

PRE COMMISSIONING FORMATS FOR GAS INSULATED SUBSTATIONS

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Erection Guidelines & Checklist

I. OBJECTIVE

On site Erection of Gas Insulated Substation needs be considered as an extension of manufacturing process and same level of quality standards must be adhered during site erection so that assembled Gas Insulated Substation complies all the criteria considered while designing. Any “short cuts” taken during site erection may lead to adverse effect on Gas Insulated Substation. Long term reliability of finally assembled Gas Insulated Substation depends significantly on the level of cleanliness and adherence to standard processes during erection. A comprehensive checklist has been given below which needs to be followed by site during installation & erection and maintained by site as installation record of GIS.

II. GUIDELINES & CHECKLIST

Sl	GIS work activity and precaution to be taken	Compliance (OK/Not OK)	Remarks (if any)
1.	Completion of Civil Works & Cleaning		
a.	GIS Hall Civil works must be complete in all respects prior to commencement of erection works of Gas Insulated Substation.	BIDDER TO NOTE - 400KV GIS IS OUTDOOR TYPE HENCE GIS HALL SHALL NOT BE AVAILABLE THERE. HENCE ALL NECESSARY PROVISION FOR COMPLETE DUST AND MOISTURE PROOF AMBIANCE FOR OUTDOOR TYPE GIS INSTALLATION IS TO BE MADE BY BIDDER. COST OF THE SAME SHALL BE DEEMED INCLUDED, BIDDER TO QUOTE ACCORDINGLY.	
b.	Thorough cleaning of GIS hall to be ensured before start of GIS Erection.		
c.	It should be ensured that dust and dirt are not present in GIS Hall.		
2.	GIS Hall Sealing		
a.	GIS Hall must be properly sealed and all the openings including Bus Duct entry from GIS wall, Windows, Roof, Fixed glasses in GIS walls must be fixed & should be in close condition.		
b.	The work of GIS hall rolling shutter, entry doors etc should also be complete to control the opening.		
c.	Bus duct exit in the GIS hall wall shall be kept covered by suitable means (metal sheet/ ply board) until permanent cover is provided after installation of bus ducts so as to make it properly sealed and should be able to withstand high wind and rains coming inside of GIS hall.		
3.	GIS Hall Floor Finish		

a.	GIS Hall floor must be compact & firm and Poly Urethane (P.U.) paint must be applied on floor before starting erection works.		
4.	GIS Door Closer		
a.	Entry door of GIS Hall must have automatic closing facility so that entry of dust/dirt can be avoided after entry of personnel.		
5.	No simultaneous Work		
a.	During the period of GIS module assembly and erection work ,any other other work in the GIS (like civil works, AHU ducts, cable laying & termination, illumination system cabling etc) should not be undertaken which can affect cleanliness or create any sort of particle, dust etc.		
b.	Walls and ceiling shall be in a condition so that neither dirt nor plaster might fall or rub off and formation of condensation water on ceiling/ walls shall be prevented under any circumstances.		
6.	Restricted Entry in GIS Hall		
a.	At the time of GIS erection work maintaining cleaning is top most requirement. Entry to only authorised persons must be allowed.		
7.	Regular Cleaning of Assembly and Erection Area		
a.	Cleanliness must be maintained in GIS Hall throughout erection process. Vacuum cleaner may be used for achieving the same.		
b.	In order to achieve same, cleaning to be carried out in GIS Hall working area by vacuum cleaner at regular intervals.		
8.	Storage Area		
a.	On arrival of GIS modules in packed condition from manufacturer's facility, the packing should be stored identified area only as decided by POWERGRID.		
b.	The storage area should be sufficiently raised above FGL such that under no circumstances during the entire storage period there should be no waterlogging in storage area and any part of packing should not be submerged due to accumulation of water.		
c.	Regular clearing of weeds and bushes must be ensured in storage area to avoid damage to packing.		

9.	Unpacking and shifting of modules		
a.	GIS modules stored in storage area which needs to be shifted to GIS Hall for erection must be unpacked immediately before installation.		
b.	Unpacking of GIS modules shall not be done inside the GIS hall to maintain cleanliness of GIS assembly area as packing contains lot of dirt and unwanted material.		
c.	Unpacking of GIS modules to be done outside of GIS hall and cleaned from outside before shifting the same to GIS hall.		
10.	Shock Recorder/Indicator		
a.	Manufacturer provides Impact Recorders in the packing of all major GIS equipments (CBs, VTs etc) from factory for monitoring of abnormal shocks during transport and handling. Mechanical Shock indicators are provided in smaller equipments and modules. Limits of shocks in all three directions to be provided by manufacturer. After unpacking material before erection, impact recorders are to be removed and recorded data to be down loaded for review of abnormal shocks.		
b.	Shock recorder data and report with analysis of recorded data to be submitted by manufacturer within 3 weeks of removal of impact recorders.		
c.	In case of shock exceeding the limits, manufacturer expert shall do joint internal inspection of affected GIS units and shall submit analysis report before giving clearance for erection.		
d.	In case of packings with shock indicators , at the time of unpacking status of shock indicator to be noted. If shock indicator found operated (shock exceeding limit) manufacturer expert shall do joint internal inspection of affected GIS units and shall submit analysis report before giving clearance for erection.		
11.	Checking of pre-filled N2 in GIS modules		
a.	GIS equipments are transported in sealed condition with transport cover and pre-filled with positive N2 pressure. At the time unpacking before erection of GIS, N2 pressure in all modules to be checked. (Checklist for checking of packing, shock and N2 pressure is given as Format - A)		

12.	Uniform & Cleaning	
a.	Persons entering the GIS Hall during the entire erection period must clean their shoes for that proper foot mat need to be kept at the entry door.	
b.	GIS erection team must wear working uniform which shall be made of non fluffy material.	
13.	AHU Operation	
a.	Prior to commencing erection, Air Handling Unit must be commissioned and made functional so that positive pressure can be maintained in GIS Hall to prevent entry of dust and foreign material from outside.	
14.	Document Submission : Prior to taking up erection works, manufacturer must submit following documents :	
a.	Method statement for carrying out erection works along with details about Material handling, Erection procedures, vacuuming & gas filling, precautions to be taken during erection.	
b.	List of T&Ps	
c.	List of consumables & cleaning agents	
d.	Reference documents to be used during erection	
15.	List of Manufacturer's Certified Engineer & Supervisor	
a.	List of engineers and supervisors certified/qualified to handle and supervise erection works of GIS as per the standard and procedures recommended by manufacturer to be submitted by the vendor prior to start of GIS erection.	
b.	Authorization Certificate for Manufacturer's Engineer & Supervisor should come from competent level.	
16.	GIS Drawings: Following Drawings should be available and displayed on the wall of GIS Hall during the entire GIS Erection period	
a.	Approved Single Line Diagram (SLD) of the project	
b.	SF6 Gas line diagram	

c.	General Arrangement drawing with details of module number of each bay		
17.	Instruction Manual		
a.	Manufacturer's instruction manual for GIS Storage, Handling , Erection and O&M should be available at site before start of GIS erection work for reference of relevant procedures		
18.	Unwanted storage of material		
a.	Only T&P and consumables required for GIS erection shall be kept in GIS during erection.		
b.	GIS hall shall not be used as general purpose store for any kind of material.		
c.	Only inventory required for immediate erection and associated T&P are allowed inside GIS at the time of GIS erection.		
19.	Erection by EOT Crane		
a.	Only EOT crane is allowed for indoor GIS erection for the quality and safety of the work.		
b.	Under no circumstances Hydra or Crane to be used for indoor GIS erection in order to avoid dust & dirt and diesel fumes from the crane.		
20.	Gas Insulated Bus Ducts (GIB)		
a.	Gas Insulated Bus Duct (GIB) assembly should be done preferably in GIS hall and to be taken to outdoor for installation with proper cover on open sides.		
b.	If sufficient space is not available in GIS hall for GIB assembly, temporary outdoor shed with dust proof arrangement must be specially made for GIB assembly meeting all safety and cleaning requirements stated at earlier points.		
21.	Gas Insulated Bus Ducts (GIB) Installation		
a.	In case of outdoor installation of Gas Insulated Bus Duct (GIB) or of GIS compartment and components shall be duly protected from		

	dust and moisture ingress using temporary covers.		
22.	Cleaning of assembly parts		
a.	Cleaning is of utmost importance and hence before assembly, all the loose metal parts, subassemblies and all contact & sealing surfaces shall be cleaned before installation of components of GIS assembly.		
b.	Only recommended cleaning agents/material by manufacturer and as described in the instruction manual to be used.		
c.	Further, Prior to opening, gas compartment shall be thoroughly cleaned and vacuum cleaning of the installation area shall also be done specially the immediate vicinity of the flanges to be connected. Dust disturbance in the area to be avoided.		
23.	Pre-installation precautions		
a.	Once the transport covers are removed, installation of flanges shall be done without any interruptions, if interruptions cannot be avoided open flanges are to be covered with clean plastic foil. Transport covers, O-rings and other packing material shall be taken out of GIS after immediately after removal.		
b.	O-rings used for temporary transport packing to be scraped after opening of transport cover and removed from GIS erection area to avoid any mixing with new O-rings to be used for erection purpose.		
c.	O Rings shall be properly stored and taken out only before installation. O-Rings are also to be cleaned before use with manufacturer authorized cleaning agent.		
d.	At all points of time during installation authorized personnel shall use disposable gloves to avoid contamination.		
24.	Cable termination work		
a.	Cable termination at GIS equipments and LCC panels shall commence only after completion of GIS equipment as during GIS installation period laying and termination of cables interferes with the GIS erection work and affects cleanliness due to spreading of metal particles generated from gland plate cutting/ grinding, cable		

	armour/ screen cuttings etc.		
25.	Field Quality Plan		
a.	Approved Field Quality Plan shall be followed strictly during site work.		

