

Ref. No.: PESL/CS/C-06/SS/Amend-01 & Clari-01

Date 18/01/2024

<< TO ALL THE BIDDERS THROUGH PORTAL >>

Sub.: **Amendment No-01 & Clarification No-01** to Bidding Documents for "Outsourcing of Operation & Maintenance Works of substations under Meerut Cluster(C-06)" [GeM Bid No: GEM/2023/B/4370887].

Dear Sir,

- 1.0 This has reference to the bidding documents for the subject Package uploaded on Government e-Marketplace (GeM) Portal [GeM Bid No. GEM/2023/B/4370887 dated 28.12.2023].
- 2.0 Please find enclosed herewith **Amendment No-01 & Clarification No-01 dated 18/01/2024** to the aforesaid Bidding Documents, which shall form an integral part of the Bidding Documents.
- 3.0 Save and except the above, all other terms and conditions of the Bidding Documents remain unchanged.

Thanking you,

For and On behalf of
Power Grid Energy Services Limited


Shivendra Sharma
Ch. Manager (CS)

Amendment no. 1 against Bidding Documents for Substation Package SS-C-06 for for O&M of (1) 765/400/220 kV Meerut Substation (GIS), (2) 765/400/220 kV Rampur Substation (GIS), (3) 400/220/132 kV Simbhavali Substation (GIS), (4) 400/220/132 kV Sambhal Substation (GIS), (5)400/220/132 kV Firozabad Substation (AIS)” through Outsource agency.

Sl. no.	Clause No	Existing provision	Amended Provision
1.	Clause no 6.0 (x), Section Project,	<p>6.0 SPECIFIC REQUIREMENT</p> <p>6.0 (x)</p> <p>The Spares required for O&M of the Sub-Station will be handed over to the Agency at the time of Handing Over of O&M activities and condition monitoring of the same is to be done by the Agency. Shifting of spares/materials from store to location of problematic equipment and shifting of failed equipment/replaced material within substation/store as per instruction of Engineer In-Charge of Employer. Agency will be responsible for safe handling of spares. Loading/Unloading of Employer supplied spares/equipment i s also in Agency’s scope however crane charges for loading/unloading of material shall be reimbursed as per actual on submission of supporting invoice. Monthly reconciliation of spares consumed is to be submitted to Employer by the Agency. At the Time of completion/termination of Contract, Agency shall hand over the spares in Healthy condition as per final reconciliation. In case of any shortage/ damage, the cost for same shall be recovered from the Agency.</p>	<p>6.0 SPECIFIC REQUIREMENT</p> <p>Clause 6.0 (x) is amended as</p> <p>The Spares required for O&M of the Sub-Station and Transmission Line will be handed over to the Agency at the time of Handing Over of O&M activities and condition monitoring of the same is to be done by the Agency.</p> <p>Shifting of spares/materials including Loading/Unloading, transportation from store to location of problematic equipment and shifting of failed equipment/replaced material within substation/store as per instruction of Engineer In-Charge of Employer.</p> <p>Agency will be responsible for safe handling of spares.</p> <p>Loading/Unloading of Employer supplied spares/equipment in future (if any) is also in Agency’s scope however crane charges for loading/unloading of material shall be reimbursed as per actual on submission of supporting invoice.</p> <p>The handling of spares as required by Transmission Line outsourced agency from Substation store (as per instruction of Engineer In-Charge of Employer) is in present scope of work.</p> <p>Shifting of spares/materials including Loading/Unloading, transportation from store to site and shifting of failed equipment/replaced material from site to substation/store (as per instruction of Engineer In-Charge of Employer) is in the scope of Transmission Line Outsourced Agency.</p>

Amendment no. 1 against Bidding Documents for Substation Package SS-C-06 for for O&M of (1) 765/400/220 kV Meerut Substation (GIS), (2) 765/400/220 kV Rampur Substation (GIS), (3) 400/220/132 kV Simbhavali Substation (GIS), (4) 400/220/132 kV Sambhal Substation (GIS), (5)400/220/132 kV Firozabad Substation (AIS)” through Outsource agency.

Sl. no.	Clause No	Existing provision	Amended Provision
			<p>Monthly reconciliation of spares (substation and Transmission Lines) consumed is to be submitted to Employer by the Agency. At the Time of completion/termination of Contract, Agency shall hand over the spares in Healthy condition as per final reconciliation. In case of any shortage/ damage, the cost for same shall be recovered from the Agency.</p>
2.	Si. No. 57 of SCC	<p>Replace the existing Provision GCC 21.2 as below: 1.LD/Deduction towards non-performance/ Absence of Manpower/ Vehicle/Damage of assets:</p> <p>1.2 Non-Deployment of T&Ps: Deployment of critical T&Ps at Sub-station / cluster level to be ensured by contractor. In case of non-deployment an amount of Rs. 5000/- per day shall be deducted from monthly bill for the period of non-deployment of T&Ps. The T&Ps of less frequent requirement needs to be arranged by contractor immediately on receipt of instruction from Employer. In case of delay in deployment of T&Ps beyond 48 hours from the receipt of intimation from SPV/PESL, An amount of Rs. 5000/- per day shall be deducted from monthly bill for the period of non-deployment of T&Ps.</p>	<p>Replace the existing Provision GCC 21.2 as below: 1.LD/Deduction towards non-performance/ Absence of Manpower/ Vehicle/Damage of assets is amended as:</p> <p>1.2 Non-Deployment of T&Ps: Deployment of critical T&Ps at Sub-station / cluster level to be ensured by contractor. In case of non-deployment an amount calculated by PESL based on rates as per POWERGRID approved norms (Testing & Measuring instruments and Tools & Plants) shall be deducted from monthly bill for the period of non-deployment of T&Ps. The T&Ps of less frequent requirement needs to be arranged by contractor immediately on receipt of instruction from Employer. In case of delay in deployment of T&Ps beyond 48 hours from the receipt of intimation from PESL, an amount calculated by PESL based on rates as per POWERGRID approved norms shall be deducted from monthly bill for the period of non-deployment of T&Ps.</p>

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Sl. no.	Clause No	Existing provision	Amended Provision
3.	Annexure-1: Maintenance Norms for Substation of Section Project of Technical Specification	Maintenance Norms for Substation	“Annexure-I (Maintenance Norms for Substation)” is replaced with “Annexure-I Rev-01 (Maintenance Norms for Substation)”
4.	Annexure-4: List of Tools & Plants of Section Project of Technical Specification	List of Tools & Plants for Substation	“Annexure-4 (List of Tools & Plants)” is replaced with “Annexure-4 Rev-01 (List of Tools & Plants)”

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Pre Bid clarification for Substation Package SS-C-06 for O&M of (1) 765/400/220 kV Meerut Substation (GIS), (2) 765/400/220 kV Rampur Substation (GIS), (3) 400/220/132 kV Simbhavali Substation (GIS), (4) 400/220/132 kV Sambhal Substation (GIS), (5)400/220/132 kV Firozabad Substation (AIS)” through Outsource agency.

Sr. No	Clause No.	Clause Description	Bidder Queries	PESL REPLY
1.	Clause no 3.3C- Roles & Responsibility of Agency’s Maintenance in-charge -Section Project	Coordination with Remote Control Centre/Other Transmission Licensees/Remote end Substation /connected Transmission Line (TL) Maintenance team.	All the coordination & Communications with the connected transmission line maintenance team shall be through PESL only.	Maintenance in-charge deployed by the agency is responsible for all the coordination & Communications with the connected transmission line maintenance team as and when required.
2.	Clause no. 5F- Employer Scope- Section Project	To provide suitable office/workspace for smooth operation and maintenance activities. The Agency has to maintain the office/workspace in good condition.	We understand that POWERGRID Energy Service Limited (PESL) will provide the office and work space free of cost and Electricity charges shall be in POWERGRID Energy Service Limited (PESL) scope and however Bidder shall be responsible for proper maintenance of Office and work pace.	Confirm.
3.	Clause no 6a of Specific requirement- Section Project	Day to day operation of substation equipment in consultation with RTAMC/employer as and when required. These operations are not covered under respective BPS item of “operation of substations”.	We understand that operation of substation is not in bidders scope except 75 mandays (in case of emergency) in each substation as defined in BOQ. If operation of substation are required more than 75 mandays than PESL provide extra charges over the 75 mandays on mutual agreed discussion with Bidders .	<ol style="list-style-type: none"> 1) All substations under present scope are operated from RTAMC/NTAMC. 2) Day to day operation of substation equipment in consultation with RTAMC/employer

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				<p>required for Maintenance of substation as and when required is in present scope.</p> <p>3) If any equipment is inoperable (other than earth switch) from RTAMC/NTAMC, then operation of such equipment as and when required is in present scope</p> <p>4) The operations mentioned (Sl.No. 2 and 3) above are not covered in 75 mandays of BPS item.</p> <p>5) If operation of substation are required more than 75 mandays, same will be dealt as per quantity variation clause in bidding documents.</p>
4.	Clause no 6q of Specific requirement- Section Project	Compliance of audits and technical circulars issued by Employer from time to time is in present scope.	Bidder will support to customer through only documentation maintained for maintenance purpose. Any other audits are not in bidders scope. Is bidder understand correct.	The work to be carried out & documentation to comply all the observations/comments noted by audits related to substation is in present scope.

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				Further, the work to be carried out & documentation to comply all the technical circulars issued by Employer from time to time is also in present scope.
5.	Clause no 1.4 of - Section Project	The work to be done under this specification shall include all labor, plant, equipment, material and performance of all work necessary for the complete Maintenance of switchyard including operation of substation as and when required. All apparatus, appliances, material, and labor etc. not specifically mentioned or included, but are necessary to complete the entire work or any portion of the work in compliance with the requirements implied in this specification is deemed to be included in the scope of contractor.	Scope of work for the assests listed in the clause 2.0 SCOPE and equipments listed in Annexure-1 only. No other equipments shall be in our scope. If any other equipments , kindly confirm & share the list of of equipments.	Clause no 1.4 of Section Project is applicable for Scope defined in Clause 2.0 of Technical Specification-Section project. If any additional scope added after award of contract, same will be dealt as per Quantity Variation clause in bidding documents.
6.	Appendix-1- TERMS AND PROCEDURES OF PAYMENT	1.1B 1. Progressive Payments shall be released on Monthly basis against the work done during the month	20% Advance payment towards mobilization & supply of Tools & testing equipments as per scope of work for each sub-station. This advance payment shall be adjusted end of the yearly basis on pro-rata basis.	Bidder may quote as per provision of Bidding documents.

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7.	Appendix-1- TERMS AND PROCEDURES OF PAYMENT	1.1B 1. Progressive Payments shall be released on Monthly basis against the work done during the month	BOQ / price -breakup is not clear hence not acceptable. We request PESL to Review the format & revise for monthly basis.	Bidder may quote as per provision of Bidding documents.
8.	BOQ	Maintenance for bays	We understand that against monthly/ quarterly / half yearly / maintenance activities as per Annexure-I for any of the bay equipment shall be deemed considered the maintenance of the bays. Hence accordingly shall be charged. Please confirm.	Maintenance activities against monthly/ quarterly / half yearly / Yearly shall be carried out as per Annexure-I (Rev 01) of Technical specification.
9.	Si No . C(VI) of BOQ	Maintenance of Spares as per TS	We understand that bidders scope is limited to maintain the maintenance spare provided by the PESL. Please clarify & share the tentative list of spares. Loading lifting & transportation charges shall be charged extra during maintenance.	As per clause no. 6.0 (x) of specific requirement of Technical specification-Section Project "The Spares required for O&M of the Sub-Station will be handed over to the Agency at the time of Handing Over of O&M activities". The cost of Loading lifting & transportation charges for Periodic, preventive &

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				<p>condition based maintenance including spares maintenance activity shall be included in present scope of work.</p> <p>Loading/Unloading of Employer supplied spares/equipment in future (if any) is also in Agency’s scope however crane charges for loading/unloading of material shall be reimbursed as per actual on submission of supporting invoice.</p>
10.	<p>7. Service Level Agreement (SLA)</p> <p>I) Asset Reliability (Weightage 20 marks) – Section Project</p>	Correctness of Operations/ Activities	<p>KPI is related to the Opertaion activity. We understand that operation is in PESL scope. As per many claues operation activities has been asked as follow:</p> <p>'-Compliance of audits and technical circulars issued by Employer from time to time. -including cordination with Substation data to NTAMC, Backup NTAMC, RTAMC & RLDC /Backup RLDC</p>	<p>1) Please refer reply in Si. No.3 of above regarding operation of Substation.</p> <p>2) As per clause 3.1 of Technical specification-Section project “The specified Minimum Manpower is required for day-to-day activities; however, Agency may be</p>

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			<p>-Permits shall be taken from Engineer In-charge of Employer/ designated authority for doing operation of sub-station.</p> <p>- Day to day operation of substation equipment in consultation with RTAMC/employer as and when required.</p> <p>-Collection & sending of SEM (Special Energy Meter) data to concerned department/authority. Time correction of SEM is also under present scope.</p> <p>In this connection we request you to include the include the operation manpower at least 1 nos. per sub-station in general shift. Kindly consider the request.</p>	<p>required to depute additional Manpower for completion of activities under its scope of work, without any additional cost to Employer.</p>
11.	Clause no 6 dd) of Specific requirement- Section Project	Any work which is not specifically mentioned but required for fulfillment of scope of work shall be in the scope of Agency.	'Any additional work not specified shall be charged extra as per mutually agreed rates.	Any work which is not specifically mentioned but required for Operation & Maintenance of Substations under present scope as per provisions of bidding documents shall be in the scope of bidder.
12.	Clause no 6 gg) of Specific requirement- Section Project	In case of non-compliance with any activity/work under the present scope, suitable recovery shall be made by the Employer.	'This is open statement, hence not acceptable. Kindly specify the compliance requirements.	Bidder may quote as per provision of the Bidding documents.
13.	Clause no.7 of Service Level	Maximum allowable deduction in a particular month shall not exceed 20% of the	Maximum allowable deduction in a particular month shall not exceed 10% of the total payable	Provision of the Bidding documents shall prevail.

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Sr. No	Clause No.	Clause Description	Bidder Queries	PESL REPLY
	Agreement (SLA)- Section Project	total contract value payable for the corresponding substation for that month (Excluding the deduction on account of fatal/non-Fatal accidents and assets damage due to wrong operations/human error)	value for the corresponding substation for that month. (Excluding the deduction on account of fatal/non-Fatal accidents and assets damage due to wrong operations/human error)	
14.	SOP (Annexure-7)- Section Project	Attending of Defect (Shutdown Nature) - Replacement of CVT/LA/WT (within 8 hours) - Replacement of CT (within 8 hours) - Replacement of CB (within 72 hours) - Completion of Bay/ICT/Reactor AMP (Within 12 Hours* / Within 8 Hours*)	In case of same make & model spare CVT/LA/WT. In case of different model & makes retrofitting may require, hence these timelines shall not be applicable & penalty shall not be applicable. Please confirm	Bidder may quote as per provision of the Bidding documents. In case of CT/CVT/LA/WT, wherever replacement may involve retro fitment/minor modification, the time lines shall be applicable upon availability of suitable mounting base.
15.	Clause no. u) of 2.2-Section Project	Responsible for maintenance, Housekeeping of the onsite Transit camp/Field hostel/Guest house including Catering service, wherever such facilities are made available.	We understand the following , please confirm. - Onsite Transit camp / field hostel/ Guest house (Please confirm the site wise details of the property to access the costing) - Our scope is limited to housekeeping & operation of kitchen (catering services) only.	1) Site wise details of the Onsite Transit camp / field hostel/ Guest house is attached at Annexure-B. 2). As per clause no. 2.2 u) of Technical specification-Section Project “The bidder shall be

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			- Civil Maintenance shall not be in our scope Please clarify	responsible for day-to-day maintenance, Housekeeping of the on-site Transit camp/Field hostel/Guest house including Catering service, wherever such facilities are made available. Cleaning & sweeping of the floor and washrooms of such accommodation will be in the scope of the Employer. 3). Minor civil maintenance work of the areas which are made available to the bidder, is in their bidder.
16.	Clause no. u) of 2.2-Section Project	The successful bidder may utilize the accommodation available in Transit camp/Field hostel/Guest house exclusively for residential usage by their deployed workforce.	We understand that utilization of Transit camp/Field hostel/Guest house for accommodation shall be free of cost for the Team. Hence we are not considering separate accommodation.). As per clause no. 2.2 u) of Technical specification-Section Project Power consumption charges shall be borne by the bidder.
17.	Clause no 6 b) of Specific requirement-Section Project	The Minimum Manpower requirement is defined at Substation level & Cluster Level. However, Agency may assess the manpower requirement at substation level for smooth & efficient operation, maintenance of	A separate contractor / agency needs to be engaged with special T&P , loading & lifting arrangements with additional expertise. Such requirements shall be dealt separately. Please confirm	Bidder may quote as per provision of the Bidding documents.

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		substation and completion of activities under its scope of work. Accordingly additional Manpower may be deputed at substation level without any additional cost to Employer		
18.	Clause no 6 w) of Specific requirement- Section Project	Any modification in protection setting and scheme shall be done only with written permission of Engineer In-charge of Employer.	Such modification works shall be dealt separately on case-to-case basis.	Bidder may quote as per provision of the Bidding documents.
19.	Clause no 6 w) of Specific requirement- Section Project	Agency will be responsible for safe handling of spares. Unloading Employer supplied spares/equipment is also in Agency's scope however crane charges for unloading of material shall be reimbursed as per actual on submission of supporting invoice	Shall be in PESL scope / Additional billing not reimbursement. Please confirm	As per clause no. 6.0(x) of specific requirement of Technical specification-Section Project Loading/Unloading of Employer supplied spares/equipment in future (if any) is also in Agency's scope however crane charges for loading/unloading of material shall be reimbursed as per actual on submission of supporting invoice. The cost of Loading lifting & transportation charges for Periodic, preventive & condition based maintenance including spares

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				maintenance activity shall be included in present scope of work.
20.	Clause no 6 aa) of Specific requirement- Section Project	Round the clock availability of minimum one no. vehicle in good running condition along with driver (Bolero or equivalent) in the substation for taking care of any O&M requirement.	We understand that one no. vehicle at each substation, please clarify.	Clause no 6 aa) of Technical Specification- Section Project "Round the clock availability of minimum one no. vehicle in good running condition along with driver (Bolero or equivalent) in each substation for taking care of any O&M requirement. Also, to meet any further requirements including emergencies, additional vehicle as per need shall be provided at no extra cost to Employer."
21.	Clause No . 3.2, Page no 13 of 69	Qualification & Experience of Manpower: If Employer finds any Manpower not suitable to execute the work as per scope, it should be replaced within 15 days of communication from Engineer In-charge.	Suitable screening shall be carried out & shall be mutually agreed, in case of replacement required shall be replaced within 45 days of communication from Engineer In-charge. Please confirm.	Bidder may quote as per provision of the Bidding documents.
22.	Annexure-4 of Section Project	Service Level Agreement (SLA) - Maximum allowable deduction in a particular month shall not exceed 20% of the total AMC charges payable for the	Maximum monthly deduction shall be limited to 10% of the monthly invoice & deduction shall not be adjusted in next month.	Bidder may quote as per provision of the Bidding documents.

