



Factory Acceptance Test (FAT) Procedures & Formats -Control Protection System



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About This Document

Purpose of this document

This document shall be used as a standard for conducting all tests during the Factory Acceptance Test (FAT) for the Control & Protection system of every substation as per POWERGRID requirements and specifications.

The aim of the Factory Acceptance Test (FAT) is to demonstrate equipment functionalities as well as the approval process of the system-parameterization by POWERGRID to reduce the change requests during commissioning at site. The general philosophy shall be to deliver a system to site only after it has been thoroughly tested and its specified performance has been verified, as far as site conditions can be simulated in a test lab.

During FAT the entire Sub-station Control and Protection system to be supplied shall be tested for complete functionality and configuration in the factory itself. The extensive testing shall be carried out during FAT. The purpose of Factory Acceptance Testing is to ensure defect free installation at site. No major change in configuration/setting of system is envisaged at site.

This document details the equipment and functions under test and the corresponding test methods as well as the test documentation.

Who should use this document

This document to be used by the Vendor representatives (Q&I, Engg, Factory) for Factory acceptance test as per the project requirement. This approved document will be followed by the Vendor Representatives (Q&I, Engg, Testing) and POWERGRID representatives to test and evaluate the complete system.

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Signature:	Signature:
Name:	Name:
Date:	Date:



1. GENERAL

1.1. Introduction

The purpose of this document is to define the Factory Acceptance Test procedures of Substation Control & Protection system supplied by the Vendor to POWERGRID.

The tests are performed by Vendor and each test, or set of tests as appropriate, is covered by an approval stage, which will be signed off upon completion by Vendor and POWERGRID representatives.

Comments are noted in separate Incident and correction reports (snag list) attached as annexure.

2. CONTROL & PROTECTION SYSTEM

2.1. FAT test methodology

FAT testing will be performed for Control & relay panels for ensuring the manufacturing as per the approved CAT-I drawings. Pre-FAT test sheets will be used as a reference for the tests to be performed during the FAT.

These test sheets will indicate the specific units that were tested during pre-FAT tests.

2.2. List of Control & Protection Panels

Feeder / Panel	Feeder Specification	Description	Drawing CSD No.	Rev. No.
401	400kV Meerut-Moradabad Line-1	LINE	CPD KZ5J SC43	CAT-I
402	TIE	TIE	CPD KZ5J SC44	CAT-I
403	ICT-500MVA-1	ICT	CPD KZ5J SC45	CAT-I
BB	Busbar Protection panel	BB	CPD KZ5J SC55	CAT-I
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2.3. Test report overview

FAT Test	Description	Line	Auto/Power Transf.	Bus/Line Reactor	Busbar	Tie	BC/TBC
FAT001	Visual Inspection	X	X	X	X	X	X
FAT002	Hardware Verification	X	X	X	X	X	X
FAT003	AC Scheme Check	X	X	X	X	X	X
FAT004	DC Scheme Check	X	X	X	X	X	X
FAT005	Auxiliary Report	X	X	X	X	X	X

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2.4. Document verification

2.4.1. Document verification test

Purpose:

This test verifies that the correct manufacturing drawings and documentation for the equipment/system under the test will be used during the Factory Acceptance Test.

Procedure:

1. Verify that approved drawings (printed and soft copies) of all assembled equipment are present.
2. Verify all required hardware and software manuals are present.
3. Guaranteed Technical Parameters (GTPs) as approved by POWERGRID.
4. A copy of Customer Technical Specification for reference is made available in the FAT room.
5. Availability of the approved Drawing list in the FAT room.

Document Verification Log:

SI No.	Description	Drg No.	Checked
1	Approved Standard MQP		<input type="checkbox"/>
2	Standard FAT Procedure		<input type="checkbox"/>
3	Approved GTP-Guaranteed Technical Particulars		<input type="checkbox"/>
4	Approved Hardware specification & BOM		
5	Latest Approved Protection Logic diagram (Line/Transformer/Reactor/BB/etc) (Refer POWERGRID Intranet) *		<input type="checkbox"/>
6	Latest Approved settings/configuration template (pdf) (Refer POWERGRID Intranet)		<input type="checkbox"/>
7	Approved GA & Schematic CRP Drawings (Line/Transformer/Reactor/BB/etc)		<input type="checkbox"/>
8	Product Manuals (Installation, Configuration, maintenance, Troubleshooting, detailed diagnostics etc.)		<input type="checkbox"/>
9	Approved Bill of Quantity spares		<input type="checkbox"/>
10	Operation and Technical Guide of IED configuration softwares.		<input type="checkbox"/>
11	Operation and Technical Guide of Ethernet Switch		
12	Other applicable drawings (not listed above)	Attach the list as annexure	<input type="checkbox"/>

Note:- *if there is a variation between the approved protection scheme and the latest approved protection logic diagram uploaded on POWERGRID intranet, later shall prevail.