Signature :	Signature :
Name :	Name :
Designation :	Designation :
GIS Manufacturer	POWERGRID Site Incharge

PRE COMMISSIONING TEST - EOT CRANE & SHOCK RECORDER

I. EOT CRANE

Load Test to be conducted on EOT Crane as per IS 3177:1999 (Reaffirmed 2004) “Indian Standard: Code of Practice for Electric Overhead Cranes and Gantry Cranes other than steel work cranes “

Note: Above test to be conducted before starting installation of GIS bays in GIS hall

PRE COMMISSIONING TEST - SHOCK RECORDER

II. SHOCK RECORDER ANALYSIS

Shock Recorders are to be provided in all the critical compartments during transportation like Circuit Breaker, Voltage Transformers etc. After receipt of compartments at site, shock recorder data needs to be downloaded preferably at site in presence of POWERGRID representative and analysis of the data needs to be submitted before start of erection activities. Incase of violation of limit for the shocks in any of the three directions, internal inspection of the compartment needs to be carried out so as to decided rectification measures based on the findings.

PRE COMMISSIONING CHECKS ON SF6 GAS

I. Quality Checks on SF6 Gas

Bay Details:

Ambient Temperature:

Reference Drawing Number:

Sl. No	Gas Compartment	Moisture Content at atmospheric pressure (in ppmv)			Dew point at atmospheric pressure			Pressure			% Purity		
		R	Y	B	R	Y	B	R	Y	B	R	Y	B

Kit Details

Make:

Model:

Calibration Validity date:

Permissible limit: Moisture Content (200 ppmv), Dew point (- 36 deg C) & Purity (99 %)

Note:

- Dew point of SF6 gas to be measured after at least 120 hours of gas filling (as per IEC 62271-203 Clause No : 10.2.101.6)
- Gas pressure reading to be monitored and recorded by the executing agency after every two weeks till energisation for identification of leakage in gas compartment if any and rectification.
- Gas quality test to be done only by using testing kit which has the pump back facility so that after measurement of gas quality, SF6 gas is not wasted and sent back to GIS compartment.

II. Checks on SF6 Density Monitor

Bay Details:

Ambient Temperature:

Density Monitor Details:

(Make & type)

Sl No	Gas Compartment	Phase	Loss of SF6(Stage I)			Lockout/trip Alarm (Stage 2A)			Lockout/trip Alarm (Stage 2B)		
			Rated/Design Value	Factory test value	Actual Value	Rated/Design Value	Factory Test value	Actual Value	Rated/Design Value	Factory Test value	Actual Value
		R									
		Y									
		B									
		R									

		Y							

III. SF6 Leakage test

Bay Details:

Sl. No	Gas Compartment	Phase	Initial filling pressure	Pressure after 24 hrs	Pressure after 7 days
		R			
		Y			
		B			
		R			
		Y			
		B			
		R			
		Y			
		B			
		R			
		Y			
		B			
		R			
		Y			
		B			

PRE COMMISSIONING CHECKS ON CIRCUIT BREAKERS

I. General Details

DETAILS	
Region:	Sub-Station:
Bay Name:	LOA No:
Make:	Year of Manufacturer:
Equipment Designation:	Type:
Sr. No:	Rated Breaking Capacity (kA):
Rating:	Control Voltage (DC):
Operating Voltage:	Date of Erection:
Date of Receipt at Site:	Date of Energisation:

II. Operating System:

Spring	
Hydraulic	
Hydro-Spring	

i. Hydraulic/Hydro-Spring System

a) Accumulator

	R Ø	Y Ø	B Ø
Make			
Serial number			
Type			
Year of manufacture			

b) Pump details

Make		Volt	
Serial number		Amperes	
Type		Hp/ kW	
Year of manufacturer		O/L setting (Thermal O/L)	

c) Details of relays/contactors used

Schematic drawing no _____

Circuit Reference	Make	Type
Oil Pressure Switch		
Closing Lockout		
Auto Reclosing Lockout		
Operational Lockout		
Anti Pumping Contactor		
Pole Discrepancy Timer		
SF6 Alarm/Lockout		

d) Operation checks

Date of Hydraulic Oil filling _____

Type of Hydraulic Oil (make of oil/ complying standard) _____

Pressurising hydraulic system

Sl.No	Description	Factory Test Value	Site Test Value	Remark Record Deficiencies, If Any
1	Pre-filling pressure of N ₂ in accumulator (bar / deg. C)			
2	Pump running time for charging hydraulic system from initial pressure to working pressure			
3	Checking over-pressure relief valve (open/close)			
4	Hydraulic pressure drop for 12 hr			
	Breaker ON position			Passing criteria: less than 3% per 12 Hrs
	Breaker OFF position			
5	Oil pressure monitor			
	Pump on / off bar			
	Pump running time			

6	Auto reclosing lockout (oil) Pressure contact _____ make/break			
7	Closing lockout (oil) pressure Contact _____ make/break			
8	Trip-1 lockout (oil) Pressure contact _____ make/break			
9	Trip-2 lockout (oil) Pressure contact _____ make/break			

Factory test report ref no: _____

Oil pressure drop during operations and pump running time in seconds

Sl.No	Description	Site Test Value
(i)	Pressure before operation(Bar)	
	Pressure after closing operation(Bar)	
	Pump running time to normalise pressure (Sec)	
(ii)	Pressure before operation(Bar)	
	Pressure after opening operation(Bar)	
	Pump running time to normalise pressure (Sec)	
(iii)	Pressure before operation(Bar)	
	Pressure after close/open operation (Bar)	
	Pump running time to normalise pressure (Sec)	
(iv)	Pressure before operation(Bar)	
	Pressure after open-close-open operation(Bar)	
	Pump running time to normalise pressure (Sec)	

Note: Pump MCB to be kept OFF in order to record drop in pressure after O/C/ CO operation. Subsequently switch ON MCB to record normalisation time.

Factory test report ref no: _____

ii) Spring Operating System**a) Motor details**

Make		Volt	
Sl no		Amperes	
Type		Hp/kw	
Year of Manufacture		Setting (thermal overload)	
Current taken by motor for charging the spring (amp)		IR of spring charging motor	

b) Spring operating time

Details	R- Ø		Y- Ø		B- Ø	
	Factory	Site	Factory	Site	Factory	Site
Charging Time						
Spring Charging Motor Supervision Time	NA		NA		NA	

Factory test report ref no: _____

c) Details of relays/contactors used : schematic drawing no

Circuit Reference	Make	Type
Closing lockout		
Auto reclosing lockout		
General lockout		
Anti pumping relay		
Pole discrepancy timer		

d) Charging of spring of Circuit Breaker manually - OK/Not OK

III. Trip/ Close Coil Resistance Measurement

COIL DETAILS	MEASURED VALUE IN Ohm		
	R - Ø	Y - Ø	B - Ø
TRIP COIL - I			
TRIP COIL – II			
CLOSE COIL			

IV. Circuitry and Operational Checks

SI No	Circuit Reference	Operational Check	
		Local	Remote
A	Tripping Through TC-I		
B	Tripping Through TC-II		
C	Closing Circuit		
D	Anti-hunting Feature		
E	Pole Discrepancy Feature		
F	Breaker Position Indication		
G	Heater In Switch Cubicle		
H	Heater In Control Cubicle		
I	Illum. In Switch Cubicle		
J	Illum. In Control Cubicle		

V. Operating Time (In milli-seconds)

Phase (Ø)	Close (Max 150ms)	Closing Coil Current	Trip		Tripping Coil Current		Close Open		OCO (OK/NOT OK)	
			Trip - I	Trip - II	Trip - I	Trip - II	Trip - I	Trip - II	Trip - I	Trip - II
R- Ø main contact										
R- Ø PIR										
Auxiliary contact										
Y - Ø main contact										
Y - Ø PIR										
Auxiliary contact										
B - Ø main contact										
B - Ø PIR										
Auxiliary contact										

Permissible limits

Timing	765 KV	400 KV	220 KV	132 KV
Close	150 ms	150 ms	150 ms	150 ms
Open	25 ms	25 ms	35 ms	40 ms
Phase to Phase time difference – Closing	5.0 ms			
Phase to Phase time difference - Opening	3.33 ms			

VI. IR Value of Control Circuit(using 500 volt megger)**Make of Kit:****Date of Calibration:**

Coil Details	Unit	Value
R – Ø TRIP COIL – I	MΩ	
R – Ø TRIP COIL – II	MΩ	
R – Ø CLOSE COIL	MΩ	
Y – Ø TRIP COIL – I	MΩ	
Y – Ø TRIP COIL – II	MΩ	
Y – Ø CLOSE COIL	MΩ	
B – Ø TRIP COIL – I	MΩ	
B – Ø TRIP COIL – II	MΩ	
B – Ø CLOSE COIL	MΩ	

Permissible limit (Minimum): 50 MΩ

CAUTION: Isolate necessary dc for trip coil I and trip coil II, closing coil before meggering.

VII. Breaker Operation Counter Reading

Counter Type	Put ✓ Mark
ELECTRICAL	
MECHANICAL	

(Reading to be recorded before energisation)

Sl. No	Phase	Reading	Date
A	R-Ø		
B	Y-Ø		
C	B-Ø		

VIII. Dynamic Contact Resistance & Travel Measurement

Availability of Travel Transducer to be ensured prior to commencement of DCRM test.

Phase (\emptyset)	Factory	Site	Remarks	Approval From CC/AM Obtained
R				
Y				
B				

IX. Operation Time Measurement of Pole Discrepancy Relay

Pole discrepancy relay	Setting	Actual

Note- 2.5 Sec for CBs with Auto Reclose Function & 0.5 Sec for CBs without Auto Reclose Function.

