Transmission Substation Pre-Commissioning Test Schedules

XDS-GTS-20-001-R2

EirGrid

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Revision History					
Revision	**Date**	**Description**	**Originator**	**Checker**	**Approver**
R0	01/09/2011	First Issue – This document supersedes XDS-WTC-12-001-R0. Section 17 added.	Paul Moran	N/A	Christy Kelleher
R1	07/03/2018	As per Due – Diligence Review Process	Conor Farrell	N/A	Paul Moran
R2	4/04/2025	Updated based on projects lesson learned	MMD	Daniele Giustini ESB Due Diligence	Neil Cowap

Contents

1. Transformer Test Sheets

S/S Name:	
Transformer No.:	
Location	

Transformer Information

Primary Voltage Ratio	kV	
Secondary Voltage Ratio	kV	
Tertiary Voltage Ratio	kV	
MVA Rating	ONAN ONAF	
Manufacturer		
Type No.		
Serial No. \ Year		
Vector Group		
Tap / % Impedance	1: Mid: Top: Bot:	

Tap changer Information

Manufacturer	
Type No.	
Serial No	
Number of Taps	

Commissioner's Information

Name: _____

List All Faults or Snags Below

_____

_____

_____

_____

_____

General Inspection

Confirm nameplate data is as per latest revision of substation SLD and design specifications	
Transformer erected in accordance with the design & manufacturers recommendations	
All Manufacturers installation, service, maintenance & operating instructions provided	
Paintwork and galvanising satisfactory	
. Confirm all relevant clearances are as per design specifications	
Wiring connections checked for tightness	
Primary connections torqued correctly	
Method of neutral point earthing for HV side	
Method of neutral point earthing for LV side	
Method of earthing for tertiary side	
Control cabinet earthed and doors bonded	
Transformer on correct operating MV voltage as per SLD and data plate orientation corresponds	
Are surge arrestors provided on the HV side?	
Are surge arrestors provided on the LV side?	
Labelling is in accordance with EirGrid and design requirements.	
MCB's, Contactors and Thermal Overloads clearly identified	
Terminal boxes of motors and protective devices sealed	
Bushings clean and damage free	
Transformer Tank correctly earthed	
Oil level correct in Main Tank & OLTC Tank and bushings	
Oil samples taken and sent for analysis	
All valves including breathers in correct position for service	
Cable ducts/pipes sealed to prevent leaks from bund area	
All Cabling adequately supported	
Silica gel Breathers in good condition {Tap change and main tank}	

Main tank Buchholz relay trips HV Circuit breaker?	
Tap change Buchholz relay trips HV Circuit breaker?	
Main tank pressure relay trips HV Circuit breaker?	
T/C tank pressure relay trips HV Circuit breaker?	
Please list any other protection that trips the HV CB (diff, LV Ref etc)	
All Transformer protection that trips the HV CB is signalled back to NCC/Interface Panel?	
Confirm cooling fans have an adequate guard to prevent access to moving parts.	
Confirm tap changer supply is interrupted by operating the following? • Limit Switches. • Motor O/L Protection. • Step by Step. • Crank Handle.	
Confirm the tap changer operation correct for? • Manual / Crank Handle. • Local Push Button. • Remote Push Button. • SCS. • Scada. • Parallel Control- Automatic. • Parallel Control- Push Button.	
Confirm tap change motor overload protection has been set?	
Confirm correct manual operating handle is provided.	
Confirm that the tap change counter is working correctly?	
Confirm that the tap change in progress lamp is working correctly	

Signed _____

For and on Behalf of _____

Date _____

2. Current Transformer Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

Current Transformer Information

Voltage					kV	
Current Ratio						
Class						
Rated Short Circuit (S/C)						kA
Rated S/C Current (Idyn)						kA
Overload Factor						
Manufacturer						
Type\Year						
Serial No.	R:		S:		T:	

Winding	USE	VA	Vk (V)	Im (mA)	Class	N-Factor	Earthed Terminal	RΩ
$1S_1$ - $1S_2$								
$2S_1$ - $2S_2$								
$3S_1$ - $3S_2$								
$4S_1$ - $4S_2$								
$5S_1$ - $5S_2$								
$6S_1$ - $6S_2$								

Commissioner's Information

Name: _____

List All Faults or Snags Below

_____

_____

_____

_____

_____

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

Confirm CT ratio, secondary winding class and sort circuit ratings are in agreement with SLD and design specification.	
Is the CT free from oil leaks, where applicable?	
Is the oil level correct?	
Are cabinet heaters working?	
Are the CT tank / Metal work adequately earthed?	
Are the Phases clearly identified?	
Are cabling in neat and tidy manner?	
Is all cabling labelled?	
Cabling numbering is correct as per design/standard?	
Core numbers in the correct terminals in the control panel.	
Correct crimps used and colour coding correct.	
Correct terminal earthed as per design.	
CT cable screens earthed.	
Are the porcelains/casing clean and free from chips and cracks?	
Condition of paint work and galvanizing satisfactory?	
Marshalling box equipment is labelled correctly?	
Current Transformer correctly labelled	
Is the CT firmly bolted down?	
CT orientation as per approved SLD.	
CT terminal isolating and shorting links are in the correct position for service.	
Is the P1 terminal towards the busbar?	
Are primary re-connection straps firmly bolted in?	
Are primary conductors correct type size?	
Is the polarity of the winding correct for all phases and cores?	
Confirm secondary terminals correctly earthed	
Are un-used CT cores shorted out and earthed?	
Is phasing correct to relays and meters?	
Is continuity of CT circuits maintained in all positions of the test switch (es)?	