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Date:	Date:



2.5. Pre-acceptance test

2.5.1. Visual inspection

Purpose: This test will be carried out on the panels before commencing any testing on the panels. This test verifies the cleanliness, physical damages, dimensions, color of the panel and its thickness, mounting arrangements and proper ferruling and labeling etc.

Procedure:

1. Record the name and reference number of the panel to be tested in the test sheet.
2. Verify the check list detailed in the test sheet and ensure that the panel under test is in line with the base document.
3. Record if any comments in the Indication and Correction Report (snag list) attached as to this document.
4. Repeat step 1 to 3 for the other control & protection panels.

Test Document:

Refer Protection FAT Test Sheet in unit 7 (Annexure)

- FAT001: Visual Inspection

Note: Copy of this Visual Inspection test sheets will be used for other panels under test

2.5.2. Hardware verification test

Purpose: This test verifies the list, identification data and the quantities of the equipment mounted in each protection panels.

Procedure:

1. Select one of the typical bays.
2. Verify the test sheet selected for the Hardware Verification Test, belongs to the selected typical panel under test.
3. Record the reference number of the selected typical panel to be tested in the test sheet.
4. Verify the list of equipment and its quantities, as specified in the test sheet and it is in line with the base documents.
5. Record if any comments in the Indication and Correction Report (snag list) attached as to this document.
6. Repeat step 3 to 5 for the other panels of the same type.
7. Repeat step 1 to 6 for the other control & protection panels.

Test Documents:

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Name:	Name:
Date:	Date:



Refer Protection FAT Test Sheet in unit 7 (Annexure)

- FAT002: Hardware Verification Test

Note: Copy of the respective Hardware Verification test sheets will be used for more than one panel of the same type under test.

2.6. Power scheme verification

2.6.1. AC scheme check

Purpose: This test verifies the AC power circuit of the panel under test. In brief, the test verifies the AC power to the MCBs, heating and lighting circuits and to the power sockets and ensures their operation is correct.

Procedure:

1. Select any of the typical bays.
2. Record the name and reference number of the panel to be tested in the test sheet.
3. Verify the check list detailed in the test sheet and ensure AC circuit is as per the scheme and AC devices are working properly.
4. Record if any comments in the Indication and Correction Report (snag list) attached as to this document.

Test Document:

Refer Protection FAT Test Sheet in unit 7 (Annexure)

- FAT003: AC Power Verification

Note: Copy of the same test sheets will be used for the other Control & protection panels

2.6.2. DC scheme check

Purpose: This test verifies the DC power circuit of the panel under test. In brief, the test verifies the DC1 and DC2 to the MCBs, DC changeovers and DCs to the various equipment in the panel.

Procedure:

1. Record the name and reference number of the panel to be tested in the test sheet.
2. Verify the check list detailed in the test sheet and ensure the DC circuit of the panel works properly.
3. Perform a DC change over and ensure for no power failures in any equipment
4. Record if any comments in the Indication and Correction Report (snag list) attached as to this document.
5. Check complete cubicle wiring as per schematic diagram.

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Date:	Date:



- 6. Repeat step 1 to 6 for the other Control & protection panels.

Test Documents:

Refer Protection FAT Test Sheet in unit 7 (Annexure)

- FAT004: DC Scheme Check

Note: Copy of the same test sheets will be used other protection panels

2.6.3. Auxiliary relay test

Purpose: This test verifies the functionality and properties of Auxiliary Relay under test.