X. Local Close Interlock Checked(with Earth Switch open)

Yes	No

XI. Final Documentation Review

i. Factory test results are available

Yes	No

ii. Final documents of Pre- Commissioning checks reviewed and approved

Yes	No

iii. Document regarding spares equipment, O&M manuals etc available at sit for O&M purpose

Yes	No

iv. After modification, if any, “As built Drawings” are available at site

Yes	No

v. CC-OS approved DCRM signatures available

Yes	No

Signature:

Signature:

Signature:

Signature:

Name:

Name:

Name:

Name:

Designation:

Designation:

Designation:

Designation:

Organization:

(Erection Agency)

(POWERGRID Site

(POWERGRID

(Supplier

I/C)

Commissioning. Team)

Representative)

Members:

(Wherever

1.

Applicable)

2.

3.

4.

PRE COMMISSIONING CHECKS ON CURRENT TRANSFORMERS

I. General Details

DETAILS	
Region:	Sub-Station:
Bay Name:	LOA No:
Make:	Rating:
Sr. No: R- Ø: Y- Ø: B- Ø:	Type:
Year of Manufacturer: R –Ø: Y- Ø: B- Ø:	Date of Receipt at site: R –Ø: Y- Ø: B- Ø:
Date of Erection: R –Ø: Y- Ø: B- Ø:	Date of Energisation:

II. Rated Data And Duty

Core	Ratio	Class	Burden	KVp	Protection / Metering
Winding I					
Winding II					
Winding III					
Winding IV					
Winding V					
Winding VI					

III. Pre-Commissioning Checks:

Sl. No	Description	Status		Remark
		Yes	No	Record Deficiencies, If Any
1	Equipment is cleaned and free from dust / dirt foreign materials etc.			
2	Equipment is free from all visible defects on physical inspection			
3	Levelling and alignment of structure and base frame is checked			
4	Erection completed as per schematic			
5	Any paint removed / scratched in transit has been touched up			
6	Check primary polarity of CTs erected as per relevant drawing. Name plate details and P1/ P2 marking are available on equipment enclosure.			
7	All the cable identification tags provided and all cores are provided with identification ferrules in CT sec box and LCC panel.			
8	Check secondary cables are properly routed and dressed with proper support/ trays and unused holes at cable entry are sealed.			
9	Check the IR value of secondary cable			
10	Check external cabling from LCC panel to relay panel completed			
11	Ensure unused secondary cores, if any, has been shorted and earthed in LCC panel.			
12	Check star point has been formed properly and grounded at relay panel end only.			
13	Check that lugs used in secondary circuit are of ring type			
14	Check direction of primary (P1/ P2) w.r.t. Bus/ line on erection			

IV. Insulation Resistance Measurement

a. Insulation Resistance Measurement in MΩ (Using 500 V Megger)

Make & Sl . No of testing kit _____

Date of last Calibration of the kit _____

Ambient temp. in ° C _____

Between	Unit	Phase		
		R Ø	YØ	B Ø
Secondary Core I – Earth	MΩ			
Secondary Core II – Earth	MΩ			
Secondary Core III – Earth	MΩ			
Secondary Core IV – Earth	MΩ			
Secondary Core V – Earth	MΩ			
Secondary Core VI – Earth	MΩ			

b.

Between	Unit	Phase		
		R Ø	YØ	B Ø
Core I – Core II	MΩ			
Core I – Core III	MΩ			
Core I – Core IV	MΩ			
Core I – Core V	MΩ			
Core I – Core VI	MΩ			
Core II – Core III	MΩ			
Core II – Core IV	MΩ			
Core II – Core V	MΩ			
Core II – Core VI	MΩ			
Core III – Core IV	MΩ			
Core III – Core V	MΩ			
Core III – Core VI	MΩ			
Core IV – Core V	MΩ			
Core IV – Core VI	MΩ			
Core V – Core VI	MΩ			

V. Measurement of Secondary Winding Resistance (In Ohm)

Make & Sl . No of testing kit _____

Date of last Calibration of the kit _____

Ambient temp. in ° C _____

Core	Terminal	Unit	R Ø		YØ		B Ø	
			Factory	Site	Factory	Site	Factory	Site
CORE I	1S1 – 1S2	Ω						
	1S1 – 1S3	Ω						
	1S1 – 1S4	Ω						
CORE II	2S1 – 2S2	Ω						
	2S1 – 2S3	Ω						
	2S1 – 2S4	Ω						
CORE III	3S1 – 3S2	Ω						
	3S1 – 3S3	Ω						
	3S1 – 3S4	Ω						
CORE IV	4S1 – 4S2	Ω						
	4S1 – 4S3	Ω						
	4S1 – 4S4	Ω						
CORE V	5S1 – 5S2	Ω						
	5S1 – 5S3	Ω						
	5S1 – 4S4	Ω						
CORE VI	6S1 – 6S2	Ω						
	6S1 – 6S3	Ω						
	6S1 – 6S4	Ω						

VI. POLARITY TEST

Core	Between		Phase		
			R Ø	YØ	B Ø
CORE I	1S1 (+VE)	1S2 (-VE)			
	1S1 (+VE)	1S3 (-VE)			
	1S1 (+VE)	1S4 (-VE)			
CORE II	2S1 (+VE)	2S2 (-VE)			
	2S1 (+VE)	2S3 (-VE)			
	2S1 (+VE)	2S4 (-VE)			
CORE III	3S1 (+VE)	3S2 (-VE)			
	3S1 (+VE)	3S3 (-VE)			
	3S1 (+VE)	3S4 (-VE)			
CORE IV	4S1 (+VE)	4S2 (-VE)			
	4S1 (+VE)	4S3 (-VE)			
	4S1 (+VE)	4S4 (-VE)			
CORE V	5S1 (+VE)	5S2 (-VE)			
	5S1 (+VE)	5S3 (-VE)			
	5S1 (+VE)	5S4 (-VE)			
CORE VI	6S1 (+VE)	6S2 (-VE)			
	6S1 (+VE)	6S3 (-VE)			
	6S1 (+VE)	6S4 (-VE)			

VII. Current Ratio Test

Make & Sl. No of testing kit _____

Date of last Calibration of the kit _____

R Phase-

Core	Between		Rated Ratio	Actual Ratio	Percentage Error
CORE I	1S1	1S2			
	1S1	1S3			
	1S1	1S4			
CORE II	2S1	2S2			
	2S1	2S3			
	2S1	2S4			
CORE III	3S1	3S2			
	3S1	3S3			
	3S1	3S4			
CORE IV	4S1	4S2			
	4S1	4S3			
	4S1	4S4			
CORE V	5S1	5S2			
	5S1	5S3			
	5S1	5S4			
CORE VI	6S1	6S2			
	6S1	6S3			
	6S1	6S4			

Y Phase-

Core	Between		Rated Ratio	Actual Ratio	Percentage Error
CORE I	1S1	1S2			
	1S1	1S3			
	1S1	1S4			
CORE II	2S1	2S2			

	2S1	2S3			
	2S1	2S4			
CORE III	3S1	3S2			
	3S1	3S3			
	3S1	3S4			
CORE IV	4S1	4S2			
	4S1	4S3			
	4S1	4S4			
CORE V	5S1	5S2			
	5S1	5S3			
	5S1	5S4			
CORE VI	6S1	6S2			
	6S1	6S3			
	6S1	6S4			

B Phase-

Core	Between		Rated Ratio	Actual Ratio	Percentage Error
CORE I	1S1	1S2			
	1S1	1S3			
	1S1	1S4			
CORE II	2S1	2S2			
	2S1	2S3			
	2S1	2S4			
CORE III	3S1	3S2			
	3S1	3S3			
	3S1	3S4			
CORE IV	4S1	4S2			
	4S1	4S3			
	4S1	4S4			

CORE V	5S1	5S2			
	5S1	5S3			
	5S1	5S4			
CORE VI	6S1	6S2			
	6S1	6S3			
	6S1	6S4			

VIII. Magnetizing Curve Performance

R Phase-

Core	Between		Rated Knee Point Voltage	Actual Knee Point Voltage	Ext. Current at Rated Knee point Voltage	Ext. Current at Actualr. Knee point Voltage
*CORE I	1S1	1S2				
	1S1	1S3				
	1S1	1S4				
*CORE II	2S1	2S2				
	2S1	2S3				
	2S1	2S4				
*CORE V	5S1	5S2				
	5S1	5S3				
	5S1	5S4				
*CORE VI	6S1	6S2				
	6S1	6S3				
	6S1	6S4				

Y Phase-

Core	Between		Rated Knee Point Voltage	Actual Knee Point Voltage	Ext. Current at Rated Knee point Voltage	Ext. Current at Actualr. Knee point Voltage
------	---------	--	--------------------------	---------------------------	--	---

*CORE I	1S1	1S2				
	1S1	1S3				
	1S1	1S4				
*CORE II	2S1	2S2				
	2S1	2S3				
	2S1	2S4				
*CORE V	5S1	5S2				
	5S1	5S3				
	5S1	5S4				
*CORE VI	6S1	6S2				
	6S1	6S3				
	6S1	6S4				

B Phase-

Core	Between		Rated Knee Point Voltage	Actual Knee Point Voltage	Ext. Current at Rated Knee point Voltage	Ext. Current at Actualr. Knee point Voltage
*CORE I	1S1	1S2				
	1S1	1S3				
	1S1	1S4				
*CORE II	2S1	2S2				
	2S1	2S3				
	2S1	2S4				
*CORE V	5S1	5S2				
	5S1	5S3				
	5S1	5S4				
*CORE VI	6S1	6S2				
	6S1	6S3				
	6S1	6S4				

*Note : To be carried out only for protection cores. Format has been designed considering a six core CT. Format may be modified by site depending upon number of Cores

IX. Final Documentation Review

i. Final documents of Pre- Commissioning checks reviewed and approved

Yes	No

ii. Document regarding spares equipment, O&M manuals etc available at site for O&M purpose

Yes	No

iii. After modification, if any, “As built Drawings” are available at site

Yes	No

Signature:

Signature:

Signature:

Signature:

Name:

Name:

Name:

Name:

Designation:

Designation:

Designation:

Designation:

Organization:

(Erection Agency)

(POWERGRID Site

(POWERGRID

(Supplier

I/C)

Commissioning. Team)

Representative)

Members:

(Wherever

1.