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		<p>corresponding substation for that month (Excluding the deduction on account of fatal/non-Fatal accidents)</p> <p>-In case the deduction exceeds 20% of contract value, same shall be adjusted during next month.</p>		
23.	Annexure-8 , Table - II, sr. No.15 of Section project	<p>1. White washing of all storage building/shed.</p> <p>2. Painting of doors and windows</p>	We understand that supply of material & paint shall be in PESL. Kindly confirm.	White washing of all storage building/shed and Painting of doors and windows works shall be executed through separate contract by Employer.
24.	Annexure-3 of Section Project	List of Testing Instruments	Shall be arranged as per GE approved vendor list / as per availability. Kindly confirm if any specific models & makes to be consider.	Bidder shall arrange Testing & Measuring Instruments and Tools & Plants (T&Ps) as per clause No 4.0 of Technical specification-Section Project.
25.	Annexure-4 of Section Project	Man lift with Self-propelled and Articulating Boom For 765kV Substations	Shall be in PESIL scope. We suggest PESL to include the same considering high value item. Specifications are also not clear. Hence not considering.	Refer Amendment-1
26.	Annexure-4 of Section Project	List of Tools & Plant for Substation.	Shall be arranged as per GE approved vendor list / as per availability. Kindly confirm if any specific models & makes to be consider.	Bidder shall arrange Testing & Measuring Instruments and Tools & Plants (T&Ps) as per clause No 4.0 of

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				technical specification-Section Project.
27.	Annexure-4 of Section Project	Hydra/Crane of suitable size (Wherever Required) / Man lift with Self-propelled and Articulating Boom For 400kV and below voltage rating Substations	We will arrange the Hydra/ Crane / Man-lift of suitable size (whenever required) however charges shall be reimbursed by PESL.	Bidder shall arrange the Hydra/ Crane / Man-lift of suitable size (whenever required) without any cost implication to PESL.
28.	Annexure-5 of Section Project	List of Consumables for Substation	We suggest you to please confirm the minimum quantities to be maintained at each sub-station.	The Minimum List of Consumables for Substation is defined at Substation level. However, Agency may assess the quantity of consumables requirement at substation level for smooth & efficient operation, maintenance of substation and completion of activities under its scope of work. Accordingly additional consumables shall be provided at substation level without any additional cost to Employer.
29.	Sr. no.18 (Supplementing Sub-Clause GCC 4.1) of SCC	A period of 15 (Fifteen) days shall be provided to successful bidder for mobilization. The effective date of the contract shall be after completion of the	A period of 60 days (Sixty) days shall be provided to successful bidder for team mobilization. However, delivery of complete test instruments & tools shall be within 6 six months.	Reasonable time period of 30 days (Maximum up to 45 days) shall be provided to successful bidder for all resource mobilization. The effective date of the contract shall be

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Pre Bid clarification for Substation Package SS-C-06 for O&M of (1) 765/400/220 kV Meerut Substation (GIS), (2) 765/400/220 kV Rampur Substation (GIS), (3) 400/220/132 kV Simbhavali Substation (GIS), (4) 400/220/132 kV Sambhal Substation (GIS), (5)400/220/132 kV Firozabad Substation (AIS)" through Outsource agency.

Sr. No	Clause No.	Clause Description	Bidder Queries	PESL REPLY
		<p>mobilization period of 15 (Fifteen) days from the date of issue of Notification of Award (NOA)/ Letter of Award (LOA).</p> <p>During the mobilization period, the Contractor shall obtain/apply for all the requisite insurance policies, licenses/clearances from appropriate authorities such as Labour Authorities, Provident Fund Commissioner etc. A copy of all such documents will be provided to Employer before commencement of work. After completion of mobilization period, work shall be started immediately at site. However, if the bidder has all the requisite documents, mobilization period may be reduced to a mutually agreed time and the same shall be tied up during post bid discussions. The Contractor shall not be allowed to work without having labour license, electrical license, workmen compensation, insurance policy etc.</p>		<p>after completion of the mobilization period, as applicable, from the date of issue of Notification of Award (NOA)/ Letter of Award (LOA).</p>

Clarification No. 1

Pre Bid clarification for Substation Package SS-C-06 for O&M of (1) 765/400/220 kV Meerut Substation (GIS), (2) 765/400/220 kV Rampur Substation (GIS), (3) 400/220/132 kV Simbhavali Substation (GIS), (4) 400/220/132 kV Sambhal Substation (GIS), (5)400/220/132 kV Firozabad Substation (AIS)" through Outsource agency.

Sr. No	Clause No.	Clause Description	Bidder Queries	PESL REPLY
30.	Annexure-4 of Section Project	Man lift with Self-propelled and Articulating Boom For 765kV Substations	Man lift with Self-propelled and Articulating Boom For 765kV Substations to be provided all the substations full time? as Majority of the substations are GIS and it will attract huge cost/investment. <u>OR if possible please arrange to provide PGCIL's end.</u>	Please Refer Amendment-1.
31.	Clause no. u) of 2.2-Section Project	Responsible for maintenance, Housekeeping of the onsite Transit camp/Field hostel/Guest house including Catering service, wherever such facilities are made available.	Please let us know at which locations accommodation facilities will be provided by M/s PGCIL? What would be the rent of each locations?	Site wise details of the Onsite Transit camp / field hostel/ Guest house is attached at Annexure-B.
32.	Annexure-1 of Section Project	Quarterly basis maintenance for Power Transformers and reactors	In the price schedule prices are to be filled for Power Transformers and reactors however in the maintenance norms what is to be done on quarterly basis is not mentioned. - Please clarify how the billing is to be done. Will PGCIL give the outage on quarterly basis?	Please Refer Amendment-1. Payment shall be paid as per work done against BPS item in line with technical specification. All non-shut down/with out shut down maintenance shall be carried out as per schedule. The Employer shall plan the outage requirement with Agency and take up with Grid Operator for arranging shutdown.

Clarification No. 1

Pre Bid clarification for Substation Package SS-C-06 for O&M of (1) 765/400/220 kV Meerut Substation (GIS), (2) 765/400/220 kV Rampur Substation (GIS), (3) 400/220/132 kV Simbhavali Substation (GIS), (4) 400/220/132 kV Sambhal Substation (GIS), (5)400/220/132 kV Firozabad Substation (AIS)" through Outsource agency.

Sr. No	Clause No.	Clause Description	Bidder Queries	PESL REPLY
				However, the final shutdown date and period shall be as per the agreement of Grid Operator.
33.	Annexure-1 of Section Project	Quarterly basis maintenance for Fire protection and maintenance.	In the price schedule prices are to be filled for Fire protection and maintenance of spares however in the maintenance norms what is to be done on quarterly basis is not mentioned. - Please clarify how the billing is to be done.	<p>Please Refer Amendment-1 for Quarterly basis maintenance for Fire protection system.</p> <p>Maintenance of spares shall be carried out as per Annexure-8 of technical specification.</p> <p>Payment shall be paid as per work done against BPS item in line with technical specification.</p> <p>All non -shut down/without shut down maintenance shall be carried out as per schedule.</p> <p>The Employer shall plan the outage requirement with Agency and take up with Grid Operator for arranging shutdown.</p> <p>However, the final shutdown date and period shall be as per the agreement of Grid Operator.</p>

Clarification No. 1

Pre Bid clarification for Substation Package SS-C-06 for O&M of (1) 765/400/220 kV Meerut Substation (GIS), (2) 765/400/220 kV Rampur Substation (GIS), (3) 400/220/132 kV Simbhavali Substation (GIS), (4) 400/220/132 kV Sambhal Substation (GIS), (5)400/220/132 kV Firozabad Substation (AIS)" through Outsource agency.

Sr. No	Clause No.	Clause Description	Bidder Queries	PESL REPLY
34.			Where it is written to do the half yearly maintenance and where it is required to take shut down and if shut down is not possible then how the billing is to be done when the work is not executed?	<p>Please Refer Amedment-1.</p> <p>Payment shall be paid as per work done against BPS item in line with technical specification.</p> <p>All non -shut down/without shut down maintenance shall be carried out as per schedule.</p> <p>The Employer shall plan the outage requirement with Agency and take up with Grid Operator for arranging shutdown.</p> <p>However, the final shutdown date and period shall be as per the agreement of Grid Operator.</p>
35.	Sr. no.18 (Supplementing Sub-Clause GCC 4.1) of SCC	A period of 15 (Fifteen) days shall be provided to successful bidder for mobilization. The effective date of the contract shall be after completion of the mobilization period of 15 (Fifteen) days from the date of issue of Notification of Award (NOA)/ Letter of Award (LOA).	It is practically not possible to mobilize the team within 15 days as we need to procure safety items; employees are to be hired; Tools are to be procured. At least 30-45 days are required to fully mobilize the team at site. Please consider at least 40 days.	Reasonable time period of 30 days (Maximum up to 45 days) shall be provided to successful bidder for all resource mobilization. The effective date of the contract shall be after completion of the mobilization period, as applicable, from the date of issue of

Clarification No. 1

Pre Bid clarification for Substation Package SS-C-06 for O&M of (1) 765/400/220 kV Meerut Substation (GIS), (2) 765/400/220 kV Rampur Substation (GIS), (3) 400/220/132 kV Simbhavali Substation (GIS), (4) 400/220/132 kV Sambhal Substation (GIS), (5)400/220/132 kV Firozabad Substation (AIS)" through Outsource agency.

Sr. No	Clause No.	Clause Description	Bidder Queries	PESL REPLY
		During the mobilization period, the Contractor shall obtain/apply for all the requisite insurance policies, licenses/clearances from appropriate authorities such as Labour Authorities, Provident Fund Commissioner etc. A copy of all such documents will be provided to Employer before commencement of work. After completion of mobilization period, work shall be started immediately at site. However, if the bidder has all the requisite documents, mobilization period may be reduced to a mutually agreed time and the same shall be tied up during post bid discussions. The Contractor shall not be allowed to work without having labour license, electrical license, workmen compensation, insurance policy etc.		Notification of Award (NOA)/ Letter of Award (LOA).

Annexure-1-Rev-01

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INDEX

Sl.No.	Activity	Periodicity	Condition	To be filled in		FORMAT NO	Page No.
				ERP*	#Controlled Doc.		
A	TRANSFORMERS AND REACTORS						
1.	Checking of bushing oil level	M	W S/D		✓	SS/MAIN/TR.REACTOR/MONTHLY	18
2.	Checking of oil level in Conservator	M	W S/D		✓	SS/MAIN/TR.REACTOR/MONTHLY	18
3.	Checking of oil level in OLTC Conservator	M	W S/D		✓	SS/MAIN/TR.REACTOR/MONTHLY	18
4.	Checking of oil level in Breather oil cup	M	W S/D		✓	SS/MAIN/TR.REACTOR/MONTHLY	18
5.	Condition of Silica Gel	M	W S/D		✓	SS/MAIN/TR.REACTOR/MONTHLY	18
6.	Checking of Oil Leak	M	W S/D		✓	SS/MAIN/TR.REACTOR/MONTHLY	18
7.	SF6 gas pressure monitoring for valve bushing of converter transformers (if applicable)	M	W S/D		✓	SS/MAIN/TR.REACTOR/MONTHLY	18
8.	Manual Starting of Oil Pumps & Fans for Transformers and Reactors upto 400kV	3M	W S/D		✓	SS/MAIN/TR.REACTOR/3MONTHLY	19
9.	On Line DGA	3M	W S/D		✓	SS/MAIN/TR.REACTOR/3MONTHLY	19
10.	On Line dry out	3M	W S/D		✓	SS/MAIN/TR.REACTOR/3MONTHLY	19
11.	Healthiness of FO WTI	3M	W S/D		✓	SS/MAIN/TR.REACTOR/3MONTHLY	19
12.	Thermovision Scanning of Bushing and its associated Terminals	3M	W S/D		✓	SS/MAIN/TR.REACTOR/3MONTHLY	19
13.	Checking of local and remote indications of OTI /WTI and noting the difference	6M	W S/D		✓	SS/MAIN/TR.REACTOR/6MONTHLY	20
14.	DGA of transformers and reactors of 400kV and 765kV class	6M	W S/D	✓		SS/MAIN/TR.REACTOR/6MONTHLY	20
15.	Auto starting of fans & pumps	Y	S/D		✓	SS/MAIN/TR.REACTOR/YEARLY	21
16.	Measurement of BDV of OLTC oil of Converter Transformers	Y	W S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	21
17.	Alarm/ trip test	Y	S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	21
18.	External cleaning of Radiators, bushings, buchholz & other accessories	Y	S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	21

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19.	Maintenance of OLTC and driving mechanism	Y	S/D			SS/MAIN/TR.REACTOR/YEARLY	21
20.	Matching of local and remote indications of OTI /WTI.	Y	S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	22
21.	Rust, Damages and repainting, if required	Y	S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	22
22.	Marshalling box & TB Maintenance – Transformer/ reactor/NGR/ Buchholz, Oil surge, SPR, bushing CT etc	Y	S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	22
23.	Application of insulating coating on Buchholz,PRD TBs to prevent mal-operation due to moisture	Y	S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	22
24.	C & Tanδ measurement for bushing (in equipments upto 400kV where any one bushing >100kV is OIP) along with measurement at Variable frequency	Y	S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	22
25.	DGA of transformers and reactors upto 220kV class	Y	W S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	24
26.	BDV, Moisture, Tan δ, Resistivity, IFT, Acidity	Y	W S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	24
27.	Online moisture measurement	Y	W S/D	✓		SS/MAIN/TR.REACTOR/YEARLY	24
28.	Core Insulation Resistance	2Y	S/D	✓		SS/MAIN/TR.REACTOR/2YEARLY	25
29.	Neutral Earth resistance measurement	2Y	S/D	✓		SS/MAIN/TR.REACTOR/2YEARLY	25
30.	C & Tanδ measurement for bushing (in 765kV equipments and equipments upto 400kV where all bushings >100kV are RIP) along with measurement at Variable frequency	2Y	S/D	✓		SS/MAIN/TR.REACTOR/2YEARLY	25
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33.	C & Tanδ measurement of winding by automatic Tanδ kit	10Y	S/D	✓		SS/MAIN/TR.REACTOR/10YEARLY	28
34.	OLTC Checking for ICTs	10Y	S/D	✓		SS/MAIN/TR.REACTOR/10YEARLY	29
35.	Winding resistance measurement (transformer)	SOS	S/D	✓		SS/MAIN/TR.REACTOR/SOS	30
36.	Winding resistance measurement (reactor)	SOS	S/D	✓		SS/MAIN/TR.REACTOR/SOS	31
37.	Winding resistance measurement (NGR)	SOS	S/D	✓		SS/MAIN/TR.REACTOR/SOS	31
38.	C & Tanδ measurement of NGR winding	SOS	S/D	✓		SS/MAIN/TR.REACTOR/SOS	31

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39.	C & Tanδ measurement of NGR bushing	SOS	S/D	✓		SS/MAIN/TR.REACTOR/SOS	31
40.	Measurement of voltage ratio for Transformer	SOS	S/D	✓		SS/MAIN/TR.REACTOR/SOS	32
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42.	Measurement of IR values (PI/DA Ratio)	SOS ⁵	S/D	✓		SS/MAIN/TR.REACTOR/SOS	34
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44.	Frequency Domain Spectroscopy (FRA)	SOS ⁶	S/D		✓	SS/MAIN/TR.REACTOR/SOS	35
45.	WTI and OTI settings	SOS	S/D		✓	SS/MAIN/TR.REACTOR/SOS	36
46.	Calibration of OTI & WTI	SOS	S/D		✓	SS/MAIN/TR.REACTOR/SOS	36
47.	OLTC Checking for Converter Transformers	SOS	S/D		✓	SS/MAIN/TR.REACTOR/SOS	36
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49.	Inhibiter content	SOS	W S/D	✓		SS/MAIN/TR.REACTOR/SOS	37
50.	Thermovision Scanning of Main Tank	SOS	S/D		✓	SS/MAIN/TR.REACTOR/SOS	37
	Checks on Spare Transformer/Reactor						
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52.	Circulation of Oil for 12 hours by running pump/filtration machine	Y	W S/D	✓		SS/MAIN/TR.REACTOR/SPARE	38
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2	Oil Level in Operating Mechanism	M	W S/D		✓	SS/MAIN/CB/MONTHLY	39
3	Oil Leakage from Grading Capacitors	M	W S/D		✓	SS/MAIN/CB/MONTHLY	39
4	Visual check of MBs (for any moisture/defects)	M	W S/D		✓	SS/MAIN/CB/MONTHLY	39
5	Healthiness of auto drain valve in pneumatic mechanism	M	W S/D		✓	SS/MAIN/CB/MONTHLY	39
6	Healthiness of Controlled switching device	M	W S/D		✓	SS/MAIN/CB/MONTHLY	39
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8	SF6 CIRCUIT BREAKER, Air/oil pump drop during duty cycle operation - O-0.3 S-CO	Y	S/D	✓		SS/MAIN/CB/ YEARLY	40

9	SF6 CIRCUIT BREAKER- Checking of Air Compressor/Hydraulic Pump operation	Y	S/D	✓		SS/MAIN/CB/ YEARLY	40
10	SF6 CIRCUIT BREAKER- Checking of spring charging motor/ air compressor motor/ hydraulic compressor motor operation timing	Y	S/D	✓		SS/MAIN/CB/ YEARLY	40
11	Checking of alarm/lockout contacts to be checked through simulation	Y	S/D	✓		SS/MAIN/CB/ YEARLY	41
12	Checking of Pole Discrepancy Relay	Y	S/D	✓		SS/MAIN/CB/ YEARLY	41
13	Checking of Anti Pumping relay	Y	S/D	✓		SS/MAIN/CB/ YEARLY	41
14	Duty Cycle operation including rapid re-closing	Y	S/D	✓		SS/MAIN/CB/ YEARLY	42
15	Check of interlocks (Local Closing Interlock)	Y	S/D	✓		SS/MAIN/CB/ YEARLY	42
16	Check of Operating Lockouts	Y	S/D	✓		SS/MAIN/CB/ YEARLY	42
17	Maintenance of Air Compressor in Pneumatic drive	Y	S/D	✓		SS/MAIN/CB/ YEARLY	42
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19	Spring Operating Mechanism	Y	S/D	✓		SS/MAIN/CB/ YEARLY	43
20	Healthiness of Operation Counter	Y	S/D	✓		SS/MAIN/CB/ YEARLY	43
21	Maintenance of Control Cabinets	Y	S/D	✓		SS/MAIN/CB/ YEARLY	43
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23	CBs Aged More Than 10 Years						
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D	Measurement of dew point in SF6 Gas (For SF6 CB) at Atmospheric pressure	4Y	S/D	✓		SS/MAIN/CB/MORE THAN 10Y/ 4YEARLY	51
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A	Measurement of Static Contact Resistance	2Y	S/D	✓		SS/MAIN/CB/LESS THAN 10Y/ 2YEARLY	52

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B	Capacitance & Tan δ Measurement of Grading Capacitor	2Y	S/D	✓		SS/MAIN/CB/LESS THAN 10Y/ 2YEARLY	53	
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A	Overhauling of Pneumatic type Drive Mechanism of CB	10Y	S/D	-		-	-	
B	Overhauling of Hydraulic type Drive Mechanism of CB	15Y	S/D	-		-	-	
C	CURRENT TRANSFORMERS							
1	Visual inspection of CT for oil leakage and crack in insulators	M	W S/D		✓	SS/MAIN/CT/MONTHLY	56	
2	Checking of bellow for expansion/ oil level	M	W S/D		✓	SS/MAIN/CT/MONTHLY	56	
3	Marshalling Box - Cleaning of MB	Y	S/D	✓		SS/MAIN/CT/YEARLY	57	
4	Checking the tightness of all electrical connections including earthing of MB	Y	S/D	✓		SS/MAIN/CT/YEARLY	57	
5	Cleaning and tightness of CT secondary terminals and checking healthiness of sec terminal bushing	Y	S/D	✓		SS/MAIN/CT/YEARLY	57	
6	Checking of Space Heater & Illumination	Y	S/D	✓		SS/MAIN/CT/YEARLY	57	
7	Check for any oil leakage from Secondary Terminal Box in case of oil filled CTs	Y	S/D	✓		SS/MAIN/CT/YEARLY	57	
8	Checking of healthiness of gaskets	Y	S/D	✓		SS/MAIN/CT/YEARLY	57	
9	Checking of leakage of SF6 gas in case of gas filled CTs	Y	S/D	✓		SS/MAIN/CT/YEARLY	57	
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14	Checking of alarm/lockout contacts to be checked through simulation	Y	S/D	✓		SS/MAIN/CT/4YEARLY	59	
15	Dissolved Gas Analysis of CT oil	SOS	S/D			SS/MAIN/CT/SOS	60	

