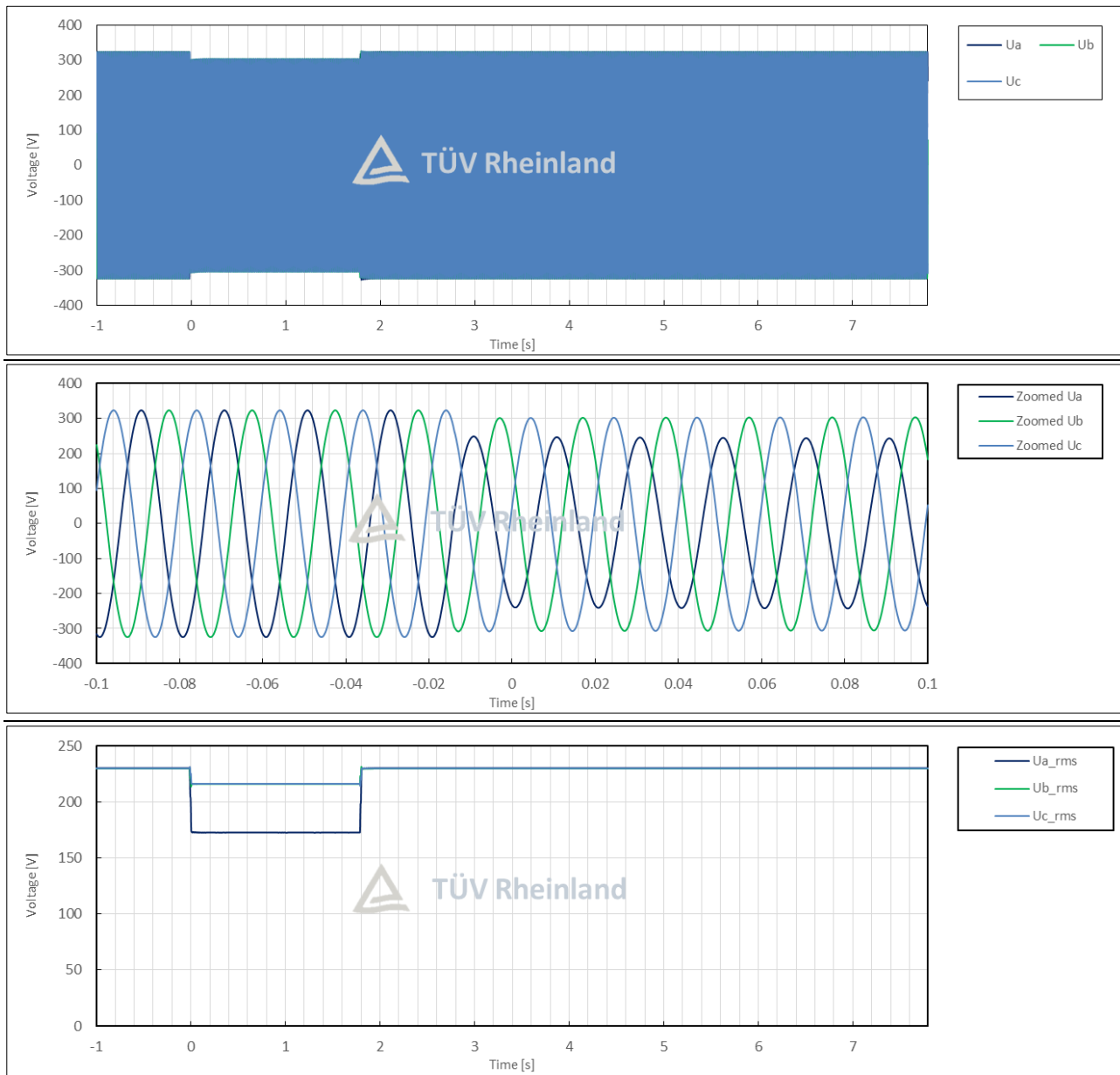


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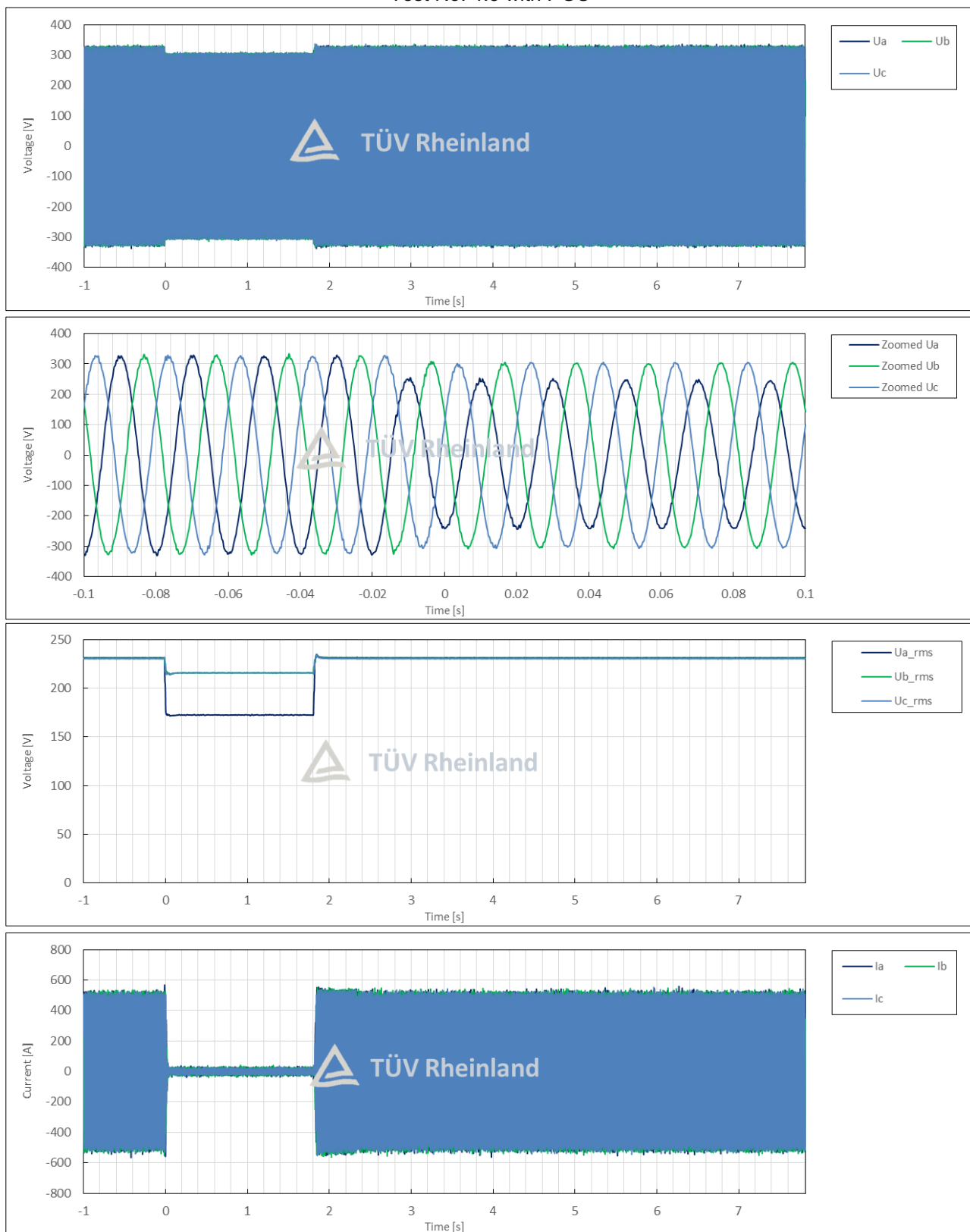
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	4.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:29:15
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.75
	5	Setting dip duration		--		1793
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	1793
	8	Fault duration in empty load test	Total	--	ms	1793
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.75
	10		Pos.		p.u.	0.87
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.75
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.03
	21		Phase 3			0.01
	22	Line current	Phase 1	t1+80ms	p.u.	0.02
	23		Phase 2			0.02
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.02
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.04
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 4.3 idle test



Test No. 4.3 with PGU



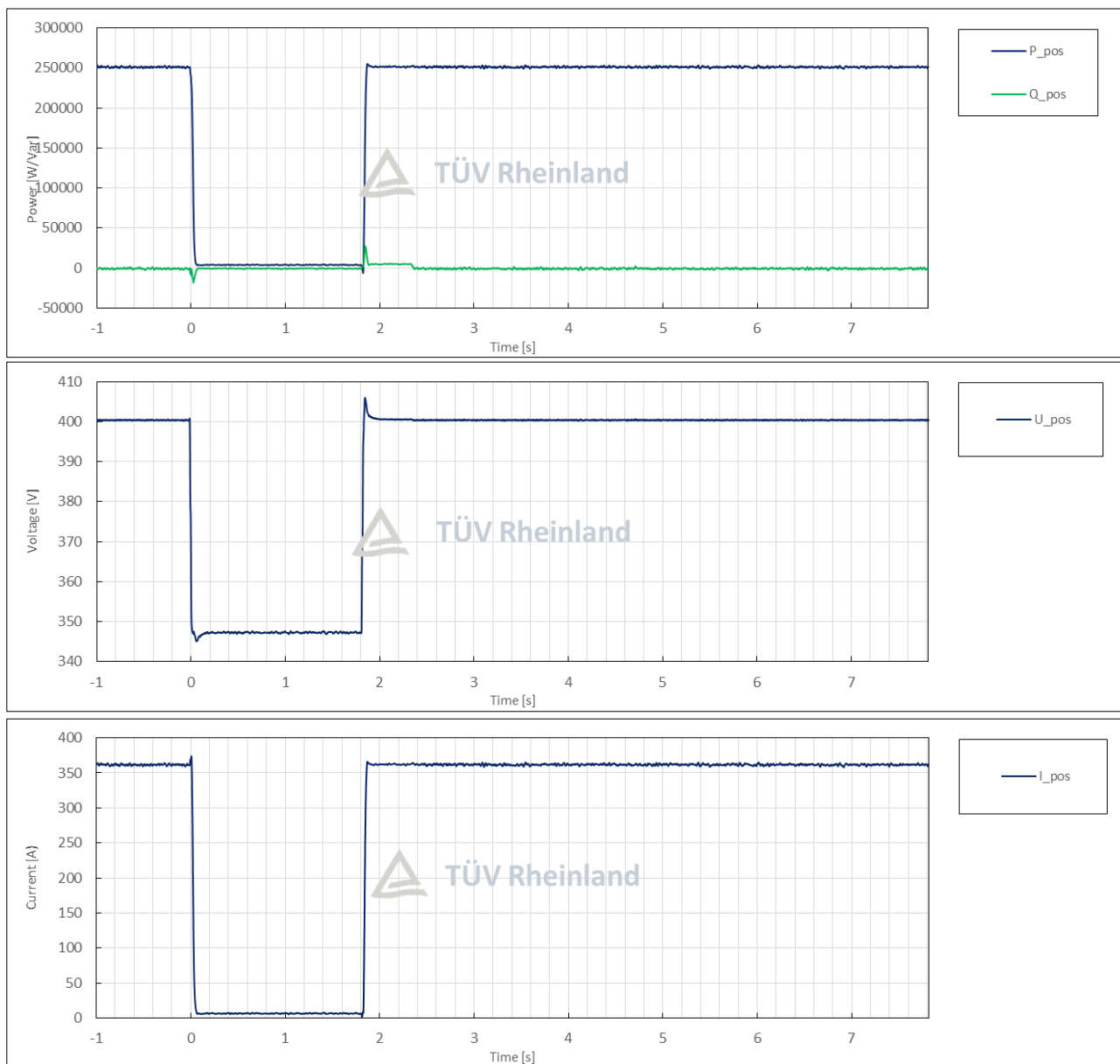
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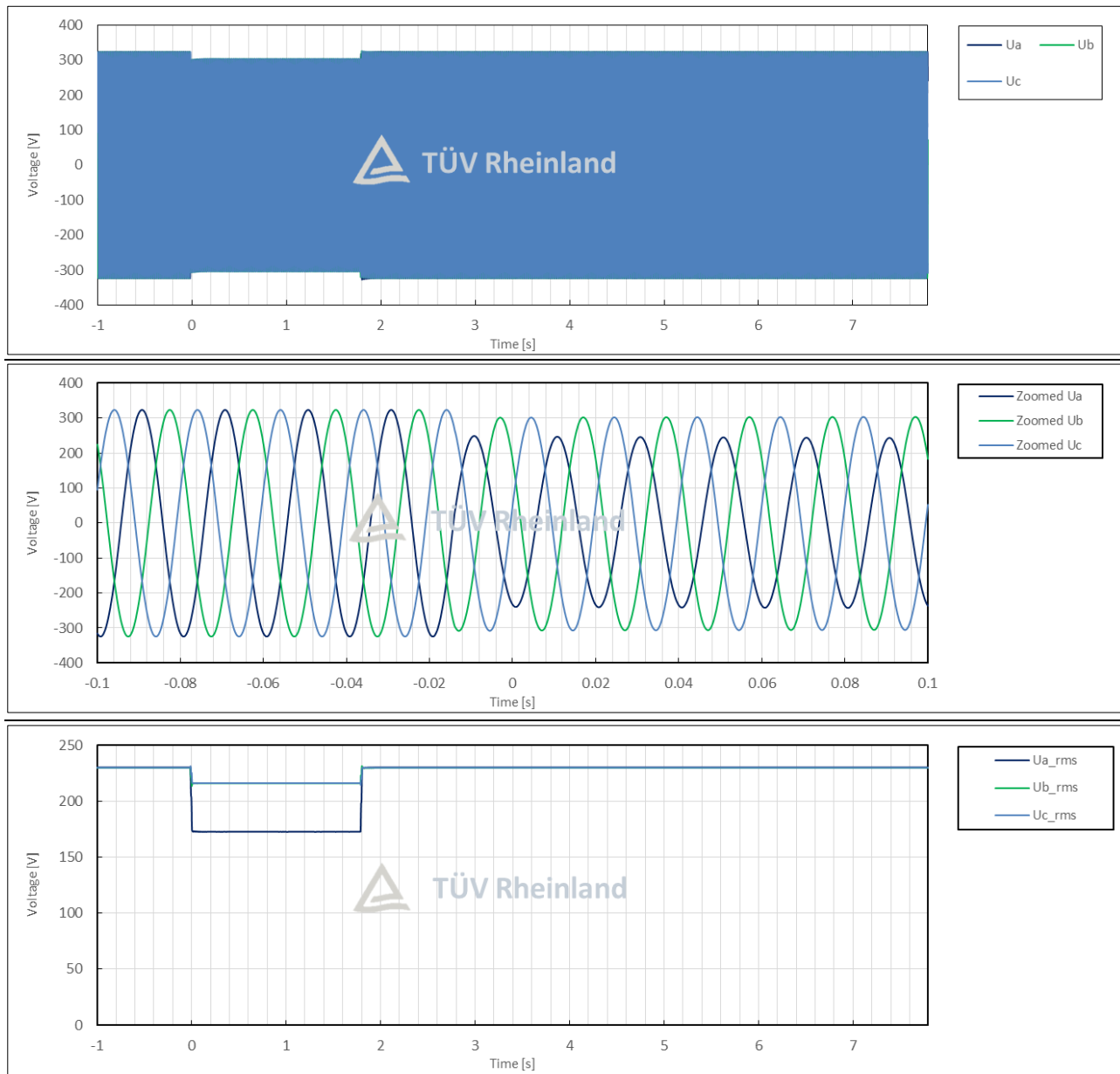


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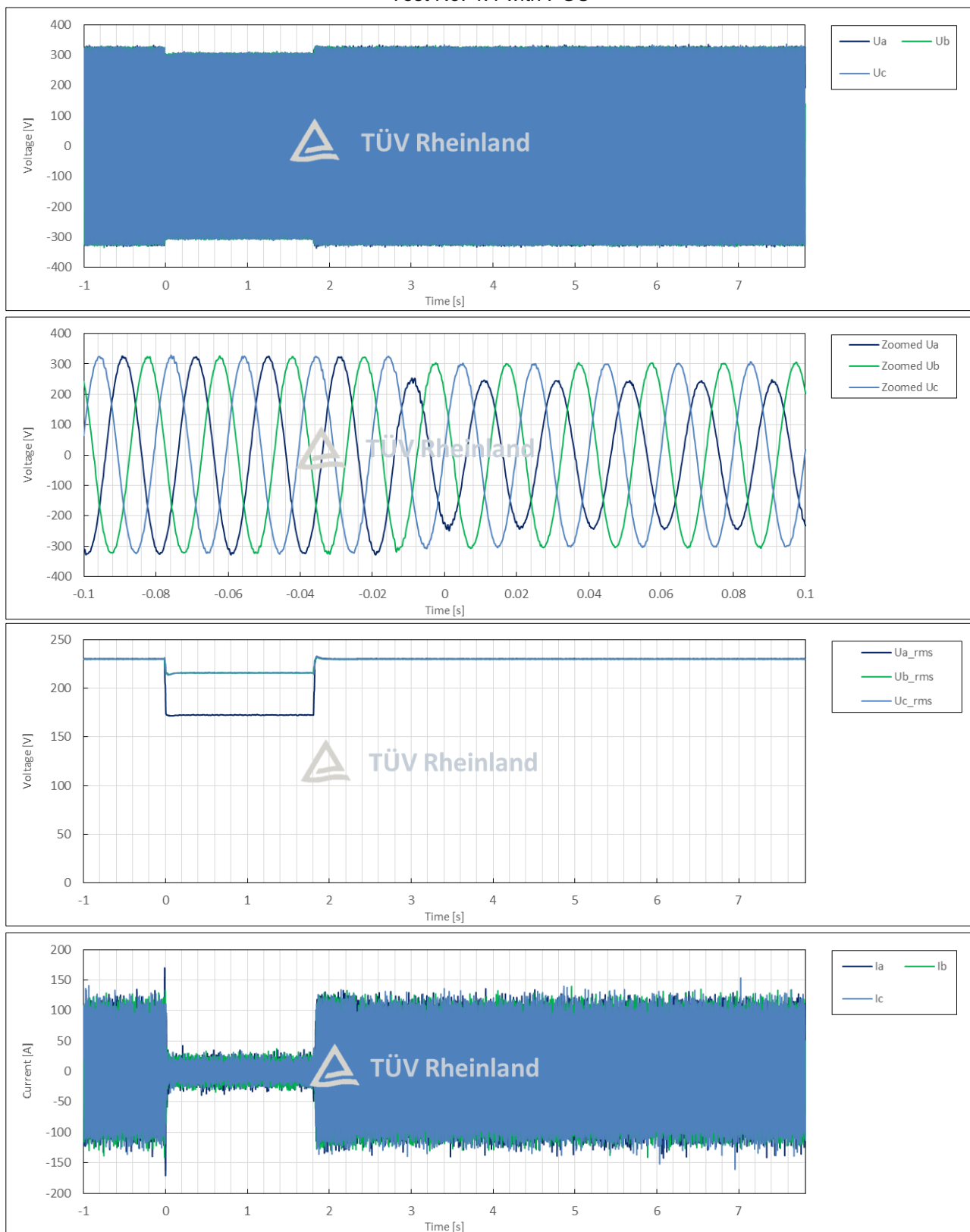
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	4.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:30:04
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.75
	5	Setting dip duration		--		1793
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	1793
	8	Fault duration in empty load test	Total	--	ms	1793
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.75
	10		Pos.		p.u.	0.87
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.75
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.02
	21		Phase 3			0.01
	22	Line current	Phase 1	t1+80ms	p.u.	0.02
	23		Phase 2			0.03
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.02
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.037
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 4.4 idle test



Test No. 4.4 with PGU



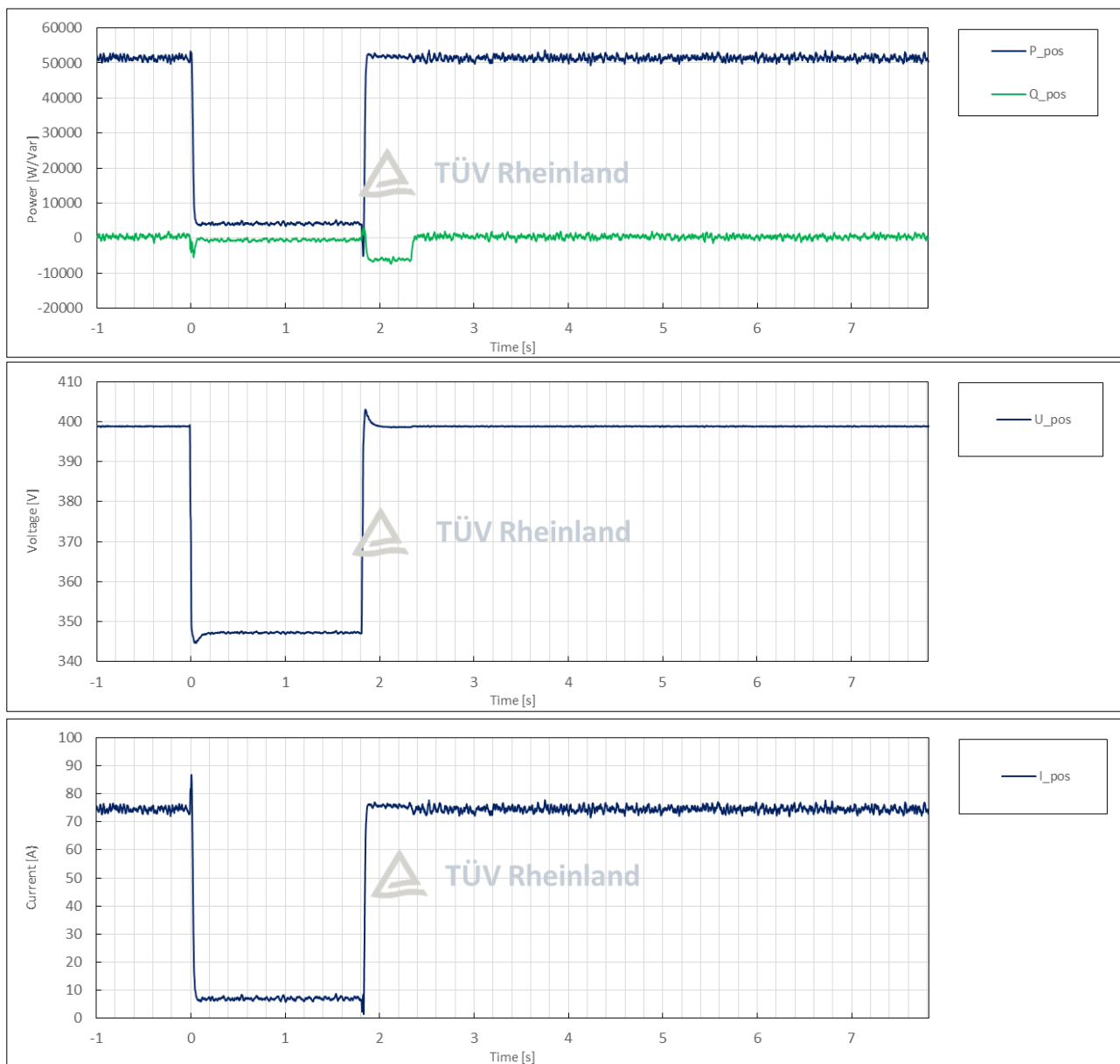
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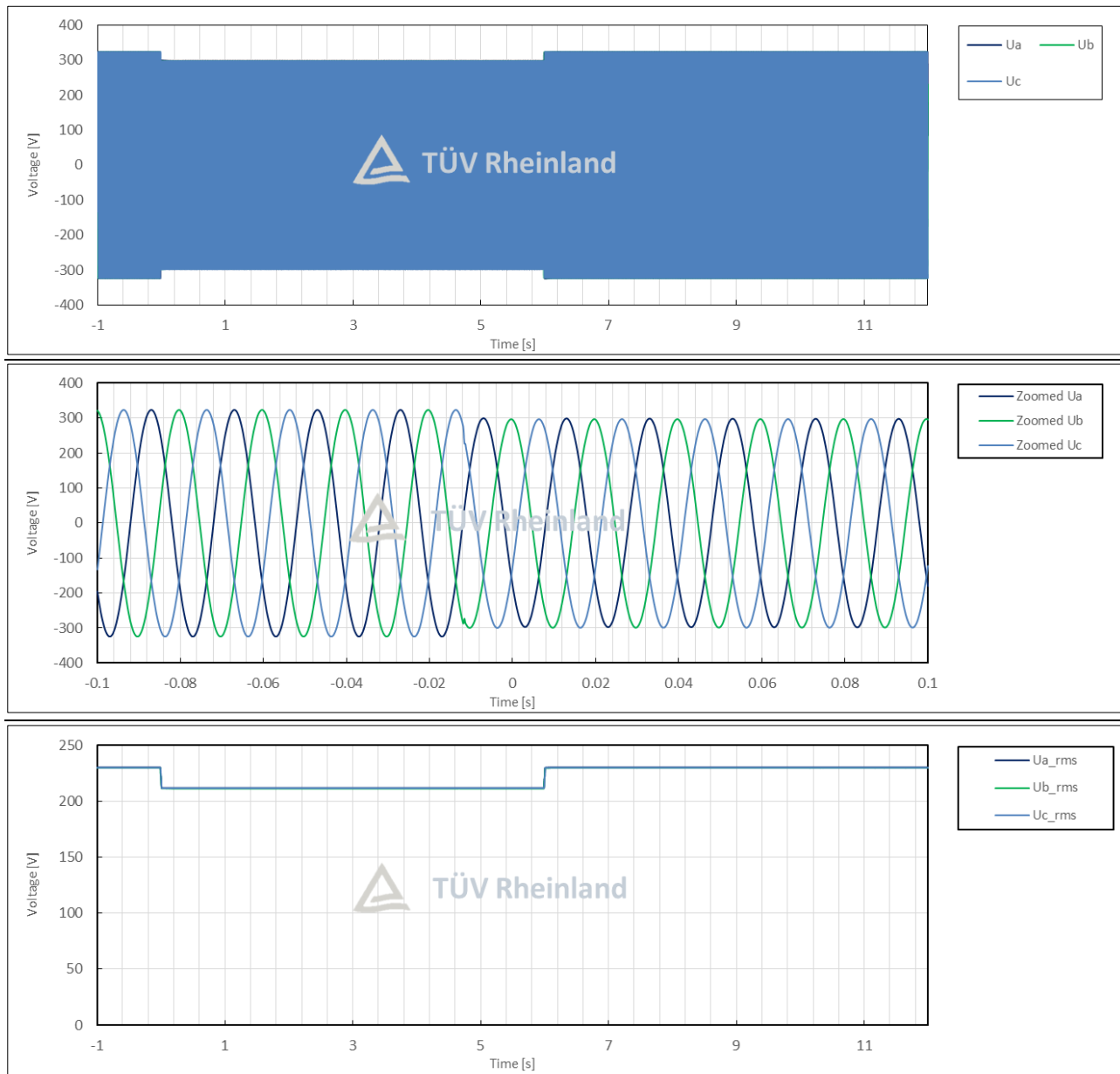


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Test report no.:

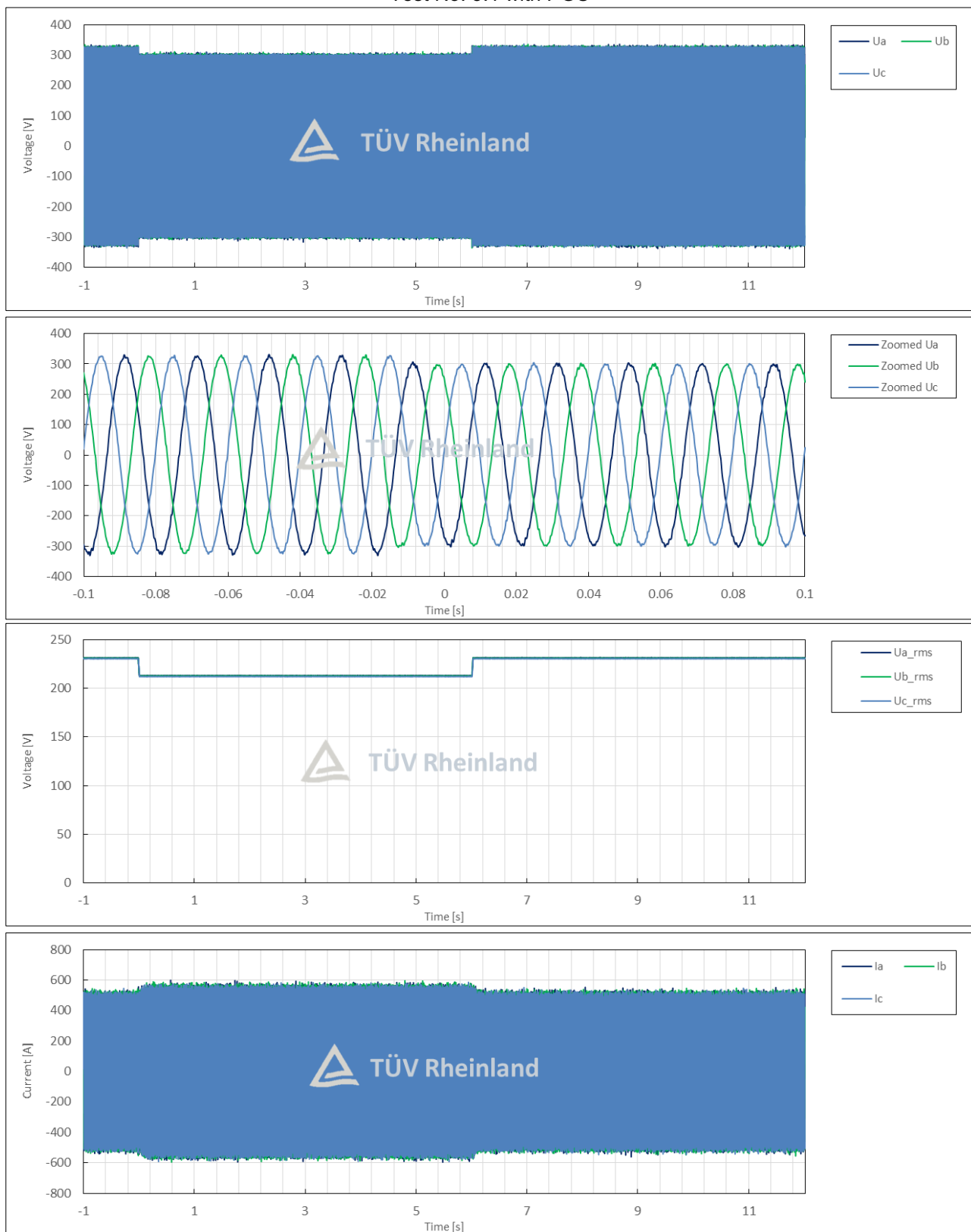
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	5.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:31:34
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.92
	5	Setting dip duration		--		5997
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	5997
	8	Fault duration in empty load test	Total	--	ms	5997
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.92
	10		Pos.		p.u.	0.92
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.01
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.92
	19	Line current	Phase 1	t1+50ms	p.u.	1.05
	20		Phase 2			1.04
	21		Phase 3			1.05
	22	Line current	Phase 1	t1+80ms	p.u.	1.06
	23		Phase 2			1.08
	24		Phase 3			1.06
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	1.00
	26		Pos.			1.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 5.1 idle test



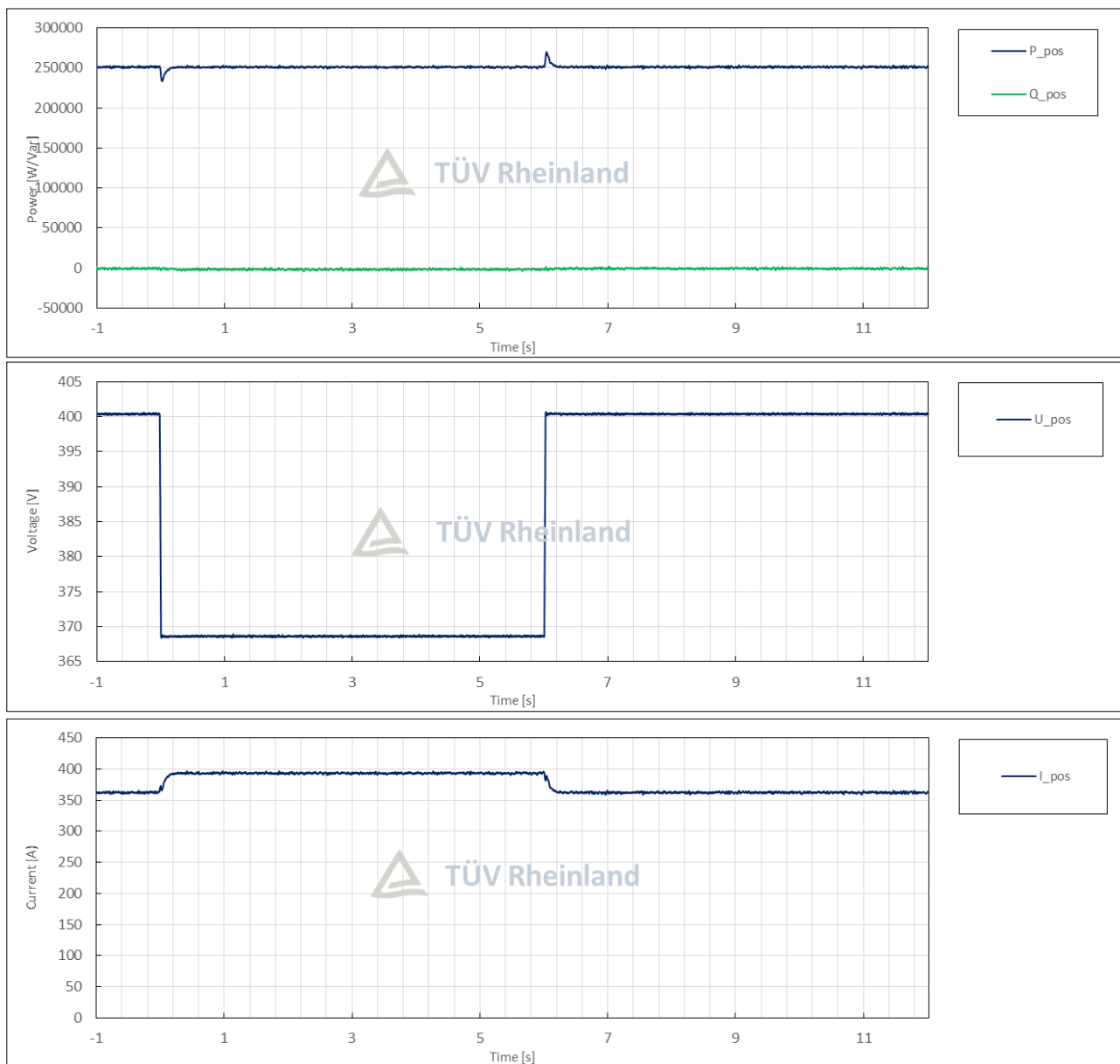
Test No. 5.1 with PGU





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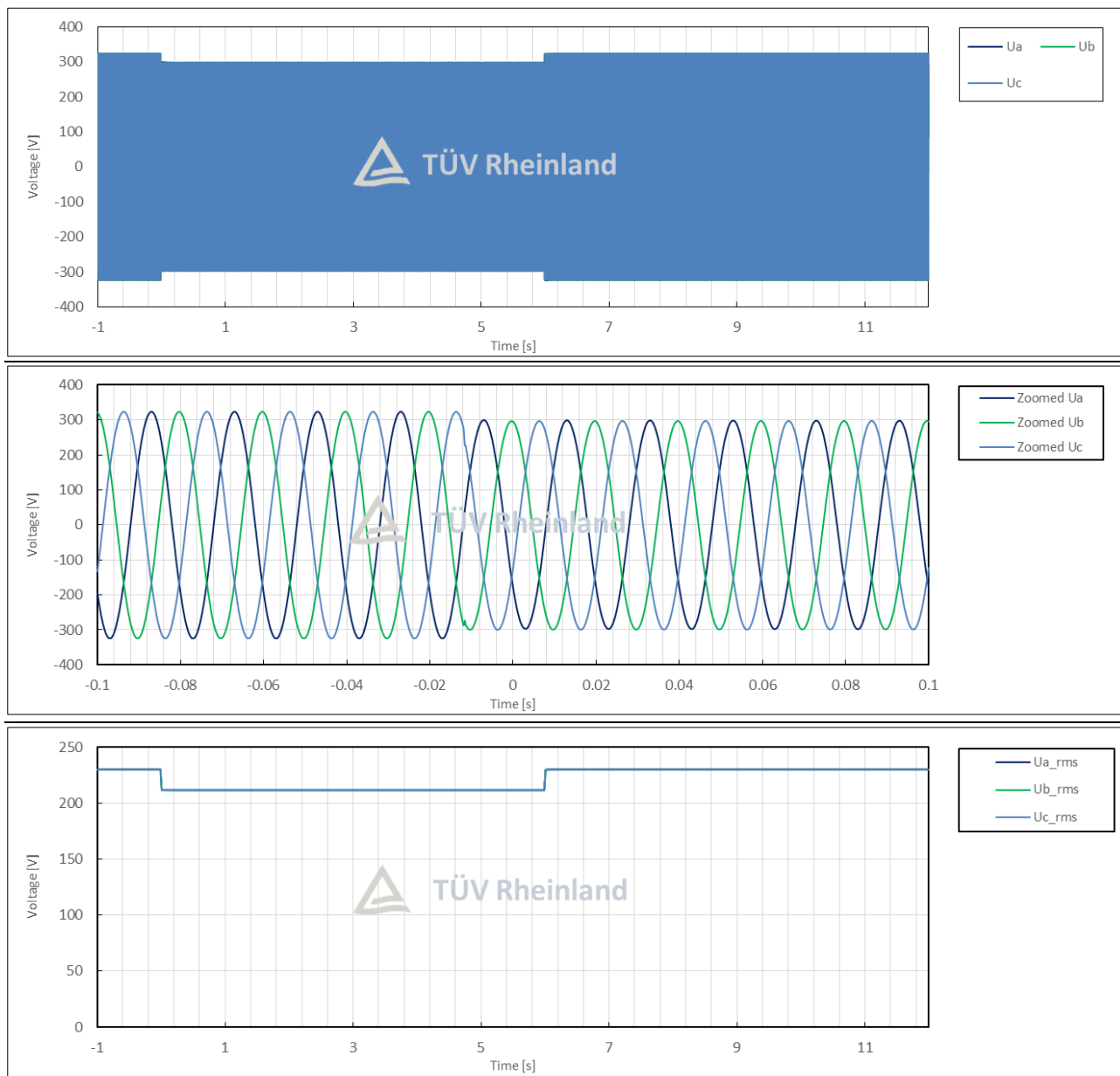


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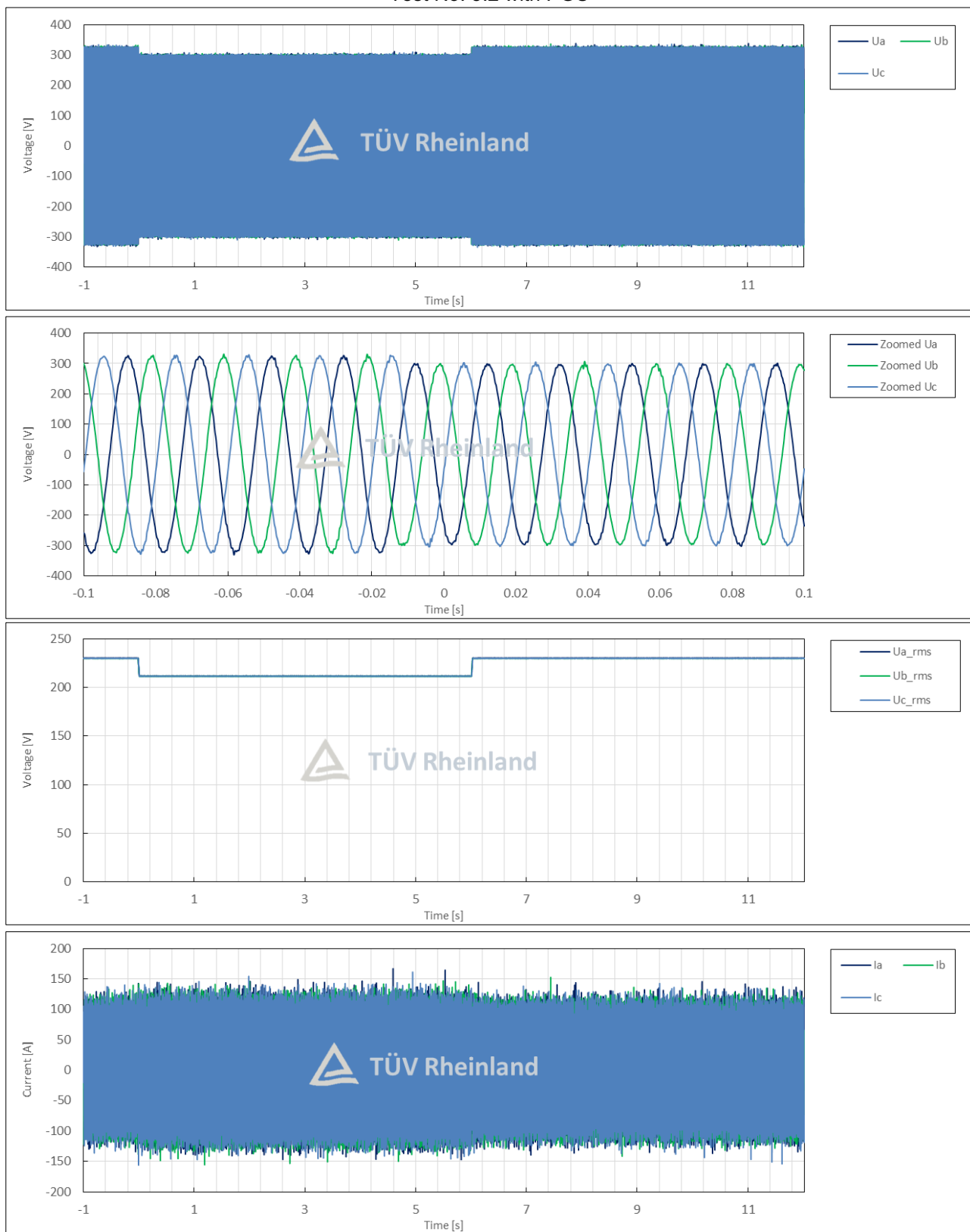
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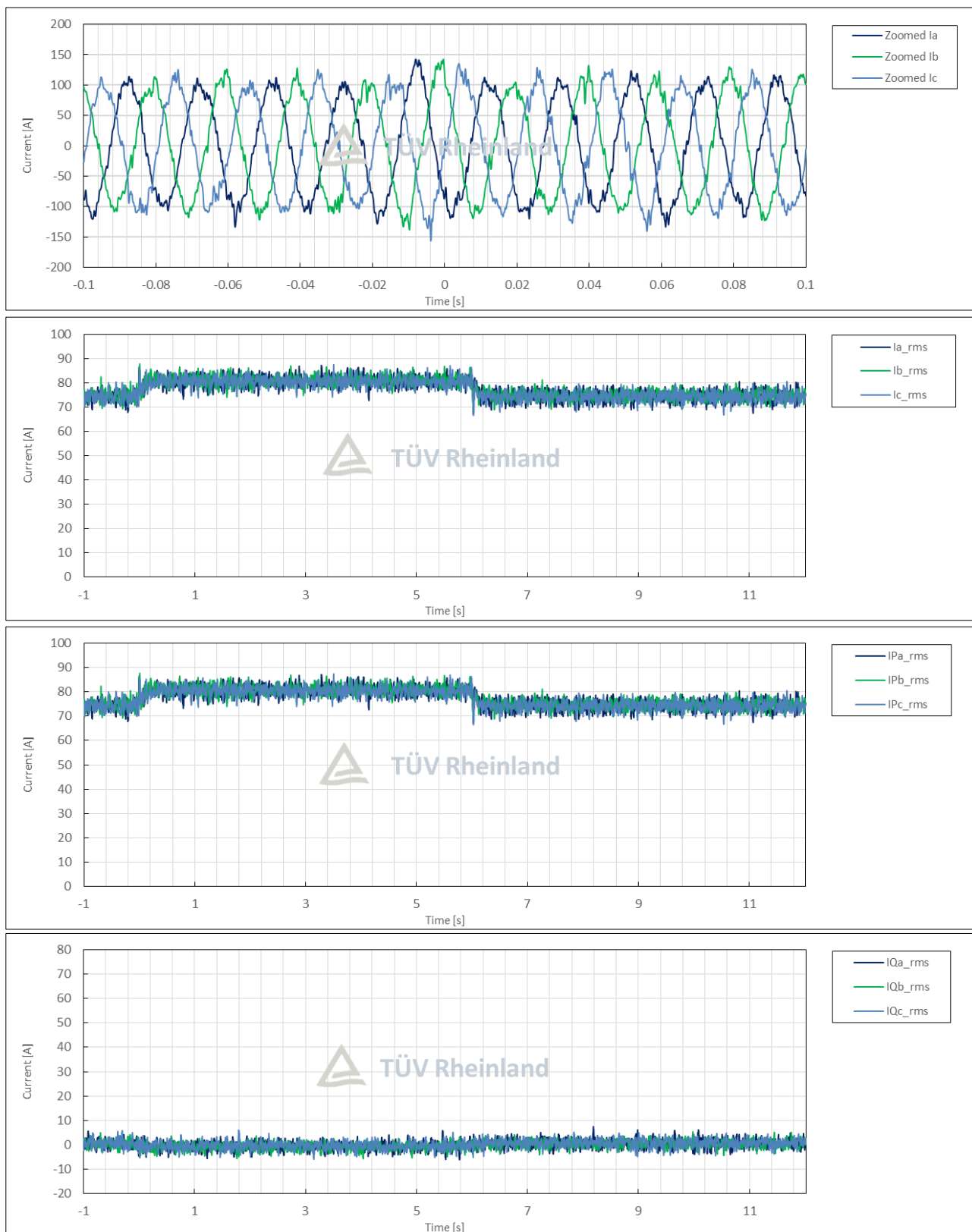
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	5.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:32:20
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.92
	5	Setting dip duration		--		5997
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	5997
	8	Fault duration in empty load test	Total	--	ms	5997
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.92
	10		Pos.		p.u.	0.92
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.92
	19	Line current	Phase 1	t1+50ms	p.u.	0.21
	20		Phase 2			0.21
	21		Phase 3			0.22
	22	Line current	Phase 1	t1+80ms	p.u.	0.21
	23		Phase 2			0.23
	24		Phase 3			0.22
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.21
	26		Pos.			0.21
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 5.2 idle test



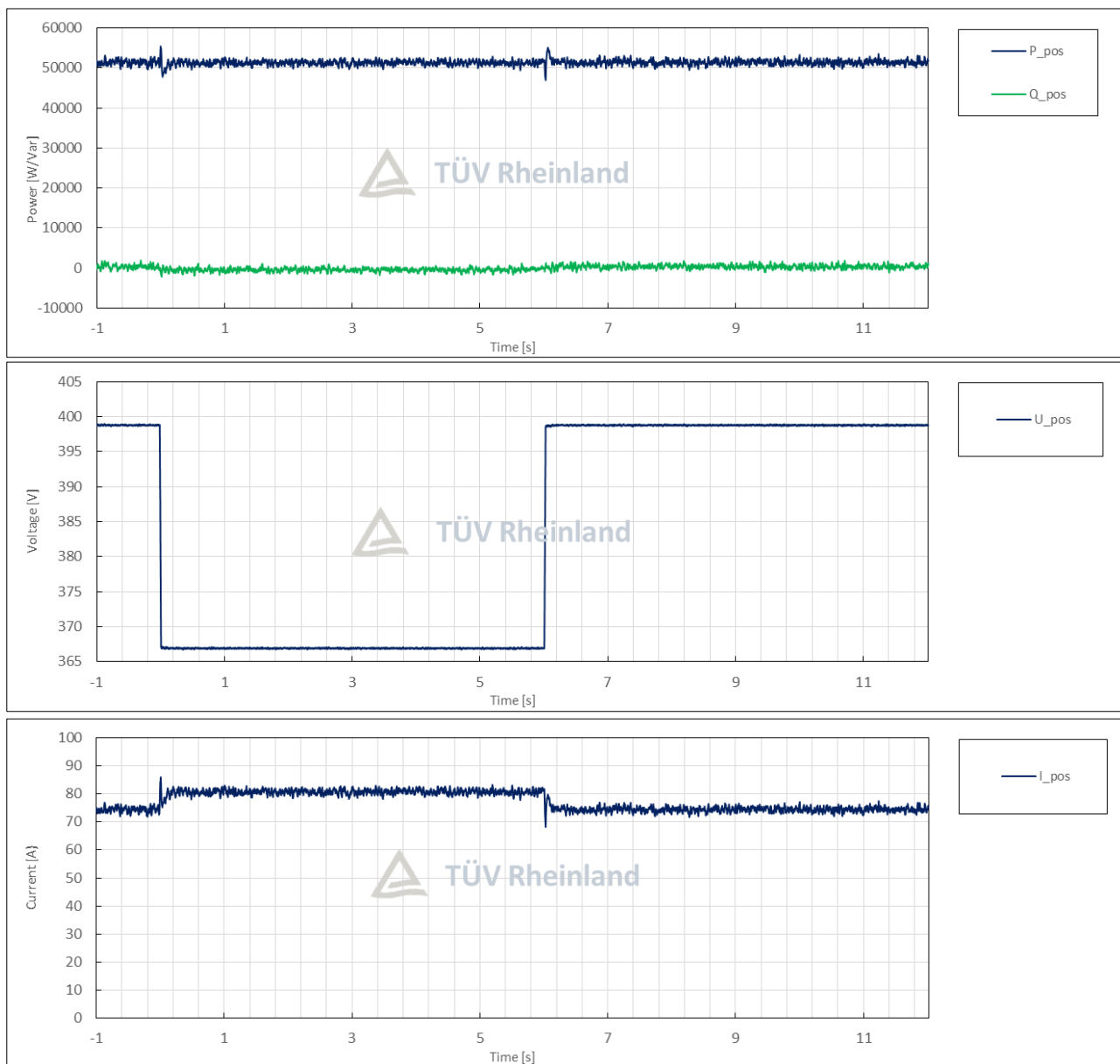
Test No. 5.2 with PGU





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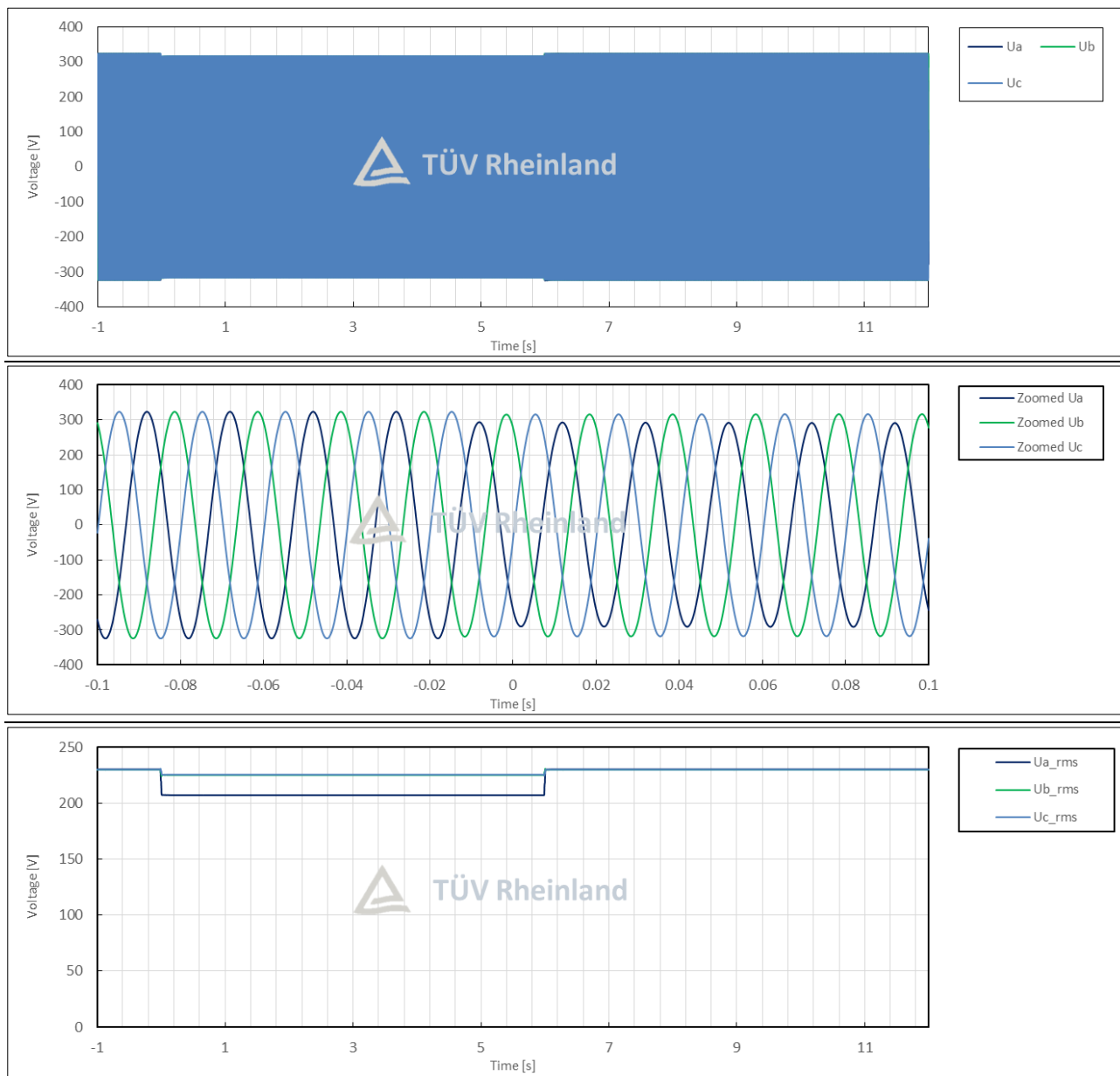


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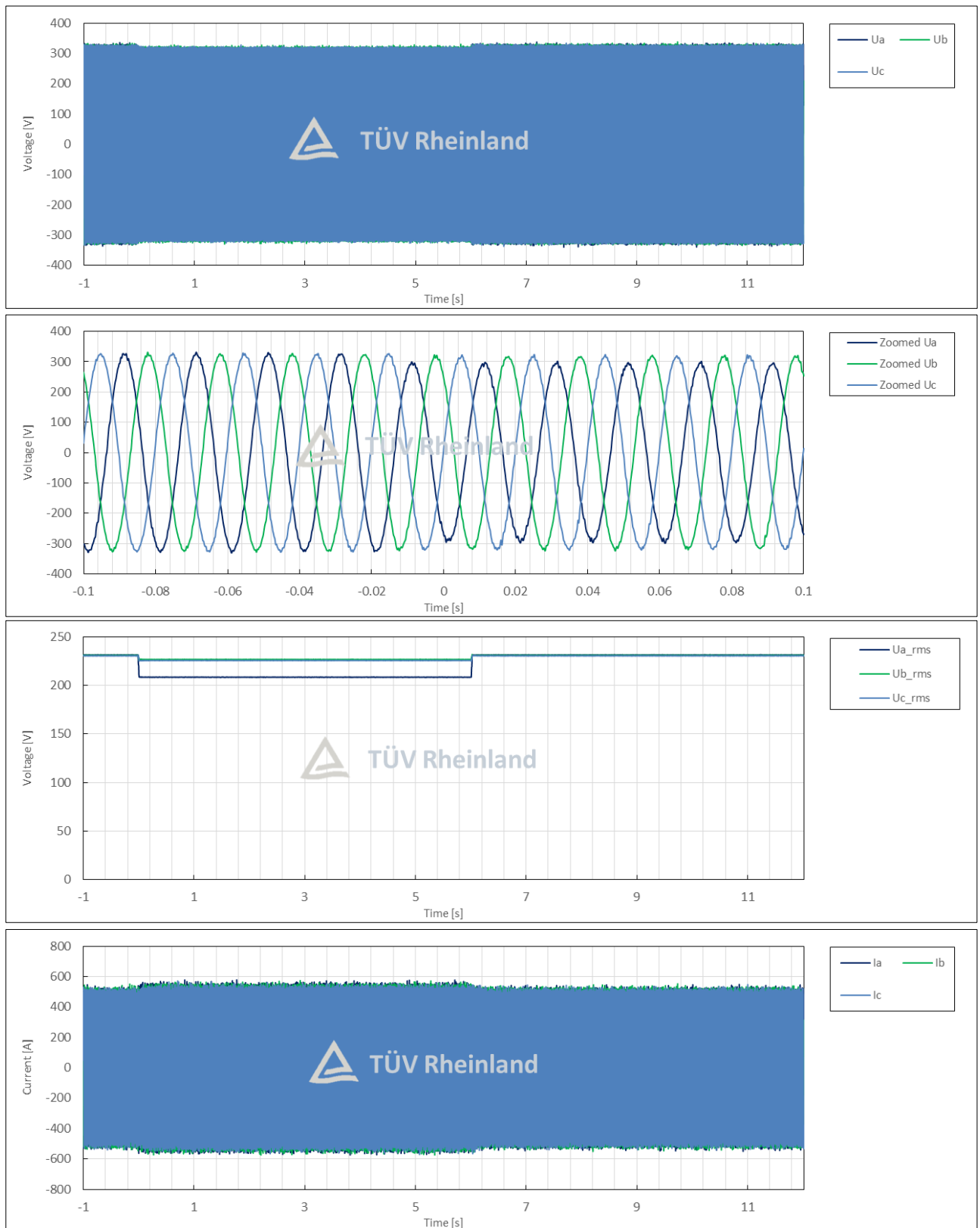
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	5.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:33:09
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.90
	5	Setting dip duration		--		6000
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	6000
	8	Fault duration in empty load test	Total	--	ms	6000
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.90
	10		Pos.		p.u.	0.95
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.01
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.91
	19	Line current	Phase 1	t1+50ms	p.u.	1.05
	20		Phase 2			1.02
	21		Phase 3			1.00
	22	Line current	Phase 1	t1+80ms	p.u.	1.06
	23		Phase 2			1.03
	24		Phase 3			1.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	1.00
	26		Pos.			1.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 5.3 idle test



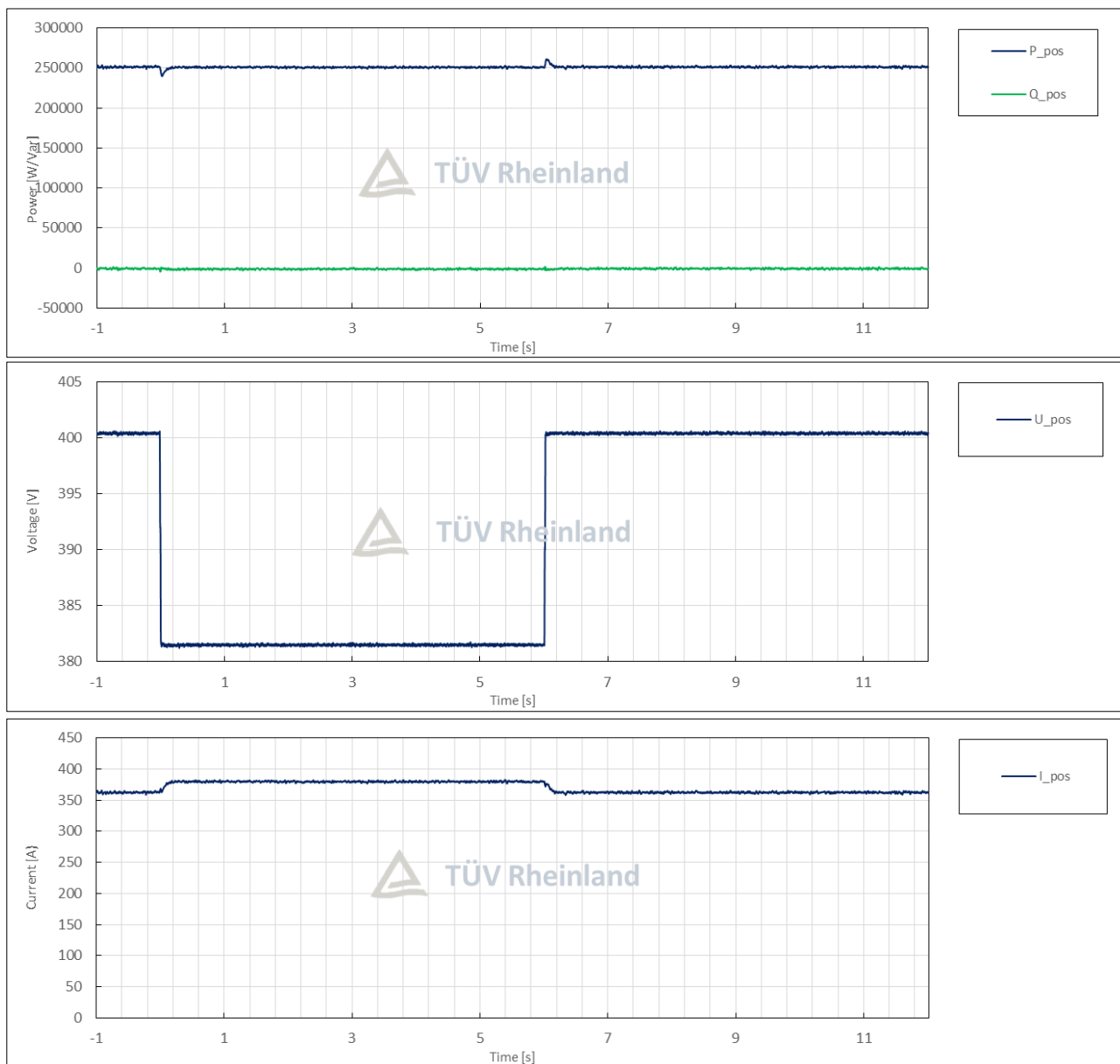
Test No. 5.3 with PGU





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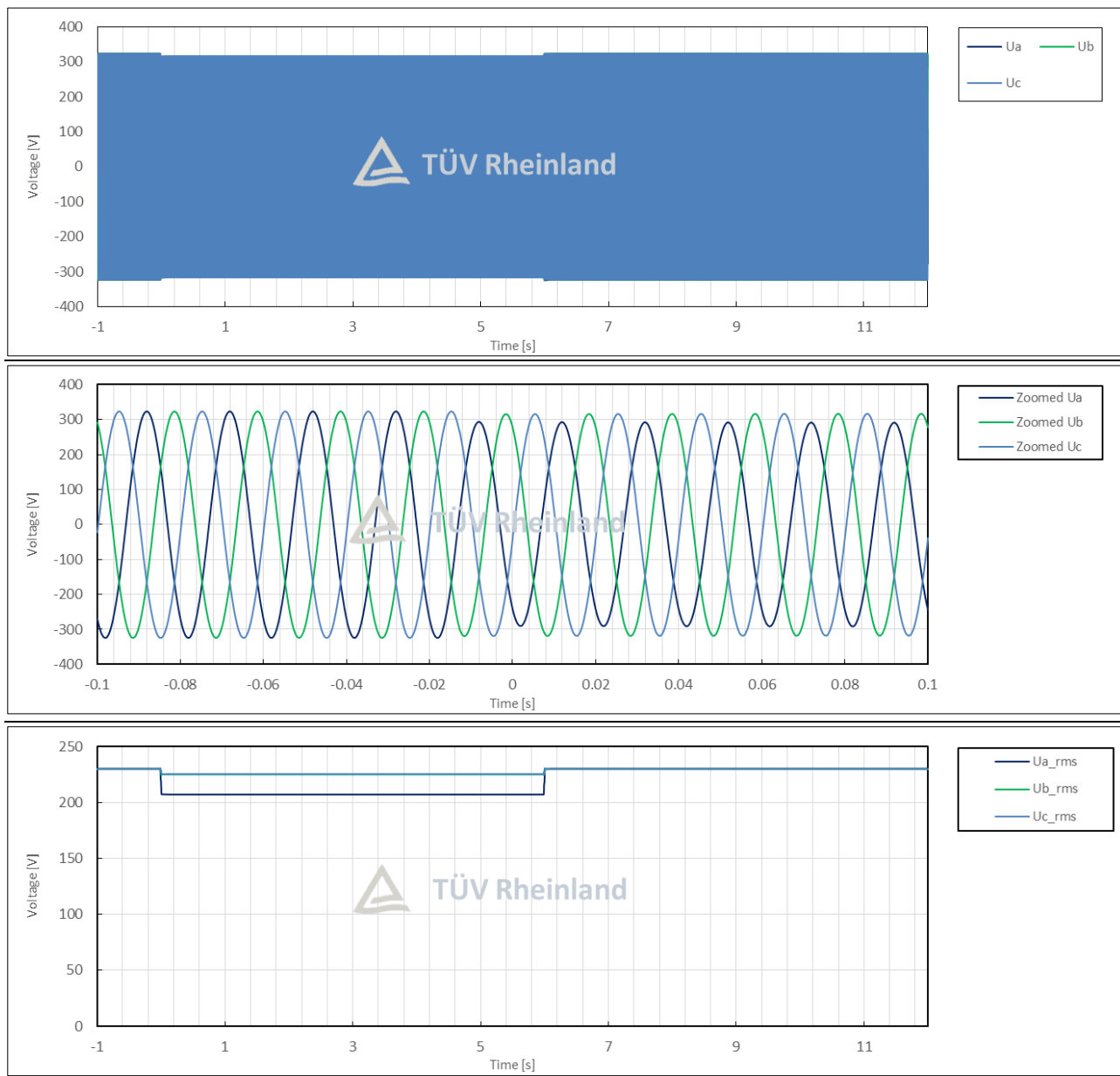


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Test report no.:

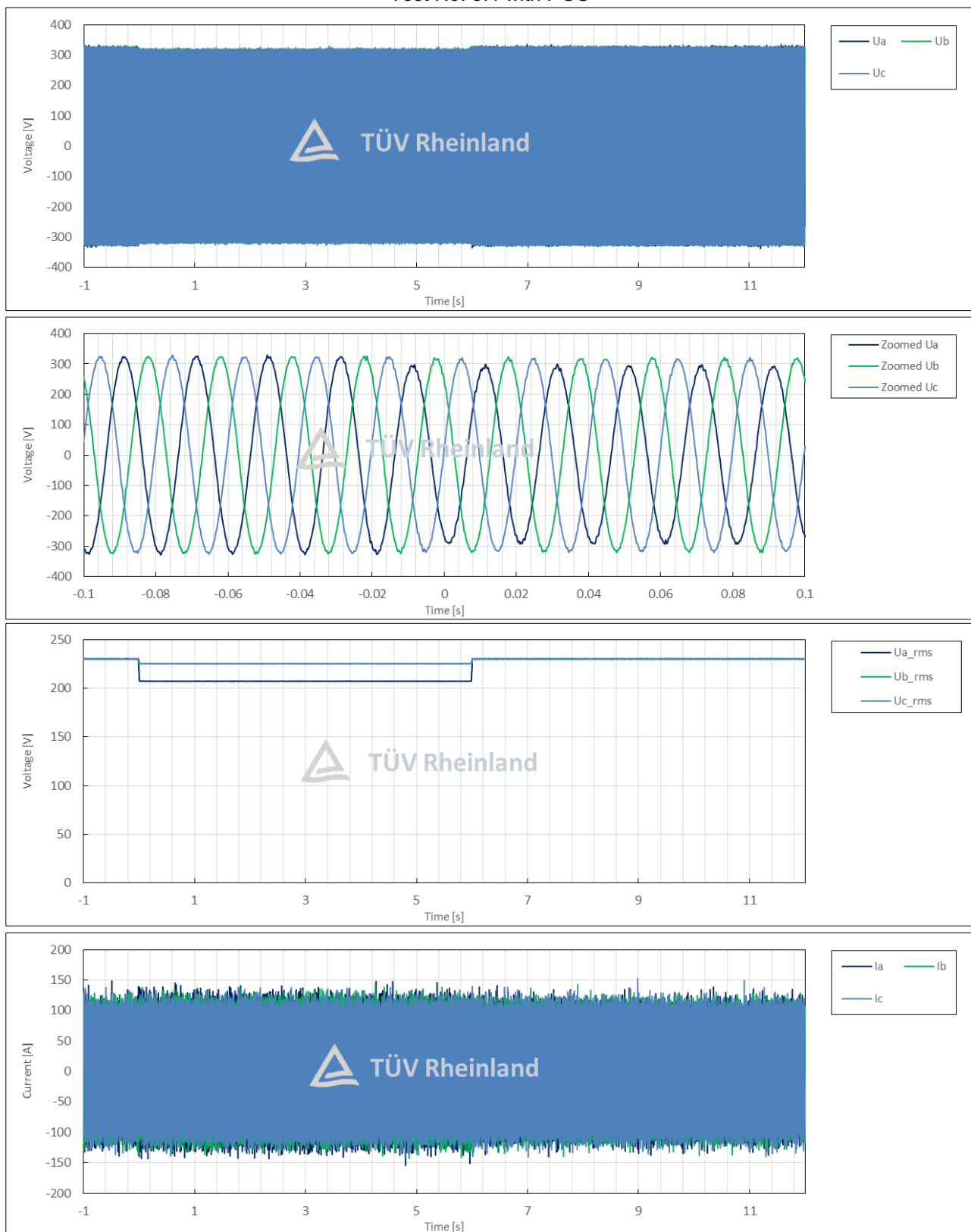
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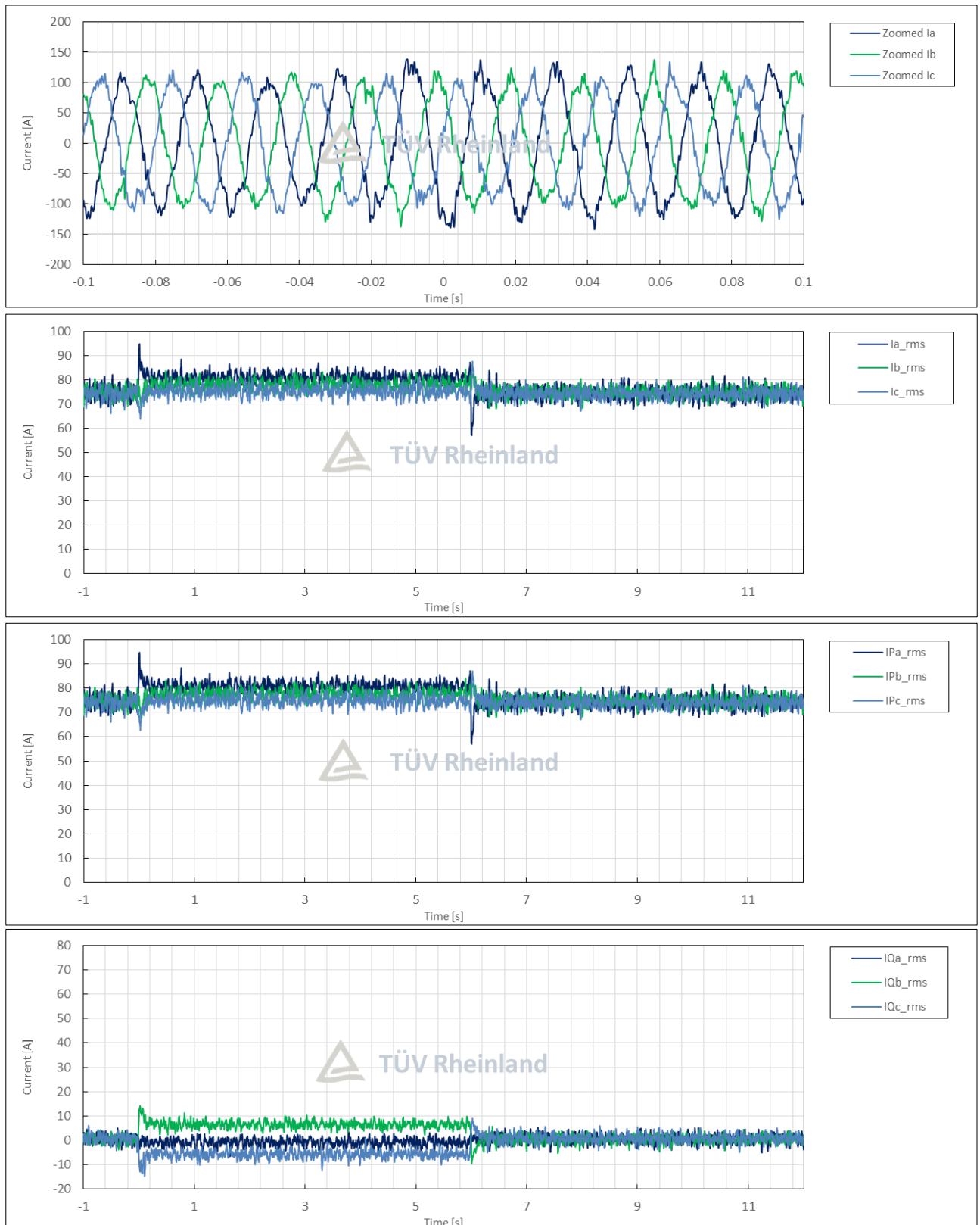
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	5.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:33:50
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.90
	5	Setting dip duration		--		6000
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	6000
	8	Fault duration in empty load test	Total	--	ms	6000
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.90
	10		Pos.		p.u.	0.95
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.90
	19	Line current	Phase 1	t1+50ms	p.u.	0.24
	20		Phase 2			0.20
	21		Phase 3			0.20
	22	Line current	Phase 1	t1+80ms	p.u.	0.23
	23		Phase 2			0.22
	24		Phase 3			0.20
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.20
	26		Pos.			0.21
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 5.4 idle test



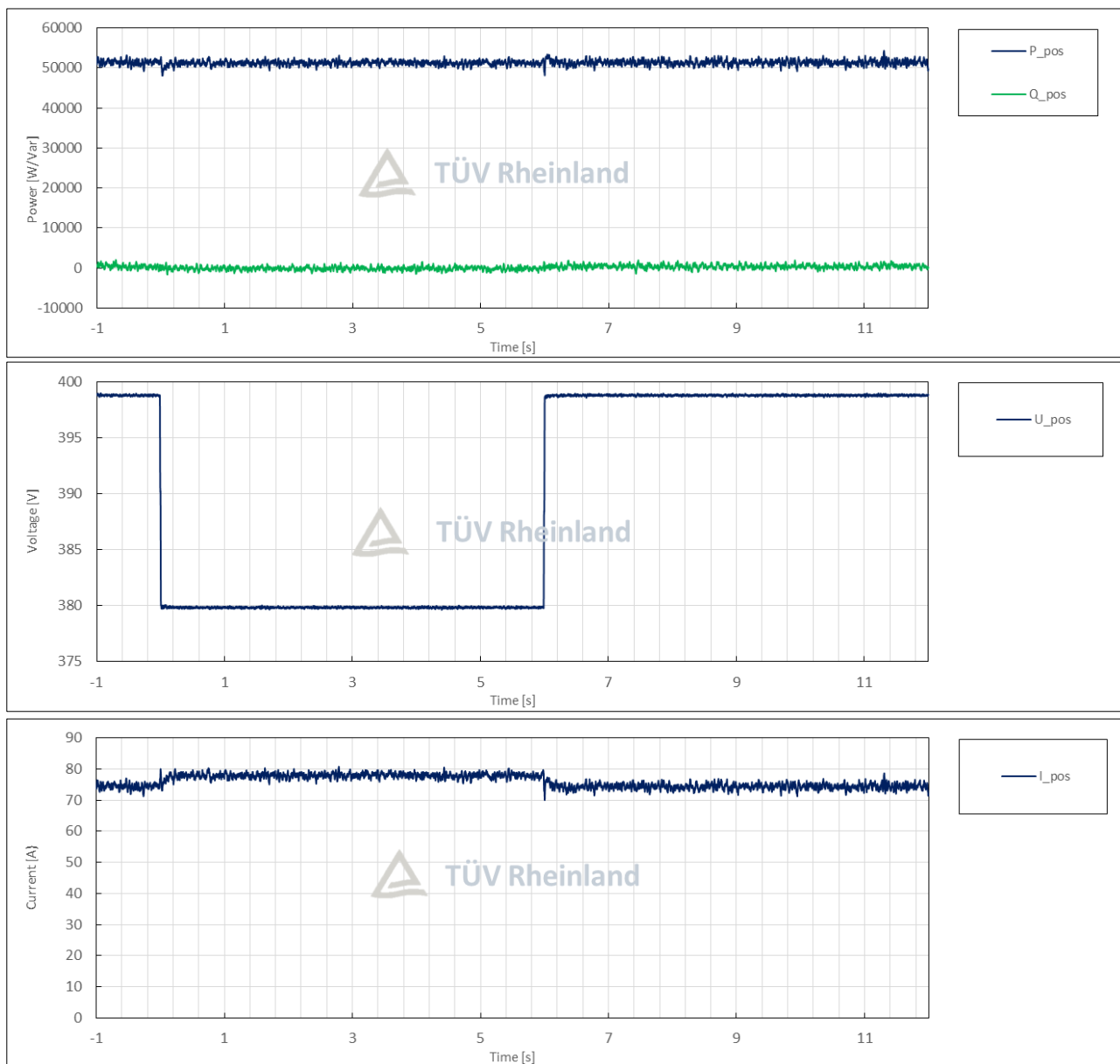
Test No. 5.4 with PGU





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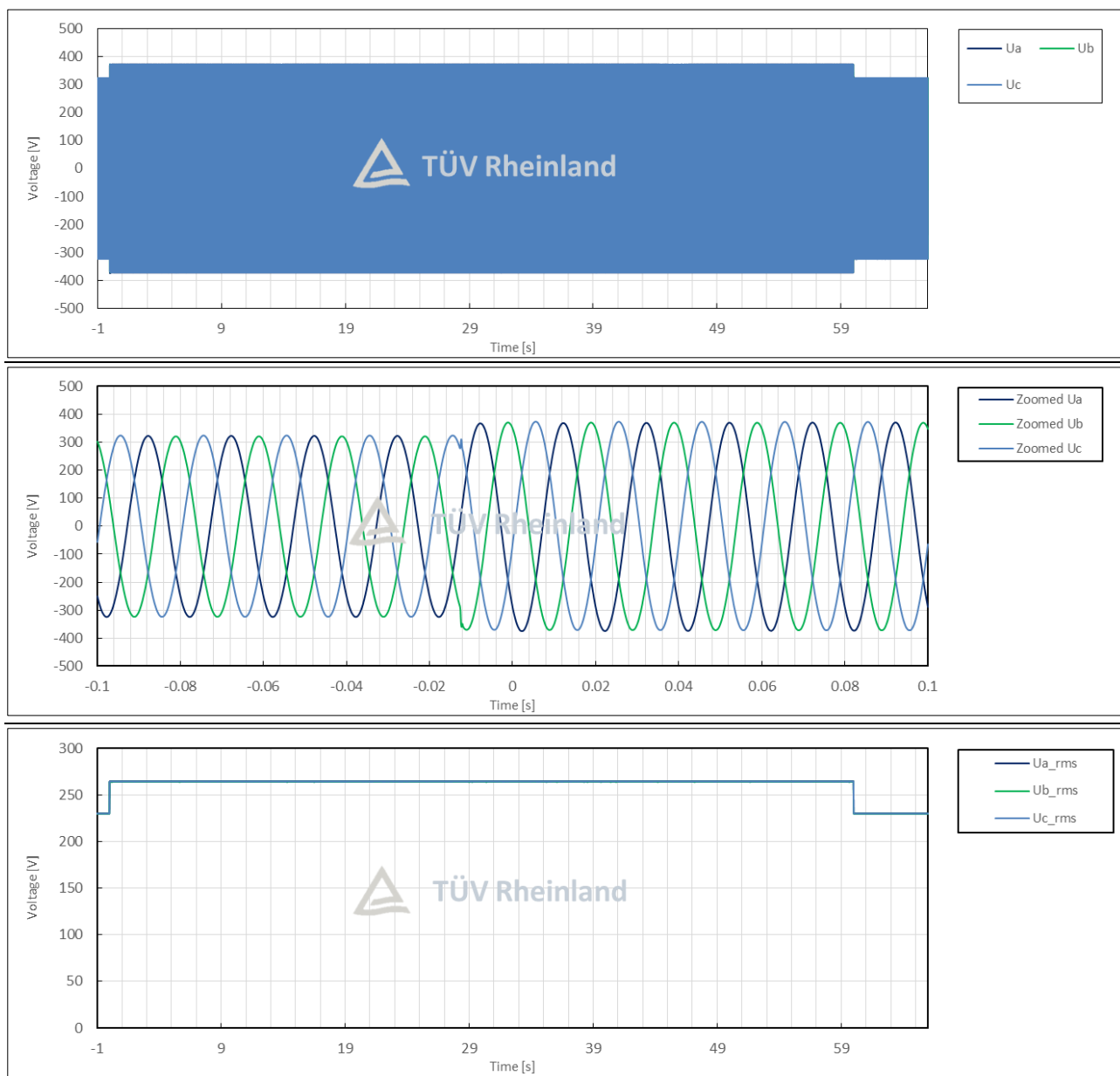


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Test report no.:

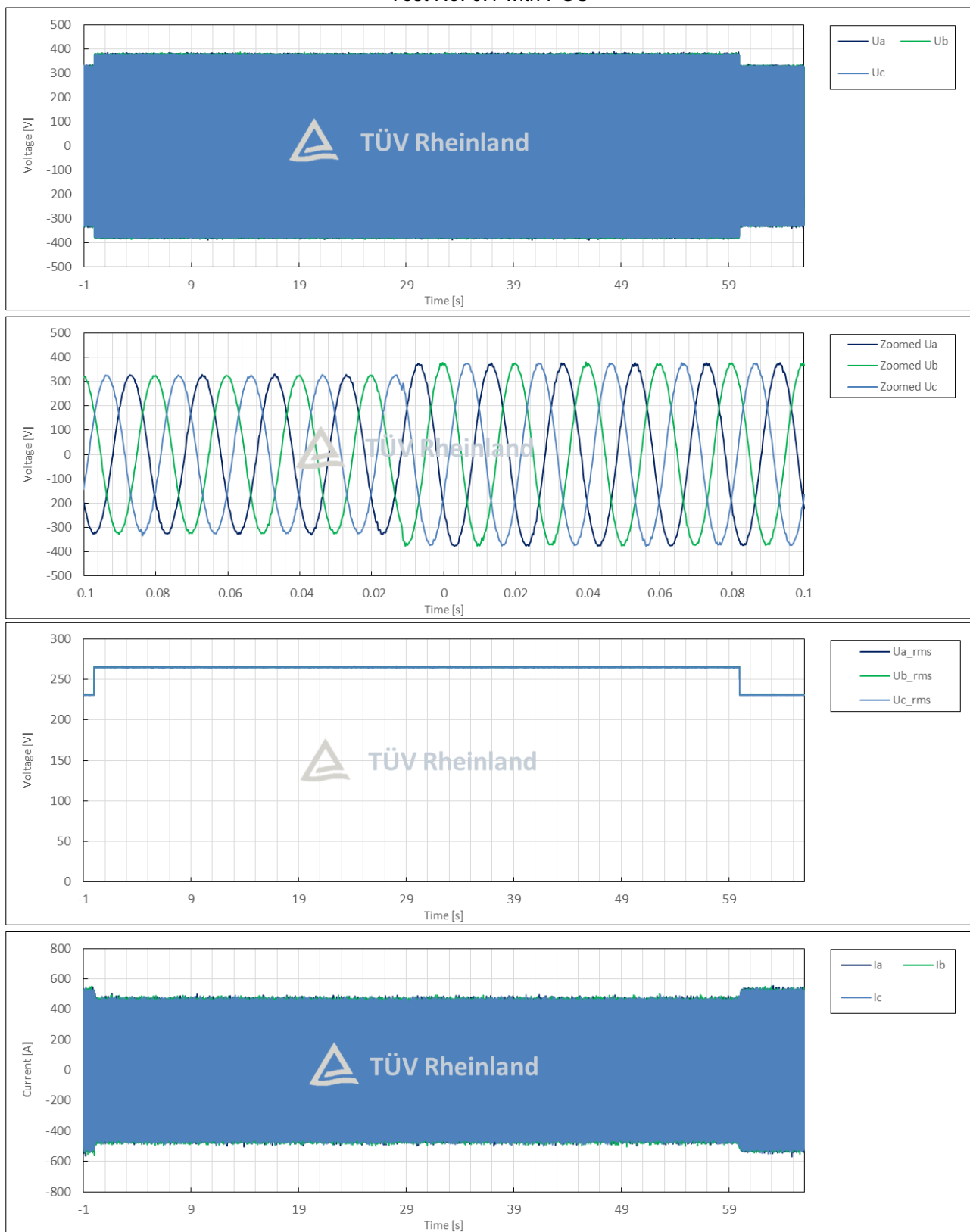
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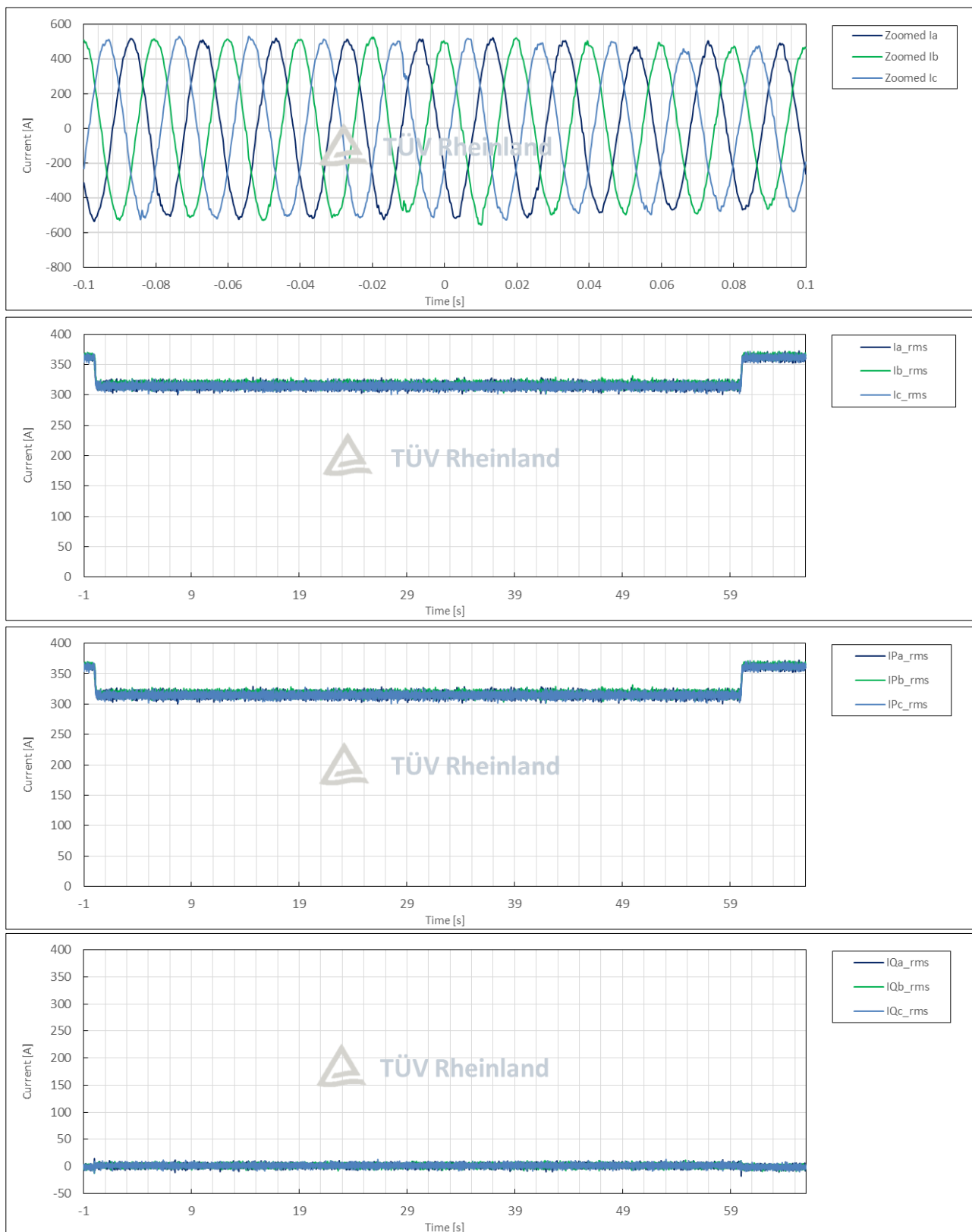
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	6.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:35:28
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.15
	5	Setting dip duration		--		59999
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	59999
	8	Fault duration in empty load test	Total	--	ms	59999
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.15
	10		Pos.		p.u.	1.15
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.01
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.16
	19	Line current	Phase 1	t1+50ms	p.u.	0.91
	20		Phase 2			0.94
	21		Phase 3			0.94
	22	Line current	Phase 1	t1+80ms	p.u.	0.90
	23		Phase 2			0.89
	24		Phase 3			0.89
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	1.01
	26		Pos.			1.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 6.1 idle test



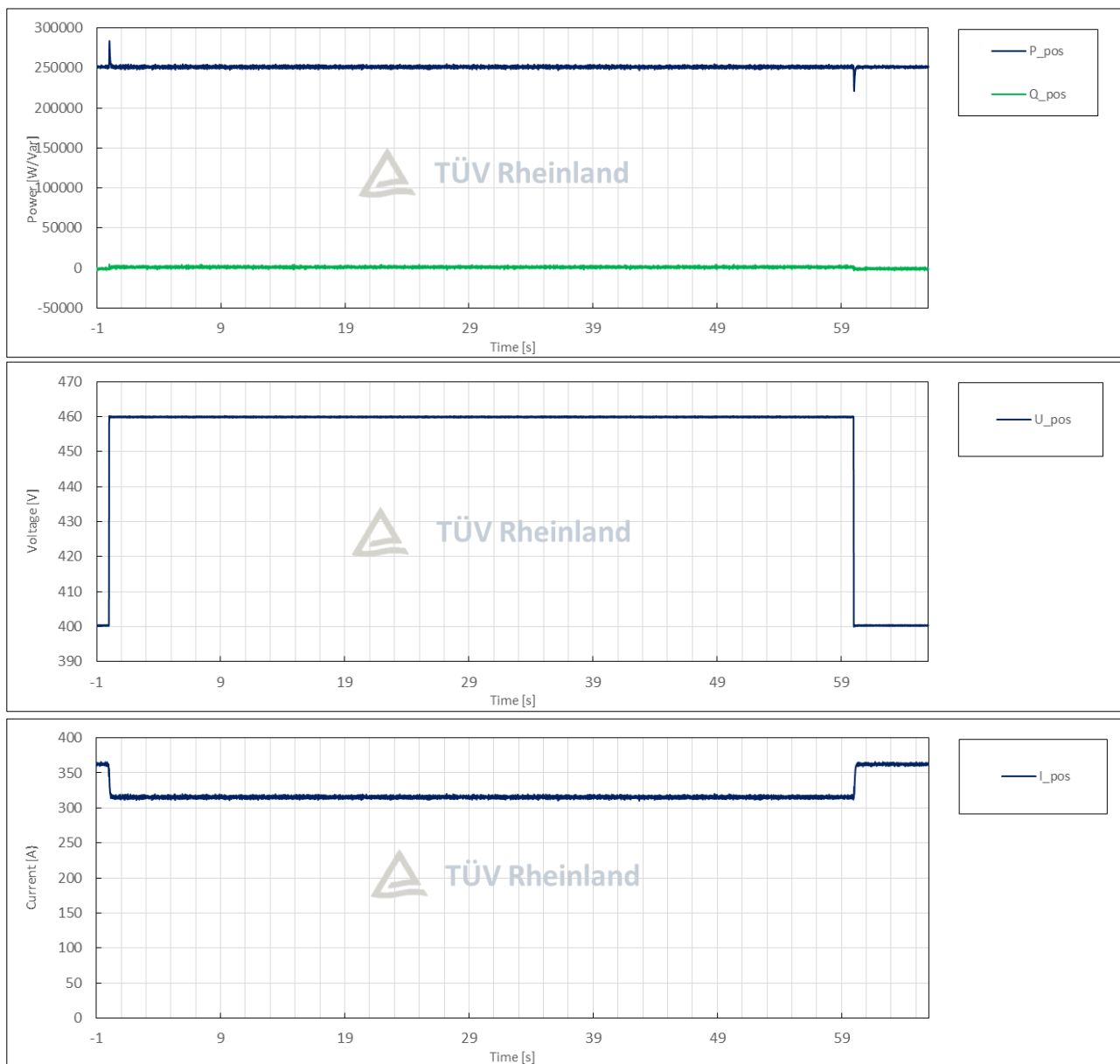
Test No. 6.1 with PGU





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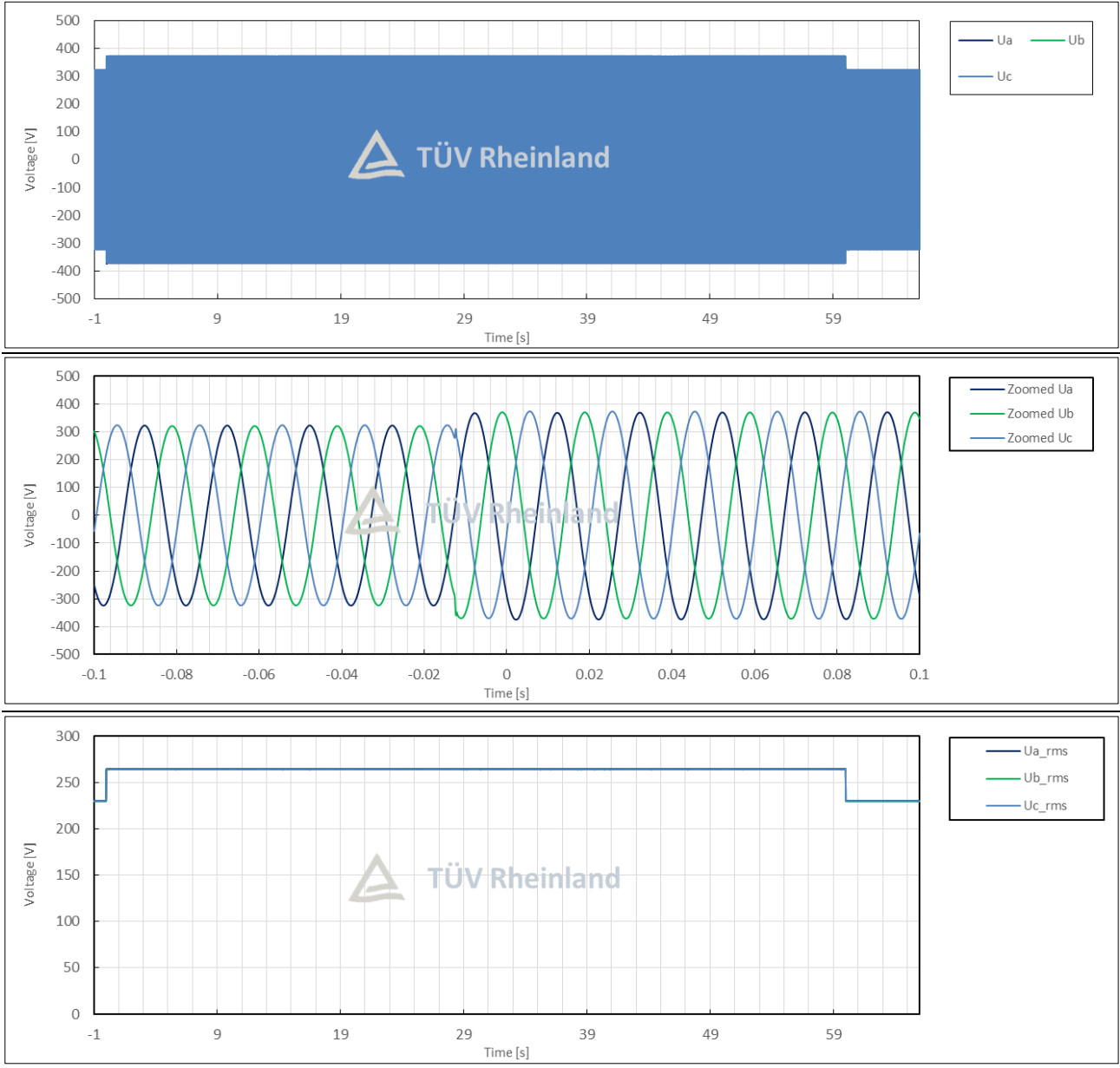


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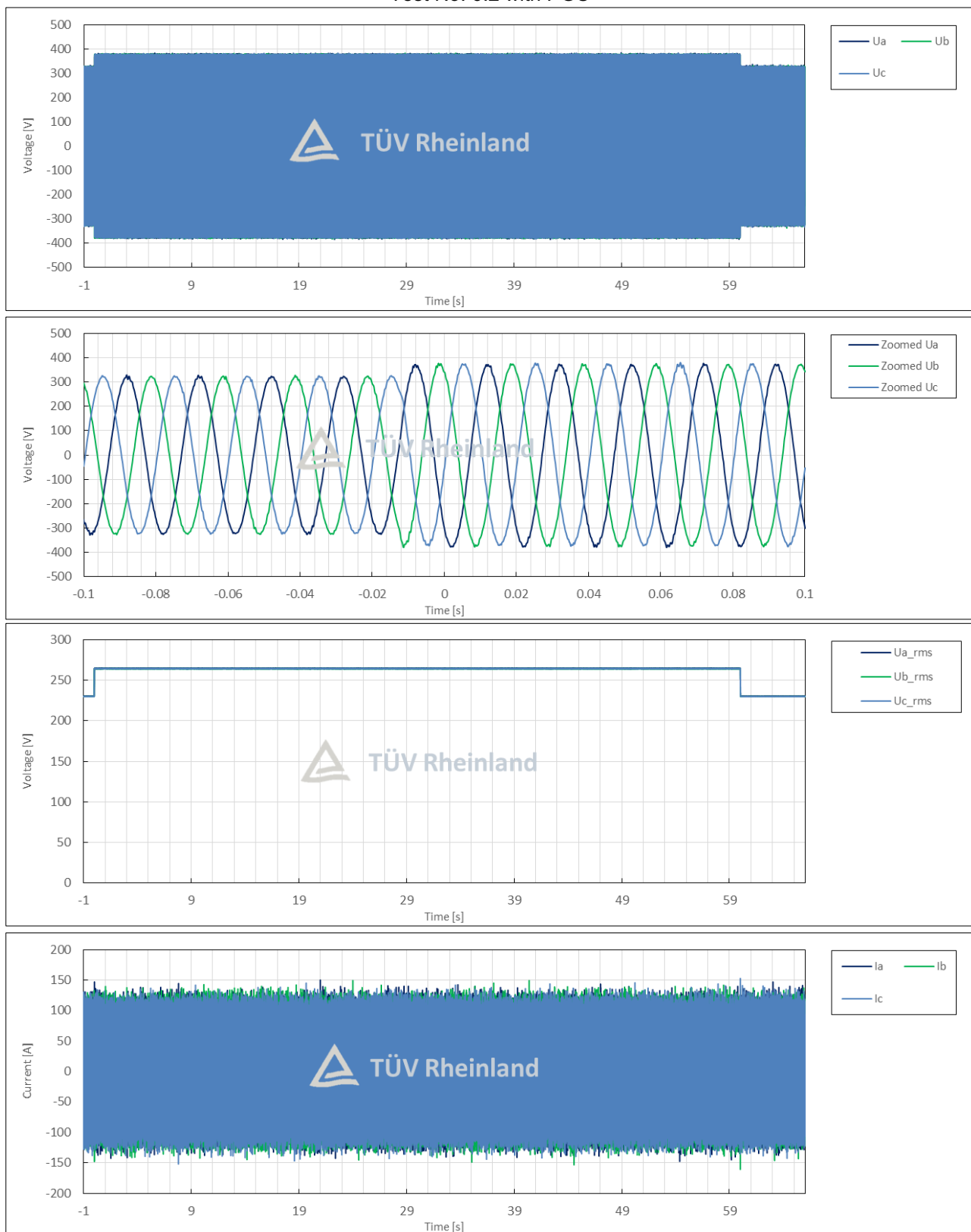
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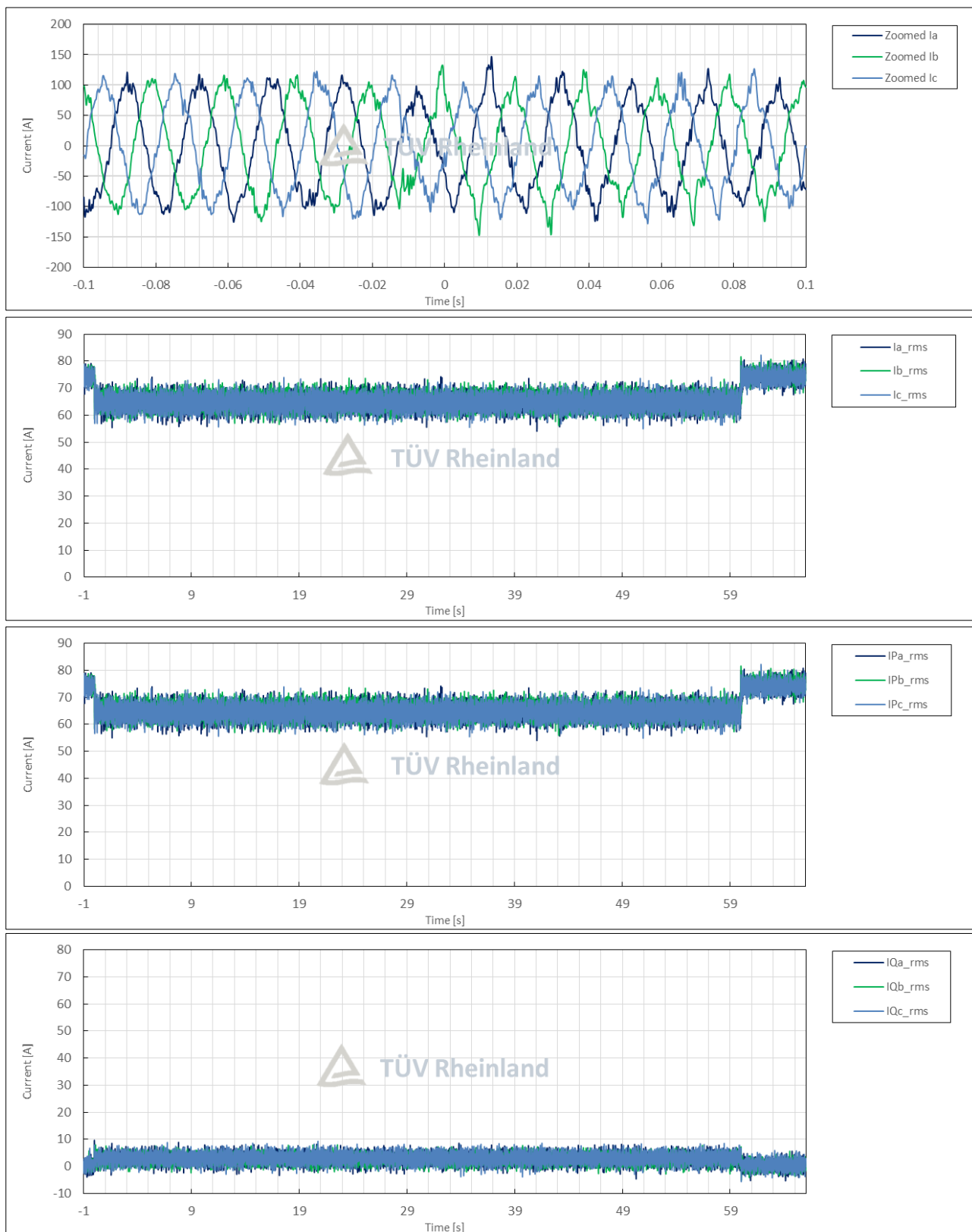
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	6.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:40:20
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.15
	5	Setting dip duration		--		59999
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	59999
	8	Fault duration in empty load test	Total	--	ms	59999
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.15
	10		Pos.		p.u.	1.15
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.15
	19	Line current	Phase 1	t1+50ms	p.u.	0.19
	20		Phase 2			0.18
	21		Phase 3			0.20
	22	Line current	Phase 1	t1+80ms	p.u.	0.18
	23		Phase 2			0.18
	24		Phase 3			0.18
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.21
	26		Pos.			0.21
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