Applicable)

2.

3.

4.

PRE COMMISSIONING CHECKS ON POTENTIAL TRANSFORMERS

I. General Details

DETAILS	
Region:	Sub-Station:
Bay Name:	LOA No:
Make:	Primary Voltage Rating:
Secondary Voltage Rating:	Secondary Voltage Burden:
Winding - I:	Winding - I:
Winding - II:	Winding - II:
Winding - III:	Winding - III:
Sr. No:	Type:
R- Ø:	
Y- Ø:	
B- Ø:	
Year of Manufacturer:	Date of Receipt at site:
R-Ø:	R-Ø:
Y- Ø:	Y- Ø:
B- Ø:	B- Ø:
Date of Erection:	Date of Energisation:
R-Ø:	
Y- Ø:	
B- Ø:	

II. Impact Recorder

Status of Impact Recorder : OK/Not OK (If Not OK case may be referred to manufacturer for inspection)

III. Pre Commissioning Checks

Sl. No	Description	Status		Remarks Record Deficiencies, If Any
		YES	NO	
1	Equipment is free from all visible defects on physical inspection			
2	Check VT LV side winding has been provided with double earthing			

3	Check that PT secondary terminal box is earthed correctly as per specified GA drg.			
4	All nuts and bolts are tightened			
5	All fittings as per outline general arrangement drawing.			
6	Labelling and identification marking is available on GIS enclosure.			
7	Any paint removed / scratched in transit has been touched up			
8	Check secondary cable end box is properly fixed and ensure cable entry at the bottom.			
9	Check rating / healthiness of fuses at PT secondary terminal box			
10	Check the IR value of secondary cable (> 50 M ohms for control cables)			
11	All the cable identification tags provided and all cores are provided with identification ferrules at secondary terminal box and LCC panel			

IV. Continuity of Winding

i. Between terminals 1a – 1n

Yes	No

ii. Between terminals 2a – 1n

Yes	No

iii. Between terminals 3a – 1n

Yes	No

V. Secondary Winding Resistance

Phase	Core – I		Core – II		Core – III	
	Factory	Site	Factory	Site	Factory	Site
R - \emptyset						
Y - \emptyset						
B - \emptyset						

Factory Test Report Ref. No: _____

VI. Insulation Resistance Measurement (at 500 V)

Between	Unit	Measured Value		
		R \emptyset	Y \emptyset	B \emptyset
Secondary Core – I to Earth	M Ω			
Secondary Core – II to Earth	M Ω			
Secondary Core – III to Earth	M Ω			
Core – I to Core – II	M Ω			
Core - I to Core – III	M Ω			
Core – II to Core – III	M Ω			

VII. Voltage Ratio Test

To be tested at the time of HV test (during fifteen minute conditioning)

Phase	Primary Voltage	Secondary Voltage		Rated Ratio	Measured Ratio	Percentage Error
		Theoretical	Measured			
R						
Y						
B						

VIII. Final Documentation Review

i. Final documents of Pre- Commissioning checks reviewed and approved

Yes	No

ii. Document regarding spares equipment, O&M manuals etc available at site for O&M purpose

Yes	No

iii. After modification, if any, “As built Drawings” are available at site

Yes	No

Signature:

Signature:

Signature:

Signature:

Name:

Name:

Name:

Name:

Designation:

Designation:

Designation:

Designation:

Organization:

(Erection Agency)

(POWERGRID Site

(POWERGRID

(Supplier

I/C)

Commissioning. Team)

Representative)

Members:

(Wherever

1.

Applicable)

2.

3.

4.

PRE-COMMISSIONING FORMATS FOR ISOLATOR AND GROUNDING SWITCH**I. GENERAL DETAILS**

DETAILS	
Region:	Sub-Station:
Feeder name:	LOA No. :
Make:	Type:
Sr. No.: R Ø:- Y Ø:- B Ø:-	Operating Voltage rating
Control Voltage:	Current Carrying capacity:
Year of Manufacture: R Ø:- Y Ø:- B Ø:-	Date of Receipt at site: R Ø:- Y Ø:- B Ø:-
Date of Erection: R Ø:- Y Ø:- B Ø:-	Date of Energisation :

II. PRE-COMMISSIONING CHECKS

SL.NO	DESCRIPTION	STATUS		REMARK / RECORD DEFICIENCIES, IF ANY
		YES	NO	
1	Equipment is free from dirt/dust foreign materials etc.			
2	Equipment is free from all visible defects on physical Inspection			
3	All nuts and bolts are tightened correctly as per specified Torque			
4	Equipment erection is complete in all respect as per instruction Manual (attach remaining activities, if any)			
5	Auxiliary contacts and relays have been cleaned and free from rust / damage			

6	Functional checking of auxiliary contacts for indications and interlocks			
7	Earth switch connected to earth firmly			
8	Earth switch link grounding point marked clearly			
9	Interlocks checked as per approved scheme with all combinations			
10	Check that operation and positioning of the limit switch & the auxiliary contacts assembly are ok			
11	Check that all three phase isolators are closing & opening at a time			
12	Position indicator of isolator/earth switch drive checked			
13	Checking of manual operation through handle			
14	Electrical operation blocking during manual operation			

III. MOTOR DETAILS

	R - Ø	Y - Ø	B - Ø
Make			
Type			
Volt			
Amperes			
Hp/ kW			
O/L setting (Thermal Over load)			

IV. INSULATION RESISTANCE MEASUREMENT

Make of testing kit :

Date of calibration :

Ambient temperature :

Using 500 volt megger measure resistance between the winding of motor and earth

SL. NO	BETWEEN	PHASE		
		R Ø	Y Ø	B Ø
1	Winding to Earth			

PERMISSIBLE LIMIT (Min): 50 M ohm

V. OPERATIONAL CHECKS

- i. Operate the isolator and record the motor current

ISOLATOR OPERATION	MOTOR CURRENT					
	R – Ø		Y – Ø		B – Ø	
	FACTORY	SITE	FACTORY	SITE	FACTORY	SITE
CLOSE						
OPEN						

- ii. Operation of isolator from local / remote Ok/Not Ok

ISOLATOR OPERATION	CONTROL PANEL	
	LOCAL	REMOTE
CLOSE	OK	OK
OPEN	OK	OK

- iii. Measurement of operating time

OPERATION	UNIT	PHASE		
		R - Ø	Y - Ø	B - Ø
OPENING TIME	Sec			
CLOSING TIME	Sec			

VI. FINAL DOCUMENTATION REVIEW

- i. Final documents of Pre- Commissioning checks reviewed and approved

Yes	No

ii. Document regarding spares equipment, O&M manuals etc available at site for O&M purpose

Yes	No

iii. After modification, if any, “As built Drawings” are available at site

Yes	No

Signature:	Signature:	Signature:	Signature:
Name:	Name:	Name:	Name:
Designation:	Designation:	Designation:	Designation:
Organization: (Supplier Representative) (Wherever Applicable)	(Erection Agency)	(POWERGRID Site I/C)	(POWERGRID Commissioning Team) Members: 1. 2. 3. 4.

PRE COMMISSIONING CHECKS ON GIS

I. Contact Resistance Measurement

Contact Resistance Measurement to be conducted for whole GIS by injecting 100 A current or more.

Contact Resistance Measurement to be carried out using following philosophy:

- a. Contact Resistance Measurement should be carried out using two adjacent Earth Switches. Measurement path shall include resistance of Main Conductor as well as Earth Switches.
- b. Long Sections by skipping adjacent Earth Switches shall not be acceptable
- c. Design/ factory test values to be provided by Manufacturer before starting Contact Resistance Measurement.
- d. In case any deviation in measured value of contact resistance w.r.t. design value, checking of connections and re-measurement should be attempted prior to forwarding results to CC/AM for review.
- e. Justification for variation in contact resistance beyond permissible limit to be taken from Manufacturer.
- f. Measurement of Contact Resistance can also be done by using milli volt drop method in case of limitation on account of cable length to be used for injecting current by CRM kit.

Typical Configuration for performing Contact Resistance Measurement for reference SLD (Double Main Bus Scheme) attached as Annexure – I has been shown in the table.

Make of Testing Kit:

Serial Number of Kit:

Date of Calibration of Kit:

Ambient Temperature:

Bay/Equipment Details	Phase	Between		Date	Measured Value	*Expected /Design Value
		Point No	Point No			
	R	1	2			
	Y	1	2			
	B	1	2			
	R	2	3			
	Y	2	3			
	B	2	3			
	R	3	4 (Bus – I)			
	Y	3	4 (Bus – I)			
	B	3	4 (Bus – I)			
	R	3	4 (Bus – II)			
	Y	3	4 (Bus – II)			
	B	3	4 (Bus – II)			
	R	3	5			
	Y	3	5			
	B	3	5			

	R	3	6			
	Y	3	6			
	B	3	6			
	R	4	5			
	Y	4	5			
	B	4	5			
	R	4	6			
	Y	4	6			
	B	4	6			
	R	6	7			
	Y	6	7			
	B	6	7			
	R	5	8			
	Y	5	8			
	B	5	8			
	R	7	8			
	Y	7	8			
	B	7	8			

Permissible limit: +/- 20 percentage of design value

Note:

1. CRM Measurement for a bay to be carried out in following parts:
 - a. Line/ICT/Reactor side Isolator Earth switch (Point no: 1) to CB – Line/ICT/Reactor side Earth switch (Point no: 2)
 - b. CB – Line/ICT/Reactor side Earth switch (Point no: 2) to CB – Bus side Earth switch (Point no: 3)
 - c. CB – Bus side Earth switch (Point no: 3) to adjacent bay CB – Bus side Earth switch (Point no: 4) (Through Both bus)
2. CRM measurement from Bus side Isolators (Q1/89A & Q2/89B) to Bus Earth Switch to be carried out for each bay for references at the time of Maintenance in future.