16	Measurement of CT Ratio	SOS	S/D		✓	SS/MAIN/CT/SOS	60
17	Measurement of Secondary Resistance	SOS	S/D		✓	SS/MAIN/CT/SOS	60
18	Magnetizing Characteristics	SOS	S/D		✓	SS/MAIN/CT/SOS	61
19	Insulation Resistance Measurement	SOS	S/D		✓	SS/MAIN/CT/SOS	61
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2	Measurement of secondary voltage	HY	W S/D	✓		SS/MAIN/CVT/6MONTHLY	63
3	Visual Checking of Earthing of HF point. (In case it is not used for PLCC)	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
4	Checking of any breakage or cracks in HF bushing.	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
5	Checking for any breakage or cracks in cementing joint	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
6	Cleaning of CVT/IVT Capacitor Stacks and tightness of terminal connections	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
7	Checking of Neutral Earthing in CVT/IVT MB and Tightness of All connections	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
8	Cleaning of Marshalling Box & Junction Box	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
9	Checking of Space heater & illumination	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
10	Checking healthiness of all gaskets	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
11	EMU Checks- Checking of oil level	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
12	EMU Checks- Checking of oil leakage	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
13	EMU Checks- Colour of Oil	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
14	Checking of Voltage Switching by Isolator auxiliary contacts (DMT Scheme)	Y	S/D	✓		SS/MAIN/CVT/YEARLY	64
15	Capacitance & Tan δ Measurement of CVT/IVT	SOS	S/D	✓		SS/MAIN/CVT/SOS	65
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2	Operating mechanism- Checking of Stopper bolts	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
3	Operating mechanism- Cleaning of Aux switch contacts & Greasing with Silicon Grease	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66

4	Operating mechanism- Lubrication of operating Mechanism hinges, Lock Joints on Levers and Bearings.	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
5	Operating mechanism- Checking & Tightening of all mounting bolts	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
6	ISOLATOR- Cleaning and Greasing of Main Contacts	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
7	ISOLATOR- Alignment of contacts/ operating levers	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
8	ISOLATOR- Tightening of Bolts, Nuts and Pins Etc	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
9	ISOLATOR- Cleaning of Support Insulators and check for cracks in insulators , if any	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
10	ISOLATOR- Checking of interlocks (Mechanical & Electrical)	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
11	ISOLATOR- Checking of corona rings for pitting & alignment	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
12	EARTH SWITCH- Checking and Alignment of Earthing Blades	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
13	EARTH SWITCH- Cleaning of Contacts	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
14	EARTH SWITCH- Operation of Earth Switch	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
15	EARTH SWITCH- Checking of continuity of Aluminium/ Copper flexible conductor Switch	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
16	EARTH SWITCH- Checking of earth connections of structure & MOM box	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
17	MARSHALLING BOXES- Checking of space heater & illumination	Y	W S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
18	MARSHALLING BOXES- Checking of healthiness of Rubber Gaskets	Y	W S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
19	MARSHALLING BOXES- Visual Check of auxiliary contacts	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
20	MARSHALLING BOXES- Cleaning and tightness of all terminations	Y	S/D	✓		SS/MAIN/ISOLATORS/YEARLY	66
21	Contact Resistance Measurement-(In Micro Ohm) of Isolators	4Y	S/D	✓		SS/MAIN/ISOLATORS/4YEARLY	67
22	Contact Resistance Measurement-(In Micro Ohm) of Earth Switch	4Y	S/D	✓		SS/MAIN/ISOLATORS/4YEARLY	67
F	SURGE ARRESTERS						
1	Checking of Leakage by Current Analyser after cleaning the porcelain surface. (THRC measurement)	4M	W S/D	✓		SS/MAIN/LA/4MONTHLY	68
2	Testing by Surge Monitor kit -Counter and meter tests.	Y	S/D	✓		SS/MAIN/LA/YEARLY	69

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3	Cleaning of LA Insulators	Y	S/D	✓		SS/MAIN/LA/YEARLY	69
4	Capacitance & Tan δ Measurement	SOS	S/D	✓		SS/MAIN/LA/SOS	70
5	Insulation Resistance Measurement	SOS	S/D	✓		SS/MAIN/LA/SOS	70
G	Station earth resistance, Bus-Bar, Bus post insulators.						
1	Measurement of station earth resistance connected with earth mat.	Y	W S/D	✓		SS/MAIN/BUSBARS &BPI/YEARLY	71
2	Cleaning of bus post insulator	Y	S/D	✓		SS/MAIN/BUSBARS &BPI/YEARLY	71
3	Checking of bus post insulator for cracks.	Y	S/D	✓		SS/MAIN/BUSBARS &BPI/YEARLY	71
4	Maintenance of Bus side Isolator as per AMP schedule (For one & half breaker scheme)	Y	S/D	✓		SS/MAIN/BUSBARS &BPI/YEARLY	71
H	WAVE TRAPS						
1	Tightness & cleanliness	Y	S/D	✓		SS/MAIN/WT/YEARLY	72
2	General inspection / cleaning of tuning unit	Y	S/D	✓		SS/MAIN/WT/YEARLY	72
I	SUB-STATION ILLUMINATION SYSTEM						
1	Check Lighting panel for fuses/MCB's, receptacle panel tightening of terminals	Y	S/D		✓	SS/MAIN/ILL/YEARLY	73
2	Checking tightness of Lighting Transformer terminal connectors	Y	S/D		✓	SS/MAIN/ILL/YEARLY	73
3	Working of Emergency DC light system incase of AC power failure	Y	S/D		✓	SS/MAIN/ILL/YEARLY	73
J	Thermo vision scanning of switch yard equipments.						
1	Transformers & Reactors	3M	W S/D		✓	SS/MAIN/TSCAN/3MONTHLY	74
2	CB	3M	W S/D		✓	SS/MAIN/TSCAN/3MONTHLY	74
3	CT	3M	W S/D		✓	SS/MAIN/TSCAN/3MONTHLY	74
4	CVT	3M	W S/D		✓	SS/MAIN/TSCAN/3MONTHLY	74
5	Isolator	3M	W S/D		✓	SS/MAIN/TSCAN/3MONTHLY	74
6	Wave trap	3M	W S/D		✓	SS/MAIN/TSCAN/3MONTHLY	76
7	Bus bar and BPI	3M	W S/D		✓	SS/MAIN/TSCAN/3MONTHLY	76

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8	All Jumpers / Droppers	3M	W S/D		✓	SS/MAIN/TSCAN/3MONTHLY	76
K	AIR CONDITIONING SYSTEM						
1	Healthiness of AC Units i. Control Room	M	W S/D		✓	SS/MAIN/AC.SYSTEM	77
	ii. Battery Room iii. Kisoks						
2	Status of Temperature & Humidity i. Control Room ii. Battery Room iii. Kisoks	3M	W S/D		✓	SS/MAIN/AC.SYSTEM	77
3	Servicing of AC Units i. Control Room ii. Battery Room iii. Kisoks	HY	S/D		✓	SS/MAIN/AC.SYSTEM	77
L	BATTERY BANK /BATTERY CHARGER / DC DISTRIBUTION SYSTEM						
1	Checking of electrolyte level and topping up with DM water, If any	M	S/D		✓	SS/MAIN/BB/MONTHLY	78
2	Checking of emergency DC lighting to Control Room	M	S/D		✓	SS/MAIN/BB/MONTHLY	78
3	Measurement of Specific gravity and voltage of cell with Charger OFF, in case of flooded cells.	M	S/D	✓		SS/MAIN/BB/MONTHLY	78
4	Checking of Charger Panel for Electrical Connection tightness and cleanliness	Y	S/D		✓	SS/MAIN/BB/YEARLY	80
5	Testing of O/V & U/V Relays	Y	S/D		✓	SS/MAIN/BB/YEARLY	80
6	Checking & Cleaning of Battery cell terminals and application of petroleum jelly (if required)	Y	S/D		✓	SS/MAIN/BB/YEARLY	80
7	Checking of tightness of VRLA Battery and dusting/ cleaning.	Y	S/D		✓	SS/MAIN/BB/YEARLY	80
8	Servicing of Air Conditioners for VRLA Batteries.	Y	S/D		✓	SS/MAIN/BB/YEARLY	80
9	Healthiness of Indicating meters like Voltmeter, Ammeter & Indicating Lamps	Y	S/D		✓	SS/MAIN/BB/YEARLY	80
10	Curative discharge test of battery set	Y	S/D	✓		SS/MAIN/BB/YEARLY	81
M	STATION FIRE PROTECTION SYSTEM						
1	Compressor cleaning / replacement of air filter	M	S/D		✓	SS/MAIN/FF.SYS/MONTHLY	82
2	Fire alarm system detector- Sequence test for annunciation in Control Room	M	W S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82

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3	Fire alarm system detector- Cleaning	M	S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82
4	Fire alarm system detector- Battery Electrolyte level checking	M	W S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82
5	Diesel engine- Checking of auto starting of Diesel Engine	M	S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82
6	Diesel engine- Check oil level, top up if required	M	W S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82
7	Pumps- Checking of operation of Hydrant pumps Sump pumps, Jockey pumps.	M	W S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82
8	Pumps- Check leakage & lubrication of Jockey Pump	M	W S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82
9	Pumps- If no. of operation of Jockey pump is more than one then leakage to be attended	M	W S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82
10	Checking for leakage of Hydrant system	M	W S/D		✓	SS/MAIN/FF.SYS/ MONTHLY	82
11	COMPRESSORS- Checking of compressor oil and replace if necessary	3M	S/D		✓	SS/MAIN/FF.SYS/3MONTHLY	83
12	COMPRESSORS- Maintenance & cleaning of compressor valves, gaskets, valve plates and replace, if necessary	3M	S/D		✓	SS/MAIN/FF.SYS/3MONTHLY	83
13	COMPRESSORS- Operation check of low oil level switch	3M	S/D		✓	SS/MAIN/FF.SYS/3MONTHLY	83
14	COMPRESSORS- Cleaning and checking for seating of the breather valve	3M	S/D		✓	SS/MAIN/FF.SYS/3MONTHLY	83
15	COMPRESSORS- Checking of V-belt tightness	3M	S/D		✓	SS/MAIN/FF.SYS/3MONTHLY	83
16	Cleaning of oil strainer of hydrant system	3M	S/D		✓	SS/MAIN/FF.SYS/3MONTHLY	83
17	Checking of healthiness of smoke detectors at various locations like AC Kiosks, Battery Room, control room etc	3M	S/D		✓	SS/MAIN/FF.SYS/3MONTHLY	83
18	Motors- Tightness of terminal connection	HY	S/D		✓	SS/MAIN/FF.SYS/6MONTHLY	84
19	Motors- Lubrication of Bearing	HY	S/D		✓	SS/MAIN/FF.SYS/6MONTHLY	84
20	Motors- Overhauling	HY	S/D		✓	SS/MAIN/FF.SYS/6MONTHLY	84
21	Pumps- Adjustments of glands for leakages and tightening of nuts and bolts	HY	S/D		✓	SS/MAIN/FF.SYS/6MONTHLY	84
22	Greasing of all valves	HY	S/D		✓	SS/MAIN/FF.SYS/6MONTHLY	84
23	Compressor- Cleaning of NRV /HP tank	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
24	Diesel engine- Check oil level, top up if required	M	S/D		✓	SS/MAIN/FF.SYS/YEARLY	85

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	oil filter, lube oil filter, air filter						
25	Pumps- Checking of alignment of pump set	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
26	Hydrant system- Checking of pressure of hydrant system at the remote end, auto starting of pumps, diesel engine etc	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
27	Hydrant system- Checking of pressure gauges and replacement of defective gauges.	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
28	Emulsifier system- Operation of Emulsifier system, check outlet pressure, check alarm, check starting of diesel/electrical pump.	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
29	Emulsifier system- Checking of detector bulbs, nozzle angle/ blocking etc.	Y	W S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
30	Electrical panels- cleaning	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
31	Electrical panels- tightening of terminals	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
32	Electrical panels- Checking of gaskets	Y	W S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
33	Painting of pipes, air lines, marshalling box	Y	W S/D		✓	SS/MAIN/FF.SYS/YEARLY	85
34	Fire alarm system- Check for operation of fire alarm system installed at various location by Agarbati or some smokedevice	Y	W S/D		✓	SS/MAIN/FF.SYS/YEARLY	86
35	Fire alarm system- Check for alarm in the control panel./SCADA	Y	W S/D		✓	SS/MAIN/FF.SYS/YEARLY	86
36	Fire alarm system- Check the condition of battery	Y	W S/D		✓	SS/MAIN/FF.SYS/YEARLY	86
37	Fire alarm system- Check for cleanliness.	Y	W S/D		✓	SS/MAIN/FF.SYS/YEARLY	86
38	Check for fully charged Cartridge & change if necessary.	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	87
39	Check for quality of charge & refill if required.	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	87
40	Check if ready for operation	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	87
41	Check for cleanliness	Y	S/D		✓	SS/MAIN/FF.SYS/YEARLY	87
N	Diesel Generator Set						
1	Checks for oil leaks of lubricating system	M	W S/D		✓	SS/MAIN/DG SET/MONTHLY	88
2	Checks for radiator air blocking and coolant level of cooling system	M	W S/D		✓	SS/MAIN/DG SET/MONTHLY	88
3	Battery Voltage & Specific Gravity Measurement	M	W S/D		✓	SS/MAIN/DG SET/MONTHLY	88

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4	Checking of auto start function	M	W S/D		✓	SS/MAIN/DG SET/MONTHLY	88
5	Servicing- DG Set Servicing Done or Not Done	HF	S/D		✓	SS/MAIN/DG SET/6MONTHLY	89
6	COOLING SYSTEM- Check for Fan hub, Drive pulley and Water pump	HF	S/D		✓	SS/MAIN/DG SET/6MONTHLY	89
7	AIR INTAKE SYSTEM- Replacement of Air Cleaning Element	HF	S/D		✓	SS/MAIN/DG SET/6MONTHLY	89
8	FUEL SYSTEM- Drain sediments from fuel tank, change fuel filter and clean fuel tank breather.	HF	S/D		✓	SS/MAIN/DG SET/6MONTHLY	89
9	Healthiness of both Battery Chargers	HF	S/D		✓	SS/MAIN/DG SET/6MONTHLY	89
10	Availability & Healthiness of 2 sets of Battery	HF	S/D		✓	SS/MAIN/DG SET/6MONTHLY	89
O	LT SWITCH GEAR						
1	LT PANELS- Cleaning of Panels, Bus Bars Insulators etc.	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	90
2	LT PANELS- Checking of indicating meters	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	90
3	LT PANELS- Checking for change over facility(MSB,LT,DG) CB's	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	90
4	LT TRANSFORMER/ TERTIARY TRANSFORMER - Test oil of LT Transformer for BDV	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	90
5	LT TRANSFORMER/ TERTIARY TRANSFORMER -IR measurement check	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	90
6	LT TRANSFORMER/ TERTIARY TRANSFORMER -Testing of OTI/WTI & Buchholz relay for L.T. Transformer (where ever applicable)	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	90
7	LT TRANSFORMER/ TERTIARY TRANSFORMER -Testing of Directional over current earth fault relay	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	90
8	Testing of 72.5 kV CB	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	90
9	Testing of 72.5 kV CT – Marshalling Box	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	91
10	Testing of 72.5 kV CT – Capacitance & Tan δ Measurement	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	91
11	Testing of PT – IR Measurement	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	91
12	LT Panels Checking	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	92

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13	Relay Checking	Y	S/D		✓	SS/MAIN/LT SWGR/YEARLY	92
P	PLCC/DTPC EQUIPMENTS						
1	General Cleaning of Cabinets.	HF	S/D		✓	SS/MAIN/PLCC	93
2	Checking of healthiness of Ventilation Fans in Cabinet.	HF	S/D		✓	SS/MAIN/PLCC	93
3	DTPC: Port Healthiness to be checked	HF	W S/D		✓	SS/MAIN/PLCC	93
4	DTPC: Interface with ULDC Panel to be checked	HF	W S/D		✓	SS/MAIN/PLCC	93
5	Level Measurements - Code transmission test	Y	S/D		✓	SS/MAIN/PLCC	93
6	Level Measurements - Code transmission reception test.	Y	S/D		✓	SS/MAIN/PLCC	93
7	Level Measurements - Coaxial level measurement Tx / Rx (pilot & protection)	HY	W S/D		✓	SS/MAIN/PLCC	93
8	LOOP TEST	HF	W S/D		✓	SS/MAIN/PLCC	93
9	POWER SUPPLY MEASUREMENTS	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
10	INPUT VOLTAGES	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
11	STABILISED DC VOLTAGES	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
12	TRANSMITTER CHECKS	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
13	FM OSCILLATOR- Frequency measurement	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
14	AM OSCILLATOR- Time measurement	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
15	OUTPUT LEVEL MEASUREMENT	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
16	RECEIVER CHECKS	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
17	Receiver level FM	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
18	Receiver level AM	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
19	ALARM CHECKS	SOS	W S/D		✓	SS/MAIN/PLCC/SOS	94
20	RETURN LOSS MEASUREMENTS	SOS	S/D		✓	SS/MAIN/PLCC/SOS	94
Q	PROTECTION SYSTEM						
3	Checking of GPS Time Synchronizing Unit (TSU) with all Disturbance Recorders & SEL's in Sub-station (Applicable for conventional (Non-SAS) substations only)	M	W S/D	✓		SS/MAIN/PROT.SYS/GEN/ MONTHLY	95

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4	Complete checking of protection scheme	Within one year of commissioning	S/D	✓		SS/MAIN/PROT.SYS/GEN/FIRSTY EAR	96
5	Testing of Distance relay	3Y	S/D	✓		SS/MAIN/PROT.SYS/21/3YEARLY	97
6	Testing of Line Differential Relay	3Y	S/D	✓		SS/MAIN/PROT.SYS/87L/3YEARLY	99
7	Testing of Transformer/ Reactor Differential Relay	3Y/1Y*	S/D	✓		SS/MAIN/PROT.SYS/87/3YEARLY	101
8	Testing of Transformer OC/EF relays	3Y/1Y*	S/D	✓		SS/MAIN/PROT.SYS/51/3YEARLY	102
9	Testing of Transformer V/f relay	3Y/1Y*	S/D	✓		SS/MAIN/PROT.SYS/OFLUX/3YEARLY	103
10	Testing of Transformer/Reactor REF relays	3Y/1Y*	S/D	✓		SS/MAIN/PROT.SYS/64/3YEARLY	104
11	Testing of Backup Impedance relay(ICT and Reactor)	3Y	S/D	✓		SS/MAIN/PROT.SYS/21R/3YEARLY	105
12	Testing of Mechanical protection	1Y	S/D	✓		SS/MAIN/PROT.SYS/MECH/3YEARLY	106
13	Testing of SAS Ring redundancy	6M	W S/D	✓		SS/MAIN/PROT.SYS/SAS/6MONTHLY	107
14	SAS System Maintenance	M	W S/D	✓		SS/MAIN/PROT.SYS/SAS/MONTHLY	108
15	Main bay LBB testing	5Y	S/D	✓		SS/MAIN/PROT.SYS/LBB/5YEARLY	109
16	Tie Bay LBB testing	5Y	S/D	✓		SS/MAIN/PROT.SYS/LBB/5YEARLY	110
17	Bus Bar protection testing	5Y	S/D	✓		SS/MAIN/PROT.SYS/BUSBAR/3YEARLY	111

**The testing interval shall be 3Yrs for Numerical Relays and 1 Yr for Non-Numerical relays*

GENERAL INSTRUCTIONS:

01. Present preventive maintenance document has been revised keeping in view of data recording in ERP. Preventive Maintenance activities shall be filled up in ERP if the templates are available in ERP or documented in hard copy if the formats are not available in ERP.
02. Formats provided in the document for each maintenance activity against the equipment level are indicative only. Records are required to be maintained in line with the template available in ERP.
03. Test Results are to be compared with factory test results/Pre-commissioning /Previous year test results and trend curve analysis to be done. In case of violation/ variation from previous test results and from similar equipment of the same premises, reasons for the same need to be brought out/ investigated by S/Stn In-charge and intimation for the same along with action plan / recommendation to regional O&M In-charge.
04. Instructions for filling up of Equipment Failure Report (EFR) are included with the Maintenance Formats as per the requirement of ISO 9001.
05. Reasons for not carrying out any test/ maintenance activity to be written clearly in Remark Column with countersigned by concerned sub- station in-charge (SSI) for approval of regional O&M In-charge. Approval copy of the same to be preserved along with other maintenance records.
06. Oil Testing formats are available in ERP and to be maintained in line with the available format.
07. Particular Test results are to be reviewed and approved by the competent authority.
08. Regional Asset Management shall carry out system implementation review of each sub-station & T/L at least once in a year by constituting a committee comprising members one each from Regional Asset Management, respective site & any other site in concerned region. Regional Asset Management head shall review the report.
10. Based on the feedback received from Sub-stations, regional Asset Management shall forward the critical issues/ observations to Corporate – Asset Management
11. The maintenance schedule for Converter Transformers (as mentioned in controlled document DOC: D-3-14-21-01 Rev 01) and Coupling Transformers (as mentioned in controlled document DOC: D-4-02-12-00 Rev-01) shall be superseded with schedule proposed in this document.
12. This Controlled Document is applicable only for Circuit Breaker of AC substation and AC feeders (Lines, Bus/Line Reactor & ICT) of HVDC terminals. HVDC terminal AC breakers for converter bay and AC Filter banks shall be governed by controlled document applicable for Preventive maintenance schedule and format for HVDC Station.