Procedure:

1. Select a Trip Relay/Lockout Relay from any one of the protection panels
2. Record the panel reference in the test sheet
3. Perform the following routine tests which is applicable for this relay
 - Name plate rating details
 - General inspection
 - Resistance check
 - Secondary injection test
 - Pick-Up / Drop-Off test (operating and resetting coil)
4. Record if any comments in the indication and correction report (snag list) attached as to this document.
5. Repeat step 1 to 5 for the same type of relays for the other panels.

Test Documents:

Refer Protection FAT Test Sheet in unit 7 (Annexure)

- FAT005: Routine Test – Auxiliary Relay

Note: Copy of FAT005 test sheet will be used for more than one relay of the same type under test

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Name:	Name:
Date:	Date:



2.7. Relay configuration & setting

The configuration of each IED in the system shall be adopted as per the approved scheme by POWERGRID. This configuration must be verified for each feeder (Line, Transformer, Reactor, Busbar & etc) as per the POWERGRID standard setting/configuration template (in pdf format).

The POWERGRID standard setting/configuration template must be referred to finalise the configuration. For any clarifications or corrections on the configurations changes if required the same has to be recorded in the observation & compliance report.

Note:

1. However, if the approved setting is not available during FAT, standard setting may be used to complete the FAT.
2. The Final setting/configuration project file must be submitted as part of the FAT documentation.

Following important points must be considered during configuration to ensure the proper Configuration & settings.

1. Defined functionality should be available in the configuration as per POWERGRID TS/Standard drawing.
2. Defining the proper input & output variables as per the approved drawings.
3. Tripping & signal assignment as per the approved Trip matrix.
4. Proper Flow of configuration as per the OEM (Ex. Proper instance of function block to avoid any delay or creating loop)
5. Only inbuilt logical functions should be used until otherwise specified.
6. Proper naming of Each section like Binary input, Protection functions, Binary output, LED, DR, SCADA & etc.
7. Naming of the IED should be proper (Ex SS_Name, Feeder Name).
8. Proper SNTP time setting (DST disabled, NTP ip address, SNTP selected).
9. DR channel configuration shall be done as per POWERGRID standard list.
10. Aesthetic alignment of the configuration in a proper readable format.

2.8. Protection relay - FAT

In addition to the standard routine tests as per the manufacturer OEM recommendations, it's important to verify the functioning and operation of Intelligent Electronic Devices (IEDs) according to specified logic required as per POWERGRID during the Factory Acceptance Testing (FAT) period.

For the demonstration of the following tests, the required simulation tools should be available during FAT.

For each feeder, the FAT reports has to be submitted along with the routine test report of the manufacturer.

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Signature:	Signature:
Name:	Name:
Date:	Date:



Line Feeder (Distance/Auto-reclose/LBB):

SI No.	Description	Checked
1	Configuration Check as per the approved drawing & Setting/ Configuration.	<input type="checkbox"/>
2	Correct operation of Tripping relays and associated auxiliary relays.	<input type="checkbox"/>
3	Carrier aided Permissive Scheme in Main-1 & Main-2.	<input type="checkbox"/>
4	Current Reversal & Weak infeed in Main-1 & Main-2.	<input type="checkbox"/>
5	Fault location for each type of faults.	<input type="checkbox"/>
6	AR logic for the One and half breaker system (Both Main & Tie with priority logic) with Main-1 & Main-2 (For Auto reclose logic refer “Pre-Commissioning Procedures and Formats for Substation Equipment & Protection System, section- Circuit Breaker Panel”, DOC ref: D-2-01-03-01-XX)	<input type="checkbox"/>
7	AR 3 Ph trip logic as per standard setting template	<input type="checkbox"/>
8	DT circuit checking with all possible condition for 1 ½, DM, DMT busbar scheme.	<input type="checkbox"/>
9	DT & Carrier send/receive logic with Carrier switch out & Carrier fail.	<input type="checkbox"/>
10	Single phase initiation to LBB relay.	<input type="checkbox"/>
11	Simulation of Cross-country fault in Distance function.	<input type="checkbox"/>
12	3Ph trip initiation to LBB relay.	<input type="checkbox"/>
13	LBB Retrip assignment & Backup assignment for one and half CB, DM & DMT scheme	<input type="checkbox"/>
14	Ensure the timing for both the LBB Retrip and Backtrip Should start only after the current pickup alongwith LBB Initiation. Resetting the current should also reset the LBB function.	<input type="checkbox"/>
15	Metering function (V, I, P, Q, Hz, PF).	<input type="checkbox"/>
16	DR Standardization as per the POWERGRID Standard. Apart from the DR standardization if the channel available required signals may be configured for better analysis.	<input type="checkbox"/>
17	Red Ferruling in the Tripping circuit	<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