Typical Configuration for performing Contact Resistance Measurement for reference SLD (One and Half Breaker Scheme) attached as Annexure – II has been shown in the table.

Bay/Equipment Details	Phase	Between		Date	Measured Value	*Expected /Design Value
		Point No	Point No			
	R	1	2			
	Y	1	2			
	B	1	2			
	R	2	3			
	Y	2	3			
	B	2	3			
	R	3	4			
	Y	3	4			
	B	3	4			
	R	4	5			
	Y	4	5			
	B	4	5			
	R	5	6			
	Y	5	6			
	B	5	6			
	R	6	14			
	Y	6	14			
	B	6	14			
	R	1	9			
	Y	1	9			
	B	1	9			
	R	6	7			
	Y	6	7			
	B	6	7			
	R	1	8			
	Y	1	8			
	B	1	8			
	R	2	16			
	Y	2	16			
	B	2	16			
	R	15	16			
	Y	15	16			
	B	15	16			
	R	3	16			
	Y	3	16			
	B	3	16			
	R	15	19			
	Y	15	19			
	B	15	19			
	R	4	20			

	Y	4	20			
	B	4	20			
	R	5	20			
	Y	5	20			
	B	5	20			
	R	20	21			
	Y	20	21			
	B	20	21			
	R	20	24			
	Y	20	24			
	B	20	24			

Permissible limit: +/- 20 percentage of design value

Note:

1. CRM measurement from Bus side Isolators to Bus Earth Switch to be carried out for each bay for references at the time of Maintenance in future.

II. DS & ES Electrical Operations Test

a. For Double Main Bus Scheme, Sample SLD for reference attached as Annexure - III

Bay Details	Equipment Details	Operation	SCADA	LCC Panel Indication Lamp	Status Indicator At Equipment
	Q1/89A	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q2/89B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q51/ES	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q52/ES	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q9/89L	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q8/89LE	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK

b. For One and Half Breaker Scheme, Sample SLD attached as Annexure - IV

Bay Details	Equipment Details	Operation	SCADA	LCC Panel Indication Lamp	Status Indicator At Equipment
	Q1A	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q51A	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q52A	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q2A	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q2C	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK

	Q52C	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q51C	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q1C	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q2B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q52B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q51B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q1B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q54A-R	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q54A-Y	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q54A-B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q11A-R	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q11A-Y	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q11A-B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q10B-R	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q10B-Y	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q10B-B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q55A-R	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q55A-Y	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q55A-B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q55B-R	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q55B-Y	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q55B-B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q10B-R	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK

	Q10B-Y	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q10B-B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q11B-R	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q11B-Y	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q11B-B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q54B-R	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q54B-Y	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK
	Q54B-B	Close	OK/NOT OK	OK/NOT OK	OK/NOT OK
		Open	OK/NOT OK	OK/NOT OK	OK/NOT OK

III. Alarms & Annunciation Check

Description of Alarm	Initiating Point		Checked At	
	Device Name (Density Monitor/ Relay etc)	Terminal No As per Drawing	LCC Panel Facia	SCADA HMI Alarm
Compartment 1 R phase Loss of SF6				
Compartment 1 Y phase Loss of SF6				
Compartment 1 B phase Loss of SF6				
Compartment 1 General Lockout				
Compartment 1 R phase Zone trip				
Compartment 1 Y phase Zone trip				
Compartment 1 B phase Zone trip				
Compartment 2 R phase Loss of SF6				
Compartment 2 Y phase Loss of SF6				
Compartment 2 B phase Loss of SF6				
Compartment 2 General Lockout				

Compartment 2 R phase Zone trip				
Compartment 2 Y phase Zone trip				
Compartment 2 B phase Zone trip				
Compartment N R phase Loss of SF6				
Compartment N Y phase Loss of SF6				
Compartment N B phase Loss of SF6				
Compartment N General Lockout				
Compartment N R phase Zone trip				
Compartment N Y phase Zone trip				
Compartment N B phase Zone trip				
CB Lockout				
CB Phase Discrepancy				
CB Motor Protection				
CB Motor Run Time Exceed				
CB Spring Discharge				
DC Failure				
Dis connector Q1 Blocked Mode				
Dis connector Q2 Blocked Mode				

Dis connector Q9 Blocked Mode				
ES Q51 Blocked Mode				
ES Q52 Blocked Mode				
ES Q53 Blocked Mode				
Dis connector Q1 Manual Mode				
Dis connector Q2 Manual Mode				
Dis connector Q9 Manual Mode				
ES Q51 Manual Mode				
ES Q52 Manual Mode				
ES Q53 Manual Mode				
Any other alarms				

IV. CHECKING OF INTERLOCKS

For Double Main Bus Scheme

Typical Configuration for checking interlocks for reference bay attached as Annexure – V has been shown in the table. The same principle should be replicated to each bay and the conditions should be derived from the scheme approved by Engineering department.

Circuit Breaker	Q0							
Operation	Q1	Q2	Q9	Q51	Q52	Possible/Not Possible	OK/Not OK	
Close	Close	Open	Close	NA	NA	Possible		
	Open	Open	Close	NA	NA	Not Possible		
	Open	Open	Open	NA	NA	Not Possible		
	Close	Open	Open	NA	NA	Not Possible		
	Open	Close	Close	NA	NA	Possible		
	Open	Open	Close	NA	NA	Not Possible		
	Open	Open	Open	NA	NA	Not Possible		
	Open	Close	Open	NA	NA	Not Possible		
	NA	NA	NA	Close	Close	Possible		
	NA	NA	NA	Open	Open	Not Possible		
	NA	NA	NA	Close	Open	Not Possible		
	NA	NA	NA	Open	Close	Not Possible		
Isolator	Q1							
Operation	C404 - Q51 (Bus Coupler Bay)	Q0	Q2	Q51	Q52	Selector Switch Position of Q1	Possible/N ot Possible	OK/Not OK
Close/Open	Open	Open	Open	Open	Open	Not in Manual	Possible	
	Close	Open	Open	Open	Open	Not in Manual	Not Possible	
	Open	Close	Open	Open	Open	Not in Manual	Not Possible	
	Open	Open	Close	Open	Open	Not in Manual	Not Possible	
	Open	Open	Open	Close	Open	Not in Manual	Not Possible	
	Open	Open	Open	Open	Close	Not in Manual	Not Possible	
	Open	Open	Open	Open	Open	Manual	Not Possible	
Operation	C404 - Q0 (Bus Coupler Bay)	C404 - Q1 (Bus Coupler Bay)	C404 - Q2 (Bus Coupler Bay)	Q0	Q2	Selector Switch Position of Q1	Possible/N ot Possible	OK/Not OK
	Close	Close	Close	Close	Close	Not in	Possible	

Close/Open						Manual		
	Open	Close	Close	Close	Close	Not in Manual	Not Possible	
	Close	Open	Close	Close	Close	Not in Manual	Not Possible	
	Close	Close	Open	Close	Close	Not in Manual	Not Possible	
	Close	Close	Close	Close	Open	Not in Manual	Not Possible	
	Close	Close	Close	Close	Close	Manual	Not Possible	

Isolator	Q2							
Operation	C404 - Q52 (Bus Coupler Bay)	Q0	Q1	Q51	Q52	Selector Switch Position of Q2	Possible/Not Possible	OK/ Not OK
Close/Open	Open	Open	Open	Open	Open	Not in Manual	Possible	
	Close	Open	Open	Open	Open	Not in Manual	Not Possible	
	Open	Close	Open	Open	Open	Not in Manual	Not Possible	
	Open	Open	Close	Open	Open	Not in Manual	Not Possible	
	Open	Open	Open	Close	Open	Not in Manual	Not Possible	
	Open	Open	Open	Open	Close	Not in Manual	Not Possible	
	Open	Open	Open	Open	Open	Manual	Not Possible	
Operation	C404 - Q0 (Bus Coupler Bay)	C404 - Q1 (Bus Coupler Bay)	C404 - Q2 (Bus Coupler Bay)	Q0	Q2	Selector Switch Position of Q2	Possible/Not Possible	OK/ Not OK
Close/Open	Close	Close	Close	Close	Close	Not in Manual	Possible	
	Open	Close	Close	Close	Close	Not in Manual	Not Possible	
	Close	Open	Close	Close	Close	Not in Manual	Not Possible	
	Close	Close	Open	Close	Close	Not in Manual	Not Possible	
	Close	Close	Close	Close	Open	Not in Manual	Not Possible	
	Close	Close	Close	Close	Close	Manual	Not Possible	

Earth Switch	Q51					
Operation	Q1	Q2	Q9	Selector Switch Position of Q51	Possible/Not Possible	OK/ Not OK
Close/Open	Open	Open	Open	Not in Manual	Possible	
	Close	Open	Open	Not in Manual	Not Possible	
	Open	Close	Open	Not in Manual	Not Possible	
	Open	Open	Close	Not in Manual	Not Possible	
	Open	Open	Open	Manual	Not Possible	

Earth Switch	Q52					
Operation	Q1	Q2	Q9	Selector Switch Position of Q52	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Not in Manual	Possible	
	Close	Open	Open	Not in Manual	Not Possible	
	Open	Close	Open	Not in Manual	Not Possible	
	Open	Open	Close	Not in Manual	Not Possible	
	Open	Open	Open	Manual	Not Possible	

Isolator	Q9							
	Q0	Q51	Q52	Q8	LV E/SW	Selector Switch Position of Q9	Possible/Not Possible	OK/Not OK
Operation	Open	Open	Open	Open	Open	Not in Manual	Possible	
Close/Open	Close	Open	Open	Open	Open	Not in Manual	Not Possible	
	Open	Close	Open	Open	Open	Not in Manual	Not Possible	
	Open	Open	Close	Open	Open	Not in Manual	Not Possible	
	Open	Open	Open	Close	Open	Not in Manual	Not Possible	
	Open	Open	Open	Open	Close	Not in Manual	Not Possible	
	Open	Open	Open	Open	Open	Manual	Not Possible	

Earth Switch	Q8				
Operation	Q9	Q9 IV side	Selector Switch Position of Q8	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Not in Manual	Possible	
	Close	Open	Not in Manual	Not Possible	
	Open	Close	Not in Manual	Not Possible	
	Open	Open	Manual	Not Possible	

For One & Half Breaker Scheme

Typical Configuration for checking interlocks for reference bay attached as Annexure – VI has been shown in the table. The same principle should be replicated to each bay and the conditions should be derived from the scheme approved by Engineering department.