TRANSFORMERS & REACTORS - MONTHLY MAINTENANCE ACTIVITY (WITHOUT SHUTDOWN)

MONTH:

YEAR:

	Equipment Details	ICT-I/ RØ	ICT-I/ YØ	ICT-I /BØ	SPARE	BR/LR RØ	BR/LR YØ	BR/LR YØ	Remarks, Observation & Action Plan in case of Non-Conformance
	Date of Commissioning								
	Make								
	Rating								
	Sl. No								
	Bay Loc								
	Date of checking (dd/mm/Year)								
Sl. No	Description of Activity								
1	Oil Level								
a	Bushing								
b	Conservator								
c	OLTC Conservator								
d	Breather oil cup								
2	Condition of Silica Gel								
3	Checking of Oil Leak								
4	SF6 gas pressure monitoring of valve bushings of converter transformers (if applicable)								

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/TR.REACTOR/ MONTHLY

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TRANSFORMERS & REACTORS – THREE MONTHLY MAINTENANCE ACTIVITY (WITHOUT SHUTDOWN)

MONTH:

YEAR:

	Equipment Details	ICT-I/ RØ	ICT-I/ YØ	ICT-I /BØ	SPARE	BR/LR RØ	BR/LR YØ	BR/LR YØ	Remarks, Observation & Action Plan in case of Non-Conformance
Sl. No	Description of Activity								
1	Manual Starting of Oil Pumps & Fans (for transformers and reactors upto 400kV)								
2	On Line DGA								
a	In service and healthy condition or not								
b	Checking of Oil Leak								
c	Results comparable with lab results or not								
3	On Line dry out								
a	In service and healthy condition or not								
b	Checking of Oil Leak								
c	Any pending alarm								
4	Healthiness of FO WTI								
5	Thermovision Scanning of Bushing, its connections and isolators on both sides of transformers/ reactors								

Sign. of Maintenance Engineer

Approval of Substation In-charge

TRANSFORMERS & REACTORS – HALF YEARLY ACTIVITY

I. CHECKING OF LOCAL AND REMOTE INDICATIONS OF OTI /WTI AND NOTING THE DIFFERENCE

Date of Measurement:

	Equipment Details	ICT-I/ RØ	ICT-I/ YØ	ICT-I /BØ	SPARE	BR/LR RØ	BR/LR YØ	BR/LR YØ	Remarks, Observation & Action Plan in case of Non-Conformance
Sl. No	Description of Activity								
1	WTI Reading - Local								
2	WTI Reading - Remote								
3	OTI Reading - Local								
4	OTI Reading - Remote								

II. CHECKS FOR DISSOLVED GAS ANALYSIS (DGA):

DGA (For Transformer/ Reactors with voltage level ≥ 400 kV)

Sampling Date	N2	O2	H2	CH4	C2H4	C2H6	C2H2	CO	CO2

Sampling frequency may change based on PALMS Severity Categorization/ DGA review meeting recommendation. Following schedule to be followed in case of severity categorization in PALMS

Category	DGA
DS3	1 month
DS2	1 month
DS1	3 months

Acceptable Limit for DGA: To be governed by limits mentioned in ERP.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/TR.REACTOR/ HALF YEARLY

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TRANSFORMERS & REACTORS –YEARLY ACTIVITY

I. AUTOSTARTING OF FANS AND PUMPS:

DONE/ NOT DONE

II. MEASUREMENT OF BDV OF OLTC OIL (FOR CONVERTER TRANSFORMERS)

PROPERTY	RØ	YØ	BØ	PERMISSIBLE LIMITS	Remarks, Observation & Action Plan in case of Non-Conformance
BDV (IN KV)				MIN. 40 KV (DURING O&M STAGE)	

III. ALARM/TRIP TEST

ALARM TEST			TRIP TEST									
WTI	OTI	PRD	DIFF. TRIP	O/C TRIP	Main Buchholz 1	Main Buchholz 2	OLTC Buchholz R/Y/B	WTI	OTI	PRD	MOG Low oil level	SPR

Remarks: Maximum temp indicator (Red pointer) to be brought back to original position after above test

IV. EXTERNAL CLEANING

LOCATION	REMARKS	LOCATION	REMARKS
Radiators	DONE/ NOT DONE	Buchholz & Gas Collecting Device	DONE/ NOT DONE
Bushings	DONE/ NOT DONE	Other Accessories	DONE/ NOT DONE

V. MAINTENANCE OF OLTC AND DRIVING MECHANISM

SI No	DESCRIPTION	STATUS		Remarks, Observation & Action Plan in case of Non-Conformance
		OK	NOT OK	
1.	Visual Inspection of Equipment			
2.	Manual Operation on all Taps & Handle Interlock Switch			
3.	Local & Remote Operation (Electrical) & L/R Switch			
4.	Matching of Tap Changer Position and Tap Position Indicator			
5.	Matching of Local & Remote Tap Position			
6.	Motorized Operation of OLTC from Minimum Tap position to Maximum Tap position			

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VI. CORRECTING DIFFERENCES OF LOCAL AND REMOTE INDICATIONS OF WTI/ OTI: OK/ NOT OK

VII. RUST, DAMAGES AND REPAINTING, IF REQUIRED

VIII. MARSHALING BOX-MAINTENANCE

Description	Tightening of Terminations DONE/ NOT DONE	Cleaning DONE/ NOT DONE	Checking of contactors Space Heater & Illumination	Condition of gaskets/ sealing	Remarks, Observation & Action Plan in case of Non-Conformance
MB of Transformer/ Reactor					
MB of OLTC					
MB of NGR					
TB of PRD					
TB of Buchholz Relay					
TB of Oil Surge Relay					
TB of SPR (If Provided)					
TB of Bushing CT					

Note:

1. All TBs and MBs to be properly cleaned during maintenance
2. Check operation of doors and hinges condition, earthing of cubicles, door seal condition, working of lights, heaters, thermostat, manual operation of switches, tightness of cable terminations etc.
3. Check for sealing of all possible points to prevent entry of rain water.

IX. APPLICATION OF INSULATING COATING ON BUCHOLTZ, PRD TBS TO PREVENT MAL-OPERATION DUE TO MOISTURE

X. C-TAN δ MEASUREMENT FOR BUSHINGS BY AUTOMATIC TAN DELTA KIT

For transformers and reactors upto 400kV, if any bushing above 100kV installed in the transformer/ reactor is OIP

Sl No	Type of Test Value	Date of Measurement	Para meters	HV Bushing			IV Bushing			LV 1 Bushing			LV 2 Bushing			Neutral Bushing	
				RØ	YØ	BØ	RØ	YØ	BØ	RØ	YØ	BØ	RØ	YØ	BØ	NGR	Neutral
1	FAT Value		Cap.														
			Tan Delta														
2	Pre-Comm Value		Cap.														
			Tan Delta														
3	Periodic Measured Value	Previous	Cap.														
			Tan Delta														

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4	Periodic Measured Value	Present	Cap.														
			Tan Delta														
5	% Variation from previous measurement		Cap.														
			Tan Delta														

Note: -

- All Bushings to be cleaned prior to measurement.
- For measurement of C and Tan delta of bushings, shorting of HV-IV-N terminals of all bushings to be made and LV winding are to be shorted
- For measurement of C1 values of the bushing, connection to made between HV terminals and test tap and measurement to be done in UST mode at 10.0KV
- Test results are to be compared with previous year test results and pre-commissioning test results
- Prior to measurement, test tap must be dried out by dry air / nitrogen. Similarly exercise to be done after completion of the test prior to putting the cover. Earthing of test plug to be ensured.
- If absolute value of $\tan\delta_1$ is more than 0.007 to be replaced immediately. If required, values to be re-confirmed at the same time without any delay or monitoring. In case of doubt, the equipment to be replaced and the replaced piece to be investigated in details. if it is found ok it can be kept as spare for future use.
- Trending of Tan delta to be done w.r.t previous results and trend curves to be attached with the filled format. Same kit to be preferred for testing which was used during previous measurement.
- In case bushing falls under various severity category in PALMS (S1-Low Severity, S2- Medium Severity, S3-High Severity), Tan Delta testing to be repeated at following frequencies

Category	OIP Bushing (>100 kV)	OIP Bushing (<100 kV)	RIP Bushing (>100 kV)	RIP Bushing (<100 kV)
BS3	3 months	6 months	6 months	1 year
BS2	6 months	1 year	1 year	2 year
BS1	1 year	1 year	1 year	2 year

Acceptable Limit for Tan δ :- 0.007 C & Tan δ value to be monitored by regional Asset Management.

- XI. VARIABLE FREQUENCY TAN DELTA:** In addition to above, variable frequency tan delta is also to be carried out from 15 Hz to 400HZ for all the bushings and frequency selection shall be as per the following and to be uploaded in ERP as document.

Freq.	17Hz	34Hz	68Hz	85Hz	102Hz	119Hz	136Hz	187Hz	255Hz	323Hz	391Hz
Cap											
Tan Delta											

Acceptable Limit for Variable Frequency Tan δ : Tan Delta at 17Hz \leq Tan Delta at 50Hz + 0.001; Tan Delta at 391Hz \leq Tan Delta at 50Hz + 0.001
In case of violation, interpretation of results to be noted from PALMS. Matter to be referred to RHQ-AM for final decision.

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XII. CHECKS FOR DISSOLVED GAS ANALYSIS (DGA):

DGA (For Transformer/ Reactors with voltage level upto 220kV)

Sampling Date	N2	O2	H2	CH4	C2H4	C2H6	C2H2	CO	CO2

Sampling frequency may change based on PALMS Severity Categorization/ DGA review meeting recommendation. Following schedule to be followed in case of severity categorization in PALMS

Category	DGA
DS3	1 month
DS2	1 month
DS1	3 months

Acceptable Limit for DGA: To be governed by limits mentioned in ERP.

XIII. CHECKS FOR OIL PARAMETERS:

Sampling Date	BDV	Water Content	DDF (Tan Delta)	Resistivity @ 90° c	IFT	Acidity	Flash Point

Sampling frequency may change based on DGA review meeting recommendation.

Note: for Ester filled equipments, Fire Point and Viscosity shall also be measured annually along with above parameters

Acceptable Limit for Oil Parameters: To be governed by limits mentioned in ERP.

XIV. ON LINE MOISTURE ESTIMATION (TREND CURVE TO BE MAINTAINED SEPARATELY)

Transformer/ ReactorDetails	Present Value (On dtd... ..)	Previous Value (On dtd... ..)
	%RS	%RS

ACTION PLAN BASED ON RELATIVE SATURATION (% RS) OF WATER IN OIL

% RS IN OIL	CONDITION	ACTION REQUIRED
0-5	DRY INSULATION	Measurement of % RS on yearly basis
6-10	MODERATE TO WET	Measurement of % RS on half yearly basis
10-20	WET	Dry out (Preferably on Line)
>20	EXTREMELY WET	Off Line Dry Out

For Tertiary Reactors, action Plan shall be decided during DGA review meeting

Sign. of Maintenance Engineer

Approval of Substation In-charge

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Format No.: SS/MAIN/TR.REACTOR/ YEARLY

TRANSFORMERS & REACTORS - 2 YEARLY ACTIVITY

I. CORE INSULATION TEST (WHERE TERMINALS ARE BROUGHT OUT)

Details of Kit..... Ambient Temperature.....

Shorting link between CC, CL & G to be removed and IR value to be taken between CC-G, CL-G & CC-CL by applying 2kV DC

Terminals	Insulation Value	Terminals	Insulation Value
CC-G		CC-CL	
CL-G		Semi-shield –G (if provided) at 1 kV	

*Acceptable Limit: Core Insulation values to be >100MΩs during service.
If the value is <10 MΩ, matter to be informed to RHQ-AM. Internal inspection to be planned based on other test results.*

II. NEUTRAL EARTH RESISTANCE MEASUREMENT TO BE CARRIED OUT AFTER DISCOONECTING LINK WITH GRID

	RESISTANCE VALUE		REMARKS
	PIT-1	PIT-2	
PREVIOUS VALUE			
PRESENT VALUE			

Acceptable Limit: Neutral Earth Resistance values to be <10 Ω during service

III. TAN δ MEASUREMENT FOR BUSHINGS BY AUTOMATIC TAN DELTA KIT

For transformers and reactors of 765kV voltage class and for transformers and reactors upto 400kV class (if all bushings above 100kV installed in the transformer/ reactor is RIP)

Sl No	Type of Test Value	Date of Measurement	Para meters	HV Bushing			IV Bushing			LV 1 Bushing			LV 2 Bushing			Neutral Bushing	
				RØ	YØ	BØ	RØ	YØ	BØ	RØ	YØ	BØ	RØ	YØ	BØ	NGR	Neutral
1	FAT Value		Cap.														
			Tan Delta														
2	Pre-Comm Value		Cap.														
			Tan Delta														
3	Periodic Measured Value	Previous	Cap.														
			Tan Delta														
Present		Cap.															
		Tan Delta															
4			Cap.														
			Tan Delta														
5	% Variation from previous measurement		Cap.														
			Tan Delta														

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Note: -

- i. All Bushings to be cleaned prior to measurement.
- j. For measurement of C and Tan delta of bushings, shorting of HV-IV-N terminals of all bushings to be made and LV winding are to be shorted
- k. For measurement of C1 values of the bushing, connection to made between HV terminals and test tap and measurement to be done in UST mode at 10.0KV
- l. Test results are to be compared with previous year test results and pre-commissioning test results
- m. Prior to measurement, test tap must be dried out by dry air / nitrogen. Similarly exercise to be done after completion of the test prior to putting the cover. Earthing of test plug to be ensured.
- n. If absolute value of $\tan\delta$ is more than 0.007 to be replaced immediately. If required, values to be re-confirmed at the same time without any delay or monitoring. In case of doubt, the equipment to be replaced and the replaced piece to be investigated in details. if it is found ok it can be kept as spare for future use.
- o. Trending of Tan delta to be done w.r.t previous results and trend curves to be attached with the filled format. Same kit to be preferred for testing which was used during previous measurement.
- p. In case bushing falls under various severity category in PALMS (S1-Low Severity, S2- Medium Severity, S3-High Severity), Tan Delta testing to be repeated at following frequencies

Category	OIP Bushing (>100 kV)	OIP Bushing (<100 kV)	RIP Bushing (>100 kV)	RIP Bushing (<100 kV)
BS3	3 months	6 months	6 months	1 year
BS2	6 months	1 year	1 year	2 year
BS1	1 year	1 year	1 year	2 year

Acceptable Limit for Tan δ :- 0.007 C & Tan δ value to be monitored by regional Asset Management.

IV. VARIABLE FREQUENCY TAN DELTA: In addition to above, variable frequency tan delta is also to be carried out from 15 Hz to 400HZ for all the bushings and frequency selection shall be as per the following and to be uploaded in ERP as document.

Freq.	17Hz	34Hz	68Hz	85Hz	102Hz	119Hz	136Hz	187Hz	255Hz	323Hz	391Hz
Cap											
Tan Delta											

Acceptable Limit for Variable Frequency Tan δ : Tan Delta at 17Hz \leq Tan Delta at 50Hz + 0.001; Tan Delta at 391Hz \leq Tan Delta at 50Hz + 0.001
In case of violation, interpretation of results to be noted from PALMS. Matter to be referred to RHQ-AM for final decision.

V. ON LINE PARTICLE COUNTS

No. of particles with size $>5 \mu\text{m}$:

No. of particles with size $>15 \mu\text{m}$:

Volume of Sample Tested:

ISO 4406 Class:

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Interpretation Table:

(ISO 4406 class)	Maximum count per 100 ml		Contamination designation	Notes
	5 µm	15 µm		
9/6 to 10/7	1 000	130	Low	Excellent oil cleanliness encountered during factory acceptance test and transformer Commissioning
11/8 to 15/12	32 000	4 000	Normal	Contamination level typical for transformers in service
16/13 to 17/14	130 000	16 000	Marginal	Contamination level found on a significant number of transformers in service
18/15 and above			High	Contamination level rare and usually indicative of abnormal operating conditions

Note:

For automatic particle counter analysis, the contaminant code is determined by:

- allocating a first scale number to the total number of particles equal to or larger than 4 µm(c),
 - allocating a second scale number to the total number of particles equal to or larger than 6 µm(c),
 - allocating a third scale number to the total number of particles equal to or larger than 14 µm(c),
- and then — writing these three numbers one after another separated by oblique strokes (slashes). For example, 22/18/13

For interpretation, the particle obtained for $\geq 6 \mu\text{m(c)}$ is to be treated as $>5 \mu\text{m}$ and the particles obtained as $\geq 14 \mu\text{m(c)}$ is to be treated as $>15 \mu\text{m}$. Particle count obtained for $\geq 4 \mu\text{m(c)}$ is to be neglected.

If the breakdown voltage and water content are near or outside the limit and the particle number is higher than the limits for any of the size ranges, oil filtration to be carried out.

VI. Measurement OF BDV OF OLTC OIL (FOR ICT)

PROPERTY	RØ	YØ	BØ	PERMISSIBLE LIMITS	Remarks, Observation & Action Plan in case of Non-Conformance
BDV (IN KV)				> 40 KV	

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/TR.REACTOR/ TWO YEARLY

TRANSFORMERS & REACTORS – 10 YEARLY ACTIVITY

I. TAN δ AND CAPACITANCE MEASUREMENT OF WINDINGS BY AUTOMATIC TAN DELTA KIT

To be also done before end of first year and before end of warranty (generally in 5th year of service)

Test Modes	Factory Measured Values		Pre-Commissioning Values		Previous Measured Value		Present Measurement		Remarks, Observation & Action Plan in case of Non-Conformance
	Capacitance	Tan δ	Capacitance	Tan δ	Capacitance	Tan δ	Capacitance	Tan δ	
HV-IV/LV in UST Mode									<u>Note:</u> Ensure that Jumpers are disconnected from all the Bushings before start of the Tests and all Bushings of individual windings (HV-IV-N) are shorted. Neutral to be disconnected from Ground.
HV-IV/LV+G in GST Mode									
HV-IV/LV with gaurd GSTg Mode									
LV / HV-IV in UST Mode									
LV/ HV-IV +G in GST Mode									
LV/ HV-IV with gaurd GSTg Mode									

Acceptable Limit for Tan δ :- 0.007

*Incase, any major work is going on requiring opening of jumpers then Tan Delta Measurement of Windings to be carried out

II. CHECKING AND CLEANING OF DIVERTER SWITCH CONTACTS (FOR OLTCs in ICT)

(Internal inspection of OLTC diverter switch carried out in association with manufacturers' representative: YES/ NO)

Sl. No	Description	Done/ Not done	Remarks, Observation & Action Plan in case of Non-Conformance
01	Check for signs of moisture such as rusting, oxidation or free-standing water and leakages		
02	Clean the inner walls of the diverter switch housing by Nylon Brush		
03	Check the fixed and moving contacts are properly engaged or not by performing manual operation for each step.		
04	Make sure each washer and screws put back again.		
05	Check the degree of contact burning. It should be within specified limit given by manufacture.		
06	Do not file or smooth the burned and pitted contact surfaces.		
07	Before installing the diverter switch, make sure that no foreign objects, tools, wires, rags etc are left in the diverter switch housing.		
08	When the diverter switch is lowered, check visually that its plug –in contacts are aligned with the contacts in the cylinder wall.		
09	Replace the oil (with new one and used oil to be discarded)		
10	After filling the oil, manually crank throughout entire range.		
11	Oil BDV to be measured and recorded (Permissible limit for new oil >60kV)		
12	On load Tap changer operation to be carried out after completion of overhauling in presence of manufacturer's representative (± 2 taps)		

* In case DCRM of OLTC carried out, report of same to be attached along with this format.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/TR.REACTOR/TEN YEARLY

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TRANSFORMERS & REACTORS - SOS ACTIVITY

I. WINDING RESISTANCE MEASUREMENT (TRANSFORMER)

Testing at Minimum, Nominal and Maximum Taps to be done in the final year before end of warranty (For e.g. for equipments where warranty is of 5 years, the testing to be done in the 5th year of service).