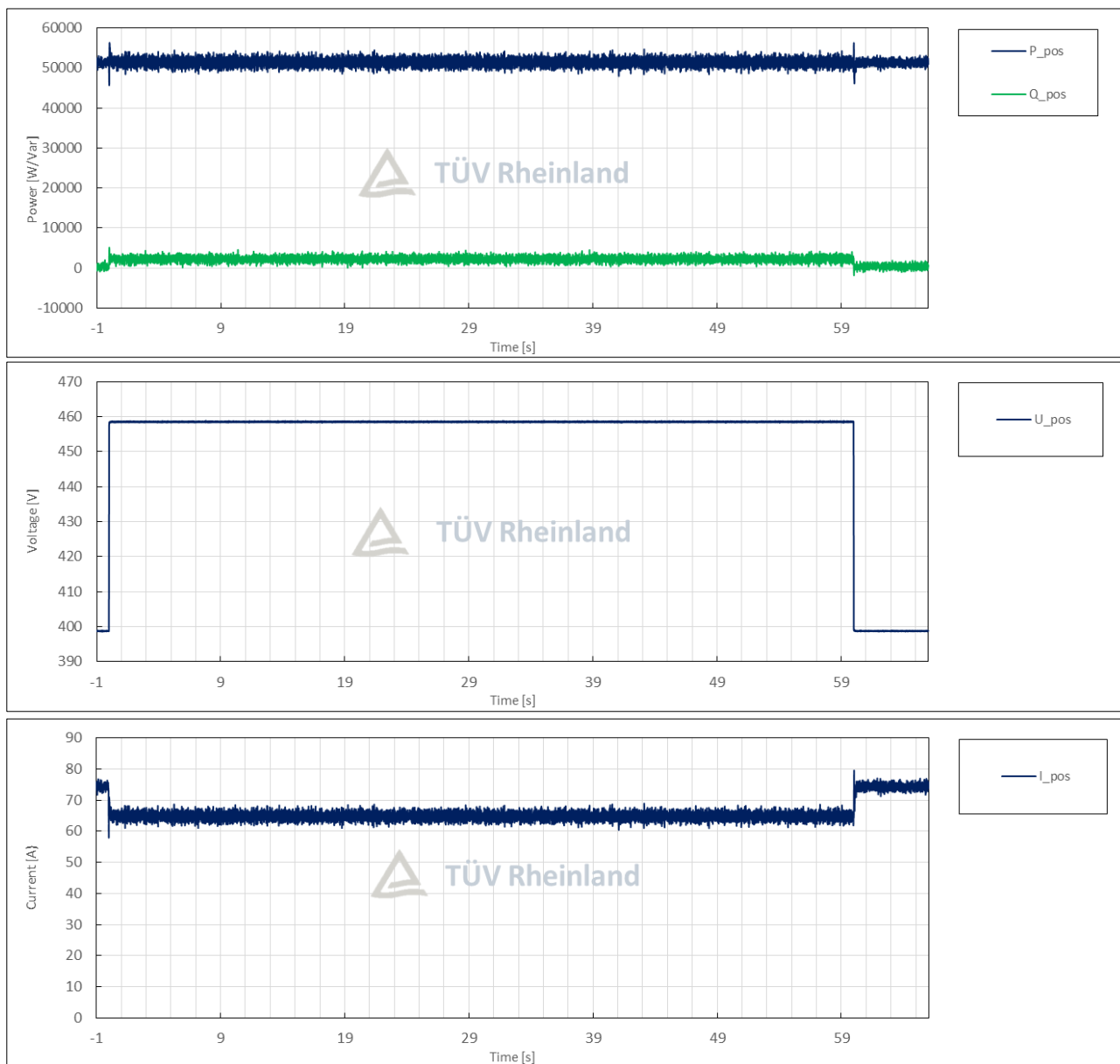
Test No. 6.2 idle test



Test No. 6.2 with PGU







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Test report no.:

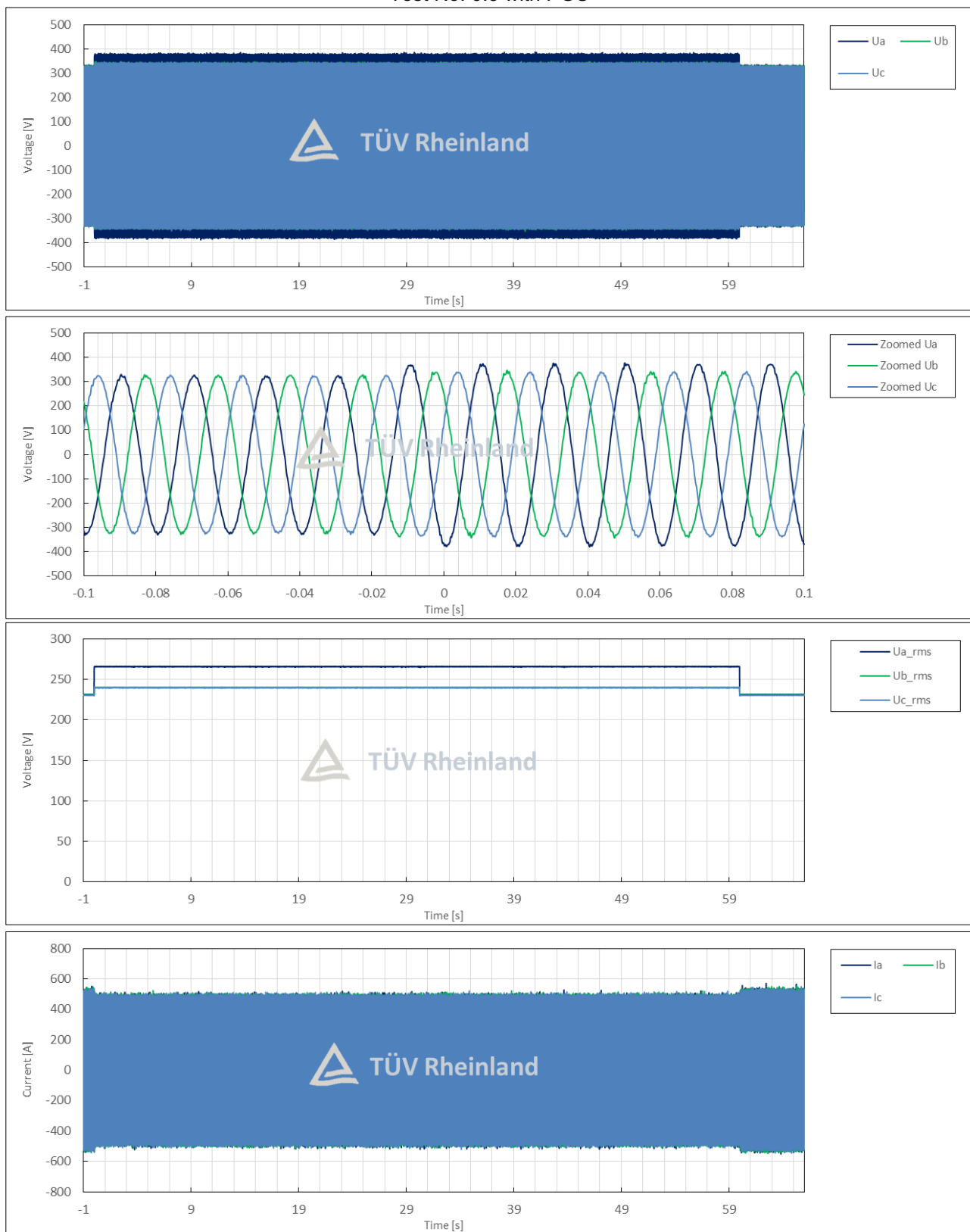
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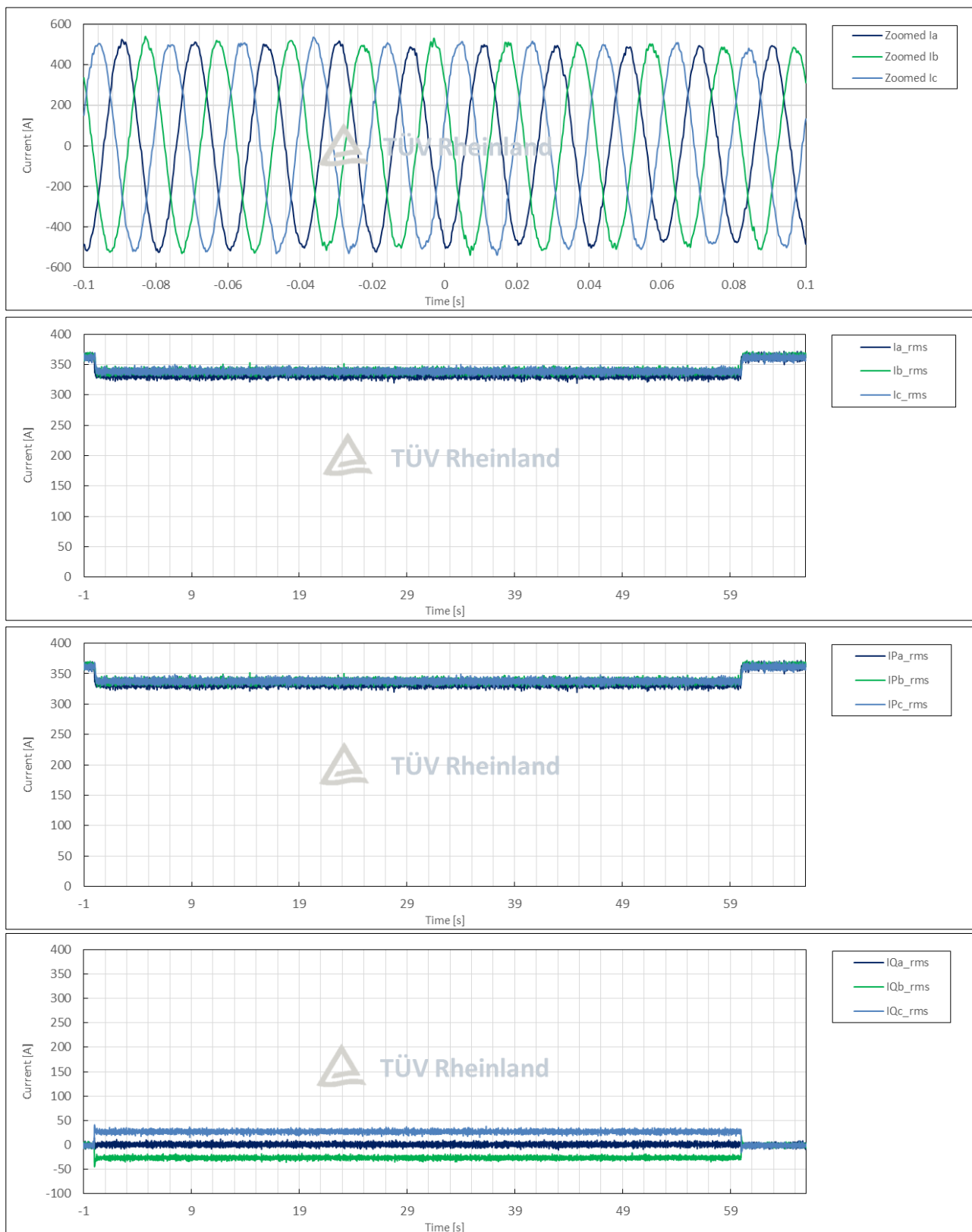
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	6.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:41:06
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.15
	5	Setting dip duration		--		59996
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	59996
	8	Fault duration in empty load test	Total	--	ms	59996
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.15
	10		Pos.		p.u.	1.07
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.16
	19	Line current	Phase 1	t1+50ms	p.u.	0.94
	20		Phase 2			0.98
	21		Phase 3			0.97
	22	Line current	Phase 1	t1+80ms	p.u.	0.92
	23		Phase 2			0.96
	24		Phase 3			0.95
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	1.00
	26		Pos.			1.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 6.3 idle test



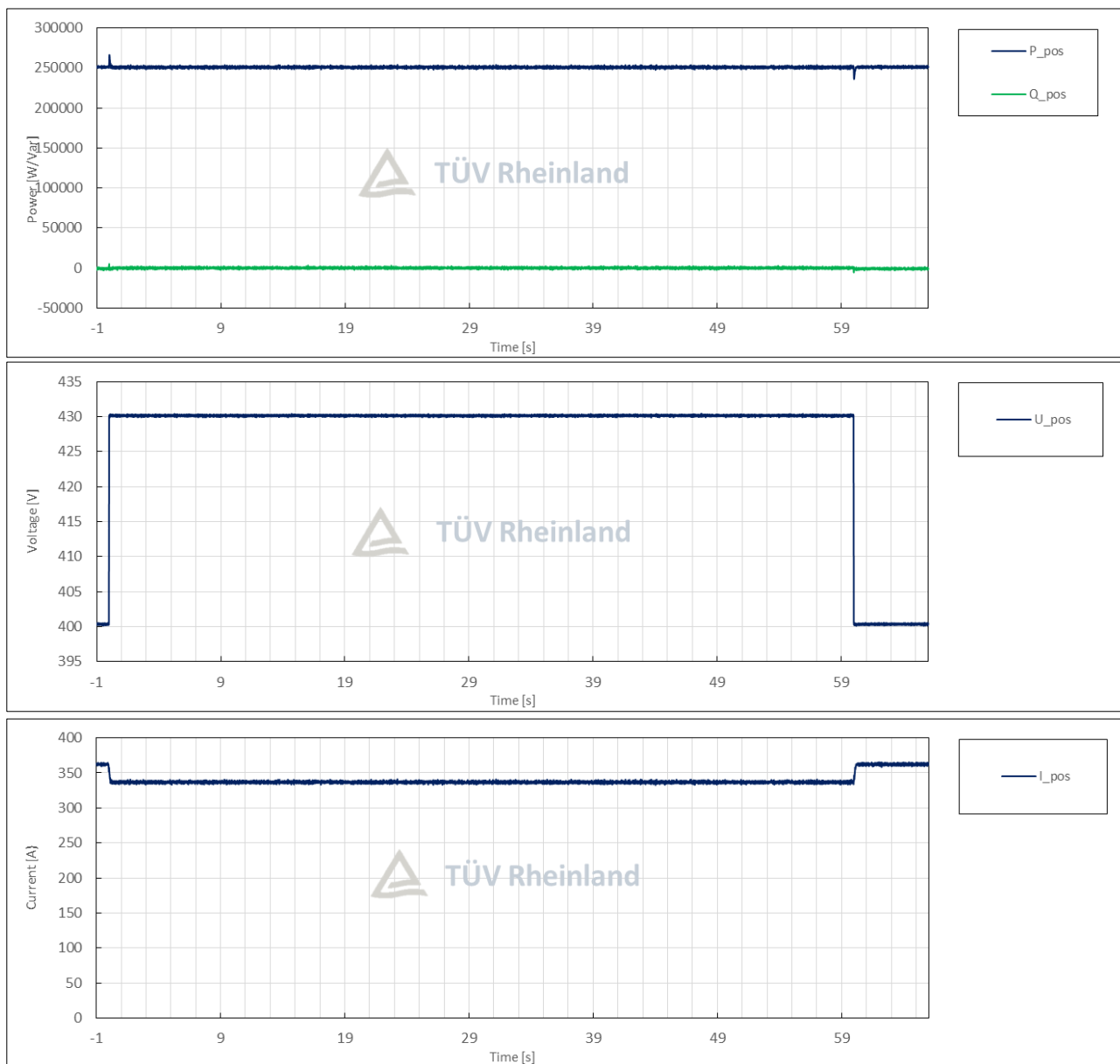
Test No. 6.3 with PGU





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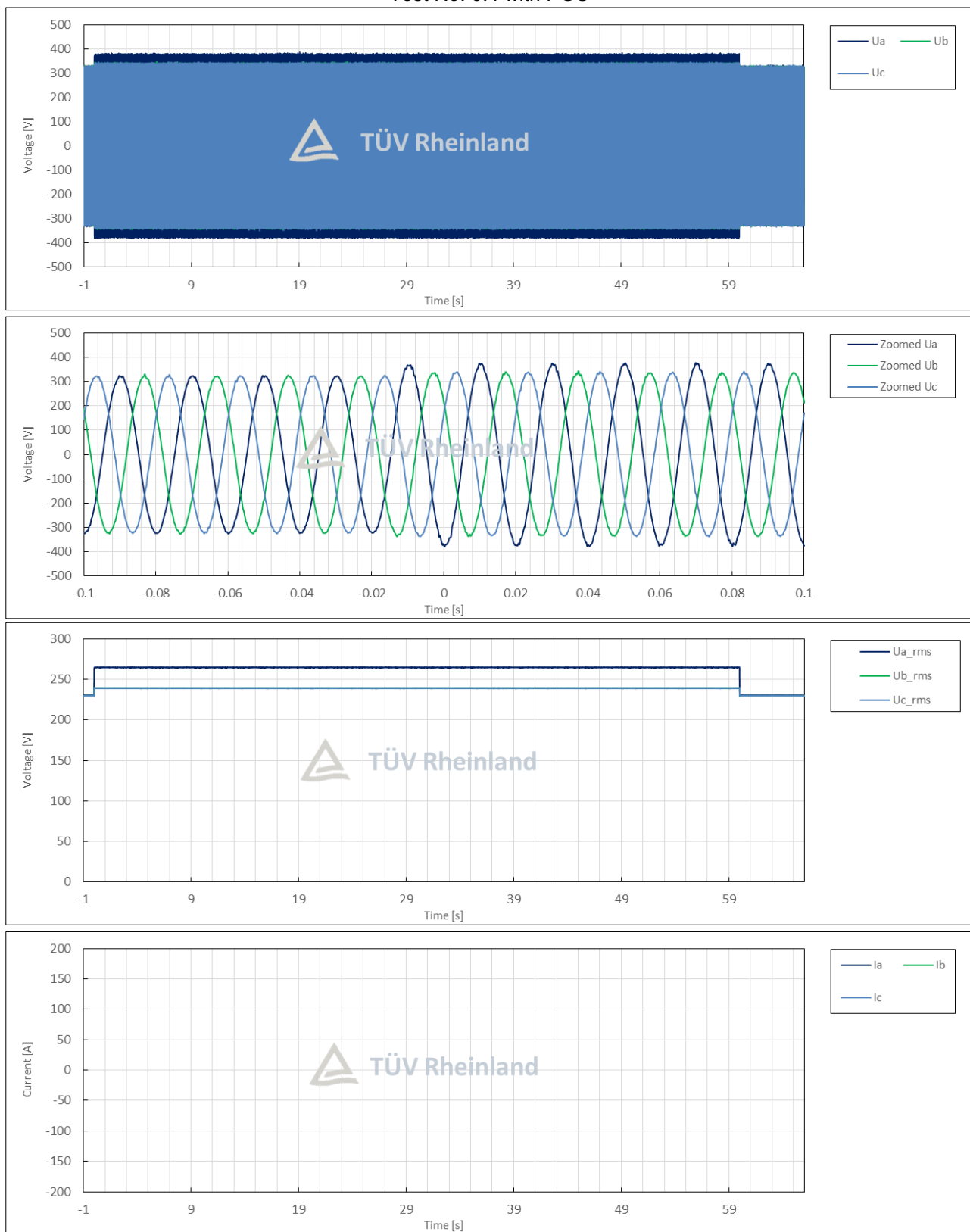
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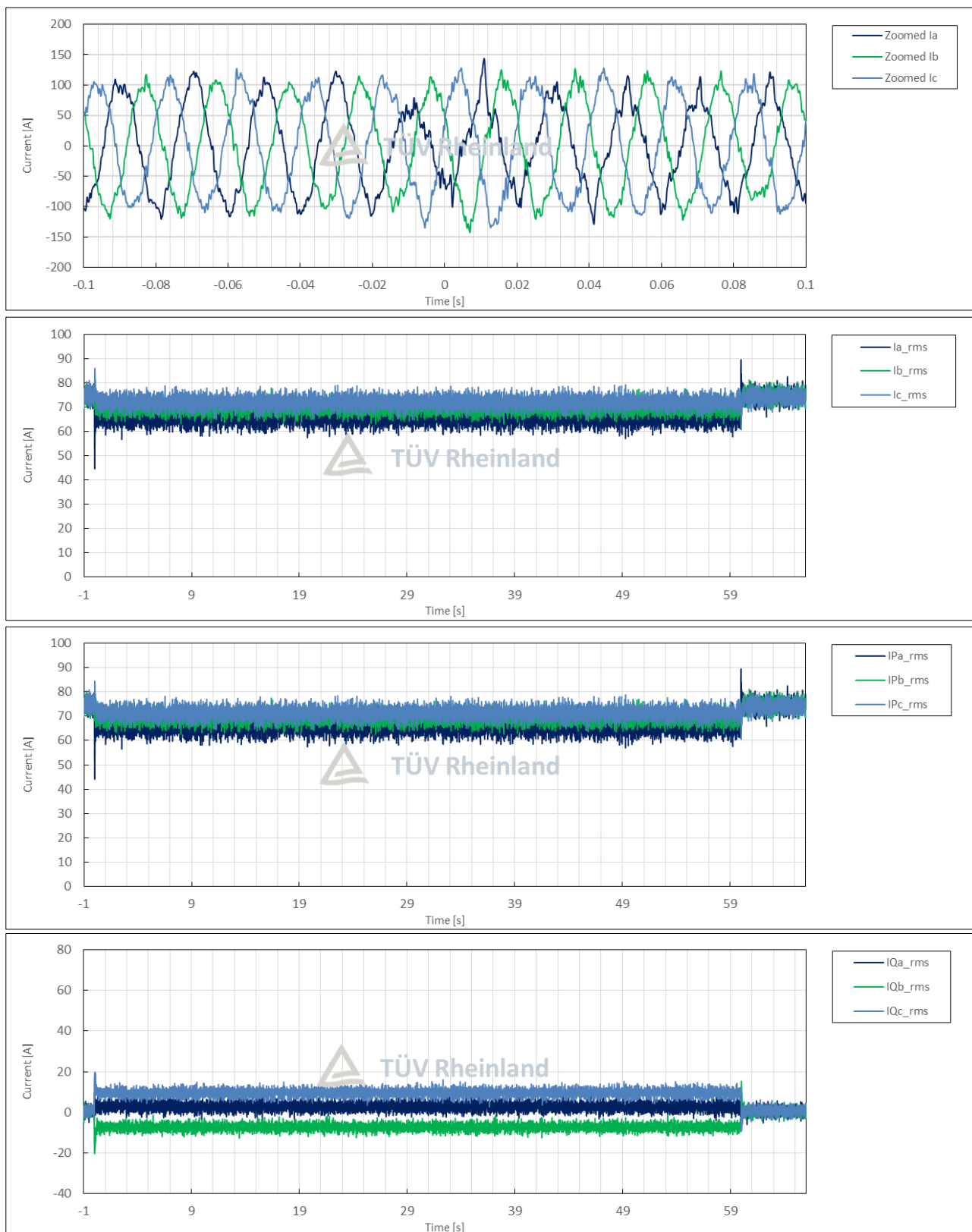
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	6.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:42:12
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.15
	5	Setting dip duration		--		59996
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	59996
	8	Fault duration in empty load test	Total	--	ms	59996
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.15
	10		Pos.		p.u.	1.07
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.15
	19	Line current	Phase 1	t1+50ms	p.u.	0.18
	20		Phase 2			0.22
	21		Phase 3			0.22
	22	Line current	Phase 1	t1+80ms	p.u.	0.18
	23		Phase 2			0.19
	24		Phase 3			0.21
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.20
	26		Pos.			0.21
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

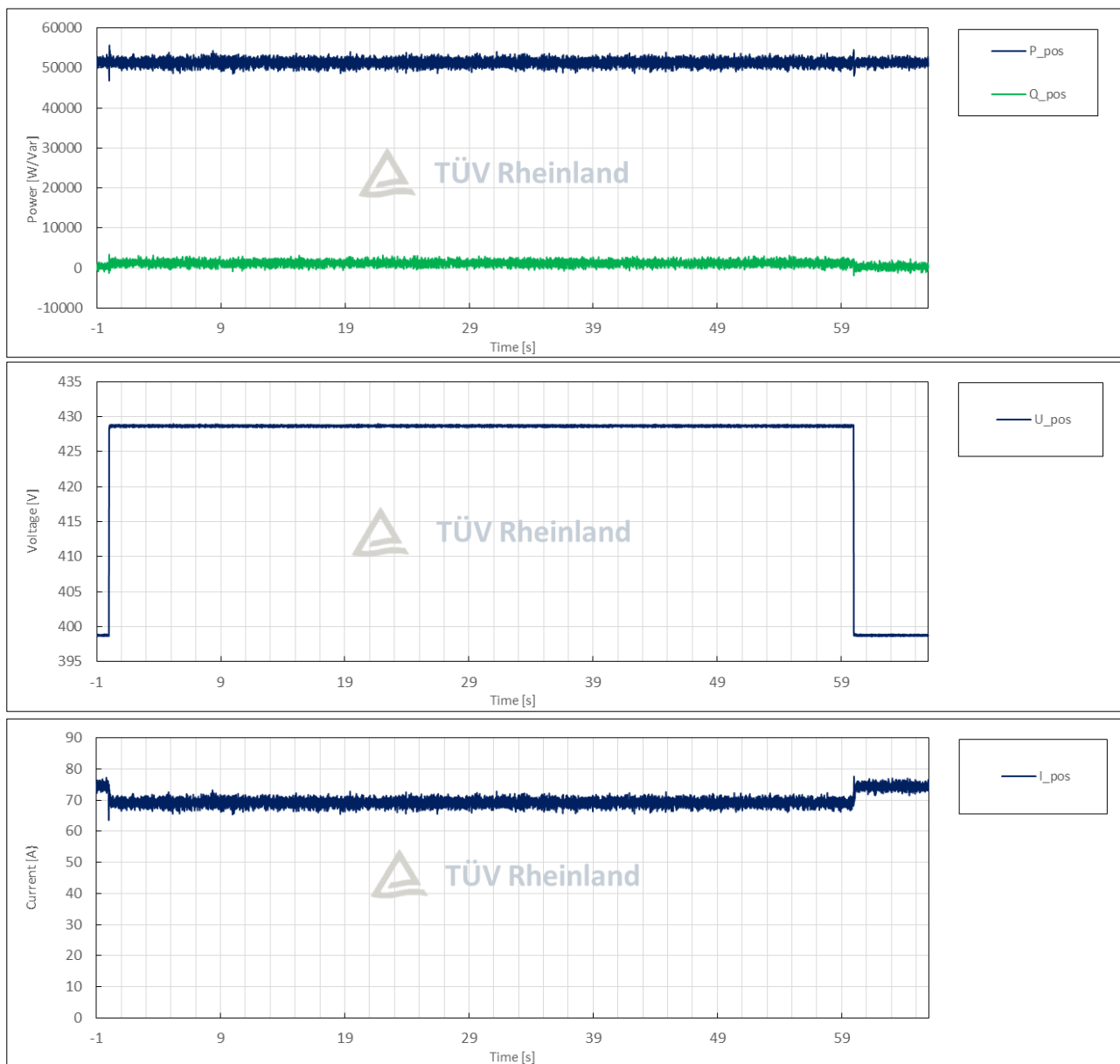
Test No. 6.4 idle test



Test No. 6.4 with PGU





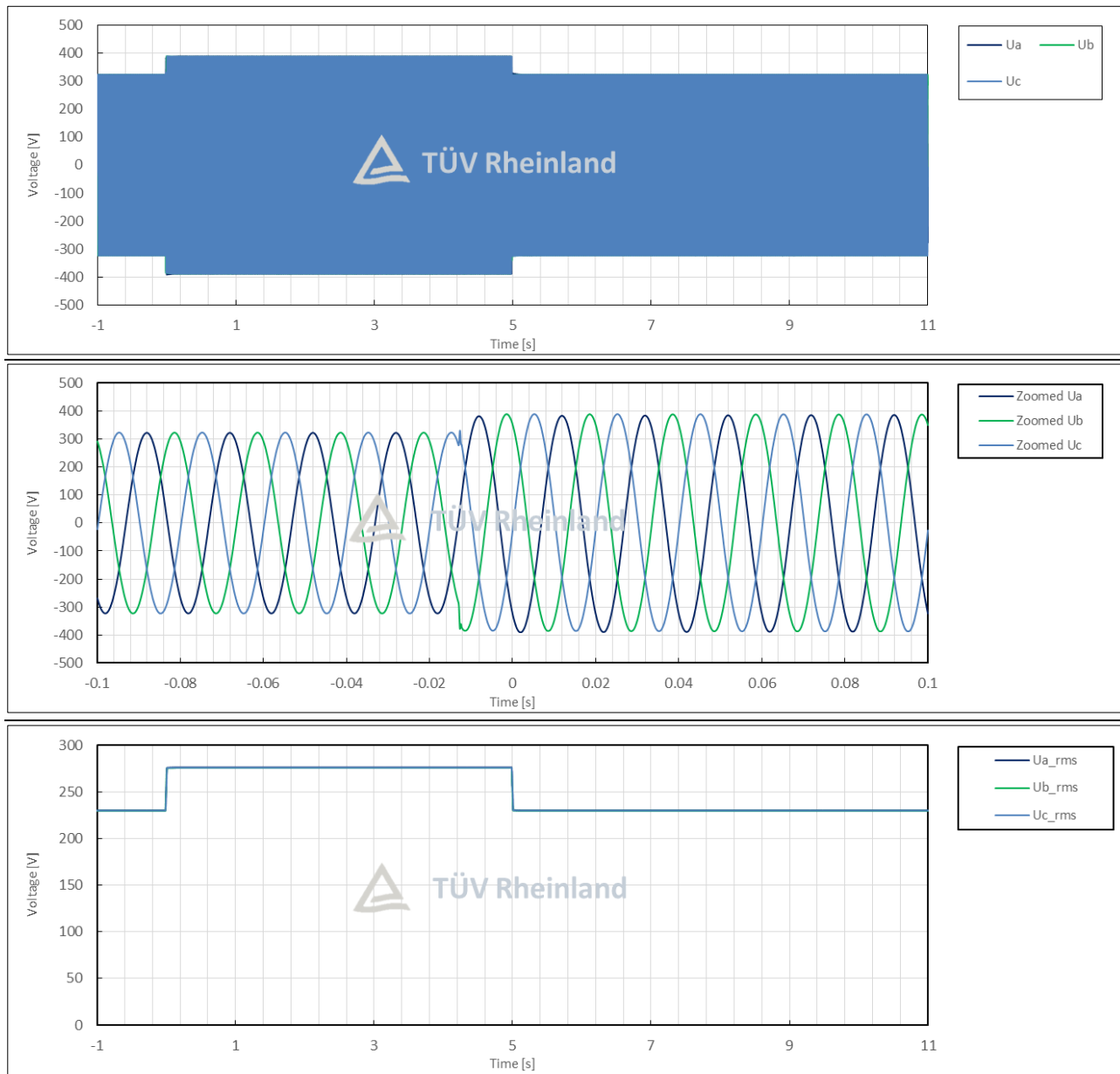


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Test report no.:

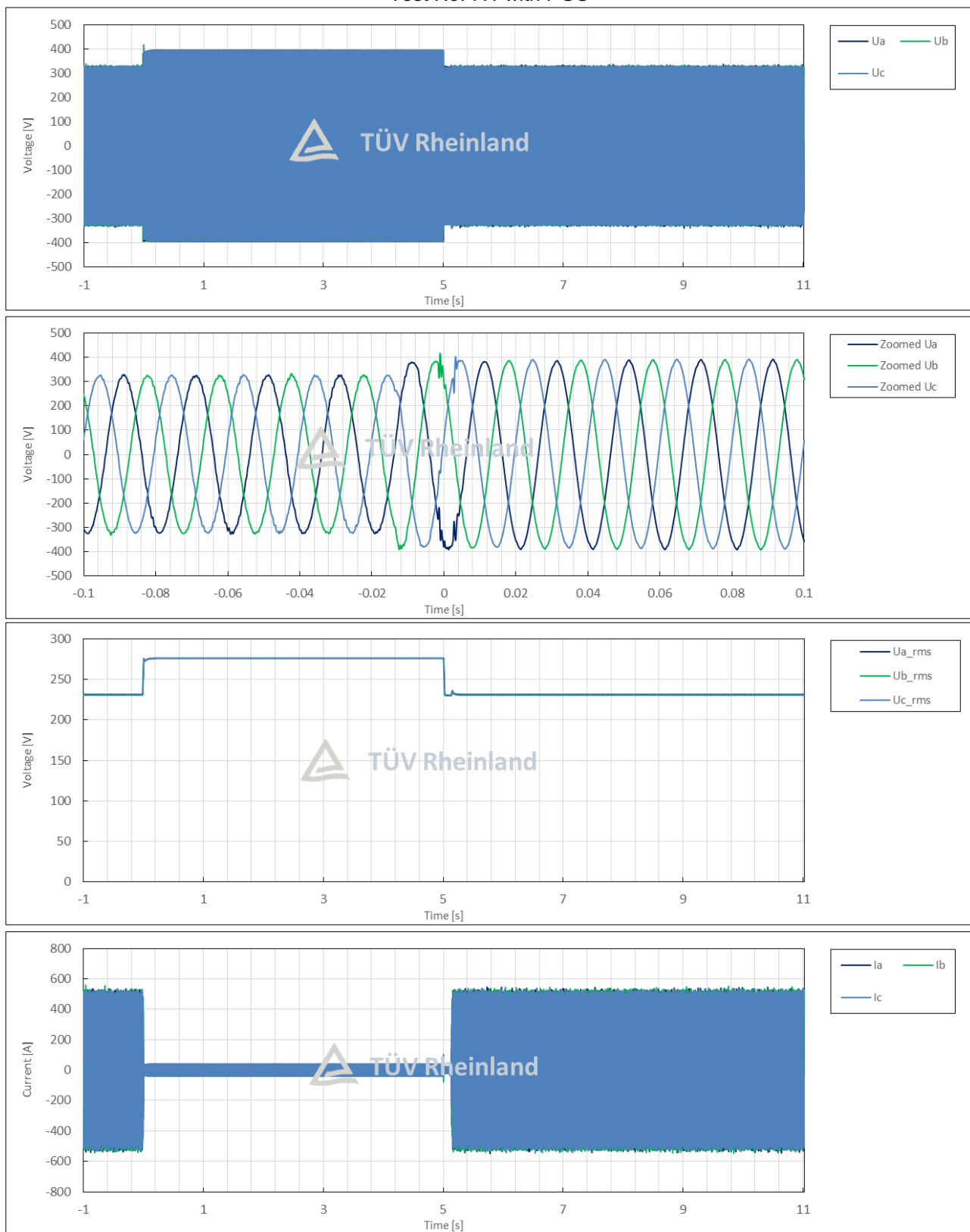
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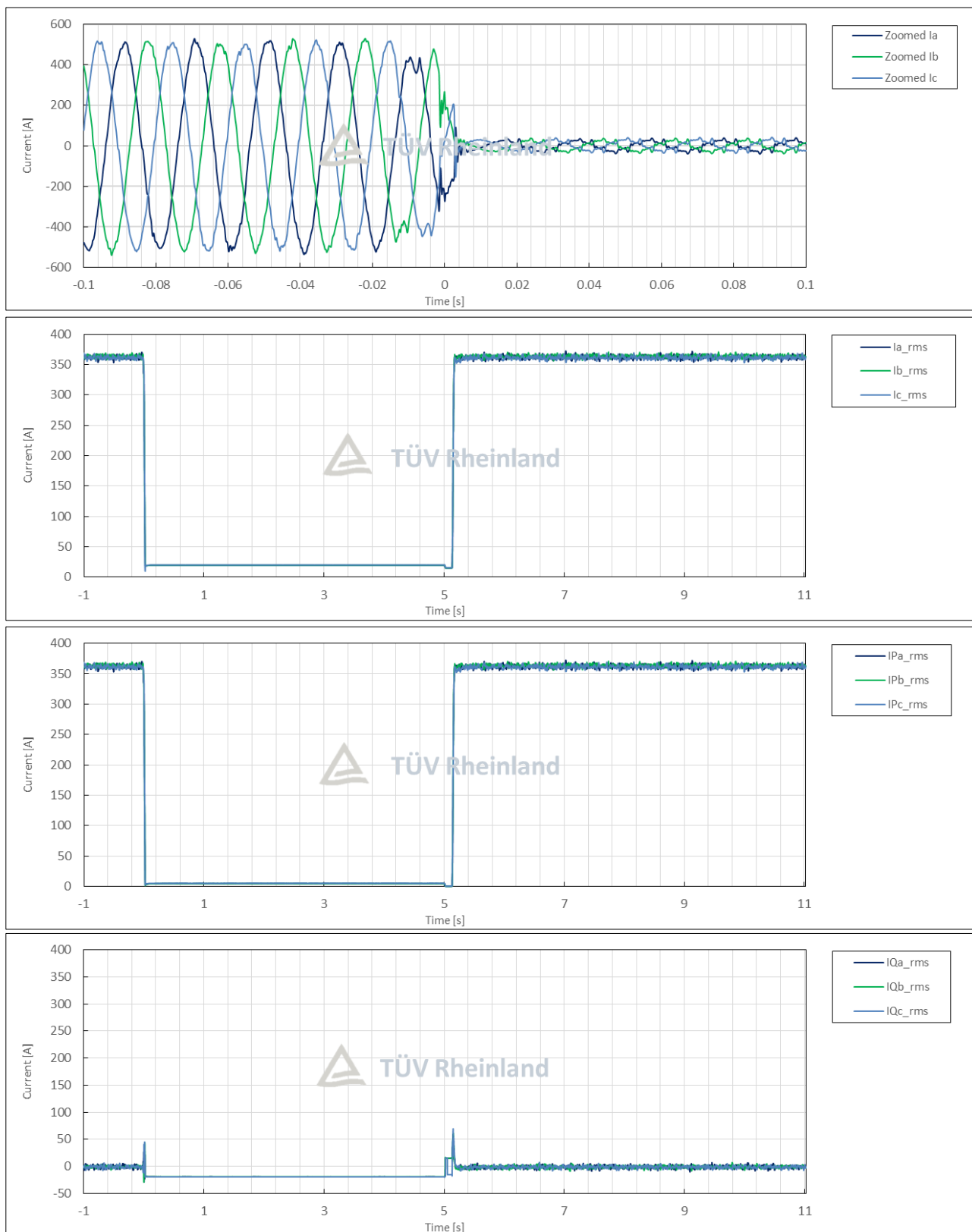
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	7.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:43:36
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		5000
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	5000
	8	Fault duration in empty load test	Total	--	ms	5000
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.20
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.20
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.05
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			-0.02
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	0.144
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

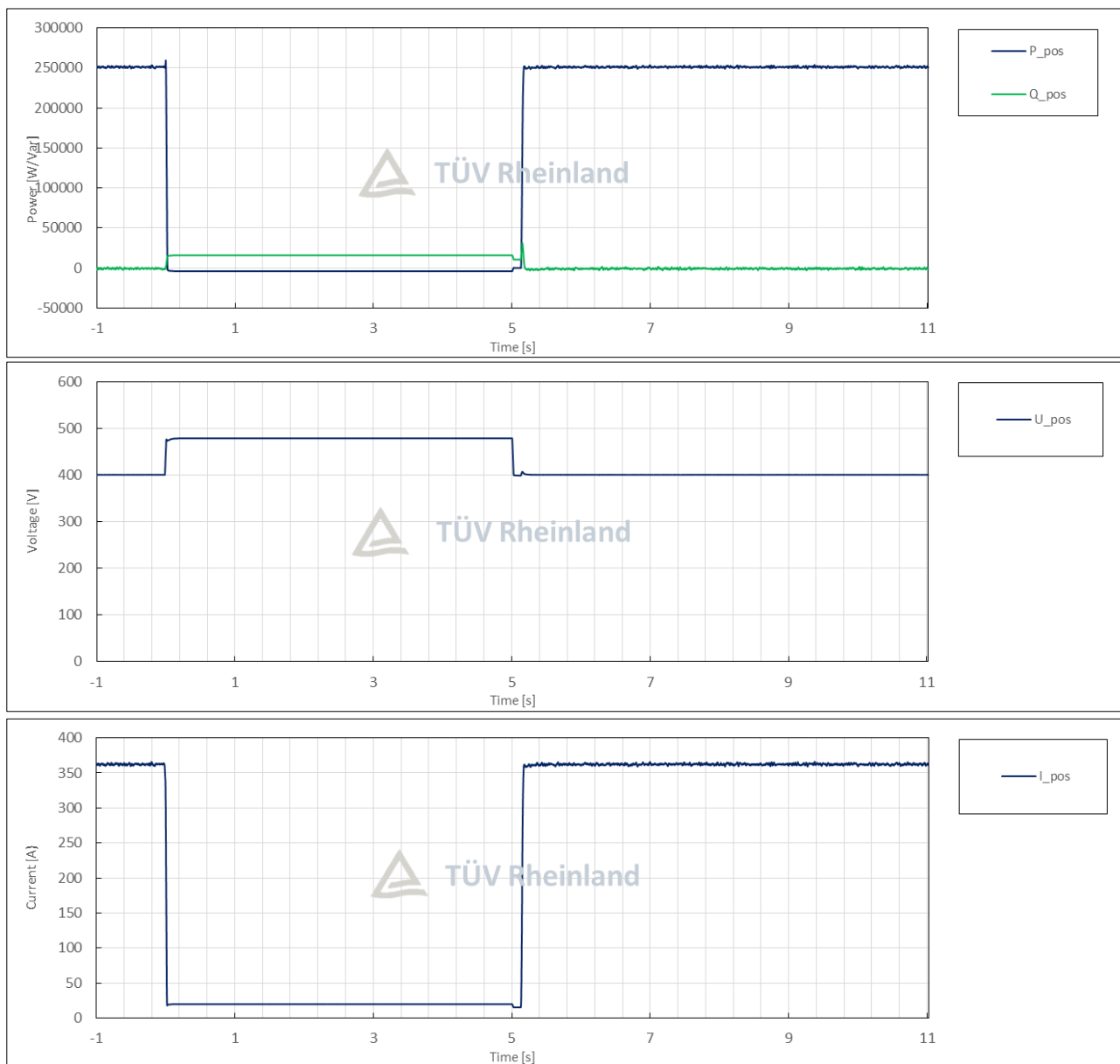
Test No. 7.1 idle test



Test No. 7.1 with PGU





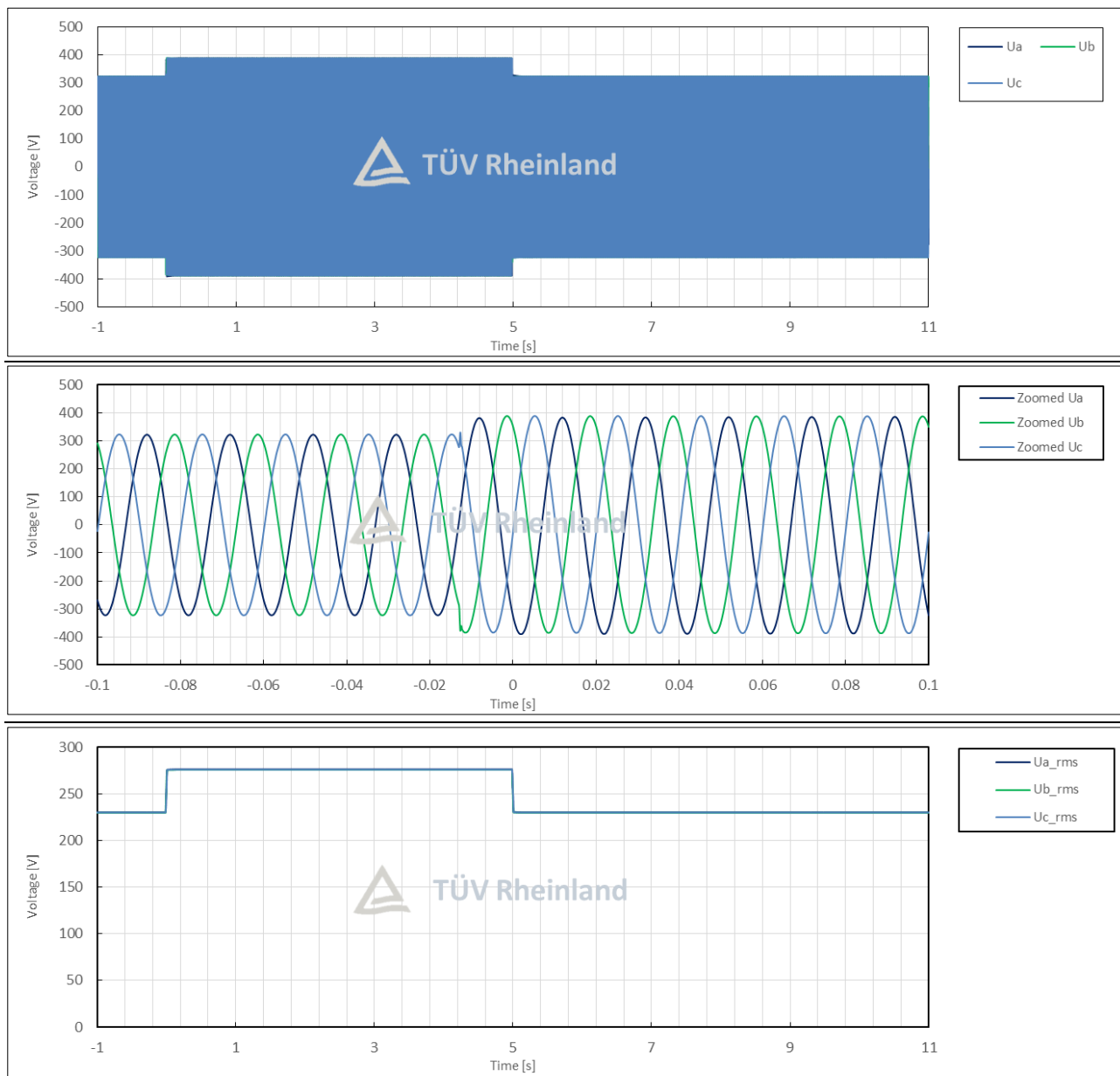


Prüfbericht-Nr.: CN25HVW8 001 Attachment 1
Test report no.:

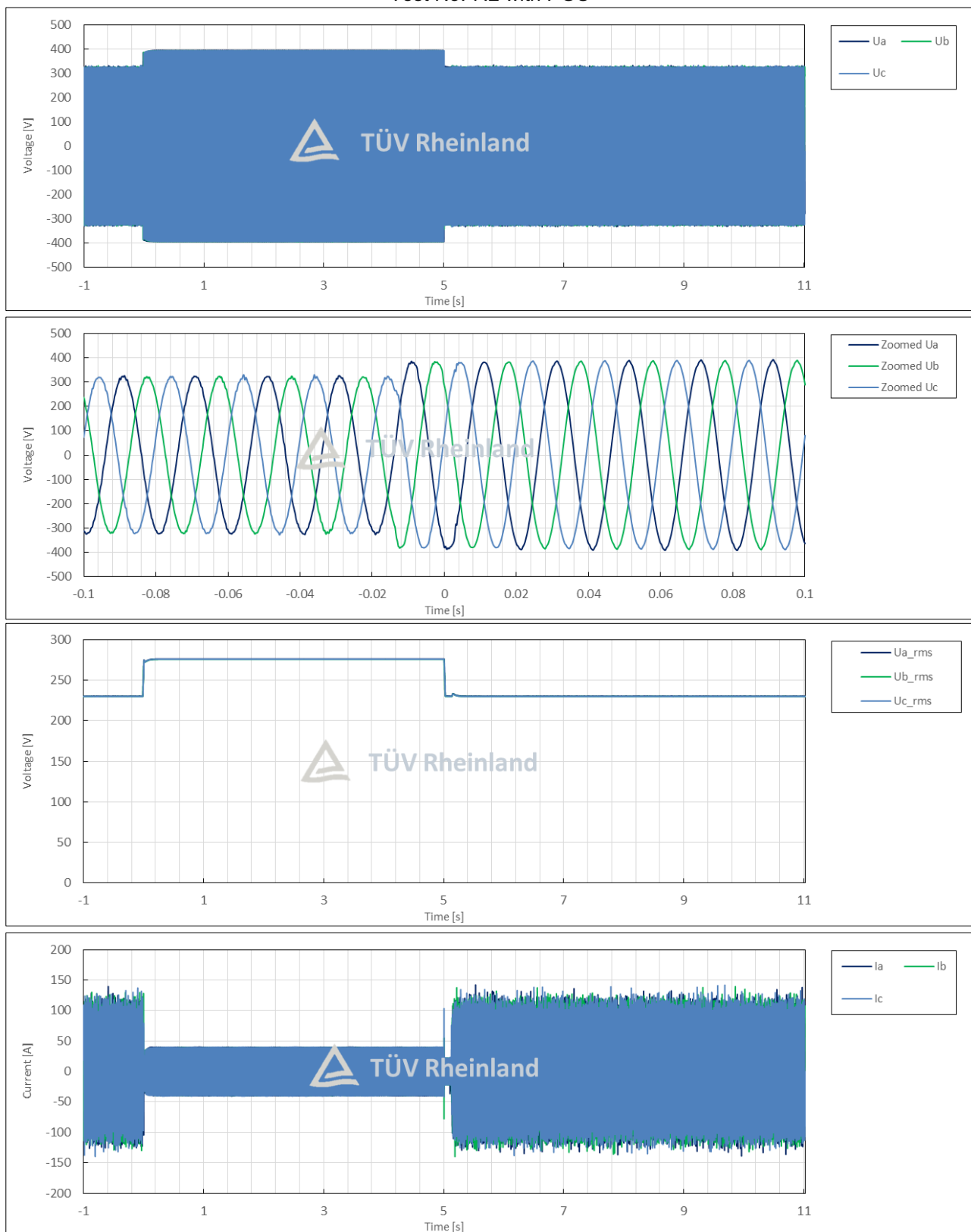
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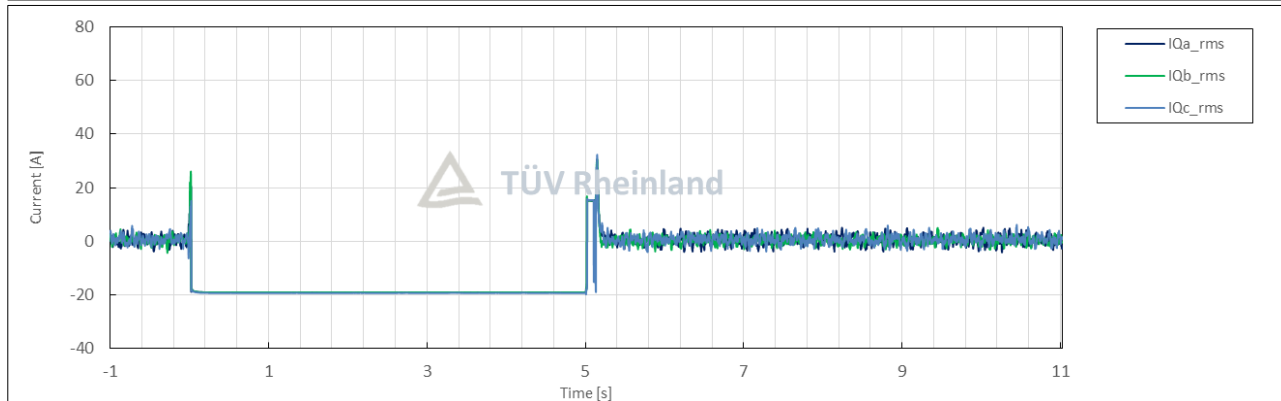
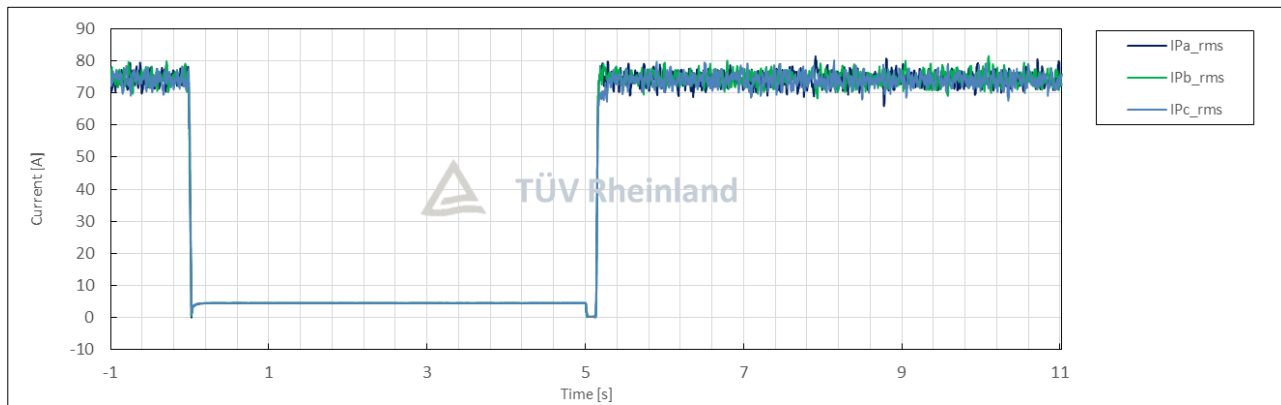
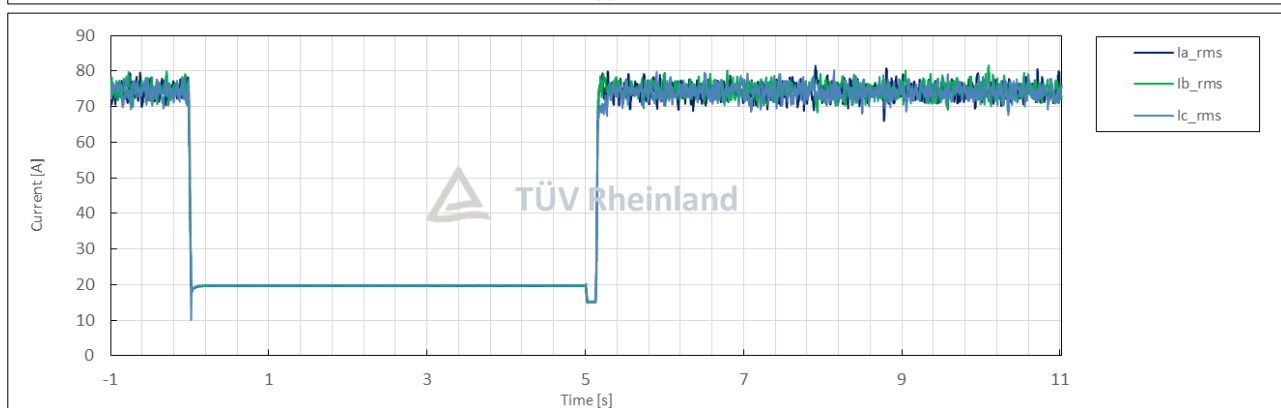
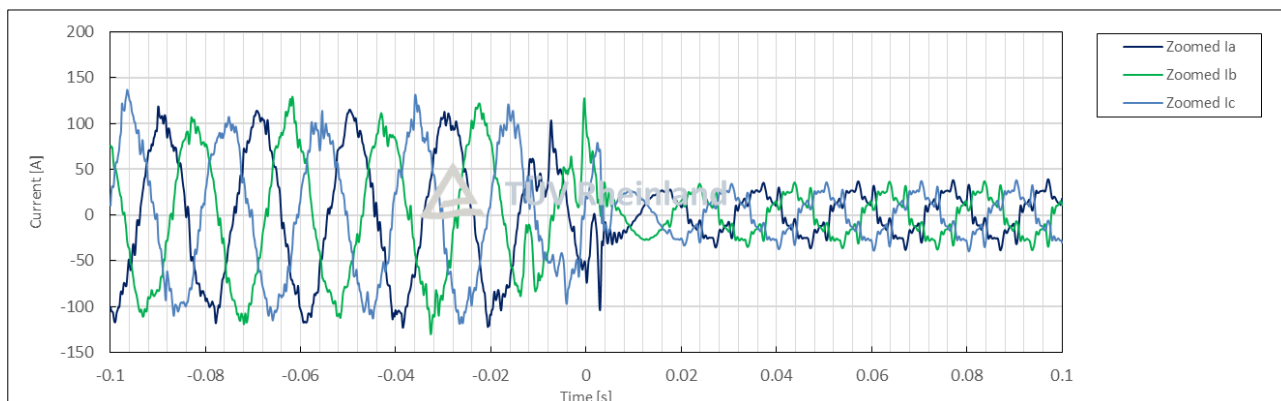
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	7.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:44:13
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		5000
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	5000
	8	Fault duration in empty load test	Total	--	ms	5000
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.20
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.20
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.05
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			-0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 7.2 idle test



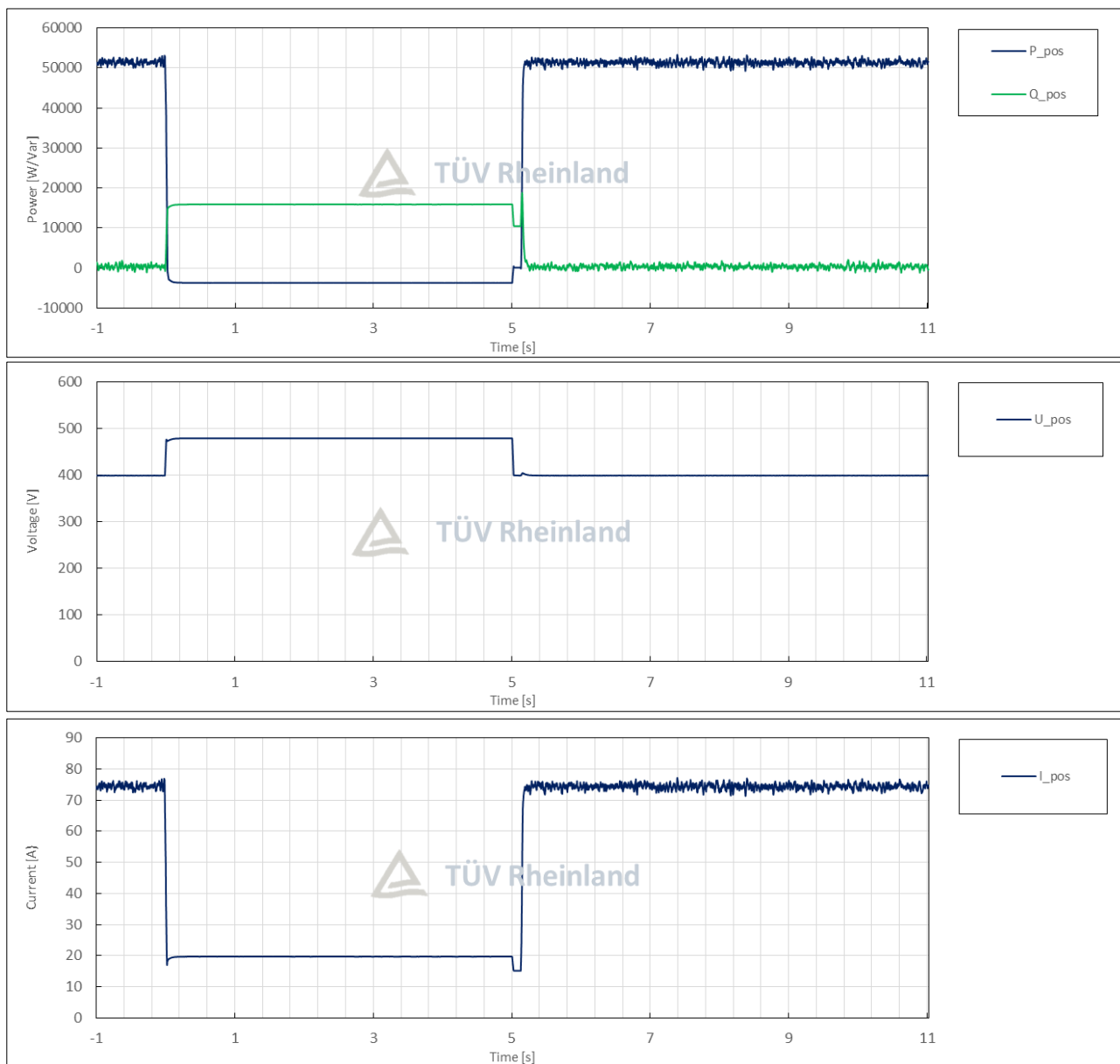
Test No. 7.2 with PGU





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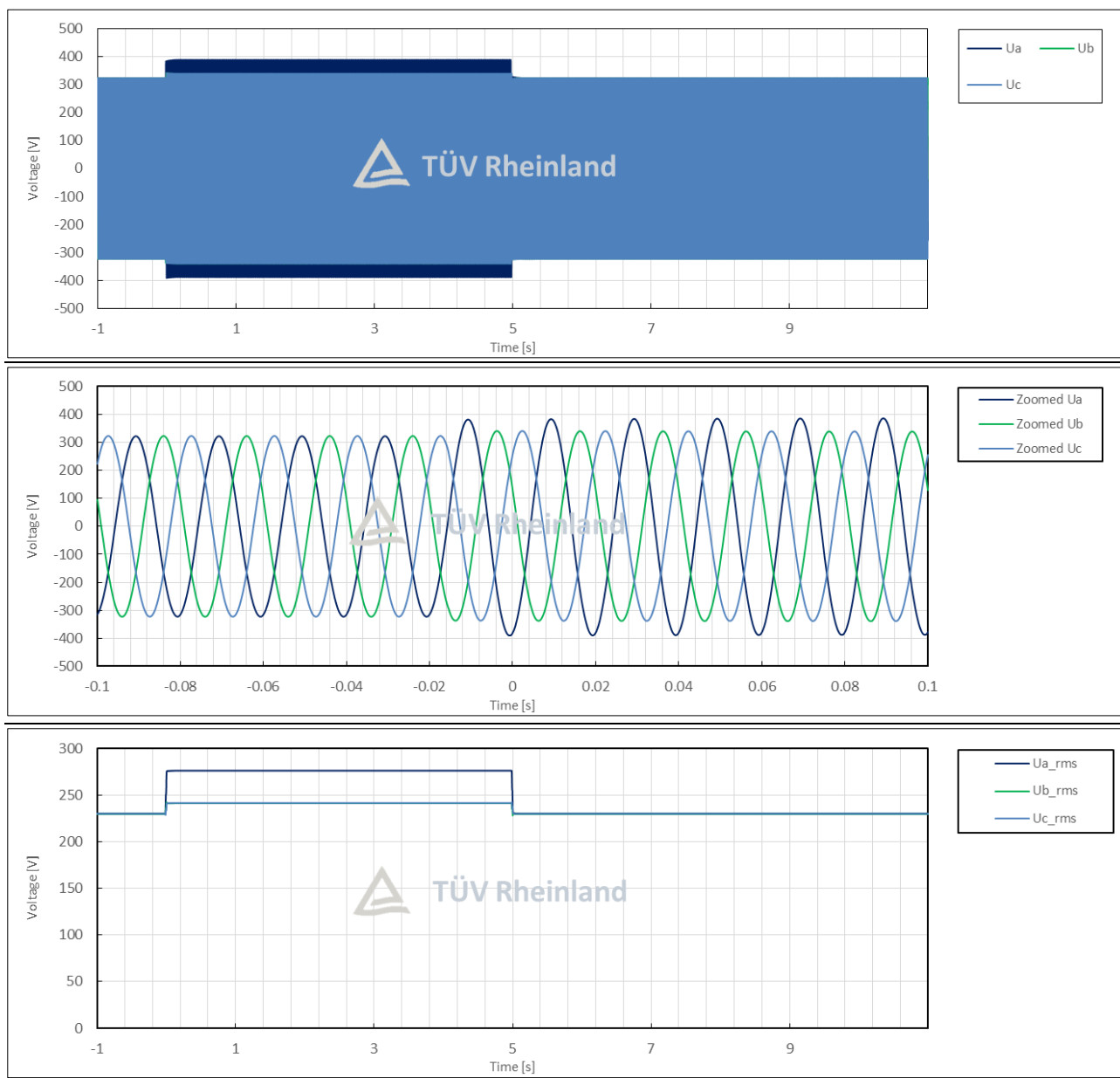


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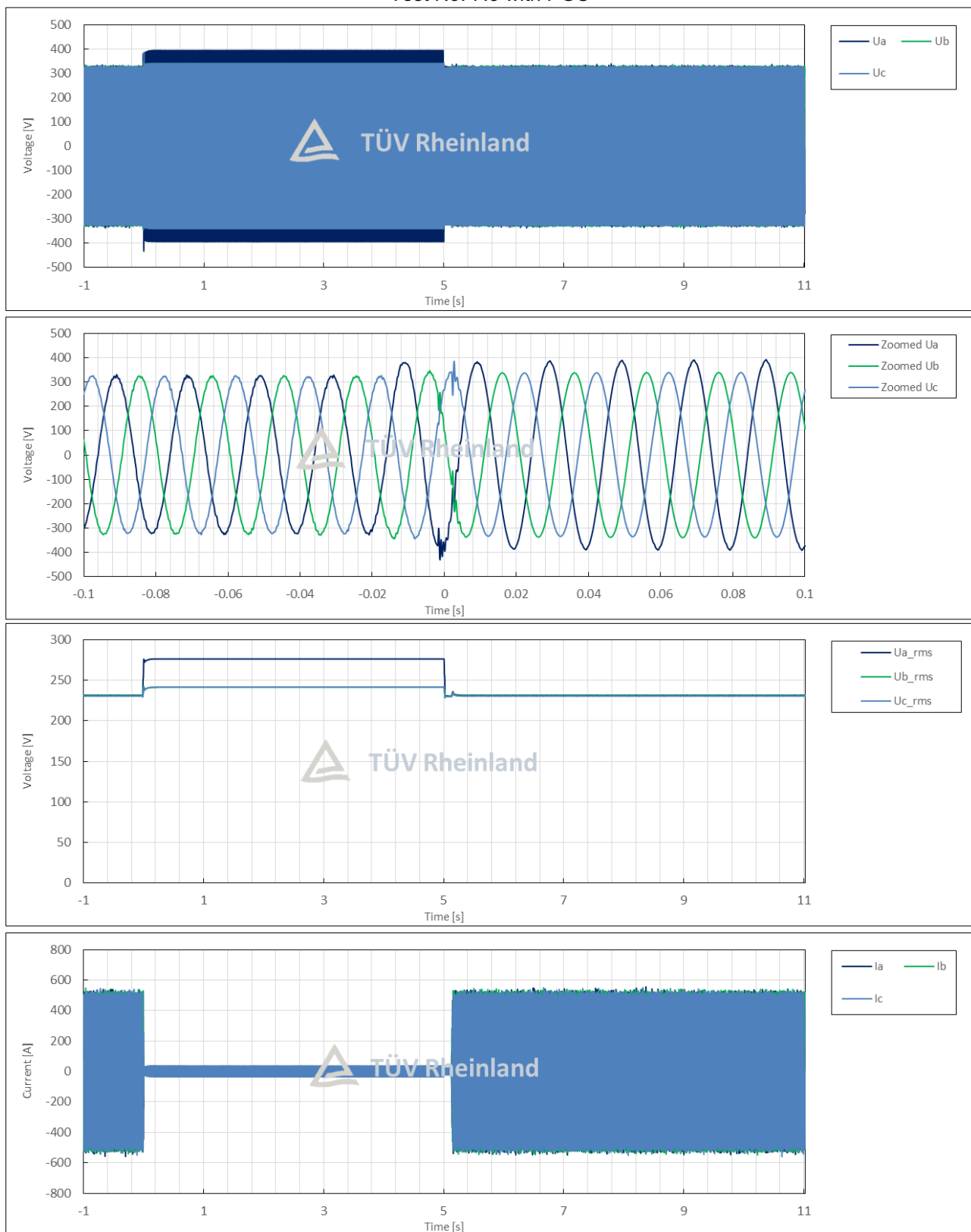
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	7.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:45:05
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		4997
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	4997
	8	Fault duration in empty load test	Total	--	ms	4997
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.10
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.20
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.04
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 7.3 idle test

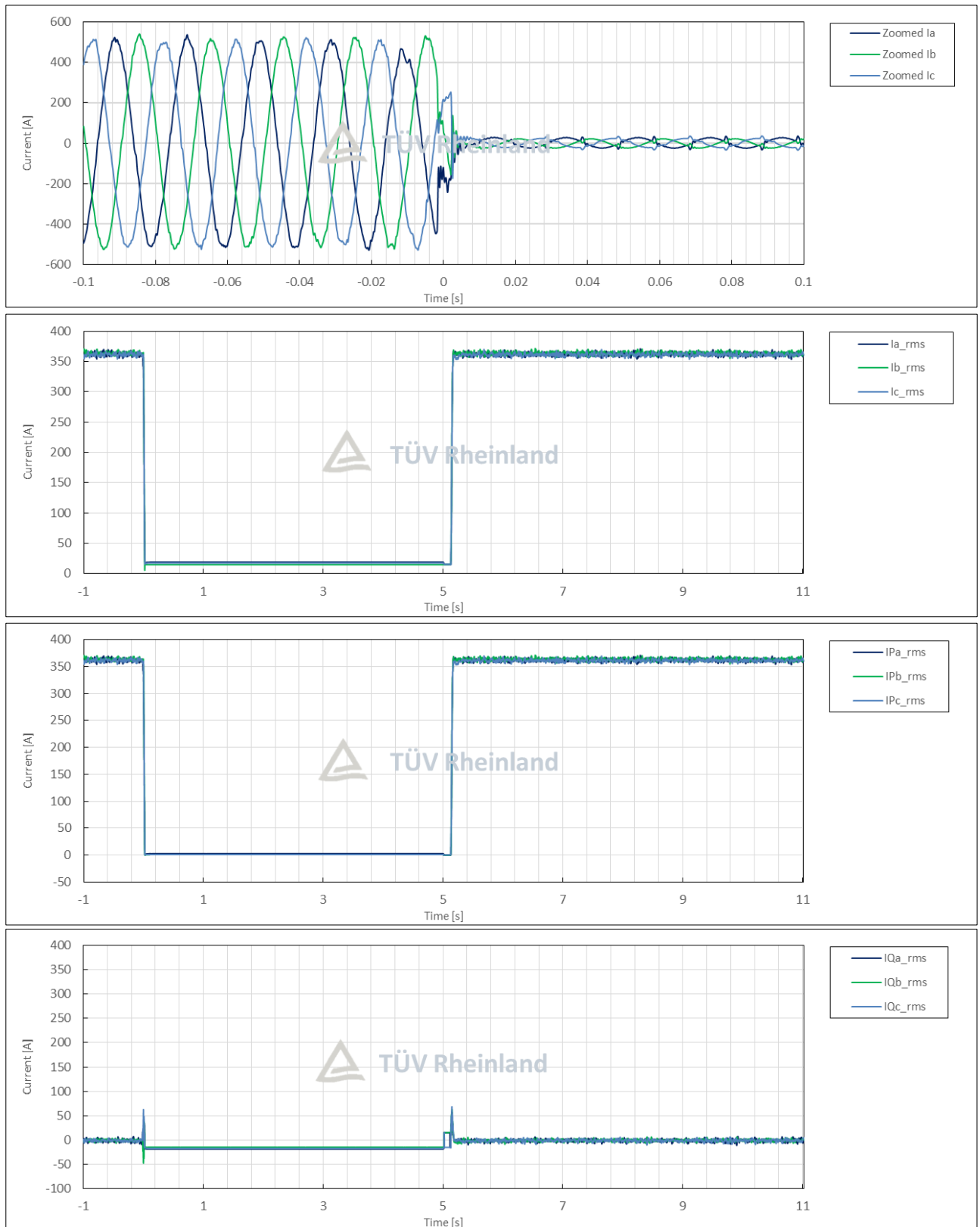


Test No. 7.3 with PGU



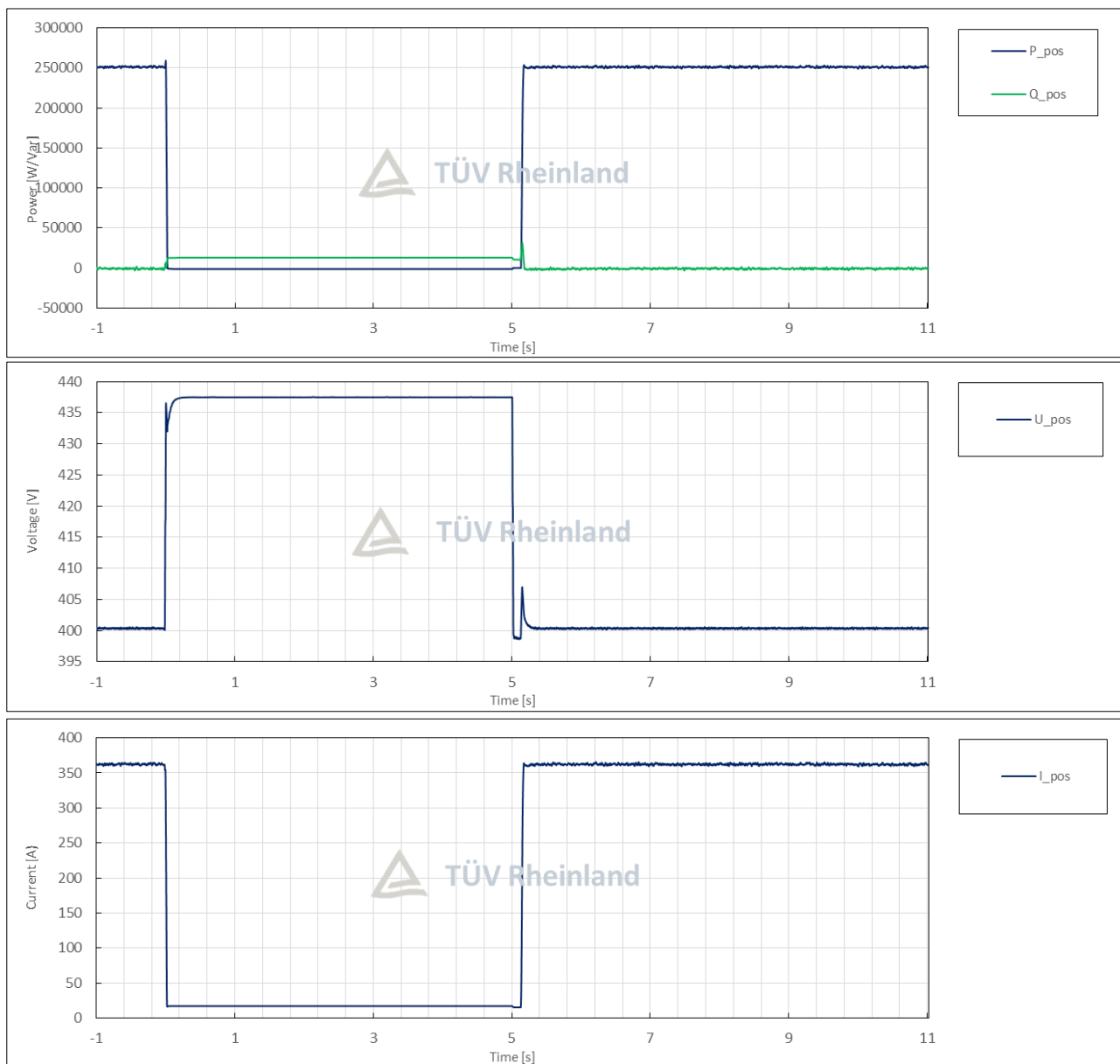
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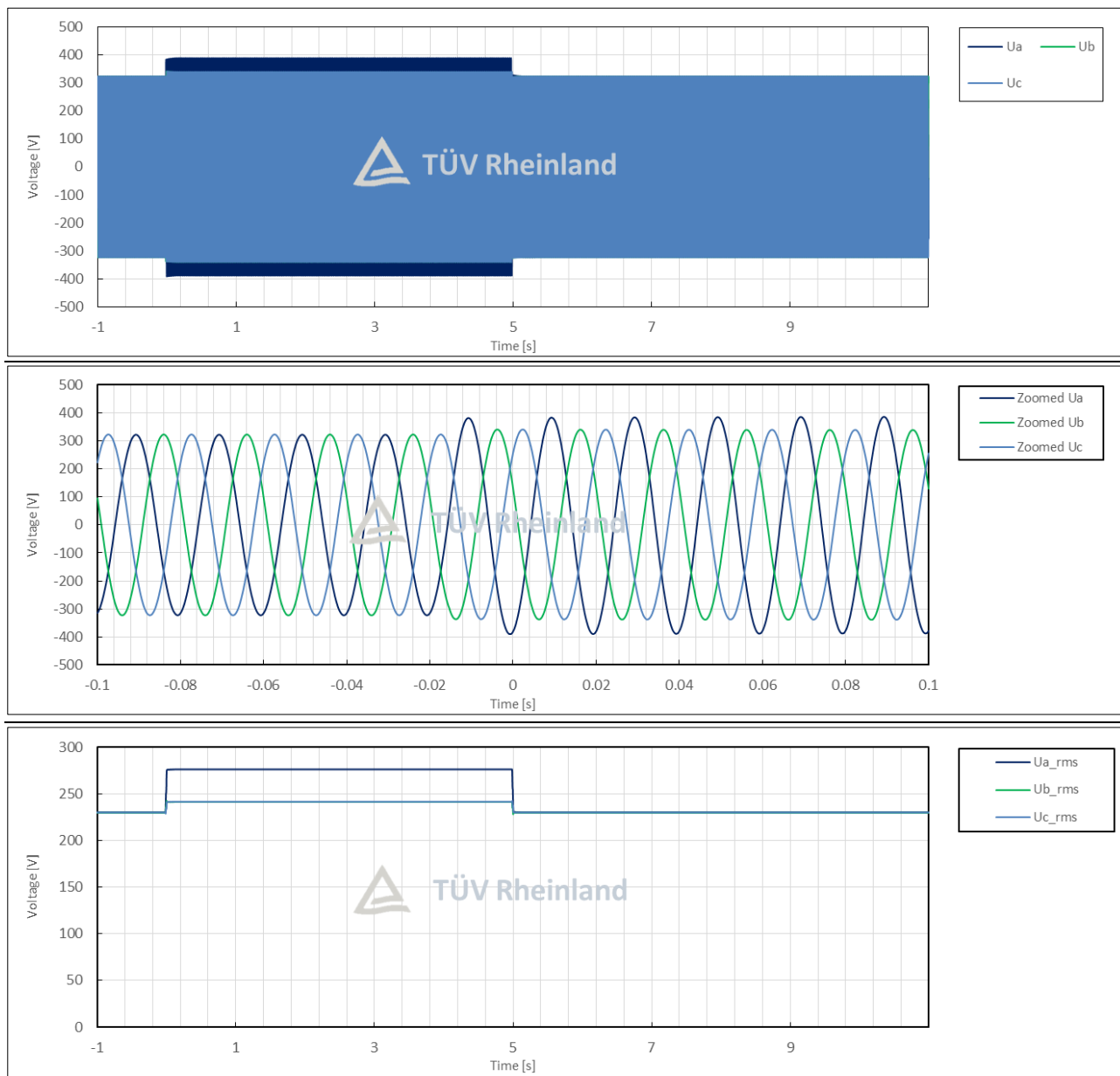


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Test report no.:

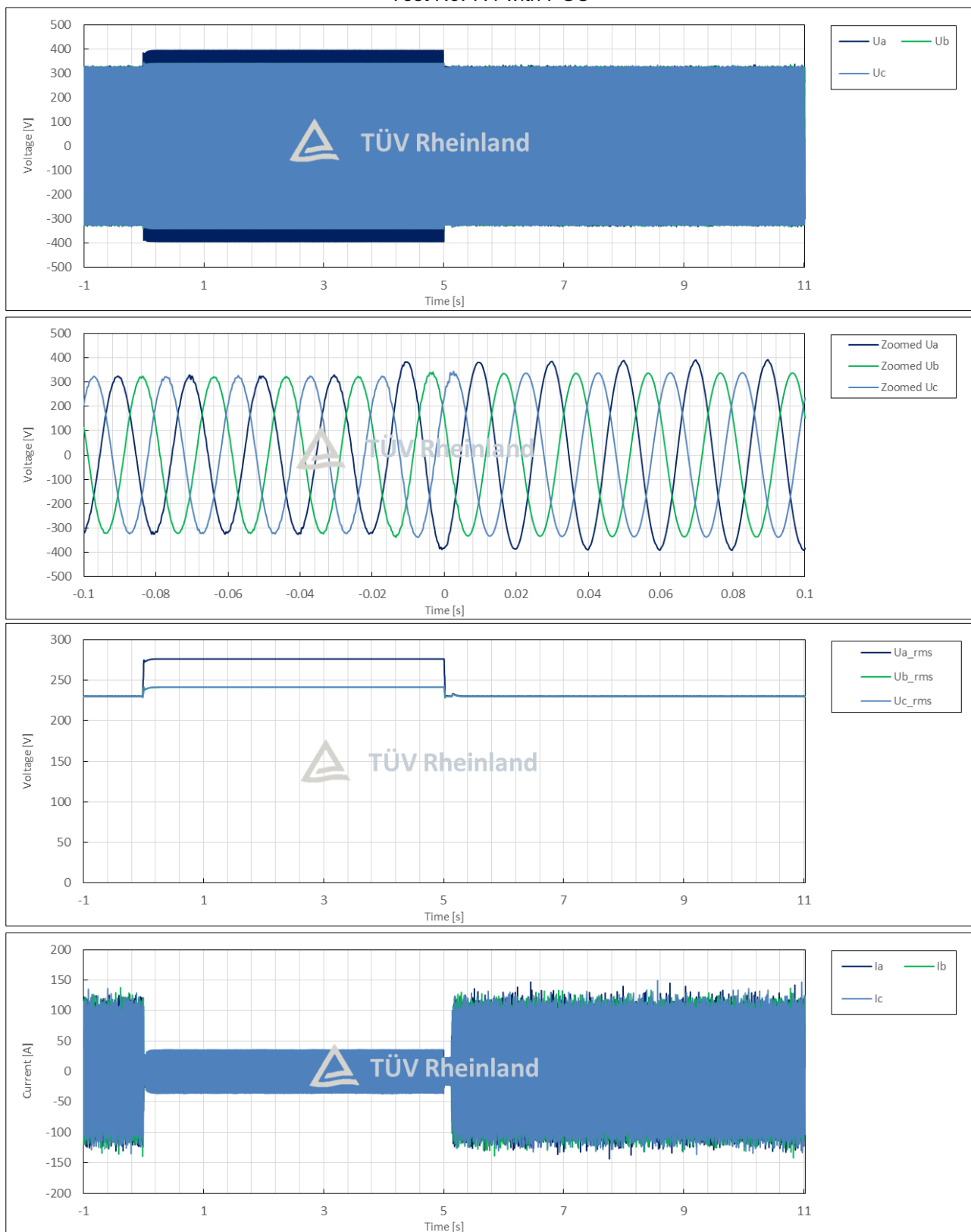
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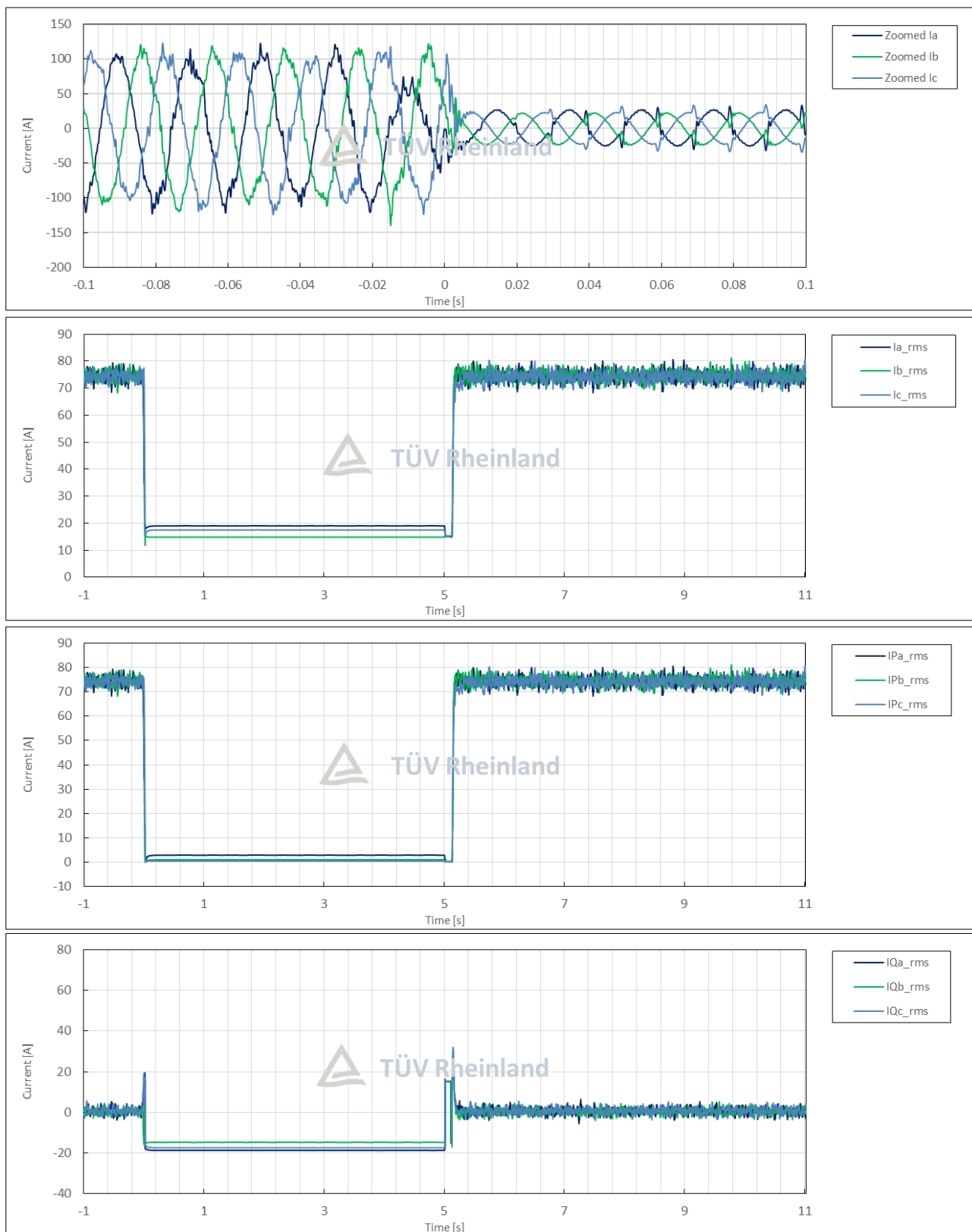
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	7.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:46:24
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		4997
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	4997
	8	Fault duration in empty load test	Total	--	ms	4997
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.10
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.20
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.04
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.144
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 7.4 idle test



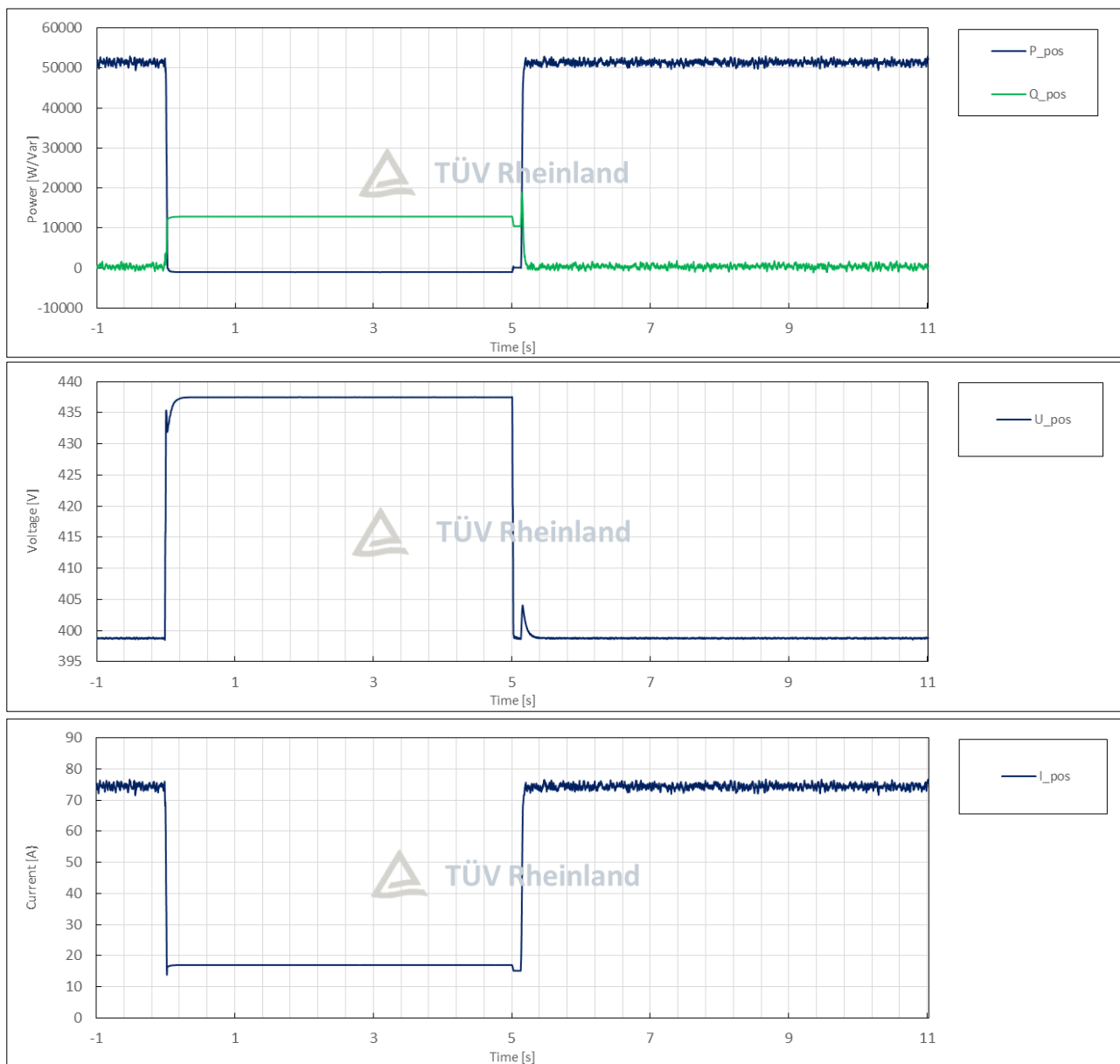
Test No. 7.4 with PGU





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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	8.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:47:03
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		104
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	104
	8	Fault duration in empty load test	Total	--	ms	104
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.20
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.06
	20		Phase 2			0.06
	21		Phase 3			0.06
	22	Line current	Phase 1	t1+80ms	p.u.	0.06
	23		Phase 2			0.06
	24		Phase 3			0.06
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.03
	26		Pos.			-0.03
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.144
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 8.1 idle test

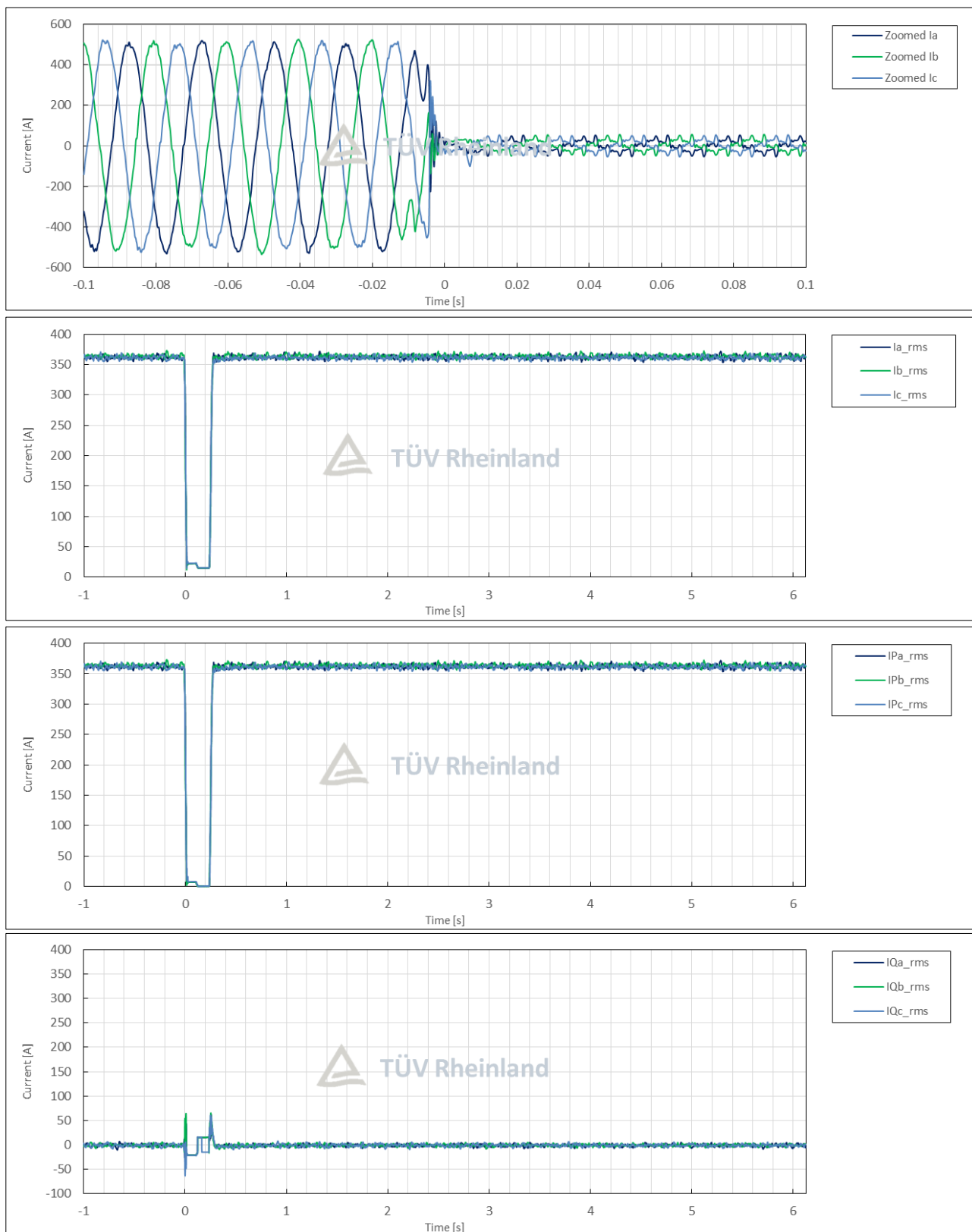


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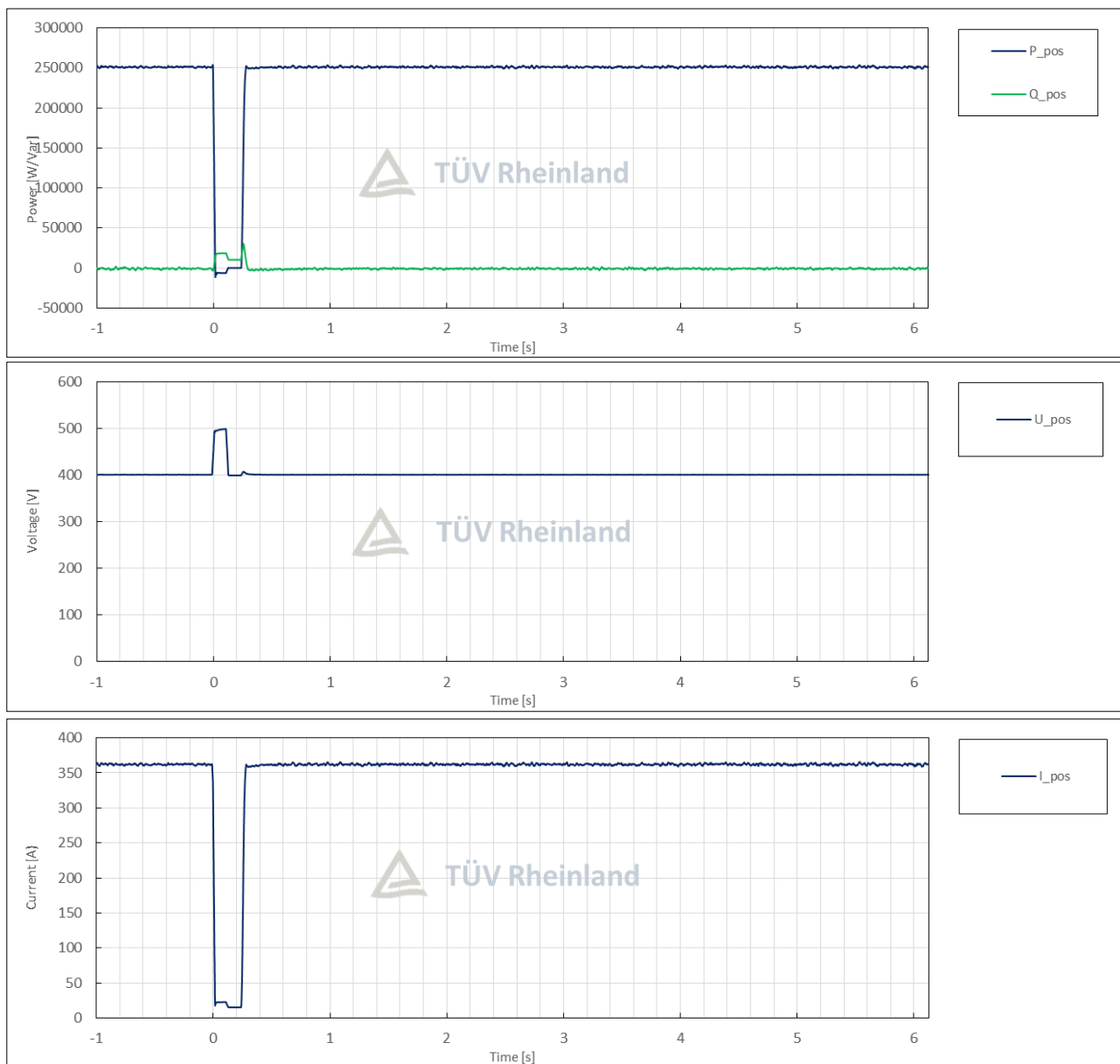
Test No. 8.1 with PGU





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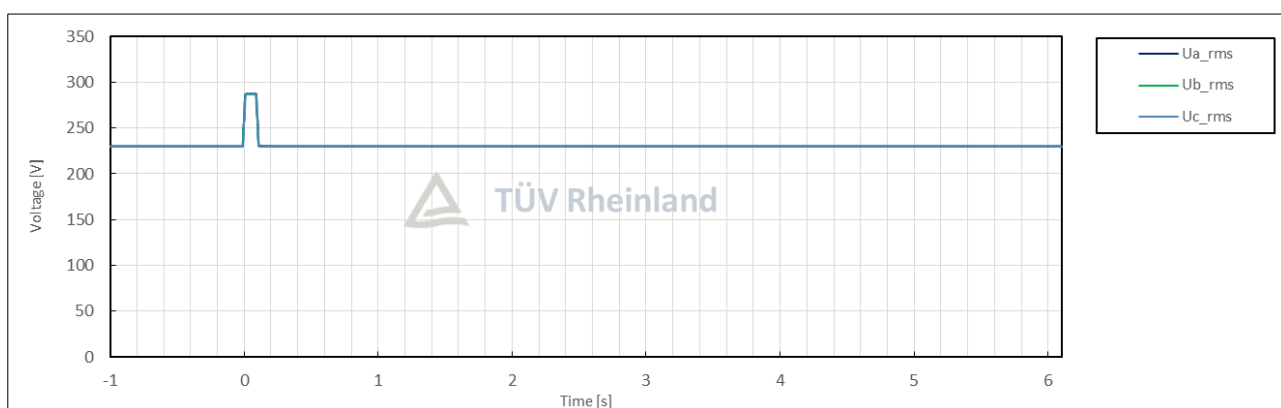
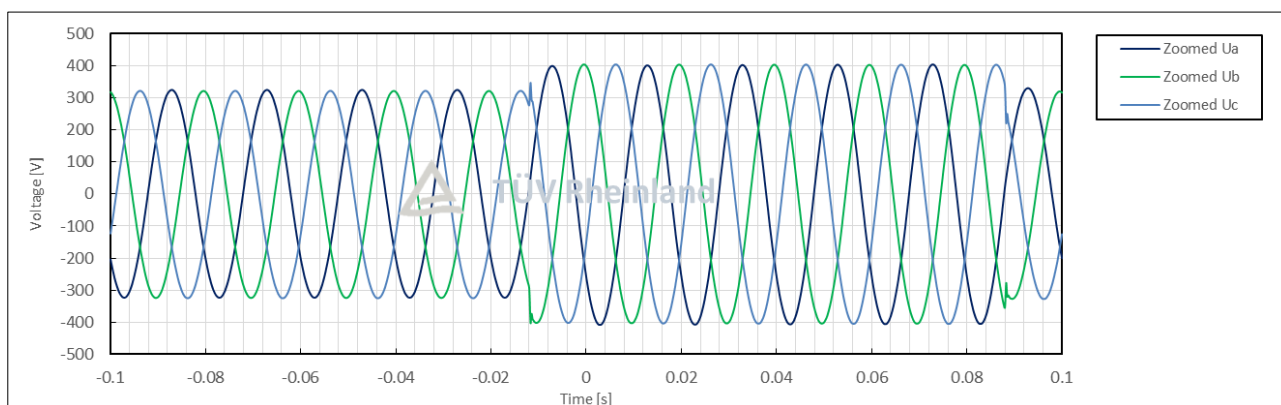
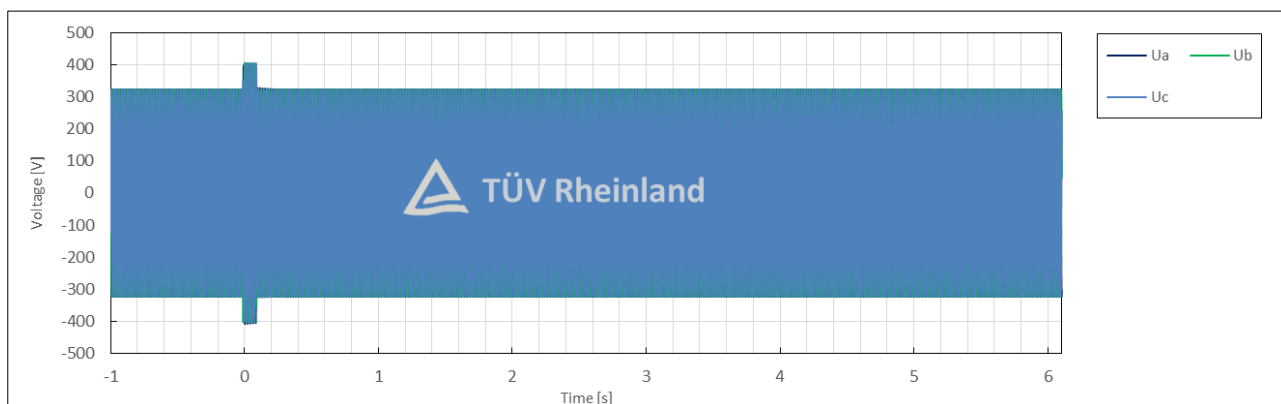


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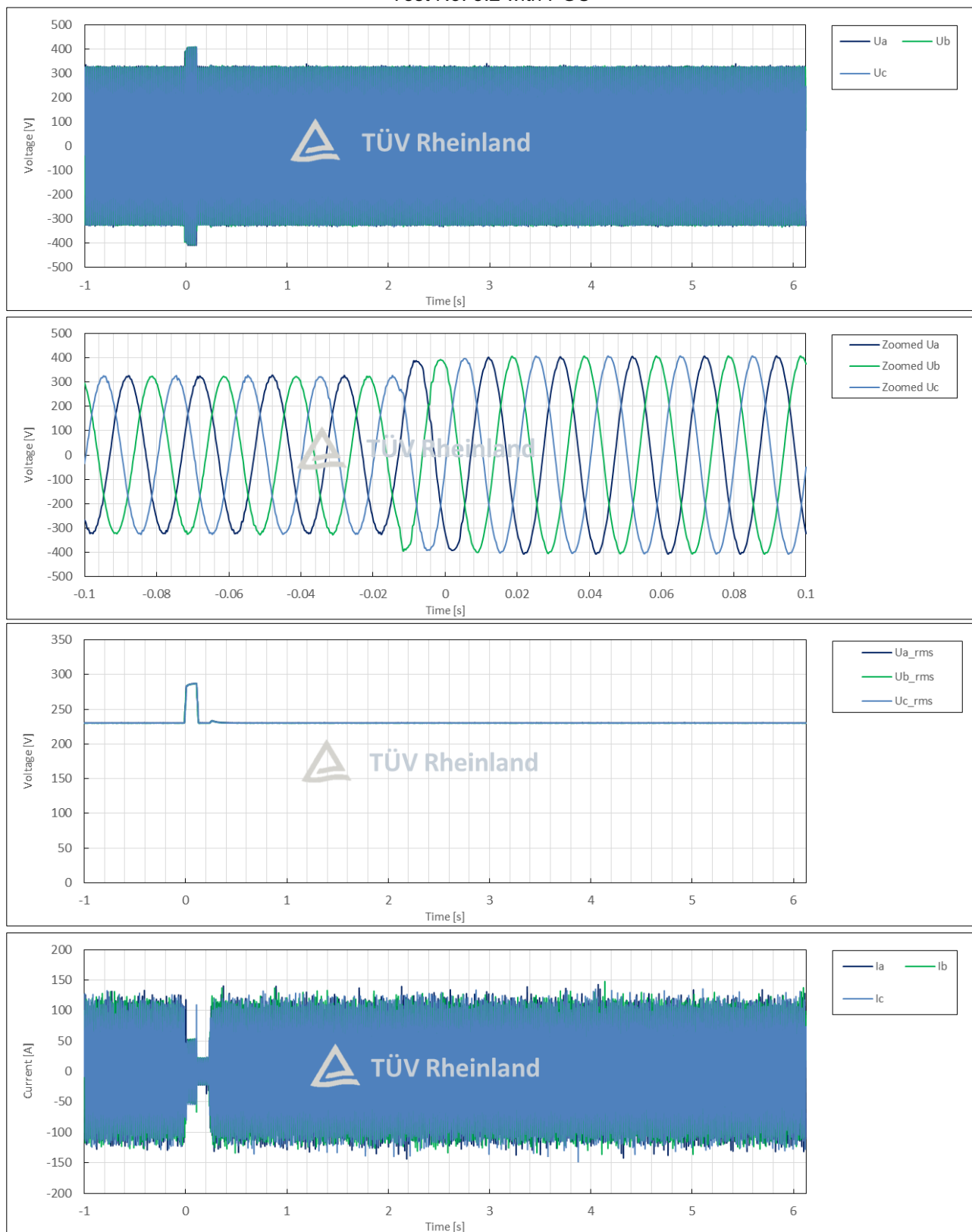
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	8.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:47:42
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		104
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	104
	8	Fault duration in empty load test	Total	--	ms	104
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.20
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.06
	20		Phase 2			0.06
	21		Phase 3			0.06
	22	Line current	Phase 1	t1+80ms	p.u.	0.06
	23		Phase 2			0.06
	24		Phase 3			0.06
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			-0.02
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.145
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 8.2 idle test