CT erected in accordance with design and manufacturer's recommendation?			
Manufacturer's guides and instructions available?			
Primary contacts greased and to correct torque?			
Are clearances between phases, to earth, to screens and fences and height of equipment overground greater than the minimum values specified?			
Correct size terminals/shorting facility and wiring used for the secondary circuit?			
Shorting facility is oriented as per design/standard.			
Correct size, type and colour for wiring has been used in accordance with design/specification.			
Have wiring connections been checked for tightness?			
Are all CT cores earthed at only one point in relay cabinet?			
IRT Readings			
Between Windings		MΩ	
Windings - Earth		MΩ	
Secondary - Earth		MΩ	
Primary - Earth		MΩ	

Signed _____

For and on Behalf of _____

Date _____

3. Voltage Transformer Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

Voltage Transformer Information

Voltage					kV	
Voltage Ratio						
Class						
Rated Short Circuit (S/C)						kA
Rated S/C Current (Idyn)						kA
Overload Factor						
Phase						
Manufacturer						
Type\Year						
Serial No.	R:		S:		T:	

Winding	USE	Class	Nominal Voltage	Fused Terminal	Earthed Terminal
1a – 1n					
2a – 2n					
3a – 3n					
4a – 4n					

Commissioner's Information

Name:

List All Faults or Snags Below

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

Is the VT free from oil leaks?	
Is the oil level correct?	
Are cabinet heaters working?	
Are the VT tank / Metal work adequately earthed?	
Are the Phases clearly identified?	
Are cabling in neat and tidy manner?	
VT correctly labelled	
Primary Winding N labelled.	
Are the porcelains/casings clean and free from chips and cracks?	
Condition of paint work and galvanizing satisfactory?	
Marshalling Box equipment labelled correctly.	
Is the VT firmly bolted down?	
Are primary re-connection straps firmly bolted in?	
Primary Conductors as per design	
Is phasing correct to relays, meters and disturbance recorders etc?	
Protection and metering class windings being used for the correct application.	
VT Terminals, MCB's and fuses are in the correct position for service.	
Correct rating and type MCBs.	
Does the test switch disconnect the relay from the VT's in the test position?	
Is the VT MCB status indication wired correctly to protection relays as per design standards?	
Do (es) the V.T. MCB (s) trip for a short on the secondary wires?	
Do (es) the V.T. MCB (s) give a signal and alarm in the tripped position?	
Does the V.T. MCB. remove the D.C. from distance relay binary input in the open position?	
Are the test sockets correctly wired for test kit connection?	
VT erected in accordance with the design & manufacturers recommendations	
All Manufacturers installation, service, maintenance & operating	

instructions provided	
Are clearances between phases, to earth, to screens and fences and height of equipment overground greater than the minimum values specified?	
Have wiring connections been checked for tightness?	
All secondary cables adequately supported, glanded and labelled	
Correct terminations and colour code used for secondary connections	
Secondary terminals correctly earthed where appropriate	
Fuses are correct rating, grazed and free of corrosion.	
Correct size and type terminals, fuses, isolating facility and wiring are used for the secondary circuit.	
VT secondary earth should not be isolatable by isolatable terminals.	
VT cable screens earthed at both ends of the VT circuit	
Primary Conductors as per design.	
Primary connections greased	
Primary connections torqued correctly	
Confirm VT specification(ratio, secondary winding class, short circuit ratings) is as per SLD and design specification	
Are the 100/√3 (110/√3) windings correctly connected in star?	
Are the 100/3 (110/3) windings correctly connected in open - delta?	
Earthing of both star and open delta connected circuits is correct as per design standard.	
Removable link is in place between earth and the primary winding N.	
Is the LV end of primary winding earthed (Big N)?	
Circuit is earthed at one point. This should be the 1st cabinet in from the marshalling box.	

IRT Readings

Between Windings	MΩ	
Windings - Earth	MΩ	
Secondary - Earth	MΩ	
Primary - Earth	MΩ	

Signed _____

For and on Behalf of _____

Date _____

4. Circuit Breaker Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

Circuit Breaker Information

Bay Voltage					kV	
CB Ratings:	Nominal Voltage				kV	
	Lightning Impulse Withstand Voltage				kV	
	Power Frequency Withstand Voltage				kV	
	Nominal Current				kA	
	S/C Current/MVA				kA/MVA	
	S/C Duration				Sec	
Manufacturer						
Year						
Mechanism Type						
Arc Breaking Medium						
Type No						
Serial No.	R:		S:		T:	
Mechanism Serial No.	R:		S:		T:	

General Inspection

Erected in accordance with the design & manufacturers recommendations	
Specification of the CB on the data plate matches the approved design/SLD.	
Supporting metalwork & control box earthed correctly	
All labels fitted	
HV Labelling and control box labelling complete (include max voltage labels)	
All earths installed as per design.	
Control cabinet earthed	
Breaker identified and phases marked	
Breaker firmly bolted down	
Porcelains /Insulators clean and free from cracks	

Cabinet / mech box heaters working	
Cabinet / mech box fuses/MCBs identified	
MCB/fuse ratings and size match requirements.	
Paintwork and galvanising satisfactory	
Metal work free of rust or treated.	
Operating coils ratings match the application	
Close/trip coils are not damaged.	
Motor run time relay is operating correctly.	
Manufacturers operating instructions available	
SF6 filling point is accessible.	
SF6 pressure correct and gauge checked	
SF6 pressure low and lockout contacts checked	
Control wiring match the design, installed correctly and labelled.	
Wiring connections checked for tightness	
Primary connections to correct torque correctly	
Confirm electrical charging of spring mechanism	
Clearances between phases, to earth, to fences/screens and height above ground greater than minimum values specified.	
Bi metal connector used on Circuit breaker HV terminals	
Approved fasteners used {i.e. main terminal nuts/bolts & washers}	
Open/close indication clear? Red (close) green (open)?	
Open / close pushbuttons indication clear?	
Levers indication clear?	
Spring closed contacts checked?	
Confirm full Close/Open spring energy.	
Locking facility on Circuit Breaker doors available	

IRT Readings

Insulation Between Phases		MΩ	R:	S:	T:
Insulation Across Open Contacts		MΩ	R:	S:	T:
Insulation of:	Trip Coil 1 to Earth	MΩ	R:	S:	T:
	Trip Coil 2 to Earth	MΩ	R:	S:	T:

Ductor Testing

	R	S	T
Resistance across closed contacts μΩ			

Functional Operation

Do all auxiliary contacts function correctly?	
Do auxiliary supplies work correct for CB {i.e. 24VDC or 24VDC & 220VDC}?	
Can the operating mechanism be fully manually charged without danger to the operator?	
Are moving parts on the breaker adequately screened? Is it supported correctly with minimal flexing?	
Plinth in satisfactory condition	
Oil level correct and acceptable quality {results attached}	
Breathers fitted.	
Confirm Operation from following locations	
Local	
Manual	
SCADA	
Remote Control	
Are the DC voltages to both trip coils separated correctly?	
Is the mutual tripping for phase discrepancy on closing correct?	
Is the mutual tripping for phase discrepancy on tripping correct?	
Does phase discrepancy give signal and alarm?	
Trip MCB/fuses isolates tripping?	
Close MCB/fuses isolates closing	
Does CB operate mechanically?	
Spring charge mechanism operating correctly?	
Anti-pumping device operating correctly?	
Motor Run Time Test completed.	
Local position indication identified “On” & “Off.	
Local control buttons / switches / latches correctly identified “On” & “Off.	
Number of stored operations.	
Was the open/close indication correct on CB, Mimic and SCADA?	
Protection trips CB irrespective of switch positions?	

SF6 Tests

SF6 Gas Gauge Reading Correctly			
SF6 Density Monitor operate correctly.			
Ambient Air Temperature - °C	**Alarm**	**Close-Block**	**Trip Coil Block**
Specified Op Pressure at 20°C (Bar)			
Corrected for Ambient Temp (Bar)			
Operate Value (Bar)			
Reset Value (Bar)			
SF6 Quality within Standards			
Reading on SF6 gauges:	**R**	**S**	**T**
SF6 pressure gauge Bar			
SF6 dew point °C			
SF6 %			
SF6 Recommended operating pressure			
Final Filling Pressure Correct?			
final SF6 gas pressure			

	Alarm	Close Block	Trip Coil 1 Block	Trip Coil 2 Block
Specified Operating Pressure at 20°C				
Corrected for ambient temperature:				
Operate:				
Reset:				

Have SF6 warning notices been affixed to the circuit breaker?	
Have low SF6 manual operation restriction notices been affixed to the circuit breaker?	
SF6 Lockout prevents operation of breaker?	
Is circuit breaker free from SF6 leaks?	
SF6 gassing equipment available?	

Signed _____

For and on Behalf of _____

Date _____

5. Disconnector/Earth Switch Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

Disconnector Information

Bay Voltage					kV	
State Disconnect Application (DA,DB,DL,DE,DT)						
DS Ratings:	Nominal Voltage				kV	
	Nominal Current				kA	
	S/C Current/MVA				kA/MVA	
Manufacturer						
Year						
Type No						
Serial No.	R:		S:		T:	

General Inspection

Erected in accordance with the design & manufacturers recommendations.	
Disconnect ratings are as per design/specification.	
Supporting metalwork earthed correctly as per design and standards.	
Control cabinet earthed.	
Driveshaft earthed.	
All labelling is in accordance with design standards/specification.	
Disconnector identified and phases marked.	
Disconnector firmly bolted down.	
Porcelains/Insulators clean and free from cracks.	
Disconnect mech box earthed correctly.	
Max voltage sign in place in disconnect mechanical box.	
Cabinet / mech box heaters working.	
Primary contacts free from contamination.	
Cabinet / mech box fuses/MCBs/auxiliary relays / switches and buttons identified	

Motor supply MCB adequately rated as per design/specifications.	
Paintwork and galvanising satisfactory.	
Manufacturers operating instructions available.	
Operating handles present.	
Operating handle effectively earthed.	
Moving parts within the disconnect mech. box adequately screened to ensure safety to all personnel.	
Lubrication been carried out as per manufacturer instructions.	
Bi-metal plate is in place and is facing the correct way.	
Wiring connections checked for tightness.	
All connections torqued.	
Primary connections to correct torque correctly and checked for tightness.	
Alignment and synchronising of contacts correct.	
Contacts grip correctly.	
Disconnects operating smoothly.	
Earth disconnect properly earthed.	
Earthing stirrups attached when required	
Clearances between phases, to earth, to fences/screens and height above ground greater than minimum values specified.	
Sufficient clearance between open contacts.	
Busbar jumpers rigid as per design.	
Busbars level and appearance correct.	
Busbar rating as per design.	
Phasing / colours correct.	

Ductor Testing

	R	S	T
Resistance across closed contacts $\mu\Omega$			

IRT Readings

	R	S	T
Insulation to earth			
Insulation between phases (in both closed and open positions)			
Insulation across open contacts			

Functional Operation

Insulation Resistance Tests satisfactory.		
Auxiliary contacts function correctly.		
Manual operation be achieved without danger to the operator.		
Operation of disconnect correct for	- Local?	
	- Manual?	
	- Remote?	
	- SCADA	
Moving parts on the disconnector adequately screened.		
Disconnector control wiring been installed correctly and have all connections been checked for tightness.		
Alignment of primary contacts correct.		
Disconnect primary contacts/blades latching and locking correctly.		
Drive arm been pinned to prevent against slippage where instructed/recommended by the manufactures.		
All disconnect/mech. box alarms enunciated correctly back to AAP/SCS.		
Earth disconnect earthing is per design specification.		
Earth leads short and free from unnecessary joints or bends.		
Are the DC voltages to the disconnector correct?		
MCB/fuses checked?		
Remote indication, discrepancy flicker and mimic correct.		
Disconnector and earthing switch, electrical and mechanical interlocks, drive arms and associated rods working correctly as to specification.		