MEASUREMENT OF HV SIDE WDG RESISTANCE AT ALL TAPS (IN mΩ)										
TAP POSN.	FACTORY TEST VALUES AT 75°C			CURRENT MEASURED WDG. RESISTANCE AT 75°C			% DEVIATION FROM THE FACTORY RESULT			Remarks, Observation & Action Plan in case of Non-Conformance
	1R1-2R1	1Y1-2Y1	1B1-2B1	1R1-2R1	1Y1-2Y1	1B1-2B1	1R1-2R1	1Y1-2Y1	1B1-2B1	
1										
2										
3										
-										
MAX										
Normal Tap										

BETWN.WDGS	FACTORY TEST VALUES AT 75°C	CURRENT MEASURED WDG. RESISTANCE AT 75°C	% DEVIATION FROM THE FACTORY RESULT	Remarks, Observation & Action Plan in case of Non-Conformance
2R1-N				
2Y1-N				
2B1-N				

BETWN.WDGS	FACTORY TEST VALUES AT 75°C	CURRENT MEASURED WDG. RESISTANCE AT 75°C	% DEVIATION FROM THE FACTORY RESULT	Remarks, Observation & Action Plan in case of Non-Conformance
3R1-3B1				
3Y1-3R1				
3B1-3Y1				

Permissible limit: - ±5% variation between phases or from Factory test results

In pre-warranty test, testing to be done at Minimum, Nominal and Maximum Taps. In case variation observed from pre-commissioning results is >0.5%, testing to be done at all taps

Formula for calculating the resistance at 75°C: $R_{75} = R_t (235+75) / (235+t)$, where R_t = Resistance measured at winding temperature t .

II. WINDING RESISTANCE MEASUREMENT (REACTOR)

Testing at Minimum, Nominal and Maximum Taps to be done in the final year before end of warranty (For e.g. for equipments where warranty is of 5 years, the testing to be done in the 5th year of service).

	FACTORY TEST VALUES AT 75°C	CURRENT MEASURED WDG. RESISTANCE AT 75°C	% DEVIATION FROM THE FACTORY RESULT	Remarks, Observation & Action Plan in case of Non- Conformance
R PHASE				
Y PHASE				
B PHASE				

III. WINDING RESISTANCE MEASUREMENT (REACTOR) – NGR WINDING

FACTORY TEST VALUES AT 75°C	CURRENT MEASURED WDG. RESISTANCE AT 75°C	% DEVIATION FROM THE FACTORY RESULT	Remarks, Observation & Action Plan in case of Non-Conformance

IV. TAN DELTA AND CAPACITANCE MEASUREMENT OF NGR WINDING

VOLTAGE	BETWEEN	CAPACITANCE			TAN DELTA			Remarks, Observation & Action Plan in case of Non- Conformance
		FACTORY Date:	PREVIOUS Date:	CURRENT Date:	FACTORY Date:	PREVIOUS Date:	CURRENT Date:	
2 KV	HV/ TANK+E							
10 KV								

V. TAN DELTA AND CAPACITANCE MEASUREMENT OF NGR BUSHING

VOLTAGE	CAPACITANCE			TAN DELTA			Remarks, Observation & Action Plan in case of Non- Conformance
	FACTORY Date:	PREVIOUS Date:	CURRENT Date:	FACTORY Date:	PREVIOUS Date:	CURRENT Date:	
2 KV							
10 KV							

VI. MEASUREMENT OF VOLTAGE RATIO (To be carried out preferably using Automatic Turns Ratio kit)

Testing at Minimum, Nominal and Maximum Taps to be done in the final year before end of warranty (For e.g. for equipments where warranty is of 5 years, the testing to be done in the 5th year of service).

PTW NO		Make & Sl. No of Equip.		Rating		DOC	
Date of Measurement		Kit Details (Make & Sl. No)		Last Calibration Date		OTI Temp	

A. RATIO BETWEEN HV & IV

Tap Position	Voltage Applied			Voltage Measured			Ratio			Factory Measured Ratio			Variation in Ratio		
	1R-N	1Y-N	1B-N	2R-N	2Y-N	2B-N	R	Y	B	R	Y	B	R	Y	B
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
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23															

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B. RATIO BETWEEN HV & LV

Tap Position	Voltage Applied			Voltage Measured			Ratio			Factory Measured Ratio			Variation in Ratio		
	1R-N	1Y-N	1B-N	B	R	B	R	B	B	R	Y	B	R	Y	B
Lowest															
Normal															
Highest															

C. RATIO BETWEEN IV & LV (RATIO TO BE TAKEN FOR ALL IN CASE OF OLTC ON NEUTRAL SIDE)

Tap Position	Voltage Applied			Voltage Measured			Ratio			Factory Measured Ratio			Variation in Ratio		
	2R-N	2Y-N	2B-N	B	R	B	R	B	R	R	Y	B	R	Y	B
Normal															

Note: The table is meant for Voltage method. If turns ratio kit is used ratio to be recorded straightaway.

The variation of result should be within ± 0.5 % from specified values or Factory test result.

In pre-warranty test, testing to be done at Minimum, Nominal and Maximum Taps. *In case variation observed from pre-commissioning results is >0.5%, testing to be done at all taps*

VII. VIBRATION MEASUREMENT (For Reactors only)

To be done in the 20th year of service for reactors

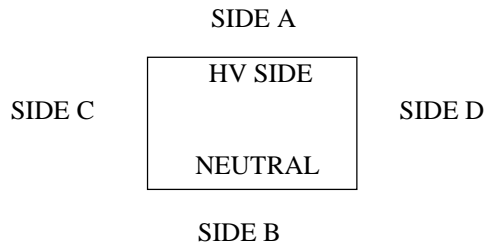
Voltage:

(Preferably 420kV)

Frequency:

MVAR:

Measurement of vibrations to be done as per existing practice (indicating the drawing with location of testing marked)



Various Location are to be shown in the Diagram with X, Y Co-Ordinates for easy identification

ZONE NO.	LOCATION OF MEASUREMENT (VIBRATION IN MICRON)																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A																			
B																			
C																			
D																			

Permissible limit: - 200 Microns (Peak to Peak) and 60 Microns (Avg)

Note: Comparison of factory, previous and current measurement to be done and observation to be recorded.

VIII. MEASUREMENT OF IR VALUES (PI/DA RATIO)-

To be done in 5th year/ before end of warranty and 20th year of service

Test Modes	IR value after 15 Seconds		IR value after 60 Seconds		IR value after 600 Seconds		IR60/IR15 (DA)	IR600/IR60 (PI)
	Pre-Comm	Actual	Pre-Comm	Actual	Pre-Comm	Actual		
HV+ IV to Tank								
LV to Tank								
HV to LV								

Permissible limit: IR for 66KV & above >500 MΩ at 30°C, Polarization Index >1.25

Interpretation table for Polarization Index:

Polarization Index (PI)	Insulation Condition
Less than 1	Dangerous
1.0 to 1.1	Poor
1.1 to 1.25	Questionable
1.25 to 2.0	Fair
>2	Good

Observations & action plan in case of non-conformance:

When the insulation resistance falls below base line values, it can, in most cases of good design and where no defect exists, be brought up to the required standard by cleaning and drying the apparatus. An insulation resistance of zero or a very low value indicates a grounded winding, a winding-to-winding short, or heavy carbon tracking. This possibility should be confirmed by additional tests such as polarization index, Winding Tan Delta, or moisture content of insulating liquid.

IX.FREQUENCY RESPONSE ANALYSIS (FRA)

Sl. No	Description	Status		Remarks & Action plan in case of Non-conformance
		Yes	No	
1.	Carried out after a) Transformer subjected to long duration through close in fault Current (cleared on backup O/C & E/F protection) / frequent through faults (Date of fault) b) Any other abnormality i.e. violation in Dissolved gases/ after any tripping c) Any shifting / Transportation (Mention Details)			On occurrence of through fault, if secondary side fault current is more than 50% of rated secondary side short circuit fault current or fault duration is more than 200ms, immediate DGA sampling for lab testing to be done. SFRA test to be done as per following conditions <ul style="list-style-type: none"> Immediately, if rise in gas values observed In next AMP, if no rise in gas values observed
2.	Carried Out as per procedure mentioned in Pre-commissioning Format			
3.	Interpretation of test results carried out by Site/ RHQ-AM			
4.	Factory & previous FRA test report available at site			

X. FREQUENCY DOMAIN SPECTROSCOPY (FRA)

To be done in 20th year of service

Name of Equipment:

Insulation assessment	
Measurement:	CHG
Capacitance, pF:	
%DF:	
%DF @ 20°C:	
Moisture, %:	
Oil Cond, @ 25°C, pS/m:	

Interpretation Chart:

%DF @ 20°C	<0.30% As New	0.30-0.50% Good	0.51-1.0% Deteriorated	>1.0% Investigate
Moisture %	<1.0% As New	1.0-2.0% Dry	2.0-3.0% Moderately Wet	>3.0% Wet
Oil Cond, @ 25°C, pS/m:	< 0.37pS/m As New	0.37-3.7pS/m Good	3.7-37pS/m Service aged	>37pS/m Deteriorated

Results to be shared with RHQ-AM. Further course of action to be taken in consultation with RHQ-AM.

XI. WTI AND OTI SETTINGS

WTI SETTINGS in °C			OTI SETTINGS in °C			NGR OTI SETTINGS in °C			FAN			PUMP		
	Set For	Actual		Set For	Actual		Set For	Actual		Set For	Actual		Set	Actual
Alarm	100		Alarm	90		Alarm			Start	65		Start	70	
Trip	110		Trip	100		Trip			Stop	60		Stop	65	

Remarks.....

XII. CHECKING OF OTI AND WTI (Use Controlled Temp. Bath with valid calibration)

Set Temperature	OTI	WTI-HV	WTI-IV	WTI-LV
Ambient to 110 °C in step of every 10 °C				

XIII. CHECKING AND CLEANING OF DIVERTER SWITCH CONTACTS (FOR OLTCs in CONVERTER TRANSFORMERS)

No. of operations completed since last overhauling/ pre-commissioning:

No. of operation at which overhauling is prescribed by OEM:

Internal inspection of OLTC diverter switch carried out in association with manufacturers' representative: YES/ NO

Sl. No	Description	Done/ Not done	Remarks, Observation & Action Plan in case of Non-Conformance
01	Check for signs of moisture such as rusting, oxidation or free-standing water and leakages		
02	Clean the inner walls of the diverter switch housing by Nylon Brush		
03	Check the fixed and moving contacts are properly engaged or not by performing manual operation for each step.		
04	Make sure each washer and screws put back again.		
05	Check the degree of contact burning. It should be within specified limit given by manufacture.		
06	Do not file or smooth the burned and pitted contact surfaces.		
07	Before installing the diverter switch, make sure that no foreign objects, tools, wires, rags etc are left in the diverter switch housing.		
08	When the diverter switch is lowered, check visually that its plug –in contacts are aligned with the contacts in the cylinder wall.		
09	Replace the oil (with new one and used oil to be discarded)		
10	After filling the oil, manually crank throughout entire range.		
11	Oil BDV to be measured and recorded (Permissible limit for new oil >60kV)		
12	On load Tap changer operation to be carried out after completion of overhauling in presence of manufacturer's representative (± 2 taps)		

* In case DCRM of OLTC carried out, report of same to be attached along with this format.

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XIV. FURAN

Following norms to be maintained for measurement of Furan parameters:

- Before energizing new Transformer/ Reactor (along with BDV/ ppm and DGA)
- Once before expiry of warranty period of Transformers/ Reactors
- In 10th and 20th year of service
- On four yearly basis after 10th year of service
- On two yearly basis, if Furan content is between 0.5 ppm to 1 ppm.
- On yearly basis, if Furan content is 1 ppm to 2 ppm
- On six monthly basis, if Furan content is > 2 ppm
- More frequently as per recommendations from CC-AM

XV. INHIBITOR CONTENT

Acceptable value: 04% to 0.08%. Factory value to be considered as reference value. If factory values are not available, then first record value is to be considered as reference value.

Following monitoring schedule to be maintained for inhibitor content.

- (a) Once before expiry of warranty period of Transformers/ Reactors
- (b) In 10th and 20th year of service
- (c) On two-yearly-basis, after 10th year of service
- (d) On yearly-basis, if inhibitor concentration of 60- 80 % of original value
- (e) On six-monthly-basis, if inhibitor concentration of 40- 60 % of original value
- (f) More frequently as per recommendations from CC-AM

Inhibitor concentration of (40 – 60) % of original value and acidity $\leq 0.06 \text{ mg}_{\text{KOH}}/\text{g}_{\text{oil}}$ IFT $\geq 30 \text{ mN/m}$, Re-inhibit to original concentration.

Inhibitor concentration <40 % of original value or acidity $>0.06 \text{ mg}_{\text{KOH}}/\text{g}_{\text{oil}}$ and IFT <30 mN/m re-inhibit to original concentration, or replace oil based on CC-AM recommendation

XVI. Thermovision Scanning of Main Tank: OK/ NOT OK

Any Critical Observation:

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/TR.REACTOR/SOS

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TRANSFORMERS & REACTORS – COLD SPARES

I. CHECKS ON COLD SPARE TRANSFORMER AND REACTOR – YEARLY ACTIVITY

Sl. No.	Description	Status		Remarks, Observation & Action Plan in case of Non-Conformance
		OK	NOT OK	
1	Operation check of OLTC for all Tap Positions			
2	Circulation of oil for 12 hrs. by running pump / filtration machine			

II. CHECKS ON COLD SPARE TRANSFORMER AND REACTOR – FIVE YEARLY ACTIVITY

Capacitance & Tan Delta of the bushings installed in the spare transformers & reactors

PHASE	VOLTAGE	CAPACITANCE			TAN DELTA			Remarks, Observation & Action Plan in case of Non-Conformance
		FACTORY Date:	PREVIOUS Date:	CURRENT Date:	FACTORY Date:	PREVIOUS Date:	CURRENT Date:	
R	2 KV							
	10 KV							
Y	2 KV							
	10 KV							
B	2 KV							
	10 KV							
Neutral	2 KV							
	10 KV							

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/TR.REACTOR/SPARE

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CIRCUIT BREAKER - MONTHLY ACTIVITY

Sub-Station:

Bay Loc. No		Make & Sl. No of Equip.		Rating	
DOC		Date			

MONTHLY MAINTENANCE WITHOUT SHUT DOWN

Date.....

ACTIVITY	OBSERVATION	ACTION TAKEN
a. Oil Leakage in Operating Mechanism b. Oil Level in Operating Mechanism (Top up, if required) c. Oil Leakage from Grading Capacitors d. Visual check of MBs (for any moisture/ defects) e. Healthiness of auto drain valve in pneumatic mechanism f. Healthiness of Controlled switching device g. Incase of Dual compressor, changeover of compressor to be done		

Sign. of Maintenance Engineer

Approval of Substation In-charge

CIRCUIT BREAKER - YEARLY ACTIVITY

I. AIR/ OIL PRESSURE DROP DURING DUTY CYCLE OPERATION - O-0.3 S-CO

	AIR/ OIL PRESSURE			
	Pre-commissioning value	Previous value	Present value	Remarks/Observations
Before Operation				
After Operation				
Drop in Pressure				

II. Checking of Air Compressor/Hydraulic Pump operation

	Set value	Actual value	Remarks/Observations
START (Pressure)			
STOP (Pressure)			

III. Checking of spring charging motor/ air compressor motor/ hydraulic compressor motor operation timing

	Pre-commissioning value	Present value	Remarks/Observations
Duration of running			

Format No: SS/MAIN/CB/ YEARLY

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IV. Checking of alarm/lockout contacts to be checked through simulation : Ok/Not Ok

V. Checking of Pole Discrepancy Relay

TRIP 'R' ph	Measure Tripping Time of Y & B pole		<i>Close/Trip time pole discrepancy at rated operating pressure</i>	<i>Permissible Limits</i>
	Set Value* in sec	Operating Value in sec		
PRECOMMG			<i>a) Phase to Phase (Max) - close operation</i>	<i>5.0ms</i>
PREVIOUS VALUE			<i>b) Phase to Phase (Max) - open operation</i>	<i>3.33ms</i>
PRESENT VALUE			<i>c) Break to Break (Max) of same pole</i>	<i>2.5 ms</i>
<i>Note- 2.5 Sec for CBs with Auto Reclose Function & 0.5 Sec for CBs without Auto Reclose Function.</i>				

Close any one pole and observe the tripping of same pole

CLOSE 'R' pole	Measure Tripping Time of R pole	
	SET Value in sec	Operating Value in sec
PRECOMMISSIONING		
PREVIOUS VALUE		
PRESENT VALUE		
<i>Note- 2.5 Sec for CBs with Auto Reclose Function & 0.5 Sec for CBs without Auto Reclose Function.</i>		

VI. Checking of Anti Pumping relay – by giving simultaneous & continuous Close & Trip command, Hunting should not take place.
OK/ NOT OK

Format No: SS/MAIN/CB/ YEARLY

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VII. **Duty Cycle operation including rapid re-closing**

O-0.3 S-CO*	Timings (ms)					
	POLE	Break 1			Break 2	
		PRECOMG.	PREVIOUS	PRESENT	PRECOMG	PREVIOUS
R						
Y						
B						

*For CO, no delay in Close/ Trip commands.
Final Timing till last Open of Duty cycle to be filled.

Note: Depending on number of Breaks, formats shall be modified.

VIII. **Check of interlocks** (Local Closing Interlock):

- 1.) Line Isolator with CB:
- 2.) Earth Switch interlocks with CB:
- 3.) Isolator interlocks with CB

IX. **Check of Operating Lockouts**

Sl. No	Test-Description	Pressure Values					
		A/R Lockout		Closing L/O		Operational Lockout	
		Set value	Actual	Set Value	Actual	Set Value	Actual
1.	Driving mechanism (Hydraulic / Pneumatic)						

X. **Maintenance of Air Compressor in Pneumatic drive:** As per manufacturer's guideline

	Remarks/ Observation
Checking of compressor oil and change if necessary	
Cleaning and Lubrication	

XI. Cleaning of Breaker Pole

	Remarks/ Observation
Support Insulators	
PIR and grading capacitor	
Interrupter Chamber	

XII. Spring Operating Mechanism

	Remarks/ Observation
Lubrication of Chain and Gears	
Checking healthiness and cleaning of rollers	
Checking healthiness of springs, Greasing if required	

XIII. Healthiness of Operation Counter

XIV. Maintenance of Control Cabinets

- Checking of tightness of all the terminations in MB.
- Checking of Door Sealing gaskets and replacement thereof, if necessary
- Check functioning of space heater/ illumination

Sign. of Maintenance Engineer

Approval of Substation In-charge

CIRCUIT BREAKER – VULNERABLE – SIEMENS MAKE - YEARLY ACTIVITY

CB Timing including PIR Checks

PHASE	BREAK	DETAILS	CLOSE TIME	OPEN TIME		CLOSE OPEN (CO)* TIME		Close coil current	Trip coil current				REMARKS & OBSERVATIONS	
				TRIP-I	TRIP - II	TRIP-I	TRIP - II		Factory Values		Present Values			
									T _{c1}	T _{c2}	T _{c1}	T _{c2}		
R1	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														
R2	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														
Y1	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														

PHASE	BREAK	DETAILS	CLOSE TIME	OPEN TIME		CLOSE OPEN (CO)* TIME		Close coil current	Trip coil current				REMARKS & OBSERVATIONS	
				TRIP-I	TRIP - II	TRIP-I	TRIP - II		Factory Values		Present Values			
									T _{c1}	T _{c2}	T _{c1}	T _{c2}		
Y2	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														
B1	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														
B2	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														

Note- 1. In case of CB fitted with Controlled switching device, the set values need to be changed in CSD when close or trip time variations are observed during AMP.

