Base Load Power Hub (BLPH)

Remote and control simulation test procedure
66KV SWITCHGEARS (GIS)

Document Number: 1723001595-EL-PRO-00023

Document Class: 2

Rev.	Date	Description	Prepared	Reviewed	Approved
02	14/03/2025	Accepted for Construction (AFC)	Y.D.LEE	Y.W.LEE	S.J.CHO
01	10/12/2024	Issue for Review (IFR)	Y.D.LEE	Y.W.LEE	S.J.CHO
00	08/03/2024	Issue for Review (IFR)	Y.D.LEE	Y.W.LEE	S.J.CHO

HYOSUNG HEAVY INDUSTRIES

This document undergoes an issuance cycle within EDMS "Fusionlive".
Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

Table of Contents

SH.	DESCRIPTION	REVISIONS							
		00	01	02					
1	Cover	X	X	X					
2	Table of Contents	X	X	X					
3	Revision / Change Log	X	X	X					
4	TEST PLAN - FAT	X	X	X					
5~10	INSPECTION & TEST PROCEDURE - FAT	X	X	X					
11~56	Sample Test Report for FAT	X	X	X					
57	TEST PLAN - SAT(ON shore)	X	X	X					
58~63	INSPECTION & TEST PROCEDURE -SAT(ON shore)	X	X	X					
64	TEST PLAN - SAT(OFF shore)	X	X	X					
65~70	INSPECTION & TEST PROCEDURE -SAT(OFF shore)	X	X	X					
71~116	Sample Test Report for SAT	X	X	X					

This document undergoes an issuance cycle within EDMS "Fusionlive".
Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

Revision / Change Log

Rev.	Description
00	ISSUE FOR REVIEW (IFR)
01	ISSUE FOR REVIEW (IFR)
02	ACCEPTED FOR CONSTRUCTION (AFC)

HOLDS LIST

No.	Description
1.	
2.	
3.	
4.	

This document undergoes an issuance cycle within EDMS "Fusionlive".
File: 1723001595-EL-PRO-00023_Remote Control Simulation test Procedure_R2_250313.docx is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

	TEST PLAN - FAT	ITP No.		1723001595-EL-PRO-00023		
		Rev. No.		2	PAGE	4 of 116
CLASSIFICATION	EXPLANATION	INSPECTED BY			TEST PLACE	
	EXPLANATION	Hyosung	Customer	-	TEST PLACE	
F.A.T (Factory Acceptance Test) Routine tests	1 Relay Test				HYOSUNG CHANGWON FACTORY	
	1.1 Diagnostic Test	H	W	-		
	1.2 Relay Setting Check	H	W	-		
	1.3 IO Operation Test	H	W	-		
	1.4 Measurement Test	H	W	-		
	1.5 Protection Test	H	W	-		
	1.6 Remote Test	H	W	-		
REMARKS	H : HOLDING POINT W : WITNESS POINT	W/S : WITNESSING OVER SAMPLE R : TEST REPORT REVIEW				

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1. Relay Test 1.1 Diagnostic Test	1) Test Purpose - In order to verify that IED is possible to check the self-diagnosis. 2) Test Method - Activate internal related signal of the IED - Check the LED lamp on the IED - Check the status via menu button of the IED - Check the event log file on the IED 3) Test Criteria - Check that the simulated signal and detected signal are matched.	Check the normal operation	Witness
1.2 Relay Setting Check	1) Test Purpose - In order to verify that each relay is correctly set according to approved setting 2) Test Method a) Final DIGSI file review - If the relay needs to be updated, check with the latest settings file and upload it b) Run DIGSI software on Engineering notebook and connect with the protection relay. Verify that the connection is successful c) After connecting online, use the Compare function to check whether there are any abnormalities in the relay setting value d) Verify that all setting values are same with approved setting table. 3) Test Criteria - Verification of DIGSI Software's Relay Setting File - Verify that the DIGSI Setting File and Relay Setting are the same	Shall meet the approval specification The reference documents for the test are as follows. ●1723001595-EL-SO-00019 IED interrogation and programming software ●1723001595-EL-SO-00020 Relay IED configuration files ●1723001595-EL-SO-00021 IEC 61850 configuration files ●123A90-DDL-EL-RE-20169 Electrical Protection Relay Setting Schedule	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.3 IO Operation Test	1) Test Purpose - In order to verify that the status of the IO module on IED. 2) Test Method a) Binary Input Test - Check the BI Point number of the signal and perform a terminal short test for that number on the external terminal block or internal terminal block - If the BI is activated, check it operates by disconnecting the wire from the relevant terminal b) Binary Output Test - After checking the relevant BO Point, control is executed on alternative program in case of a circuit breaker / Disconnector / Earth Switch test. * The “Functional logic diagram” document must be approved before testing, and it is confirmed that it operates under the applicable conditions during the BO test. - For other BO points, After connecting to the relay using the DIGSI5 program perform an ON/OFF test through test mode. 3) Test Criteria - Check whether the relevant BI Points match the program - Check that BO POINT output operates normally ● The logic within the protection function must match the approved functional logic diagram.	Shall meet the approval specification Check the normal operation The reference documents for the test are as follows. ●1723001595-EL-DG-00012 FUNCTIONAL LOGIC DIAGRAM ●1723001595-EL-DG-00015 CIRCUIT AND WIRING DIAGRAM for DLCP	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.4 Measurement Test	1) Test Purpose - In order to verify that the status of the CT/PT module on IED. 2) Test Method - Using the test terminals of the CTT of the DCLP panel and normal operation of the protection relay is confirmed through a measurement test. * For reference, the protective relay test equipment used is Doble, Omicron and ISA etc. - Review approval documentation and drawings for test relays prior to testing. (check whether CT and PT ratio, polarity, and I/O list) - Using the test terminal, separate the secondary side of the CT and the protection relay. - Connect the test equipment to the cable on the protection relay side, and test by wiring so that the output of the test equipment can be connected - After injection the secondary CT test value to each A/B/C phase from the test equipment, and record the current value measured by the protection relay. - After injection the secondary CT test value to three-phase from the test equipment, and record the I1, I2, and I0 values measured at the protection relay. - Check whether process communication between MU and IED is normal. (Compare the injection value on the MU equipment side with the relay value through SV) - Connect the network for process bus communication to test Sample Value between the protective relay test equipment and MU. - Generate Sample Values from the test equipment to the process address set in the MU. 3) Test Criteria - Compare the injection value and the operation value. - To check that the value of difference should be within the tolerance range.	Check the normal operation The reference documents for the test are as follows. ●1723001595-EL-DG-00015 CIRCUIT AND WIRING DIAGRAM for DLCP	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.5 Protection Test	1) Test Purpose - In order to verify that equipment is accurately protected through the current and voltage input to the protection relay. 2) Test Method - Generate Sample Values from the protective relay test equipment used is Omicron or Meger and normal operation of the protection relay is confirmed through a protection function test. * PTP time synchronization is required between devices when generating sample values. - Review approval documentation and drawings for test relays prior to testing. (check whether CT and PT ratio, polarity, and I/O list) - Check the relay setting calculation report and setting table in advance and confirm that the protection relay settings have been completed as per the report. - Using the test terminal block, separate the secondary side of the CT and the protection relay. - Connect relays and equipment to the Process Bus network to use Sample Values. - Connect the test equipment to the cable on the protection relay side, and test by wiring so that the output of the test equipment can be connected the input part of each protection relay. - Referring to the submitted the relay setting calculation report, input the required test values for each protection element using test equipment then record whether the protection element operates normally and detailed data.	Check the normal operation	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.5 Protection Test	- Directional Overcurrent Protection, Phase/Ground (67, 67N) 1) Threshold Test 2) Characteristic Angle Test 3) Operating Time Test - Transformer Differential Protection (87T) 1) Threshold Test 2) Slope Characteristic Test 3) Blocking with 2nd Harmonic Test 4) Blocking with 5th Harmonic Test 5) Operating Time Test - Overcurrent Protection, Phase/Ground (50, 51, 50N, 51G) 1) Threshold Test 2) Operating Time Test 3) Test Criteria - Compare the setting value and the operation value. - To check that the value of difference should be within the tolerance range. - After FAT, a detailed result report is submitted in a separate form.	Shall meet the approval specification The reference documents for the test are as follows. ●123A90-DDL-EL-RE-20168 Electrical Protection Relay Selectivity	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.6 Remote Test	1) Test Purpose - In order to verify that the IEC61850 communication status of the relay. 2) Test Method a) IEC 61850 configuration files review - If the relay needs to be updated, check with the latest settings file and upload it b) Check by comparing the submitted IO LIST (including IEC61850 address) with the setting file. c) Run the program that can check the IEC61850 address on enginnering notebook and check that the protection relay is properly connected to the Station bus network. (Check each EMCS and HV-SCADA communication module.) - Communication tests use programs that support IEC61850 cilent communication, such as IEC 61850 client browser or SICAM PAS etc. d) Refer to the IO list and change the value of the test tag to check whether the communication signal changes at the same time. e) To change the tag value for communication testing, refer to the items below. - IO Module test - Measurement test - Protection test f) The test program checks whether the value of the tag being tested is changed normally. 3) Test Criteria - Compare the relay value and the value of the alternative program. - When the relay value is changed, the remote tag value is immediately updated.	Shall meet the approval specification The reference documents for the test are as follows. ● 1723001595-EL-SO-00020 Relay IED configuration files ● 1723001595-EL-SO-00021 IEC 61850 configuration files ● 1723001595-EL-LIS-00011 Switchgear IO list	Witness

HOLLANDSE KUST NOORD OFFSHORE WIND PARK
PROTECTION RELAY FAT REPORT



04 DEC, 2024

CROSSWIND

ROSETTI MARINO
Group of Companies

Protection Relay Report

1. Protection Relay Technical Specifications

Panel	CP-100E1
Maker	SIEMENS
Model No.	7UT85
Function	87T, 87N
Serial Number	BM2408001638

2. Basic Settings

2-1. Power System

2-1-1. General

NO.	Settings	Value
11.2311.101	Phase sequence	A B C

2-2. Meas.point FDR_I1

2-2-1. CT 3-phase/General

NO.	Settings	Value
11.931.8881.115	CT connection	3-phase + IN-separate
11.931.8881.127	Tracking	active
11.931.8881.130	Measuring-point ID	1

2-2-2. CT 3-phase/CT phases

NO.	Settings	Value
11.931.8881.101	Rated primary current	250.0 [A]
11.931.8881.102	Rated secondary current	1 [A]
11.931.8881.117	Current range	100 x IR
11.931.8881.118	internal CT type	CT IEC 61850-9-2
11.931.8881.142	Invert current polarity	no
11.931.8881.114	inverted phases	none

2-2-3. CT IN

NO.	Settings	Value
11.931.8881.104	Rated primary current	250.0 [A]
11.931.8881.105	Rated secondary current	1 [A]
11.931.8881.119	Current range	100 x IR
11.931.8881.120	Internal CT type	CT IEC 61850-9-2

2-2-4. CT 3-phase/MP disconnection

NO.	Settings	Value
11.931.8881.173	Current check	active
11.931.8881.112	I< threshold	0.100 [A]

2-2-5. CT 1

NO.	Settings	Value
11.931.3841.101	Rated primary current	250.0 [A]
11.931.3841.109	Rat	250.0
11.931.3841.103	Magnitude correction	1.00000
11.931.3841.117	Phase	IA
11.931.3841.102	Rated frequency	50.00 [Hz]
11.931.3841.118	Ratio of clipping limit	100.00
11.931.3841.119	Meas. accuracy class	0.2 [s]
11.931.3841.120	Prot. accuracy class	1
11.931.3841.121	Second. loop time const.	0.21 [s]
11.931.3841.123	Transient perform. Class	TPM

2-2-6. CT 2

NO.	Settings	Value
11.931.3842.101	Rated primary current	250.0 [A]
11.931.3842.109	Rat	250.0
11.931.3842.103	Magnitude correction	1.00000
11.931.3842.117	Phase	IB
11.931.3842.102	Rated frequency	50.00 [Hz]
11.931.3842.118	Ratio of clipping limit	100.00
11.931.3842.119	Meas. accuracy class	0.2 [s]
11.931.3842.120	Prot. accuracy class	1
11.931.3842.121	Second. loop time const.	0.21 [s]
11.931.3842.123	Transient perform. Class	TPM

2-2-7. CT 3

NO.	Settings	Value
11.931.3843.101	Rated primary current	250.0 [A]
11.931.3843.109	Rat	250.0
11.931.3843.103	Magnitude correction	1.00000
11.931.3843.117	Phase	IC
11.931.3843.102	Rated frequency	50.00 [Hz]
11.931.3843.118	Ratio of clipping limit	100.00
11.931.3843.119	Meas. accuracy class	0.2 [s]
11.931.3843.120	Prot. accuracy class	1
11.931.3843.121	Second. loop time const.	0.21 [s]
11.931.3843.123	Transient perform. Class	TPM

2-2-8. CT 4

NO.	Settings	Value
11.931.3844.101	Rated primary current	250.0 [A]
11.931.3844.109	Rat	250.0
11.931.3844.103	Magnitude correction	1.00000
11.931.3844.117	Phase	IN
11.931.3844.102	Rated frequency	50.00 [Hz]
11.931.3844.118	Ratio of clipping limit	100.00
11.931.3844.119	Meas. accuracy class	0.2 [s]
11.931.3844.120	Prot. accuracy class	1
11.931.3844.121	Second. loop time const.	0.21 [s]
11.931.3844.123	Transient perform. Class	TPM

2-2-9. Brk.wire det.

NO.	Settings	Value
11.931.5581.1	Mode	off
11.931.5581.101	Mode of blocking	blocking

2-2-10. Supv. Balan. I

NO.	Settings	Value
11.931.2491.1	Mode	off
11.931.2491.101	Release threshold	0.500 [A]
11.931.2491.102	Threshold min/max	0.50
11.931.2491.6	Delayfailure indication	5.00 [s]

2-2-11. Supv. Ph.seq.I

NO.	Settings	Value
11.931.2551.1	Mode	off
11.931.2551.6	Delayfailure indication	5.00 [s]
11.931.2551.102	Release threshold	0.500 [A]

2-2-12. Supv. Sum I

NO.	Settings	Value
11.931.2431.1	Mode	off
11.931.2431.102	Threshold	0.100 [A]
11.931.2431.101	Slope factor	0.10
11.931.2431.6	Delay failure indication	5.00 [s]

2-3. Meas.point I-3ph TR 2nd

2-3-1. CT 3-phase/General

NO.	Settings	Value
11.932.8881.115	CT connection	3-phase
11.932.8881.127	Tracking	active
11.932.8881.130	Measuring-point ID	2

2-3-2. CT 3-phase/CT phases

NO.	Settings	Value
11.932.8881.101	Rated primary current	600.0 [A]
11.932.8881.102	Rated secondary current	1 [A]
11.932.8881.117	Current range	100 x IR
11.932.8881.118	internal CT type	CT protection
11.932.8881.116	Neutr.point in dir.of.ref.obj	no
11.932.8881.114	inverted phases	none

2-3-3. CT 3-phase/MP disconnection

NO.	Settings	Value
11.932.8881.173	Current check	active
11.932.8881.112	I<threshold	0.100 [A]

2-3-4. CT 1

NO.	Settings	Value
11.932.3841.103	Magnitude correction	1.00000
11.932.3841.117	Phase	IA

2-3-5. CT 2

NO.	Settings	Value
11.932.3842.103	Magnitude correction	1.00000
11.932.3842.117	Phase	IB

2-3-6. CT 3

NO.	Settings	Value
11.932.3843.103	Magnitude correction	1.00000
11.932.3843.117	Phase	IC

2-3-7. Brk.wire det.

NO.	Settings	Value
11.932.5581.1	Mode	off
11.932.5581.101	Mode of blocking	blocking

2-3-8. Supv. Balan. I

NO.	Settings	Value
11.932.2491.1	Mode	on
11.932.2491.101	Release threshold	0.500 [A]
11.932.2491.102	Threshold min/max	0.50
11.932.2491.6	Delayfailure indication	5.00 [s]

2-3-9. Supv. Ph.seq.I

NO.	Settings	Value
11.932.2551.1	Mode	on
11.932.2551.6	Delayfailure indication	5.00 [s]
11.932.2551.102	Release threshold	0.500 [A]

2-4. Meas.point I-1ph TR neut

2-4-1. CT 1-phase/General

NO.	Settings	Value
11.951.2311.101	Rated primary current	250.0 [A]
11.951.2311.102	Rated secondary current	1 [A]
11.951.2311.103	Current range	100 x IR
11.951.2311.104	internal CT type	CT protection
11.951.2311.116	Term.1,3,5,7 in dir.of.ref.obj	yes
11.951.2311.105	Tracking	inactive
11.951.2311.130	Measuring-point ID	3

2-4-2. CT 1

NO.	Settings	Value
11.951.3841.103	Magnitude correction	1.00000
11.951.3841.117	Phase	Ix

2-5. Meas.point FDR_I2

2-5-1. CT 3-phase/General

NO.	Settings	Value
11.933.8881.115	CT connection	3-phase + IN-separate
11.933.8881.127	Tracking	active
11.933.8881.130	Measuring-point ID	4

2-5-2. CT 3-phase/CT phases

NO.	Settings	Value
11.933.8881.101	Rated primary current	250.0 [A]
11.933.8881.102	Rated secondary current	1 [A]
11.933.8881.117	Current range	100 x IR
11.933.8881.118	internal CT type	CT IEC 61850-9-2
11.933.8881.142	Invert current polarity	no
11.933.8881.114	inverted phases	none

2-5-3. CT IN

NO.	Settings	Value
11.933.8881.104	Rated primary current	250.0 [A]
11.933.8881.105	Rated secondary current	1 [A]
11.933.8881.119	Current range	100 x IR
11.933.8881.120	Internal CT type	CT IEC 61850-9-2

2-5-4. CT 3-phase/MP disconnection

NO.	Settings	Value
11.933.8881.173	Current check	active
11.933.8881.112	I< threshold	0.100 [A]

2-5-5. CT 1

NO.	Settings	Value
11.933.3841.101	Rated primary current	250.0 [A]
11.933.3841.109	Rat	250.0
11.933.3841.103	Magnitude correction	1.00000
11.933.3841.117	Phase	IA
11.933.3841.102	Rated frequency	50.00 [Hz]
11.933.3841.118	Ratio of clipping limit	100.00
11.933.3841.119	Meas. accuracy class	0.2 [s]
11.933.3841.120	Prot. accuracy class	1
11.933.3841.121	Second. loop time const.	0.21 [s]
11.933.3841.123	Transient perform. Class	TPM

2-5-6. CT 2

NO.	Settings	Value
11.933.3842.101	Rated primary current	250.0 [A]
11.933.3842.109	Rat	250.0
11.933.3842.103	Magnitude correction	1.00000
11.933.3842.117	Phase	IB
11.933.3842.102	Rated frequency	50.00 [Hz]
11.933.3842.118	Ratio of clipping limit	100.00
11.933.3842.119	Meas. accuracy class	0.2 [s]
11.933.3842.120	Prot. accuracy class	1
11.933.3842.121	Second. loop time const.	0.21 [s]
11.933.3842.123	Transient perform. Class	TPM

2-5-7. CT 3

NO.	Settings	Value
11.933.3843.101	Rated primary current	250.0 [A]
11.933.3843.109	Rat	250.0
11.933.3843.103	Magnitude correction	1.00000
11.933.3843.117	Phase	IC
11.933.3843.102	Rated frequency	50.00 [Hz]
11.933.3843.118	Ratio of clipping limit	100.00
11.933.3843.119	Meas. accuracy class	0.2 [s]
11.933.3843.120	Prot. accuracy class	1
11.933.3843.121	Second. loop time const.	0.21 [s]
11.933.3843.123	Transient perform. Class	TPM

2-5-8. CT 4

NO.	Settings	Value
11.933.3844.101	Rated primary current	250.0 [A]
11.933.3844.109	Rat	250.0
11.933.3844.103	Magnitude correction	1.00000
11.933.3844.117	Phase	IN
11.933.3844.102	Rated frequency	50.00 [Hz]
11.933.3844.118	Ratio of clipping limit	100.00
11.933.3844.119	Meas. accuracy class	0.2 [s]
11.933.3844.120	Prot. accuracy class	1
11.933.3844.121	Second. loop time const.	0.21 [s]
11.933.3844.123	Transient perform. Class	TPM

2-5-9. Brk.wire det.

NO.	Settings	Value
11.933.5581.1	Mode	off
11.933.5581.101	Mode of blocking	blocking

2-5-10. Supv. Balan. I

NO.	Settings	Value
11.933.2491.1	Mode	off
11.933.2491.101	Release threshold	0.500 [A]
11.933.2491.102	Threshold min/max	0.50
11.933.2491.6	Delayfailure indication	5.00 [s]

2-5-11. Supv. Ph.seq.I

NO.	Settings	Value
11.933.2551.1	Mode	off
11.933.2551.6	Delayfailure indication	5.00 [s]
11.933.2551.102	Release threshold	0.500 [A]

2-5-12. Supv. Sum I

NO.	Settings	Value
11.933.2431.1	Mode	off
11.933.2431.102	Threshold	0.100 [A]
11.933.2431.101	Slope factor	0.10
11.933.2431.6	Delay failure indication	5.00 [s]

2-6. TR Side 1_P1

2-6-1. General/Rated values

NO.	Settings	Value
913.91.103	Rate apparent power	7.00 [MVA]
913.91.102	Rated voltage	66.00 [kV]
913.91.101	Rate current	61 [A]

2-6-2. General/Side data

NO.	Settings	Value
913.91.149	Neutral point	isolated
913.91.104	Winding configuration	D (Delta)
913.91.163	vector group numeral	0
913.91.130	side number	Side 1
913.91.210	MI3ph1 usesMeasP with ID	1
913.91.215	CT mismatch MI-3ph 1	4.083
913.91.216	CT mismatch MI-3ph 1 IN	4.083

2-6-3. General/Tap changer

NO.	Settings	Value
913.91.44	Tap changer	No function block available

2-6-4. General/Tap changer phase

NO.	Settings	Value
913.91.45	Tap changer	No function block available

2-7. TR Side 2

2-7-1. General/Rated values

NO.	Settings	Value
912.91.103	Rate apparent power	7.00 [MVA]
912.91.102	Rated voltage	6.90 [kV]
912.91.101	Rate current	586 [A]

2-7-2. General/Side data

NO.	Settings	Value
912.91.149	Neutral point	grounded
912.91.104	Winding configuration	Y (Wye)
912.91.163	vector group numeral	11
912.91.130	side number	Side 2
912.91.210	MI3ph1 usesMeasP with ID	2
912.91.214	MI-1ph usesMeasP with ID	3
912.91.215	CT mismatch MI-3ph 1	1.024
912.91.223	CT mismatch MI-1ph	0.427

2-7-3. General/Tap changer

NO.	Settings	Value
912.91.44	Tap changer	No function block available

2-7-4. General/Tap changer phase

NO.	Settings	Value
912.91.45	Tap changer	No function block available

2-8. Transform. Neut.p 1

2-8-1. General/Rated values

NO.	Settings	Value
912.9421.104	Rate current	586 [A]

2-8-2. General/Power-system data

NO.	Settings	Value
912.9421.214	MI1ph usesMeasP with ID	3
912.9421.223	CT mismatch MI-1ph	0.43

2-9. TR Side1_P2

2-9-1. General/Rated values

NO.	Settings	Value
821.9451.101	Rate current	600.00 [A]

2-9-2. General/Power-system data

NO.	Settings	Value
821.9451.149	Power-sys. Neutral point	grounded

Differential Protection(87T)

1. Setting Table

1-1. 87T General

NO.	Settings	Value
901.1691.2311.100	Meas. gnd. Current side 1	no
901.1691.2311.105	CT mismatch side 1 M3ph 1	1.024
901.1691.2311.109	CT mismatch side 1 M1ph	0.427
901.1691.2311.110	CT mismatch side 2 M3ph 1	4.083
901.1691.2311.191	Reference side is	Side 1
901.1691.2311.151	MU-ID Side 1 Mp3ph 1	2
901.1691.2311.155	MU-ID Side 1 Mp1ph	3
901.1691.2311.156	MU-ID Side 2 Mp3ph 1	1

1-2. 87T I-DiFF

1-2-1. 87T I-DiFF/General

NO.	Settings	Value
901.1691.11041.1	Mode	on
901.1691.11041.2	Operate & flt.rec. blocked	no
901.1691.11041.6	Operate delay	0.00 [s]

1-2-2. 87T I-DiFF/Operate curve

NO.	Settings	Value
901.1691.11041.3	Threshold	0.20 [I/IrObj]
901.1691.11041.100	Slope 1	0.30
901.1691.11041.101	Intersection 1 Irest	0.67 [I/IrObj]
901.1691.11041.102	Slope 2	0.75
901.1691.11041.103	Intersection 2 Irest	2.00 [I/IrObj]

1-2-3. 87T I-DiFF/Starting detection

NO.	Settings	Value
901.1691.11041.106	Starting detection	yes
901.1691.11041.107	Thresh.startup detection	0.1 [I/IrObj]
901.1691.11041.108	Factor increasing char.	2.0
901.1691.11041.109	Max. perm. Start. Time	5.0 [sec]

1-2-4. 87T I-DiFF/DC offset detection

NO.	Settings	Value
901.1691.11041.110	Factor increasing char. DC	2.3

1-2-5. 87T I-DiFF/Inrush blocking

NO.	Settings	Value
901.1691.11041.115	Blocking with 2. harmonic	yes
901.1691.11041.116	2nd harmonic content	12 [%]
901.1691.11041.117	Crossblock. time 2nd har.	0.50 [s]
901.1691.11041.118	Blocking with CWA	yes

1-2-6. 87T I-DiFF/Overexcit. blocking

NO.	Settings	Value
901.1691.11041.121	Blocking with 3rd harm.	no
901.1691.11041.122	3rd harmonics content	30 [%]
901.1691.11041.123	Crossblock. time 3rd har.	0.00 [s]
901.1691.11041.124	Blocking with 5th harm.	no
901.1691.11041.125	5th harmonics content	30 [%]
901.1691.11041.126	Crossblock. time 5th har.	0.00 [s]
901.1691.11041.127	Limit Idiff 3., 5. harmonics	1.5 [I/IrObj]

1-2-7. 87T I-DiFF/Ext. fault detection

NO.	Settings	Value
901.1691.11041.128	Threshold add-on stabiliz.	2.00 [I/IrObj]
901.1691.11041.129	Time of add-on stabiliz.	0.30 [s]
901.1691.11041.130	Cross-blk. time add-on st.	0.30 [s]

1-3. 87T I-DIFF fast

NO.	Settings	Value
901.1691.11071.1	Mode	on
901.1691.11071.3	Threshold	5.0 [I/IrObj]
901.1691.11071.6	Operate delay	0.00 [sec]
901.1691.11071.100	Operate & flt.rec. blocked	no

2. Test Value

2-1. 87T 66kV HV Side Minimum Pickup Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	0.049 [A]	0.050 [A]	±2[%]	Pass
BØ	0.049 [A]	0.049 [A]		Pass
CØ	0.049 [A]	0.050 [A]		Pass
3Ø	0.049 [A]	0.050 [A]		Pass

2-2. 87T 66kV HV Side Minimum Operate Time Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	30.00 [msec]	34.30 [msec]	±1[%] or 10[ms]	Pass
BØ	30.00 [msec]	34.60 [msec]		Pass
CØ	30.00 [msec]	31.00 [msec]		Pass
3Ø	30.00 [msec]	31.80 [msec]		Pass

2-3. 87T 6.9kV LV Side Minimum Pickup Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	0.338 [A]	0.332 [A]	±2[%]	Pass
BØ	0.338 [A]	0.333 [A]		Pass
CØ	0.338 [A]	0.332 [A]		Pass
3Ø	0.195 [A]	0.199 [A]		Pass

2-4. 87T 6.9kV LV Side Minimum Operate Time Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	30.00 [msec]	33.00 [msec]	±1[%] or 10[ms]	Pass
BØ	30.00 [msec]	31.70 [msec]		Pass
CØ	30.00 [msec]	32.40 [msec]		Pass
3Ø	30.00 [msec]	31.90 [msec]		Pass

2-5. 87T 66kV HV Side & LV Side Slope Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Side2= Ia=fixed∠30°, Ib=fixed∠-90°, Ic=fixed∠150°(LV Side)
- Side1= Ia=variable∠0°, Ib=variable∠-120°, Ic=variable∠120°(HV Side)

Phase	TEST POINT		SIDE-2 (Fix)	SIDE-1 (Variable)		Limit	Result
	Ir(pu)	Id(pu)	Current	Expected(A)	Pickup(A)		
3Ø	0.67	0.20	0.459 [A]	0.164 [A]	0.167 [A]	±2[%]	Pass
	1.0	0.30	0.684 [A]	0.245 [A]	0.247 [A]		Pass
	2.5	0.97	1.490 [A]	0.612 [A]	0.617 [A]		Pass

2-6. 87T 2nd Harmonic block Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Fundamental wave 5A to each phase, test by applying the second harmonic current

TEST			Limit	Result
Phase	Expected Current	Pickup Current		
AØ	0.600 [A]	0.588 [A]	±2[%]	Pass
BØ	0.600 [A]	0.589 [A]		Pass
CØ	0.600 [A]	0.588 [A]		Pass
3Ø	0.600 [A]	0.588 [A]		Pass

2-7. 87T 66kV HV Side Fast stage Pickup Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- Test by 87 Fast Threshold Setting Value to 5[I/IrObj]
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	1.225 [A]	1.230 [A]	±2[%]	Pass
BØ	1.225 [A]	1.210 [A]		Pass
CØ	1.225 [A]	1.230 [A]		Pass
3Ø	1.225 [A]	1.210 [A]		Pass

2-8. 87T 66kV HV Side Fast stage Operate Time Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- Test by 87 Fast Threshold Setting Value to 5[I/IrObj]
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	18.00 [msec]	13.00 [msec]	±1[%] or 10[ms]	Pass
BØ	18.00 [msec]	11.20 [msec]		Pass
CØ	18.00 [msec]	11.60 [msec]		Pass
3Ø	18.00 [msec]	11.70 [msec]		Pass

2-9. 87T 6.9kV LV Side Fast stage Pickup Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Test by 87 Fast Threshold Setting Value to 5[I/IrObj]
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	8.454 [A]	8.440 [A]	±2[%]	Pass
BØ	8.454 [A]	8.430 [A]		Pass
CØ	8.454 [A]	8.450 [A]		Pass
3Ø	4.881 [A]	4.870 [A]		Pass

2-10. 87T 6.9kV LV Side Fast stage Operate Time Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Test by 87 Fast Threshold Setting Value to 5[I/IrObj]
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	18.00 [msec]	12.20 [msec]	±1[%] or 10[ms]	Pass
BØ	18.00 [msec]	12.30 [msec]		Pass
CØ	18.00 [msec]	12.50 [msec]		Pass
3Ø	18.00 [msec]	12.30 [msec]		Pass

3. Test Result

Setting Value Verification and Test Results : Good

Restricted Ground-Fault Protection(87N. REF)

1. Setting Table

1-1. 87N. REF 1

NO.	Settings	Value
912.10081.1	Mode	on
912.10081.2	Operate & flt.rec. blocked	no
912.10081.103	Threshold	0.10 [I/IrObj]
912.10081.105	Slope	0.05
912.10081.109	Operate delay	0.10 [s]

2. Test Value

2-1. 87N REF Minimum Pickup Test (Neutral Side 100%)

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- ZCT Source : X43 1(AØ), 2(NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
NØ	0.234 [A]	0.236 [A]	±2[%]	Pass

2-2. 87N REF Minimum Pickup Test (Neutral Side 50%, Phase Side 50%)

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- ZCT Source : X43 1(AØ), 2(NØ)
- Neutral Side = IN=variable∠0°
- Phase Side = Ia=fixed∠180°
- A Phase current is fixed to 0.049A which is 50% of the pickup value
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
NØ	0.117 [A]	0.117 [A]	±2[%]	Pass

2-3. 87N REF Minimum Operate Time Test (Neutral Side 100%)

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- ZCT Source : X43 1(AØ), 2(NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
NØ	30.00 [msec]	29.80 [msec]	±1[%] or 10[ms]	Pass

2-4. 87N REF Minimum Operate Time Test (Neutral Side 50%, Phase Side 50%)

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- ZCT Source : X43 1(AØ), 2(NØ)
- Neutral Side = IN=variable∠0°
- Phase Side = Ia=fixed∠180°
- A Phase current is fixed to 0.049A which is 50% of the pickup value
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
NØ	30.00 [msec]	35.90 [msec]	±1[%] or 10[ms]	Pass

2-3. 87N REF Slope Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- ZCT Source : X43 1(AØ), 2(NØ)
- Neutral Side = IN=fixed∠0°
- Phase Side = Ia=Variable∠0°

Phase	TEST POINT		SIDE-1 (Fix)	SIDE-2 (Variable)		Limit	Result
	Ir(pu)	Id(pu)	Current	Expected(A)	Pickup(A)		
NØ	3.0	0.15	3.691 [A]	1.391 [A]	1.390 [A]	±2[%]	Pass
	4.0	0.20	4.919 [A]	1.854 [A]	1.850 [A]		Pass
	5.0	0.25	6.149 [A]	2.318 [A]	2.320 [A]		Pass

3. Test Result

Setting Value Verification and Test Results : Good

7UT85 Protection Relay Interlock Test

1. Test

Source	Division	Condition		Verification		Remark
		Initiate	Block	LED	LOR	
87T	Trip	-	-	LED 1.6	Trip	
87N	Trip	-	-	LED 1.7	Trip	

2. Remarks

- Neutral side CT polarity cannot be verified and requires further confirmation later

3. Test Result

Setting Value Verification and Test Results : Good

Protection Relay Report

1. Protection Relay Technical Specifications

Panel	CP-100E1
Maker	SIEMENS
Model No.	7SJ85
Function	50-1, 50-2, 51, 51N, 51G
Serial Number	BM2408016119

2. Basic Settings

2-1. Power System

2-1-1. General

NO.	Settings	Value
11.2311.101	Phase sequence	A B C

2-2. Meas.point FDR_I1

2-2-1. CT 3-phase/General

NO.	Settings	Value
11.931.8881.115	CT connection	3-phase + IN-separate
11.931.8881.127	Tracking	active
11.931.8881.130	Measuring-point ID	1

2-2-2. CT 3-phase/CT phases

NO.	Settings	Value
11.931.8881.101	Rated primary current	250.0 [A]
11.931.8881.102	Rated secondary current	1 [A]
11.931.8881.117	Current range	100 x IR
11.931.8881.118	Internal CT type	CT IEC 61850-9-2
11.931.8881.142	Invert current polarity	no
11.931.8881.114	Inverted phases	none

2-2-3. CT IN

NO.	Settings	Value
11.931.8881.104	Rated primary current	250.0 [A]
11.931.8881.105	Rated secondary current	1 [A]
11.931.8881.119	Current range	100 x IR
11.931.8881.120	Internal CT type	CT IEC 61850-9-2

2-2-4. CT 3-phase/MP disconnection

NO.	Settings	Value
11.931.8881.173	Current check	active
11.931.8881.112	I< threshold	0.100 [A]

2-2-5. CT 1

NO.	Settings	Value
11.931.3841.101	Rated primary current	250.0 [A]
11.931.3841.109	Rat	250.0
11.931.3841.103	Magnitude correction	1.00000
11.931.3841.117	Phase	IA
11.931.3841.102	Rated frequency	50.00 [Hz]
11.931.3841.118	Ratio of clipping limit	100.00
11.931.3841.119	Meas. accuracy class	0.2 [s]
11.931.3841.120	Prot. accuracy class	1
11.931.3841.121	Second. loop time const.	0.21 [s]
11.931.3841.123	Transient perform. Class	TPM

2-2-6. CT 2

NO.	Settings	Value
11.931.3842.101	Rated primary current	250.0 [A]
11.931.3842.109	Rat	250.0
11.931.3842.103	Magnitude correction	1.00000
11.931.3842.117	Phase	IB
11.931.3842.102	Rated frequency	50.00 [Hz]
11.931.3842.118	Ratio of clipping limit	100.00
11.931.3842.119	Meas. accuracy class	0.2 [s]
11.931.3842.120	Prot. accuracy class	1
11.931.3842.121	Second. loop time const.	0.21 [s]
11.931.3842.123	Transient perform. Class	TPM

2-2-7. CT 3

NO.	Settings	Value
11.931.3843.101	Rated primary current	250.0 [A]
11.931.3843.109	Rat	250.0
11.931.3843.103	Magnitude correction	1.00000
11.931.3843.117	Phase	IC
11.931.3843.102	Rated frequency	50.00 [Hz]
11.931.3843.118	Ratio of clipping limit	100.00
11.931.3843.119	Meas. accuracy class	0.2 [s]
11.931.3843.120	Prot. accuracy class	1
11.931.3843.121	Second. loop time const.	0.21 [s]
11.931.3843.123	Transient perform. Class	TPM

2-2-8. CT 4

NO.	Settings	Value
11.931.3844.101	Rated primary current	250.0 [A]
11.931.3844.109	Rat	250.0
11.931.3844.103	Magnitude correction	1.00000
11.931.3844.117	Phase	IN
11.931.3844.102	Rated frequency	50.00 [Hz]
11.931.3844.118	Ratio of clipping limit	100.00
11.931.3844.119	Meas. accuracy class	0.2 [s]
11.931.3844.120	Prot. accuracy class	1
11.931.3844.121	Second. loop time const.	0.21 [s]
11.931.3844.123	Transient perform. Class	TPM

2-2-9. Brk.wire det.

NO.	Settings	Value
11.931.5581.1	Mode	off
11.931.5581.101	Mode of blocking	blocking

2-2-10. Supv. Balan. I

NO.	Settings	Value
11.931.2491.1	Mode	off
11.931.2491.101	Release threshold	0.500 [A]
11.931.2491.102	Threshold min/max	0.50
11.931.2491.6	Delayfailure indication	5.00 [s]

2-2-11. Supv. Ph.seq.I

NO.	Settings	Value
11.931.2551.1	Mode	off
11.931.2551.6	Delayfailure indication	5.00 [s]
11.931.2551.102	Release threshold	0.500 [A]

2-2-12. Supv. Sum I

NO.	Settings	Value
11.931.2431.1	Mode	off
11.931.2431.102	Threshold	0.100 [A]
11.931.2431.101	Slope factor	0.10
11.931.2431.6	Delay failure indication	5.00 [s]

2-3. Meas.point FDR_I2

2-3-1. CT 3-phase/General

NO.	Settings	Value
11.932.8881.115	CT connection	3-phase + IN-separate
11.932.8881.127	Tracking	active
11.932.8881.130	Measuring-point ID	2

2-3-2. CT 3-phase/CT phases

NO.	Settings	Value
11.932.8881.101	Rated primary current	250.0 [A]
11.932.8881.102	Rated secondary current	1 [A]
11.932.8881.117	Current range	100 x IR
11.932.8881.118	internal CT type	CT IEC 61850-9-2
11.932.8881.116	Neutr.point in dir.of.ref.obj	no
11.932.8881.114	inverted phases	none

2-3-3. CT IN

NO.	Settings	Value
11.932.8881.104	Rated primary current	250.0 [A]
11.932.8881.105	Rated secondary current	1 [A]
11.932.8881.119	Current range	100 x IR
11.932.8881.120	Internal CT type	CT IEC 61850-9-2

2-3-4. CT 3-phase/MP disconnection

NO.	Settings	Value
11.932.8881.173	Current check	active
11.932.8881.112	I< threshold	0.100 [A]

2-3-5. CT 1

NO.	Settings	Value
11.932.3841.101	Rated primary current	250.0 [A]
11.932.3841.109	Rat	250.0
11.932.3841.103	Magnitude correction	1.00000
11.932.3841.117	Phase	IA
11.932.3841.102	Rated frequency	50.00 [Hz]
11.932.3841.118	Ratio of clipping limit	100.00
11.932.3841.119	Meas. accuracy class	0.2 [s]
11.932.3841.120	Prot. accuracy class	1
11.932.3841.121	Second. loop time const.	0.21 [s]
11.932.3841.123	Transient perform. Class	TPM

2-3-6. CT 2

NO.	Settings	Value
11.932.3842.101	Rated primary current	250.0 [A]
11.932.3842.109	Rat	250.0
11.932.3842.103	Magnitude correction	1.00000
11.932.3842.117	Phase	IB
11.932.3842.102	Rated frequency	50.00 [Hz]
11.932.3842.118	Ratio of clipping limit	100.00
11.932.3842.119	Meas. accuracy class	0.2 [s]
11.932.3842.120	Prot. accuracy class	1
11.932.3842.121	Second. loop time const.	0.21 [s]
11.932.3842.123	Transient perform. Class	TPM

2-3-7. CT 3

NO.	Settings	Value
11.932.3843.101	Rated primary current	250.0 [A]
11.932.3843.109	Rat	250.0
11.932.3843.103	Magnitude correction	1.00000
11.932.3843.117	Phase	IC
11.932.3843.102	Rated frequency	50.00 [Hz]
11.932.3843.118	Ratio of clipping limit	100.00
11.932.3843.119	Meas. accuracy class	0.2 [s]
11.932.3843.120	Prot. accuracy class	1
11.932.3843.121	Second. loop time const.	0.21 [s]
11.932.3843.123	Transient perform. Class	TPM

2-3-8. CT 4

NO.	Settings	Value
11.932.3844.101	Rated primary current	250.0 [A]
11.932.3844.109	Rat	250.0
11.932.3844.103	Magnitude correction	1.00000
11.932.3844.117	Phase	IN
11.932.3844.102	Rated frequency	50.00 [Hz]
11.932.3844.118	Ratio of clipping limit	100.00
11.932.3844.119	Meas. accuracy class	0.2 [s]
11.932.3844.120	Prot. accuracy class	1
11.932.3844.121	Second. loop time const.	0.21 [s]
11.932.3844.123	Transient perform. Class	TPM

2-3-9. Brk.wire det.

NO.	Settings	Value
11.932.5581.1	Mode	off
11.932.5581.101	Mode of blocking	blocking

2-3-10. Supv. Balan. I

NO.	Settings	Value
11.932.2491.1	Mode	off
11.932.2491.101	Release threshold	0.500 [A]
11.932.2491.102	Threshold min/max	0.50
11.932.2491.6	Delayfailure indication	5.00 [s]

2-3-11. Supv. Ph.seq.I

NO.	Settings	Value
11.932.2551.1	Mode	off
11.932.2551.6	Delayfailure indication	5.00 [s]
11.932.2551.102	Release threshold	0.500 [A]

2-3-12. Supv. Sum I

NO.	Settings	Value
11.932.2431.1	Mode	off
11.932.2431.102	Threshold	0.100 [A]
11.932.2431.101	Slope factor	0.10
11.932.2431.6	Delay failure indication	5.00 [s]

2-4. Meas.point TR 2nd neut

2-4-1. CT 3-phase/General

NO.	Settings	Value
11.951.2311.101	Rated primary current	250.0 [A]
11.951.2311.102	Rated secondary current	1 [A]
11.951.2311.103	Current range	100 x IR
11.951.2311.104	Internal CT type	CT protection
11.951.2311.116	Term. 1,3,5,7 in dir. of obj.	yes
11.951.2311.105	Tracking	inactive
11.951.2311.130	Measuring-point ID	3

2-4-2. CT 1

NO.	Settings	Value
11.951.3841.103	Magnitude correction	1.00000
11.951.3841.117	Phase	Ix

2-5. Meas.point BUS_V2

2-5-1. VT 3-phase/General

NO.	Settings	Value
11.943.8911.101	Rated primary voltage	66.008 [kV]
11.943.8911.102	Rated secondary voltage	80 [V]
11.943.8911.103	Matching ratio Vph / VN	1.00
11.943.8911.104	VT connection	3 ph-to-gnd volt. + VN
11.943.8911.106	Inverted phases	none
11.943.8911.111	Tracking	active
11.943.8911.130	Measuring-point ID	4
11.943.8911.136	Internal VT type	VT IEC 61850-9-2

2-5-2. VT1

NO.	Settings	Value
11.943.3811.101	Rated primary voltage	38.11 [kV]
11.943.3811.110	VRtg reference	phase-to-ground
11.943.3811.109	Rat	820.0
11.943.3811.103	Magnitude correction	1.00000
11.943.3811.108	Phase	VA
11.943.3811.102	Rated frequency	50.00 [Hz]
11.943.3811.118	Ratio of clipping limit	1.73
11.943.3811.119	Meas. accuracy class	0.2 [s]
11.943.3811.120	Prot. accuracy class	1

2-5-3. VT2

NO.	Settings	Value
11.943.3812.101	Rated primary voltage	38.11 [kV]
11.943.3812.110	VRtg reference	phase-to-ground
11.943.3812.109	Rat	820.0
11.943.3812.103	Magnitude correction	1.00000
11.943.3812.108	Phase	VB
11.943.3812.102	Rated frequency	50.00 [Hz]
11.943.3812.118	Ratio of clipping limit	1.73
11.943.3812.119	Meas. accuracy class	0.2 [s]
11.943.3812.120	Prot. accuracy class	1

2-5-4. VT3

NO.	Settings	Value
11.943.3813.101	Rated primary voltage	38.11 [kV]
11.943.3813.110	VRtg reference	phase-to-ground
11.943.3813.109	Rat	820.0
11.943.3813.103	Magnitude correction	1.00000
11.943.3813.108	Phase	VC
11.943.3813.102	Rated frequency	50.00 [Hz]
11.943.3813.118	Ratio of clipping limit	1.73
11.943.3813.119	Meas. accuracy class	0.2 [s]
11.943.3813.120	Prot. accuracy class	1

2-5-5. VT4

NO.	Settings	Value
11.943.3814.101	Rated primary voltage	38.11 [kV]
11.943.3814.110	VRtg reference	phase-to-ground
11.943.3814.109	Rat	820.0
11.943.3814.103	Magnitude correction	1.00000
11.943.3814.108	Phase	VN
11.943.3814.102	Rated frequency	50.00 [Hz]
11.943.3814.118	Ratio of clipping limit	1.73
11.943.3814.119	Meas. accuracy class	0.2 [s]
11.943.3814.120	Prot. accuracy class	1

2-5-6. Supv. balan. V

NO.	Settings	Value
11.943.2521.1	Mode	off
11.943.2521.101	Release threshold	50.000 [V]
11.943.2521.102	Threshold min/max	0.75
11.943.2521.6	Delay failure indication	5.00 [s]

2-5-7. Supv. ph.seq.V

NO.	Settings	Value
11.943.2581.1	Mode	off
11.943.2581.6	Delay failure indication	5.00 [s]

2-5-8. Supv. sum V

NO.	Settings	Value
11.943.2461.1	Mode	off
11.943.2461.3	Threshold	25.000 [V]
11.943.2461.6	Delay failure indication	5.00 [s]

2-5-9. VT miniatureCB

NO.	Settings	Value
11.943.2641.101	Response time	0.00 [s]

2-6. Meas.point FDR_V2

2-6-1. VT 3-phase/General

NO.	Settings	Value
11.944.8911.101	Rated primary voltage	66.008 [kV]
11.944.8911.102	Rated secondary voltage	80 [V]
11.944.8911.103	Matching ratio Vph / VN	1.00
11.944.8911.104	VT connection	3 ph-to-gnd volt. + VN
11.944.8911.106	Inverted phases	none
11.944.8911.111	Tracking	active
11.944.8911.130	Measuring-point ID	5
11.944.8911.136	Internal VT type	VT IEC 61850-9-2

2-6-2. VT1

NO.	Settings	Value
11.944.3811.101	Rated primary voltage	38.11 [kV]
11.944.3811.110	VRtg reference	phase-to-ground
11.944.3811.109	Rat	820.0
11.944.3811.103	Magnitude correction	1.00000
11.944.3811.108	Phase	VA
11.944.3811.102	Rated frequency	50.00 [Hz]
11.944.3811.118	Ratio of clipping limit	1.73
11.944.3811.119	Meas. accuracy class	0.2 [s]
11.944.3811.120	Prot. accuracy class	1

2-6-3. VT2

NO.	Settings	Value
11.944.3812.101	Rated primary voltage	38.11 [kV]
11.944.3812.110	VRtg reference	phase-to-ground
11.944.3812.109	Rat	820.0
11.944.3812.103	Magnitude correction	1.00000
11.944.3812.108	Phase	VB
11.944.3812.102	Rated frequency	50.00 [Hz]
11.944.3812.118	Ratio of clipping limit	1.73
11.944.3812.119	Meas. accuracy class	0.2 [s]
11.944.3812.120	Prot. accuracy class	1

2-6-4. VT3

NO.	Settings	Value
11.944.3813.101	Rated primary voltage	38.11 [kV]
11.944.3813.110	VRtg reference	phase-to-ground
11.944.3813.109	Rat	820.0
11.944.3813.103	Magnitude correction	1.00000
11.944.3813.108	Phase	VC
11.944.3813.102	Rated frequency	50.00 [Hz]
11.944.3813.118	Ratio of clipping limit	1.73
11.944.3813.119	Meas. accuracy class	0.2 [s]
11.944.3813.120	Prot. accuracy class	1

2-6-5. VT4

NO.	Settings	Value
11.944.3814.101	Rated primary voltage	38.11 [kV]
11.944.3814.110	VRtg reference	phase-to-ground
11.944.3814.109	Rat	820.0
11.944.3814.103	Magnitude correction	1.00000
11.944.3814.108	Phase	VN
11.944.3814.102	Rated frequency	50.00 [Hz]
11.944.3814.118	Ratio of clipping limit	1.73
11.944.3814.119	Meas. accuracy class	0.2 [s]
11.944.3814.120	Prot. accuracy class	1

2-6-6. Supv. balan. V

NO.	Settings	Value
11.944.2521.1	Mode	off
11.944.2521.101	Release threshold	50.000 [V]
11.944.2521.102	Threshold min/max	0.75
11.944.2521.6	Delay failure indication	5.00 [s]

2-6-7. Supv. ph.seq.V

NO.	Settings	Value
11.944.2581.1	Mode	off
11.944.2581.6	Delay failure indication	5.00 [s]

2-6-8. Supv. sum V

NO.	Settings	Value
11.944.2461.1	Mode	off
11.944.2461.3	Threshold	25.000 [V]
11.944.2461.6	Delay failure indication	5.00 [s]

2-6-9. VT miniatureCB

NO.	Settings	Value
11.944.2641.101	Response time	0.00 [s]

2-7. Meas.point BUS_V1

2-7-1. VT 3-phase/General

NO.	Settings	Value
11.941.8911.101	Rated primary voltage	66.008 [kV]
11.941.8911.102	Rated secondary voltage	80 [V]
11.941.8911.103	Matching ratio Vph / VN	1.00
11.941.8911.104	VT connection	3 ph-to-gnd volt. + VN
11.941.8911.106	Inverted phases	none
11.941.8911.111	Tracking	active
11.941.8911.130	Measuring-point ID	6
11.941.8911.136	Internal VT type	VT IEC 61850-9-2

2-7-2. VT1

NO.	Settings	Value
11.941.3811.101	Rated primary voltage	38.11 [kV]
11.941.3811.110	VRtg reference	phase-to-ground
11.941.3811.109	Rat	820.0
11.941.3811.103	Magnitude correction	1.00000
11.941.3811.108	Phase	VA
11.941.3811.102	Rated frequency	50.00 [Hz]
11.941.3811.118	Ratio of clipping limit	1.73
11.941.3811.119	Meas. accuracy class	0.2 [s]
11.941.3811.120	Prot. accuracy class	1

2-7-3. VT2

NO.	Settings	Value
11.941.3812.101	Rated primary voltage	38.11 [kV]
11.941.3812.110	VRtg reference	phase-to-ground
11.941.3812.109	Rat	820.0
11.941.3812.103	Magnitude correction	1.00000
11.941.3812.108	Phase	VB
11.941.3812.102	Rated frequency	50.00 [Hz]
11.941.3812.118	Ratio of clipping limit	1.73
11.941.3812.119	Meas. accuracy class	0.2 [s]
11.941.3812.120	Prot. accuracy class	1

2-7-4. VT3

NO.	Settings	Value
11.941.3813.101	Rated primary voltage	38.11 [kV]
11.941.3813.110	VRtg reference	phase-to-ground
11.941.3813.109	Rat	820.0
11.941.3813.103	Magnitude correction	1.00000
11.941.3813.108	Phase	VC
11.941.3813.102	Rated frequency	50.00 [Hz]
11.941.3813.118	Ratio of clipping limit	1.73
11.941.3813.119	Meas. accuracy class	0.2 [s]
11.941.3813.120	Prot. accuracy class	1

2-7-5. VT4

NO.	Settings	Value
11.941.3814.101	Rated primary voltage	38.11 [kV]
11.941.3814.110	VRtg reference	phase-to-ground
11.941.3814.109	Rat	820.0
11.941.3814.103	Magnitude correction	1.00000
11.941.3814.108	Phase	VN
11.941.3814.102	Rated frequency	50.00 [Hz]
11.941.3814.118	Ratio of clipping limit	1.73
11.941.3814.119	Meas. accuracy class	0.2 [s]
11.941.3814.120	Prot. accuracy class	1

2-7-6. Supv. balan. V

NO.	Settings	Value
11.941.2521.1	Mode	off
11.941.2521.101	Release threshold	116.667 [V]
11.941.2521.102	Threshold min/max	0.75
11.941.2521.6	Delay failure indication	5.00 [s]

2-7-7. Supv. ph.seq.V

NO.	Settings	Value
11.941.2581.1	Mode	off
11.941.2581.6	Delay failure indication	5.00 [s]

2-7-8. Supv. sum V

NO.	Settings	Value
11.941.2461.1	Mode	off
11.941.2461.3	Threshold	58.333 [V]
11.941.2461.6	Delay failure indication	5.00 [s]

2-7-9. VT miniatureCB

NO.	Settings	Value
11.941.2641.101	Response time	0.00 [s]

2-8. Meas.point FDR_V1

2-8-1. VT 3-phase/General

NO.	Settings	Value
11.942.8911.101	Rated primary voltage	66.008 [kV]
11.942.8911.102	Rated secondary voltage	80 [V]
11.942.8911.103	Matching ratio Vph / VN	1.00
11.942.8911.104	VT connection	3 ph-to-gnd volt. + VN
11.942.8911.106	Inverted phases	none
11.942.8911.111	Tracking	active
11.942.8911.130	Measuring-point ID	7
11.942.8911.136	Internal VT type	VT IEC 61850-9-2

2-8-2. VT1

NO.	Settings	Value
11.942.3811.101	Rated primary voltage	38.11 [kV]
11.942.3811.110	VRtg reference	phase-to-ground
11.942.3811.109	Rat	820.0
11.942.3811.103	Magnitude correction	1.00000
11.942.3811.108	Phase	VA
11.942.3811.102	Rated frequency	50.00 [Hz]
11.942.3811.118	Ratio of clipping limit	1.73
11.942.3811.119	Meas. accuracy class	0.2 [s]
11.942.3811.120	Prot. accuracy class	1

2-8-3. VT2

NO.	Settings	Value
11.942.3812.101	Rated primary voltage	38.11 [kV]
11.942.3812.110	VRtg reference	phase-to-ground
11.942.3812.109	Rat	820.0
11.942.3812.103	Magnitude correction	1.00000
11.942.3812.108	Phase	VB
11.942.3812.102	Rated frequency	50.00 [Hz]
11.942.3812.118	Ratio of clipping limit	1.73
11.942.3812.119	Meas. accuracy class	0.2 [s]
11.942.3812.120	Prot. accuracy class	1

2-8-4. VT3

NO.	Settings	Value
11.942.3813.101	Rated primary voltage	38.11 [kV]
11.942.3813.110	VRtg reference	phase-to-ground
11.942.3813.109	Rat	820.0
11.942.3813.103	Magnitude correction	1.00000
11.942.3813.108	Phase	VC
11.942.3813.102	Rated frequency	50.00 [Hz]
11.942.3813.118	Ratio of clipping limit	1.73
11.942.3813.119	Meas. accuracy class	0.2 [s]
11.942.3813.120	Prot. accuracy class	1

2-8-5. VT4

NO.	Settings	Value
11.942.3814.101	Rated primary voltage	38.11 [kV]
11.942.3814.110	VRtg reference	phase-to-ground
11.942.3814.109	Rat	820.0
11.942.3814.103	Magnitude correction	1.00000
11.942.3814.108	Phase	VN
11.942.3814.102	Rated frequency	50.00 [Hz]
11.942.3814.118	Ratio of clipping limit	1.73
11.942.3814.119	Meas. accuracy class	0.2 [s]
11.942.3814.120	Prot. accuracy class	1

2-8-6. Supv. balan. V

NO.	Settings	Value
11.942.2521.1	Mode	off
11.942.2521.101	Release threshold	116.667 [V]
11.942.2521.102	Threshold min/max	0.75
11.942.2521.6	Delay failure indication	5.00 [s]

2-8-7. Supv. ph.seq.V

NO.	Settings	Value
11.942.2581.1	Mode	off
11.942.2581.6	Delay failure indication	5.00 [s]

2-8-8. Supv. sum V

NO.	Settings	Value
11.942.2461.1	Mode	off
11.942.2461.3	Threshold	58.333 [V]
11.942.2461.6	Delay failure indication	5.00 [s]

2-8-9. VT miniatureCB

NO.	Settings	Value
11.942.2641.101	Response time	0.00 [s]

2-9. VI 3ph CB 2nd_P2

2-9-1. General/Rated values

NO.	Settings	Value
822.9451.101	Rated current	600.00 [A]
822.9451.102	Rated voltage	66.00 [kV]
822.9451.103	Rated apparent power	68.59 [MVA]

2-9-2. Power-system data

NO.	Settings	Value
822.9451.149	Power-sys. neutral point	grounded

2-9-3. Measurements

NO.	Settings	Value
822.9451.158	P, Q sign	not reversed

2-10. I 1ph TR neut

2-10-1. General/Rated values

NO.	Settings	Value
1151.9421.101	Rated current	250.00 [A]

2-10-2. Power-system data

NO.	Settings	Value
1151.9421.214	MI-1ph uses MeasP with ID	3
1151.9421.223	CT mismatch MI-1ph	1.00

Definite-time overcurrent protection - 3 Phase(50-1)

1. Setting Table

1-1. 50 Definite-T 1 General

NO.	Settings	Value
822.1941.661.1	Mode	on
822.1941.661.2	Operate & flt.rec. blocked	no
822.1941.661.8	Method of measurement	fundamental comp.
822.1941.661.3	Threshold	1.600 [A]
822.1941.661.6	Operate delay	0.80 [s]

2. Test Value

2-1. 50 Overcurrent, Phases Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	1.600 [A]	1.600 [A]	±1[%] or 5[mA]	Pass
BØ	1.600 [A]	1.600 [A]		Pass
CØ	1.600 [A]	1.600 [A]		Pass
3Ø	1.600 [A]	1.600 [A]		Pass

2-2. 50 Overcurrent, Phases Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	0.800 [sec]	0.810 [sec]	±1[%] or 10[ms]	Pass
BØ	0.800 [sec]	0.809 [sec]		Pass
CØ	0.800 [sec]	0.808 [sec]		Pass
3Ø	0.800 [sec]	0.810 [sec]		Pass

Definite-time overcurrent protection - 3 Phase(50-2)

1. Setting Table

1-1. 50 Definite-T 1 General

NO.	Settings	Value
822.1941.662.1	Mode	on
822.1941.662.2	Operate & flt.rec. blocked	no
822.1941.662.8	Method of measurement	fundamental comp.
822.1941.662.3	Threshold	4.17 [A]
822.1941.662.6	Operate delay	0.05 [s]

2. Test Value

2-1. 50 Overcurrent, Phases Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	4.170 [A]	4.170 [A]	±1[%] or 5[mA]	Pass
BØ	4.170 [A]	4.170 [A]		Pass
CØ	4.170 [A]	4.170 [A]		Pass
3Ø	4.170 [A]	4.170 [A]		Pass

2-2. 50 Overcurrent, Phases Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	50.0 [msec]	49.7 [msec]	±1[%] or 10[ms]	Pass
BØ	50.0 [msec]	49.9 [msec]		Pass
CØ	50.0 [msec]	48.7 [msec]		Pass
3Ø	50.0 [msec]	49.2 [msec]		Pass

Inverse-time overcurrent protection - 3 Phase(51)

1. Setting Table

1-1. 51 Inverse-T 1 General

NO.	Settings	Value
822.1941.691.1	Mode	on
822.1941.691.2	Operate & flt.rec. blocked	no
822.1941.691.8	Method of measurement	fundamental comp.
822.1941.691.3	Threshold	0.340 [A]
822.1941.691.130	Type of character. Curve	IEC Normal inverse
822.1941.691.131	Reset	Instantaneous
822.1941.691.101	Time dial	0.35

2. Test Value

2-1. 51 Overcurrent, Phases Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by increasing the current magnitude(Threshold value 1.1pu)

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	0.374 [A]	0.375 [A]	±1[%] or 5[mA]	Pass
BØ	0.374 [A]	0.375 [A]		Pass
CØ	0.374 [A]	0.375 [A]		Pass
3Ø	0.374 [A]	0.375 [A]		Pass

2-2. 51 Overcurrent, Phases Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by changing the current magnitude in multiples of the setting value

Division	150%	200%	300%	500%	Limit	Result
Output Current	0.51 [A]	0.68 [A]	1.02 [A]	1.70 [A]		
Expected Time	6.018 [sec]	3.510 [sec]	2.206 [sec]	1.498 [sec]		
Operating Time						
AØ	6.031 [sec]	3.507 [sec]	2.211 [sec]	1.510 [sec]	±1 [%] or ±10 [ms]	Pass
BØ	6.032 [sec]	3.516 [sec]	2.212 [sec]	1.507 [sec]		Pass
CØ	6.032 [sec]	3.518 [sec]	2.215 [sec]	1.512 [sec]		Pass
3Ø	6.033 [sec]	3.506 [sec]	2.212 [sec]	1.511 [sec]		Pass

3. Test Result

Setting Value Verification and Test Results : Good

Definite-time overcurrent protection - Neutral(51N)

1. Setting Table

1-1. 51N Definite-T 1 General

NO.	Settings	Value
822.211.2311.9	Measured value	3I0 calculated
822.211.751.1	Mode	on
822.211.751.2	Operate & flt.rec. blocked	no
822.211.751.26	Dynamic settings	no
822.211.751.8	Method of measurement	fundamental comp.
822.211.751.3	Threshold	0.100 [A]
822.211.751.4	Dropout ratio	0.95
822.211.751.101	Dropout delay	0.00 [s]
822.211.751.6	Operate delay	0.10 [s]
822.211.751.7	Operate delay mode	Running dur.DO-delay

2. Test Value

2-1. 51N Overcurrent, 1-Phase Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
NØ	0.100 [A]	0.101 [A]	±1[%] or 5[mA]	Pass

2-2. 51N Overcurrent, Phases Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
NØ	0.100 [sec]	0.110 [sec]	±1[%] or 10[ms]	Pass

3. Test Result

Setting Value Verification and Test Results : Good

Definite-time overcurrent protection - Ground(51G)

1. Setting Table

1-1. 51G Definite-T 1 General

NO.	Settings	Value
1151.1891.12661.1	Mode	on
1151.1891.12661.2	Operate & flt.rec. blocked	no
1151.1891.12661.8	Method of measurement	fundamental comp.
1151.1891.12661.3	Threshold	0.100 [A]
1151.1891.12661.6	Operate delay	0.50 [s]

2. Test Value

2-1. 51G Overcurrent, 1-Phase Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- ZCT Source : X41 1(AØ), 2(NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
GØ	0.100 [A]	0.100 [A]	±1[%] or 5[mA]	Pass

2-2. 51G Overcurrent, 1-Phase Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- ZCT Source : X41 1(AØ), 2(NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
GØ	0.500 [sec]	0.510 [sec]	±1[%] or 10[ms]	Pass

3. Test Result

Setting Value Verification and Test Results : Good

7SJ85 Protection Relay Interlock Test

1. Test

Source	Division	Condition		Verification		Remark
		Initiate	Block	LED	LOR	
50-1	Trip	-	-	LED 1.6	Trip	
50-2	Trip	-	-	LED 1.6	Trip	
51	Trip	-	-	LED 1.6	Trip	
51N	Trip	-	-	LED 1.7	Trip	
51G	Trip	-	-	LED 1.8	Trip	

2. Test Result

Setting Value Verification and Test Results : Good

	TEST PLAN - SAT	ITP No.		1723001595-EL-PRO-00023	
		Rev. No.	2	PAGE	57 of 116
CLASSIFICATION	EXPLANATION	INSPECTED BY			TEST PLACE
	EXPLANATION	Hyosung	Customer	-	TEST PLACE
S.A.T (Site Acceptance Test) Routine tests	1 Relay Test				
	1.1 Diagnostic Test	H	W	-	ON shore
	1.2 Relay Setting Check	H	W	-	ON shore
	1.3 IO Operation Test	H	W	-	ON shore
	1.4 Measurement Test	H	W	-	ON shore
	1.5 Protection Test	H	W	-	ON shore
	1.6 Remote Test	H	W	-	ON shore
REMARKS	H : HOLDING POINT W/S : WITNESSING OVER SAMPLE W : WITNESS POINT R : TEST REPORT REVIEW * Only Remote Test items require OFF shore testing.				

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1. Relay Test 1.1 Diagnostic Test	1) Test Purpose - In order to verify that IED is possible to check the self-diagnosis. 2) Test Method - Activate internal related signal of the IED - Check the LED lamp on the IED - Check the status via menu button of the IED - Check the event log file on the IED 3) Test Criteria - Check that the simulated signal and detected signal are matched.	If it is performed on the FAT, it is omitted on the SAT.	Witness
1.2 Relay Setting Check	1) Test Purpose - In order to verify that each relay is correctly set according to approved setting 2) Test Method a) Final DIGSI file review - If the relay needs to be updated, check with the latest settings file and upload it b) Run DIGSI software on Engineering notebook and connect with the protection relay. Verify that the connection is successful c) After connecting online, use the Compare function to check whether there are any abnormalities in the relay setting value d) Verify that all setting values are same with approved setting table. 3) Test Criteria - Verification of DIGSI Software's Relay Setting File - Verify that the DIGSI Setting File and Relay Setting are the same	If it is performed on the FAT, it is omitted on the SAT. The reference documents for the test are as follows. ●1723001595-EL-SO-00019 IED interrogation and programming software ●1723001595-EL-SO-00020 Relay IED configuration files ●1723001595-EL-SO-00021 IEC 61850 configuration files ●123A90-DDL-EL-RE-20169 Electrical Protection Relay Setting Schedule	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.3 IO Operation Test	1) Test Purpose - In order to verify that the status of the IO module on IED. 2) Test Method a) Binary Input Test - After operating the BI-related operation signal on the field equipment check whether the relay BI operates. b) Binary Output Test - After checking the relevant BO Point, control is executed on alternative program in case of a circuit breaker / Disconnector / Earth Switch test. * The “Functional logic diagram” document must be approved before testing, and it is confirmed that it operates under the applicable conditions during the BO test. - For other BO points, After connecting to the relay using the DIGSI5 program perform an ON/OFF test through test mode. 3) Test Criteria - Check whether the relevant BI Points match the program - Check that BO POINT output operates normally ● A reference to the approved document "Functional logic diagram	Shall meet the approval specification The reference documents for the test are as follows. ●1723001595-EL-DG-00012 FUNCTIONAL LOGIC DIAGRAM ●1723001595-EL-DG-00015 CIRCUIT AND WIRING DIAGRAM for DLCP ● 1723001595-EL-LIS-00011 Switchgear IO list	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.4 Measurement Test	1) Test Purpose - In order to verify that the status of the CT/PT module on IED. 2) Test Method - Using the test terminals of the CTT of the DCLP panel and normal operation of the protection relay is confirmed through a measurement test. * For reference, the protective relay test equipment used is Doble, Omicron and ISA etc. - Review approval documentation and drawings for test relays prior to testing. (check whether CT and PT ratio, polarity, and I/O list) - Using the test terminal, separate the secondary side of the CT and the protection relay. - Connect the test equipment to the cable on the protection relay side, and test by wiring so that the output of the test equipment can be connected - After injection the secondary CT test value to each A/B/C phase from the test equipment, and record the current value measured by the protection relay. - After injection the secondary CT test value to three-phase from the test equipment, and record the I1, I2, and I0 values measured at the protection relay. - Check whether process communication between MU and IED is normal. (Compare the injection value on the MU equipment side with the relay value through SV) 3) Test Criteria - Compare the injection value and the operation value. - To check that the value of difference should be within the tolerance range.	Shall meet the approval specification The reference documents for the test are as follows. ●1723001595-EL-DG-00015 CIRCUIT AND WIRING DIAGRAM for DLCP	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.5 Protection Test	1) Test Purpose - In order to verify that equipment is accurately protected through the current and voltage input to the protection relay. 2) Test Method - Generate Sample Values from the protective relay test equipment used is Omicron or Meger and normal operation of the protection relay is confirmed through a protection function test. * PTP time synchronization is required between devices when generating sample values. - Review approval documentation and drawings for test relays prior to testing. (check whether CT and PT ratio, polarity, and I/O list) - Check the relay setting calculation report and setting table in advance and confirm that the protection relay settings have been completed as per the report. - Using the test terminal block, separate the secondary side of the CT and the protection relay. - Connect relays and equipment to the Process Bus network to use Sample Values. - Connect the test equipment to the cable on the protection relay side, and test by wiring so that the output of the test equipment can be connected the input part of each protection relay. - Referring to the submitted the relay setting calculation report, input the required test values for each protection element using test equipment then record whether the protection element operates normally and detailed data.	Shall meet the approval specification	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.5 Protection Test	- Directional Overcurrent Protection, Phase/Ground (67, 67N) 1) Threshold Test 2) Characteristic Angle Test 3) Operating Time Test - Transformer Differential Protection (87T) 1) Threshold Test 2) Slope Characteristic Test 3) Blocking with 2nd Harmonic Test 4) Blocking with 5th Harmonic Test 5) Operating Time Test - Overcurrent Protection, Phase/Ground (50, 51, 50N, 51G) 1) Threshold Test 2) Operating Time Test 3) Test Criteria - Compare the setting value and the operation value. - To check that the value of difference should be within the tolerance range. - After FAT, a detailed result report is submitted in a separate form.	Shall meet the approval specification The reference documents for the test are as follows. ●123A90-DDL-EL-RE-20168 Electrical Protection Relay Selectivity	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.6 Remote Test	1) Test Purpose - In order to verify that the IEC61850 communication status of the relay. 2) Test Method a) IEC 61850 configuration files review - If the relay needs to be updated, check with the latest settings file and upload it b) Check by comparing the submitted IO LIST (including IEC61850 address) with the setting file. c) Run the program that can check the IEC61850 address on Site Engineering Workstation and check that the protection relay is properly connected to the Station bus network. (the EMCS program is used on-shore.) d) When configuring a network, each relay communication module must be connected to a system that matches it. e) Refer to the IO list and change the value of the test tag to check whether the communication signal changes at the same time. f) To change the tag value for communication testing, refer to the items below. - IO Module test - Measurement test - Protection test g) This test is performed by EMCS in case of on-shore 3) Test Criteria - Compare the relay value and the value of the alternative program. - When the relay value is changed, the remote tag value is immediately updated.	Shall meet the approval specification The reference documents for the test are as follows. ● 1723001595-EL-SO-00020 Relay IED configuration files ● 1723001595-EL-SO-00021 IEC 61850 configuration files ● 1723001595-EL-LIS-00011 Switchgear IO list	Witness

	TEST PLAN - SAT	ITP No.		1723001595-EL-PRO-00023	
		Rev. No.	2	PAGE	64 of 116

CLASSIFICATION	EXPLANATION	INSPECTED BY			TEST PLACE
	EXPLANATION	Hyosung	Customer	-	TEST PLACE
S.A.T (Site Acceptance Test) Routine tests	1 Relay Test				
	1.1 Diagnostic Test	H	W	-	OFF shore
	1.2 Relay Setting Check	H	W	-	OFF shore
	1.3 IO Operation Test	H	W	-	OFF shore
	1.4 Measurement Test	H	W	-	OFF shore
	1.5 Protection Test	H	W	-	OFF shore
	1.6 Remote Test	H	W	-	OFF shore

REMARKS

H : HOLDING POINT W/S : WITNESSING OVER SAMPLE

W : WITNESS POINT R : TEST REPORT REVIEW

* Only Remote Test items require OFF shore testing.

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1. Relay Test 1.1 Diagnostic Test	1) Test Purpose - In order to verify that IED is possible to check the self-diagnosis. 2) Test Method - Activate internal related signal of the IED - Check the LED lamp on the IED - Check the status via menu button of the IED - Check the event log file on the IED 3) Test Criteria - Check that the simulated signal and detected signal are matched.	If it is performed on the FAT, it is omitted on the SAT.	Witness
1.2 Relay Setting Check	1) Test Purpose - In order to verify that each relay is correctly set according to approved setting 2) Test Method a) Final DIGSI file review - If the relay needs to be updated, check with the latest settings file and upload it b) Run DIGSI software on Engineering notebook and connect with the protection relay. Verify that the connection is successful c) After connecting online, use the Compare function to check whether there are any abnormalities in the relay setting value d) Verify that all setting values are same with approved setting table. 3) Test Criteria - Verification of DIGSI Software's Relay Setting File - Verify that the DIGSI Setting File and Relay Setting are the same	If it is performed on the FAT, it is omitted on the SAT. The reference documents for the test are as follows. ●1723001595-EL-SO-00019 IED interrogation and programming software ●1723001595-EL-SO-00020 Relay IED configuration files ●1723001595-EL-SO-00021 IEC 61850 configuration files ●123A90-DDL-EL-RE-20169 Electrical Protection Relay Setting Schedule	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.3 IO Operation Test	1) Test Purpose - In order to verify that the status of the IO module on IED. 2) Test Method a) Binary Input Test - After operating the BI-related operation signal on the field equipment check whether the relay BI operates. b) Binary Output Test - After checking the relevant BO Point, control is executed on alternative program in case of a circuit breaker / Disconnector / Earth Switch test. * The “Functional logic diagram” document must be approved before testing, and it is confirmed that it operates under the applicable conditions during the BO test. - For other BO points, After connecting to the relay using the DIGSI5 program perform an ON/OFF test through test mode. 3) Test Criteria - Check whether the relevant BI Points match the program - Check that BO POINT output operates normally ● A reference to the approved document "Functional logic diagram	If it is performed on the SAT at ON Shore, it is omitted on the SAT at OFF-Shore. The reference documents for the test are as follows. ●1723001595-EL-DG-00012 FUNCTIONAL LOGIC DIAGRAM ●1723001595-EL-DG-00015 CIRCUIT AND WIRING DIAGRAM for DLCP ● 1723001595-EL-LIS-00011 Switchgear IO list	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.4 Measurement Test	1) Test Purpose - In order to verify that the status of the CT/PT module on IED. 2) Test Method - Using the test terminals of the CTT of the DCLP panel and normal operation of the protection relay is confirmed through a measurement test. * For reference, the protective relay test equipment used is Doble, Omicron and ISA etc. - Review approval documentation and drawings for test relays prior to testing. (check whether CT and PT ratio, polarity, and I/O list) - Using the test terminal, separate the secondary side of the CT and the protection relay. - Connect the test equipment to the cable on the protection relay side, and test by wiring so that the output of the test equipment can be connected - After injection the secondary CT test value to each A/B/C phase from the test equipment, and record the current value measured by the protection relay. - After injection the secondary CT test value to three-phase from the test equipment, and record the I1, I2, and I0 values measured at the protection relay. - Check whether process communication between MU and IED is normal. (Compare the injection value on the MU equipment side with the relay value through SV) 3) Test Criteria - Compare the injection value and the operation value. - To check that the value of difference should be within the tolerance range.	If it is performed on the SAT at ON Shore, it is omitted on the SAT at OFF-Shore. The reference documents for the test are as follows. ●1723001595-EL-DG-00015 CIRCUIT AND WIRING DIAGRAM for DLCP	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.5 Protection Test	1) Test Purpose - In order to verify that equipment is accurately protected through the current and voltage input to the protection relay. 2) Test Method - Generate Sample Values from the protective relay test equipment used is Omicron or Meger and normal operation of the protection relay is confirmed through a protection function test. * PTP time synchronization is required between devices when generating sample values. - Review approval documentation and drawings for test relays prior to testing. (check whether CT and PT ratio, polarity, and I/O list) - Check the relay setting calculation report and setting table in advance and confirm that the protection relay settings have been completed as per the report. - Using the test terminal block, separate the secondary side of the CT and the protection relay. - Connect relays and equipment to the Process Bus network to use Sample Values. - Connect the test equipment to the cable on the protection relay side, and test by wiring so that the output of the test equipment can be connected the input part of each protection relay. - Referring to the submitted the relay setting calculation report, input the required test values for each protection element using test equipment then record whether the protection element operates normally and detailed data.	If it is performed on the SAT at ON Shore, it is omitted on the SAT at OFF-Shore.	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.5 Protection Test	- Directional Overcurrent Protection, Phase/Ground (67, 67N) 1) Threshold Test 2) Characteristic Angle Test 3) Operating Time Test - Transformer Differential Protection (87T) 1) Threshold Test 2) Slope Characteristic Test 3) Blocking with 2nd Harmonic Test 4) Blocking with 5th Harmonic Test 5) Operating Time Test - Overcurrent Protection, Phase/Ground (50, 51, 50N, 51G) 1) Threshold Test 2) Operating Time Test 3) Test Criteria - Compare the setting value and the operation value. - To check that the value of difference should be within the tolerance range. - After FAT, a detailed result report is submitted in a separate form.	The reference documents for the test are as follows. ●123A90-DDL-EL-RE-20168 Electrical Protection Relay Selectivity	Witness

Test Items	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1.6 Remote Test	1) Test Purpose - In order to verify that the IEC61850 communication status of the relay. 2) Test Method a) IEC 61850 configuration files review - If the relay needs to be updated, check with the latest settings file and upload it b) Check by comparing the submitted IO LIST (including IEC61850 address) with the setting file. c) Run the program that can check the IEC61850 address on Site Engineering Workstation and check that the protection relay is properly connected to the Station bus network. (the HV-SCADA program is used off-shore.) d) When configuring a network, each relay communication module must be connected to a system that matches it. e) Refer to the IO list and change the value of the test tag to check whether the communication signal changes at the same time. f) To change the tag value for communication testing, refer to the items below. - IO Module test - Measurement test - Protection test g) This test is performed by HV-SCADA 3) Test Criteria - Compare the relay value and the value of the alternative program. - When the relay value is changed, the remote tag value is immediately updated.	Shall meet the approval specification The reference documents for the test are as follows. ● 1723001595-EL-SO-00020 Relay IED configuration files ● 1723001595-EL-SO-00021 IEC 61850 configuration files ● 1723001595-EL-LIS-00011 Switchgear IO list	Witness

HOLLANDSE KUST NOORD OFFSHORE WIND PARK
PROTECTION RELAY SAT REPORT



09 DEC, 2024

CROSSWIND

ROSETTI MARINO
Group of Companies

Protection Relay Report

1. Protection Relay Technical Specifications

Panel	CP-100E1
Maker	SIEMENS
Model No.	7UT85
Function	87T, 87N
Serial Number	BM2408001638

2. Basic Settings

2-1. Power System

2-1-1. General

NO.	Settings	Value
11.2311.101	Phase sequence	A B C

2-2. Meas.point FDR_I1

2-2-1. CT 3-phase/General

NO.	Settings	Value
11.931.8881.115	CT connection	3-phase + IN-separate
11.931.8881.127	Tracking	active
11.931.8881.130	Measuring-point ID	1

2-2-2. CT 3-phase/CT phases

NO.	Settings	Value
11.931.8881.101	Rated primary current	250.0 [A]
11.931.8881.102	Rated secondary current	1 [A]
11.931.8881.117	Current range	100 x IR
11.931.8881.118	internal CT type	CT IEC 61850-9-2
11.931.8881.142	Invert current polarity	no
11.931.8881.114	inverted phases	none

2-2-3. CT IN

NO.	Settings	Value
11.931.8881.104	Rated primary current	250.0 [A]
11.931.8881.105	Rated secondary current	1 [A]
11.931.8881.119	Current range	100 x IR
11.931.8881.120	Internal CT type	CT IEC 61850-9-2

2-2-4. CT 3-phase/MP disconnection

NO.	Settings	Value
11.931.8881.173	Current check	active
11.931.8881.112	I< threshold	0.100 [A]

2-2-5. CT 1

NO.	Settings	Value
11.931.3841.101	Rated primary current	250.0 [A]
11.931.3841.109	Rat	250.0
11.931.3841.103	Magnitude correction	1.00000
11.931.3841.117	Phase	IA
11.931.3841.102	Rated frequency	50.00 [Hz]
11.931.3841.118	Ratio of clipping limit	100.00
11.931.3841.119	Meas. accuracy class	0.2 [s]
11.931.3841.120	Prot. accuracy class	1
11.931.3841.121	Second. loop time const.	0.21 [s]
11.931.3841.123	Transient perform. Class	TPM

2-2-6. CT 2

NO.	Settings	Value
11.931.3842.101	Rated primary current	250.0 [A]
11.931.3842.109	Rat	250.0
11.931.3842.103	Magnitude correction	1.00000
11.931.3842.117	Phase	IB
11.931.3842.102	Rated frequency	50.00 [Hz]
11.931.3842.118	Ratio of clipping limit	100.00
11.931.3842.119	Meas. accuracy class	0.2 [s]
11.931.3842.120	Prot. accuracy class	1
11.931.3842.121	Second. loop time const.	0.21 [s]
11.931.3842.123	Transient perform. Class	TPM

2-2-7. CT 3

NO.	Settings	Value
11.931.3843.101	Rated primary current	250.0 [A]
11.931.3843.109	Rat	250.0
11.931.3843.103	Magnitude correction	1.00000
11.931.3843.117	Phase	IC
11.931.3843.102	Rated frequency	50.00 [Hz]
11.931.3843.118	Ratio of clipping limit	100.00
11.931.3843.119	Meas. accuracy class	0.2 [s]
11.931.3843.120	Prot. accuracy class	1
11.931.3843.121	Second. loop time const.	0.21 [s]
11.931.3843.123	Transient perform. Class	TPM

2-2-8. CT 4

NO.	Settings	Value
11.931.3844.101	Rated primary current	250.0 [A]
11.931.3844.109	Rat	250.0
11.931.3844.103	Magnitude correction	1.00000
11.931.3844.117	Phase	IN
11.931.3844.102	Rated frequency	50.00 [Hz]
11.931.3844.118	Ratio of clipping limit	100.00
11.931.3844.119	Meas. accuracy class	0.2 [s]
11.931.3844.120	Prot. accuracy class	1
11.931.3844.121	Second. loop time const.	0.21 [s]
11.931.3844.123	Transient perform. Class	TPM

2-2-9. Brk.wire det.

NO.	Settings	Value
11.931.5581.1	Mode	off
11.931.5581.101	Mode of blocking	blocking

2-2-10. Supv. Balan. I

NO.	Settings	Value
11.931.2491.1	Mode	off
11.931.2491.101	Release threshold	0.500 [A]
11.931.2491.102	Threshold min/max	0.50
11.931.2491.6	Delayfailure indication	5.00 [s]

2-2-11. Supv. Ph.seq.I

NO.	Settings	Value
11.931.2551.1	Mode	off
11.931.2551.6	Delayfailure indication	5.00 [s]
11.931.2551.102	Release threshold	0.500 [A]

2-2-12. Supv. Sum I

NO.	Settings	Value
11.931.2431.1	Mode	off
11.931.2431.102	Threshold	0.100 [A]
11.931.2431.101	Slope factor	0.10
11.931.2431.6	Delay failure indication	5.00 [s]

2-3. Meas.point I-3ph TR 2nd

2-3-1. CT 3-phase/General

NO.	Settings	Value
11.932.8881.115	CT connection	3-phase
11.932.8881.127	Tracking	active
11.932.8881.130	Measuring-point ID	2

2-3-2. CT 3-phase/CT phases

NO.	Settings	Value
11.932.8881.101	Rated primary current	600.0 [A]
11.932.8881.102	Rated secondary current	1 [A]
11.932.8881.117	Current range	100 x IR
11.932.8881.118	internal CT type	CT protection
11.932.8881.116	Neutr.point in dir.of.ref.obj	no
11.932.8881.114	inverted phases	none

2-3-3. CT 3-phase/MP disconnection

NO.	Settings	Value
11.932.8881.173	Current check	active
11.932.8881.112	I<threshold	0.100 [A]

2-3-4. CT 1

NO.	Settings	Value
11.932.3841.103	Magnitude correction	1.00000
11.932.3841.117	Phase	IA

2-3-5. CT 2

NO.	Settings	Value
11.932.3842.103	Magnitude correction	1.00000
11.932.3842.117	Phase	IB

2-3-6. CT 3

NO.	Settings	Value
11.932.3843.103	Magnitude correction	1.00000
11.932.3843.117	Phase	IC

2-3-7. Brk.wire det.

NO.	Settings	Value
11.932.5581.1	Mode	off
11.932.5581.101	Mode of blocking	blocking

2-3-8. Supv. Balan. I

NO.	Settings	Value
11.932.2491.1	Mode	on
11.932.2491.101	Release threshold	0.500 [A]
11.932.2491.102	Threshold min/max	0.50
11.932.2491.6	Delayfailure indication	5.00 [s]

2-3-9. Supv. Ph.seq.I

NO.	Settings	Value
11.932.2551.1	Mode	on
11.932.2551.6	Delayfailure indication	5.00 [s]
11.932.2551.102	Release threshold	0.500 [A]

2-4. Meas.point I-1ph TR neut

2-4-1. CT 1-phase/General

NO.	Settings	Value
11.951.2311.101	Rated primary current	250.0 [A]
11.951.2311.102	Rated secondary current	1 [A]
11.951.2311.103	Current range	100 x IR
11.951.2311.104	internal CT type	CT protection
11.951.2311.116	Term.1,3,5,7 in dir.of.ref.obj	yes
11.951.2311.105	Tracking	inactive
11.951.2311.130	Measuring-point ID	3

2-4-2. CT 1

NO.	Settings	Value
11.951.3841.103	Magnitude correction	1.00000
11.951.3841.117	Phase	Ix

2-5. Meas.point FDR_I2

2-5-1. CT 3-phase/General

NO.	Settings	Value
11.933.8881.115	CT connection	3-phase + IN-separate
11.933.8881.127	Tracking	active
11.933.8881.130	Measuring-point ID	4

2-5-2. CT 3-phase/CT phases

NO.	Settings	Value
11.933.8881.101	Rated primary current	250.0 [A]
11.933.8881.102	Rated secondary current	1 [A]
11.933.8881.117	Current range	100 x IR
11.933.8881.118	internal CT type	CT IEC 61850-9-2
11.933.8881.142	Invert current polarity	no
11.933.8881.114	inverted phases	none

2-5-3. CT IN

NO.	Settings	Value
11.933.8881.104	Rated primary current	250.0 [A]
11.933.8881.105	Rated secondary current	1 [A]
11.933.8881.119	Current range	100 x IR
11.933.8881.120	Internal CT type	CT IEC 61850-9-2

2-5-4. CT 3-phase/MP disconnection

NO.	Settings	Value
11.933.8881.173	Current check	active
11.933.8881.112	I< threshold	0.100 [A]

2-5-5. CT 1

NO.	Settings	Value
11.933.3841.101	Rated primary current	250.0 [A]
11.933.3841.109	Rat	250.0
11.933.3841.103	Magnitude correction	1.00000
11.933.3841.117	Phase	IA
11.933.3841.102	Rated frequency	50.00 [Hz]
11.933.3841.118	Ratio of clipping limit	100.00
11.933.3841.119	Meas. accuracy class	0.2 [s]
11.933.3841.120	Prot. accuracy class	1
11.933.3841.121	Second. loop time const.	0.21 [s]
11.933.3841.123	Transient perform. Class	TPM

2-5-6. CT 2

NO.	Settings	Value
11.933.3842.101	Rated primary current	250.0 [A]
11.933.3842.109	Rat	250.0
11.933.3842.103	Magnitude correction	1.00000
11.933.3842.117	Phase	IB
11.933.3842.102	Rated frequency	50.00 [Hz]
11.933.3842.118	Ratio of clipping limit	100.00
11.933.3842.119	Meas. accuracy class	0.2 [s]
11.933.3842.120	Prot. accuracy class	1
11.933.3842.121	Second. loop time const.	0.21 [s]
11.933.3842.123	Transient perform. Class	TPM

2-5-7. CT 3

NO.	Settings	Value
11.933.3843.101	Rated primary current	250.0 [A]
11.933.3843.109	Rat	250.0
11.933.3843.103	Magnitude correction	1.00000
11.933.3843.117	Phase	IC
11.933.3843.102	Rated frequency	50.00 [Hz]
11.933.3843.118	Ratio of clipping limit	100.00
11.933.3843.119	Meas. accuracy class	0.2 [s]
11.933.3843.120	Prot. accuracy class	1
11.933.3843.121	Second. loop time const.	0.21 [s]
11.933.3843.123	Transient perform. Class	TPM

2-5-8. CT 4

NO.	Settings	Value
11.933.3844.101	Rated primary current	250.0 [A]
11.933.3844.109	Rat	250.0
11.933.3844.103	Magnitude correction	1.00000
11.933.3844.117	Phase	IN
11.933.3844.102	Rated frequency	50.00 [Hz]
11.933.3844.118	Ratio of clipping limit	100.00
11.933.3844.119	Meas. accuracy class	0.2 [s]
11.933.3844.120	Prot. accuracy class	1
11.933.3844.121	Second. loop time const.	0.21 [s]
11.933.3844.123	Transient perform. Class	TPM

2-5-9. Brk.wire det.

NO.	Settings	Value
11.933.5581.1	Mode	off
11.933.5581.101	Mode of blocking	blocking

2-5-10. Supv. Balan. I

NO.	Settings	Value
11.933.2491.1	Mode	off
11.933.2491.101	Release threshold	0.500 [A]
11.933.2491.102	Threshold min/max	0.50
11.933.2491.6	Delayfailure indication	5.00 [s]

2-5-11. Supv. Ph.seq.I

NO.	Settings	Value
11.933.2551.1	Mode	off
11.933.2551.6	Delayfailure indication	5.00 [s]
11.933.2551.102	Release threshold	0.500 [A]

2-5-12. Supv. Sum I

NO.	Settings	Value
11.933.2431.1	Mode	off
11.933.2431.102	Threshold	0.100 [A]
11.933.2431.101	Slope factor	0.10
11.933.2431.6	Delay failure indication	5.00 [s]

2-6. TR Side 1_P1

2-6-1. General/Rated values

NO.	Settings	Value
913.91.103	Rate apparent power	7.00 [MVA]
913.91.102	Rated voltage	66.00 [kV]
913.91.101	Rate current	61 [A]

2-6-2. General/Side data

NO.	Settings	Value
913.91.149	Neutral point	isolated
913.91.104	Winding configuration	D (Delta)
913.91.163	vector group numeral	0
913.91.130	side number	Side 1
913.91.210	MI3ph1 usesMeasP with ID	1
913.91.215	CT mismatch MI-3ph 1	4.083
913.91.216	CT mismatch MI-3ph 1 IN	4.083

2-6-3. General/Tap changer

NO.	Settings	Value
913.91.44	Tap changer	No function block available

2-6-4. General/Tap changer phase

NO.	Settings	Value
913.91.45	Tap changer	No function block available

2-7. TR Side 2

2-7-1. General/Rated values

NO.	Settings	Value
912.91.103	Rate apparent power	7.00 [MVA]
912.91.102	Rated voltage	6.90 [kV]
912.91.101	Rate current	586 [A]

2-7-2. General/Side data

NO.	Settings	Value
912.91.149	Neutral point	grounded
912.91.104	Winding configuration	Y (Wye)
912.91.163	vector group numeral	11
912.91.130	side number	Side 2
912.91.210	MI3ph1 usesMeasP with ID	2
912.91.214	MI-1ph usesMeasP with ID	3
912.91.215	CT mismatch MI-3ph 1	1.024
912.91.223	CT mismatch MI-1ph	0.427

2-7-3. General/Tap changer

NO.	Settings	Value
912.91.44	Tap changer	No function block available

2-7-4. General/Tap changer phase

NO.	Settings	Value
912.91.45	Tap changer	No function block available

2-8. Transform. Neut.p 1

2-8-1. General/Rated values

NO.	Settings	Value
912.9421.104	Rate current	586 [A]

2-8-2. General/Power-system data

NO.	Settings	Value
912.9421.214	MI1ph usesMeasP with ID	3
912.9421.223	CT mismatch MI-1ph	0.43

2-9. TR Side1_P2

2-9-1. General/Rated values

NO.	Settings	Value
821.9451.101	Rate current	600.00 [A]

2-9-2. General/Power-system data

NO.	Settings	Value
821.9451.149	Power-sys. Neutral point	grounded

Differential Protection(87T)

1. Setting Table

1-1. 87T General

NO.	Settings	Value
901.1691.2311.100	Meas. gnd. Current side 1	no
901.1691.2311.105	CT mismatch side 1 M3ph 1	1.024
901.1691.2311.109	CT mismatch side 1 M1ph	0.427
901.1691.2311.110	CT mismatch side 2 M3ph 1	4.083
901.1691.2311.191	Reference side is	Side 1
901.1691.2311.151	MU-ID Side 1 Mp3ph 1	2
901.1691.2311.155	MU-ID Side 1 Mp1ph	3
901.1691.2311.156	MU-ID Side 2 Mp3ph 1	1

1-2. 87T I-DiFF

1-2-1. 87T I-DiFF/General

NO.	Settings	Value
901.1691.11041.1	Mode	on
901.1691.11041.2	Operate & flt.rec. blocked	no
901.1691.11041.6	Operate delay	0.00 [s]

1-2-2. 87T I-DiFF/Operate curve

NO.	Settings	Value
901.1691.11041.3	Threshold	0.20 [I/IrObj]
901.1691.11041.100	Slope 1	0.30
901.1691.11041.101	Intersection 1 Irest	0.67 [I/IrObj]
901.1691.11041.102	Slope 2	0.75
901.1691.11041.103	Intersection 2 Irest	2.00 [I/IrObj]

1-2-3. 87T I-DiFF/Starting detection

NO.	Settings	Value
901.1691.11041.106	Starting detection	yes
901.1691.11041.107	Thresh.startup detection	0.1 [I/IrObj]
901.1691.11041.108	Factor increasing char.	2.0
901.1691.11041.109	Max. perm. Start. Time	5.0 [sec]

1-2-4. 87T I-DiFF/DC offset detection

NO.	Settings	Value
901.1691.11041.110	Factor increasing char. DC	2.3

1-2-5. 87T I-DiFF/Inrush blocking

NO.	Settings	Value
901.1691.11041.115	Blocking with 2. harmonic	yes
901.1691.11041.116	2nd harmonic content	12 [%]
901.1691.11041.117	Crossblock. time 2nd har.	0.50 [s]
901.1691.11041.118	Blocking with CWA	yes

1-2-6. 87T I-DiFF/Overexcit. blocking

NO.	Settings	Value
901.1691.11041.121	Blocking with 3rd harm.	no
901.1691.11041.122	3rd harmonics content	30 [%]
901.1691.11041.123	Crossblock. time 3rd har.	0.00 [s]
901.1691.11041.124	Blocking with 5th harm.	no
901.1691.11041.125	5th harmonics content	30 [%]
901.1691.11041.126	Crossblock. time 5th har.	0.00 [s]
901.1691.11041.127	Limit Idiff 3., 5. harmonics	1.5 [I/IrObj]

1-2-7. 87T I-DiFF/Ext. fault detection

NO.	Settings	Value
901.1691.11041.128	Threshold add-on stabiliz.	2.00 [I/IrObj]
901.1691.11041.129	Time of add-on stabiliz.	0.30 [s]
901.1691.11041.130	Cross-blk. time add-on st.	0.30 [s]

1-3. 87T I-DIFF fast

NO.	Settings	Value
901.1691.11071.1	Mode	on
901.1691.11071.3	Threshold	5.0 [I/IrObj]
901.1691.11071.6	Operate delay	0.00 [sec]
901.1691.11071.100	Operate & flt.rec. blocked	no

2. Test Value

2-1. 87T 66kV HV Side Minimum Pickup Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	0.049 [A]		±2[%]	
BØ	0.049 [A]			
CØ	0.049 [A]			
3Ø	0.049 [A]			

2-2. 87T 66kV HV Side Minimum Operate Time Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	30.00 [msec]		±1[%] or 10[ms]	
BØ	30.00 [msec]			
CØ	30.00 [msec]			
3Ø	30.00 [msec]			

2-3. 87T 6.9kV LV Side Minimum Pickup Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	0.338 [A]		±2[%]	
BØ	0.338 [A]			
CØ	0.338 [A]			
3Ø	0.195 [A]			

2-4. 87T 6.9kV LV Side Minimum Operate Time Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	30.00 [msec]		±1[%] or 10[ms]	
BØ	30.00 [msec]			
CØ	30.00 [msec]			
3Ø	30.00 [msec]			

2-5. 87T 66kV HV Side & LV Side Slope Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Side2= Ia=fixed∠30º, Ib=fixed∠-90º, Ic=fixed∠150º(LV Side)
- Side1= Ia=variable∠0º, Ib=variable∠-120º, Ic=variable∠120º(HV Side)

Phase	TEST POINT		SIDE-2 (Fix)	SIDE-1 (Variable)		Limit	Result
	Ir(pu)	Id(pu)	Current	Expected(A)	Pickup(A)		
3Ø	0.67	0.20	0.459 [A]	0.164 [A]		±2[%]	
	1.0	0.30	0.684 [A]	0.245 [A]			
	2.5	0.97	1.490 [A]	0.612 [A]			

2-6. 87T 2nd Harmonic block Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Fundamental wave 5A to each phase, test by applying the second harmonic current

TEST			Limit	Result
Phase	Expected Current	Pickup Current		
AØ	0.600 [A]		±2[%]	
BØ	0.600 [A]			
CØ	0.600 [A]			
3Ø	0.600 [A]			

2-7. 87T 66kV HV Side Fast stage Pickup Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- Test by 87 Fast Threshold Setting Value to 5[I/IrObj]
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	1.225 [A]		±2[%]	
BØ	1.225 [A]			
CØ	1.225 [A]			
3Ø	1.225 [A]			

2-8. 87T 66kV HV Side Fast stage Operate Time Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (HV) : IED S.V BLPH_EW300 / FDR_P1 (AØ), (BØ), (CØ), (NØ)
- Test by 87 Fast Threshold Setting Value to 5[I/IrObj]
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	18.00 [msec]		±1[%] or 10[ms]	
BØ	18.00 [msec]			
CØ	18.00 [msec]			
3Ø	18.00 [msec]			

2-9. 87T 6.9kV LV Side Fast stage Pickup Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Test by 87 Fast Threshold Setting Value to 5[I/IrObj]
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	8.454 [A]		±2[%]	
BØ	8.454 [A]			
CØ	8.454 [A]			
3Ø	4.881 [A]			

2-10. 87T 6.9kV LV Side Fast stage Operate Time Test

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- Test by 87 Fast Threshold Setting Value to 5[I/IrObj]
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	18.00 [msec]		±1[%] or 10[ms]	
BØ	18.00 [msec]			
CØ	18.00 [msec]			
3Ø	18.00 [msec]			

3. Test Result

Setting Value Verification and Test Results : Good

Restricted Ground-Fault Protection(87N. REF)

1. Setting Table

1-1. 87N. REF 1

NO.	Settings	Value
912.10081.1	Mode	on
912.10081.2	Operate & flt.rec. blocked	no
912.10081.103	Threshold	0.10 [I/IrObj]
912.10081.105	Slope	0.05
912.10081.109	Operate delay	0.10 [s]

2. Test Value

2-1. 87N REF Minimum Pickup Test (Neutral Side 100%)

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- ZCT Source : X43 1(AØ), 2(NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
NØ	0.234 [A]		±2[%]	

2-2. 87N REF Minimum Pickup Test (Neutral Side 50%, Phase Side 50%)

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- ZCT Source : X43 1(AØ), 2(NØ)
- Neutral Side = IN=variable∠0°
- Phase Side = Ia=fixed∠180°
- A Phase current is fixed to 0.049A which is 50% of the pickup value
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
NØ	0.117 [A]		±2[%]	

2-3. 87N REF Minimum Operate Time Test (Neutral Side 100%)

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- ZCT Source : X43 1(AØ), 2(NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
NØ	30.00 [msec]		±1[%] or 10[ms]	

2-4. 87N REF Minimum Operate Time Test (Neutral Side 50%, Phase Side 50%)

① Test Condition

- Output : Test Trip BO 2.2 , X21A (11,12)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- ZCT Source : X43 1(AØ), 2(NØ)
- Neutral Side = IN=variable∠0°
- Phase Side = Ia=fixed∠180°
- A Phase current is fixed to 0.049A which is 50% of the pickup value
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
NØ	30.00 [msec]		±1[%] or 10[ms]	

2-3. 87N REF Slope Test

① Test Condition

- Output : Test Pickup BO 2.1 , X22A (9,10)
- CT Source (LV) : X42 1(AØ), 3(BØ), 5(CØ), 6(NØ)
- ZCT Source : X43 1(AØ), 2(NØ)
- Neutral Side = IN=fixed∠0°
- Phase Side = Ia=Variable∠0°

Phase	TEST POINT		SIDE-1 (Fix)	SIDE-2 (Variable)		Limit	Result
	Ir(pu)	Id(pu)	Current	Expected(A)	Pickup(A)		
NØ	3.0	0.15	3.691 [A]	1.391 [A]		±2[%]	
	4.0	0.20	4.919 [A]	1.854 [A]			
	5.0	0.25	6.149 [A]	2.318 [A]			

3. Test Result

Setting Value Verification and Test Results : Good

7UT85 Protection Relay Interlock Test

1. Test

Source	Division	Condition		Verification		Remark
		Initiate	Block	LED	LOR	
87T	Trip	-	-			
87N	Trip	-	-			

2. Remarks

- Neutral side CT polarity cannot be verified and requires further confirmation later

3. Test Result

Setting Value Verification and Test Results : Good

Protection Relay Report

1. Protection Relay Technical Specifications

Panel	CP-100E1
Maker	SIEMENS
Model No.	7SJ85
Function	50-1, 50-2, 51, 51N, 51G
Serial Number	BM2408016119

2. Basic Settings

2-1. Power System

2-1-1. General

NO.	Settings	Value
11.2311.101	Phase sequence	A B C

2-2. Meas.point FDR_I1

2-2-1. CT 3-phase/General

NO.	Settings	Value
11.931.8881.115	CT connection	3-phase + IN-separate
11.931.8881.127	Tracking	active
11.931.8881.130	Measuring-point ID	1

2-2-2. CT 3-phase/CT phases

NO.	Settings	Value
11.931.8881.101	Rated primary current	250.0 [A]
11.931.8881.102	Rated secondary current	1 [A]
11.931.8881.117	Current range	100 x IR
11.931.8881.118	Internal CT type	CT IEC 61850-9-2
11.931.8881.142	Invert current polarity	no
11.931.8881.114	Inverted phases	none

2-2-3. CT IN

NO.	Settings	Value
11.931.8881.104	Rated primary current	250.0 [A]
11.931.8881.105	Rated secondary current	1 [A]
11.931.8881.119	Current range	100 x IR
11.931.8881.120	Internal CT type	CT IEC 61850-9-2

2-2-4. CT 3-phase/MP disconnection

NO.	Settings	Value
11.931.8881.173	Current check	active
11.931.8881.112	I< threshold	0.100 [A]

2-2-5. CT 1

NO.	Settings	Value
11.931.3841.101	Rated primary current	250.0 [A]
11.931.3841.109	Rat	250.0
11.931.3841.103	Magnitude correction	1.00000
11.931.3841.117	Phase	IA
11.931.3841.102	Rated frequency	50.00 [Hz]
11.931.3841.118	Ratio of clipping limit	100.00
11.931.3841.119	Meas. accuracy class	0.2 [s]
11.931.3841.120	Prot. accuracy class	1
11.931.3841.121	Second. loop time const.	0.21 [s]
11.931.3841.123	Transient perform. Class	TPM

2-2-6. CT 2

NO.	Settings	Value
11.931.3842.101	Rated primary current	250.0 [A]
11.931.3842.109	Rat	250.0
11.931.3842.103	Magnitude correction	1.00000
11.931.3842.117	Phase	IB
11.931.3842.102	Rated frequency	50.00 [Hz]
11.931.3842.118	Ratio of clipping limit	100.00
11.931.3842.119	Meas. accuracy class	0.2 [s]
11.931.3842.120	Prot. accuracy class	1
11.931.3842.121	Second. loop time const.	0.21 [s]
11.931.3842.123	Transient perform. Class	TPM

2-2-7. CT 3

NO.	Settings	Value
11.931.3843.101	Rated primary current	250.0 [A]
11.931.3843.109	Rat	250.0
11.931.3843.103	Magnitude correction	1.00000
11.931.3843.117	Phase	IC
11.931.3843.102	Rated frequency	50.00 [Hz]
11.931.3843.118	Ratio of clipping limit	100.00
11.931.3843.119	Meas. accuracy class	0.2 [s]
11.931.3843.120	Prot. accuracy class	1
11.931.3843.121	Second. loop time const.	0.21 [s]
11.931.3843.123	Transient perform. Class	TPM

2-2-8. CT 4

NO.	Settings	Value
11.931.3844.101	Rated primary current	250.0 [A]
11.931.3844.109	Rat	250.0
11.931.3844.103	Magnitude correction	1.00000
11.931.3844.117	Phase	IN
11.931.3844.102	Rated frequency	50.00 [Hz]
11.931.3844.118	Ratio of clipping limit	100.00
11.931.3844.119	Meas. accuracy class	0.2 [s]
11.931.3844.120	Prot. accuracy class	1
11.931.3844.121	Second. loop time const.	0.21 [s]
11.931.3844.123	Transient perform. Class	TPM

2-2-9. Brk.wire det.

NO.	Settings	Value
11.931.5581.1	Mode	off
11.931.5581.101	Mode of blocking	blocking

2-2-10. Supv. Balan. I

NO.	Settings	Value
11.931.2491.1	Mode	off
11.931.2491.101	Release threshold	0.500 [A]
11.931.2491.102	Threshold min/max	0.50
11.931.2491.6	Delayfailure indication	5.00 [s]

2-2-11. Supv. Ph.seq.I

NO.	Settings	Value
11.931.2551.1	Mode	off
11.931.2551.6	Delayfailure indication	5.00 [s]
11.931.2551.102	Release threshold	0.500 [A]

2-2-12. Supv. Sum I

NO.	Settings	Value
11.931.2431.1	Mode	off
11.931.2431.102	Threshold	0.100 [A]
11.931.2431.101	Slope factor	0.10
11.931.2431.6	Delay failure indication	5.00 [s]

2-3. Meas.point FDR_I2

2-3-1. CT 3-phase/General

NO.	Settings	Value
11.932.8881.115	CT connection	3-phase + IN-separate
11.932.8881.127	Tracking	active
11.932.8881.130	Measuring-point ID	2

2-3-2. CT 3-phase/CT phases

NO.	Settings	Value
11.932.8881.101	Rated primary current	250.0 [A]
11.932.8881.102	Rated secondary current	1 [A]
11.932.8881.117	Current range	100 x IR
11.932.8881.118	internal CT type	CT IEC 61850-9-2
11.932.8881.116	Neutr.point in dir.of.ref.obj	no
11.932.8881.114	inverted phases	none

2-3-3. CT IN

NO.	Settings	Value
11.932.8881.104	Rated primary current	250.0 [A]
11.932.8881.105	Rated secondary current	1 [A]
11.932.8881.119	Current range	100 x IR
11.932.8881.120	Internal CT type	CT IEC 61850-9-2

2-3-4. CT 3-phase/MP disconnection

NO.	Settings	Value
11.932.8881.173	Current check	active
11.932.8881.112	I< threshold	0.100 [A]

2-3-5. CT 1

NO.	Settings	Value
11.932.3841.101	Rated primary current	250.0 [A]
11.932.3841.109	Rat	250.0
11.932.3841.103	Magnitude correction	1.00000
11.932.3841.117	Phase	IA
11.932.3841.102	Rated frequency	50.00 [Hz]
11.932.3841.118	Ratio of clipping limit	100.00
11.932.3841.119	Meas. accuracy class	0.2 [s]
11.932.3841.120	Prot. accuracy class	1
11.932.3841.121	Second. loop time const.	0.21 [s]
11.932.3841.123	Transient perform. Class	TPM

2-3-6. CT 2

NO.	Settings	Value
11.932.3842.101	Rated primary current	250.0 [A]
11.932.3842.109	Rat	250.0
11.932.3842.103	Magnitude correction	1.00000
11.932.3842.117	Phase	IB
11.932.3842.102	Rated frequency	50.00 [Hz]
11.932.3842.118	Ratio of clipping limit	100.00
11.932.3842.119	Meas. accuracy class	0.2 [s]
11.932.3842.120	Prot. accuracy class	1
11.932.3842.121	Second. loop time const.	0.21 [s]
11.932.3842.123	Transient perform. Class	TPM

2-3-7. CT 3

NO.	Settings	Value
11.932.3843.101	Rated primary current	250.0 [A]
11.932.3843.109	Rat	250.0
11.932.3843.103	Magnitude correction	1.00000
11.932.3843.117	Phase	IC
11.932.3843.102	Rated frequency	50.00 [Hz]
11.932.3843.118	Ratio of clipping limit	100.00
11.932.3843.119	Meas. accuracy class	0.2 [s]
11.932.3843.120	Prot. accuracy class	1
11.932.3843.121	Second. loop time const.	0.21 [s]
11.932.3843.123	Transient perform. Class	TPM

2-3-8. CT 4

NO.	Settings	Value
11.932.3844.101	Rated primary current	250.0 [A]
11.932.3844.109	Rat	250.0
11.932.3844.103	Magnitude correction	1.00000
11.932.3844.117	Phase	IN
11.932.3844.102	Rated frequency	50.00 [Hz]
11.932.3844.118	Ratio of clipping limit	100.00
11.932.3844.119	Meas. accuracy class	0.2 [s]
11.932.3844.120	Prot. accuracy class	1
11.932.3844.121	Second. loop time const.	0.21 [s]
11.932.3844.123	Transient perform. Class	TPM

2-3-9. Brk.wire det.

NO.	Settings	Value
11.932.5581.1	Mode	off
11.932.5581.101	Mode of blocking	blocking

2-3-10. Supv. Balan. I

NO.	Settings	Value
11.932.2491.1	Mode	off
11.932.2491.101	Release threshold	0.500 [A]
11.932.2491.102	Threshold min/max	0.50
11.932.2491.6	Delayfailure indication	5.00 [s]

2-3-11. Supv. Ph.seq.I

NO.	Settings	Value
11.932.2551.1	Mode	off
11.932.2551.6	Delayfailure indication	5.00 [s]
11.932.2551.102	Release threshold	0.500 [A]

2-3-12. Supv. Sum I

NO.	Settings	Value
11.932.2431.1	Mode	off
11.932.2431.102	Threshold	0.100 [A]
11.932.2431.101	Slope factor	0.10
11.932.2431.6	Delay failure indication	5.00 [s]

2-4. Meas.point TR 2nd neut

2-4-1. CT 3-phase/General

NO.	Settings	Value
11.951.2311.101	Rated primary current	250.0 [A]
11.951.2311.102	Rated secondary current	1 [A]
11.951.2311.103	Current range	100 x IR
11.951.2311.104	Internal CT type	CT protection
11.951.2311.116	Term. 1,3,5,7 in dir. of obj.	yes
11.951.2311.105	Tracking	inactive
11.951.2311.130	Measuring-point ID	3

2-4-2. CT 1

NO.	Settings	Value
11.951.3841.103	Magnitude correction	1.00000
11.951.3841.117	Phase	Ix

2-5. Meas.point BUS_V2

2-5-1. VT 3-phase/General

NO.	Settings	Value
11.943.8911.101	Rated primary voltage	66.008 [kV]
11.943.8911.102	Rated secondary voltage	80 [V]
11.943.8911.103	Matching ratio Vph / VN	1.00
11.943.8911.104	VT connection	3 ph-to-gnd volt. + VN
11.943.8911.106	Inverted phases	none
11.943.8911.111	Tracking	active
11.943.8911.130	Measuring-point ID	4
11.943.8911.136	Internal VT type	VT IEC 61850-9-2

2-5-2. VT1

NO.	Settings	Value
11.943.3811.101	Rated primary voltage	38.11 [kV]
11.943.3811.110	VRtg reference	phase-to-ground
11.943.3811.109	Rat	820.0
11.943.3811.103	Magnitude correction	1.00000
11.943.3811.108	Phase	VA
11.943.3811.102	Rated frequency	50.00 [Hz]
11.943.3811.118	Ratio of clipping limit	1.73
11.943.3811.119	Meas. accuracy class	0.2 [s]
11.943.3811.120	Prot. accuracy class	1

2-5-3. VT2

NO.	Settings	Value
11.943.3812.101	Rated primary voltage	38.11 [kV]
11.943.3812.110	VRtg reference	phase-to-ground
11.943.3812.109	Rat	820.0
11.943.3812.103	Magnitude correction	1.00000
11.943.3812.108	Phase	VB
11.943.3812.102	Rated frequency	50.00 [Hz]
11.943.3812.118	Ratio of clipping limit	1.73
11.943.3812.119	Meas. accuracy class	0.2 [s]
11.943.3812.120	Prot. accuracy class	1

2-5-4. VT3

NO.	Settings	Value
11.943.3813.101	Rated primary voltage	38.11 [kV]
11.943.3813.110	VRtg reference	phase-to-ground
11.943.3813.109	Rat	820.0
11.943.3813.103	Magnitude correction	1.00000
11.943.3813.108	Phase	VC
11.943.3813.102	Rated frequency	50.00 [Hz]
11.943.3813.118	Ratio of clipping limit	1.73
11.943.3813.119	Meas. accuracy class	0.2 [s]
11.943.3813.120	Prot. accuracy class	1

2-5-5. VT4

NO.	Settings	Value
11.943.3814.101	Rated primary voltage	38.11 [kV]
11.943.3814.110	VRtg reference	phase-to-ground
11.943.3814.109	Rat	820.0
11.943.3814.103	Magnitude correction	1.00000
11.943.3814.108	Phase	VN
11.943.3814.102	Rated frequency	50.00 [Hz]
11.943.3814.118	Ratio of clipping limit	1.73
11.943.3814.119	Meas. accuracy class	0.2 [s]
11.943.3814.120	Prot. accuracy class	1

2-5-6. Supv. balan. V

NO.	Settings	Value
11.943.2521.1	Mode	off
11.943.2521.101	Release threshold	50.000 [V]
11.943.2521.102	Threshold min/max	0.75
11.943.2521.6	Delay failure indication	5.00 [s]

2-5-7. Supv. ph.seq.V

NO.	Settings	Value
11.943.2581.1	Mode	off
11.943.2581.6	Delay failure indication	5.00 [s]

2-5-8. Supv. sum V

NO.	Settings	Value
11.943.2461.1	Mode	off
11.943.2461.3	Threshold	25.000 [V]
11.943.2461.6	Delay failure indication	5.00 [s]

2-5-9. VT miniatureCB

NO.	Settings	Value
11.943.2641.101	Response time	0.00 [s]

2-6. Meas.point FDR_V2

2-6-1. VT 3-phase/General

NO.	Settings	Value
11.944.8911.101	Rated primary voltage	66.008 [kV]
11.944.8911.102	Rated secondary voltage	80 [V]
11.944.8911.103	Matching ratio Vph / VN	1.00
11.944.8911.104	VT connection	3 ph-to-gnd volt. + VN
11.944.8911.106	Inverted phases	none
11.944.8911.111	Tracking	active
11.944.8911.130	Measuring-point ID	5
11.944.8911.136	Internal VT type	VT IEC 61850-9-2

2-6-2. VT1

NO.	Settings	Value
11.944.3811.101	Rated primary voltage	38.11 [kV]
11.944.3811.110	VRtg reference	phase-to-ground
11.944.3811.109	Rat	820.0
11.944.3811.103	Magnitude correction	1.00000
11.944.3811.108	Phase	VA
11.944.3811.102	Rated frequency	50.00 [Hz]
11.944.3811.118	Ratio of clipping limit	1.73
11.944.3811.119	Meas. accuracy class	0.2 [s]
11.944.3811.120	Prot. accuracy class	1

2-6-3. VT2

NO.	Settings	Value
11.944.3812.101	Rated primary voltage	38.11 [kV]
11.944.3812.110	VRtg reference	phase-to-ground
11.944.3812.109	Rat	820.0
11.944.3812.103	Magnitude correction	1.00000
11.944.3812.108	Phase	VB
11.944.3812.102	Rated frequency	50.00 [Hz]
11.944.3812.118	Ratio of clipping limit	1.73
11.944.3812.119	Meas. accuracy class	0.2 [s]
11.944.3812.120	Prot. accuracy class	1

2-6-4. VT3

NO.	Settings	Value
11.944.3813.101	Rated primary voltage	38.11 [kV]
11.944.3813.110	VRtg reference	phase-to-ground
11.944.3813.109	Rat	820.0
11.944.3813.103	Magnitude correction	1.00000
11.944.3813.108	Phase	VC
11.944.3813.102	Rated frequency	50.00 [Hz]
11.944.3813.118	Ratio of clipping limit	1.73
11.944.3813.119	Meas. accuracy class	0.2 [s]
11.944.3813.120	Prot. accuracy class	1

2-6-5. VT4

NO.	Settings	Value
11.944.3814.101	Rated primary voltage	38.11 [kV]
11.944.3814.110	VRtg reference	phase-to-ground
11.944.3814.109	Rat	820.0
11.944.3814.103	Magnitude correction	1.00000
11.944.3814.108	Phase	VN
11.944.3814.102	Rated frequency	50.00 [Hz]
11.944.3814.118	Ratio of clipping limit	1.73
11.944.3814.119	Meas. accuracy class	0.2 [s]
11.944.3814.120	Prot. accuracy class	1

2-6-6. Supv. balan. V

NO.	Settings	Value
11.944.2521.1	Mode	off
11.944.2521.101	Release threshold	50.000 [V]
11.944.2521.102	Threshold min/max	0.75
11.944.2521.6	Delay failure indication	5.00 [s]

2-6-7. Supv. ph.seq.V

NO.	Settings	Value
11.944.2581.1	Mode	off
11.944.2581.6	Delay failure indication	5.00 [s]

2-6-8. Supv. sum V

NO.	Settings	Value
11.944.2461.1	Mode	off
11.944.2461.3	Threshold	25.000 [V]
11.944.2461.6	Delay failure indication	5.00 [s]

2-6-9. VT miniatureCB

NO.	Settings	Value
11.944.2641.101	Response time	0.00 [s]

2-7. Meas.point BUS_V1

2-7-1. VT 3-phase/General

NO.	Settings	Value
11.941.8911.101	Rated primary voltage	66.008 [kV]
11.941.8911.102	Rated secondary voltage	80 [V]
11.941.8911.103	Matching ratio Vph / VN	1.00
11.941.8911.104	VT connection	3 ph-to-gnd volt. + VN
11.941.8911.106	Inverted phases	none
11.941.8911.111	Tracking	active
11.941.8911.130	Measuring-point ID	6
11.941.8911.136	Internal VT type	VT IEC 61850-9-2

2-7-2. VT1

NO.	Settings	Value
11.941.3811.101	Rated primary voltage	38.11 [kV]
11.941.3811.110	VRtg reference	phase-to-ground
11.941.3811.109	Rat	820.0
11.941.3811.103	Magnitude correction	1.00000
11.941.3811.108	Phase	VA
11.941.3811.102	Rated frequency	50.00 [Hz]
11.941.3811.118	Ratio of clipping limit	1.73
11.941.3811.119	Meas. accuracy class	0.2 [s]
11.941.3811.120	Prot. accuracy class	1

2-7-3. VT2

NO.	Settings	Value
11.941.3812.101	Rated primary voltage	38.11 [kV]
11.941.3812.110	VRtg reference	phase-to-ground
11.941.3812.109	Rat	820.0
11.941.3812.103	Magnitude correction	1.00000
11.941.3812.108	Phase	VB
11.941.3812.102	Rated frequency	50.00 [Hz]
11.941.3812.118	Ratio of clipping limit	1.73
11.941.3812.119	Meas. accuracy class	0.2 [s]
11.941.3812.120	Prot. accuracy class	1

2-7-4. VT3

NO.	Settings	Value
11.941.3813.101	Rated primary voltage	38.11 [kV]
11.941.3813.110	VRtg reference	phase-to-ground
11.941.3813.109	Rat	820.0
11.941.3813.103	Magnitude correction	1.00000
11.941.3813.108	Phase	VC
11.941.3813.102	Rated frequency	50.00 [Hz]
11.941.3813.118	Ratio of clipping limit	1.73
11.941.3813.119	Meas. accuracy class	0.2 [s]
11.941.3813.120	Prot. accuracy class	1

2-7-5. VT4

NO.	Settings	Value
11.941.3814.101	Rated primary voltage	38.11 [kV]
11.941.3814.110	VRtg reference	phase-to-ground
11.941.3814.109	Rat	820.0
11.941.3814.103	Magnitude correction	1.00000
11.941.3814.108	Phase	VN
11.941.3814.102	Rated frequency	50.00 [Hz]
11.941.3814.118	Ratio of clipping limit	1.73
11.941.3814.119	Meas. accuracy class	0.2 [s]
11.941.3814.120	Prot. accuracy class	1

2-7-6. Supv. balan. V

NO.	Settings	Value
11.941.2521.1	Mode	off
11.941.2521.101	Release threshold	116.667 [V]
11.941.2521.102	Threshold min/max	0.75
11.941.2521.6	Delay failure indication	5.00 [s]

2-7-7. Supv. ph.seq.V

NO.	Settings	Value
11.941.2581.1	Mode	off
11.941.2581.6	Delay failure indication	5.00 [s]

2-7-8. Supv. sum V

NO.	Settings	Value
11.941.2461.1	Mode	off
11.941.2461.3	Threshold	58.333 [V]
11.941.2461.6	Delay failure indication	5.00 [s]

2-7-9. VT miniatureCB

NO.	Settings	Value
11.941.2641.101	Response time	0.00 [s]

2-8. Meas.point FDR_V1

2-8-1. VT 3-phase/General

NO.	Settings	Value
11.942.8911.101	Rated primary voltage	66.008 [kV]
11.942.8911.102	Rated secondary voltage	80 [V]
11.942.8911.103	Matching ratio Vph / VN	1.00
11.942.8911.104	VT connection	3 ph-to-gnd volt. + VN
11.942.8911.106	Inverted phases	none
11.942.8911.111	Tracking	active
11.942.8911.130	Measuring-point ID	7
11.942.8911.136	Internal VT type	VT IEC 61850-9-2

2-8-2. VT1

NO.	Settings	Value
11.942.3811.101	Rated primary voltage	38.11 [kV]
11.942.3811.110	VRtg reference	phase-to-ground
11.942.3811.109	Rat	820.0
11.942.3811.103	Magnitude correction	1.00000
11.942.3811.108	Phase	VA
11.942.3811.102	Rated frequency	50.00 [Hz]
11.942.3811.118	Ratio of clipping limit	1.73
11.942.3811.119	Meas. accuracy class	0.2 [s]
11.942.3811.120	Prot. accuracy class	1

2-8-3. VT2

NO.	Settings	Value
11.942.3812.101	Rated primary voltage	38.11 [kV]
11.942.3812.110	VRtg reference	phase-to-ground
11.942.3812.109	Rat	820.0
11.942.3812.103	Magnitude correction	1.00000
11.942.3812.108	Phase	VB
11.942.3812.102	Rated frequency	50.00 [Hz]
11.942.3812.118	Ratio of clipping limit	1.73
11.942.3812.119	Meas. accuracy class	0.2 [s]
11.942.3812.120	Prot. accuracy class	1

2-8-4. VT3

NO.	Settings	Value
11.942.3813.101	Rated primary voltage	38.11 [kV]
11.942.3813.110	VRtg reference	phase-to-ground
11.942.3813.109	Rat	820.0
11.942.3813.103	Magnitude correction	1.00000
11.942.3813.108	Phase	VC
11.942.3813.102	Rated frequency	50.00 [Hz]
11.942.3813.118	Ratio of clipping limit	1.73
11.942.3813.119	Meas. accuracy class	0.2 [s]
11.942.3813.120	Prot. accuracy class	1

2-8-5. VT4

NO.	Settings	Value
11.942.3814.101	Rated primary voltage	38.11 [kV]
11.942.3814.110	VRtg reference	phase-to-ground
11.942.3814.109	Rat	820.0
11.942.3814.103	Magnitude correction	1.00000
11.942.3814.108	Phase	VN
11.942.3814.102	Rated frequency	50.00 [Hz]
11.942.3814.118	Ratio of clipping limit	1.73
11.942.3814.119	Meas. accuracy class	0.2 [s]
11.942.3814.120	Prot. accuracy class	1

2-8-6. Supv. balan. V

NO.	Settings	Value
11.942.2521.1	Mode	off
11.942.2521.101	Release threshold	116.667 [V]
11.942.2521.102	Threshold min/max	0.75
11.942.2521.6	Delay failure indication	5.00 [s]

2-8-7. Supv. ph.seq.V

NO.	Settings	Value
11.942.2581.1	Mode	off
11.942.2581.6	Delay failure indication	5.00 [s]

2-8-8. Supv. sum V

NO.	Settings	Value
11.942.2461.1	Mode	off
11.942.2461.3	Threshold	58.333 [V]
11.942.2461.6	Delay failure indication	5.00 [s]

2-8-9. VT miniatureCB

NO.	Settings	Value
11.942.2641.101	Response time	0.00 [s]

2-9. VI 3ph CB 2nd_P2

2-9-1. General/Rated values

NO.	Settings	Value
822.9451.101	Rated current	600.00 [A]
822.9451.102	Rated voltage	66.00 [kV]
822.9451.103	Rated apparent power	68.59 [MVA]

2-9-2. Power-system data

NO.	Settings	Value
822.9451.149	Power-sys. neutral point	grounded

2-9-3. Measurements

NO.	Settings	Value
822.9451.158	P, Q sign	not reversed

2-10. I 1ph TR neut

2-10-1. General/Rated values

NO.	Settings	Value
1151.9421.101	Rated current	250.00 [A]

2-10-2. Power-system data

NO.	Settings	Value
1151.9421.214	MI-1ph uses MeasP with ID	3
1151.9421.223	CT mismatch MI-1ph	1.00

Definite-time overcurrent protection - 3 Phase(50-1)

1. Setting Table

1-1. 50 Definite-T 1 General

NO.	Settings	Value
822.1941.661.1	Mode	on
822.1941.661.2	Operate & flt.rec. blocked	no
822.1941.661.8	Method of measurement	fundamental comp.
822.1941.661.3	Threshold	1.600 [A]
822.1941.661.6	Operate delay	0.80 [s]

2. Test Value

2-1. 50 Overcurrent, Phases Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	1.600 [A]		±1[%] or 5[mA]	
BØ	1.600 [A]			
CØ	1.600 [A]			
3Ø	1.600 [A]			

2-2. 50 Overcurrent, Phases Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	0.800 [sec]		±1[%] or 10[ms]	
BØ	0.800 [sec]			
CØ	0.800 [sec]			
3Ø	0.800 [sec]			

Definite-time overcurrent protection - 3 Phase(50-2)

1. Setting Table

1-1. 50 Definite-T 1 General

NO.	Settings	Value
822.1941.662.1	Mode	on
822.1941.662.2	Operate & flt.rec. blocked	no
822.1941.662.8	Method of measurement	fundamental comp.
822.1941.662.3	Threshold	4.17 [A]
822.1941.662.6	Operate delay	0.05 [s]

2. Test Value

2-1. 50 Overcurrent, Phases Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	4.170 [A]		±1[%] or 5[mA]	
BØ	4.170 [A]			
CØ	4.170 [A]			
3Ø	4.170 [A]			

2-2. 50 Overcurrent, Phases Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
AØ	50.0 [msec]		±1[%] or 10[ms]	
BØ	50.0 [msec]			
CØ	50.0 [msec]			
3Ø	50.0 [msec]			

Inverse-time overcurrent protection - 3 Phase(51)

1. Setting Table

1-1. 51 Inverse-T 1 General

NO.	Settings	Value
822.1941.691.1	Mode	on
822.1941.691.2	Operate & flt.rec. blocked	no
822.1941.691.8	Method of measurement	fundamental comp.
822.1941.691.3	Threshold	0.340 [A]
822.1941.691.130	Type of character. Curve	IEC Normal inverse
822.1941.691.131	Reset	Instantaneous
822.1941.691.101	Time dial	0.35

2. Test Value

2-1. 51 Overcurrent, Phases Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by increasing the current magnitude(Threshold value 1.1pu)

TEST			Limit	Result
Phase	Expected	Pickup Current		
AØ	0.374 [A]		±1[%] or 5[mA]	
BØ	0.374 [A]			
CØ	0.374 [A]			
3Ø	0.374 [A]			

2-2. 51 Overcurrent, Phases Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (BØ), (CØ), (NØ)
- Test by changing the current magnitude in multiples of the setting value

Division	150%	200%	300%	500%	Limit	Result
Output Current	0.51 [A]	0.68 [A]	1.02 [A]	1.70 [A]		
Expected Time	6.018 [sec]	3.510 [sec]	2.206 [sec]	1.498 [sec]		
Operating Time						
AØ					±1 [%] or ±10 [ms]	
BØ						
CØ						
3Ø						

3. Test Result

Setting Value Verification and Test Results : Good

Definite-time overcurrent protection - Neutral(51N)

1. Setting Table

1-1. 51N Definite-T 1 General

NO.	Settings	Value
822.211.2311.9	Measured value	3I0 calculated
822.211.751.1	Mode	on
822.211.751.2	Operate & flt.rec. blocked	no
822.211.751.26	Dynamic settings	no
822.211.751.8	Method of measurement	fundamental comp.
822.211.751.3	Threshold	0.100 [A]
822.211.751.4	Dropout ratio	0.95
822.211.751.101	Dropout delay	0.00 [s]
822.211.751.6	Operate delay	0.10 [s]
822.211.751.7	Operate delay mode	Running dur.DO-delay

2. Test Value

2-1. 51N Overcurrent, 1-Phase Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
NØ	0.100 [A]		±1[%] or 5[mA]	

2-2. 51N Overcurrent, Phases Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- CT Source : IED S.V BLPH_EW300 / FDR_P2 (AØ), (NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
NØ	0.100 [sec]		±1[%] or 10[ms]	

3. Test Result

Setting Value Verification and Test Results : Good

Definite-time overcurrent protection - Ground(51G)

1. Setting Table

1-1. 51G Definite-T 1 General

NO.	Settings	Value
1151.1891.12661.1	Mode	on
1151.1891.12661.2	Operate & flt.rec. blocked	no
1151.1891.12661.8	Method of measurement	fundamental comp.
1151.1891.12661.3	Threshold	0.100 [A]
1151.1891.12661.6	Operate delay	0.50 [s]

2. Test Value

2-1. 51G Overcurrent, 1-Phase Pickup Test

① Test Condition

- Output : Test Pickup BO 3.2 , X21A (21,22)
- ZCT Source : X41 1(AØ), 2(NØ)
- Test by increasing the current magnitude

TEST			Limit	Result
Phase	Expected	Pickup Current		
GØ	0.100 [A]		±1[%] or 5[mA]	

2-2. 51G Overcurrent, 1-Phase Operate Time Test

① Test Condition

- Output : Test Trip BO 3.3 , X21A (23,24)
- ZCT Source : X41 1(AØ), 2(NØ)
- Test by suddenly changing the current magnitude

TEST			Limit	Result
Phase	Expected	Operating Time		
GØ	0.500 [sec]		±1[%] or 10[ms]	

3. Test Result

Setting Value Verification and Test Results : Good

7SJ85 Protection Relay Interlock Test

1. Test

Source	Division	Condition		Verification		Remark
		Initiate	Block	LED	LOR	
50-1	Trip	-	-			
50-2	Trip	-	-			
51	Trip	-	-			
51N	Trip	-	-			
51G	Trip	-	-			

2. Test Result

Setting Value Verification and Test Results : Good