Remarks

Signed

For and on Behalf of

Date

6. Surge Arrestor Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

Surge Arrestor Information

Voltage kV			
Manufacturer			
Year			
Type No Phases Neutral			
No. of Stacks			
	R:	S:	T:
Serial No.			
Class			
Surge Arrestor Rated Voltage Ur			
Continuous operating voltage Uc			
Pressure relief current			
Nominal discharge current In			
Short Time Current Rating Is			
Counter readings			

Ammeter Information

	Ammeter	Counter Ammeter
Serial No.		
Manufacturer		
Year		
Type No		

General Inspection

Erected in accordance with the design & manufacturers recommendations.	
All Manufacturers installation, service, maintenance & operating instructions provided.	
Surge arrestor type suitable for the installed location (indoor/outdoor).	
Supporting metalwork and arrestor earthed correctly as in spec.	
Earthing leads, short and direct with no sharp bends and free of unnecessary joints.	
Earthing leads connected to dedicated earth rod.	
Blast indicators positioned correctly.	
All labelling is in accordance with design standards/specification and can phasing be easily identified.	
Arrestor identified and phases marked.	
Arrestor firmly bolted down.	
Porcelains/Insulators clean and free from cracks.	
Leads from base of Surge Arrester insulated correctly.	
Primary connections to correct torque correctly and checked for tightness.	
Earthed in accordance with design.	
Paintwork and galvanizing satisfactory.	
In existing station, confirm arcing horns removed from within the protection zone.	
Clearances between phases, to earth, to fences/screens and height above ground greater than minimum values specified.	

IRT Readings

Stack Section	Applied Voltage		R	S	T	N
HV to Middle		MΩ				
Middle to Base		MΩ				
HV to Base		MΩ				
Insulated Bolts to Earth		MΩ				

Ammeter Readings

Applied Voltage		R	S	T	N
	mA				

Remarks

Signed	
For and on Behalf of	
Date	

7. GIS Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

General Checks

Painting is satisfactory	
Assembly of the general arrangement is in accordance with the design and OEM's drawings and instructions	
Assembly of the earthing circuit is in accordance with the design and OEM's drawings and instructions	

Civil Works

Civil works have been installed correctly and in accordance with the design	
No visible signs of pollution that could be harmful to the dielectric withstand of the equipment	
Outdoor erection works have temporary protection measures against dust and rain.	

GIS Components

GIS components have been installed correctly and in accordance with the design and OEM's drawings and instructions.	
All pipe junctions have been sealed.	
Tightness of bolts and connections as per OEM's instructions.	
Interlocks are functioning as per design.	
Gas quality, moisture content and percentage of purity of SF6 (or alternative) gas is in accordance with OEM's instructions.	
Density switches operate properly at each level alarm	
Gas pressure on all compartments has been checked according to OEM's instructions.	
SATs have been performed and all relevant documentation has been submitted.	

Circuit Breaker

Electrical circuits of the CB conform to the wiring diagram.	
Serial Number of the CB is in accordance with the design.	
Signalling (position, alarms, lockout) has been checked and operates in accordance with the design.	

Heating has been checked and operates in accordance with the design.	
Filling Pressure of Insulation / Extinguishing fluids is in accordance with OEM's acceptance levels.	
A dewpoint check has been carried out and results are in accordance with OEM's acceptance levels.	
A check of the total impurities of the insulation has been carried out and results are in accordance with OEM's acceptance level	
Mechanical operating tests and measurements have been carried out and relevant documentation has been submitted.	

Disconnectors and Earthing Switches

Serial Numbers of the DS/ES are in accordance with the design.	
Mechanical Operating tests have been carried out on a complete assembled disconnector for the electrical operating mechanism.	
Mechanical Operating tests have been carried out on a complete assembled disconnector for the manual operating mechanism.	
Maximum hand operating torque has been recorded.	
Mechanical operating tests have been carried out on a complete assembled earthing switch	

Current Transformers

Serial Numbers of the CTs are in accordance with the design.	
Assembly of the CT in accordance with the design and OEM's drawings and instructions.	
SATs have been performed and all relevant documentation has been submitted.	

Voltage Transformers

Serial Numbers of the VTs are in accordance with the design.	
Assembly of the VTs in accordance with the design and OEM's drawings and instructions.	
SATs have been performed and all relevant documentation has been submitted.	
Earth connection of the terminal box is linked to earth	
One of the terminals of each winding is connected to earth	

Low Voltage Equipment

Assembly of LCC in accordance with the design and OEM's drawings and instructions	
Wiring has been checked and is in accordance with the design.	
Interlocks functioning properly and in accordance with the design.	
Protection, control, measuring and regulative equipment is in accordance with the design.	
Heating operates in accordance with the design	

Lighting operates in accordance with the device.	

Remarks

Signed

For and on Behalf of

Date

8. Cables and Wiring Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

Cables installed correctly in accordance with the cable schedule.	
Cables glanded correctly at both ends.	
Cable sizes correct.	
Number of cores correct.	
Core colours correct.	
Ferrules correct.	
Cable number correct and fitted at each end of the cable.	
Termination method satisfactory.	
All cores terminated in the correct position.	
Wiring and terminations checked for tightness.	
Cable screens earthed correctly.	
SCADA cabling correctly fixed, terminated & identified {sheath earthed correctly}	
All cables adequately fixed and supported.	
Spare cores neatly tied off.	
Sufficient slack provided in all cables & cores.	

Remarks

Signed _____

For and on Behalf of _____

Date _____

9. AC/DC Boards & Circuits Test Sheets

S/S Name:	
Bay/Circuit Name:	
Name of Board Manufacturer	AC DC
AC/DC Board ID Number	AC DC
Location	

General Inspection

AC/DC Board – Visual & Mechanical Inspection	
AC/DC board rating is as per design specification.	
Earthing of AC/DC Board is as per design specification.	
Correct current ratings and characteristic type of all protective devices (i.e. fuses, MCBs, MCCBs) for each circuit are as per design specification.	
All labelling is in accordance with EirGrid functional specification and all MCBs are correctly labelled with device number and circuit function as per design specification.	
Correct earth AC neutralising arrangement is installed as per design specification.	
AC/DC board cabling is glanded correctly, cable identification is in place and cable screens are earthed.	
AC/DC Boards fixed securely to either the floor or wall.	
Access to live parts in the AC/DC board is restricted by a screen/cover.	
Shields are in place between terminals where required.	
Correct colour coding of all conductors used in the AC/DC board. ETCI regulations apply to the wire in the AC board.	
Cable sizes conform to the design and all terminal shorting links are tight.	
Cable identification is in place, core numbers are visible on field wiring – faced outwards.	
Correct terminals used for MCB Open/Trip signals.	
Confirm the following for all AC/DC Connections	
All connections are secure.	
All spare cores are safely secured.	
All stranded cables have correct ferrules used.	
Terminal sizes against design.	
Maximum of two connections per terminal.	