For an ICT Main Bay

Isolator	709-89A						
Operation	709-89AE2	Bus side Earth Switch Any Other bay-89AE2	709-89BE	709-89AE1	709-52	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Close	Not Possible	

Isolator	709-89B							
							Possible/Not Possible	OK/ Not OK
Operation	709-89BE	709-89AE1	709-52	709-89TSE1R	709-89TSE1Y	709-89TSE1B		
Close/Open	Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Open	Not Possible	
	Open	Open	Close	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Open	Close	Not Possible	

Earth Switch	709-89AE2			
Operation	Isolator of Main Bay connected to Bus same as 709	709-89A	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Earth Switch	709-89AE1			
Operation	709-89A	709-89B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	
Earth Switch	709-89BE			
Operation	709-89A	709-89B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Circuit Breaker	709-52 (Local Operation)			
Operation	709-89AE1	709-89BE	Possible/Not Possible	OK/Not OK
Close/Open	Close	Close	Possible	
	Open	Close	Not Possible	
	Close	Open	Not Possible	

Isolator	709-89T-R											
Operation	709-52	708-52	LV Side - Main CB	LV Side - Tie CB	709-89T-S1R&S2R	709-89TE-R	LV Side ICT - 89TE-R	709-89TSE1 R	709-89TSE1 Y	709-89TSE1 B	Possible/Not Possible	OK / Not OK
Close/Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Close	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Close	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Close	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Open	Close	Not Possible	

Isolator	709-89T-Y											
Operation	709-52	708-52	LV Side - Main CB	LV Side - Tie CB	709-89T-S1Y&S2Y	709-89TE-Y	LV Side ICT - 89TE-Y	709-89TSE1R	709-89TSE1Y	709-89TSE1E1B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Close	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Close	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Close	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Open	Close	Not Possible	
Isolator	709-89T-B											
Operation	709-52	708-52	LV Side - Main CB	LV Side - Tie CB	709-89T-S1B&S2B	709-89TE-B	LV Side ICT - 89TE-B	709-89TSE1R	709-89TSE1Y	709-89TSE1E1B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Close	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Close	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Close	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Open	Close	Not Possible	

Isolator	709-89T-S1R&S2R											
Operation	709-52	708-52	LV Side - Main CB	LV Side - Tie CB	709-89T-R	709-89T-S1Y&S2Y	709-89T-S1B&S2B	709-89TSE1 R	709-89TSE1 Y	709-89TSE1 B	Possible/ Not Possible	OK / Not OK
Close/Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Close	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Close	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Close	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Open	Close	Not Possible	

Isolator	709-89T-S1Y&S2Y											
Operation	709-52	708-52	LV Side - Main CB	LV Side - Tie CB	709-89T-Y	709-89T-S1R&S2R	709-89T-S1B&S2B	709-89TSE1 R	709-89TSE1 Y	709-89TSE1 B	Possible/ Not Possible	OK/ Not OK
Close/Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Close	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Close	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Close	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Open	Close	Not Possible	

Isolator	709-89T-S1B&S2B											
Operation	709-52	708-52	LV Side - Main CB	LV Side - Tie CB	709-89T-B	709-89T-S1R&S2R	709-89T-S1Y&S2Y	709-89TSE 1 R	709-89TSE1 Y	709-89TSE 1 B	Possible/Not Possible	OK / Not OK
Close/Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Close	Open	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Close	Open	Open	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Close	Open	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Open	Open	Open	Open	Open	Close	Not Possible	

For a Tie Bay (Line & ICT)

Isolator	708-89A							
Operation	708-52	708-89AE	708-89BE	709-89TSE1R	709-89TSE1Y	709-89TSE1B	Possible/Not Possible	OK/ Not OK
Close/Open	Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Open	Not Possible	
	Open	Open	Close	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Open	Not Possible	
	Open	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Open	Close	Not Possible	

Isolator	708-89B				
Operation	708-52	708-89AE	708-89BE	Possible/Not Possible	OK/ Not OK
Close/Open	Open	Open	Open	Possible	
	Close	Open	Open	Not Possible	
	Open	Close	Open	Not Possible	
	Open	Open	Close	Not Possible	

Earth Switch	708-89AE			
Operation	708-89A	708-89B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Earth Switch	708-89BE			
Operation	708-89A	708-89B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Circuit Breaker	708-52 (Local Operation)			
Operation	708-89AE	709-89BE	Possible/Not Possible	OK/Not OK
Close/Open	Close	Close	Possible	
	Open	Close	Not Possible	
	Close	Open	Not Possible	

For a Line Main Bay

Isolator	707-89A						
Operation	707-89AE2	Bus side Earth Switch Any Other bay-89AE2	707-89BE	707-89AE1	707-52	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Open	Not Possible	
	Open	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Open	Close	Not Possible	

Isolator	707-89B				
Operation	707-89BE	707-89AE1	707-52	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Possible	
	Close	Open	Open	Not Possible	
	Open	Close	Open	Not Possible	
	Open	Open	Close	Not Possible	

Isolator	707-89L				
Operation	707-89LE	708-52	707-52	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Possible	
	Close	Open	Open	Not Possible	
	Open	Close	Open	Not Possible	
	Open	Open	Close	Not Possible	

Earth Switch	707-89AE1			
Operation	707-89A	707-89B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Earth Switch	707-89BE			
Operation	707-89A	707-89B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Earth Switch	707-89AE2			
Operation	Isolator of Main Bay connected to Bus same as 707	707-89A	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Circuit Breaker	707-52 (Local Operation)			
Operation	707-89AE1	709-89BE	Possible/Not Possible	OK/Not OK
Close/Open	Close	Close	Possible	
	Open	Close	Not Possible	
	Close	Open	Not Possible	

For ICT (without Spare ICT Switching Scheme) Main Bay

Typical Configuration for checking interlocks for reference bay attached as Annexure – VII has been shown in the table. The same principle should be replicated to each bay and the conditions should be derived from the scheme approved by Engineering department.

Isolator	4Z-89B					
Operation	4n-89BE2	4Z-52	4Z89BE/BE-1	4Z-89AE	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Open	Possible	
	Close	Open	Open	Open	Not Possible	
	Open	Close	Open	Open	Not Possible	
	Open	Open	Close	Open	Not Possible	
	Open	Open	Open	Close	Not Possible	

Earth Switch	4Z-89BE/BE1			
Operation	4Z-89B	4Z-89A	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Isolator	4Z-89A				
Operation	4Z-52	4Z-89AE	4Z-BE/BE1	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Possible	
	Close	Open	Open	Not Possible	
	Open	Close	Open	Not Possible	
	Open	Open	Close	Not Possible	

Earth Switch	4Z-89AE			
Operation	4Z-89B	4Z-89B	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Isolator	4Z-89T				
Operation	4Z-52	4B-52	4Z-89TE	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Open	Possible	
	Close	Open	Open	Not Possible	
	Open	Close	Open	Not Possible	
	Open	Open	Close	Not Possible	

Earth Switch	4Z-89TE			
Operation	4Z-89T	220 KV Line Isolator	Possible/Not Possible	OK/Not OK
Close/Open	Open	Open	Possible	
	Close	Open	Not Possible	
	Open	Close	Not Possible	

Circuit Breaker	4Z-52 (Local Operation)				
Operation	4Z-52 Mode	4Z-89AE	4Z-89BE/BE1	Possible/Not Possible	OK/Not OK
Close/Open	Local	Open	Open	Possible	
	Local	Close	Open	Not Possible	
	Local	Open	Close	Not Possible	

V. High Voltage and Partial Discharge Measurements

a. Onsite Sensitivity Test

The sensitivity verification test to be done in accordance to CIGRE Task Force 15/33.03.05 of working group 15.03. the onsite UHF sensor Sensitivity verification is done before performing HV test & PD test so as to ascertain the proper functioning of UHF sensors & kit. Artificial pulses are injected into PD couplers to stimulate electromagnetic wave and measured in the adjacent couplers. Sensitivity test is performed by injecting a artificial pulse magnitude equivalent to apparent charge of 5 pc in UHF sensors and then detecting PD in adjacent UHF sensors. The calibration/test report of artificial pulse injector to prove equivalence to 5 pC in accordance to Step I of the CIGRE Task Force TF 15/33.05.05 procedure is required to be submitted by the testing agency. Sensitivity values measured at sensors during on-site sensitivity verification test as a reference value and saved to compare with actual PD measured to determine if actual PD is less/ more than 5 pC. By conducting sensitivity test, it can be ensured that a defect/ particle creating a partial discharge of 5 pc or above can be detected during PD measurements by the kit. As per CIGRE recommendation, Onsite Sensitivity Test should be done using same UHF sensors, Pulse Generator & PD Test System which have been in the factory at the time of determination of artificial pulse magnitude.