Line Feeder (Differential/Distance/Autoreclose/LBB):

SI No.	Description	Checked
1	Configuration Check as per the approved drawing & Setting/ Configuration.	<input type="checkbox"/>
2	Correct operation of Tripping relays and associated auxiliary relays.	<input type="checkbox"/>
3	Communication failure of Differential enabling the Distance Z-1 function.	<input type="checkbox"/>
4	Carrier aided Permissive Scheme in Main-1 & Main-2.	<input type="checkbox"/>
5	Current Reversal & Weak infeed in Main-1 & Main-2.	<input type="checkbox"/>
6	Fault locator & Mutual compensation Fault location (If applicable).	<input type="checkbox"/>
7	AR logic for the One and half breaker system (Both Main & Tie with priority logic) with Main-1 & Main-2 (For Auto reclose logic refer “Pre-Commissioning Procedures and Formats for Substation Equipment & Protection System, section- Circuit Breaker Panel”, DOC ref: D-2-01-03-01-XX)	<input type="checkbox"/>
8	AR 3 Ph trip logic as per POWERGRID standard protection logic diagram.	<input type="checkbox"/>
9	DT circuit checking with all possible condition for 1 ½, DM, DMT busbar scheme.	<input type="checkbox"/>
10	DT & Carrier send/receive logic with Carrier switch out & Carrier fail.	<input type="checkbox"/>
11	Simulation of Cross-country fault in Distance function.	<input type="checkbox"/>
12	Single phase initiation to LBB relay.	<input type="checkbox"/>
13	3Ph trip initiation to LBB relay.	<input type="checkbox"/>
14	Ensure the timing for both the LBB Retrip and Backtrip Should start only after the current pickup alongwith LBB Initiation. Resetting the current should also reset the LBB function.	<input type="checkbox"/>
15	LBB Retrip assignment & Backup assignment for one and half CB, DM & DMT scheme	<input type="checkbox"/>
16	Metering function (V, I, P, Q, Hz, PF).	<input type="checkbox"/>
17	DR Standardization as per the POWERGRID Standard. Apart from the DR standardization if the channel available required signals may be configured for better analysis	<input type="checkbox"/>
18	Red Ferruling in the Tripping circuit	<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



Transformer Feeder (Differential/REF/Backup OC&EF/Backup Impedance):

SI No.	Description	Checked
1	Configuration Check as per the approved drawing & Setting/ Configuration .	<input type="checkbox"/>
2	Correct operation of Tripping relays and associated auxiliary relays.	<input type="checkbox"/>
3	Differential & HV Overflux operation	<input type="checkbox"/>
4	REF & LV Overflux operation	<input type="checkbox"/>
5	HV OC&EF operation.	<input type="checkbox"/>
6	IV/LV OC&EF operation	<input type="checkbox"/>
7	Backup impedance operation	<input type="checkbox"/>
8	Blocking logic for Backup impedance as per the POWERGRID requirement.	<input type="checkbox"/>
9	Configuration check of 33kV Protection to the Utility feeder & Tertiary feeder availability.	<input type="checkbox"/>
10	Mechanical protection logic has to be implemented as per POWERGRID standard protection logic diagram.	<input type="checkbox"/>
11	Mechanical protection operation extended to Master trip operation.	<input type="checkbox"/>
12	Simulation of the VT Selection logic as per the POWERGRID requirement. VT selection output stability should be checked during / after BCU restart and intermediate state of associated BCU binary inputs.	<input type="checkbox"/>
13	3Ph trip initiation to LBB relay.	<input type="checkbox"/>
14	Ensure the timing for both the LBB Retrip and Backtrip Should start only after the current pickup alongwith LBB Initiation. Resetting the current should also reset the LBB function.	<input type="checkbox"/>
15	LBB Retrip assignment & Backup assignment for one and half CB, DM & DMT scheme	<input type="checkbox"/>
16	Metering function (V, I, P, Q, Hz, PF).	<input type="checkbox"/>
17	DR Standardization as per the POWERGRID Standard. Apart from the DR standardization if the channel available required signals may be configured for better analysis.	<input type="checkbox"/>
18	Simulation of Spare selection logic the CT switching & Tripping scheme. Spare selection output stability should be checked during / after BCU restart and intermediate state of associated BCU binary inputs.	<input type="checkbox"/>
19	Red Ferruling in the Tripping circuit	<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