2. Above PIR opening times is to be noted wherever applicable.

* CO Time is to be measured with simultaneous Close-Trip Commands. In case provision does not exist for simultaneous Close/ Trip commands in kit, Trip command to be given at least 10 ms prior to closing of CB contacts.

Sign. of Maintenance Engineer

Approval of Substation In-charge

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Format No: SS/MAIN/CB/ VUL/YEARLY

CIRCUIT BREAKER – NON VULNERABLE – OTHER MAKE EXCEPT SIMENES – 2 YEARLY ACTIVITY

CB Timing including PIR Checks (To be also done before end of first year)

PHASE	BREAK	DETAILS	CLOSE TIME	OPEN TIME		CLOSE OPEN (CO)* TIME		Close coil current	Trip coil current				REMARKS & OBSERVATIONS	
				TRIP-I	TRIP - II	TRIP-I	TRIP - II		Factory Values		Present Values			
									T _{c1}	T _{c2}	T _{c1}	T _{c2}		
R1	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														
R2	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														
Y1	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														

PHASE	BREAK	DETAILS	CLOSE TIME	OPEN TIME		CLOSE OPEN (CO)* TIME		Close coil current	Trip coil current				REMARKS & OBSERVATIONS	
				TRIP-I	TRIP - II	TRIP-I	TRIP - II		Factory Values		Present Values			
									T _{c1}	T _{c2}	T _{c1}	T _{c2}		
Y2	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														
B1	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														
B2	Break 1	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
		OPENING TIME PRIOR TO MAIN CONTACTS												
	AUXILIARY CONTACT (NO)													
	Break 2	PIR CONTACT												
		MAIN CONTACT												
		PIR INSERTION TIME*												
		PIR & MAIN CONTACTS OVERLAP TIME/ PIR												
OPENING TIME PRIOR TO MAIN CONTACTS														
AUXILIARY CONTACT (NC)														

Note- 1. In case of CB fitted with Controlled switching device, the set values need to be changed in CSD when close or trip time variations are observed during AMP.

2. Above PIR opening times is to be noted wherever applicable.

* CO Time is to be measured with simultaneous Close-Trip Commands. In case provision does not exist for simultaneous Close/ Trip commands in kit, Trip command to be given at least 10 ms prior to closing of CB contacts.

Sign. of Maintenance Engineer

Approval of Substation In-charge

CIRCUIT BREAKER – AGE MORE THAN 10 YEAR– YEARLY ACTIVITY

Measurement of Static Contact Resistance

CB POLES	CONTACT RESISTANCE IN MICRO OHMS			
	Interrupter 1	Interrupter 2	Interrupter 3	Interrupter 4
R phase				
Y phase				
B phase				

Note: Permissible Limits

<i>a) Contact Resistance of CB (in Micro-Ohm)</i>	<i>765kV</i>	<i>400kV</i>	<i>220kV</i>	<i>132kV</i>
	<i>75 μΩ*</i>	<i>75 μΩ*</i>	<i>100 μΩ</i>	<i>100 μΩ</i>
<i>b) Contact Resistance of CB terminal connector</i>		<i>10 Micro-Ohm per connector</i>		

** 75 μΩ (Micro-Ohm) per break*

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/CB/MORE THAN 10Y/ YEARLY

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CIRCUIT BREAKER – AGE MORE THAN 10 YEAR– 2 YEARLY ACTIVITY

I. Dynamic Contact Resistance and Contact Travel Measurement: (To be also done before end of first year)

CB POLES	BREAK	Remarks on DCRM Signature from RHQ/OS
R1 phase	BREAK 1	
	BREAK 2	
R2 phase	BREAK 1	
	BREAK 2	
Y1 phase	BREAK 1	
	BREAK 2	
Y2 phase	BREAK 1	
	BREAK 2	
B1 Phase	BREAK 1	
	BREAK 2	
B2 Phase	BREAK 1	
	BREAK 2	

Dynamic Contact Resistance signature for CO operation for all the breaks of CB to be recorded and compared with the earlier signatures. Minimum delay (co time) should be 300ms. Depending on number of Breaks, formats shall be modified.

Sampling frequency for DCRM and Contact Travel Measurement --- 10 KHZ

In addition to normal frequency, DCRM, CRM & TIMING Measurement test is to be carried out in month of April of next financial year AMP cycle if any of following condition is met :

- i. More than 150 nos. switching operations are performed by CB since last contact resistance measurement test. For the purpose of counting switching operations, One no. Close & Open cumulatively shall be considered as One no. Switching Operation. Only, onload operations shall be considered as switching operation and off line operations shall not be considered as switching operations
- ii. Summation of square of fault current cleared by any CB pole exceeds 200 kA sq since last contact resistance test.

Notifications for carrying out tests such as DCRM, CRM & Timing upon meeting any such condition as per above shall be triggered in SAP.

Format No.: SS/MAIN/CB/MORE THAN 10Y/2 YEARLY

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II. Capacitance & Tan δ Measurement of Grading Capacitor (To be also done before end of first year)

DESCRIPTION	INTERRUPTER 1			INTERRUPTER 2			INTERRUPTER 3			INTERRUPTER 4		
	R-PH	Y -PH	B-PH	R-PH	Y -PH	B-PH	R-PH	Y -PH	B-PH	R-PH	Y -PH	B-PH
CAPACITANCE												
FACTORY VALUE												
PRE-COMM VALUE												
PREVIOUS VALUE												
PRESENT VALUE												
Tan δ												
FACTORY VALUE												
PRE-COMM VALUE												
PREVIOUS VALUE												
PRESENT VALUE												

Note: Normally Capacitance and Tan δ measurement is to be carried out in UST mode but if interference is more then, same may be done in GSTg mode with one side grading capacitor grounded and other side connected to guard. **Depending on number of Interrupters/ Grading Capacitor, Format shall be modified.**

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/CB/MORE THAN 10Y/2 YEARLY

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CIRCUIT BREAKER – AGE MORE THAN 10 YEAR– 4 YEARLY ACTIVITY

Measurement of dew point in SF6 Gas at atmospheric pressure (For SF6 CB) (To be also done before end of first year)

CB POLE	DEW POINT MEASUREMENT		
	PRE-COMG.	PREVIOUS	PRESENT
	DEG C	DEG C	DEG C
R1 phase			
R2 phase			
Y1 phase			
Y2 phase			
B1 phase			
B2 phase			

Sign. of Maintenance Engineer

Approval of Substation In-charge

CIRCUIT BREAKER – AGE LESS THAN 10 YEAR– 2 YEARLY ACTIVITY

Measurement of Static Contact Resistance (To be also done before end of first year)

CB POLES	CONTACT RESISTANCE IN MICRO OHMS			
	Interrupter 1	Interrupter 2	Interrupter 3	Interrupter 4
R phase				
Y phase				
B phase				

Note: Permissible Limits

<i>a) Contact Resistance of CB (in Micro-Ohm)</i>	<i>765kV</i>	<i>400kV</i>	<i>220kV</i>	<i>132kV</i>
	<i>75 μΩ*</i>	<i>75 μΩ*</i>	<i>100 μΩ</i>	<i>100 μΩ</i>
<i>b) Contact Resistance of CB terminal connector</i>		<i>10 Micro-Ohm per connector</i>		

** 75 μΩ (Micro-Ohm) per break*

Format No.: SS/MAIN/CB/LESS THAN 10Y/2 YEARLY

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Capacitance & Tan δ Measurement of Grading Capacitor

DESCRIPTION	INTERRUPTER 1			INTERRUPTER 2			INTERRUPTER 3			INTERRUPTER 4		
	R-PH	Y -PH	B-PH	R-PH	Y -PH	B-PH	R-PH	Y -PH	B-PH	R-PH	Y -PH	B-PH
CAPACITANCE												
FACTORY VALUE												
PRE-COMM VALUE												
PREVIOUS VALUE												
PRESENT VALUE												
Tan δ												
FACTORY VALUE												
PRE-COMM VALUE												
PREVIOUS VALUE												
PRESENT VALUE												

Note: Normally Capacitance and Tan δ measurement is to be carried out in UST mode but if interference is more then, same may be done in GSTg mode with one side grading capacitor grounded and other side connected to guard. **Depending on number of Interrupters/ Grading Capacitor, Format shall be modified.**

Sign. of Maintenance Engineer

Approval of Substation In-charge

CIRCUIT BREAKER – AGE MORE THAN 10 YEAR– 4 YEARLY ACTIVITY

Dynamic Contact Resistance and Contact Travel Measurement: (To be also done before end of first year)

CB POLES	BREAK	Remarks on DCRM Signature from RHQ/OS
R1 phase	BREAK 1	
	BREAK 2	
R2 phase	BREAK 1	
	BREAK 2	
Y1 phase	BREAK 1	
	BREAK 2	
Y2 phase	BREAK 1	
	BREAK 2	
B1 Phase	BREAK 1	
	BREAK 2	
B2 Phase	BREAK 1	
	BREAK 2	

Dynamic Contact Resistance signature for CO operation for all the breaks of CB to be recorded and compared with the earlier signatures. Minimum delay (co time) should be 300ms. Depending on number of Breaks, formats shall be modified.

Sampling frequency for DCRM and Contact Travel Measurement --- 10 KHZ

In addition to normal frequency, DCRM, CRM & TIMING Measurement test is to be carried out in month of April of next financial year AMP cycle if any of following condition is met :

- i. More than 150 nos. switching operations are performed by CB since last contact resistance measurement test. For the purpose of counting switching operations, One no. Close & Open cumulatively shall be considered as One no. Switching Operation. Only, onload operations shall be considered as switching operation and off line operations shall not be considered as switching operations
- ii. Summation of square of fault current cleared by any CB pole exceeds 200 kA sq since last contact resistance test.

Notifications for carrying out tests such as DCRM, CRM & Timing upon meeting any such condition as per above shall be triggered in SAP.

Format No.: SS/MAIN/CB/LESS THAN 10Y/4 YEARLY

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Measurement of dew point in SF6 Gas at atmospheric pressure (For SF6 CB) (To be also done before end of first year)

CB POLE	DEW POINT MEASUREMENT		
	PRE-COMG.	PREVIOUS	PRESENT
	DEG C	DEG C	DEG C
R1 phase			
R2 phase			
Y1 phase			
Y2 phase			
B1 phase			
B2 phase			

In case, SF6 Gas is topped or replaced then SF6 Gas testing is to be carried out for that CB pole after SF6 gas filling and also after one week of Gas filling.

Sign. of Maintenance Engineer

Approval of Substation In-charge

CURRENT TRANSFORMER MONTHLY ACTIVITY

Dt. of Commissioning..... Make Rating S. No. Bay Loc.

Date (dd/mm/yy):

LOCATION		ACTIVITY		Remarks, Observation & Action Plan in case of Non-Conformance
		Visual inspection of CT for oil leakage and crack in insulators	Checking of bellow for expansion/ oil level	
Bay No.	R-Φ			
	Y-Φ			
	B-Φ			
Bay No.	R-Φ			
	Y-Φ			
	B-Φ			

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/CT/MONTHLY

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CURRENT TRANSFORMER – YEARLY ACTIVITY

I. Marshalling Box

1. Cleaning of MB.....
2. Checking the tightness of all electrical connections including earthing of MB
3. Cleaning and tightness of CT secondary terminals and checking healthiness of sec terminal bushing
4. Checking of Space Heater & Illumination.....
5. Check for any oil leakage from Secondary Terminal Box in case of oil filled CTs.....
6. Checking of healthiness of gaskets Good Needs Replacement (Replaced On:)
7. Checking of leakage of SF6 gas in case of gas filled CTs.....

II. Capacitance & Tan δ Measurement : (Only incase of Oil filled CT)

CT Details/ Phase	Capacitance				Tan δ (<i>Max 0.007</i>) <i>Rate of rise of Tan δ - 0.001 per year (max)</i>			
	Factory Value (Date.....)	Pre-com Value (Date.....)	Previous valu (Date.....)	Measured Value (Date.....)	Factory Value (Date.....)	Pre-commg Value (Date.....)	Previous value (Date... ..)	Measured Value (Date.....)
R- Φ								
Y- Φ								
B- Φ								

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/CT/YEARLY

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CURRENT TRANSFORMER -2 YEARLY ACTIVITY

I. Capacitance & Tan δ Measurement (SF6 filled CT) (To be also done before end of first year)

CT Details/ Phase	Capacitance				Tan δ (<i>Max 0.007</i>) <i>Rate of rise of Tan δ - 0.001 per year (max)</i>			
	Factory Value (Date.....)	Pre-com Value (Date.....)	Previous valu (Date.....)	Measured Value (Date.....)	Factory Value (Date.....)	Pre-commg Value (Date.....)	Previous value (Date... ..)	Measured Value (Date.....)
R- Φ								
Y- Φ								
B- Φ								

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No.: SS/MAIN/CT/2-YEARLY

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CURRENT TRANSFORMER -4 YEARLY ACTIVITY

I. Nitrogen pressure checking (wherever provision exists)

CT Details	Bay No./ Feeder	R	Y	B	Remarks

Note: To be carried out one year after commissioning and then after every four years. Wherever valves found to be damaged, same need to be replaced. Wherever N2 pressure found to be low, same to be filled with dry N2. The measurement to be taken with accurate and calibrated kit.

Note: Permissible Limits

<i>N2 gas filling required pressure</i>	<i>Pressure</i>	<i>Reference</i>
<i>a) At 10°C amb. Temperature</i>	<i>0.10kg/cm2</i>	<i>CC-AM Technical Circular No. 14/2004 (Rev.I)</i>
<i>b) At 20°C amb. Temperature</i>	<i>0.20kg/cm2</i>	
<i>c) At 30°C amb. Temperature</i>	<i>0.30kg/cm2</i>	
<i>d) At 40°C amb. Temperature</i>	<i>0.40kg/cm2</i>	
<i>e) At 50°C amb. Temperature</i>	<i>0.50kg/cm2</i>	

II. Dew Point & SO2 Measurement – SF6 Gas (For SF6 Filled CT) (To be also done before end of first year)

CT	DEW POINT (in Deg C)& SO2 (in ppmv) MEASUREMENT			
	PRE-COMG.	PREVIOUS		PRESENT
R-Φ				
Y-Φ				
B-Φ				

In case, SF6 Gas is topped or replaced then SF6 Gas testing is to be carried out for that CT after SF6 gas filling and also after one week of Gas filling.

III. Checking of Alarm & Lockout Contacts through Simulation in SF6 Filled CTs – OK/NOT OK

Sign. of Maintenance Engineer

Approval of Substation In-charge

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Format No.: SS/MAIN/CT/4 YEARLY

CURRENT TRANSFORMER – SOS ACTIVITY

Sub-Station:

Dt. of Commissioning..... **Make.....** **Rating.....** **S. No.** **Bay Loc.....**

PTW NO..... **Date.....**

I. Dissolved Gas Analysis

For new CTs, 1st sampling to be carried out within one month of commissioning and 2nd sampling to be carried out within six month to 12 months of commissioning.

II. Measurement of CT Ratio

Primary Current	Secondary Current	Ratio	<i>Permissible ratio Error</i>	<i>Reference</i>
100 Amp.			<i>Protection Core : +/- 3 %</i>	<i>IS-2705</i>
500 Amp.			<i>Metering Core: +/- 1 %</i>	

III. Measurement of Secondary Resistance

Core	Resistance Value			Remarks
	RØ	YØ	BØ	
1				
2				
3				
4				
5				

IV. Magnetising Characteristics

Applied Voltage in Secondary (Volts)	Measured Current (mA)	Primary Voltage (Volts)

V. Insulation Resistance Measurement

Applied Voltage	IR-15	IR-60	IR-600	Absorption Coefficient IR-60/ IR-15	Polarization Index IR-600/ IR-60

Note: Permissible Limits

<i>IR Value</i>	<i>Permissible Limit</i>	<i>Remarks</i>
<i>a) Primary – Earth</i>	<i>1000 M-OHM (Min)</i>	<i>by 5.0/10.0kV Megger</i>
<i>b) Secondary – Earth</i>	<i>50 M-OHM (Min)</i>	<i>by 0.5kV Megger</i>
<i>c) Control Cables</i>	<i>50 M-OHM(Min)</i>	<i>by 0.5kV Megger</i>

Sign. of Maintenance Engineer

Approval of Substation In-charge

CAPACITIVE VOLTAGE TRANSFORMER MONTHLY ACTIVITY**Sub-Station:****Dt. of Commissioning** **Make** **Rating** **S. No.** **Bay Loc.****MONTHLY MAINTENANCE OF CVT – W/SD**

- (i) Checking of Oil Leaks

Sign. of Maintenance Engineer**Approval of Substation In-charge**

CAPACITIVE VOLTAGE TRANSFORMER – SIX MONTHLY ACTIVITY

Measurement of voltage

Name of Feeder/ Bay	Measurement	Values Volts (for Core-3)			Voltage variation w.r.t		Remarks/ Observations & Action plan
		Bus-I	Bus-II	Line	Bus-I	Bus-II	
	R-N						
	Y-N						
	B-N						

Note: Measurement to be carried out simultaneously for same phase of Bus CVTs and line CVTs with 0.2 class multi-meter.
Readings to be taken from Control Panel. In case of discrepancy the readings should be rechecked at Switchyard.
During measurement care is to be taken that System Voltage remains moreover same.

Note: Permissible Limits for CVTs used for puposes other than metering. For CVTs used for commercial metering accuracy class limits to be followed.

<i>Drift in secondary Voltage (to be measured by 0.2 / 0.5 class Multimeter)</i>	<i>Condition</i>	<i>Measurement Frequency</i>	<i>Reference</i>
<i>a) Upto ± 0.5 volts</i>	<i>Healthy</i>	<i>6 monthly</i>	<i>POWERGRID Practice</i>
<i>b) + 0.5 to +0.8 volts</i>	<i>To be monitored</i>	<i>3 monthly</i>	
<i>c) +0.8 to +1.2 volts</i>	<i>Close monitoring</i>	<i>monthly</i>	
<i>d) +1.2 to +1.5 volts</i>	<i>Close monitoring</i>	<i>15 days</i>	
<i>e) Above +1.5 volts</i>	<i>Alarming</i>	<i>replacement</i>	
<i>f) -0.8 to -4.0 volts</i>	<i>Close monitoring</i>	<i>15 days</i>	
<i>g) Beyond -4.0 volts</i>	<i>Alarming</i>	<i>replacement</i>	

Sign. of Maintenance Engineer

Approval of Substation In-charge

CAPACITIVE VOLTAGE TRANSFORMER – YEARLY ACTIVITY

YEARLY MAINTENANCE OF CVT/IVT

Sl. No.	Description	Remarks/ Observation	Action taken/ plan
1	Visual Checking of Earthing of HF Point. (In case it is not used for PLCC)		
2	Checking of any breakage or cracks in HF bushing.		
3	Checking for any breakage or cracks in cementing joint		
4	Cleaning of CVT/IVT Capacitor Stacks and tightness of terminal connections		
5	Checking of Neutral Earthing in CVT/IVT MB and Tightness of All connections		
6	Cleaning of Marshalling Box & Junction Box		
7	Checking of Space heater & illumination		
8	Checking healthiness of all gaskets		
9.	EMU Checks- a.) Checking of oil level		
	b.) Checking of oil leakage		
	c.) Colour of Oil		
10.	Checking of Voltage Switching by Isolator auxiliary contacts (DMT Scheme)		

Sign. of Maintenance Engineer

Approval of Substation In-charge

CAPACITIVE VOLTAGE TRANSFORMER – SOS ACTIVITY

This measurement is to be carried out only when there is increase in temperature of the capacitor stacks during Thermo-vision scanning w.r.t other stacks or other units to the tune of 3-4 deg C or more. Measurements are to be carried out stack-wise. Due to the presence of EMU connected to the bottom stack, Tan delta values may come negative in some cases which can be ignored.

Capacitance & Tan δ Measurement of CVT/IVT

(All Stacks measured together between HV and HF point as well as for each stack)
While measuring Bottom and Middle stack, short middle/Top stack respectively.

STACK	PRE COMMISSIONING VALUES						MEASURED VALUES					
	CAPACITANCE			TAN δ			CAPACITANCE			TAN δ		
	R \emptyset	Y \emptyset	B \emptyset	R \emptyset	Y \emptyset	B \emptyset	R \emptyset	Y \emptyset	B \emptyset	R \emptyset	Y \emptyset	B \emptyset
TOP												
MIDDLE												
BOTTOM												
TOTAL (Between HV and HF point)												

Note: In case of deviation/ discrepancy in test results w.r.t. Factory/ Pre- commissioning values, the problem could be due to EMU PT insulation in few makes of CVTs.

In such case, secondary voltage measurement to be taken for any further decision.

Remark: *Tan Delta (Max.): 0.007, Change in Tan δ from pre commissioning value: +0.003 (Max.), Change in Capacitance from pre- commissioning value: \pm 6% (Max.)*

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/CVT/SOS

ISOLATORS AND EARTH SWITCHES – YEARLY ACTIVITY

I. OPERATING MECHANISM

S.No.	Description	Activity
1	Maintenance of Linkages including transmission gears	
2	Checking of Stopper bolts	
3	Cleaning of Aux. switch contacts & Greasing with Silicon Grease	
4	Lubrication of operating Mechanism hinges, Lock Joints on Levers and Bearings	
5	Checking & Tightening of all mounting bolts	

II. ISOLATOR

S.No	Description	Remarks
1	Cleaning and Greasing of Main Contacts	
2	Alignment of contacts/ operating levers	
3	Tightening of Bolts, Nuts and Pins Etc.	
4	Cleaning of Support Insulators and check for cracks in insulators , if any	
5	Checking of interlocks (Mechanical & Electrical)	
6	Checking of corona rings for pitting & alignment	

III. EARTH SWITCH

S.No	Description	Remarks
1	Checking and Alignment of Earthing Blades	
2	Cleaning of Contacts	
3	Operation of Earth Switch	
4	Checking of continuity of Aluminium/ Copper flexible conductor	
5	Checking of earth connections of structure & MOM box	

IV. MARSHALLING BOXES OF ISOLATORS AND EARTH SWITCHES

S.No	Description	Remarks
1	Checking of space heater & illumination	
2	Checking of healthiness of Rubber Gaskets	
3	Visual Check of auxiliary contacts	
4	Cleaning and tightness of all terminations	

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/ISOLATORS/YEARLY

ISOLATORS AND EARTH SWITCHES – FOUR YEARLY ACTIVITY

I. Contact Resistance Measurement-(In Micro Ohm) of Isolators

Test results	Contact Resistance			<i>Max. Permissible Limit</i>
	R Phase	Y Phase	B Phase	
Pre-commissioning Values				<i>300 micro-ohm</i>
Previous Values				
Present Values				

Note: Contact Resistance is to be measured for total ie, Main/ Transfer Contacts, in case of HCB Isolators and both the Main Contacts in case of HDB Isolators. Individual measurement shall be carried out when the measured values are higher to identify the defect for rectification.

II. Contact Resistance Measurement-(In Micro Ohm) of Earth Switch

Test results	Contact Resistance			<i>Max. Permissible Limit</i>
	R Phase	Y Phase	B Phase	
Pre-commissioning Values				<i>300 micro-ohm</i>
Previous Values				
Present Values				

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/ISOLATORS/4YEARLY

LIGHTNING ARRESTER – FOUR MONTHLY ACTIVITY

I. Checking of Leakage by Current Analyser (mA) after cleaning the porcelain surface.

Phase	Total Current (μ A)	3 rd Harmonic Resistive Current (I_3R) in μ A	Remarks
R			<p><i>For New LA</i> <i>I_3R Upto 30 μ Amp</i> <i>For LA in service</i> <i>I_3R= upto 150 μ Amp- Normal</i> <i>I_3R= 150 to 350μ Amp- to be tested for insulation resistance test & to be removed on low value</i> <i>I_3R= Beyond 350μ Amp to be removed (gapless LAs)</i> <i>I_3R= Beyond 500μ Amp to be removed (gapped & 765 kV LAs)</i></p> <p><i>The limiting values are based on I_3R. The kits like LCM 1 and LCM 2 gives indication of I_b, I_r & I_r corrected. To get I_3R, the I_r corrected values are to be divided by 4.</i></p> <p><i>Preferably to be carried out after rainy season.</i></p>
Y			
B			

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/LA/4 MONTHLY

LIGHTNING ARRESTER –YEARLY ACTIVITY

- I. Testing by Surge Monitor kit -Counter and meter tests : Ok/Not OK**

- II. Cleaning of LA Insulators**

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/LA/YEARLY

LIGHTNING ARRESTER – SOS ACTIVITY

MAKE		Rating/Type	
Serial No		Dt. of Commissioning	
Bay Loc.		PTW NO	
DATE			

(a) Capacitance and Tan Delta Measurement

Details of Kit used: (Make, Rating & Sl. No) Date of Last Calibration:.....

Stack	Capacitance			Tan Delta		
	Pre-Commg.	Previous Value	Present Value	Pre-Commg	Previous Value	Present Value
1						
2						
3						
4						
5						

Note: Capacitance & Tan Delta value shall be comparable with pre-commissioning values

(b) Insulation Resistance Measurement

Details of Kit used: (Make, Rating & Sl. No) Date of Last Calibration:.....

Stack	Pre-Commissioning Value	Previous Value	Present Value
Date of meas:			
1			
2			
3			
4			
5			

Note: Permissible Limit of IR = 1000 Mega Ohm (Min.)

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/LA/SOS

MAINTENANCE OF BUSBAR AND BUS POST INSULATOR - YEARLY ACTIVITY

SL. NO.	ACTIVITY	MEASURED VALUE	OBSERVATION
1	MEASUREMENT OF STATION EARTH RESISTANCE CONNECTED WITH EARTH MAT		
2	CLEANING OF INSULATORS	DONE / NOT DONE	
3	CHECKING OF INSULATORS FOR CRACKS	DONE / NOT DONE	
4	Maintenance of Bus side Isolators as per AMP schedule (For One & Half Breaker scheme)	DONE/NOT DONE	

Note: Max. Permissible Limit for Station Earth Resistance = 1.0 Ohm

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/BUSBARS &BPI/YEARLY

MAINTENANCE OF WAVE TRAP**YEARLY MAINTENANCE OF WAVE TRAP**

SL.NO.	ACTIVITY	REMARKS
1	TIGHTNESS AND CLEANLINESS	
2	GENERAL INSPECTION/ CLEANING OF TUNING UNIT	

Sign. of Maintenance Engineer**Approval of Substation In-charge**

Format No: SS/MAIN/WT/YEARLY

SUB-STATION ILLUMINATION SYSTEM- YEARLY ACTIVITY

Location		Dt. of Commissioning	
DATE		PTW NO	

S.NO	JOB DESCRIPTION	REMARKS & OBSERVATION	DATE	SIGNATURE
1	Check Lighting panel for fuses/MCB's, receptacle panel tightening of terminals.			
2	Checking tightness of Lighting Transformer terminal connectors			
3.	Working of Emergency DC Light system in case of AC power failure			

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/ILL/YEARLY

THERMOVISION SCANNING OF SWITCHYARD EQUIPMENTS (THREE MONTHLY ACTIVITY)

NAME OF SUBSTATION:

NAME OF BAY:

MAKE OF CAMERA:

DATE OF COMMISSIONING:

DATE OF MEASUREMENT:

AMBIENT TEMPERATURE:

S.N	Equipment	POINT OF MEASUREMENT	TEMPERATURE IN DEGREE C						Remarks
			R phase		Y phase		B phase		
		I. Main Bay Equipments	Previous	Present	Previous	Present	Previous	Present	
01	Transformer/ Reactor	a) 400kV/220kV Bushing Insulators							
		b) 400kV/ 220kV Bushing Connectors							
		c) 400kV/ 220kV Turrets							
		d) All four sides of Transformer/ Reactor							
		e) Radiator Bank/ Oil Pipes							
02	CB	CONNECTOR / CLAMP OF CIRCUIT BREAKER (52)							
		A) TOWARDS LINE SIDE							
		B) TOWARDS BUS SIDE							
03	CT	a) CT Insulators							
		b) Connector Clamp							
		- Line Side							
		- Bus Side							
04	CVT	Top Stack							
		Middle Stack							
		Bottom Stack							
		Metallic Tank							
05	Isolators	I) Connector / Clamp Of S / R Isolator (89r)							
		A) Towards Line Side							
		B) Towards S / R Side							
		C) Isolator Contact							
		II) Connector / Clamp Of Line Isolator (89l)							
		A) Towards Line Side							
		B) Towards Bus Side							
		C) Isolator Contact							

Format No: SS/MAIN/TSCAN/THREE MONTHLY

S.N	Equipment	POINT OF MEASUREMENT	TEMPERATURE IN DEGREE C						Remarks
			R phase		Y- Phase		B-Phase		
			Previous	Present	Previous	Present	Previous	Present	
		iii) CONNECTOR / CLAMP OF ISOLATOR- BUS SIDE (89)							
		a) TOWARDS BREAKER SIDE							
		b) TOWARDS BUS SIDE							
		c) ISOLATOR CONTACT							
		iv) Connector/Clamp Of Isolator-Ct Side (89)							
		a) TOWARDS BREAKER SIDE							
		b) TOWARDS BUS SIDE							
		c) ISOLATOR CONTACT							
		II. Tie Bay Equipments							
01	CB	CONNECTOR / CLAMP OF CIRCUIT BREAKER (52)							
		A) TOWARDS LINE SIDE							
		B) TOWARDS BUS SIDE							
02	CT	Connector Clamp of CT- A							
		a) Towards Breaker Side							
		b) Towards Line Side							
03	CT	Connector Clamp of CT- B							
		a) Towards Breaker Side							
		b) Towards Line Side							
04	Isolators	CONNECTOR / CLAMP OF ISOLATOR (89A)							
		a) Towards Breaker Side							
		b) Towards Bus Side							
		c) Isolator Contact							
05	Isolators	CONNECTOR / CLAMP OF ISOLATOR (89B)							
		a) Towards Breaker Side							
		b) Towards Bus Side							
		c) Isolator Contact							

Format No: SS/MAIN/TSCAN/THREE MONTHLY

S.N	Equipment	POINT OF MEASUREMENT	TEMPERATURE IN DEGREE C						Remarks
			R phase		Y- Phase		B-Phase		
			Previous	Present	Previous	Present	Previous	Present	
		III. All Jumpers/ Droppers joints related to							
	Jumpers / Droppers Joints	a) Main Bay							
		b) Tie Bay							
		c) Strung bay							
		d) Rigid Bus (IPS tube)							
	Wave Trap	CONNECTOR / CLAMP							
		A) TOWARDS LINE SIDE							
		B) TOWARDS BUS SIDE							
	Bus Bar & BPI	a) All Conductor Joints							
		b) Terminal Connectors/ Clamps							

*The format to be modified as per the actual site layout.

Thermovision scanning to be carried out preferably at high power flow and high ambient temperature condition. Wherever problem found, Thermovision scanning to be carried out after rectification and readings to be recorded.

Note: In addition to the above point wise measurement, thermal profile of Transformer & Reactor (including bushing, conservator & radiator), CB, CT, CVT, LA also to be done and profile to be compared with the sister unit. In case of discrepancy, further confirmatory tests need to be carried out to verify the condition of the instrument.

Permissible Limits:

	Temp. Above ambient	Condition	Reference
Thermovision Scanning	<i>Upto 15°C</i>	<i>Normal</i>	<i>IEEE/C 37.010.1979</i>
	<i>Above 15 to 50°C</i>	<i>Alert</i>	
	<i>Above 50 °C</i>	<i>To be immediately attended</i>	

Relative phase to phase comparison limit to be defined as 5 deg C. To be uploaded at Plant Level. Thermovision scanning to be completed prior to availing shutdown to avoid repeated outages and preferably to be carried out during peak load period.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/TSCAN/THREE MONTHLY

**MONTHLY /QUARTERLY / HALF YEARLY ACTIVITY OF SUB-STATION AIR
CONDITIONING SYSTEM**

Sub-Station:

DATE OF MAINTENANCE :
PTW NO:
DATE OF COMMISSIONING:

MAINTENANCE DONE BY:
DATE :
MAKE:

AC UNIT NO:
RATING:

Controlled Area	Healthiness of AC Units (Monthly)	Status of Temperature & Humidity Control (3 Monthly)	*Servicing of AC Unit (Half Yearly)
Control Room	OK/NOT OK	OK/NOT OK	Done/Not Done
Battery Room	OK/NOT OK	OK/NOT OK	Done/Not Done
Kiosk – 1	OK/NOT OK	OK/NOT OK	Done/Not Done
Kiosk – 2	OK/NOT OK	OK/NOT OK	Done/Not Done
Kiosk- 3	OK/NOT OK	OK/NOT OK	Done/Not Done

Rows to be modified as per requirement

Note:

As most of the substations are having packaged Air conditioning system, the above format may be modified as per the maintenance procedure recommended by OEM.

*Incase, frequency of servicing required is more as per OEM then same frequency may be adopted

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/AC.SYSTEM

BATTERY SETS- MONTHLY ACTIVITY**Sub-Station:****DATE OF INSPECTION:****BATTERY SET: I/II****VOLTAGE: 24 / 48 / 110 / 220 VOLTS****MONTH:****BATTERY VOLTAGE: _____ VOLT**

- (a) Checking of electrolyte level and topping up with DM water, If any
 (b) Checking of emergency DC lighting to Control Room

(SWITCH OFF CHARGER TO NOTE TOTAL BATTERY VOLTAGE EXCEPT 24V BATTERY OF HVDC STATION)

- (c) Measurement of Specific gravity and *voltage of cell with Charger OFF, in case of flooded cells

CELL NO	BATTERY VOLTAGE	SP. GRAVITY	CELL TEMP °C		CELL NO	BATTERY VOLTAGE	SP. GRAVITY	CELL TEMP °C
1					29			
2					30			
3					31			
4					32			
5					33			
6					34			
7					35			
8					36			
9					37			
10					38			
11					39			
12					40			
13					41			
14					42			
15					43			
16					44			
17					45			
18					46			
19					47			
20					48			
21					49			
22					50			
23					51			
24					52			
25					53			
26					54			
27					55			
28					56			

Format No: SS/MAIN/BB/MONTHLY

(SHEET 2 OF 2 FOR 220 VOLT BATTERY SET)

CELL NO	BATTERY VOLTAGE	SP. GRAVITY	CELL TEMP °C	CELL NO	BATTERY VOLTAGE	SP. GRAVITY	CELL TEMP °C
57				84			
58				85			
59				86			
60				87			
61				88			
62				89			
63				90			
64				91			
65				92			
66				93			
67				94			
68				95			
69				96			
70				97			
71				98			
72				99			
73				100			
74				101			
75				102			
76				103			
77				104			
78				105			
79				106			
80				107			
81				108			
82				109			
83				110			

Checking of any Earth fault in DC System wherever E/F relays are not provided. In case of VRLA Battery, only Battery Voltage are to be recorded. E/F relay to be set at 3 mA setting to identify earth fault at initial stage.

Note:

Permissible Limits (Manufacturer recommendation to be followed)

<i>Data</i>	<i>Permissible Limits</i>	<i>Remarks</i>
<i>Specific Gravity</i>	<i>1200 ± 5GM/L at 27°C</i>	<i>ANSI/IEEE - 450-1987</i>

Cell no. 109 & 110 to be connected in parallel. All spare cells also to be connected in parallel.

*Voltage of each cell to be noted for VRLA Batteries by dis-connecting the battery bank from charger & connecting the battery to station load for 4 hours

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/BB/MONTHLY

BATTERY BANK /BATTERY CHARGER/DC DISTRIBUTION SYSTEM ACTIVITY**Sub-Station:****Dt. of Commissioning..... Make.....Type.....****DCDB No..... Battery Bank No.....Charger No.....****PTW No. Date.....****Yearly Maintenance**

- Checking of Charger Panel for Electrical Connection tightness and cleanliness
- Checking & Cleaning of Battery cell terminals and application of petroleum jelly (if Required)
- Checking of tightness of VRLA Battery and dusting/ cleaning.
- Servicing of Air Conditioners for VRLA Batteries.
- Healthiness of Indicating meters like Voltmeter, Ammeter & Indicating Lamps
- Relay Checking

	MAKE/TYPE	Set Values		Operate Values	
		Volt	Time delay	Volt	Time delay
O/V Relay					
U/V Relay					

Sign. of Maintenance Engineer**Approval of Substation In-charge**

Format No. SS/MAIN/BB/YEARLY

BATTERY BANK /BATTERY CHARGER / DC DISTRIBUTION SYSTEM ACTIVITY**Sub-Station:****One yearly Maintenance Record – S/D Activity****DISCHARGE TEST OF BATTERY SET (To be carried out with automatic discharge kit)**

- (I) Connect the load to battery, Start the timing and continue to maintain the discharge rate at 10 % Battery capacity as per standard capacity measurement procedures.
- (II) Record hourly the temp, current, voltage and Sp. Gravity of individual cells as well as Battery terminal voltage.
- (III) Charge the battery (in Boost mode) to full capacity and measure the temperature, voltage and specific gravity of individual cell.

Date/Hours	Cell No	Cell Voltage	Battery Terminal Voltage

Battery Discharge test data to be filled in ERP.

Sign. of Maintenance Engineer**Approval of Substation In-charge**

Format No. SS/MAIN/BB/YEARLY

STATION FIRE PROTECTION SYSTEM-MONTHLY ACTIVITY

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

S.NO	EQUIPMENTS	ACTIVITIES	REMARKS & OBSERVATION
1	COMPRESSOR	Cleaning/Replacement of Air Filter	
2	FIRE ALARM SYSTEM	Detectors	
		i) Sequence test for annunciation in Control Room panel	
		ii) Cleaning	
		iii) Battery Electrolyte level checking	
3	DIESEL ENGINE	i) Checking of auto starting of Diesel Engine	
		ii) Check oil level, top up if required	
4	PUMPS	i) Checking of operation of Hydrant pumps Sump pumps, Jockey pumps.	
		ii) Check leakage & lubrication of Jockey Pump	
		iii) If no. of operation of Jockey pump is more than one then leakage to be attended	
5.	HYDRANT SYSTEM	Checking for leakage of Hydrant system	

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No. SS/MAIN/FF.SYS/MONTHLY

STATION FIRE PROTECTION SYSTEM-QUARTERLY ACTIVITY

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

S. N.	EQUIPMENTS	JOB DESCRIPTION	REMARKS & OBSERVATIONS
1.	COMPRESSORS	(i) Checking of compressor oil and replace if necessary	
		(ii) Maintenance & cleaning of compressor valves, gaskets, valve plates and replace, if necessary	
		(iii) Operation check of low oil level switch	
		(iv) Cleaning and checking for seating of the breather valve	
		(iv) Checking of V-belt tightness	
2.	HYDRANT SYSTEM	(i) Cleaning of oil strainer	
3.	FIRE ALARM SYSTEM	(i) Checking of healthiness of smoke detectors at various locations like AC Kisoks, Battery Room, control room etc	

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No. SS/MAIN/FF.SYS/ QUARTERLY

STATION FIRE PROTECTION SYSTEM-HALF YEARLY ACTIVITY

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

SL. NO.	EQUIPMENTS	JOB DESCRIPTION	REMARKS & OBSERVATIONS
1.	MOTORS	Tightness of terminal connection	
		Lubrication of Bearing	
		Overhauling	
2.	PUMPS	Adjustments of glands for leakages and tightening of nuts and bolts	
3.	GENERAL	Greasing of all valves	

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No. SS/MAIN/FF.SYS/ HALF YEARLY

STATION FIRE PROTECTION SYSTEM-YEARLY ACTIVITY

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

S.N.	EQUIPMENTS	JOB DESCRIPTION	REMARKS & OBSERVATION
1	COMPRESSOR	- Cleaning of NRV /HP tank	
2	DIESEL ENGINE	- Checking/replacement of fuel oil filter, lube oil filter, air filter	
3	PUMPS	- Checking of alignment of pump set	
4	HYDRANT SYSTEM	- Checking of pressure of hydrant system at the remotest end, auto starting of pumps, diesel engine etc - Checking of pressure gauges and replacement of defective gauges.	Pr = - Kg/cm ²
5	EMULSIFIER SYSTEM	- Operation of Emulsifier system, check outlet pressure, check alarm, check starting of diesel/electrical pump. - Checking of detector bulbs, nozzle angle/blocking etc.	Pr = - Kg/cm ²
6	ELECTRICAL PANELS	- Cleaning - Tightening of terminals, - Checking of gaskets	
7	GENERAL	- Painting of pipes, air lines, marshalling box	

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No. SS/MAIN/FF.SYS/YEARLY

SUB-STATION FIRE ALARM SYSTEM- YEARLY ACTIVITY

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

01. Check for operation of fire alarm system installed at various location including AC Kisok, Battery Room etc by Agarbati etc
02. Check for alarm in the control panel/SCADA.
03. Check the condition of battery
04. Check for cleanliness.

Sign. of Maintenance Engineer

Approval of Substation In-charge

YEARLY ACTIVITY FORMAT FOR SUB-STATION FIRE EXTINGUISHERS

Sub-Station:

Dt. Of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

- 01. Check for fully charged Catridge & change if necessary.
- 02. Check for quality of charge & refill if required.- SOS
- 03. Check if ready for operation.
- 04. Check for cleanliness.

LOCATION	TYPE	QUANTITY	REFILLING DATE	NEXT DUE DATE FOR REFILLING

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No:SS/MAIN/FF.SYS/SOS

MONTHLY ACTIVITY FORMAT FOR SUB-STATION DG SET

Sub-Station:

DG SET NO :

DATE OF MAINTENANCE :

**MAINTENANCE. DONE
BY:**

DG SET CAPACITY:

PTW NO/DATE:

**RUNNING HOURS OF
DG SET -:**

S.NO	EQUIPMENTS	JOB DESCRIPTION	REMARKS & OBSERVATION
1	LUBRICATING SYSTEM	Checks for oil leaks	
2	COOLING SYSTEM	Checks for radiator air blocking and coolant level	
3	GENERAL	Battery Voltage & Specific Gravity Measurement.	
4	GENERAL	Checking of auto start function	

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/DG SET/MONTHLY

SIX MONTHLY ACTIVITY FORMAT FOR SUB-STATION DG SET

DG SET NO :

DATE OF MAINTENANCE :

**MAINTENANCE
DONE BY:**

CAPACITY:

PTW NO/DATE:

S.NO	EQUIPMENTS	JOB DESCRIPTION	REMARKS & OBSERVATION
1	Servicing	DG Set Servicing Done or Not Done	
2	COOLING SYSTEM	Check for Fan hub, Drive pulley and Water pump	
3	AIR INTAKE SYSTEM	Replacement of Air Cleaning Element	
4	FUEL SYSTEM	Drain sediments from fuel tank, change fuel filter and clean fuel tank breather.	
5	General	-Checking for electrical connections for tightness.	
		Healthiness of both Battery Chargers	
		Availability & Healthiness of 2 sets of Battery	

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/DG SET/6 MONTHLY

YEARLY ACTIVITY RECORD FOR LT SWITCHGEAR

I. LT PANELS

- Cleaning of Panels, Bus Bars Insulators etc.
- Checking of indicating meters
- Checking of auto change over facility (MSB,LT,DG) CBs

II. LT TRANSFORMER/ TERTIARY TRANSFORMER (Details Sl.No. Make Dt. Of Comm.)

- Test oil of LT Transformer for BDV (To be tested locally) : _____(Min BDV value :40kV)
- IR measurement check
- Testing of OTI/WTI & Buchholz relay for L.T. Transformer (where ever applicable)
- Testing of Directional over current earth fault relay

Note: Permissible Limits : Min IR Value for LT Transformer/Switchgear = 100 Mega Ohm.

III. Testing of 72.5 kV CB

CB timings

PHASE	DETAILS	CLOSE TIME	OPEN TIME		Close coil current	Trip coil current		REMARKS & OBSERVATIONS
			TRIP-I	TRIP - II		Present Values		
						T _{c1}	T _{c2}	
R	MAIN CONTACT							
Y	MAIN CONTACT							
B	MAIN CONTACT							

Contact Resistance

Phase	Contact Resistance Measured (in micro-ohm)	Remarks/Observations
R		
Y		
B		

Format No: SS/MAIN/LT SWGR/YEARLY

IV. Testing of 72.5 kV CT:

Marshalling Box

- Checking the tightness of all electrical connections including earthing of MB
- Cleaning and tightness of CT secondary terminals and checking healthiness of sec terminal bushing
- Check for any oil leakage from Secondary Terminal Box in case of oil filled CTs.....
- Checking of healthiness of gaskets Good Needs Replacement (Replaced On:)

Capacitance & Tan δ Measurement

Details of Kit used: (Make, Rating & Sl. No)

CT Details/ Phase	Capacitance				Tan δ			
	Factory Value (Date.....)	Pre-commg Value (Date.....)	Previous value (Date.....)	Measured Value (Date.....)	Factory Value (Date.....)	Pre-commg Value (Date.....)	Previous value (Date.....)	Measured Value (Date... ..)
R φ								
Y φ								
B φ								

V. Testing of 72.5 kV PT:

- Insulation Resistance Measurement at 5kv : _____

Format No: SS/MAIN/LT SWGR/YEARLY

VI. LT SWITCHGEARS

Sl	Distribution Board	Checking for Cleaning	Checking for Tightness	Healthiness of Panel Meters	Healthiness of Indicating Lamps
1.	Main Switch Borad				
2.	AC Dist. Board				
3.	DC Dist Board				
4.	AC Ventilation Board				
5.	Lighting Dist Board				

VII. Relay Checking and TRIP TEST

	MAKE/TYPE SR. NO.	Set Values		Operate Values	
		Volt/Current	Time delay	Volt/Current	Time delay
O/C Relay					
E/F Relay					
U/V Relay					

Sign. of Maintenance Engineer

Approval of Substation In-charge

PLCC/DTPC EQUIPMENT MAINTENANCE RECORD

Dt. Of Commissioning.....
Name of Line/Direction.....

Sub-Station:
Make/Model.....

Cab. Sl. No

YEARLY/ HALF YEARLY MAINTENANCE - PTW No. Date:.....

- (a) General Cleaning of Cabinets (06 monthly).
- (b) Checking of healthiness of Ventilation Fans in Cabinet (06 monthly).
- (c) DTPC: Port Healthiness to be checked (06 monthly).
- (e) DTPC : Interface with ULDC Panel to be checked (06 monthly).
- (f) Level Measurements

SR. No.	MAINTENANCE ACTIVITY	Periodicity	TEST POINTS (T.P.) WHERE MESUREMENTS TO BE DONE	SPEECH/	PROTECTION -I	PROTECTION -II
				Tx.....Rx....	Tx.....Rx....	Tx.....Rx....
1	TRANSMISSION OF PROTN. CODE CODE I CODE II CODE III	Yearly (S/D)				
2	RECEIPT OF PROTN. CODE CODE I CODE II CODE III	Yearly(S/D)				
3	Coaxial level measurement Tx / Rx (pilot & protection)	06 monthly (NON S/D)				
4	LOOP TEST	06 monthly (NON S/D)				

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/PLCC

PLCC EQUIPMENT MAINTENANCE RECORD

SOS MAINTENANCE

SR. No.	MAINTENANCE ACTIVITY	TEST POINTS (T.P.) WHERE MESUREMENTS TO BE DONE	SPEECH Tx.....Rx.....	PROTECTION-I Tx.....Rx.....	PROTECTION-II Tx.....Rx.....
1.0	POWER SUPPLY MEASUREMENTS				
1.1	INPUT VOLTAGES				
1.2	STABILISED DC VOLTAGES				
2.0	TRANSMITTER CHECKS				
2.1	FM OSCILLATOR- Frequency measurement				
2.2	AM OSCILLATOR- Time measurement				
2.3	OUTPUT LEVEL MEASUREMENT				
3.0	RECEIVER CHECKS				
3.1	Receiver level FM				
3.2	Receiver level AM				
4.0	ALARM CHECKS				
4.1	Check Alarm Contacts with Buzzer/ Ohm meter after inserting test plug "IN POSITION"				

RETURN LOSS MEASUREMENTS (SOS ACTIVITY) (As per commissioning format)

Note: This is only a guide line. The format to be modified as per actual PLCC system available at site.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/PLCC/SOS

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

MONTHLY PREVENTIVE MAINTENANCE RECORD –GENERAL

S.no	ACTIVITY	Remarks
1.	Testing of Disturbance Recorder for test prints Feeder I Feeder II and so on	
2.	Testing of Event Logger (Min two events to be checked)	
3	Checking of GPS Time Synchronizing Unit (TSU) with all Disturbance Recorders & SEL' s in Sub-station	

In case of mal-operation/ non-operation of numerical relay, the respective fault file to be downloaded and shall be replayed in the spare relay with same setting file for analyzing the cause of mal-operation. In case of similar behavior observed in spare relay also, setting file needs to be checked. Matter to be investigated in consultation with the supplier.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No: SS/MAIN/PROT.SYS/GEN/MONTHLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

FIRST YEAR PREVENTIVE MAINTENANCE RECORD –GENERAL

SN	ACTIVITY	Remarks
1.	Testing of Transmission line protection as per the pre-commissioning document check-list	
2.	Testing of Transformer protection as per the pre-commissioning document check-list	
3	Testing of Line Reactor/Bus Reactor as per the pre-commissioning document check-list	
4	Testing of Bus-Bar protection as per the pre-commissioning document check-list	
5	Testing of LBB* protection as per the pre-commissioning document check-list	

*During Tie LBB protection test, tripping of adjacent feeder to be isolated.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/GEN/FIRSTYEAR

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

3-YEARLY PREVENTIVE MAINTENANCE RECORD –DISTANCE RELAY

SN	ACTIVITY	Remarks
1.	Test the reach test of the distance relay	
2.	Test ZCom tripping	
3	Test STUB protection	
4	Test SOTF protection	
5	Test DEF relay	
6	Test VT fuse failure blocks distance protection	
7	Test PSB blocking of distance zones	
8	Test Single phase autoreclosure (successful)	
9	Test Single phase autoreclsoure lockout/blocking with both carrier unhealthy and CB unhealthy (one by one)	

10	Test Overvoltage protection	
11	Check Relay unhealthy alarm	

NOTE: The test report generated from the test kit along with DR and EL shall be saved (at least for one test of each type) which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 5 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/21/3YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

THREE YEARLY PREVENTIVE MAINTENANCE RECORD – LINE DIFFERENTIAL

SN	ACTIVITY	Remarks
1.	Test Differential pick-up level	
2.	Check that the distance function gets enabled on communication fail	
3	Check Reach test of Distance function	
4	Test ZCom tripping	
5	Test STUB protection	
6	Test SOTF protection	
7	Test Over Voltage protection	
8	Test DEF protection	
9	Test Single phase auto-reclosure (successful)	

10	Test Single phase auto-reclsoure lockout/blocking withboth carrier unhealthy and CB unhealthy (one by one)	
11	Check Relay unhealthy alarm	

NOTE: The test report generated from the test kit along with DR and EL shall be saved (atleast for one test of each type)which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 5 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/87L/3YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

3-YEARLY PREVENTIVE MAINTENANCE RECORD – TRANSFORMER/REACTOR DIFFERENTIAL PROTECTION

SN	ACTIVITY	Remarks
1.	Test pick-up current of differential relay	Setting: R Phase Pickup: Y Phase Pickup: B Phase Pickup:
2.	Test Operating Characteristic of differential relay	
3	Check blocking of tripping of 2 nd harmonic and 5 th harmonic blocking	
4	Check High set function	Setting: R Phase Pickup: Y Phase Pickup B Phase Pickup
5	Check Relay unhealthy alarm	

NOTE: Relevant DR and EL shall be saved (atleast for one test of each type)which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 5 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/87/3YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

3-YEARLY PREVENTIVE MAINTENANCE S RECORD – TRANSFORMER OC/EF

SN	ACTIVITY	Remarks
1.	Verify IDMT Charachetrstic	:
2.	Test directionality	
3	Test blocking of tripping of 2 nd harmonic and 5 th harmonic blocking	
4	Test High set function (if applicable)	
5	Check Relay unhealthy alarm	

NOTE: Relevant DR and EL shall be saved (atleast for one test of each type)which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 5 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/51/3YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

3-YEARLY PREVENTIVE MAINTENANCE RECORD –TRANSFORMER OVERFLUXING

SN	ACTIVITY	Remarks
1.	Test for all the stages. Stage-1 Stage-2	Pick-up value Drop off value Setting time Actual time Action: Alarm/Trip

NOTE: Relevant DR and EL shall be saved (atleast for one test of each type)which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 5 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/OFLUX/3YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

3-YEARLY PREVENTIVE MAINTENANCE RECORD – REF PROTECTION

SN	ACTIVITY	Remarks
1.	Measure value of Stabilising resistor	Setting value: Measured Value:
2.	Measure differential pick-up current	Setting value: Measured value: Time of operation:
3	Test CT selection scheme (in case of Single phase bank with spare)	
4	Check Relay unhealthy alarm	

NOTE: Relevant DR and EL shall be saved (atleast for one test of each type)which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 5 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/64/3YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

3-YEARLY PREVENTIVE MAINTENANCE RECORD – REACTOR BACK-UP IMPEDANCE RELAY

SN	ACTIVITY	Remarks
1.	Check Reach test	
2.	Check time of operation	Setting: Actual:
3	Check trip block in case of VT fail	
4	Check Relay unhealthy alarm	

NOTE: Relevant DR and EL shall be saved (atleast for one test of each type)which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 5 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/21R/3YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

3-YEARLY PREVENTIVE MAINTENANCE RECORD – MECHANICAL TRIPPING

SN	ACTIVITY	Remarks
1.	Test Bucholz alarm and Trip	
2.	Test PRD Trip	
3	Test WTI/OTI Alarm and Trip	Alarm Setting: Actual: Trip Setting: Actual:
4	Check Relay unhealthy alarm	
5	Test Spare selection logic (in case of single phase bank with spare)	

NOTE: Relevant DR and EL shall be saved (atleast for one test of each type)which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 5 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/Mech/3YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

6 MONTHLY PREVENTIVE MAINTENANCE S RECORD – TESTING OF SAS RING REDUNDANCY

SN	ACTIVITY	Remarks
1.	Switch off Control room EFS-1, Check if all the devices report to SAS. Switch on Control room EFS-1	
2.	Switch off Control room EFS-2, Check if all the devices report to SAS. Switch on Control room EFS-2	
3	In any kiosk, switch off one EFS*. Only the devices connected to this switch shall go offline from SAS, remaining device shall remain connected.	

NOTE: The Kiosk EFS shall be switched off on rotation basis. After every six months the redundancy at Kiosk level shall be tested by switching off a different EFS.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/SAS/6MONTHLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

MONTHLY PREVENTIVE MAINTENANCE RECORD – SAS SYSTEM MAINTENANCE

SN	ACTIVITY	Remarks
1.	Carry out Server (software)maintenance based on OEM procedure	
2.	Clean the air filter of the CPU units	
3	Check the general cleanliness of the SAS and SUX panel	
4	Check the general cleanliness of the Kiosk Panel room	
5	Simulate “Fire in kiosk” at one of the kiosks on sample basis and check the alarm in SAS.	

NOTE: The Kiosk Fire Alarms shall be tested on rotation basis. After every month the alarm shall be tested in a different kiosk.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/SAS/MONTHLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

5-YEARLY PREVENTIVE MAINTENANCE RECORD – TESTING MAIN BAY LBB

SN	ACTIVITY	Remarks
1.	Check pick-up value of LBB	Setting: Actual:
2.	Check that Retrip trips the same CB	Time Delay Setting: Actual time delay:
3	Check that the Back-trip trips the Bus	Time Delay Setting: Actual time delay: Bay no of CBs tripped:
4	Check all the initiations of LBB	

NOTE: TO BE DONE DURING BUS SHUTDOWN

NOTE: Relevant DR and EL shall be saved (atleast for one test of each type)which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 6 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/LBB/5YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

5-YEARLY PREVENTIVE MAINTENANCE RECORD – TESTING TIE BAY LBB

SN	ACTIVITY	Remarks
1.	Check pick-up value of LBB	Setting: Actual:
2.	Check that Retrip trips the same CB	Time Delay Setting: Actual time delay:
3	Check that the Back-trip trips the Other Main CB*	Time Delay Setting: Actual time delay:
4	Check all the initiations for LBB	

NOTE: ISOLATE THE TRIPPING OF ADJACENT BAY CB

NOTE: Relevant DR and EL shall be saved (atleast for one test of each type) which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 6 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/LBB/5YEARLY

PREVENTIVE MAINTENANCE RECORD FOR PROTECTION SYSTEM

Sub-Station:

Dt. of Commissioning.....

Make.....

Type.....

PTW No.

Date.....

Date of Maintenance.....

5-YEARLY PREVENTIVE MAINTENANCE S RECORD – BUS BAR PROTECTION

SN	ACTIVITY	Remarks
1.	Check pick-up value of differential	Setting: Actual:
2.	Check the pick-up value of Circuitary Fault	Time Delay Setting: Actual time delay:
3	Check the operating time	No of Bays CB Tripped: Time:
4	Simulate all the Bus Bar protection alarms	Check in SCADA

NOTE: Relevant DR and EL shall be saved (at least for one test of each type) which shall demonstrate successful testing. The record shall be archived in softcopy for a period of 6 years.

Sign. of Maintenance Engineer

Approval of Substation In-charge

Format No : SS/MAIN/PROT.SYS/BUSBAR/5YEARLY

List of Tools & Plant for Substation (to kept at Substation all the time)

Sl. No	Name of Item
1.	SF6 gas filling trolley
2.	Heavy duty drill machine with stand with drill bits
3.	Hand operated oil pump for lifting oil drum Barrel
4.	Bench vice
5.	Poly propylene ropes
6.	Wheel mounted manual telescopic ladder (Max. height 8 meters)
7.	Self-supporting Aluminum Ladders as per requirement
8.	Hand Trolley
9.	Air blower with hot air attachment
10.	Vacuum cleaner (Industrial type)
11.	Spanners, screw drives of different size
12.	Torque wrench
13.	Pulley and D-shackle of different sizes
14.	Crimping tool for control cable & power cable for all size.
15.	Oil Sample Bottles/Syringe: 50 ml Capacity Syringes :20 Nos. 1 lr. Capacity Bottle: 20 Nos.

Tentative List of Tools & Plant – Substation (to be arranged as and when required)

Sl. No	Name of Item
1.	SF6 Gas Handling Plant
2.	Off-Line Transformer Oil Filtration Plant Capacity 10000Ltr/Hr
3.	Standalone Vacuum pump
4.	Mobile Dry Air Plant (Heatless type)
5.	Tirfor 5&10 Ton capacity
6.	Turn buckle with braking arrangement (6Ton capacity)
7.	Drum lifting hydraulic jack (6 Ton)
8.	Gas cutter
9.	Digital Camera (20X Zoom)
10.	Hydra/Crane of suitable size (Wherever Required)
11.	Man lift with Self-propelled and Articulating Boom
12.	Welding Machine (1-Ph & 3-Ph)
13.	Hydraulic conductor cutter

NOTE: T&P used in maintenance work should have valid load test certificate. The load T&Ps shall be tested yearly for verifying the healthiness w. r. t. safety guidelines.

Details of Guest House/Field Hostel/Transit Camp

Sl. No.	Station	Guest House available or not	Nos. of Rooms to be maintained by outsourcing agency	No. of Room for PESL	No. of rooms can be provided to Outsourcing agency (SSM)
1	Rampur	Yes	7 (1 Dormitory+6 Normal)	3 Normal	1 Dormitory + 3 Normal
2	Sambhal	Yes	7 (1 Dormitory+6 Normal)	3 Normal	1 Dormitory + 3 Normal
3	Meerut	Yes	3 (2 Normal + 1 Dormitory)	1 Normal	1 Dormitory + 1 Normal
4	Simbhavali	Yes	3 (2 Normal + 1 Dormitory)	1 Normal	1 Dormitory + 1 Normal
5	Firozabad	Yes	9 (1 VIP+ 1 Dormitory+7 Normal)	3 Normal + 1 VIP	1 Dormitory + 4 Normal