No insulation trapped under terminals.	
AC Board Operation	
AC voltage measurement between all phases and each phase to neutral.	Phase to Phase Phase to Neutral
Phase rotation from the house supply is correct.	
Open and trip signals to station signalling system for all applicable MCBs specified in the design.	
MCBs and fuses correctly isolate each circuit.	
All connections are secure, and that all spare cores are safely secured in a tidy manner.	
Changeover Facilities	
Clear and concise labelling of the switching positions for the main and backup supplies.	
Phasing is correct between main and backup supplies at changeover facilities.	
Phase rotation is correct for both supplies.	
Mechanical interlocking between main incoming supply and backup supply at changeover switch.	
Earth neutralising arrangement for both main and backup supplies is correct as per design specification.	
Functional operation of the changeover facilities is correct.	
DC Board Operations	
Insulation resistance test (IRT) on the main DC board circuitry. Record the lowest insulation resistance values @500 V DC.	Pos – Earth Ω Neg – Earth Ω Pos – Neg Ω
Measure the Positive to Negative, Positive to Earth and Negative to Earth voltages of the main board circuitry and each outgoing circuit. Record the average values.	Pos – Neg V DC Pos –Earth V DC Neg – Earth V DC

DC polarity at all MCBs is as per the manufacturer's instructions depending on connection arrangement.	
Correct segregation of DC supplies between each circuit.	
Instruments on the DC board are correctly rated and calibrated.	
No AC voltage is present at the DC board.	
DC MCB's alarms and trip signals operate correctly to the station signal system.	
MCB trip alarms are not wired through isolatable link terminals, while the MCB open alarm signals are isolatable.	
AC/DC IRT Results	
AC Board IRT Results	
Phase to Phase	Ω
Phase to Earth	Ω
Phase to Neutral	Ω
Neutral to Earth	Ω
DC Board IRT Results	
Positive to Negative	Ω
Positive to Earth	Ω
Negative to Earth	Ω

Remarks

Signed

For and on Behalf of

Date

10. Busbar and Supports Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

Surge Arrestor Information

Voltage		kV	
Ratings	Nominal Current	kA	
	S/C Current/MVA	kA/MVA	
Type of Busbar			
Material (copper/aluminium)			

General Inspection

Erected in accordance with the design & manufacturers recommendations.	
Voltage rating of the busbar insulator is correct as per design/SLD.	
Supporting metalwork earthed correctly.	
Supporting metalwork free of rust.	
Busbars identified and phases marked.	
Busbar Supports firmly bolted down.	
Porcelains/Insulators clean and free from cracks.	
No stress on steel work from line terminations.	
Busbar connections installed match the design.	
Primary connections to correct torque and greased.	
Earthing stirrups installed correctly.	
Confirm all unused cubicles are screened under live busbar.	
Confirm all walkways are screened correctly.	
Paintwork and galvanizing satisfactory.	
Clearances between phases, to earth, to fences/screens and height above ground greater than minimum values specified.	
Vibration dampers, if required, are installed.	
Busbar jumpers rigid as per design.	
Expansion Joint is installed as per specifications, where applicable.	
Ductor Tests done across ALL jointed connections on busbars and results attached.	

Insulation Resistance tests satisfactory	
All connections torqued	
Busbars level and appearance correct	
Busbar rating as per design	
MES/GIS test report reviewed and passed and results are attached for the Commissioner to review.	
Where applicable confirm MES/GIS busbar covers are in place.	
Where applicable confirm MES busbar chambers are free from debris.	
OEM Test report for busbar chamber electrical clearances is attached for the commissioner to review, where applicable.	

Electrical Clearance of Busbar (AIS Only)	Measurement	Pass/Fail
Confirm phase to phase electrical clearance of the busbar.		
R phase – S Phase		
S Phase – T Phase		
T Phase – R Phase		
Confirm phase to earth electrical clearance of the busbar.		
R phase – Earth		
S Phase – Earth		
T Phase – Earth		
Confirm electrical clearance of the busbar phases against the following:		
Busbar to Ground		
Busbar To Fence		
Busbar above Walkways		

Remarks

_____

_____

_____

_____

_____

Signed _____

For and on Behalf of _____

Date _____

11. Cabinets Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	
Cabinet Name	
Manufacturer	
Voltage	

General Inspection

Cabinet manufacturers documentation/as-built drawings available.	
Cabinet mounted on support rails and bolted down correctly.	
Cabinet earth conductor connected and secure.	
Cabinet contents checked against design drawings.	
Cabinet are completed as per relevant EirGrid functional specifications.	
Cabinet identification labels fitted to front and rear.	
All cabinet equipment labelled correctly.	
Protection relay supplies checked and energized.	
Cabinet supply MCB's correctly labelled.	
Cabinet doors bonded.	
Wiring and terminations checked for tightness.	
Max voltage level warning labels fitted.	
All trunking lids fitted.	
Trunking adequate.	
Do (es) the test switch (es) disconnect the relay(s) from the CT's in test position?	
Is tripping interrupted for all positions except NORMAL on the test switch?	
Is continuity maintained on withdrawing all relay current input modules?	
Are the test sockets correctly wired for test kit connection?	
Individual earths connected to earth bar from all switches and relays.	
Layout as per design.	
All required cabinet equipment fitted {relays, switches, test sockets etc.}	
Have wiring connections been checked for tightness?	

Remarks

Signed	
For and on Behalf of	
Date	

12. Control Circuits Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	
Type	
Manufacturer	

DC Supplies

Confirm that the RTU signal/status supply (PSO) is wired as per design.	
Confirm the RTU command supply is wired as per design.	

Alarm/Signal Testing

Did all alarms operate correctly and was the bay/cubicle or equipment number/name text details with time stamping correctly displayed?	
Were all alarms/signals confirmed locally on the station AAP?	