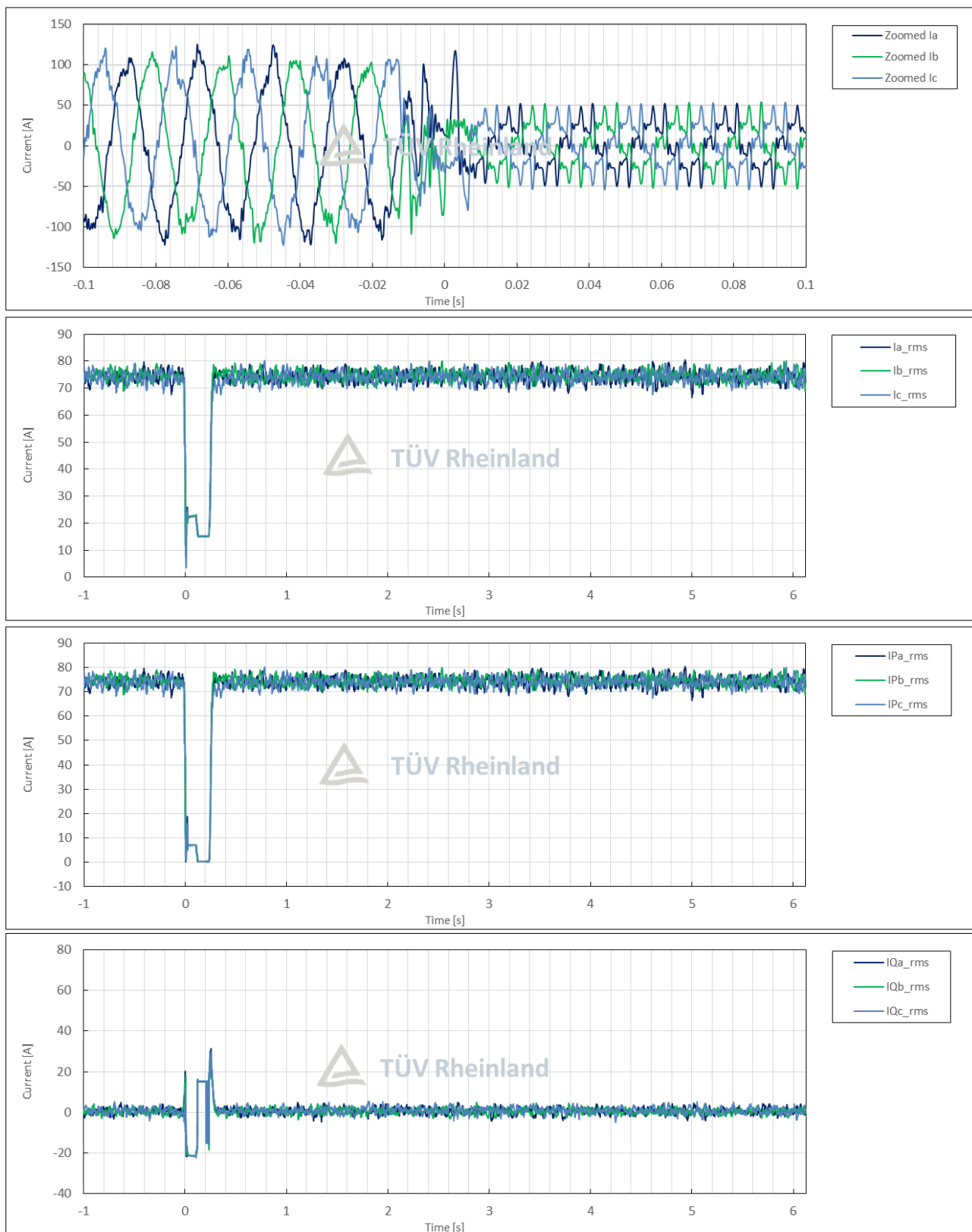


Test No. 8.2 with PGU



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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	8.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:48:23
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		100
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	100
	8	Fault duration in empty load test	Total	--	ms	100
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.19
	10		Pos.		p.u.	1.10
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.01
	14		Pos.			1.01
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.06
	20		Phase 2			0.04
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.06
	23		Phase 2			0.04
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			-0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.01
	29		Pos.			1.01
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 8.3 idle test



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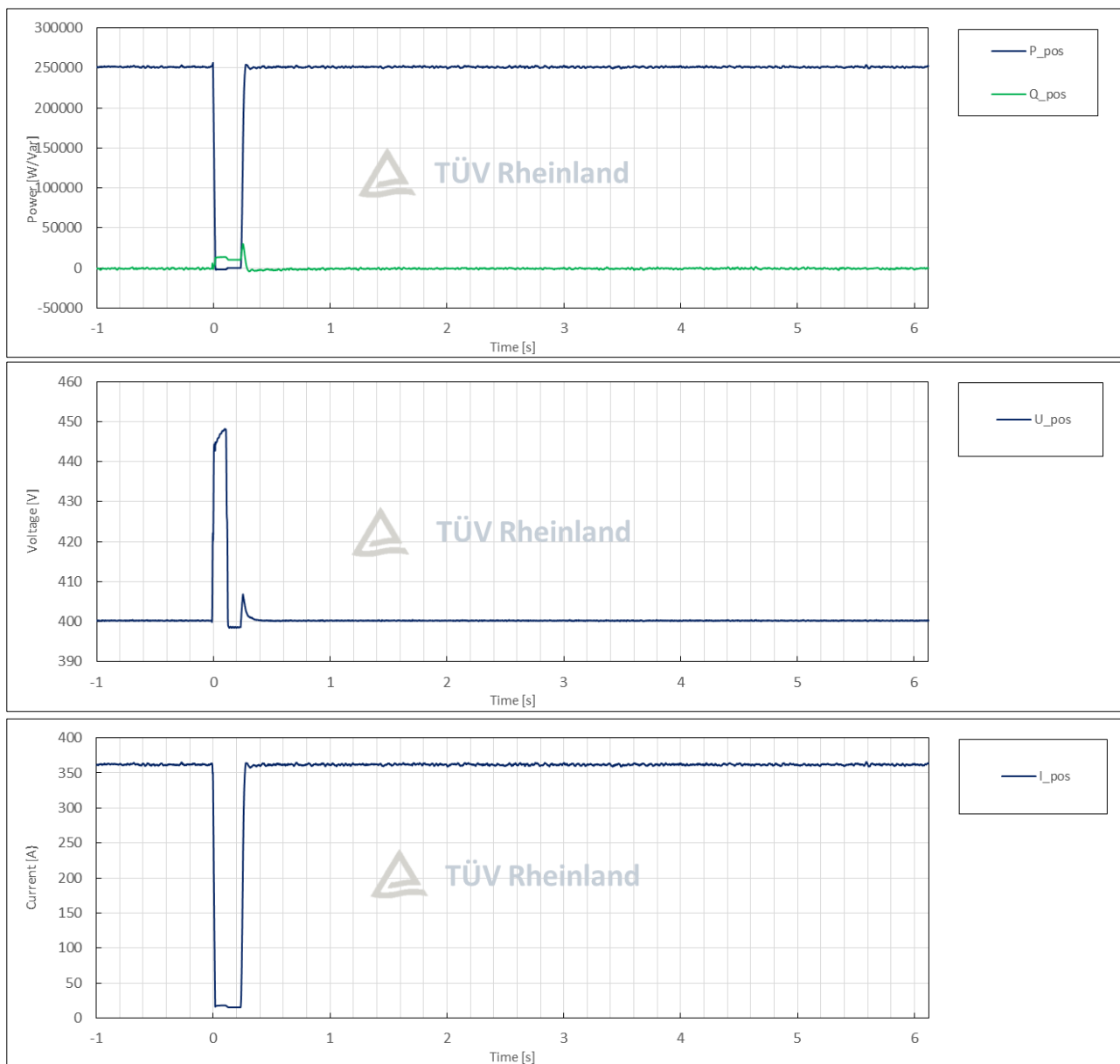
Test No. 8.3 with PGU





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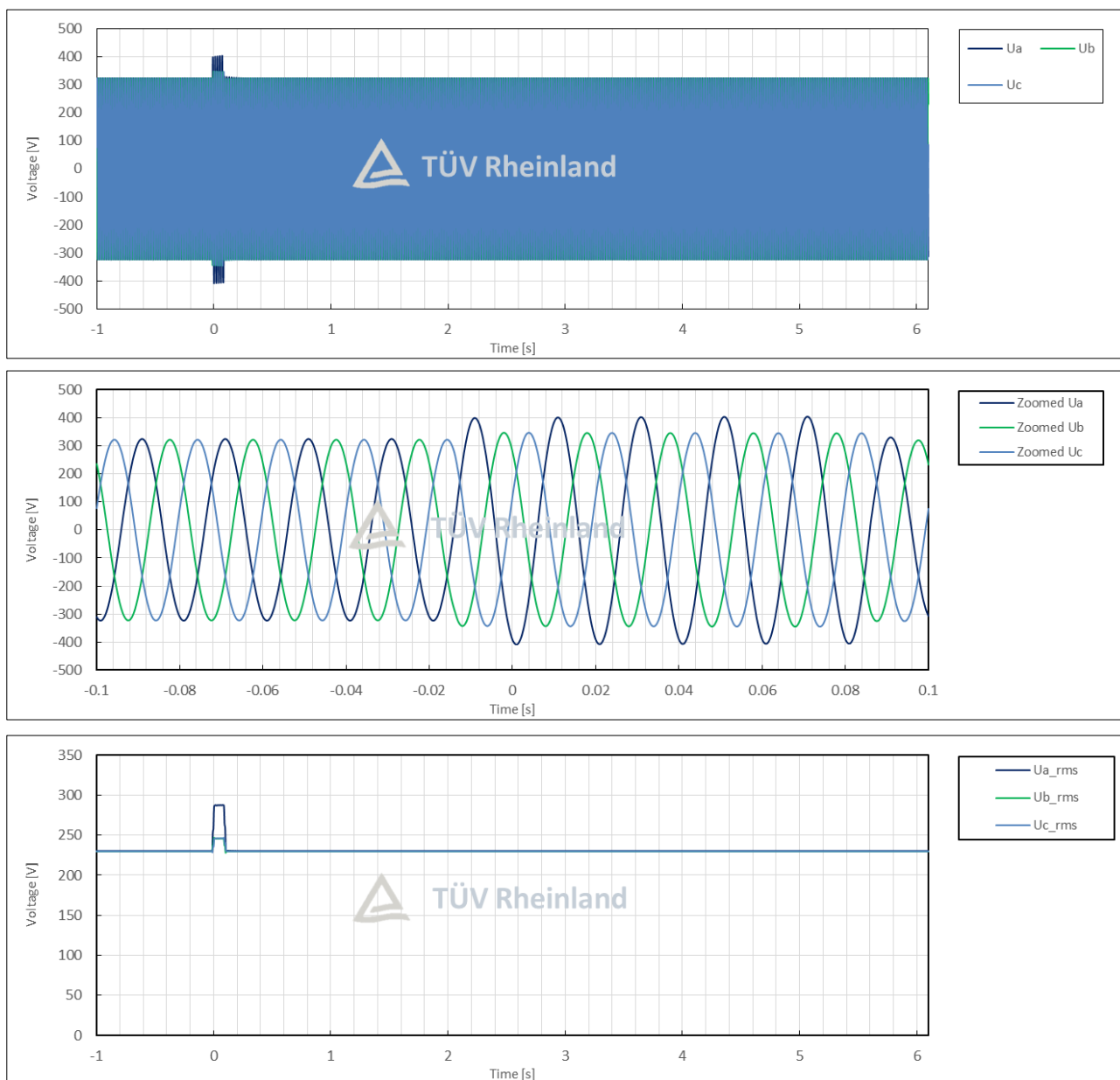


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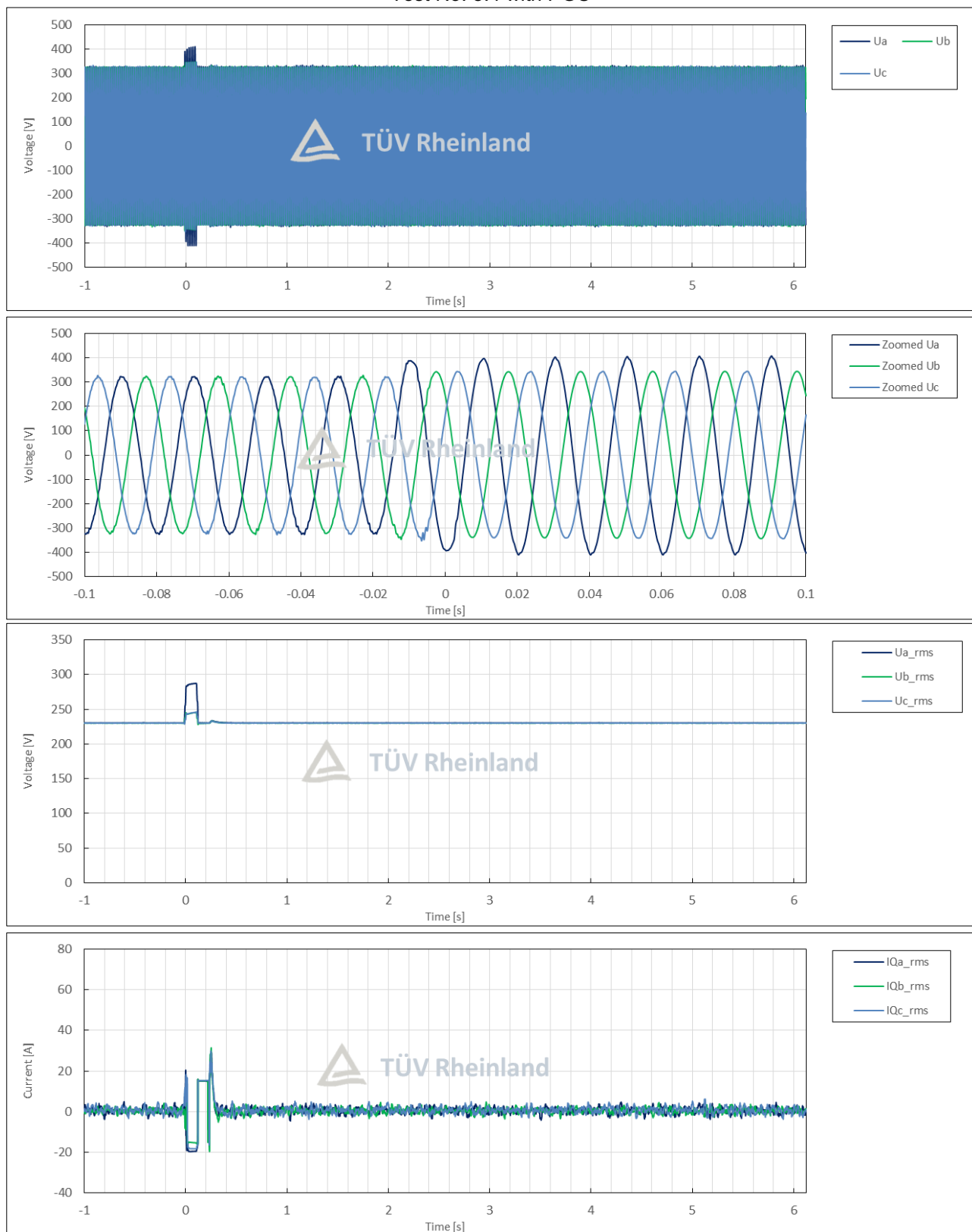
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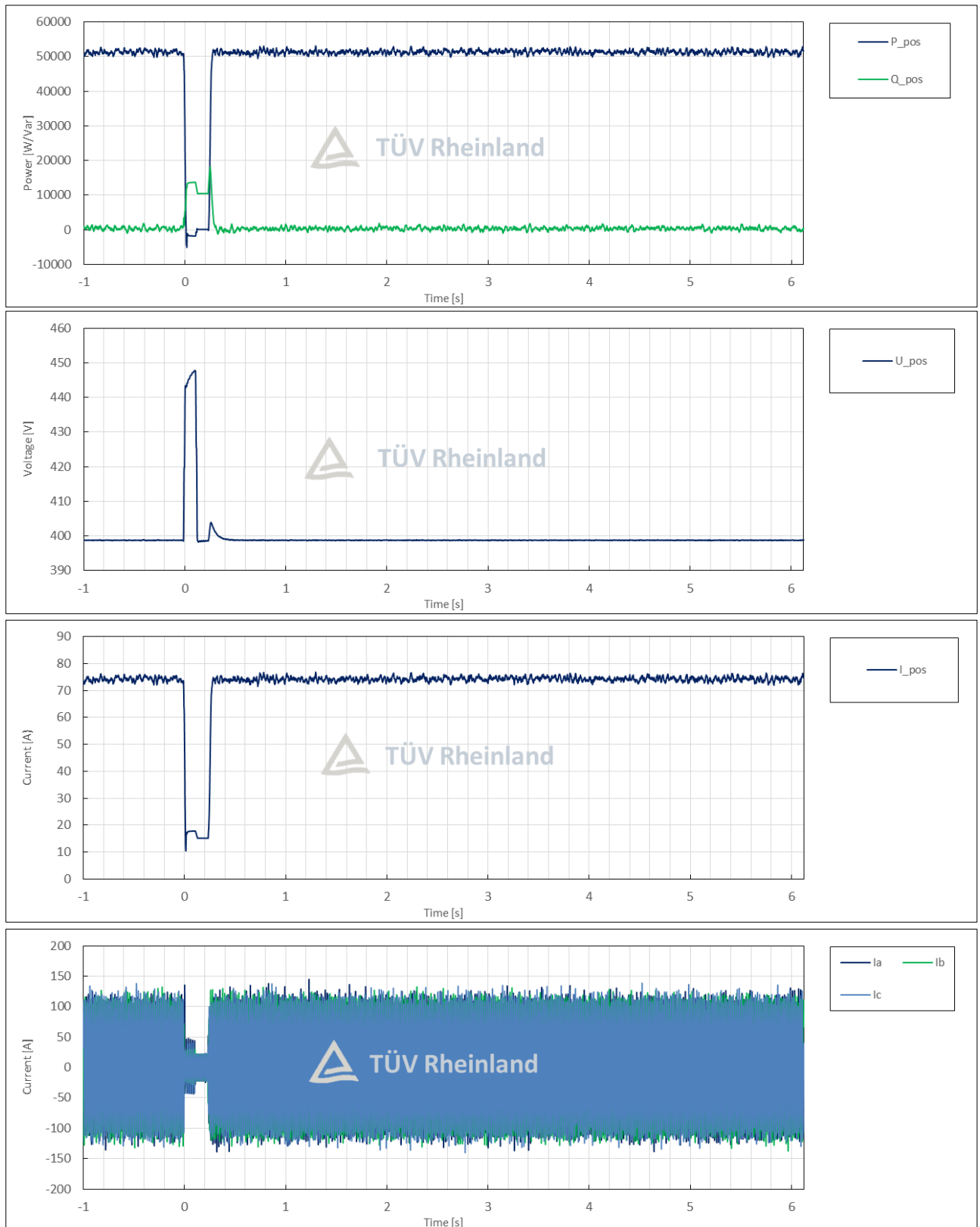
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	8.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:49:08
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		100
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	100
	8	Fault duration in empty load test	Total	--	ms	100
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.19
	10		Pos.		p.u.	1.10
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.06
	20		Phase 2			0.04
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.06
	23		Phase 2			0.04
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			-0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

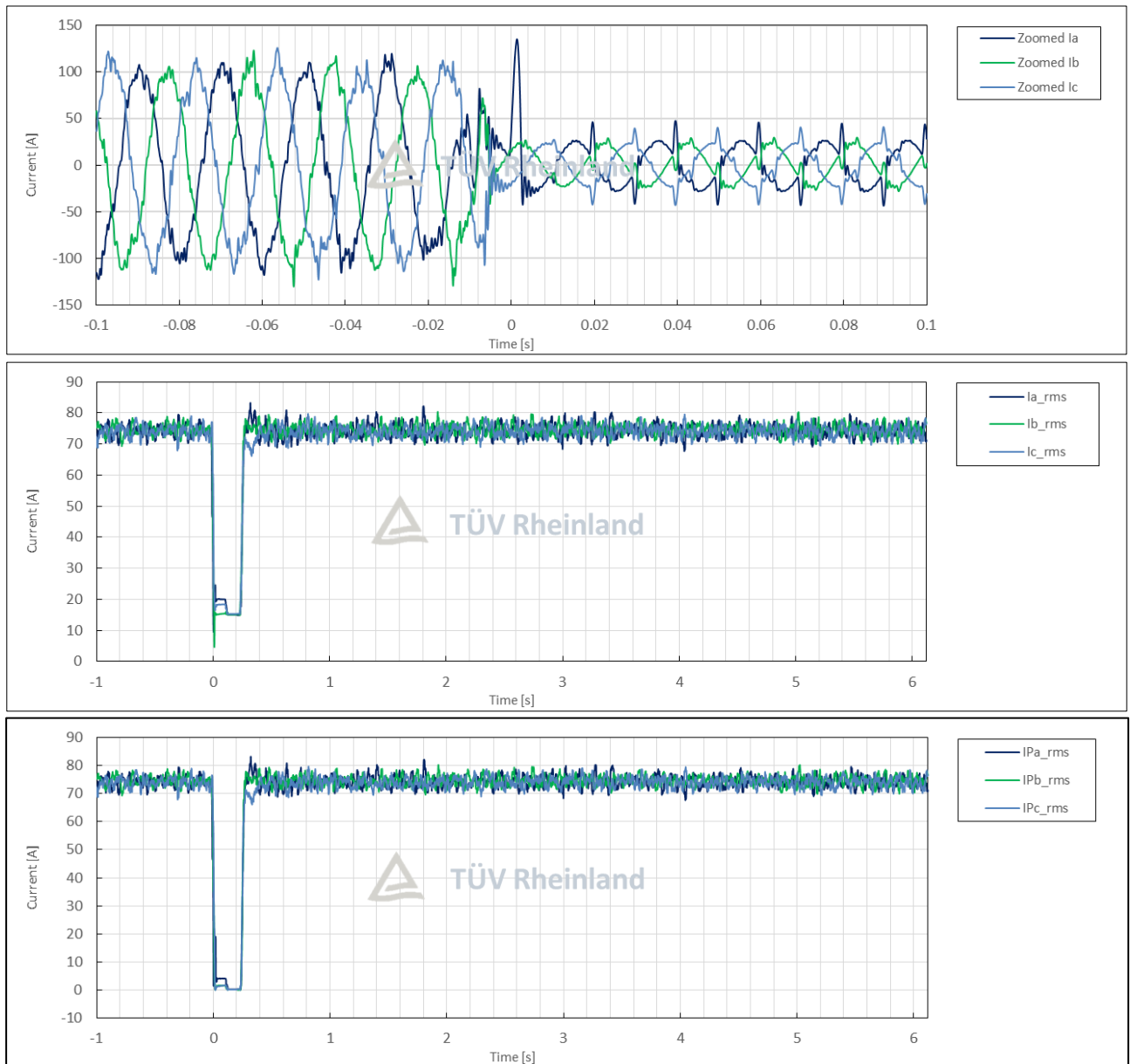
Test No. 8.4 idle test



Test No. 8.4 with PGU







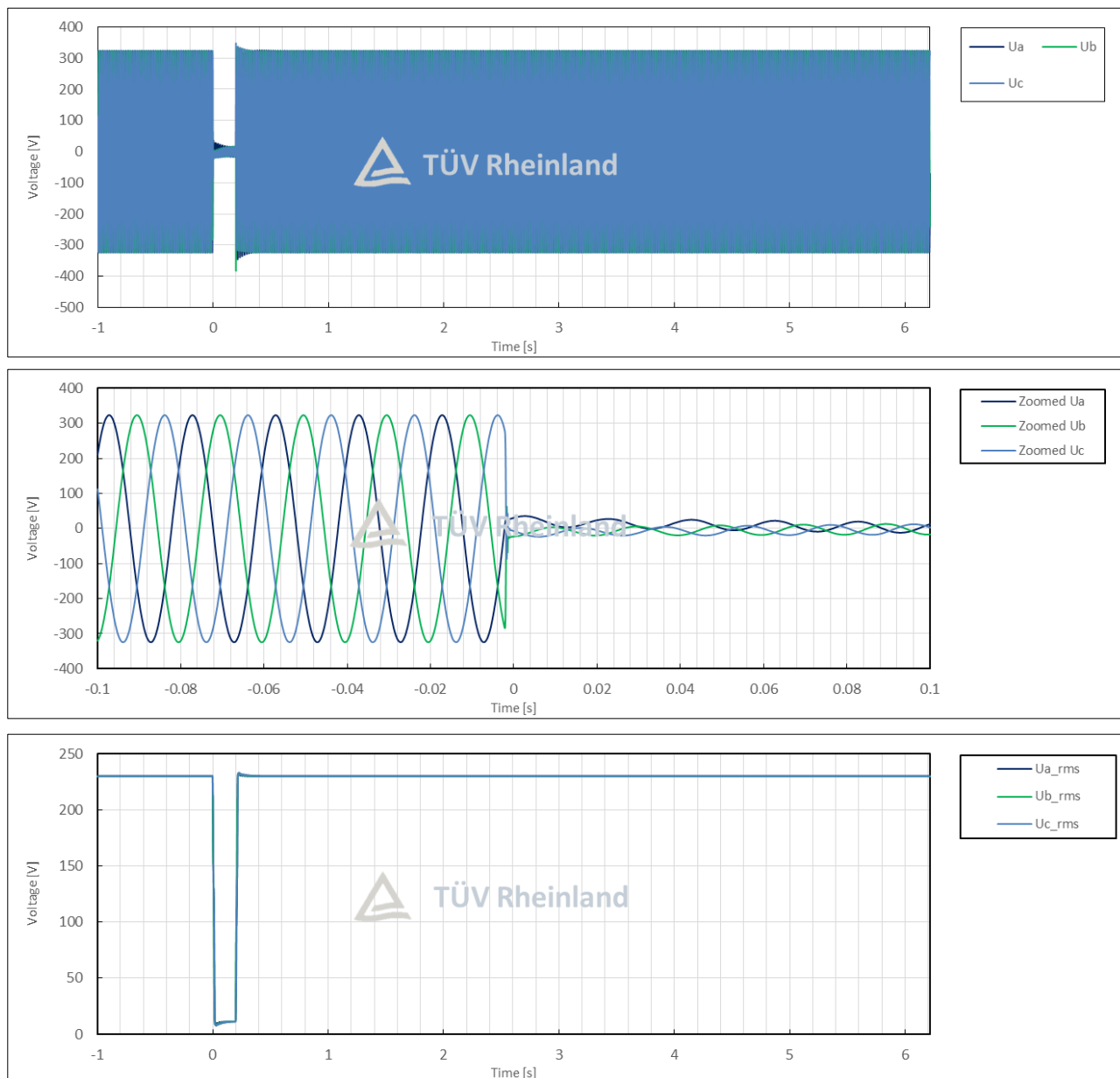
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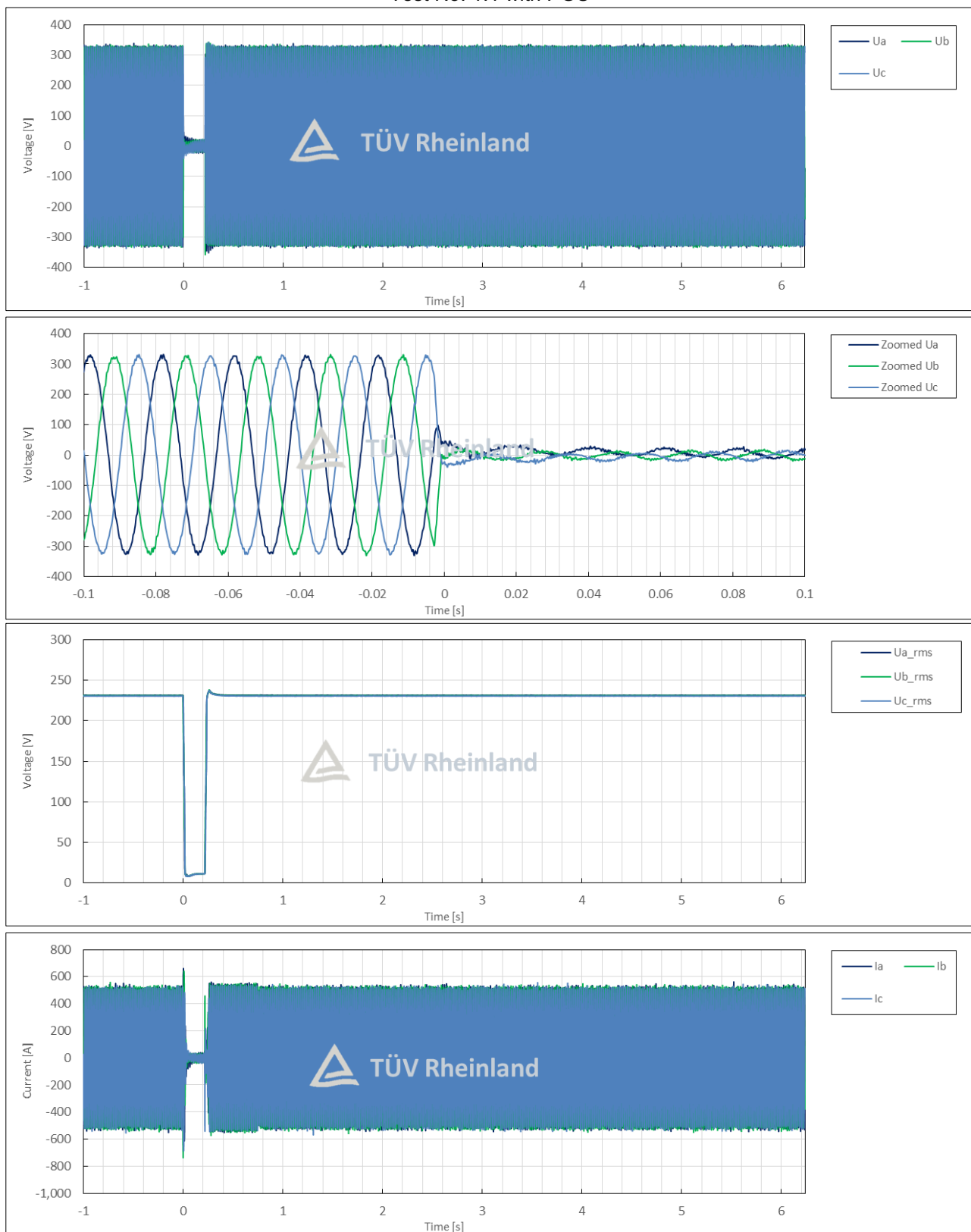
DC Input:885V

Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	1.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:50:10
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.05
	5	Setting dip duration		--		217
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	217
	8	Fault duration in empty load test	Total	--	ms	217
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.05
	10		Pos.		p.u.	0.05
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cos ϕ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.05
	19	Line current	Phase 1	t1+50ms	p.u.	0.07
	20		Phase 2			0.06
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.04
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.033
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 1.1 idle test



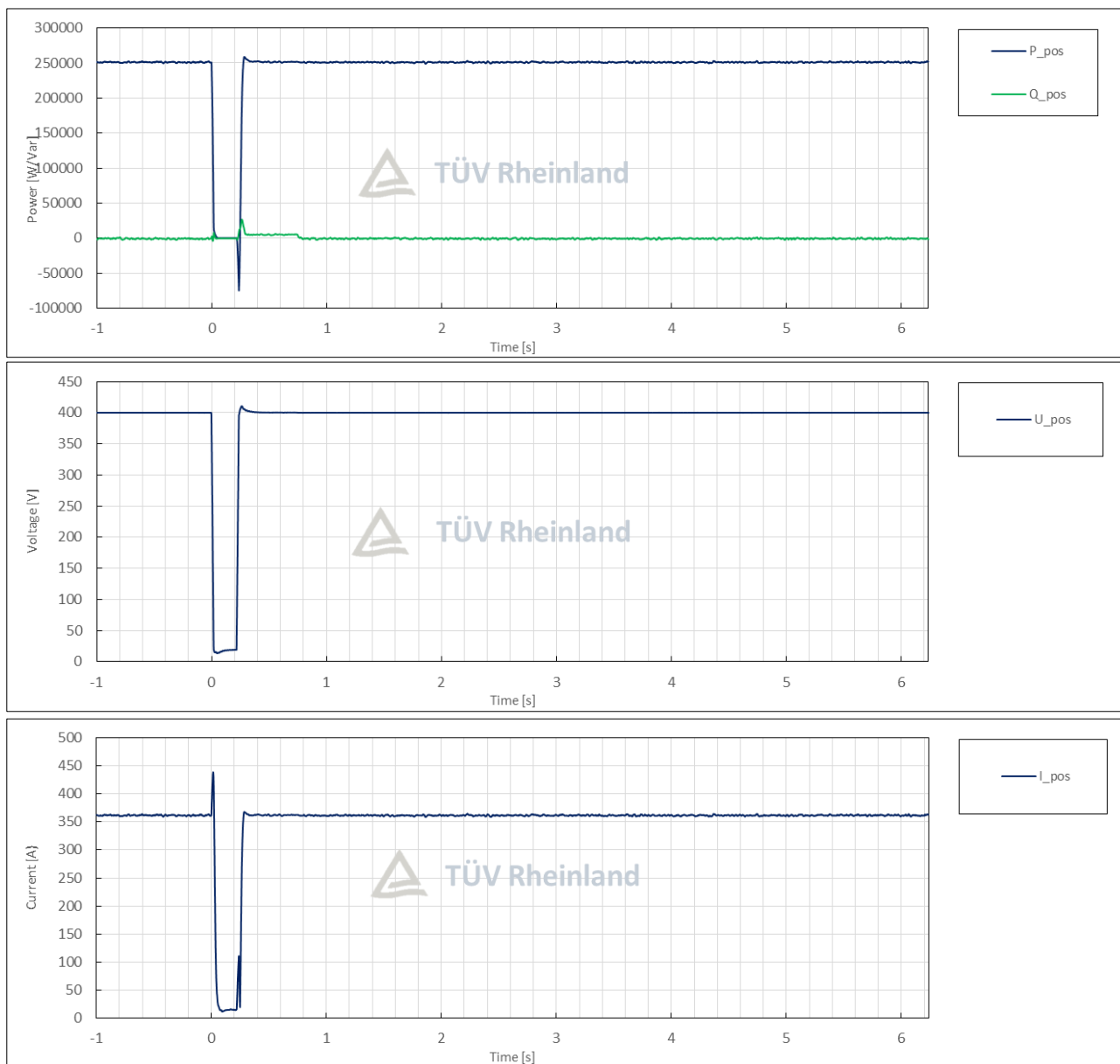
Test No. 1.1 with PGU





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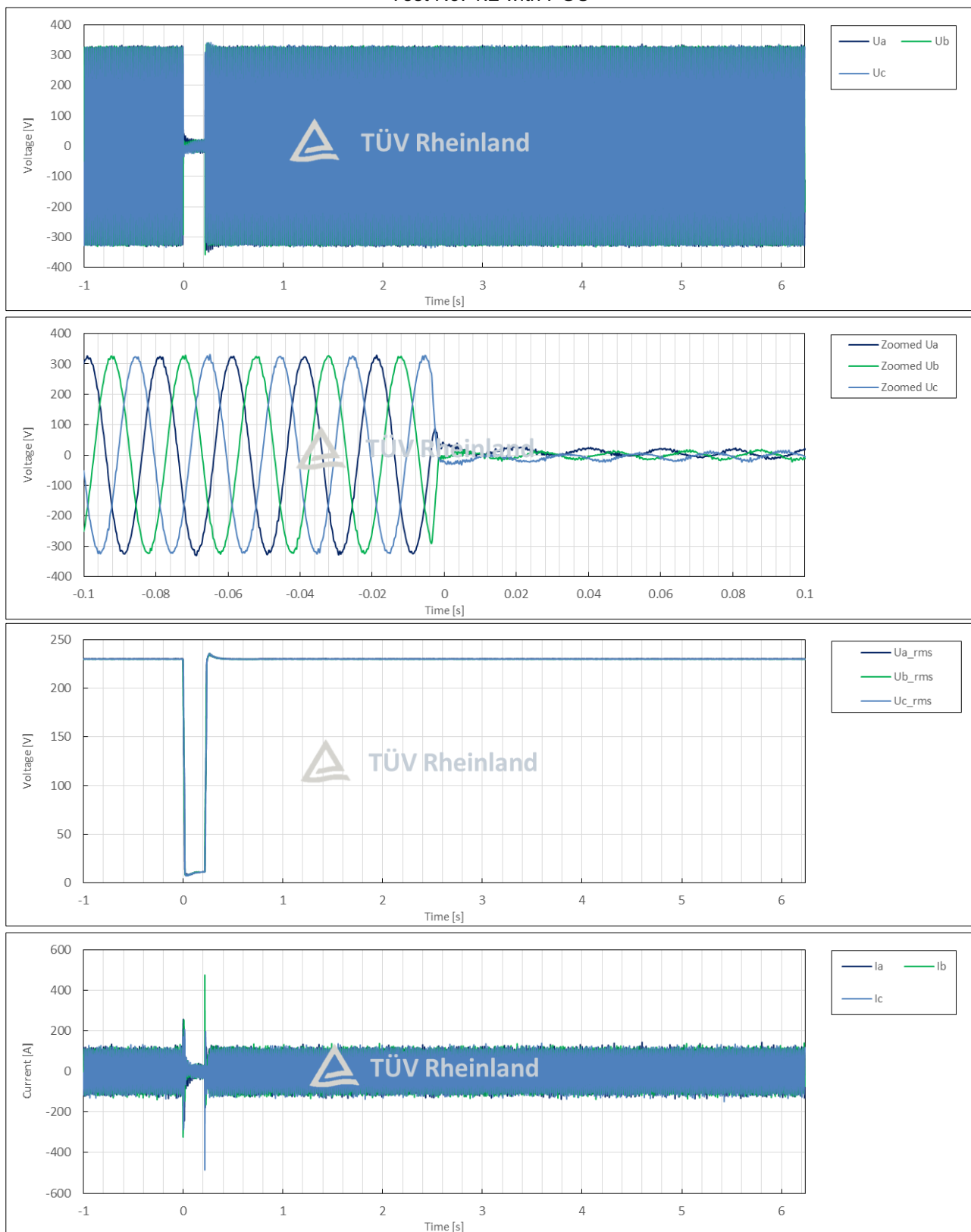
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	1.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:50:49
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.05
	5	Setting dip duration		--		217
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	217
	8	Fault duration in empty load test	Total	--	ms	217
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.05
	10		Pos.		p.u.	0.05
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.05
	19	Line current	Phase 1	t1+50ms	p.u.	0.06
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.04
	23		Phase 2			0.03
	24		Phase 3			0.04
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.033
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 1.2 idle test

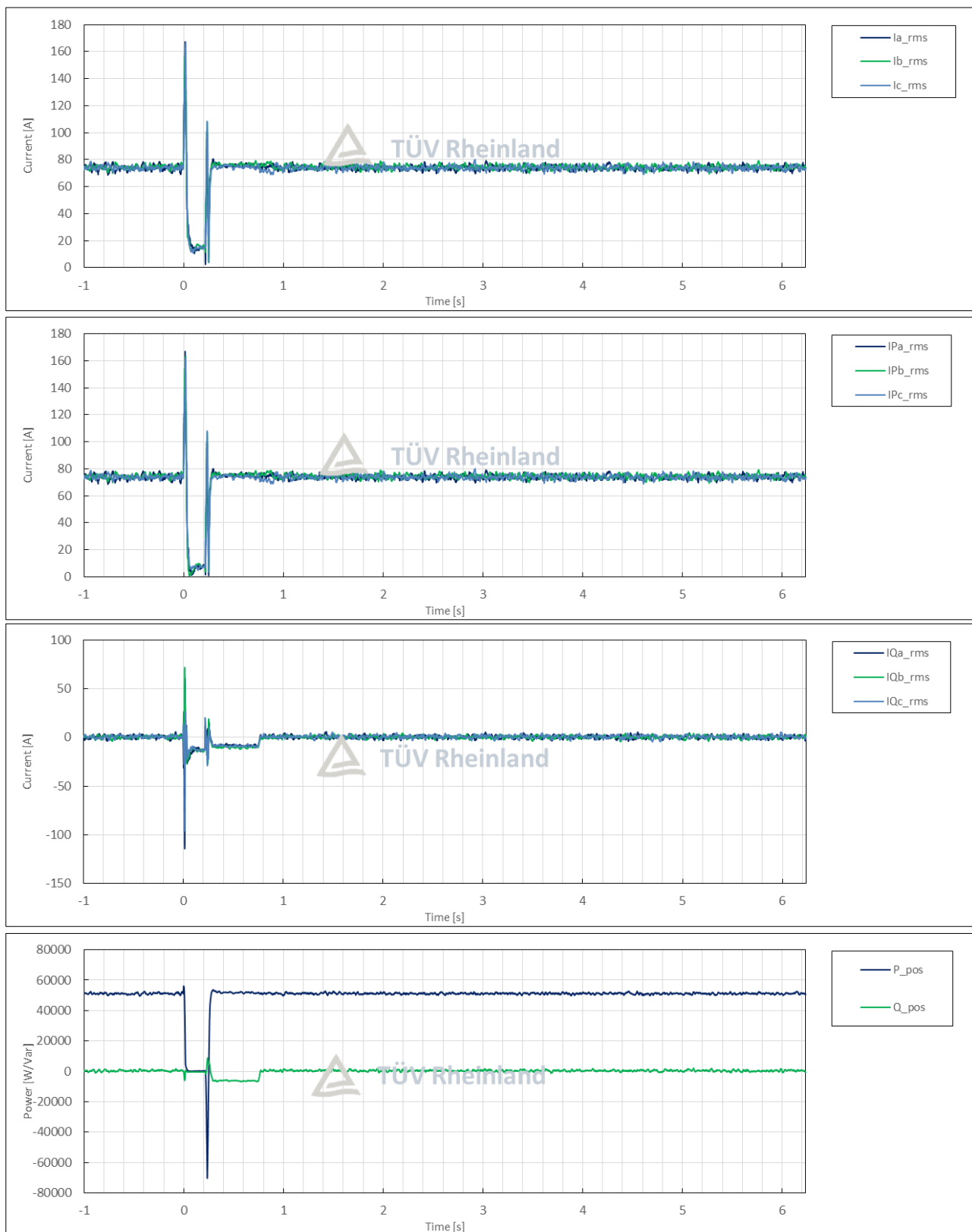


Test No. 1.2 with PGU



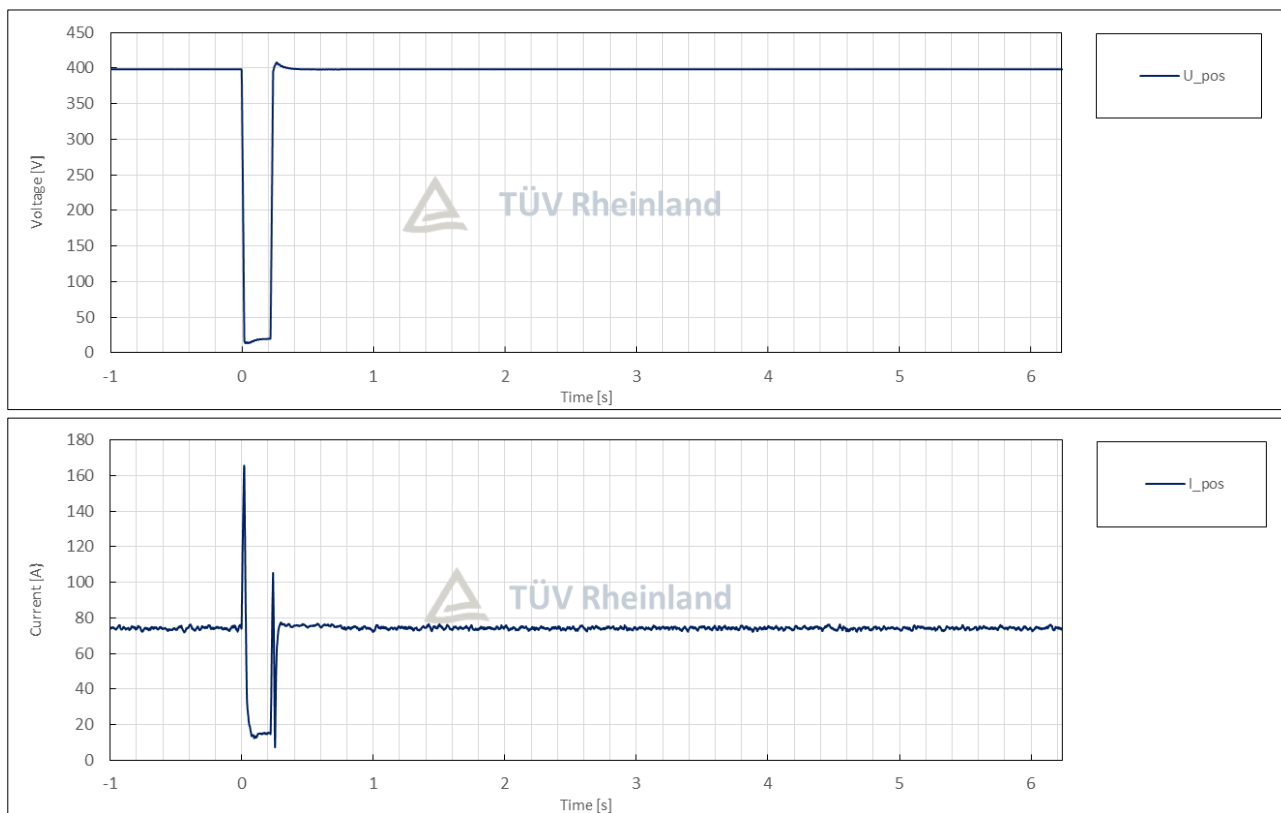
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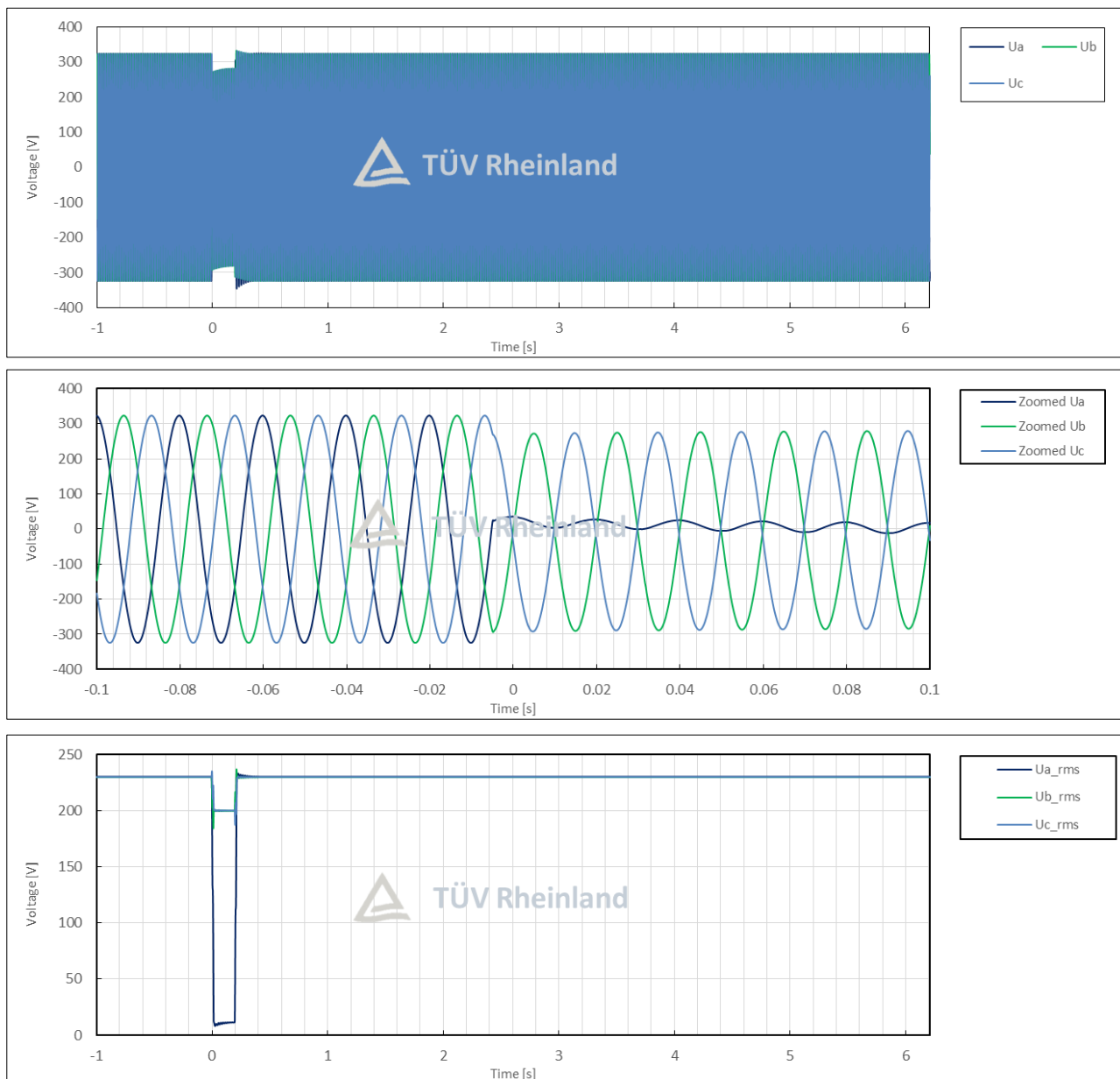


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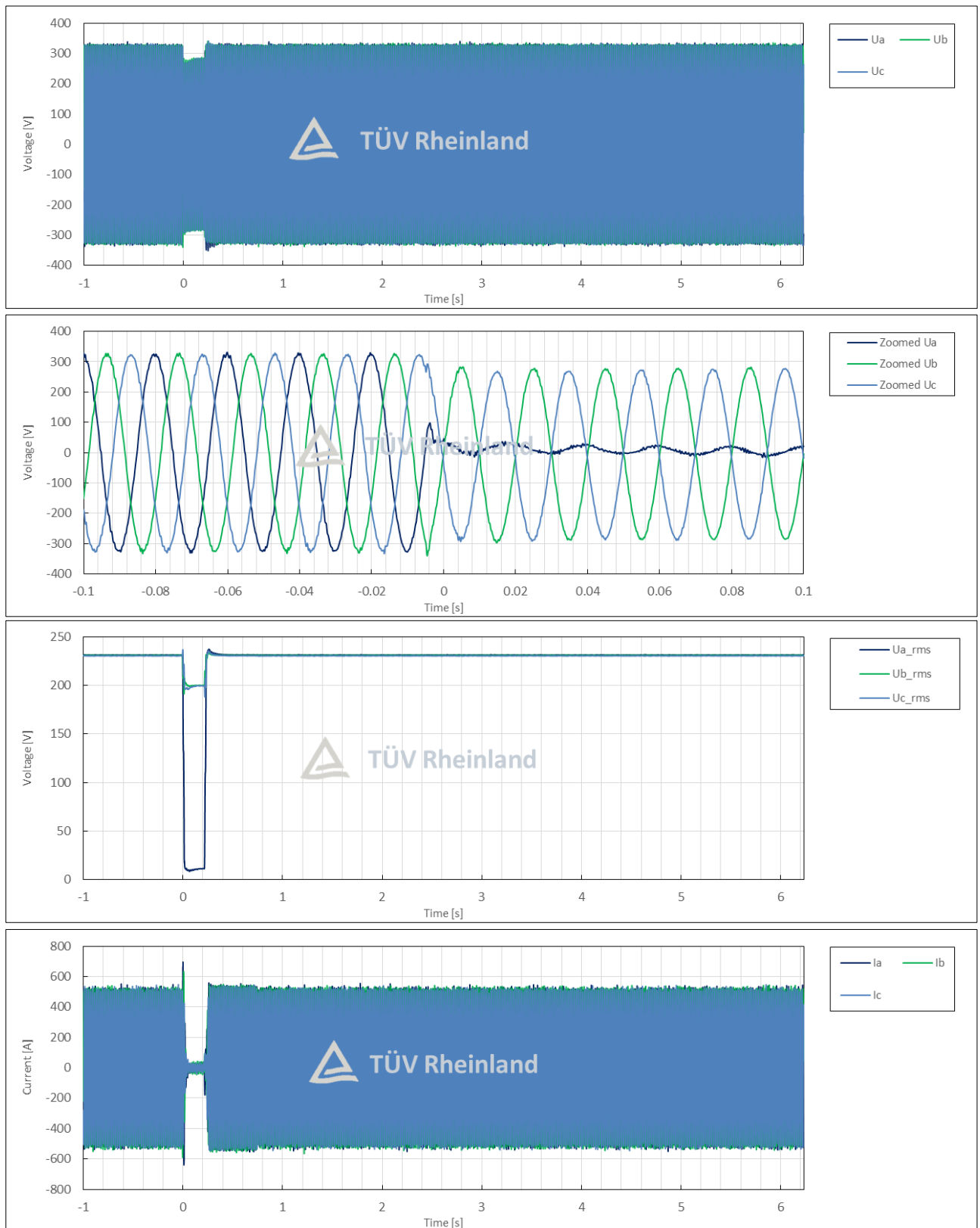
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	1.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:51:27
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.05
	5	Setting dip duration		--		211
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	211
	8	Fault duration in empty load test	Total	--	ms	211
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.05
	10		Pos.		p.u.	0.53
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.05
	19	Line current	Phase 1	t1+50ms	p.u.	0.06
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.02
	23		Phase 2			0.05
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.035
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 1.3 idle test



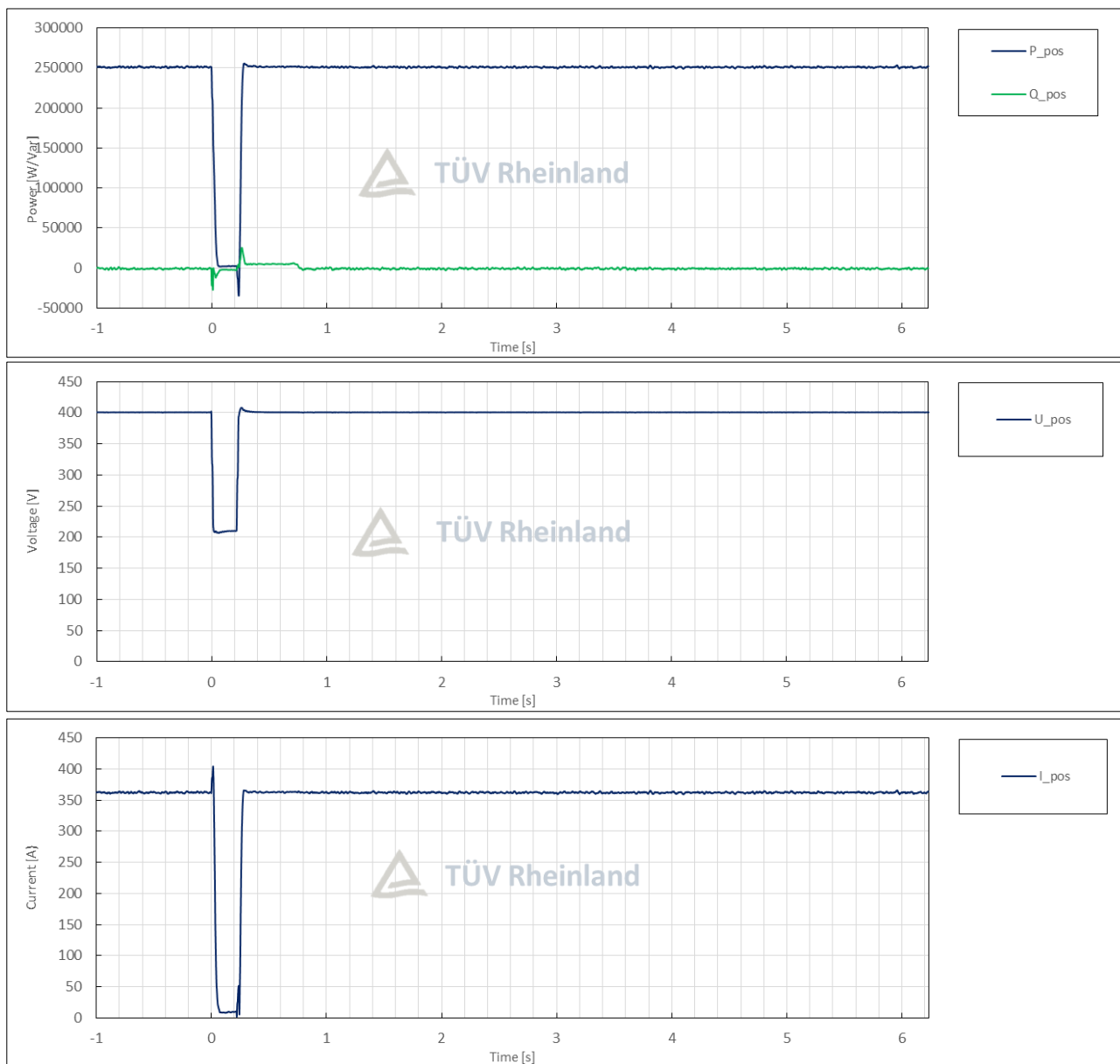
Test No. 1.3 with PGU





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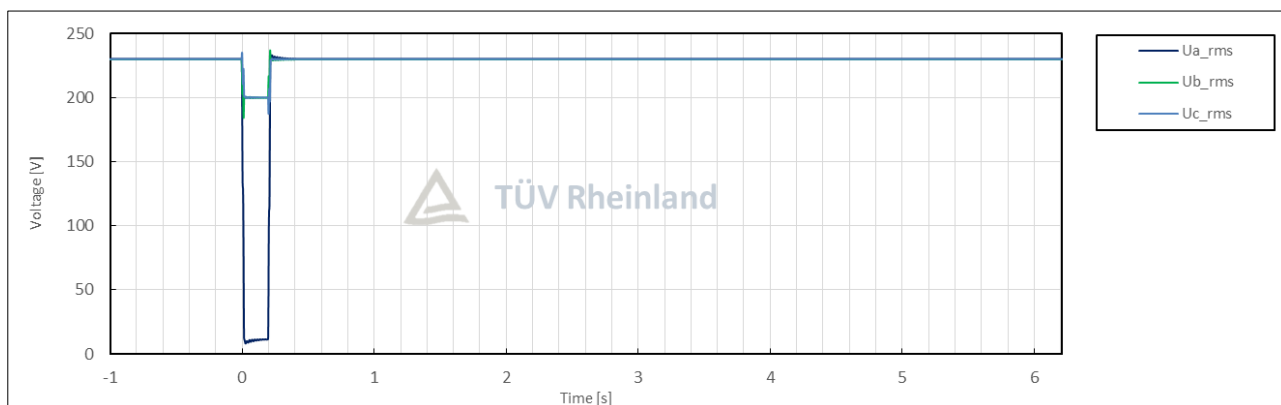
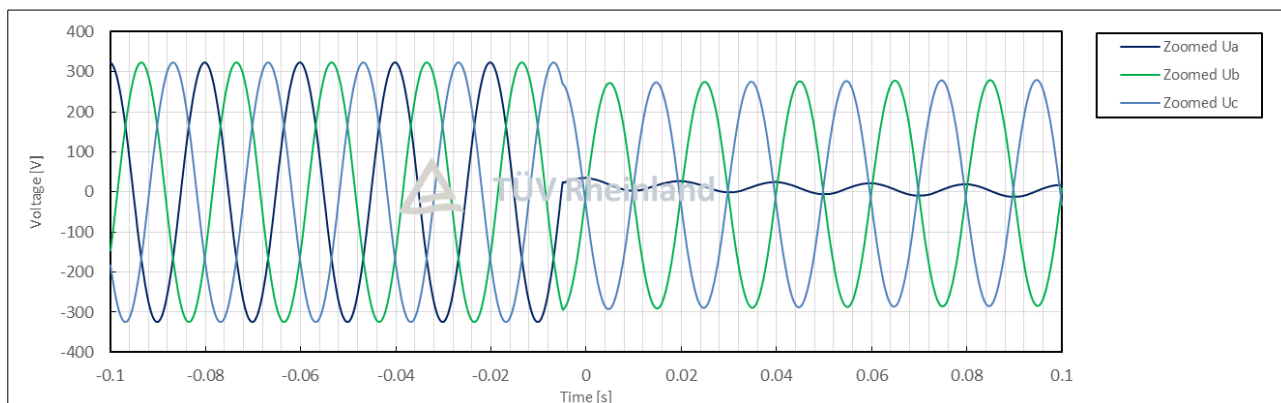
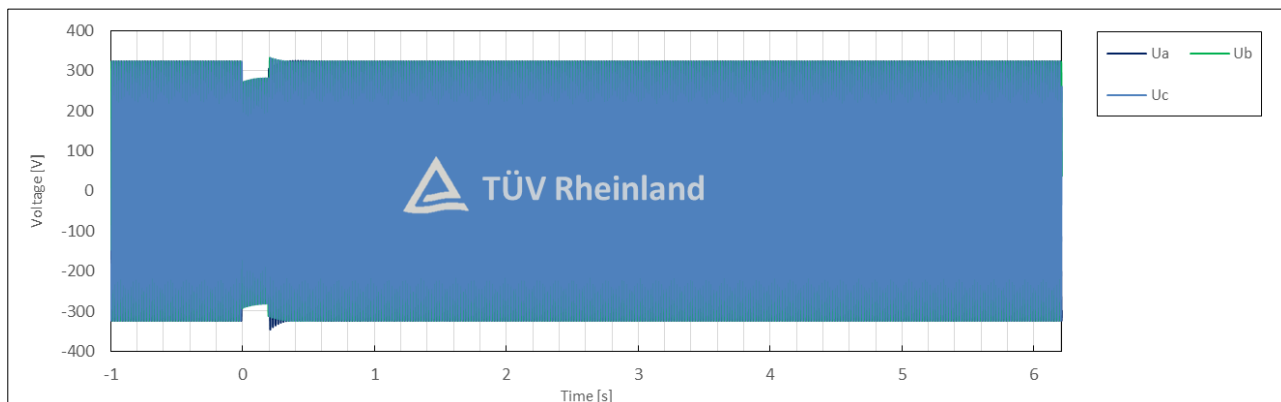


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Test report no.:

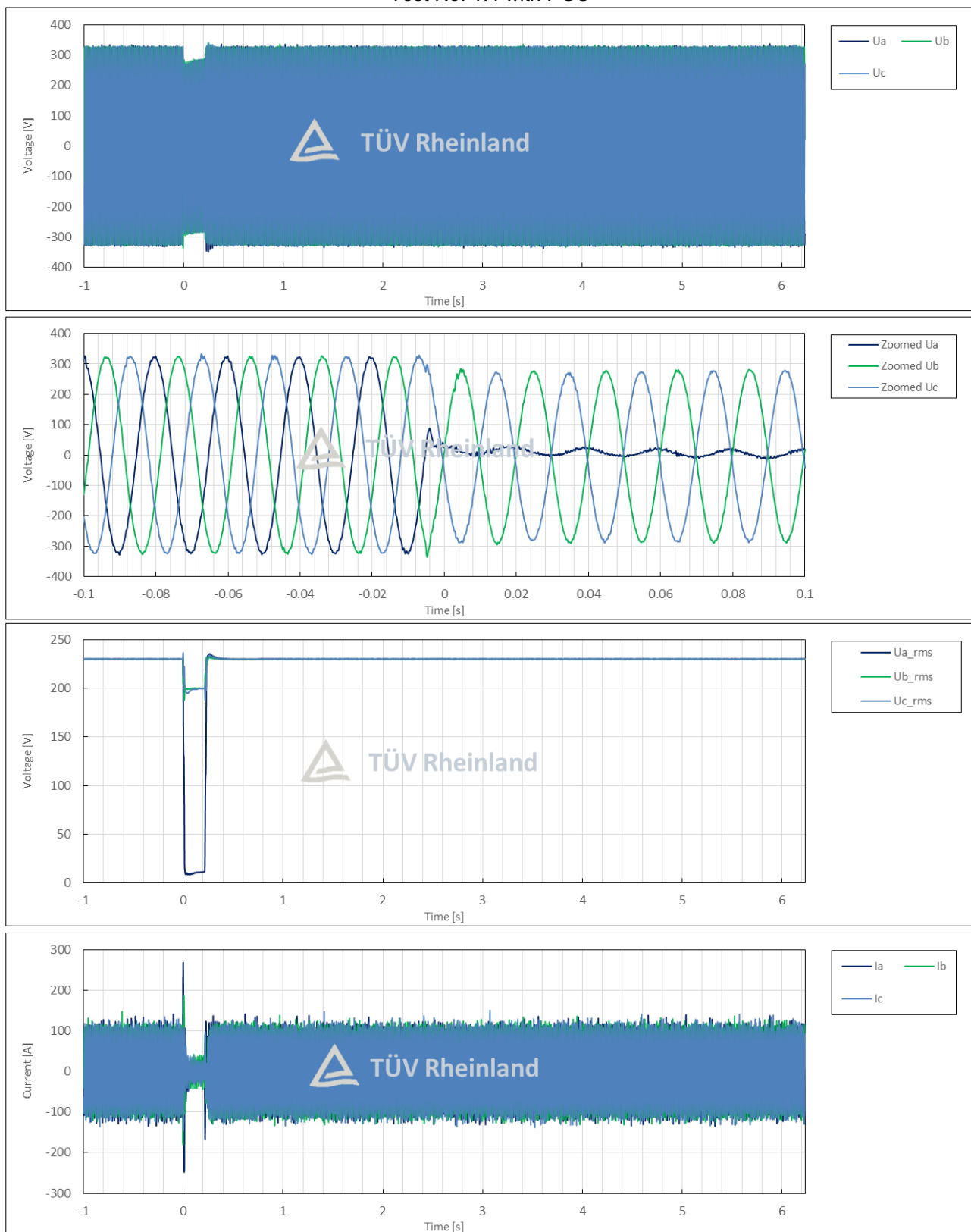
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	1.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	14:59:08
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.05
	5	Setting dip duration		--		211
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	211
	8	Fault duration in empty load test	Total	--	ms	211
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.05
	10		Pos.		p.u.	0.53
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cos ϕ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.05
	19	Line current	Phase 1	t1+50ms	p.u.	0.04
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.02
	23		Phase 2			0.05
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.033
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 1.4 idle test



Test No. 1.4 with PGU



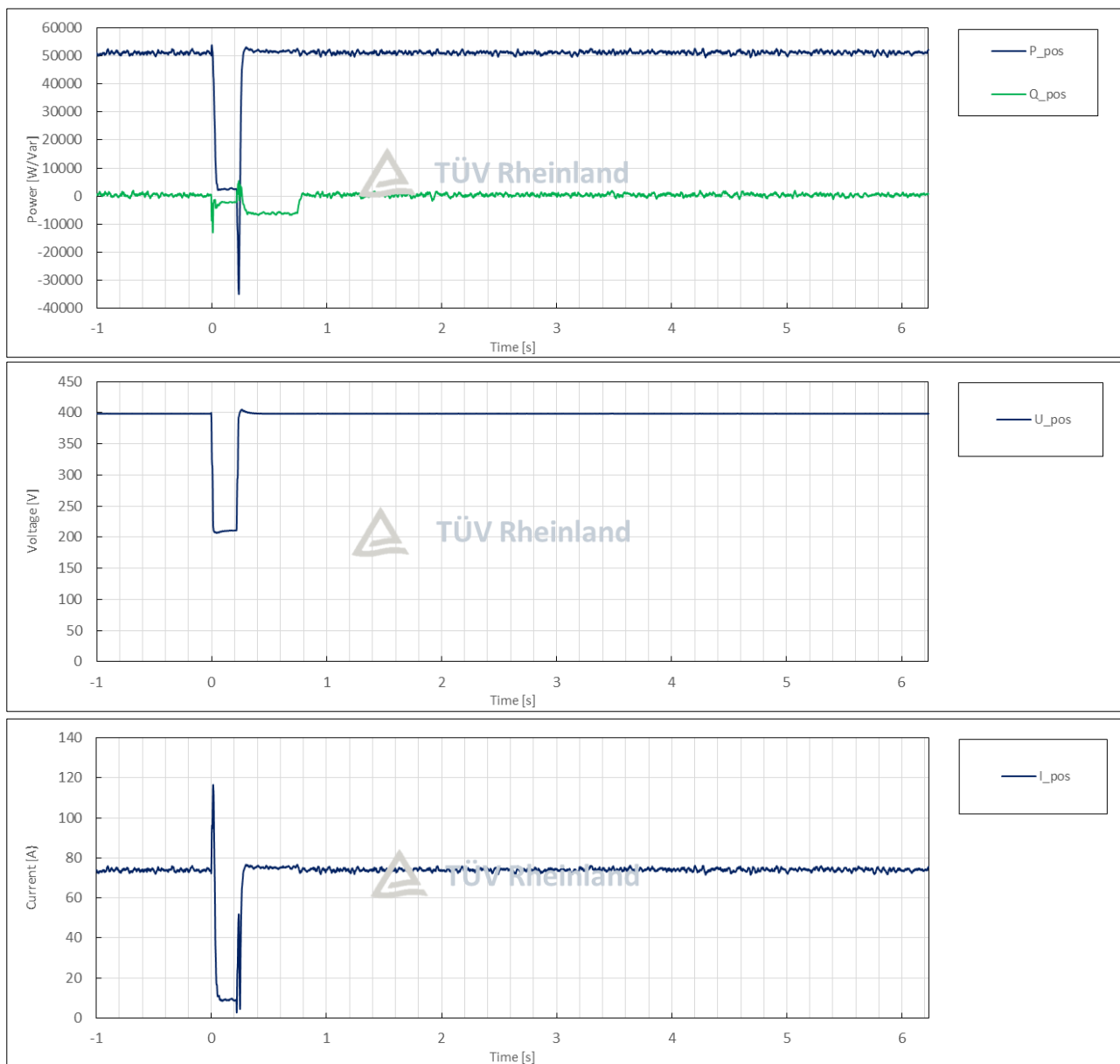
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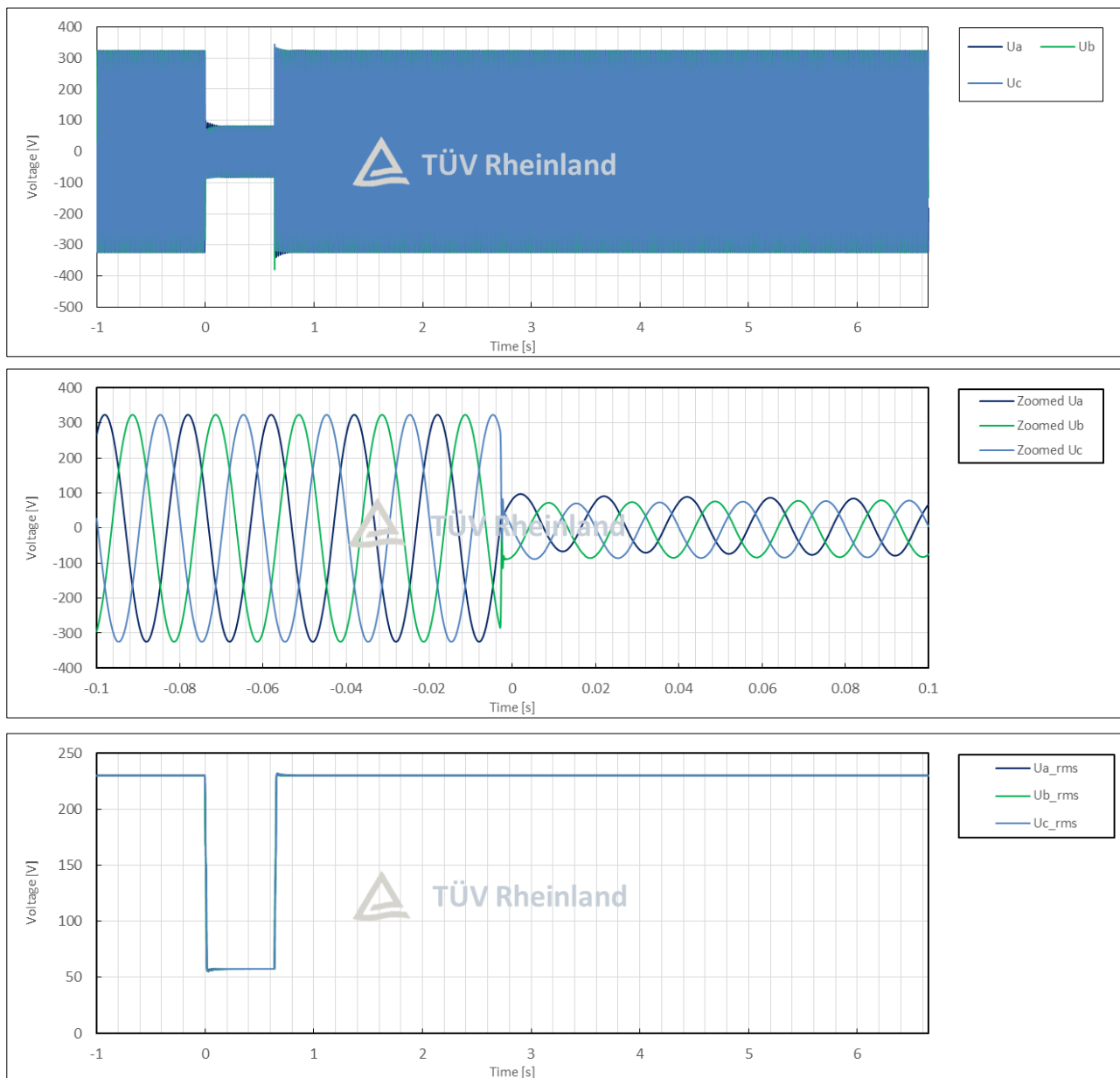


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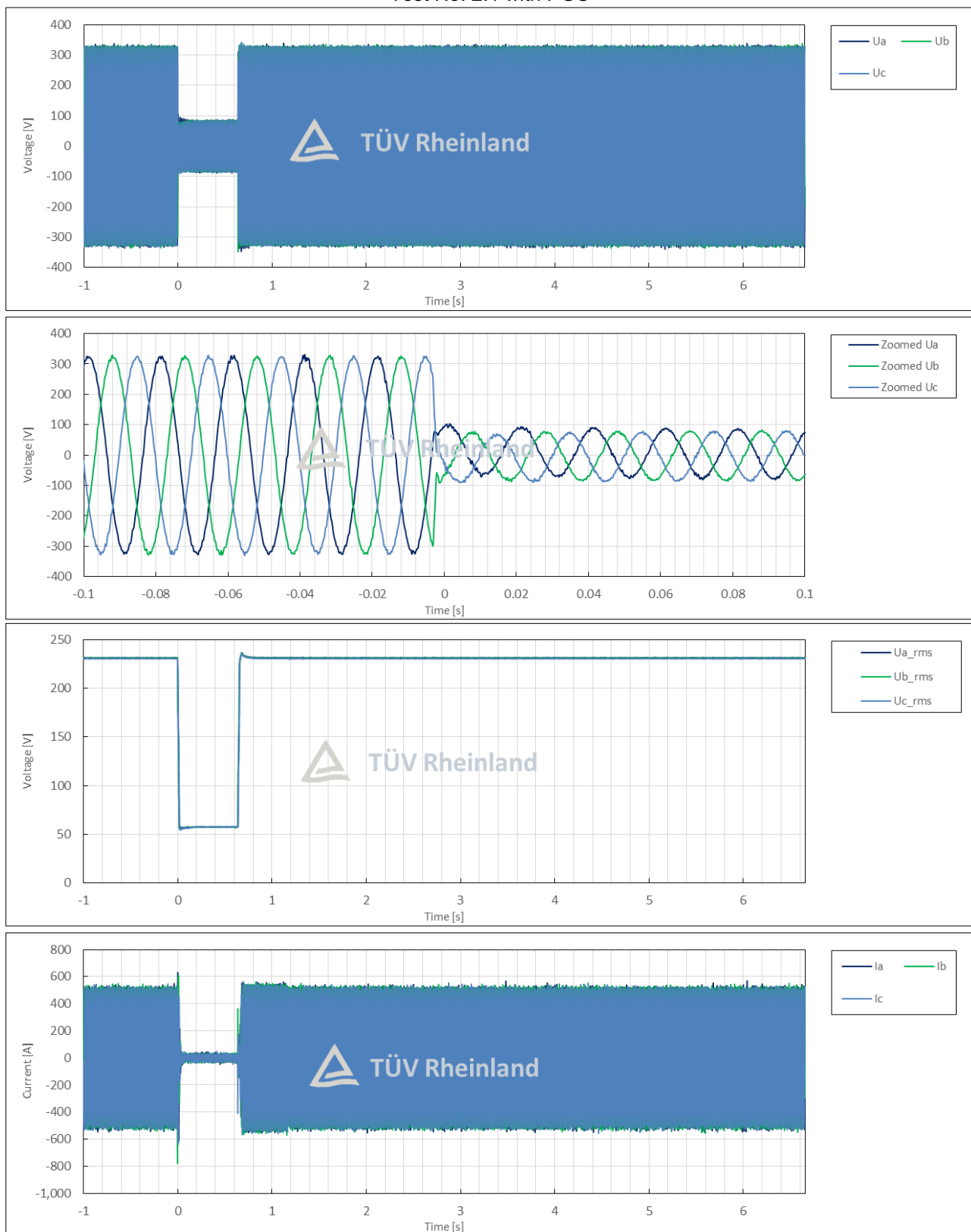
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	2.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:00:27
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		655
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	655
	8	Fault duration in empty load test	Total	--	ms	655
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.25
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.06
	22	Line current	Phase 1	t1+80ms	p.u.	0.04
	23		Phase 2			0.04
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.033
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

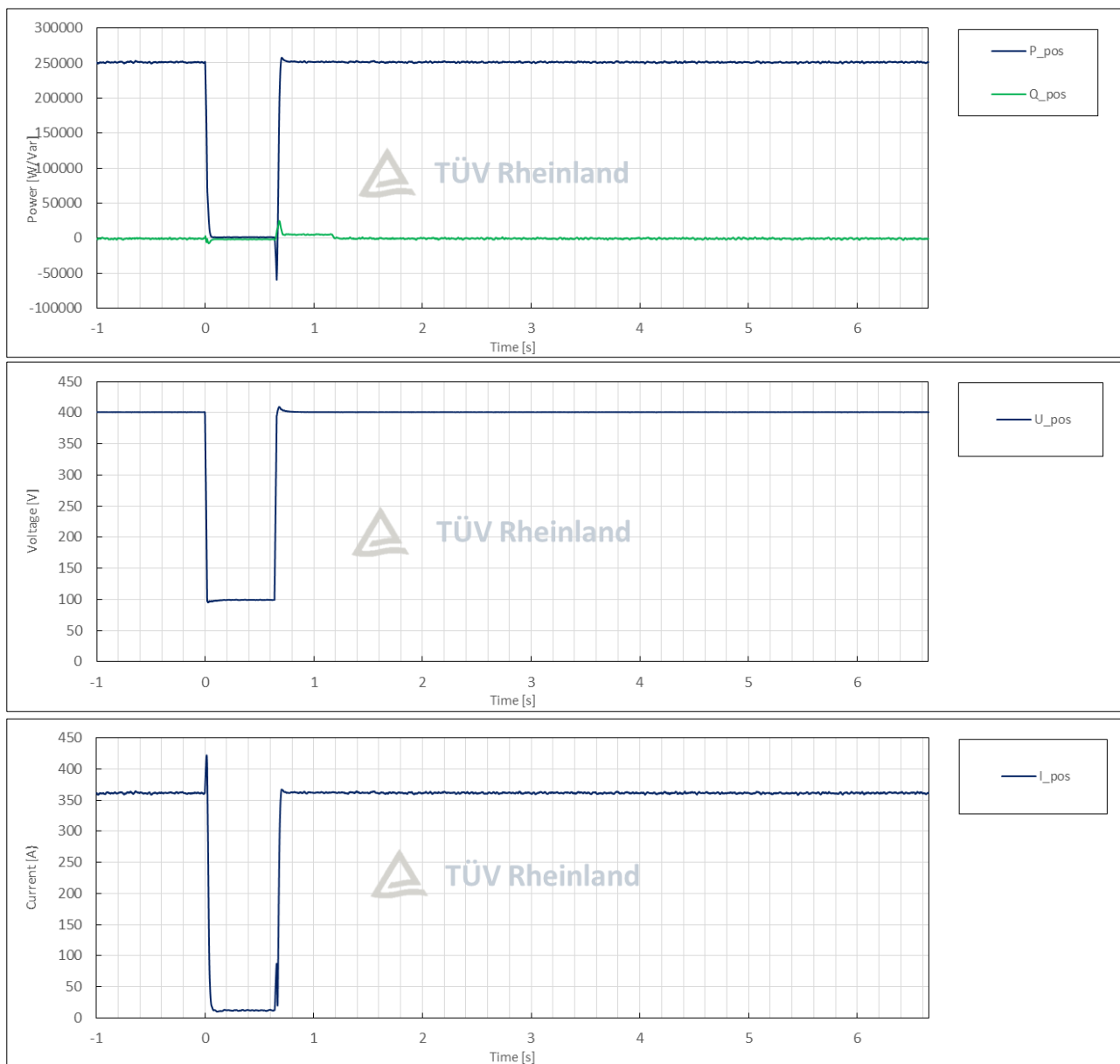
Test No. 2.1 idle test



Test No. 2.1 with PGU





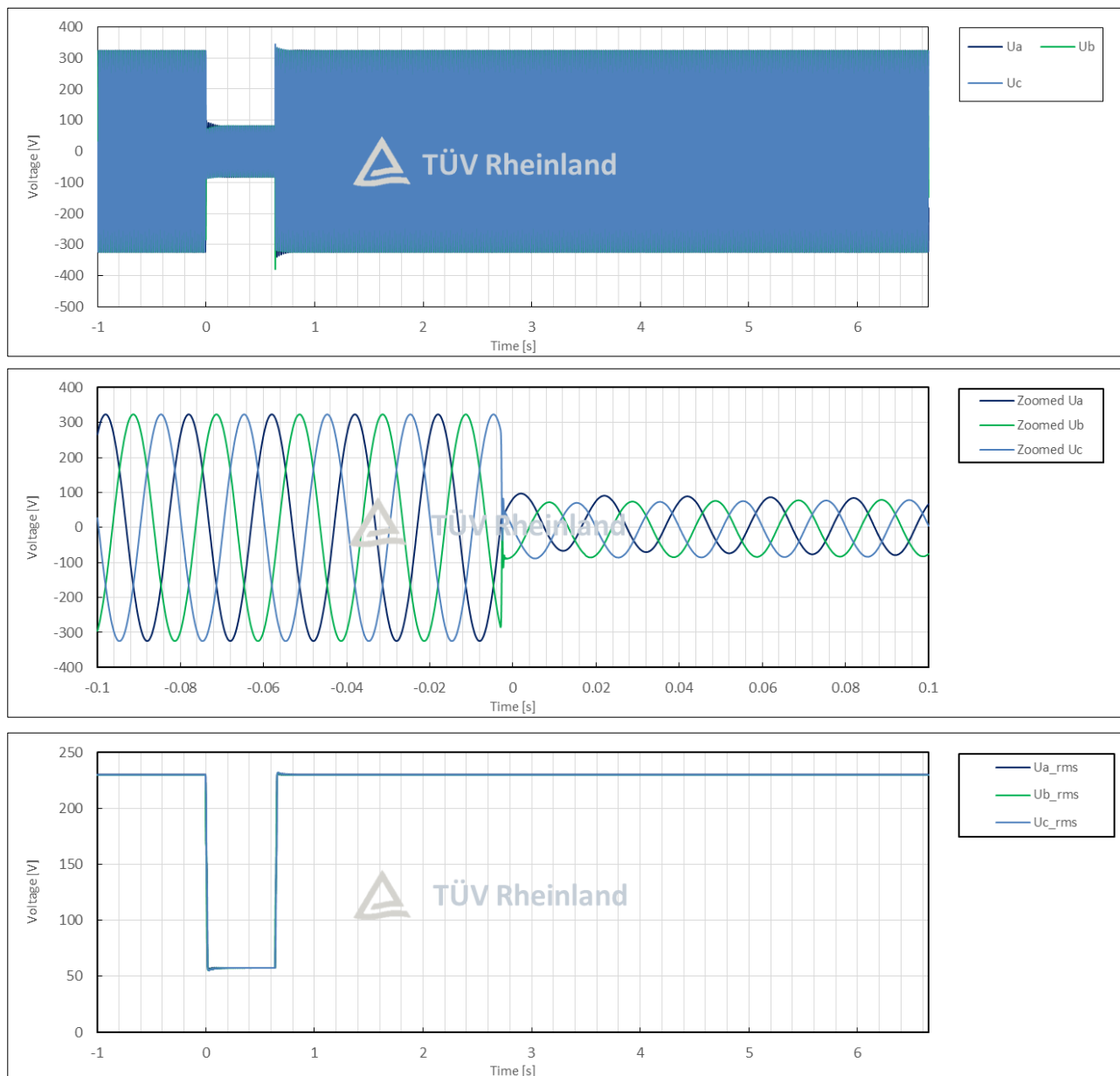


Prüfbericht-Nr.: CN25HVW8 001 Attachment 1
Test report no.:

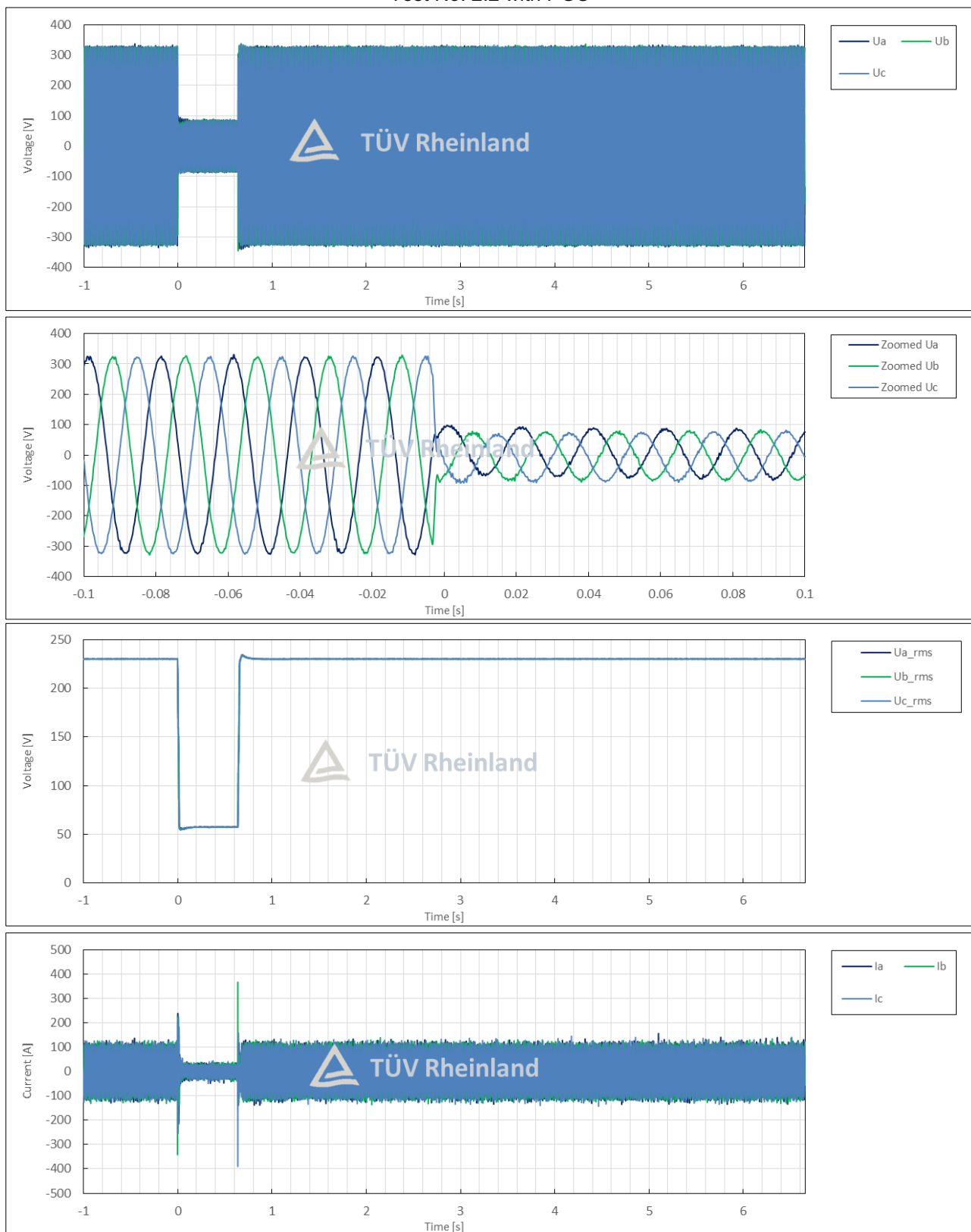
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	2.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:01:06
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		655
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	655
	8	Fault duration in empty load test	Total	--	ms	655
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.25
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.04
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.04
	24		Phase 3			0.03
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.033
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 2.2 idle test



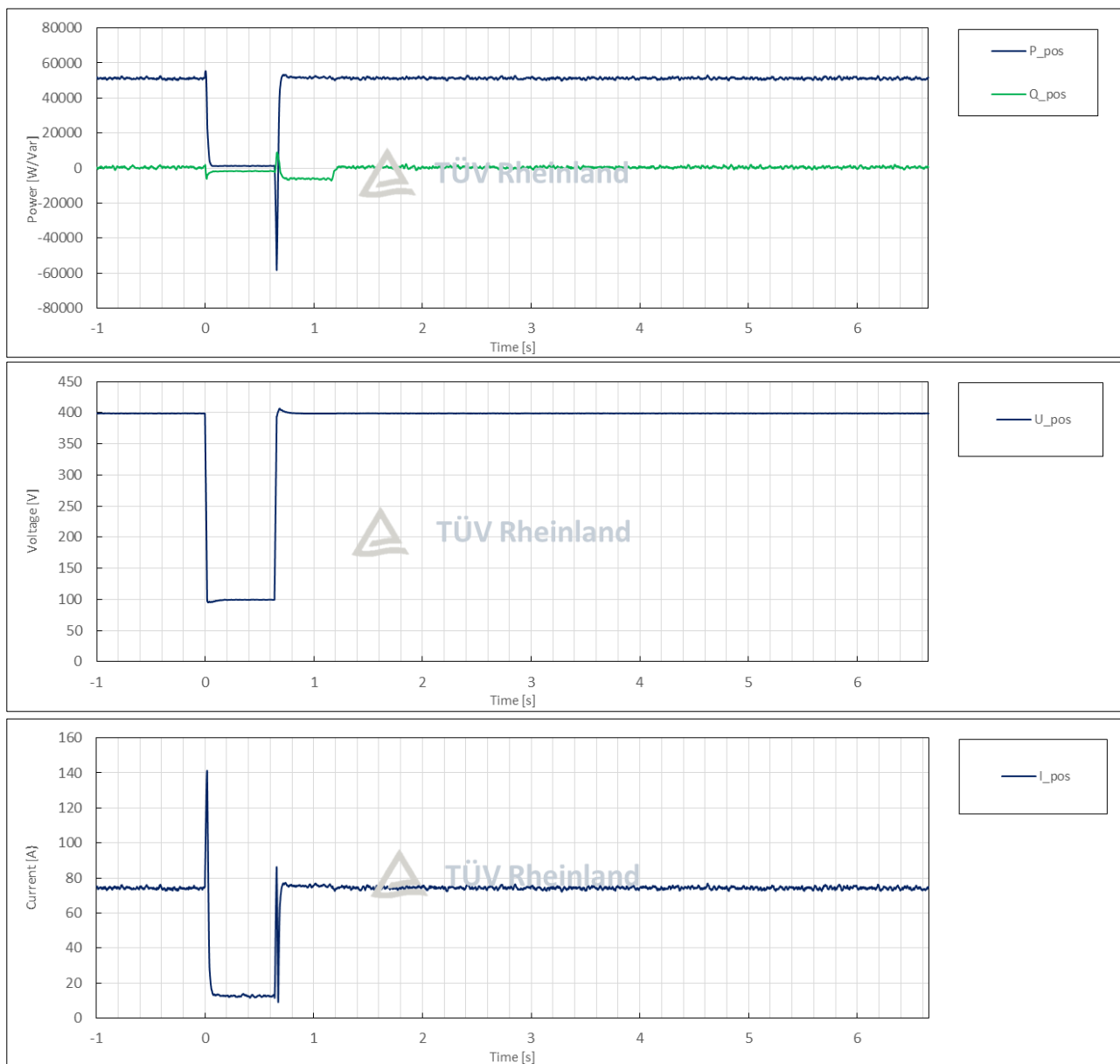
Test No. 2.2 with PGU



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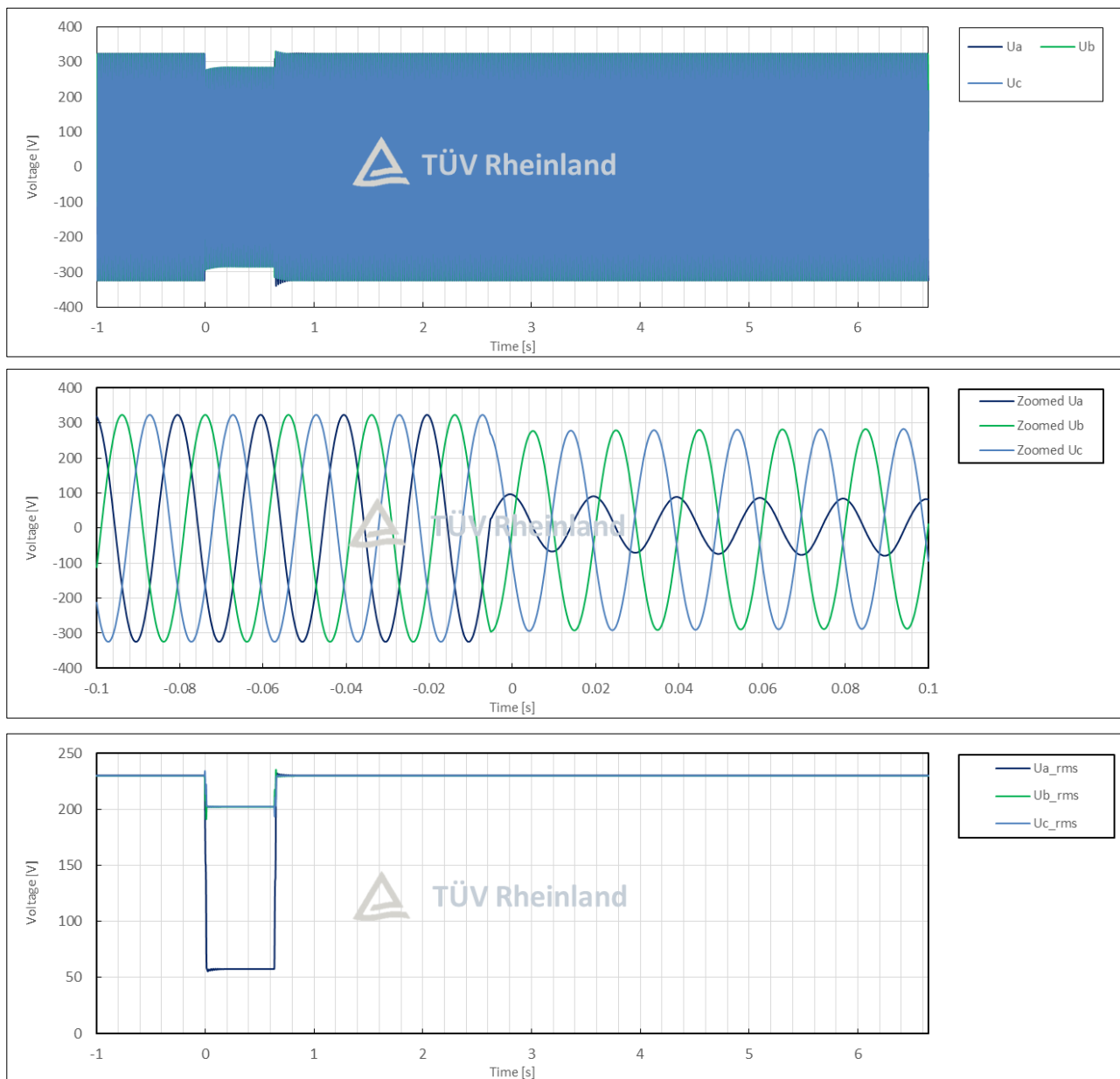


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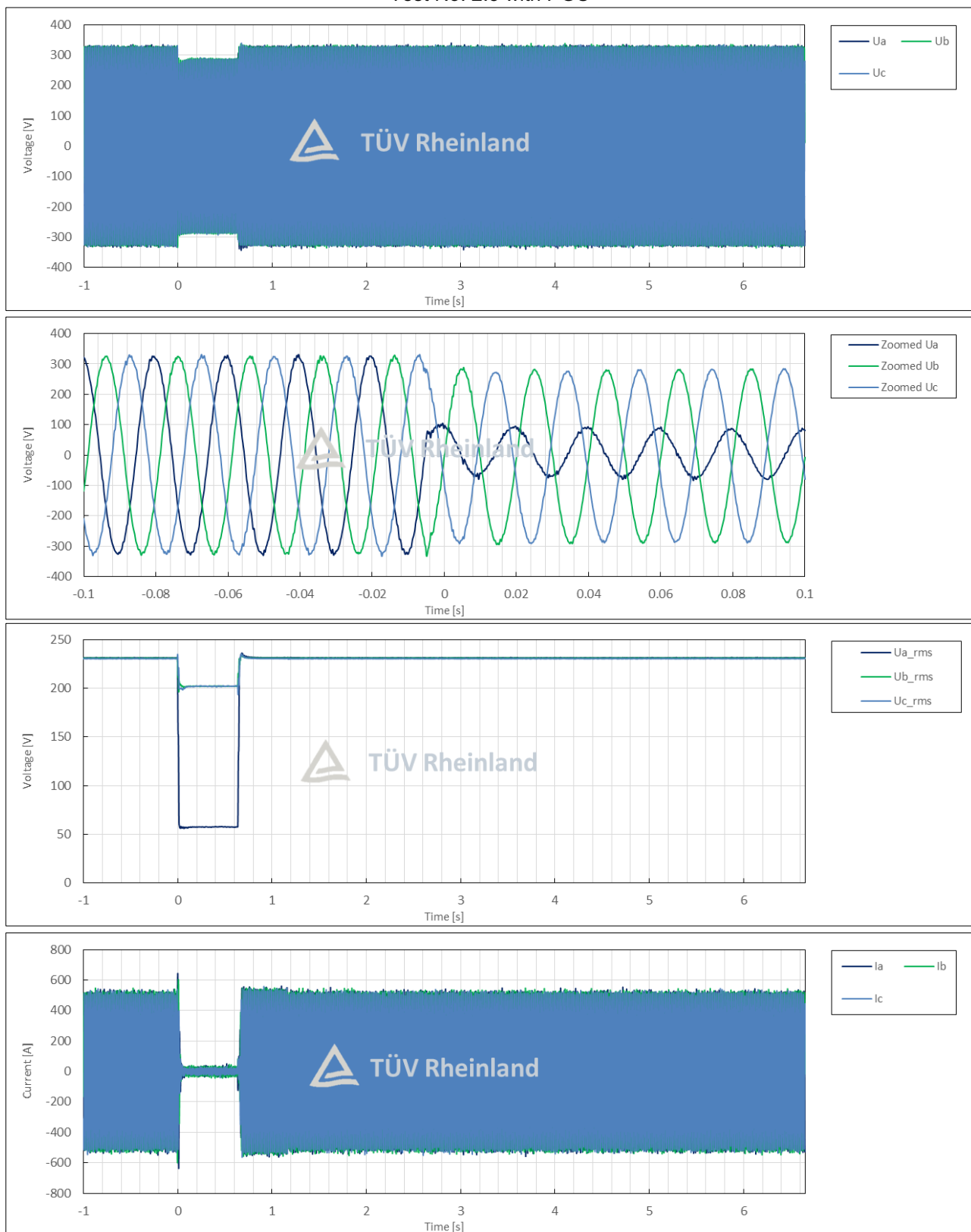
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	2.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:01:43
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		650
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	650
	8	Fault duration in empty load test	Total	--	ms	650
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.63
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.03
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.04
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 2.3 idle test



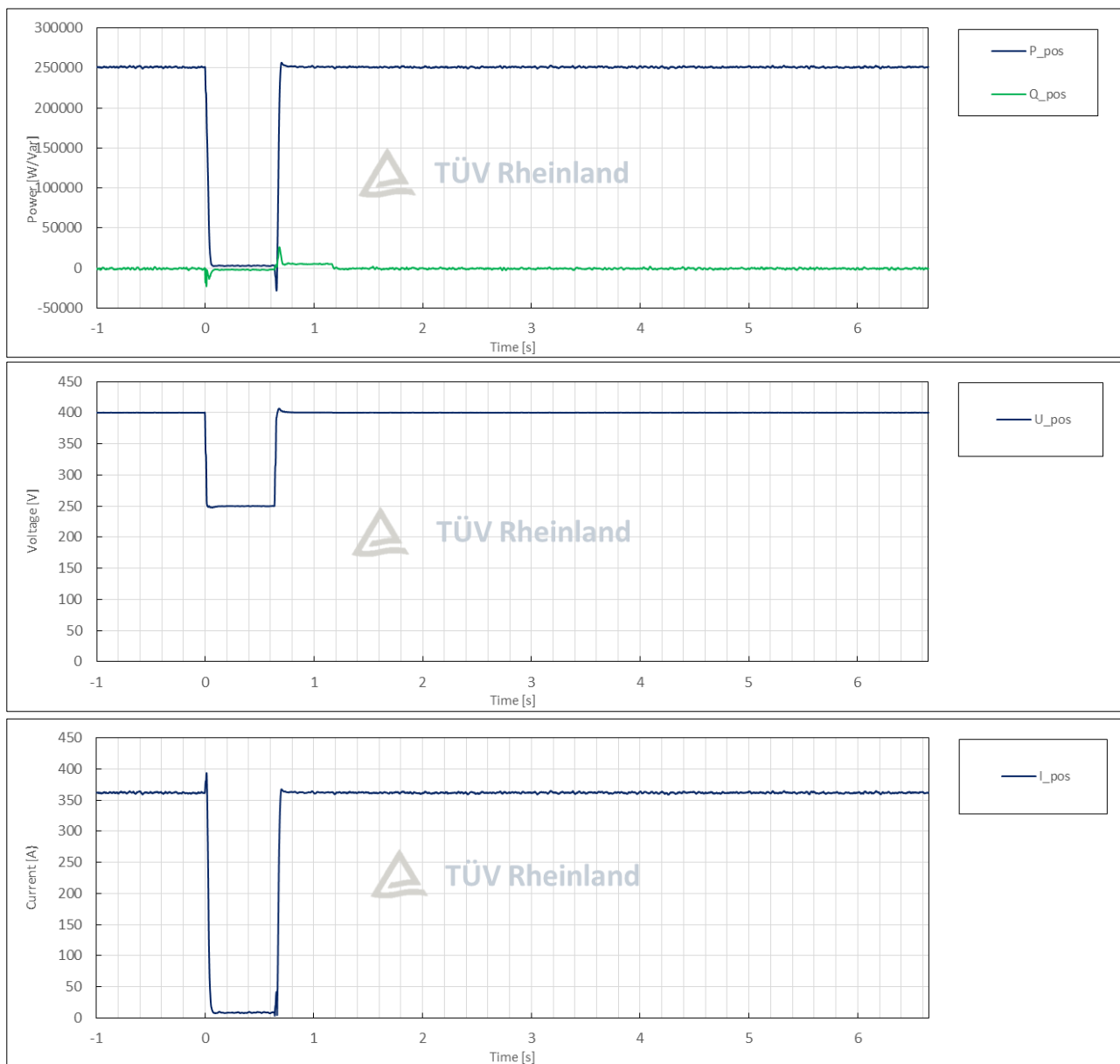
Test No. 2.3 with PGU





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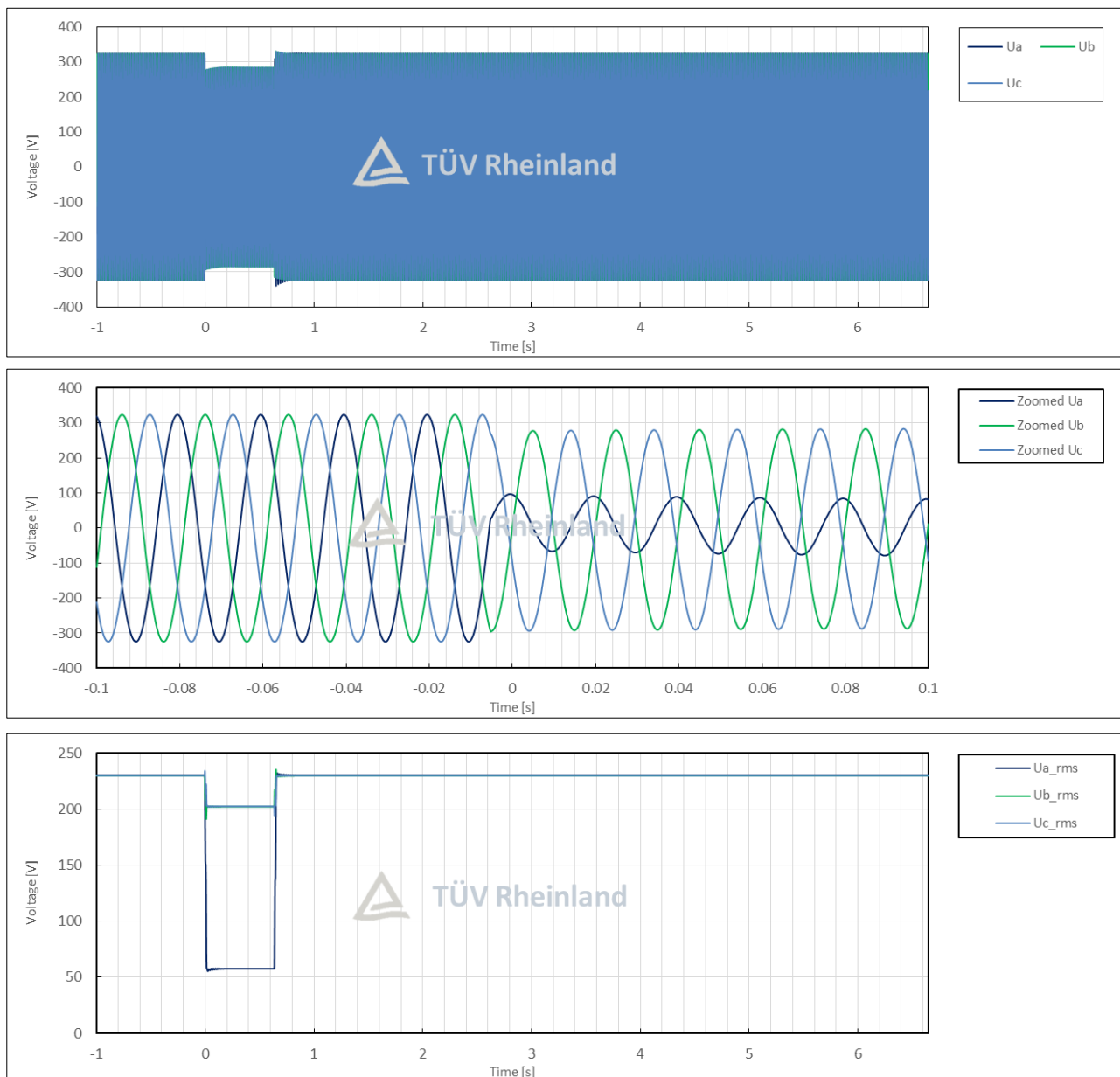