The artificial pulse injected at any PD coupler must be detectable by the adjacent PD couplers and if the same is not detected, matter to be taken up with manufacturer for review of location of PD couplers of GIS.

Requirements:

Sensitivity test plan to be submitted to Site Incharge for approval with following details :

- Single Line Diagram showing position of UHF sensors along with sensor ID
- Sensor Combinations to be used for sensitivity measurement as per "Sensitivity – Sensor Combination Table" shown below.
- Test report of artificial pulse injector to prove equivalence to 5 pC in accordance to Step I of the CIGRE Task Force TF 15/33.05.05
- Calibration report of standard signal generator.

Typical Configuration for conducting Sensitivity test for reference SLD attached as Annexure – VIII has been shown in the table.

Sensitivity – Sensor Combination Table

Bay/ Equipment Details	Phase	Pulse Injected at Sensor No	Measuring Sensor & Measured Value (in dB, %, mV)		Measuring Sensor & Measured Value (in dB, %, mV)		Measuring Sensor & Measured Value (in dB, %, mV)	
			Sensor	Value	Sensor	Value	Sensor	Value
	R	1	2					
	Y	1	2					
	B	1	2					
	R	2	8		1			
	Y	2	8		1			
	B	2	8		1			
	R	6	5		10		9	
	Y	6	5		10		9	

	B	6	5		10		9	
	R	10	11		4			
	Y	10	11		4			
	B	10	11		4			

Based on above combinations shown in table as reference, sensitivity test for different combinations possible at site shall be performed.

Prior to commencement of test, sensitivity test plan submitted by manufacturer to be sent to CC/AM for approval atleast one week in advance.

b. High Voltage Test

High Voltage test is performed on GIS before commencing PD measurement. Test voltage will be applied between phase and earth with other two phases and enclosure in earthed condition. Test voltage will be supplied by a resonant test system of variable frequency. High Voltage is achieved by resonating the test kit at a particular frequency. The resonant frequency will be different depending on capacitance of GIS test sections. Test frequency should not be less than frequency guaranteed by VT manufacturer.

Requirements:

1. Secondary circuit of VT are open.
2. Secondary circuit of CT are short circuited and earthed.
3. HV cables are disconnected from GIS.
4. ICTs, Reactors and Transmission lines are disconnected from GIS.
5. Valid Calibration report of HV test kit is available.
6. All the Earth switches of the testing section shall be open and earthing link shall be tight
7. Voltage transformers to be connected (minimum upto rated voltage) and tested with switchgear

Note: It is to be ensured that all pre commissioning test shall be completed before starting High Voltage test (as per IEC 62271-102 Clause No : 10.2.101.1.1).

Prior to commencement of HV test, test plan for same submitted by manufacturer to be sent to CC/AM for approval atleast one week in advance.

Make of Testing Kit:

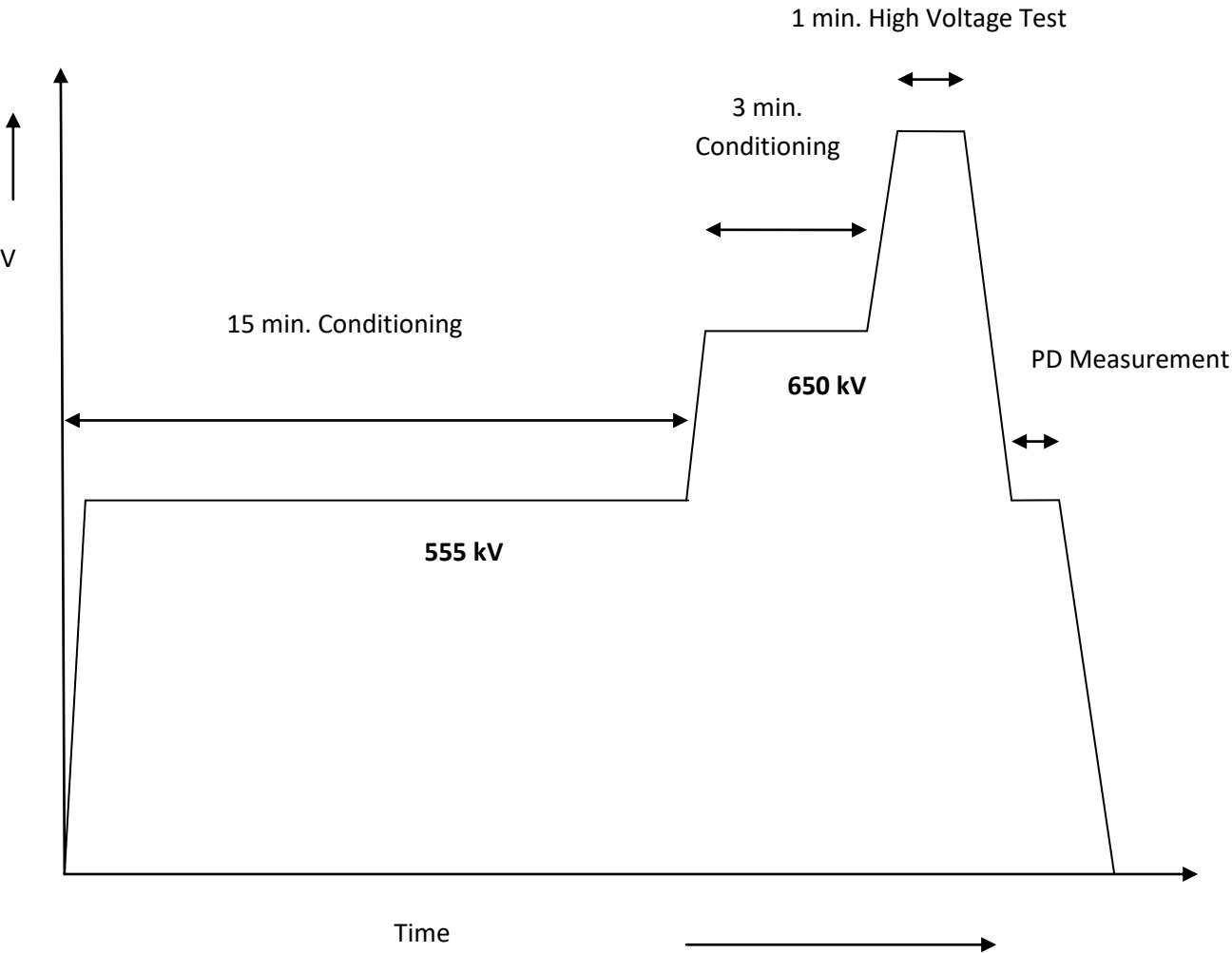
Serial Number of Kit:

Date of Calibration of Kit:

Ambient Temperature:

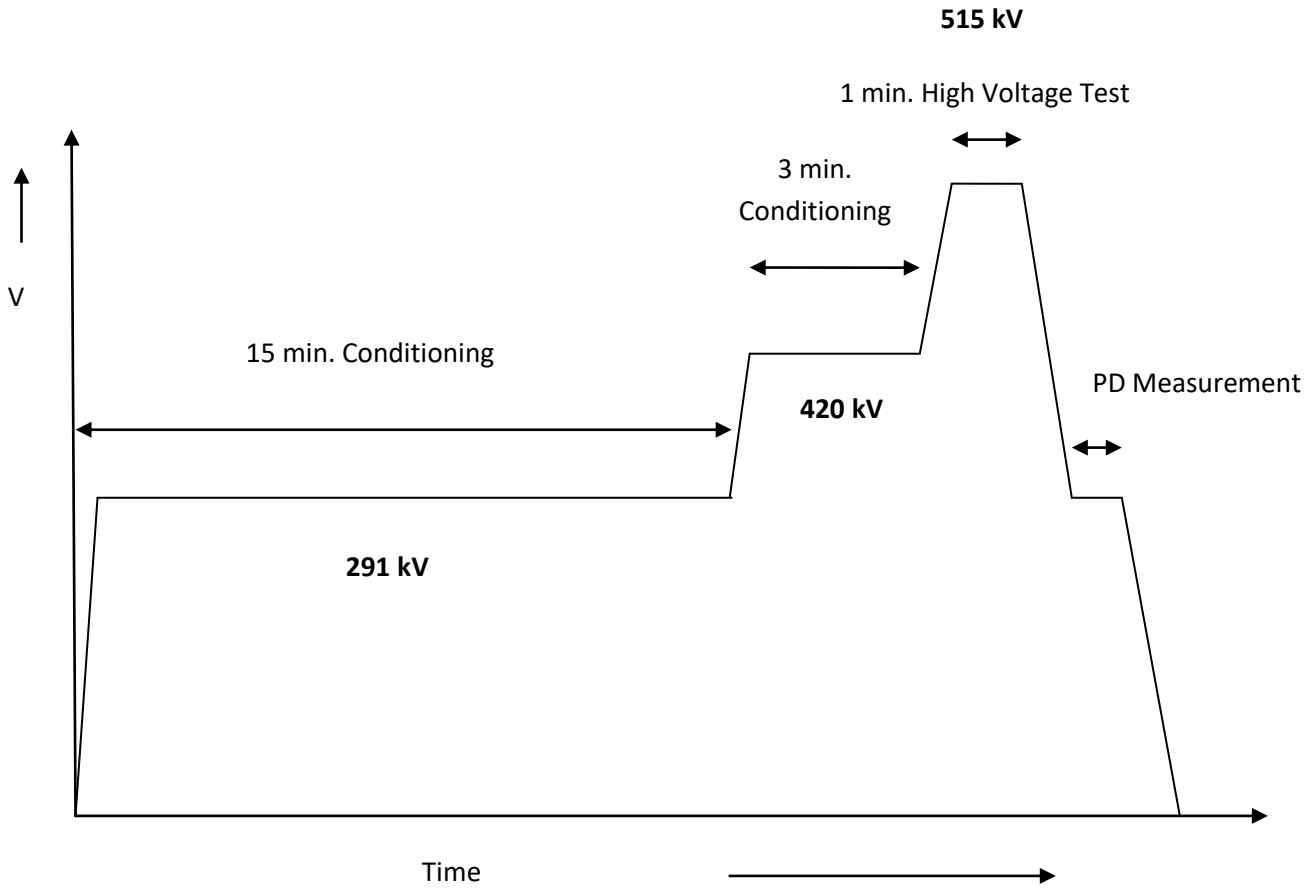
800 KV GIS

760 kV



Note: $U_d = 0.45 \times 0.8 \times \text{lightning impulse voltage}$
As per IEC 62271-203