Bus/Line Reactor Feeder (Differential/REF/Backup Impedance):

SI No.	Description	Checked
1	Configuration Check as per the approved drawing & Setting/ Configuration.	<input type="checkbox"/>
2	Correct operation of Tripping relays and associated auxiliary relays.	<input type="checkbox"/>
3	Differential operation	<input type="checkbox"/>
4	REF operation	<input type="checkbox"/>
5	Backup impedance operation.	<input type="checkbox"/>
6	Blocking logic for Backup impedance as per the POWERGRID requirement.	<input type="checkbox"/>
7	Mechanical protection logic has to be implemented as per POWERGRID standard protection logic diagram.	<input type="checkbox"/>
8	NGR Bypass operation, NGR equipment alarms such as CB alarms, Closing coil alarms & output configuration as per POWERGRID requirement.	<input type="checkbox"/>
9	Simulation of the VT Selection logic as per the POWERGRID requirement. VT selection output stability should be checked during / after BCU restart and intermediate state of associated BCU binary inputs.	<input type="checkbox"/>
10	3Ph trip initiation to LBB relay.	<input type="checkbox"/>
11	Ensure the timing for both the LBB Retrip and Backtrip Should start only after the current pickup alongwith LBB Initiation. Resetting the current should also reset the LBB function.	<input type="checkbox"/>
12	LBB Retrip assignment & Backup assignment for one and half CB, DM & DMT scheme	<input type="checkbox"/>
13	Metering function (V, I, P, Q, Hz, PF).	<input type="checkbox"/>
14	DR Standardization as per the POWERGRID Standard. Apart from the DR standardization if the channel available required signals may be configured for better analysis.	<input type="checkbox"/>
15	Simulation of Spare selection logic the CT switching & Tripping scheme. Spare selection output stability should be checked during / after BCU restart and intermediate state of associated BCU binary inputs.	<input type="checkbox"/>
16	Red Ferruling in the Tripping circuit	<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



Centralized busbar differential relay

SI No.	Description	Checked
1	Configuration Check as per the approved drawing & Setting/ Configuration	<input type="checkbox"/>
2	Correct operation of Tripping relays and associated auxiliary relays.	<input type="checkbox"/>
3	For the status of the switchgear Double point type to be considered	<input type="checkbox"/>
4	For Centralized Busbar testing refer “Pre-Commissioning Procedures and Formats for Substation Equipment & Protection System,” DOC ref: D-2-01-03-01-XX) and simulate all logic as per the 1 ½, DM, DMT busbar scheme.	<input type="checkbox"/>
5	The report for the centralized busbar scheme has to be submitted as per the Point no 4.	<input type="checkbox"/>
6	DR Standardization as per the POWERGRID Standard. Apart from the DR standardization if the channel available required signals may be configured for better analysis.	<input type="checkbox"/>
7	Red Ferruling in the Tripping circuit	

De-Centralized busbar differential relay

SI No.	Description	Checked
1	Configuration Check as per the approved drawing & Setting/ Configuration.	<input type="checkbox"/>
2	Correct operation of Tripping relays and associated auxiliary relays.	<input type="checkbox"/>
3	For the status of the switchgear Double point type considered	<input type="checkbox"/>
4	For De-centralized Busbar testing refer “Pre-Commissioning Procedures and Formats for Substation Equipment & Protection System , DOC ref: D-2-01-03-01-XX) and simulate all logic as per the 1 ½, DM, DMT busbar scheme.	<input type="checkbox"/>
5	The report for the de-centralized busbar scheme has to be submitted as per the Point no 4.	<input type="checkbox"/>
6	DR Standardization as per the POWERGRID Standard. Apart from the DR standardization if the channel available required signals may be configured for better analysis.	<input type="checkbox"/>
7	Red Ferruling in the Tripping circuit	<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



Bay control Unit(BCU) – Feeders

SI No.	Description	Checked
1	Interlock for the respective bays.	<input type="checkbox"/>
2	Metering function (V, I, P, Q, Hz, PF).	<input type="checkbox"/>
3	Graphical display of HMI page in BCU as per the SLD & their control	<input type="checkbox"/>
4	Measurement of bay in HMI page as per the SLD (if Menu not available)	<input type="checkbox"/>

Ethernet Switch & DR PC

Note:- If Ethernet Switch & DR PC only supplied as a part of Project without SAS, then SAS FAT procedure (DOC ref: D-2-03-20-05-XX) to be referred for checking the Performance, Document & configuration.