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Test report no.:

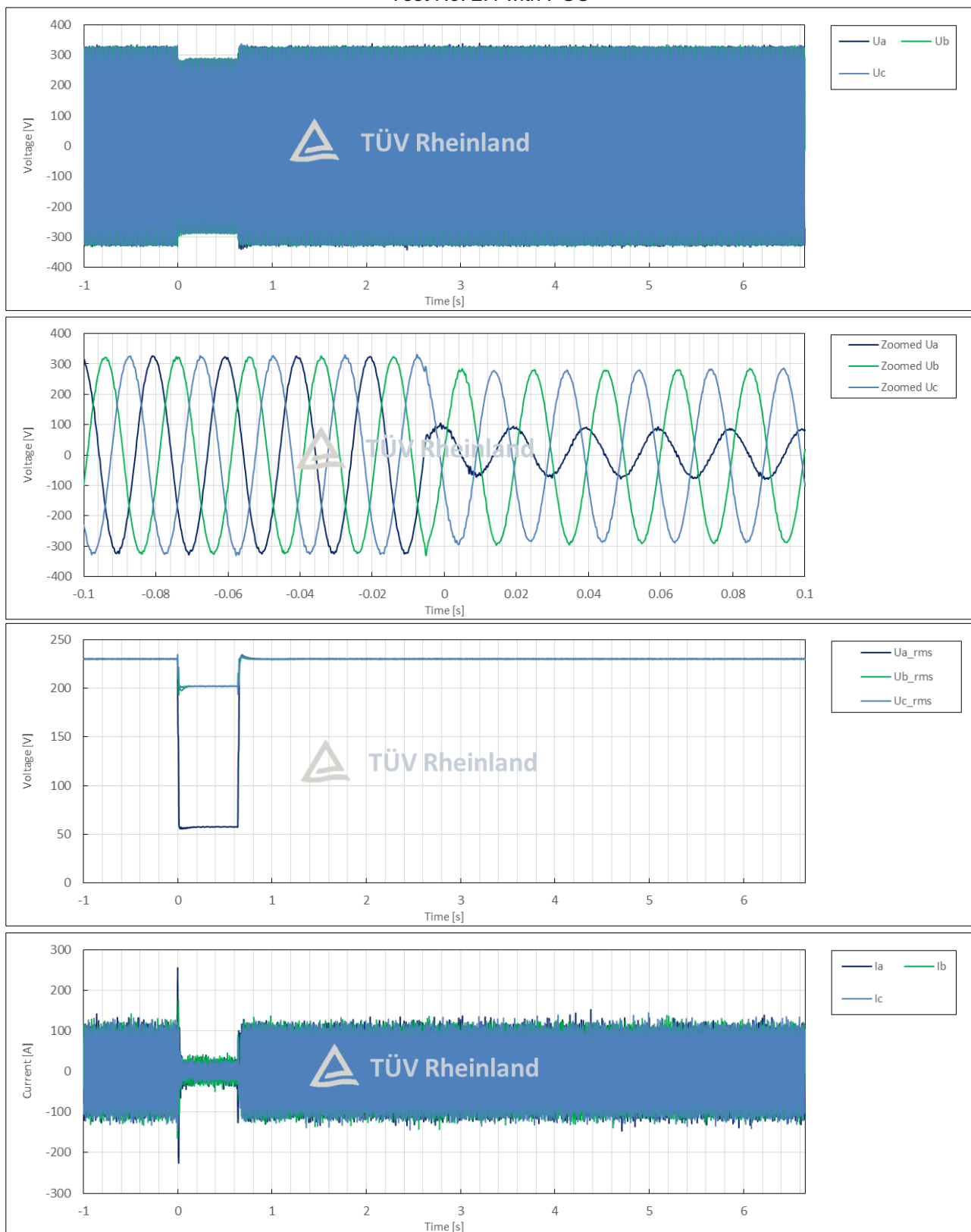
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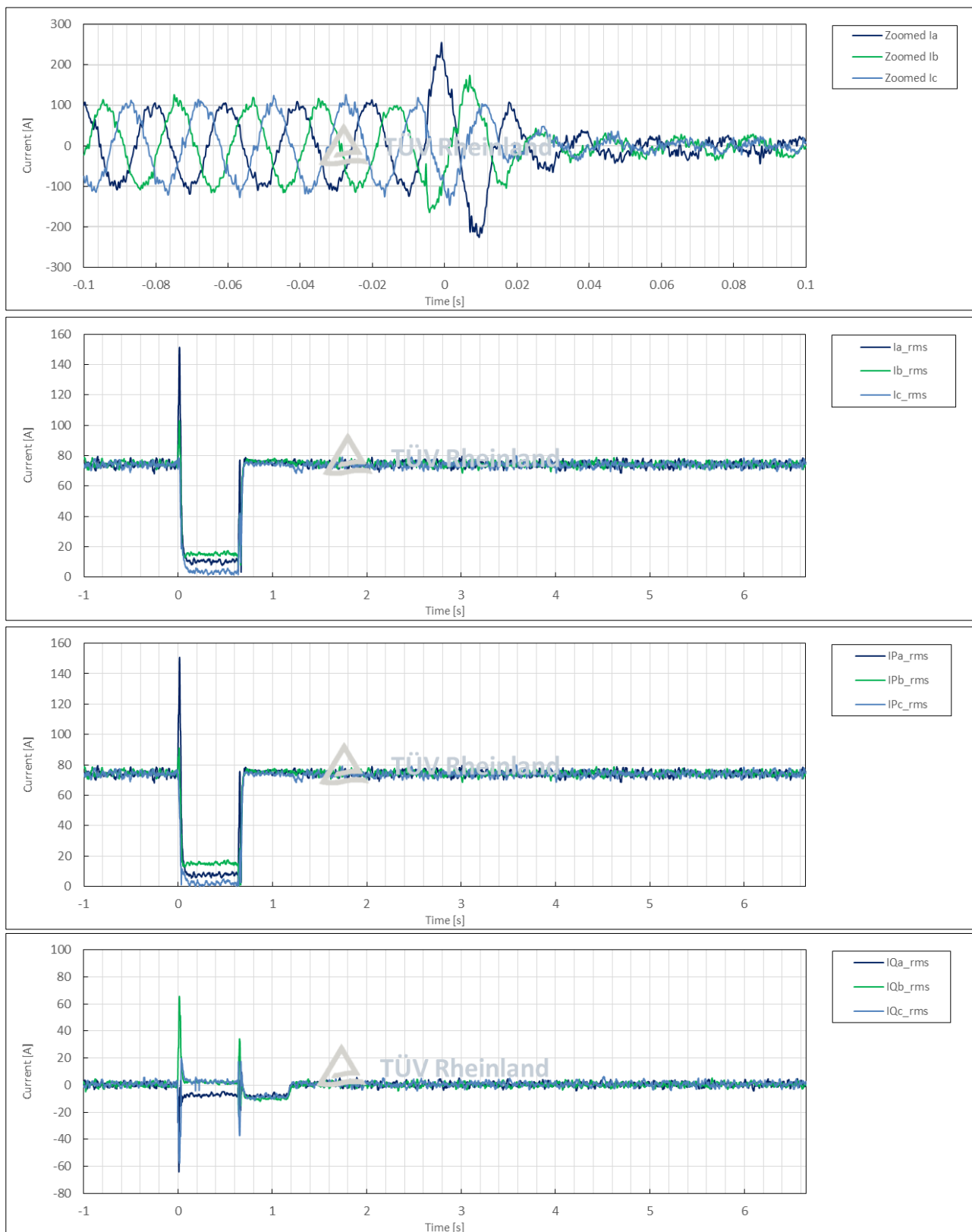
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	2.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:02:21
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		650
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	650
	8	Fault duration in empty load test	Total	--	ms	650
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.63
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.04
	20		Phase 2			0.04
	21		Phase 3			0.03
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.04
	24		Phase 3			0.02
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.033
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 2.4 idle test



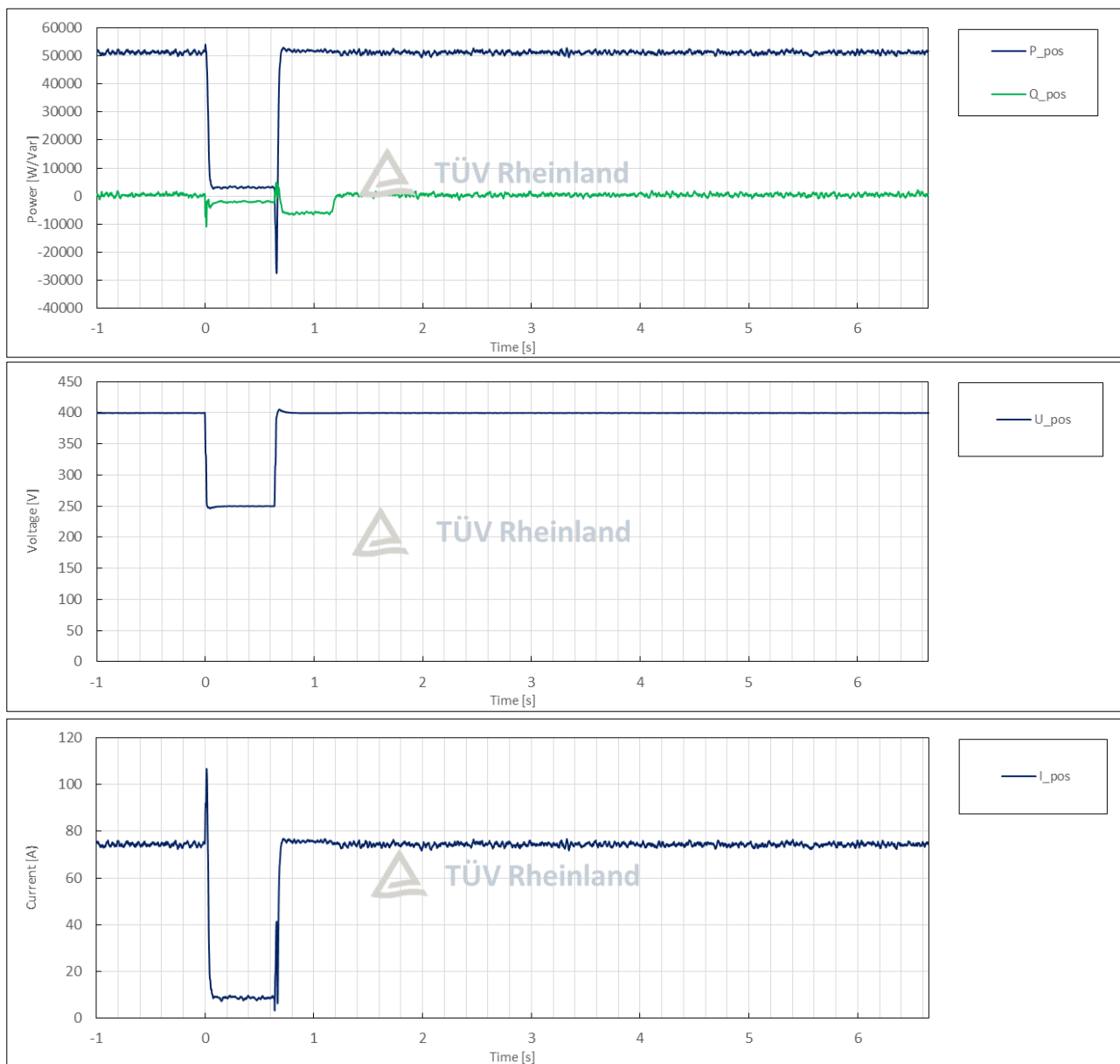
Test No. 2.4 with PGU





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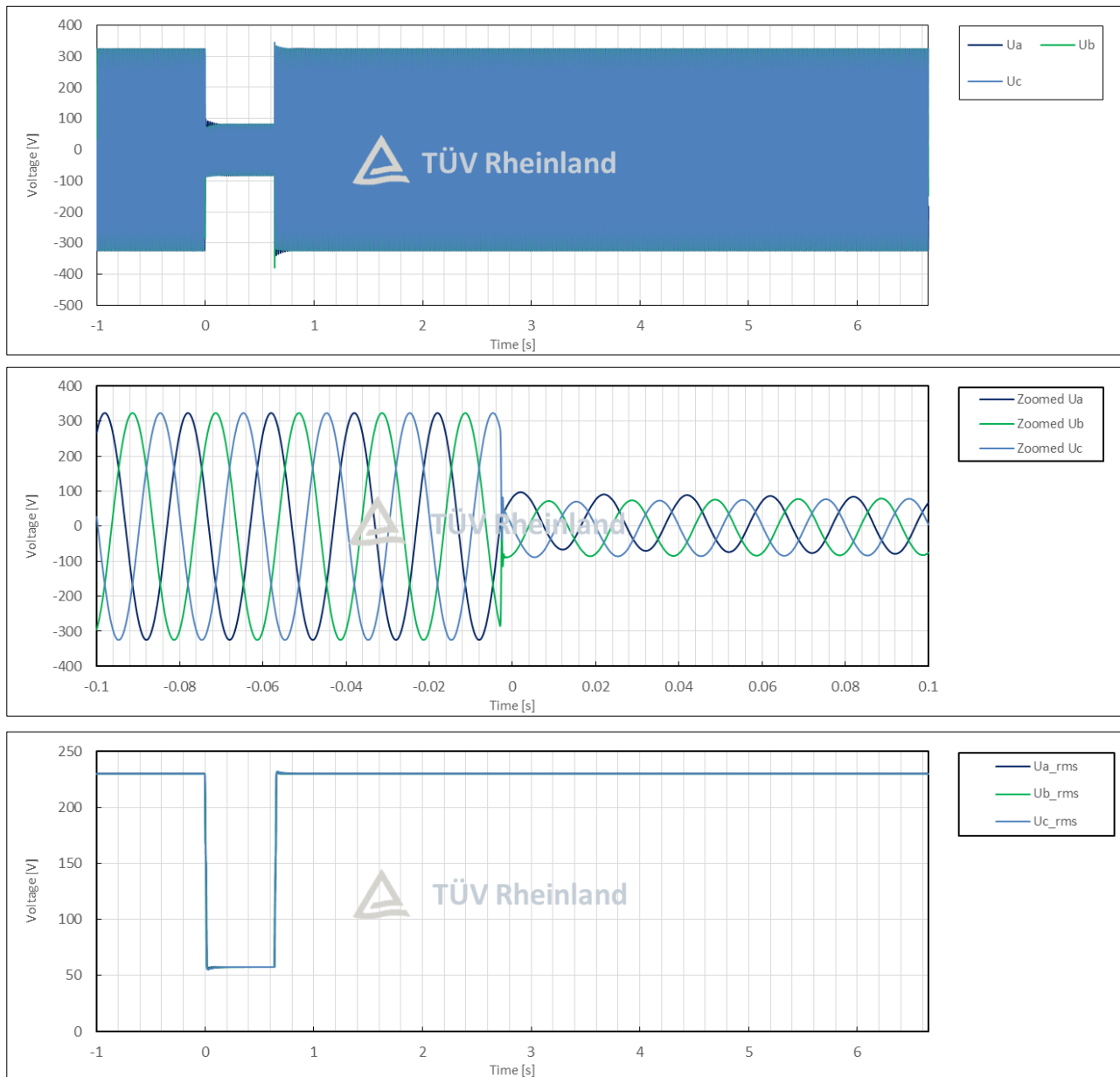


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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	3.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:04:05
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		655
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	655
	8	Fault duration in empty load test	Total	--	ms	655
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.25
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.50
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.04
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.03
	24		Phase 3			0.02
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.034
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

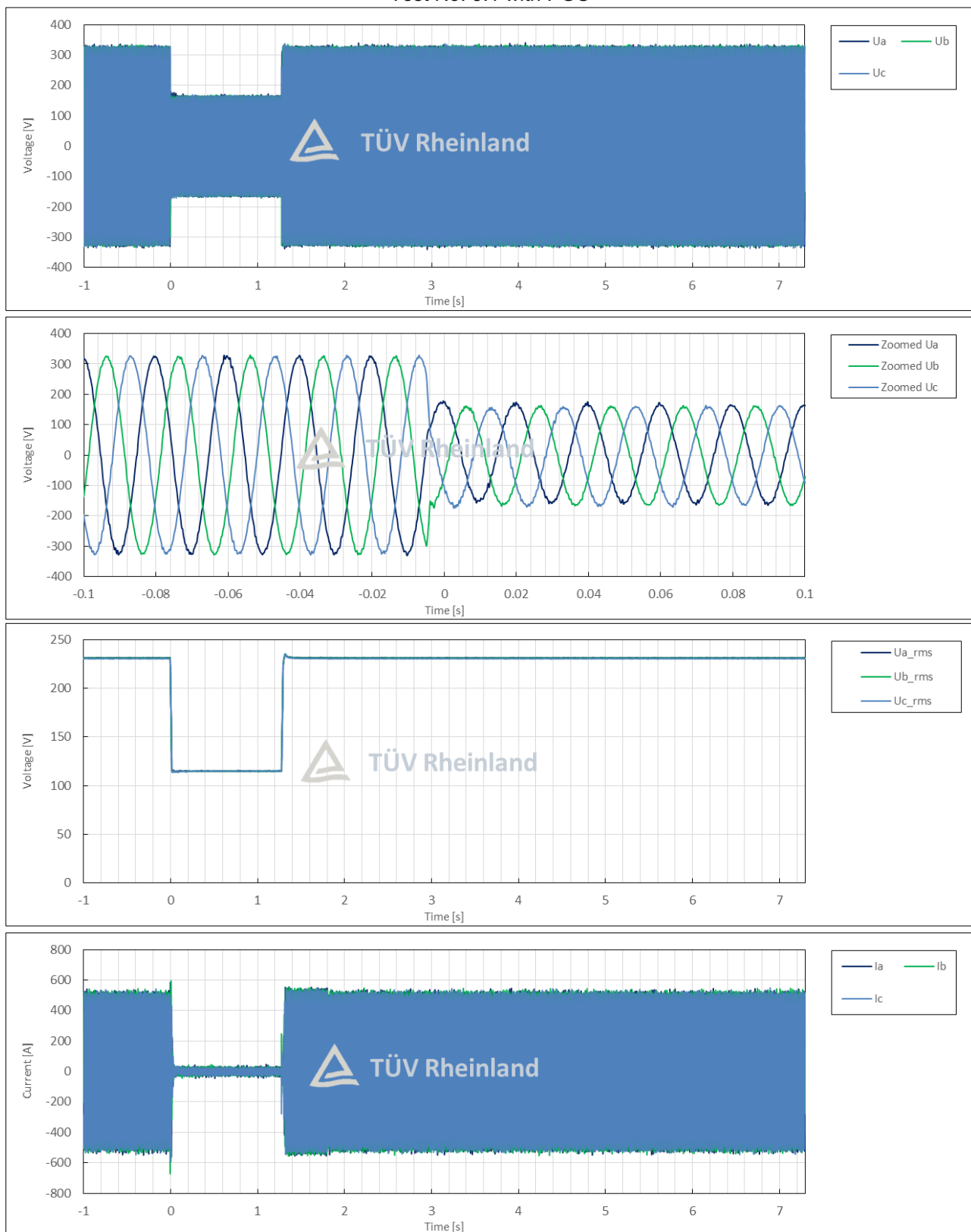
Test No. 3.1 idle test



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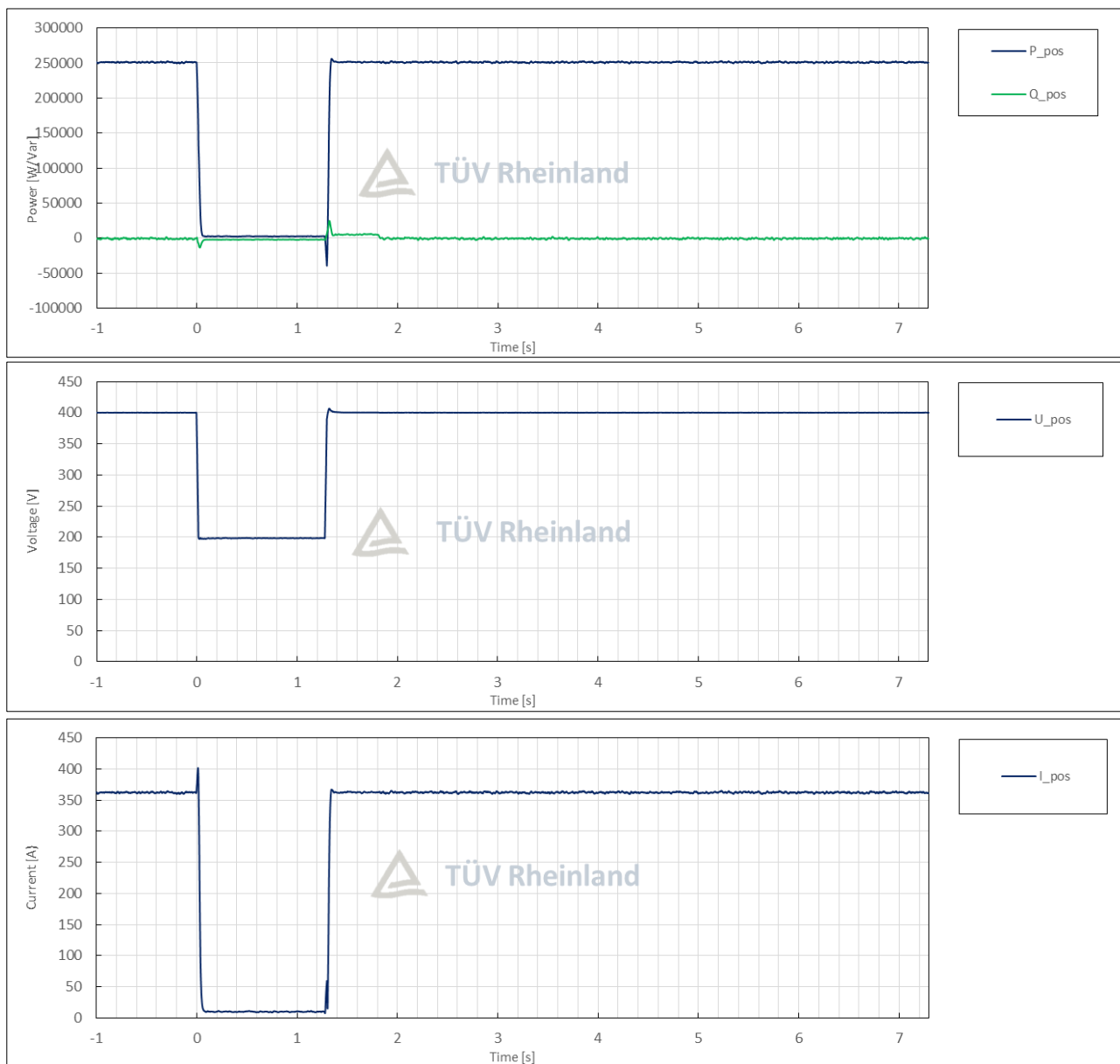
Test No. 3.1 with PGU





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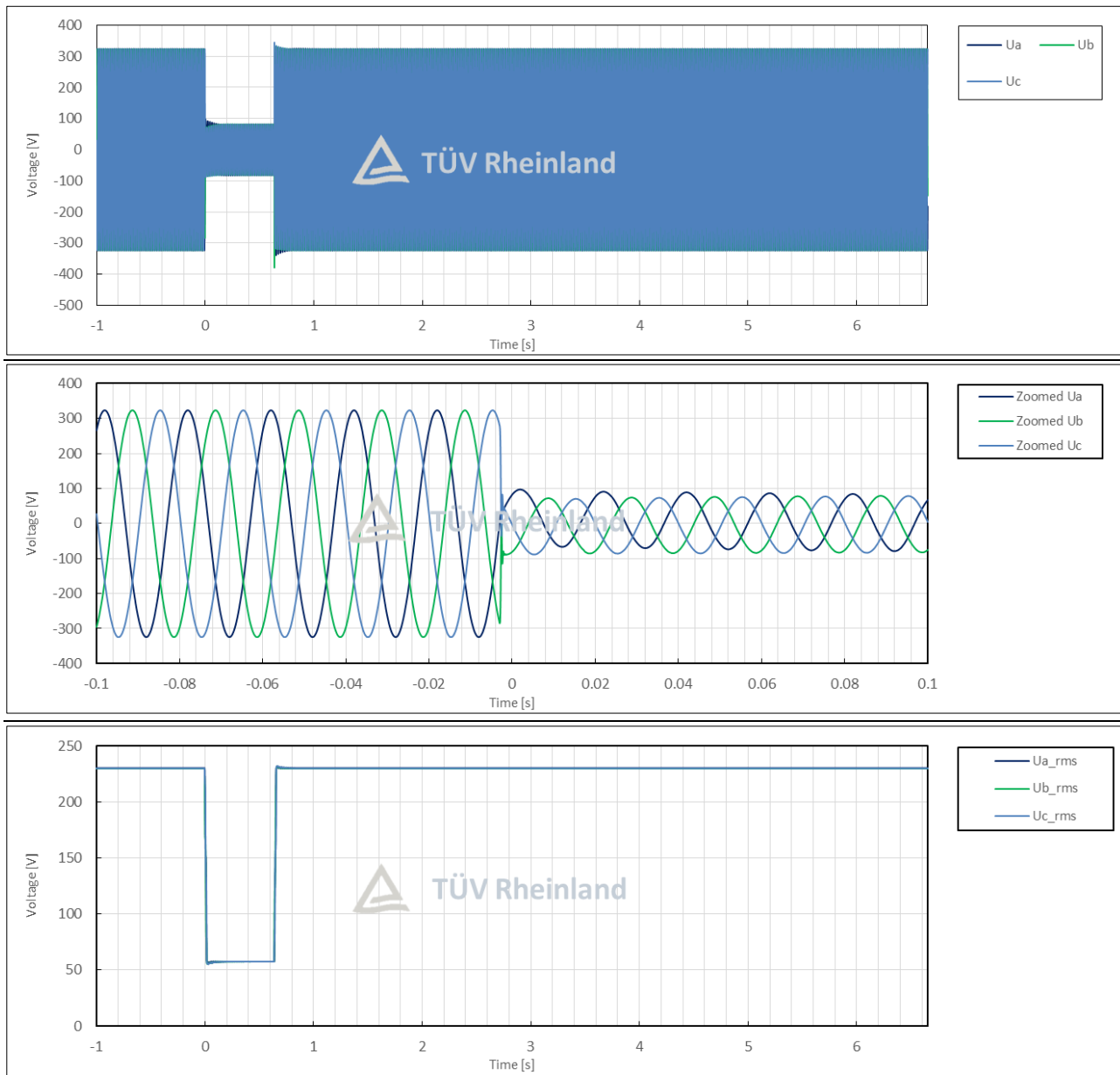


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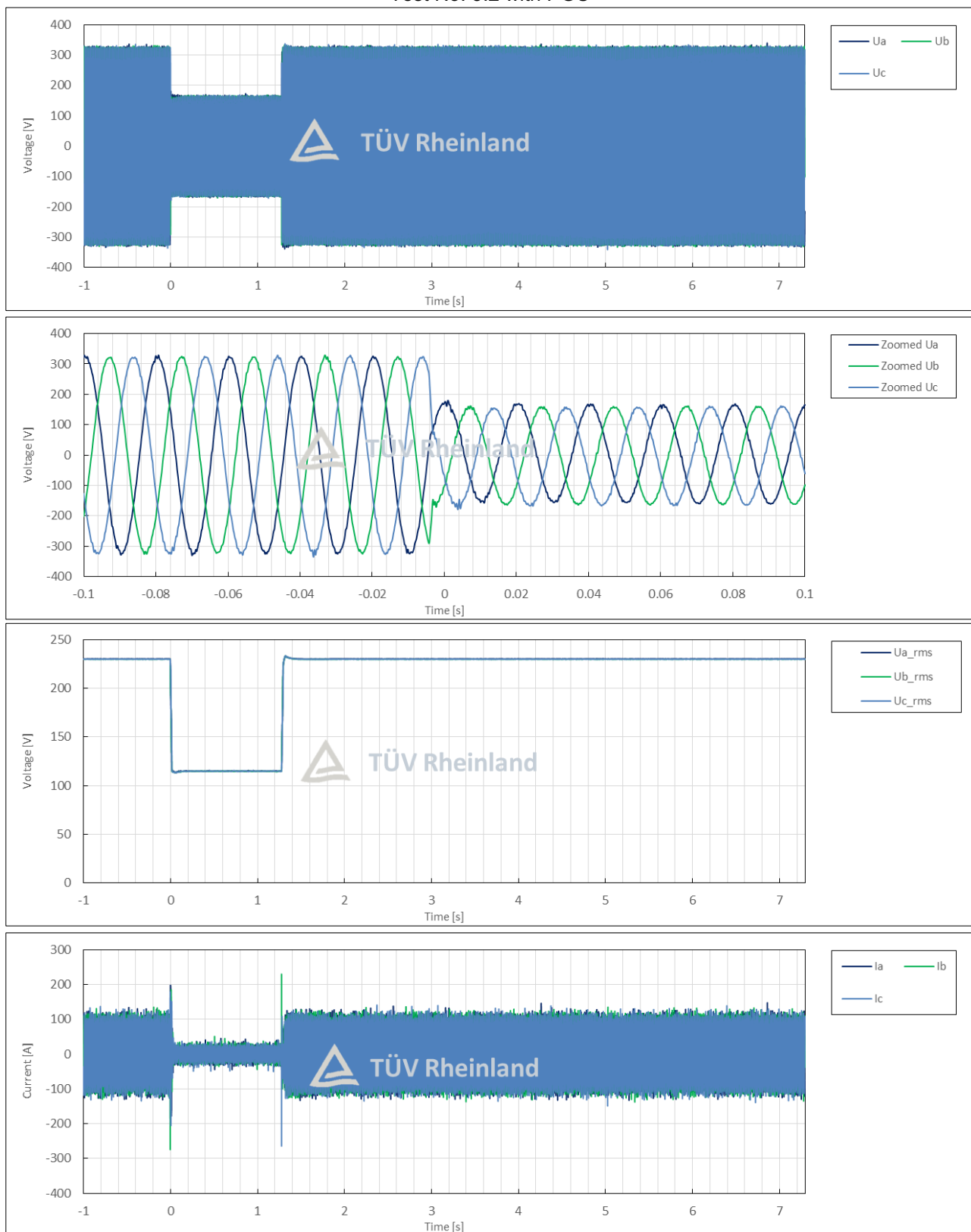
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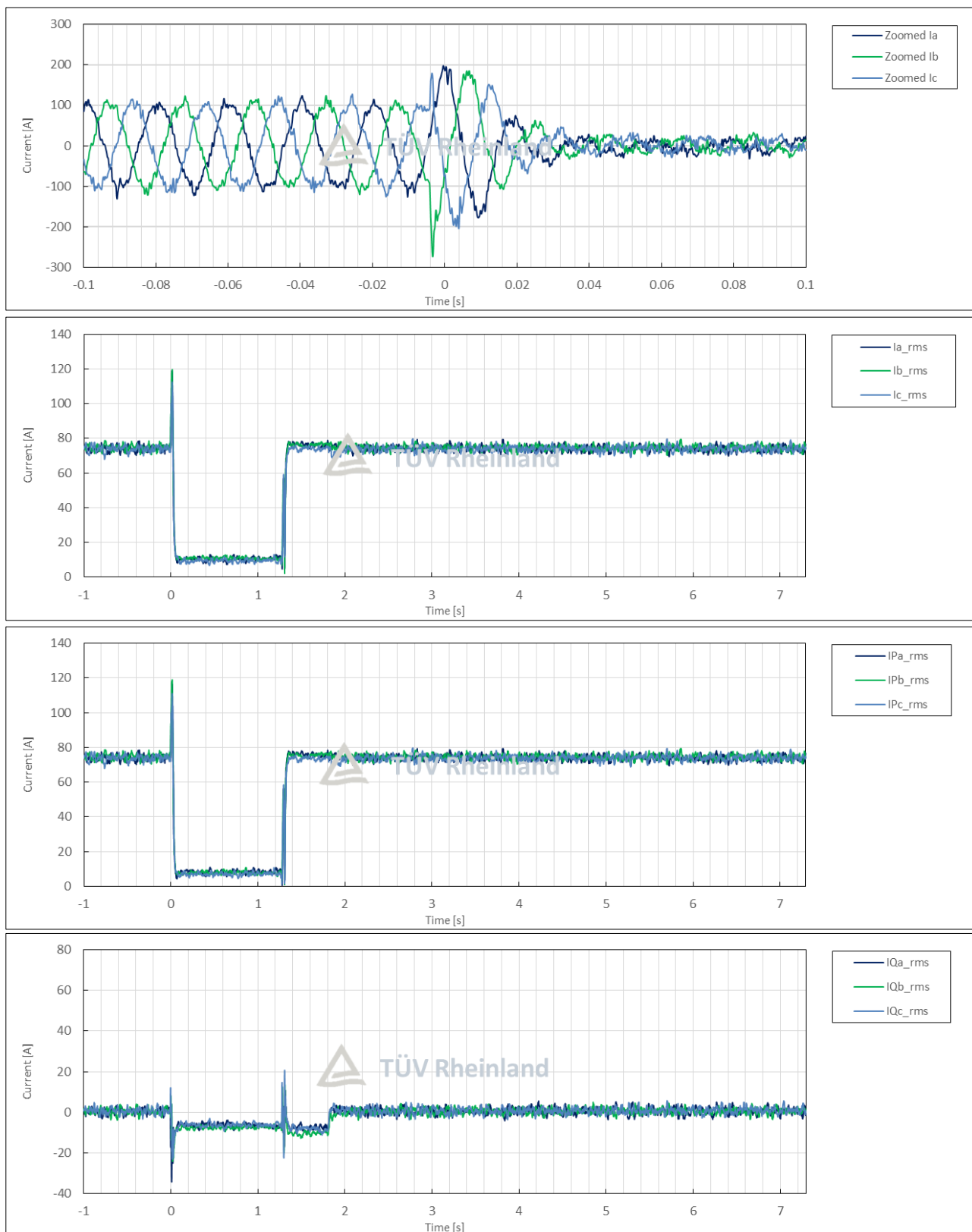
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	3.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:04:45
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		655
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	655
	8	Fault duration in empty load test	Total	--	ms	655
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.25
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.50
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.03
	21		Phase 3			0.03
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.03
	24		Phase 3			0.02
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	0.032
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 3.2 idle test



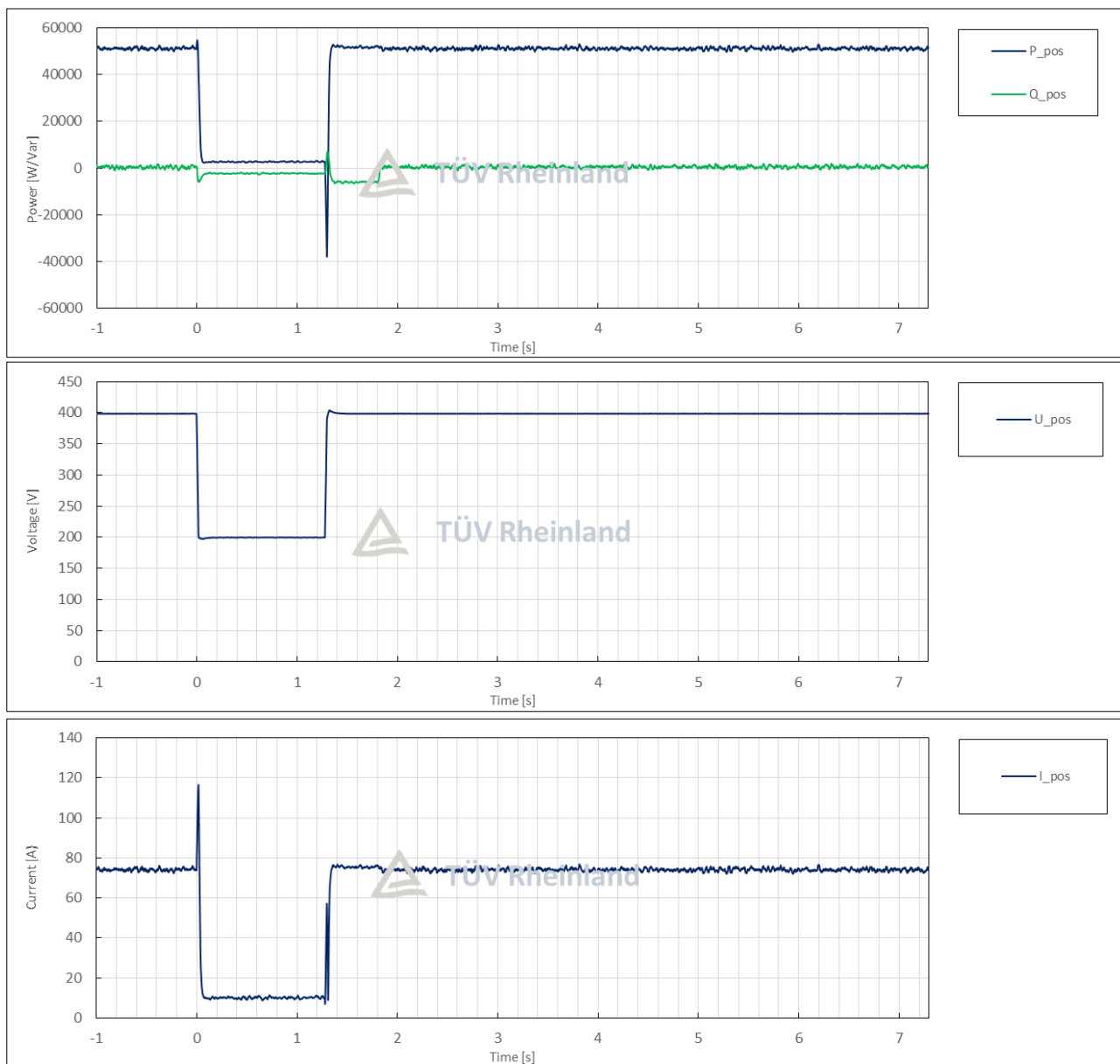
Test No. 3.2 with PGU





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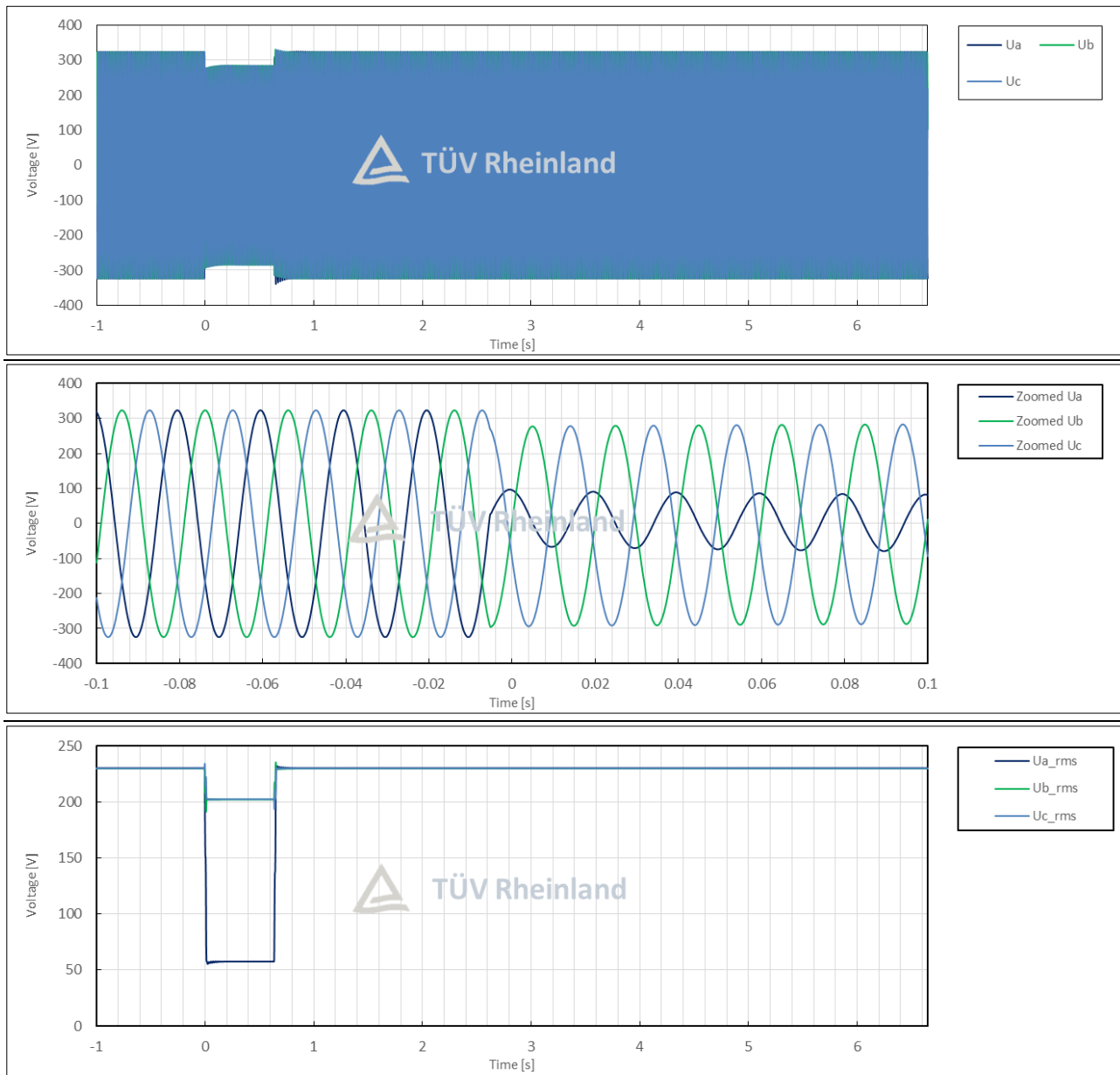


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Test report no.:

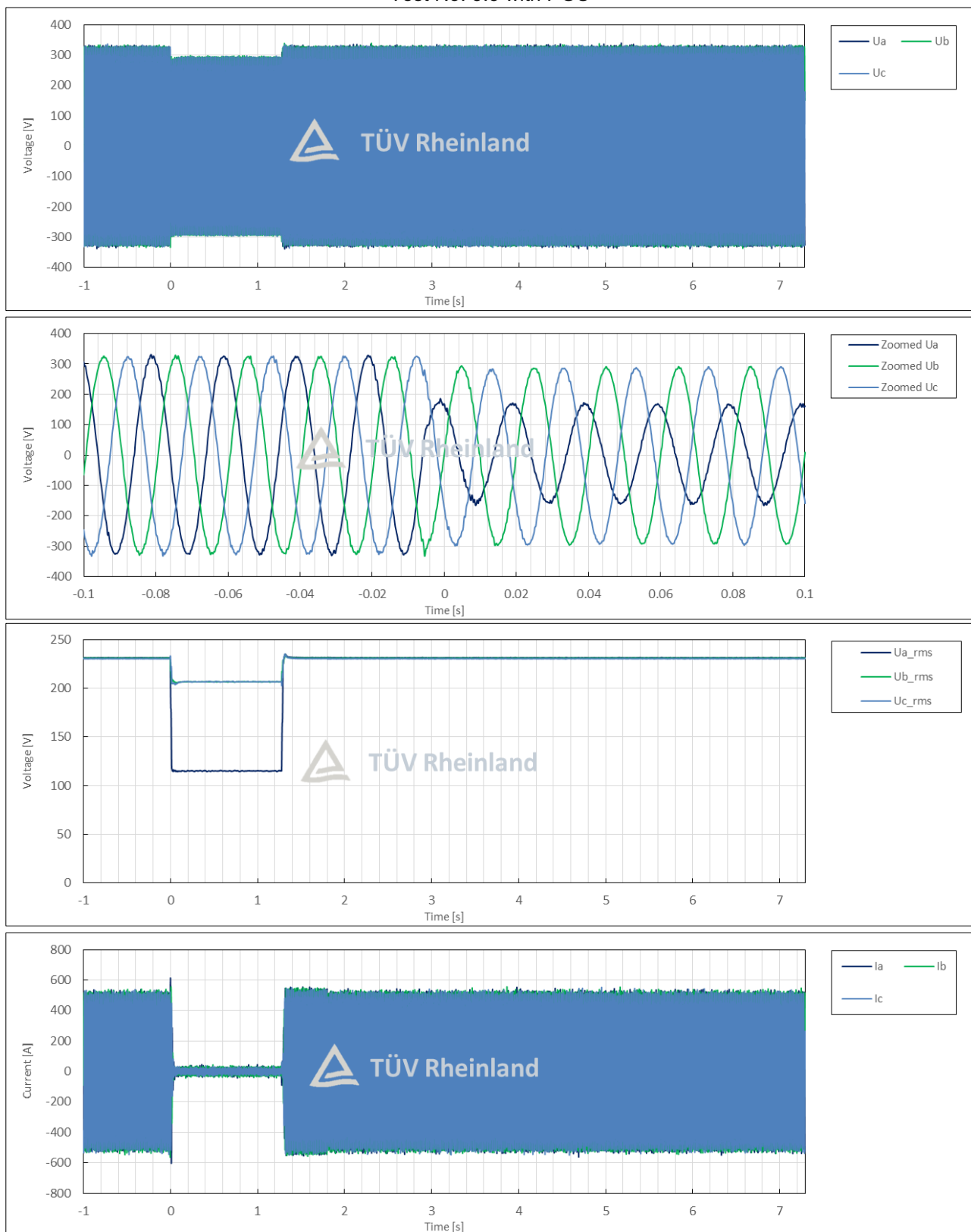
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5.8	TABLE: Verification of dynamic network supporting (FVRT)					P/F
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	3.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:05:24
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		650
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	650
	8	Fault duration in empty load test	Total	--	ms	650
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.63
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cos ϕ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.50
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.03
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.03
	24		Phase 3			0.00
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	30	Active power rising time	Pos.	--	s	0.035
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 3.3 idle test



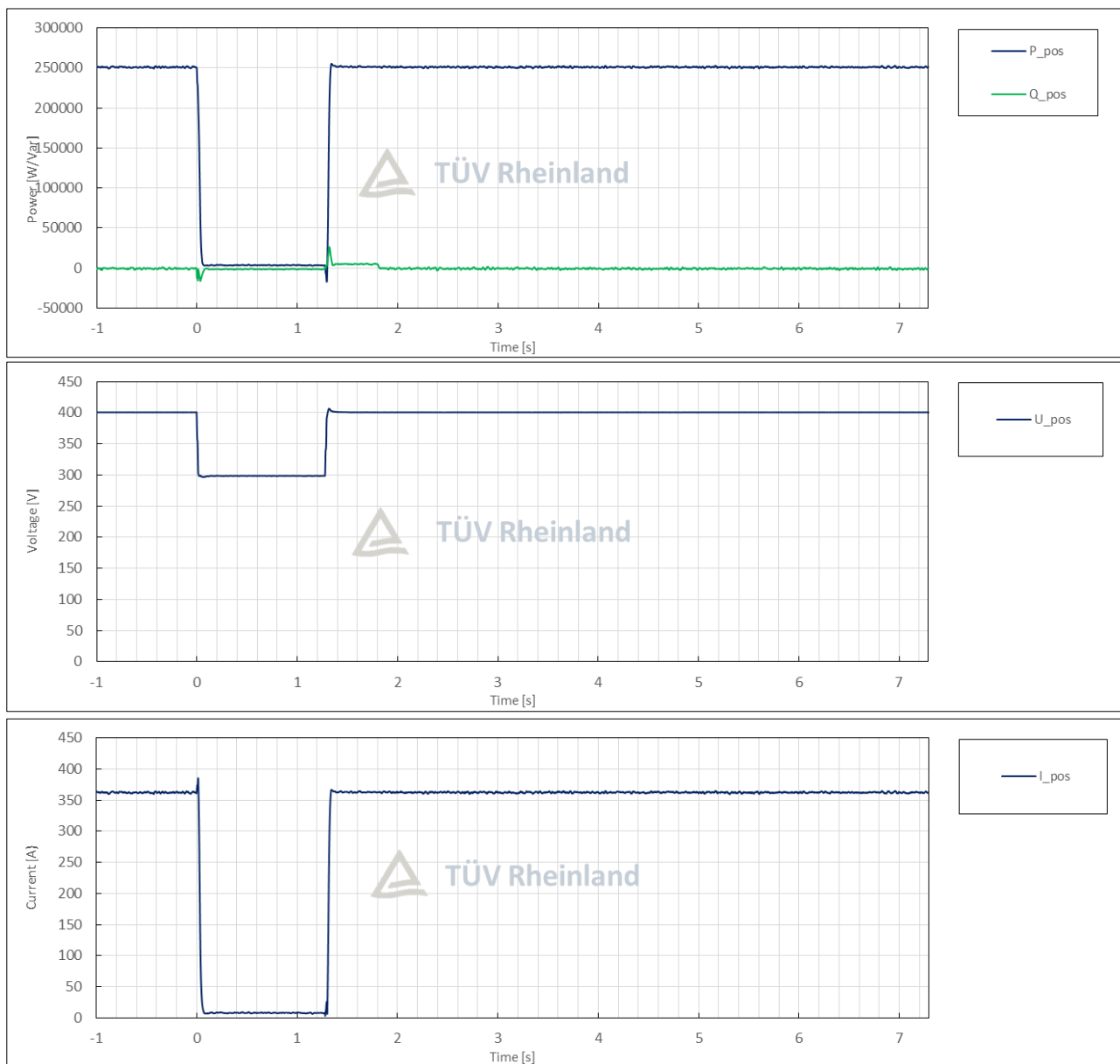
Test No. 3.3 with PGU





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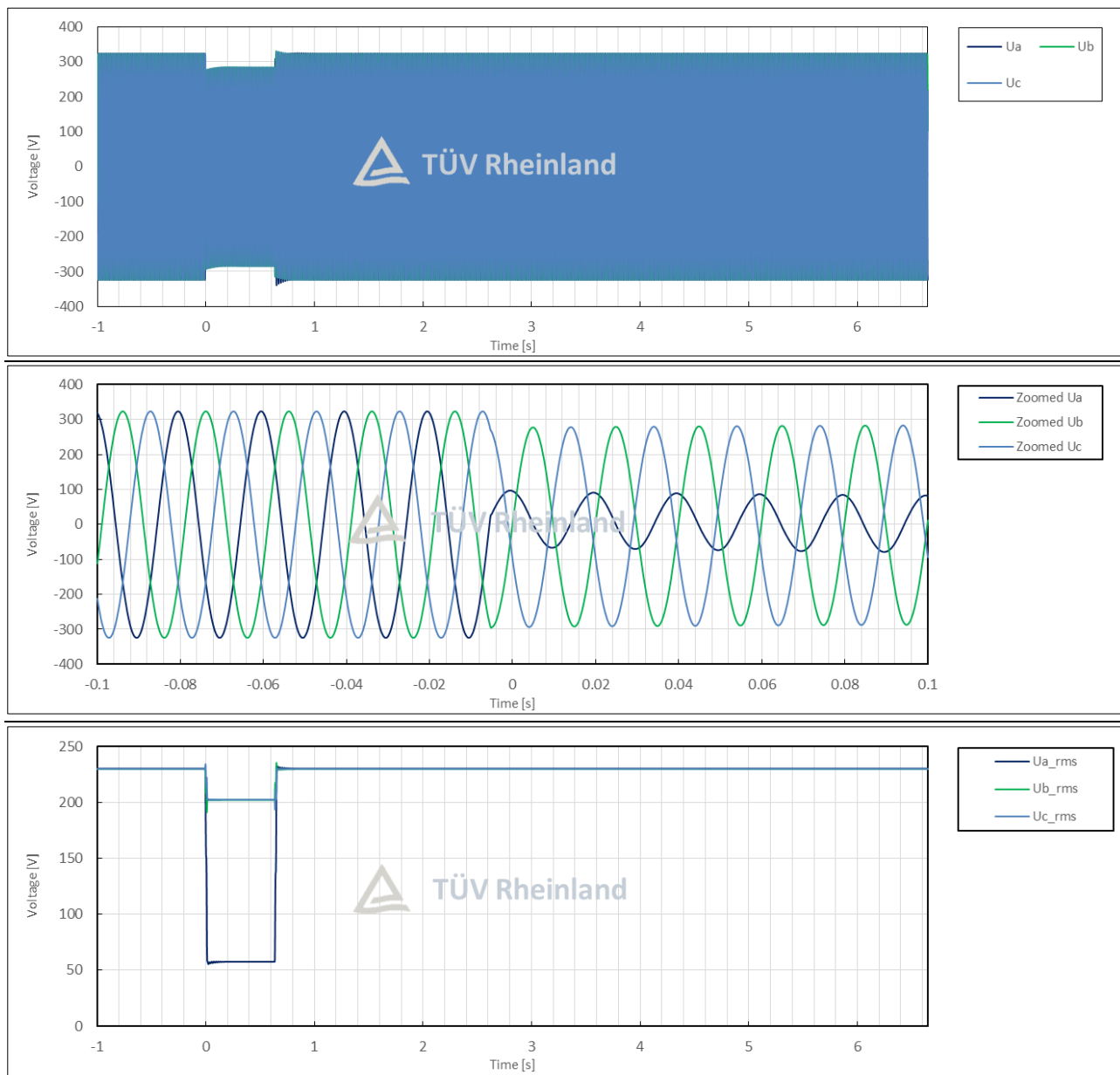


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Test report no.:

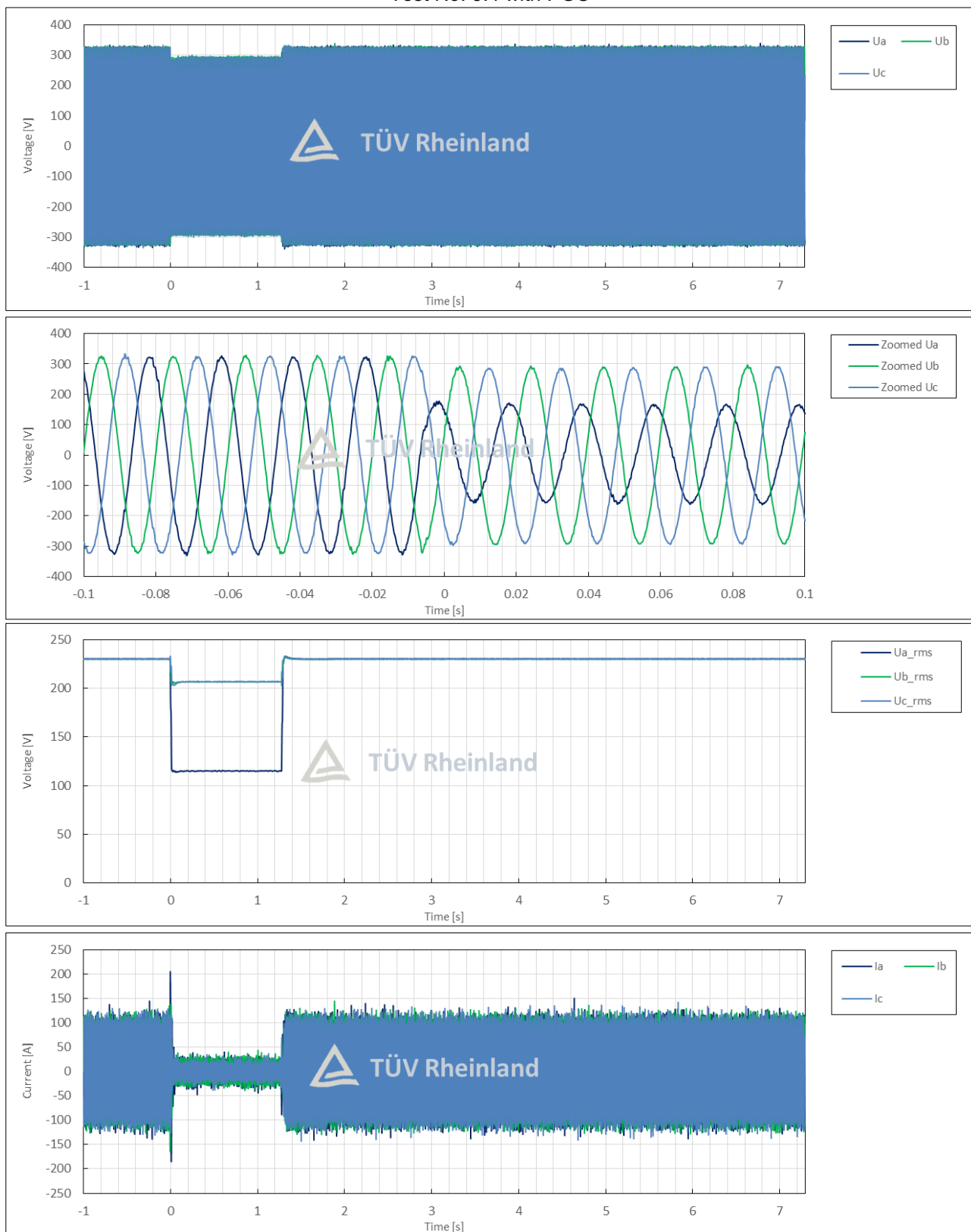
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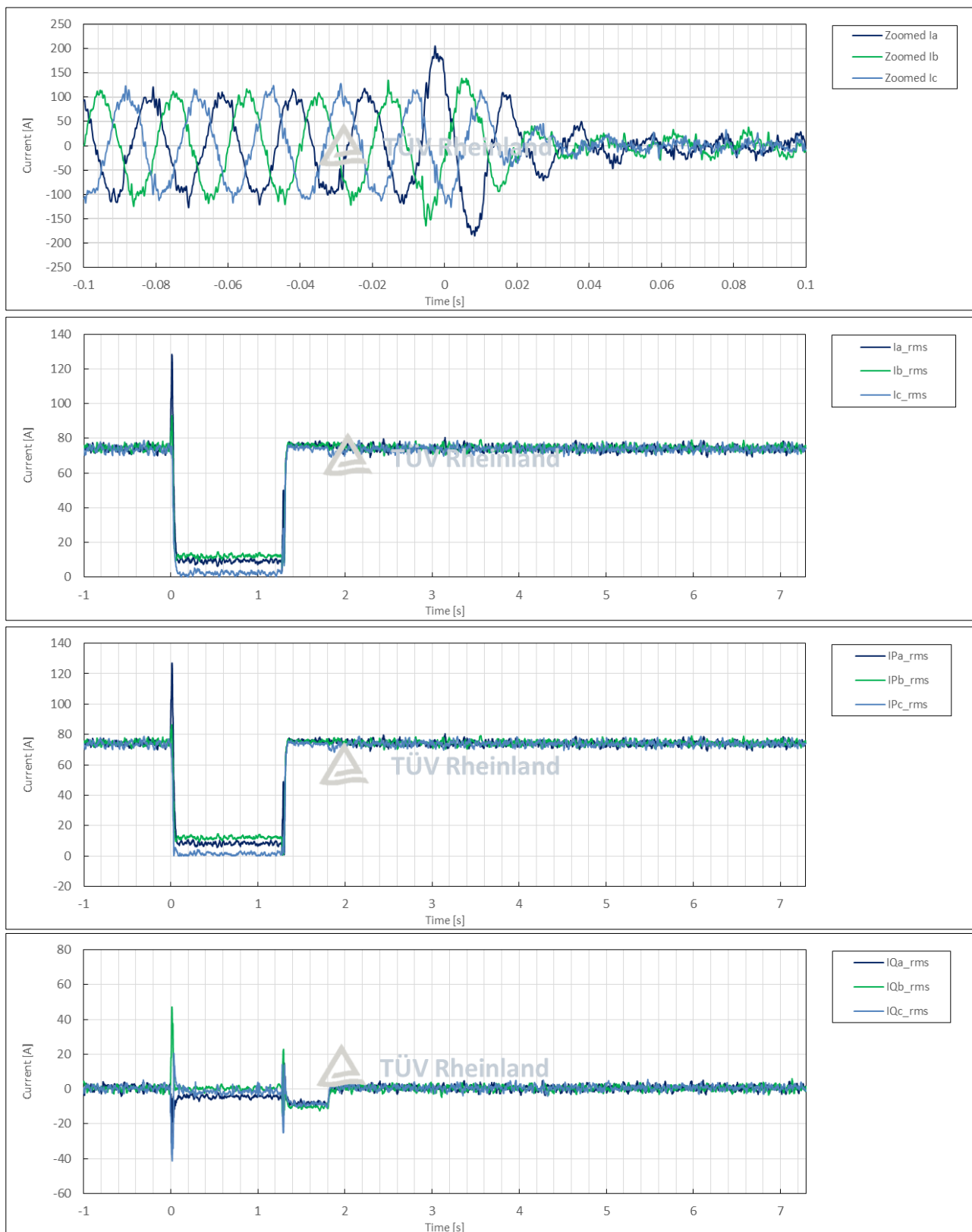
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	3.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:09:48
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.25
	5	Setting dip duration		--		650
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	650
	8	Fault duration in empty load test	Total	--	ms	650
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.25
	10		Pos.		p.u.	0.63
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.50
	19	Line current	Phase 1	t1+50ms	p.u.	0.04
	20		Phase 2			0.03
	21		Phase 3			0.02
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.03
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.02
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.032
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 3.4 idle test



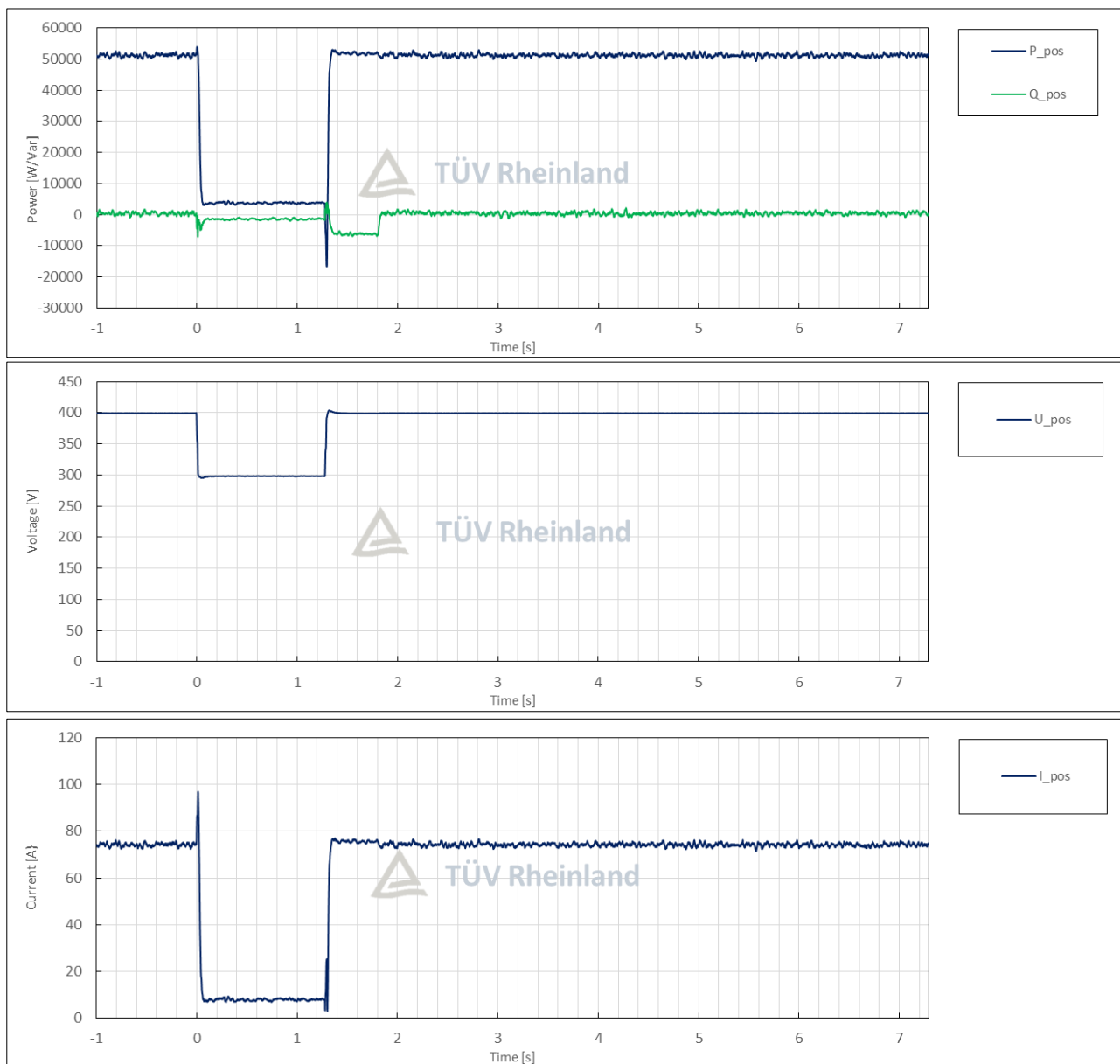
Test No. 3.4 with PGU





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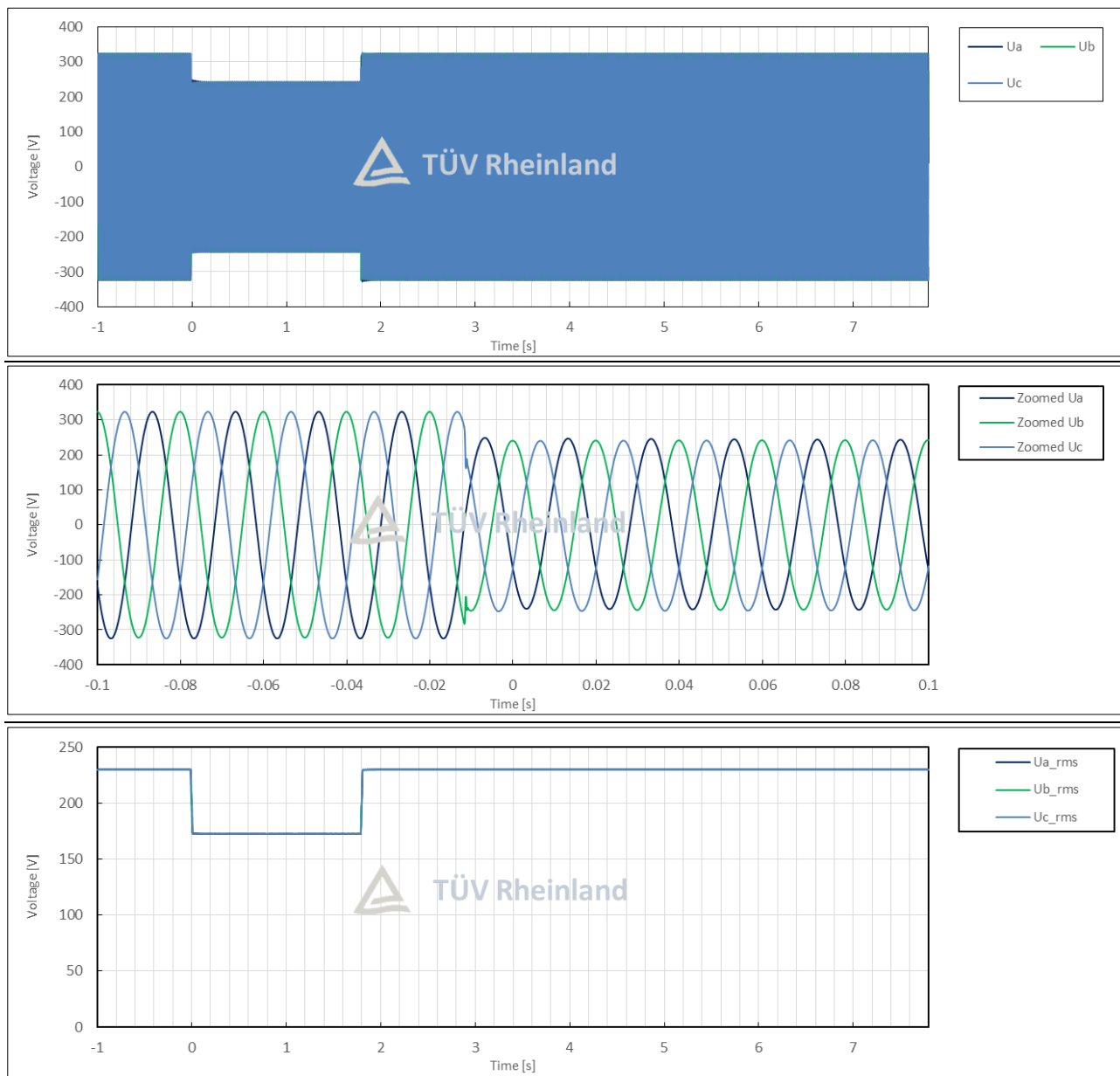


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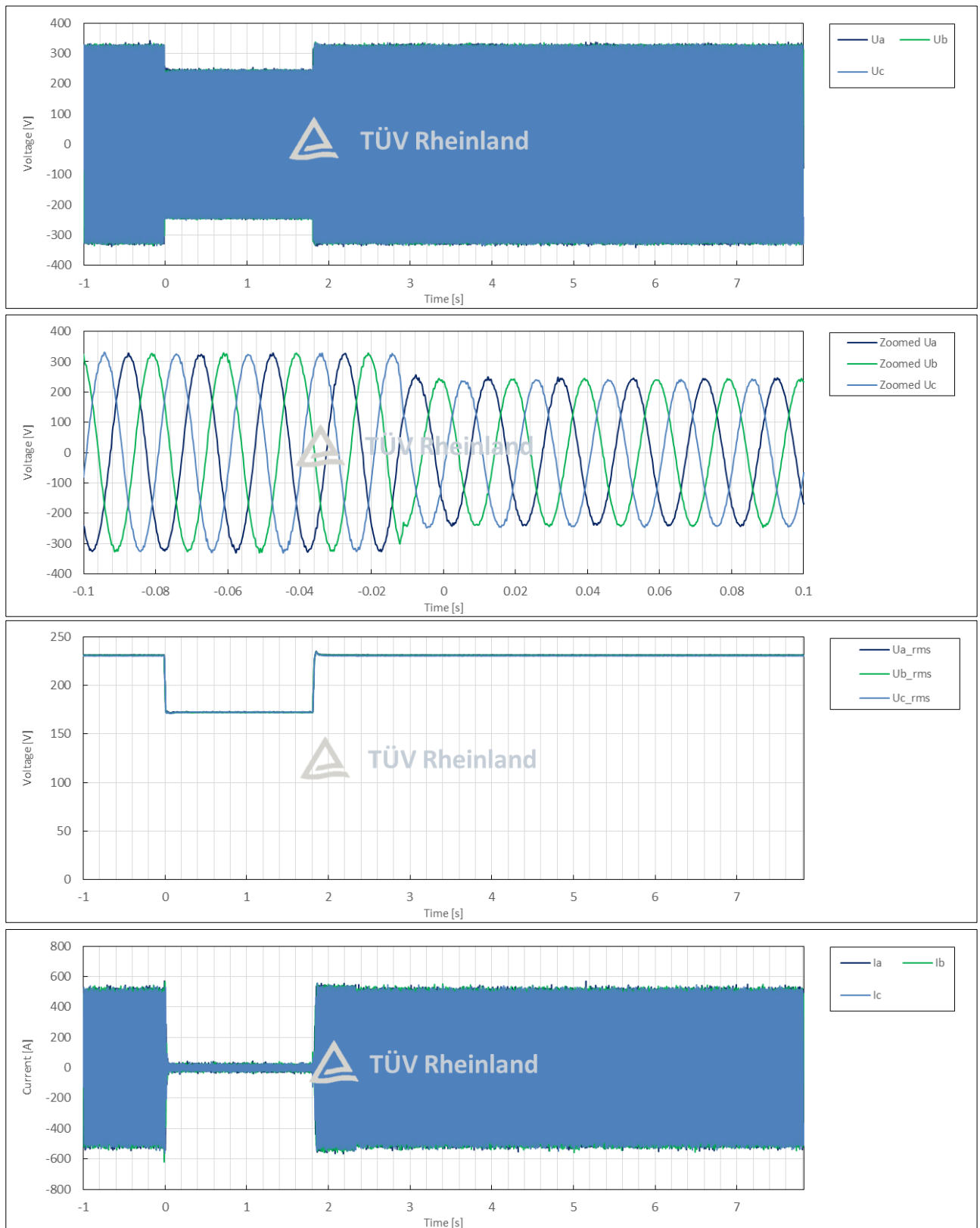
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	4.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:23:20
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.75
	5	Setting dip duration		--		1798
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	1798
	8	Fault duration in empty load test	Total	--	ms	1798
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.75
	10		Pos.		p.u.	0.75
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.75
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.03
	21		Phase 3			0.03
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.02
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.01
	26		Pos.			0.01
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.04
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 4.1 idle test



Test No. 4.1 with PGU





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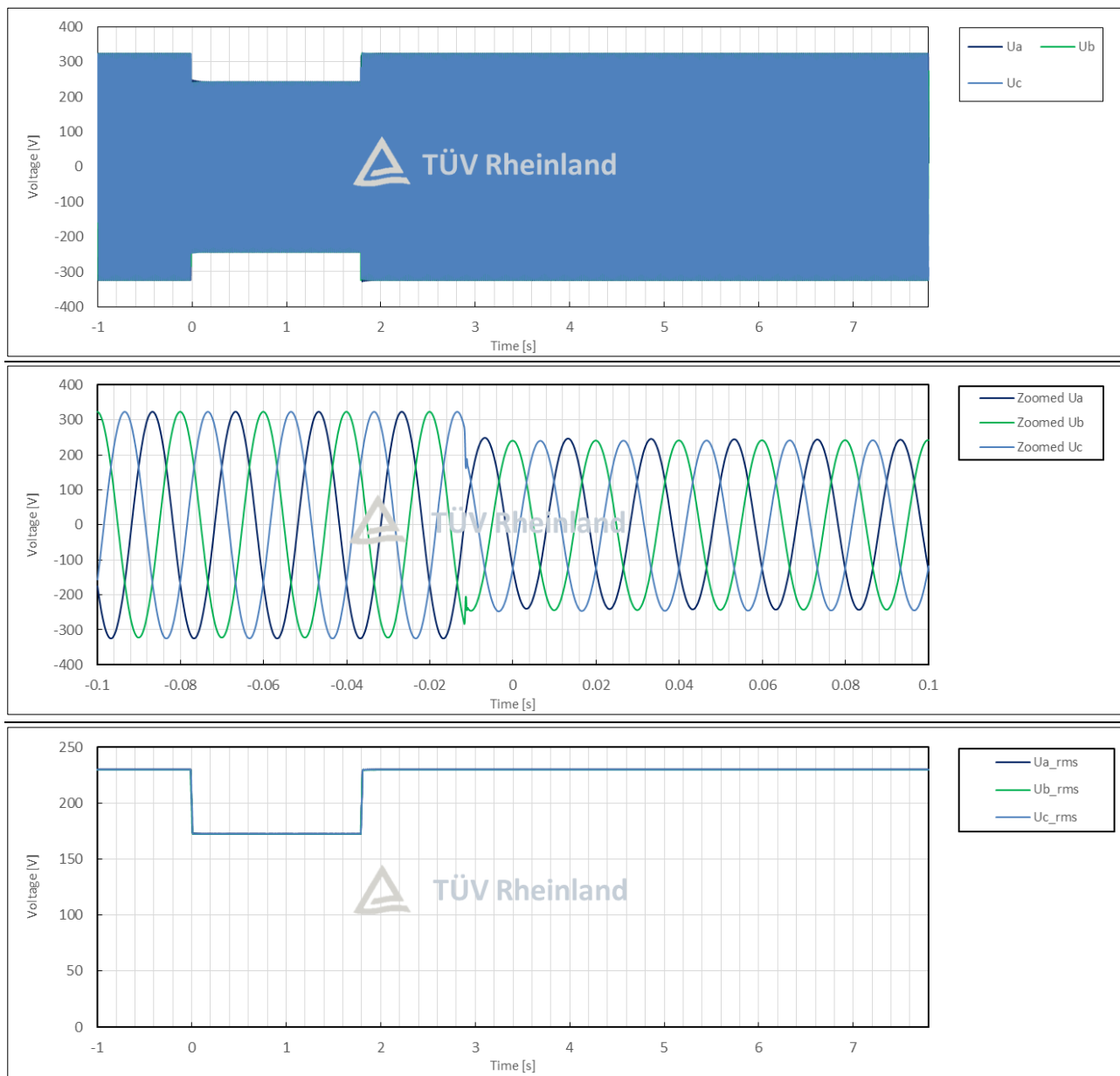


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Test report no.:

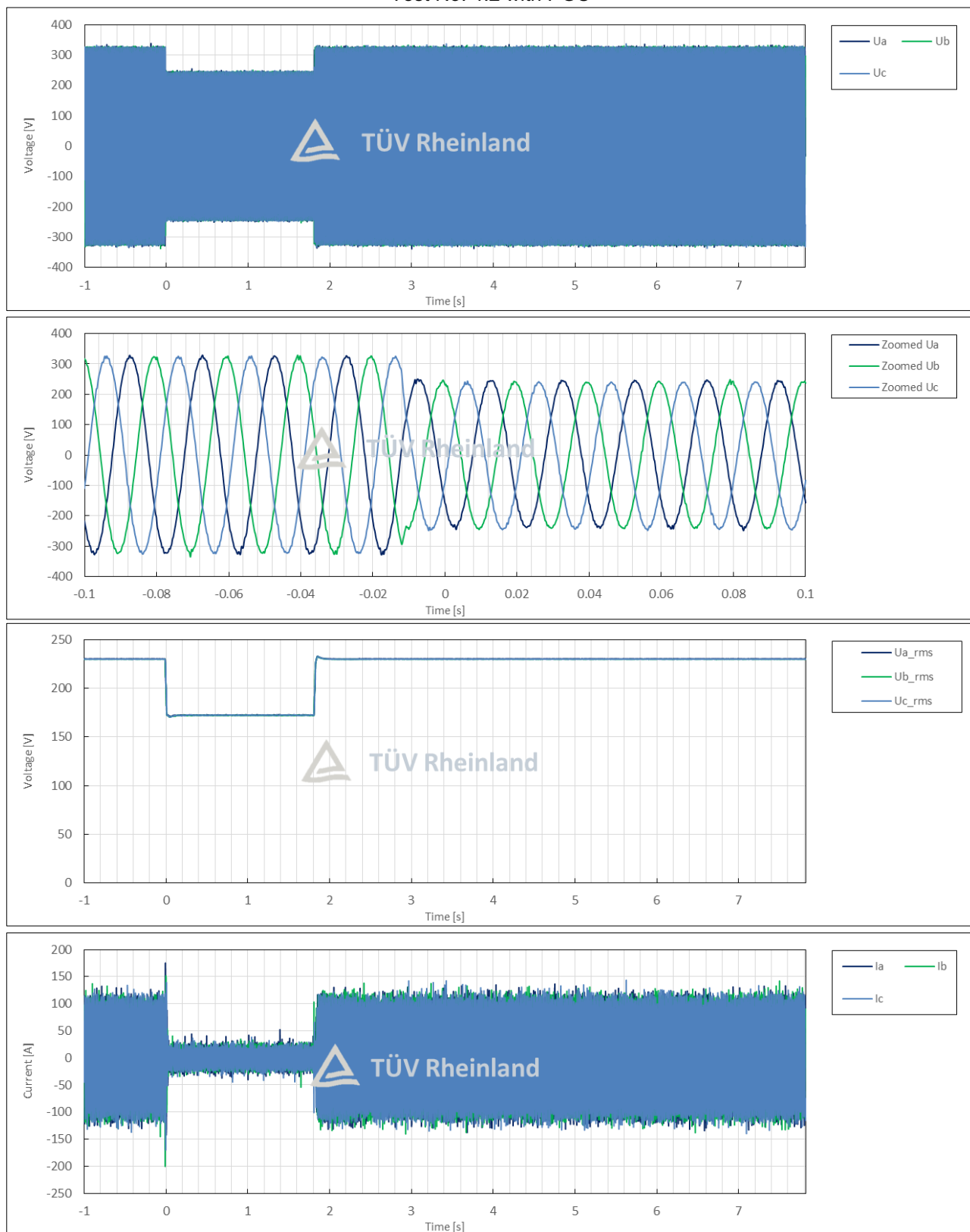
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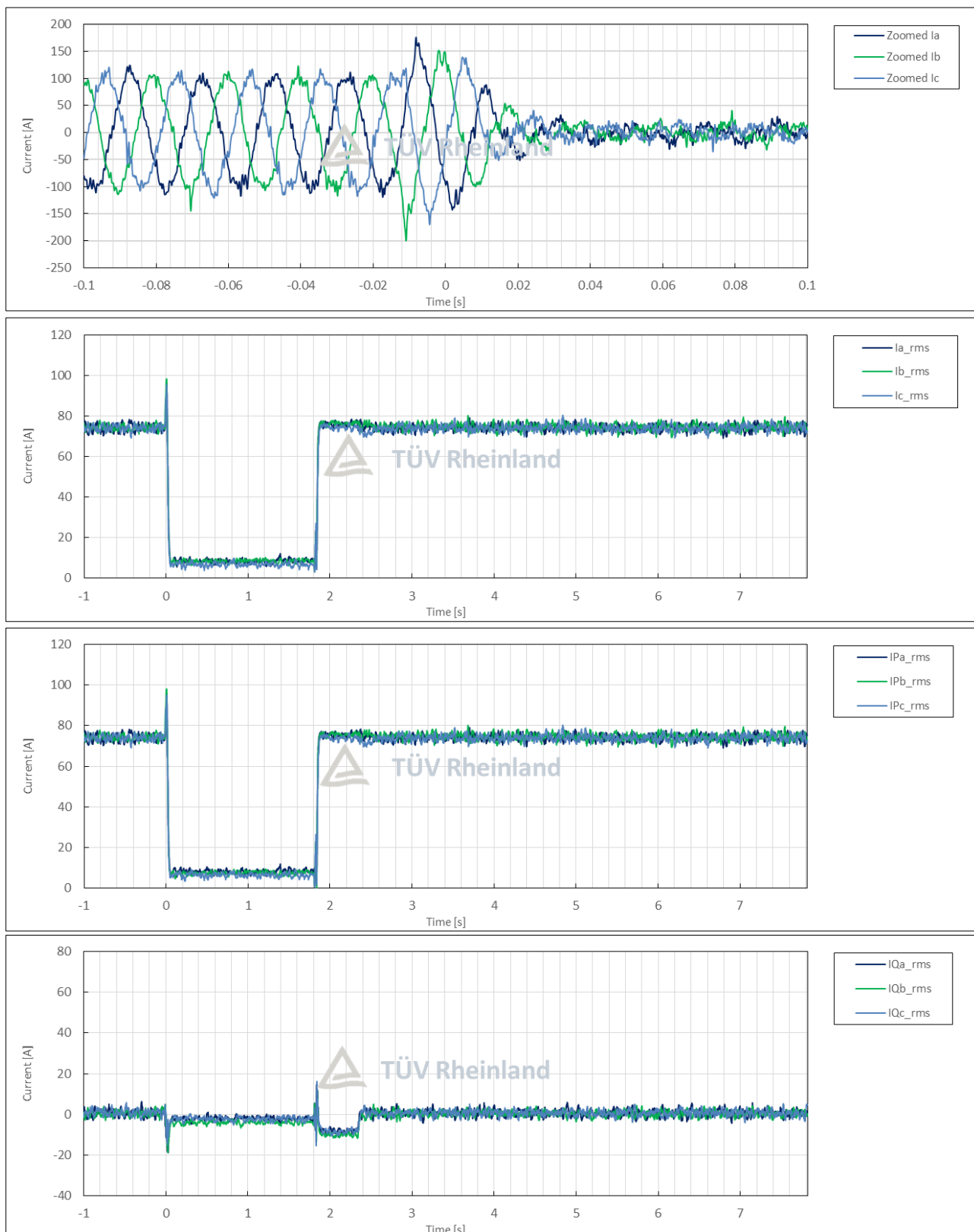
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	4.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:24:56
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.75
	5	Setting dip duration		--		1798
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	1798
	8	Fault duration in empty load test	Total	--	ms	1798
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.75
	10		Pos.		p.u.	0.75
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.75
	19	Line current	Phase 1	t1+50ms	p.u.	0.02
	20		Phase 2			0.02
	21		Phase 3			0.02
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.02
	24		Phase 3			0.02
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.02
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.037
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 4.2 idle test



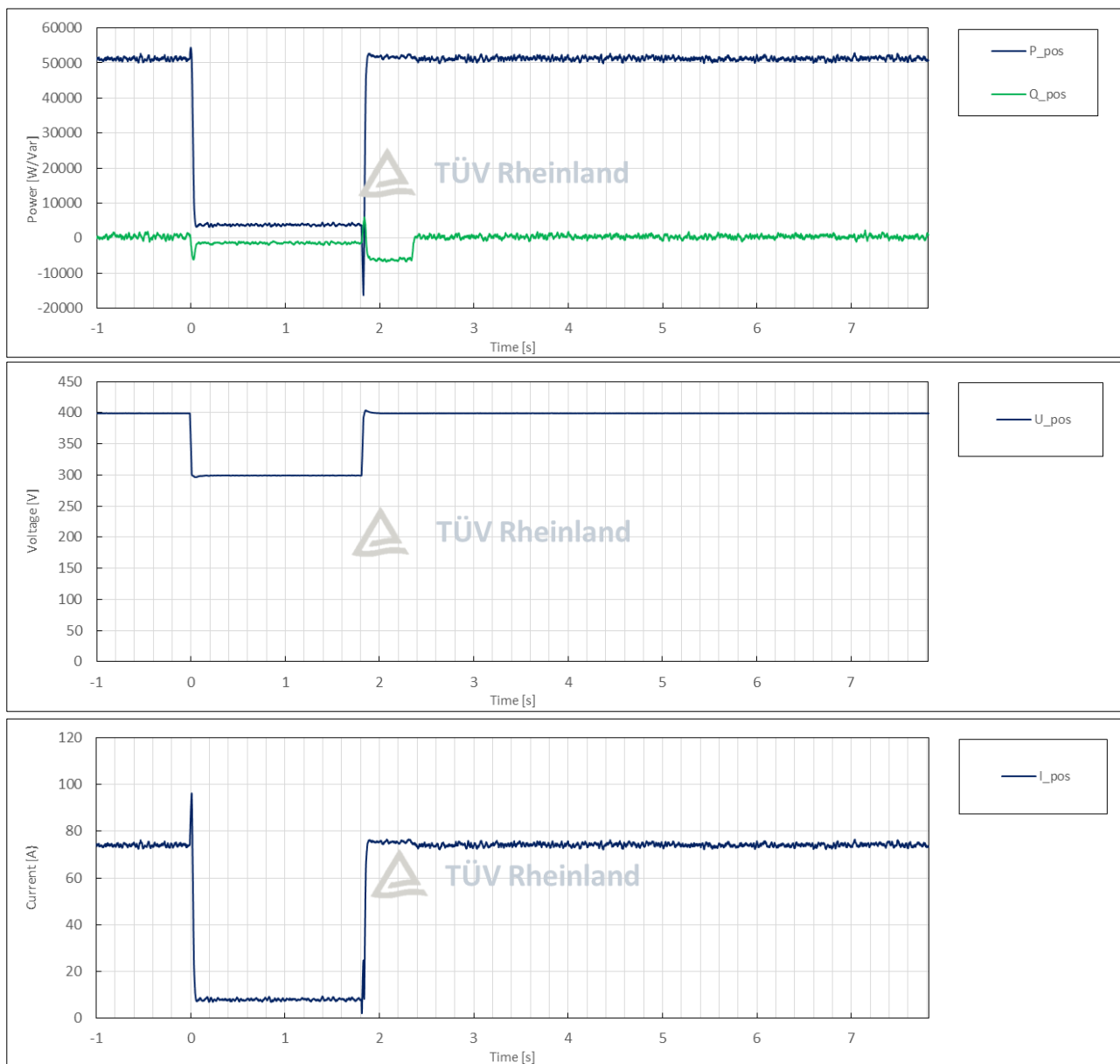
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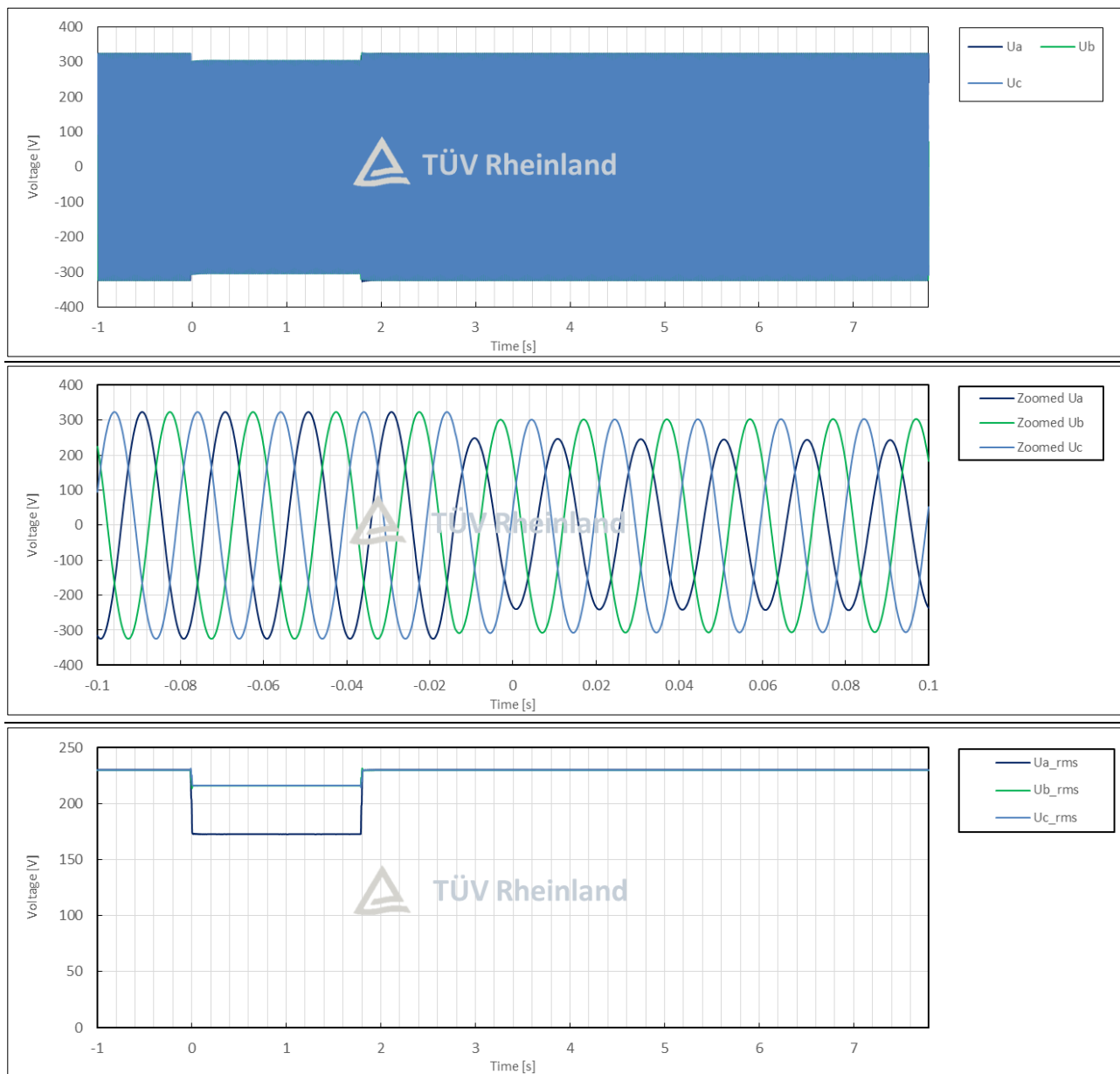


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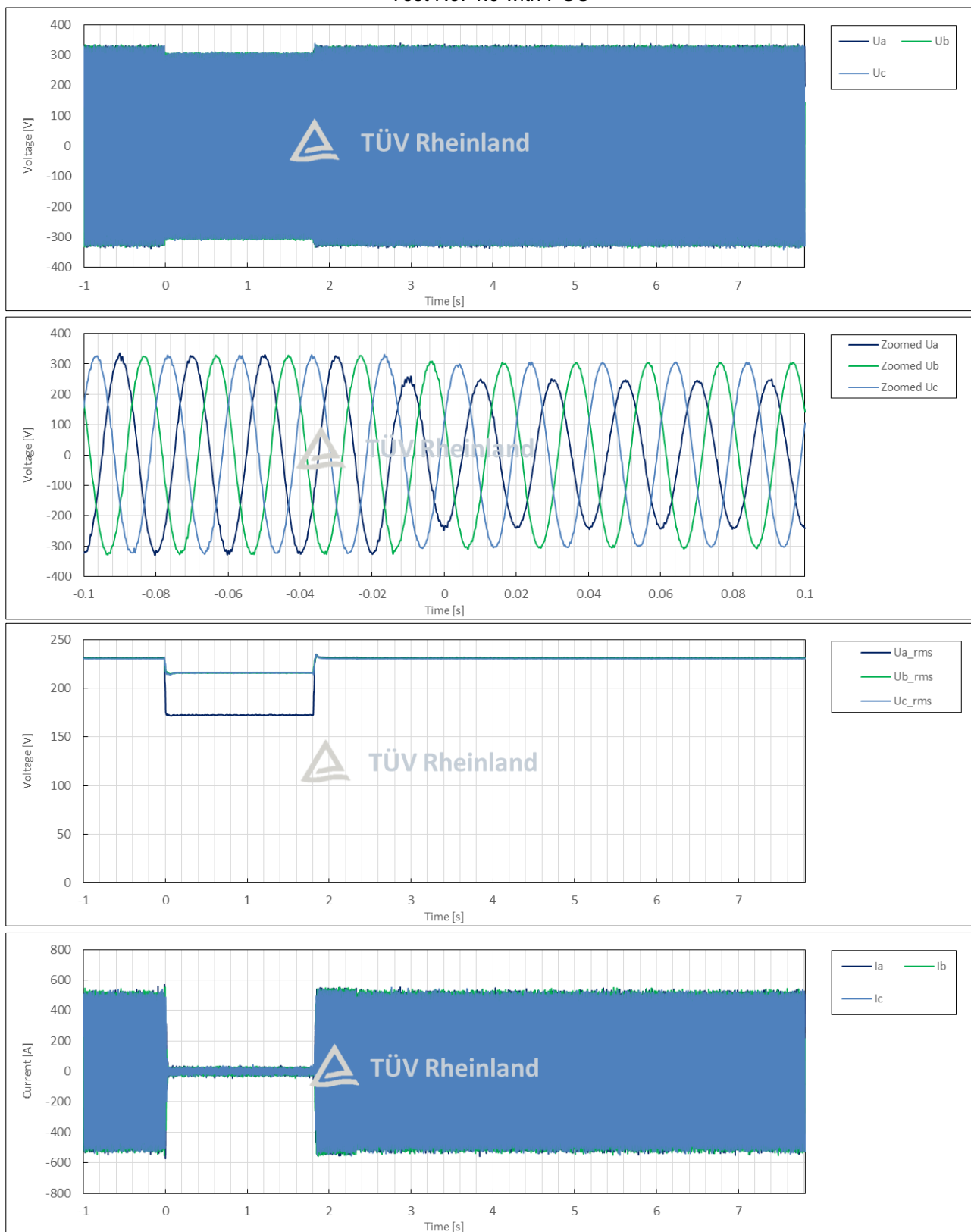
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	4.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:25:41
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.75
	5	Setting dip duration		--		1793
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	1793
	8	Fault duration in empty load test	Total	--	ms	1793
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.75
	10		Pos.		p.u.	0.87
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.75
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.03
	21		Phase 3			0.01
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.02
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.02
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.04
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 4.3 idle test



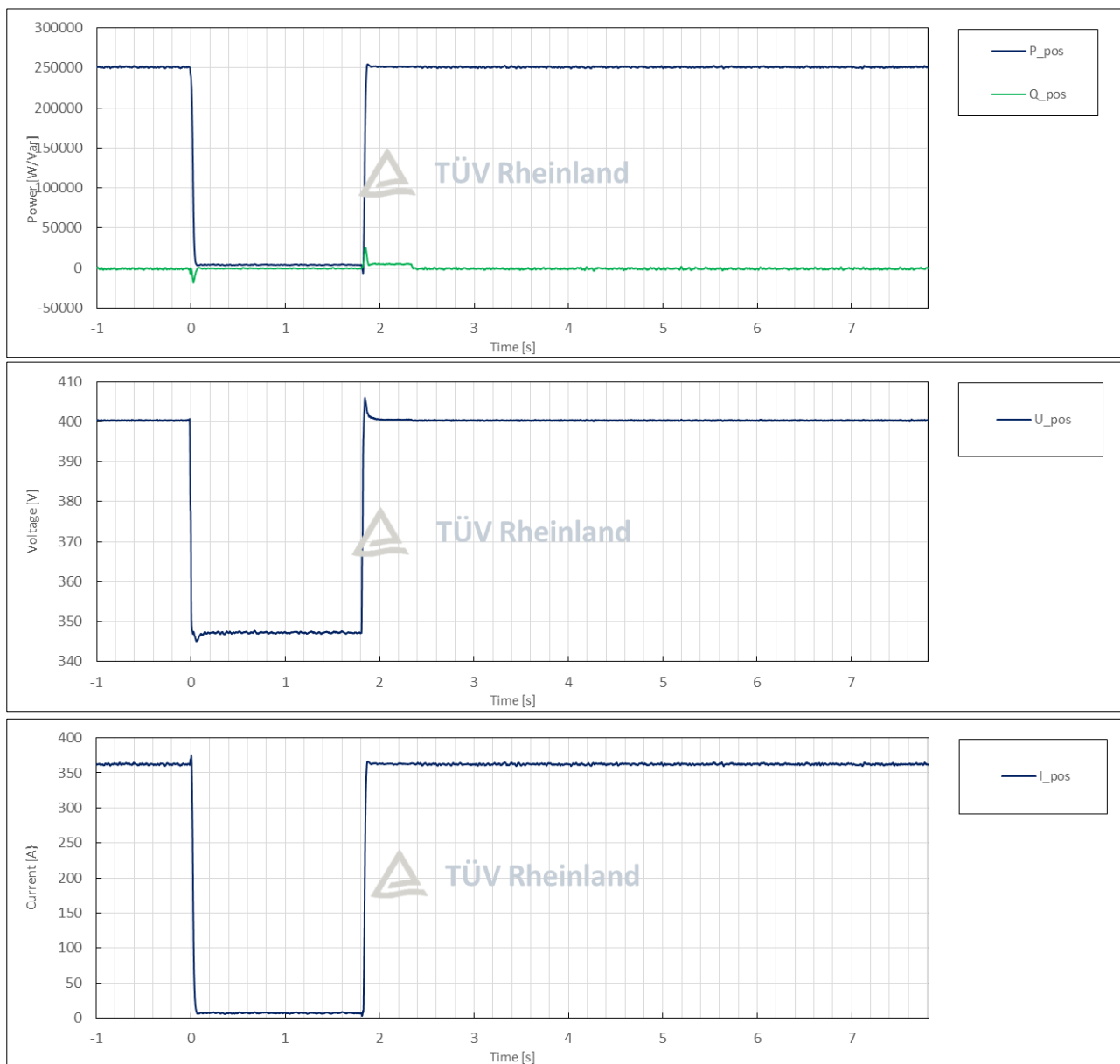
Test No. 4.3 with PGU





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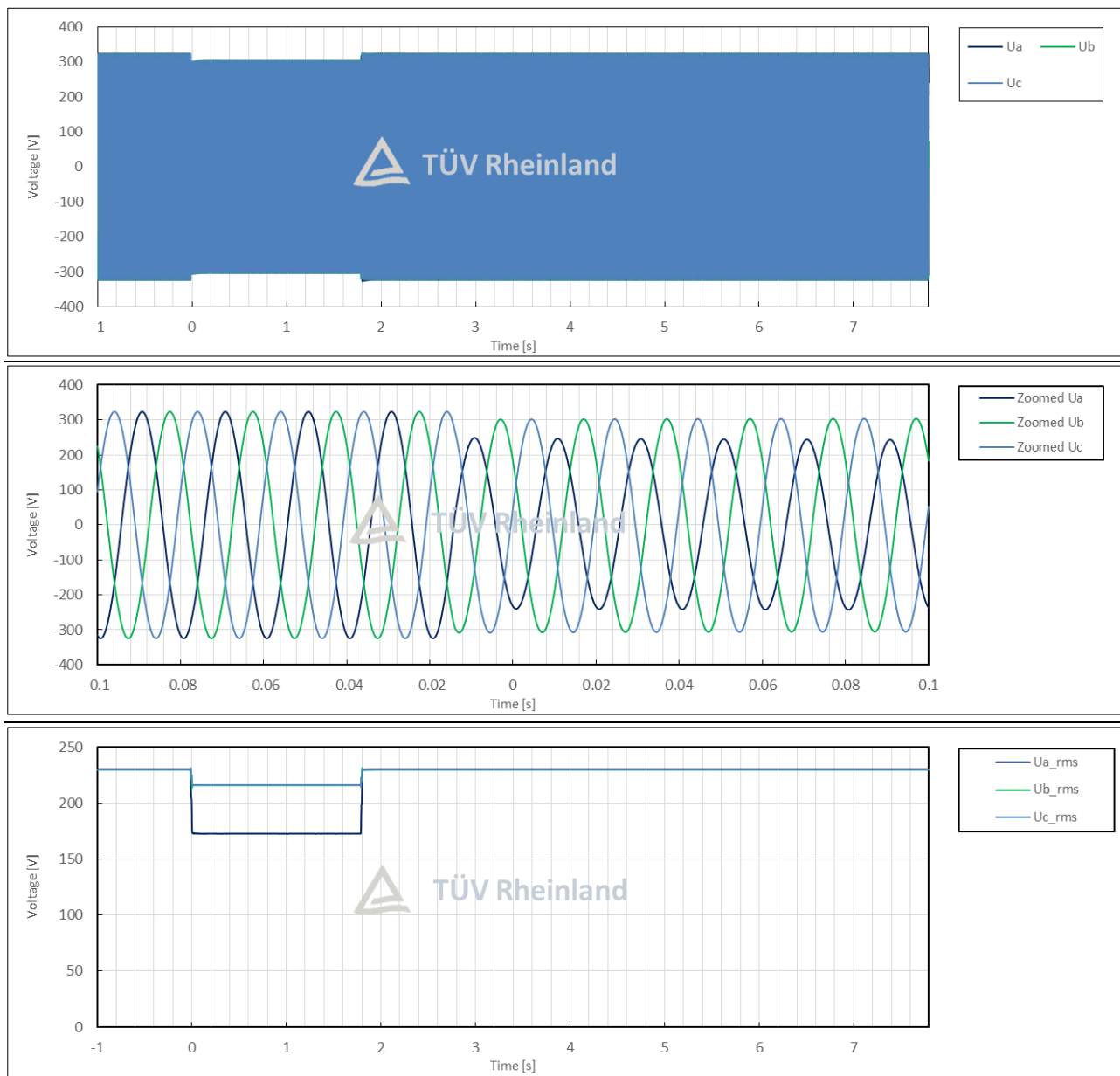


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Test report no.:

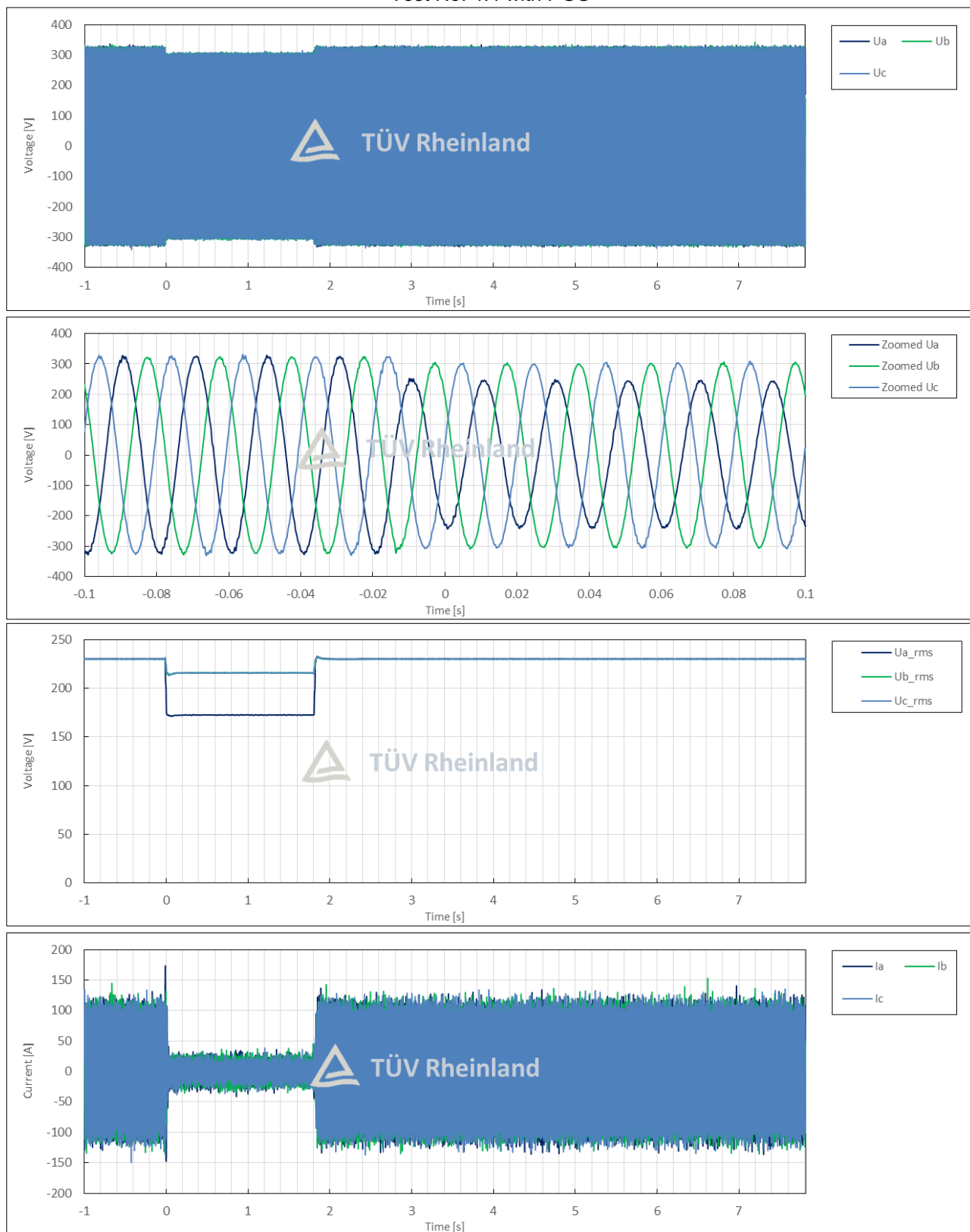
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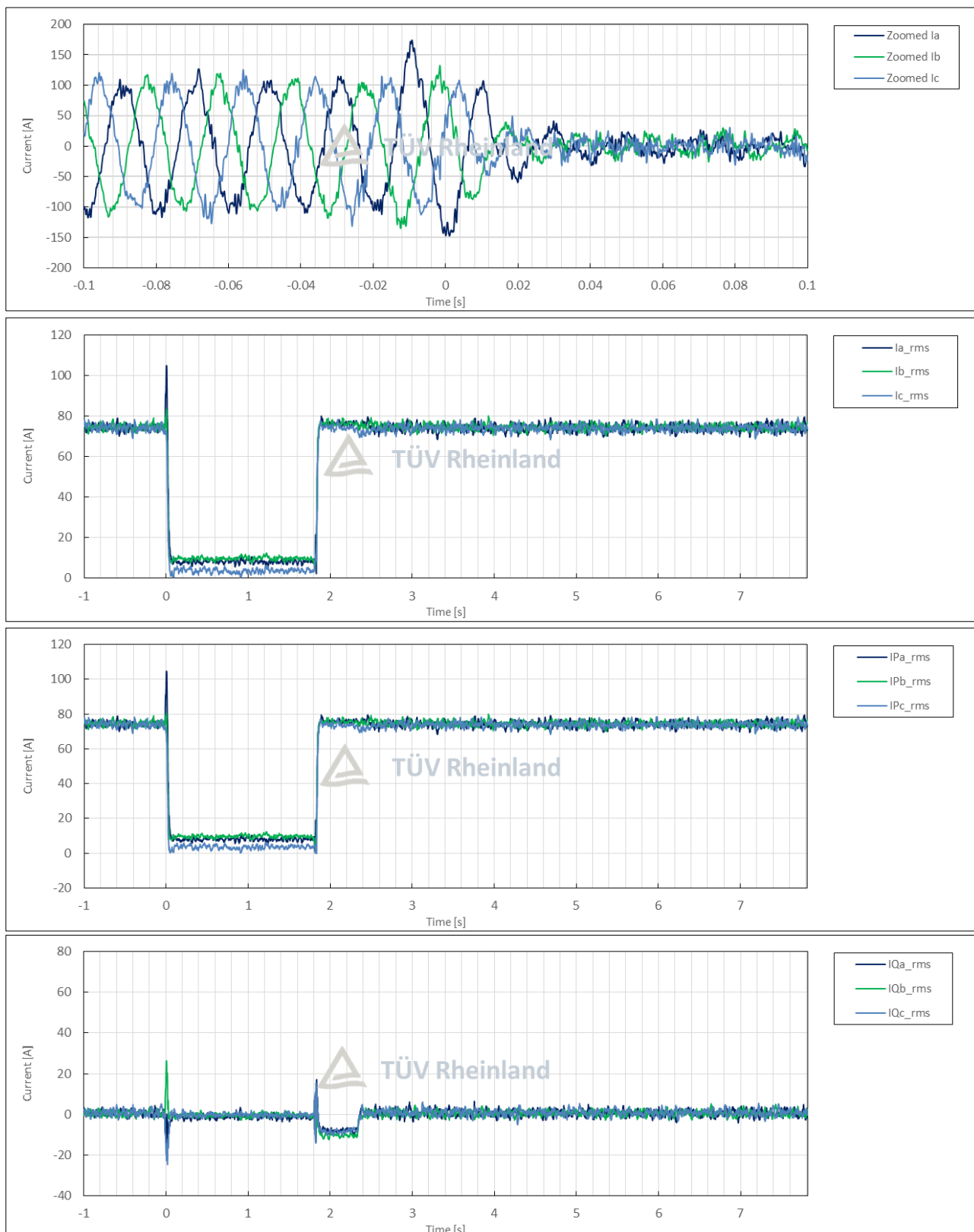
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	4.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:28:02
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.75
	5	Setting dip duration		--		1793
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	1793
	8	Fault duration in empty load test	Total	--	ms	1793
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.75
	10		Pos.		p.u.	0.87
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.75
	19	Line current	Phase 1	t1+50ms	p.u.	0.03
	20		Phase 2			0.02
	21		Phase 3			0.01
	22	Line current	Phase 1	t1+80ms	p.u.	0.03
	23		Phase 2			0.02
	24		Phase 3			0.01
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.02
	26		Pos.			0.02
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.037
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 4.4 idle test



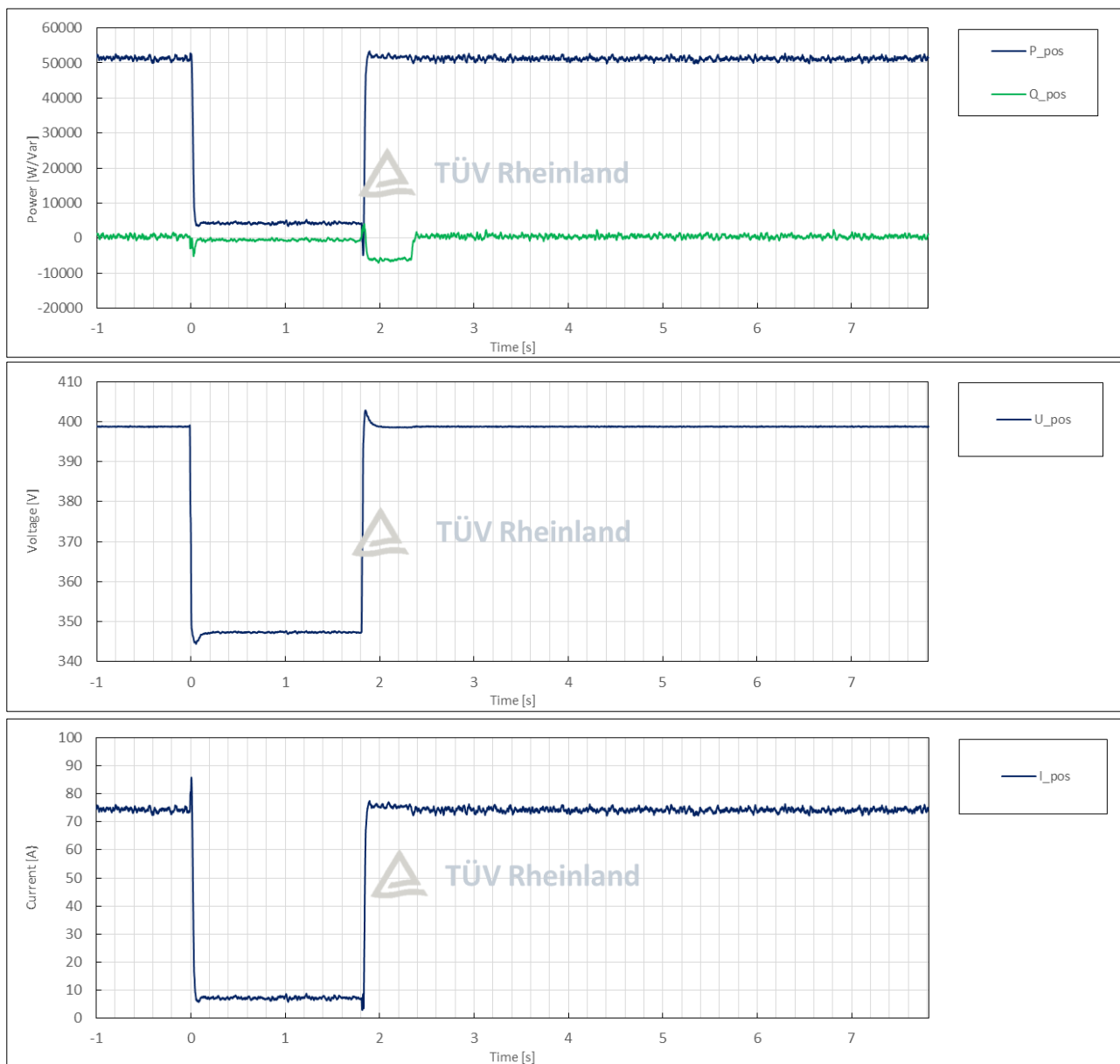
Test No. 4.4 with PGU





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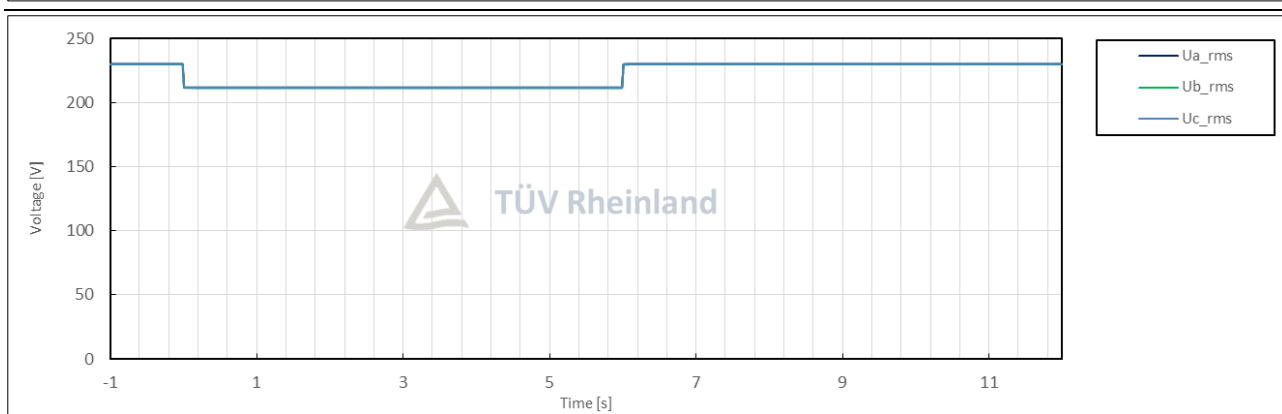
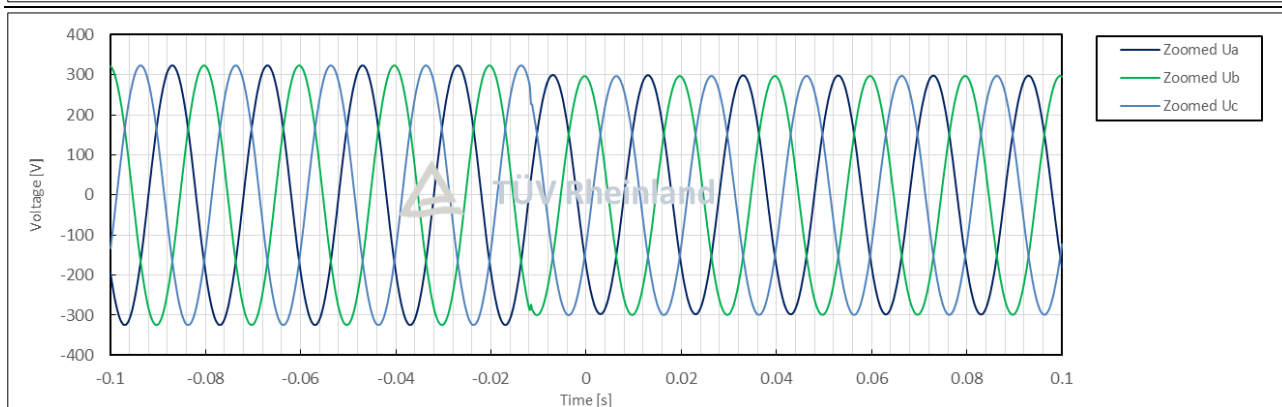
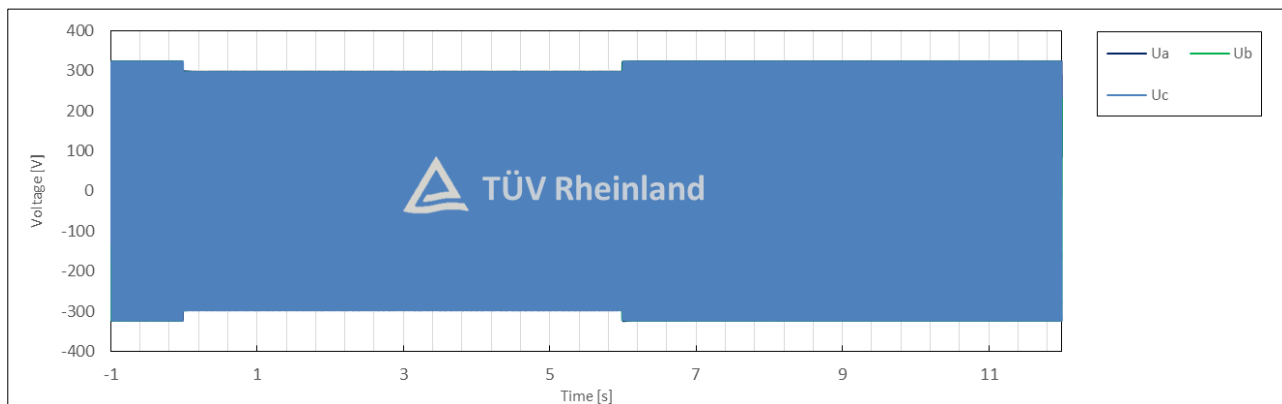


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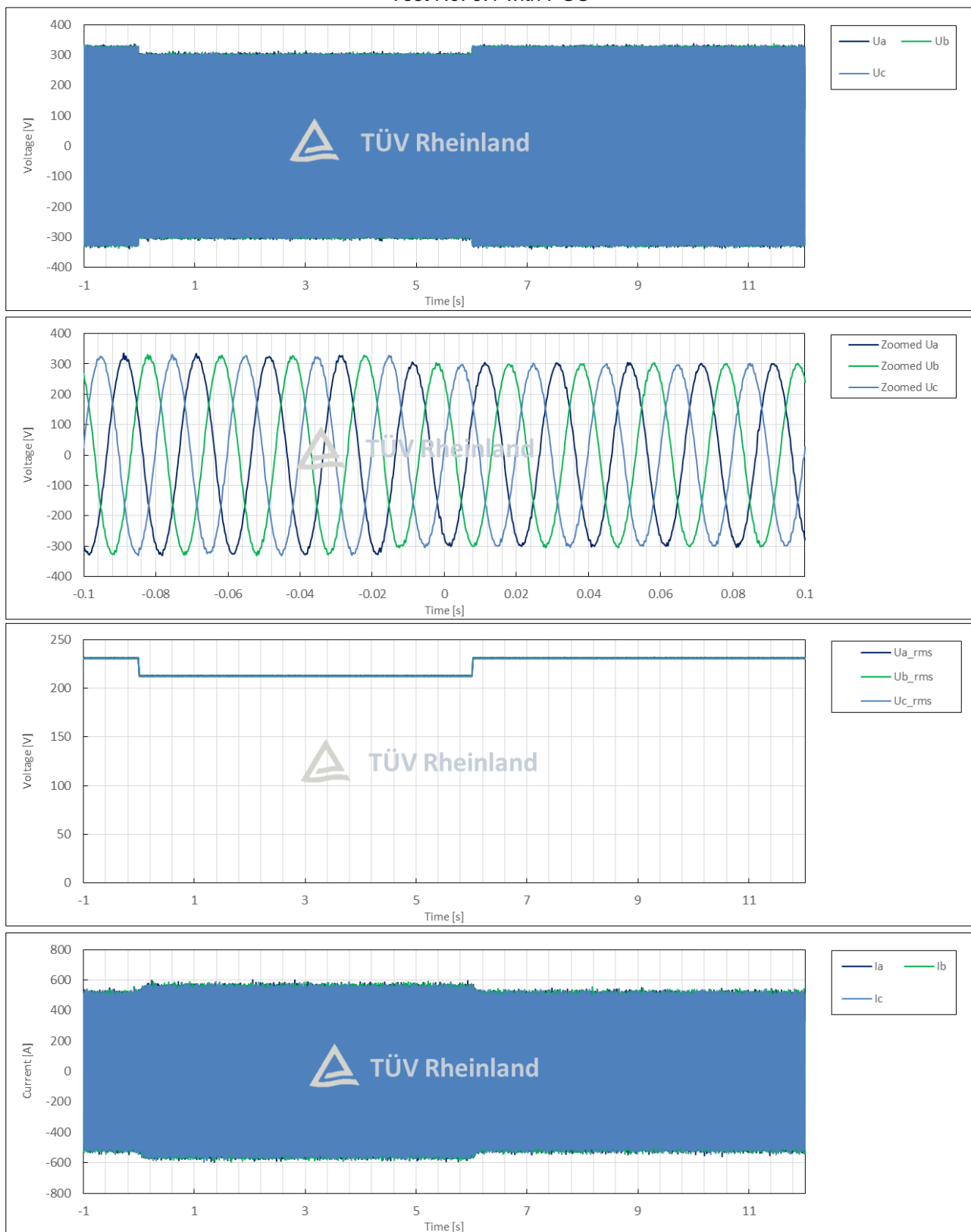
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	5.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:28:54
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.92
	5	Setting dip duration		--		5997
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	5997
	8	Fault duration in empty load test	Total	--	ms	5997
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.92
	10		Pos.		p.u.	0.92
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.92
	19	Line current	Phase 1	t1+50ms	p.u.	1.04
	20		Phase 2			1.06
	21		Phase 3			1.04
	22	Line current	Phase 1	t1+80ms	p.u.	1.06
	23		Phase 2			1.08
	24		Phase 3			1.06
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	1.00
	26		Pos.			1.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 5.1 idle test



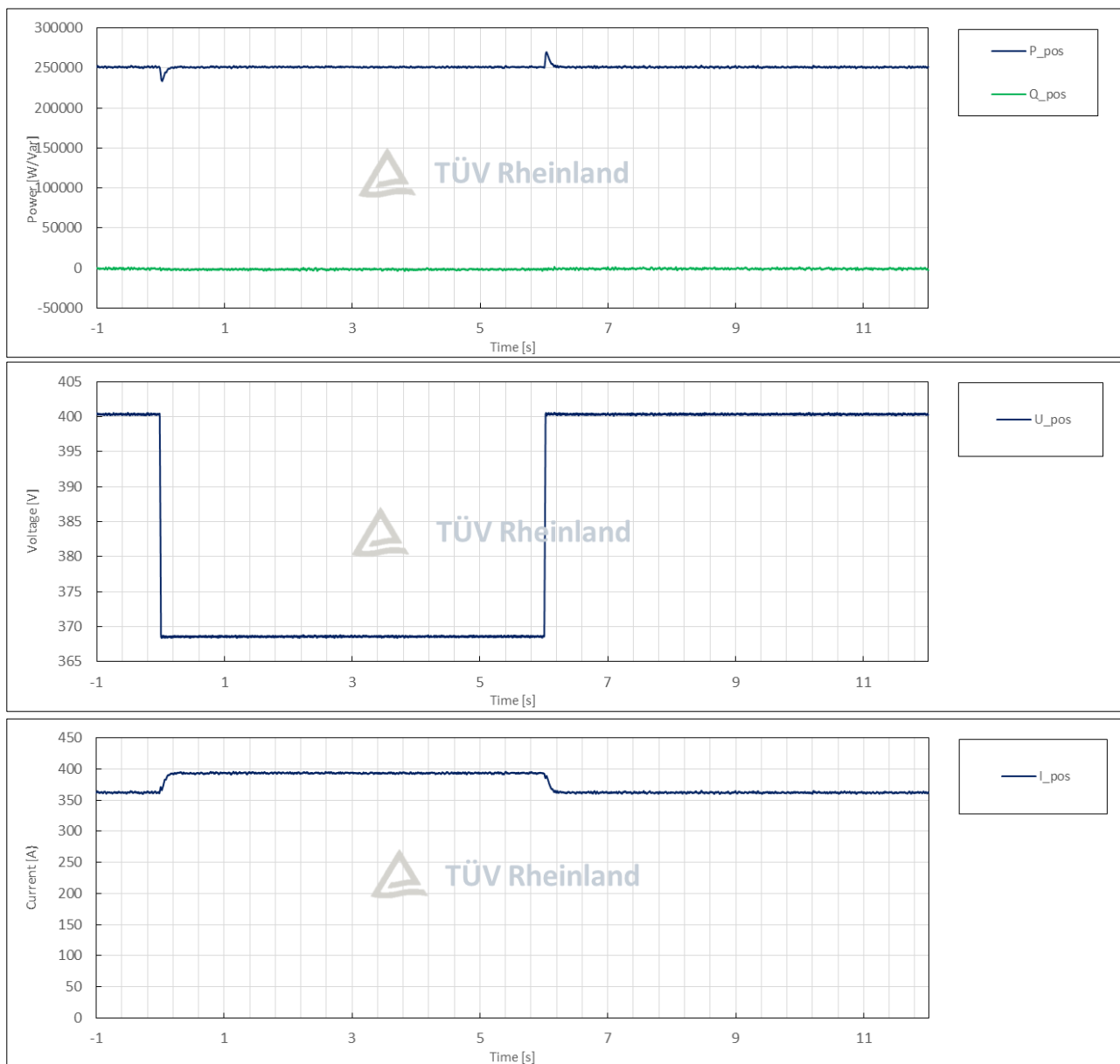
Test No. 5.1 with PGU





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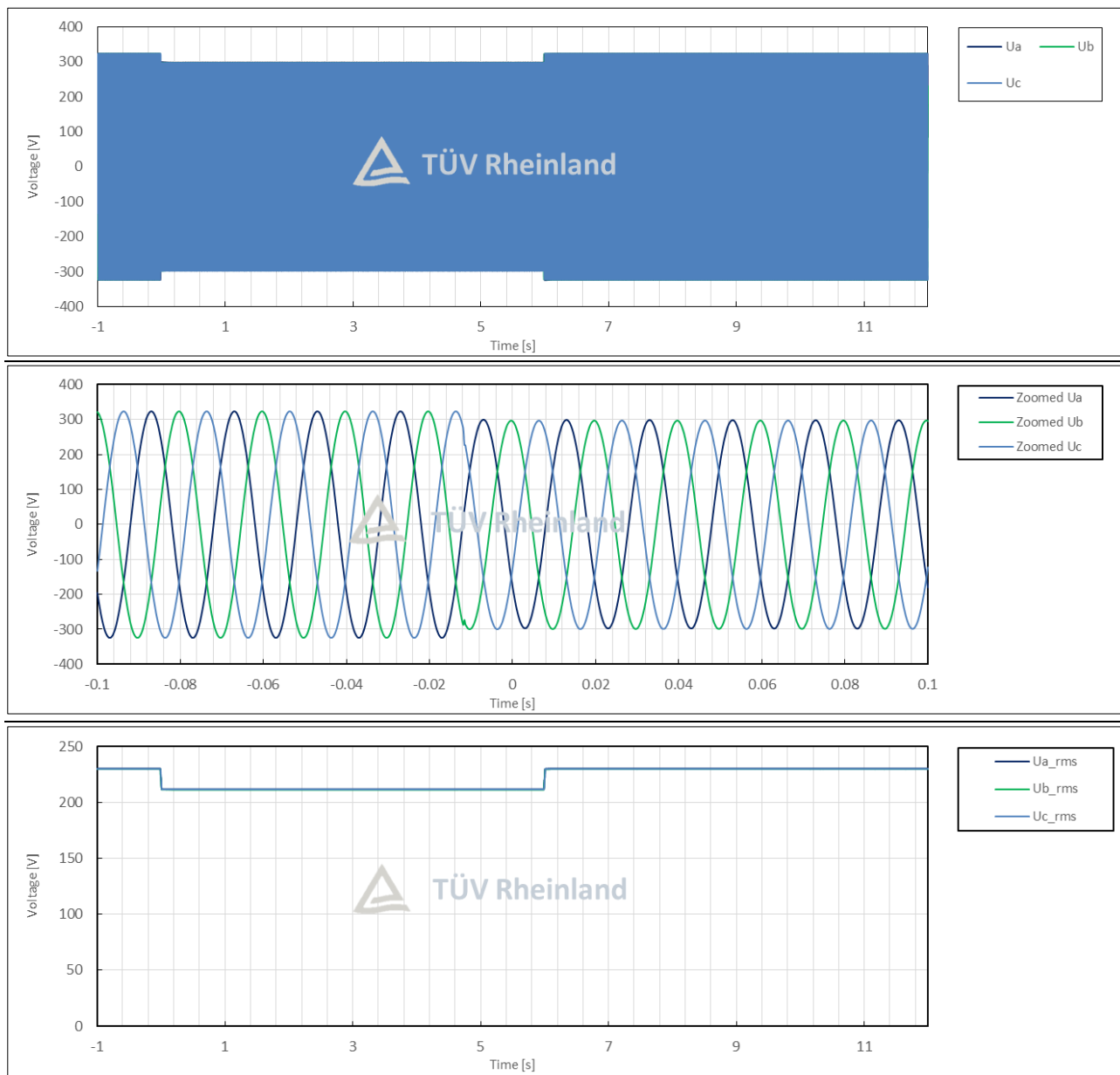


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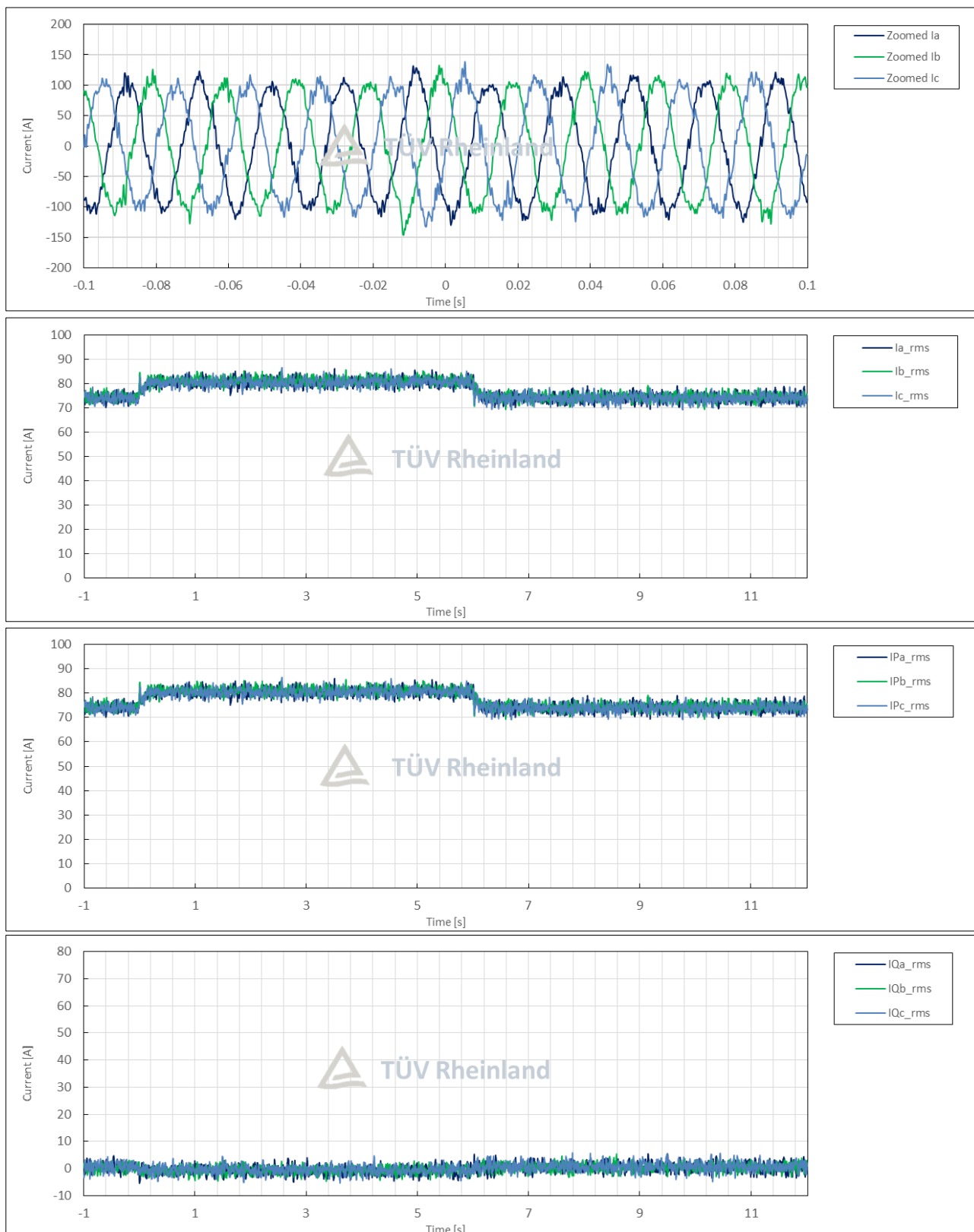
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	5.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:29:44
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.92
	5	Setting dip duration		--		5997
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	5997
	8	Fault duration in empty load test	Total	--	ms	5997
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.92
	10		Pos.		p.u.	0.92
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.92
	19	Line current	Phase 1	t1+50ms	p.u.	0.22
	20		Phase 2			0.21
	21		Phase 3			0.22
	22	Line current	Phase 1	t1+80ms	p.u.	0.22
	23		Phase 2			0.22
	24		Phase 3			0.22
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.21
	26		Pos.			0.21
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 5.2 idle test



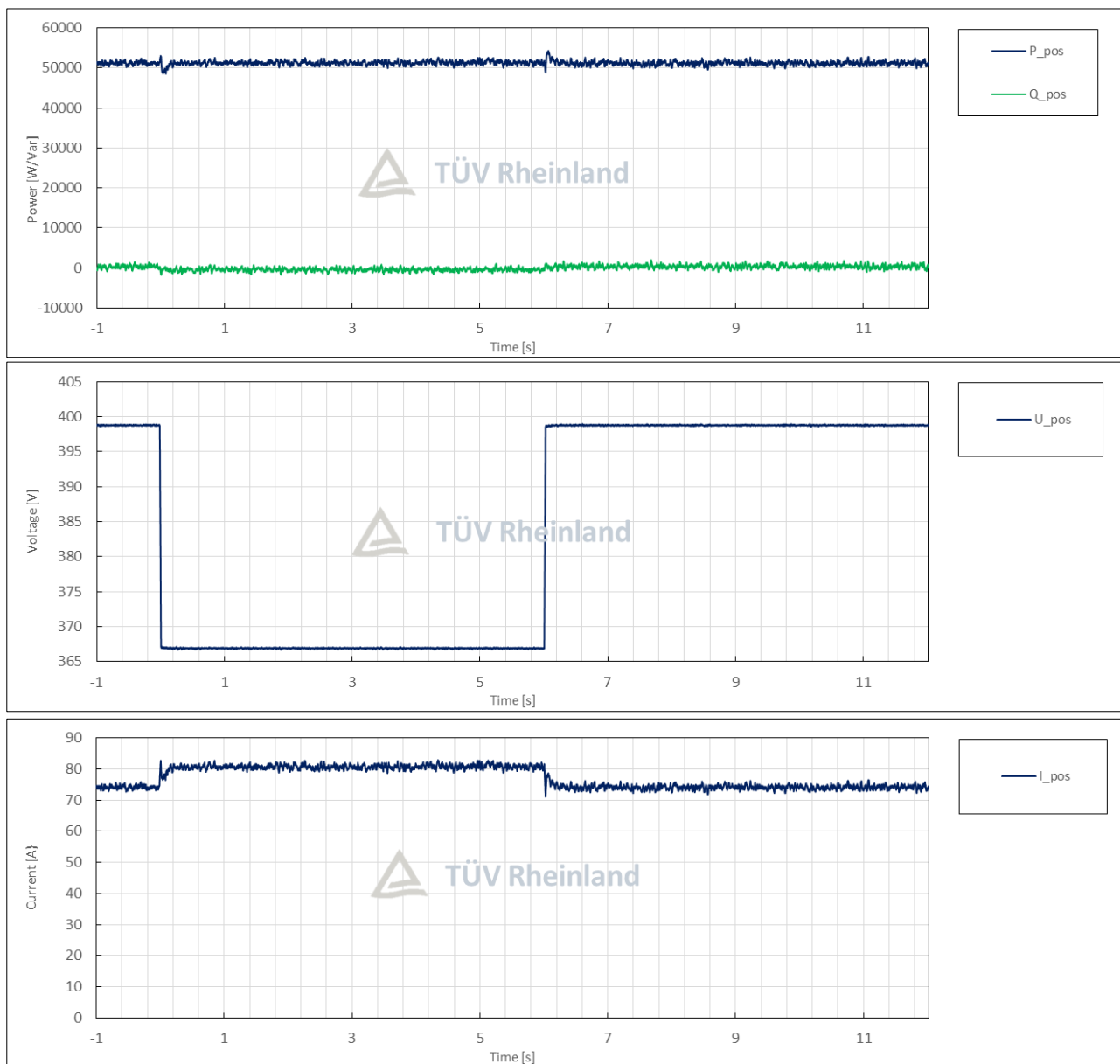
Test No. 5.2 with PGU





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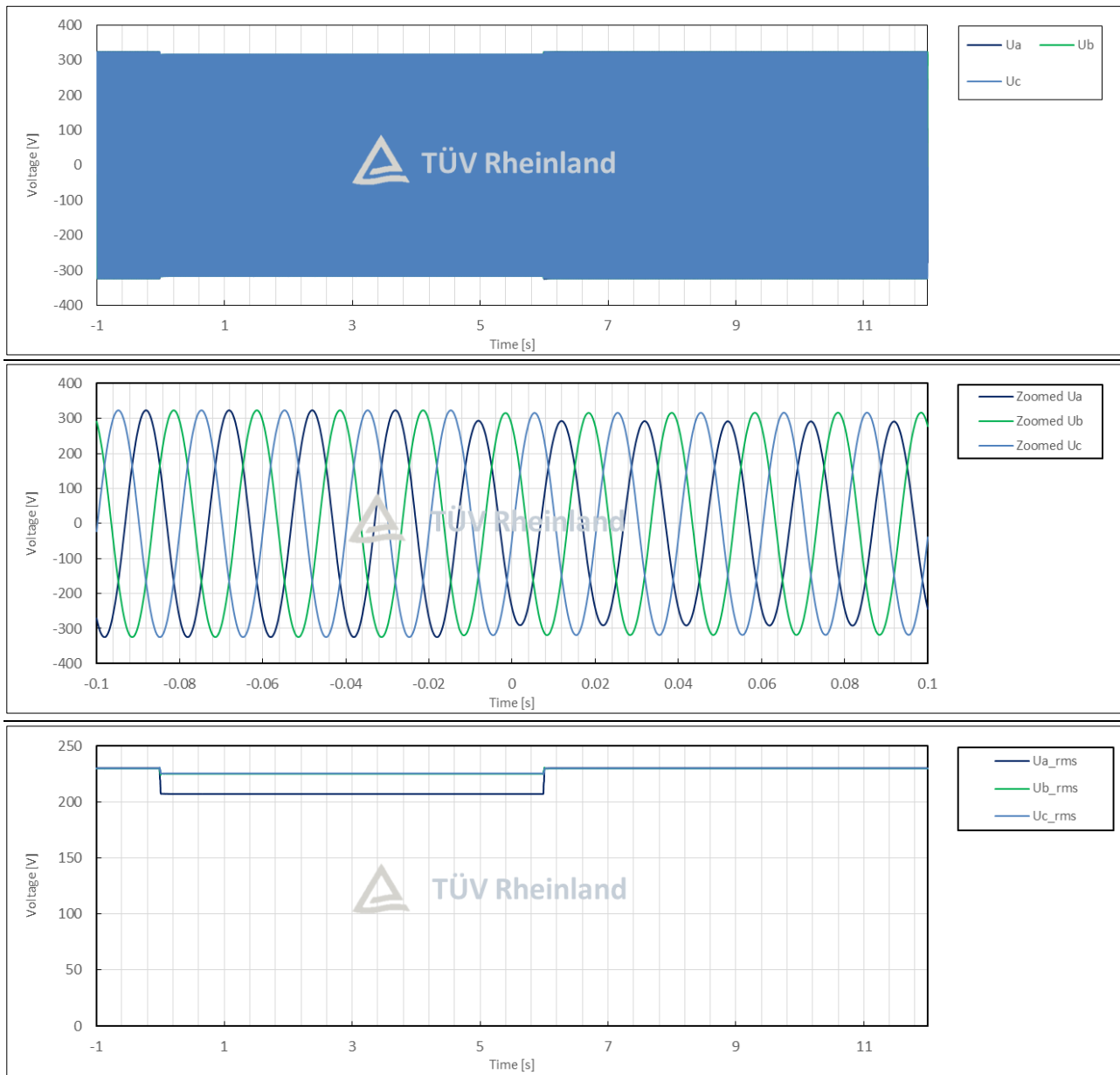


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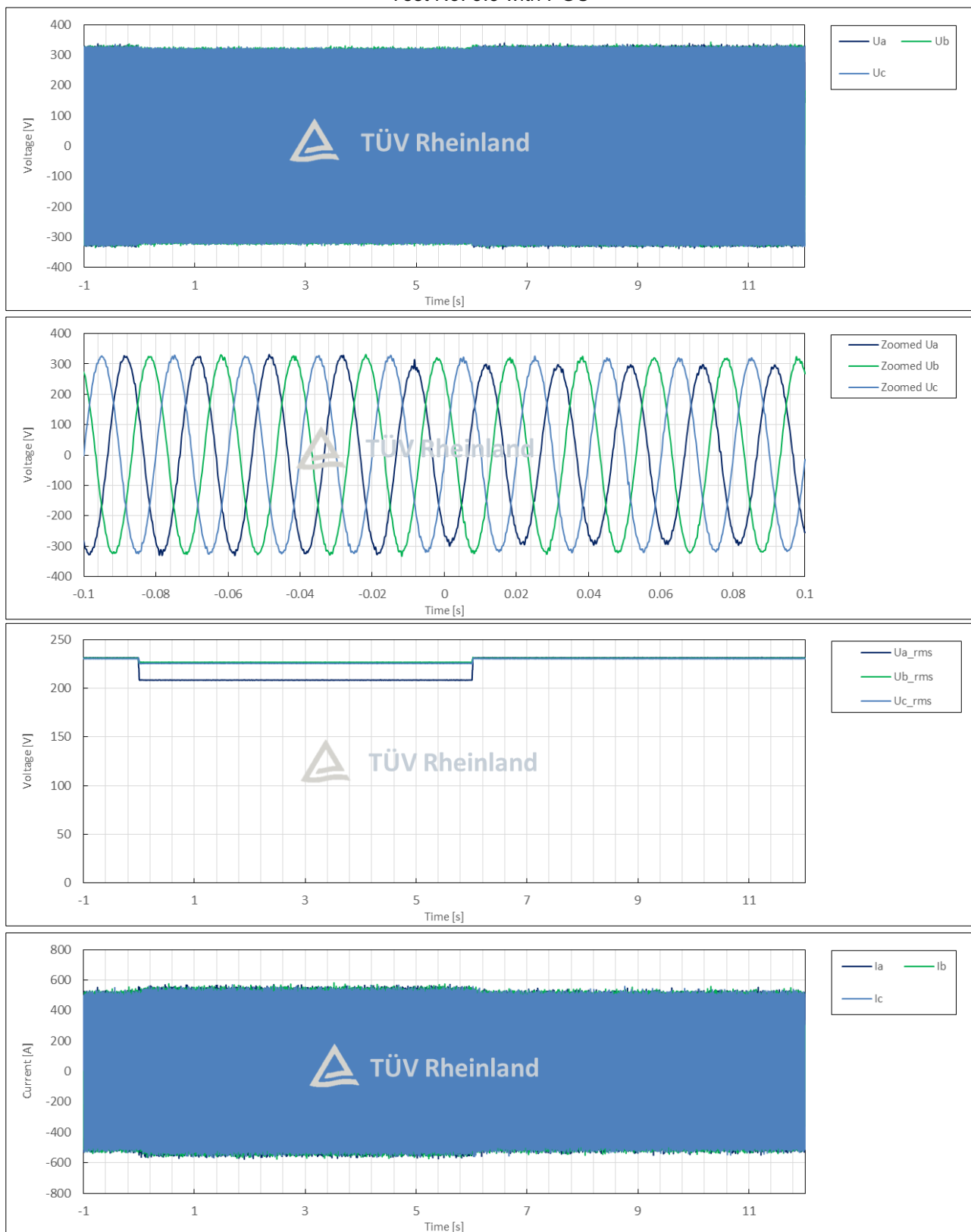
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	5.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:30:40
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.90
	5	Setting dip duration		--		6000
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	6000
	8	Fault duration in empty load test	Total	--	ms	6000
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.90
	10		Pos.		p.u.	0.95
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.91
	19	Line current	Phase 1	t1+50ms	p.u.	1.04
	20		Phase 2			1.02
	21		Phase 3			1.00
	22	Line current	Phase 1	t1+80ms	p.u.	1.06
	23		Phase 2			1.04
	24		Phase 3			1.02
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	1.00
	26		Pos.			1.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 5.3 idle test



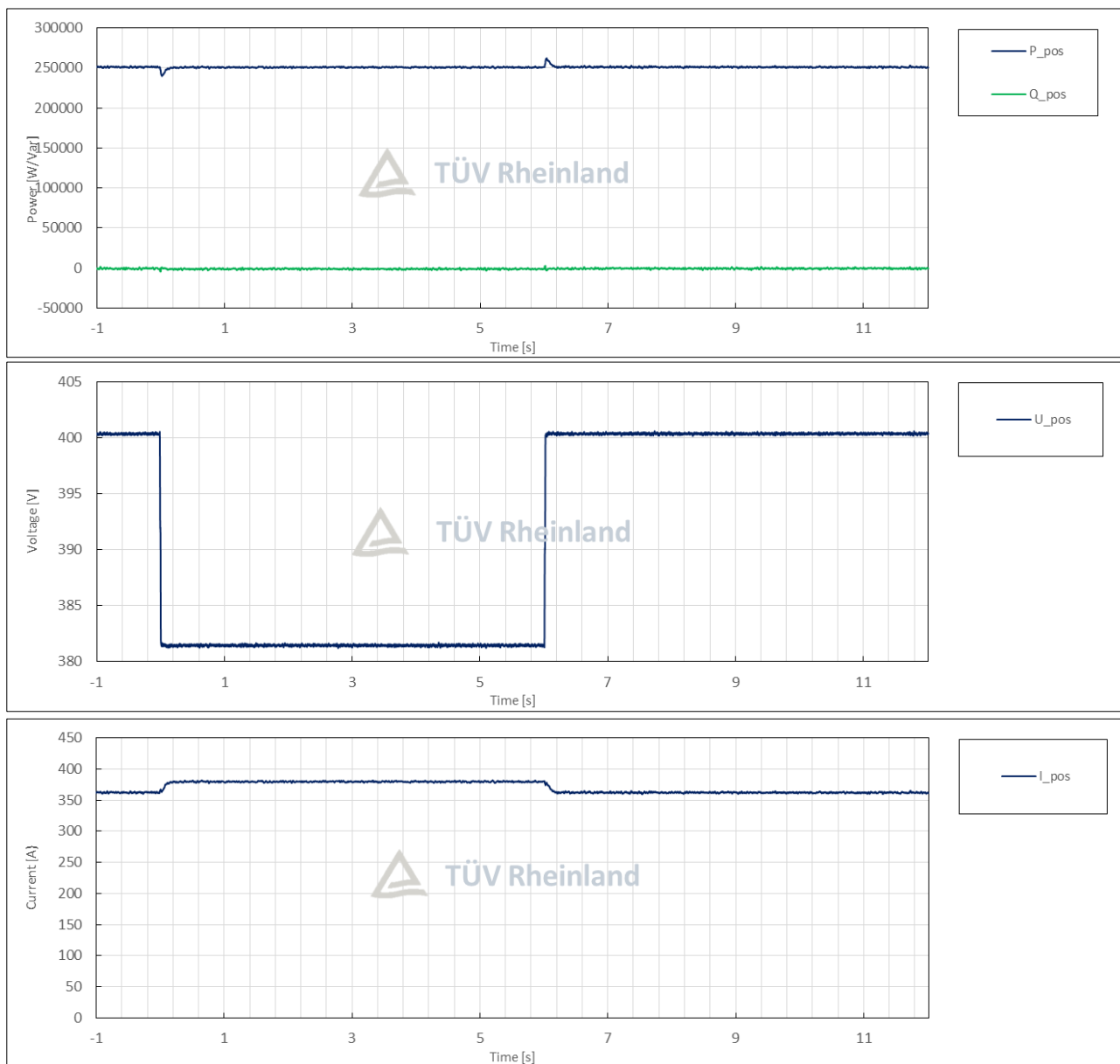
Test No. 5.3 with PGU





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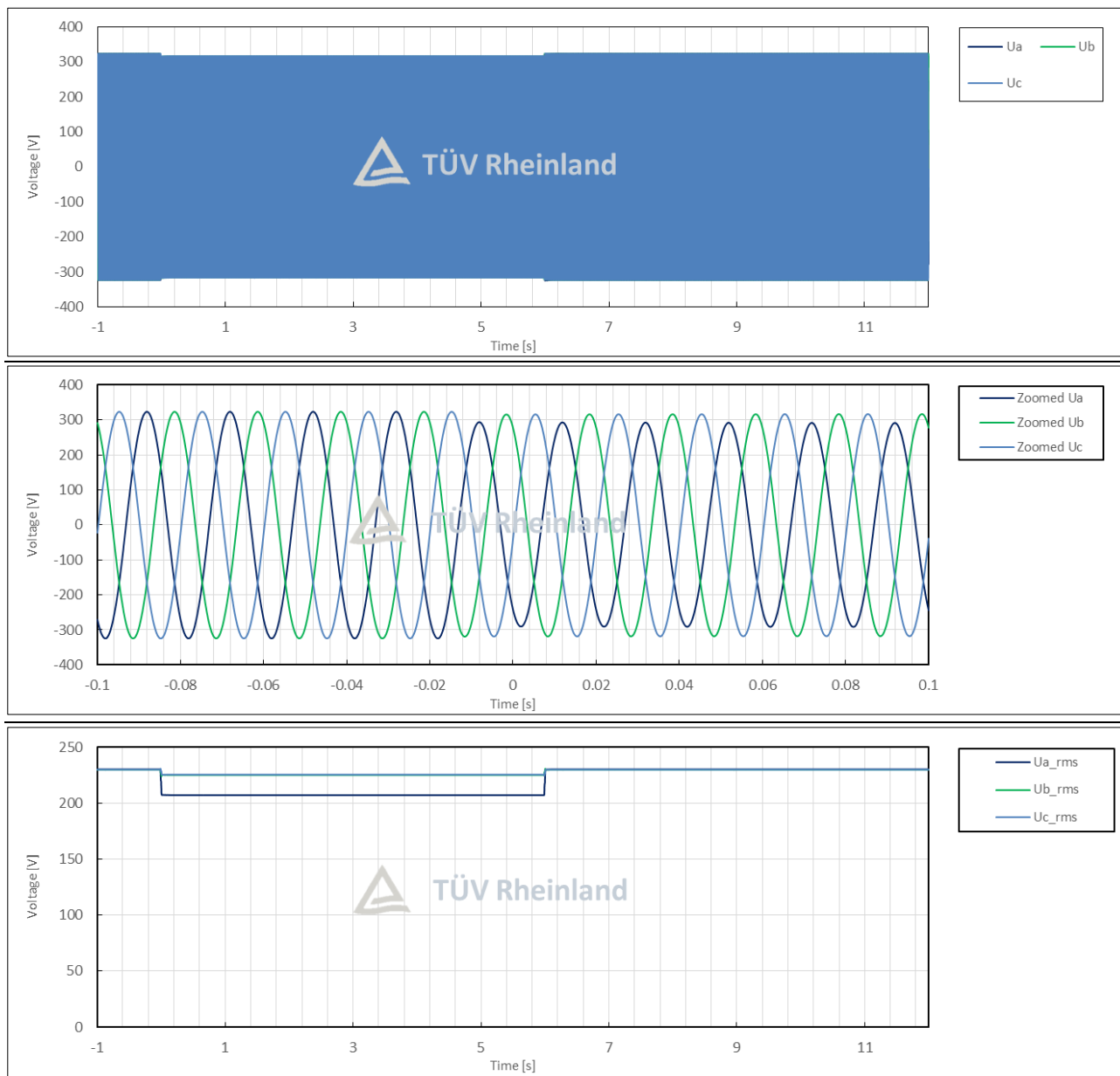


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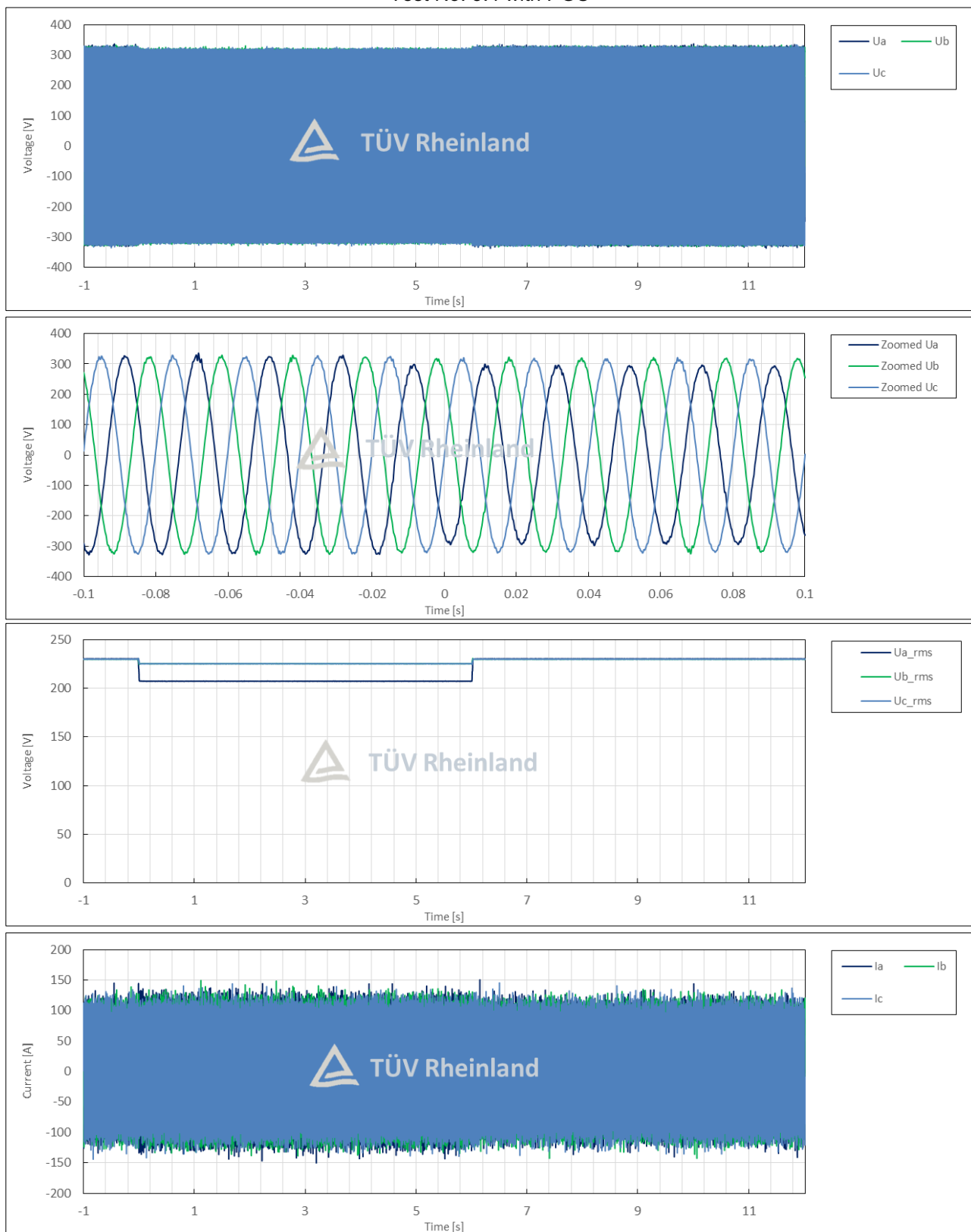
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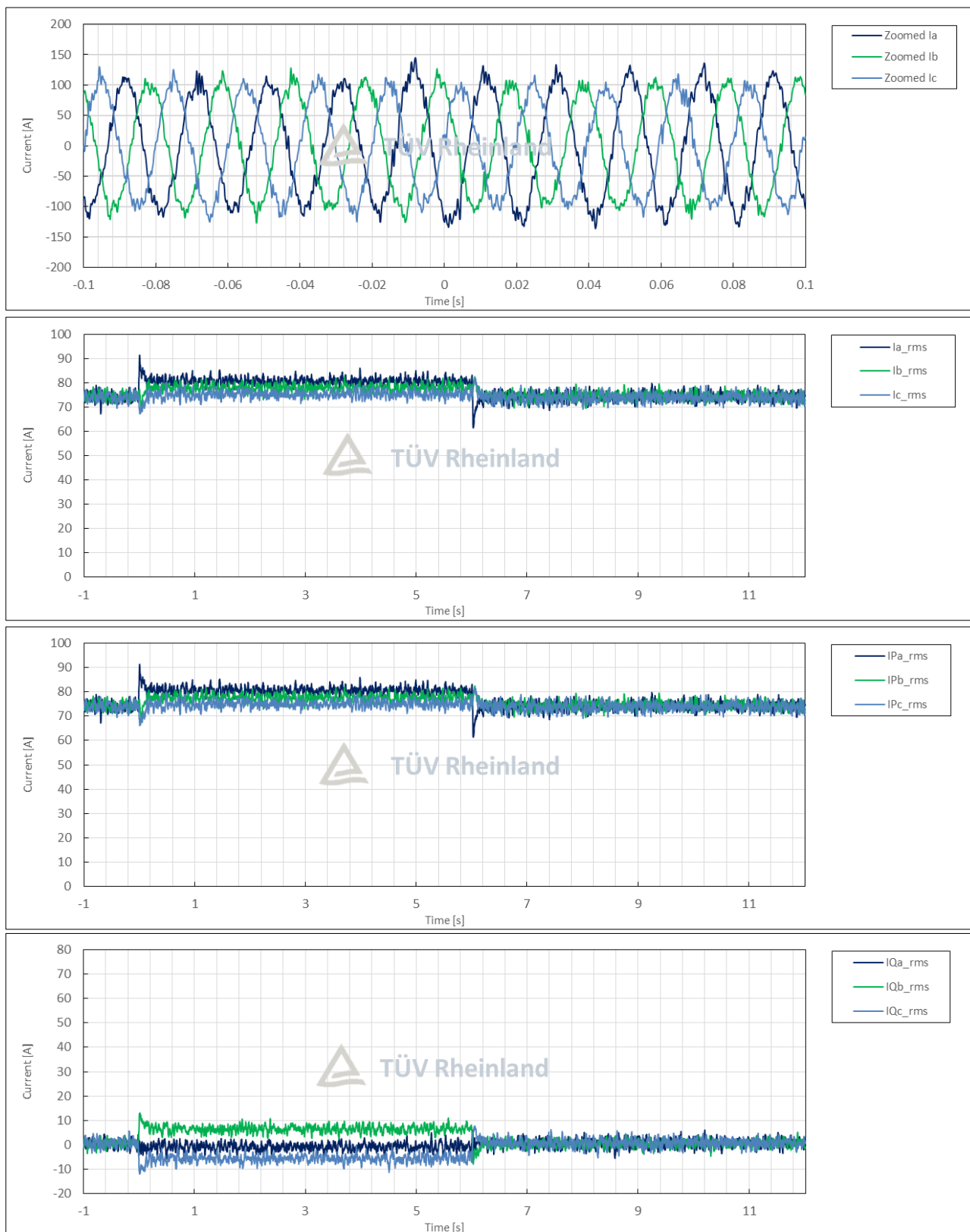
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	5.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:31:16
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	0.90
	5	Setting dip duration		--		6000
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	6000
	8	Fault duration in empty load test	Total	--	ms	6000
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	0.90
	10		Pos.		p.u.	0.95
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.21
	14		Pos.			0.21
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	0.90
	19	Line current	Phase 1	t1+50ms	p.u.	0.24
	20		Phase 2			0.21
	21		Phase 3			0.19
	22	Line current	Phase 1	t1+80ms	p.u.	0.23
	23		Phase 2			0.21
	24		Phase 3			0.19
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.20
	26		Pos.			0.20
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 5.4 idle test



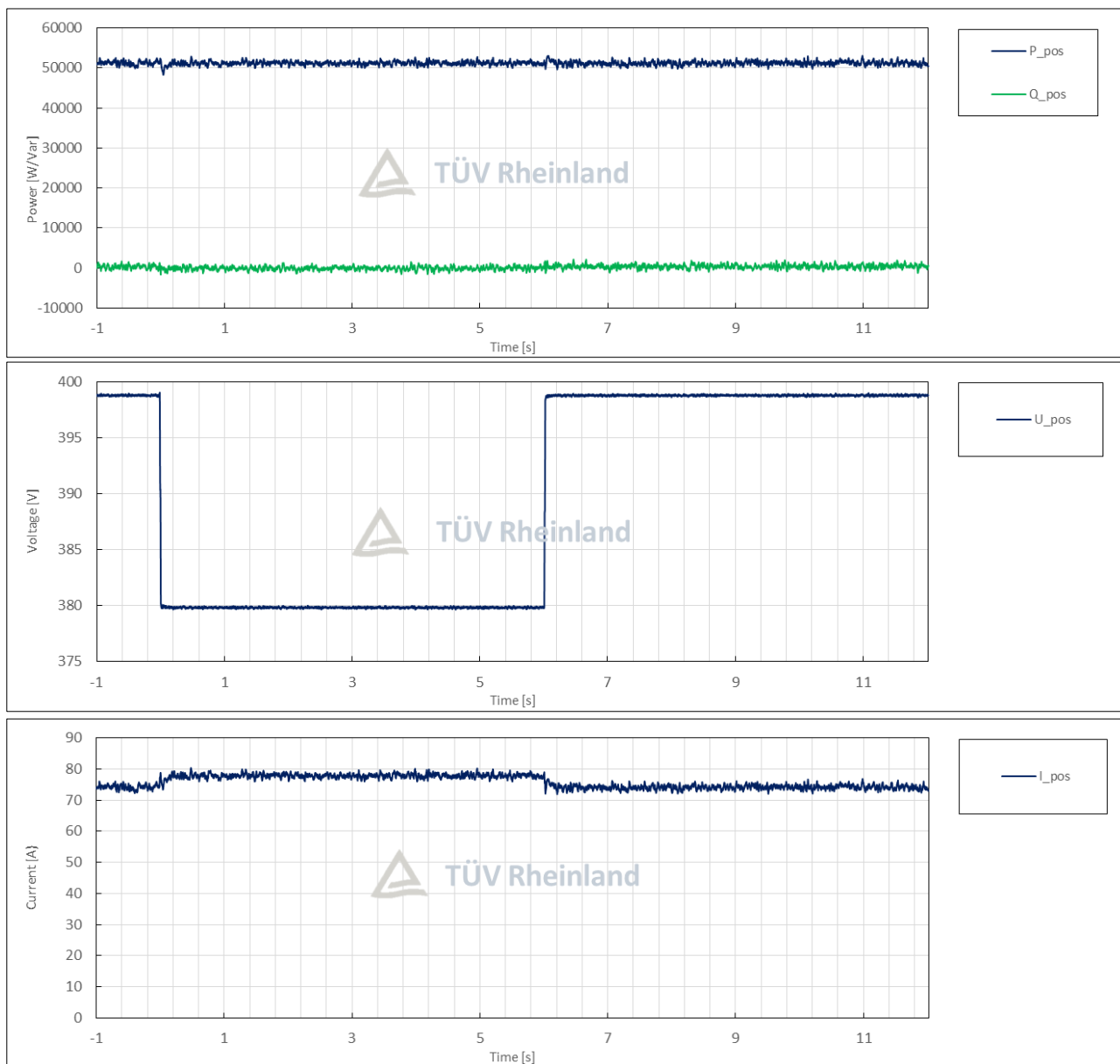
Test No. 5.4 with PGU





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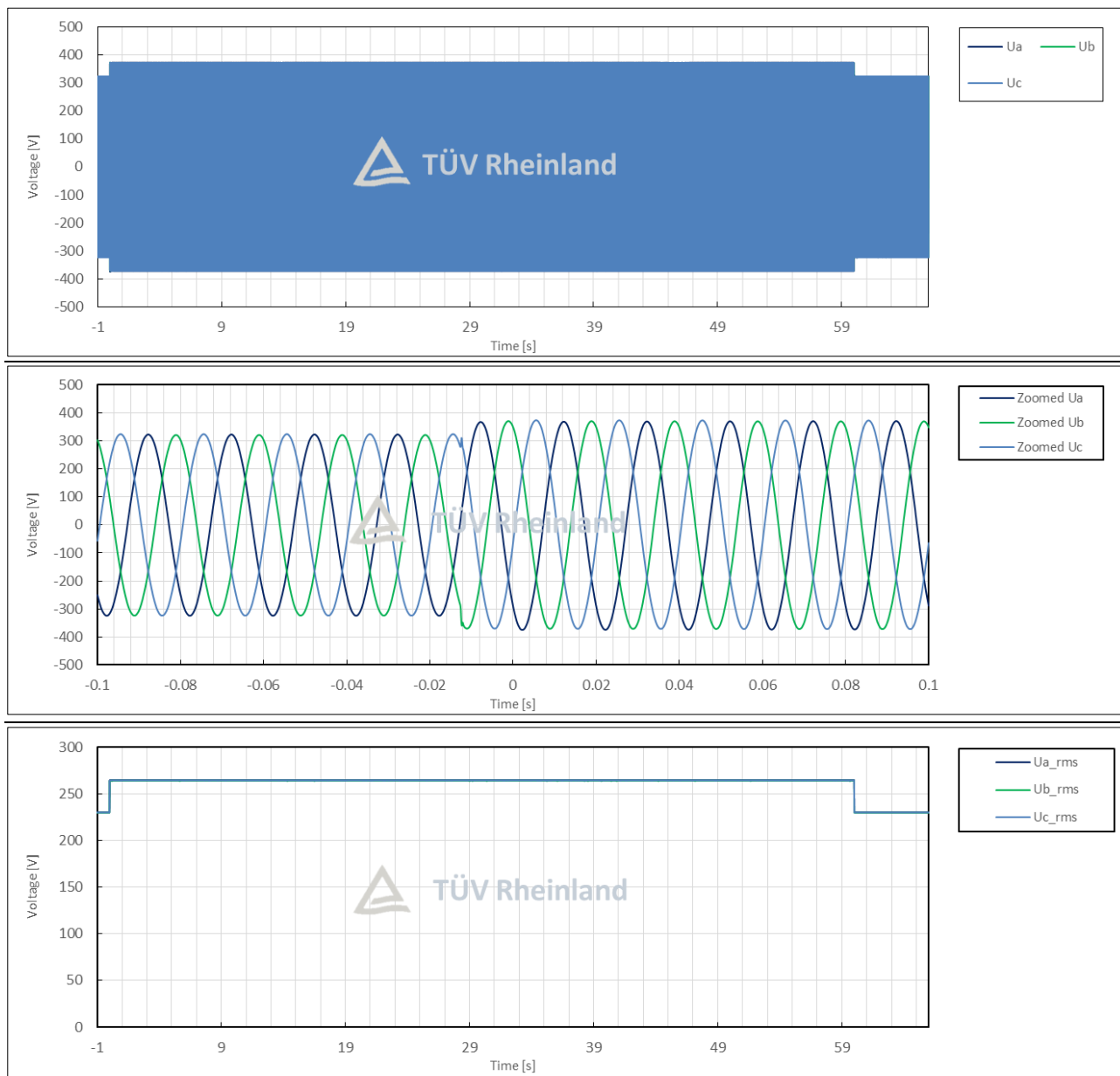


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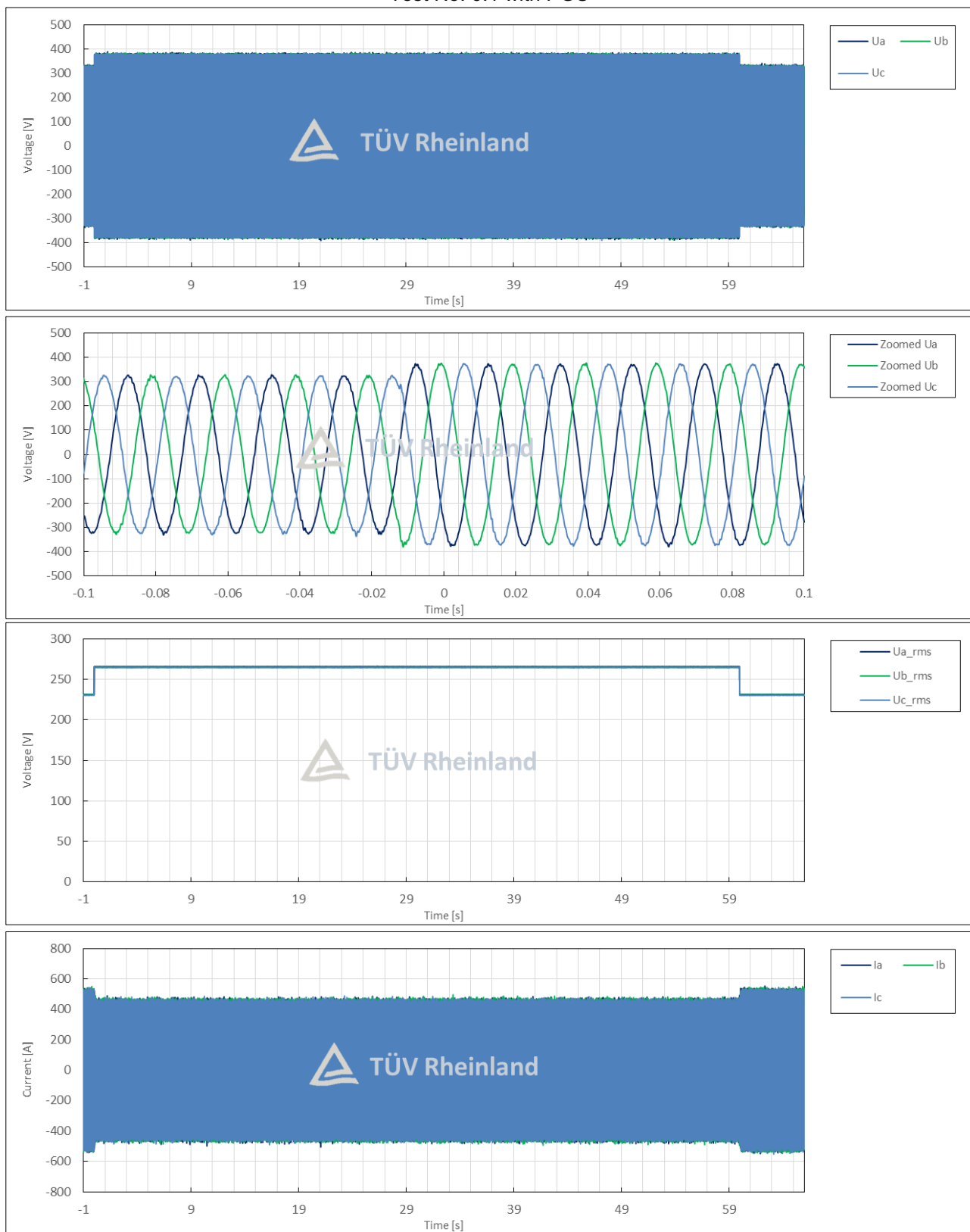
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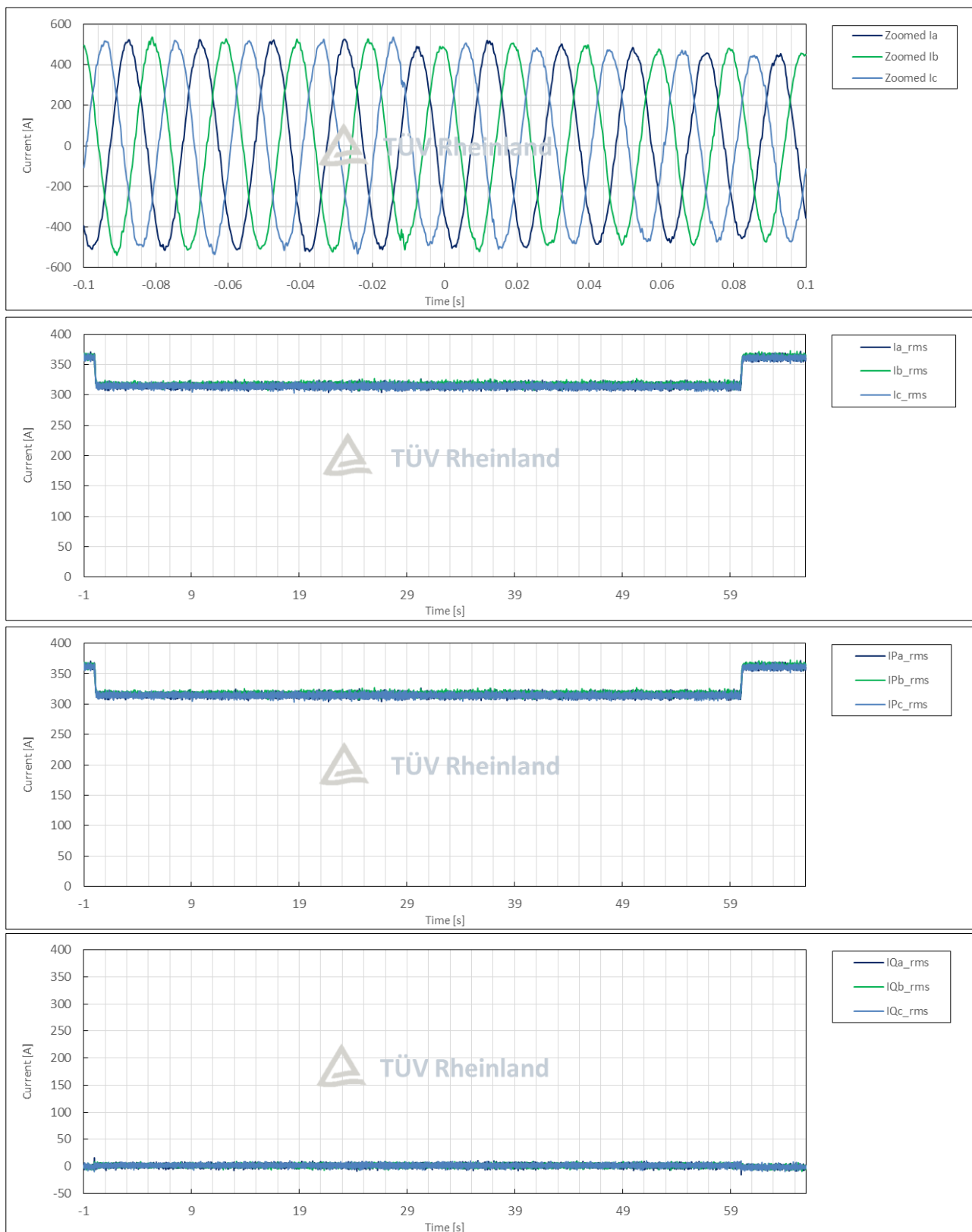
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	6.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:32:08
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.15
	5	Setting dip duration		--		59999
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	59999
	8	Fault duration in empty load test	Total	--	ms	59999
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.15
	10		Pos.		p.u.	1.15
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.16
	19	Line current	Phase 1	t1+50ms	p.u.	0.93
	20		Phase 2			0.92
	21		Phase 3			0.92
	22	Line current	Phase 1	t1+80ms	p.u.	0.89
	23		Phase 2			0.89
	24		Phase 3			0.89
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	1.00
	26		Pos.			1.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 6.1 idle test



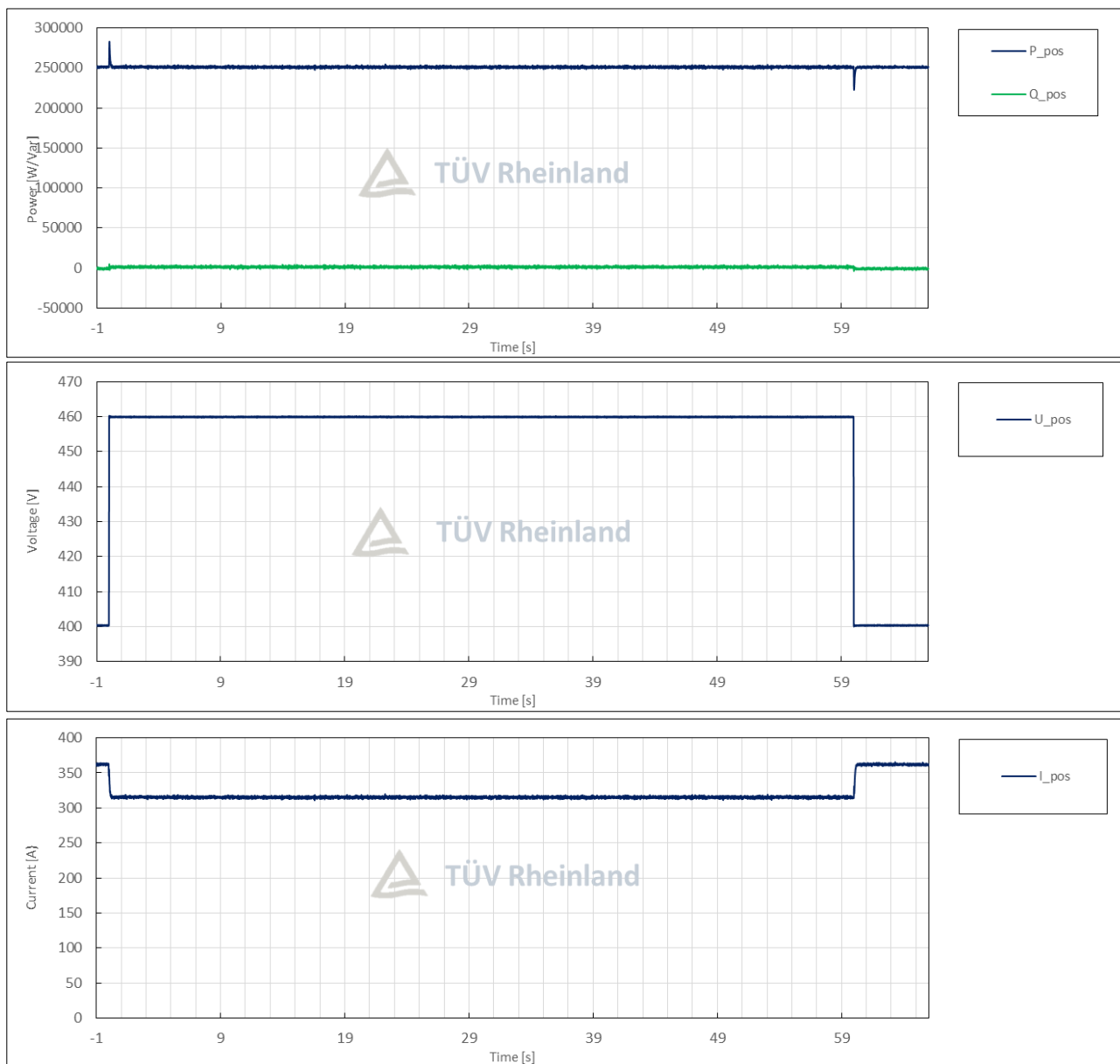
Test No. 6.1 with PGU





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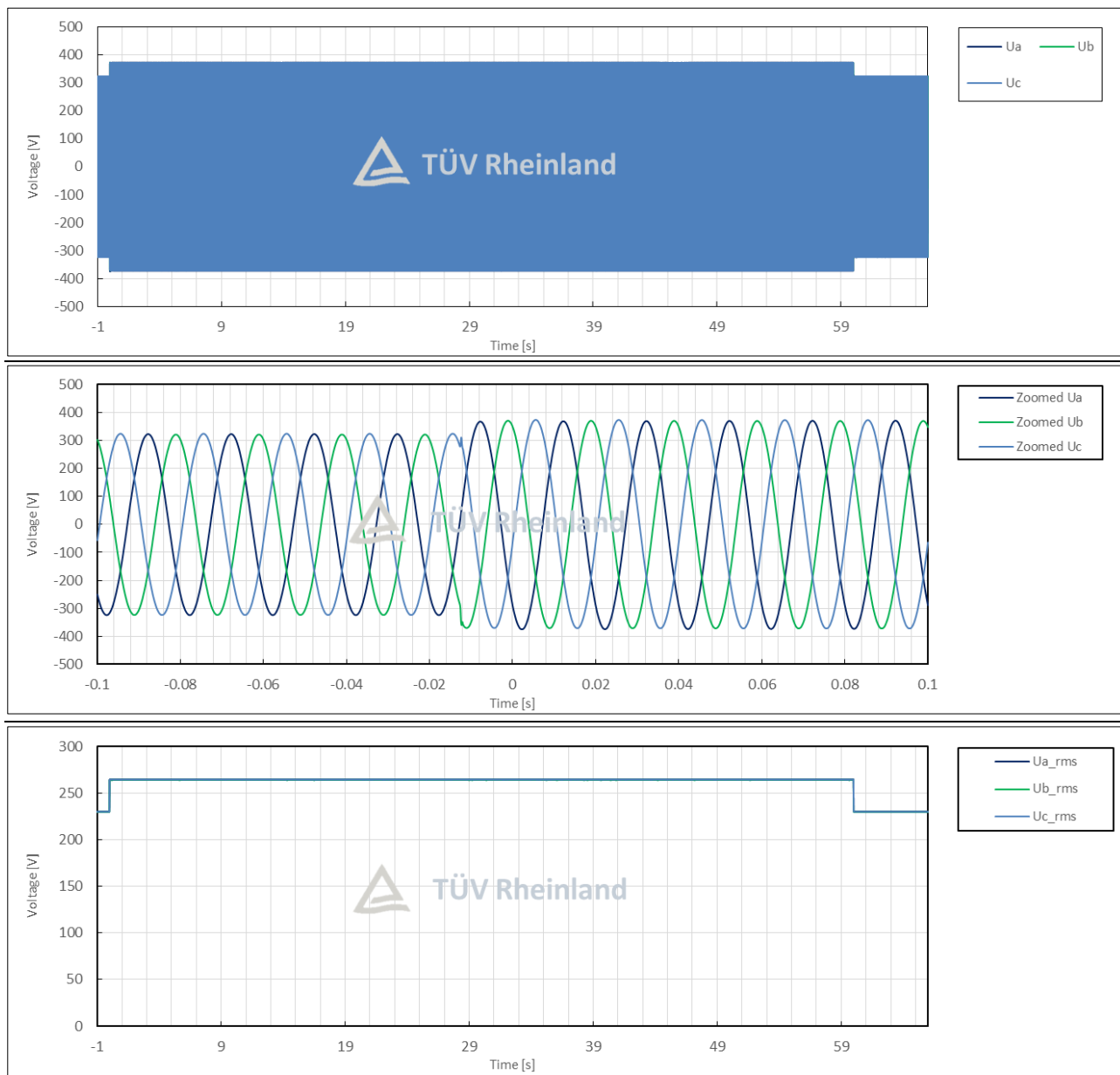


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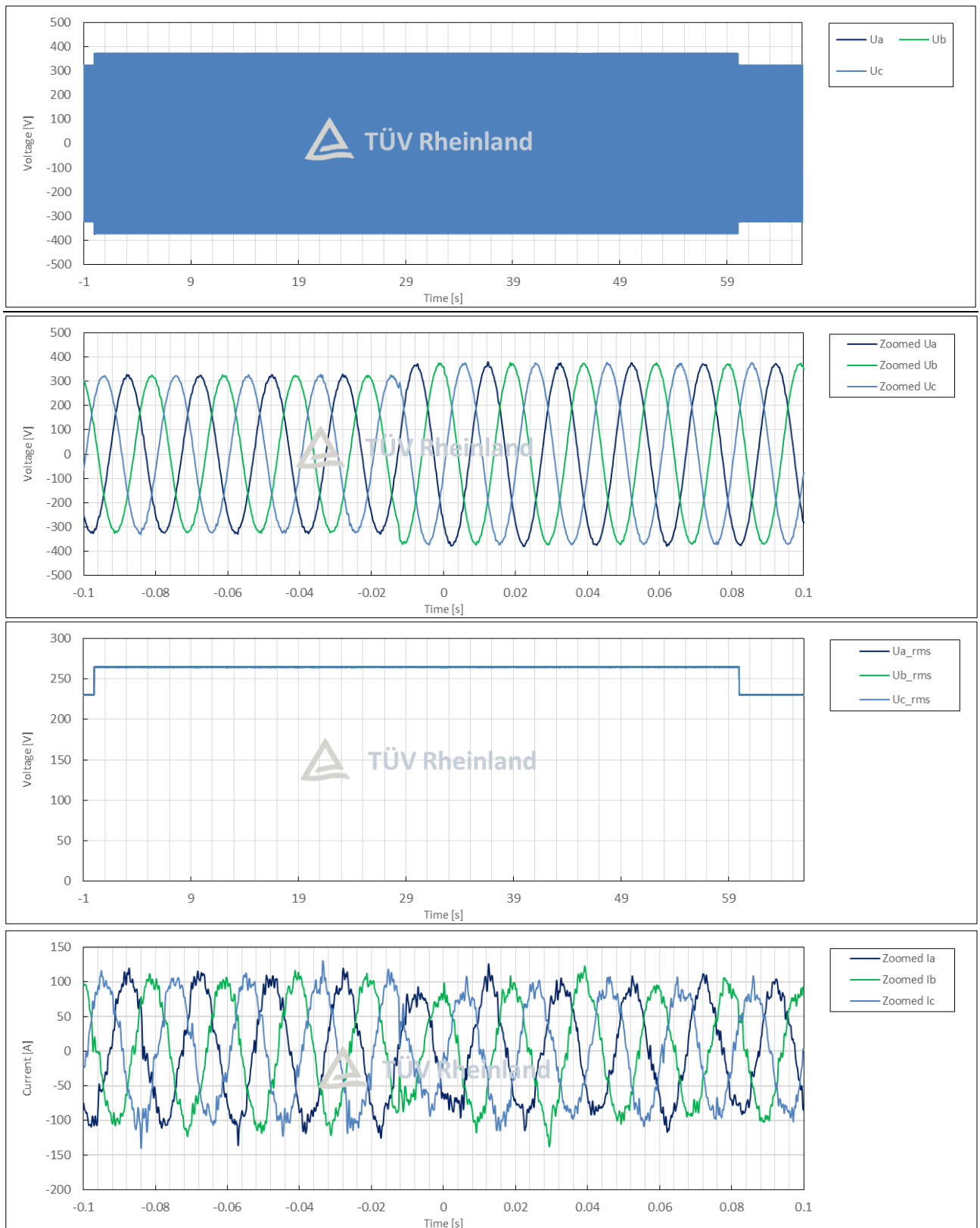
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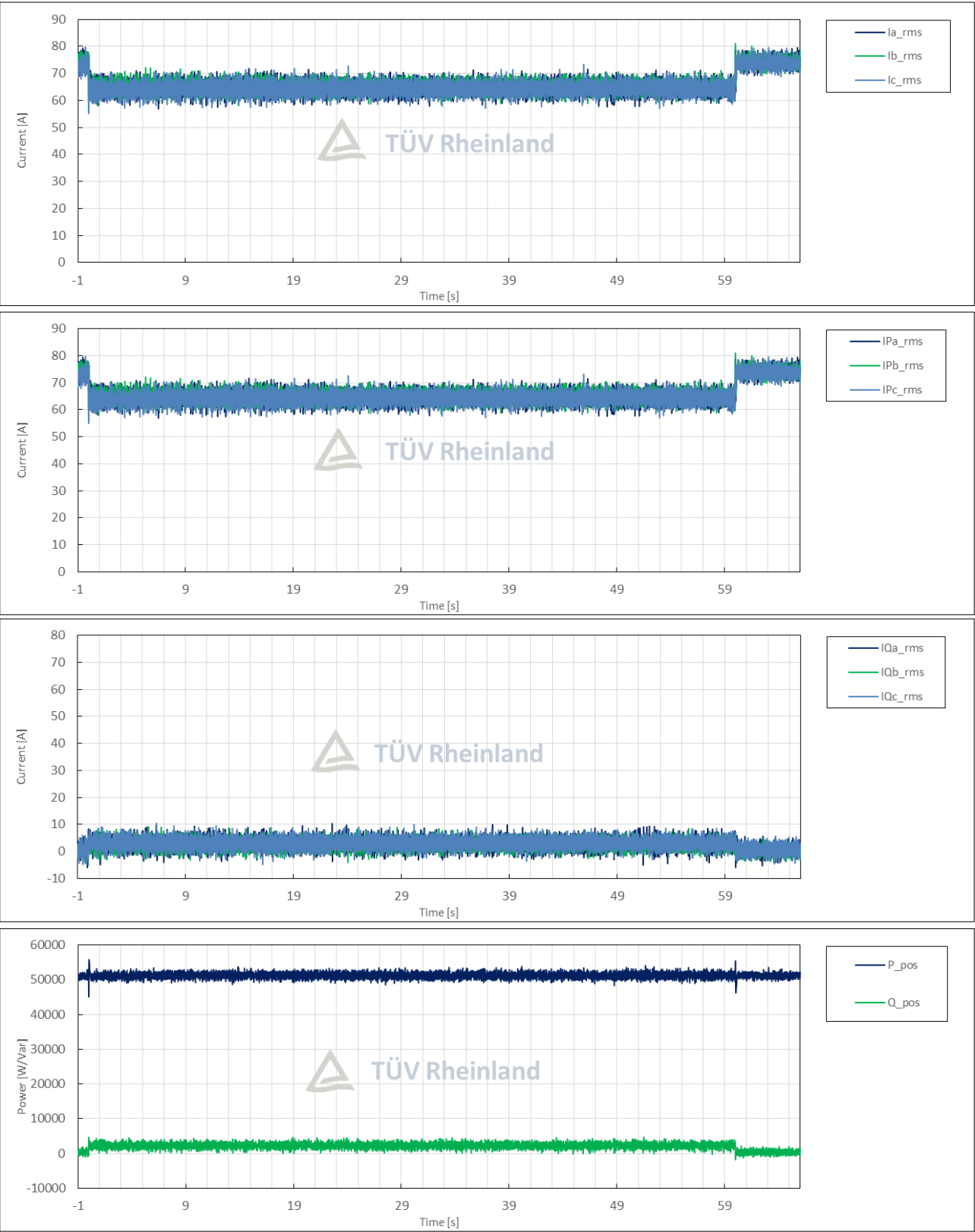
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	6.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:33:03
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.15
	5	Setting dip duration		--		59999
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	59999
	8	Fault duration in empty load test	Total	--	ms	59999
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.15
	10		Pos.		p.u.	1.15
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.15
	19	Line current	Phase 1	t1+50ms	p.u.	0.18
	20		Phase 2			0.19
	21		Phase 3			0.20
	22	Line current	Phase 1	t1+80ms	p.u.	0.18
	23		Phase 2			0.18
	24		Phase 3			0.18
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.21
	26		Pos.			0.21
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 6.2 idle test



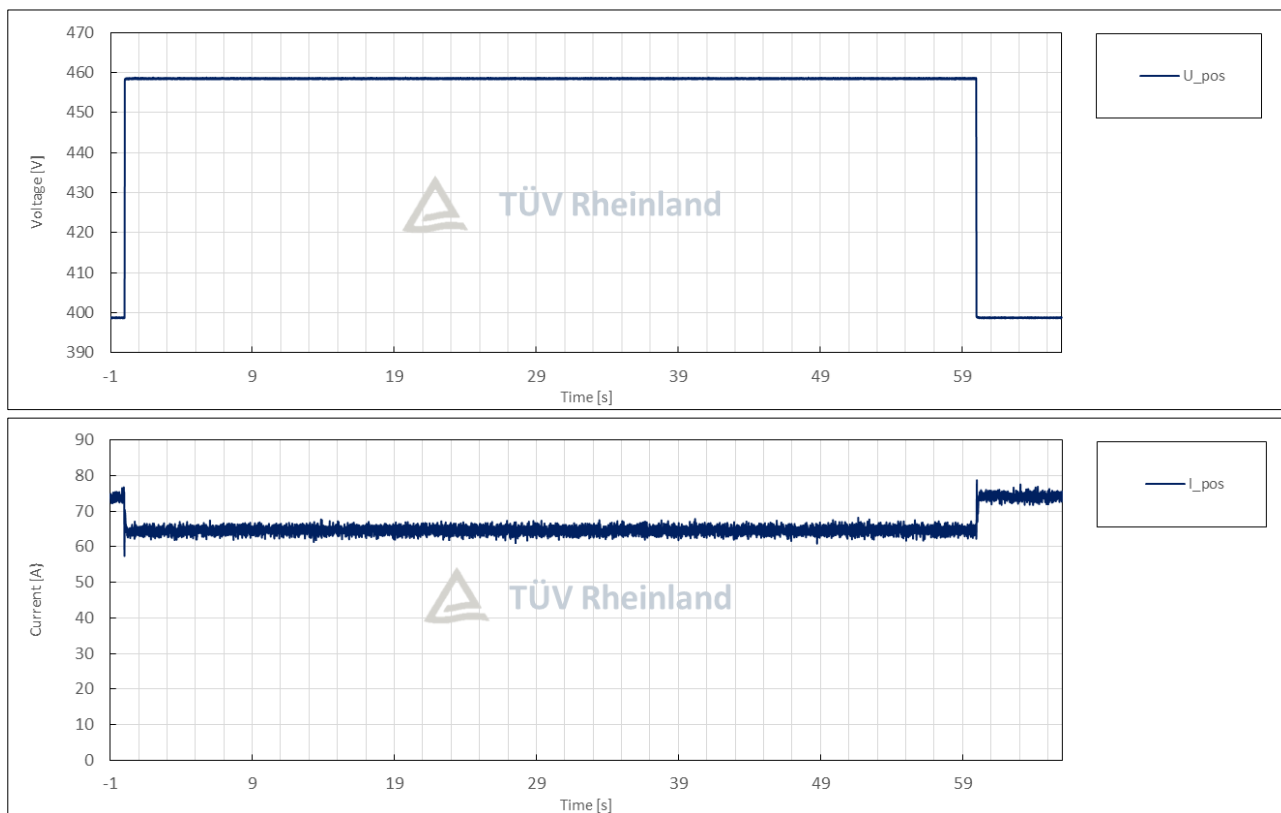
Test No. 6.2 with PGU





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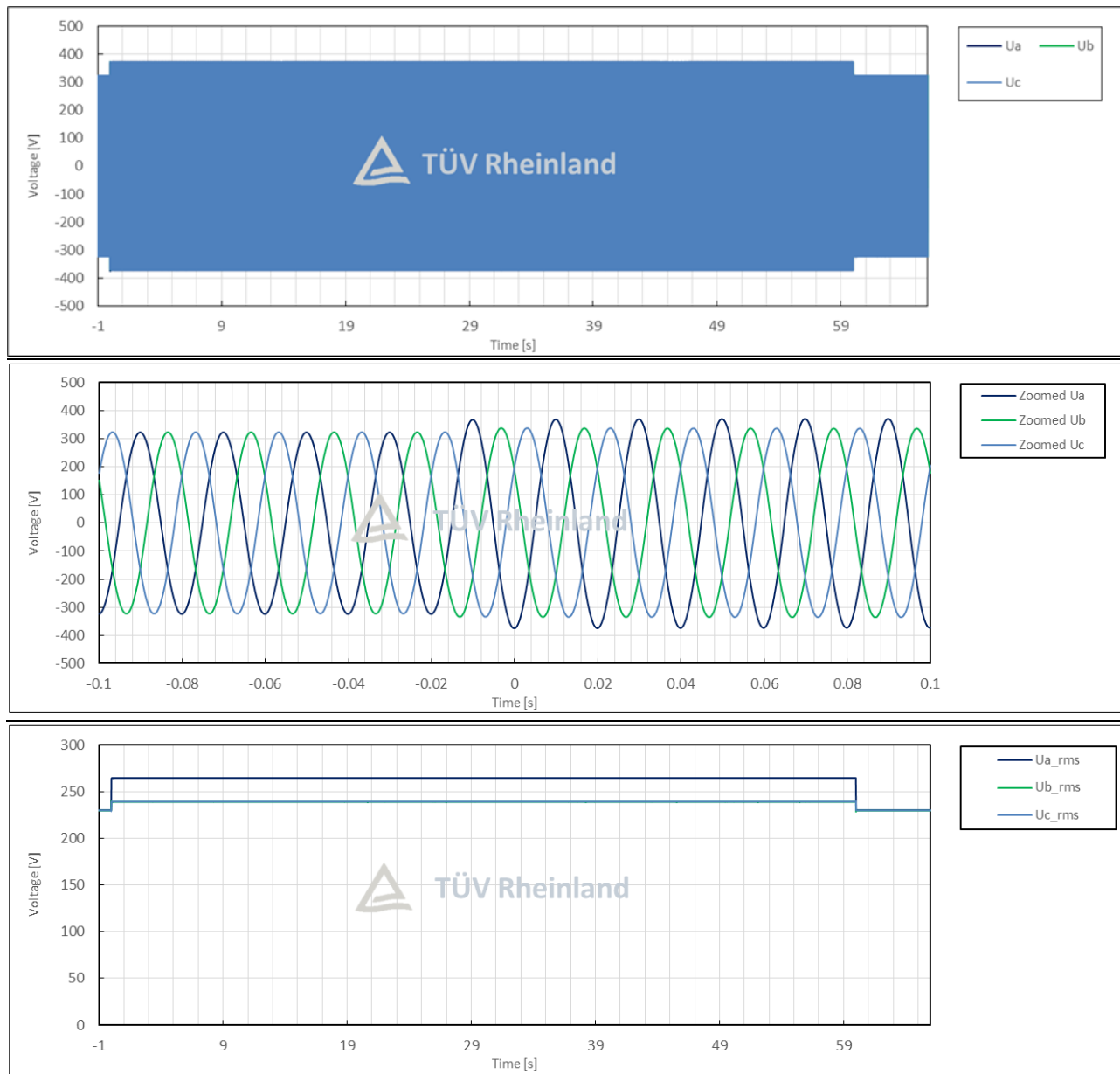


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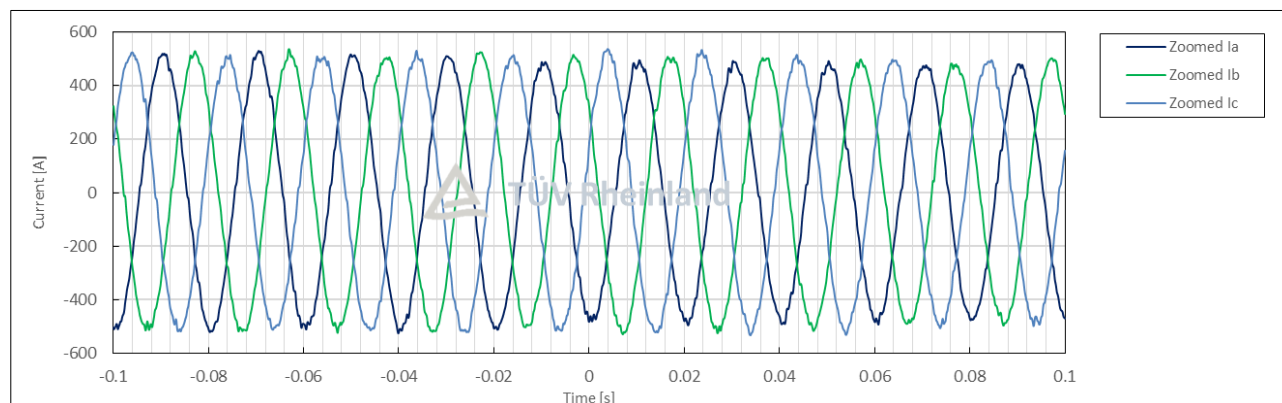
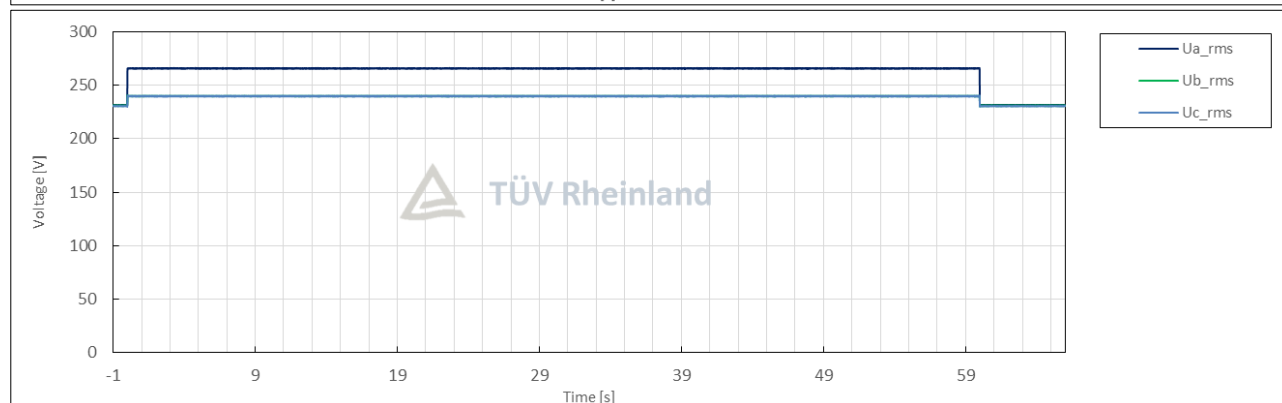
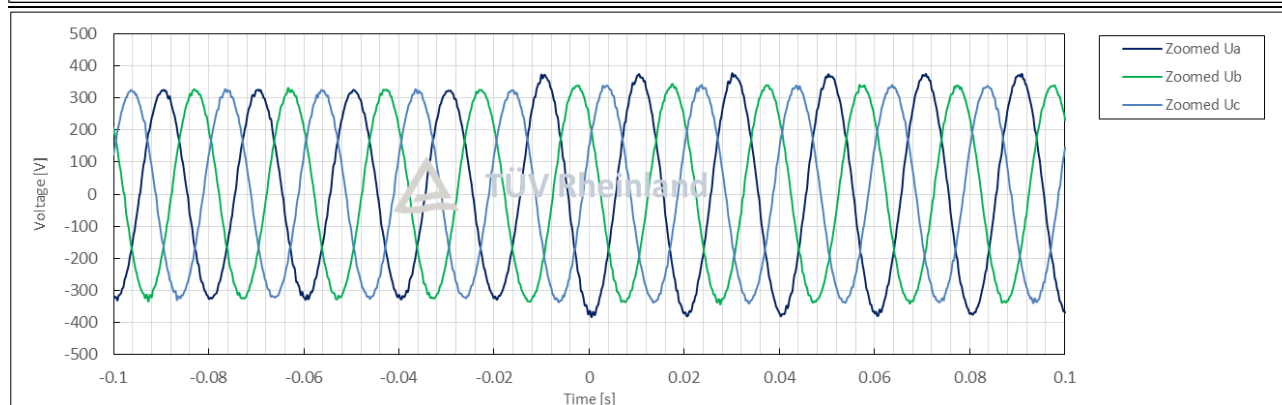
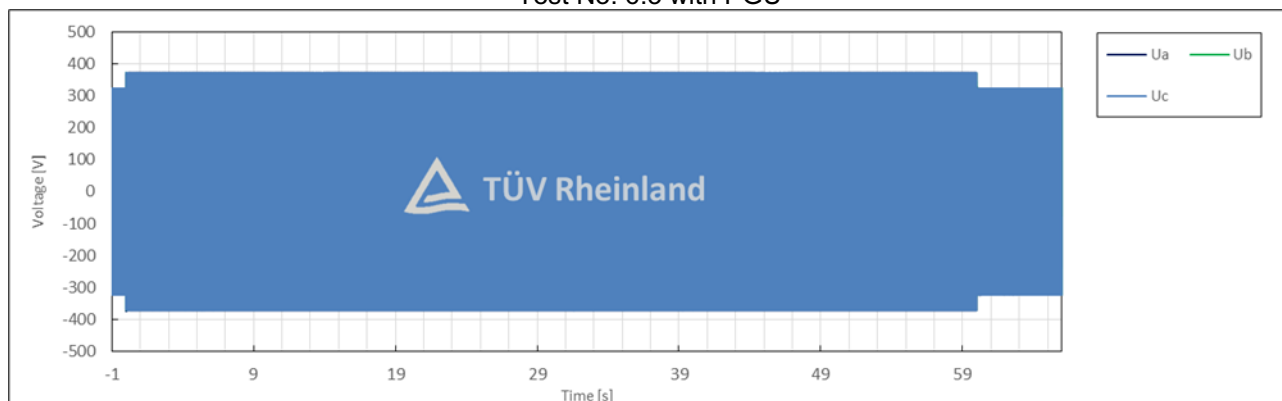
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	6.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:33:47
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.15
	5	Setting dip duration		--		59996
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	59996
	8	Fault duration in empty load test	Total	--	ms	59996
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.15
	10		Pos.		p.u.	1.07
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.16
	19	Line current	Phase 1	t1+50ms	p.u.	0.93
	20		Phase 2			0.97
	21		Phase 3			0.99
	22	Line current	Phase 1	t1+80ms	p.u.	0.92
	23		Phase 2			0.96
	24		Phase 3			0.96
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	1.00
	26		Pos.			1.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 6.3 idle test