General Inspection

Station Mimic/Mosaic Panels have the following:	
Control and position indication of all switchgear at control panel and/or mosaic and to SCADA.	
Equipment representation and control of equipment is clear and unambiguous in station mimic/mosaic panels.	
Appropriate control switches and indications are in place in station mimic/mosaic panels.	
Identification labelling of all bay and busbar components are correct.	
Correct RAL colours are used to represent the voltage level of the equipment.	
Any potential means of bypassing a busbar sectionaliser in the station is clearly outlined, e.g., via house transformer.	
The position of measurand displays or digital measurand fields correctly reflect the location of where the measurement is obtained.	
Confirm the following for BCUs or integrated bay controls on protective devices:	
Correct representation of the bay/cubicle equipment layout according to the approved SLD.	
Identification labelling of all plant and components is correct.	
External labelling of switches, controls and LEDs are correct.	
Panels and equipment associated with SCADA, signalling and metering have the following labelling applied:	
Panel identification labels.	
Safety notices and warning labels.	

Maximum voltage labels.	
Confirm that the equipment is suitable for the intended application and confirm that the equipment model/type number, current and voltage ratings are correct.	
Confirm that all alarms are signalled correctly in station and at SCADA interface.	
Confirm that station metering is functioning correctly.	
Confirm RTU/ radio interface correct.	
Confirm bay units installed correctly	
Labelling of components, bays/cubicles and busbars are correct.	
Equipment representation and control of equipment is clear and unambiguous.	
Appropriate control switches and indications are in place.	
Confirm wiring to star coupler correctly installed.	
Confirm bay control units installed correctly.	
Confirm that input/output signals from source to bay unit correct.	
Check that control system is functionally operational. In the event of problems, please ensure that designer is advised.	
Confirm all Fibre cable is installed in fibre ducting within station ducting.	
All Cables correctly earthed.	
All Manufacturers installation, service, maintenance & operating instructions provided.	
Layout as per design.	

Remarks

Signed _____

For and on Behalf of _____

Date _____

13. Protection Relay & IED Test Sheets

S/S Name:	
Bay/Circuit Name:	
Application (Protection Control)	
Type of Relay/IED	
Manufacturer	

General Inspection

Confirm no physical damage to the relay / IED.	
Confirm no ingress of moisture, dust or any other particle which could impair the performance of the equipment.	
Confirm no damage to keypad or HMI.	
Confirm no signs of contact erosion due to arcing or corrosion.	
Confirm no signs of excessive heating.	
Confirm nameplate ratings as per appropriate application and substation single line diagram and nominal voltage and current values.	
Confirm all wiring and connection shall be verified for correctness and tightness.	
Confirm labelling is appropriate to the application.	
Confirm relay/IED is powered up and no faults present.	
Confirm text is uploaded to alarm system and excel template attached.	

Remarks

Signed _____

For and on Behalf of _____

Date _____

14. Earthing Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

Main station gates earthed	
The Earth Grid in the above-named station has been installed as per station specific design and instructions.	
Station resistance was measured on this date indicating a value of: Ω	
All temporary/ secondary station gates earthed as per design.	
All equipotential bonding is completed as per design.	
Substation earthing bars are installed as per design requirements.	
Installed surface layer material is as per design and EPR study e.g. crushed stone, tarmacadam.	
Earthing conductor is as per design specification.	
All over ground earthing conductors are green PVC.	
Crimps of all over ground connections are inspected, made correctly and stamped with a die appropriate for the size of the conductor.	
All over ground connections are tight, verified by completing a pull check.	
All bolts connecting earths to metal work shall be marked as torqued. Complete a sample check to confirm.	
All bolted earthing connections shall be a single conductor, except the flexible earth on the compound gate or station doors.	
All below ground connections have a unique connection identifier and location on the Grid Layout Drawing.	
Picture of each earth grid connection attached, for all below ground connections.	
Resistance value of each connection attached, for all below ground connections.	
Pedestrian gate bonded to main gate with flexible earths.	
Control building doors earthed with flexible earths.	
Perimeter fence earthed at correct intervals as specified.	
Substation perimeter fencing is earthed in accordance with specific design requirements.	

No third-party property is connected to the substation inner or outer compound fences.	
Public telephone system isolated from local earth?	
Fire post support steelwork earthed.	
Station lighting columns earthed.	
Outside Tap support steelwork earthed.	
Integrity of earth conductors to grid inspected?	
Earthing switches checked for both freedom of movement in both directions and for correct primary contact wipe.	
Biocycle/ wastewater unit if used functioning.	
Contact Resistance Test Completed (Test Results attached)	
Is there a photo register of all underground crimps/cad welds?	
Earth conductor insulated from metal work?	
All metallic objects are bonded to the substation grid.	
All connectors in contact with galvanised steel are tinned and have contact grease applied.	
All exposed support steelwork earthed {e.g. uprights, screen posts etc.}	
Bolts connecting earths to metal work marked as torqued.	
All substation trunking, cable trays and cable ladders are earthed and bonded in line with design/specification requirements.	
Ductor Tests done across ALL connections and results included?	
All cabinet earthing conforms to specification?	
Have earthing stirrups and parking bars been installed as per design?	

Remarks

Signed _____

For and on Behalf of _____

Date _____

15. Auxiliary Supplies Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

AC/DC distribution boards checked according to schematics.	
AC/DC distribution boards labelled.	
Correct identification labels fitted to all MCBs.	
Charger and distribution board earth conductors connected and secure.	
AC supplies backed up with diesel generator? Functionality checked?	
Supplies checked and battery system energized.	
Battery manufacturers recommended initial charging completed.	
Confirm that no fault voltage exists on the DC supply.	

Remarks

Signed _____

For and on Behalf of _____

Date _____

16. Battery Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	
Type	
Manufacturer	
Serial Number	
Battery Type	
Battery Year	

Battery Information

Nominal Voltage	V	
Nominal Voltage per cell/block		V DC
Number of cells/blocks		
Measured Voltage	V	
Capacity	Ah	

General Inspection

Ensure that battery stands are laid straight, evenly and are secured.	
Ensure that batteries are laid straight and evenly.	
Battery cells are connected correctly.	
Cell/blocks are numbered.	
Ensure that all inter-cell connections are tight with terminals greased and shrouded where required and no connections are stripped.	
Paintwork and galvanising in good condition, touched up where Necessary.	
Module earthed as per design including all exposed steelwork e.g. stairs , screening etc.	
Battery assembled and all connections torqued correctly.	
Supplies checked and battery system energised as per manufacturers/ suppliers instructions.	
Correct Fuses installed in correct positions.	
Ensure that there are no leaks and no damaged cases and batteries are clean.	
All technical data, test certificates and manuals to be made available.	
Make sure that the electrolyte level is at maximum.	

Ensure that correct size, type and colour of cable used between charger and battery.	
Battery cables/conductors are insulated from the frame and wall and adequately protected.	
Ensure that each battery/cell is easily accessible.	
All access plates re-fitted	
Ensure that the floor is epoxy-coated and clean and swept out.	
Ensure that shower or eye-wash facilities are available and suitably located	
Ensure that extractor fan is working or ventilation is proper and according to design.	
Safety notices on outside of entrance door and inside walls of room fitted.	
Protective equipment for use in the battery room as per EirGrid and ESB requirements is available.	
All Warning labels, Identification labels and operational labels Fitted.	
All electrical fittings are checked to be ATEX rated/Certified	
Ensure that there is a sign showing full details of the battery.	
Battery maintenance kit provided.	
Special battery lock and key fitted on door of battery room.	
Battery room door fire rated.	
Battery room identification labelling, safety notices and additional signage is correct as per design specifications.	
All lighting equipment is suitable for battery room environment.	
Battery room light switch is located outside, within 1.5m of the battery room door. It shall be ATEX Rated/Certified and have its function labelled.	
Battery room heater is suitably rated for a battery room environment. Also the room ambient temperature is correct as per design.	
Fire alarm installation completed and operational with alarms/ signals confirmed. Cert attached.	
Battery room Fire extinguishers located at all designated locations.	

Remarks

Signed

For and on Behalf of

Date

17. Battery Charger Test Sheet

Battery Discharge Test

All battery cells shall have passed for the ten-hour discharge period in advance of pre-commissioning handover to ESB Networks. Safety Note

Battery systems can discharge extremely high currents. Extreme care must be taken to avoid any possibility of a short circuit being applied to the battery terminals as test connections are being made or broken.

Battery Under Test _____

Has a Battery Capacity Test been completed by the installer? If Yes please attach results to the relevant test report. If No complete table below.	
Capacity Test Conditions	
Capacity	Ah
Nominal Voltage	V
Load	A
Temperature	°C

Cell No.	Voltage HR 1	Voltage HR 2	Voltage HR 3	Voltage HR 4	Voltage HR 5	Voltage HR 6	Voltage HR 7	Voltage HR 8	Voltage HR 9	Voltage HR 10	Specific Gravity @ HR1	Specific Gravity @ HR10	Comments
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													

Cell No.	Voltage HR 1	Voltage HR 2	Voltage HR 3	Voltage HR 4	Voltage HR 5	Voltage HR 6	Voltage HR 7	Voltage HR 8	Voltage HR 9	Voltage HR 10	Specific Gravity @ HR1	Specific Gravity @ HR10	Comments
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													
41													
42													
43													
44													
45													
46													
47													

Cell No.	Voltage HR 1	Voltage HR 2	Voltage HR 3	Voltage HR 4	Voltage HR 5	Voltage HR 6	Voltage HR 7	Voltage HR 8	Voltage HR 9	Voltage HR 10	Specific Gravity @ HR1	Specific Gravity @ HR10	Comments
48													
49													
50													
51													
52													
53													
54													
55													
56													
57													
58													
59													
60													
61													
62													
63													
64													
65													
66													
67													
68													
69													
70													
71													

Cell No.	Voltage HR 1	Voltage HR 2	Voltage HR 3	Voltage HR 4	Voltage HR 5	Voltage HR 6	Voltage HR 7	Voltage HR 8	Voltage HR 9	Voltage HR 10	Specific Gravity @ HR1	Specific Gravity @ HR10	Comments
72													
73													
74													
75													
76													
77													
78													
79													
80													
81													
82													
83													
84													
85													
86													
87													
88													
89													
90													
91													
92													
93													
94													
95													

Cell No.	Voltage HR 1	Voltage HR 2	Voltage HR 3	Voltage HR 4	Voltage HR 5	Voltage HR 6	Voltage HR 7	Voltage HR 8	Voltage HR 9	Voltage HR 10	Specific Gravity @ HR1	Specific Gravity @ HR10	Comments
96													
97													
98													
99													
100													
101													
102													
103													
104													
105													
106													
107													
108													
109													
110													

Signed

For and on Behalf of

Date

18. Battery Charger Check Sheet

S/S Name:	
Bay/Circuit Name:	
Location	

Battery Information

Battery Charger Manufacturer	
Make and Type	
Battery Charger ID	
Serial No	
DC Voltage V	
Charger Number	

General Inspection

Ensure that charger is securely mounted and is level to the floor.	
Charger installed as per manufacturer's instructions.	
All labelling is in accordance with EirGrid functional specification.	
Ensure that relevant cabling is neat and that no cables are damaged.	
Ensure that cables are correctly connected and numbered as per design schematics.	
Charger door opens without obstruction.	
Charger Vents are not obstructed.	
Charger and distribution board earth conductors connected and Secure.	
Battery manufacturers recommended initial charging completed.	
Battery discharge test completed results attached.	
Ensure that MCBs/ fuses are clearly labelled and rated correctly.	
Ensure that there are no earth-faults from the charger.	
Ensure correct operation of all alarms and indications from the charger.	
Ensure correct settings on battery charger.	
Ensure correct operation in boost mode for fast charging and float charging (trickle charge) mode for continuous operation.	
Ensure LVD contactor is of the N/C type to prevent inadvertent operation.	
Ensure that all cubicles are clean and dusted out.	

Ensure that no part or component of the battery charger is damaged.	
Ensure correct operation of all meters and indicators.	
Battery Charger has stable incoming AC supply and record measured AC supply voltage.	V AC
Battery Charger is isolated via the link box.	
Ensure manufacturer schematics, design schematics and the charger layout and wiring match and are correct.	
All manuals and drawings are available.	
Battery Changeover Facilities	
Battery charger changeover equipment labelling is correct, and that the function of equipment is clear and unambiguous.	
A change over from one charger to the other doesn't result in the disconnection of the load supply voltage via the LVD or dropping diode circuit.	
Battery Supervision Relay	
Battery supervision relay is earthed correctly as per manufacturer's instructions and design specifications	
Over-voltage and under-voltage threshold alarm levels are set.	
Positive and negative earth fault threshold alarm levels are set.	
Battery to be powered up and connected to the chargers for a minimoium of 4 weeks in advance of commissioning hand over	

Remarks

Signed _____

For and on Behalf of _____

Date _____

19. Phasing Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

Confirm that the phasing of the busbars is in accordance with the layout drawing and phasing diagram (in general R, S and T from the centre of the station).	
Confirm all required labelling is fitted.	
Confirm installation is in accordance with SLD.	
Confirm that the phasing of the transformer bay matches the transformer phasing.	
Confirm that the phasing of feeder bays matches the phasing of the incoming circuits as per the station phasing diagram.	
Confirm that the phasing of current transformer and voltage transformer secondary circuit connections between the instrument transformers and the protection relays and other instrumentation equipment is correct.	
Confirm that the phasing of the trip circuit connections between the protection relays and the circuit breaker trip coils is correct (if single pole tripping and reclosing is used).	

Remarks

Signed _____

For and on Behalf of _____

Date _____

20. Miscellaneous Non-Plant Items Check

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

Danger notices fitted to compound fencing, doors and gates.	
Where applicable, confirm that an electrical completion certificate has been issued for the building services installation as part of the pre-commissioning handover pack.	
All rooms in control building properly labelled.	
Battery room ventilation checked.	
All battery system/components should be confirmed to be free of earth and any other faults.	
First Aid Kit and Safety Rubber Mats on site.	
Safety and Artificial Respiration notices erected.	
Standard locks fitted to main and compound gates and to station doors.	
AIS cubicles are clean and ready for commissioning.	
Adequate identification for station, transformers and cubicles.	
Special warning notices fitted on transformer and VT cubicle screens.	
Satisfactory appearance of grass, paths, gravel, weeds and site drainage.	
Cable trenches covered by reinforced paving slabs.	
Have all cable trenches/ joint pits/ excavations been back filled.	
Paintwork and galvanizing satisfactory.	
Unwanted materials removed.	
Station heating and lighting safe, adequate and working.	
Socket outlets controlled by 30mA RCD.	
Electrical Installation Completion Certificate Issued.	
Intruder alarm Certificate has been issued for the building services installation as part of the pre-commissioning handover pack.	
Access and Egress arrangements satisfactory.	
Fire alarm Certificate has been issued for the building services installation as part of the pre-commissioning handover pack.	
Adequate Fire Fighting equipment installed at all approved locations.	
Station telephone in operation & adequately isolated electrically.	

Security Fence height at least 2.4 meters, with no climbing aids & a clearance of 2.4m to terms.	
Confirm depth of stone coverage >150mm.	
All ducting size correct and installed as per current policy and is certified as clear and free from debris cert attached.	
Sump pump functioning and operation confirmed.	
All sump Pump manufacturers installation, service, maintenance & operating instructions provided.	
All Transformer Bund Pump manufacturers installation, service, maintenance & operating instructions provided.	
All switchgear are in an operational state with supplies on.	
All HV connections are completed correctly.	
SF6 gas extraction system operation and function confirmed.	
SF6 gas is filled to operating levels.	
Labelling is completed throughout the station.	
All labelling to be properly identified and engraved.	
Spares and tools supplied.	
Locking facilities supplied for all equipment.	
Confirm that all trips are operational.	
Confirm no temporary jumpers or “commissioning bypass” are present.	
On chain link fencing, check that fence straining bolts are cut short outside at corner posts – all cuts touched up.	

Remarks

Signed _____

For and on Behalf of _____

Date _____

21. Interlocking Pre-Commissioning Test Sheets

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

Confirm the correct type of auxiliary contacts from the HV equipment are used for Interlocking circuitry.	
Confirm all permissive and blocking conditions shall be confirmed in both directions i.e. for opening and closing conditions.	
Confirm Interlocking between circuit breakers (CB's) and disconnectors.	
Interlocking Between Disconnectors and earth switches :	
Earthing switches should not be closed onto a locally energised circuit.	
Disconnectors should not potentially energise an earthed section via closed earthing switch.	
Where applicable verify Cross transformer interlocking conditions to confirm that it is not possible to close an earth disconnector when the transformer is live from either side.	
Where applicable, all interlocking tests should conform to the approved interlocking conditions associated with the station issued by the station designer.	

Remarks

Signed _____

For and on Behalf of _____

Date _____

22. Pre-Commissioning Handover Certificate

STATION:

EQUIPMENT AVAILABLE FOR COMMISSIONING:- Confirm below whether Certificates and Documents were attached.

Fire Monitoring System certificate of compliance.	
Intruder Alarm Monitoring System certificate of compliance.	
Electrical completion certificate for the building services installation.	
Installed lifting equipment/ apparatus certification.	
RECI/ ESCCA completion certificate for LV installation.	

OUTSTANDING ITEMS:-

COMMON ITEMS (e.g. signalling system, auxiliary supplies, control panel etc….)

BAY 1

BAY 2

BAY 3

BAY 4

For Pre-Commissioning

Signed _____

For and on Behalf of _____

Date _____

Accepted on behalf of EirGrid

Signed _____

For and on Behalf of _____

Date _____

23. Torquing Checks

S/S Name:	
Bay/Circuit Name:	
Location	

General Inspection

Confirm torquing is completed in accordance with the Manufacturer's Installation Instructions.	

TORQUE SETTINGS FOR LV DIN PANEL {extract - LV DIN Panel Installation Manual - P33}			
Item	Connection	Nm	Ft-Lbs
1	Network cable terminations for fuse- switches and disconnectors	40	29.5
2	Connection of fuse-switches and disconnectors to phase busbars	70	51.6
3	Copper laminate connections to transformer and LV panel terminals	100	73.7
4	Fishplate connections for extension LV panel	70	51.6
5	Connection of 380mm2 NAYY cable to transformer and LV panel terminals	50	36.9