3. STATEMENT OF SYSTEM ACCEPTANCE

Upon successful completion of all applicable tests and the proper disposition of all documented and witnessed discrepancies resulting from tests specified in the procedure, the system, tested and witnessed by the POWERGRID, is accepted.

Note:- The approved corrected copies of the scheme drawings based on the FAT shall be submitted before SAT.

Documents Verification during FAT:

SI No.	Description	Doc No.	Submitted
1	Visual Inspection report for each feeder		<input type="checkbox"/>
2	Hardware Verification report for each feeder		<input type="checkbox"/>
3	AC Scheme Check Report for each feeder		<input type="checkbox"/>
4	DC Scheme Check Report for each feeder		<input type="checkbox"/>
5	Auxiliary Relay Report for each feeder		<input type="checkbox"/>
6	Typical configuration for each feeder verified (Line, Transformer, Bus reactor, Line reactor, Busbar)		<input type="checkbox"/>
7	Specified Logic Verification-Line Feeder (Distance/Auto-reclose/LBB) Report		<input type="checkbox"/>
8	Specified Logic Verification-Line Feeder (Differential/Distance/Auto reclose/LBB) Report		<input type="checkbox"/>

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SI No.	Description	Doc No.	Submitted
9	Specified Logic Verification-Transformer Feeder (Differential/REF/Backup OC&EF/Backup Impedance) Report		<input type="checkbox"/>
10	Specified Logic verification-Bus/Line Reactor Feeder (Differential/REF/Backup Impedance) Report		<input type="checkbox"/>
11	Centralised Busbar protection Report		<input type="checkbox"/>
12	De-Centralised Busbar Protection Report		<input type="checkbox"/>
13	Project Backup after complete FAT for all feeder configuration for all Relays involved in the FAT		<input type="checkbox"/>
14	Operation and Technical Guide for Protection IEDs		<input type="checkbox"/>
15	Operation and Technical Guide for BCU & other IEDs supplied		<input type="checkbox"/>
16	Operation and Technical Guide IED configuration softwares		<input type="checkbox"/>
17	Operation and Technical Guide Ethernet Switch		<input type="checkbox"/>
18	Other applicable equipment Operational & Technical Guide		<input type="checkbox"/>

Softwares/License details Backup:

Software/License	Doc. No.	Checked
Protection & Control each type Software & license		<input type="checkbox"/>
CSD, FOTS, RTCC & Other Devices Software & license		<input type="checkbox"/>
Antivirus software & license		<input type="checkbox"/>
Other applicable equipment Operational & Technical Guide		<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



4. OBSERVATION AND COMPLIANCE REPORT

Observations during FAT & its compliance shall be recorded in "log sheets".

OBSERVATION AND COMPLIANCE REPORT

LOG SHEET:

Sr. No.	Observations	Compliance	Remarks

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



5. GLOSSARY

BCU: Bay Control Unit
DR: Disturbance Recorder
EWS: Engineering Workstation
FAT: Factory Acceptance Test
FPT: Functional Performance Test
FST: Factory Simulation Test
GTW: Gateway
GPS: Global Positioning System
IED: Intelligent Electronic Device
NMS: Network Management (Monitoring) System
OWS: Operator Workstation
RCC: Remote Control Centre
RSCC: Regional System Co-ordination Centre
SAS: Sub-station Automation System
SAT: Site Acceptance Test
SCADA: System Control & Monitoring System

POWERGRID Representative	Manufacturer Representative
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Date:	Date:



6. ANNEXURE

Annexure -PreFAT Formats

POWERGRID Representative	Manufacturer Representative
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Name:	Name:
Date:	Date:



**Factory Acceptance Test (FAT)
Procedures & Formats
Control Protection System**

**Doc: PG/CC/CRP/FAT,
Rev01**



Factory Acceptance Test - Protection System	
Visual Inspection	
Manufacturer:	Equipment:
Contractor:	Feeder/Circuit:

VISUAL INSPECTION

Ref: FAT001

Name of the Panel:

Actions: Verify the check list and ensure that the panel under test is in line with the base document.