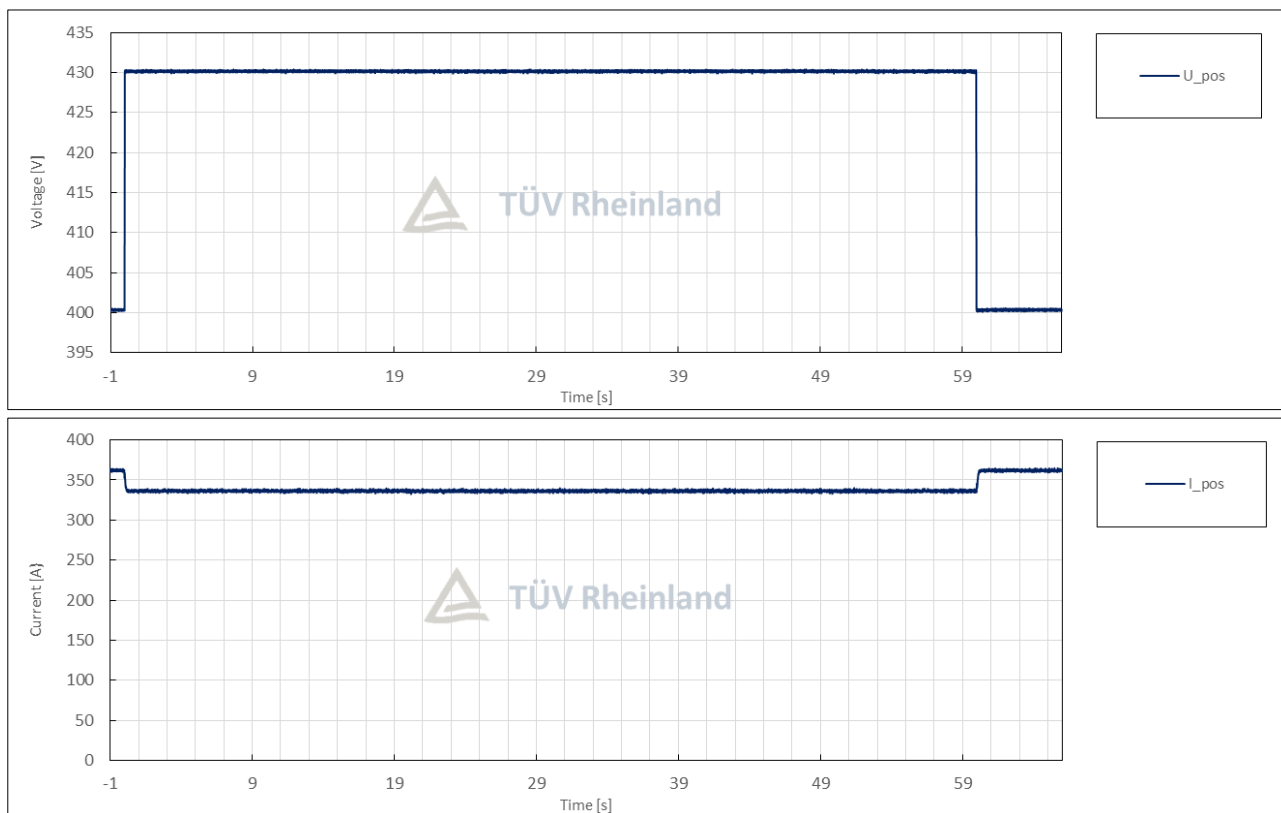
Test No. 6.3 with PGU





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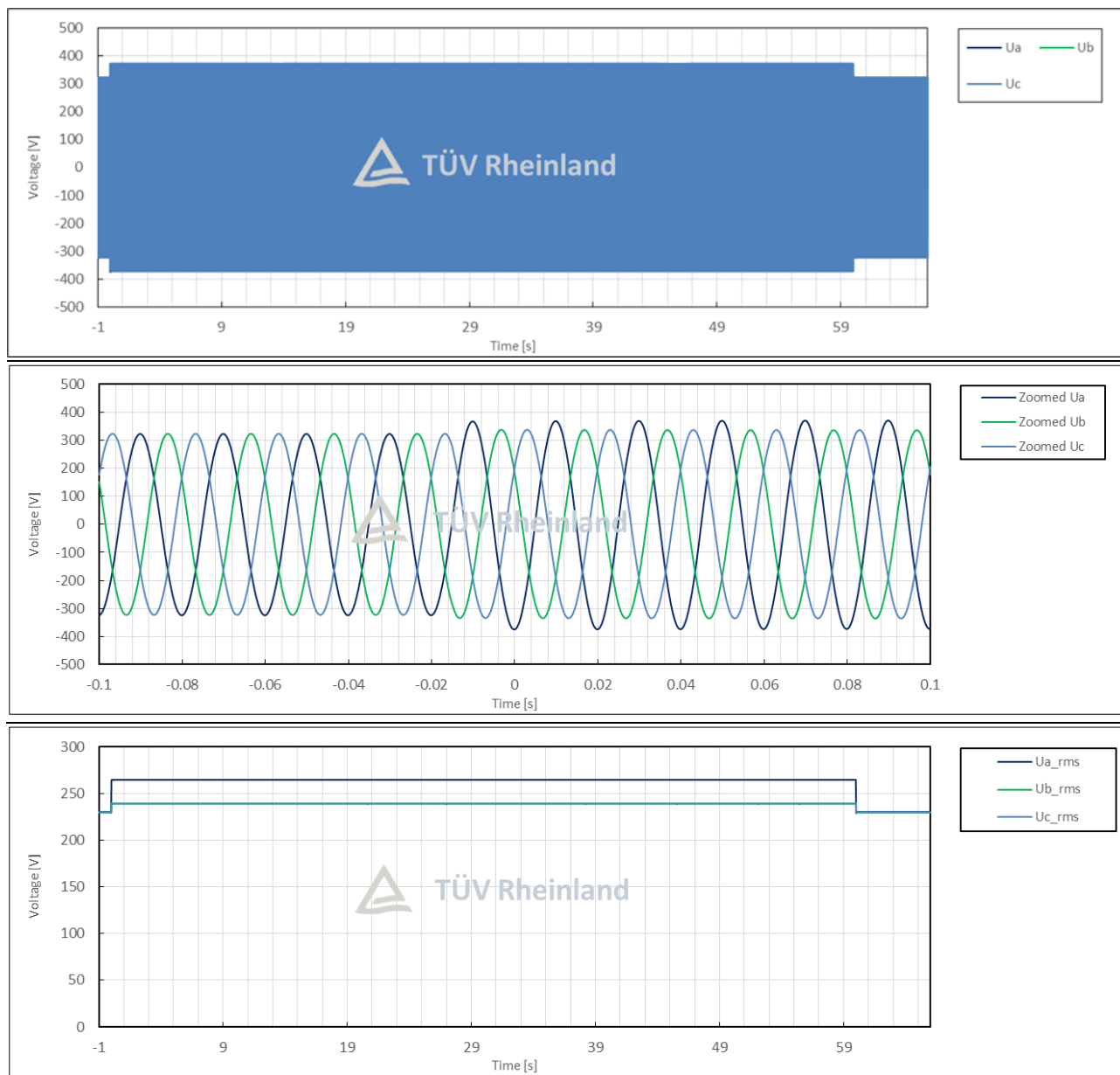


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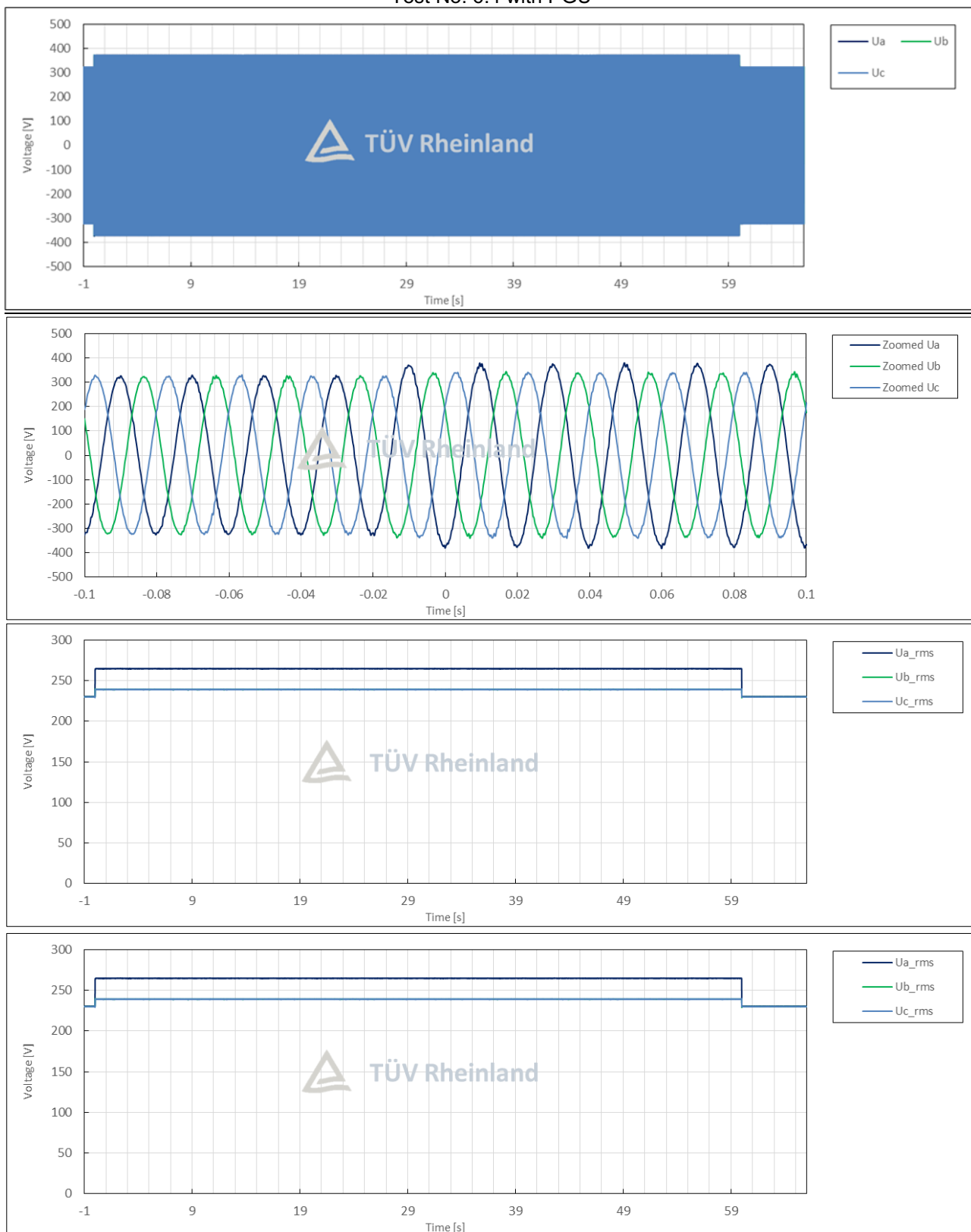
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	6.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:34:39
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.15
	5	Setting dip duration		--		59996
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	59996
	8	Fault duration in empty load test	Total	--	ms	59996
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.15
	10		Pos.		p.u.	1.07
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.15
	19	Line current	Phase 1	t1+50ms	p.u.	0.16
	20		Phase 2			0.22
	21		Phase 3			0.22
	22	Line current	Phase 1	t1+80ms	p.u.	0.18
	23		Phase 2			0.20
	24		Phase 3			0.20
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.20
	26		Pos.			0.20
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.21
	29		Pos.			0.21
	39	Active power rising time	Pos.	--	s	N/A
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 6.4 idle test

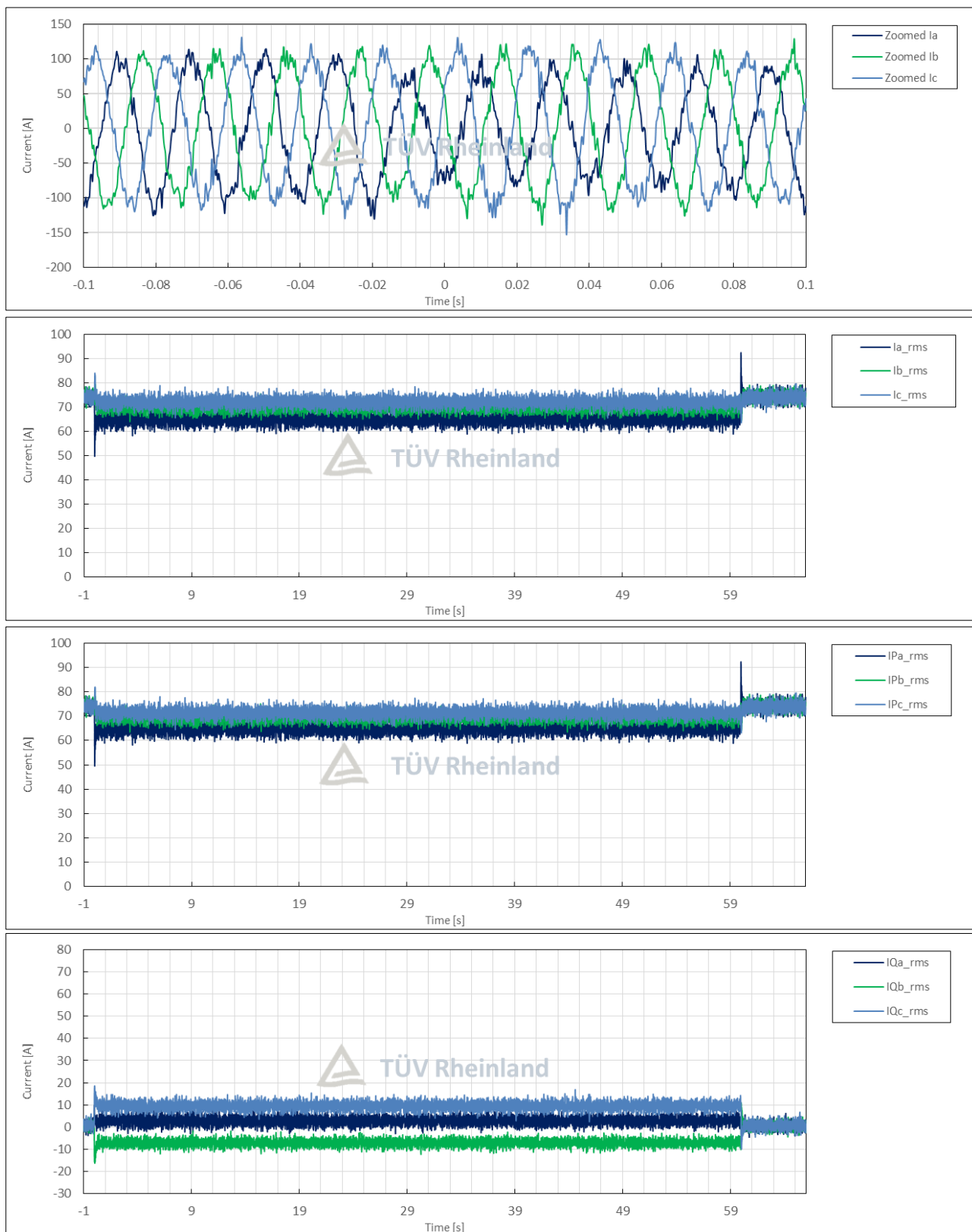


Test No. 6.4 with PGU



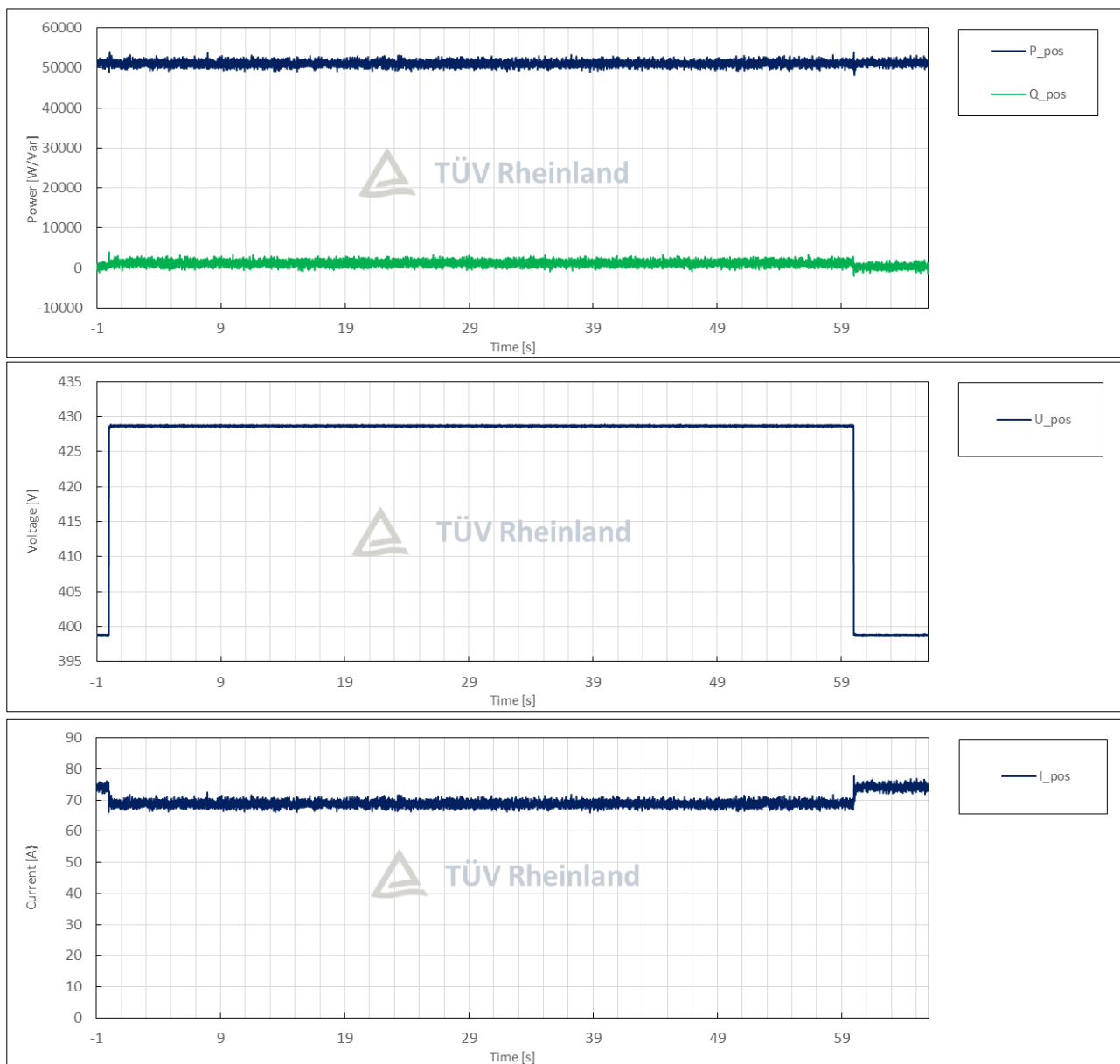
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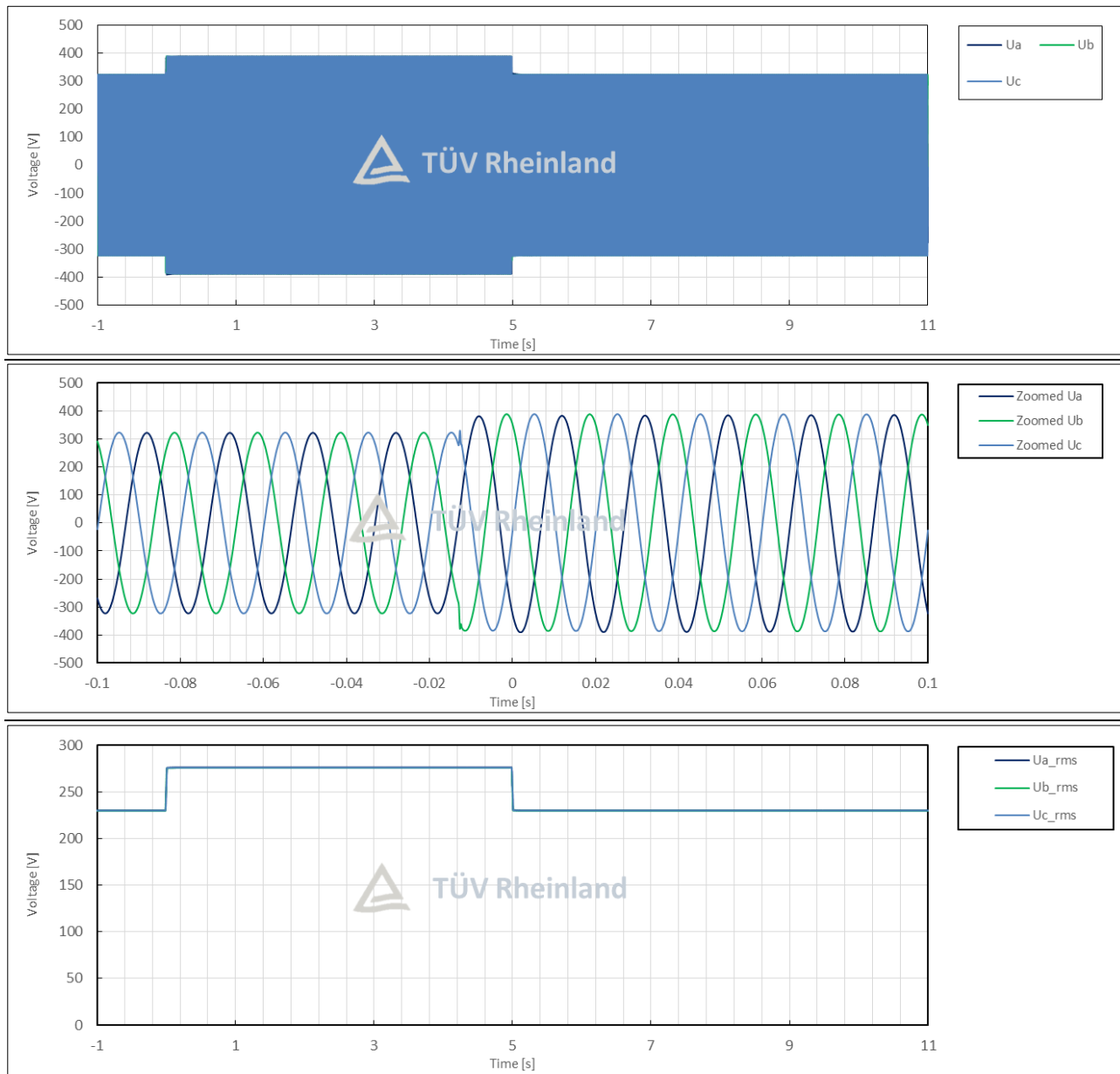


Prüfbericht-Nr.: CN25HVW8 001 Attachment 1
Test report no.:

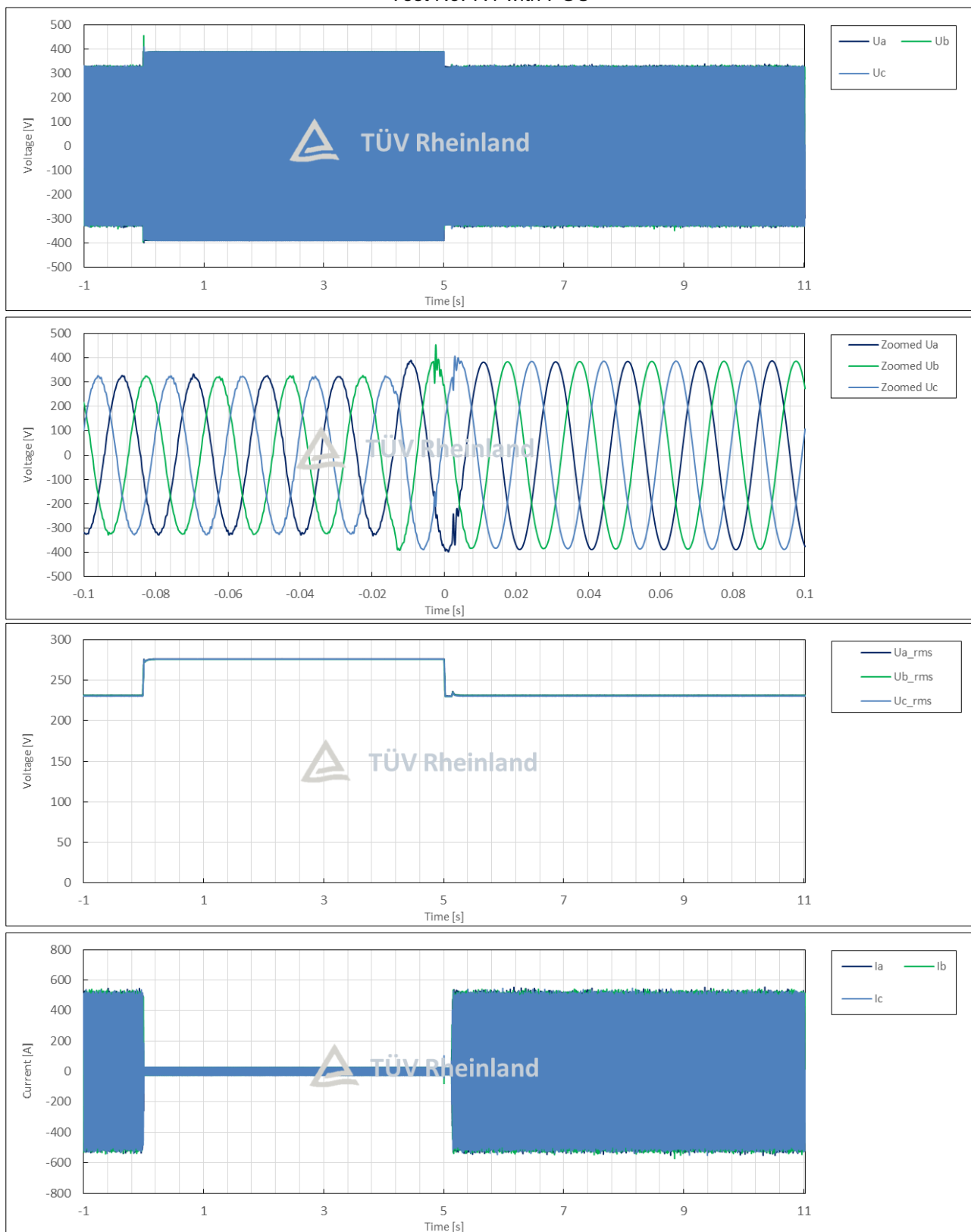
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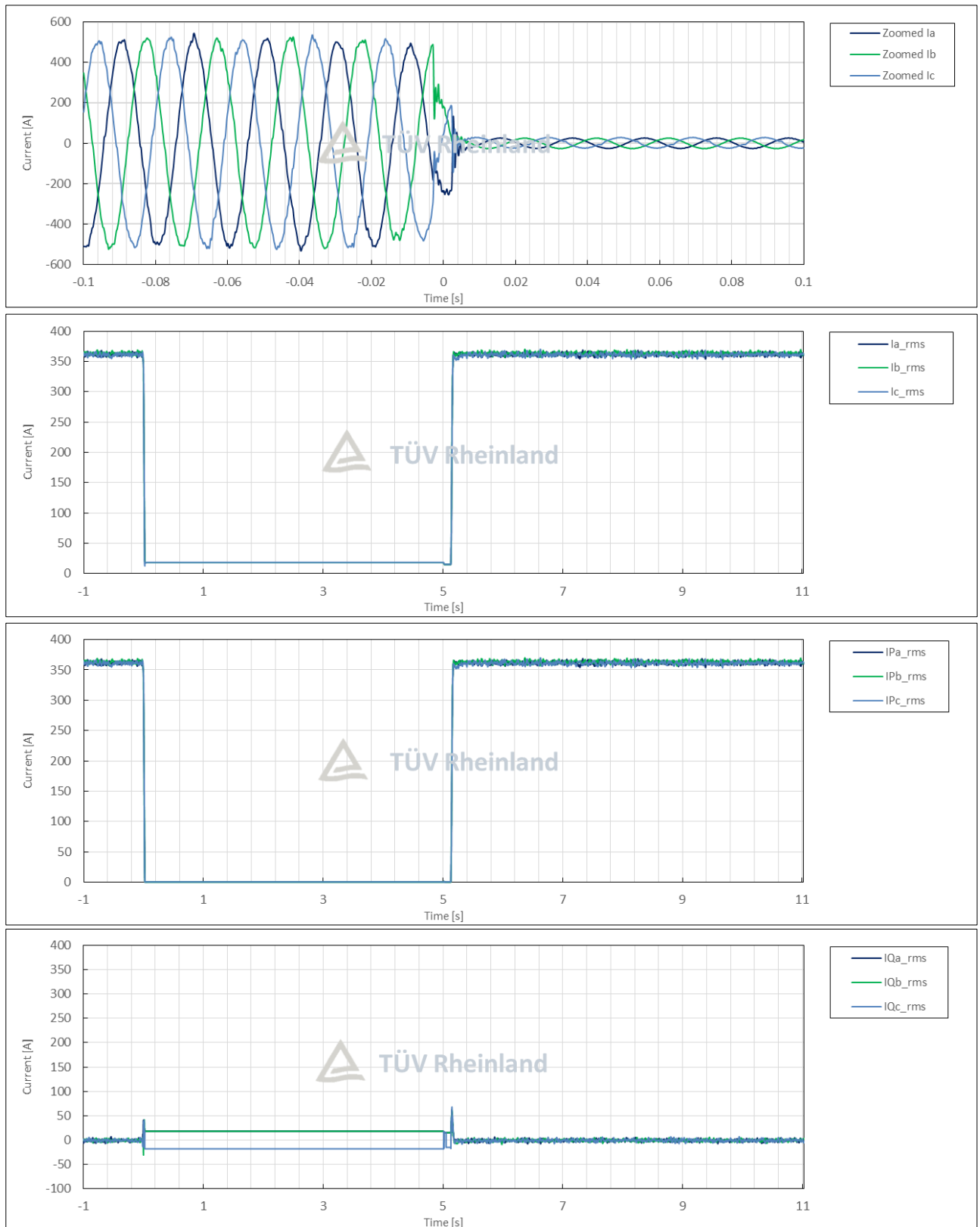
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	7.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	15:35:47
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		5000
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	5000
	8	Fault duration in empty load test	Total	--	ms	5000
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.20
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.20
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.05
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 7.1 idle test



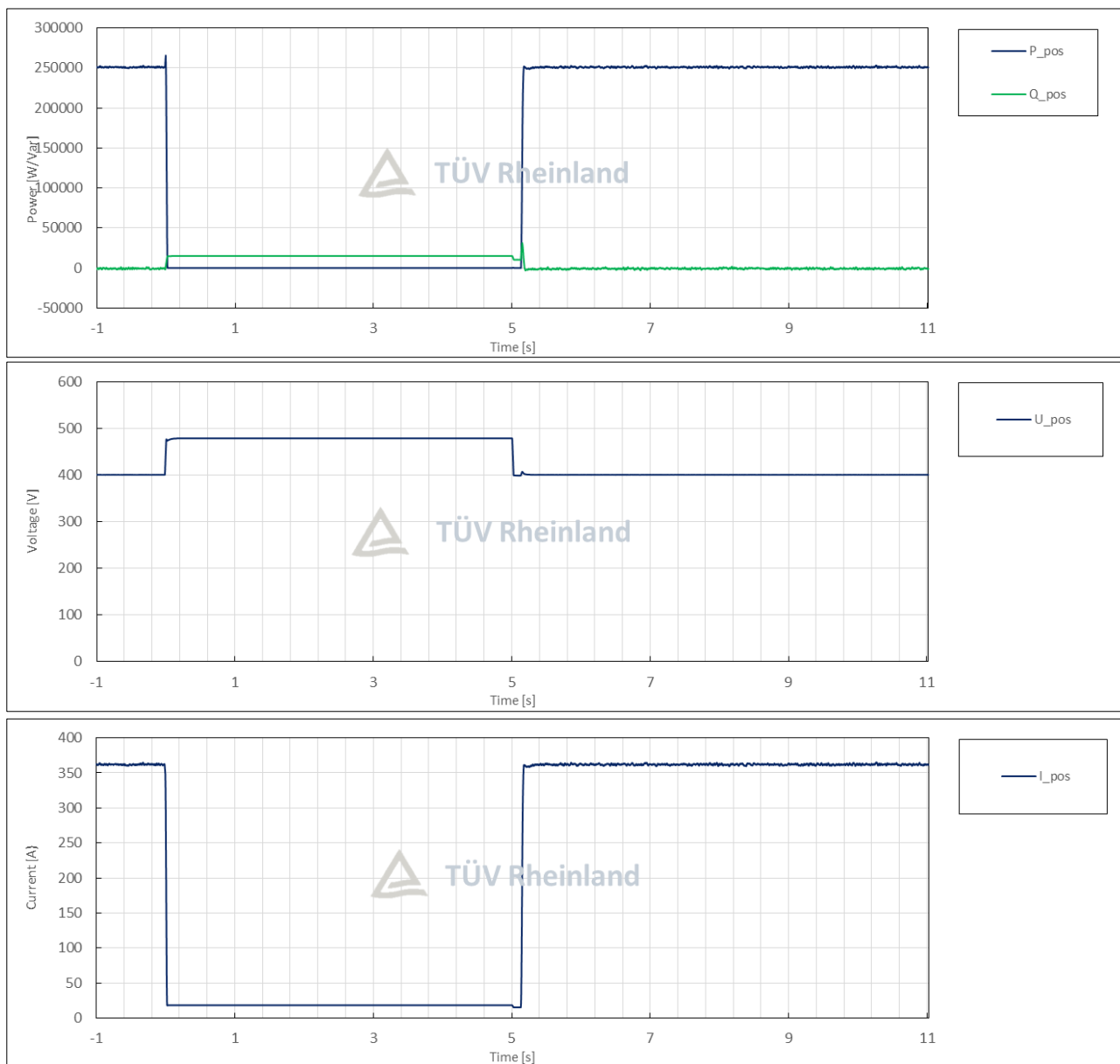
Test No. 7.1 with PGU





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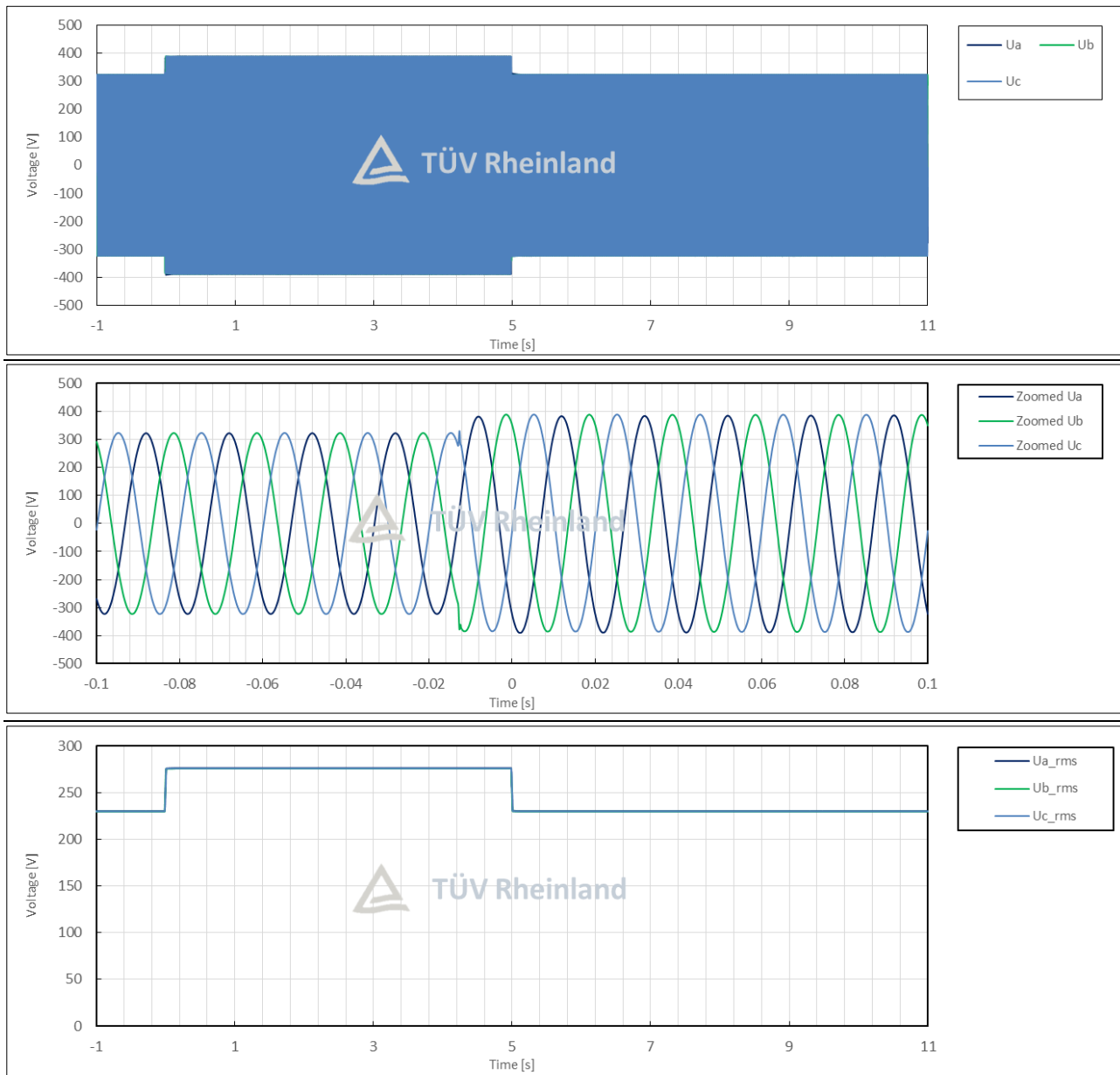


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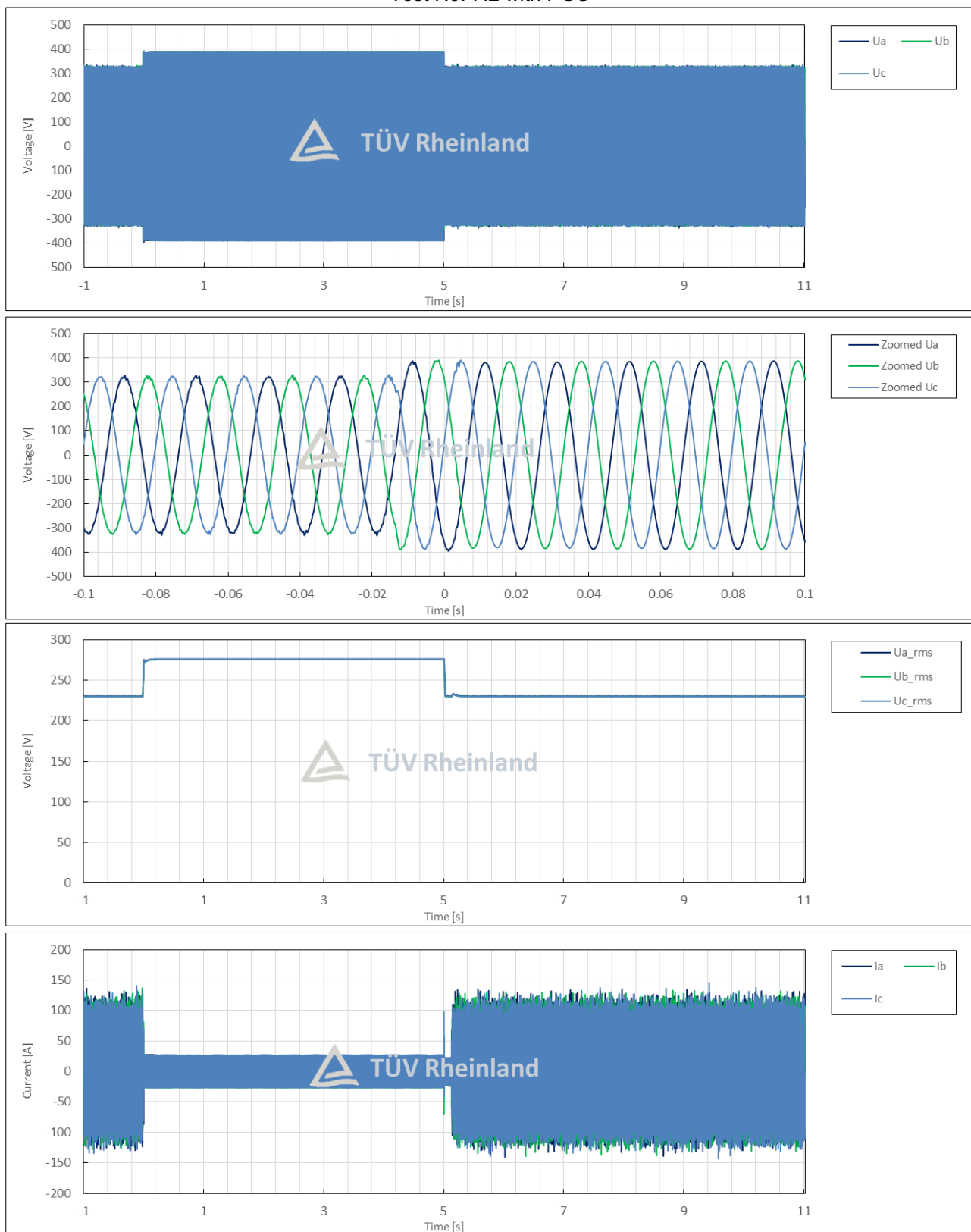
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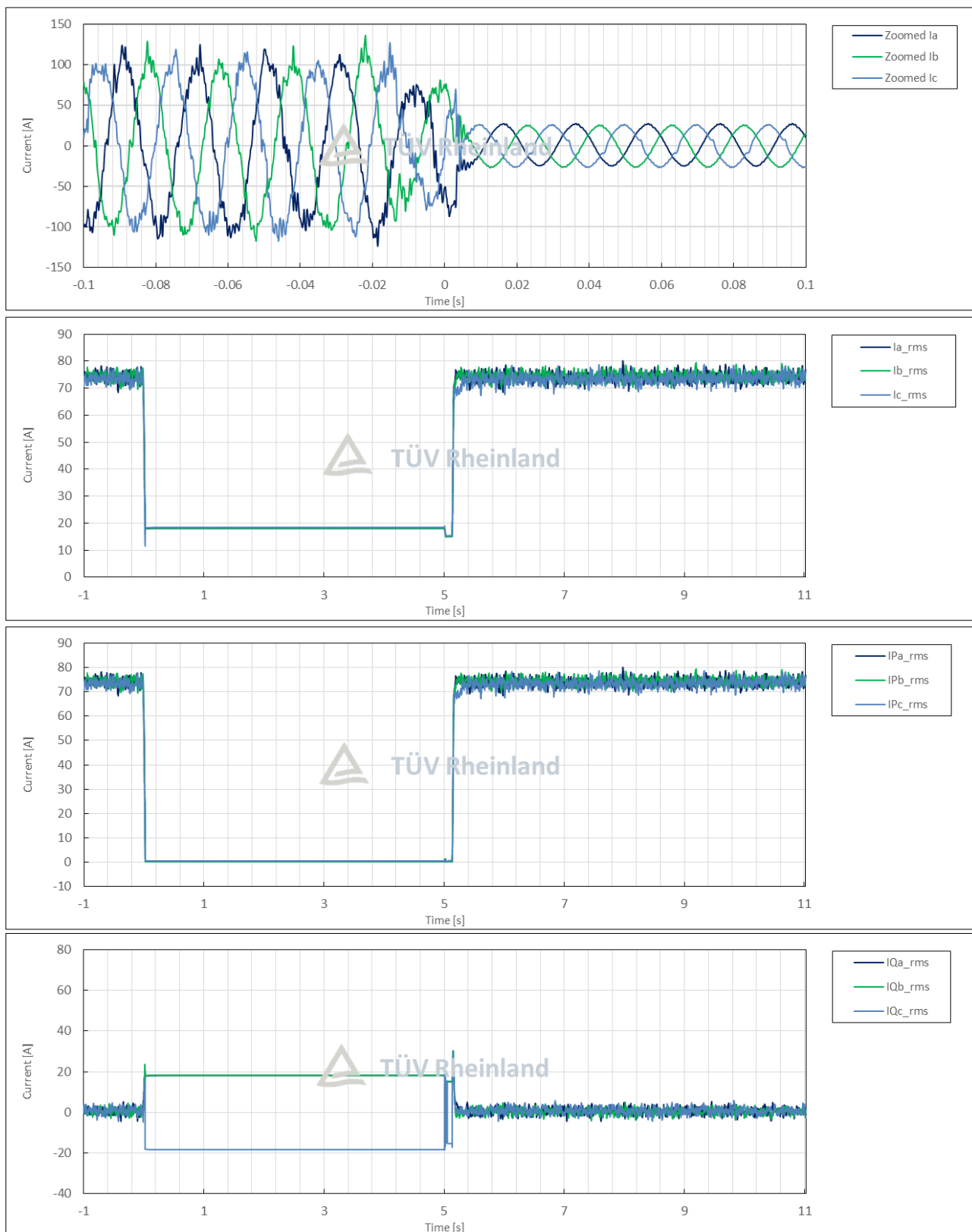
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	7.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	16:04:33
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		5000
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	5000
	8	Fault duration in empty load test	Total	--	ms	5000
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.20
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.20
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.05
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.144
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

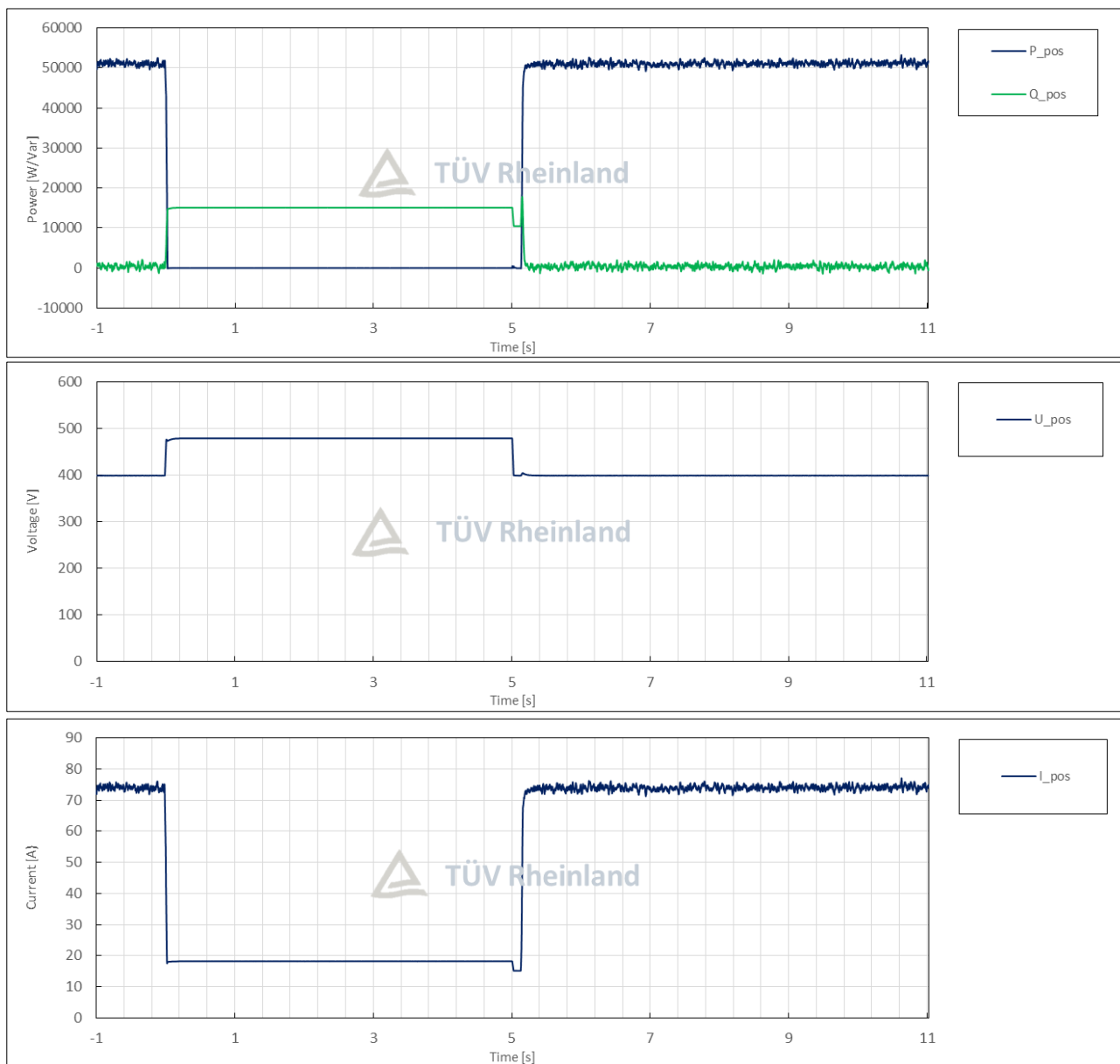
Test No. 7.2 idle test



Test No. 7.2 with PGU





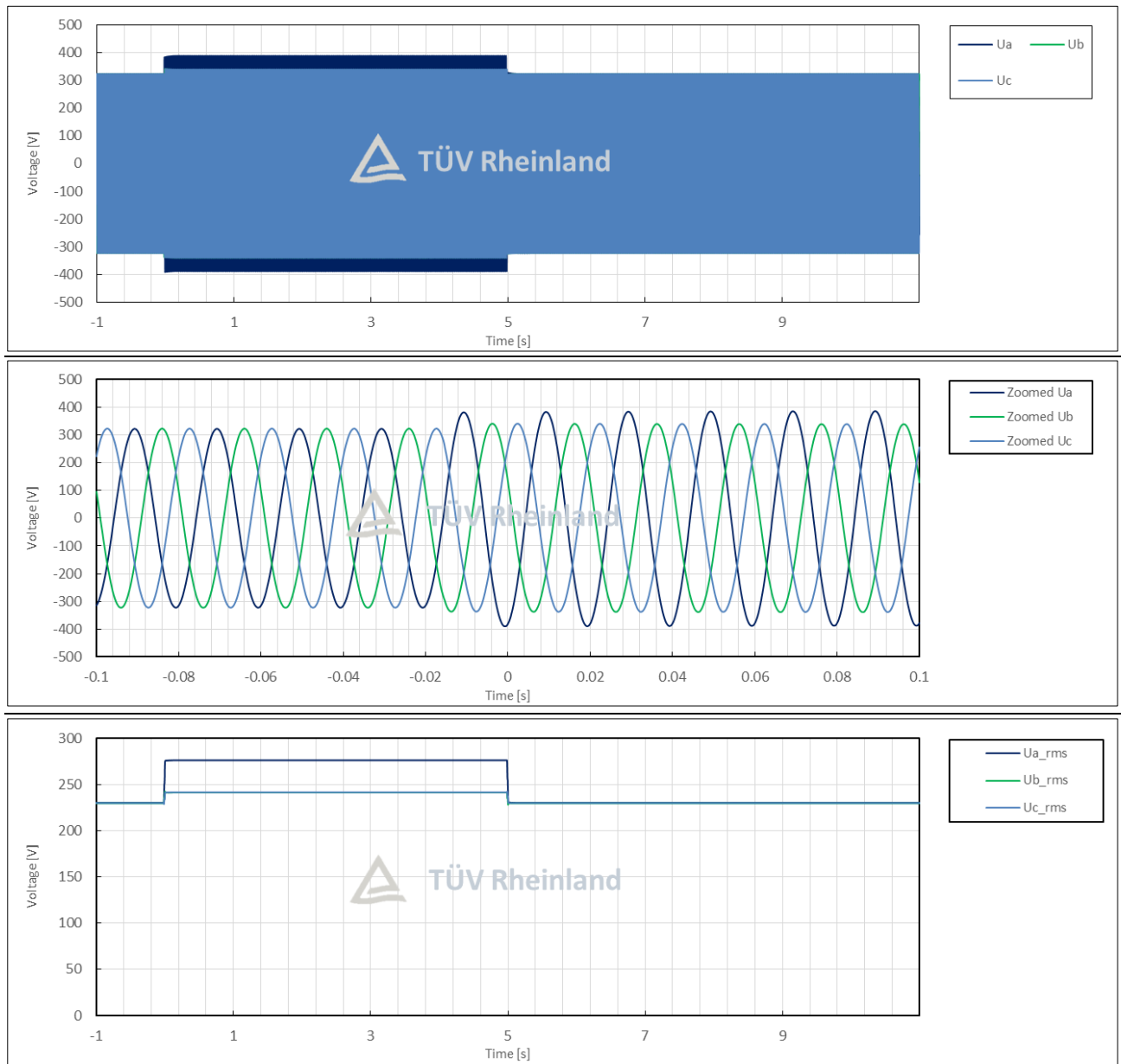


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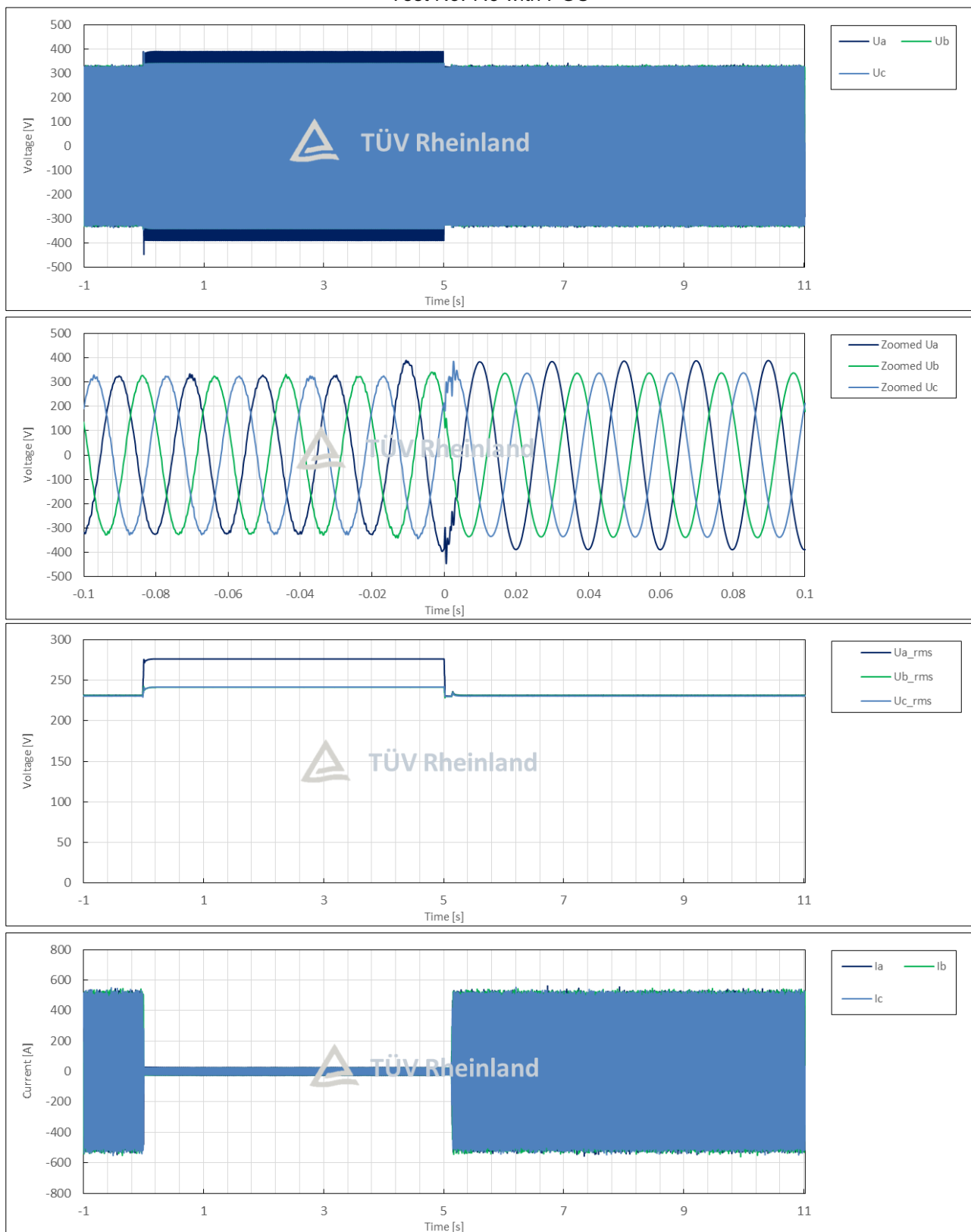
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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	7.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	16:21:43
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		4997
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	4997
	8	Fault duration in empty load test	Total	--	ms	4997
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.10
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.20
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.04
	24		Phase 3			0.04
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 7.3 idle test

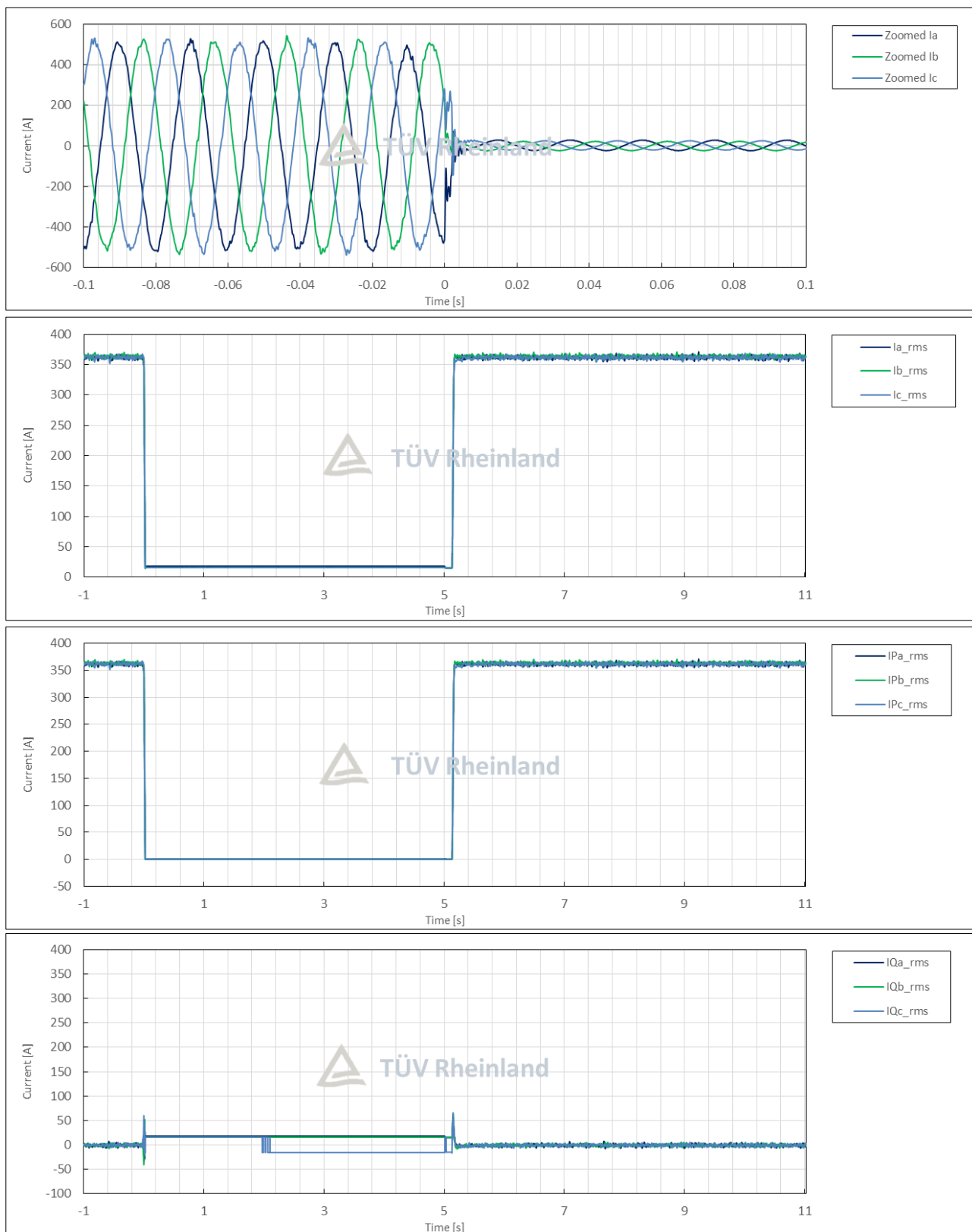


Test No. 7.3 with PGU



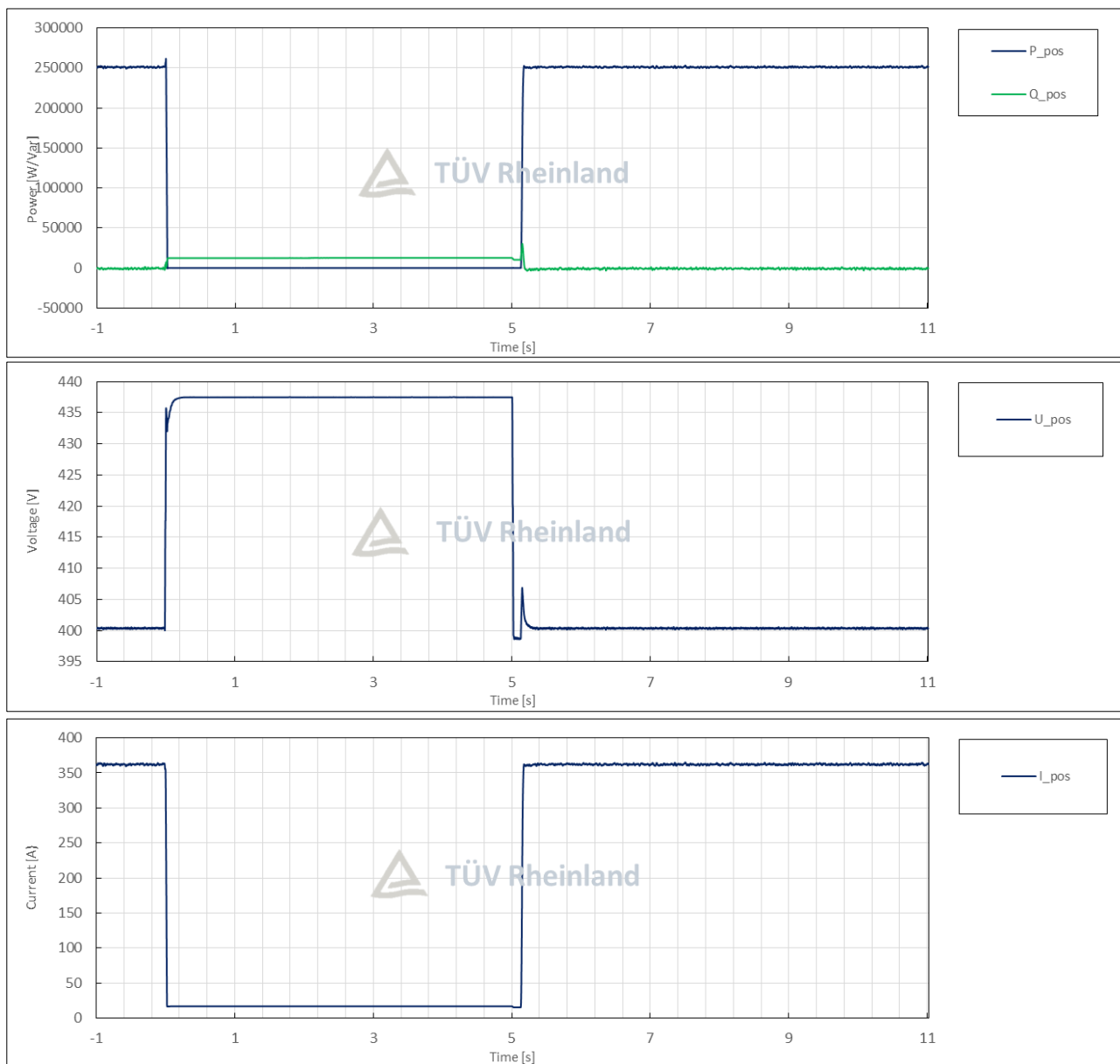
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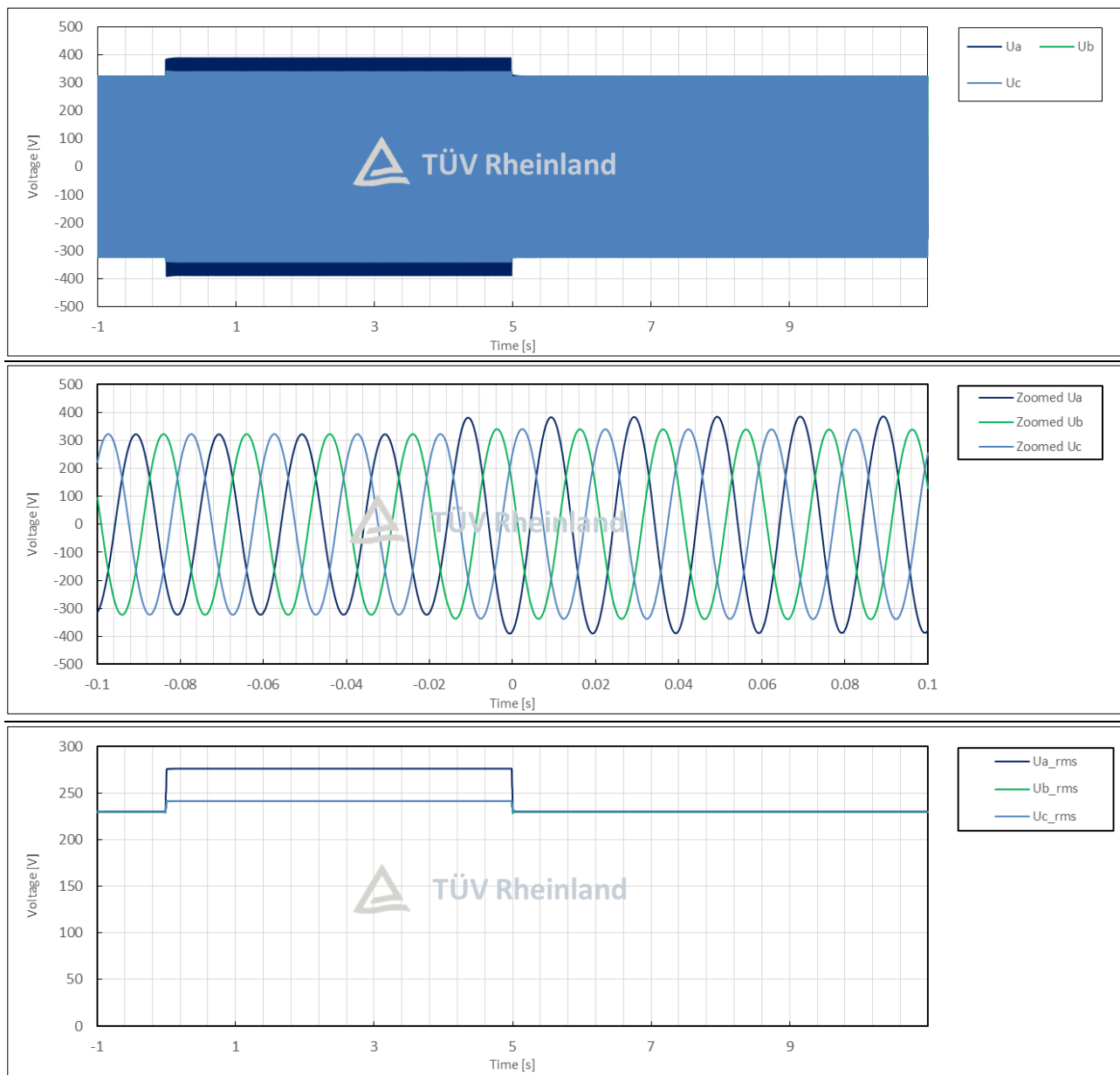


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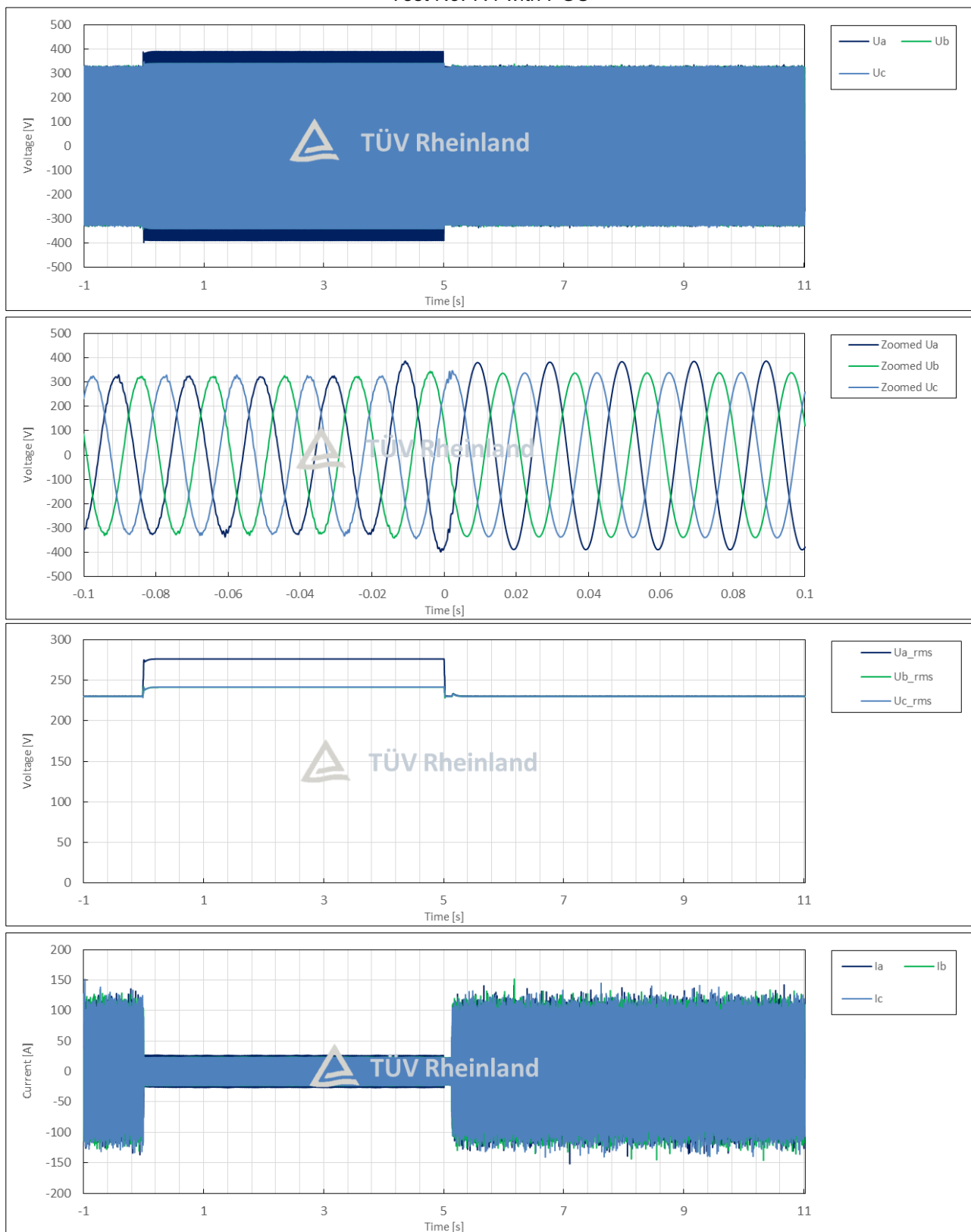
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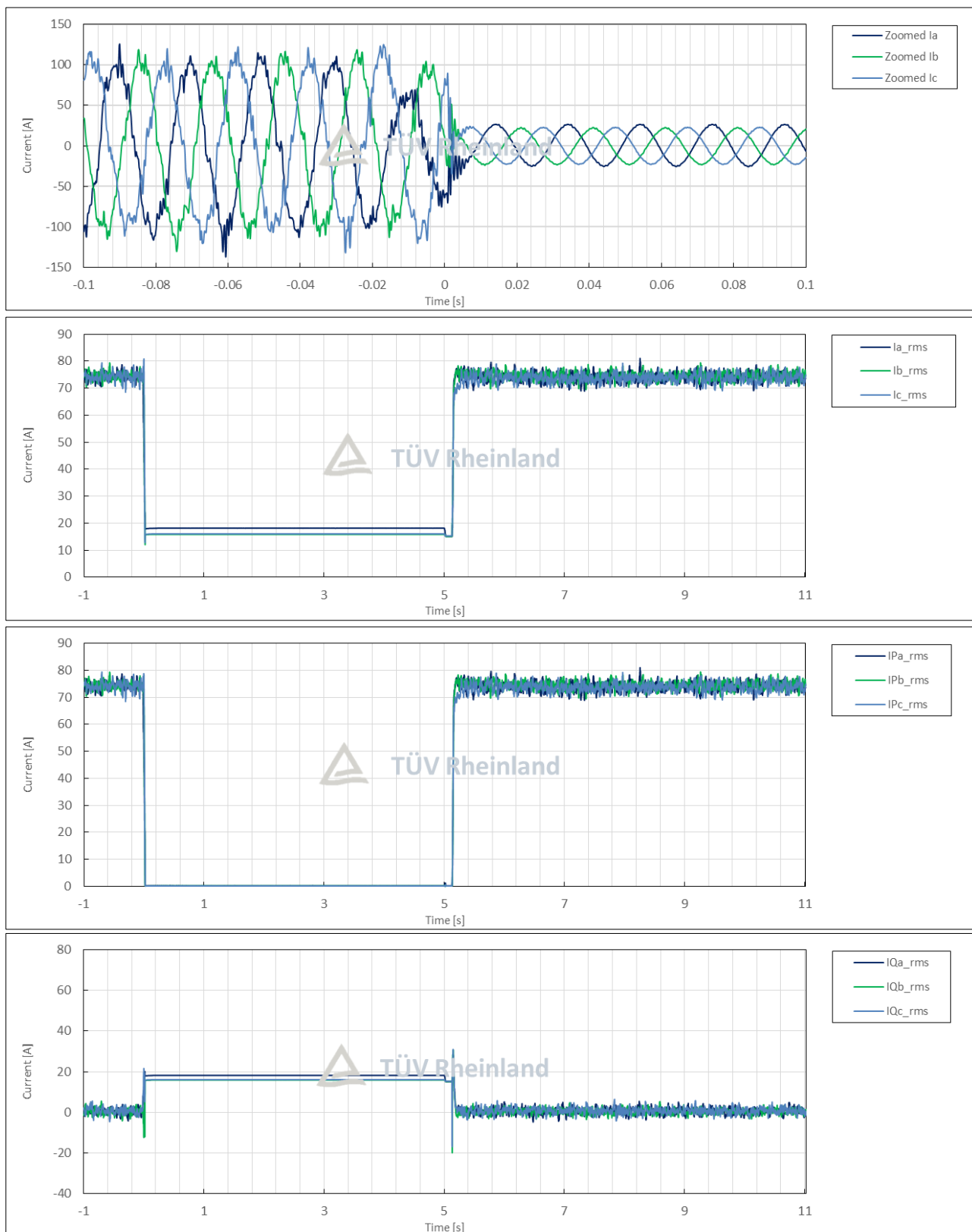
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	7.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	16:22:28
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		4997
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	4997
	8	Fault duration in empty load test	Total	--	ms	4997
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.10
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.21
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.20
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.04
	24		Phase 3			0.04
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.142
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 7.4 idle test



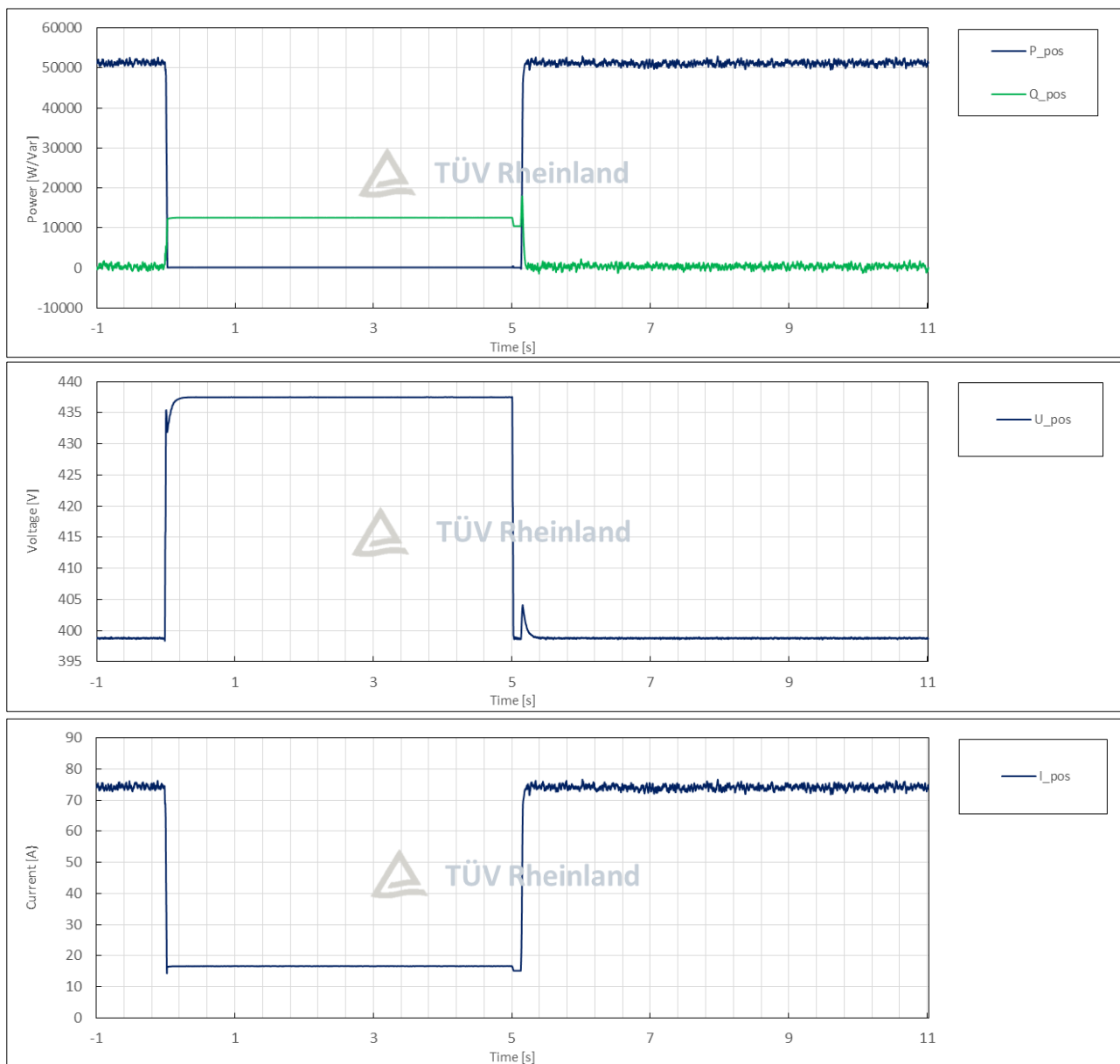
Test No. 7.4 with PGU





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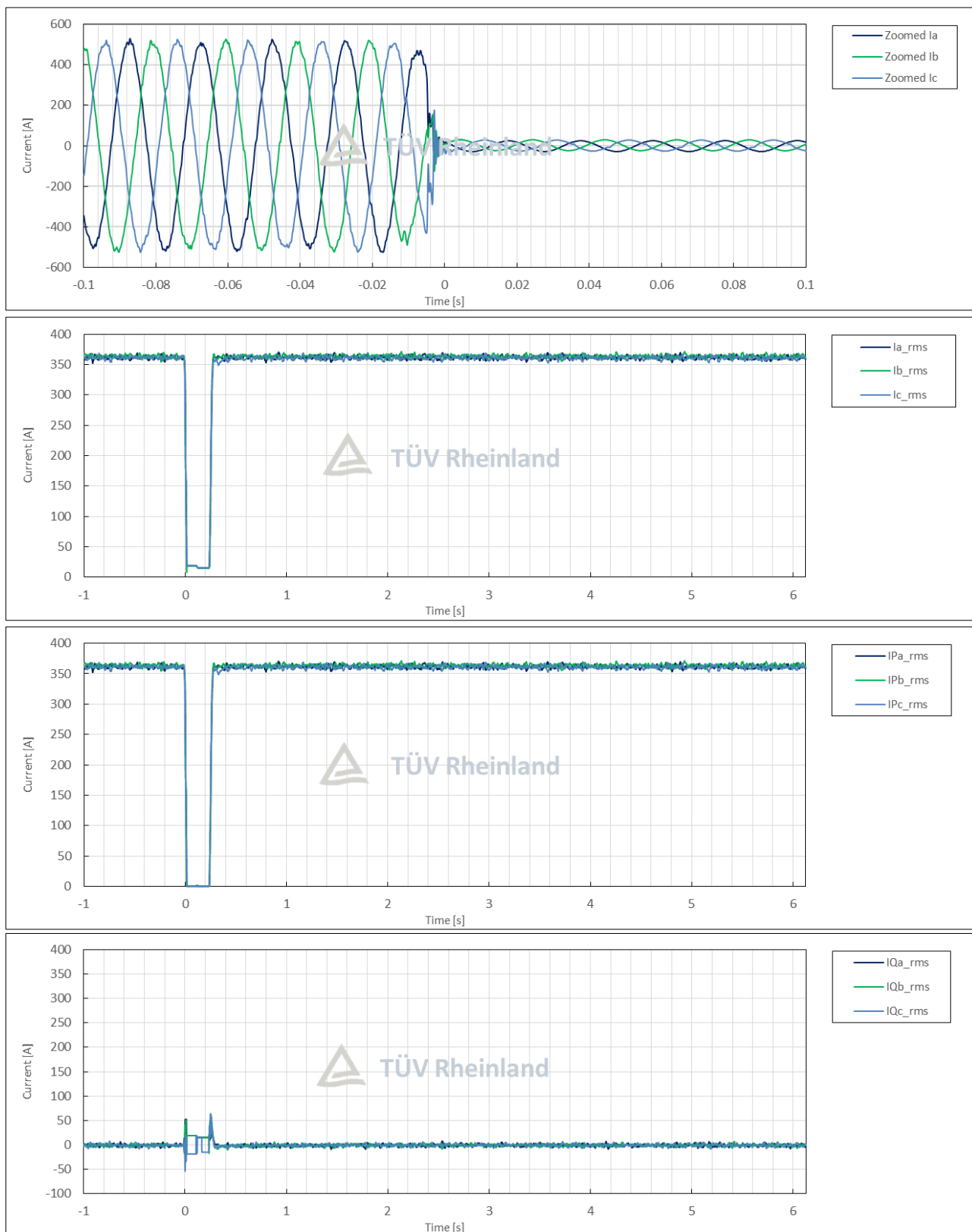
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	8.1
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	16:23:20
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		104
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	104
	8	Fault duration in empty load test	Total	--	ms	104
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.20
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.05
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 8.1 idle test



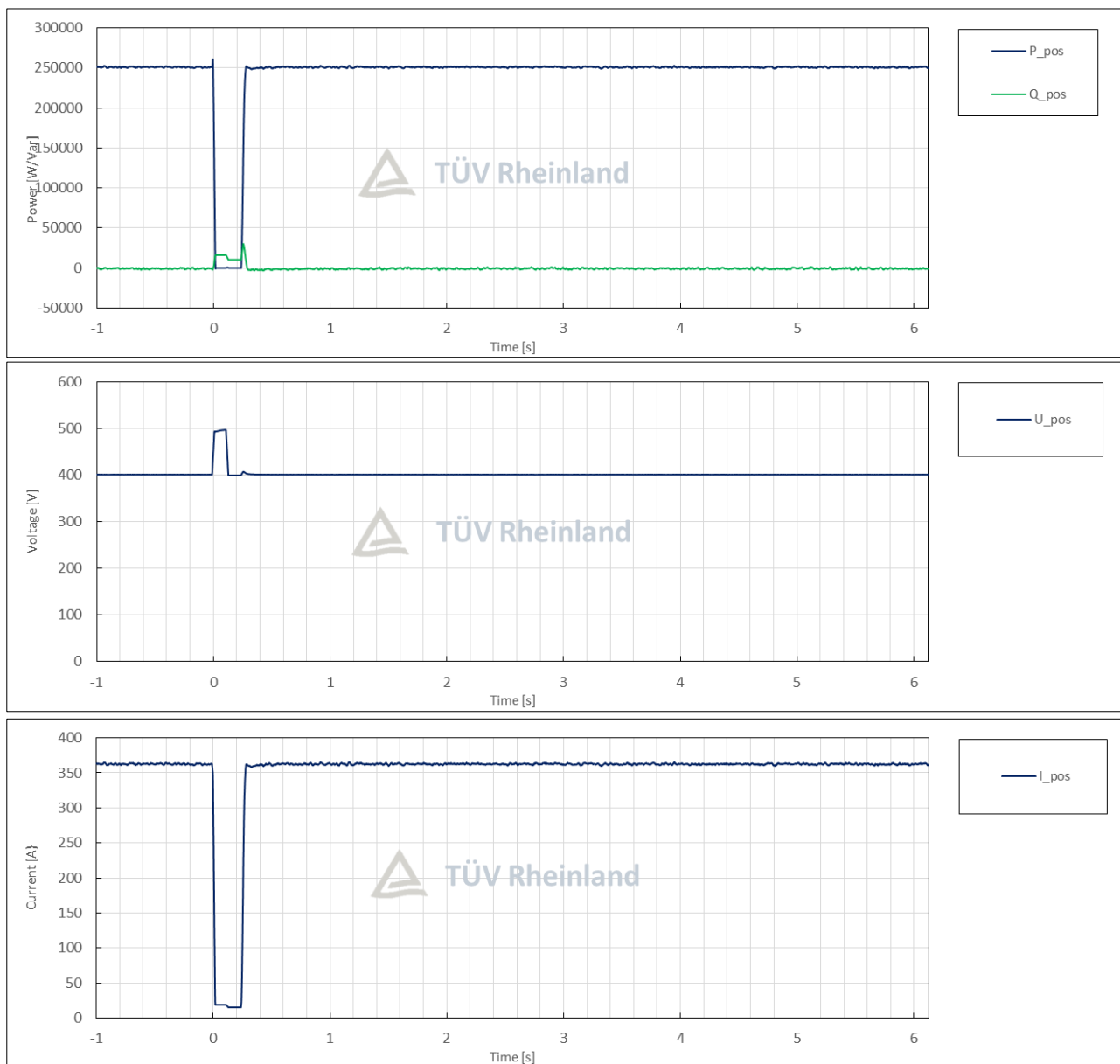
Test No. 8.1 with PGU





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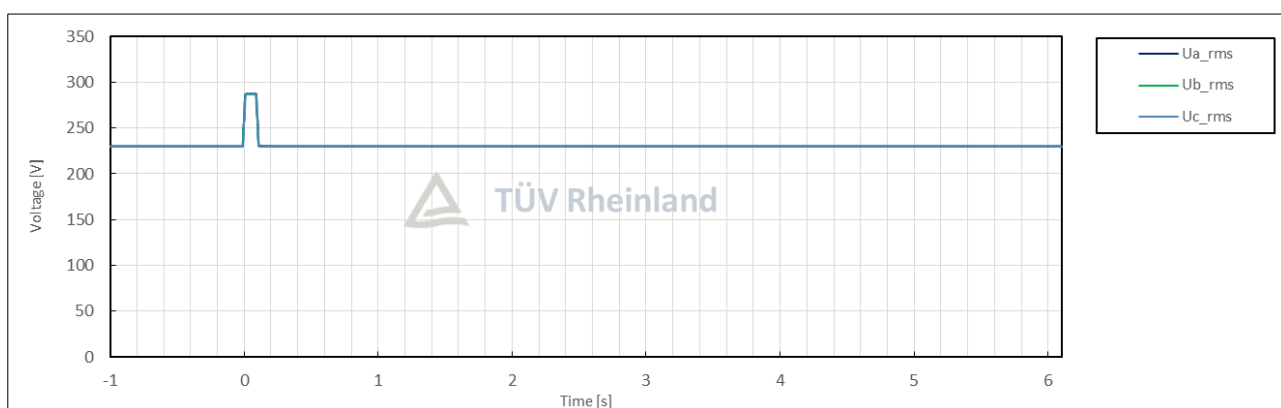
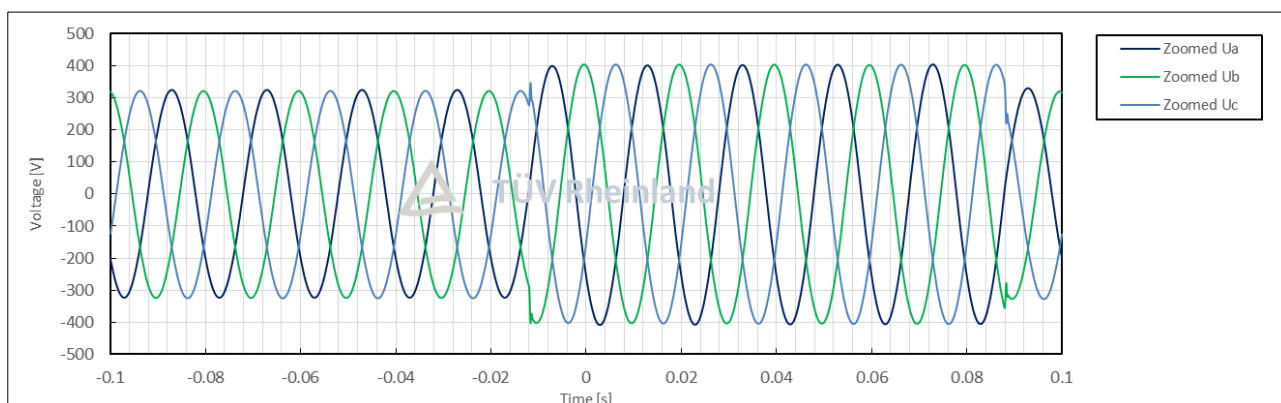
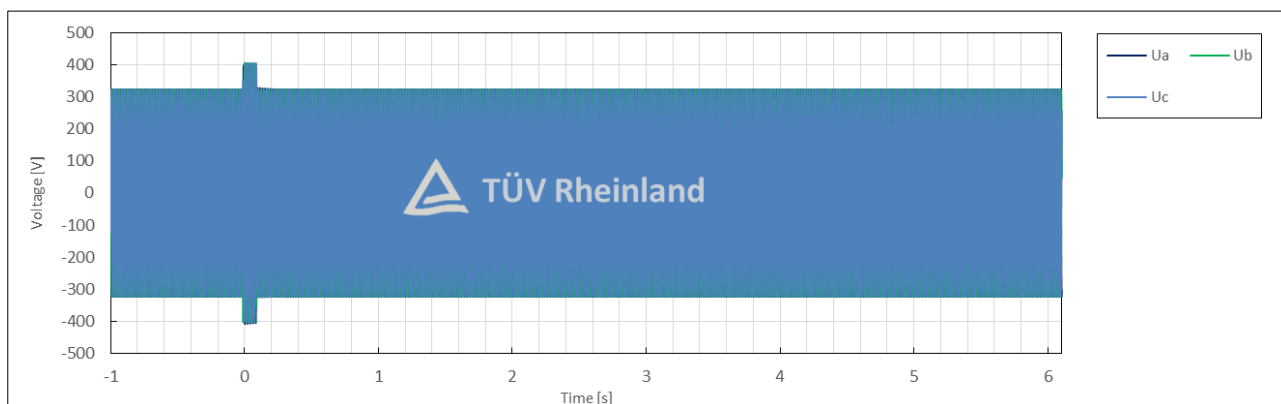


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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	8.2
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	16:25:02
	3	Fault type (phase)	--	--		3-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		104
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	104
	8	Fault duration in empty load test	Total	--	ms	104
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.20
	10		Pos.		p.u.	1.20
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.05
	21		Phase 3			0.05
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.05
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 8.2 idle test

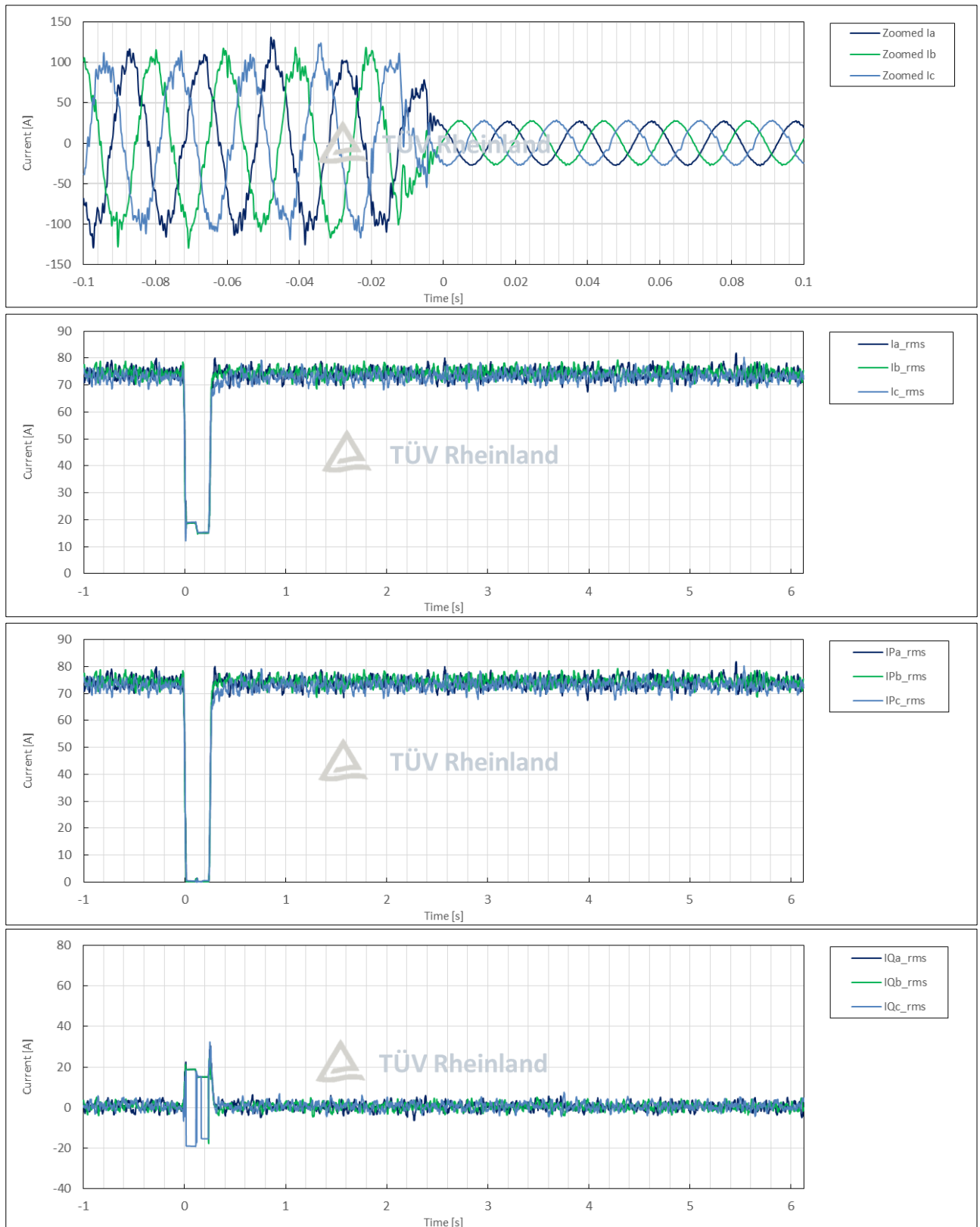


Test No. 8.2 with PGU



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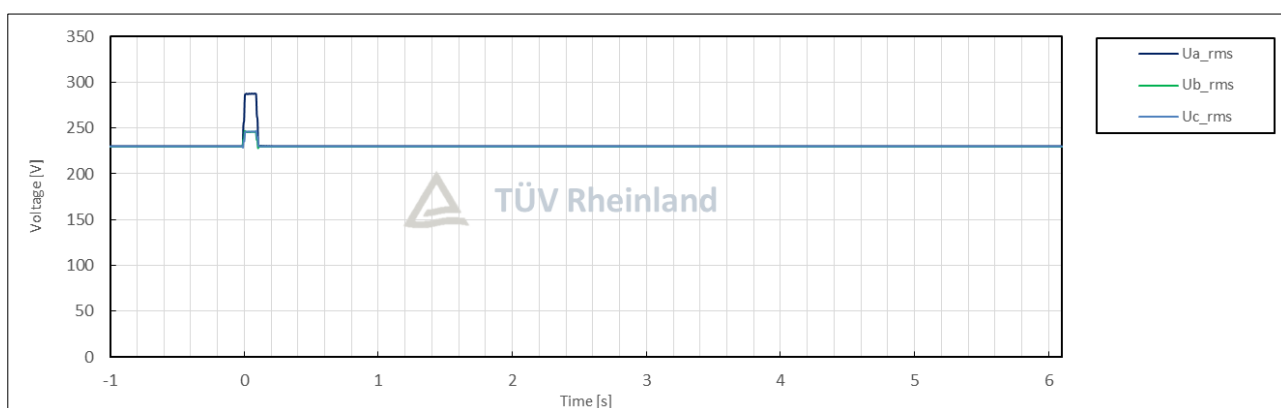
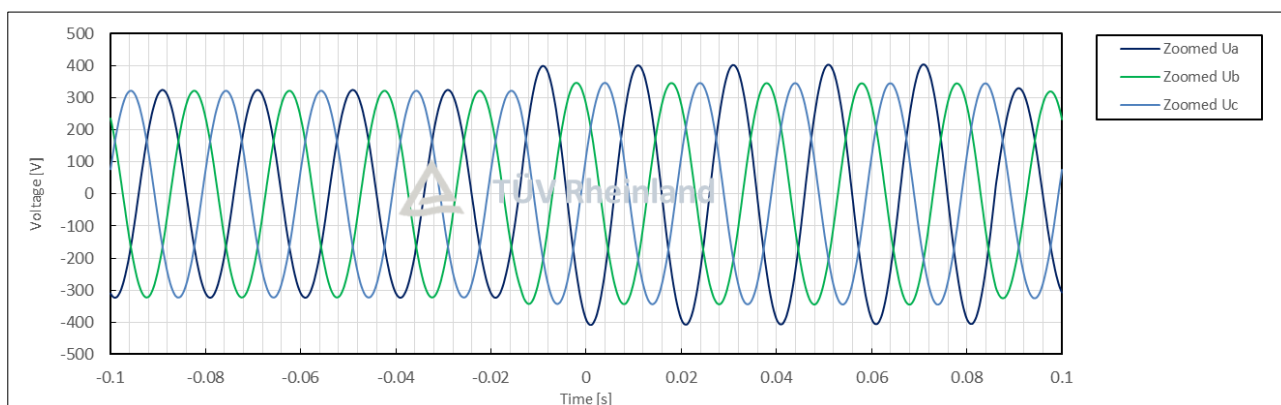
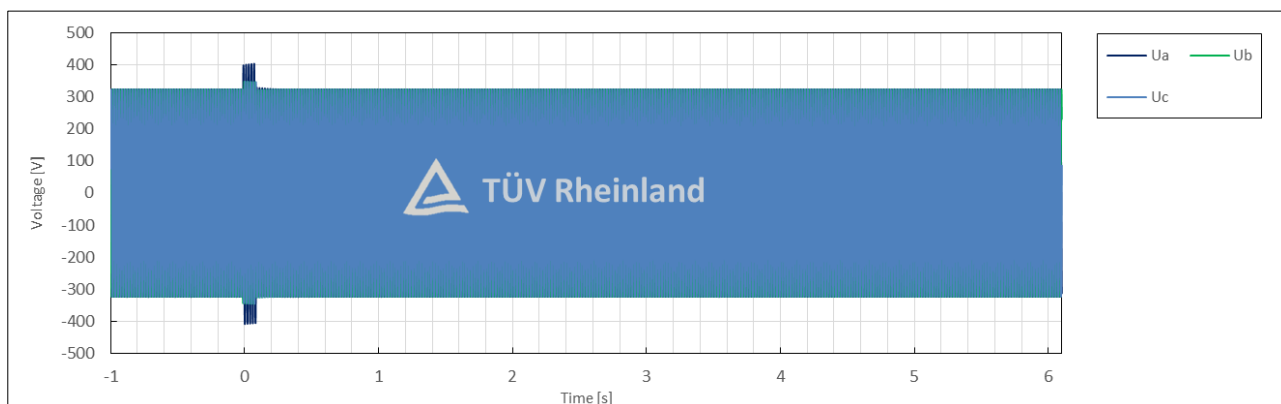


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Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	8.3
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	16:25:55
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		100
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	100
	8	Fault duration in empty load test	Total	--	ms	100
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.19
	10		Pos.		p.u.	1.10
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.01
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	1.00
	13	Active power	Total	t1-10s to t1	p.u.	1.00
	14		Pos.			1.00
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.04
	24		Phase 3			0.05
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.01
	28	Active power	Total	t2+3s to t2+10s	p.u.	1.00
	29		Pos.			1.00
	39	Active power rising time	Pos.	--	s	0.143
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 8.3 idle test



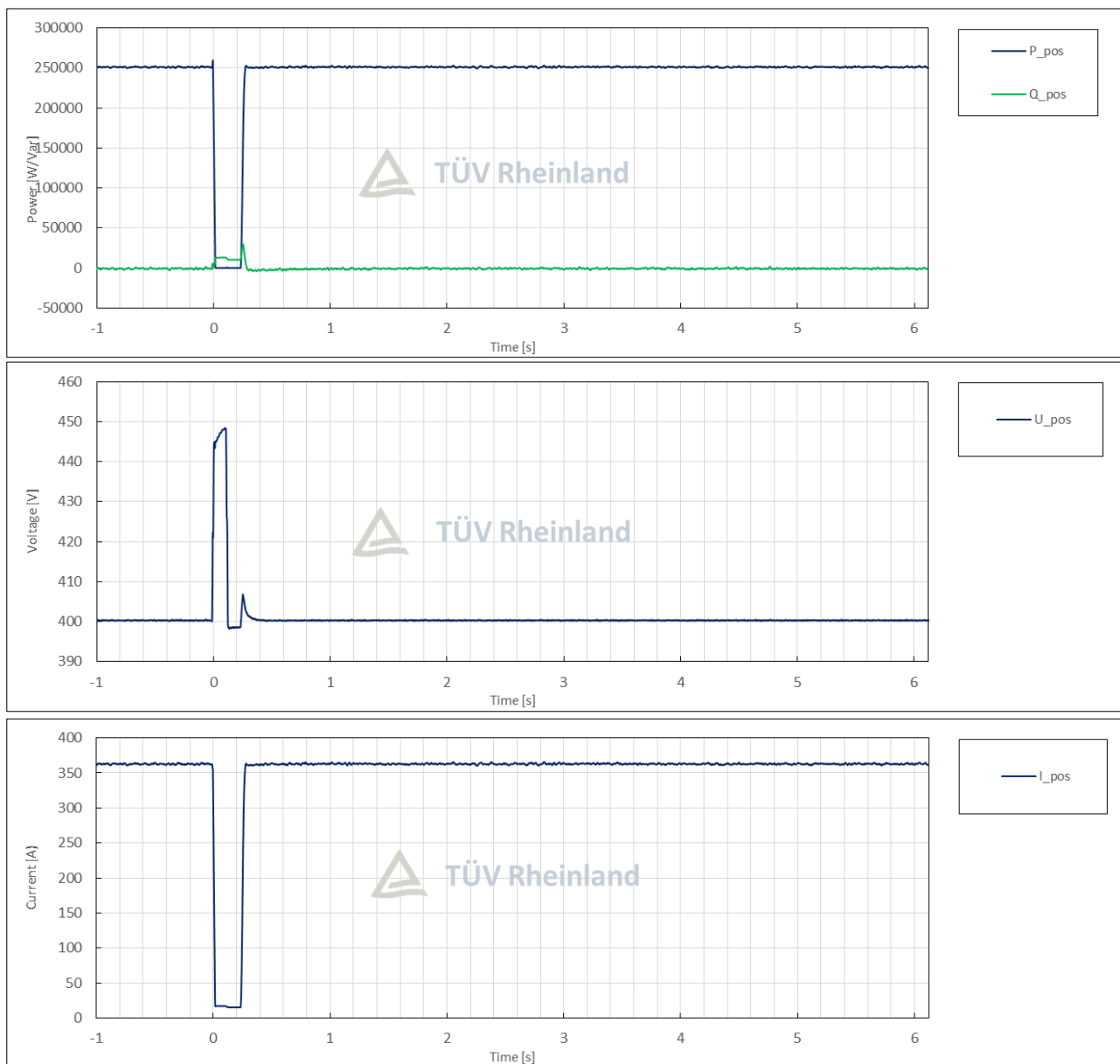
Test No. 8.3 with PGU





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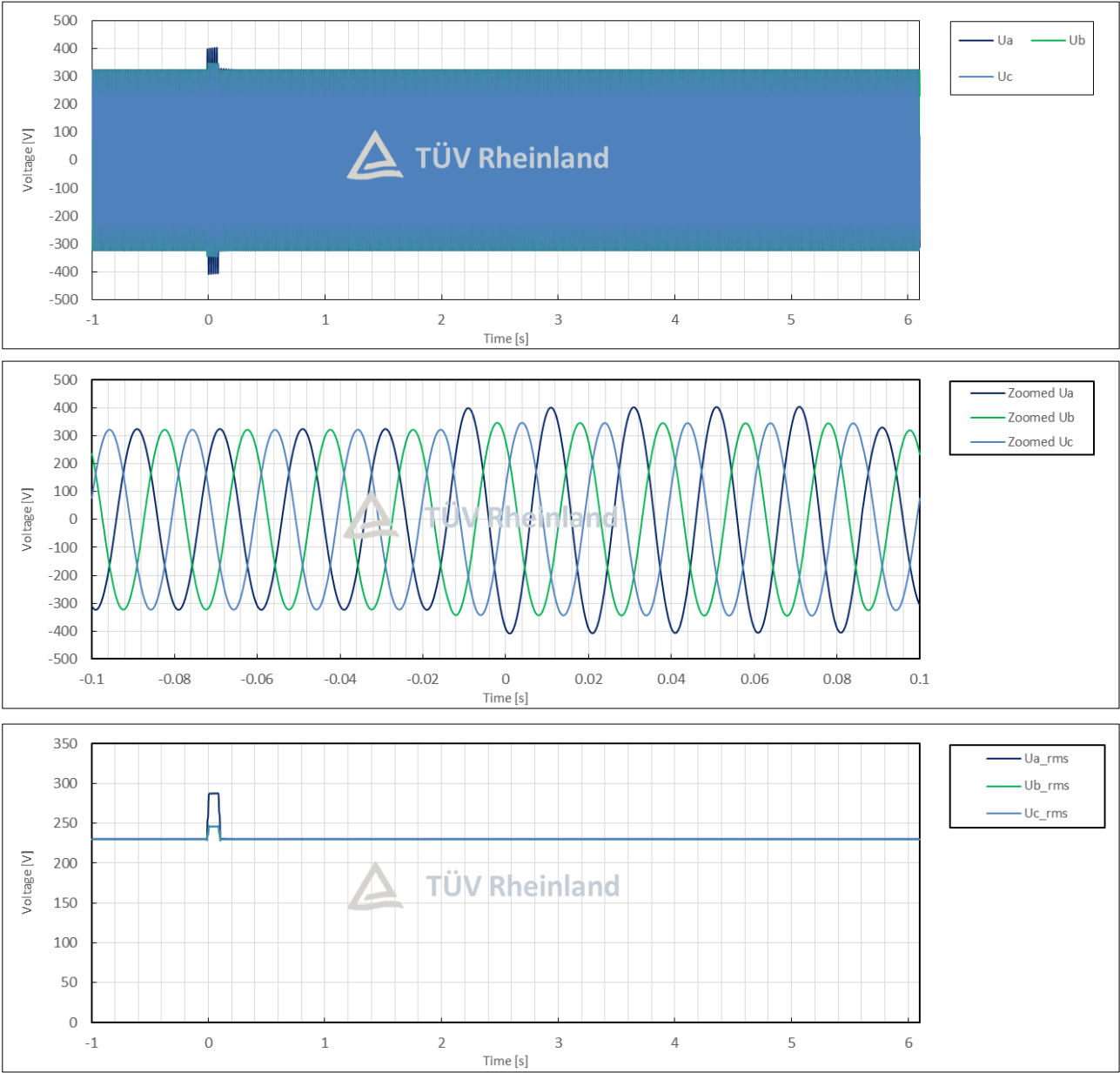