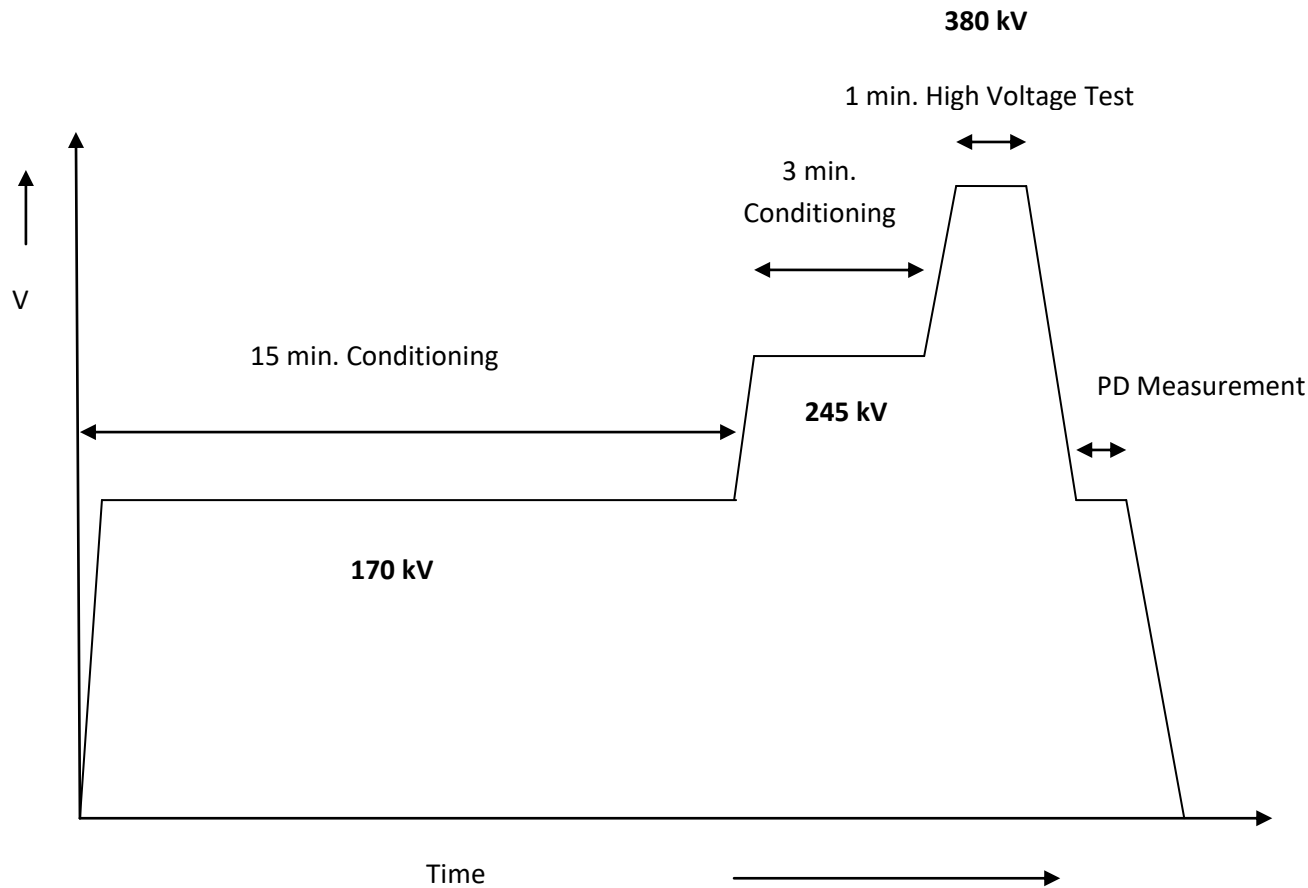
Bay/Equipment Details	Phase	Date	555 KV for 15 minutes	650 KV for 3 minutes	760 KV for 1 minute	PD Voltage 555 KV	Remarks (if any) Regarding Flashovers
	R						
	Y						
	B						
	R						
	Y						
	B						
	R						
	Y						

420 KV GIS

Note: $U_d = 0.45 \times 0.8 \times \text{lightning impulse voltage}$
As per IEC 62271-203

Bay/Equipment Details	Phase	Date	291 KV for 15 minutes	420 KV for 3 minutes	515 KV for 1 minute	PD Voltage 291 KV	Remarks (if any) Regarding Flashovers
	R						
	Y						
	B						
	R						
	Y						
	B						
	R						
	Y						
	B						

245 KV GIS



Note: $U_d = 0.45 \times 0.8 \times \text{lightning impulse voltage}$
As per IEC 62271-205

Bay/Equipment Details	Phase	Date	170 KV for 15 minutes	245 KV for 3 minutes	380 KV for 1 minute	PD Voltage 170 KV	Remarks (if any) Regarding Flashovers
	R						
	Y						
	B						
	R						
	Y						
	B						
	R						
	Y						
	B						

c. Partial Discharge Measurement

PD measurement is conducted to detect any void/contamination/surface defect/floating particle defect in GIS before commissioning. PD test to be done immediately after completion of Hi Voltage as shown in HV test diagram above.

Maximum permissible Limit for PD measurement of GIS is 5 pC as per IEC 62271-203. The PD measurement taken for each UHF coupler is compared with the results obtained in sensitivity test to compare if the actual PD is higher than 5 pC.

Note:

1. Background Noise pattern without High Voltage and artificial pulse injection shall also recorded for reference at the time of PD Measurement.
2. PD Measurement kit to be synchronized with Voltage feedback from Hi voltage test system.
3. PD graphs corresponding to each sensor measured during test needs to be saved both in soft as well as hard form for future reference at the time of O&M period.
4. In case any partial discharge is observed at any sensor, PRPD pattern of that sensor to be recorded to ascertain type of partial discharge (void/floating electrode/noise stc).

d. Switching Impulse Test (To be carried out only incase provision for this test exists in Scope of Contract)

Switching Impulse Test is carried out on 800kV rating Gas Insulated Substation to detect presence of contaminations & abnormal field configurations.

Requirements

- a. GIS must be filled with SF6 at rated pressure.
- b. Secondary windings of all CTs should be short circuited & grounded.
- c. Voltage Transformers must be open
- d. Surge Arresters must be dis-mantled.
- e. During Test, ICTs, Reactors, Transmission lines & Cables must be disconnected from GIS.
- f. Valid Calibration report of Impulse Voltage Generator test kit is available.
- g. All the Earth switches of the testing section shall be open and earthing link shall be tight

Procedure

GIS shall be subjected to three impulses of each polarity (positive & negative) and values of impulses shall be calculated as per following formula mentioned in IEC 62271 – 100 :

Test Voltage = $0.8 \times \text{Rated Switching Impulse Level}$

As per Technical Specifications, Rated Switching Impulse Level for 800kV GIS has been mentioned as 1550kV.

Test Voltage = $0.8 \times 1550 = 1240\text{kV peak}$

In order to pass the test, GIS must withstand three impulses of each polarity (positive & negative) with full test test voltage (i.e. 1240kV pk).

VI. Earth Resistance Measurement

Earth Resistance needs to be measured for Outdoor Yard (at each voltage level) and each Bay in GIS Hall.

Indoor GIS Hall

SI	Bay	Resistance (In Ohm)

Outdoor (To be Measured at Minimum 2 locations in yard for each Voltage Level)

SI	Voltage Level	Resistance (In Ohm)	
		Location – I	Location – II

FORMAT FOR RECORD OF MAJOR FAILURES OF EQUIPMENT AND COMPONENTS DURING PRE-COMMISSIONING STAGE

In order to have complete information of problems observed during pre-commissioning stage for assessment of quality of product and erection workmanship, record of major problems is required to be maintained. This helps in identifying the critical area vulnerable/ prone to failure and analysing the same to avert the same in future during O&M stage with the help of manufacture/ supplier. The record of major problems observed during erection and pre-commissioning stage to be maintained in the format given below and to be signed by contractor, manufacturer & POWERGRID. The problems including GIS mechanical assembly parts, motor drives & drive mechanism, SF6 gas leakage, Density monitor and contacts, items rejected due to transport /storage damage, failures observed during HV test with details of location and reason found after opening the compartment, detection of partial discharge during HV test , improper contact resistance, CB, Isolator, CT, VT improper test values, indication and interlocks etc may be recorded.

SL. NO.	DATE OF OBSERVATION	BAY NO	EQUIPMENT/COMPONENT DETAILS	DESCRIPTION OF PROBLEM	ACTION TAKEN
1.					
2					
3					
4					
5					
6					

Signature

POWERGRID

CONTRACTOR

MANUFACTURER

FORMAT FOR RECORDING HEALTHINESS OF GIS PACKING ON RECEIPT AT SITE

SI	Packing No./ Description	Physical damage to packing (Yes/No)	Positive N2 pressure (Yes/No)	Shock Indicator Operated (Yes/No)	Impact Recorder data & Report submitted (Yes/No)	Impact Limit Violation (Yes/No)	Remarks (if any)
1.							
2.							
3.							
4.							
5.							
.							
10.							

Signature :	Signature :
Name :	Name :
Designation :	Designation :
GIS Manufacturer	POWERGRID Site Incharge