Sr.No.	Description	Passed	Failed
1	Ensure all the equipment are free of all foreign materials (dust, solder, droppings, etc)	<input type="checkbox"/>	<input type="checkbox"/>
2	Visually inspect the units and individual modules for cleanliness, healthiness and ensure that they are free from damage	<input type="checkbox"/>	<input type="checkbox"/>
3	Verify that the dimension of the panel as per GA	<input type="checkbox"/>	<input type="checkbox"/>
4	Visually inspect that the equipment are arranged as per the GA drawing of the panel (drawing pocket inside panel is available)	<input type="checkbox"/>	<input type="checkbox"/>
5	Verify the panel outside color and inside color is as per approved drawing	<input type="checkbox"/>	<input type="checkbox"/>
6	Verify the cabinet type is SWING FRAME	<input type="checkbox"/>	<input type="checkbox"/>
7	Verify the locker system of the panel is provided	<input type="checkbox"/>	<input type="checkbox"/>
8	Verify the size of the earthing bar is as per approved drawing	<input type="checkbox"/>	<input type="checkbox"/>
9	Verify the panel name plate and the equipment labels are correct and visible	<input type="checkbox"/>	<input type="checkbox"/>
10	Verify proper labeling is done for all the cables	<input type="checkbox"/>	<input type="checkbox"/>
11	Check for the arrangement of terminal blocks as per the drawing	<input type="checkbox"/>	<input type="checkbox"/>
12	Check the shorting and isolating accessories of CT terminals	<input type="checkbox"/>	<input type="checkbox"/>
13	Verify whether proper ferruling is done or not	<input type="checkbox"/>	<input type="checkbox"/>
14	Check if earth shield connections are provided	<input type="checkbox"/>	<input type="checkbox"/>
15	Check ventilation is provided as per the drawings	<input type="checkbox"/>	<input type="checkbox"/>
16	Check for proper panel door earthing	<input type="checkbox"/>	<input type="checkbox"/>
17	Verify paint thickness as specified in GA drawing	<input type="checkbox"/>	<input type="checkbox"/>
18	Check comprehensiveness of painting against external scratches, rusting, dents/damages etc.	<input type="checkbox"/>	<input type="checkbox"/>
19	Minimum spare TBs should be available as per TS & Truff size should be as accommodate with sufficient space for Field Cable.	<input type="checkbox"/>	<input type="checkbox"/>

POWERGRID Representative		Manufacturer Representative	
Signature:		Signature:	
Name:		Name:	
Date:		Date:	



**Factory Acceptance Test (FAT)
Procedures & Formats
Control Protection System**

**Doc: PG/CC/CRP/FAT,
Rev01**

		Factory Acceptance Test - Protection System	
Hardware verification			
Manufacturer:		Equipment:	
Contractor:		Feeder/Circuit:	
		Page:	23 of 26

HARDWARE VERIFICATION TEST

Ref: FAT002

Name of the Panel:

Actions: Verify the list of equipment and ensure the identification data, manufacturer and quantities are correct.

Sr.No.	Description	Passed	Failed
1	Verify the list of equipment of the scheme drawing as per GA with the existing cubicle layout & record any non-availability of equipment	<input type="checkbox"/>	<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



**Factory Acceptance Test (FAT)
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Rev01**



Factory Acceptance Test - Protection System

Hardware verification

Manufacturer:	Equipment:
Contractor:	Feeder/Circuit:
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AC POWER VERIFICATION

Ref: FAT003

Name of the Panel:

Actions: Verify the check list and ensure that the AC circuit of the panel is correct and the devices are working properly.