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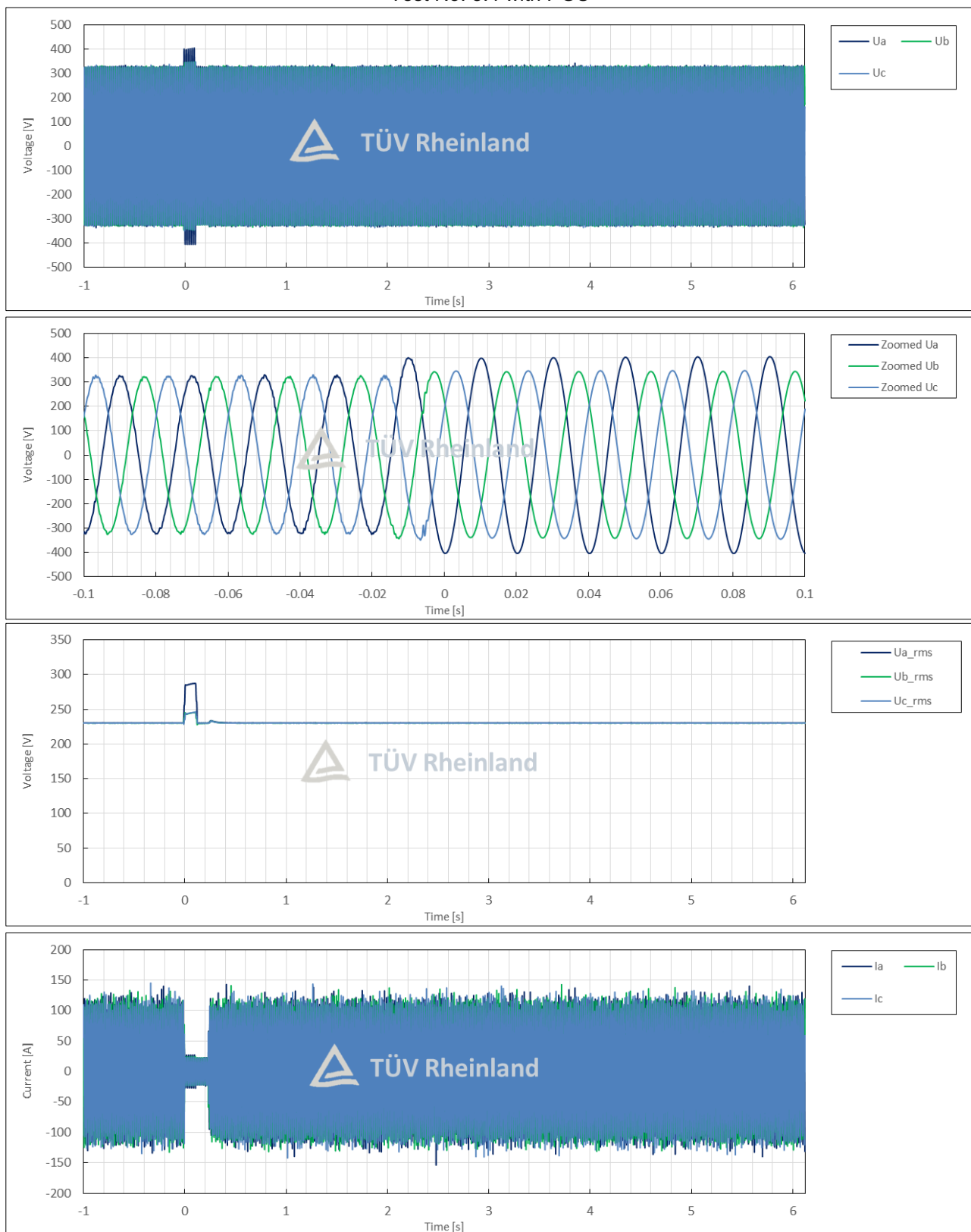
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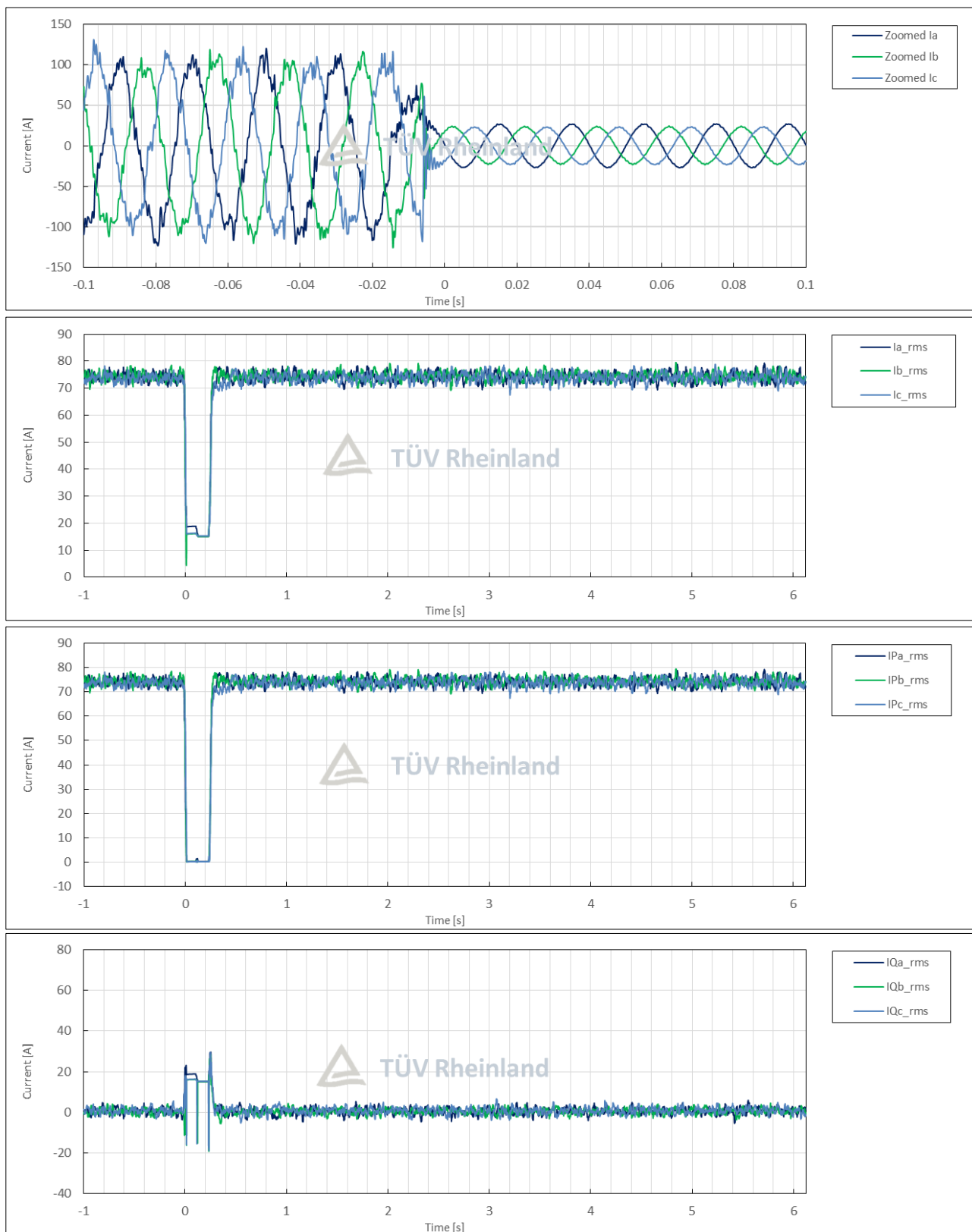
Condition						Measurement
	No.	Parameter	Phase ref.	Time ref.	unit	
General Info.	0	Test number	--	--	--	8.4
	1	Date	--	--	dd.mm.yyyy	25.2.2025
	2	Time (start of test)	--	--	hh:mm:ss.f	16:26:31
	3	Fault type (phase)	--	--		2-phase fault
	4	Setting voltage depth	Line to line	--	p.u.	1.20
	5	Setting dip duration		--		100
	6	Point of fault entry	Total	--	ms	0
	7	Point of fault clearance	Total	--	ms	100
	8	Fault duration in empty load test	Total	--	ms	100
	9	Voltage depth/height in empty load test	Total	t1+100ms to t2 and t1-10s to t1	p.u.	1.19
	10		Pos.		p.u.	1.10
Before dip <t1	11	Voltage	Line to neutral	t1-100s to t1	p.u.	1.00
	12	Current	Pos.	t1-500ms to t1-100ms	p.u.	0.20
	13	Active power	Total	t1-10s to t1	p.u.	0.20
	14		Pos.			0.20
	15	Reactive power	Total	t1-10s to t1	p.u.	0.00
	16		Pos.			0.00
	17	Cosφ	--	t1-10s to t1	--	1.000
During dip t1 to t2	18	Voltage	Line to neutral	t1+100ms to t2-20ms	p.u.	1.25
	19	Line current	Phase 1	t1+50ms	p.u.	0.05
	20		Phase 2			0.04
	21		Phase 3			0.04
	22	Line current	Phase 1	t1+80ms	p.u.	0.05
	23		Phase 2			0.04
	24		Phase 3			0.04
	25	Active power	Total	t1+100ms to t2-20ms	p.u.	0.00
	26		Pos.			0.00
After dip > t2	27	Voltage	Line to neutral	t2+3s to t2+10s	p.u.	1.00
	28	Active power	Total	t2+3s to t2+10s	p.u.	0.20
	29		Pos.			0.20
	39	Active power rising time	Pos.	--	s	0.144
	31	Reactive power	Total	t2+3s to t2+10s	p.u.	0.00
	32		Pos.			0.00
	33	Reactive power rising time	Pos.	--	s	N/A
	34	PGU does not disconnect from grid till 60s after fault	--	t2 to t2+60s	Yes / No	No

Test No. 8.4 idle test



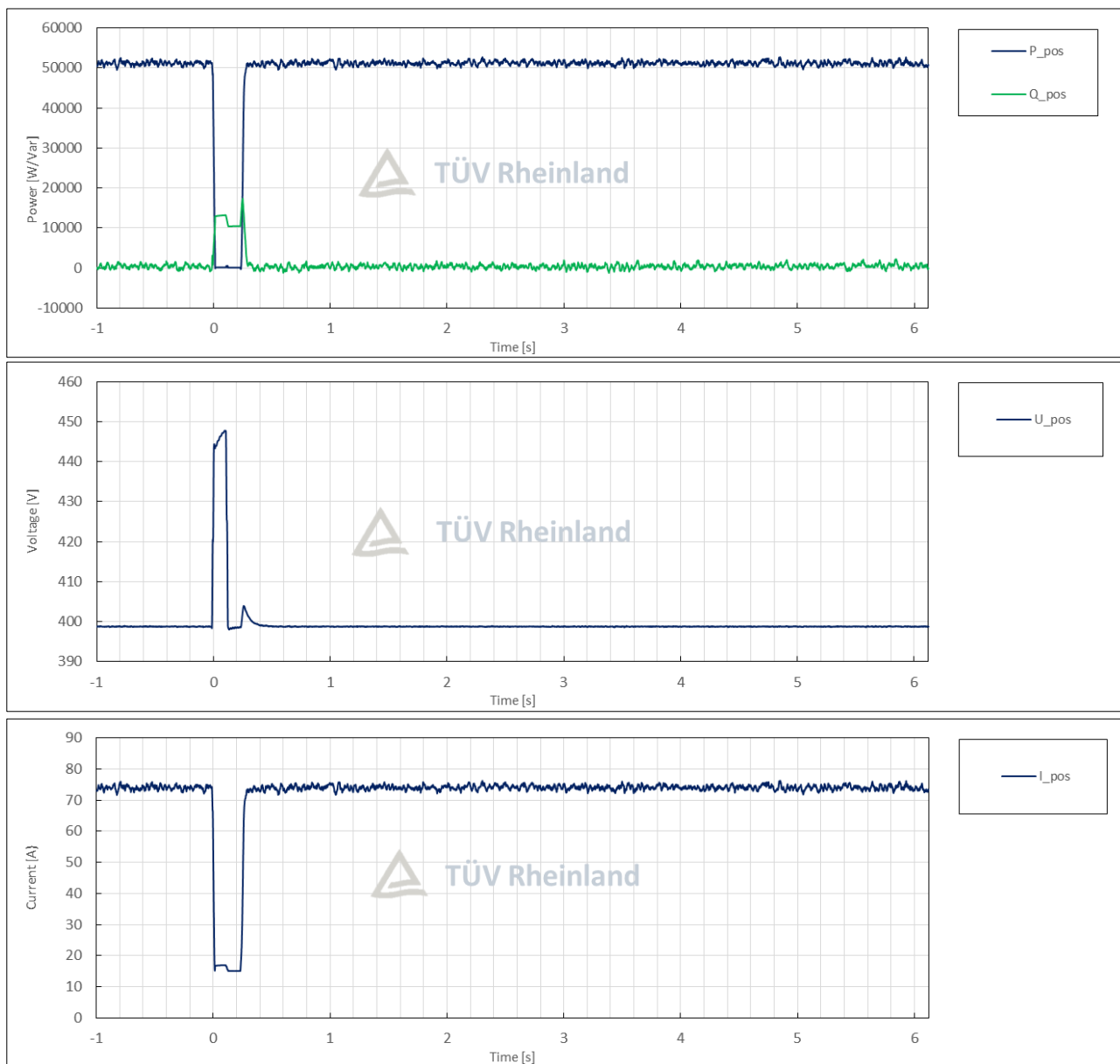
Test No. 8.4 with PGU

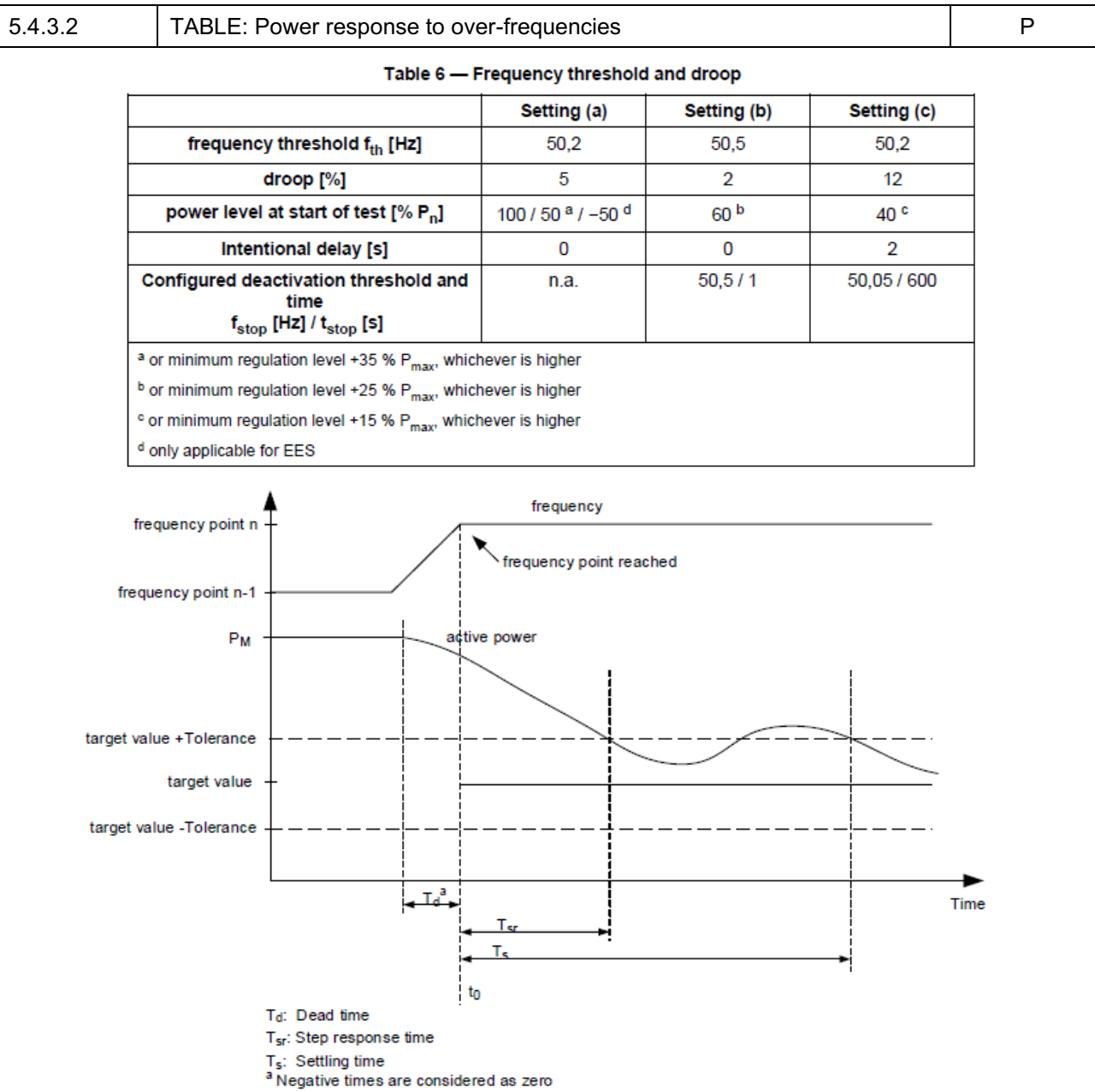




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systems with energy storage ($P_{ref} = P_{max}$)
all other non-synchronous generating technology ($P_{ref} = P_M$)

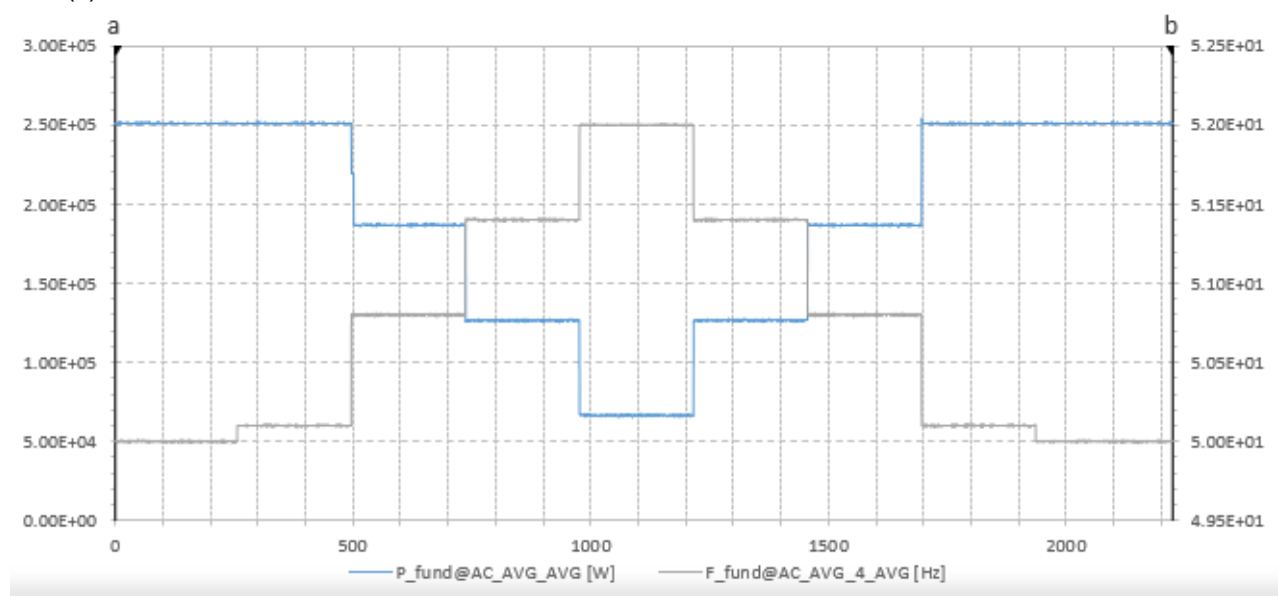
Systems with energy storage ($P_{ref} = P_{max}$)

All other non-synchronous generating technology ($P_{ref} = P_M$)

Results shall be reported in tables and graphs.

Parameter	Test No. 1 (For ESS)- Setting (a)-100%Pn							P
Test Conditions	Measurements					Target value	Δ	Limitation
f [Hz]	P/Pn	f [Hz]	Tsr [s]	Ts [s]	Td [s]	P/Pn	Δ P/Pn	Δ P/Pn
50.00	100.40%	50.00	--	--	--	100%	0.40%	$\pm 10\%$
50.10	100.39%	50.10	--	--	--	100%	0.39%	
50.80	74.70%	50.80	0.4	0.4	0.1	76%	-1.30%	
51.40	50.57%	51.40	0.4	0.4	0.1	52%	-1.43%	
52.00	26.62%	52.00	0.5	0.5	0.1	28%	-1.38%	
51.40	50.56%	51.40	0.5	0.5	0.1	52%	-1.44%	
50.80	74.68%	50.80	0.4	0.4	0.1	76%	-1.32%	
50.10	100.38%	50.10	--	--	0.0	100%	0.38%	
50.00	100.39%	50.00	--	--	--	100%	0.39%	

Note(s):



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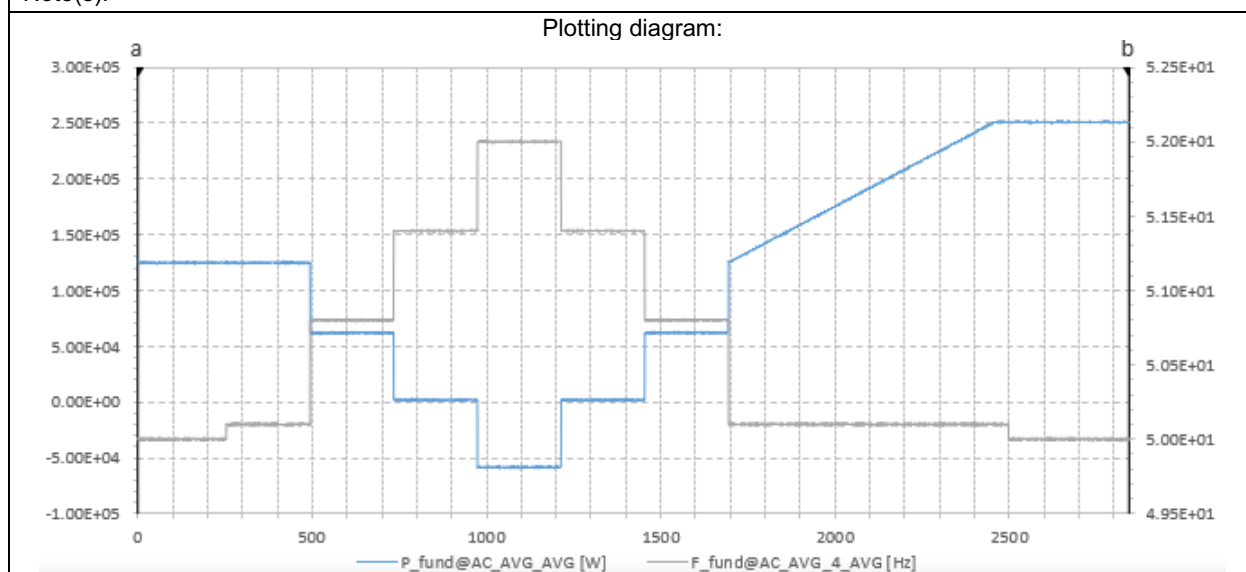
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Parameter		Test No. 2 (For EES)- Setting (a) (50%)Pn						P
Test Conditions		Measurements					Target	Limit
f [Hz]	P _{rim} [%]	P/Pn	f [Hz]	T _{rise} [s]	T _{set} [s]	T _d [s]	P/Pn [%]	ΔP [%]
50.00	50	49.93%	50.00	--	--	--	50%	±10%
50.10	50	49.92%	50.10	0.5	0.5	0.1	50%	
50.80	50	24.76%	50.80	0.5	0.5	0.1	26%	
51.40	50	0.68%	51.40	0.4	0.4	0.1	2%	
52.00	50	-23.41%	52.00	0.4	0.4	0.1	-22%	
51.40	50	0.69%	51.40	0.6	0.6	0.1	2%	
50.80	50- >100	24.78%	50.80	0.5	0.5	0.1	26%	
Test Conditions		Measurements				Target		Limit
f [Hz]	P _{rim} [%]	P/Pn [%]	f [Hz]	ΔP/Δt [%/min]	P/Pn		ΔP [%]	ΔP/Δt [%/min]
50.10	100	250924	50.10	9.07	100%		≤±10	≤10
50.00	100	250947	50.00	--	100%		≤±10	--

Note(s):



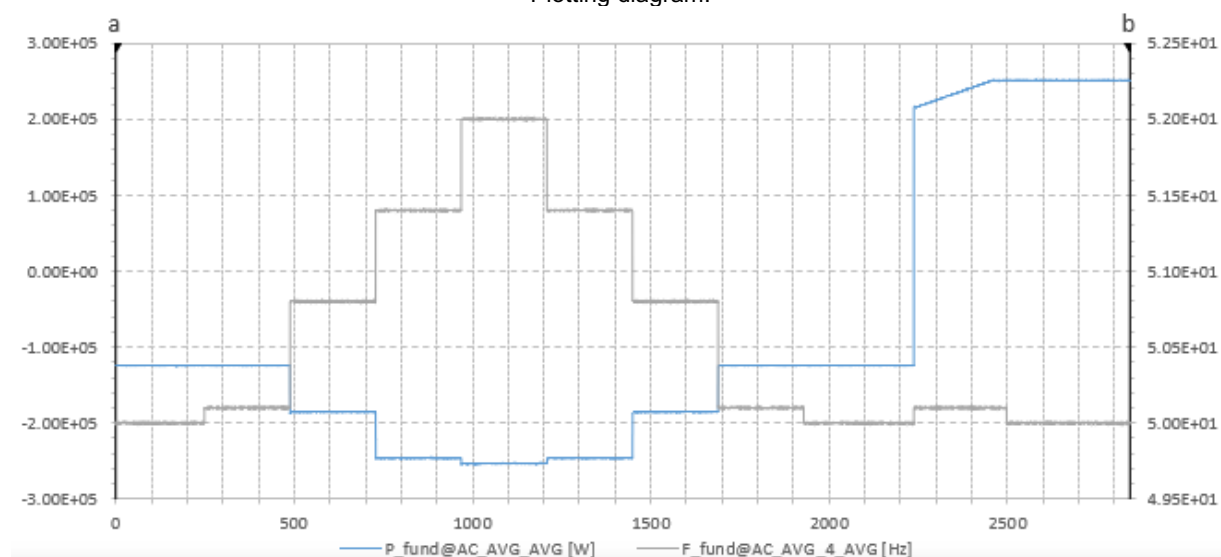
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Parameter	Test No. 3 (For EES)- Setting (a)-(-50%)Pn						P
Test Conditions	Measurements					Target	Limit
f [Hz]	P/Pn	f [Hz]	T _{rise} [s]	T _{set} [s]	T _d [s]	P/Pn [%]	ΔP [%]
50.00	-49.71%	50.00	--	--	--	-50%	±10%
50.10	-49.72%	50.10	0.8	0.8	0.2	-50%	
50.80	-74.19%	50.80	0.8	0.8	0.2	-74%	
51.40	-98.57%	51.40	0.9	0.9	0.2	-98%	
52.00	-101.33%	52.00	0.8	0.8	0.1	-100%	
51.40	-98.57%	51.40	1.0	1.0	0.1	-98%	
50.80	-74.20%	50.80	1.0	1.0	0.2	-74%	
50.10	-49.71%	50.10	--	--	--	-50%	
Test Conditions	Measurements					Target	Limit

Note(s):

Plotting diagram:

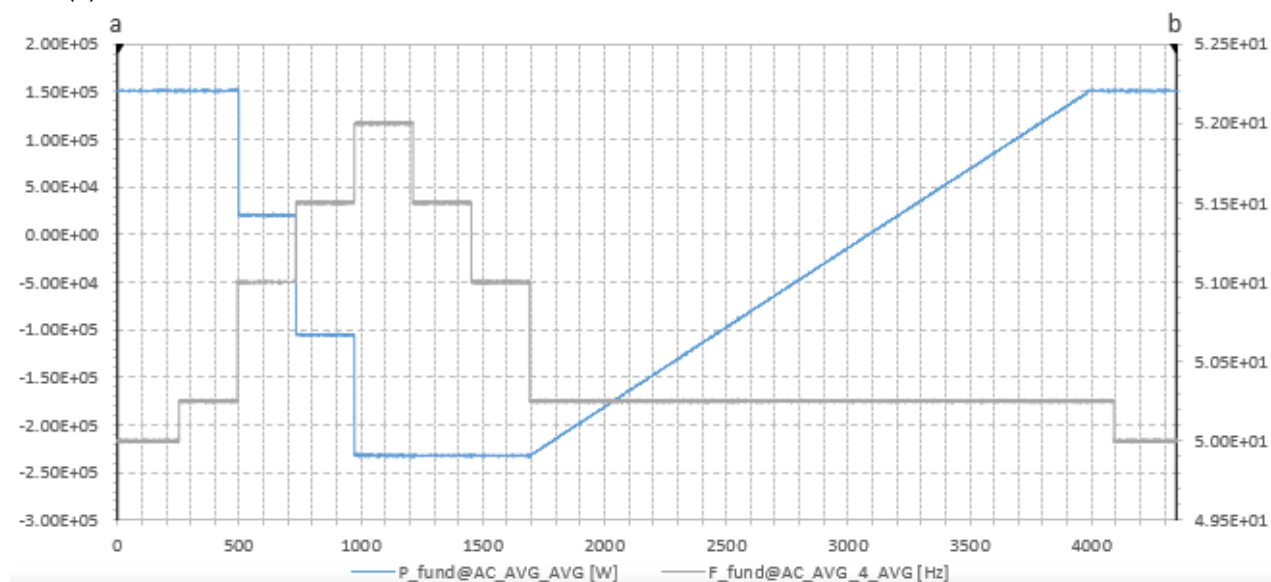


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Parameter	Test No. 4 (For EES)- Setting (b)-60Pn							P
Test Conditions	Measurements					Target value	Δ	Limitation
f [Hz]	P/Pn	f [Hz]	Tsr [s]	Ts [s]	Td [s]	P/Pn	Δ P/Pn	Δ P/Pn
50.00	60.33%	50.00	--	--	--	60%	0.33%	$\pm 10\%$
50.25	60.33%	50.25	0.9	0.9	0.1	60%	0.33%	
51.00	8.08%	51.00	0.8	0.8	0.1	10%	-1.92%	
51.50	-42.22%	51.50	0.8	0.8	0.2	-40%	-2.22%	
52.00	-92.84%	52.00	1.0	1.0	0.1	-90%	-2.84%	
51.50	-92.87%	51.50	0.8	0.8	0.1	-90%	-2.87%	
51.00	-92.85%	51.00	0.8	0.8	0.1	-90%	-2.85%	
50.25	60.33%	50.25	--	--	--	60%	0.33%	
50.00	60.33%	50.00	--	--	--	60%	0.33%	
Test Condition	Measurement				Limitation			
	Power Gradient [%Pn/min]		Delay Time [s]		Power Gradient [%Pn/min]		Delay Time [s]	
51.00-50.25	7.99		1.4		$\leq 10\%$		$\geq 1s$	

Note(s):

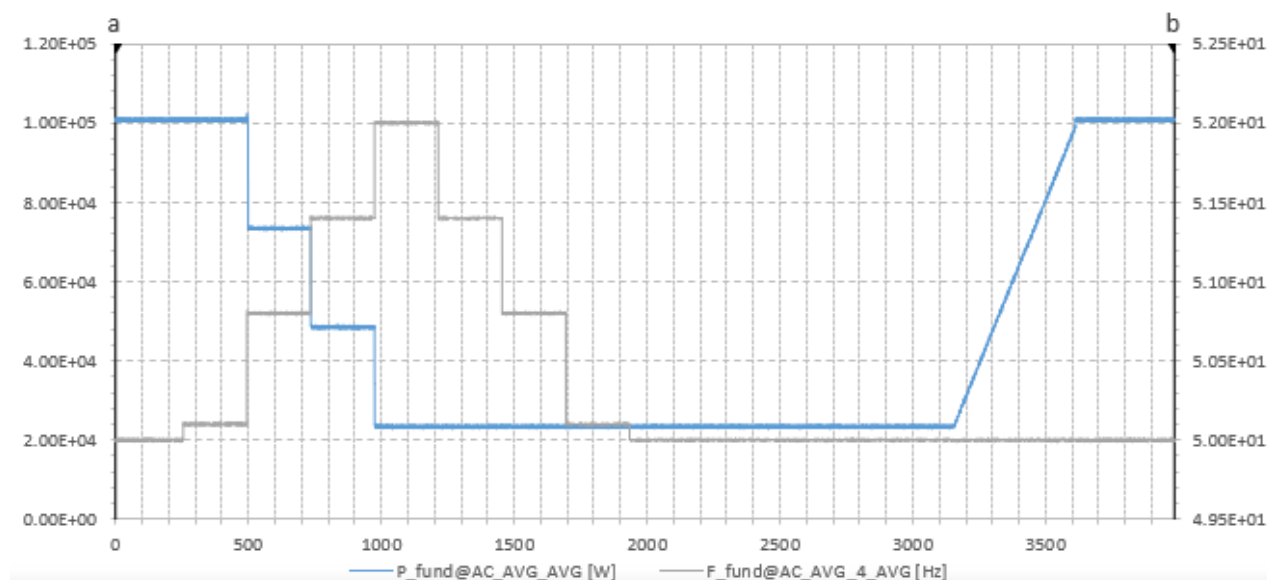


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Parameter	Test No. 5 (For EES)- Setting (c)-40Pn							P
Test Conditions	Measurements					Target value	Δ	Limitation
f [Hz]	P/Pn	f [Hz]	Tsr [s]	Ts [s]	Td [s]	P/Pn	Δ P/Pn	Δ P/Pn
50.00	40.32%	50.00	--	--	--	40%	0.32%	±10%
50.10	40.33%	50.10	0.4	0.4	0.1	40%	0.33%	
50.80	29.36%	50.80	0.4	0.4	0.1	30%	-0.64%	
51.40	19.38%	51.40	0.5	0.5	0.1	20%	-0.62%	
52.00	9.36%	52.00	0.5	0.5	0.1	10%	-0.64%	
51.40	9.36%	51.40	--	--	--	10%	-0.64%	
50.80	9.37%	50.80	--	--	--	10%	-0.63%	
50.10	9.38%	50.10	--	--	--	10%	-0.62%	
50.00	40.32%	50.00	--	--	--	40%	0.32%	
Test Condition	Measurement				Limitation			
	Power Gradient [%Pn/min]		Delay Time [s]		Power Gradient [%Pn/min]		Delay Time [s]	
50.10-50.00	7.95		613		≤ 10%		≥ 600s	

Note(s):



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5.4.3.3

TABLE: Power response to under-frequency

P

Table 9 — Frequency threshold and droop

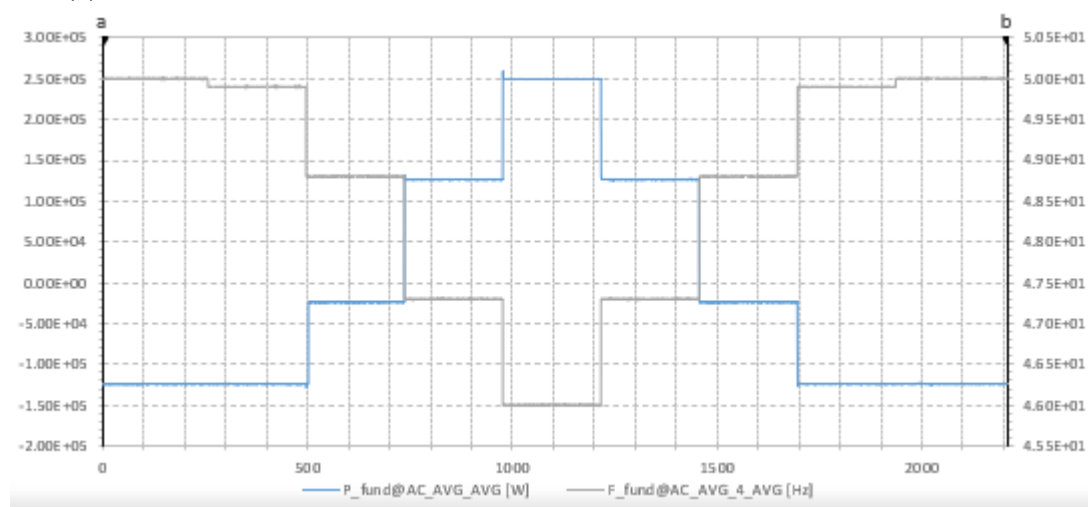
	Setting (a)	Setting (b)	Setting (c)
threshold frequency f_{th} [Hz]	49,8	49,5	49,8
droop [%]	5	2	12
power level at start of test [% P_n]	-50 / 0 ^a	0 ^a	5 0 ^a
Intentional delay [s]	0	0	2
configured deactivation threshold	No	No	No
P_{ref}	P_{max}	P_{max}	P_{max}
^a or minimum regulating level, whichever is higher			

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Parameter	Test No. 1 (For EES)- Setting (a)-(-50%)P_n							P
Test Conditions	Measurements					Target value	Δ	Limitation
f [Hz]	P/P _n	f [Hz]	Trise [s]	Tsettling [s]	Tv [s]	P/P _n	Δ P/P _n	Δ P/P _n
50.00	-49.72%	50.00	--	--	--	-50%	0.28%	±10%
49.90	-49.72%	49.90	--	--	--	-50%	0.28%	
48.80	-9.61%	48.80	0.5	0.5	0.1	-10%	0.39%	
47.30	50.48%	47.30	0.5	0.5	0.1	50%	0.48%	
46.00	99.81%	46.00	0.5	0.5	0.1	100%	-0.19%	
47.30	50.47%	47.30	0.5	0.5	0.1	50%	0.47%	
48.80	-9.62%	48.80	0.6	0.6	0.2	-10%	0.38%	
49.90	-49.71%	49.90	--	--	--	-50%	0.29%	
50.00	-49.71%	50.00	--	--	--	-50%	0.29%	

Note(s):



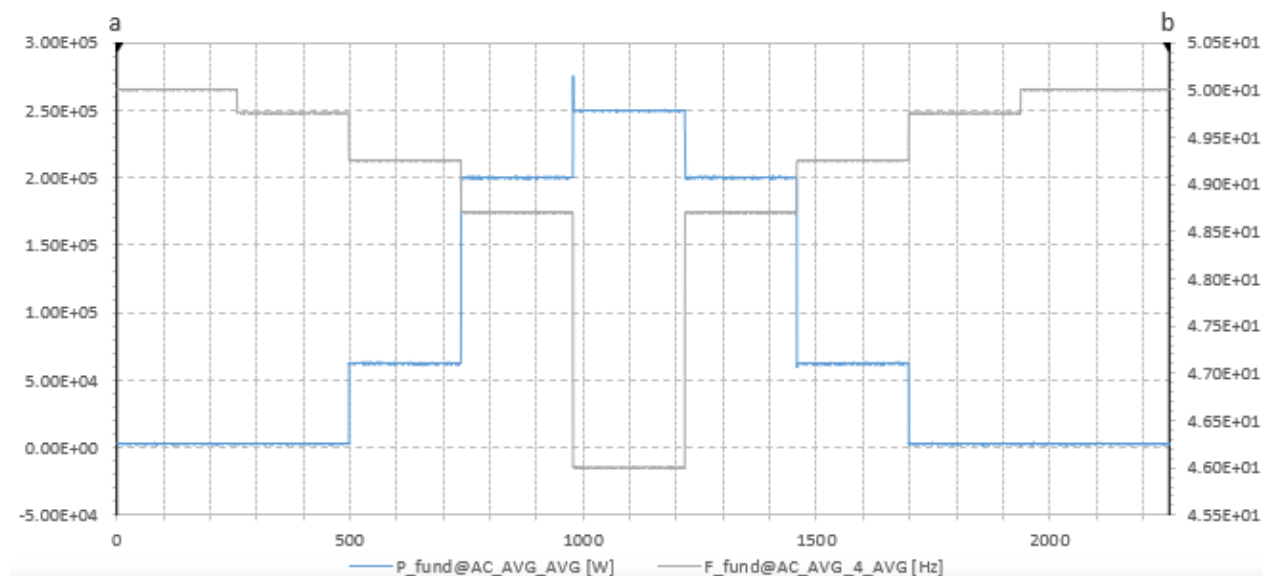
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Parameter	Test No. 2 (For EES)- Setting (b)-0%Pn							P
Test Conditions	Measurements					Target value	Δ	Limitation
f [Hz]	P/Pn	f [Hz]	Trise [s]	Tsettling [s]	Tv [s]	P/Pn	Δ P/Pn	Δ P/Pn
50.00	1.04%	50.00	--	--	--	0%	1.04%	$\pm 10\%$
49.75	1.04%	49.75	--	--	--	0%	1.04%	
49.25	24.94%	49.25	0.6	0.6	0.1	25%	-0.06%	
48.70	79.94%	48.70	0.4	0.4	0.1	80%	-0.06%	
46.00	99.80%	46.00	0.4	0.4	0.1	100%	-0.20%	
48.70	79.93%	48.70	0.5	0.5	0.1	80%	-0.07%	
49.25	24.87%	49.25	0.5	0.5	0.1	25%	-0.13%	
49.75	1.01%	49.75	--	--	0.1	0%	1.01%	
50.00	1.01%	50.00		--	--	0%	1.01%	

Note(s):

P(f) curve setting for test: f1: 49.5Hz; fstop: 49.5Hz (Deactivated); Droop: 2% (100%Pref / Hz)

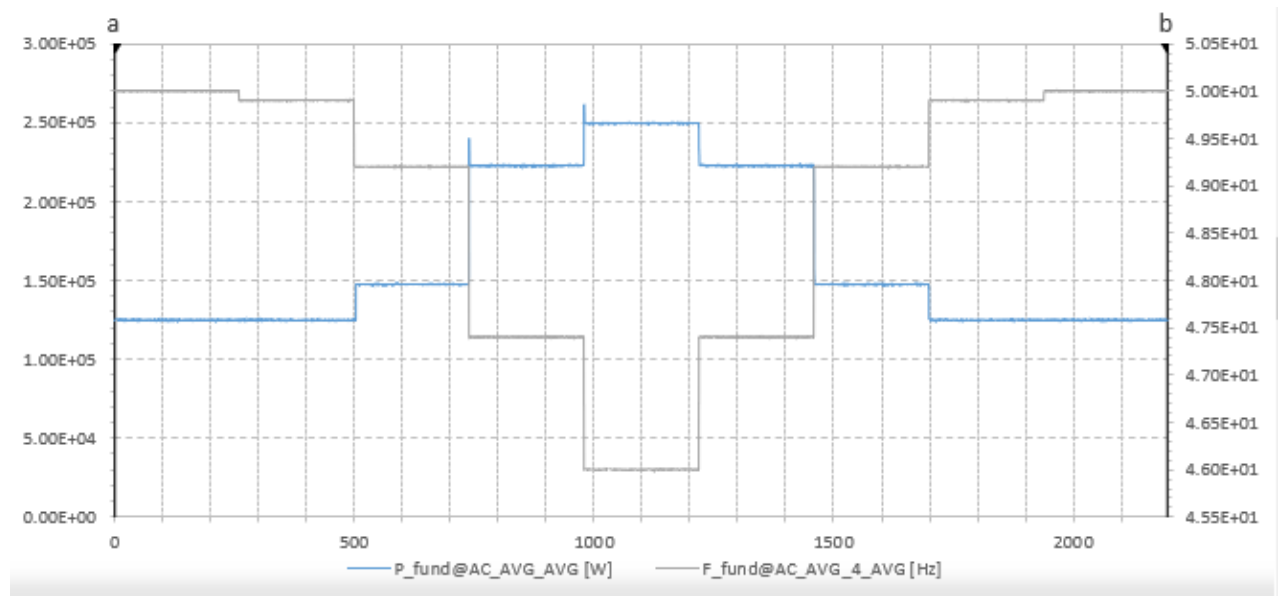


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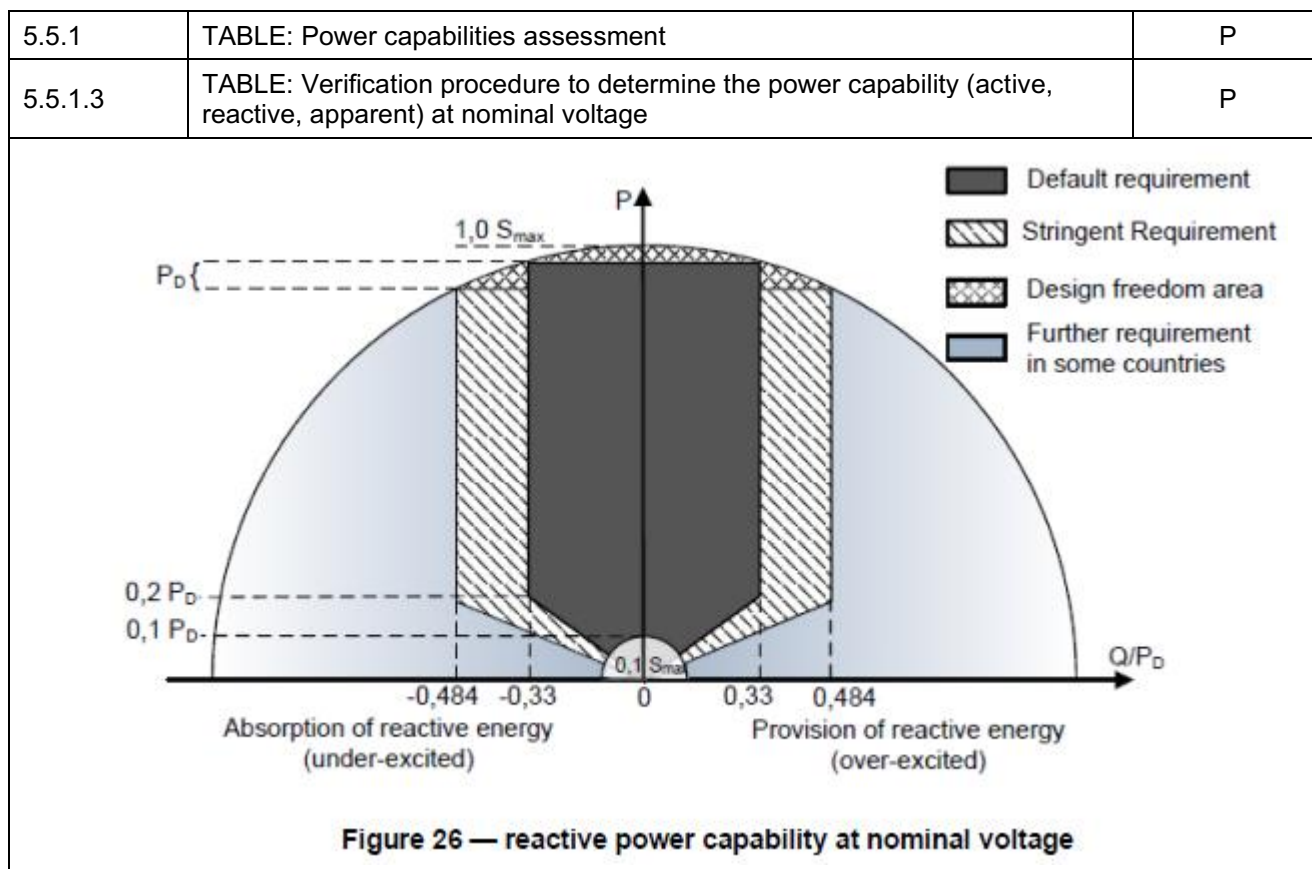
Parameter	Test No. 3 (For EES)- Setting (c)-50%Pn							P
Test Conditions	Measurements					Target value	Δ	Limitation
f [Hz]	P/Pn	f [Hz]	Trise [s]	Tsettling [s]	Tv [s]	P/Pn	Δ P/Pn	Δ P/Pn
50.00	49.92%	50.00	--	--	--	50%	-0.08%	$\pm 10\%$
49.90	49.92%	49.90	--	--	--	50%	-0.08%	
49.20	58.97%	49.20	0.9	0.9	0.1	60%	-1.03%	
47.40	89.04%	47.40	0.9	0.9	0.1	90%	-0.96%	
46.00	99.80%	46.00	0.8	0.8	0.1	100%	-0.20%	
47.40	89.05%	47.40	0.8	0.8	0.1	90%	-0.95%	
49.20	58.97%	49.20	0.8	0.8	0.1	60%	-1.03%	
49.90	49.92%	49.90	--	--	0.1	50%	-0.08%	
50.00	49.92%	50.00	--	--	--	50%	-0.08%	

Note(s):



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Test Conditions		Measurements				Limit
P/Pn [%]	Q/Pn [%]	P/Pn	Q/Pn	cos(φ)	U/Un	Q/Pn
0%	0	2.14%	-0.15%	0.906	99.97%	--
10%		10.03%	-0.21%	0.996	100.01%	≤ ±2%
20%		20.08%	-0.28%	0.999	99.64%	
30%		30.15%	-0.35%	1.000	99.69%	
40%		40.17%	-0.41%	1.000	99.74%	
50%		50.10%	-0.46%	1.000	99.79%	
60%		60.10%	-0.53%	1.000	99.85%	
70%		70.11%	-0.62%	1.000	99.91%	
80%		80.13%	-0.73%	1.000	99.96%	
90%		90.15%	-0.85%	1.000	100.02%	
100%		99.76%	-0.97%	1.000	100.07%	
0%	max. under-excited	-0.44%	-100.35%	-0.004	99.62%	--
10%		10.03%	-100.39%	0.099	99.68%	≤ -22.2%

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20%		20.07%	-100.44%	0.196	99.74%	$\leq -41.6\%$
30%		30.10%	-100.49%	0.287	99.79%	
40%		40.12%	-100.55%	0.371	99.85%	
50%		43.57%	-100.58%	0.397	99.87%	
60%		43.57%	-100.58%	0.397	99.87%	
70%		43.56%	-100.58%	0.397	99.87%	
80%		43.55%	-100.58%	0.397	99.87%	
90%		43.55%	-100.58%	0.397	99.87%	
Smax		43.56%	-100.58%	0.397	99.87%	
0%	max. over-excited	0.06%	99.98%	0.001	100.30%	--
10%		10.12%	99.95%	0.101	100.36%	$\geq +22.2\%$
20%		20.17%	99.91%	0.198	100.41%	$\geq +41.6\%$
30%		30.18%	99.85%	0.289	100.46%	
40%		40.22%	99.80%	0.374	100.52%	
50%		45.51%	99.76%	0.415	100.55%	
60%		45.52%	99.77%	0.415	100.55%	
70%		45.52%	99.76%	0.415	100.55%	
80%		45.51%	99.80%	0.415	100.55%	
90%		45.51%	99.80%	0.415	100.55%	
Smax		45.53%	99.79%	0.415	100.55%	

5.5.1.6

TABLE: Verification procedure for reactive power capability considering voltage range

P

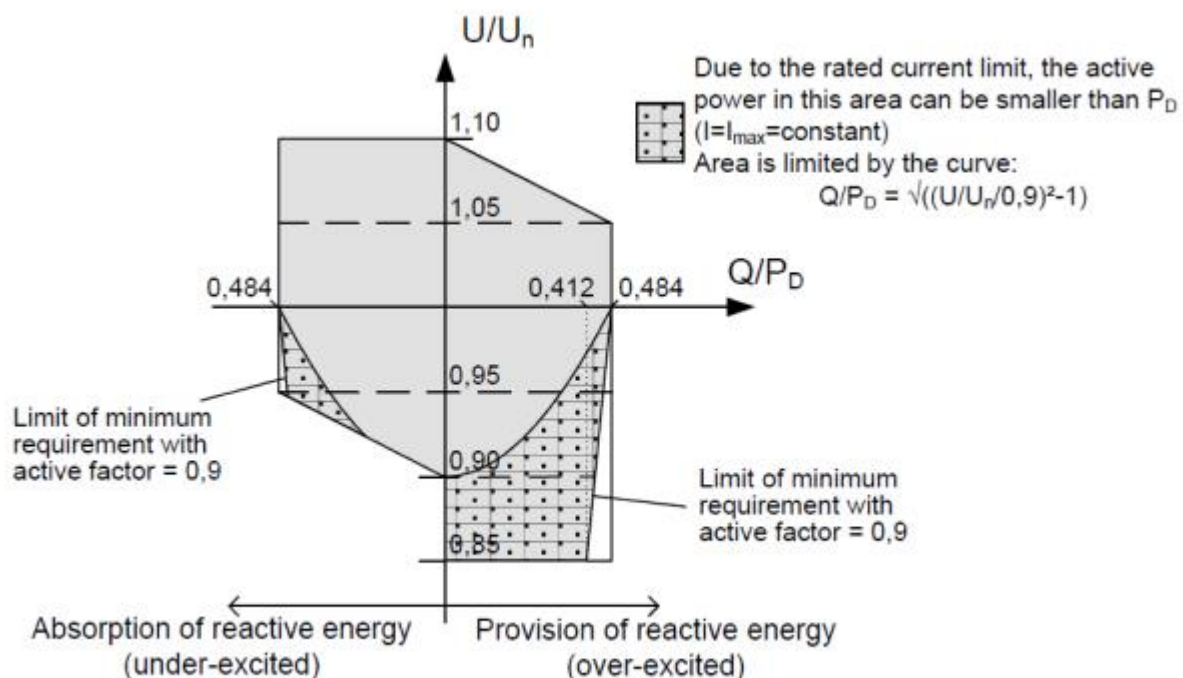


Figure 30 — Example: U-Q normalized diagram taken from the EN 50549-1

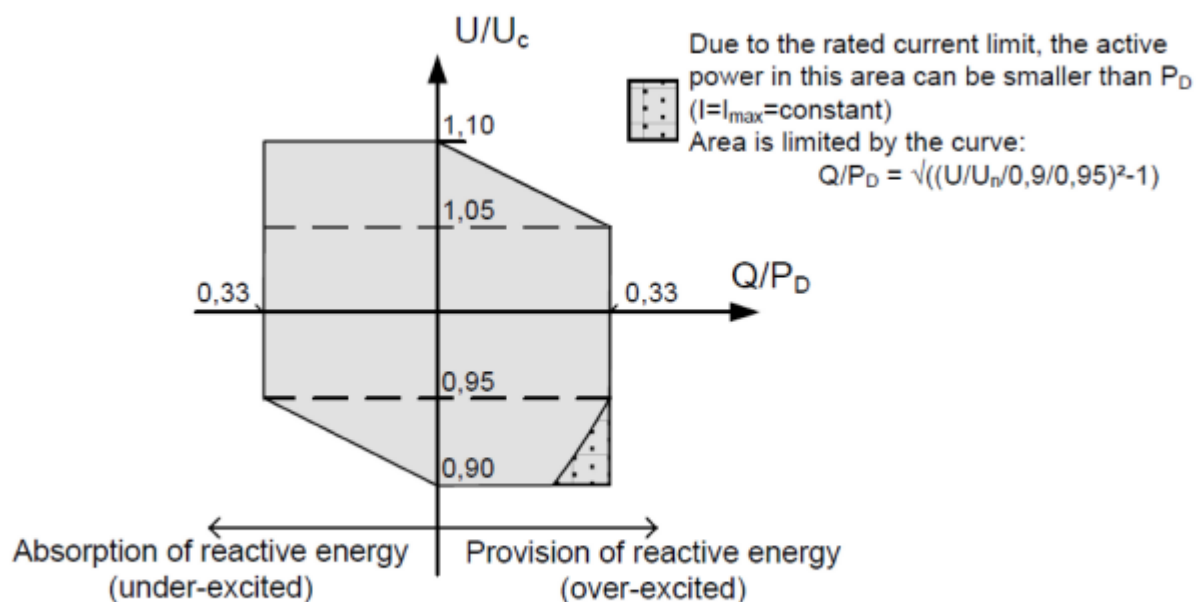


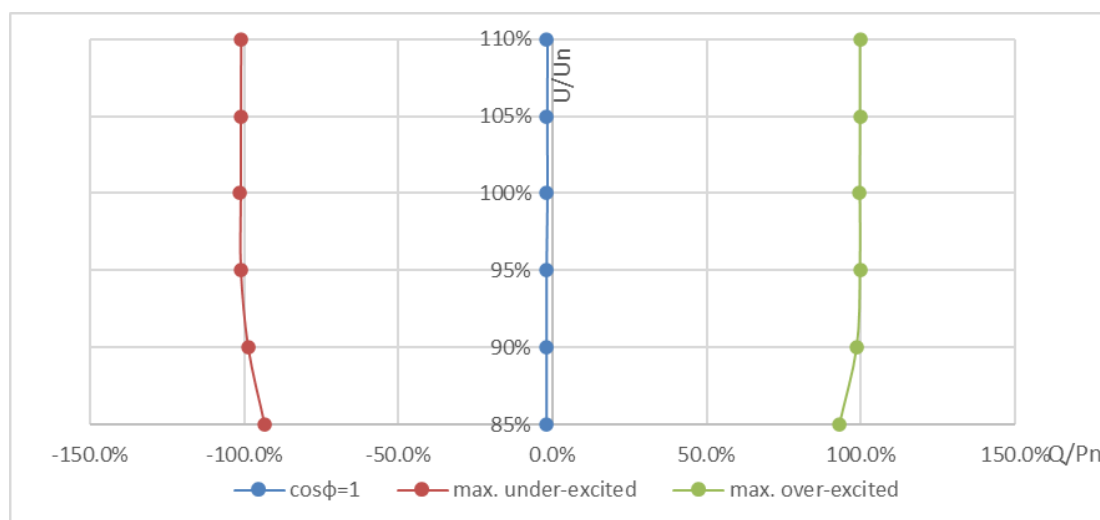
Figure 31 — Example of U-Q normalized diagram taken from the EN 50549-2

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Test Conditions		Measurements					Target value	Δ	Δ Limit
U/Un	Q/Pn [%]	P/Pn	Q/Pn	S/Sn	I/In	U/Un	Q/Pn	Δ Q/Pn	Δ Q/Pn
85%	0	93.22%	-1.94%	93.24%	109.99%	85.13%	--	--	--
90%		93.22%	-1.94%	93.24%	109.99%	85.13%	--	--	
95%		100.39%	-1.94%	100.41%	106.03%	95.08%	--	--	
100%		100.01%	-1.81%	100.03%	100.37%	100.06%	--	--	
105%		100.43%	-1.83%	100.44%	95.99%	105.04%	--	--	
110%		100.36%	-1.81%	100.38%	91.61%	109.99%	--	--	
85%	max. under-excited	-0.95%	-93.42%	93.43%	110.33%	85.02%	--	--	--
90%		-1.00%	-98.91%	98.92%	110.33%	90.02%	--	--	
95%		24.63%	-101.33%	104.28%	110.23%	94.97%	-41.4%	-59.93%	$\leq 2\%$
100%		42.89%	-101.37%	110.07%	110.16%	100.30%	-43.6%	-57.77%	
105%		44.98%	-101.33%	110.86%	105.88%	105.10%	-43.6%	-57.73%	
110%		45.00%	-101.27%	110.82%	101.03%	110.10%	-43.6%	-57.67%	
85%	max. over-excited	-0.50%	93.21%	93.22%	110.26%	84.89%	37.1%	56.11%	$\geq -2\%$
90%		-0.53%	98.70%	98.70%	110.25%	89.89%	39.2%	59.50%	
95%		30.27%	99.79%	104.28%	110.16%	95.06%	41.4%	58.39%	
100%		45.52%	99.74%	109.63%	109.96%	100.12%	43.6%	56.14%	
105%		45.54%	99.77%	109.67%	104.80%	105.09%	43.6%	56.17%	
110%		45.55%	99.80%	109.71%	100.10%	110.07%	--	--	--

Diagram:



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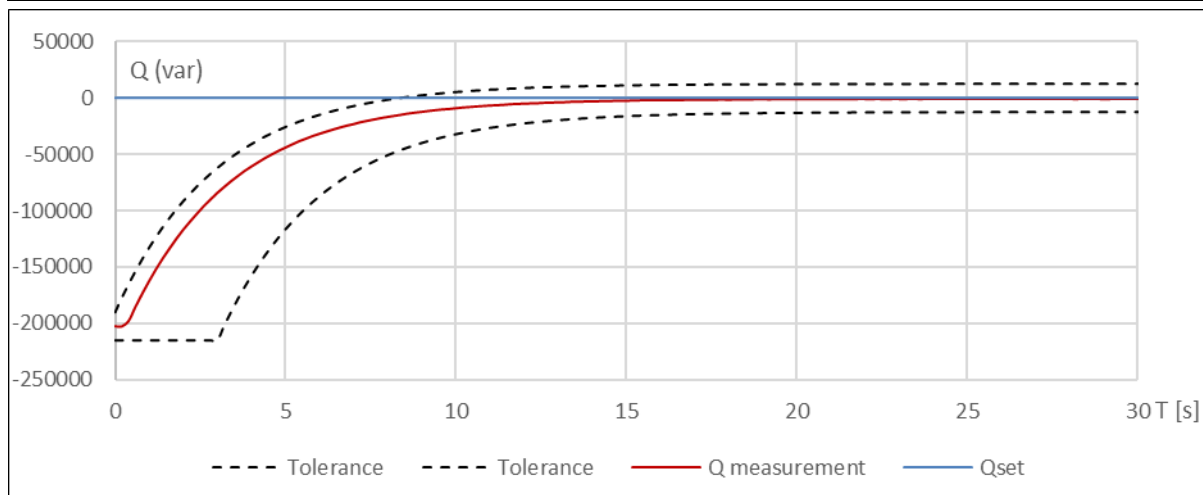
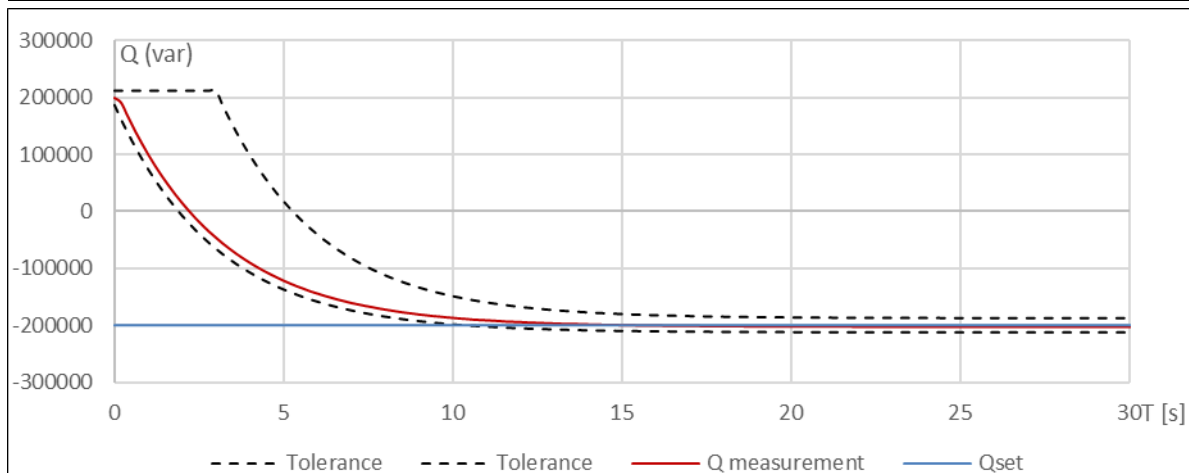
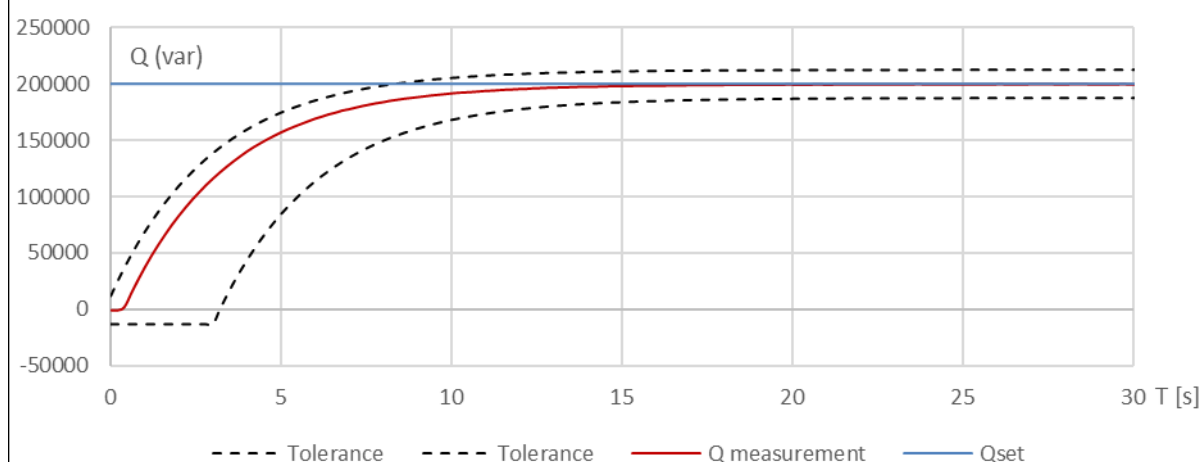
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5.5.2	TABLE: Voltage support by reactive power- test to determine the reactive power control modes				P
5.5.2.3	TABLE: Verification procedure for Set point control				
Test no.1: Test for reactive power set point control accuracy					
P=50%P _n					
Reactive power step Q/P _n (pu)	Voltage	Set point Value	Measured Value	Deviation	Δ Limit
	p.u.	Q/P _n p.u.	Q/P _n p.u.	Q/P _n p.u.	±2%S _{max}
Q=0	230.5	0	906	0.36%	
Q _{max,oe}	231.3	100%	246815	-1.27%	
Q _{max,ue}	229.7	-100%	-247924	0.83%	

Test no.2: Test for dynamic response			P
Tau= shortest time constant (not longer than 3s) 3s			
Reactive power set point step p.u.	Generating unit response time setting	Measured response behaviour	
		dead time	response time / settling time
Q=0 → 80%Q _{max,oe}	9s	0.4	9.6
80%Q _{max,oe} → 80%Q _{max,ue}	9s	0.2	9.4
80%Q _{max,ue} → Q=0	9s	0.4	9.0
Tau= longest time (if longest time>60s, then test 60s) 60s			
Reactive power set point step p.u.	Generating unit response time setting	Measured response behaviour	
		dead time	response time / settling time
Q=0 → 80%Q _{max,oe}	180s	0.0	178.6
80%Q _{max,oe} → 80%Q _{max,ue}	180s	0.0	179.0
80%Q _{max,ue} → Q=0	180s	0.0	179.8
Diagram: Tau= 3s			

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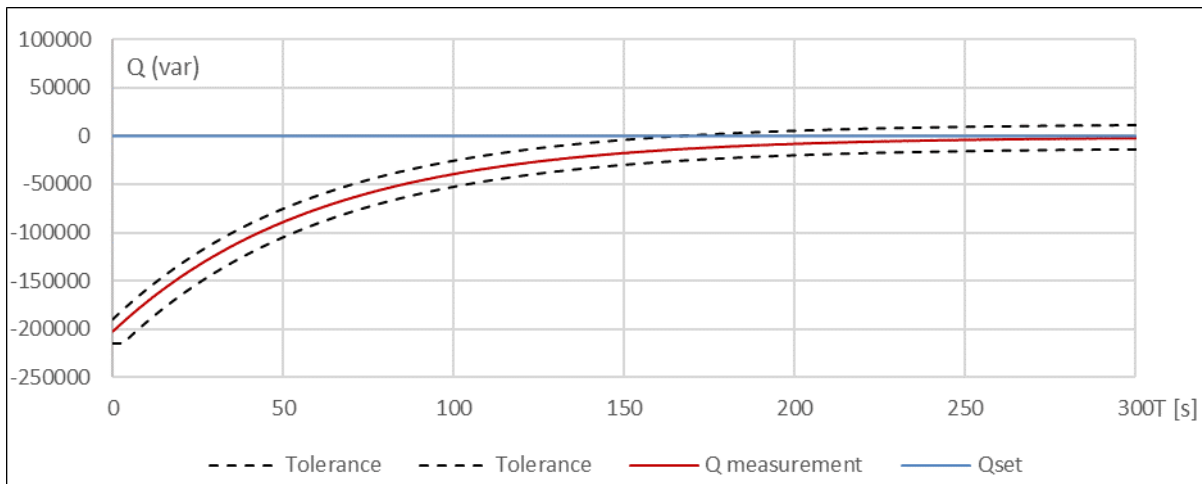
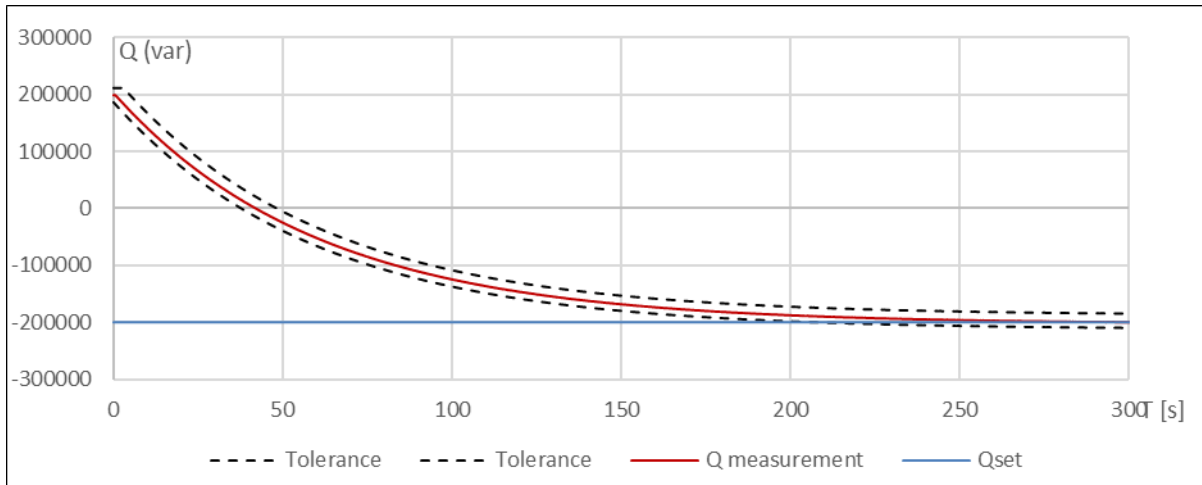
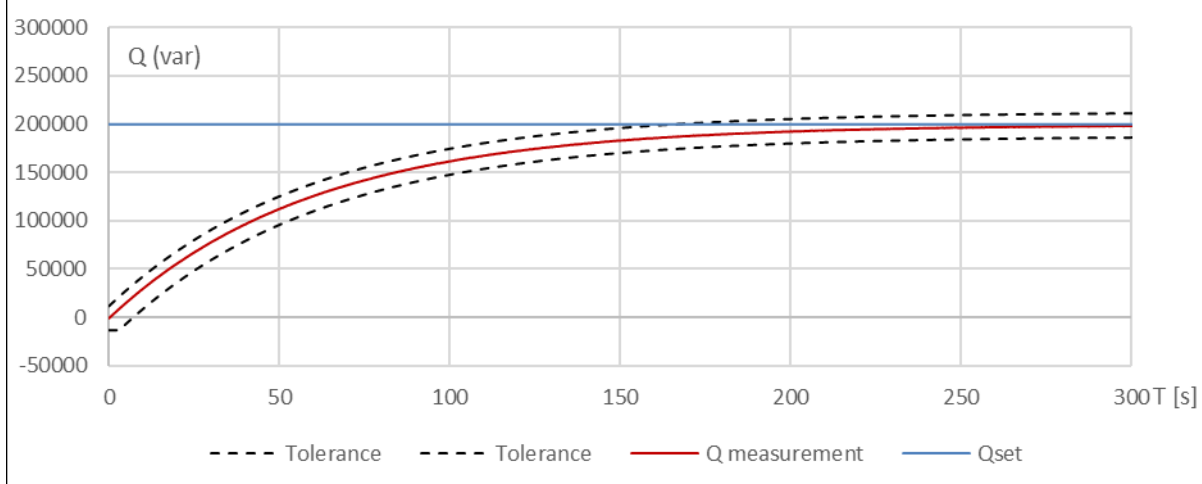
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Tau= 60s

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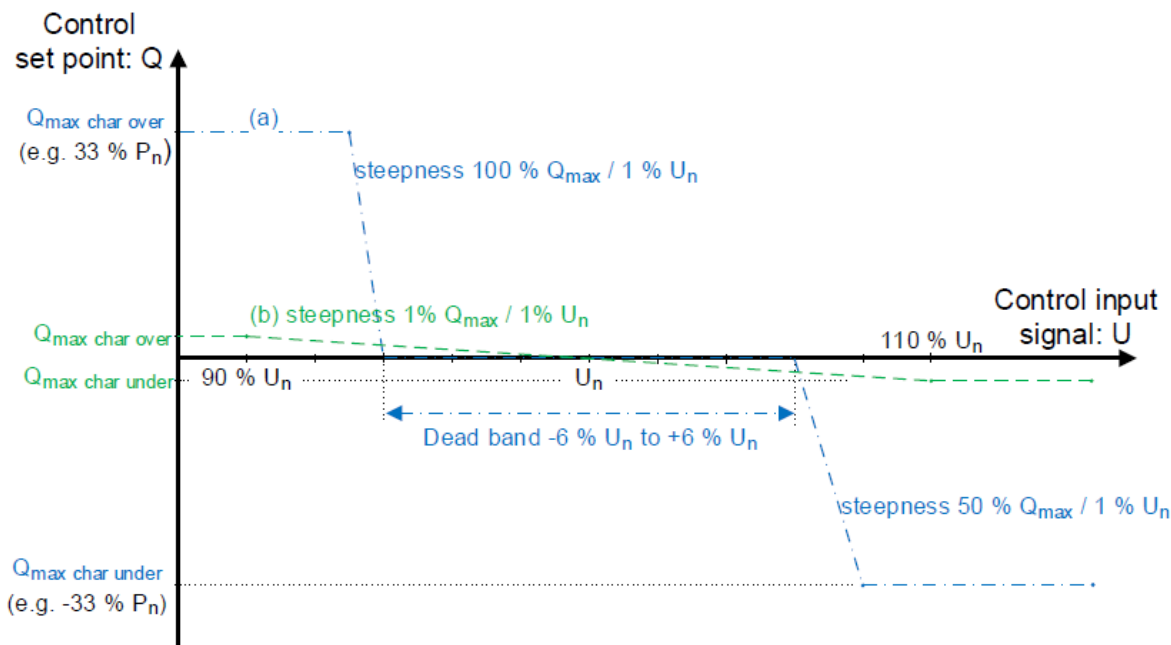
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5.5.2.4

TABLE: Verification procedure for voltage related control mode for reactive power $Q(U)$

P

Figure 33 — $Q(U)$ example characteristics for setting (a) and (b) for the testTable 17 — $Q(U)$ characteristic configuration

parameter of characteristic	Setting (a)	Setting (b)
dead band (horizontal section of the characteristic curve around U_n) db_{char}	as wide as possible but extending not more than from $-6\% U_n$ to $+6\% U_n$.	0
minimum and maximum reactive power of the characteristic $Q_{max char}^a$	$\geq 95\%$ of $Q_{max over}$ and $Q_{max under}$ respectively ^b	10 % of $Q_{max over}$ and $Q_{max under}$ respectively
Slope of the steepest section of the characteristic curve ^a	as steep as configurable, ^c	as flat as configurable ^d

^a If an unsymmetrical configuration is possible, this shall be apparent in the chosen configuration by using different steepness and different values for maximum reactive power $Q_{max char}$ for over voltage and under voltage.

^b if Q_{max} , based on the capability curve of the EUT, is above $60\% P_n$, $Q_{max char}$ shall not exceed $60\% P_n$.

^c if the maximum configurable steepness exceeds $100\% Q_{max} / 1\% U_n$ the configured value during the test shall not exceed $100\% Q_{max} / 1\% U_n$.

^d if the minimum configurable steepness is below $1\% Q_{max} / 1\% U_n$ the configured value during the test shall not be below $1\% Q_{max} / 1\% U_n$.

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Table 18 — Q(U) additional parameter configuration

parameter	Setting (a)	Setting (b)
Time constant	as fast as possible but not slower as 3 s	as slow as possible but not slower as 20 s
Min cos φ	0,4	deactivated
Lock-in power	deactivated	20 %P _n ^a
Lock-out power	deactivated	5 %P _n ^b
^a or minimum regulation level +20 % P _n , whichever is higher.		
^b or minimum regulation level +5 % P _n , whichever is higher		

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5.5.2.4.2 TABLE: Test procedure for steady-state behaviour

Test procedure for accuracy-**Setting (a)**

Q(U) curve settings:		Set points		X1		X2		X3		X4	
		U/Un		93%		94%		106%		108%	
		Q/Qmax		100%		0		0		-100%	
Test Conditions		Measurements				Target value	Δ	Δ Limits			
U/Un	P/Pn	Q/Pn	U/Un	Cosφ	Q/Pn*	ΔQ/ Smax	ΔQ/ Smax			Cosφ	
100%	100%	-0.47%	100.5%	1.000	0	0.47%	≤ ±2 Smax%		≥0.4		
103%	100%	-0.29%	103.5%	1.000	0	0.29%					
105%	100%	-0.17%	105.5%	1.000	0	0.17%					
107%	100%	-29.74%	107.5%	0.959	-30%	0.26%					
108%	100%	-59.87%	108.7%	0.839	-60%	0.13%					
111%	100%	-60.23%	111.2%	0.837	-60%	0.23%					
114%	100%	-60.03%	114.2%	0.838	-60%	0.03%					
115%	100%	-59.95%	115.2%	0.838	-60%	0.05%					
114%	100%	-60.02%	114.2%	0.838	-60%	0.02%					
111%	100%	-60.23%	111.2%	0.837	-60%	0.23%					
108%	100%	-59.94%	108.7%	0.839	-60%	0.06%					
107%	100%	-29.75%	107.5%	0.959	-30%	0.25%					
105%	100%	-0.18%	105.5%	1.000	0	0.18%					
103%	100%	-0.30%	103.5%	1.000	0	0.30%					
100%	100%	-0.48%	100.5%	1.000	0	0.48%					
97%	100%	-0.65%	97.5%	1.000	0	0.65%					
94%	100%	-0.82%	94.5%	1.000	0	0.82%					
93%	100%	59.54%	92.9%	0.812	60%	0.46%					
90%	100%	59.47%	90.7%	0.802	60%	0.53%					
87%	100%	59.37%	87.7%	0.787	60%	0.63%					
85%	100%	59.32%	85.7%	0.775	60%	0.68%					
87%	100%	59.37%	87.7%	0.787	60%	0.63%					
90%	100%	59.46%	90.7%	0.802	60%	0.54%					
93%	100%	59.53%	92.9%	0.812	60%	0.47%					
94%	100%	-0.83%	94.5%	1.000	0	0.83%					

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97%	100%	-0.66%	97.5%	1.000	0	0.66%
100%	100%	-0.49%	100.5%	1.000	0	0.49%
100%	20%	0.18%	100.07%	1.000	0	0.18%
103%	20%	0.32%	103.06%	1.000	0	0.32%
105%	20%	0.43%	105.06%	1.000	0	0.43%
107%	20%	-29.28%	107.79%	0.571	-30%	0.72%
108%	20%	-47.02%	108.98%	0.396	-60%	12.98%*
111%	20%	-46.91%	110.92%	0.397	-60%	13.09%*
114%	20%	-46.75%	113.92%	0.398	-60%	13.25%*
115%	20%	-46.70%	114.92%	0.399	-60%	13.30%*
114%	20%	-46.75%	113.92%	0.398	-60%	13.25%*
111%	20%	-46.92%	110.92%	0.397	-60%	13.08%*
108%	20%	-47.01%	108.98%	0.396	-60%	12.99%*
107%	20%	-29.20%	107.79%	0.572	-30%	0.80%
105%	20%	0.42%	105.06%	1.000	0	0.42%
103%	20%	0.32%	103.06%	1.000	0	0.32%
100%	20%	0.18%	100.07%	1.000	0	0.18%
97%	20%	0.05%	97.07%	1.000	0	0.05%
94%	20%	0.68%	94.64%	0.999	0	0.68%
93%	20%	37.12%	92.38%	0.485	60%	22.88%*
90%	20%	37.03%	90.21%	0.486	60%	22.97%*
87%	20%	36.90%	87.22%	0.488	60%	23.10%*
85%	20%	36.82%	85.23%	0.488	60%	23.18%*
87%	20%	36.91%	87.22%	0.487	60%	23.09%*
90%	20%	37.03%	90.21%	0.486	60%	22.97%*
93%	20%	37.12%	92.38%	0.485	60%	22.88%*
94%	20%	0.64%	94.64%	0.999	0	0.64%
97%	20%	0.06%	97.07%	1.000	0	0.06%
100%	20%	0.18%	100.07%	1.000	0	0.18%

Note(s):

Time constant: as fast as possible but not slower as 3 s.

Min cos φ : 0.4,

P lock-in: deactivated; P lock-out: deactivated.

*: The accuracy exceeding 2% Smax is due to prioritizing the requirement of Min cos φ : 0.4.

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Test procedure for accuracy- Setting (b)						
Q(U) curve settings:	Set points	X1		X2		X3
	U/Un	90%		100%		110%
	Q/Qmax	10%		0%		-10%
Test Conditions		Measurements		Target value	Δ	Δ Limits
U/Un	P/Pn	Q/Pn	U/Un	Q/Pn*	$\Delta Q/ S_{max}$	$\Delta Q/ S_{max}$
100%	100%	-0.63%	100.50%	0.00%	-0.63%	$\leq \pm 2 S_{max}\%A$
103%	100%	-2.24%	103.48%	-1.80%	-0.44%	
106%	100%	-3.85%	106.46%	-3.60%	-0.25%	
109%	100%	-5.44%	109.45%	-5.40%	-0.04%	
112%	100%	-5.83%	112.43%	-6.00%	0.17%	
115%	100%	-5.83%	115.42%	-6.00%	0.17%	
112%	100%	-5.84%	112.43%	-6.00%	0.16%	
109%	100%	-5.45%	109.45%	-5.40%	-0.05%	
106%	100%	-3.85%	106.47%	-3.60%	-0.25%	
103%	100%	-2.26%	103.49%	-1.80%	-0.46%	
100%	100%	-0.67%	100.51%	0.00%	-0.67%	
97%	100%	1.17%	97.07%	1.80%	-0.63%	
94%	100%	2.79%	94.05%	3.60%	-0.81%	
91%	100%	4.43%	91.03%	5.40%	-0.97%	
88%	100%	4.83%	87.99%	6.00%	-1.17%	
85%	100%	4.73%	84.95%	6.00%	-1.27%	
88%	100%	4.82%	87.78%	6.00%	-1.18%	
91%	100%	4.41%	91.04%	5.40%	-0.99%	
94%	100%	2.79%	94.06%	3.60%	-0.81%	
97%	100%	1.16%	97.08%	1.80%	-0.64%	
100%	100%	-0.71%	100.53%	0.00%	-0.71%	
100%	20%	0.51%	100.07%	0.00%	0.51%	
103%	20%	-1.13%	103.06%	-1.80%	0.67%	
106%	20%	-2.82%	106.14%	-3.60%	0.78%	
109%	20%	-4.41%	109.04%	-5.40%	0.99%	
112%	20%	-5.24%	112.04%	-6.00%	0.76%	

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115%	20%	-5.07%	115.03%	-6.00%	0.93%
112%	20%	-5.24%	112.03%	-6.00%	0.76%
109%	20%	-4.41%	109.04%	-5.40%	0.99%
106%	20%	-2.82%	106.14%	-3.60%	0.78%
103%	20%	-1.13%	103.06%	-1.80%	0.67%
100%	20%	0.52%	100.07%	0.00%	0.52%
97%	20%	2.17%	97.08%	1.80%	0.37%
94%	20%	3.82%	94.09%	3.60%	0.22%
91%	20%	5.49%	91.10%	5.40%	0.09%
88%	20%	5.83%	88.11%	6.00%	-0.17%
85%	20%	5.61%	85.12%	6.00%	-0.39%
88%	20%	5.71%	88.11%	6.00%	-0.29%
91%	20%	5.48%	91.10%	5.40%	0.08%
94%	20%	3.82%	94.09%	3.60%	0.22%
97%	20%	2.17%	97.08%	1.80%	0.37%
100%	20%	0.51%	100.07%	0.00%	0.51%

Note(s):

Time constant: as slow as possible but not slower as 20 s.

P lock-in: 20%Pn; P lock-out: 5%Pn.

5.5.2.4.3 TABLE: Test procedure for dynamic behaviour

P

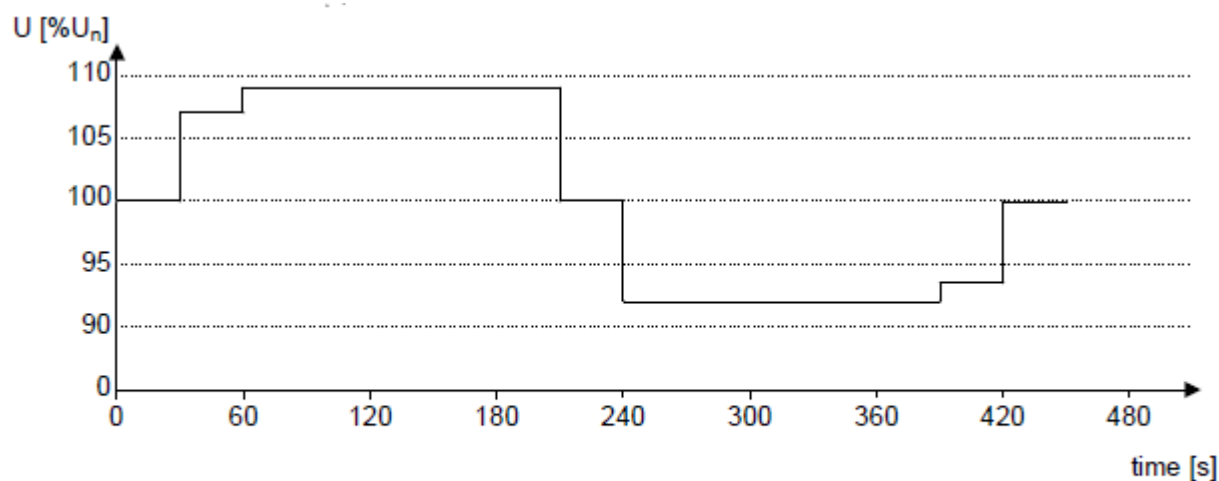


Figure 34 — Example voltage profile for setting (a) applied for the test of the dynamic behaviour of the $Q(U)$, assuming < 30 s for stabilization of P and Q

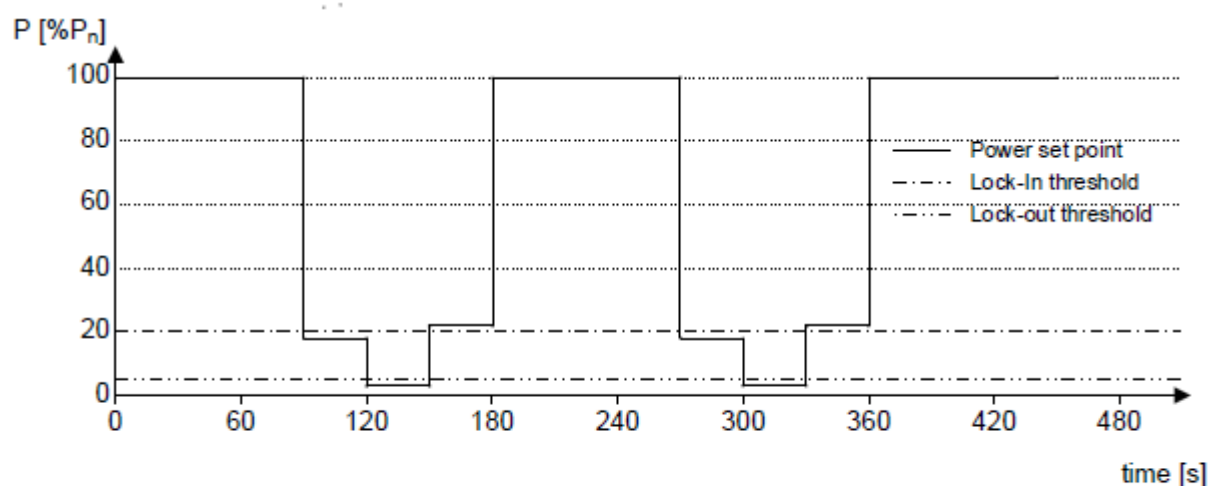
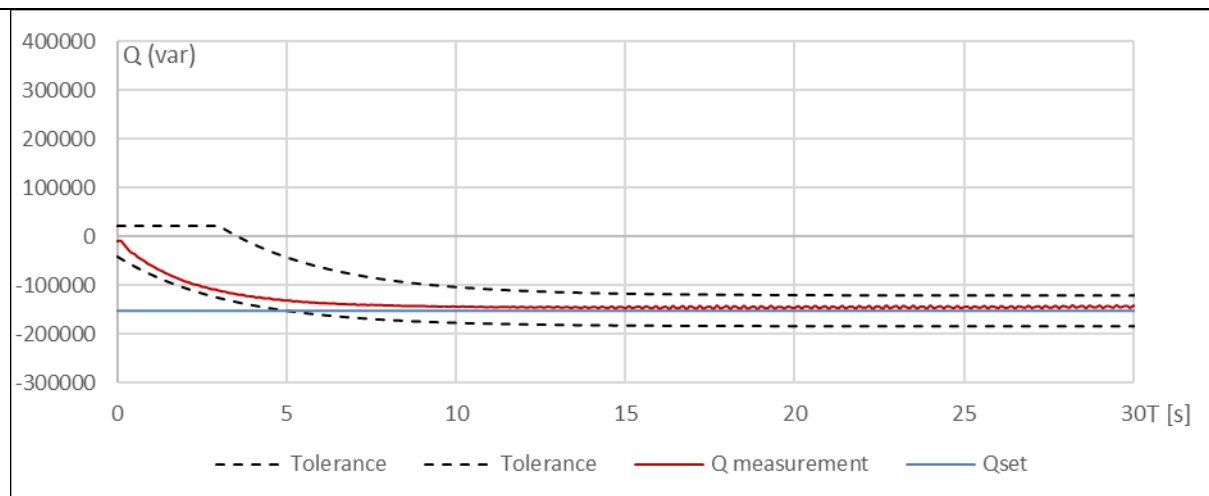


Figure 35 — Example active power set point profile for setting (a) applied for the test of the dynamic behaviour of the $Q(U)$ control, assuming < 30 s for stabilization of P and Q

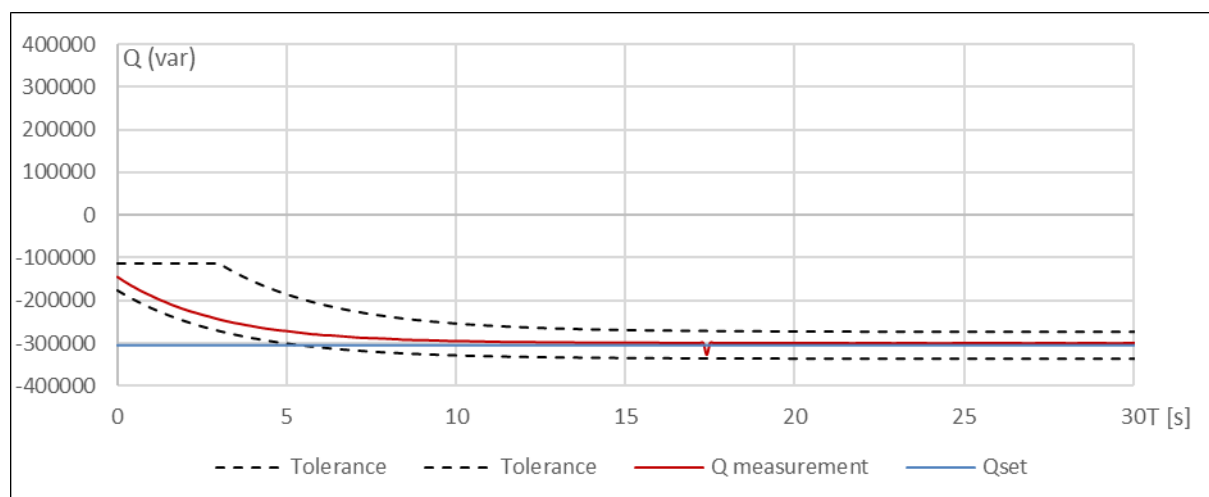
Q(U) curve settings:	Set points	X1			X2		X3	
	U/Un	90%			100%		110%	
	Q/Qmax	10%			0%		-10%	
	Tau	20s						
Test Conditions		Measurements			Deviation	Target value	Compliance to the PT-1 curve?	Δ Limits
U/Un	P/Pn	Q/Pn [%]	P/Pn [%]	U/Un [%]	ΔQ/Pn [%]	Q/Pn*	Yes/No	ΔQ/Pn
100%	100%	-0.68%	100.59%	100.5%	-0.68%	0%	N/A	≤ ±5%
105%	100%	-3.34%	100.61%	105.5%	-0.34%	-3%	Yes	
110%	100%	-5.98%	100.64%	110.4%	0.02%	-6%	Yes	
110%	18%	-4.95%	18.12%	110.0%	1.05%	-6%	N/A	
110%	3%	0.78%	2.87%	110.0%	0.78%	0%	Yes	
110%	22%	-4.97%	22.15%	110.1%	1.03%	-6%	Yes	
110%	100%	-5.94%	100.65%	110.4%	0.06%	-6%	N/A	
100%	100%	-0.65%	100.58%	100.5%	-0.65%	0%	Yes	
90%	100%	4.69%	99.28%	90.6%	-1.31%	6%	Yes	
90%	18%	5.81%	18.20%	90.1%	-0.19%	6%	N/A	
90%	3%	-0.13%	2.90%	90.0%	-0.13%	0%	Yes	
90%	22%	5.79%	22.16%	90.1%	-0.21%	6%	Yes	
90%	100%	4.69%	99.26%	90.6%	-1.31%	6%	N/A	
100%	100%	-0.66%	100.60%	100.5%	-0.66%	0%	Yes	
Note(s): P lock-in: 20%Pn; P lock-out: 5%Pn.								
Diagram: U/Un: 100%-105%								

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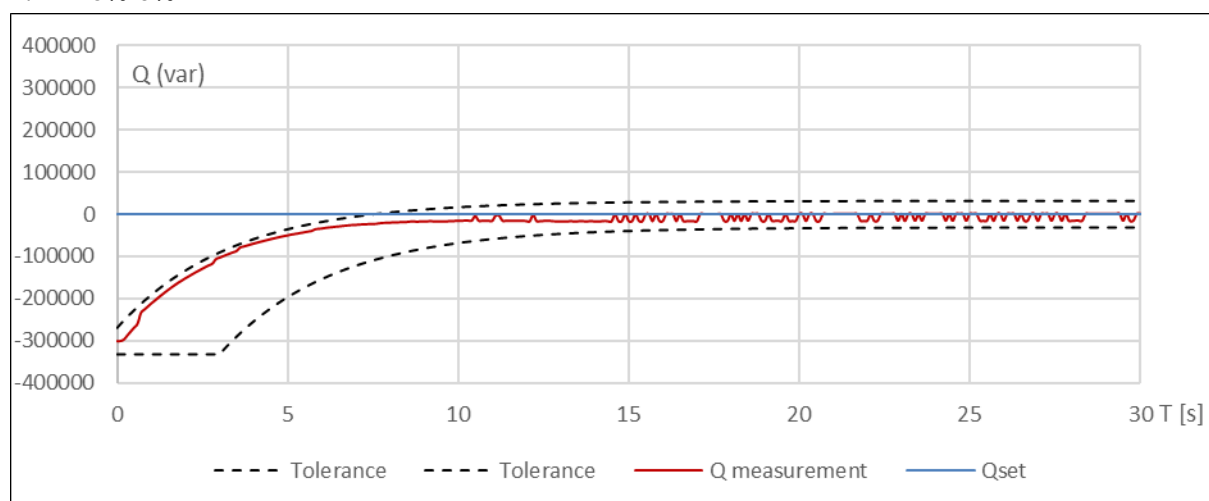
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U/Un: 105%-110%



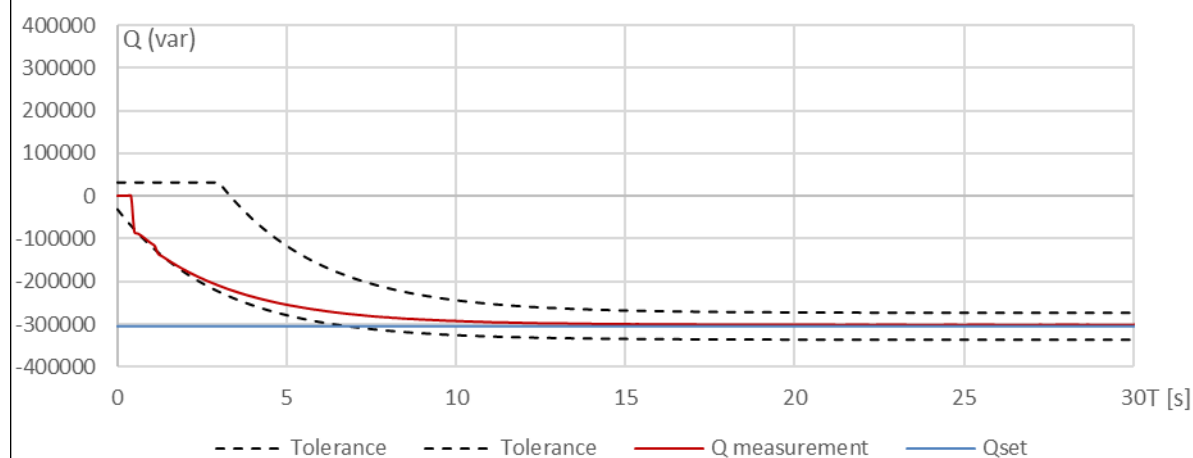
P/Pn:18%-3%



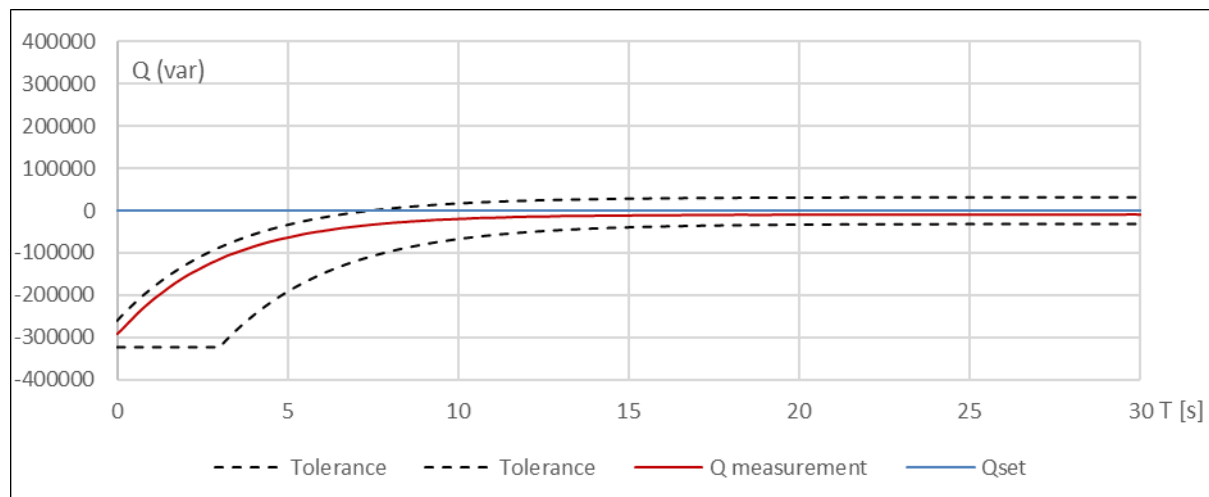
P/Pn:3%-22%

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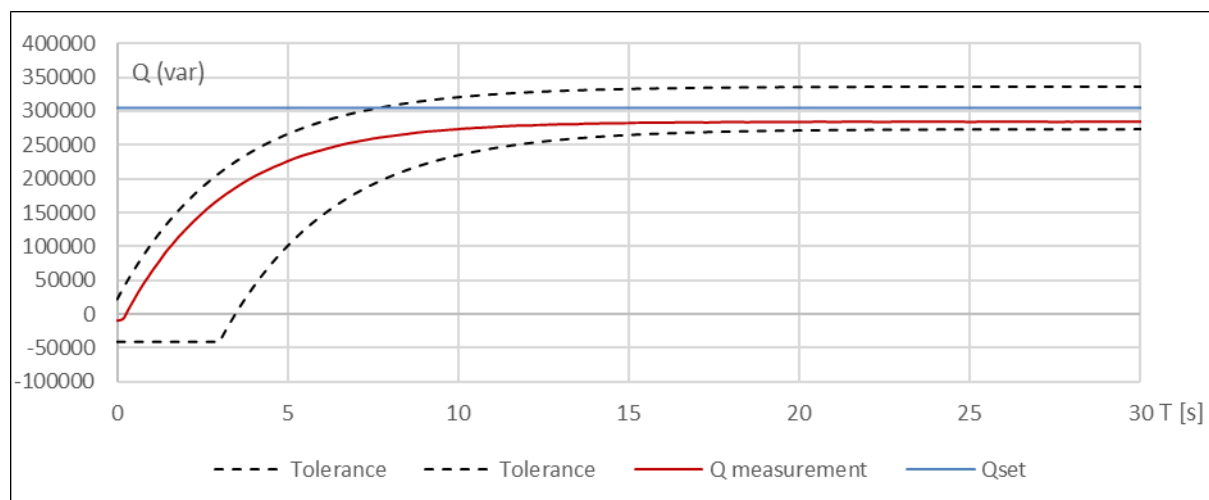
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$U/U_n: 110\%-100\%$



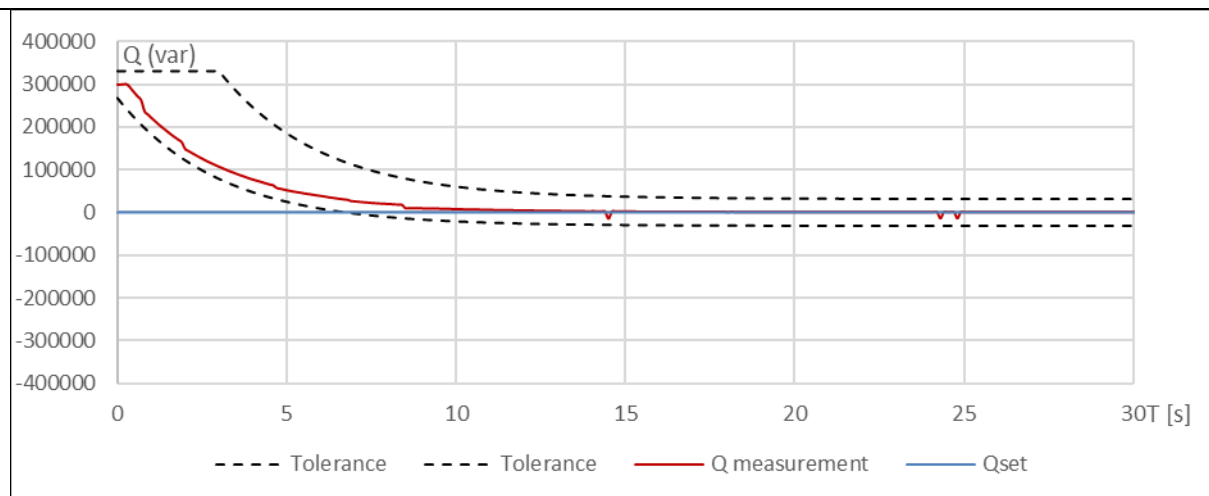
$U/U_n: 100\%-90\%$



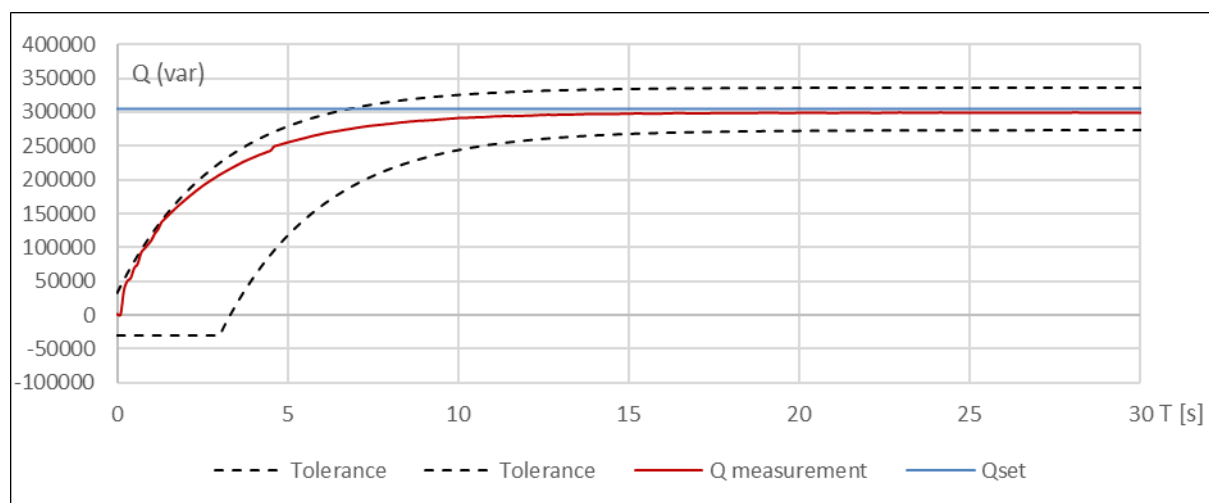
$P/P_n: 18\%-3\%$

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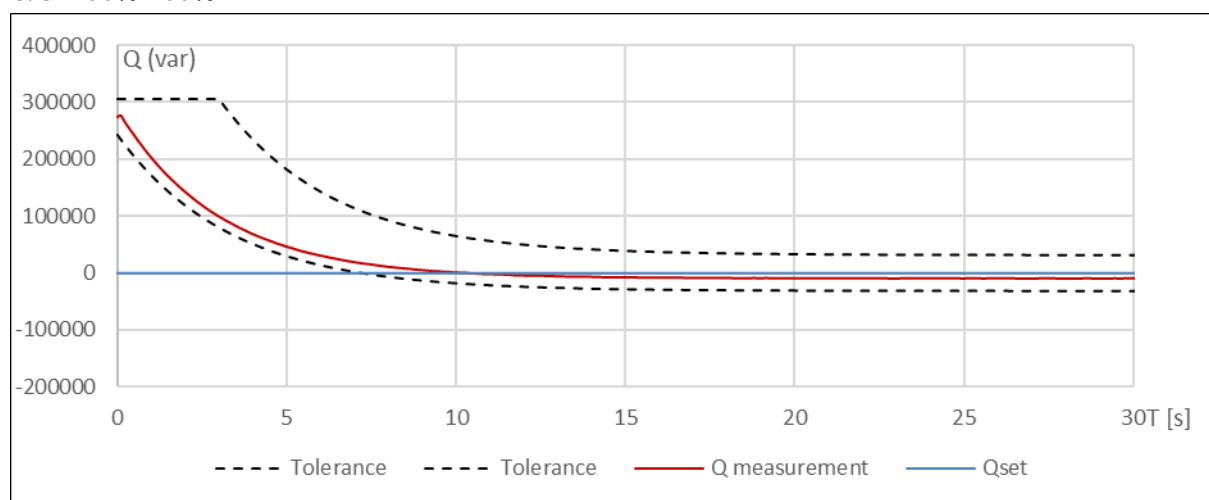
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P/Pn:3%-22%



U/Un: 90%-100%



5.5.2.5	TABLE: Verification procedure for power related control modes for reactive power	P
---------	--	---

Table 19 — Q (P) or cos φ (P) characteristic configuration

parameter of characteristic	Setting (a)	Setting (b)	Setting (c)
minimum and maximum reactive power (Cos Φ ^b) of the characteristic $Q_{\max \text{ char}}^a$	≥ 95 % of $Q_{\max \text{ over}}$ and $Q_{\max \text{ under}}$ respectively but not more than 60 % P_n	10 % of $Q_{\max \text{ over}}$ and $Q_{\max \text{ under}}$ respectively	$Q_{\max \text{ char over}} = 0 \% P_n$ $Q_{\max \text{ char over}} = 33 \% P_n$
Slope of the steepest section of the characteristic curve ^a	as steep as configurable, but not more than $200 \% Q_{\max} / 10 \% P_n$	as flat as configurable, but not less than $2 \% Q_{\max} / 10 \% P_n$	0 below 50 % P_n ; $20 \% Q_{\max} / 10 \% P_n$ above 50 % P_n
Time constant	as fast as possible but not slower as 3 s	as slow as possible but not slower as 20 s ^c	3,33 s

^a If multiple sections with different steepness are configurable, this shall be apparent in the chosen configuration by using different steepness and different values for maximum reactive power $Q_{\max \text{ char over}}$ and $Q_{\max \text{ char under}}$

^b The Cos Φ(P) characteristic shall be configured accordingly with the Cos Φ value representing the given reactive power value at P_n .

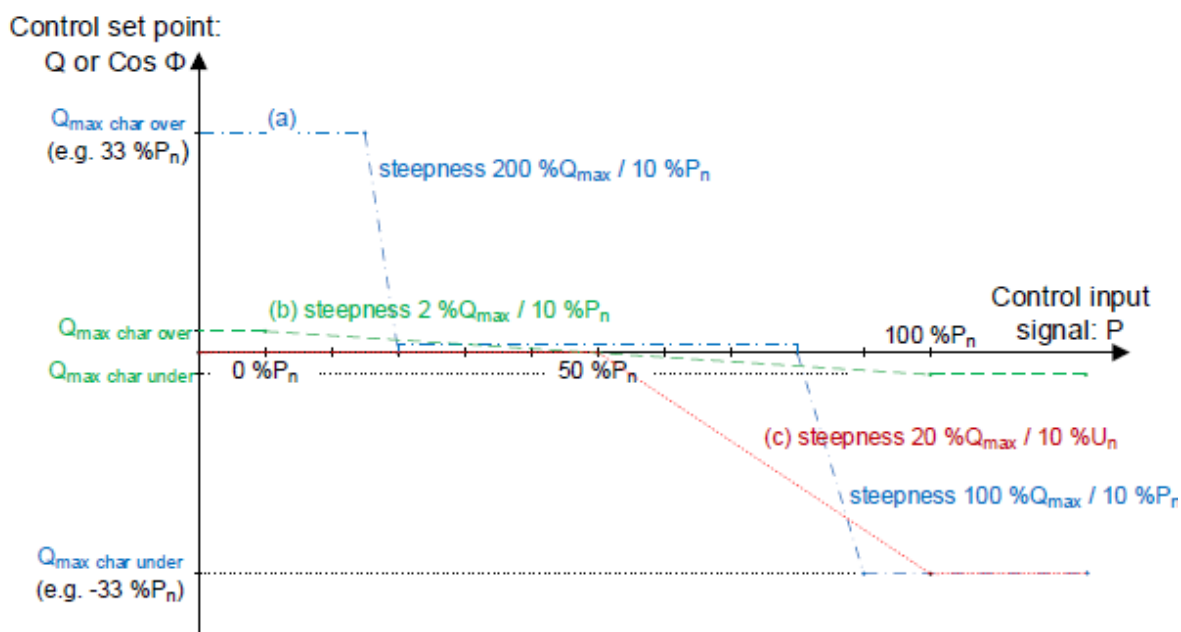
^c The test is considered significant also for slower values of the time constant, as slow time constants are technical less demanding. 20 s is chosen to reduce test duration compared to 60 s as defined in EN 50549-2:2019.

Setting (c) represents a commonly applied characteristic.

Table 20 — cos φ (P) optional additional parameter configuration if applicable

parameter	Setting (a)	Setting (b)	
Lock-in voltage	deactivated	105 % U_n	
Lock-out voltage	deactivated	100 % U_n	

5.5.2.5.2 Test procedure for quasi-stationary behaviour

**Setting (a)**

cosφ (P) curve settings:	Set points		1	2	3	4	
	P/Pn		15%	20%	80%	90%	
	Q		100%Q max over	0	0	100%Q max under	
Test Conditions		Measurements			Target value	Δ	Δ Limits
P / Pn	U / Un	P / Pn	Q / Pn	cosφ	Q / Pn	Δ Q / Smax	Δ Q / Smax
10%	100%	10.13%	60.39%	0.165	60%	0.39%	±2%
15%	100%	10.13%	60.39%	0.165	60%	0.39%	
20%	100%	20.55%	0.17%	1.000	0	0.17%	
30%	100%	30.11%	0.14%	1.000	0	0.14%	
40%	100%	40.53%	0.06%	1.000	0	0.06%	
50%	100%	50.16%	-0.02%	1.000	0	0.02%	
60%	100%	60.58%	-0.10%	1.000	0	0.10%	
70%	100%	70.19%	-0.19%	1.000	0	0.19%	
80%	100%	80.59%	-0.68%	1.000	0	0.68%	

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85%	100%	86.08%	-31.09%	0.940	-30%	1.09%
90%	100%	90.70%	-48.49%	0.882	-48%	0.49%
100%	100%	91.38%	-48.95%	0.881	-48%	0.95%
90%	100%	90.70%	-48.54%	0.882	-48%	0.54%
85%	100%	86.08%	-31.02%	0.941	-30%	1.02%
80%	100%	80.59%	-0.42%	1.000	0	0.42%
70%	100%	70.19%	-0.19%	1.000	0	0.19%
60%	100%	60.58%	-0.10%	1.000	0	0.10%
50%	100%	50.16%	-0.01%	1.000	0	0.01%
40%	100%	40.53%	0.06%	1.000	0	0.06%
30%	100%	30.12%	0.13%	1.000	0	0.13%
20%	100%	20.54%	0.18%	1.000	0	0.18%
15%	100%	14.95%	58.85%	0.246	60%	1.15%
10%	100%	10.13%	60.39%	0.165	60%	0.39%

Setting (c)											
cosφ (P) curve settings:	Set points		1		2		3		4		
	P/Pn		20%		40%		50%		100%		
	Q		0		0		0		-Qmax		
Test Conditions		Measurements				Target value		Δ		Δ Limits	
P / Pn	U / Un	P / Pn	Q / Pn	cosφ	Q / Pn	Δ Q / Smax	Δ Q / Smax				
10%	100%	10.10%	0.24%	0.999	0	0.24%	±2%				
20%	100%	20.54%	0.18%	1.000	0	0.18%					
30%	100%	30.12%	0.14%	1.000	0	0.14%					
40%	100%	40.54%	0.06%	1.000	0	0.06%					
50%	100%	50.16%	-0.01%	1.000	0	0.01%					
60%	100%	60.56%	-12.15%	0.980	-12%	0.15%					
70%	100%	70.12%	-23.83%	0.947	-24%	0.17%					
80%	100%	80.48%	-36.54%	0.911	-36%	0.54%					
90%	100%	90.02%	-48.31%	0.881	-48%	0.31%					
100%	100%	91.44%	-48.98%	0.882	-48%	0.98%					
90%	100%	90.03%	-48.34%	0.881	-48%	0.34%					

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80%	100%	80.48%	-36.57%	0.910	-36%	0.57%	
70%	100%	70.13%	-23.85%	0.947	-24%	0.15%	
60%	100%	60.56%	-12.16%	0.980	-12%	0.16%	
50%	100%	50.17%	-0.01%	1.000	0	0.01%	
40%	100%	40.55%	0.06%	1.000	0	0.06%	
30%	100%	30.13%	0.15%	1.000	0	0.15%	
20%	100%	20.55%	0.18%	1.000	0	0.18%	
10%	100%	10.11%	0.23%	0.999	0	0.23%	

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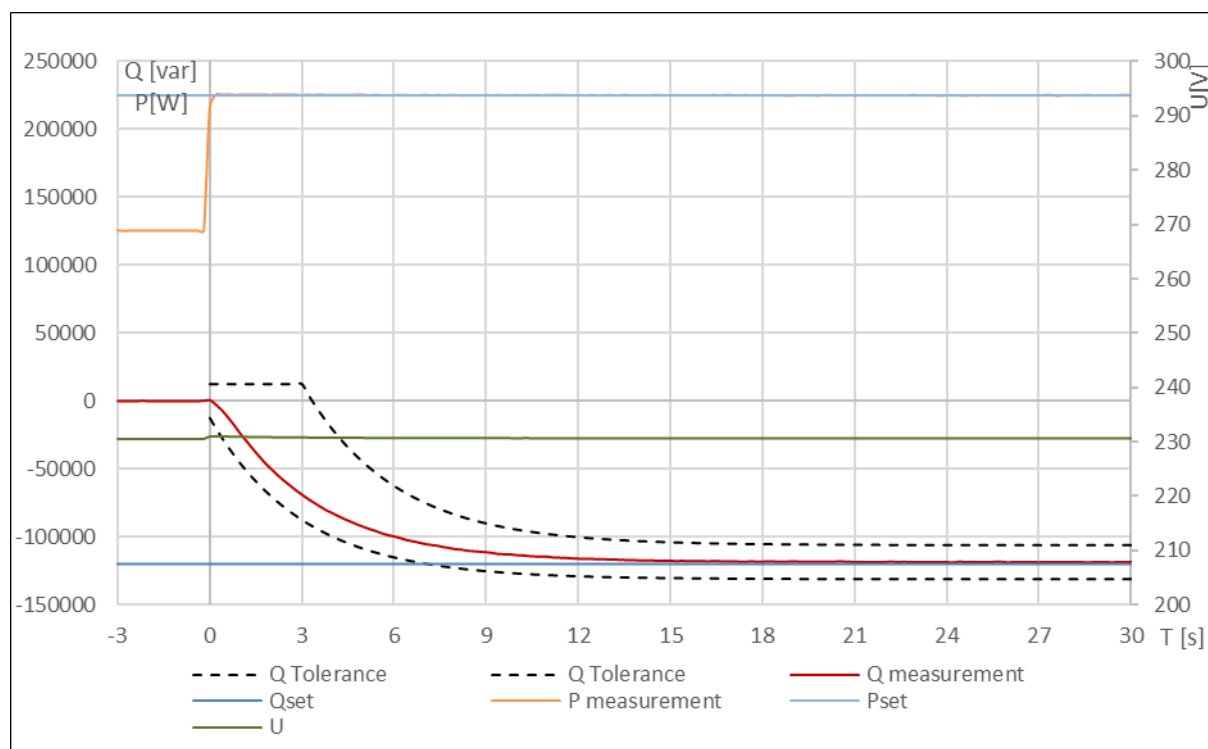
5.5.2.5.3 Test procedure for dynamic behaviour

Setting (a)-Time constant: as fast as possible but not slower as 3s-3s

Test Conditions	Measurements					
	T _{sr} [s]	T _s [s]	T _d [s]	Reactive power/P _n [%]	Active power/P _n [%]	Grid voltage/U _n [%]
20%P _n	--	--	--	0.19%	20.57%	100.04%
20%P _n -> 50%P _n	--	--	--	0.07%	50.19%	100.17%
50%P _n -> 90%P _n	8.7	8.7	0.2	-47.41%	90.10%	100.30%
90%P _n -> 50%P _n	8.6	8.6	0.2	-30.02%	50.20%	100.17%
50%P _n -> 20%P _n	--	--	--	0.13%	50.25%	100.22%

Diagram:

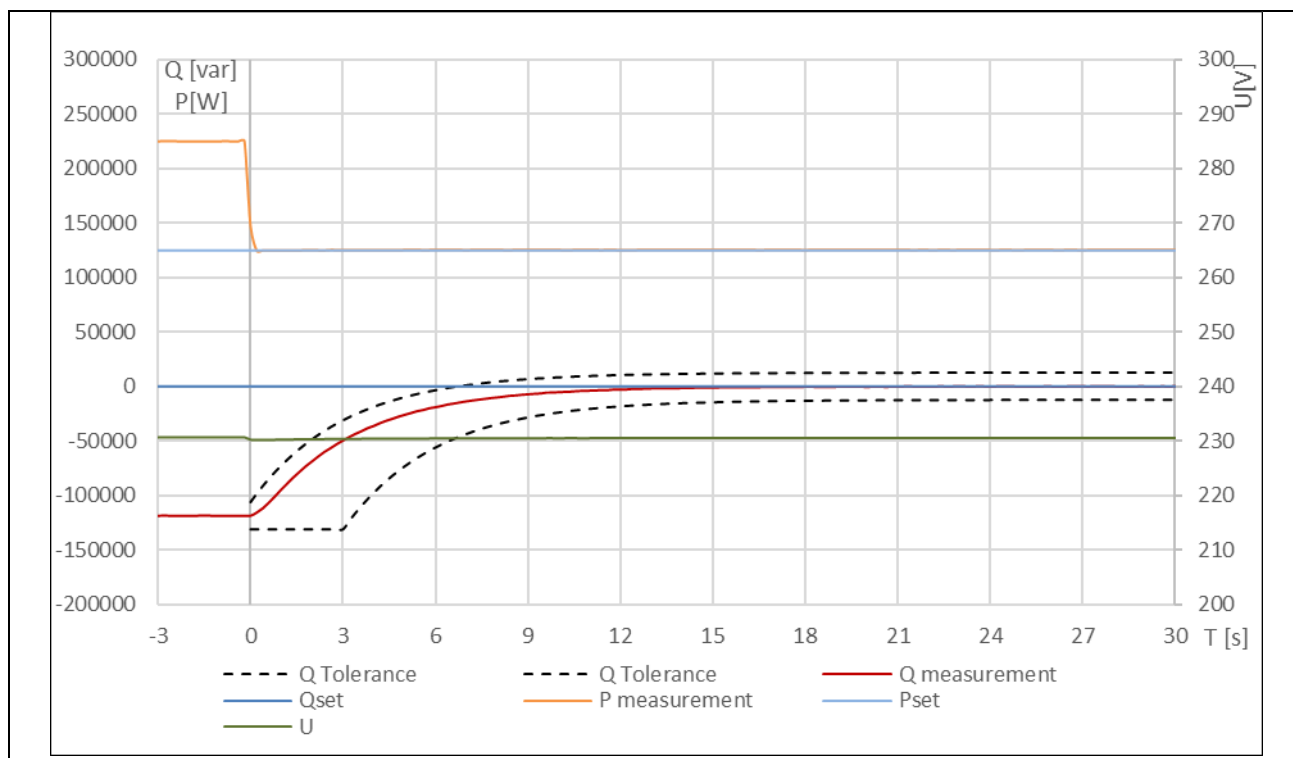
50%P_n -> 90%P_n:



90%P_n -> 50%P_n:

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Setting (c)–Time constant: 3.33s

Test Conditions		Measurements					
P	U/Un	Tsr [s]	Ts [s]	Td [s]	Reactive power [var]	Active power [W]	Grid voltage [V]
20%Pn	107%	--	--	--	1274.5	51440.2	246.1
20%Pn -> 50%Pn	107%	--	--	--	858.5	125464.2	246.5
50%Pn -> 90%Pn	107%	9.4	9.4	0.1	-117572.9	225119.4	246.6
90%	103%	--	--	--	-118213.5	225030.8	236.7
90%	98%	9.2	9.2	0.2	-1283.4	225466.0	226.0
90%	107%	9.4	9.4	0.2	-118183.8	225119.2	246.6
90%	100%	--	--	--	-118711.7	224950.1	230.7
90%Pn -> 50%Pn	100%	9.5	9.5	0.2	-94.3	125443.4	230.5
50%Pn -> 20%Pn	100%	--	--	--	474.0	51368.1	230.2

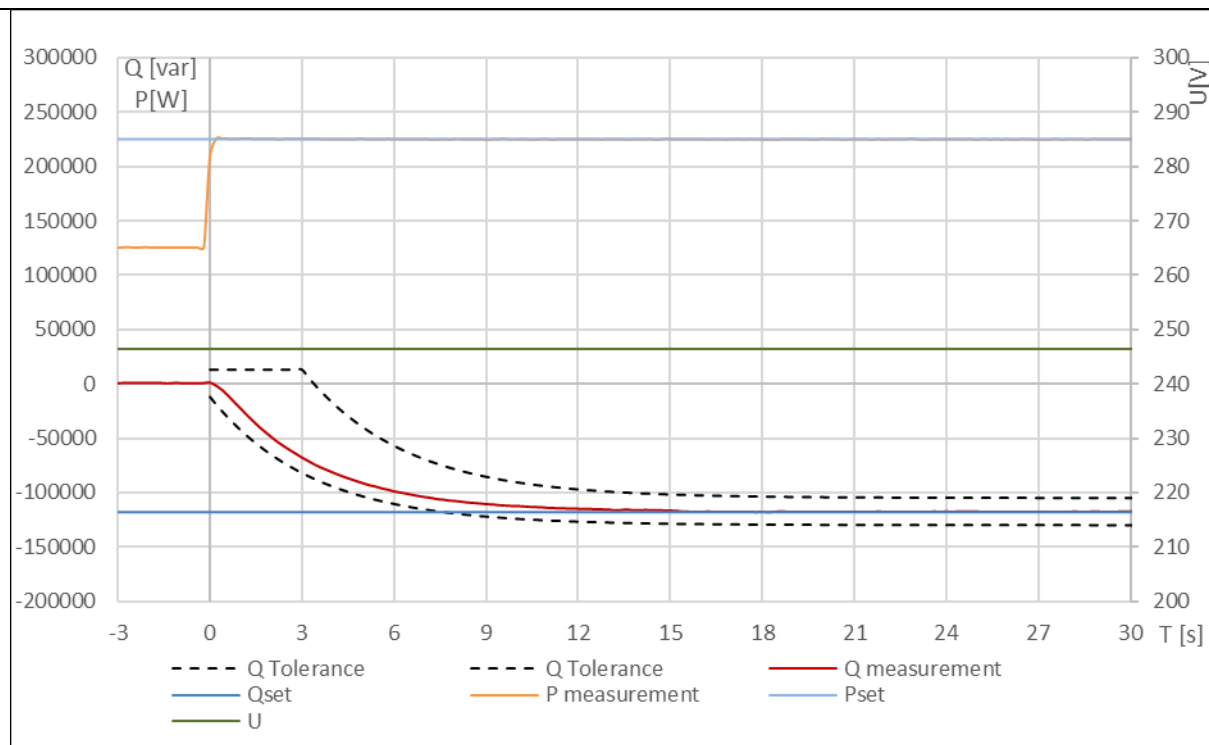
Diagram:

- Graph showing the measured reactive power, active power and grid voltage as 10-period averages, together with the calculated dynamic tolerance bands (see e.g. Figure 32) for each step.

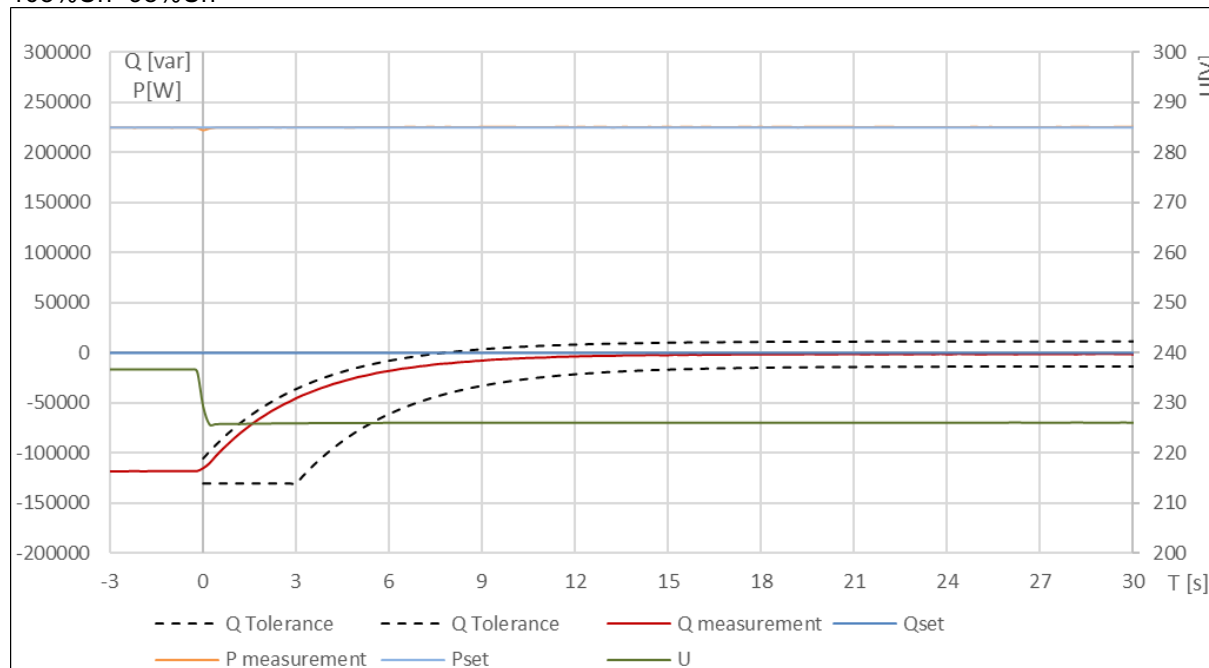
50%Pn -> 90%Pn:

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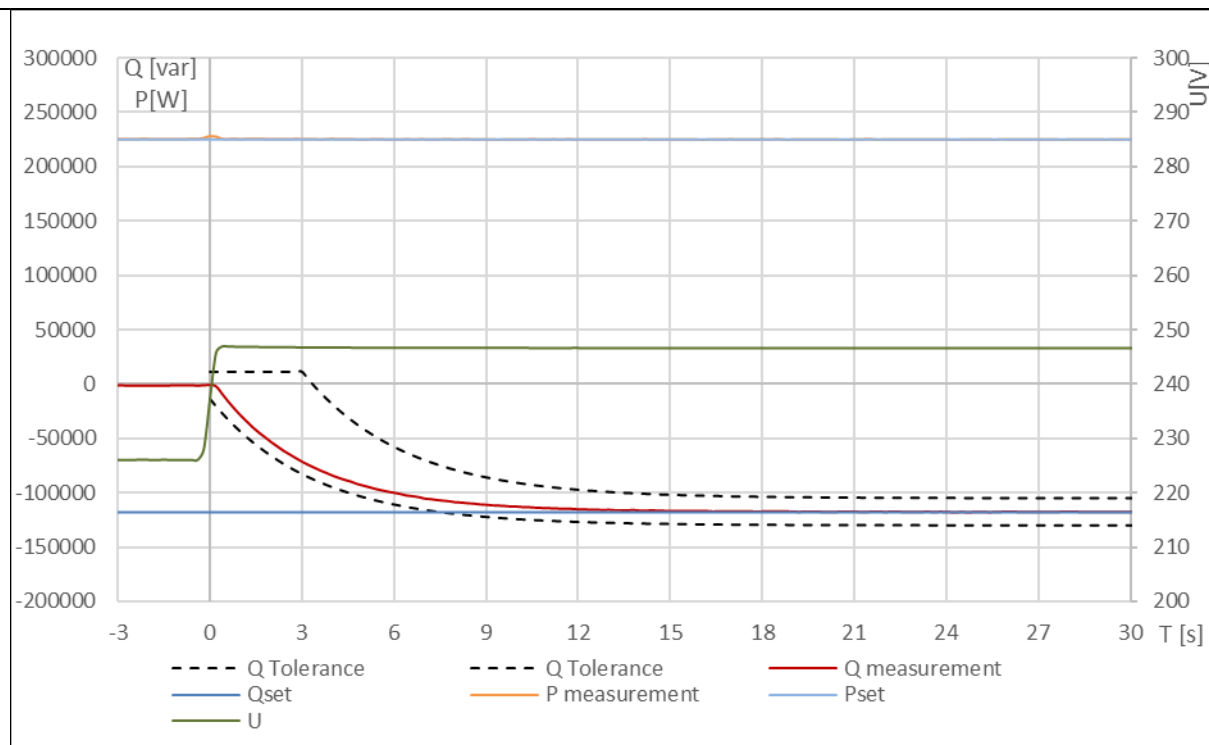
103%Un -98%Un



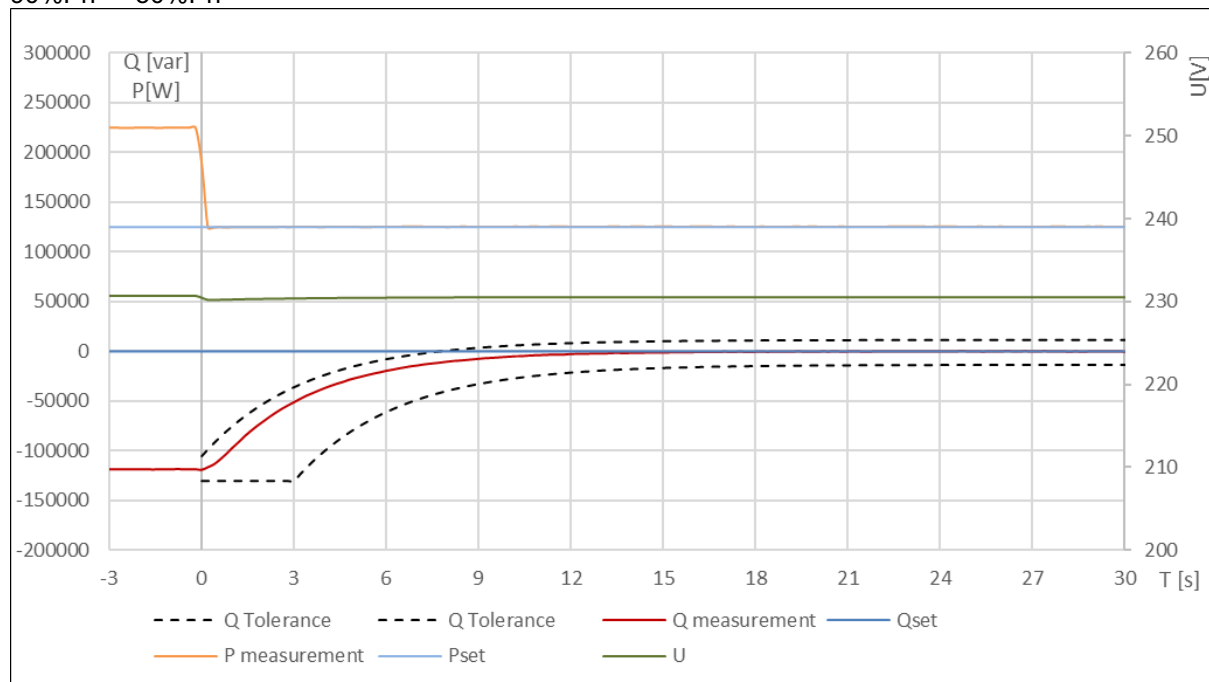
98%Un -107%Un

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90%Pn -> 50%Pn



Lock-in voltage: 105%Un

Lock out voltage: 100%Un

5.6	TABLE: Voltage related active power reduction - P(U)								P	
P(U) curve settings:	Set points	1				2				
	U/Un	110%				115%				
	P/Pn	100%				0%				
	Q(U) function activated and configured the QU function to setting (a) .									
	Set-pointsα	X1α	X2α	X3α	X4α					
	U/Unα	93%α	94%α	106%α	108%α					
	Q/Qmaxα	100%α	0α	0α	-100%α					
Test procedure for steady-state behaviour										
Test Conditions		Measurements			Target value		Δ		Δ Limits	
U/Un	P/Pn	P/Pn	Q/Pn	U/Un	P/Pn	Q/Pn	ΔP/Smax	ΔQ/Smax	ΔP/Smax	ΔQ/Smax
100%	100 %	100.13%	-0.41%	100.5%	100%	0%	0.13%	-0.41%	≤ ±2%	≤ ±2%
103%		100.15%	-0.25%	103.5%	100%	0%	0.15%	-0.25%		
106%		100.17%	-0.28%	106.3%	100%	0%	0.17%	-0.28%		
109%		92.12%	-60.35%	109.2%	100%*	-60%*	-7.88%	-0.35%		
112%		60.33%	-59.81%	112.8%	60%	-60%*	0.33%	0.19%		
115%		1.40%	-59.28%	115.9%	0%	-60%**	1.40%	0.72%		
112%		60.22%	-59.80%	112.8%	60%	-60%*	0.22%	0.20%		
109%		92.10%	-60.34%	109.2%	100%*	-60%*	-7.90%	-0.34%		
106%		100.14%	-0.28%	103.5%	100%	0%	0.14%	-0.28%		
103%		100.14%	-0.47%	106.3%	100%	0%	0.14%	-0.47%		
100%		100.12%	-0.45%	100.5%	100%	0%	0.12%	-0.45%		
Note:										
*: Due to the influence of the maximum current limit, it is allowed to reduce the active power under the condition that I reaches I _{max} .										
**: It is acceptable If Q has not reached the target value, but has already reached the maximum capacity value.										
Test procedure:										

Test procedure for dynamic behaviour-Tau ≥ 3 s (eg.5s) P: 5 s ($3\tau = 15$ s); Q: 5 s ($3\tau = 15$ s) 3.33S

P=100%Pn

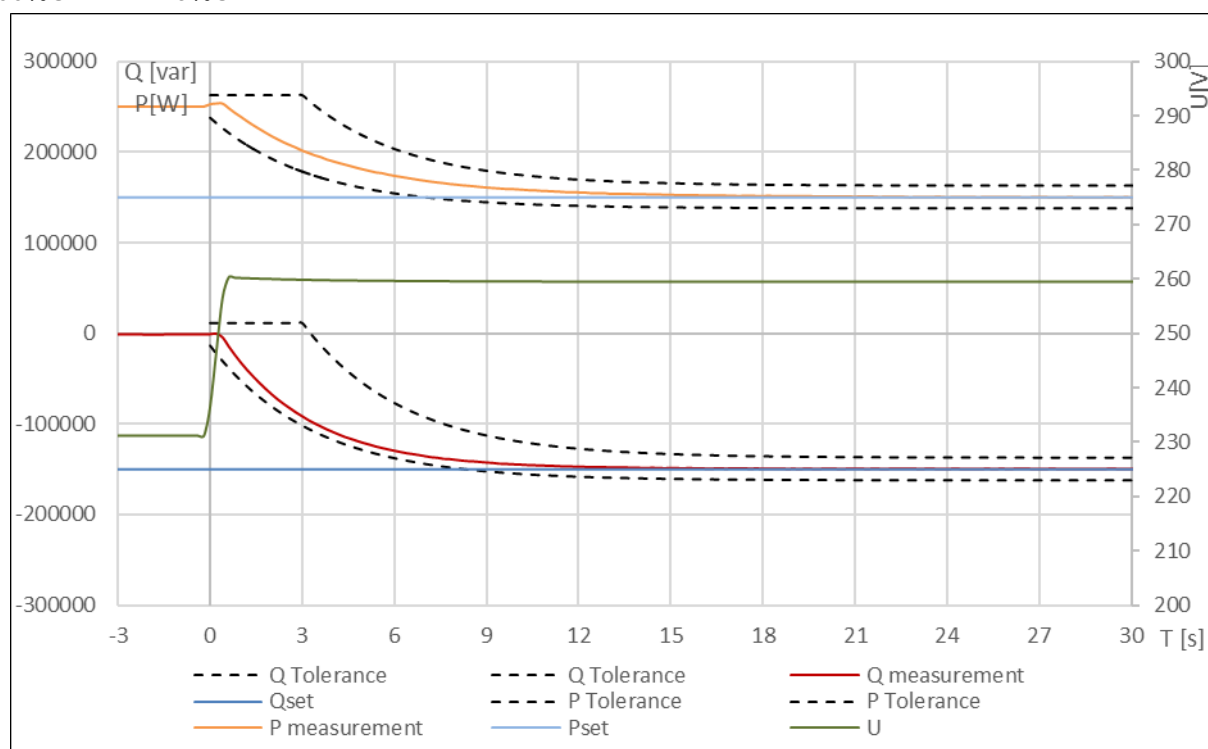
Q(U) function activated and configured the QU function to **setting (a)**.

Test Conditions	Measurements					
	Dead time		response time		settling time	
	P	Q	P	Q	P	Q
100%Un -> 112.5%Un	0.4	0.4	9.2	9.4	9.2	9.4
112.5%Un -> 115%Un	0.2	--	9.9	--	9.9	--
115%Un -> 112.5%Un	0.2	--	10.0	--	10.0	--
112.5%Un -> 100%Un	0.4	0.2	8.6	8.4	8.6	8.4

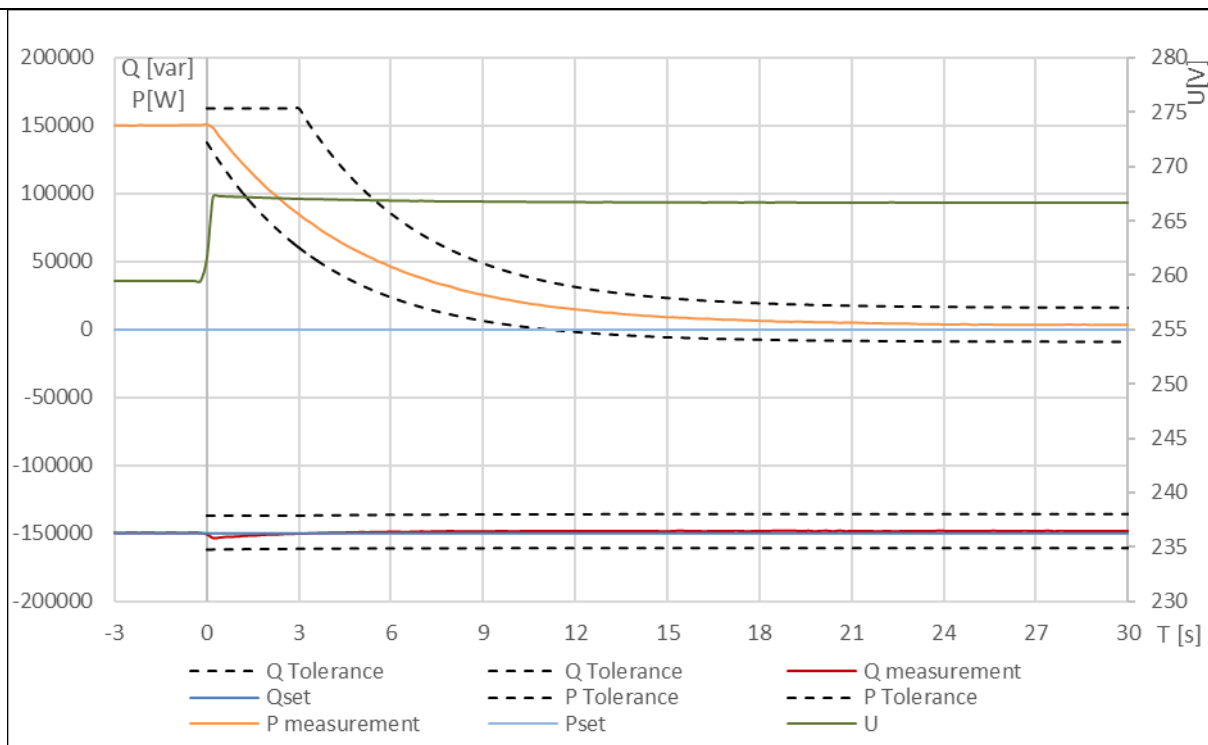
Diagram:

Graph showing the measured active power, reactive power and grid voltage as 10-period averages, together with the calculated dynamic tolerance bands (see e.g. Figure 32) for each step.

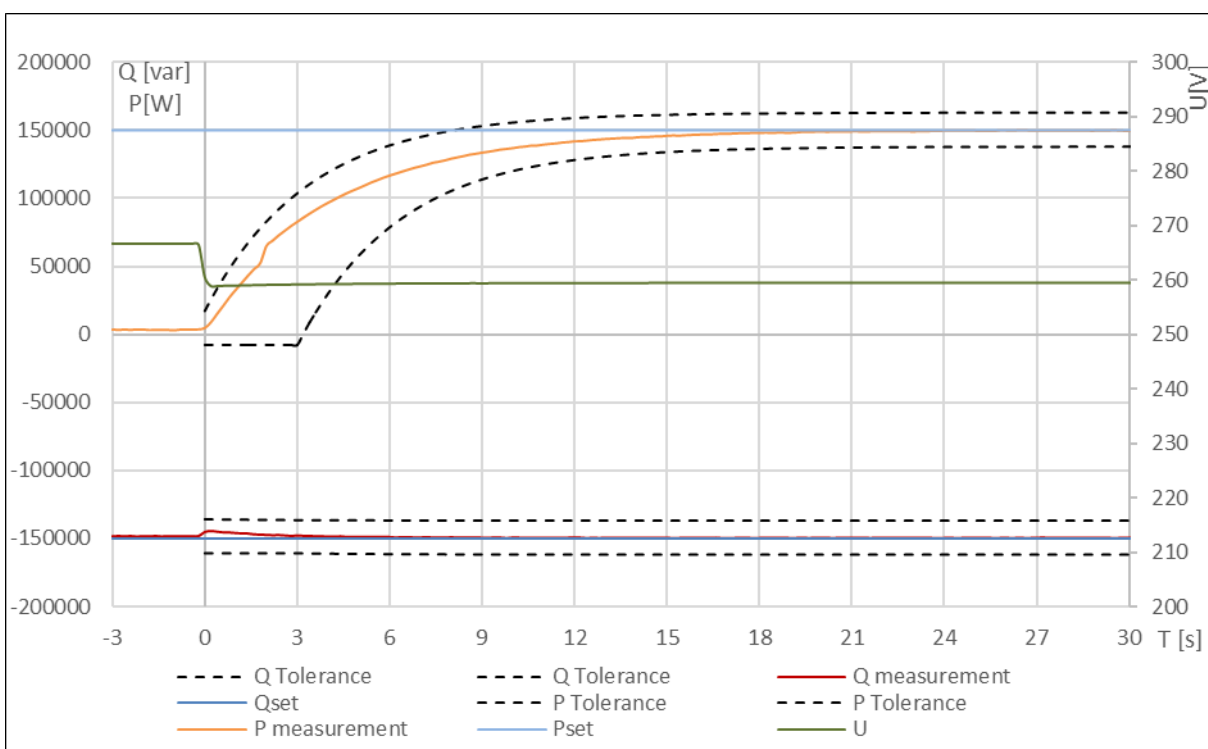
100%Un -> 112.5%Un:



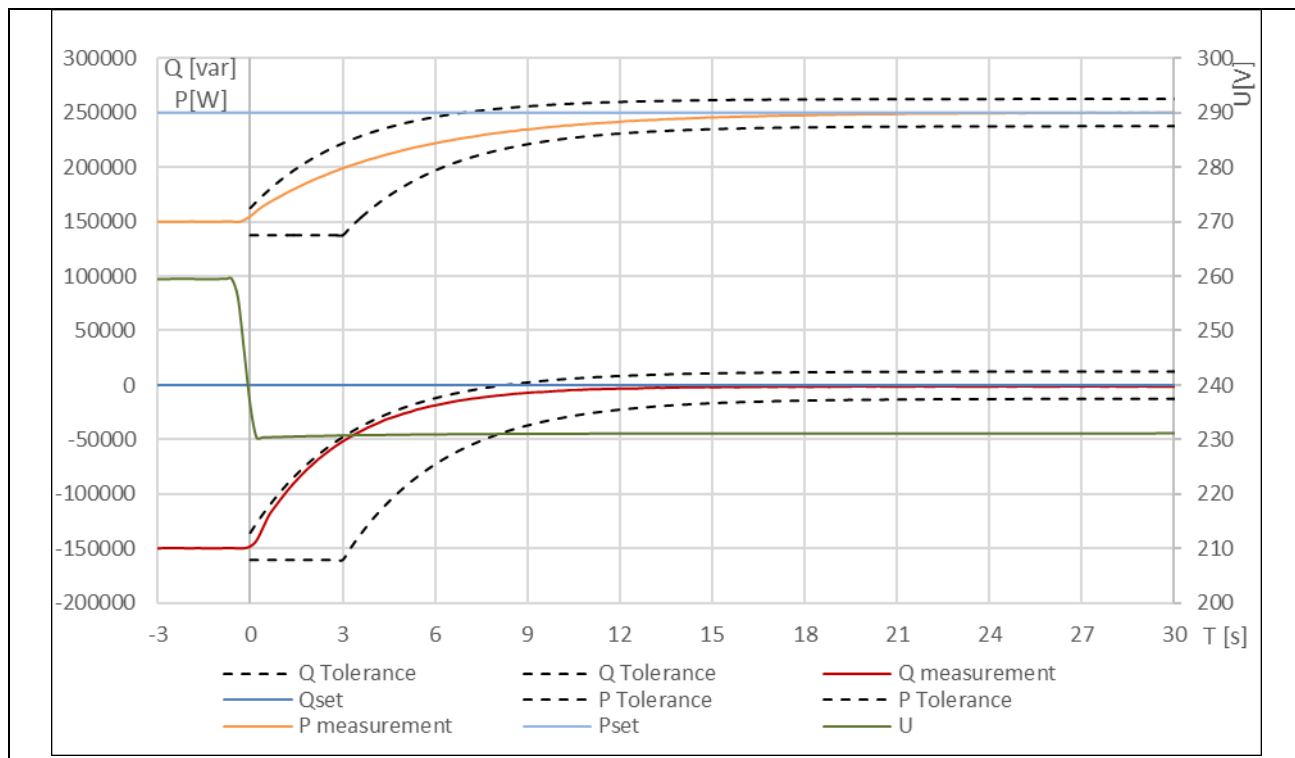
112.5%Un -> 115%Un:



115%Un -> 112.5%Un:



112.5%Un -> 100%Un:



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5.7.2		Power Quality										P
5.7.2.2.1		TABLE: Harmonics, Inter-harmonics, and Higher frequency harmonics (linter & lhigher)										P
Harmonics												
P/P _n [%]	0	10	20	30	40	50	60	70	80	90	100	Limit
Order No.	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
THC	0.62	0.64	0.72	0.75	0.83	0.93	1.01	1.08	1.14	1.19	1.22	--
1	0.573	10.13 8	20.58 9	30.18 0	40.58 2	50.18 5	60.58 8	70.18 8	80.57 5	90.15 3	100.1 18	--
2	0.111	0.111	0.105	0.106	0.116	0.116	0.121	0.125	0.119	0.124	0.124	--
3	0.214	0.220	0.225	0.259	0.417	0.474	0.496	0.497	0.505	0.500	0.500	--
4	0.112	0.114	0.104	0.116	0.121	0.129	0.134	0.135	0.136	0.133	0.135	--
5	0.186	0.167	0.272	0.137	0.226	0.346	0.415	0.448	0.464	0.476	0.480	--
6	0.127	0.112	0.108	0.117	0.134	0.131	0.135	0.143	0.140	0.136	0.133	--
7	0.174	0.165	0.293	0.250	0.215	0.262	0.329	0.365	0.373	0.384	0.392	--
8	0.099	0.113	0.110	0.119	0.125	0.133	0.137	0.136	0.137	0.142	0.144	--
9	0.162	0.168	0.156	0.310	0.242	0.226	0.281	0.325	0.351	0.350	0.354	--
10	0.092	0.102	0.101	0.111	0.115	0.125	0.123	0.121	0.119	0.127	0.122	--
11	0.133	0.138	0.140	0.176	0.195	0.163	0.188	0.216	0.235	0.250	0.258	--
12	0.085	0.092	0.086	0.096	0.099	0.103	0.105	0.109	0.103	0.103	0.107	--
13	0.124	0.141	0.141	0.147	0.182	0.169	0.164	0.195	0.216	0.238	0.239	--
14	0.071	0.075	0.078	0.088	0.086	0.093	0.096	0.091	0.091	0.089	0.093	--
15	0.119	0.138	0.100	0.153	0.152	0.181	0.165	0.198	0.228	0.247	0.255	--
16	0.069	0.076	0.073	0.079	0.077	0.082	0.079	0.084	0.084	0.082	0.080	--
17	0.104	0.113	0.106	0.109	0.117	0.149	0.138	0.155	0.185	0.203	0.211	--
18	0.070	0.075	0.073	0.081	0.079	0.081	0.083	0.081	0.082	0.085	0.080	--
19	0.102	0.126	0.145	0.101	0.150	0.174	0.145	0.157	0.184	0.205	0.219	--
20	0.076	0.080	0.080	0.085	0.088	0.088	0.092	0.089	0.089	0.092	0.113	--
21	0.115	0.112	0.124	0.100	0.113	0.132	0.154	0.169	0.197	0.238	0.260	--
22	0.082	0.091	0.096	0.103	0.111	0.110	0.105	0.104	0.104	0.106	0.102	--
23	0.119	0.132	0.149	0.132	0.133	0.151	0.191	0.203	0.248	0.289	0.309	--
24	0.083	0.097	0.097	0.107	0.110	0.113	0.112	0.114	0.118	0.120	0.114	--
25	0.112	0.128	0.138	0.134	0.128	0.136	0.159	0.167	0.187	0.217	0.246	--
26	0.072	0.082	0.081	0.095	0.106	0.087	0.090	0.093	0.101	0.156	0.102	--
27	0.075	0.079	0.078	0.086	0.082	0.082	0.087	0.087	0.097	0.105	0.115	--
28	0.056	0.057	0.054	0.060	0.064	0.064	0.064	0.065	0.067	0.066	0.065	--
29	0.064	0.070	0.075	0.075	0.070	0.069	0.071	0.077	0.080	0.088	0.100	--
30	0.047	0.044	0.039	0.044	0.045	0.044	0.045	0.046	0.048	0.047	0.048	--
31	0.050	0.054	0.050	0.058	0.055	0.057	0.058	0.059	0.059	0.064	0.070	--
32	0.038	0.034	0.033	0.036	0.036	0.036	0.037	0.037	0.038	0.036	0.036	--
33	0.038	0.035	0.034	0.040	0.043	0.045	0.045	0.045	0.044	0.046	0.047	--
34	0.034	0.031	0.027	0.029	0.030	0.030	0.031	0.031	0.031	0.032	0.031	--
35	0.038	0.032	0.032	0.040	0.044	0.046	0.045	0.046	0.046	0.044	0.047	--
36	0.032	0.027	0.023	0.025	0.026	0.026	0.026	0.027	0.026	0.026	0.028	--
37	0.036	0.028	0.027	0.033	0.039	0.041	0.044	0.045	0.045	0.046	0.046	--
38	0.031	0.024	0.022	0.023	0.024	0.025	0.024	0.024	0.024	0.024	0.026	--

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Harmonics												
P/P _n [%]	0	10	20	30	40	50	60	70	80	90	100	Limit
Order No.	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
39	0.032	0.025	0.022	0.025	0.030	0.035	0.037	0.037	0.038	0.040	0.036	--
40	0.030	0.024	0.021	0.023	0.023	0.022	0.023	0.023	0.025	0.024	0.023	--
41	0.035	0.027	0.023	0.027	0.031	0.036	0.038	0.039	0.039	0.041	0.040	--
42	0.030	0.023	0.021	0.021	0.023	0.023	0.023	0.023	0.024	0.023	0.022	--
43	0.036	0.028	0.023	0.025	0.030	0.033	0.035	0.037	0.040	0.041	0.041	--
44	0.029	0.024	0.022	0.022	0.023	0.023	0.023	0.024	0.023	0.024	0.023	--
45	0.031	0.026	0.023	0.023	0.026	0.028	0.031	0.034	0.033	0.032	0.033	--
46	0.030	0.025	0.022	0.023	0.024	0.024	0.024	0.025	0.024	0.024	0.025	--
47	0.035	0.029	0.025	0.025	0.028	0.029	0.031	0.033	0.036	0.038	0.038	--
48	0.028	0.024	0.022	0.024	0.025	0.024	0.026	0.026	0.025	0.025	0.025	--
49	0.032	0.028	0.025	0.024	0.026	0.027	0.030	0.033	0.034	0.037	0.038	--
50	0.025	0.022	0.020	0.021	0.024	0.022	0.023	0.022	0.023	0.023	0.026	--

Inter-harmonics												
P/P _n [%]	0	10	20	30	40	50	60	70	80	90	100	Limit
f [Hz]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
75	0.184	0.150	0.130	0.137	0.143	0.149	0.150	0.152	0.152	0.155	0.155	--
125	0.177	0.149	0.132	0.139	0.146	0.148	0.150	0.154	0.154	0.155	0.155	--
175	0.152	0.138	0.127	0.134	0.140	0.141	0.142	0.144	0.145	0.147	0.149	--
225	0.105	0.103	0.101	0.106	0.110	0.110	0.111	0.111	0.112	0.114	0.116	--
275	0.062	0.063	0.062	0.066	0.068	0.068	0.067	0.069	0.070	0.070	0.072	--
325	0.034	0.035	0.034	0.037	0.038	0.038	0.038	0.038	0.038	0.039	0.039	--
375	0.018	0.018	0.018	0.019	0.020	0.020	0.020	0.021	0.021	0.021	0.021	--
425	0.010	0.010	0.010	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.013	--
475	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.009	--
525	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.007	0.007	0.007	0.007	--
575	0.004	0.004	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	--
625	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	--
675	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.006	0.005	0.006	--
725	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.006	--
775	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.006	--
825	0.001	0.000	0.002	0.000	0.001	0.001	0.001	0.001	0.001	0.002	0.001	--
875	0.004	0.003	0.006	0.002	0.003	0.003	0.006	0.005	0.005	0.005	0.005	--
925	0.004	0.003	0.006	0.002	0.003	0.003	0.006	0.005	0.005	0.005	0.005	--
975	0.004	0.003	0.006	0.002	0.003	0.003	0.006	0.005	0.005	0.005	0.005	--
1025	0.003	0.003	0.006	0.002	0.003	0.002	0.006	0.004	0.004	0.005	0.005	--
1075	0.003	0.003	0.006	0.002	0.003	0.002	0.006	0.004	0.004	0.005	0.005	--
1125	0.003	0.003	0.006	0.002	0.003	0.002	0.006	0.004	0.004	0.005	0.005	--
1175	0.003	0.003	0.006	0.002	0.003	0.002	0.006	0.004	0.004	0.005	0.005	--
1225	0.003	0.003	0.006	0.002	0.003	0.002	0.006	0.004	0.004	0.005	0.005	--
1275	0.004	0.003	0.006	0.002	0.003	0.003	0.006	0.004	0.004	0.005	0.005	--

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Inter-harmonics												
P/P _n [%]	0	10	20	30	40	50	60	70	80	90	100	Limit
f [Hz]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
1325	0.003	0.003	0.006	0.003	0.003	0.003	0.006	0.004	0.005	0.005	0.005	--
1375	0.004	0.003	0.006	0.003	0.003	0.003	0.006	0.004	0.005	0.005	0.005	--
1425	0.004	0.004	0.006	0.003	0.003	0.003	0.006	0.005	0.005	0.005	0.005	--
1475	0.004	0.004	0.006	0.003	0.003	0.003	0.005	0.004	0.004	0.005	0.004	--
1525	0.004	0.003	0.005	0.002	0.002	0.002	0.005	0.004	0.004	0.004	0.004	--
1575	0.003	0.003	0.005	0.002	0.002	0.002	0.005	0.004	0.004	0.004	0.004	--
1625	0.003	0.003	0.005	0.002	0.002	0.002	0.005	0.004	0.004	0.004	0.004	--
1675	0.003	0.003	0.005	0.002	0.002	0.002	0.005	0.004	0.004	0.004	0.004	--
1725	0.003	0.003	0.005	0.002	0.002	0.002	0.005	0.004	0.004	0.004	0.004	--
1775	0.003	0.003	0.005	0.002	0.002	0.002	0.005	0.004	0.004	0.004	0.004	--
1825	0.184	0.150	0.130	0.137	0.143	0.149	0.150	0.152	0.152	0.155	0.155	--
1875	0.177	0.149	0.132	0.139	0.146	0.148	0.150	0.154	0.154	0.155	0.155	--
1925	0.152	0.138	0.127	0.134	0.140	0.141	0.142	0.144	0.145	0.147	0.149	--
1975	0.105	0.103	0.101	0.106	0.110	0.110	0.111	0.111	0.112	0.114	0.116	--

Higher frequency harmonics												
P/P _n [%]	0	10	20	30	40	50	60	70	80	90	100	Limit
f [kHz]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
2.1	0.603	0.598	0.527	0.603	0.673	0.705	0.734	0.747	0.763	0.772	0.773	--
2.3	0.526	0.534	0.490	0.547	0.599	0.626	0.643	0.654	0.659	0.667	0.674	--
2.5	0.619	0.609	0.543	0.626	0.708	0.736	0.770	0.788	0.805	0.815	0.817	--
2.7	0.561	0.582	0.522	0.601	0.651	0.684	0.710	0.730	0.741	0.756	0.758	--
2.9	0.485	0.522	0.491	0.545	0.587	0.612	0.629	0.648	0.654	0.654	0.656	--
3.1	0.499	0.526	0.477	0.520	0.577	0.611	0.614	0.624	0.615	0.626	0.632	--
3.3	0.391	0.418	0.431	0.469	0.481	0.498	0.509	0.510	0.514	0.514	0.522	--
3.5	0.349	0.382	0.378	0.415	0.439	0.450	0.458	0.461	0.459	0.456	0.468	--
3.7	0.319	0.345	0.340	0.374	0.397	0.405	0.414	0.411	0.417	0.411	0.416	--
3.9	0.296	0.319	0.316	0.347	0.353	0.368	0.369	0.375	0.380	0.373	0.381	--
4.1	0.274	0.289	0.286	0.311	0.324	0.335	0.336	0.337	0.341	0.342	0.341	--
4.3	0.261	0.279	0.272	0.291	0.312	0.324	0.318	0.325	0.326	0.311	0.317	--
4.5	0.240	0.250	0.253	0.270	0.285	0.287	0.282	0.289	0.289	0.292	0.301	--
4.7	0.231	0.244	0.250	0.261	0.268	0.273	0.272	0.276	0.274	0.276	0.278	--
4.9	0.223	0.231	0.232	0.247	0.254	0.263	0.263	0.265	0.262	0.267	0.264	--
5.1	0.222	0.230	0.232	0.244	0.255	0.258	0.256	0.261	0.260	0.263	0.256	--
5.3	0.223	0.227	0.231	0.243	0.251	0.254	0.253	0.257	0.255	0.255	0.254	--
5.5	0.252	0.258	0.253	0.252	0.276	0.283	0.267	0.266	0.269	0.263	0.267	--
5.7	0.237	0.249	0.244	0.271	0.289	0.279	0.297	0.303	0.307	0.308	0.314	--
5.9	0.250	0.262	0.266	0.284	0.293	0.294	0.300	0.303	0.297	0.298	0.298	--
6.1	0.278	0.294	0.299	0.301	0.310	0.316	0.316	0.316	0.317	0.317	0.313	--
6.3	0.274	0.313	0.312	0.353	0.365	0.357	0.372	0.373	0.378	0.375	0.363	--
6.5	0.278	0.319	0.310	0.336	0.355	0.358	0.364	0.368	0.370	0.365	0.372	--

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Higher frequency harmonics

P/P _n [%]	0	10	20	30	40	50	60	70	80	90	100	Limit
f [kHz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
6.7	0.336	0.360	0.320	0.340	0.362	0.373	0.372	0.369	0.372	0.373	0.371	--
6.9	0.261	0.324	0.319	0.340	0.373	0.404	0.420	0.427	0.422	0.351	0.338	--
7.1	0.237	0.260	0.250	0.274	0.299	0.285	0.293	0.296	0.302	0.333	0.368	--
7.3	0.213	0.216	0.208	0.222	0.232	0.234	0.238	0.239	0.247	0.245	0.245	--
7.5	0.185	0.184	0.192	0.191	0.195	0.197	0.201	0.202	0.203	0.207	0.209	--
7.7	0.165	0.157	0.146	0.161	0.162	0.163	0.166	0.169	0.171	0.172	0.172	--
7.9	0.149	0.140	0.127	0.139	0.140	0.143	0.144	0.146	0.149	0.149	0.149	--
8.1	0.133	0.120	0.109	0.117	0.122	0.125	0.124	0.126	0.127	0.129	0.128	--
8.3	0.122	0.110	0.099	0.104	0.109	0.110	0.112	0.115	0.115	0.116	0.115	--
8.5	0.112	0.098	0.087	0.094	0.096	0.098	0.100	0.102	0.103	0.103	0.102	--
8.7	0.105	0.092	0.082	0.085	0.089	0.092	0.092	0.093	0.094	0.094	0.094	--
8.9	0.099	0.084	0.075	0.078	0.080	0.083	0.084	0.085	0.085	0.085	0.089	--

Note(s):

Each phase output current > 75A, The harmonic currents are measured per EN 61000-4-7+A1.
 The worst value of three phases shall be determined.

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5.7.2.3.3	Flicker - Generation units with a rated current > 75 A		P
Grid impedance angle, ψ_k : 30°			
Measurement	Plt	0.02872	
	P/Pn [%]	Pst	C Ψ k
1	10	0.012448	0.18672
2	20	0.012464	0.18696
3	30	0.012481	0.18722
4	40	0.012498	0.18747
5	50	0.012515	0.18773
6	60	0.012531	0.18797
7	70	0.012548	0.18822
8	80	0.012565	0.18848
9	90	0.012582	0.18873
10	100	0.012615	0.18923
11	100	0.012649	0.18974
12	100	0.012632	0.18948
Grid impedance angle, ψ_k : 50°			
Measurement	Plt	0.03144	
	P/Pn [%]	Pst	C Ψ k
1	10	0.013625	0.20438
2	20	0.013643	0.20465
3	30	0.013661	0.20492
4	40	0.01368	0.20520
5	50	0.013698	0.20547
6	60	0.013716	0.20574
7	70	0.013735	0.20603
8	80	0.013753	0.20630
9	90	0.013772	0.20658
10	100	0.013808	0.20712
11	100	0.013845	0.20768
12	100	0.013827	0.20741

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Grid impedance angle, ψ_k : 70°			
Measurement	Plt	0.03273	
	P/Pn [%]	Pst	C Ψ_k
1	10	0.014187	0.21281
2	20	0.014206	0.21309
3	30	0.014225	0.21338
4	40	0.014244	0.21366
5	50	0.014264	0.21396
6	60	0.014283	0.21425
7	70	0.014302	0.21453
8	80	0.014321	0.21482
9	90	0.01434	0.21510
10	100	0.014379	0.21569
11	100	0.014417	0.21626
12	100	0.014398	0.21597
Grid impedance angle, ψ_k : 85°			
Measurement	Plt	0.03240	
	P/Pn [%]	Pst	C Ψ_k
1	10	0.014045	0.21068
2	20	0.014064	0.21096
3	30	0.014083	0.21125
4	40	0.014102	0.21153
5	50	0.014121	0.21182
6	60	0.014139	0.21209
7	70	0.014158	0.21237
8	80	0.014177	0.21266
9	90	0.014196	0.21294
10	100	0.014234	0.21351
11	100	0.014273	0.21410
12	100	0.014253	0.21380

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5.7.2.3.5	Rapid voltage changes - Generation units with a rated current > 75 A			P
Voltage fluctuations caused by switching operations				
Grid frequency f [Hz]	50			
Grid voltage U _n [V]	230/400			
Rated current I _n [A]	360			
Remarks:	K _{imax} : is the ratio between the measured I _{max} and the I _{nom} (nominal current) of the device.			
Reactive set-point control, Q = 0				
Max. number of switching operations, N ₁₀	1			
Max. number of switching operations, N ₁₂₀	12			
Case of switching operation	Cut-in at 10% of rated power			
Grid impedance angle, ψ _k	30°	50°	70°	85°
Flicker step factor, k _f (ψ _k)	0.0046	0.0045	0.0044	0.0044
Voltage change factor, k _u (ψ _k)	0.1130	0.1130	0.1130	0.1130
Reactive set-point control, Q = 0				
Max. number of switching operations, N ₁₀	1			
Max. number of switching operations, N ₁₂₀	12			
Case of switching operation	Cut-in at 100% of rated power			
Grid impedance angle	30°	50°	70°	85°
Flicker step factor, k _f (ψ _k)	0.0103	0.0090	0.0093	0.0072
Voltage change factor, k _u (ψ _k)	0.1130	0.1130	0.1130	0.1130
Reactive set-point control, Q = 0				
Max. number of switching operations, N ₁₀	1			
Max. number of switching operations, N ₁₂₀	12			
Case of switching operation	Service disconnection			
Grid impedance angle	30°	50°	70°	85°
Flicker step factor, k _f (ψ _k)	0.0060	0.0059	0.0058	0.0057
Voltage change factor, k _u (ψ _k)	0.1130	0.1130	0.1130	0.1130
Worst case over all switching operations, k _{imax}				
Note(s): Each phase output current > 75A, the voltage fluctuations shall be comply with IEC 61400-21-1.				

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5.7.2.4	TABLE: Verification procedure for DC injection			P
Test Conditions	Measurements			Limit
	Idc / In [%]			Idc/In
	L1	L2	L3	
30% - 40% Sn	0.006	0.006%	0.006%	Max(0.5%In,20mA)
60% - 70% Sn	0.05%	0.05%	0.05%	Max(0.5%In,20mA)
> 95% Sn	0.22%	0.22%	0.21%	Max(0.5%In,20mA)
Note(s):				

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5.8.3.2	TABLE: Interface protection Voltage and frequency protections				P
Condition	Setting	Measurement			Limitation
		Trip value [V]			
		L123			
U<	20%Un	43.9			±1% of U _n
		43.9			
		43.9			
U<	45%Un	102.7			
		102.7			
		102.7			
U<	65%Un	102.3			
		102.3			
		102.3			
U<	100%Un	230.8			
		230.8			
		230.9			
Condition	Setting	Measurement			
		Trip value [V]			
		L1-N	L2-N	L3-N	
U<	20%Un	43.7	43.8	43.6	
		44.0	44.2	44.7	
		43.6	43.6	44.3	
U<	45%Un	102.7	102.3	102.7	
		102.7	102.3	102.7	
		102.7	102.3	102.7	
U<	65%Un	150.0	148.3	150.0	
		149.8	148.3	150.0	
		150.0	148.9	150.0	
U<	100%Un	230.4	229.7	230.2	
		230.6	229.7	230.9	
		230.8	229.1	230.8	
Condition	Setting	Measurement			

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		Trip value [V]			
		L1-L2	L2-L3	L3-L1	
U<	20%Un	45.0	44.8	44.9	
		44.4	45.0	44.9	
		45.0	44.8	45.1	
U<	45%Un	102.7	102.7	102.7	
		102.7	102.7	102.7	
		101.9	102.7	102.7	
U<	65%Un	150.0	150.1	149.9	
		150.0	150.1	149.9	
		150.0	150.0	149.2	
U<	100%Un	230.9	230.9	230.9	
		230.9	230.5	230.8	
		230.9	230.9	230.7	
Notes: Ramp signal test					

Condition	Setting	Measurement	Limitation
		Trip value [V]	
		L123	
U<<	20%Un	44.5	±1% of U _n
		44.5	
		44.0	
U<<	45%Un	102.3	
		102.3	
		102.3	
U<<	65%Un	149.4	
		149.4	
		149.4	
U<<	100%Un	229.9	
		229.9	
		229.9	
Condition	Setting	Measurement	
		Trip value [V]	

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		L1-N	L2-N	L3-N	
U<<	20%Un	45.0	44.7	45.0	
		44.9	45.0	45.0	
		45.0	44.5	45.0	
U<<	45%Un	102.3	102.7	103.9	
		102.2	102.5	102.9	
		103.9	102.7	103.9	
U<<	65%Un	149.3	148.7	150.0	
		149.3	148.8	149.8	
		149.5	148.8	149.8	
U<<	100%Un	230.3	229.6	230.9	
		230.3	228.9	230.9	
		230.3	229.3	230.9	
Condition	Setting	Measurement			
		Trip value [V]			
		L1-L2	L2-L3	L3-L1	
U<<	20%Un	44.9	44.2	44.9	
		45.0	45.0	44.2	
		45.0	45.0	45.0	
U<<	45%Un	101.9	102.5	102.6	
		103.9	103.9	103.9	
		103.7	103.8	103.7	
U<<	65%Un	149.9	150.0	150.0	
		150.0	150.0	149.5	
		148.9	150.0	150.0	
U<<	100%Un	230.8	230.9	230.7	
		230.7	230.5	230.9	
		230.7	230.9	230.8	
Notes: Ramp signal test					

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Condition	Setting	Measurement			Limitation
		Trip value [V]			
		L 123			
U>	100%Un	229.7			±1% of U _n
		229.7			
		229.7			
U>	106%Un	243.6			
		243.6			
		243.6			
U>	112%Un	257.5			
		257.5			
		257.5			
U>	120%Un	279.0			
		279.0			
		277.8			
Condition	Setting	Measurement			
		Trip value [V]			
		L1-N	L2-N	L3-N	
U>	100%Un	228.9	229.7	229.7	
		229.7	228.2	229.1	
		229.7	228.6	229.8	
U>	106%Un	243.6	243.2	243.6	
		243.6	243.6	243.6	
		243.4	243.3	243.6	
U>	112%Un	257.4	257.4	257.5	
		257.3	257.4	257.5	
		257.3	257.4	257.5	
U>	120%Un	277.0	277.0	276.0	
		276.0	275.5	275.6	
		276.0	277.0	275.9	
Condition	Setting	Measurement			
		Trip value [V]			
		L1-L2	L2-L3	L3-L1	

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U>	100%Un	229.3	229.7	229.6	
		229.7	229.3	229.6	
		229.5	229.8	229.6	
U>	106%Un	243.6	243.6	243.6	
		243.6	243.6	243.6	
		243.6	243.6	243.6	
U>	112%Un	257.4	257.2	257.3	
		257.4	257.0	257.4	
		257.4	257.5	257.5	
U>	120%Un	275.0	276.0	276.0	
		275.7	275.8	276.0	
		275.9	275.9	275.7	
Notes: Ramp signal test					

Condition	Setting	Measurement			Limitation
		Trip value [V]			
		L123			
U>>	100%Un	231.1			± 1% of U _n
		231.1			
		231.1			
U>>	109%Un	252.9			
		252.4			
		252.4			
U>>	118%Un	272.4			
		272.4			
		272.5			
U>>	130%Un	300.0			
		300.0			
		300.0			
Condition	Setting	Measurement			
		Trip value [V]			
		L1-N	L2-N	L3-N	
U>>	100%Un	229.6	229.7	229.7	

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		229.7	229.7	229.8	
		229.6	229.8	229.8	
U>>	109%Un	250.3	249.8	250.5	
		250.5	250.5	250.6	
		250.5	250.4	250.5	
U>>	118%Un	272.4	272.4	272.5	
		272.4	272.4	271.3	
		272.4	272.4	271.3	
U>>	130%Un	298.4	298.5	299.7	
		298.8	298.5	299.8	
		299.6	298.5	298.4	
Condition	Setting	Measurement			
		Trip value [V]			
		L1-L2	L2-L3	L3-L1	
U>>	100%Un	229.5	229.8	229.8	
		229.5	229.5	229.6	
		229.7	229.7	229.5	
U>>	109%Un	250.4	250.5	250.6	
		250.5	250.6	250.5	
		250.2	250.2	250.6	
U>>	118%Un	271.3	271.2	271.3	
		271.3	271.3	271.3	
		271.2	271.3	271.3	
U>>	130%Un	298.3	299.0	299.0	
		299.3	298.4	299.0	
		298.9	299.5	299.0	

Notes: Ramp signal test

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Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L123			
U<	100	119			100-200
		111			
		119			
U<	30000	30010			30000-30100
		30010			
		30040			
U<	60000	60010			60000-60100
		60020			
		60040			
U<	100000	100040			100000-100100
		100020			
		100010			
Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L1-N	L2-N	L3-N	
U<	100	163	160	147	100-200
		151	146	122	
		172	174	150	
U<	30000	30070	30020	30050	30000-30100
		30050	30010	30040	
		30030	30010	30040	
U<	60000	60020	60020	60030	60000-60100
		60010	60010	60040	
		60040	60010	60040	
U<	100000	100020	100040	100060	100000-100100
		100040	100070	100040	
		100050	100070	100060	
Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L1-L2	L2-L3	L3-L1	
U<	100	115	118	102	100-200
		109	127	127	
		124	117	108	

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U<	30000	30030	30090	30050	30000-30100
		30010	30030	30090	
		30030	30090	30010	
U<	60000	60030	60010	60010	60000-60100
		60010	60010	60030	
		60020	60030	60020	
U<	100000	100010	100020	100070	100000-100100
		100010	100040	100050	
		100020	100010	100010	
Note(s): Jump signal test					

Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L123			
U<<	100	126			100-200
		126			
		142			
U<<	1500	1510			1500-1600
		1510			
		1540			
U<<	3000	3090			3000-3100
		3090			
		3090			
U<<	5000	5050			5000-5100
		5020			
		5030			
Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L1-N	L2-N	L3-N	
U<<	100	110	140	107	100-200
		117	171	106	
		111	140	100	
U<<	1500	1510	1560	1530	1500-1600
		1510	1560	1520	
		1520	1530	1510	

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U<<	3000	3040	3010	3070	3000-3100
		3010	3010	3030	
		3010	3010	3060	
U<<	5000	5050	5080	5070	5000-5100
		5070	5060	5090	
		5060	5060	5080	
Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L1-L2	L2-L3	L3-L1	
U<<	100	121	132	122	100-200
		131	123	118	
		138	118	110	
U<<	1500	1590	1530	1520	1500-1600
		1570	1540	1540	
		1510	1550	1550	
U<<	3000	3040	3010	3060	3000-3100
		3080	3030	3010	
		3010	3050	3040	
U<<	5000	5060	5080	5090	5000-5100
		5060	5080	5080	
		5060	5070	5060	
Note(s): Jump signal test					

Condition	Setting [ms]	Measurement	Limitation
		Trip time	
		L123	
U>	100	100.05	100-200
		100.06	
		100.07	
U>	30000	30010	30000-30100
		30020	
		30010	
U>	60000	60030	60000-60100
		60040	
		60060	

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U>	100000	100050			100000-100100
		100060			
		100070			
Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L1-N	L2-N	L3-N	
U>	100	167	192	143	100-200
		142	193	152	
		173	185	160	
U>	30000	30030	30030	30040	30000-30100
		30030	30010	30010	
		30050	30040	30010	
U>	60000	60050	60040	60050	60000-60100
		60050	60040	60010	
		60010	60040	60070	
U>	100000	100040	100080	100040	100000-100100
		100070	100010	100050	
		100030	100060	100050	
Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L1-L2	L2-L3	L3-L1	
U>	100	161	133	180	100-200
		145	135	167	
		145	157	137	
U>	30000	30020	30010	30010	30000-30100
		30010	30010	30030	
		30040	30020	30030	
U>	60000	60060	60010	60060	60000-60100
		60030	60010	60050	
		60020	60070	60010	
U>	100000	100060	100090	100040	100000-100100
		100040	100060	100020	
		100030	100080	100040	
Note(s): Jump signal test					

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Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L123			
U>>	100	138			100-200
		188			
		151			
U>>	1500	1510			1500-1600
		1510			
		1510			
U>>	3000	3010			3000-3100
		3010			
		3050			
U>>	5000	5010			5000-5100
		5090			
		5060			
Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L1-N	L2-N	L3-N	
U>>	100	128	159	150	100-200
		140	151	134	
		140	166	143	
U>>	1500	1550	1510	1560	1500-1600
		1540	1540	1530	
		1530	1570	1510	
U>>	3000	3090	3080	3070	3000-3100
		3070	3080	3090	
		3060	3090	3070	
U>>	5000	5020	5030	5020	5000-5100
		5060	5060	5080	
		5080	5030	5090	
Condition	Setting [ms]	Measurement			Limitation
		Trip time			
		L1-L2	L2-L3	L3-L1	
U>>	100	155	146	132	100-200
		149	150	142	
		142	160	137	

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U>>	1500	1550	1540	1510	1500-1600
		1540	1560	1510	
		1570	1580	1520	
U>>	3000	3060	3070	3070	3000-3100
		3060	3070	3080	
		3080	3080	3080	
U>>	5000	5050	5090	5040	5000-5100
		5040	5040	5030	
		5050	5060	5040	
Note(s): Jump signal test					

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Condition	Setting	Measurement	Limitation
		Trip value [Hz]	
F>	50Hz	50.03	$\pm 0.1\%$ of f_n
		50.02	
		50.02	
F>	50.5Hz	50.52	
		50.52	
		50.52	
F>	51.5Hz	51.53	
		51.53	
		51.52	
F>	52Hz	52.0	
		52.0	
		52.0	

Condition	Setting	Measurement	Limitation
		Trip value [Hz]	
F>>	50Hz	50.02	$\pm 0.1\%$ of f_n
		50.02	
		50.02	
F>>	50.5Hz	50.52	
		50.53	
		50.53	
F>>	51.5Hz	51.50	
		51.50	
		51.53	
F>>	52Hz	52.0	
		52.0	
		52.0	

Condition	Setting	Measurement	Limitation
		Trip value [Hz]	
F<	47Hz	47.0	$\pm 0.1\%$ of f_n
		47.0	
		47.0	

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F<	48Hz	47.97	
		47.97	
		47.97	
F<	49Hz	48.97	
		48.97	
		48.97	
F<	50Hz	49.97	
		49.97	
		49.97	

Condition	Setting	Measurement	Limitation
		Trip value [Hz]	
F<<	47Hz	46.97	$\pm 0.1\%$ of f_n
		46.97	
		46.98	
F<<	48Hz	47.97	
		47.97	
		47.97	
F<<	49Hz	48.97	
		48.97	
		48.97	
F<<	50Hz	49.97	
		49.97	
		49.97	

Condition	Setting [ms]	Measurement	Limitation
		Trip time	
F>	100	194	100-200
		178	
		193	
F>	30000	30060	30000-30100
		30040	
		30070	
F>	60000	60010	60000-60100
		60010	

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		60020	
F>	100000	100040	100000-100100
		100050	
		100030	
Note(s):			

Condition	Setting [ms]	Measurement	Limitation
		Trip time	
F>>	100	165	100-200
		191	
		171	
F>>	1500	1560	1500-1600
		1560	
		1540	
F>>	3000	3080	3000-3100
		3040	
		3040	
F>>	5000	5040	5000-5100
		5060	
		5090	
Note(s):			

Condition	Setting [ms]	Measurement	Limitation
		Trip time	
F<	100	179	100-200
		159	
		198	
F<	30000	30010	30000-30100
		30070	
		30010	
F<	60000	60040	60000-60100
		60040	
		60020	
F<	100000	100010	100000-100100
		100060	

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		100030	
Note(s):			

Condition	Setting [ms]	Measurement	Limitation
		Trip time	
F<<	100	196	100-200
		183	
		163	
F<<	1500	1520	1500-1600
		1540	
		1550	
F<<	3000	3010	3000-3100
		3010	
		3040	
F<<	5000	5010	5000-5100
		5090	
		5080	
Note(s):			

5.8.3.2.4		TABLE: Reset time and reset ratio						P	
Condition	Setting U/Un [ms]	Measurement						Limitation	
		L1-N		L2-N		L3-N			
		Reset time	Result	Reset time	Result	Reset time	Result	Reset time	Result
U> Un- 1.13Un(2940ms)- 1.08Un(3200ms)- Un	1.1Un/ 3000	≤50ms	No trip	≤50ms	No trip	≤50ms	No trip	≤50ms	No trip
		≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
		≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
U>> Un- 1.23Un(40ms)- 1.18Un(300ms)- Un	1.2Un/ 100	≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
		≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
		≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
U< Un- 0.87Un(2940ms)- 0.92Un(3200ms)- Un	0.9Un/ 3000	≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
		≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
		≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		

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$U <<$ U_n 0.77 U_n (40ms)- 0.82 U_n (300ms)- U_n	0.8 U_n / 100	≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
		≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		
		≤50ms	No trip	≤50ms	No trip	≤50ms	No trip		

Condition	Setting HZ/ [ms]	Measurement		Limitation	
		Reset time	Result	Reset time	Result
$F <$ 50HZ- 49.2HZ(2940ms)- 49.7HZ(3200ms)- 50HZ	49.5/ 3000	≤50ms	No trip	≤50ms	No trip
		≤50ms	No trip		
		≤50ms	No trip		
$F <<$ 50HZ- 48.2HZ(40MS)- 48.7HZ(300ms)- 50HZ	48.5/ 100	≤50ms	No trip		
		≤50ms	No trip		
		≤50ms	No trip		
$F >$ 50HZ- 50.8HZ(2940ms)- 50.3HZ(3200ms)- 50HZ	50.5/ 3000	≤50ms	No trip		
		≤50ms	No trip		
		≤50ms	No trip		
$F >>$ 50HZ- 51.8HZ(40ms)- 51.3HZ(300ms)- 50HZ	51.5 100	≤50ms	No trip		
		≤50ms	No trip		
		≤50ms	No trip		

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5.8.3.3	TABLE: Overvoltage 10 min mean protection		P
Condition	Setting	Measurement	Limitation
		Trip value [V]	
U>	110%Un	253.8	±1% of Un
Condition	Setting	Measurement	Limitation
		Trip time	
a) Operation under 100%Un for 10 minutes, then jumped from 100%Un to 112%Un.			
U>	600	517	450-550s
b) Operation under 100%Un for 10 minutes, then jumped from 100%Un to 108%Un.			
U>	600	No disconnection	No disconnect
c) Operation under 106%Un for 10 minutes, then jumped from 106%Un to 114%Un.			
U>	600	318	225-375s (≤ ½ a) ± 75s)
Note(s):			

[illegible]

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5.8.6		TABLE: Islanding detection				P	
Power 100%							
Input : 875 Vdc, P _{EUT} : 500 kW							
Conditions	P _R [kW]	Q _L [kVar]	Q _C [kVar]	Q _f	Trip time [ms]	Limitation [ms]	
P _R : -10% Q _C : +10%	L1: 178.750	L1: 167.083	L1: 147.000	0.940	244	2000	
	L2: 175.542	L2: 166.667	L2: 146.250	0.951			
	L3: 170.042	L3: 166.667	L3: 146.625	0.939			
P _R : -10% Q _C : +5%	L1: 178.750	L1: 166.667	L1: 155.167	0.941	316	2000	
	L2: 175.542	L2: 166.250	L2: 154.375	0.951			
	L3: 170.042	L3: 166.667	L3: 154.771	0.937			
P _R : -10% Q _C : 0%	L1: 178.750	L1: 166.250	L1: 163.333	0.968	556	2000	
	L2: 175.542	L2: 166.667	L2: 162.500	0.970			
	L3: 170.042	L3: 166.667	L3: 162.917	0.970			
P _R : -10% Q _C : -5%	L1: 178.750	L1: 166.250	L1: 171.500	0.991	335	2000	
	L2: 175.542	L2: 166.667	L2: 170.625	0.999			
	L3: 170.042	L3: 166.250	L3: 171.083	0.992			
P _R : -10% Q _C : -10%	L1: 178.750	L1: 166.250	L1: 179.667	0.990	227	2000	
	L2: 175.542	L2: 166.667	L2: 178.750	0.997			
	L3: 170.042	L3: 166.667	L3: 179.208	0.991			
P _R : -5% Q _C : +10%	L1: 170.625	L1: 166.667	L1: 147.000	0.992	270	2000	
	L2: 167.542	L2: 166.250	L2: 146.250	0.998			
	L3: 162.333	L3: 166.667	L3: 146.625	0.991			
P _R : -5% Q _C : -10%	L1: 170.625	L1: 166.667	L1: 179.667	0.990	275	2000	
	L2: 167.583	L2: 166.250	L2: 178.750	0.997			
	L3: 162.333	L3: 167.083	L3: 179.208	0.991			
P _R : 0% Q _C : +10%	L1: 162.500	L1: 166.667	L1: 147.000	0.996	337	2000	
	L2: 159.583	L2: 166.667	L2: 146.250	0.998			
	L3: 154.583	L3: 166.667	L3: 146.625	0.999			
P _R : -5% Q _C : +5%	L1: 172.500	L1: 166.667	L1: 165.833	0.950	578	2000	
	L2: 170.000	L2: 166.250	L2: 165.833	0.951			
	L3: 165.417	L3: 166.667	L3: 166.250	0.949			

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Power 100%						
Input : 875 Vdc, P _{EUT} : 500 kW						
Conditions	P _R [kW]	Q _L [kVar]	Q _C [kVar]	Q _f	Trip time [ms]	Limitation [ms]
P _R : -5% Q _C : 0%	L1: 172.500	L1: 166.667	L1: 173.750	0.972	930	2000
	L2: 170.417	L2: 166.667	L2: 174.167	0.974		
	L3: 165.417	L3: 167.083	L3: 174.583	0.974		
P _R : -5% Q _C : -5%	L1: 172.917	L1: 166.250	L1: 181.667	0.993	703	2000
	L2: 170.417	L2: 166.667	L2: 182.500	0.999		
	L3: 165.417	L3: 167.083	L3: 182.917	0.994		
P _R : 0% Q _C : +5%	L1: 163.750	L1: 166.667	L1: 165.417	0.999	903	2000
	L2: 161.250	L2: 166.250	L2: 165.833	1.001		
	L3: 156.250	L3: 167.500	L3: 166.250	1.004		
P _R : 0% Q _C : 0%	L1: 162.500	L1: 175.083	L1: 163.333	1.002	935	2000
	L2: 159.583	L2: 167.083	L2: 162.500	1.004		
	L3: 154.583	L3: 167.083	L3: 162.917	1.002		
P _R : 0% Q _C : -5%	L1: 164.583	L1: 166.667	L1: 182.083	1.045	925	2000
	L2: 161.667	L2: 166.667	L2: 182.500	1.049		
	L3: 156.667	L3: 167.083	L3: 183.333	1.050		
P _R : +5% Q _C : +5%	L1: 155.833	L1: 167.083	L1: 165.417	1.050	566	2000
	L2: 153.750	L2: 167.083	L2: 165.833	1.051		
	L3: 148.333	L3: 166.667	L3: 166.667	1.053		
P _R : +5% Q _C : 0%	L1: 156.250	L1: 166.250	L1: 173.750	1.073	908	2000
	L2: 153.333	L2: 166.667	L2: 173.750	1.078		
	L3: 147.917	L3: 166.667	L3: 174.583	1.080		
P _R : +5% Q _C : -5%	L1: 157.500	L1: 167.500	L1: 175.417	1.071	572	2000
	L2: 156.250	L2: 170.833	L2: 176.250	1.076		
	L3: 158.333	L3: 168.333	L3: 190.417	1.064		
P _R : 0% Q _C : -10%	L1: 162.500	L1: 166.250	L1: 179.667	1.040	422	2000
	L2: 159.583	L2: 166.667	L2: 178.750	1.045		
	L3: 154.583	L3: 166.667	L3: 179.208	1.048		

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Power 100%						
Input : 875 Vdc, P _{EUT} : 500 kW						
Conditions	P _R [kW]	Q _L [kVar]	Q _C [kVar]	Q _f	Trip time [ms]	Limitation [ms]
P _R : +5% Q _C : +10%	L1: 154.375	L1: 166.667	L1: 147.000	1.047	266	2000
	L2: 151.625	L2: 166.667	L2: 146.250	1.049		
	L3: 146.917	L3: 167.083	L3: 146.625	1.050		
P _R : +5% Q _C : -10%	L1: 154.375	L1: 166.250	L1: 179.667	1.069	267	2000
	L2: 151.625	L2: 166.667	L2: 178.750	1.074		
	L3: 146.917	L3: 166.667	L3: 179.208	1.060		
P _R : +10% Q _C : +10%	L1: 146.250	L1: 166.667	L1: 147.000	1.040	188	2000
	L2: 143.625	L2: 166.667	L2: 146.250	1.041		
	L3: 139.125	L3: 167.083	L3: 146.625	1.042		
P _R : +10% Q _C : +5%	L1: 146.292	L1: 166.250	L1: 155.167	1.043	276	2000
	L2: 143.625	L2: 166.667	L2: 154.375	1.045		
	L3: 139.125	L3: 166.667	L3: 154.792	1.047		
P _R : +10% Q _C : 0%	L1: 146.333	L1: 166.667	L1: 163.333	1.065	448	2000
	L2: 143.625	L2: 166.667	L2: 162.500	1.073		
	L3: 139.125	L3: 167.500	L3: 162.917	1.075		
P _R : +10% Q _C : -5%	L1: 146.375	L1: 166.667	L1: 171.500	1.066	275	2000
	L2: 143.625	L2: 166.667	L2: 170.625	1.070		
	L3: 139.125	L3: 167.083	L3: 171.042	1.062		
P _R : +10% Q _C : -10%	L1: 146.333	L1: 167.083	L1: 179.667	1.062	202	2000
	L2: 143.625	L2: 167.083	L2: 178.792	1.065		
	L3: 179.208	L3: 139.125	L3: 166.667	1.060		
Power 66%						
Input : 821 Vdc, P _{EUT} : 330 kW						
Conditions	P _R [kW]	Q _L [kVar]	Q _C [kVar]	Q _f	Trip time [ms]	Limitation [ms]
P _R : 0% Q _C : -5%	L1: 105.417	L1: 110.000	L1: 120.833	1.044	244	2000
	L2: 105.000	L2: 109.583	L2: 120.833	1.046		
	L3: 104.583	L3: 109.583	L3: 121.250	1.048		

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Power 66%						
Input : 821 Vdc, P _{EUT} : 330 kW						
Conditions	P _R [kW]	Q _L [kVar]	Q _C [kVar]	Q _f	Trip time [ms]	Limitation [ms]
P _R : 0% Q _C : -4%	L1: 105.000	L1: 110.000	L1: 120.000	1.044	267	2000
	L2: 105.417	L2: 109.583	L2: 120.417	1.040		
	L3: 104.583	L3: 109.583	L3: 120.417	1.044		
P _R : 0% Q _C : -3%	L1: 105.417	L1: 110.000	L1: 119.167	1.037	270	2000
	L2: 105.000	L2: 109.583	L2: 119.167	1.039		
	L3: 104.583	L3: 109.583	L3: 119.167	1.039		
P _R : 0% Q _C : -2%	L1: 105.417	L1: 110.000	L1: 117.500	1.030	336	2000
	L2: 105.417	L2: 110.417	L2: 117.917	1.033		
	L3: 104.583	L3: 110.000	L3: 117.917	1.031		
P _R : 0% Q _C : -1%	L1: 105.417	L1: 110.000	L1: 116.667	1.026	422	2000
	L2: 105.000	L2: 110.000	L2: 117.083	1.032		
	L3: 104.583	L3: 110.000	L3: 117.083	1.028		
P _R : 0% Q _C : 0%	L1: 105.833	L1: 110.000	L1: 111.667	1.000	908	2000
	L2: 105.417	L2: 110.000	L2: 111.250	1.002		
	L3: 105.000	L3: 110.000	L3: 111.667	1.000		
P _R : 0% Q _C : +1%	L1: 105.417	L1: 110.000	L1: 114.167	1.015	703	2000
	L2: 105.417	L2: 110.417	L2: 114.583	1.019		
	L3: 104.583	L3: 110.000	L3: 114.583	1.021		
P _R : 0% Q _C : +2%	L1: 105.000	L1: 110.000	L1: 113.333	1.015	578	2000
	L2: 105.417	L2: 109.583	L2: 113.750	1.011		
	L3: 104.583	L3: 109.583	L3: 113.750	1.015		
P _R : 0% Q _C : +3%	L1: 105.000	L1: 110.000	L1: 112.500	1.011	572	2000
	L2: 105.000	L2: 109.583	L2: 112.917	1.011		
	L3: 104.583	L3: 109.583	L3: 112.500	1.006		
P _R : 0% Q _C : +4%	L1: 105.417	L1: 110.000	L1: 110.417	0.998	566	2000
	L2: 105.000	L2: 110.417	L2: 107.917	0.992		
	L3: 104.583	L3: 110.000	L3: 110.833	1.000		

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Power 66%						
Input : 821 Vdc, P _{EUT} : 330 kW						
Conditions	P _R [kW]	Q _L [kVar]	Q _C [kVar]	Q _f	Trip time [ms]	Limitation [ms]
P _R : 0% Q _C : +5%	L1: 105.417	L1: 110.000	L1: 109.167	0.992	556	2000
	L2: 105.000	L2: 109.583	L2: 109.167	0.994		
	L3: 104.583	L3: 110.000	L3: 110.000	0.996		
Power 33%						
Input : 757 Vdc, P _{EUT} : 165 kW						
Conditions	P _R [kW]	Q _L [kVar]	Q _C [kVar]	Q _f	Trip time [ms]	Limitation [ms]
P _R : 0% Q _C : -5%	L1: 53.333	L1: 55.000	L1: 63.750	1.061	188	2000
	L2: 52.500	L2: 55.417	L2: 65.000	1.091		
	L3: 52.917	L3: 55.000	L3: 65.000	1.079		
P _R : 0% Q _C : -4%	L1: 53.333	L1: 55.000	L1: 62.917	1.054	202	2000
	L2: 52.500	L2: 55.000	L2: 64.167	1.080		
	L3: 52.917	L3: 55.000	L3: 64.167	1.072		
P _R : 0% Q _C : -3%	L1: 52.917	L1: 55.000	L1: 62.917	1.062	227	2000
	L2: 52.500	L2: 55.000	L2: 63.750	1.077		
	L3: 52.917	L3: 55.000	L3: 63.750	1.069		
P _R : 0% Q _C : -2%	L1: 53.333	L1: 55.000	L1: 62.917	1.054	275	2000
	L2: 52.500	L2: 55.000	L2: 62.917	1.070		
	L3: 52.917	L3: 55.000	L3: 63.333	1.065		
P _R : 0% Q _C : -1%	L1: 53.333	L1: 55.000	L1: 62.083	1.047	316	2000
	L2: 52.500	L2: 55.000	L2: 62.500	1.066		
	L3: 52.917	L3: 55.000	L3: 62.917	1.062		
P _R : 0% Q _C : 0%	L1: 52.917	L1: 55.000	L1: 55.833	1.000	930	2000
	L2: 52.500	L2: 55.000	L2: 55.000	1.000		
	L3: 52.917	L3: 55.000	L3: 55.833	1.000		
P _R : 0% Q _C : +1%	L1: 53.333	L1: 55.000	L1: 61.250	1.047	448	2000
	L2: 52.500	L2: 55.000	L2: 61.667	1.059		
	L3: 52.917	L3: 55.000	L3: 61.667	1.051		

Power 33%						
Input : 757 Vdc, P _{EUT} : 165 kW						
Conditions	P _R [kW]	Q _L [kVar]	Q _C [kVar]	Q _f	Trip time [ms]	Limitation [ms]
P _R : 0% Q _C : +2%	L1: 52.917	L1: 55.000	L1: 59.583	1.033	337	2000
	L2: 52.500	L2: 55.000	L2: 60.833	1.052		
	L3: 52.917	L3: 55.000	L3: 60.833	1.036		
P _R : 0% Q _C : +3%	L1: 53.333	L1: 55.000	L1: 59.167	1.022	276	2000
	L2: 52.500	L2: 55.000	L2: 60.417	1.048		
	L3: 52.917	L3: 55.000	L3: 60.417	1.040		
P _R : 0% Q _C : +4%	L1: 53.333	L1: 55.000	L1: 58.750	1.018	275	2000
	L2: 52.500	L2: 55.000	L2: 60.000	1.044		
	L3: 52.917	L3: 55.000	L3: 60.417	1.040		
P _R : 0% Q _C : +5%	L1: 52.917	L1: 55.000	L1: 57.083	1.011	266	2000
	L2: 52.500	L2: 55.000	L2: 56.667	1.015		
	L3: 52.500	L3: 55.000	L3: 57.500	1.022		
Note(s):						

5.9

TABLE: Connection and starting

P

Table 32 — Default parameter automatic reconnection after tripping according to EN 50549-1:2019 and EN 50549-2:2019

Parameter	Range	Default setting
Lower frequency	47,0Hz – 50,0 Hz	49,5 Hz
Upper frequency	50,0 Hz – 52,0 Hz	50,2 Hz
Lower voltage	50 %U _n – 100 %U _n	85 % U _n ^a / 90 % U _c ^b
Upper voltage	100 % – 120 % U _n	110 %U _n ^a / 110 %U _c ^b
Observation time	10 s – 600 s	60 s
Active power increase gradient	6 % – 3000 %/min	10 %/min
^a In case of EN 50549-1:2019		
^b In case of EN 50549-2:2019		

When the interface protection has been triggered, it shall be examined whether the system can only be connected within the tolerance ranges $0,85 U_n \leq U \leq 1,10 U_n$ or $0,90 U_c \leq U \leq 1,10 U_c$ and $47,5 \text{ Hz} \leq f \leq 50,05 \text{ Hz}$ and after the voltage and frequency remain within the tolerance ranges 60 s.

Table 33 — Default parameter starting to generate electrical power according to EN 50549-1:2019 and EN 50549-2:2019

Parameter	Range	Default setting
Lower frequency	47,0Hz – 50,0 Hz	49,5 Hz
Upper frequency	50,0 Hz – 52,0 Hz	50,1 Hz
Lower voltage	50 %U _n – 100 %U _n	85 % U _n ^a / 90 % U _c ^b
Upper voltage	100 % – 120 % U _n	110 %U _n ^a / 110 %U _c ^b
Observation time	10 s – 600 s	60 s
Active power increase gradient	6 % – 3000 %/min	disabled
^a In case of EN 50549-1:2019		
^b In case of EN 50549-2:2019		

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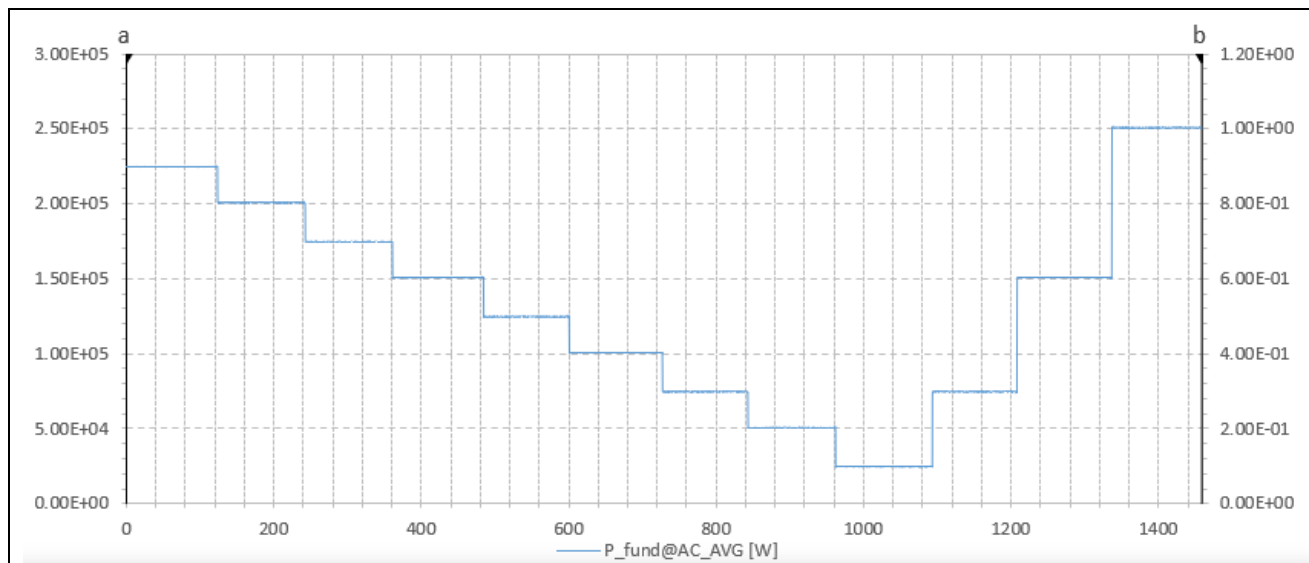
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Condition	Measurement		Limitation	
	Delay time [s]	Power Gradient [per minute]	Delay time	Power Gradient
Connection:				
U>	115.0	--	≥60s	--
U<	120.8	--		
f>	112.4	--		
f<	116.2	--		
Reconnection:				
U>	117.8	8.43	≥60s	≤10%Pn/minutes
U<	112.2	7.45		
f>	116.6	8.91		
f<	119.4	8.05		
Note(s):				

5.10	TABLE: Active power reduction on set point					P
Active power step [p.u. of Pn]	Requested set point value	Actual value		accuracy Actual value - Set point		Limit
P/Pn	W	W	P/Pn [p.u.]	W	P/Pn [p.u.]	P/Pn [p.u.]
90%	225000	224709	89.88%	225000	0.12%	± 5%Pn
80%	200000	200714	80.29%	200000	0.29%	
70%	175000	174730	69.89%	175000	0.11%	
60%	150000	150721	60.29%	150000	0.29%	
50%	125000	124680	49.87%	125000	0.13%	
40%	100000	100635	40.25%	100000	0.25%	
30%	75000	74602	29.84%	75000	0.16%	
20%	50000	50744	20.30%	50000	0.30%	
10%	25000	24630	9.85%	25000	0.15%	
30%	75000	74608	29.84%	75000	0.16%	+ 5%Pn
60%	150000	150742	60.30%	150000	0.30%	
100%	250000	250735	100.29%	250000	0.29%	

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Test Conditions	Measurements	Limitation
P/Pn	Gradient	Gradient
90% to 10%	0.45%Pn/s	0.33-0.66%Pn/s
Note(s):		

5.11	TABLE: Remote information exchange		P
Test Conditions		Measurements [s]	Δ Limit
Command signal from connection to disconnection		0.602	≤ 1 s
Note(s):			

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5.12	TABLE: Requirements regarding single fault tolerance of interface protection system and interface switch	P
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No.	component No.	fault	test voltage (Vd.c.)	test time	fuse No.	Input current (A)	Result
Liquid Cooling System							
1.	Liquid cooling control system power supply	Wrong connected	832	10min	-	-	Abnormal power supply of liquid cooling unit, liquid cooling unit stops running.
2.	Liquid cooling unit water supply pump communication	O-C	832	10min	-	-	Liquid-cooled unit pump, compressor stop running, reported circulating water pump frequency converter communication failure
3.	Liquid-cooled unit outlet water pressure sensor	O-C	832	10min	-	-	Liquid-cooled unit stopped and reported the outlet water pressure sensor. The equipment alarmed
4.	Liquid-cooled unit outlet water temperature sensor	O-C	832	10min	-	-	Liquid-cooled unit pump can run normally, the compressor works, reported the water temperature sensor failure, equipment alarms
5.	Liquid cooling unit 485 communication	O-C	832	10min	-	-	Liquid-cooled unit can't start.
6.	Evaporative fan	O-C	832	10min	-	-	Liquid-cooled unit can't start.
Fire Protection							
7.	Fire protection system	O-C	832	10min	-	-	The system shut down immediately. One of the detectors has a wiring fault and the concentrator K6/COM loop is open.
8.	Fire system primary alarm (smoke alarm)	O-C	832	10min	-	-	The system shuts down immediately. The audible and visual alarms are activated, and the EMS interface displays a VOC alarm.
9.	Fire system secondary alarm (smoke sensor alarm, temperature sensor alarm)	O-C	832	10min	-	-	The system shuts down immediately. Audible and visual alarm activated, aerosol released.
10.	Combustible gas concentration over limit	O-C	832	10min	-	-	System shutdown immediately. High hydrogen concentration, exhaust grille opens, exhaust fan activates, H2 alarm displayed.

[illegible]

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Revision History:

Date YYYY-MM-DD	Contents of modification (latest on top)	Prepared by	Approved by
2023-02-02	Originated and released into QM system	5.1.2e	5.1.2e



PHOTO DOCUMENTATION

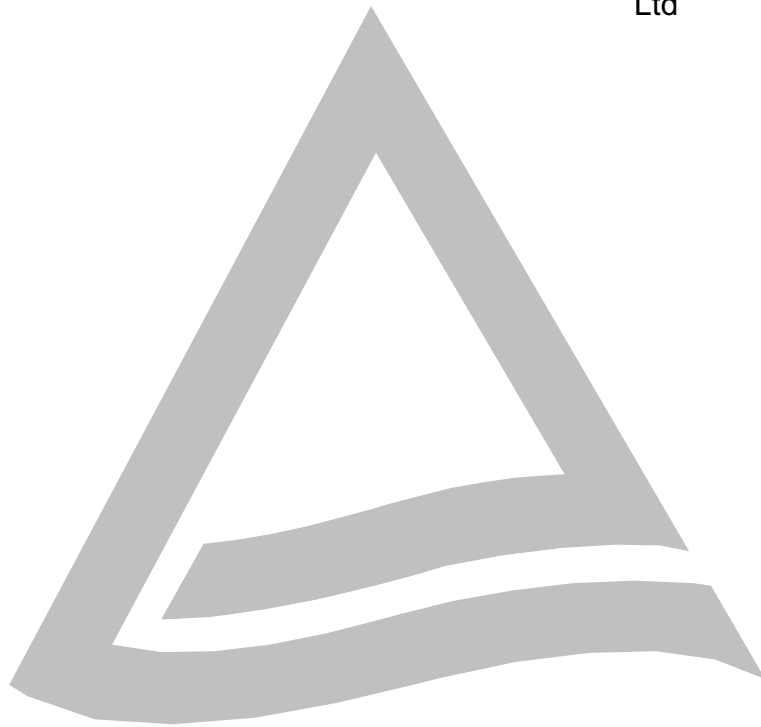
CN25HVW8 001 attachment 2

for

C&I Energy storage system

CESS932-500-01D, CESS699-375-01D,
CESS466-250-01D

Suzhou RCT Power Energy Technology Co.,
Ltd



This documentation consists of 9 pages (excluding this cover page)

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Photo 1-Overall view of CESS932-500-01D



Photo 2-Back view of CESS932-500-01D

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Photo 3-Side view of CESS932-500-01D



Photo 4-Internal view 1(CESS932-500-01D)

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Photo 5-Internal view 2(CESS932-500-01D)



Photo 6-Internal view 1 front side(CESS699-375-01D)

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Photo 7-Internal view 2 back side(CESS699-375-01D)



Photo 8-Internal view 1 front side (CESS466-250-01D)

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Photo 9-Internal view 2 back side (CESS466-250-01D)

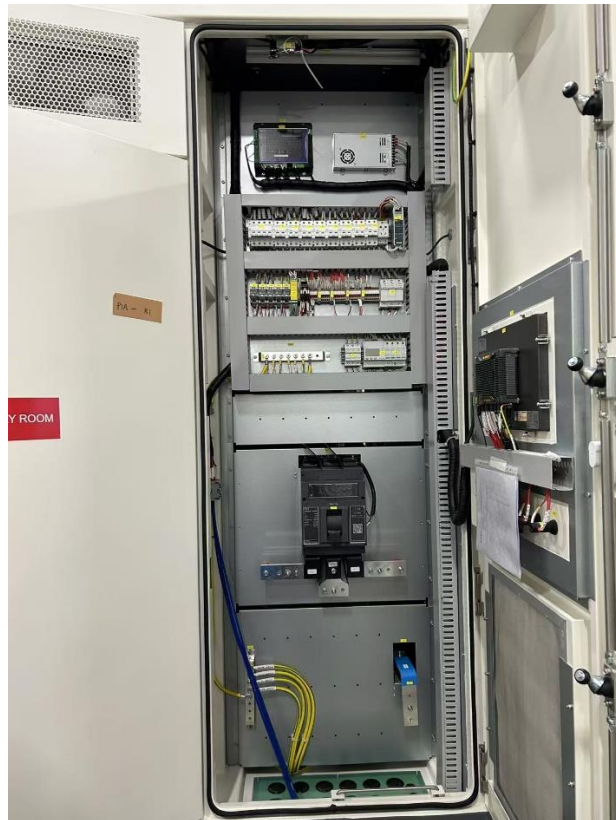


Photo 10- Auxiliary Power cabinet

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Photo 11- Battery rack with PCS



Photo 12-Switch gear and PCS module

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Photo 13-Liquid-cooling system



Photo 14-Fire panel

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Photo 15-Air conditioner



Photo 16- Controller Computer

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Photo 17- 24V Power supply

Legenda toegepaste uitzonderingsgrondslagen

In dit document zijn gegevens definitief geanonimiseerd op grond van:

Wet	Artikel	Omschrijving	Pagina's
Wet open overheid	Art. 5.1 lid 2 sub e	De eerbiediging van de persoonlijke levenssfeer	1, 3, 36, 401, 449
Burgerlijk wetboek 6	Art. 6:230b BW	Dit gegeven hoeft volgens art. 6:230b BW alleen verstrekt te worden aan de afnemer van de verleende diensten.	18, 30, 407