Sr.No.	Description	Passed	Failed
1	Ensure that rated AC supply is given to panel at the incoming terminals	<input type="checkbox"/>	<input type="checkbox"/>
2	Verify the equipment under test are rated for proper AC supply	<input type="checkbox"/>	<input type="checkbox"/>
3	Verify the supply at the 1phase AC supply in OFF condition	<input type="checkbox"/>	<input type="checkbox"/>
4	Switch ON the supply and verify the ON/OFF operation of LAMP of the cubicle by operating the miniature position switch	<input type="checkbox"/>	<input type="checkbox"/>
5	Verify the power supply at the socket DS is correct	<input type="checkbox"/>	<input type="checkbox"/>
6	Verify the power supply at the power socket is correct	<input type="checkbox"/>	<input type="checkbox"/>
7	Switch ON the supply and verify the operation of thermostat, heater and indicator lamp. Adjusting the thermostat settings to 25°C for heater ON and ensure the Heater circuit placement doesn't affect any cable entry.	<input type="checkbox"/>	<input type="checkbox"/>
8	AC circuit wiring checked according to corresponding drawing	<input type="checkbox"/>	<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



Factory Acceptance Test - Protection System	
Hardware verification	
Manufacturer:	Equipment:
Contractor:	Feeder/Circuit:
	Page: 25 of 26

DC SCHEME CHECK

Ref: FAT004

Name of the Panel:

Actions: Verify the check list and ensure that the DC circuit of this panel is correct, and the devices are working properly.

S.No	Description	Passed	Failed
1	Ensure that rated DC supplies DC1 and DC2 are given to panel at the incoming terminals	<input type="checkbox"/>	<input type="checkbox"/>
2	Verify the equipment under test are rated for proper DC supply	<input type="checkbox"/>	<input type="checkbox"/>
3	Check continuity for DC circuit as per the drawing to ensure proper polarity before power ON	<input type="checkbox"/>	<input type="checkbox"/>
4	Check the Proper Co-ordination of the DC Fuse rating from the source -1 & 2 to till downstream circuit Fuse rating	<input type="checkbox"/>	<input type="checkbox"/>
5	Verify DC1 and DC2 at the main supply is in OFF condition. Now switch on DC Source-1. Check DC voltage at Fuse of DC Source-2. No DC voltage should be present. Switch off DC Source-1.	<input type="checkbox"/>	<input type="checkbox"/>
6	Verify DC1 and DC2 at the main supply is in OFF condition. Now switch on DC Source-2. Check DC voltage at Fuse of DC Source-1. No DC voltage should be present. Switch off DC Source-1.	<input type="checkbox"/>	<input type="checkbox"/>
7	Switch ON the DC1 and DC2 main MCBs and verify the supply at all other supply in the OFF condition	<input type="checkbox"/>	<input type="checkbox"/>
8	Switch ON all the supply in the panels and verify that all equipment rated for DC voltage is working properly	<input type="checkbox"/>	<input type="checkbox"/>
9	Perform a DC change over and ensure that no power failure happened in any of the equipment in the panel	<input type="checkbox"/>	<input type="checkbox"/>
10	Ensure that there is no mixing of DC1 and DC2 supply in the panel	<input type="checkbox"/>	<input type="checkbox"/>
11	Cubicle scheme checked according to corresponding drawing	<input type="checkbox"/>	<input type="checkbox"/>

POWERGRID Representative	Manufacturer Representative
Signature:	Signature:
Name:	Name:
Date:	Date:



Manufacturer:	Equipment:
Contractor:	Feeder/Circuit:
	Page:
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Auxiliary Relay – xxxx

Ref: FAT005

Feeder Reference:

1. Name Plate Rating Details of the Equipment

Record the following details of the relay.

Relay Make	
Relay Model	
Order Number	
Serial Number	
Rated Voltage	
Contacts Details	

2. General Inspection of Relay

Sr.No.	Description	Passed	Failed
1	Installation and correct wiring as per drawing	<input type="checkbox"/>	<input type="checkbox"/>
2	Terminal tightness	<input type="checkbox"/>	<input type="checkbox"/>
3	Relay earth connected to local earth bar	<input type="checkbox"/>	<input type="checkbox"/>

3. Secondary Injection Test

Pick-up / Drop-off Test

Inject the relay via the front panel test sockets (if possible) and record the pick-up and drop-off values in the table below.

Operating Coil

V	mA	V	mA	Drop-Off		Result

POWERGRID Representative

Manufacturer Representative

Signature:

Signature:

Name:

Name:

Date:

Date: