



भारत सरकार/Government of India
विद्युत मंत्रालय/Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/Central Electricity Authority
विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग
Power System Engineering & Technology Development Division

दिनांक: 01.05.2025

सेवा में,

<As per attached list>

विषय: Report of Standing Committee of Experts on Failure of 220 kV and above Voltage Class Substation Equipment failed between July 2023 to December 2024-reg.

महोदया/महोदय,

You are kindly aware that a Standing Committee of Experts was constituted vide CEA Letter No CEA/SETD/220-O/2012/1-80 dated 01.01.2013 under Section 73, Clause (1) of the Electricity Act, 2003 to investigate the failure of 220 kV and above Voltage class substation equipment and recommend remedial measures to avert failures in future.

2. In this connection, a meeting of the Standing Committee of the Experts was held on 24.03.2025 and 25.03.2025 at CEA HQ, New Delhi in hybrid mode to discuss the cause of failures of the substation equipment reported by various utilities to CEA which had failed during the period from July 2023 to December 2024.
3. Based on data provided by Utilities and deliberations during the meetings, the report of the Standing Committee for the failure of the Equipment that occurred during the period from July 2023 to December 2024 has been prepared and is enclosed herewith for kind information and necessary action please.

Encl: as above

भवदीय,

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(जुलाई 2023 – दिसंबर 2024)**

**REPORT OF STANDING COMMITTEE OF EXPERTS ON FAILURE OF 220 kV &
ABOVE VOLTAGE CLASS SUBSTATION EQUIPMENT
(July 2023 - Dec 2024)**



**GOVERNMENT OF INDIA
MINISTRY OF POWER
CENTRAL ELECTRICITY AUTHORITY**

May 2025

(In fulfilment of CEA's obligation under Section 73(I) of the Electricity Act, 2003)

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EXECUTIVE SUMMARY

As per its mandate to investigate the failure of 220 kV and above voltage class substation/ switchyard equipment and recommend measures to avert recurrence of such failures in future, the Stading Committee receives reports of failures of various substation/ switchyard equipment from various power utilities, which then investigates the failures, and brings out the report for the benefit of the Power Sector as a whole.

As part of this process, the failures of substation equipment that occurred during the period, 1st July 2023 - 31st December 2024, were analysed by the Committee in their meeting held on 24th March 2025 and 25th March 2025. Total 26 Utilities reported the failure incidences. A total of 162 failure incidences of Transformers, Reactors, Instrument Transformers, Surge Arresters, Circuit Breakers, Disconnectors, Wave Trap, Coupling Capacitors, Bay, Cable, and PASS Module of 220 kV and above voltage rating were reported between 1st July 2023 and 31st December 2024 to CEA.

Out of these equipment failures, total 36 cases of Transformer failure were reported. These 36 Transformers consist of 12 Nos. of 400 kV class Transformers and 24 Nos. of 220 kV class Transformers, and none were of 765 kV class. W.r.t. Reactors, total 4 failures were reported during the period, out of which 1 were 765 kV class and 3 were 400 kV class.

Coming to Current Transformers, a total of 42 no of failures cases were reported during the period out of which 34 were of 220 kV class, 5 were of 400 kV class and 3 were of 765 kV class. W.r.t. Potential Transformers/ CVT failures, total 15 Nos. were reported, out of which 12 were of 220 kV class, 3 were of 400 kV class and none were of 765 kV class.

Total 42 No. of failure cases of Surge arrestors were reported out of which 35 were of 220 kV class, 7 were of 400 kV class and none were of 765 kV class. Failures of Circuit breakers which were reported to CEA were 10, out of which 6 were of 220 kV class, 4 were of 400 kV class and none were of 765 kV class.

Other equipment for which failures were reported include 3 Nos. of Disconnector/Isolator, 3 Nos. of Coupling Capacitors, 4 Nos. of Wave Trap, 1 No. of GIS Bay, 1 No. of Cable and 1 No. of Pass Module.

Out of the total 162 failures of the equipment that occurred during the period, 22 Nos. of equipment failed within five years, 38 Nos of equipment failed in 5-10 years of period. 66 Nos of equipment failed during 10-20 years of their operation. 31 Nos of equipment failed had operation of more than 20 years. For five equipment, Utilities did not provide the commissioning date.

It has been suggested that to prevent the failure of the equipment especially Transformers and Reactors, the practice of Condition Based Monitoring using online modern diagnostic tools should be followed. In case Transformers/ Reactors are reaching their end of Service of life, then close monitoring of these equipment should be carried out. The frequency/ periodicity of measurement should be changed depending on the condition/ healthiness of the equipment in operation. The trend of test results should be monitored rather than the absolute values of test results. The regular cleaning of dust deposited on the housings of major equipment and bushings of transformer in Thermal Power Plant or area with heavy

pollution are essential to avoid flash over across the insulators as frequent flashovers may lead to failure of the equipment.

A centralized electrical asset monitoring system has been suggested to be implemented to monitor the condition of all Medium voltage and high voltage electrical assets like GIS, AIS, Breakers, Power Cables including Transformers. All FAT, SAT and Periodic testing data for all electrical equipment shall be stored in this system for performing health assessment. The system shall have advanced health index models that utilize analytics and threshold limits as prescribed by latest IEEE, IEC, and CIGRE standards / recommendations. This system shall also be capable of integrating online monitoring of sensors installed at electrical assets, and inspection records/ reports from the visual inspection of assets. It shall have the capabilities to monitor DGA, Partial discharge – Electrical & UHF, bushing, fan control, fiber optic monitoring and other monitoring parameters. This system shall be installed for transformers, including existing and new transformers; shall support cloud and on-premise installation and provide access to electrical asset health dashboards at engineer's PC, Mobile, Laptops or tablets.

In case of Surge Arrestor, 3rd harmonic resistive component of leakage current is a very good method for assessing healthiness of SA and therefore it should be regularly monitored. In case of Circuit breaker, Dynamic Contact Resistance Measurement (DCRM) test should be conducted once in two years.

The necessity of having regular operation & maintenance of substation equipment has been emphasized, and the Utilities have been requested to align their practices in line with the model O& M guidelines issued by CEA in this regard.

1 Background

Under Section 73, Clause (I) of the Electricity Act, 2003, CEA vide office order no: CEA/SETD/220-O/2012/1-80 dated 01.01.2013 (**Annexure-V**) constituted a Standing Committee of Experts in the field of design and operation of EHV Substations from CEA, various power utilities and research/academic institutes to investigate the failure of 220 kV and above voltage class substation/ switchyard equipment such as Power/Generator Transformer, Circuit Breaker (CB), Instrument Transformer [i.e. Current Transformer (CT), Potential Transformer (PT) and Capacitor Voltage Transformer (CVT)], Surge Arrester (SA), Isolator etc. and recommend measures to avert recurrence of such failures in future. As part of this activity, CEA has been receiving reports of failures of various substation/ switchyard equipment from power utilities.

All the utilities are required to report any event of failure of substation equipment at the earliest in the specified format for reporting the incident (available on CEA website and attached as **Annexure-IV**) along with all the additional information [like Disturbance Recorder (DR)/ Event Logger (EL) report], SLD, Test reports, O&M history, photographs etc.) to be submitted by the utilities while reporting the incident.

The objective of the Standing Committee was to investigate the causes of failures, deliberate the failures of various substation/ switchyard equipment of Power utilities, suggest remedial measures to prevent recurrence of such events in future and prepare a report which would serve as a repository of case studies of failures and suggested remedial measures for future.

In this connection, a meeting of the Standing Committee of Experts to investigate the failure of 220 kV and above voltage Class Substation equipment for the period of July 2023 to December 2024 was held on 24.03.2025 and 25.03.2025 at CEA HQ, New Delhi in hybrid mode under the chairmanship of Chief Engineer, PSE&TD Division, CEA, and Chairman of the Standing Committee. List of participants is given at **Annexure-I**.

2 Introduction

Sh. N.R.L.K. Prasad, Chief Engineer (PSE&TD), CEA and Chairperson of the Standing Committee, extended warm welcome to all the Members & Participants, and gave a brief background about the formation and mandates of the committee. He stated that to enable Standing Committee carry out its work, it is important that the Utilities report the instances of failures in their network/ system well within time as per regulatory provisions, and ensure proper analysis of their respective events by the Committee by undertaking site visits, if required, in time.

It was informed that as per Regulation 48 (8) of CEA (Measures relating to Safety and Electric Supply) Regulations, failures of any 220 kV and above voltage level substation equipment shall be reported by the owner utility within 48 hours of occurrence of the failure, to the Authority, and the reasons for failure and measures to be taken to avoid recurrence of failure shall be sent to the Authority within one month of the occurrence as per stipulated formats, along

with all the additional information (like Disturbance Recorder (DR)/ Event Logger (EL) report], SLD, Test Reports, O&M history, Photographs etc.). He requested all utilities to adhere to these timelines strictly.

It was informed that for the period of July 2023 to December 2024, a total of 170 incidents of failure of substation equipment were reported to CEA by 27 Utilities (Aptransco, AEGCL, Adani, BBMB, CSPTCL, DTL, DVC, IndiGrid, KPTCL, KSEB, MSETCL, MPPTCL, MSPGCL, NEEPCO, NHPC, NPCIL, NTPC, OPTCL, Powergrid, RRVUNL, RVPNL, TANTRANSCO, Torrent Power Ltd, TVNL, UPPTCL, WBPDC, GETCO). Failure of forty Transformers, four Reactors, forty seven Current Transformer, thirteen PTs/CVTs, forty four Surge Arresters/LA, nine Circuit Breakers, three Disconnectors/Isolators, four Wave Trap, three Coupling Capacitor, one GIS Bay, one Cable Fault and one PASS (Plug and Switch System) Module (Hybrid Switchgear) were reported.

In this connection, he also raised concern w.r.t. non-participation of the Utilities, who have reported failure incidences, in the meeting. It was noted that out of the 27 Utilities who have reported failures, representatives from only 17 Utilities attended the Standing Committee meeting. No representative from CSPTCL, KPTCL, MSPGCL, NEEPCO, NPCIL, RRVUNL, TANTRANSCO, Torrent Power Ltd, TVNL, WBPDC attended the meeting.

He requested all the utilities to furnish a brief on the action taken by various utilities w.r.t. recommendations given by the standing committee in their past meetings such as centralized asset monitoring system, condition based monitoring, etc. He also emphasized on the need to for undertaking regular O&M of substation equipment, and requested utilities to present a brief on O&M practices being followed by them for various substation equipment such as Transformer, Reactors, Circuit Breaker, CT, PT/CVT, Isolator/Disconnector, Surge Arrester/LA etc. covering various aspects like the tests conducted on the equipment, periodicity of testing and permissible limits/acceptable range of test results.

Thereafter presentations by Utilities for their respective failure incidents were held. The failure incidents and their subsequent findings were deliberated upon by the members of the committee.

3 Deliberations held during Standing Committee Meeting

1. A total of 162 failure incidence of Transformer, Reactors, Instrument Transformers, Surge Arresters, Circuit Breakers, Disconnectors, Wave Trap, Coupling Capacitors, GIS Bay, Cable and PASS Module of 220 kV and above voltage rating between 1st July 2023 and 31st December 2024 were reported by 26 Utilities (AP Transco, AEGCL, Adani Transmission Ltd, BBMB, CSPTCL, DTL, DVC, IndiGrid, KPTCL, KSEB, MSETCL, MPPTCL, MSPGCL, NEEPCO, NHPC, NPCIL, OPTCL, Powergrid, RRVUNL, RVPNL, TANTRANSCO, Torrent Power Ltd, TVNL, UPPTCL, WBPDC, GETCO). Complete details of all the reported equipment failures are given at **Annexure-II**. The details of the deliberations of the standing committee meeting are presented in the ensuing paras.

2. Representative of **Adani Transmission Ltd** presented 3 Nos. of failures covering failure of CT at Mundra S/s, GIS Isolator at Saki S/s and Cable at Aarey S/s. Representative from M/s Adani Transmission stated that in case of the failure of CT, the CT was sent to OEM and it was found that the rupture disc was operated, minor burning marks were observed on the primary conductor, flashover observed on one side of HV spacer on active part and grading was found to be removed from the Aluminum mantel which fell down inside the insulator. Root cause Analysis could not be done due to substantial damage to CT, however, the probable cause is due to minor welding cracks in grading and loose contact between HV spacer & Active part.

For the case of failure of GIS Isolator at Saki S/s, ATL representative stated that heavy contamination of gas was observed in Y phase chamber of Bus Isolator module of Bay-8 (Bus Coupler). The absorbent bag from top of inspection window fell due to broken absorbent cage. The installation in the similar network was inspected and absorbent cage was replaced. The Committee recommended to change the cage material, if required.

For the case of failure of Cable at Aarey S/s, ATL representative mentioned that as per the report of the patrolling personnel, the cable got damaged due to excessive vertical pressure during heavy material movement of Metro Works. CE (PSE&TD), CEA recommended to find the actual root cause of the fault after consultation with the OEM and requested to increase the patrolling frequency of such critical sites.

3. Representative of **OPTCL** presented failure of three Surge Arrester and one CT. OPTCL representative stated that two number of Surge Arrester had served for more than 25 years. He further stated that one Surge Arrester served only for two years. The reason of failure Surge Arrester within two years could not be identified. This one faulty Surge Arrester was beyond repair and was replaced with the Surge Arrester of same make. CE (PSE&TD), CEA requested to keep the replaced Surge Arrester under monitoring as there may be design issue with Surge Arrestor. Further, the committee recommended to monitor the leakage current of Surge Arrester at the time of commissioning and in every 2 years thereafter. Representative of M/s Adani Transmission was of view that Switching Impulse Protection Level (SIPL) and Lightning Impulse Protection Level (LIPL) should be defined instead of Switching Impulse withstand Level (SIWL) and Lightening Impulse withstand Level (LIWL) to prevent the failure of Surge Arresters.

For the reported CT failure, OPTCL representative informed that oil leakage could be the reason of failure of CT. CE (PSE&TD), CEA remarked that since the CT has served for only 6 years, detailed reason should be found out for the failure. OPTCL representative informed that Tan delta of CT is being measured regularly and if the measured value of Tan delta of the CTs are found to be high, they are kept under observation and depending on the abnormality of the results they are replaced with good ones. The committee recommended regular thermos-vision scanning of clamps and connectors for detection of hotspots and taking remedial measures thereof.

4. Representative of **BBMB** presented failure of one auto-transformer at Panipat and three Surge Arrester. BBMB representative informed that the internal inspection of auto-transformer was carried out and it was found that there was complete burning of transformer windings. The auto-transformer is thus found to be beyond repair. The transformer has served around 45 years after commissioning. He further stated that they have adopted the measure of condition-based monitoring for replacement of old transformer.

For the failure of Surge Arresters, BBMB representative informed that the damage seems to have occurred due to transient voltage surge/dielectric breakdown or degradation of ZnO blocks due to their ageing factors. The committee recommended to monitor the leakage current before and after monsoon to ascertain the effect of moisture.

5. Representative of **Powergrid** presented the failure of three Transformers occurred at HVDC Talcher, Muzaffarnagar and Maharanibag and one Reactor occurred during July 2023 to December 2023. For the failure of converter transformer at HVDC Talcher, Powergrid representative informed that fault may have occurred inside the Star winding which might have led to observance of carbonization and burnt paper pieces inside snout and take off lead of Y1 bushing. Deviations in magnetization current and voltage ratio during post failure LV test results also indicate that there is a fault in the secondary star winding. Based on LV test results and internal inspection observations, it is inferred that the said converter transformer failed due to insulation failure of secondary star winding. Further, it was also informed that the Talcher area has high ambient temperature and the Converter Transformer is continuously on overload condition at 1.25 p.u. (1250 MW). This might have led to the failure of Converter Transformer. OEM i.e. M/s Siemens has enhanced the pump capacity in 2007 considering the generally overload condition found at Talcher. However, OEM has not taken any action to improve the design to address the high ambient temperature at Talcher end. Powergrid representative stated that to avoid the reoccurrence of such failure, RLDC has been communicated to reduce the load to 1 p.u.

For the other two transformers i.e. 400/220 kV, 315 MVA Muzaffarnagar Substation, 400/220 kV, 500 MVA at Maharanibag GIS Substation, the main tank got burst at the bottom bell joint. As it was found that main tank got burst, the committee recommended to improve the tank design, if required.

For the failure of Reactor at Balipara S/s, from the LV test results and internal inspection, it was observed that the Y-Phase winding at lead take-off got damaged. It was suspected that said Reactor failed due to failure of the inter- turn insulation of the of the Y-Phase winding.

Further, Powergrid representative presented the failure of four Transformers and one Reactor during the period of January 2024 to December 2024. For the failure of Transformer at Kaithal Substation, it was informed that there is a history of occurrence of frequent through faults in 220 kV side feeder. From the LV test report, DGA history, physical and internal inspection of the failed ICT, it was inferred that there was dielectric

failure of B phase series winding during through fault in associated 220 kV transmission line. Director (PSE&TD), CEA requested to review the design of the ICT after consultation with OEM because the Transformers are generally designed to bear such through faults. CE (PSE&TD), CEA recommended to reduce the Earth resistance to substation wherever it is higher than 0.5 ohm.

ICT at Munirabad failed due to dielectric failure of B-Phase series winding. For the case of ICT failure at Kala substation, from the Disturbance recorder, DGA history, Physical and internal inspection of the failed ICT, it was inferred that there is flashover between Tap winding of B phase bottom to main tank.

For the failure of ICT at Birpara substation, Powergrid representative stated that the line connecting to Bhutan from Birpara Substation is having too many faults. These faults led to weakening of the Transformer. In the present case of failure of ICT at Birpara Substation, it was inferred that there was flash over in the Y-Phase OLTC selector switch. CE (PSE&TD), CEA requested that the proper maintenance practices should be followed where OLTC is required with ICTs. The reactor failed suddenly during charging of the reactor due to flashover/ arcing across the winding in bottom part. During the flashover/ arcing, high fault current (approx. 9 kA) has flown in the reactor.

The committee recommended that the failure event which occur within 10 years of services is a matter of concern, therefore such matters should be got thoroughly investigated by utilities with the help of OEM for improving the product design.

6. Representative of **AEGCL** presented the failure of one Auto-Transformer at Namrup GSS. He briefed that the transformer was of CGL make and served for around 44 years, therefore, ageing could be the reason of failure. He stated that the failed 220/132 kV, 50 MVA Transformer was replaced with the 220/132 kV, 100 MVA transformer of same make.
7. Representative of **DVC** presented the failure of one Auto-Transformer and two Lightning Arresters. He stated that in case of failure of Auto-Transformer at Barjora S/s, it was found during internal inspection that the Y phase HV winding failed and heavy gas generated inside tank & OLTC of Auto-Transformer. The transformer is of BHEL make and served for around 30 years. During the previous routine maintenance before fault, abnormal values of Tan delta of R-phase bushing were observed. DVC has written the letter to OEM to quote the price for repairing of failed Auto-Transformer.

For the failure of LA at Purulia Substation, he informed that LA had served for around 30 years, therefore aging could be the reason of the failure. In case of failure of LA at Barjora Substation, he informed that LA had served for around 18 years, therefore, ageing could be the reason of failure in case of LA failure at Barjora S/s. Both the faulty LAs at Paulia S/s and at Barjora S/s were beyond repair.

8. Representative of **MPPTCL** presented the failure of one Auto-Transformer at Barwaha Substation. It was informed that on the incident day METRO department has taken a

scheduled shut down on line-II for testing different condition of interlocks between CB/Isolators at their end. This line-II was earthed at both ends, however, line-I was charged. As per information from METRO substation during testing some wrong operation happened and line-I supply extended to line-II through METRO 132 kV Bus, therefore, leading to creation of a dead 3 phase earthed line fault. The line was tripped in time from both ends. This fault was fed by above Transformer from 220 kV Substation Bhopal. The transformer has served only for 5 years. Root Cause of Transformer failure could not be identified as the transformer got burnt completely. NIFPS system operated but could not save the Transformer as main tank OLTC diverter switch cover blasted therefore no nitrogen blanket could be maintained.

Other than Transformer, MPPTCL reported failure of two Current Transformers, one CVT, six Surge Arresters and three Wave Traps. MPPTCL representative informed that they are replacing the SCT make CTs as they have the high rate of failure. Representative of MPPTCL informed that LA at Chichli S/s is of the rating 66 kV, 10 kA MOCV 56 kV. As the Committee is to discuss the failure of 220 kV and above equipment, therefore the LA may be removed from the Agenda. Committee noted the same.

9. Representative of **GETCO** presented the failure of one Transformers at Jambuva S/s and one Transformer at Morbi S/s. Both the Transformers have served for around 6 years. For the Transformer Failure at Morbi substation, GETCO representative informed that the high intensity Phase to Ground fault took place in 66 kV line which was cleared by protective system of 66 kV line. Subsequently, fault developed in transformer and the Transformer tripped in differential and buchholz relay. It seems that after the clearance of UG cable line fault well within time, transformer LV winding could not withstand recovery voltage which lead to damage to LV winding insulation. CE (PSE&TD), CEA requested to provide the proper distance protection at 66 kV lines or provide suitable back-up protection to the transformer.

For the transformer failure at Jambuva Substation, GETCO representative informed that a monkey got electrocuted on 66 kV Jambuva B – Dabhoi line bus Isolators which caused tripping of transformer.

The committee recommended to contact OEM regarding improvement in the design of the transformer, if required, since the transformers have failed within 6 years of service only.

10. Representative of **MSETCL** from **Pune Zone** presented the failure of three Transformers at Kurkumbh, Alephta and Chinchwad Substation. For the failure of Transformer at Kurkumbh Substation, he intimated that the 33 kV side feeder fault might have created the axial force which could not be sustained by the transformer HV/LV winding. The HV R-ph and B-ph winding might have got their inter-turn shorted. For the failure of ICT at Alephta, MSETCL representative informed that flashover took place on OLTC driver shaft between Y and B phase due to failure of dielectric strength. The transformer had been repaired at site itself by replacing the driver shaft.

For the failure of ICT at Chinchwad substation, he informed that ICT got failed due to inter-turn shorting of Y-phase series winding. CE (PSE&TD), CEA enquired about non-operation of differential protection even after inter-turn fault was present. MSETCL representative replied that the fault current was very low. The committee recommended to check the setting of the differential relay. The committee also recommended to discuss with the Discom regarding the issue of failure of Transformer due to frequent downstream feeder faults to prevent such failure. MSETCL representative intimated that MSETCL has formed a committee regarding transformer repair, the committee has conducted detailed study on the transformer failure and it has been observed that major cause of failure of Power Transformer is that the LV windings are not mechanically strong to bear the frequent distribution side outgoing feeder faults. He further suggested that wherever there is an issue of failure of Power Transformer due to frequent feeder faults, NGR is being used in LV neutral. This led to bringing the fault current level down and therefore, low axial forces on the transformer winding.

Representative of **MSETCL** from **Nagpur Zone** presented the failure of one Transformer at Purti Substation and one current transformer. For the failure of Power Transformer at Purti Substation, he informed that station AC supply got failed due to 33 kV feeder fault. This led to station DC supply failure because of weak VRLA battery set. It was observed that Oil spilled out from PRV and flashover was observed on Transformer bushing. No protection operated and fault was eventually cleared by remote end Circuit breaker. It was informed that only one set of battery is available with the substation. CE (PSE&TD), CEA requested to follow CEA Regulations with respect to the requirement of providing Battery sets and Chargers. MSETCL also representative informed that frequent failure have been observed on 220/33 kV transformers because the windings of these transformers are not mechanically strong and frequent fault have been observed on 33 kV side feeder which feeds distribution Network.

11. Representative of **NHPC** presented the failure of one Transformer at Dhauliganga, one CVT at Chamara Power Station and one Circuit Breaker at Dhauliganga. NHPC representative informed that the transformer of rating 11/400/V 3, 48.33 MVA, 1 phase at Dulhasti Power Station did not actually fail. During the DGA test on transformer as a preventive measure, increasing amount of gases were found. As per the recommendation of OEM, the transformer was replaced with the spare. The committee has recommended to conduct the periodic DGA to assess the healthiness of transformer. Further the Committee also noted that since the Transformer did not get failed and was taken out of service as a preventive measure, the instant case shall not be considered as ICT failure, hence should be removed from the list of Transformers failures.
In case of CVT failure, NHPC representative informed that the CVT had served for around 29 years, therefore, ageing of equipment could be the reason of failure of CVT.

In case of failure of Circuit Breaker at Dhauliganga, NHPC representative informed that number of operations are high for Circuit Breaker at Dhauliganga Power Station. Due to frequent operations, the Circuit Breaker got failed.

12. Representative of **DTL** presented the failure of one Transformer at Pappankalan-I S/s and two Surge Arrester at Mehrauli and Okhla S/s. For the failure of Transformer, DTL representative informed that internal inspection was carried out before fault and CFT (Core, Frame and Tank Insulation Resistance) test was not normal. Earlier, the Transformer showed high values of Acetylene during routine PMS (Preventive Maintenance Schedule) maintenance. Filtration of the Oil was carried out and after the filtration of the Oil, DGA results were found normal before taking the Transformer into service. It was intimated that this transformer served DTL for about 31 years and the deterioration of insulation due to ageing and frequent fault at 66 kV level may have resulted in failure of the transformer.

For the failure of Surge Arresters, it was intimated that both the SAs had completed their life as per the preventive maintenance schedule.

13. Representative of **KSEBL** presented the failure of one Auto-Transformer of 66.67 MVA at Edappon Substation and one GIS bay at Ettumanoor Substation. For the failure of Auto-Transformer, KSEBL representative informed that two squirrels climbed on to the tertiary bus bar thereby causing a dead short circuit between the live part of the tertiary bus bar and earth. The tertiary winding of the transformer got completely damaged and required to be replaced. CE (PSE&TD), CEA suggested to KSEBL representative to get the relay settings checked as long time taken to isolate the fault might have led to damage of tertiary winding.

For the failure of GIS bay, KSEBL representative mentioned that the flash occurred at gas barrier insulation. Gas purity test was conducted after failure and high SO₂ levels in the CB and Line isolator compartments were detected indicating occurrence of flashover. Committee recommended to take the opinion of the OEM for failure of the Gas barrier insulation.

14. Representative of **NTPC** presented the failure of two Current Transformers at Sipat Power Station. It was informed that the routine DGA test of oil sample was conducted for both the CTs and high concentration of H₂ was found. Both the CTs did not fail but replaced as a preventive measure. Further, it was intimated by the NTPC representative that NTPC has now adopted the policy of replacing CTs after 20 years of service since CTs become more prone to failure after 20 years of life.

Committee noted that since the CTs did not get failed and were taken out of service as a preventive measure, therefore, these failure shall be removed from the list of CT failures.

15. Representative of **IndiGrid** presented the failure of one ICT at Kabulpur S/s, one Reactor Kadarapur S/s and one Lightning Arrester at Bari S/s. He briefed that one ICT at 400/220/132kV Grid S/S, Kabulpur failed during earth fault in 220 kV line. During the fault, Transformer winding might have experienced forces and weak insulation of the winding might have got damaged leading to short circuit in the winding. The failure of ICT was due to inter-turn shorting of winding conductor caused by weakening of insulation. He further informed that the ICT was repaired in 2014 due to through faults at 220 kV side and after repairing, the ICT was working satisfactorily. The committee observed that

proper coordination should be established between downstream network protection system and substation equipment protection system. In view of this Committee recommended IndiGrid to check the protection provided in downstream network.

For the Bus Reactor failure at Kadarapur S/s, IndiGrid representative briefed that the Bus Reactor got tripped while taking the Bus Reactor into service. The switching transient might have caused flashover in the B-phase winding and resulted in tripping of the Bus Reactor. It was observed that NIFPES system operated and oil was drained. OEM has visited the site and declared the Reactor unrepairable. M/s IndiGrid was in the process of procuring new Reactor. The committee suggested that OEM be requested to provide the reason for the failure of Reactor and get suitable recommendations.

Further, IndiGrid informed that LA at Bari S/s did not get failed however, due to heavy rain the foundation got tilted and the LA got damaged. After this incident, foundation of all the LAs have been checked and strengthened to avoid such incidents in future. The committee observed that the LA did not get fail and was damaged due to foundation, the same shall be removed from the list of LA failures.

16. Representative of **RRVNL** presented the failure of one Transformer at Bhiwadi S/s, one Reactors at Ramgarh S/s, five Current Transformers, two Circuit Breakers and two Surge Arresters. For the failure of Transformer, RRVNL representative informed that fault occurred on the 220/132 kV, 160 MVA Transformer-II. The Y-phase Circuit Breaker pole on Transformer-II got stuck while clearing the fault, and the LBB command was triggered. As a result, all 220 kV Circuit Breakers at the Bhiwadi substation tripped on the LBB command, except for the 220 kV Bhiwadi (PG)-II Circuit Breaker, which failed to operate because its Y-phase pole was stuck. The line was then tripped from the remote end using Zone-2 protection. The Transformer-II caught fire and NIFPES system could not operate due to damaged cable in the yard. CE (PSE&TD), CEA requested to RRVNL to contact OEM and submit complete report since transformer got failed within 10 years of service only.

For the failure of Reactor, RRVNL representative mentioned that all the bushing and winding of the reactor got completely damaged. In such condition, the testing of said reactor was not possible and therefore could not be carried out. He further mentioned that Disturbance Recorder (DR) could not be able to record this event due to some internal issue. CE (PSE&TD), CEA stated that it might be possible that DR has not been particularly configured to record that event or DR has been configured to record unwanted events also causing overloading of DR, and rectify the same. The committee recommended to RRVNL to take up the matter with OEM since the reactor got failed within 7 years of service only.

For the failure of CT of 33 kV, 1000/1 A, 4 core at Sri Ganganagar, representative of RRVNL stated that the rating of the CT is 33 kV. The mandate of the Committee is to investigate the failure of Substation equipment of 220 kV and above, therefore the same may be removed from the list of failures. The committee noted it.

17. Representative of **KPTCL** presented the failure of one Current Transformer. He stated that heavy arcing was observed at P1 terminal of 'Y' phase CT of 220 kV Doni line – 2 bay which tripped on overcurrent relay. During this incident, due to heavy arcing at P1 terminal of CT, Oil tank got damaged and resulted in small holes on the top of CT and oil spill-over. The CT has served for around 25 years. However, it can be repaired and put in service again.
18. **UPPTCL** reported the failure of six Transformers, twenty four CTs, four PT/CVTs, four Circuit Breakers, one Isolator, one Wave Trap and one Pass Module. However, UPPTCL representative informed that due to his late nomination, he could not gather the information of all the failures occurred of UPPTCL. Taking strong exception to this, the Committee stated that as this is a Standing Committee constituted to deal with substation equipment failures, all its members including that from UPPTCL are there on permanent basis. Therefore last minute nomination is not acceptable. If any official representative attends on behalf of the regular member, he/ she should come at the meeting with all details, and requested UPPTCL to kindly ensure the same.

Then UPPTCL representative presented only two transformers failure report. UPPTCL representative presented the case of failure of 315 MVA, 440/220/33 kV ICT at Rasara Substation. He informed that during the inspection it was observed that flashover occurred in tertiary winding due to insulation failure. The transformer was failed during warranty period. On-site inspection of transformer was done by OEM. However, OEM decided to conduct further testing and repairing at their works.

For the failure of ICT at Sarnath, UPPTCL representative informed that the Transformer did not fail and it was taken out of service as a preventive measure due to observed increasing trend of Acetylene in transformer oil. Therefore, this may not be considered as a transformer failure. Accordingly, the mentioned Transformer may be removed from the list of the failures of the Transformers. The committee noted same.

19. **Representatives of AP Transco, RRVUNL, TANTRANSCO, Torrent Power Limited, CSPTCL, TVNL, NPCIL, NEEPCO, MSPGCL, WBPDC and TTC did not attend the meeting. Therefore, failure events reported by these Utilities could not be discussed.**

20. The Chief Engineer (PSE&TD), CEA concluded the deliberations with the following remarks:
 - a. Each Utility is required to intimate each incidence of failure of equipment to Chairperson of the Standing Committee within 48 hours of occurrence of the failure. Further, each Utility shall submit the detailed report of equipment failure within one month of occurrence of failure as per the format available on CEA website along with all the relevant information such as test reports, photographs, OEM recommendation etc. This will help not only in analysing the failure events, but also enable the Committee members to undertake site visit in time, if required.

- b. CEA, vide Office Order no: CEA-PS-14-97/3/2018-PSETD Division-Part(5) dated 03.02.2025, has reconstituted the Standing Committee, as per which from January 2025 onwards, failures of only Transformers and Reactors are required to be reported and the same shall be discussed during future meetings of the Standing Committee.
- c. All Utilities should furnish the action taken report on the recommendation suggested by the Standing Committee and O&M practices being followed for various substation equipment.
- d. Eight failures as per the agenda i.e. one LA of rating 66 kV, 10 kA at Chichli S/s of MPPTCL, 1one GT of rating 1/400/V 3, 48.33 MVA, 1 phase GT at Dulhasti Power Station of NHPC, two Current Transformers at Sipat Power Station of NTPC, one CT of rating 33 kV, 1000/1 A, 4 core at Sri Ganganagar S/s of RRVPNL, one LA at Bari S/s of IndiGrid, one 315 MVA, 440/220/33 kV ICT at Rasara Substation would be removed from the list of failures as they are not actual failures, but taken out of service for maintenance purposes .

4 Statistics & Analysis of the failure of Substation equipment

4.1 Statistics of Reporting of Equipment Failure to CEA

SN	Category	Number of Equipment Failure	Number of Utilities	Remarks
1	Failures of Equipment reported within 48 hrs on their own by the Utilites	1	1	IndiGrid (315 MVA, 400/220 kV ICT at Kabulpur Substation of JKTTP (Subsidiary of IndiGrid). However, Detailed report was submitted after CEA letter
2	Failures of Equipment intimated by Utilities after 48 hours on their own	1	1	IndiGrid (125 MVA Bus Reactor at Kadarapur)- Preliminary detailed report was also submitted within one month
3	Failures of Equipment for which Detailed Report was submitted by Utilities within one month by their own	0	0	
4	Failures of Equipment for which Detailed Report was submitted by Utilities after One Month on their own	5	5	(i) Adani Transmission Ltd (Cable Fault at Saki) (ii) CSPTCL (105 MVA Auto Transformer at Khedemara), (iii) BBMB (105 MVA Auto Transformer at Panipat) (iv) DTL (100 MVA Transformer at Pappankalan-I) (v) AP Transco (220 kV CT at Tallapally Substation)

5	Failures of Equipment for which Detailed Report was submitted by Utilities only after CEA letter	163	25	(i) Includes Utilities viz. Adani Transmission Ltd, BBMB and DTL which have reported failures of equipment other than those mentioned at S.No.-4, only after CEA letter (ii) Includes Indgrid who have reported failures of some of equipment of after CEA letter
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4.2 General Statistics of Reported Equipment Failures

The Committee investigates failures of 220 kV and above voltage class equipment only. A total of 162 failure incidences of Transformers, Reactors, Instrument Transformers, Surge Arresters, Circuit Breakers, Disconnectors, Wave Trap, Coupling Capacitors, GIS Bay, Cable and PASS Module of 220 kV and above voltage rating were reported between 1st July 2023 and 31st December 2024 to CEA. The voltage wise quantity of each equipment has been indicated in the Table-1 below:

Table-1: Voltage wise segregation of Equipment

Equipment	Voltage Class			Quantity (Nos.)
	220 kV	400 kV	765 kV	
	Quantity (Nos.)			
Transformers	24	12	0	36
Reactors	0	3	1	4
Current Transformers	34	5	3	42
PT/ CVT	12	3	0	15
Surge Arresters	35	7	0	42
Circuit Breakers	6	4	0	10
XLPE Cables	1	0	0	1
Wavetrap	4	0	0	4
Coupling Capacitors	3	0	0	3
BAY	1	0	0	1
GIS Bus-2 Disconnector	3	0	0	3
Pass Module	1	0	0	1
			Total	162

Quantity of failed equipment and years of service put in by these equipment before failures is given in Table-2.

Table-2: Year of Service of failed Equipment

Years of Service	Nos. of equipment failed											
	Transformers	Reactors	CT	CVT/PT	SA	CB	Cable	Wave-trap	CC	Disconnector	GIS Bay	Pass Module
0-5	10	0	3	1	3	2	0	1	0	0	1	1
5-10.	4	3	20	4	4	0	0	2	0	1	0	0
10-15.	11	0	7	0	17	1	1	0	0	1	0	0
15-20	8	0	6	2	7	3	0	0	1	1	0	0
>20	3	1	4	8	8	4	0	1	2	0	0	0
	36	4	40	15	39	10	1	4	3	3	1	1

Note (i) In some cases, years of service have been considered taking the difference between re-Commissioning (after repairing of the equipment) and failure date.

(ii) For the 5 case of equipment failures, date of commissioning was not provided by Utility, therefore only above analysis was carried out for 157 failures of equipment.

Table-3: Region wise Substation Equipment failed

Equipment	NR	WR	SR	ER	NER
Transformer	11	16	5	3	1
Reactor	2	-	1	-	1
CT	27	10	3	2	-
PT/CVT	6	8	1	-	-
Surge Arresters	20	14	2	6	-
Circuit Breakers	9	-	-	-	1
Isolator/Disconnecter	1	1	1	-	-
Wave-trap	1	3	-	-	-
Bay	-	-	1	-	-
Cable	-	1	-	-	-
Pass Module	1	-	-	-	-
Coupling Capacitors	-	3	-	-	-
Total	78	56	14	11	3

Table-4: Utility wise Substation Equipment failed

Utility	Region	Transformer	Reactor	CT	PT/CVT	Surge Arresters	Circuit Breakers	Wave trap	Isolator/ Coupling Capacitor	Pass Module/ Cable/ GIS Bay	Total
Adani Transmissi on Ltd	WR	-	-	1	-	-	-		1	1	3
AEGCL	NER	1	-	-	-	-	-	-	-	-	1
AP Transco	SR	-	-	1	-	-	-	-	-	-	1
BBMB	NR	1	-	-	-	3	-	-	-	-	4
CSPTCL	WR	1	-	-	-	-	-	-	-	-	1
DTL	NR	1	-	-	-	2	-	-	-	-	3
DVC	ER	1	-	-	-	2	-	-	-	-	3
GETCO	WR	2	-	-	-	-	-	-	-	-	2
IndiGrid	NR	1	1	-	-	-	-	-	-	-	2
KPTCL	SR	-	-	1	-	-	-	-	-	-	1
KSEB	SR	1	-	-	-	-	-	-	-	1	2
MPPTCL	WR	1	-	2	1	5	-	3	-	-	12
MSETCL	WR	11	-	5	7	8	-	-	3	-	34
MSPGCL	WR	-	-	2	-	-	-	-	-	-	2
NEEPCO	NER	-	-	-	-	-	1	-	-	-	1
NHPC	NR	-	-	-	1	-	1	-	-	-	2
NPCIL	SR	-	-	-	-	-	-	-	1	-	1
OPTCL	ER	-	-	1	-	3	-	-	-	-	4
PowerGrid	NR	3	-	-	-	-	-	-	-	-	3
	WR	1	-	-	-	-	-	-	-	-	1
	SR	1	1	-	-	-	-	-	-	-	2
	ER	2	-	-	-	-	-	-	-	-	2
	NER	-	1	-	-	-	-	-	-	-	1
RRUVNL	NR	-	-	-	1	2	1	-	-	-	4
RRVPNL	NR	1	1	3	-	2	3	-	-	-	10
TANTRANS CO	SR	3	-	1	1	2	-	-	-	-	7
Torrent Power	WR	-	-	-	-	1	-	-	-	-	1
TVNL	ER	-	-	1	-	-	-	-	-	-	1
UPPTCL	NR	4		24	4	11	4	1	1	1	50
WBDCL	ER	-	-	-	-	1	-	-	-	-	1
Total		36	4	42	15	42	10	4	6	3	162

Complete details of all the above-mentioned equipment failures is provided in **Annexure-II**. The probable cause of failure is based on information, data, and reports furnished by the utility. The type of equipment wise analysis of failures is presented in ensuing paras.

4.3 Failure of Transformers

- Transformer, the costliest equipment in a switchyard/substation, is expected to serve the entire life of a substation which is considered to be 35 years. However, it has been observed that many transformers installed in Indian utilities have failed within first few years of service which is a matter of concern. Even one

Transformer of CSPTCL at Khedamara S/s has failed on the day of commissioning itself.

- ii. Summary of Inter Connecting Transformers/Generator Transformers (GTs) reported to CEA that have failed between 1st July 2023 and 31st Dec 2024 is detailed below (Table 5):

Table 5: Summary of failure of Transformers

S.N.	Utility	Substation Name	Make	Rating	Year of Commissioning	Date of Failure	Probable cause of failure
1.	AEGCL	220 kV Namrup GSS	CGL	50 MVA, 220/132 kV, 3-Phase	04.04.2012	25.05.2024	Ageing
2.	BBMB	400 KV GSS BBMB Panipat	TELK	150 MVA, 400/220 kV, 1-phase	19.09.1979	28.03.2024	Tertiary winding failure/Ageing
3.	CSPTCL	400 KV S/s, Dn. Khedamara, Bhilai	BHEL	105 MVA, 400/220/33 kV, 1-phase	11.05.2024	11.05.2024	Erection Deficiency
4.	DTL	220 kV S/s, Pappankalan-I	BHEL	100 MVA 220/66/11 kV, 3-Phase	04.11.2020	22.08.2024	Transformer Internal Fault
5.	DVC	220 kV S/s, DVC Barjora	BHEL	150 MVA, 230 kV/138 kV/ 6.9 kV, 3-Phase	30.04.2010	27.10.2024	Internal Fault
6.	GETCO	220 kV S/s, Morbi	IMP	160 MVA 220/66 kV, 3-Phase	12.03.2019	31.07.2024	LV Winding Insulation failure
7.	GETCO	220 kV S/s, Jambuva	BHEL	160 MVA 220/66 kV, 3-Phase	05.12.2018	04.09.2024	Winding failure
8.	IndiGrid	400 kV S/s, Kabulpur	Crompton Greaves Limited	315 MVA, 400/220/33 kV, 3-Phase	06.03.2012	11.08.2024	Inter turn Shorting of Winding
9.	KSEB	220 kV S/s, Edappon	Crompton Graves	66.67 MVA, 220/110/33 kV, 1-Phase	2007	23.08.2023	Insulation failure of tertiary winding

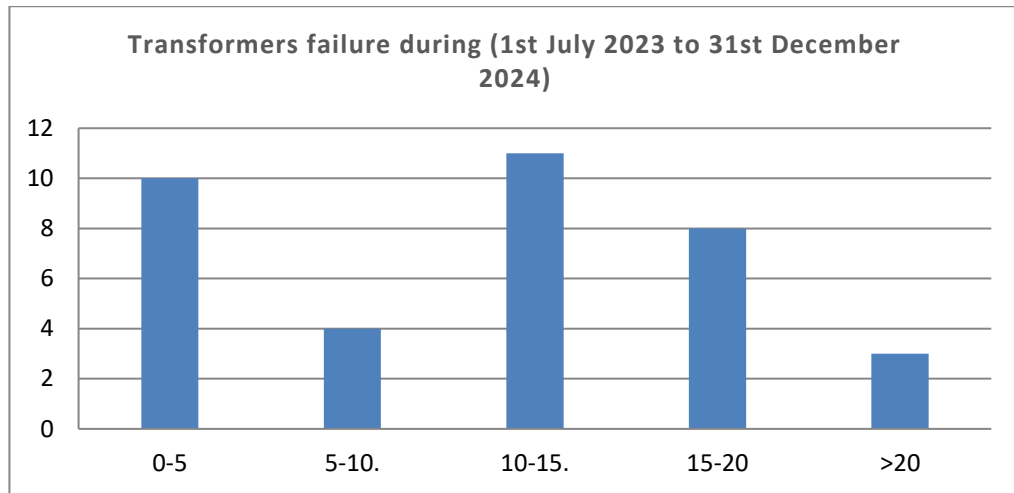
10.	MPPTCL	220 kV S/s, Barwaha	BBL	160 MVA, 220/132/33 kV, 3-Phase	23.12.2018	09.09.2023	Internal failure
11.	MSETCL	220 kV S/s, Chinchwad-1	EMCO MAKE Repaired by M/s Mahati Industries. Ltd, Yawat.	50 MVA, 220/22, 3- phase	12.09.2022	05.07.2023	Displacement of LV winding due to feeder fault
12.	MSETCL	220 kV S/s, Hinjewadi-1	VIJAI Electricals.	50 MVA, 220/22, 3- phase	12.07.2009	25.08.2023	HV Y phase Winding failure
13.	MSETCL	220 kV Bhokardan S/s	BBL	25 MVA, 220/33 kV, 3- phase	19.02.2022	12.05.2024	Insulation failure
14.	MSETCL	220 kV Vankusawa de S/s	EMCO	50 MVA, 220/33 kV, 3- Phase	25.03.2002	28.05.2024	Internal Fault
15.	MSETCL	220 kV Bothe S/s	T&R	100 MVA, 220/33 kV, 3- Phase	10.05.2013	04.06.2024	Internal Fault
16.	MSETCL	220 KV Kandalgaon S/s	Toshiba	125 MVA, 220/100 kV, 3-Phase	19.11.2022	15.07.2024	Winding failure
17.	MSETCL	220 kV Bhosari-2 S/s	EMCO MAKE (Repaired by M/s Mahati Industries. Ltd, Yawat.)	50 MVA, 220/22 kV, 3- Phase	28.06.2024	24.07.2024	Internal fault
18.	MSETCL	220 kV Kurkumbh	EMCO	50 MVA, 220/33 kV, 3- Phase	31.07.2007	20.08.2024	Winding Displacement
19.	MSETCL	220 kV Purti	EMCO (repaired by M/s Vishvas Power)	25 MVA, 220/33 kV, 3 Phase	08.12.2018	28.08.2024	Transformer Internal Fault and Failure of Station DC supply.

20.	MSETCL	220 kV Alephata	EMCO	100 MVA, 220/132 kV, 3 Phase	31.07.2010	23.09.2024	OLTC failure
21.	MSETCL	220 kV Chinchwad-1	CGL MAKE (Overhauled by AVAL in 2011)	150 MVA, 220-22kV, 3- Phase	12.10.2011	11.11.2024	Inter-turn insulation failure
22.	POWERGRID	400/220 kV Muzaffargarh S/s	TELK	500 MVA, 400/220 kV, 3-Phase	2009	23.08.2023	220 kV side Winding Insulation failure
23.	POWERGRID	+/- 500 KV HVDC Kaniha S/s	Siemens	397 MVA, 400 kV, 1- Phase (R-Ph)	2002	29.10.2023	Insulation failure of secondary star winding.
24.	POWERGRID	400/220 kV Maharanibagh S/s	CGPISL	500 MVA, 400/220 kV, 3-Phase	2010	30.10.2023	Dielectric failure between Y-B phase.
25.	POWERGRID	400/220 kV Kaithal S/s	CGPISL	315 MVA, 400/220 kV, 3-Phase	2007	11.05.2024	Dielectric failure of B- Phase winding.
26.	POWERGRID	400/220 kV Munirabad S/s	BHEL	315 MVA, 400/220 kV, 3-Phase	2007	07.06.2024	Dielectric failure of B- Phase series winding
27.	POWERGRID	400/220 kV Kala S/s	Vijai Electrical	315 MVA, 400/220 kV, 3-Phase	2014	21.07.2024	Flashover between Tap winding of B- Phase (bottom side) to main tank.
28.	POWERGRID	220/132 kV Birpara S/s	BHEL	160 MVA, 220/132 kV, 3-Phase	2013	30.07.2024	OLTC failure
29.	RRVNL	220 kV GSS Bhiwadi	BHEL	160 MVA, 220/132 kV	06.01.2014	24.7.2023	Internal Fault
30.	TANTRANSCO	230 kV Veeranam	T&R	50 MVA, 230/33 kV	21.09.2006	05.10.2023	Internal fault

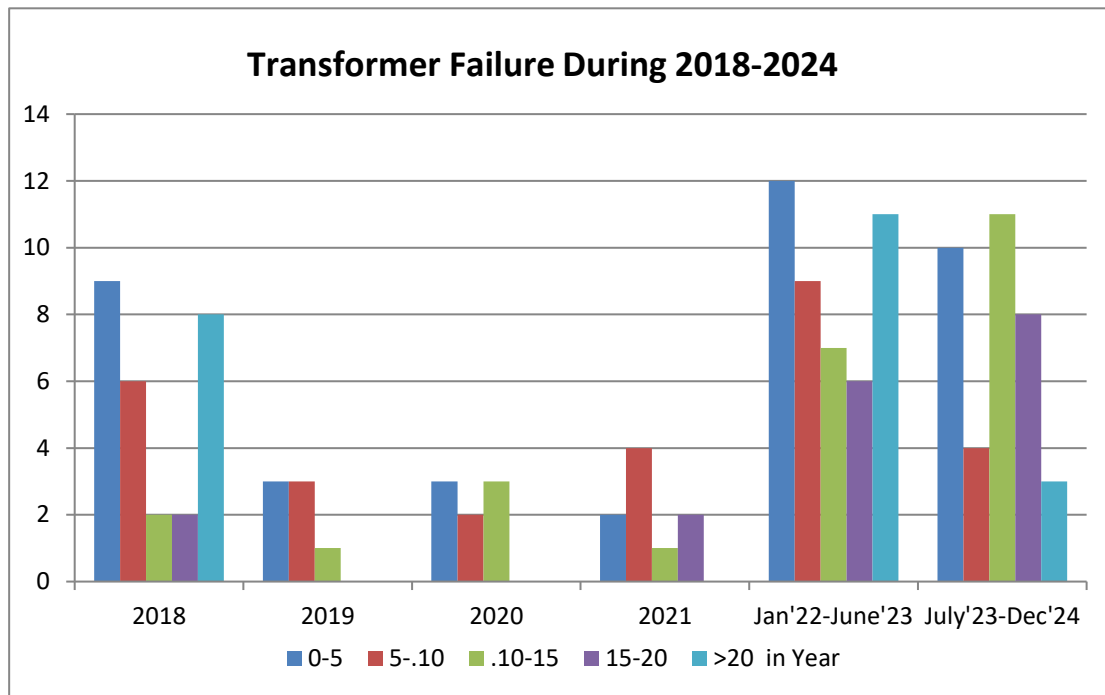
31.	TANTRA NSCO	230/110-33 kV Udayathur WIND FARM S/s	ALSTOM	50 MVA, 230/33 kV, 3 Phase	12.03.2007	04.11.2023	Winding Insulation failure
32.	TANTRA NSCO	400/230- 110 kV Alamathy S/s	BHEL	315 MVA, 400 kV/230 kV	2004	25.05.2024	Internal fault
33.	UPPTCL	220 KV Faridpur S/s	IMP	160 MVA, 3 Phase	30.09.2022	10.08.2023	Due to insufficiency of data, Cause of failure could not be ascertained
34.	UPPTCL	400 kV GIS RASARA, BALLIA	BHEL- Bhopal	500 MVA, 400/220/33 kV, 3-Phase	18.04.2022	26.10.2023	Insulation failure
35.	UPPTCL	400 kV Gorakhpur S/s	HITACHI	240 MVA, 400/220/33 kV, 3-Phase	10.04.2019	11.11.2023	Insulation failure
36.	UPPTCL	220 kV Bhartna S/s	CGL	100 MVA 220/132 kV, 3 Phase	04.08.2008	18.09.2024	Internal fault

Note: The probable cause of failure is based on information, data, and reports furnished by the utility.

- iii. As can be seen from Table 5 above, thirty six (36) transformer failure cases from July 2023 to December 2024 have been reported by fourteen (14) Utilities to CEA. It is highlighted that a large number of transformer failure cases remain unreported as many of power utilities [State Transmission Utilities, Private Utilities/Licensees, Central Transmission Utilities, Public Sector Power Utilities] in the Country have not reported the failures.
- iv. Out of total 36 failures of the Transformers occurred, 24 were of 220 kV class, 12 of 400 kV class and none of 765 class. 10 Nos. of Transformers failed within five years, 4 Nos. of Transformers failed in 5-10 years of period. 19 Nos. of Transformers failed during 10-20 years of their operation. 3 Nos. of Transformers failed who had operation of more than 20 years. The transformers failures that occurred between 1st July 2023 and 31st December 2024 from the commissioning of the equipment is as per the below graph below:



- v. Failures of transformers during 2018-2024: The number of different transformer failures as reported in the last 7 years to CEA has been shown in the graph below:



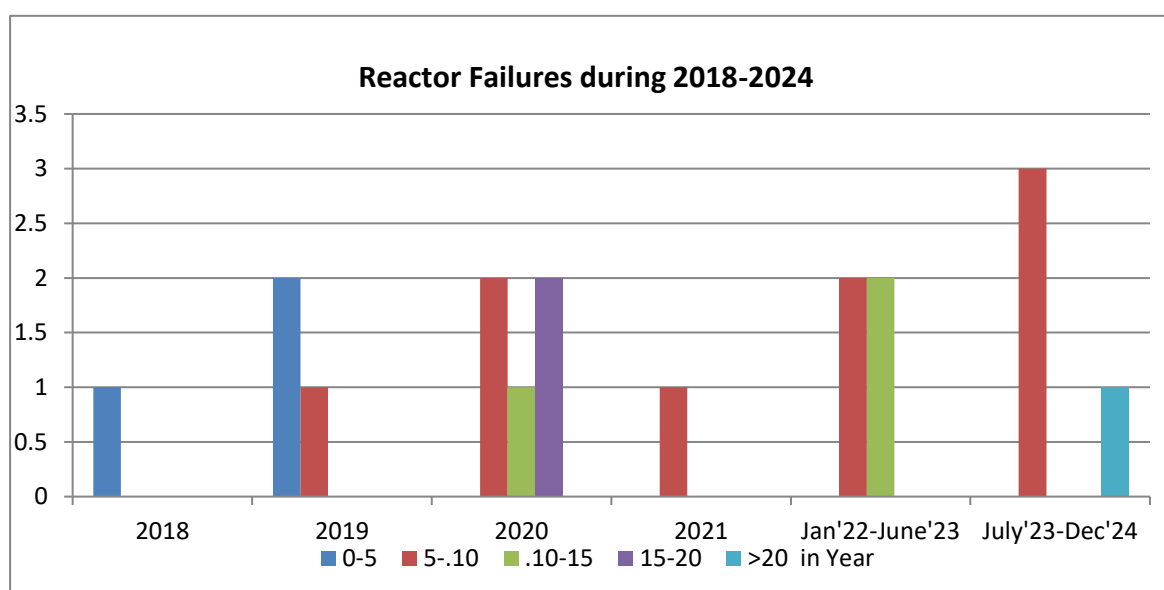
4.4 Failure of Reactors

- i. Failure of the following Reactors have been reported to CEA during the period from July 2023 and December 2024 by three (3) utilities. Cause of failure is based on information, data and reports furnished by the utility.

Table 6: Summary of failures of Reactor

S.N.	Utility	Substation Name	Make	Rating	Year of Commissioning	Date of Failure	Probable cause of failure
1.	INDIGRID	Kadarpur Ss	GE	125 MVar, 400 kV, 3-Phase	2019	03.08.2024	Internal fault
2.	POWERGRID	400/220 kV Balipara S/s	BHEL	50 MVar, 420 kV, 3-Phase	1998	14.08.2023	Inter-turn insulation failure
3.	POWERGRID	765/400 kV Srikakulam S/s	ABB	80 MVar, 765 kV, 1-Phase	2017	12.05.2024	Flashover/ arcing across the winding
4.	RRVNL	400 kV GSS Ramgarh Jaislmer	BHEL	50 MVar, 400 kV, 3-Phase	06.12.2017	09.05.2024	Internal Fault

- ii. Failures of reactors during 2018-2024: The number of different reactor failures as reported in the last 7 years to CEA has been shown in the graph below.



4.5 Failure of Instrument Transformers (CT/PT/CVT)

Current Transformers (CT)

- i. Summary of failure of CTs between July 2023 and December 2024 as reported to CEA is detailed below (Table 7):

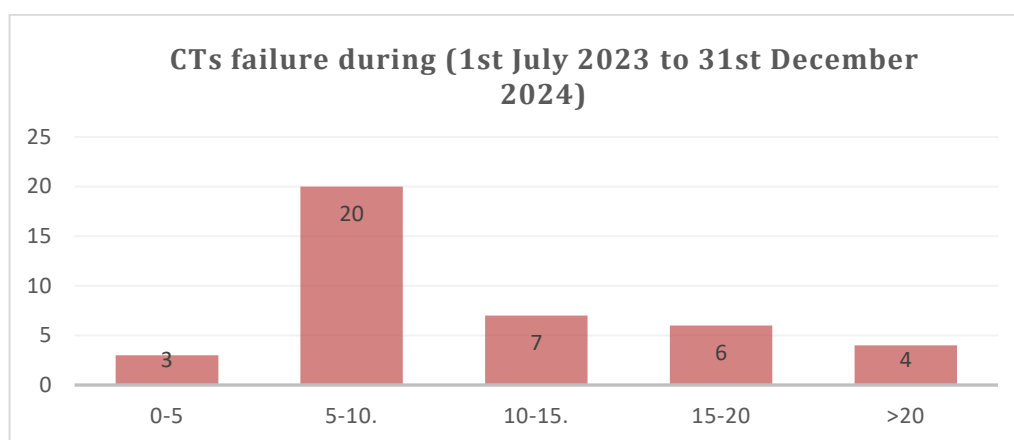
Table 7: Summary of failure of CTs

S. N.	Utility	Make	Rating	Year of Commissioning	Date of Failure
1.	Adani Transmission	Siemens	420 kV, 3000 A	2013	06.08.2023
2.	AP TRANSCO	GE T&D	220 kV, 960 A	03.06.2023	31.07.2024
3.	KPTCL	ABB	220 kV, 1200-600/1-1-1-1-1	29.3.1999	10.06.2024
4.	MPPTCL	CGL	220 kV, 800/1	23.11.2014	15.07.2023
5.	MPPTCL	MEHRU	800/1-1-1-1-1-1 1	18.03.2016	19.07.2023
6.	MSETCL	BHEL	400 kV, 7 Core, 2000/1, 2800 Amp CT	1999	29.09.2023
7.	MSETCL	BHEL	245 kV, 800/1 A.	28.03.2018	30.09.2024
8.	MSETCL	Areva T&D India Ltd.	220 kV	22.03.2010	03.11.2024
9.	MSETCL	MEHRU	800-400/1, 5 Core, 0.2S	7.02.2009	25.11.2024
10.	MSETCL	AREVA T&D INDIA Ltd	400 kV (2000 - 1000 - 500 A/1 A)	29.12.2009	23.12.2024
11.	MSPGCL	High Volt Trans	220 kV, 1200 - 600 - 300 / 1 A	1996	23.08.2023
12.	MSPGCL	HBB	220 kV, 1200 - 600 - 300 / 1 A		12.11.2023
13.	OPTCL	ALSTOM	220 kV,		27.12.2023

			1200-600-300/1-1-1-1-1		
14.	RRVNL	Mehru Electrical and Mechanical Engineers (P) Ltd.	245 kV, 800-400/1 A, 5 Core	17.05.2016	20.10.2023
15.	RRVNL	SCT	220 kV, 400-800/1A, 5C	01.09.2017	21.09.2023
16.	RRVNL	SCT Ltd.	220 kV/ 800/1 A	08.02.2011	22.09.2023
17.	TAN TRANSOCO	ABB	245 kV, 1600-1200-800-300/1 A, 5 Core	25.04.2006	26.08.2023
18.	TVNL	ALSTOM	245/220 kV, 1600/2-2-1-2-2	04.05.2014	21.12.2024
19.	UPPTCL	SCT	220 kV, 800/1	15.08.2015	14.07.2023
20.	UPPTCL	SCT	245 kV, 1000-800-500-300/1	14.02.2015	12.08.2023
21.	UPPTCL	Hepta care	11000/1	03.03.2020	11.09.2023
22.	UPPTCL	Heptacare	245 kV, 1000-800-500-300/1 A	01.03.2019	30.10.2023
23.	UPPTCL	Heptacase power Ltd.	245 kV	10.02.2018	27.12.2023
24.	UPPTCL	SCT limited	245 kV, 1000-800-500-300/1 A	15.05.2017	11.04.2024
25.	UPPTCL	BHEL	220 kV, 1000-800-500/1-1-1 A	06.05.2006	11.04.2024
26.	UPPTCL	Heptacare	245 kV, 1000-800-500/300/1 A	22.05.2018	21.04.2024
27.	UPPTCL	SCT	245 kV, 100/800/500/300/1 A	03.03.2011	07.05.2024

28.	UPPTCL	TELK	400 kV, 2000/1000/500/1 Amp	31.12.2005	10.5.2024
29.	UPPTCL	BHEL	220 kV, 1000-800- 500/1-1-1 A	06.05.2006	11.04.2024
30.	UPPTCL	SCT	245 kV, 1000-800-500- 300/1 A, 5 Core	27.08.2006	19.05.2024
31.	UPPTCL	Heptacare	245 kV, 1000-800-500- 300/1 A 5 Core	04.06.2016	20.05.2024
32.	UPPTCL	SCT	245 kV 800/400-1 A	30.06.2010	20.05.2024
33.	UPPTCL	SCT	220 KV	21.05.2015	22.05.2024
34.	UPPTCL	SCT	220 KV	26.09.2014	22.05.2024
35.	UPPTCL	Hepta care Power Industries (P) Ltd	245 kV	19.07.2018	19.05.2024
36.	UPPTCL	SCT	245 kV, 1000/800/500/300/1 A	08.11.2015	29.05.2024.
37.	UPPTCL	Heptacar e	245 kV, 1000-800- 500/300/1A	26.12.2018	29.05.2024
38.	UPPTCL	Heptacar e	245 kV, 1000/800/500/300/1 A	24.05.2016	30.05.2024
39.	UPPTCL	Electrical Stampings	1000/800/500/300/1 A	10.04.2019	31.05.2024
40.	UPPTCL	BHEL	420 kV, 2000/1000/500/1 A	19.12.1993	07.07.2024
41.	UPPTCL	Heptacare	245 kV	2018	05.09.2024
42.	UPPTCL	Heptacar e Power Industries Limited	220 kV, 1000-800-500/ 1-1-1-1-1 A	17.03.2017	06.10.2024

- ii. It is observed that forty two (42) Nos. of cases of Current Transformers failure that occurred during the period from July 2023 to December 2024 have been reported to CEA by eleven (11) utilities out which 34 were of 220 kV class, 5 were of 400 kV class and 3 were of 765 kV class.
- iii. Out of total 42 failures of the Current Transformers occurred, 3 Nos. of Current Transformers failed within five years, 20 Nos. of Current Transformers failed in 5-10 years of period. 13 Nos. of Current Transformers failed during 10-20 years of their operation. 4 Nos. of Current Transformers failed which had operation of more than 20 years. For 2 Nos of Current Transformers, Utility has not given commissioning date, therefore analysis could not be carried out. The Current Transformers failures occurred between 1st July 2023 to 31st December 2024 from the commissioning of the equipment is as per the below graph below:



Failure of Instrument Transformers (PT/CVT)

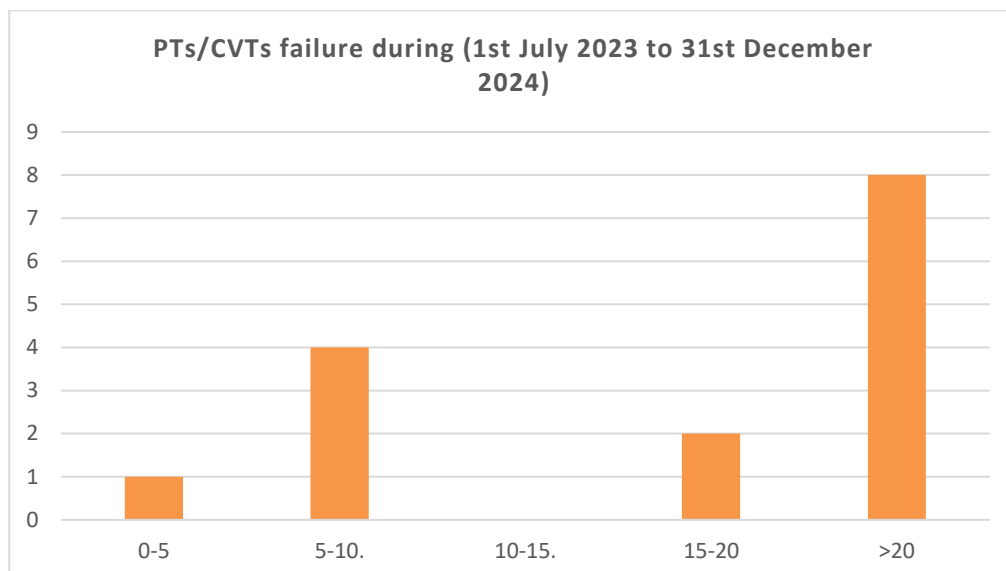
- iv. Summary of failure of PTs/ CVTs, between July 2023 and December 2024 as reported to CEA is detailed below (Table 8):

Table 8: Summary of failure of PTs/CVTs

S. N.	Utility	Make	Rating	Year of Commissioning	Date of Failure
1.	MPPTCL	SCT	220 kV	29.03.1993	01.10.2023
2.	MSETCL	BHEL	220 kV/110 V PT, 3 Core, 500 kVA 3P, 100 VA 3P, 100 VA 3P	13.03.2007	08.07.2023
3.	MSETCL	Crompton Greaves	245 kV, 245/1050/50	09.09.2000	29.09.2023
4.	MSETCL	TOSHIBA	220 kV/110 V PT, 3 Core, 200 VA 3P, 50 VA 3P, 50 VA 0.2	28.05.2018	08.10.2023

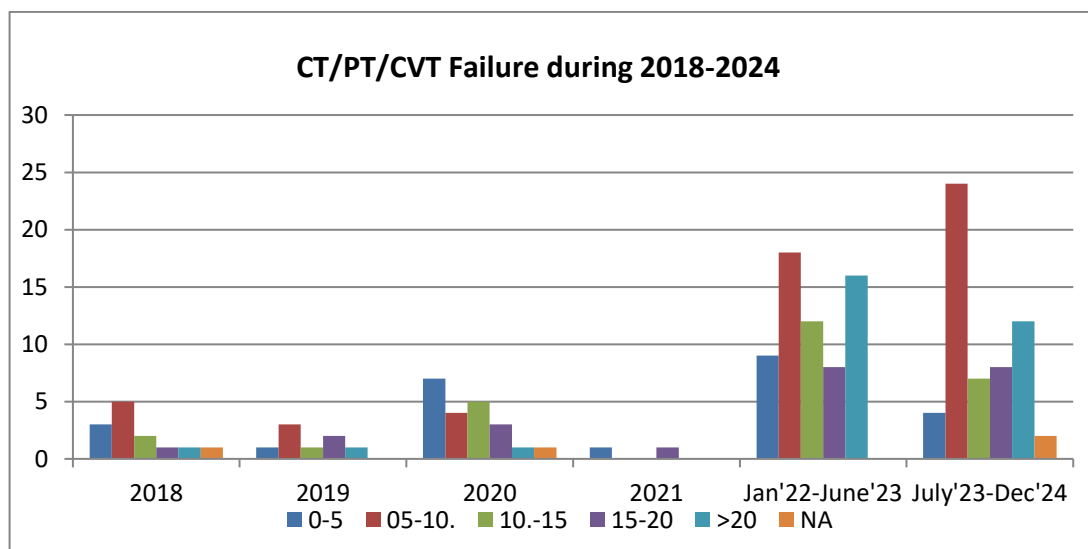
5.	MSETCL	CGL	245 kV, 220 kV/110 V Class: 3P/3P/0.5	23.02.2006	07.01.2024
6.	MSETCL	CGL	220 KV	01.05.2000	04.02.2024
7.	MSETCL	MEHRU	220 kV	13.03.2024	28.08.2024
8.	MSETCL	Crompton Greaves Ltd	220 kV	07.06.2001	22.11.2024
9.	NHPC	Trench Electric	400 kV/ 110/110/110 V	1994	04.08.2023
10.	RVUNL	BHEL	4400pF, (400/v3) kV/ (110//v3) V	20.01.2017	28.03.2024
11.	TANTRANSCO	BHEL	230/v3 KV -110/v3V	19.09.2002	22.11.2023
12.	UPPTCL	WS Industries	220 kV CVT	1992	01.08.2023
13.	UPPTCL	HBB	220 kV/110 V	24.03.1983	18.09.2023
14.	UPPTCL	BHEL	400 kV/ 110 V	02.10.2017	11.10.2023
15.	UPPTCL	ABB	245 kV/110 V	31.12.2018	10.12.2024

- v. It is observed that fifteen (15) Nos. of cases of PTs/CVTs failure that occurred during the period from July 2023 to December 2024 have been reported to CEA by eleven (11) utilities out of which 12 were of 220 kV class, 3 were of 400 kV class and none were of 765 kV class.
- vi. Out of total 15 failures of the PTs/CVTs occurred, 1 Nos. of PTs/CVTs failed within five years, 4 Nos. of PTs/CVTs failed in 5-10 years of period. 2 Nos. of PTs/CVTs failed during 10-20 years of their operation. 8 Nos. of PTs/CVTs failed which had operation of more than 20 years. The PTs/CVTs failures occurred between 1st July 2023 to 31st December 2024 from the commissioning of the equipment is as per the below graph below:



Analysis of failures

- vii. In the case of Instrument Transformer, fifty seven (57) Nos. of failure occurred during the period from July 2023 to December 2024 have been reported to CEA by thirteen (13) Utilities. However, it may be noted that due to only a handful of utilities reporting the failure, it is not possible to successfully capture the statistics of service life of key electrical equipment in the substations across various utilities in India.
- viii. In most of the cases of failure of CT/ CVT/ PT, the equipment had blasted or flashed over. In such cases, it becomes difficult to pin point the cause of failure. However, such failures may be attributed to deterioration of internal insulation and moisture ingress. Some of the failures of equipment could be due to ageing.
- ix. The number of different PT/CVT failures as reported in last 7 years to CEA has been shown in the graph below:



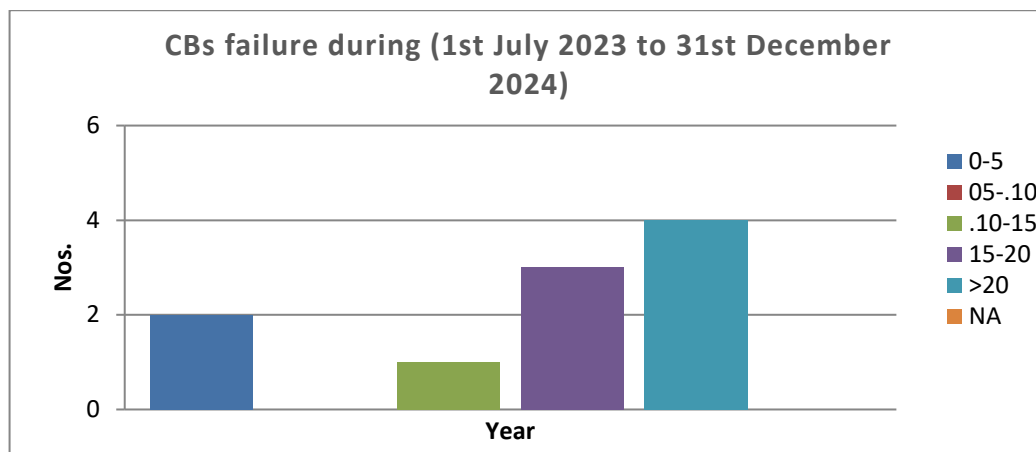
4.6 Failure of Circuit Breakers (CBs)

- i. Total ten (10) Nos. of Circuit breakers failures occurred between July 2023 and December 2024 as reported to is as below (Table-9):

Table 9: Summary of failure of CBs

S.N.	Utility	Make	Rating	Year of Commissioning	Date of Failure
1.	NEEPCO	CGL	245 kV, 3150A	02.09.2023	14.12.2023
2.	NHPC	GE	220 kV	2004	16.09.2023
3.	RRVUNL	CGL	420 kV/ 2000 A	2001	31.10.2023
4.	RRVPNL	HBB	245 kV	28.06.1990	30.09.2023
5.	RRVPNL	ABB	220/245 kV	31.03.1998	16.10.2023
6.	RRVPNL	Siemens	400 kV	06.03.2019	15.11.2023
7.	UPPTCL	Siemens	245 kV	25.08.2006	11.01.2024
8.	UPPTCL	ABB	420 kV	15.03.2006	19.08.2024
9.	UPPTCL	Siemens	245 kV/ 1250 A	03.03.2011	21.08.2024
10.	UPPTCL	Siemens	420 kV/ 2000 A	23.09.2024	22.09.1998

- ii. It is observed that ten (10) Nos. of cases of CBs failure that occurred during the period from July 2023 to December 2024 have been reported to CEA by five (5) utilities out which 6 were of 220 kV class, 4 were of 400 kV class and none were of 765 kV class. However, it may be noted that due to a handful of utilities reporting the failure, it is not possible to successfully capture the statistics of service life
- iii. The Circuit breakers failures occurred between July 2023 and December 2024 from the commissioning of the equipment is as per the below graph below:



4.7 Failures of Surge Arresters/Lightning Arrester (SA/LA)

- i. Total forty two (42) Nos. of cases of SA/LA failure that occurred between July 2023 to December 2024 were reported to CEA by twelve (12) utilities. Summary of failure of Surge Arrestors is as below (Table-10):

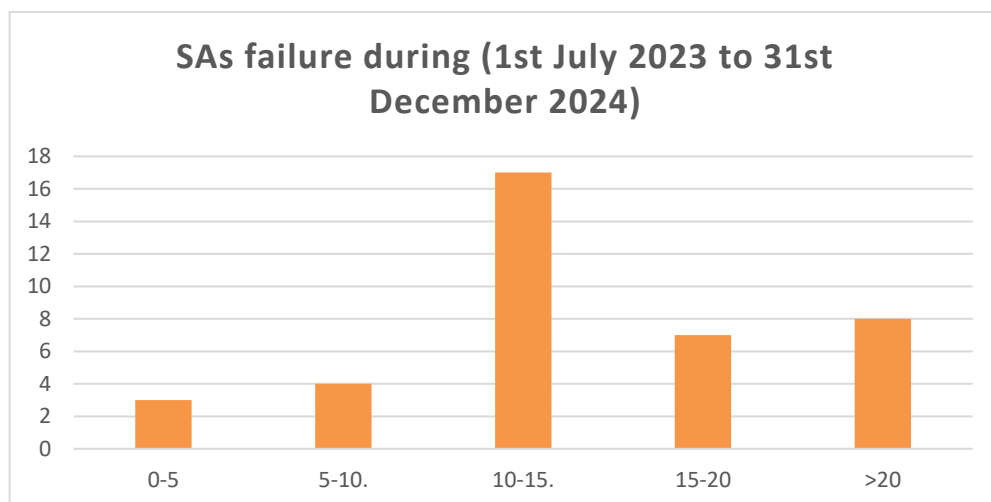
Table 10: Summary of failure of SA/LA

S N	Utility	Make	Rating	Year of Commissioning	Date of Failure
1.	BBMB	CGL	220 kV	16.10.2006	20.08.2023
2.	BBMB	CGL	198 kV	18.10.2006	21.08.2023
3.	BBMB	CGL	198 kV	21.08.2009	29.10.2023
4.	DTL	Elpro Industries	198 kV, 10 kA		31.01.2024
5.	DTL	W.S Industries (India) Ltd	198 kV, 10 kA	1992	01.10.2024
6.	DVC	MOGARD	198 kV	11.04.1994	09.07.2024
7.	DVC	CGL	198 kV, 10 KA	01.06.2006	13.07.2024
8.	MPPTCL	Oblum Electrical Industries Pvt Ltd	198 kV	25.08.2011	21.07.2023
9.	MPPTCL	Lamco Industries Pvt. Ltd.	198 kV, MCOV: 168 kV	16.03.2016	28.07.2023
10.	MPPTCL	Oblem	198 kV	14.09.1995	05.09.2023
11.	MPPTCL	Oblem	198 kV	11.08.2011	23.09.2023
12.	MPPTCL	WSI	336 kV	1991	25.09.2023

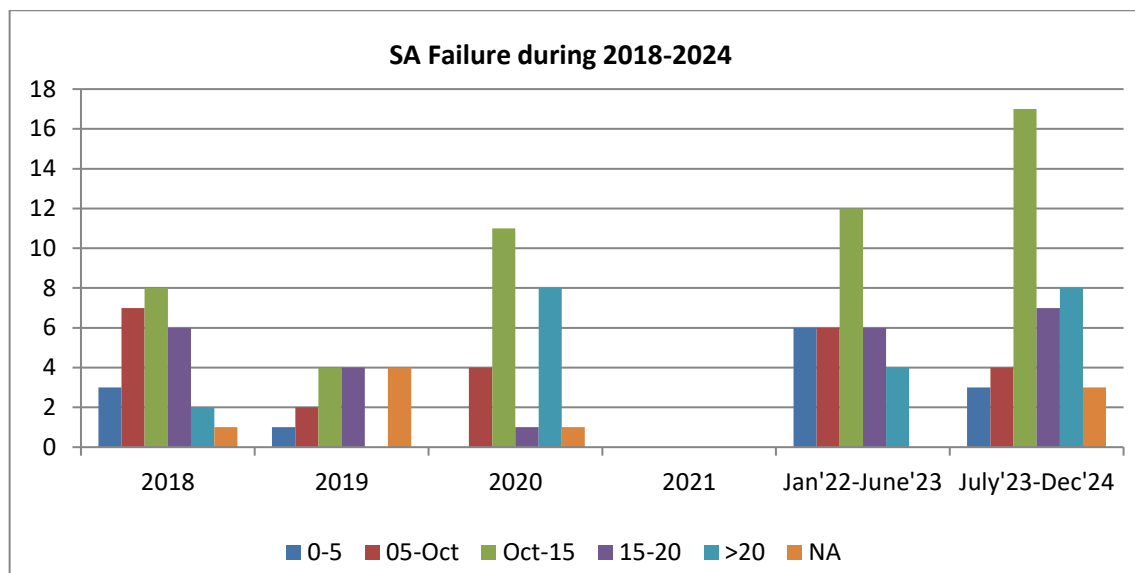
13.	MSETCL	Lamco Industries Pvt. Ltd.	198 kV, 40 kA	14.08.2014	08.07.2023
14.	MSETCL	CGL	198 kV, 40 kA	23.02.2012	28.07.2023
15.	MSETCL	LAMCO	198 kV	11.12.2018	15.08.2023
16.	MSETCL	CGL	198 kV	27.04.2002	24.02.2024
17.	MSETCL	Oblum Electricals	198 kV, 10 kA	28.03.2013	24.07.2024
18.	MSETCL	CGL	390 kV	01.01.2012	12.08.2024
19.	MSETCL	Elpro International Ltd.	245 kV	2004	20.10.2024
20.	MSETCL	CGL	198 kV	08.03.2004	31.10.2024
21.	OPTCL	Lamco Industries Pvt Ltd	72 kV, 10 KA	06.08.2021	12.08.2023
22.	OPTCL	CGL	220 kV		09.11.2023
23.	OPTCL	CGL	216 kV, 10 kA		29.12.2023
24.	RRVUNL	Elpro International Ltd.	395 kV	2012	17.11.2023
25.	RRUVNL	ELPRO	360 kV, 20 kA	2010	28.12.2024
26.	RRVPNL	OBLUM	198 kV	08.02.2011	06.08.2023
27.	RRVPNL	Oblum	220/198 kV, 10 kA	22.02.2012	19.09.2023
28.	Torrent Power Limited	CGL	400 kV	2012	18.12.2023
29.	TANTRAN SCO	CGL	230 kV/ 110 V	09.08.2024	09.08.2024
30.	TANTRAN SCO	CGL	220 kV, MCOV-168 kV	2006	24.09.2024
31.	UPPTCL	Oblum electrical industries Pvt. Ltd.	198 kV	2010	09.09.2023
32.	UPPTCL	Lamco Industries Pvt. Ltd.	198 kV, 10 A	26.06.2016	11.09.2023
33.	UPPTCL	CGL	360 kV	24.01.2012	14.09.2023
34.	UPPTCL	Oblum Electrical Industries Pvt. Ltd, Hyderabad	198 kV	2010	24.02.2024
35.	UPPTCL	Oblum	198 kV	31.03.2010	17.04.2024

36.	UPPTCL	Oblum Electrical industries Pvt.Ltd	198 kV, 10 kA	24.05.2016	17.07.2024
37.	UPPTCL	CGL	220 kV	10.06.2012	31.07.2024
38.	UPPTCL	Metover Metal Oxide	198 kV	01.01.2004	22.08.2024
39.	UPPTCL	Oblum electrical industries Pvt. Ltd Hyderabad	198 kV	29.05.2012	29.08.2024
40.	UPPTCL	OBLUM	198 kV	27.08.2006	12.09.2024
41.	UPPTCL	LAMCO	198 kV	2021	08.12.2024
42.	WBPDC	XI' AN XD Co. Ltd (China)	360 kV	21.12.2007	16.05.2024

- ii. Out of these, forty two (42) Nos. of SAs failures reported to CEA, 35 are of 220 kV class, seven (7) Nos. of SAs are of 400 kV class.
- iii. Out of total 42 failures of the Surge Arrestors occurred, 3 Nos. of Surge Arrestors failed within five years, 4 Nos. of Surge Arrestors failed in 5-10 years of period. 24 Nos. of Surge Arrestors failed during 10-20 years of their operation. 8 Nos. of Surge Arrestors failed which had operation of more than 20 years. For three equipment Utilities did not provide the commissioning date, therefore analysis could not be carried out.
- iv. The number of Surge Arrestors failures occurred between July 2023 and December 2024 from the commissioning of the equipment is as per the below graph below:



- v. Failures of SAs during 2018-2024: The number of different SA/LA failures as reported in the last 7 years to CEA has been shown in the graph below:



4.8 Failures of Wave Trap, Coupling Capacitors (CC), Disconnectors/Isolators, GIS Bay, XLPE Cable and Pass Module:

- i. As reported to CEA total 4 Nos. of Wave Trap, 3 Nos. of Coupling Capacitor, 3 Nos. of Disconnector/Isolator, 1 No. of GIS Bay, 1 No. of Cable and 1 No. of PASS Module failed between July 2023 to December 2024. Summary of failures of these equipment is as below (Table-11).

Table 11: Summary of failure of Other equipment

S.N.	Utility	Equipment	Make	Rating	Year of Commissioning	Date of Failure
1.	MPPTCL	Wave Trap	AREVA	220 kV	29.06.2016	24.07.2023
2.	MPPTCL	Wave Trap	--	4400 pf, 0.5 H, 150-500 kHz	17.05.2018	05.09.2023
3.	MPPTCL	Wave Trap	WS Bengaluru	220 kV	28.05.1996	05.10.2023
4.	UPPTCL	Wave Trap	GE T&D	220 kV	07.06.2019	06.11.2023
5.	MSETCL	CC	W S INDUSTRIES INDIA LTD (WSI)	245 kV, 6600 pF	20.10.1982	31.08.2023
6.	MSETCL	CC	NA	NA	25.12.1995	14.10.2023
7.	MSETCL	CC	Areva T&D Ltd	245 kV	31.03.2008	29.03.2024
8.	Adani Transmission Ltd	GIS Bus-2 Disconnector	New Northeast Electric India Private	252 kV	30.06.2011	03.12.2024

			Limited (NHVS)			
9.	UPPTCL	Isolator	Jiangsu Jingke Smart Electric Co Ltd	220 kV	30.10.2019	15.11.2024
10.	NPCIL	Isolator	ZAO Elegazkonversi ya (Russia)	132 kV, 1350 A	2008	03.12.2024
11.	Adani Transmissi on Ltd	Cable fault (Y Phase)	Taihan, Korea	220 kV, 800 A, 0.191 pF	14.04.2011	07.05.2024
12.	KSEB	Bay	GE T&D India	245 kV	19.05.2022	23.10.2023
13.	UPPTCL	Pass Module	Hitachi Energy (ABB)	245 kV	12.01.2021	01.10.2024

5 Observations

- i. It is observed that reported failures are primarily due to the following reasons:
 - a) Normal Ageing
 - b) Improper Erection
 - c) Failure of Insulation system for CB/CT/PT/CVT/SA.
 - d) Failure of Insulation system & Bushing for Transformers & Reactors.
 - e) Lack of prudent maintenance practices
 - f) Frequent System Faults and transient over voltages generated by the system.
- ii. In most of the failure cases of CT/PT/CVT/SA, equipment blasted or got completely damaged making it impossible to carry out any test after failure. Without tests, internal condition of the failed equipment cannot be assessed and cause of failure cannot be determined. However, in most of the cases it is assumed that degradation of insulation due to ingress of moisture and transient system voltages might be the reason of failure of these equipment.
- iii. As the utilities have been intimating failure events to CEA with extended delay times, the required site visits could not be undertaken by the Committee.
- iv. Condition Based Maintenance (CBM) Practices using modern diagnostic tools is yet to be adopted in large scale by many utilities, and in general, periodic Time Based Maintenance (TBM) is still being practiced. Adequate modern Diagnostic tools are also not available with most of the State Utilities.
- v. Sometimes due to unavailability of shut down, maintenance of equipment is deferred which affects the efficient functioning of the equipment and further deteriorate the health of equipment.

- vi. In most cases of the failures, utilities do not furnish factory test reports, pre-commissioning test reports, history of O&M & repairs, relay settings, environmental & system conditions at the time of failure etc. which makes it very difficult to analyze the cause of failure.
- vii. In case of failure of transformers and reactors, report of detailed internal inspection carried out by the Original Equipment Manufacturer (OEM) at site or at its works are not provided.

6 Recommendations

Recommended measures suggested by the Committee for the Utilities to improve the performance of the substation equipment are listed below. These have been given with the objective that the utilities take necessary action to improve performance of equipment and use modern diagnostic tools for condition assessment so as to keep substation equipment healthy for long trouble-free and reliable operation.

6.1 General Recommendations

- 1) All the utilities should furnish preliminary information of failure of substation equipment of 220 kV and above voltage class within 48 hours of the occurrence of the failure and detailed report within a Month in the prescribed format available at **Annexure-IV** and also on CEA website. The report should accompany tests carried out after failure, test reports and details of previous maintenance, pre-commissioning test reports, and photographs of the failed equipment.
- 2) The utilities should report to the Original Equipment Manufacturer (OEM) about the failure of equipment, even if the warranty has expired, which may help the manufacturers to take corrective action for improving the product design.
- 3) The practice of Condition Based Monitoring using online modern diagnostic tools should be followed instead of conventional Periodic / Time-Based Maintenance. A list of diagnostic tools is given in CEA Grid Standard regulation which can be used for one substation or a pool of substations depending upon requirement.
- 4) Regular O&M of Substation equipment shall be carried out. In this regard, Model O&M Guidelines given at **Annexure-III** should be followed by Utilities.
- 5) A centralized Asset Monitoring System shall be installed that can monitor all Medium voltage and high voltage electrical assets like GIS, AIS, Breakers, Power Cables including Transformers for condition based maintenance. All FAT, SAT and Periodic testing data for all electrical equipment shall be stored in this system for performing health assessment. The system shall have advanced health index models that utilizes analytics and threshold limits as prescribed by latest IEEE, IEC, and CIGRE standards / recommendations. This system shall also be capable of integrating online monitoring of sensors installed at electrical

assets, and inspection records/reports from the visual inspection of assets. It shall have the capabilities to monitor DGA, Partial discharge – Electrical & UHF, bushing, fan control, fiber optic monitoring and other monitoring parameters. This system shall support cloud and on-premise installation and provide access to electrical asset health dashboards at engineer's PC, Mobile, Laptops or tablets.

- 6) Condition monitoring as mentioned in Standard specifications and technical parameters for transformers and reactors (66 kV & above voltage class) CEA standard shall be adopted.
- 7) The frequency/ periodicity of measurement should be changed depending on the condition/ healthiness of the equipment in operation. The trend of test results should be monitored rather than the absolute values of test results.
- 8) Utilities should follow the best practices for maintenance of each equipment. All the equipment which have reached/ approaching end of service life need to be monitored closely and utility should plan and take action in advance for replacement of such equipment in a phased manner.
- 9) The utilities should make it a practice to carry out various tests on major electrical equipment at sites one or two months prior to expiry of warranty period of respective equipment so that any abnormality observed in test results can be discussed with OEM for taking up further necessary action within warranty period.
- 10) The utilities must be careful during installation of transformers at site and long hanging connecting leads which might touch with other parts of the transformer, should be avoided.
- 11) The utilities must be careful while storing the equipment as spare or keeping transformer uncharged in the yard for long time before putting in to service. The OEM's recommendation for storage should be followed strictly. Spare equipment should be periodically tested as per OEM's recommendation.
- 12) Utilities should take appropriate actions for repair/ replacement of concerned equipment as soon as some abnormality is observed through visual inspection or diagnostic tests.
- 13) Frequent failures of equipment of any particular make should be thoroughly investigated in consultation with OEM and necessary action including design modification, if required, should be carried out by OEM.
- 14) Most of the utilities are facing problem due to shortage of supporting staff for operation & maintenance of sub-station equipment. The manpower should be strengthened for efficient operation & maintenance.
- 15) The regular cleaning of dust deposited on the housings of major equipment and bushings of transformer in Thermal Power Plant are essential to avoid flash over

across the insulators, as such frequent flashover across the bushing / housing of equipment (due to operation in such dusty environment) may lead to failure of equipment. Wherever feasible, the porcelain housings of major equipment (CB/LA/CT/CVT) and bushings of transformer may be protected by providing Room Temperature Vulcanisation (RTV) coating. RTV coating over porcelain housing of equipment (CB/LA/CT/CVT) / bushings of transformer & reactors may also be considered by utilities for substation equipment installed in pollution prone areas.

- 16) Utilities should create and maintain complete database of equipment/transformers including previous test reports (reports of factory tests/pre-commissioning tests/tests during O&M etc.), operation & maintenance history of equipment with make, model & year of commissioning etc. for proper evaluation, interpretation of test results and for taking Run-Refurbish-Replacement decision.
- 17) However, merely maintaining the history of O&M is not sufficient. Test results are not useful if correct method of testing is not followed. All tests and maintenance should be carried out as per best practices. The method of testing as well as the conditions while conducting the tests should be consistent / identical to previous testing condition as far as possible. For example, test voltage, tap position at which test is conducted, etc., should be maintained while measuring IR or Turns Ratio, or conducting SFRA and other similar tests. Details of test kits, should be maintained so that the test results can be compared with subsequent test results. For variation in temperature, required correction factors could be incorporated. Calibration of the testing instruments should be ensured for reliability of the assessment.
- 18) Utilities should explore the possibility of installation of CCTV cameras in the substation, covering transformer area so that transformers could be monitored from the control room and any mishap with the transformer could be recorded for further analysis. It would also help to determine the point of initiation and actual cause in case of fire in transformer.
- 19) If any damaged equipment is sent to the manufacturer's works for repair, detailed investigation report including probable causes of failure should be submitted to the Standing Committee for benefit of the other utilities.

6.2 Recommendations for Transformers (ICT & GT), Reactors and Instrument Transformers (CT/PT/CVT)

- 1) Proper handling, loading, transportation, unloading, and storage at site before assembling play important role in satisfactory operation of equipment.
- 2) The erection of major equipment including transformers/reactors should always be carried out by experienced technical team under the close supervision of manufacturer.

- 3) Inordinate delay in commissioning of equipment after reaching at site should be avoided.
- 4) When there is a wide gap between the year of manufacturing and year of commissioning of the transformers/ reactors, proper care must be taken to ensure satisfactory operation of transformer/ reactor. Storage and periodic testing of transformer/ reactor should be done as per manufacturer's recommendations.
- 5) Transformer/ reactors should not be kept for more than three (3) months with dry air/inert gas (Nitrogen) filling and all throughout the period, required pressure needs to be maintained in order to avoid the exposure of active part to atmosphere. After three (3) months, transformer/ reactor should be filled with oil under vacuum and it should be provided with oil conservator including oil level indicator and breather. The oil parameters need to be monitored regularly.
- 6) As far as possible the transformer/ reactor should be transported filled with dry air. Use of nitrogen for this purpose should be avoided.
- 7) The height of the fire wall between two transformers/reactors should be at least 600 mm above the highest point of the transformer and fire wall should be rated for four-hour fire rating so that fire in one transformer/reactor does not affect adjacent transformers/ reactor.
- 8) Whenever there is movement of transformer either from manufacturing works or from one station to other, Sweep frequency response analysis (SFRA) should be carried out before movement and after shifting to new location and in case of any discrepancy, OEM may be contacted. SFRA signature would provide valuable information about deformation in winding /core during transportation.
- 9) On Load Tap Changer (OLTC) is one of the contributors to the failure of transformer. Possibility of eliminating OLTC from 400 kV & 765 kV class transformer should be considered (based on system studies) in consultation with Regional Power Committee (RPC) and Regional Load Despatch Centre (RLDC)/Grid-India and CEA. The reduction in in number of taps/steps can also be considered in case of OLTC of 220 kV and below voltage class transformers. The removal of OLTC will simplify the design and manufacturing of transformers.
- 10) Tertiary winding should be avoided, wherever feasible, as it increases the probability of failure of the transformer. Tertiary terminals of transformer prone to short circuiting by external element such as bird or animal may be suitably insulated.
- 11) Transformer should be subjected to short circuit withstand test as per CEA (Technical Standards for Construction of Electrical Plants and Electric

Lines), 2022 Regulations, to verify its capability to withstand dynamic effect of short circuit. The design review of the transformers should be carried out properly before commencement of manufacturing. Stage inspection should also be carried out to check manufacturing process as well as quality of material used in subsequent transformers.

- 12) An internal inspection of the failed transformer on-site is warranted at times to locate fault inside the transformer and to assess the extent of damage. As far as possible, internal inspection should be carried out in association with OEM / in presence of representative of OEM. All safety precautions must be observed at all times. Internal inspection must be performed by experienced staff with proper training. The internal inspection should not cause any further damage to the transformer and precaution should be taken to prevent ingress of moisture and any foreign material into the transformer and hence internal inspection should be meticulously planned.
- 13) As far as possible, LV test and SFRA should be conducted after through fault to check the integrity of the transformer.
- 14) The capacitance and tan delta measurement of transformer bushing at variable frequency and Dissolved gas analysis (DGA) of bushing oil should be carried out for health assessment of bushings as this has been proved to be very effective in assessing the condition of in-service bushings.
- 15) Residual Life Assessment (RLA) should be conducted for old and aged transformers (approaching end of service life) for proper planning to replace them in stages.
- 16) Periodic oil testing including DGA (wherever feasible) in the case of instrument transformers are recommended. Health of gaskets and bellows needs to be checked periodically for CTs. Thermo-vision scanning of CTs, CVTs and PTs should also be carried out regularly as a good maintenance practice.
- 17) While measuring tan delta of transformer bushing/CT/PT/CVT, apart from absolute value, rate of rise of tan delta should also be monitored and it should not be more than 0.1% per year. Frequency of measurement should be increased in case tan delta value is approaching 0.7%. Following tables can be referred while measuring tan δ and capacitance of CVTs:

Change in Capacitance	Monitoring Frequency
upto $\pm 2\%$	Three yearly
$\pm 2\%$ to $\pm 3\%$	Yearly
Above $\pm 6\%$	Alarming

(Source: - CBIP Manual on EHV Substation Equipment Maintenance)

- 18) The change in secondary voltage of CVTs is a very good indicator of the condition/health of CVTs. Following table may be referred to for monitoring of secondary voltage:

Drift in secondary Voltage (to be measured by 0.2 / 0.5 class multimeter)	Condition	Monitoring Frequency
Upto ± 0.5 volts	Healthy	Six monthly
± 0.5 to ± 0.8 volts	To be monitored	03 monthly
+0.8 to +1.2 volts	Close monitoring	Monthly
+1.2 to +2.0 volts	Close monitoring	15 days
above +2.0 volts	Alarming	replacement
-0.8 to -4.0 volts	Close monitoring	15 days
less than -4.0 volts	Alarming	replacement

(Source: - CBIP Manual on EHV Substation Equipment Maintenance)

- 19) Following table can be referred while measuring $\tan \delta$ of CTs:

Value of $\tan \delta$	Monitoring Frequency
Upto 0.007 (annual rise@0.001)	Yearly
0.007 to 0.011	Half Yearly
Above 0.011	Replace the CT

(Source: - CBIP Manual on EHV Substation Equipment Maintenance)

- 20) Oil level in CTs should be checked before charging. For CTs with metallic bellows, the oil should be present up to the top of the bellows for proper functioning. The oil leakage needs to be checked periodically. Bellows level should be closely watched. The level of bellows of all CTs in one bay should be same at any point of time. Different bellows level may be an indicator of oil leakage, gassing or fault. Similarly, Capacitor units & EMU of CVTs in one bay should have same oil level indication at any point of time.
- 21) Varistors protect the CVT from over voltage due to Ferro-resonance (FR) oscillations. They may fail in service due to sustained FR or if the energy to be handled exceeds designed limit. If a varistor fails, it should be replaced by the varistor of the same voltage rating.

- 22) At substations where fault level has increased beyond the design level, suitable corrective measures such as splitting of bus or employment of fault limiting devices should be adopted.

6.3 Recommendations for Surge Arrester

- 1) Measurement of the 3rd harmonic resistive component of leakage current is a very good method for assessing healthiness of SA. If 3rd harmonic component of resistive current is more than 150 μA , then Insulation Resistance (IR) value test should also be conducted and if current exceeds 350 μA , then SA should be removed from service and replaced. The measurement of leakage current before and after the monsoon should be carried out so as to ascertain the effect of moisture.
- 2) Before erection, the condition of the Arrester unit should be checked and it should be ensured that there is no damage during erection. If SA is kept on an uneven surface, it is likely to damage the pressure relief diaphragm. Any damage to this thin & sensitive material while handling & erecting will result into moisture entry into Surge Arrester, which will lead to its failure.
- 3) Thermal scanning is another simple on-line check often used on SAs to locate hot spot due to improper/defective terminations/excessive watt loss.
- 4) The specification of SA should include Dip test/ Sealing Test which can be carried out at manufacturer's works to ensure proper sealing against ingress of moisture.

6.4 Recommendations for Circuit Breaker

- 1) Dynamic Contact Resistance Measurement (DCRM) test kit is a very important tool to assess the healthiness of circuit breaker. This test may be carried out once in two years. Moreover, while formulating the specification for procurement of CB for new substation, provision for procurement of Operational Analyzer along with Dynamic Contact Resistance Measurement (DCRM) test kit should be included for one substation or a group of nearby substations depending upon the requirement.

6.5 Recommendations for Disconnectors

- 1) Disconnectors used for transferring load currents from one bus system to another should be designed and tested for bus transfer current switching duty.
- 2) Measurement of resistance of disconnector main contacts should be carried out and it should not exceed 300 micro ohms.

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Annexure-II
Detailed Information of All Failed Equipment Reported to
CEA between July 2023 and December 2024

Annexure-II: Detailed Information of Failed Equipment Reported to CEA between July 2023 and December 2024

Detailed information in respect of following failures is given in subsequent pages of this annexure:

S. N.	Failure report	Utility	Equipment	Serial No.	Date of Failure
TRANSFORMERS					
1.	Failure of 50 MVA, 220/ 132 kV Auto Transformer at 220 kV Namrup GSS	AEGCL	Auto Transformer	24242	25.05.2024
2.	Failure of 150 MVA, 400/220 kV ICT at 400 kV BBMB Panipat GSS	BBMB	ICT	140020-1	28.03.2024
3.	Failure of 105 MVA, 400/220/33 kV Auto Transformer at 400 kV CSPTCL, Khedamara, Bhilai S/s	CSPTCL	Auto Transformer	6008143	11.05.2024
4.	Failure of 100 MVA, 220/66/11 kV Power Transformer at 220 kV Pappankalan -I	DTL	Power Transformer	2004053	22.08.2024
5.	Failure of 150 MVA, 230/138/6.9 kV, 3-Phase Auto Transformer at DVC Barjora S/s	DVC	Auto Transformer	2020277	27.10.2024
6.	Failure of 150 MVA, 220/66 kV Power Transformer at 220 kV T Morbi S/s	GETCO	Transformer	PT-8011	31.07.2024
7.	Failure of 160 MVA, 220/66 kV Power Transformer at 220 kV Jambuva S/s	GETCO	Transformer	2043554	04.09.2024
8.	Failure of 315 MVA, 220/66 kV ICT at 400 kV Kabulpur S/s	IndiGrid	ICT	T09935/01	11.08.2024
9.	Failure of 66.67 MVA, 220/110/33 kV Auto Transformer at Edappon S/s	KSEB	Auto Transformer	T 8737/6	23.08.2023
10.	Failure of 160 MVA, 220/132/33 kV Auto Transformer at 220 kV Barwaha S/s	MPPTCL	Auto Transformer	5649/04	09.09.2023
11.	Failure of 50 MVA, 220/22 kV Power Transformer at 220 kV Chinchwad-1 S/s	MSETCL	Power Transformer	HT-1758/1289 6	05.07.2023

12.	Failure of 50 MVA, 220/22 kV 3-Phase Power Transformer at 220/22 kV Hinjewadi S/s	MSETCL	Power Transformer	90050B01	25.08.2023
13.	Failure of 25 MVA, 220/33 kV Power Transformer at 220 kV Bhokardan S/s	MSETCL	Power Transformer	4659/8	12.05.2024
14.	Failure of Power 50 MVA, 220/33 kV Transformer at 220 kV Vankusawade S/s	MSETCL	Power Transformer	HT1501/12 076	28.05.2024
15.	Failure of 100 MVA, 220/33 kV Power Transformer at 220 kV Bothe S/s	MSETCL	Power Transformer	610041	04.06.2024
16.	Failure of 125 MVA, 220/100 kV, ICT at 220 kV Kandalgaon S/s	MSETCL	ICT	6401334	15.07.2024
17.	Failure of 50 MVA, 220/22 kV ICT at 220 KV Bhosari-2 S/s	MSETCL	ICT	TF 3- HT- 1758/1289 6	24.07.2024
18.	Failure of 50 MVA, 220/33 kV Power Transformer at 220 kV Kurkumbh	MSETCL	Power Transformer	1666/1252 1	20.08.2024
19.	Failure of 25 MVA, 220/33 kV Power Transformer at 220 kV Purti S/s	MSETCL	Power Transformer	HT/1289/1 1442	28.08.2024
20.	Failure of 100 MVA, 220/132 kV ICT at 220 kV Alephata S/s	MSETCL	ICT	HT- 1456/1193 7	23.09.2024
21.	Failure Report of 150 MVA, 220 kV ICT at Chinchwad-1 Substation of MSETCL	MSETCL	ICT	T 8519/2	11.11.2024
22.	Failure report of 500 MVA, 400/220 kV, ICT at Muzaffarnagar S/s	POWERGRID	Power Transformer	140140-1	23.08.2023
23.	Failure report of 397 MVA 400 kV, Converter Transformer at HVDC Kaniha S/s	POWERGRID	Converter Transformer	N 408577	29.10.2023
24.	Failure report of 500 MVA, 400/220 kV ICT at Maharanibagh S/s	POWERGRID	Power Transformer	BH- T09753/02	30.10.2023
25.	Failure report of 315 MVA, 400/220 kV ICT-1 at Kaithal S/s	POWERGRID	ICT	T09202/2	11.05.2024
26.	Failure report of 315 MVA, 400/220 kV, ICT-2 at Munirabad S/s	POWERGRID	ICT	6006349	07.06.2024

27.	Failure report of 315 MVA, 400/220 kV, ICT-1 at Kala S/s	POWERGRID	ICT	90122A02	21.07.2024
28.	Failure report of 160 MVA, 220/132 kV ICT-2 at Birpara S/s	POWERGRID	ICT	2032713	30.07.2024
29.	Failure report of 160 MVA, 220/132 kV Auto Transformer at Bhiwadi GSS	RRVNL	AUTO Transformer	2034845	24.7.2023
30.	Failure Report of 50 MVA, 230/33 kV Power Transformer at Veeranam S/s	TANTRANSCO	Power Transformer	400022/4/143P	05.10.2023
31.	Failure report of 50 MVA, 230/33 kV Power Transformer at Udayathur S/s	TANTRANSCO	Power Transformer	B.29922	04.11.2023
32.	Failure report of 315 MVA, 400/ 230 kV ICT at Alamathy Substation of TANTRANSCO	TANTRANSCO	ICT	6006118	25.05.2024
33.	Failure report of 160 MVA, 3 Phase Auto-transformer at Faridpur Substation of UPPTCL	UPPTCL	Power Transformer	PT-7290	10.08.2023
34.	Failure report of 500 MVA, 400/220/33 kV, ICT at Rasara S/s	UPPTCL	Power Transformer	6007901	26.10.2023
35.	Failure of 240 MVA, 400/220/33 kV ICT at 400 kV Gorakhpur S/s	UPPTCL	Power Transformer	71128-1	11.11.2023
36.	Failure of 100 MVA, 220/132 kV Auto Transformer at 220 kV Bhartna S/s	UPPTCL	Auto Transformer	23387	18.09.2024
Reactors					
37.	Failure of 125 MVar, 400 kV Bus Reactor at Kadarapur S/s	INDIGRID	Reactor	T-7120/3, B-31163	03.08.2024
38.	Failure of 50 MVar, 400/220 kV Bus Reactor at Balipara S/s	POWERGRID	Reactor	6005276	14.08.2023
39.	Failure of 80 MVar, 765/400 KV Line Reactor at Srikakulam S/s	POWERGRID	Reactor	15026/08	12.05.2024
40.	Failure of 50 MVar, 400 kV Bus Reactor at GSS Ramgarh Jaisalmer	RVPNL	Reactor	6007650	09.05.2024
Current Transformers					

41.	Failure report of 420 kV CT at HVDC Mundra Substation	Adani Transmission	CT	4CT113	06.08.2023
42.	Failure report of 220 kV CT at Tallapally Substation	APTRANS CO	CT	37994026426	31.07.2024
43.	Failure report of 220 kV CT at Gadag S/s	KPTCL	CT	ID 220020	10.06.2024
44.	Failure report of 220 kV CT at Chhegaon S/s	MPPTCL	CT	2014/53310	15.07.2023
45.	Failure report of 220 kV CT at Shivpur S/s	MPPTCL	CT	OC5395/1/35/14	19.07.2023
46.	Failure report of 400 kV CT at Chandrapur S/s	MSETCL	CT	6160911	29.09.2023
47.	Failure report of 220 kV CT at Koradi -II S/s	MSETCL	CT	2454864	30.09.2024
48.	Failure Report of 220 kV CT at Airoli Knowledge Park S/s	MSETCL	CT	42090600798	03.11.2024
49.	Failure report of 220 kV CT at Apta S/s	MSETCL	CT	OC-2064/2/204/01	25.11.2024
50.	Failure Report of 400 kV CT at Chakan S/s	MSETCL	CT	200808125	23.12.2024
51.	Failure report of 220 kV B-phase CT of Pedhambe S/s	MSPGCL	CT	0-42/I/8/3	23.08.2023
52.	Failure report of 220 kV Y-phase CT of Pedhambe S/s	MSPGCL	CT	IB 069651	12.11.2023
53.	Failure report of 220 kV CT Katapali S/s	OPTCL	CT	37994010128/2016	27.12.2023
54.	Failure Report of 220 kV CT at SEZ-I, Jaipur S/s	RRVNL	CT	05120/1/34/13	20.10.2023
55.	Failure Report of 220 kV CT at Khushkhera S/s	RRVNL	CT	665	21.09.2023
56.	Failure report of 220 kV CT at Ganganagar S/s	RRVNL	CT	2009/629	22.09.2023
57.	Failure Report of 230 kV CT at Veeranam, S/s	TANTRAN SCO	CT	2105314	26.08.2023
58.	Failure report of 220 kV CT at Tenughat Thermal Power Station	TVNL	CT	20030154/2003	21.12.2024

59.	Failure report of 220 kV CT at Boner S/s	UPPTCL	CT	1408	14.07.2023
60.	Failure report of 220 kV CT at C.B. Ganj Substation of UPPTCL	UPPTCL	CT	2014/1588	12.08.2023
61.	Failure report of 220 kV CT at Hafizpur S/s	UPPTCL	CT	KN 744	11.09.2023
62.	Failure report of 220 kV CT at Muradnagar S/s	UPPTCL	CT	KN531	30.10.2023
63.	Failure report of 220 kV CT at Ghazipur S/s	UPPTCL	CT	KN 749	27.12.2023
64.	Failure report of 220 kV CT at Fatehpur S/s	UPPTCL	CT	2014/1619	11.04.2024
65.	Failure report of 220 kV CT at Greater Noida S/s	UPPTCL	CT	2239732	11.04.2024
66.	Failure report of 400 kV CT at Sarh, Kanpur S/s	UPPTCL	CT	KN-849	21.04.2024
67.	Failure report of 220 kV CT at Jolly Road-Muzaffarnagar S/s	UPPTCL	CT	2009/3087	07.05.2024
68.	Failure report of 220 kV CT at Jolly Road-Muzaffarnagar S/s	UPPTCL	CT	240048017	10.5.2024
69.	Failure report of 220 kV CT at Greater Noida S/s	UPPTCL	CT	2239723	11.04.2024
70.	Failure report of 220 kV CT at Atrauli S/s	UPPTCL	CT	2004/784	19.05.2024
71.	Failure report of 220 kV CT at Sikandrarao S/s	UPPTCL	CT	BN-433	20.05.2024
72.	Failure report of 220 kV CT at Jahangirabad S/s	UPPTCL	CT	2007/2025	20.05.2024
73.	Failure report of 220 kV CT at Sahibabad S/s	UPPTCL	CT	2014/1632	22.05.2024
74.	Failure report of 220 kV CT at Rampur S/s	UPPTCL	CT	2012/1199	22.05.2024
75.	Failure report of 400 kV CT at Bansi Siddharth Nagar S/s	UPPTCL	CT	MN-737	19.05.2024
76.	Failure report of 400 kV CT at Basti S/s	UPPTCL	CT	2008/879	29.05.2024.
77.	Failure report of 220 kV CT at Sarh, Kanpur S/s	UPPTCL	CT	KN-850	29.05.2024
78.	Failure report of 220 kV CT at Bhelupur S/s	UPPTCL	CT	KN/186	30.05.2024
79.	Failure report of 220 kV CT at Pahadi, Chitrakoot S/s	UPPTCL	CT	2017/ESM/587	31.05.2024
80.	Failure report of 400 kV CT at Kasara, Mau S/s	UPPTCL	CT	6156404	07.07.2024
81.	Failure report of 220 kV CT at Bhadaura S/s	UPPTCL	CT	KN860	05.09.2024

82.	Failure report of 220 kV CT at Muradnagar S/s	UPPTCL	CT	BN-624	06.10.2024
Potential Transformers/Capacitive Voltage Transformer					
83.	Failure report of 220 kV PT at Ratlam S/s	MPPTCL	PT	37	01.10.2023
84.	Failure report of 220 kV PT at Niwaliphata S/s	MSETCL	PT	2243620	08.07.2023
85.	Failure report of 220 kV PT at Dhamangaon S/s	MSETCL	PT	13053	29.09.2023
86.	Failure report of 220 kV PT at Kharepatan S/s	MSETCL	PT	552974	08.10.2023
87.	Failure report of 220 kV PT at Chinchwad1 S/s	MSETCL	PT	15061	07.01.2024
88.	Failure report of 220 kV PT at Kharghar S/s	MSETCL	PT	24405	04.02.2024
89.	Failure Report of 220 kV PT at Panvel S/s	MSETCL	PT	OP 12648/1/14 /23	28.08.2024
90.	Failure report of 220 kV PT at Mahape S/s	MSETCL	PT	10007	22.11.2024
91.	Failure report of 400 kV CVT at Chamera Power Station-I	NHPC	CVT	90278402	04.08.2023
92.	Failure report of 400 kV CVT at STPS, Suratgarh	STPS, RVPNL	CVT	6192045	28.03.2024
93.	Failure Report of 230 kV PT at Meelavittan S/s	TANTRA NSCO	PT	Y- 2234377	22.11.2023
94.	Failure report of 220 kV CVT at Badaun S/s	UPPTCL	CVT	24420122	01.08.2023
95.	Failure report of 220 kV CVT at Sahajahanpur S/s	UPPTCL	CVT	NA	18.09.2023
96.	Failure report of 400 kV CVT at Fatehabad, Agra S/s	UPPTCL	PT	6193169	11.10.2023
97.	Failure report of 220 kV CVT at Manth, Mathura Substation of UPPTCL	UPPTCL	CVT	2218306	10.12.2024
Circuit Breakers					
98.	Failure report of 245 kV CB at Kopili Power Station	NEEPCO	CB	Y-phase, 57749C	14.12.2023
99.	Failure report of 220 kV CB at Dhauliganga Power Station	NHPC	CB		16.09.2023
100.	Failure report of 400 kV CB of Suratgarh S/s	RRVUNL	CB	13413 C	31.10.2023

101.	Failure Report of 220 kV CB at Beawar S/s	RRVPNL	CB	IB/105364/1	30.09.2023
102.	Failure Report of 220 kV CB at Sanganer S/s	RRVPNL	CB	NJ96012DD003	16.10.2023
103.	Failure report of 400 kV CB at Bhensara S/s	RRVPNL	CB	19264 & 19473	15.11.2023
104.	Failure report of 220 kV CB at Gorakhpur S/s	UPPTCL	CB	IB 111145	11.01.2024
105.	Failure report of 400 kV CB at Gorakhpur S/s	UPPTCL	CB	45000006	19.08.2024
106.	Failure report of 220 kV CB at Jolly Road-Muzaffarnagar S/s	UPPTCL	CB	2010/02/7171	21.08.2024
107.	Failure report of 400 kV CB at Unnao S/s	UPPTCL	CB	6724 C	23.09.2024
Surge Arresters/Lightning Arresters					
108.	Failure report of 220 kV LA at Sangrur S/s	BBMB	SA	51888	20.08.2023
109.	Failure report of 220 kV LA at Jamalpur S/s	BBMB	SA	51886	21.08.2023
110.	Failure report of 220 kV LA at Jalandhar Substation S/s	BBMB	SA	51986	29.10.2023
111.	Failure report of 220 kV SA at Mehrauli S/s	DTL	SA	12.89.127	31.01.2024
112.	Failure report of 220 kV SA at Okhla S/s	DTL	SA	9268	01.10.2024
113.	Failure report of 198 kV LA at Parulia S/s	DVC	LA	59 (R Phase)	09.07.2024
114.	Failure report of 198 kV LA at Barjora S/s	DVC	LA	34069	13.07.2024
115.	Failure report of 400 kV LA at Astha S/s	MPPTCL	LA	4	21.07.2023
116.	Failure report of 220 kV LA at Pithampur S/s	MPPTCL	LA	737A	28.07.2023
117.	Failure report of 220 kV LA at Indore South S/s	MPPTCL	LA	5	05.09.2023
118.	Failure report of 400 kV LA at Indore South S/s	MPPTCL	LA	26	23.09.2023
119.	Failure report of 400 kV LA at Bhopal S/s	MPPTCL	LA	89/6/114	25.09.2023
120.	Failure report of 220 kV LA at Badnera S/s	MSETCL	SA	681C	08.07.2023
121.	Failure report of 220 kV LA at Flagship S/s	MSETCL	SA	78650	28.07.2023

122.	Failure report of 220 kV SA at Satara MIDC S/s	MSETCL	SA	242A/B,243 C	15.08.2023
123.	Failure report of 220 kV LA at Kathapur S/s	MSETCL	LA	12568	24.02.2024
124.	Failure report of 220 kV LA at Bhosari-2 S/s	MSETCL	LA	Rph-1570 ; Yph-1573 ; Bph-1597	24.07.2024
125.	Failure report of 400 kV LA at Dhule S/s	MSETCL	LA	109430	12.08.2024
126.	Failure Report of 220 kV LA at Warora S/s	MSETCL	LA	2034824	20.10.2024
127.	Failure Report of 220 kV LA at Taloja S/s	MSETCL	LA	15504	31.10.2024
128.	Failure Report of 220 kV SA at Deogarh S/s	OPTCL	SA	192 A/B/C	12.08.2023
129.	Failure report of 220/132/33 kV LA at Therubali S/s	OPTCL	LA	9609038	09.11.2023
130.	Failure report of 220 kV SA at Budhipadar S/s	OPTCL	SA	9609040	29.12.2023
131.	Failure report of 400 kV SA at CTPP, Chhabra S/s	RRVUNL	SA	56807	17.11.2023
132.	Failure report of 400 kV LA at CTPP Chhabra Switchyard Phase – I	RRUVNL	LA	54 TOP, 54 MIDDLE-1, 54 MIDDLE-2, 54 BOT	28.12.2024
133.	Failure report of 220 kV SA at Alwar S/s	RRVPNL	SA	35	06.08.2023
134.	Failure Report of 220 kV SA at Kishangarh S/s	RRVPNL	SA	17	19.09.2023
135.	Failure report of 400 kV SA at PGCIL Navsari S/s	Torrent Power Limited	SA	134249	18.12.2023
136.	Failure report of 220 kV SA at Alamathy S/s	TANTRAN SCO	SA	24622	09.08.2024
137.	Failure report of 220 kV SA at Alamathy S/s	TANTRAN SCO	SA	27210	24.09.2024
138.	Failure report of 220 kV SA at Hafizpur	UPPTCL	SA	94	09.09.2023
139.	Failure report of 220 kV LA at Bahraich S/s	UPPTCL	SA	113A, B, C	11.09.2023
140.	Failure report of 360 kV R-Phase LA at Unnao S/s	UPPTCL	LA	S-2011-0578	14.09.2023

141.	Failure report of 400 kV LA at Azamgarh S/s	UPPTCL	LA	81	24.02.2024
142.	Failure report of 220 kV LA at Phulpur Prayagraj S/s	UPPTCL	LA		17.04.2024
143.	Failure report of 220 kV LA at Bhelupur S/s	UPPTCL	LA	76	17.07.2024
144.	Failure report of 220 kV SA at Sec-62	UPPTCL	SA		31.07.2024
145.	Failure report of 220 kV LA at Mainpuri S/s	UPPTCL	LA		22.08.2024
146.	Failure report of 220 kV LA at Gajokhar, Varanasi S/s	UPPTCL	LA	3896 C	29.08.2024
147.	Failure report of 220 kV SA at Atrauli S/s	UPPTCL	SA		12.09.2024
148.	Failure report of 400 kV LA at Bithoor S/s	UPPTCL	LA	017C	08.12.2024
149.	Failure report of LA at Sagardighi Thermal Power Project	WBPDC	LA	3886	16.05.2024
Wave Trap					
150.	Failure report of 220 kV Wave Trap at Bina S/s	MPPTCL	Wave Trap	111C2028	24.07.2023
151.	Failure report of 220 kV Wave Trap at Indore South S/s	MPPTCL	Wave Trap	-	05.09.2023
152.	Failure report of 220 kV Wave Trap at Bina S/s	MPPTCL	Wave Trap	L5838	05.10.2023
153.	Failure report of 220 kV Wave Trap at Bareilly S/s	UPPTCL	Wave Trap	379930093 06	06.11.2023
Coupling Capacitors					
154.	Failure report of 220 kV Coupling Capacitor at Pusad S/s	MSETCL	CC	97040305	31.08.2023
155.	Failure report of 220 kV Coupling Capacitor at Jindal S/s	MSETCL	CC	NA	14.10.2023
156.	Failure report of 220 kV Coupling Capacitor at Karad S/s	MSETCL	CC		29.03.2024
Disconnectors/ Isolator					
157.	Failure report of 220 kV GIS Bus-2 Disconnector of 220 kV at Saki EHV S/s	Adani Electricity Mumbai Ltd -	GIS Bus-2 Disconnector	NA	03.12.2024

		Transmiss ion			
158.	Failure report of 220 kV Isolator at Pratap Vihar S/s	UPPTCL	Isolator	H217001F1	15.11.2024
159.	Failure report of 220 kV Isolator at Kudankulam Nuclear Power Project	NPCIL	Isolator	NA	03.12.2024
XLPE Cable/GIS Bay/Pass Module					
160.	Failure report of 220 kV Cable at Aarey EHV S/s	Adani Transmiss ion Ltd	XLPE Cable	NA	07.05.2024
161.	Failure report of 220 kV GIS bay at Ettumanoor S/s	KSEB	GIS Bay	B105-CB6/ 016 /GD174- 013	23.10.2023
162.	Failure report of 245 kV Pass Module at Nirpura S/s	UPPTCL	Pass Module	245D079	01.10.2024

1. Failure report of 220 kV Auto Transformer at 220 kV Namrup GSS, AEGCL

i.	Name of Substations	:	220 kV Namrup GSS
ii.	Utility	:	AEGCL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Auto Transformer
iv.	Rating (MVA/ MVAR, Voltage ratio, 1-phase/3-phase)	:	50 MVA, 220/132 kV, 3-Phase.
v.	Make (Original equipment manufacturer)	:	CGL
vi.	Serial No.	:	24242
vii.	Date and time of occurrence of fault	:	25-05-2024 at 20:12 Hrs,
viii.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
ix.	Year of Manufacturing	:	1980
x.	Date of Commissioning	:	04-04-2012
xi.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	No test was conducted. Deformation in shape of the switch housing was observed along with damage on its surroundings fibre insulation. Considering the damage the switch has incurred, repairing and restoration of the switch is not feasible at site.
xii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ materials etc.)	:	Tap changer diverter switch of Y-Phase got completely detached from the OLTC chamber and fell on the ground causing heavy oil drainage and deformation in shape of the switch housing along with damage of its surrounding fibre insulation.
xiii.	Probable cause of failure	:	Ageing
xiv.	IF OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	No
xv.	Present condition of equipment (Whether repairable or beyond repair)	:	- AEGCL has already replaced the 220/132 kV, 50 MVA Transformer (Make -CGL, SI No.: 24242, YOM: 1980) which was tripped on 25-05-2024 at 20:12 hrs. - The new Transformer i.e 220/132kV, 100 MVA transformer (make- CGL, SI No.: T10765/2) have successfully commissioned on 17-02-2025 at 15:55 hrs. The transformer

			was shifted from 220 kV Salakati GSS, AEGCL.
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Tan-Delta value of all windings and IR values were not found within permissible limit.
xvii.	Details of any previous failure on the same unit	:	No
xviii.	Is tertiary winding provided (Yes/No)	:	Yes
xix.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xx.	Whether tertiary terminals are bare/insulated	:	Insulated
xxi.	Whether relay time is synchronized with UTC	:	Yes
xxii.	Bushing details (OIP/RIP/RIS, Porcelain/Polymer housing)	:	Porcelain
xxiii.	On Load Tap Changer or Off Circuit Tap Changer	:	OLTC
xxiv.	Tap positing of OLTC at the time of failure	:	15
xxv.	Past record of Operation of OLTC	:	Nil
xxvi.	Tap Range	:	1 to 17
xxvii.	Details of Protection provided for ICT/GT/Reactor	:	Differential, REF, Buchhloz, PRV, Over Current/Earth Fault
xxviii.	Details of Protection operated	:	Differential and REF Protection
xxix.	Whether equipment is properly earthed	:	Yes
xxx.	Earth Resistance of Substation and date of its measurement	:	0.678 ohms
xxxi.	Surge Arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	Yes
xxxii.	Type of Fire protection provided (Emulsifier system/N ₂ Injection based fire protection system/foam based protection etc.)	:	Foam Based Protection

xxxiii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Clear Sky
xxxiv.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/oil filled	:	N/A
xxxv.	Number of through faults the equipment was subjected to before failure	:	NIL

2. Failure report of 150 MVA, 400 kV ICT at Panipat S/s of BBMB

i.	Name of Substation	:	400 kV GSS BBMB PANIPAT
ii.	Utility	:	BBMB
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	150 MVA, 400/220 kV Single Phase Transformer T-2 of 450 MVA ICT BANK-1
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/3-phase)	:	150 MVA ,400/220 kV Single Phase Auto Transformer
v.	Make (Original equipment manufacturer)	:	TELK
vi.	Serial No.	:	140020-1
vii.	Date and time of occurrence of fault	:	28-03-2024 at 05:24 Hrs.
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During normal operation/working
ix.	Year of Manufacturing	:	1977
x.	Date of Commissioning	:	19.09.1979
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	At 05:22 Hrs. dated 28.03.2024, 400/220 kV 450 MVA ICT Bank-I tripped with very loud sound. The 400 kV Breaker X-5, X-6 and 220 kV Breaker A-9 of ICT-I were found tripped due to operation of differential protection & different relays of ICT-I installed on 400 kV Panel. On inspection of Yard, it was found that 150 MVA T/F T-2 (Yellow Phase) unit of ICT Bank-I (T/F, T-1, and T-2 & T-3) was under fire. The fire was so huge that it could only be extinguished by calling fire brigade vehicles from IOCL Panipat, Panipat Thermal Power Station, NFL, & Amp; Cityfire service Panipat. Immediate actions were also taken by the O&M/Protection staff of BBMB to control / extinguish the fire. Due to heavy flames and wind pressure which was towards unit T-I (Red Phase), this unit T-I also caught fire and as a result, its HV Bushing, LV Bushing, 2 Nos. Tertiary Bushing and Neutral Bushing with Neutral CT and Tertiary Bus, Upper gantry with Disc Insulators and conductor were damaged completely. Due to severe heat the gaskets also got damaged. Also, the control cables entering the cabinets of unit 2, unit 1 and unit 3 were also burnt. The inner side photographs of the transformer T-2 taken after opening of inspection window shows

			complete burning of transformer winding of T/F T-2. Hence this T/F T-2 got completely burnt/damaged and is found to be non-repairable /re-usable. The healthiness of the T/F windings of the partially damaged unit T-1 was checked after cooling down of T/F T-2 and found in order. Hence decision was taken to revive the ICT bank-1 by repairing 150 MVA T/F T-1 and the revival work is under progress and is likely to be completed by 27.04.2024. In place of damaged T/F T-2, spare unit T/F T-7 will be used as yellow phase after isolating damaged T/F T-2.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	Nil, because burnt transformer was not fit for testing as it was found completely burnt.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/material etc.)	:	Heavy fire, damage to all components of transformer and also damaged to HV, LV, Tertiary and neutral bushing of nearby 150 MVA, 400/220 kV transformer.
xiv.	Probable cause of failure	:	Tertiary winding failure/Ageing
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached	:	No
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Transformer caught fire at the time of tripping and damaged/brunt completely and is not repairable/reusable.
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Last maintenance carried out on 27-03-2023 and found nothing abnormal.
xviii.	Details of any previous failure on the same unit	:	Nil
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No

xxi.	Whether tertiary terminals are bare/insulated	:	Insulated
xxii.	Details of protection for Tertiary	:	Neutral Displacement Relay
xxiii.	Whether relay time is synchronized with UTC	:	NDR is electro mechanical however differential relay is time synchronized.
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/polymer housing)	:	OIP, Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	OLTC
xxvi.	Tap position of OLTC at the time of failure	:	11
xxvii.	Past record of Operation of OLTC	:	3/10/2020
xxviii.	Tap Range	:	1-17
xxix.	Details of Protection provided for ICT / GT / Reactor	:	Differential, LBB, B/U, REF, NDR, Buchholz, PRD, OTI, WTI and other auxiliary relays.
xxx.	Details of Protection operated	:	400 kV side:- Differential trip 7UT85 GENERAL TRIP Differential A Differential B Differential C Buchholz trip WTI OTI AUX RELAY TYPE VAA 30B Phase Buchholz trip 30B Winding temp trip 30BB NIFPES 30EE WTI FOR DR 220 kV side:- 86D Master & 86E INTER TRIP MICOM P141(B/U O/C+E/F) OC-B OC-H/S LBB 7VK6 3 PHASE EXT INITIATION MASTER TRIP RELAY VAJ 86A 86B 86C
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.2 ohms, 24/04/2024

xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	Yes Yes Found non-readable due to burnt
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	630 and 1050 kVp
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	1175 and 1425 kVp
xxxvi.	Type of Fire protection provided (Emulsifier system/N2Injectionbasedfire protection system/ foam based protection etc.)	:	N2 Injection based fire protection System
xxxvii.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Clear Sky
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/oil filled	:	NA
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit with stand Capability was verified on the basis of calculation?	:	Yes
xl.	Number of through faults the equipment was subjected to before failure	:	400 Nos.

3. Failure report of 105 MVA, 400/220/33 kV Auto Transformer at 400 kV Khedamara, S/s of CSPTCL

i.	Name of substation	:	400 kV S/s CSPTCL, Khedamara, Bhilai
ii.	Utility	:	CSPTCL
iii.	Faulty Equipment (ICT/ Auto Transformer/ GT/ Reactor)	:	Auto Transformer
iv.	Rating (MVA/ MVAR, Voltage ratio, 1-phase / 3-phase)	:	105 MVA, 400/220/33 kV ,1-phase
v.	Make (Original equipment manufacturer)	:	BHEL
vi.	Serial No.	:	6008143
vii.	Date & time of occurrence/discovery of fault	:	11.05.2024 at 12 :36:52:218 Hrs.
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	2022-2023
x.	Date of Commissioning	:	11.05.2024
xi.	Sequence of events/ Description of fault (SOE with time stamp, protection operated during fault)	:	The Transformer got tripped on following indications: 1. Main 1 Differential Protection Operated 2. Main 2 Differential Protection Operated 3. REF Protection Operated 4. Main Buchholz B phase 5. PRV trip B phase 6. OTI trip B phase 7. WTI trip B phase
xii.	Details of test done after failure (What test were conducted after discovery of failure. If no tests were conducted, reason for the same may be stated)	:	No
xiii.	Observation (Visual observation e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ material etc.)	:	400 kV Bushing of Unit-I got busted and fire incidence took place along with spilling out of oil from the turret which led to the spreading of fire to other side of transformer and soon it damaged few other components of Transformer. Following were observed during internal inspection: 1. 400 KV bushing (S.N.1837018) of Unit-1 was completely damaged 2. 220 KV bushing (S.N.2234024) and 33 KV bushings (3.1 & 3.2) (S.N.2220813 & S.N. 2220812 respectively) were damaged and displaced. 3. /Stiffeners of the main tank found cracked at many locations and the joint of main tank with 400 kV side turret bottom found cracked.

			4. OLTC system components (Chamber, diaphragm, OSR Relay) were damaged. 5. Various body protection devices (PRV, WTI, OTI probes, RTD, OSR, and cables) were damaged. 6. Cables of the Main Marshalling box and OLTC Drive Mechanism Box were damaged by fire. 7. Drive mechanism box was fire-damaged. 8. Oil drained from bell cover joints. 9. Pipe lines of the High Velocity Water Spray System (Emulsifier system) were damaged by porcelain debris from the bushing burst. 10. Pipe lines of the NIFPS system were damaged during the fire incident. 11. Internal inspection of Unit-1 (Sr. No. 6008143) showed heavy pitting and flashover marks on the HV bushing's stress shield, metallic pipe structure, and wood structure supporting the HV lead. This indicated a breakdown of insulation, causing a phase-to-ground fault. 12. Photographs of HV lead and assembly during pre-erection showed a metallic pipe structure in Unit-1 but not in Units-2 and -3. Additional haft paper and insulation sheets were observed on Unit-1's HV lead. 13. HV lead was disconnected from the copper bar inside the bushing without burnt marks on copper strands. 14. Heavy burnt mark & damage observed on HV lead takeoff point from winding.
xiv.	Probable cause of failure	:	Flashover between HV line lead and its metallic pipe transport support leading to bursting of 400 kV bushing <u>ROOT CAUSE ANALYSIS OF FAILURE</u> Post failure inspection of transformer carried out at site and at BHEL Bhopal works. It was found that active part of the transformer is intact. No deformation / damage observed in core and windings of the transformer. Tapping lead connection also found in order. Various low voltage tests carried out at BHEL works were found satisfactorily. Transformer has failed on occurrence of phase to ground fault which took place due to

			flashover between HV line lead and its metallic pipe transport support. Due to arcing in oil, pressure buildup inside the transformer and causing welding cracks of tank and damage of HV line lead. Generally metallic support structure is used to secure HV lead during transportation which was supposed to be removed during erection. However, this support was remained unnoticed & left inadvertently after erection of bushing.
xv.	Present condition of equipment (Whether repairable or beyond repair)	:	Due to extensive damage, CSPTCL recommended not repairing the unit on-site. CSPTCL requested BHEL to arrange for the faulty unit transfer back to their works and provide a replacement within four months. Accordingly, the Transformer was sent to Factory.
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes attach the test reports c) What steps were taken to address the abnormality?	: : :	Not applicable as new equipment
xvii.	Details of any previous failure on the same unit	:	Not applicable
xviii.	Is tertiary winding provided (Yes/ No)	:	Yes
xix.	Tertiary loaded (Yes/ No) if yes, specify load on tertiary	:	Yes
xx.	Whether tertiary terminals are bare / insulated	:	Bare
xxi.	Details of protection for tertiary	:	NDR
xxii.	Whether relay time is synchronized with UTC	:	Yes
xxiii.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing):-	:	OIP
xxiv.	On load tap changer or off circuit Tap changer	:	On load tap changer
xxv.	Tap position of OLTC at the time of failure	:	Tap 13
xxvi.	Past record of Operation of OLTC	:	NA - New equipment
xxvii.	Tap Range	:	Tap 1 to Tap 17

xxviii.	Details of Protection provided for ICT/ GT/ Reactor	:	Body Protection, Differential bus bar, NDR, REF
xxix.	Details of protection operated	:	Differential, REF, Buchholz, PRV, OTI, WTI
xxx.	Whether equipment is properly earthed	:	Yes
xxxi.	Earth Resistance of Substation and date of its measurement	:	0.21 ohm dated 02.05.2024
xxxii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	a) Yes b) Yes c) No
xxxiii.	Lighting Impulse and Switching Impulse Withstand Voltage of the bushing of all voltage level	:	HV-SIL: 1050 kVp BIL: 1425 kVp IV- BIL: 1050 kVp LV-BIL: 250 kVp
xxxiv.	Lighting Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	HV-LI: 1300 kVp SI: 1050 kVp IV- LI: 950 kVp LV-LI: 250 kVp
xxxv.	Type of Fire protection provided (Emulsifier system/ N2 injection based fire protection system/ foam based protection etc.)-	:	Emulsifier System NIFPS
xxxvi.	Weather condition at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Clear sky
xxxvii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled /Nitrogen filled / oil filled	:	a) 07.01.2023 to 11.05.2024 b) Uncharged c) Nitrogen filled
xxxviii.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Yes
xxxix.	Number of through faults the equipment was subjected to before failure	:	Not Applicable

4. Failure report of 100 MVA Power Transformer at Pappankalan-I of DTL

i.	Name of substation	:	220 kV S/s Pappankalan-I
ii.	Utility/owner of substation	:	Delhi Transco Limited.
iii.	Faulty Equipment (ICT, Auto-transformer/GT/ Reactor etc.	:	100 MVA Power Transformer; Three winding with unloaded and Earthed Tertiary winding.
iv.	Rating	:	100 MVA 220/66/11 kV; Connected at 66 kV (LV side)
v.	Make	:	M/s BHEL
vi.	Serial No-	:	2004053
vii.	Date and time of occurrence of fault	:	22.08.2024 at 01:13 hrs.
viii.	Fault discovered during (Operation or Periodic testing/ maintenance)	:	After Post tripping testing and Internal inspection.
ix.	Year of Manufacturing	:	1988
x.	Year of Commissioning	:	Originally commissioned at 220 kV Najafgarh in the year 1993, Shifted to 220 kV PPK-I and commissioned on date-04.11.2020
xi.	Sequence of Events leading to failure/ Description of fault	:	On date 22.08.2024 at 01:13 Hrs. the 220 kV/66 kV; 100 MVA Pr Tr No 1, BHEL make Tripped on following relay indications: a) Differential trip Group A Y&B Phase b) Differential trip Group B Y&B Phase c) Differential trip A, B, C of both side of differential relay d) Master Trip 86 e) 66 kV Incomer Tripped on Inter Tripping.
xii.	Tests conducted on failed transformer after fault along with test reports.	:	a) Dissolved gas analysis on main Tank Bottom Oil sample (22.08.2024) b) Capacitance and Tan delta (24.08.2024) c) Frequency Response analysis (SFRA), 24.08.2024) d) Magnetic balance & Magnetizing current (22.08.2024) and post inspection (04.10.2024) e) DC Winding resistance (22.08.2024) f) Insulation resistance (22.08.2024) g) IR test of CFT (22.08.2024).
xiii.	Visual observations during site visit [e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.]	:	During visual inspection, no such deformities were noticed. No Fire, No Oil Leakage. All HV and LV side Bay Equipment's found Intact. No Physical deformation in Transformer Tank / accessories.
xiv.	Probable cause of failure	:	Transformer Internal Fault

xv.	If OEM representative had inspected the equipment or visited the site after failure, their remark, MOM to be attached.	:	No.
xvi.	Details of previous maintenance activity carried out on equipment.	:	The transformer has been subjected routine testing and maintenance as per the approved PMS of the company.
xvii.	Present condition of equipment (whether repairable or beyond repair)	:	After carrying out the internal inspection of the transformer on 26.09.2024, the report/ status has been sent to internal OS dept of DTL for further issuance of the tripping/ failure report of the same.
xviii.	Details of any previous failure on same unit	:	09.04.2024 to 27.04.2024: The rise in H ₂ , C ₂ H ₂ , C ₂ H ₄ , C ₂ H ₆ , CH ₄ gases was observed during the routine DGA test on 09.04.2024. The internal inspection was carried out on 18.04.2024. During the internal inspection, the R-phase OLTC leads coming out from the main winding were found dark colored, carbonized and flashed. The insulation between core to Frame was not satisfactory due to heating of the core. The same was repaired by providing insulation. Transformer was energized on 27.04.2024.
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No). If yes, specify load on tertiary.	:	Tertiary is unloaded and earthed
xxi.	Whether tertiary terminals are bare/ Insulated	:	Insulated.
xxii.	Details of Protection for tertiary.	:	HT Tape Insulated
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	The type of bushing and housing: OIP/RIP, Porcelain / polymer housing	:	OIP in 220 kV & 66 kV Side and Porcelain in 11kV
xxv.	On load tap changer or Off circuit tap changer	:	On load tap changer
xxvi.	Tap position OLTC at the time of failure	:	5 (Normal Tap)
xxvii.	Past record of Operation of OLTC	:	Tap Changed from 03 To 05 on 21.05.2024 Tap rotation during PMS activities on date. 14.03.2024
xxviii.	Tap Range	:	1-17
xxix.	Protection provided for transformer	:	PRV, SPR, Buchholz, OSR, Differential, HV REF, LV REF, MOG, WTI (HV, MV, LV) Trip and alarm, OTI trip and alarm.
xxx.	Protection operated during fault	:	a) Differential trip b) Master Trip 86 c) 66 kV Incomer Tripped on Inter Tripping.

xxxi.	Whether equipment is properly earthed.	:	Yes
xxxii.	Surge Arrestor a) Is SA provided for protection b) Whether healthiness of SA is monitored c) Whether reading of SA Counter changed during failure	:	Yes Yes No
xxxiii.	Lighting Impulse and switching Impulse withstand voltage of bushings of all the voltage level.	:	HV- 1050 kVp LV- 325 kVp TV- 170 kVp
xxxiv.	Lighting Impulse and switching Impulse withstand voltage of windings of all the voltage level.	:	HV- 1050 kVp LV- 325 kVp TV- 170 kVp
xxxv.	Type of Fire protection provided (Emulsifier system Injection based fire Protection system/ for based protection etc.)	:	Soak Pit
xxxvi.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Clear
xxxvii.	Storage condition of equipment at site before commissioning Period of storage Idle charged or uncharged Dry air filled/ Nitrogen filled/ Oil filled	:	NA
xxxviii.	Whether short circuits test carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation	:	-
xxxix.	Number of through fault equipment is subjected to before failure	:	4
xl.	Maintenance record, last overhaul carried out	:	Last overhauling done in 2020.
xli.	Any major break down before this failure	:	No
xlii.	Any test conducted prior to fault (DGA, capacitance & Tan-delta of bushing & winding resistance, turns ratio, SFRA, low voltage tests etc.)	:	DGA, Tran delta and capacitance LV Testing as per PMS schedule, winding resistance, SFRA, Voltage ratio
xliii.	Reports of test conducted after failure	:	Post tripping various tests has been carried out. Observations are as under:- DC Winding Resistance Test:- These results are in permissible range. INSULATION RESISTANCE TEST: IR Test conducted at 5 kV Insulation Tester. The IR Value between HV and MV winding observed in Giga Ohm with PI of 1.52.

		The IR Value between HV and Earth observed in Mega Ohm with PI of 1.38. The IR Value between MV and LV observed in Mega Ohm only with PI of 1.70 The IR Value between MV and Earth observed in Gega Ohm with PI of 1.41 The IR Value between LV and Earth observed in Mega Ohm only with PI of 1.70 The IR Value between LV and HV observed in Gega Ohm with PI of 1.43 DGA Test:- Post tripping results of DGA done on 22.08.2024 has shown Acetylene (C₂H₂) of the order of 58.1 ppm as compared to 0.5 ppm of 1st prior results done on 24.06.2024. Hydrogen increased from 09 ppm (24.06.24) to 1058 ppm (22.08.2024) Carbon Mono-oxide CO increased from 62 ppm (24.06.24) to 184 ppm (22.08.2024) Magnetising Current and balance:- It has been noticed that magnetising current of B phase is in the order of Ampere whereas magnetising current of R and Y-Ph winding is in the order of mili-ampere and when tested from HV side also, LV side magnetic balance showing similar results. No induction in B-phase when R and Y phases is energized. Magnetic balance of tertiary winding also showing abnormal results as complete voltage is not building when excited between Y-B phases. TTR Test:- Slightly Deviation observed in TTR at various taps in B- Ph (220 kV-66 kV) and No deviation observed in (220 kV-11 kV) windings of the transformer. Capacitance and Tan Delta test:- No major noticeable change in Winding / Bushing Tan Delta / Capacitance values has been observed within permissible limits. Tan Delta kit tripped for B-phase when Excitation current measured at 10 kV to 500 V on HV side. At the time of Testing Oil in Tank was at normal level.
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		SFRA Test:- The graphs are mismatching to that of previous test results. Physical internal inspection was carried out by O&M team on 26 September 2024 Internal inspection of the transformer carried out and inspected all the power circuit area like OLTC Tap leads, Bushing leads, outside of the windings and core areas. However, nowhere blackish, burnt type things have been noticed. Bushing connections have been found to be ok. The insulation applied on the lead (tap) and connections leads of bushing found to be brownish due to ageing
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5. Failure report of 150 MVA, 220/132/33 kV Auto Transformer at Barjora S/s of DVC

i.	Name of Substation	:	220/132/33 kV DVC Barjora
ii.	Utility	:	DVC
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	150 MVA Auto Transformer
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/ 3-phase)	:	150 MVA, 230/138/6.9 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	BHEL
vi.	Serial No.	:	2020277
vii.	Date and time of occurrence of fault	:	27/10/2024 at 22:00 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	No
ix.	Year of Manufacturing	:	2007
x.	Date of Commissioning	:	30.04.2010
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	Relay details are as follows: R, Y, B-phase Operated, Differential Operator, REF Operated, Buchholz Trip, OSR Trip, PRV Trip, lock out Operated (86A, 86B), NIFPS Operated
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	Magnetic Balance test, Magnetizing current test, tan delta of bushing, TTR test, DC Winding resistance test, IR.
- During the magnetic balance test when voltage applied in Y-Phase the voltage induced in R & B-phase should be 50% of voltage applied in Y-Phase and sum of induced voltage of R & B should be equal to applied voltage in Y-Phase. But test report shows that when 233.1 volts applied on Y-phase, voltage induced in R & B-phases are very small (approximately 4.76% in R-phase and 3.72 % in B-Phase) and also sum so induced voltages in R & B-phases are 19.78 V which is very less than the applied voltage in Y-phase. Current drawn in Y-phase is very less compared to R & B-phase. - Magnetizing current drawn in Y-Phase (HV side) is very less compared to R & B-phase. - Y-Phase winding resistance is very low compared to R & B-Phases (% deviation in winding resistance between R & Y-phase=974.57% & between Y & B-phase is 974.47%). - No continuity in HV side between Y-Phase to R-Phase, Y-Phase to B-Phase & Y-Phase to Neutral. - The fault current in Y-Phase at the time of tripping was 22.27 kA.			
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various	:	HV side: R, Y-phase Bushing damaged, LV Bushing porcelain damaged, crack observed in R, Y, B-Phase OLTC cover.

	components of transformer and nearby equipment / material etc.)		
xiv.	Probable cause of failure	:	Internal fault
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Yes, OEM (BHEL) representative visited the site. Due to fault in HV winding and heavy damage in OLTC main parts, the transformer is not repairable at site and need to send to BHEL Jhansi works for dismantling and assessment of rectification work for remedial action.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Will be decided by OEM after inspection of the failed transformer at their workshop premises
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Maintenance has been done previously and during maintenance of Auto-Transformer, Tan-delta of R-Phase bushing found 2.105 %, (b) Yes (c) R-Phase Bushing has been replaced on 12/04/2024
xviii.	Details of any previous failure on the same unit	:	No
xix.	Is tertiary winding provided (Yes/ No)	:	Yes
xx.	Tertiary loaded (Yes/ No) If yes, specify load on tertiary	:	No load on tertiary winding
xxi.	Whether tertiary terminals are bare/ insulated		Bare
xxii.	Details of protection for Tertiary	:	No
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	OIP Bushing
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer

xxvi.	Tap position of OLTC at the time of failure	:	9B th position (Normal Position)
xxvii.	Past record of Operation of OLTC	:	No
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	O/C, E/F, Differential Protection, REF, Buchholz, PRV, WTI, OTI, OSR (For Auto Transformer)
xxx.	Details of Protection operated	:	ATR R, Y, B-phase Operated, Differential Operated, REF Operated, Buchholz Trip, OSR Trip, PRV Trip, lock out Operated (86A,86B), NIFPS Operated
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.42 Ohm and measured on 12-04-2024
xxxiii.	Surge arrester: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes, Surge Arrester provided (b) Yes, Healthiness Monitored (c) No, SA counter not changed
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	For 220 kV withstand voltage 460 kVp. For 138 kV withstand voltage 275 kVp For 6.9 kV withstand voltage 170 kVp
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	for 220 kV withstand voltage 950 kVp. for 138 kV withstand voltage 550 kVp for 6.9 kV withstand voltage 75 kVp
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	N2 Injection based fire protection system provided
xxxvii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Weather condition was clear

xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ Oil filled	:	(a) Less than one year (b) Uncharged condition (c) Nitrogen filled
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	No, HV bushing was damaged and disconnected
xl.	Number of through faults the equipment was subjected to before failure	:	Nil

6. Failure report of MVA2 20/66 kV Power Transformer at Morbi Substation of GETCO

i.	Name of Substation	:	220 kV Morbi Substation
ii.	Utility	:	GETCO
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Power Transformer
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/ 3- phase)	:	160 MVA, 220/66 kV, 3 PHASE
v.	Make (Original equipment manufacturer)	:	IMP
vi.	Serial No.	:	PT-8011
vii.	Date and time of occurrence of fault	:	31.07.2024 23:52 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	2018
x.	Date of Commissioning	:	12.03.2019
xi.	Sequence of events/Description of fault (SOE with time stamp, protection operated during fault)	:	On Date 31.07.2024 160 MVA 220/66 kV Transformer No-4 Tripped in differential protection and Buchholz alarm during the fault on 66 kV Morbi Bela line no. 3 (UG Cable)
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	1] Routine tests of the Transformer were carried out after the failure. [TURN RATIO, MAGNETIC BALANCE HV, OPEN CIRCUIT, VECTOR GROUP, INSULATION RESISTANCE, TRANSFORMER OIL, SHORT CIRCUIT, MAGNETIC BALANCE LV, LV CHARGING CURRENT, WINDING RESISTANCE HV/LV] 2] TAN DELTA, SFRA,
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Internal inspection was carried out on Dated 13.08.2024 1. All tapping winding on selector switch checked and found ok 2. No any spark/flushed loose connection on selector switch observed. 3. Minor carbon & copper particles observed at bottom of R-phase winding. It seems that tapping winding might be shorted but location is not approachable at site.
xiv.	Probable cause of failure	:	LV Winding Insulation failure

			Transformer tripped after the clearance of 66 kV Morbi – Bela line 3 (UG cable) fault. High intensity Ph-G fault took place in 66 kV line which was cleared by protective system of 66 kV line After above incident, fault developed in transformer and tripped in differential and buchholz trip. It seems that after the clearance of UG cable line fault well within time, transformer LV winding could not withstand recovery voltage which lead to damage to LV winding insulation.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc.	:	Departmentally internal inspection was carried out and it was concluded that transformer is not repairable at site hence declared as failed.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	It seems that tapping winding might be shorted but location is not approachable at site.
xvii.	Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) Whether any abnormality observed in these tests. If yes, attach the test reports. What steps were taken to address the abnormality?	:	Last Tan Delta Testing was carried out on Dtd.02.11.2023 and results found normal.
xviii.	Details of any previous failure on the same unit	:	No
xix.	Is tertiary winding provided (Yes/No)	:	No
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NA
xxi.	Whether tertiary terminals are bare/ insulated	:	NA
xxii.	Details of protection for Tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	No
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain /polymer housing)	:	OIP, Porcelain

xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	ON LOAD TAP CHANGER
xxvi.	Tap position of OLTC at the time of failure	:	11
xxvii.	Past record of Operation of OLTC	:	-
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	NA
xxx.	Details of Protection operated	:	1) Differential Trip 2) Buchholz Alarm 3) Master 86 Relay & Inter-trip
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.81 ohm / 10.01.2024
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	Yes Yes, it is being monitored No
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	NA
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	HV – 1050/460 kVp HV (N) 170/75 kVp LV – 350/160 kVp LV (N) 170/75 kVp
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Nitrogen (N2) Injection based fire protection system (NIFPS)
xxxvii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Rainy
xxxviii.	Storage condition of equipment at site before commissioning: Period of storage Idle charged or uncharged Dry air filled/Nitrogen filled/ Oil filled	:	Nitrogen filled.
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand	:	Short circuit test was carried out.

xl.	Capability was verified on the basis of calculation?	:	Yes
xli.	Number of through faults the equipment was subjected to before failure	:	01

7. Failure report of 160 MVA 220/66 kV Power Transformer at Jambuva Substation of GETCO

i.	Name of Substation	:	220 kV Jambuva Substation
ii.	Utility	:	GETCO
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Power Transformer
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/ 3- phase)	:	160 MVA 220/66 kV TR-1
v.	Make (Original equipment manufacturer)	:	BHEL
vi.	Serial No.	:	2043554
vii.	Date and time of occurrence of fault	:	04.09.2024 at 13:58 Hrs
viii.	Fault discovered during (Operation periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	2018
x.	Date of Commissioning	:	05.12.2018
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	HV SIDE: Differential trip, Dir. EF trip, Gr A, B operated Fault data: (R-0A, Y-6.143 kA, B-4.750 kA) LV SIDE: OC-EF, R-34A, Y- 7.16 kA, B- 6.02 kA, E- 6.11 kA
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	1] Routine tests of Transformer were carried out after the failure. [TURN RATIO, MAGNETIC BALANCE HV, OPEN CIRCUIT, VECTOR GROUP, INSULATION RESISTANCE, TRANSFORMER OIL, SHORT CIRCUIT, MAGNETIC BALANCE LV, LV CHARGING CURRENT, WINDING RESISTANCE HV/LV] 2] TAN DELTA, SFRA, IDAX
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ material etc.)	:	After testing, Results were sent to M/S BHEL for review and M/S BHEL reviewed the test results and found that LV winding resistance value is higher in the range of 20-37% with respect to previous test results & magnetic balance is also abnormal. Presence of acetylene also indicates the fault in transformer. Considering this, Charging of transformer is not recommended. As per BHEL opinion, transformer needs to be

			shifted at BHEL works for thorough inspection after dismantling of winding.
xiv.	Probable cause of failure	:	Winding failure Transformer was tripped in reflected fault: Monkey electrocuted on 66 kV Jambuva B – Dabhoi line bus Isolators.
xv.	Present condition of equipment (Whether repairable or beyond repair)		Budgetary offer invited for repairing of TR From OEM
xvi.	Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) Whether any abnormality observed in these tests. If yes, attach the test reports. What steps were taken to address the abnormality?	:	Last maintenance was carried out on dated 02.06.2024.
xvii.	Details of any previous failure on the same unit	:	NO
xviii.	Is tertiary winding provided (Yes/No)	:	NO
xix.	Tertiary loaded (Yes/ No) If yes, specify load on tertiary	:	NA
xx.	Whether tertiary terminals are bare/ insulated		NA
xxi.	Details of protection for Tertiary	:	NA
xxii.	Whether relay time is synchronized with UTC	:	NO
xxiii.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	OIP, Porcelain
xxiv.	On Load Tap Changer or Off Circuit Tap Changer	:	ON LOAD TAP CHANGER
xxv.	Tap position of OLTC at the time of failure	:	14
xxvi.	Past record of Operation of OLTC	:	NA
xxvii.	Tap Range	:	1 to 17
xxviii.	Details of Protect provided for ICT/ GT/ Reactor	:	NA

xxix.	Details of Protection operated	:	Differential trip, Dir. EF trip, Gr A, B operated Fault data:
xxx.	Whether equipment is properly earthed	:	YES
xxxi.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes, it is being monitored (c) No
xxxii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Nitrogen (N2) Injection based fire protection system (NIFPS)
xxxiii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Clear
xxxiv.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Short circuit test was carried out.
xxxv.	Number of through faults the equipment was subjected to before failure	:	None

8. Failure report of 315 MVA, 400/220/132 kV ICT at Kabulpur of Jhajjar KT Transco Pvt. Ltd (IndiGrid)

i.	Name of Substation	:	400/220/132 kV Grid Substation Kabulpur
ii.	Utility	:	Jhajjar KT Transco Pvt. Ltd., Indi-grid
iii.	Faulty Equipment (ICT/ Autotransformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/MVAr, Voltage ratio, 1-phase/3-phase)	:	315 MVA, 400/220/33 kV, 3 – Phase
v.	Make (Original equipment manufacturer)	:	Crompton Greaves Limited
vi.	Serial No.	:	T09935/01
vii.	Date and time of occurrence of fault	:	11.08.2024 and 06:07:41.094 Hrs.
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	2011
x.	Date of Commissioning	:	06.03.2012
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	1 Distance protection of 220 kV Sampla line operated on 220 kV B-phase line to earth fault recorded at a distance of 200 Mtrs. 2 Differential protection relay & Time delayed directional over-current and earth fault relay (67 HV) of ICT 1 picked up. 3 Transformer differential protection relay ICT1_87T_7UT operated. 4 Transformer PRV operated through ICT1_87T_7UT relay. 5 Master relay 86.1 and 86.2 operated & tripped the transformer ICT1. 6 ICT-1 400 kV side Circuit breaker opened. 7 ICT-1 220 kV side Circuit breaker opened. 8 B and R phase OSR and Main tank Buchholz relay operated.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	SFRA test conducted. Due to winding short, the testing kit was not injecting current and so LV test; AC and DC testing were not done.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformers and nearby equipment / material etc.)	:	Cracks on the HV B phase bottom, IV B phase, deformation in the main tank, bushing damage in HV – R, Y and B Phase, IV – R, Y and B phase and oil spilled in heavy quantity in the surroundings of ICT.

xiv.	Probable cause of failure	:	• Catastrophic failure of 400/220 kV, 315 MVA ICT-1 is due to inter-turn shorting of winding conductor caused by weakening of insulation. • During earth fault in 220 kV line, Transformer winding would have experienced forces and weak insulation of winding is damaged leading to short circuit in the winding. • Above failure was caused by excessive current flowing the transformer and looking into preventive maintenance test results/DGA result/operation parameter of ICT, the nature of failure is sudden and caused by factors beyond reasonable controls.
xv.	If OEM representatives had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Yes
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond repair
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Yes No NA
xviii.	Details of any previous failure on the same unit	:	2014
xix.	Is tertiary winding provided (Yes/ No)	:	Yes
xx.	Tertiary loaded (Yes/ No) If yes, specify load on tertiary	:	Yes – Station auxiliary load
xxi.	Whether tertiary terminals are bare/ insulated	:	Bare
xxii.	Details of protection for Tertiary	:	Earth fault – DMT and IDMT. Over current – DMT and IDMT.
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	OIP, Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer

xxvi.	Tap position of OLTC at the time of failure	:	Tap position – 10
xxvii.	Past record of Operation of OLTC	:	25-October-2016 (9b to 10)
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, REF, Over fluxing, 3rd and 5th Harmonic, and Earth fault, over current, Buchholz, PRV, OSR and WTI & OTI.
xxx.	Details of Protection operated	:	• 87 R - Differential protection Operated • 64R- Restricted Earth fault relay protection Operated • PRV Operated • OSR Operated • Buchholz Relay Operated
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.03 & 0.04 (with grid) and 18.05.2024
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	Yes Yes No
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	Mentioned in the GTP and Factory test report attached.
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	Mentioned in the GTP and Factory test report attached.
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/foam-based protection etc.)	:	Emulsifier system
xxxvii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Cloudy and moist
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ Oil filled	:	This Equipment was directly delivered from the factory with, fully charged with N2 filled during commissioning; this equipment is healthy since charging.
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer, or short circuit withstand capability was verified on the basis of calculation?	:	Yes
xl.	Number of through faults the equipment was subjected to before failure	:	5 Nos (for the year 2024)



Bulging of tank and crack on stiffener toward B-phase observed after tripping of the Transformer. It resulted in oil drain from Transformer.



- 400 kV HV Bushings of R, Y & B phase and 220 kV IV Bushings of R, Y and B phase found crack.
- Oil leakage observed from tertiary bushings.



B-phase 400 kV HV Bushing shield found detached and shield mount lugs broken

NCT mounting support found broken



- B and Y-phase OLTC found damaged;
- B-phase selector switch mounting lug found broken;
- B-Phase selector switch displaced its mounting position;
- Y-Phase selector switch mounting lug also found broken.



Bulging observed on B-phase HV winding conductors



Burn Marks on Insulations Paper
Carbon deposition observed on all over the active part



9. Failure Report of 66.67 MVA, 220/110/33 kV Single phase Auto Transformer at Edappon substation of KSEB

i.	Name of Substation	:	220 kV Substation, Edappon
ii.	Utility	:	KSEB
iii.	Faulty Equipment	:	Auto – Transformer
iv.	Rating (MVA/MVAr, Voltage ratio, 1-phase/ 3-phase)	:	66.67 MVA 220/110/33 kV Single phase
v.	Make (Original equipment manufacturer)	:	Crompton Graves
vi.	Serial No.	:	T 8737/6
vii.	Date and time of occurrence of fault	:	23-08-2023 / 17:49 hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	1999
x.	Date of Commissioning	:	2007
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	1. Differential protection Relay operated 2. Tertiary E/F protection Relay operated 3. Buchholz Alarm operated
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	1. DGA: presence of Methane 167 ppm, Ethylene 330 ppm, Acetylene 469 ppm which shows an arcing inside the transformer. 2. IR value of tertiary to earth winding is 108 k Ohm 3. The magnetization current test could not be done due to over current indication
xiii.	Observations	:	Two Squirrels climbed on tertiary bus bar thereby a dead short circuit occurred between the live and earth part of the tertiary bus bar
xiv.	Probable cause of failure	:	The test result reveals that the insulation of the tertiary winding has failed and corrective measures may be taken.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	No
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable

xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Quarterly maintenance done on 29.05.2023 (b) No abnormality observed (c) NA
xviii.	Details of any previous failure on the same unit	:	Yes
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xxi.	Whether tertiary terminals are bare/ insulated	:	Partially Insulated
xxii.	Details of protection for Tertiary	:	REF Relay
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/polymer housing)	:	Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxvi.	Tap position of OLTC at the time of failure	:	Three
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	1 - 11
xxix.	Details of Protection provided for ICT / GT / Reactor	:	NA
xxx.	Details of Protection operated	:	1. Differential protection Relay operated 2. Tertiary E/F protection Relay operated 3. Buchholz Alarm operated
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.632 Ohm / 09.06.2023

xxxiii.	(d) Surge arrestor : (e) Is SA provided for protection (f) Whether healthiness of SA is monitored (g) Whether reading of SA counter changed during failure	:	NA
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	NA
xxxv.	Lightning Impulse and Switching Impulse With stand Voltage of the winding of all voltage level	:	NA
xxxvi.	Type of Fire protection provided (Emulsifier system/N ₂ Injectionbasedfire protection system/ foam based protection etc.)	:	Foam based protection
xxxvii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Clear Sky
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/Oil filled	:	NA
xxxix.	Whether short circuit test was carried out on this transformer or same design Transformer or short circuit with stand Capability was verified on the basis of calculation?	:	NA
xl.	Number of through faults the equipment was subjected to before failure	:	NA

10. Failure report of 160 MVA, 220/132/33 kV Auto Transformer at Barwaha Substation of MPPTCL

i.	Name of substation	:	220 kV Barwaha Substation
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment (ICT/ Auto Transformer / GT / Reactor	:	Auto Transformer
iv.	Rating (MVA /MVA _r , Voltage ratio, 1-phase / 3-phase)	:	160 MVA, 220/132/33 kV, 3-Phase
v.	Make	:	Bharat Bijlee Ltd
vi.	Serial No.	:	5649/04
vii.	Date & time of occurrence/discovery of fault	:	Date- 09/09/2023 Time- 05:59 Hrs.
viii.	Fault discovered during	:	During service
ix.	Year of Manufacturing	:	2018
x.	Date of Commissioning	:	23-12-2018
xi.	Sequence of events/ Description of fault (SOE with time stamp, protection operated during fault) :-	:	160 MVA Transformer (Make-BBL) caught fire and tripped on RYB phase differential & High set differential Protection. Transformer was isolated from both sides.
xii.	Details of test done after failure (What test were conducted after discovery of failure. If no tests were conducted, reason for the same may be stated)	:	No testing was done as transformer burnt completely.
xiii.	Observation (Visual observation e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ material etc.)	:	Transformer burnt completely. All bushings shattered. Radiator bank detached. The foundation rail became crooked. OLTC diverter switch of R & Y phase cover might have blown away. Bulging of top main tank near diverter switch of Y phase observed. Selector switch was completely burnt. NIFPS NIFPS system operated but not solved the purpose. As main tank OLTC diverter switch cover blasted, no nitrogen cushioning maintained. Fire was quenched by foam tenders.
xiv.	Probable cause of failure	:	As no testing was done post transformer failure, therefore reason of failure could not be ascertained. However, it appears that there is Internal failure inside transformer tank.
xv.	If OEM representative had inspected the equipment or visited the site after failure their remarks, MoM etc. may be attached	:	NO

xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond repair
xvii.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activates) b) Whether any abnormality observed in these tests. If yes attach the test reports c) What steps were taken to address the abnormality?	:	(a) Pre Monsoon Maintenance of transformer done on dated 06.05.2023. Oil parameters and DGA test done. (b) In DGA test result of Transformer Oil, Acetylene value found to be increased. (c) The Matter was taken up with M/s BBL
xviii.	Details of any previous failure on the same unit	:	NO
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) if yes, specify load on tertiary	:	NO
xxi.	Whether tertiary terminals are bare / insulated	:	Bare
xxii.	Details of protection for tertiary	:	NO
xxiii.	Whether relay time is synchronized with UTC	:	NO
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/Polymer housing):-	:	OIP
xxv.	On load tap changer or off circuit Tap changer	:	On load tap changer
xxvi.	Tap position of OLTC at the time of failure	:	10 th
xxvii.	Past record of Operation of OLTC	:	Working satisfactory
xxviii.	Tap Range	:	Tap 1 to Tap 17
xxix.	Details of Protection provided for ICT/GT/Reactor	:	Differential, REF, overload, over flux, NIFPS, all body protection etc.
xxx.	Details of protection operated	:	RYB phase differential & High set differential Protection, NIFPS, OSR, Buchholz, PRV operated
xxxi.	Whether equipment is properly earthed	:	EQUIPEMENT WAS PROPERLY EARTHED
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.08 ohm dated 13.06.2023
xxxiii.	Surge Arrestor: a) Is SA provided for protection b) Whether healthiness of SA is monitored c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) No

xxxiv.	Lighting Impulse and Switching Impulse Withstand Voltage of the bushing of all voltage level	:	a) 1U, 1V, 1W :-1050 kVp b) 1N:-325 kVp c) 2U,2V,2W :- 650 kVp d) 3U,3V,3W :- 325 kVp
xxxv.	Type of Fire protection provided (Emulsifier system/N2 injection based fire protection system/foam based protection etc.)-		Nitrogen Injection Fire Protection system
xxxvi.	Weather condition at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Drizzling
xxxvii.	Storage condition of equipment at site before commissioning: a) Period of storage b) Idle charged or uncharged c) Dry air filled /Nitrogen filled / oil filled	:	No Storage at site before commissioning
xxxviii.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Yes
xxxix.	Number of through faults the equipment was subjected to before failure	:	72 Nos

11. Failure report of 50 MVA, 220/22 kV Power Transformer at Chinchwad-1 of MSETCL

i.	Name of Substation	:	220 kV Chinchwad-1 Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment	:	Power Transformer
iv.	Rating (MVA/MVAr, Voltage ratio, 1-phase/ 3- phase)	:	50 MVA, 220-22, 3-Phase
v.	Make (Original equipment manufacturer)	:	EMCO MAKE Repaired by M/s Mahati Industries. Ltd, Yawat
vi.	Serial No.	:	HT-1758/12896
vii.	Date and time of occurrence of fault	:	05.07.2023 at 19.04 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	2007-2008 (Repaired in the year 2021 by M/s Mahati Industries Ltd)
x.	Date of Commissioning	:	12.09.2022
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	220/22 kV 50 MVA TF No.-8 HV CB and LV2 CB Tripped on Differential protection with 22 kV Ruston feeder fault. TF fault records are as follows: Relay Indication: Diff Bias Operated, Diff R Ph, Diff Y Ph, Diff B Ph, 86 Operated, 86 LV opertd, IA1=98.40 A, IB1= 667.3 A, IC1= 109.2 A, IA3= 921 A, IB3 =412 A, IC3 =1.115 kA. IADiff =1.696, IBDiff =3.367, ICDiff =1.671. IA Bias = 1.593, IB Bias = 1.856 IC Bias = 0.911. 22 kV Ruston feeder Fault currents are: >2ABC. Ia=5796 A, Ib= 5664 A, Ic=5344 A In=1988 A; TESTING REMARKS: The TFR tested for routine tests. The test results are not in order and indicate LV winding short with core. LV to core IR values are zero (no voltage generated). Core to frame IR zero. Excitation currents of Y phase LV higher than the kit capacity. Tan delta of LV to HV - No signal

			could be generated by kit. LV Y phase capacitance is zero. SFRA test shows LV Y phase short.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	IR values test, Excitation current test, Tan delta test, SFRA test, Low voltage test, DGA test of Transformer oil.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	LV to Earth IR Value is 0 ohm. i.e. Voltage doesn't get injected. Low voltage test indicates Y ph LV short. DGA of tank oil shows presence of Acetylene (29 ppm)
xiv.	Probable cause of failure	:	Displacement of LV winding due to feeder fault.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Yes
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	SFRA yearly, winding tan delta two yearly, Bushing tan delta yearly, transformer testing yearly, P.I value Measurement taken; No abnormality observed
xviii.	Details of any previous failure on the same unit	:	The 220/22 kV 50 MVA Transformer failed at 220 kV Baggoan S/s under Vashi Zone & then transported to M/s Mahati Industries for repair. Again, the Transformer was failed at 220 kV Hinjewadi-2 S/s on dated 01/12/2021 & same was repaired by M/s Mahati Industries Ltd under GP & after repairs again commissioned at 220 kV Chinchwad-1 S/s on dated 12/09/2022.
xix.	Is tertiary winding provided (Yes/No)	:	No
xx.	Whether relay time is synchronized with UTC	:	Yes

xxi.	Bushing details (OIP/RIP/RIS, Porcelain/ polymer housing)	:	Porcelain
xxii.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxiii.	Tap position of OLTC at the time of failure	:	10
xxiv.	Past record of Operation of OLTC	:	Healthy
xxv.	Tap Range	:	1 to 17
xxvi.	Details of Protection provided for ICT/GT/Reactor	:	Differential, OC Backup, REF, Buchholz, temperature trip, PRV, OSR, Fire protection
xxvii.	Details of Protection operated	:	Differential protection, Buchholz alarm and LV backup operated
xxviii.	Whether equipment is properly earthed	:	Yes
xxix.	Earth Resistance of Substation and date of its measurement	:	11.05.2023 HV (Pit No 60 A) =0.15 'Ω ; HV (Pit No 60E) =0.10 'Ω LV Side (Pit No E1) =0.35 'Ω LA Side (60C,D,E) = (0.20 'Ω, 0.2 'Ω, 0.10 'Ω)
xxx.	Surge arrester: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes- LCM tested. Dated :25.04.2023 (R phs = 7 μA, Y phs = 5 μA, B phs = 11 μA) (c) No
xxxi.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	NA
xxxii.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	NA
xxxiii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	NO PROTECTION
xxxiv.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Rainy
xxxv.	Storage condition of equipment at site before commissioning: (d) Period of storage (e) Idle charged or uncharged (f) Dry air filled/Nitrogen filled/ Oil filled	:	Nitrogen filled

xxxvi.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand	:	Yes
xxxvii.	capability was verified on the basis of calculation?		Yes
xxxviii.	Number of through faults the equipment was subjected to before failure	:	No. of 22 kV feeder trappings on TF-8 = 293

12. Failure report of 50 MVA, 220 kV Power Transformer at Hinjewadi-1 Substation of MSETCL

i.	Name of Substation	:	220 kV Hinjewadi-1 Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/Auto-transformer/GT/Reactor etc.)	:	Power Transformer
iv.	Rating (MVA/ MVAR, Voltage ratio, 1-phase/3- phase)	:	50 MVA, 220/22, 3-phase
v.	Make (Original equipment manufacturer)	:	VIJAI Electricals.
vi.	Serial No.	:	90050B01
vii.	Date and time of occurrence of fault	:	25.08.2023 at 03:22 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	2009
x.	Date of Commissioning	:	12.07.2009
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	220/22 kV Transformer-2 tripped on dated 18/07/2023 at 20:04 Hrs on Differential protection. As per the testing recommendations, Transformer charged at 23:49 Hrs and DGA of Transformer oil was taken. 1st DGA results on dated 19.07.2023 found high Acetylene = 30 ppm & 29 ppm for top and bottom samples respectively. 2nd DGA results on dated 29.07.2023 found Acetylene = 275 ppm, Ethylene= 96 ppm, Hydrogen= 481 ppm for Top sample & Acetylene = 268 ppm, Ethylene 91 ppm, Hydrogen 470 ppm for bottom sample. 3rd DGA results on dated 06.08.2023 found Acetylene = 279 ppm, Ethylene 135 ppm, Hydrogen 485 ppm for Top sample & Acetylene = 270ppm, Ethylene 130 ppm, Hydrogen= 490 ppm for bottom sample. On dated 25.08.2023, 220/22 kV, 50 MVA, Vijai make Transformer No-2 tripped on Differential protection along with 22 kV Tata

		technology feeder (I>1N, I>2BN Fault currents Ia-36 A, Ib-9156 A, Ic-44 A, In-9140 A) TF Window indications:- 1) 86 Operated 2) Differential trip, General trip, Differential R,Y,B 3) Buchholz trip, 4) PRD trip, 5) OLTC buchholz trip, 6) External REF trip, 7) Differential high set trip. TF Fault value: IL1 - 67.42 A, IL2 - 11650.85 A, IL3 - 32.80 A, In - 11551.74 A 50 MVA, 220/22 kV Vijay make Transformer-2 is recommended for INTERNAL INSPECTION by Testing team. Internal inspection carried out on dated 26.08.2023 & Transformer declared faulty.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	: Transformer was tested for open circuit currents on HV/LV sides, short circuit currents, HV/LV magnetization core, magnetic balance vector group test HV/LV, WRM test, OLTC continuity test and IR values. Also, SFRA & Tan delta was taken by TCC mobile unit. IR Values @ 5 kV TF air jump- 30°C HV to E= 150 MΩ, LV to E =58 MΩ, HV to LV =8 MΩ The TF tested for routine tests after tripping. The Tan Delta of HV UST, GST and GSTg found abnormally high. Oil DGA shows strong presence of acetylene. IR values of HV (40 M Ohm) and HV-LV (8 M Ohm) found abnormally low. Excitation currents at 10 kV found increased.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	: Heavy oil Leakage from Transformer Main Tank at the time of tripping. In internal inspection carried out on dated 26.08.2023, HV Y Phase winding & permali pressure ring found damaged, hence Transformer declared faulty.
xiv.	Probable cause of failure	: HV Y ph winding & permali pressure ring damaged due to 22 kV Tata technology feeder fault.

xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Not Visited
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Half yearly maintenance carried out on dt. 04.06.2023. IR values of TF, CT & LA taken. CB CRM & Timing test, Tan delta of CT taken, Isolator maintenance done. In view of tripping on dt 18.07.2023 following test carried out on dt 19.07.2023 SFRA taken match with previous results. On dt.20.07.2023 HV & LV winding resistance taken results found in order. On dt 21.07.2023 TF winding tan delta found in order but bushing tan delta found more than previous value but may be due to rainy weather as testing remark. Also TF tested for OC & SC test, in short circuit test Yph current is comparatively less than R & B ph currents. Magnetic balance test shows 2-3 V difference between applied voltage & sum of induced voltage in other two phases. IR & PI measured. In view of above TF is kept under observation & DGA to be repeated. (b) None. All results found in order (c) NA
xviii.	Details of any previous failure on the same unit	:	NIL
xix.	Is tertiary winding provided (Yes/No)	:	NA
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NA
xxi.	Whether tertiary terminals are bare/insulated	:	NA
xxii.	Details of protection for Tertiary	:	NA

xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxvi.	Tap position of OLTC at the time of failure	:	9
xxvii.	Past record of Operation of OLTC	:	Healthy
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, OC Backup, REF, Buchholz, temperature trip, PRV, OSR,
xxx.	Details of Protection operated	:	Differential Protection operated, Buchholz trip, PRD trip, REF, Diff high set trip
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	Test Dt: 16.02.2023 TF HV =0.26 Ω TF LV =0.16 Ω HV Netural-0.19 Ω , LV Neutral-0.16 Ω LA (HV) = (0.16 Ω , 0.36 Ω , 0.17 Ω)
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes-LCM tested. Dtd :28.04.2023 (R phase = 9 μ A, Y phase=4 μ A, B phase=7 μ A) (c) No
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	NA
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	NA
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Not Provided

xxxvii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Rainy
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ Oil filled	:	(a) Period of storage: Not Known. (b) Idle charged or uncharged: Not Known (c) Dry air filled/Nitrogen filled/ Oil filled: Nitrogen filled
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Yes
xl.	Number of through faults the equipment was subjected to before failure	:	LV alongwith HV side tripping=1; LV side tripping =3 (2022-23)

13. Failure report of 25 MVA, 220/33 kV ICT at Bhokardan Substation of MSETCL

i.	Name of Substation	:	220 kV Bhokardan SS
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	25 MVA, 220/33 kV, BBL TF-I
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/ 3-phase)	:	25 MVA, 220/33kV, 3 phase
v.	Make (Original equipment manufacturer)	:	Bharat Bijlee Ltd
vi.	Serial No.	:	4659/8
vii.	Date and time of occurrence of fault	:	12.05.2024 at 06:45 am
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	2002 (Repaired at 2015)
x.	Date of Commissioning	:	19.02.2022
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	Transformer tripped on Differential Protection and Main Tank Buchholz Protection when taking trial on 33 kV Pipalgaon Feeder (Yph-Bph Fault). Flame Test taken and found that internal gases are flammable. (Flame having chattering sound)
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	1) Main Buchholz relay Flame test 2) Open Circuit 3) Short Circuit 4) Winding Tan-Delta & Capacitance 5) Oil DGA 6) HV and IV Magnetic Balance 7) HV and IV Excitation Current at 10kV 8) Megger 9) HV and IV Winding resistance
xiii.	Observations : (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Internal visual inspection carried out by S/s I/C and representative from M/S SETONSITE Electricals Pvt. Ltd, Aurangabad. It is observed that Y phase top permali wood structure found broken and LV winding found damaged. Also, insulation spacers, blocks of Y phase LV winding observed expelled out.

xiv.	Probable cause of failure	:	Probable cause will be insulation failure which may further identified by repairer at company site. Transformer already having high tan delta and it is repaired job.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	OEM (Original Equipment Manufacturer) not visited.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Equipment cannot be repaired at site.
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) The routine testing of said T/F was carried out on dated 12.09.2023. Capacitance & Tan delta of winding, bushing current excitation at 10 kV etc. carried out during routine testing. (b) Transformer winding tan delta values are above limit. (c) Not applicable
xviii.	Details of any previous failure on the same unit	:	No
xix.	Is tertiary winding provided (Yes/No)	:	No
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NA
xxi.	Whether tertiary terminals are bare/insulated	:	NA
xxii.	Details of protection for Tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	OLTC
xxvi.	Tap position of OLTC at the time of failure	:	11
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, REF, HV Bup, LV Bup, MBA, MBT, OSR, PRV, WTA, WTT, OTA, OTT
xxx.	Details of Protection operated	:	Differential, MBA, MBT

xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.27 Ohm to 1.98 Ohm on 2024 as informed by S/S I/C.
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Provided (b) SA LCM test carried out as per frequency, results were in order. (c) No change in SA counter on the date of occurrence. As informed by S/S I/C.
xxxiv.	Type of Fire protection provided (Emulsifier system/ N ₂ Injection based fire protection system/ foam based protection etc.)	:	Foam based fire protection system
xxxv.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Rainy
xxxvi.	Storage condition of equipment at site before commissioning:(a) Period of storage(b) Idle charged or uncharged(c) Dry air filled/Nitrogen filled/ Oil filled	:	Nitrogen Filled
xxxvii.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	440V SC test carried out
xxxviii.	Number of through faults the equipment was subjected to before failure	:	--

14. Failure report of 50 MVA, 220/33 kV, Power Transformer at Vankusawade Substation of MSETCL

i.	Name of Substation	:	220 kV Vankusawade Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/ Auto transformer/ GT/ Reactor etc.)	:	Power Transformer

iv.	Rating (MVA/ MVar, Voltage ratio, 1-phase/ 3- phase)	:	3-Phase, 220/33 kV, 50 MVA
v.	Make (Original equipment manufacturer)	:	EMCO
vi.	Serial No.	:	HT1501/12076
vii.	Date and time of occurrence of fault	:	28.05.2024 at 17:08 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	NA
ix.	Year of Manufacturing	:	2002
x.	Date of Commissioning	:	25.03.2002
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	50 MVA 220/33 kV EMCO Make Power Transformer-1 & 3 was running parallel for generation evacuation of feeder no. 1, 2,3,4,5,6,7,8,9,10 & 11. Due to 33 kV Y phase CT of 33 kV Feeder-10 burst, both the power transformers 1 & 3 tripped on LV backup protection. After isolating the faulty 33 kV Vankusawade Feeder-10, Transformer-3 charged successfully whereas the 50 MVA Power Transformer-1 was again tripped with Relay indication- Buchholz Alarm & Trip. (Within 15 seconds of charging).
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	Transformer Low voltage tests, winding resistance, Bushing & winding Tan delta, SFRA, DGA
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	No any external abnormality observed.
xiv.	Probable cause of failure	:	Due to 33 kV Y phase CT of 33 kV Feeder-10 burst, both the power Transformers 1 & 3 tripped on LV backup protection. After isolating the faulty 33 kV Vankusawade Feeder-10, Transformers - 3 charged successfully whereas the 50 MVA Power Transformers -1 was again tripped with Relay indication- Buchholz Alarm & Trip. (Within 15 seconds of charging). However, it appears that there has been internal fault in the Transformer.

xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	NA
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable, Agency allocation done by C.O., Mumbai-M/s Mahati Industries, Pune
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Yearly winding & bushing Tan delta, Half yearly DGA testing. (b) No abnormality was observed.
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Is tertiary winding provided (Yes/No)	:	No
xx.	Whether relay time is synchronized with UTC	:	Not synchronized due to the old Duo bias relay.
xxi.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	OIP Porcelain
xxii.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxiii.	Tap position of OLTC at the time of failure	:	7
xxiv.	Past record of Operation of OLTC	:	Operational
xxv.	Tap Range	:	1 to 17
xxvi.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, Backup O/C E/f, REF Protection and Auxiliary Protection- Buchholz, PRV, OSR, WTI OTI etc.
xxvii.	Details of Protection operated	:	Window Indication:- 1. Internal Fault 2. Main Buchholz Alarm Relay Indication:- 3. Main Buchholz Trip 4. Main Buchholz Alarm
xxviii.	Whether equipment is properly earthed	:	Yes

xxix.	Earth Resistance of Substation and date of its measurement	:	0.69 Ohm (Avg. Pit resistance) on dt.13.02.2024
xxx.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) Not Changed.
xxxi.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	460 kV / 1050 kVp
xxxii.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	HV WINDING - LI 950 / AC 395 HVn WINDING - LI 95 /AC 38 LV /LVn WINDING - LI 170 /AC 70.
xxxiii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	NA
xxxiv.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Foggy weather with high wind.
xxxv.	Storage condition of equipment at site before commissioning:(a) Period of storage(b) Idle charged or uncharged(c) Dry air filled/Nitrogen filled/ Oil filled	:	NA
xxxvi.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand	:	NA
xxxvii.	Capability was verified on the basis of calculation?	:	NA
xxxviii.	Number of through faults the equipment was subjected to before failure	:	11

15. Failure report of 100 MVA, 220/33 kV Power Transformer at Bothe S/s of MSETCL

i.	Name of Substation	:	220 kV Bothe Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/ Auto-Transformer/ GT/ Reactor etc.)	:	Power Transformer
iv.	Rating (MVA/MVAr, Voltage ratio, 1-phase/ 3- phase)	:	3-Phase, 220/33 kV, 100 MVA
v.	Make (Original equipment manufacturer)	:	T&R Ltd.
vi.	Serial No.	:	610041
vii.	Date and time of occurrence of fault	:	04.06.2024 at 14:07 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	NA
ix.	Year of Manufacturing	:	2008
x.	Date of Commissioning	:	10.05.2013
xi.	Sequence of events/ Description of fault	:	On dated 04.06.2024 at 14:07, 33 kV feeder-1 get tripped on O/C during heavy rain & lighting at site. At the same instance 100 MVA T&R make Transformer tripped (on Dated 04.06.2024 at 14:07) on Differential protection and Buchholz Alarm & Trip. There was heavy lightning fault on 33 kV feeder 1, and fault location is very near to substation. Also, CTR system was operated and 107approximately 7000 liter oil got drained.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	Transformer O/C test, magnetizing current & magnetizing balance test, winding resistance, Bushing & winding Tan delta, SFRA, oil DGA test
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	No any external abnormality observed.
xiv.	Probable cause of failure	:	Tripping of 33 kV Feeder-1 on OC because of heavy lightning on 33 kV Feeder-1 conductor and fault location is very near to substation. However, it appears that there has been internal fault in the Transformer.

xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Yes
xvi.	Present condition of equipment (Whether repairable or beyond repair)		Repairable
xvii.	(a) Details of previous maintenance activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Yearly winding & bushing Tan delta, half yearly DGA testing. IR test, yearly maintenance done (b) No abnormality was observed.
xviii.	Details of any previous failure on the same unit	:	No
xix.	Is tertiary winding provided (Yes/No)	:	No
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NA
xxi.	Whether tertiary terminals are bare/ insulated	:	NA
xxii.	Details of protection for Tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	HV Bushing- OIP, LV Bushing- Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxvi.	Tap position of OLTC at the time of failure	:	8
xxvii.	Past record of Operation of OLTC	:	Operational
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/GT/Reactor	:	Differential, Backup O/C, E/f, REF Protection and Auxillary Protection- Buchholz, PRV, OSR, WTI OTI etc.

xxx.	Details of Protection operated	:	Window Indication:- 1. General Trip 2. Differential, R pahse, Y phase, B pahse 3. Diff rest trip 4. Buchholz Alarm 5. Buchholz trip Relay Indication:- 1. Differential protection operated 2. Buchholz Trip 3. General trip
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.6 Ohm on dt.06.04.2024
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) Fault is on LV side of T/F, counter not changed.
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	460 kV /1050 kVp
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	460 kV /1050 kVp
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	NIFPS
xxxvii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Rainy and Thunderstorm, lightning
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand	:	NA

16. Failure report of 125 MVA 220/100 kV ICT at Kandealgaon S/s of MSETCL

i.	Name of Substation	:	220 kV Kandealgaon S/s
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	125 MVA 220/100 kV ICT No.1
iv.	Rating (MVA/ MVAR, Voltage ratio, 1-phase/ 3- phase)	:	125 MVA, 220/100 kV, 3 Phase
v.	Make (Original equipment manufacturer)	:	Toshiba
vi.	Serial No.	:	6401334
vii.	Date and time of occurrence of fault	:	Date 15.07.2024 at 05:58 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During Working Condition.
ix.	Year of Manufacturing	:	1965
x.	Date of Commissioning	:	19.11.2022
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	W/I :- 1. Differential Protection Operated 2. T/F internal fault. 3. Main Buchholz alarm. 4. Trip ckt faulty LV Bkr. 5. Problem in LV Bkr. 6. Master trip really 86G.1 7. Auxiliary RCY for Trafo FUNCS(30AB) R/I :- 1. LED- Differential Optd. 2. Buchholz trip off 3. Diff. trip B 4. Diff Cur :- I diff -2148 A 5. Restr Cur :- I res – 3555 A 6. 729ms per Diff. Trip C Diff Cur :- 7. I diff - 2148A 8. Restr Cur :-I res- 2422 A 9. Buchholz alarm On CTR :- 1. Differential relay trip 2. T/F trip.
xii.	Details of Tests done after failure (What tests were conducted after the discovery)	:	SFRA, Open Circuit Test, Short Circuit Test, Magnetic Balance Winding Resistance Measurement

	of failure. If no tests were conducted, reasons for the same may be stated.)		
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	1) Heavy Carbon Observe on Winding on B Phase Winding. 2) Copper Particle in Dust Form Observed on B Phase Winding 3) Copper Particle Observed at Top Permawood Ring and B Phase Winding 4) Insulation Arrangement of B Phase Winding was Found Disturbed. 5) Removed H/N Bushing for Inspection and Refitting the Same. 6) Insulation Arrangement Of R&Y Winding Found Intact 7) Tap Leads Found Intact. 8) OLTC Selector Switch Found Intact.
xiv.	Probable cause of failure	:	The test result was abnormal & were indicating fault in B phase winding.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	NIL
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the Abnormality?	:	13.01.2024 Maintenance and testing work done
xvii.	Details of any previous failure on the same unit	:	Nil
xviii.	Is tertiary winding provided (Yes/No)	:	NO
xix.	Whether relay time is synchronized with UTC	:	NO
xx.	Bushing details (OIP/RIP/RIS, Porcelain / polymer housing)	:	Porcelain
xxi.	On Load Tap Changer or Off Circuit Tap Changer	:	On load Tap Changer
xxii.	Tap position of OLTC at the time of failure	:	9
xxiii.	Past record of Operation of OLTC	:	Nil

xxiv.	Tap Range	:	1 -17
xxv.	Details of Protection provided for ICT/GT/Reactor	:	N2 Injection based fire protection system, MAKE- CTR, differential protection, auxiliary protection.
xxvi.	Details of Protection operated	:	W/I :- 1. Differential Protection Operated 2. T/F internal fault. 3. Main Buchholz alarm. 4. Trip ckt faulty LV Bkr. 5. Problem in LV Bkr. 6. Master trip really 86G.1 7. Auxiliary RCY for Trafo FUNCS(30AB) R/I :- LED- Differential Optd. Buchholz trip off Diff. trip B Diff Cur :- I diff -2148A Restr Cur :- I res - 3555A 729ms per Diff. Trip C Diff Cur :- I diff - 2148A Restr Cur :-I res- 2422A Buchholz alarm On CTR :- 1. Differential relay trip 2. T/F trip.
xxvii.	Whether equipment is properly earthed	:	Yes
xxviii.	Earth Resistance of Substation and date of its measurement	:	Earth Resistance of S/s - 1.0 ohm dt.15.02.2023
xxix.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) YES (b) YES (c) YES
xxx.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	YES
xxxi.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	YES
xxxii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	YES, N2 Injection based fire protection system, MAKE- CTR
xxxiii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Rainy

xxxiv.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ Oil filled	:	a) 8 years idle at site at Other MSETCL S/s. b) Uncharged C) Dry Air Filled
xxxv.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand Capability was verified on the basis of calculation?	:	YES

17. Failure report of 50 MVA, 220/22 kV ICT at Bhosari-2 Substation of MSETCL

i.	Name of Substation	:	220 kV Bhosari-2 Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/ Auto-Transformer/ GT/ Reactor etc.)	:	220/22 kV 50 MVA, EMCO (Repaired by Mahati) Transformer No 3 along with HV & LV Bushings
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/ 3- phase)	:	50 MVA, 220-22 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	EMCO MAKE (Repaired by M/s Mahati Industries. Ltd, Yawat.)
vi.	Serial No.	:	Transformer-3- HT-1758/12896; EHV Bushing - 2453001392; 2453001428; 2453001336
vii.	Date and time of occurrence of fault	:	24.07.2024 at 23.02 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	No fault observed during operation or periodic testing/ maintenance. Transformer Caught Fire.
ix.	Year of Manufacturing	:	2007-2008 (Repaired by M/s Mahati Industries Ltd in year 2024)
x.	Date of Commissioning	:	28.06.2024
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	High Set Differential trip & REF trip. 86 A operated 86 B operated.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	No any kind of tests are done as the transformer caught fire. All HV & LV bushings burst, complete oil burnt, main tank crack & damaged, winding & core burnt. Radiators & its piping damaged. All turrets damaged, oil found drained due to multiples leakages from bottom parts & conservator to main tank piping opened. All wheels get dislocated from the rail track, PRV thrown away, all 3 HV LA burst, FCC panel burnt at back side auxiliary protection cable burnt, breather burnt, MOG & fan damaged.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	All HV & LV bushings burst, complete oil burnt, main tank crack & damaged, winding & core burnt. Radiators & its piping damaged. All turrets damaged, oil found drained due to multiples leakages from bottom parts & conservator to main tank piping opened. All wheels get dislocated from the rail track, PRV thrown away, all 3 HV LA burst, FCC panel burnt at back side auxiliary protection cable burnt, breather burnt, MOG & fan damaged.

xiv.	Probable cause of failure	:	Transformer internal fault. B phase fault current observed in DR is 20 kA at the time of fault.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Inspection done by the repairing agency M/s Mahati Industries on dated 25.07.2024.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Transformer is in guarantee period & matter is taken up with repairer M/s. Mahati, Pune
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) All testing & maintenance was carried out at the time of T/F commissioning & charged on the date 28.06.2024. (b) No abnormality was found during testing before commissioning. (c) No abnormality
xviii.	Details of any previous failure on the same unit	:	Transformer previously failed at 1. First Failure – 220 kV Bapagaon S/Stn 2. Second Failure – 220 kV Hinjewadi ph 2 S/s - Dtd 01.12.2021 under GP 3. Third Failure - 220kV Chinchwad 1 S/s - Dtd 05.07.2023 under GP 4. Forth Failure - 220kV Bhosari 2 S/Stn - 24.07.2024 under GP
xix.	Is tertiary winding provided (Yes/No)	:	NO
xx.	Whether relay time is synchronized with UTC	:	NO
xxi.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	Porcelain
xxii.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxiii.	Tap position of OLTC at the time of failure	:	6
xxiv.	Past record of Operation of OLTC	:	Healthy
xxv.	Tap Range	:	1 to 19
xxvi.	Details of Protection provided for ICT/GT/Reactor	:	Differential, OC Backup, REF, Buchholz, temperature trip, PRV, OSR
xxvii.	Details of Protection operated	:	High Set Differential trip & REF trip. 86 A operated 86 B operated.

xxviii.	Whether equipment is properly earthed	:	Yes
xxix.	Earth Resistance of Substation and date of its measurement	:	30.03.24 HV (Pit No 45) =0.28 Ω ; HV (Pit No 46) =0.14 Ω Body (50)=0.73 Ω LV Side (72,73,74) =0.28,0.27,0.28 Ω LA Side (47,48,49) = (0.12 Ω , 0.30 Ω , 0.20 Ω)
xxx.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes-LCM tested. Dated :12.07.2024 (R phs = 20 μ A, Y phs=7 μ A, B phs= 7 μ A) (c) LA & counter caught fire due to burning of Transformer. Hence counter readings not seen.
xxxi.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	NO
xxxii.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	NO
xxxiii.	Type of Fire protection provided(Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc	:	NO
xxxiv.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Heavy Rain & wind.
xxxv.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ Oil filled	:	(a) Period of storage - 2 Months (b) Idle charged or uncharged - Uncharged (c) Dry air filled/Nitrogen filled/ Oil filled - Nitrogen filled
xxxvi.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Yes
xxxvii.	Number of through faults the equipment was subjected to before failure	:	22 kV PMAY -2 Feeder - No of tripping – 2 Nos Details of tripping - 1) Tripped on R Ph Fault current: Ia:2586.4 A 2) H/H tripped on R PH Ia: 2566.8 (Since then, feeder is under permit till date)

18. Failure Report of 50 MVA, 220/33 kV Power Transformer at Kurkumbh Substation of MSETCL

i.	Name of Substation	:	220 kV Kurkumbh
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Power Transformer
iv.	Rating (MVA/MVAr, Voltage ratio, 1-phase/3- phase)	:	50 MVA, 220/33 kV, Three Phase
v.	Make (Original equipment manufacturer)	:	EMCO
vi.	Serial No.	:	1666/12521
vii.	Date and time of occurrence of fault	:	20.08.2024, at 20:10 HRs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During 33 kV Feeder 2 phase fault
ix.	Year of Manufacturing	:	2006
x.	Date of Commissioning	:	31.07.2007 at 220 kV Kurkumbh
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	On 20.08.2024 at 20:10 Hrs, the Transformer tripped along with the 33 kV Shirsuphal feeder fault. The flame test carried out but could not conclusive as the small amount of gases had accumulated in the Buchholz. The differential Relay protection has operated correctly within time, no other protection operated.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	

The Transformer is tested for following tests:

1. IR test carried out; the results found in order.
2. Tan Delta & Capacitance test for winding carried out, all the results found in order.
3. In 10 kV Excitation tests, The R ph and B ph currents found doubled compared to previous results. For HV Y ph, kit tripped beyond 1.5 kV (190 mA). For LV Y ph, kit tripped beyond 25 V (185 mA)
4. Low voltage test carried out at tap No. 9. During the single phase magnetizing current measurement test, High current observed for HV Y ph and LV Y ph .
5. The Magnetic balance test found disturbed.
6. Deviation observed in voltages measured during vector group tests.
7. DGA reports received on 21.08.2024 indicated presence of acetylene.

8. From the SFRA test results the observations are follows.

- a) For HV R ph and B ph HV open circuit test, the deviation observed below 3 kHz.
- b) For LV R ph and B ph open circuit test, the deviation observed below 3 kHz.
- c) For HV Y Ph open circuit test, the deviation observed below 1 kHz.
- d) For HV Y Ph open circuit test, the deviation observed below 1 kHz and from range 200 kHz to 1 MHz.

As per the test results and observations, The Transformer declared as a faulty.

xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	No physical deformation of external body. Internal inspection carried out and found that Y phase permawood ring found broken. Y phase winding has been displaced.
xiv.	Probable cause of failure	:	Y phase winding has been displaced; the 33 kV Feeder fault, might have created the axial forces could not be sustained by the Transformer HV/LV winding.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	No
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) 1) SFRA, Bushing tan delta, Winding tan delta, 2) DGA, 3) Auxiliary Protection tests 4) Protection trials b) All tests were normal. c) Nil
xviii.	Details of any previous failure on the same unit	:	No
xix.	Is tertiary winding provided (Yes/No)	:	No
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xxi.	Whether tertiary terminals are bare/ insulated	:	NA

xxii.	Details of protection for Tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	NA as relay is old generation type
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	OIP, Porcelain housing
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxvi.	Tap position of OLTC at the time of failure	:	9
xxvii.	Past record of Operation of OLTC	:	OLTC is in working condition
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	i) Differential Protection, ii) OC&EF Protection, iii) REF Protection iv) Auxiliary Protections.
xxx.	Details of Protection operated	:	On 20.08.2024@ 20:10 hrs, the transformer tripped along with the 33 kV Shirsuphal feeder fault. The flame test carried out but could not conclusive as the small amount of gases had accumulated in the Buchholz. The differential Relay protection has operated correctly within time, no other protection operated.
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.1 to 0.6 ohm, 06.05.2024
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	a) Yes b) Yes c) No
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	1050 kVp
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	HV: 950 kVp, LV:170 kVp

xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	N2 Injection based fire protection system
xxxvii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	clear
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	(a) 7 days (b) uncharged (c) Oil filled
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Confirmed prior commissioning

19. Failure Report of 25 MVA, 220/33 kV Power Transformer at Purti Substation of MSETCL

i.	Name of Substation	:	220 kV PURTI
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/ auto-transformer/ GT/ reactor etc.)	:	Power Transformer
iv.	Rating (MVA/MVAr, Voltage ratio, I-phase/ 3-phase)	:	25 MVA, 220/33 kV PTR 1
v.	Make (Original equipment manufacturer)	:	EMCO (repaired by M/s Vishvas Power)
vi.	Serial No.	:	HT/1289/11442
vii.	Date and time of occurrence of fault	:	28.08.2024 at 23:00 Hrs
viii.	Fault discovered during operation or periodic testing/ maintenance	:	During tripping
ix.	Year of manufacturing	:	1992 (Year of repair 2018)
x.	Date of commissioning	:	08.12.2018 at 220 kV Purti Sub station
xi.	Sequence of events/Description of fault (SoE with time stamp, protection operated during fault)	:	1) Transformer is tripped on PRV and Buchholz trip relay at 23:10 Hrs on dated 28.08.2024 2) Oil is spilled from PRV. 3) LV testing of Transformer is carried out on dt 29.08.2024. It is found that results of LV test are not satisfactory. Open circuit short circuit result not in order, Magnetic balance found shifted and IR result for LV E found zero and also voltage dropped to zero. 4) Non-Operation of Protection system as there is DC failure during Occurrence.
xii.	Details of tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same way be stated.)	:	SFRA and Insulation Resistance Test were conducted and results were abnormal.

xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer / reactor and nearby equipment/ material etc.)	:	Oil spilled out from PRV and flashover was observed on transformer during tripping.
xiv.	Probable cause of failure	:	Due to close up 33 kV feeder fault, station AC Supply failed. This led to station DC Supply failure, due to weak VRLA battery set. The fault was eventually cleared from remote end line CB's. It seems that due to probable transformer internal fault along with failure of station DC Supply resulted in failure of transformer.
xv.	If original equipment manufacturer representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Internal inspection from OEM/ authorized repairer is recommended.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Transformers sent for repairs.
xvii.	(a)Details of previous maintenance(Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	YES, Diagnostic testing carried out on dated 28.06.2024 Tan delta values are as: Winding : HV-LV(UST) CAP= 4127 pF, Tan delta= 0.323% HV-E (GST) CAP= 4204 pF , Tan delta= 0.410% LV-E (GST) CAP= 8466 pF, Tan delta = 0.421% HV-GST(A+B)CAP=8335 pF, Tan delta=0.370 % LV-GST (A+B)CAP=12590 pF ,Tan delta= 0.395% LV-HV (UST) CAP= 4128 pF , Tan delta = 0.319 % HV R ph bushing cap = 368.3 pF , Tan delta = 0.551 % HV Y ph bushing cap = 366.7pF , Tan delta = 0.271% HV B ph bushing cap = 371.5 pF , Tan delta = 0.541 %
xviii.	Details of any previous failure on the same unit	:	Transformer was repaired in year 2018 at VPES and commissioned on date 08.12.2018

xix.	Is tertiary winding provided	:	NO
xx.	Whether relay time is synchronized with UTC?	:	NA
xxi.	Bushing details (OIP/ RIP/ RIS, Porcelain/polymer housing)	:	OIP
xxii.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxiii.	Tap position of OLTC at the time of failure	:	3
xxiv.	Past record of operation of OLTC	:	Tap change operation was carried out as per change in system voltage
xxv.	Tap Range	:	1 to 17
xxvi.	Details of Protection provided for ICT/GT/Reactor	:	1) Differential Prot. Relay 2) HV B/UP Prot Relay 3) LV B/UP Prot Relay 4) REF Prot 5) Buchholz Relay 6) Main PRV 7) OSR 8) MOG 9) WTI 10) OTI
xxvii.	Details of Protection operated	:	PRV. Operated, buchholz Trip and alarm relay.
xxviii.	Whether equipment is properly earthed	:	Yes
xxix.	Earth resistance of substation and date of its measurement	:	All earth pit values are below 1 ohms, Date:- 17.04.2024
xxx.	Surge arrester: (a) Is SA provided for protection? (b) Whether healthiness of SA is monitored? (c) Whether reading of SA counter changed during failure?	:	a) YES b) YES c) NO
xxxi.	Lightning I impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	BIL: 735/1050 kV
xxxii.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	
xxxiii.	Type of fire protection provided (Einulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	NA
xxxiv.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Heavy Rains and lightening

xxxv.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ oil-filled	:	NA
xxxvi.	Whether short circuit test was carried out on this transformer or same design transformer/ reactor or short circuit withstand capability was verified on the basis of calculation?	:	NO

20. Failure Report of 100 MVA, 220 kV ICT at Alephata Substation of MSETCL

i.	Name of Substation	:	220 kV Alephata
ii.	Utility	:	EHV O&M Division, Manchar, Pune
iii.	Faulty Equipment	:	ICT No. 1
iv.	Rating (MVA/MVAr, Voltage ratio, 1-phase/ 3-phase)	:	100 MVA, 220/132 kV
v.	Make (Original equipment manufacturer)	:	EMCO
vi.	Serial No.	:	HT-1456/11937
vii.	Date and time of occurrence of fault	:	23.09.2024 at 03:31 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Tripping
ix.	Year of Manufacturing	:	1999
x.	Date of Commissioning	:	31.07.2010
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	1) Equipment Detail: 220/132 kV, 100 MVA EMCO Make ICT No 1. 2) Date: 23.09.2024 3) Time: 03:31 4) Occurrence Details: 220 kV LBB Operated Due to 100 MVA, 220/132 kV EMCO MAKE ICT 1, (Sr no. HT-1456/11937) tripped on Buchholz, PRV and Internal Fault, Also ICT body stiffener partially found cracked and Oil drain Out. 5) W/I: For ICT 1 Transformer Internal Fault, Main Buchholz Alarm 6) R/I: For ICT 1 • Differential Relay (Alstrom Mi com 643) General Trip, Y ph Diff, B ph Diff, Differential, Buchholz Alarm • CTR Indication: PRV Trip, Buchholz Trip, CB Trip

xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	Testing result for Bushing & Winding Tan Delta & SFRA test & Excitation test result found satisfactory.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	External Observation of ICT: 1. All 3 Nos 132 kV IV porcelain Bushing displaced from the support and shifted from flange. 2. HV Y phase Bushing Flange found Cracked 3. Stiffener gas welding cracked and Oil spread from bottom Bell Hardware and gasket from 132 kV Side & Minor from 220 kV Side. Internal Observation Of ICT: 1. Flash over on Bakelite OLTC drive shaft between Y and B phase due to failure of dielectric strength. 2. Drive shaft between R phase to Y Phase Found intact. 3. All Tap Leads found Healthy 4. Minor Flashover observed on Y Phase Selector switch 5. All 3 Phases R, Y, B winding insulation arrangement found healthy, No flashover Observed on winding It Indicates winding seems to be healthy 6. Other than diverter switch, Inspection Done found healthy
xiv.	Probable cause of failure	:	1. Flash over on Bakelite OLTC drive shaft between Y and B phase due to failure of dielectric strength. 2. Drive shaft between R phase to Y Phase found intact
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	NA
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable

xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Diagnostic testing was carried out on dated 15.02.2024. (b) DGA report of ICT Result is within limit. (c) NA
xviii.	Details of any previous failure on the same unit	:	1st commissioning: On date 28.03.2001 at 220 kV Ranjangaon substation. Removed from services from 220 kV Ranjangaon S/s in Augmentation scheme on dated 25.05.2010 2nd commissioning: On dated 31.07.2010 at 220 kV Alephata S/s.
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xxi.	Whether tertiary terminals are bare/ insulated	:	Insulated
xxii.	Details of protection for Tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	NA
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	OIP Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxvi.	Tap position of OLTC at the time of failure	:	15
xxvii.	Past record of Operation of OLTC	:	Good
xxviii.	Tap Range	:	01 to 17

xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	HV Side: Differential relay, Buchholz relay, OSR relay, REF, Trip Circuit Supervision Relay, 86 master trip protection, PRV, CTR (N2 fire protection), Timer for 50 LBB, Auxiliary relay For Trans Non Trip, Auxiliary relay for Trans Trip, Auxiliary relay for CB Supervision relay LV: Trip Circuit supervision relay, LV Backup Relay, Stuck Breaker Protection Relay, Voltage Selection Relay, Master trip 86 Relay, Timer for 50 LBB, Colt Multi. Relay, DC supervision Relay, Auxiliary Relay.
xxx.	Details of Protection operated	:	Differential relay, Buchholz relay, PVR relay protection operated.
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.3 ohm and 23.01.2024
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Healthy (LCM values enclosed herewith.) (c) No
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	NA
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	NA
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	N2 Injection based fire protection system
xxxvii.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Rainy
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ Oil filled	:	NA



xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand Capability was verified on the basis of calculation?	:	Yes, at factory
xl.	Number of through faults the equipment was subjected to before failure	:	Only 1 No

21. Failure Report of 150 MVA, 220 kV ICT at Chinchwad-1 Substation of MSETCL

i.	Name of Substation	:	220 kV Chinchwad-1
ii.	Utility	:	MSETCL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	150 MVA, 220/132 kV CGL make ICT No. 7
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/3- phase)	:	150 MVA, 220/22 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	CGL MAKE (Overhauled by AVAL in 2011)
vi.	Serial No.	:	T 8519/2
vii.	Date and time of occurrence of fault	:	11.11.2024 at 03:05Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	In operation
ix.	Year of Manufacturing	:	1998
x.	Date of Commissioning	:	12.10.2011
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	Buchholz Trip 30A, 86 Master Trip Operated
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	Winding & Bushing tan delta measurement, Excitation test, SFRA, Open circuit, Short circuit, Ratio test, Winding resistance measurement test, PI values, DGA test were conducted. • The DGA test revealed presence of 138 ppm acetylene which indicated arcing/flash-over in the tank. • The winding resistance for 1V-2V found on higher side but the 2V-N test results show the results match with the previous, which indicates inter-turn shorting in the series winding of Y ph, i.e. between 1V-2V. • Magnetic Balance test shows unbalance.

			- SFRA test results for 1V-2V open circuit and 2V-N open circuit show shorting in Y ph winding. - Short circuit test shows rise in current of Y-ph. Excitation test showed abnormally high current for HV Y-ph. - However, Tan-delta and capacitance test results found normal and within permissible limits which indicated no damage to the insulation between the winding and core/frame.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Blackening & traces of arcing seen near HV Y Phase lead connection to winding.
xiv.	Probable cause of failure	:	Inter-turn insulation failure in HV Y phase winding (Near HV Side Connection)
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	No
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) On dt. 17.05.2024 Pre-Monsoon Activities carried out including trials taken on Auxiliary Protection. Testing - PI -20.04.2023, Bushing Tan Delta - 20.04.2023, DGA - 17.08.2024 (b) No any Abnormalities found (c) NA
xviii.	Details of any previous failure on the same unit	:	Not available
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No

xxi.	Whether tertiary terminals are bare/insulated		Bare
xxii.	Details of protection for Tertiary	:	Not Available
xxiii.	Whether relay time is synchronized with UTC	:	No
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/ Polymer housing)	:	OIP Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxvi.	Tap position of OLTC at the time of failure	:	13
xxvii.	Past record of Operation of OLTC	:	Healthy
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/GT/Reactor	:	Differential Prot., HV & LV Back up Prot. REF, GAS/Oil Actuated Relay (Buchholz Relay), NIFPS, Over Temperature Protection(HV & LV Winding, Oil), High Oil Pressure Release (PRV), OSR
xxx.	Details of Protection operated	:	Buchholz Relay
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.35 Ohm on dtd 16.05.2024
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (ICT HV: R phase: 28 micro A Y phase: 11 micro B phase :31 micro A ICT LV : R phase : 12 microA Y phase: 04 micro B phase :13 micro A) (c) No
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	1050 kVp
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	950 kVp

xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc	:	N2 Injection
xxxvii.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Clear Sky (Night time)
xxxviii.	Storage condition of equipment at site before commissioning:(a) Period of storage(b) Idle charged or uncharged(c) Dry air filled/Nitrogen filled/ Oil filled	:	NA
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	No No
xl.	Number of through faults the equipment was subjected to before failure	:	ICT 7 tripped 3 Nos. of times on fault

22. Failure report of 500 MVA, 400/220 kV ICT at Muzaffarnagar Substation of Powergrid

i.	Name of Substation	:	400/220 kV Muzaffarnagar Substation
ii.	Utility	:	POWERGRID
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/ MVA _r , Voltage Ratio, 1 phase/ 3 phase)	:	500 MVA, 400/220 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	TELK
vi.	Serial No.	:	140140-1
vii.	Date and time of occurrence of fault	:	23.08.2023 at 08:01 Hrs
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	2008
x.	Year of Commissioning	:	2009
xi.	Sequence of events/ Description of Fault (SOE with time stamp, Protection operated during fault)	:	Differential, REF, Buchholz relay & PRD, WTI trip operated at 08:01 Hrs on 23.08.2023.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	During the fault, all the 220 kV Bushings, 400 kV B phase Bushing found damaged and OLTC of Y & B phase was also damaged and fallen on bottom of main tank. 220 kV Y phase tap winding and OLTC was also found burnt. In view of the above, LV test could not be carried out in the ICT.
xiii.	Observations	:	

Based on the Disturbance recorder, physical and internal inspection of the failed ICT, following are the observations:

- The main tank of ICT busted from 220 kV B & Y phase bottom bell joint. The main tank shifted around 500 mm from original position from 220 kV B & Y phase with huge bulging in B phase.
- The bell tank joint bolts were found sheared with impact & spread over 20-30 meters from ICT.
- Porcelain pieces of 220 kV bushings were shattered inside the main tank including internal insulation material i.e. paper & permawood.
- Permawood and insulation materials were also found shattered outside the main tank towards 220 kV side.
- 220 kV B & Y phase OLTC chamber i.e. diverter & tap selector assembly fell on bottom of ICT tank.
- Severe mechanical damage has been observed in B phase OLTC.
- Burning and heavy fire related damages have been observed in Y phase bottom winding, Y-phase tap leads and Y-phase OLTC.

(viii) Marshalling box of the ICT mounted on 220 kV side was also damaged due to failure impact																																																			
(ix) Due to fault, ICT caught fire towards 220kV side and same was extinguished with emulsifier, hydrant system and rain.																																																			
(x) All Oil spilled to sump pit from heavy opening mentioned at point no1. The main tank & OLTC conservator oil level was NIL.																																																			
(xi) All 220 kV Bushings, 400kV B phase bushing, 33kV Y & B phase bushings got damaged during incidence.																																																			
xiv.	Probable cause of failure	:	220 kV side winding dielectric failure. Flashover between B phase bottom bushing connection lug to metallic support corner of B phase OLTC.																																																
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	NO																																																
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond Repair																																																
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits. <table><tr><th>Date</th><th>H2</th><th>C H4</th><th>C2 H4</th><th>C2 H6</th><th>C2 H2</th><th>CO</th><th>CO2</th></tr><tr><td>24.05 .2023</td><td>11</td><td>21</td><td>1</td><td>2</td><td>0</td><td>1122</td><td>10604</td></tr><tr><td>10.05 .2022</td><td>10</td><td>17</td><td>1</td><td>2</td><td>0</td><td>1159</td><td>10129</td></tr><tr><td>15.06 .2021</td><td>12</td><td>19</td><td>1</td><td>2</td><td>0</td><td>1330</td><td>10770</td></tr><tr><td>08.01 .2021</td><td>13</td><td>19</td><td>1</td><td>2</td><td>0</td><td>1271</td><td>9306</td></tr><tr><td>18.04 .2020</td><td>11</td><td>18</td><td>1</td><td>2</td><td>0</td><td>1162</td><td>8684</td></tr></table> Pre Fault DGA was normal. (All values are in ppm).	Date	H2	C H4	C2 H4	C2 H6	C2 H2	CO	CO2	24.05 .2023	11	21	1	2	0	1122	10604	10.05 .2022	10	17	1	2	0	1159	10129	15.06 .2021	12	19	1	2	0	1330	10770	08.01 .2021	13	19	1	2	0	1271	9306	18.04 .2020	11	18	1	2	0	1162	8684
Date	H2	C H4	C2 H4	C2 H6	C2 H2	CO	CO2																																												
24.05 .2023	11	21	1	2	0	1122	10604																																												
10.05 .2022	10	17	1	2	0	1159	10129																																												
15.06 .2021	12	19	1	2	0	1330	10770																																												
08.01 .2021	13	19	1	2	0	1271	9306																																												
18.04 .2020	11	18	1	2	0	1162	8684																																												
xviii.	Details of any previous failure on the same unit	:	NA																																																
xix.	Is tertiary winding provided (Yes/No)	:	YES																																																
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NO																																																

xxi.	Whether tertiary terminals are bare/ insulated	:	Insulated
xxii.	Details of protection of tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	YES
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/Polymer housing)	:	OIP
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer
xxvi.	Tap Position of OLTC at the time of failure	:	Nominal
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	17
xxix.	Details of Protection provided for ICT/GT/Reactor	:	Differential, REF, Buchholz, PRD, WTI/OTI Trip
xxx.	Details of Protection Operated	:	Differential, REF, Buchholz relay, PRD & WTI trip operated
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.74 ohm
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) NO
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushing of all voltage level	:	
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system
xxxvii.	Weather conditions at the time of Failure (Clear sky/rainy/thunderstorm etc.)	:	Clear
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA

xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	NA
xl.	Number of through faults the equipment was subjected to before failure	:	NA



400kV B-Phase Bushing damaged



220kV Side main tank

23. Failure report of 397 MVA, 400 kV Converter Transformer at HVDC Kaniha Substation of Powergrid

i.	Name of Substation	:	+/- 500 kV HVDC Kaniha S/s
ii.	Utility	:	POWERGRID
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Converter Transformer
iv.	Rating (MVA/ MVAR, Voltage Ratio, 1 phase/ 3 phase)	:	400 kV, 397 MVA, 1-Phase (R-Ph)
v.	Make (Original equipment manufacturer)	:	Siemens AG
vi.	Serial No.	:	N 408577
vii.	Date and time of occurrence of fault	:	29.10.2023, 11:47:17 hrs
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	2002
x.	Year of Commissioning	:	2002
xi.	Sequence of events/ Description of Fault (SOE with time stamp, Protection operated during fault)	:	Differential, REF, Buchholz relay & PRD, WTI trip operated at 08:01 Hrs on 23.08.2023
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	Magnetizing current test, DGA, Voltage ratio test, SFRA, winding resistance test.

1. Dissolved Gas Analysis (DGA)

Date	Gas Content (ppm)							Remarks
	H2	CH4	C2H2	C2H4	C2H6	CO	CO2	
29.10.2023	80	534	33	1746	405	44	464	Top Sample after Tripping.
29.10.2023	70	121	24	254	93	49	461	Bottom sampe after Tripping.

The DGA results shows rise in fault gases.

2. Magnetization Current Test

Tap	HV SYSTEM (1.1-1.2)	
	Voltage Applied (Volt)	Measured Current (mA)
-4	400	1000
6	400	800

16

400

542.3

Deviations were noticed in magnetization current in all 3 windings i.e. Primary, secondary star and secondary delta of this failed converter transformer.

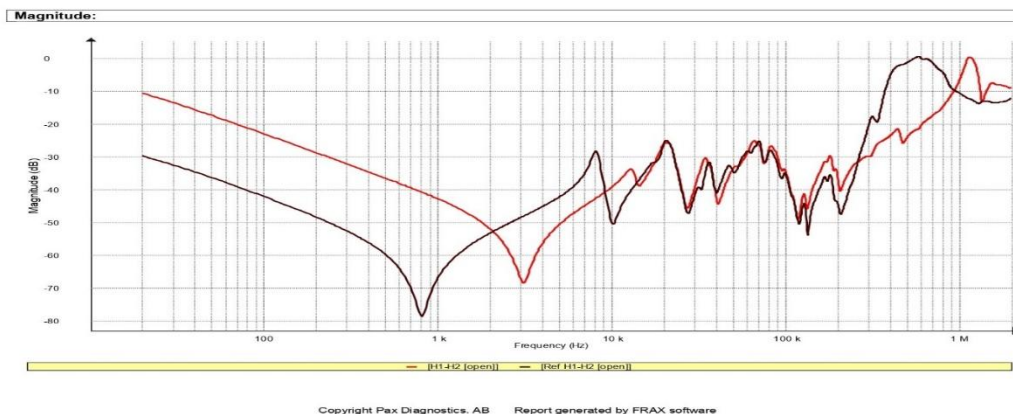
3. Voltage Ratio Test

Voltage Ratio Test:

Turn Ratio: HV (line side) / LV (Star side)

Tap position	Applied voltage. Line side (V) 1.1-1.2	Measured Voltage. Star side (V) Y1-Y2	Ratio Ref. (1.1-1.2/Y1-Y2)	Ratio (1.1-1.2/Y1-Y2)	Deviation (in %)	Remarks
-4	400	192.45	1.807	2.078	15.042	
-3	400	190.2	1.831	2.103	14.888	
-2	400	188.3	1.854	2.124	14.556	
-1	400	185.8	1.878	2.153	14.622	
0	400	183.6	1.902	2.179	14.542	
1	400	181.23	1.926	2.207	14.605	
2	400	179	1.950	2.235	14.612	
3	400	176.7	1.974	2.264	14.702	
4	400	174.5	1.997	2.292	14.763	
5	400	172.4	2.021	2.320	14.792	
6	400	169.9	2.045	2.354	15.122	
7	400	168.4	2.069	2.375	14.810	
8	400	166.5	2.093	2.402	14.798	
9	400	164.7	2.117	2.429	14.746	
10	400	163	2.140	2.454	14.650	
11	400	161.1	2.164	2.483	14.725	
12	400	159.2	2.188	2.513	14.830	
13	400	157.3	2.212	2.543	14.966	
14	400	155.4	2.236	2.574	15.129	
15	400	153.5	2.260	2.606	15.325	
16	400	151.7	2.283	2.637	15.476	

4. SFRA



xiii.

Observations
(Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)

:

Internal Inspection Observations:

1) The contacts of the selector moving switch found normal.

2) Shunt parts inside the walls (radiator and valve winding side) look normal. 3) Electrical contacts of the shields were normal; no carbonisation was found on accessible shields. 4) Insulation rubber gaskets between the main tank base and frame found normal. 5) Carbon/black traces are noticed at bottom of frame clamping. 6) Minor heating marks & Burnt paper/carbon particles were noticed in the core lead and on top of core laminations. 7) Burnt paper/carbon particles were found on top Perma wood ring near star winding Y1 bushing. 8) Bushing connection & lead take-out area of star winding Y1 checked after dismantling the bushing; many burnt paper & carbon traces found on Star winding Y1 Bushing BCT, snout area, winding lead takeout area inside snout.			
xiv.	Probable cause of failure	:	Based on LV test results and internal inspection observations, the said converter transformer failed due to insulation failure of secondary star winding.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	YES
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits.
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Is tertiary winding provided (Yes/No)	:	NA
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NA
xxi.	Whether tertiary terminals are bare/insulated	:	NA
xxii.	Details of protection of tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	YES
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/Polymer housing)	:	OIP
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer

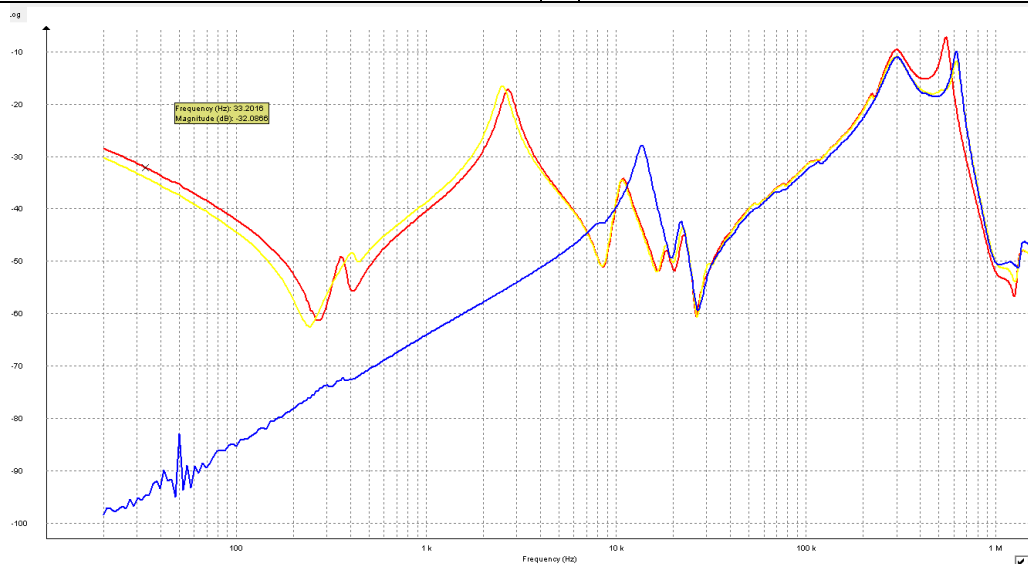
xxvi.	Tap Position of OLTC at the time of failure	:	Nominal
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	16
xxix.	Details of Protection provided for ICT/GT/Reactor	:	Differential, REF, Buchholz, PRD, WTI/OTI
xxx.	Details of Protection Operated	:	Differential trip operated
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.53
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) NO
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushing of all voltage level	:	
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system
xxxvii.	Weather conditions at the time of Failure (Clear sky/rainy/thunderstorm etc.)	:	Clear
xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	NA
xl.	Number of through faults the equipment was subjected to before failure	:	NA



Carbon & burnt paper on Star winding Y1 Bushing winding lead take-out area

24. Failure report of 500 MVA, 400/220 kV ICT at Maharanibagh Substation of Powergrid

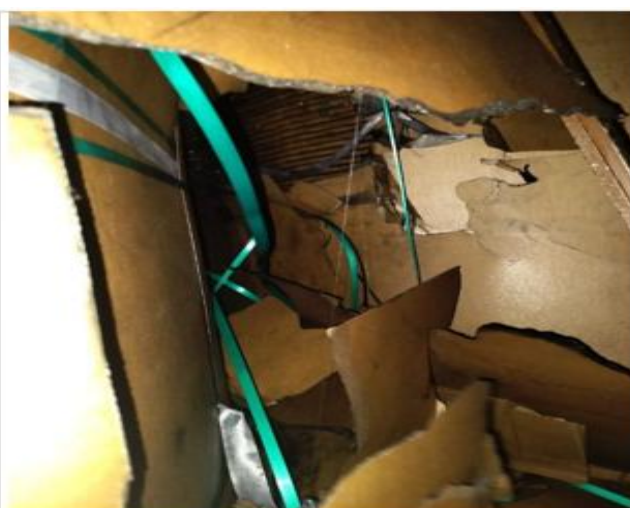
i.	Name of Substation	:	400/220 kV Maharanibagh GIS Substation
ii.	Utility	:	POWERGRID
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/ MVAR, Voltage Ratio, 1 phase/ 3 phase)	:	500 MVA, 400/220 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	CGPISL
vi.	Serial No.	:	BH-T09753/02
vii.	Date and time of occurrence of fault	:	30.10.2023 at 17:31 hrs.
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	2010
x.	Year of Commissioning	:	2010
xi.	Sequence of events/ Description of Fault (SOE with time stamp, Protection operated during fault)	:	Differential, REF, PRD, Buchholz protection operated at 17:31 Hrs on 30.10.2023
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	



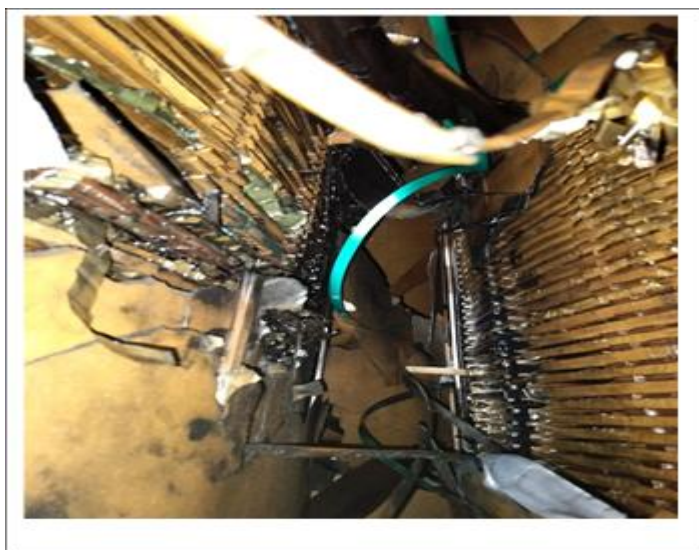
In SFRA Signature (HV-IV open circuit), B phase open circuit signature is flat.			
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)	:	
Based on the physical and internal inspection of the failed ICT & LV test report, following are the observations: 1) The main tank of ICT busted from 400 kV Y & B phase bottom bell joint. The main tank opened around 100 mm from bottom joint on HV side with huge bulging. 2) The bell tank joint bolts were found sheared with impact & spread over 10-20 meters from ICT. 3) All Oil spilled to sump pit from heavy opening mentioned at point no1. The main tank & OLTC conservator oil level was found NIL. 4) The 400 kV, 220 kV & 33 kV Bushings were found healthy, and no major impact of fault was seen on bushings. 5) Severe mechanical damage has been observed in Y & B phase OLTC. 6) Burning and heavy fire related damages have been observed in Y phase & B Phase Series winding. 7) Perma wood and insulation materials were also found shattered outside the main tank towards 400 kV side.			
xiv.	Probable cause of failure	:	Dielectric failure between Y-B phase
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	YES
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond Repair
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits.

xviii.	Details of any previous failure on the same unit	:	NA
xix.	Is tertiary winding provided (Yes/No)	:	YES
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NO
xxi.	Whether tertiary terminals are bare/insulated	:	Insulated
xxii.	Details of protection of tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	YES
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/Polymer housing)	:	OIP
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer
xxvi.	Tap Position of OLTC at the time of failure	:	Nominal
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	17
xxix.	Details of Protection provided for ICT/GT/Reactor	:	Differential, REF, Buchholz, PRD, WTI/OTI Trip
xxx.	Details of Protection Operated	:	Differential, REF, Buchholz relay, PRD trip operated
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.85 ohm
xxxiii.	Surge arrester: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) NO
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushing of all voltage level	:	
xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	
xxxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system
xxxvii.	Weather conditions at the time of Failure (Clear sky/rainy/thunderstorm etc.)	:	Clear

xxxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	NA
xl.	Number of through faults the equipment was subjected to before failure	:	NA



Broken pressboard & barriers of series winding of Y & B Phase



Y-phase to B-phase Series winding fault.

25. Failure report of 315 MVA, 400/220 kV ICT-1 at Kaithal Substation of Powergrid

i.	Name of Substation	:	400/220 kV Kaithal Substation
ii.	Utility	:	POWERGRID
iii.	Faulty Equipment (ICT/ Autotransformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/ MVAR, Voltage Ratio, 1 phase/ 3 phase)	:	400/220 kV,315 MVA,3-Phase
v.	Make (Original equipment manufacturer)	:	CGPISL
vi.	Serial No.	:	T09202/2
vii.	Date and time of occurrence of fault	:	11.05.2024 at 00.51 hrs.
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	2006
x.	Year of Commissioning	:	2007
xi.	Sequence of events/Description of Fault (SOE with time stamp, Protection operated during fault)	:	Differential, Backup Over Current, PRD, Buchholz, OTI and WTI protection operated
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	

1) Post failure DGA (ppm)

Date	H2	CH4	C2H2	C2H4	C2H6
11.05.2024	1364	974	1928	2235	174

LV test Results (Post Failure)
2) Magnetization Current Test

HV – N		
1.1-N	220	19.8 mA
1.2-N	223	3.39 mA
1.3-N	221	70 mA

3) Magnetic Balance Test

Applied Voltage	1U-1N	1V-1N	1W-1N
1U-1N	232.1	213	0.02

	1V-1N	41.13	234.2	0.02
	1W-1N	-	-	231.6
	Applied Voltage	2U-N	2V-N	2W-N
	2U-1N	230	229	0.12
	2V-1N	231.8	231.8	0.2
	2W-1N	49.4	121	222.4

From the LV test report, DGA history, Physical and internal inspection of the failed ICT, it is suspected that there is dielectric failure of B phase series winding during through fault in associated 220 kV transmission line. Due to fault in series winding, high fault current (approx. 23 kA) flown from HV side which results in development of high mechanical forces in the ICT.

xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)	:	
1) Bulging of main tank at bell joints observed on 220 kV side. 2) The transformer main tank box stiffener on tertiary and IV side found ruptured. 3) Crack observed on all 220kV bushings flange due to severe mechanical force developed inside the transformer during the fault. Minor cracks on HV bushing flange were also observed. 4) B-Phase winding geometry has changed. The top and bottom clamping ring dislocated. 5) B-Phase IV side outer cylinder found broken. HV lead connecting to OLTC lead no-3 dislodged from its original position. Copper conductor came out along with HV lead from the top disc of the series winding. 6) The top yoke frame at B-Phase HV side shifted from its original position. 7) Approximately 75 KL Oil spilled to sump pit from bell tank joint and cracked tank stiffener. The main tank & OLTC conservator oil level was NIL. 8) Burnt paper and carbon particles were found on the tank bottom.			
xiv.	Probable cause of failure	:	Dielectric failure of B-Phase winding during frequent through fault in 220 kV feeders of HBVN.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	YES
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond repair
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits.

	conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?		
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Is tertiary winding provided (Yes/ No)	:	YES
xx.	Tertiary loaded (Yes/ No) If yes, specify load on tertiary	:	YES
xxi.	Whether tertiary terminals are bare/ insulated	:	Insulated
xxii.	Details of protection of tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	YES
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing)	:	OIP
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer
xxvi.	Tap Position of OLTC at the time of failure	:	11
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	1-17 (+10%)
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, REF, Buchholz, PRD, WTI/OTI Trip, Backup Over Current,
xxx.	Details of Protection Operated	:	Differential, PRD, Buchholz, OTI and WTI trip operated
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.75 ohm
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) NO
xxxiv.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system

xxxv.	Weather conditions at the time of Failure (Clear sky/rainy/thunderstorm etc.)	:	Rainy / thunderstorm
xxxvi.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA
xxxvii.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	NA
xxxviii.	Number of through faults the equipment was subjected to before failure	:	History of frequent faults in 220 kV feeders. 04 Nos through faults occurred at the time of incidence.



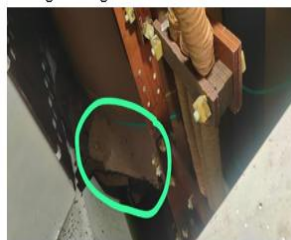
Crack observed on HV Bushings Flange



Oil gushed out



Broken Outer Cylinder – B Ph Winding



Raptured Tank Stiffener



26. Failure report of 315 MVA, 400/220 kV ICT-2 at Munirabad Substation of Powergrid

i.	Name of Substation	:	400/220 kV Munirabad Substation
ii.	Utility	:	Powergrid
iii.	Faulty Equipment (ICT/ Autotransformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/MVAR, Voltage Ratio, 1 phase/ 3 phase)	:	315 MVA, 400/220 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	BHEL
vi.	Serial No.	:	6006349
vii.	Date and time of occurrence of fault	:	07.06.2024 at 16:02 hrs.
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	2006
x.	Year of Commissioning	:	2007
xi.	Sequence of events/ Description of Fault (SOE with time stamp, Protection operated during fault)	:	Differential protection operated
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	

1) Dissolved Gas Analysis (ppm)

Date of Measurement	H ₂	CH ₄	C ₂ H ₂	C ₂ H ₄	C ₂ H ₆	CO	CO ₂
07.06.2024	165	50	81	46	3	377	3010

2) Winding Resistance Measurement

Tap Position	Winding Resistance (HV-IV)	Resistance At 75° C
R-Phase		
9(Nor) on 09.06.2024	0.2519	0.2992
Factory	0.2785	0.3234
Y-Phase		
9(Nor) on 09.06.2024	0.2427	0.2883
Factory	0.2788	0.3237
B-Phase		

9(Nor) on 09.06.2024	0.5162	0.6131
Factory	0.2795	0.3245

3) SFRA



HV to IV all open condition, deviation was observed in B-ph of HV to IV at 1 kHz to 5 kHz.

Conclusion:

- From the LV test it is observed that short circuit impedance values are violated. The % impedance of HV to IV and HV to LV are falling under 25.165% and 58.35% respectively & short circuit currents are reduced 50% and 30% compared with other phases.
- B Phase series winding resistance value is clear indicative of fault in the winding. In SFRA response, generation of new resonances is also complementing the winding resistance test results which indicates fault in B phase series winding
- There is increase of all the fault gases after tripping of ICT including high concentrations of H₂ & C₂H₂.

xiii. Observations
(Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)

1. Snout provided on B-ph HV winding lead take off was found loose.
2. Black marks were observed at the bottom of the HV winding of B-PH.
3. For detail inspection and to localize the fault, the outer barrier and press board was removed from the B-ph winding at the lead take off.
 - a) Out of 8 Nos. of winding conductors at HV lead take-off, 3 Nos. conductors was found broken.
 - b) Further, out of the 5 Nos. intact winding conductors, 2 Nos. of winding conductors were melted.
 - c) 4 Nos. disc layer conductor was melted.

d) 1 No disc layer conductor was melted and separated. e) Black marks were observed on below and above the HV winding lead take off. f) Melted residues of copper were scattered on the winding area. g) Insulation paper was damaged at the faulty area. h) Insulation paper was found in blackish and melted at some area.			
xiv.	Probable cause of failure	:	Dielectric failure of B-Phase series winding
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	NO
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Under Repair
xvii.	Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) Whether any abnormality observed in these tests. If yes, attach the test reports. What steps were taken to address the abnormality?	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits.
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Is tertiary winding provided (Yes/No)	:	YES
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NO
xxi.	Whether tertiary terminals are bare/insulated	:	Insulated
xxii.	Details of protection of tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	YES
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing)	:	OIP
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer
xxvi.	Tap Position of OLTC at the time of failure	:	Nominal
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	1-17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, REF, Buchholz, PRD, WTI/OTI Trip, Backup Over Current,
xxx.	Details of Protection Operated	:	Differential Protection operated

xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.85 ohm
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) No
xxxiv.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system
xxxv.	Weather conditions at the time of Failure (Clear sky/ rainy/ thunderstorm etc.)	:	Normal



3nos conductor was found broken.



2 No's of winding conductors were melted



4No's disc layer conductor were found melted



Black marks were observed on below the HV winding lead take off.

27. Failure report of 315 MVA, 400/220 kV ICT-1 at Kala GIS Substation of Powergrid

i.	Name of Substation	:	400/220 kV Kala Substation
ii.	Utility	:	POWERGRID
iii.	Faulty Equipment (ICT/ Autotransformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/ MVA _r , Voltage Ratio, 1 phase/ 3 phase)	:	315 MVA, 400/220 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	Vijai Electrical
vi.	Serial No.	:	90122A02
vii.	Date and time of occurrence of fault	:	21.07.2024 at 03:23 hrs
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	2013
x.	Year of Commissioning	:	2014
xi.	Sequence of events/ Description of Fault (SOE with time stamp, Protection operated during fault)	:	REF, Differential protection of B-phase along with PRV1, PRV2 & Buchholz protection
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	Magnetization current test, Magnetic Balance test, SFRA, Voltage Ratio, Winding Resistance, Winding IR

1) Dissolved Gas Analysis (ppm)

Sample	Sampling date	H ₂	CH ₄	C ₂ H ₄	C ₂ H ₆	C ₂ H ₂	CO	CO ₂
Main tank bottom	21.07.2024	1329	298	288	24	282.1	1182	12125
Main tank top	21.07.2024	1227	320	313	27	308.6	1213	12245

2) Post Failure Oil Parameters

Sample	Sample Date	BDV	Water	Res(E12)	TanD	IFT	Acidity	Flash
Main tank top	21.07.2024	52.2	10.6	144.5	0.0008	33.6	0.03	146.1

xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)	:	All IV (245 kV) bushings & mounting flanges were found cracked. Y Ph IV side LA found dislodged from mounting base. Minor crack observed at HV side Y phase box stiffener & B phase corner plate stiffeners at welding joints. Flashover marks observed from B-phase bottom tap leads to main tank. Copper on CTC Tap Leads at B Ph was found in burnt condition and copper granules observed scattered. Burnt and carbonized crepe paper scrap found at bottom near to B phase in IV side. OLTC Bakelite batons at tap selector found broken / dislodged from fastening joint in all the three phases. Wooden support of IV B phase leads was also found damaged.
xiv.	Probable cause of failure	:	Flashover between Tap winding of B-Phase (bottom side) to main tank.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	YES
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Under Repair
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits.
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Is tertiary winding provided (Yes/No)	:	YES
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	NO
xxi.	Whether tertiary terminals are bare/ insulated	:	Insulated
xxii.	Details of protection of tertiary	:	NA

xxiii.	Whether relay time is synchronized with UTC	:	YES
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing)	:	OIP
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer
xxvi.	Tap Position of OLTC at the time of failure	:	Nominal
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	1-17 (+10%)
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, REF, Buchholz, PRD, WTI/OTI Trip, Backup Over Current,
xxx.	Details of Protection Operated	:	REF, Differential protection of B-phase along with PRV1, PRV2 & Buchholz protection
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.58 ohm
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) No
xxxiv.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA
xxxv.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	NA
xxxvi.	Number of through faults the equipment was subjected to before failure	:	Frequent through faults reported earlier in 220 kV feeders.
xxxvii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system
xxxviii.	Weather conditions at the time of Failure (Clear sky/ rainy/ thunderstorm etc.)	:	Rainy/thunderstorm



Crack in 220 kV -Phase bushing flange



Crack in 220 kV Y-Phase bushing flange



Cracks in HV side plate stiffeners welding side bottom near to B phase joints towards B Phase



Burnt and carbonized crepe paper – IV



Flashover between B-phase tap lead and tank bottom

28. Failure report of 160 MVA, 220/132 kV ICT-2 at Birpara Substation of Powergrid

i.	Name of Substation	:	220/132 kV Birpara Substation
ii.	Utility	:	POWERGRID
iii.	Faulty Equipment (ICT/ Autotransformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/ MVA _r , Voltage Ratio, 1 phase/ 3 phase)	:	160 MVA, 220/132 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	BHEL
vi.	Serial No.	:	2032713
vii.	Date and time of occurrence of fault	:	30.07.2024 at 11:21 hrs.
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	2012
x.	Year of Commissioning	:	2013
xi.	Sequence of events/ Description of Fault (SOE with time stamp, Protection operated during fault)	:	Differential, PRD and Buchholz protection
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	

1) Dissolved Gas Analysis (ppm)

Date	H ₂	CH ₄	C ₂ H ₂	C ₂ H ₄	C ₂ H ₆
01/08/2024	126	53	159	104	12

2) Magnetization Current Test

HV – N		
1.1-N	241	1.546 mA
1.2-N	241	1615 mA
1.3-N	241	1.55 mA

IV – N		
2.1-N	240	3.09 mA
2.2-N	237	6700 mA

2.3-N	239	3.15 mA
-------	-----	---------

The magnetization current of 1.2-N & 2.2-N (HV & LV Y Ph – N) found to be very high in comparison to other phases.

3) Magnetic Balance Test

Applied Voltage	1U-1N	1V-1N	1W-1N
1U-1N	241.1	1.23	240.4
1V-1N	139.7	240.4	155.4
1W-1N	240.6	1.29	241.2

Voltage not induced in Y-phase winding.

4) Voltage Ratio Test

Tap Position	Measured Ratio			Rated Ratio			% Deviation		
	R	Y	B	R	Y	B	R	Y	B
12	1.601	2.311	1.607	1.67	1.67	1.67	-4.13	+38.32	-3.77

xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)	:	Flash mark observed in Y-Phase OLTC selector switch. OLTC assembly found intact in R & B-Phases. No carbon deposition found inside the transformer. No abnormality was found in HV side of transformer. Bushings are found intact with no physical damage. No physical damage observed in the main tank. No damage observed in 220 & 132 side LAs and as per operation records, there is no increment in LA counter.
xiv.	Probable cause of failure	:	Flash over in the Y-Phase OLTC selector switch

xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	NO
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Under Repair
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits.
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Is tertiary winding provided (Yes/ No)	:	NO
xx.	Whether relay time is synchronized with UTC	:	YES
xxi.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing)	:	OIP & RIP
xxii.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer
xxiii.	Tap Position of OLTC at the time of failure	:	12
xxiv.	Past record of Operation of OLTC	:	NA
xxv.	Tap Range	:	13
xxvi.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, REF, Buchholz, PRD, WTI/OTI Trip, Backup Over Current,
xxvii.	Details of Protection Operated	:	Differential, PRD and Buchholz protection
xxviii.	Whether equipment is properly earthed	:	Yes
xxix.	Earth Resistance of Substation and date of its measurement	:	0.82 Ohm
xxx.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) No
xxxi.	Type of Fire protection provided	:	Emulsifier system

	(Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)		
xxxii.	Weather conditions at the time of Failure (Clear sky/rainy/thunderstorm etc.)	:	Normal
xxxiii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA
xxxiv.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	NA
xxxv.	Number of through faults the equipment was subjected to before failure	:	NA



Flash mark on Y-Ph OLTC selector switch

29. Failure report of 160 MVA, 220/132 kV, BHEL Make Auto Power Transformer at Bhiwadi GSS of RRVPNL

i.	Name of Substation	:	220 kV GSS Bhiwadi
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	160 MVA, 220/132 kV BHEL Make Auto Power Transformer
iv.	Rating (MVA/ MVAR, Voltage ratio, 1-phase/ 3- phase)	:	220/132 kV, 160 MVA BHEL Make Auto Power Transformer
v.	Make (Original equipment manufacturer)	:	BHEL Jhansi
vi.	Serial No.	:	2034845
vii.	Date and time of occurrence of fault	:	03.29 AM on dated 24.7.2023
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	NO
ix.	Year of Manufacturing	:	2013
x.	Date of Commissioning	:	06.01.2014
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	Differential relay protection opted, High Impedance Circulating Current Y Phase Operated, O/C Y Phase High set, Buchholz Trip 1&2, Buchholz Alarm1, Master Trip 86A & 86 B Opt, B/B Protection 96 opted, PD Opted 220 kV System Tripped and transformer Caught fire, bushing damaged.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	Due to Internal Fault transformer caught fire and bushing damaged. Hence the protection Testing is not possible.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Bulging of tank, Leakage from valve and bushing, Bushing Damaged, cable burnt.
xiv.	Probable cause of failure	:	Since the Transformer got completely damaged therefore proper investigation

			could not be done. However, it seems that due to Internal Fault Transformer failed.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	CTR (NIFPES's OEM) remarks (MOM attached): From the site condition, it is observed that fire started at the bottom of transformer at due to which control cables (passing through affected area) and connected in NIFPES outdoor panel got damaged and system could not operate in AUTO and Remote Electric Mode. Hence, NIFPES was operated manually after one hour and fire was curtailed. NIFPES was checked by connecting new cables and found working satisfactorily. RRVPNL was requested to add prevention mode in the operation logic of NIFPES in order to prevent the transformer from Explosion and Subsequent fire. Had the system been commissioned with Auto Prevention Mode, transformer could have been saved immediately and much before transformer catches the fire. It was also requested to RRVPNL to carry out preventive maintenance of NIFPES time to time as per procedure given in O&M manual.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Due to Internal Fault at 03.29.32 hrs on dated 24.7.2023 transformer caught fire Hence the protection Testing is not possible and it cannot be used further for the system and transformer beyond the repair.
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Maintenance carried out on dated 4.6.2023 and following activities carried out. (1) Check Oil level, Oil level in breather, silica gel condition, Oil level in OLTC tank, air in the Main conservator Oil, Check auto starting of cooler oil pump and fans in local, remote, auto, cleaning in MK box, Ne pressure, (2) check bushing for crack and clean dirt check oil level in Bushing, Check for OLTC Driving Mechanism

			(3) Testing/Checking of PRD, Buchholz relay and OLTC surge relay, IR value, Tightening Nuts and Bolts of clamp fixture Jumper, (4) Check Temperature setting for operation of cooling fans and oil Pump, (5) Check/ maintenance of OLTC Driving Mechanism motor, shaft gear, coupling etc. No any abnormality observed
xviii.	Details of any previous failure on the same unit	:	No
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xxi.	Whether tertiary terminals are bare/ insulated	:	connected with RVT
xxii.	Details of protection for Tertiary	:	NO (NDR Alarm)
xxiii.	Whether relay time is synchronized with UTC	:	NO (static Relay)
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/polymer housing)	:	Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxvi.	Tap position of OLTC at the time of failure	:	11
xxvii.	Past record of Operation of OLTC	:	Healthy and operated
xxviii.	Tap Range	:	01 to 21
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, O/C, E/F, Buchholz, REF, High Impedance circulating, LBB, Auxiliary Protection,
xxx.	Details of Protection operated	:	Differential relay protection opted, High Imp. Circulating Current Y Phase Opt, O/C Y Phase High set, Buchholz Trip 1&2, Buchholz Alarm1, Master Trip 86A & 86 B Opt, B/B Protection 96 opted, PD Opted
xxxi.	Whether equipment is properly earthed	:	Yes, properly Earthed
xxxii.	Earth Resistance of Substation and date of its measurement	:	0.18 ohm

xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	SA provided, and healthy and SA counter reading not visible
xxxiv.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	N2 Injection Based
xxxv.	Weather conditions at the time of failure (Clear Sky /rainy/ thunderstorm etc.)	:	Cloudy
xxxvi.	Storage condition of equipment at site before commissioning: Period of storage Idle charged or uncharged Dry air filled/Nitrogen filled/ Oil filled	:	Transformer commissioning on dated 6.1.2014, Nitrogen Filled before commissioning
xxxvii.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Yes
xxxviii.	Number of through faults the equipment was subjected to before failure	:	Transformer tripped on dated 04.07.2023 on O/C Y Phase, 86, Earth wire broken and fall on 132 kV Bus



BHEL make Transformer caught fire due to internal fault.

30. Failure Report of 50 MVA, 230/33 kV Power Transformer at Veeranam Substation of TANTRANSCO

i.	Name of Substation	:	230 kV Veeranam
ii.	Utility	:	TANTRANSCO
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Power Transformer -IV
iv.	Rating (MVA/ MVAR, Voltage ratio, 1-phase/3-phase)	:	50 MVA, 230/33 kV
v.	Make (Original equipment manufacturer)	:	T&R
vi.	Serial No.	:	400022/4/143P
vii.	Date and time of occurrence of fault	:	5.10.2023/13.28 Hrs
viii.	Fault discovered during (Operation or periodic testing / maintenance)	:	Operation
ix.	Year of Manufacturing	:	2006
x.	Date of Commissioning	:	21.09.2006
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	Buchholz trip operated, LV 4 86A, 3-Phase O/L relay operated. Buchholz trip indication.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	Magnetic balance test DGA test for oil

1) Dissolved Gas Analysis (ppm)

Date	Hydrogen	Methane	Ethane	Ethylene	Acetylene
27.01.2023 (Bottom)	5	6	1	6	0.05
06.10.2023 (Top)	3	4	1	8	0.01
06.10.2023 (Bottom)	7	11	2	29	41.92
06.10.2023 (OLTC)	5	7	2	16	0.15

DGA shows slight increase in fault gases compared with previous results. This may be due to development of suspected high thermal/ arcing fault inside the Power Transformer.

2) Magnetic Balance Test

Rn	Yn	Bn	Mag Current (mA)
----	----	----	------------------

On LV side at Tap No. 11			
250 V	201 V	50 V	48.8
66.8 V	252 V	186 V	26.8
29 V	225 V	249 V	30
On HV side at Tap No. 11			
251 V	185.5 V	66.6 V	2.3
67.3 V	252 V	191 V	1.4
40.2 V	207.9 V	248.0 V	1.4
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Oil spread out from Main tank PRV.
Findings of Open Inspection on 09.10.2023 1) HV&LV Bushing terminals, OLTC tap leads terminals and both Neutral bushing terminals found intact. 2) Core coil assembly found visibly disturbed. 3) Bottom side surge rings of LV side B-phase & Y-phase found dis-located and moved out of their original position in both the coils. 4) Wooden supports beneath the surge rings of all the 3 phases found dis-located and few wooden blocks of size 300x52x40 mm found fallen at the bottom of the Main tank of HV & LV sides. 5) Two numbers broken wooden Bolts & nuts found fallen at the bottom of the Main tank in HV Side. 6) First turn of the B-phase HV coil found dis-located and bare copper was visible. 7) Burnt pieces of insulation paper found at the bottom of the Main tank mostly on the LV side. 8) No arcing marks found anywhere inside the Main Tank. 9) One number metal washer found at the bottom of the Main Tank near B-phase LV side. 10) Press boards and pressure screws on top side of coils in all the three phases are intact. 11) All the earth bands provided inside the Main Tank were found intact. 12) Two numbers of 33 kV Cable work for load sharing proposal found to be in progress. One number cable found to have terminated at one end with sheath earthed and another end is free. Both ends are free in another cable. The free ends of cable are in open condition.			
xiv.	Probable cause of failure	:	Internal fault
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Yes. From the internal observation, it is suspected that either LV-Y phase or LV-B phase coil might have deformed and collapsed. The source of Acetylene may be either of above LV coils, and the Transformer could not be rectified at site.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repair work under progress

xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Maintenance works on 18.04.2023 No, abnormalities No, abnormalities
xviii.	Details of any previous failure on the same unit	:	No
xix.	Is tertiary winding provided (Yes/No)	:	No
xx.	Whether relay time is synchronized with UTC	:	No
xxi.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	OIP Porcelain
xxii.	On Load Tap Changer or Off Circuit Tap Changer	:	ON Load
xxiii.	Tap position of OLTC at the time of failure	:	11
xxiv.	Past record of Operation of OLTC	:	Nil
xxv.	Tap Range	:	1-17
xxvi.	Details of Protection provided for ICT/ GT/ Reactor	:	O/L
xxvii.	Details of Protection operated	:	Buchholz trip
xxviii.	Whether equipment is properly earthed	:	Yes
xxix.	Earth Resistance of Substation and date of its measurement	:	19.03.2023
xxx.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) monitored
xxxi.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Clear

31. Failure report of 50 MVA, 230 kV Power Transformer at Udayathur Substation of TANTRANSCO

i.	Name of Substation	:	230/110/33 kV Udayathur WIND FARM S/s				
ii.	Utility	:	TANTRANSCO				
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Power Transformer-II 50 MVA				
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/3-phase)	:	50 MVA, 230/33 kV, 3-Phase				
v.	Make (Original equipment manufacturer)	:	ALSTOM				
vi.	Serial No.	:	B.29922				
vii.	Date and time of occurrence of fault	:	04.11.23 at 07:01 hrs				
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During 33 kV SRF III feeder fault tripping				
ix.	Year of Manufacturing	:	2005				
x.	Date of Commissioning	:	12.03.2007				
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	33 kV SRF III feeder got tripped due to fault at 6:56 Hrs with indications O/C & E/F Protection operated. Also, at 6:58 Hrs, LV-1,2,3,4 got tripped. AT 07:01 Hrs. Buchholz alarm only was noticed in Power Transformer-II panel. Power Transformer-II HV breaker H/T at 07:58 hrs.				
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	SC & OC tests, winding resistance test Magnetizing current tests (HV & LV), Core balance test, DC polarity test, Ratio test and DGA test.				

1) Dissolved Gas Analysis (ppm)							
Date	Hydro gen	Met hane	Etha ne	Ethyle ne	Acetylene	CO ₂	CO
Limits	300	300	1000	400	150	1200 0	700
27.10.2023 (Bottom)	7	277	65	531	0.01	-	-
06.11.2023 (Top)	14	498	136	1020	11.57	-	-

	06.11.2023 (Bottom)	15	628	163	1079	10.88	-	-	
	06.11.2023 (OLTC)	6	5	2	12	2.63	-	-	
DGA shows increase in fault gas level when compared with the previous test dated 27.10.2023. This may be due to development of suspected high energy thermal/arcing fault (i.e. Circulating current or overheated joints) inside the Power Transformer.									
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)				:	1. HV - Y ph Bushing lead insulation papers found loosened and symptoms of Bushing lead got shaken was found. 2. HV -B ph bushing lead found intact, packing materials below the pressure board were dislocated and wooden pieces found at the bottom of the tank. 3. Wooden pieces found over top of the core near B ph suspected to be packing materials between core step and core frame. Conclusion: From the Internal examination observation and Magnetic balance test results, it is construed, that B ph LV Coil has failed and cause for failure is suspected to be abnormal fault current in B ph at the time of 33 kV SRF.3 feeder fault trip.			
xiv.	Probable cause of failure				:	Winding Insulation failure			
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.				:	Yes. The cause for 33 kV SFR-III feeder B-phase breaker limb flash over is suspected to be either due to fault current more than the rupturing capacity of the breaker or due to sustained flow of fault current.			
xvi.	Present condition of equipment (Whether repairable or beyond repair)				:	Power Transformer-II kept out of service due to failure.			

xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	1. On 26.10.2023 Monthly maintenance carried out on Power Transformer-II. In this day Existing silica gel was replaced by new silica gel provided in all containers. Also, IR value Measured on HV to Earth and LV to Earth values are found satisfactory. 2. In the year 2023 – 5 times oil samples taken on Power Transformer-II (before failure of Transformer) test results enclosed here with.
xviii.	Details of any previous failure on the same unit	:	NIL
xix.	Is tertiary winding provided (Yes/No)	:	No
xx.	Whether relay time is synchronized with UTC	:	YES
xxi.	Bushing details (OIP/ RIP/ RIS, Porcelain / polymer housing)	:	Porcelain
xxii.	On Load Tap Changer or Off Circuit Tap Changer	:	On load Tap changer
xxiii.	Tap position of OLTC at the time of failure	:	TAP: 8
xxiv.	Past record of Operation of OLTC	:	NO
xxv.	Tap Range	:	1 to 17
xxvi.	Details of Protection provided for ICT/GT/Reactor	:	Nil
xxvii.	Details of Protection operated	:	Yes
xxviii.	Whether equipment is properly earthed	:	Yes
xxix.	Earth Resistance of Substation and date of its measurement	:	Earth resistance measured on 19.04.23. Individual value 1.2 ohm, Combined value 0.14 ohm
xxx.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	Surge arrestor Provided. Counter reading not change at the time of failure.
xxxi.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Drizzling

xxxii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ Oil filled	:	Not known
xxxiii.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Yes
xxxiv.	Number of through faults the equipment was subjected to before failure	:	No

32. Failure report of 315 MVA, 400/ 230 kV of ICT at Alamathy Substation of TANTRANSCO

i.	Name of Substation	:	Alamathy 400/230-110 kV Substation
ii.	Utility	:	Tamilnadu Transmission Corporation Ltd. (TANTRANSCO)
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/ 3-phase)	:	315 MVA, 400/230 kV
v.	Make (Original equipment manufacturer)	:	BHEL
vi.	Serial No.	:	6006118
vii.	Date and time of occurrence of fault	:	25.05.2024 at 06.32 Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During normal service
ix.	Year of Manufacturing	:	2004
x.	Date of Commissioning	:	Over hauled by M/s Shree Abirami Engineering works, Porur, Chennai and Re-commissioned on 05.12.2022
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	Enclosed as Annexure -1, as downloaded from DR &EL.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	R phase unit completely burnt and damaged due to Fire and it is beyond repairable.

xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Fire emerged from the R Phase unit of ICT 3.
xiv.	Probable cause of failure	:	Internal fault
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	Yes, M/s Shree Abirami Engineering works, Porur, Chennai representative visited on 25.05.2024.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	R Phase beyond repairable. Y & B Phase need internal examination.
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Maintenance date 01.02.2024, Annual Relay Test on: 25.10.2022 DGA: 13.02.2024 Tan Delta test on :25.10.2022 (b) No abnormality observed during in service so far and also during Annual relay testing and Maintenance works. (c) No abnormality observed
xviii.	Details of any previous failure on the same unit	:	NO
xix.	Is tertiary winding provided (Yes/No)	:	YES
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xxi.	Whether tertiary terminals are bare/insulated	:	Insulated
xxii.	Details of protection for Tertiary	:	Used only for delta connection and not loaded.
xxiii.	Whether relay time is synchronized with UTC	:	YES
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/ polymer housing)	:	OIP, Porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxvi.	Tap position of OLTC at the time of failure	:	5
xxvii.	Past record of Operation of OLTC	:	NIL
xxviii.	Tap Range	:	1 to 17

xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	1) Differential Protection 2) Buchholz relay 3) PRV for MAIN and OLTC tanks 4) NIFPS 5) Back up OC EL relay 6) Oil and Winding temp trip relays 7) OLTC surge relay.
xxx.	Details of Protection operated	:	Protection Operated details: 1. Differential trip 2. Buchholz trip 3. WTI Trip 4. OTI Trip 5. PRV Trip and 6. NIFPS operated
xxxi.	Whether equipment is properly earthed	:	Yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	Individual: 2.7 ohm Combined: 0.25 ohm Date of measurement: 24/12/2021
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) No
xxxiv.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	N2 Injection based fire protection system
xxxv.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Clear sky
xxxvi.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	Nitrogen filled at M/s Shree Abirami Engineering works while in storage.
xxxvii.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit withstand capability was verified on the basis of calculation?	:	Yes. Short circuit test was done on 21.10.22 before Re-commissioning. (Enclosed)
xxxviii.	Number of through faults the equipment was subjected to before failure	:	5

33. Failure report of 160 MVA, 3 Phase Auto-transformer at Faridpur Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Faridpur
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT / Reactor etc.)	:	Auto-transformer
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase / 3-phase)	:	160 MVA, 3 Phase
v.	Make (Original equipment manufacturer)	:	IMP
vi.	Serial No.	:	PT-7290
vii.	Date and time of occurrence of fault	:	10.08.2023
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	--
ix.	Year of Manufacturing	:	2014
x.	Date of Commissioning	:	30.09.2022
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	PRV, 86A & 86B, 67/67N
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	DGA, Short Circuit voltage Ratio, MBT
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Nil
xiv.	Probable cause of failure	:	Due to insufficiency of data, Cause of failure could not be ascertained.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	-

xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond repair
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Routine test performed (b) N/A (c) N/A
xviii.	Details of any previous failure on the same unit	:	-
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xxi.	Whether tertiary terminals are bare/insulated	:	Bare
xxii.	Details of protection for Tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing)	:	O/P
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load
xxvi.	Tap position of OLTC at the time of failure	:	13
xxvii.	Past record of Operation of OLTC	:	-
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Primary & Backup protection
xxx.	Details of Protection operated	:	
xxxi.	Whether equipment is properly earthed	:	yes
xxxii.	Earth Resistance of Substation and date of its measurement	:	<1 ohm

xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) No
xxxiv.	Type of Fire protection provided (Emulsifier system/N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier
xxxv.	Weather conditions at the time of failure (clear sky/ rainy/ thunder storm etc.)	:	Rainy
xxxvi.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/Oil filled	:	(a) 02 year (b) Idle & uncharged (c) oil filled
xxxvii.	Whether short circuit test was carried out on this transformer or same design Transformer or short circuit withstand capability was verified on the basis of calculation?	:	Yes

34. Failure report of 500 MVA, 400/220/33 kV, 3-Phase ICT at Rasara Substation of UPPTCL

i.	Name of Substation	:	400 kV GIS Rasara, Ballia
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	ICT
iv.	Rating (MVA/ MVar, Voltage ratio, 1-phase/ 3-phase)	:	500 MVA, 400/220/33 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	BHEL-Bhopal
vi.	Serial No.	:	6007901
vii.	Date and time of occurrence of fault	:	26.10.2023, 20:30 Hrs.
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Fault discovered during operation
ix.	Year of Manufacturing	:	2019
x.	Date of Commissioning	:	18.04.2022
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	1. A Flashover with loud sound from 33 kV tertiary bushing. 2. Fault time 20:34:15.038 (as per DR) and fault clear time 20:34:15.162 3. Differential 871 (RYB) operated 4. REF, PRV & Buchholz not operated.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	IR test, Tan delta of bushing & Windings, UR of CFT. Winding Resistance Measurement, Turns Ratio, Magnetic Balance test, Magnetizing current, Short circuit test, DGA of oil.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Black spots on Y & B phase of tertiary bushing due to heavy flashover, oil spillage from inspection cover near tertiary bushing.
xiv.	Probable cause of failure	:	Insulation failure

xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	On –site inspection done by BHEL-Bhopal representative. Nothing found during visual inspection. Manufacturer decided further testing & repairing at their works.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Repairable
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) ICT commissioned on 18.04.2022 (b) No (c) No abnormality during pre-commissioned test.
xviii.	Details of any previous failure on the same unit	:	None
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xxi.	Whether tertiary terminals are bare/ insulated	:	Bare
xxii.	Details of protection for Tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/RIP/RIS, Porcelain/ polymer housing)	:	OIP porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer
xxvi.	Tap position of OLTC at the time of failure	:	9b
xxvii.	Past record of Operation of OLTC	:	No operation
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT /GT/ Reactor	:	Differential, REF, Over fluxing, back up O/C & E/F at HV & IV, PRV, buchholz, OSR.

xxx.	Details of Protection operated	:	Yes
xxxi.	Whether equipment is properly earthed	:	0.02 ohms as measured on 24.01.2023
xxxii.	Earth Resistance of Substation and date of its measurement	:	
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) No
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	Switching impulse withstand voltage of the HV terminals (1U,1V,1W)=1050 kVp Lighting impulse voltage withstand voltage of HV terminals (1u, 1V, 1W)-FW 1300 kVp, CW 1430 kVp. Lightning impulse voltage withstand voltage of IV terminals (2U, 2V, 2W) = FW 950 kVp, CW 1045 kVp. Lightning impulse voltage withstand voltage of LV terminals (3U, 3V, 3W) = FW 250 kVp, CW 275 kVp.
xxxv.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier & NIFPS
xxxvi.	Weather conditions at the time of failure (clear sky/ rainy/ thunder storm etc.)	:	Clear sky
xxxvii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/Oil filled	:	(a) 7 months (b) uncharged (c) Oil filled

xxxviii.	Whether short circuit test was carried out on this transformer or same design Transformer or short circuit withstand Capability was verified on the basis of calculation?	:	On calculation basis
xxxix.	Number of through faults the equipment was subjected to before failure	:	1 (Transformer tripped due to overloading)

35. Failure report of 400/220/33 kV, 240 MVA 3 Phase ICT at Gorakhpur Substation of UPPTCL

i.	Name of Substation	:	400 kV S/s Gorakhpur
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	ICT/ Autotransformer
iv.	Rating (MVA/ MVA _r , Voltage ratio, 1-phase/ 3-phase)	:	240 MVA, 400/220/33 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	Hitachi
vi.	Serial No.	:	71128-1
vii.	Date and time of occurrence of fault	:	11.11.2023,15:51Hrs.
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Fault discovered during operation
ix.	Year of Manufacturing	:	1979
x.	Date of Commissioning	:	10.04.2019
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	Differential 871 (RYB) operated 2nd Harmonics block, PRV, buchholz alarm & trip, 86A/ 86B/ 86LBB trip.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	IR test, Tan delta of bushing and windings Magnetic balance test, Magnetizing current, Short circuit test.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Leakage of oil from HV R-Phase and tertiary.
xiv.	Probable cause of failure	:	Insulation failure
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	NA

xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(b) No
xviii.	Details of any previous failure on the same unit	:	None
xix.	Is tertiary winding provided (Yes/No)	:	Yes
xx.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xxi.	Whether tertiary terminals are bare/insulated	:	Insulated
xxii.	Details of protection for Tertiary	:	NA
xxiii.	Whether relay time is synchronized with UTC	:	Yes
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	OIP porcelain
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	On load tap changer
xxvi.	Tap position of OLTC at the time of failure	:	11
xxvii.	Past record of Operation of OLTC	:	NA
xxviii.	Tap Range	:	1 to 17
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, REF, Overfluxing, back up O/C & E/F at HV & IV, PRV, buchholz, OSR.
xxx.	Details of Protection operated	:	Differential 87T (R, Y, B) operated, 2nd harmonics block, PRV, buchholz alarm & trip, 86A/86B/86LBB trip.
xxxi.	Whether equipment is properly earthed	:	Yes

xxxii.	Earth Resistance of Substation and date of its measurement	:	0.2 ohms as measured on 25.01.2023
xxxiii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) No
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	Switching impulse withstand voltage of the HV terminals (1U,1V,1W)=1080 kVp lighting impulse voltage withstand voltage of HV terminals (1u,1V,1W)-FW 1300 kVp, Lightning impulse voltage withstand voltage of IV terminals (2U,2V,2W)=FW 900 kVp, Lightning impulse voltage withstand voltage of LV terminals (3U,3V,3W)=FW 200 kVp.
xxxv.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier
xxxvi.	Weather conditions at the time of failure (clear sky/ rainy/ thunder storm etc.)	:	Clear sky
xxxvii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/Oil filled	:	(a) 7 months (b) uncharged (c) Oil filled
xxxviii.	Whether short circuit test was carried out on this transformer or same design Transformer or short circuit withstand Capability was verified on the basis of calculation?	:	On calculation basis
xxxix.	Number of through faults the equipment was subjected to before failure	:	1 (T/F tripped due to overloading)

36. Failure report of 100 MVA, 220/132 kV Auto Transformer at Bhartna Substation Etawah of UPPTCL

i.	Name of Substation	:	220 kV Bhartna S/s, Etawah
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment (ICT/Auto-transformer/GT/Reactor etc.)	:	Auto Transformer
iv.	Rating (MVA/MVAR, Voltage ratio, 1-phase/3- phase)	:	100 MVA 220/132 kV, 3 Phase
v.	Make (Original equipment manufacturer)	:	CGL
vi.	Serial No.	:	23387
vii.	Date and time of occurrence of fault	:	18.09.2024, 6:55 Hrs.
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
ix.	Year of Manufacturing	:	1972
x.	Date of Commissioning	:	04.08.2008
xi.	Sequence of events/Description of fault (SOE with time stamp, Protection operated during fault)	:	Differential Protection. 22ms
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	Ratio test, Magnetic Current Magnetic balance, Vector Balance S/C test, IR value oil test etc.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Damage to various components of Transformer
xiv.	Probable cause of failure	:	Internal Fault
xv.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond repair (after service of 5/years)

xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Magnetic Current, Magnetic Balance, Ratio test, Vector Balance, S/c test oil test. No -
xvii.	Details of any previous failure on the same unit	:	01/No LV Bushing & Y8 OLTC
xviii.	Is tertiary winding provided (Yes/No)	:	Yes
xix.	Tertiary loaded (Yes/No) If yes, specify load on tertiary	:	No
xx.	Whether tertiary terminals are bare/insulated	:	Insulated
xxi.	Details of protection for Tertiary	:	--
xxii.	Whether relay time is synchronized with UTC	:	-
xxiii.	Bushing details (OIP/RIP/RIS, Porcelain/ polymer housing)	:	OIP
xxiv.	On Load Tap Changer or Off Circuit Tap Changer	:	On Load Tap Changer
xxv.	Tap position of OLTC at the time of failure	:	13
xxvi.	Past record of Operation of OLTC	:	-
xxvii.	Tap Range	:	1-17
xxviii.	Details of Protection provided for ICT/GT/Reactor	:	--
xxix.	Details of Protection operated	:	Differential Protection, Buchholz trip, OTI, Backup Protection
xxx.	Whether equipment is properly earthed	:	Yes
xxxi.	Earth Resistance of Substation and date of its measurement	:	Yes

xxxii.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes
xxxiii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier System
xxxiv.	Weather conditions at the time of failure (clear sky/ rainy/ thunder storm etc.)	:	Rainy

37. Failure of 125 MVar, 400 kV Bus Reactor at Kadarpur Substation of IndiGrid

i.	Name of Substation	:	GPTL-400/220kV GIS Kadarpur Substation.
ii.	Utility	:	IndiGrid
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Bus Reactor
iv.	Rating (MVA/MVar, Voltage ratio, 1-phase/3-phase)	:	125 MVar, 400 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	GE
vi.	Serial No.	:	T-7120/3 B-31163
vii.	Date and time of occurrence of fault	:	03.08.2024 at 03:51Hrs
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During charging of Reactor
ix.	Year of Manufacturing	:	2018
x.	Date of Commissioning	:	December 2019
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	125 MVar Bus Reactor (Make: GE) got tripped while taking into service at 03:51 AM on 3rd August 2024. All electrical (i.e. Differential, REF) and other Auxiliary protection (i.e. Bucholz, PRV and WTI/OTI) operated.
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure? If no tests were conducted, reasons for the same may be stated.)	:	LV tests
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	Flashover marks on turrets and bulging observed on front side tank body. When the PRD and NIFPS operated during the incident, oil leaked out and drained.
xiv.	Probable cause of failure	:	Preliminary site Internal inspection completed, however RCA from OEM is awaited. However, some internal fault appears to be in Transformer.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	OEM's engineers visited Kadarpur Substation on 07.08.24 and done the Bus reactor preliminary internal inspection.
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	After completion of internal inspection reactor filled with dry air.

xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) 2 yearly maintenance activity performed, during maintenance Bushing Tan δ and Capacitance, Winding Tan δ and capacitance testing done. (b) No (c) Not Applicable
xviii.	Details of any previous failure on the same unit	:	No.
xix.	Whether relay time is synchronized with UTC	:	Yes
xx.	Bushing details (OIP/RIP/RIS, Porcelain/polymer housing)	:	Oil to SF6 (RIP)
xxi.	Details of Protection provided for ICT/ GT/ Reactor	:	REF, Differential Protection, Backup impedance, Buchholz Relay, PRV 1&2, WTI, OTI and NIFPES.
xxii.	Details of Protection operated	:	REF, Differential, Buchholz Relay, PRV 1&2, WTI, OTI and NIFPS.
xxiii.	Whether equipment is properly earthed	:	Yes
xxiv.	Earth Resistance of Substation and date of its measurement	:	With Grid-0.43 Ω /Without Grid-3.52 Ω , Tested date: 08/12/2023 Due Date: 08/12/2024
xxv.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) SA protection provided. (b) Yes (c) No
xxvi.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	HV – LIWL: 1425 kVp, SIWL: 1050 kVp Neutral – LIWL: 650 kVp
xxvii.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	HV – LIWL: 1300 kVp, SIWL: 1050 kVp Neutral – 550 kVp
xxviii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/foam-based protection etc.)	:	NIFPS
xxix.	Weather conditions at the time of failure (clear sky/rainy/thunderstorm etc.)	:	Cloudy



xxx.	Storage condition of equipment at site before commissioning: Period of storage Idle charged or uncharged Dry air filled/Nitrogen filled/ Oil filled	:	This Equipment was directly delivered from the factory with, fully charged with N2 filled during commissioning, this equipment is healthy since charging.
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38. Failure report of 50 MVA, 420 kV Bus Reactor at Balipara Substation of Power grid

i.	Name of Substation	:	400/220 kV Balipara S/s
ii.	Utility	:	POWERGRID
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Reactor
iv.	Rating (MVA/ MVA, Voltage Ratio, 1-phase/ 3-phase)	:	50 MVA, 420 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	BHEL
vi.	Serial No.	:	6005276
vii.	Date and time of occurrence of fault	:	14.08.2023 at 00:29:52 Hrs
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	1993
x.	Year of Commissioning	:	1998
xi.	Sequence of events/Description of Fault (SOE with time stamp, Protection operated during fault)	:	Buchholz relay & PRD trip operated at 00:29:52 Hrs on 14.08.2023
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	DGA & LV tests

1) Dissolved Gas Analysis (ppm)

Date of Sampling	H ₂	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₂ H ₂	CO	CO ₂
14.08.2023 (Top Sample)	297	2	36	83	88.1	226	1729
14.08.2023 (Bottom Sample)	294	4	36	84	86.3	229	1748

2) Magnetizing Current Test

Magnetizing current in mA		
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Phase	Precomm after Bushing Replace	After tripping
R Phase	229 V / 65.6 mA	234 V / 66.3 mA
Y Phase	228 V / 64.1 mA	235 V / 48.4 mA
B Phase	230 V / 66.1 mA	234V / 66.4 mA

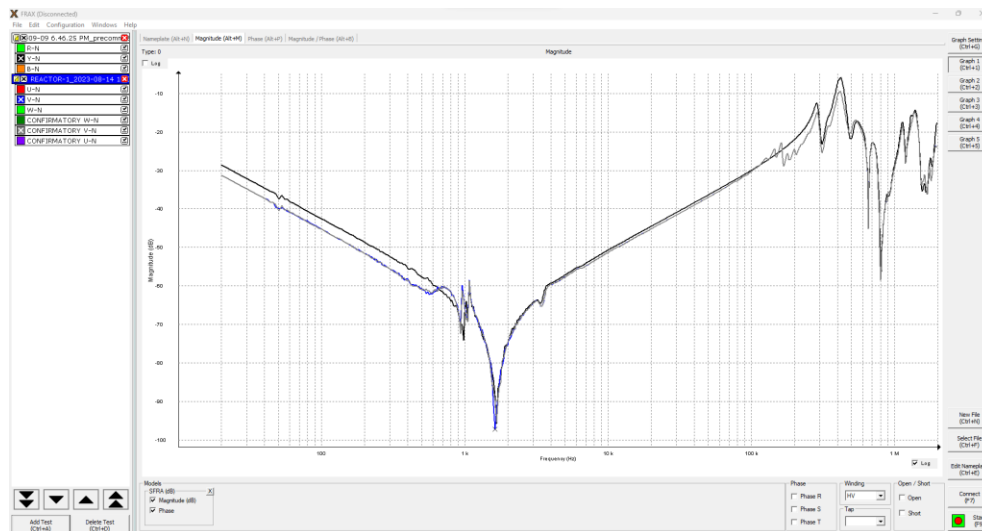
Conclusion: Violation in Y-ph magnetizing current is observed.

3) Insulation Resistance Test

Phase	09.09.2019	09.07.2021	After Fault- 14.08.2023
CL-G	680 MΩ	572 MΩ	213 MΩ
CC-G	530 MΩ	440 MΩ	0 MΩ
CC-CL	610 MΩ	620 MΩ	209 MΩ

Conclusion: Insulation Resistance of CC-G is observed as Zero.

4) SFRA: Y Phase Pre-commissioning (09.09.2019) vs After fault.



Conclusion: Deviation is SFRA observed.

xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)	:	The insulating oil spilled out from PRD and gas traces were found in Buchholz relay.
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Internal inspection has been carried out and observation are followings:

- Lead exit tube of Y-Ph winding was removed and insulation burnt marks observed on the winding lead exit (snout).

- b) After removing the bushing leads, it was found that Y-Phase winding near bottom take-off point is severely burnt, and the winding conductors were broken and came out.
- c) Carbon particles & burnt crepe paper noticed on the tank floor and on the lead exit support of HV Y phase winding.
- d) The bushing lead connections of R, Y & B HV side windings were checked visually, and no burnt mark/black spot observed.

No dislocation of winding press boards and supports were seen inside the tank.

xiv.	Probable cause of failure	:	Inter-turn insulation failure
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	Yes
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond Repair
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits.
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Whether relay time is synchronized with UTC	:	YES
xx.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing)	:	OIP
xxi.	On Load Tap Changer or Off Circuit Tap Changer	:	NA
xxii.	Details of Protection provided for ICT/GT/Reactor	:	Differential, REF, Backup Impedance, Buchholz, PRD, WTI Trip, OTI Trip
xxiii.	Details of Protection Operated	:	Buchholz relay, PRD trip operated
xxiv.	Whether equipment is properly earthed	:	Yes
xxv.	Earth Resistance of Substation and date of its measurement	:	0.64 ohm
xxvi.	Surge arrestor: (a) Is SA provided for protection	:	(a) Yes (b) Yes

	(b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure		(c) NO
xxvii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system
xxviii.	Weather conditions at the time of Failure (Clear sky/ rainy/ thunderstorm etc.)	:	Clear
xxix.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA



Damage at HV take-off point Y-Ph winding.



Carbon powder on lead exit support



Carbon Powder on tank floor

39. Failure report of 80 MVA, 765 kV Line Reactor at Srikakulam Substation

i.	Name of Substation	:	765/400 kV Srikakulam S/s
ii.	Utility	:	POWERGRID
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	Reactor
iv.	Rating (MVA/ MVA _r , Voltage Ratio, 1 phase/ 3 phase)	:	80 MVA _r , 765 kV, 1-Phase
v.	Make (Original equipment manufacturer)	:	ABB
vi.	Serial No.	:	15026/08
vii.	Date and time of occurrence of fault	:	12.05.2024 at 20:51 Hrs.
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	Operation
ix.	Year of Manufacturing	:	2016
x.	Year of Commissioning	:	2017
xi.	Sequence of events/Description of Fault (SOE with time stamp, Protection operated during fault)	:	PRD-1&2 protection operated
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	DGA & LV tests

1) Dissolved Gas Analysis (ppm)

Sample Date	H2	CH4	C2H4	C2H6	C2H2	CO	CO2	CO2/CO
14.05.2024	171	386	907	123	805.6	305	1506	4.93

2) Winding Resistance Test

Winding Resistance (HV-N) @ 31 °C	Resistance at 75° C	Pre-commissioning Value At 75° C	% Deviation
3.612	4.209	1.9768	+112.94%

xiii.	Observations	:	
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	(Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)		
	1) Main tank got ruptured and cracks observed at tank corner welding joints and stiffeners at HV side. 2) HV side bottom inspection cover shattered and found 2mtrs away from the reactor with pressboard and paper insulation came out from the opening. 3) Complete oil gushed out from the main tank. 4) PNRV was kept in auto mode and same was found in operated condition accordingly, oil was found in conservator and MOG is also found OK. 5) PRD-1 completely damaged and fell on the ground. 6) HV Bushing got damaged during incidence and insulator parts were scattered around the reactor. 7) No oil was found in Neutral bushing.		
xiv.	Probable cause of failure	:	Flashover/ arcing across the winding in bottom part.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	Yes
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Beyond Repair
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	All maintenance activities were carried out as per POWERGRID norms and results were within acceptable limits.
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Whether relay time is synchronized with UTC	:	YES
xx.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing)	:	OIP
xxi.	Details of Protection provided for ICT/ GT/ Reactor	:	Differential, REF, Backup Impedance, Buchholz, PRD, WTI Trip, OTI Trip
xxii.	Details of Protection Operated	:	PRD trip operated

xxiii.	Whether equipment is properly earthed	:	Yes
xxiv.	Earth Resistance of Substation and date of its measurement	:	0.71
xxv.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) NO
xxvi.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system
xxvii.	Weather conditions at the time of Failure (Clear sky/ rainy/ thunderstorm etc.)	:	Rainy
xxviii.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA



HV lead take out was found dislocated



Hv winding discs were found severely burnt



Physical damage of HV bushing



HV side inspection cover got busted and found 2mtrs away from the reactor. Also, pressboard and paper insulation were came out.



Main tank ruptured & cracks observed at stiffeners



Top side main tank ruptured near HV bushing.

40. Failure report of 50 MVA, 400 kV Bus Reactor at Ramgarh Jaisalmer Substation of RRVPNL

i.	Name of Substation	:	400 kV GSS Ramgarh, Jaisalmer
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment (ICT/ Autotransformer/ GT/ Reactor etc.)	:	Reactor
iv.	Rating (MVA/ MVA, Voltage Ratio, 1 phase/ 3 phase)	:	50 MVA, 400 kV, 3-Phase
v.	Make (Original equipment manufacturer)	:	BHEL
vi.	Serial No.	:	6007650
vii.	Date and time of occurrence of fault	:	09.05.2024 at 02:11 hrs.
viii.	Fault discovered during (Operation or periodic testing/ Maintenance)	:	No
ix.	Year of Manufacturing	:	2017
x.	Year of Commissioning	:	06.12.2017
xi.	Sequence of events/ Description of Fault (SOE with time stamp, Protection operated during fault)	:	21 R, R, Y, B Ph Z1, Z4, PSB opt o/c
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no test were conducted, reason for the same may be stated)	:	It is found that all the bushing and body of the reactor and wiring are completely damaged. In such condition the test of said reactor is quite impossible.
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment/ Material etc.)	:	Tank body busted (welding joint open)
xiv.	Probable cause of failure	:	The Cause of failure could not be ascertained as the post failure test could not be conducted due to complete damage of the Reactor. However, it appears that there is internal fault in the Reactor.
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MOM etc. may be attached.	:	NO- in progress
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	Seem to be completely failure, beyond repairable
xvii.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities)	:	10-09-2023 clearing and tightening.

	(b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?		NO
xviii.	Details of any previous failure on the same unit	:	NA
xix.	Whether relay time is synchronized with UTC	:	YES
xx.	Bushing details (OIP/ RIP/ RIS, Porcelain/ Polymer housing)	:	OIP PORCELAIN
xxi.	Details of Protection provided for ICT/ GT/ Reactor	:	PRD and Buchholz
xxii.	Details of Protection Operated	:	Differential, PRD and Buchholz protection
xxiii.	Whether equipment is properly earthed	:	Yes
xxiv.	Earth Resistance of Substation and date of its measurement	:	0.53 Ohm 27-03-21
xxv.	Surge arrestor: (a) Is SA provided for protection (b) Whether healthiness of SA is monitored (c) Whether reading of SA counter changed during failure	:	(a) Yes (b) Yes (c) NO
xxvi.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushing of all voltage level	:	1300 kVp 1050 kVp
xxvii.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	1300 kVp 1050 kVp
xxviii.	Type of Fire protection provided (Emulsifier system/ N2 Injection based fire protection system/ foam based protection etc.)	:	Emulsifier system
xxix.	Weather conditions at the time of Failure (Clear sky/ rainy/ thunderstorm etc.)	:	Clear
xxx.	Storage condition of equipment at site before commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/ Nitrogen filled/ Oil filled	:	NA
xxxi.	Number of through faults the equipment was subjected to before failure	:	2

41. Failure report of 420 kV CT at HVDC Mundra Substation of Adani Transmission Ltd

i.	Name of Substation	:	HVDC Mundra
ii.	Utility	:	Adani
iii.	Faulty Equipment and the associated feeder	:	10C01C-YPH
iv.	Rating	:	420 kV, 3000 A
v.	Short circuit withstand current and duration	:	40 kA/ 1 Sec
vi.	Make	:	SIEMENS
vii.	Serial No.	:	4CT113
viii.	Date and time of occurrence of fault	:	06.02.2023, 10:37 Hrs
ix.	Fault discovered during	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2012
xii.	Date of commissioning	:	2013
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	No
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Since damages were substantial, RCA could not be done
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	No abnormality noticed.

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No any Previous failure
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Sequence of events attached
xix.	Details of protection operated	:	Rupture Disc Operation
xx.	Details of tests done after failure	:	Yes
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No
xxii.	Probable cause of failure	:	Damage of internal shell due to vibrations

42. Failure report of 220 kV CT at Tallapally Substation of APTRANSCO

i.	Name of Substation	:	220 kV, Tallapally
ii.	Utility	:	APTRANSCO
iii.	Faulty Equipment and the associated feeder	:	220 kV CT at 220 kV TPL-Rentachintala-2 feeder, Y-Phase
iv.	Rating (Voltage/ current/ current-ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV, 960 A
v.	Short circuit withstand current and duration	:	40 kA/ 1sec
vi.	Make (Original equipment manufacturer)	:	GE T&D
vii.	Serial No.	:	37994026426
viii.	Date and time of occurrence of fault	:	31.07.2024 at 10:22 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	--
x.	Weather conditions at the time of failure (Clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2019
xii.	Date of commissioning	:	07-06-2023
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not Applicable
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Yearly measuring IR values CT on 01.06.2024. R-Phase: 4.30 Gohm, Y-Phase: 4.20 Gohm, B-Phase: 4.35 Gohm. Tan delta values measured on 07-06-2023, R-Phase:0.07, Y-Phase: 0.08, B-Phase : 0.09
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	--

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	On 31-07-2024 at 10:22 hrs, at 220 kV switching station Tallapalli the 220 kV GE Make Y Phase CT in 220 kV TPL-Rentachintala-2 feeder blasted due to internal fault and Bus-Bar protection operated and causes tripping of all 220 kV feeders on Bus-1&3 at 220 kV S/s Tallapalli. 220 kV Rentachintala-2 feeder kept isolated and all the remaining feeders taken into service one by one. After replacing the failed GE make CT with new CG power make CT for 220 kV TPL-Rentachintala-2 feeder in Y phase and then feeder taken into service at 06:55 Hrs on 01-08-2024
xix.	Details of protection operated	:	--
xx.	Details of tests done after failure	:	CT blasted and replaced with a new one, then MRT wing conducted all the necessary tests before charging the feeder and also conducted signature analysis and Fault line locator test by EHT lines wing Tallapalli.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Normal
xxii.	Probable cause of failure	:	Internal Fault

43. Failure report of 220 kV CT at Gadag Substation of KPTCL

i.	Name of Substation	:	220/110 kV S/s Gadag
ii.	Utility	:	KPTCL
iii.	Faulty Equipment and the associated feeder	:	Current Transformer (1200-600/1-1-1-1).
iv.	Rating (Voltage/ current/ current-ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV Class (Y Phase 220 kV Gadag- Doni Line-2)
v.	Short circuit with stand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	ABB
vii.	Serial No.	:	ID 220020
viii.	Date and time of occurrence of fault	:	10.6.2024 at 20:15 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operational during in normal service.
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Heavy rain with thunder and lighting
xi.	Year of manufacturing	:	April-1996
xii.	Date of commissioning	:	29.03.1999
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not applicable
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	--
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Equipment faulty, faulty equipment replaced by new one and charged line in presence of RT Staff Hubballi at 21:17 Hrs on 11.6.2024 (Make BHEL, SL.no: 2457904, YOM:2012)
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	IR Test on 18.12.2003

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Gadag- Doni line-2 tripped on Over current relay due to Y Phase CT of 220 kV Class was Faulty (CT Jump opened)
xix.	Details of protection operated	:	-
xx.	Details of tests done after failure	:	Physical inspection, small holes found in top of the C.T. and oil Spill over.
xxi.	Observations	:	Nil
xxii.	Probable cause of failure	:	Ageing

44. Failure report of 220 kV CT at Chhegaon Substation MPPTCL

i.	Name of Substation	:	400 kV S/s Chhegaon
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	R Phase CT Brust 220 kV SSTPH-
iv.	Rating	:	220 kV, 800/ 1
v.	Short circuit withstand current and duration	:	9066 A, Duration- 28 msec.
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	2014/ 53310
viii.	Date and time of occurrence of fault	:	15.07.2023 at 21:47 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	NA
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	2014
xii.	Date of commissioning	:	23.11.2014
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Burst
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) IR value of C.T. on dated 12.06.2021 (b) No
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NO

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	On dated 15.07.2023 at 21:47 hrs. 220 kV Bus bar Protection operated due to failure of R-Phase 220 kV CT of SSTP11-11 Feeder. Simultaneously 8 No. 220 kV feeder, 4 No. 220 kV class Transformer, 1 No. 220 kV Bus tie & 2 No. 220 kV Incoming I & II of 315 MVA Transformer Tripped.
xix.	Details of protection operated	:	220 kV Bus Bar operated
xx.	Details of tests done after failure	:	Installed new C.T. after testing Tan Delta, IR Value of polarity
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NO
xxii.	Probable cause of failure	:	As the CT got burst so cause of failure could not be determined.

45. Failure report of 220 kV CT at Shivpur Substation of MPPTCL

i.	Name of Substation	:	220 kV S/s Shivpur
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	Y Phase 220 kV CT of 160 MVA Transformer
iv.	Rating (Voltage/ current/ current-ratio/ capacitance/ MCOV etc., as applicable)	:	800/ 1-1-1-1-1 1
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	MEHRU
vii.	Serial No.	:	OC5395/1/35/14
viii.	Date and time of occurrence of fault	:	19.07.2023 at 23:48 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Service
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Cloudy
xi.	Year of manufacturing	:	2014
xii.	Date of commissioning	:	18.03.2016
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Replaced
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Previous maintenance Dt. 18.07.2023 (b) High Tan Delta observed 2.41% and Capacitance 667.7 pF (c) Oder for PD test of 220 kV CT was done by SE T&C Guna test was going to be done in next 10 days.
xvii.	Details of previous failure	:	NO

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	On 19.07.2023 at 23:48 hrs, 160 MVA Transformer tripped on Differential Relay, during inspection Y phase 220 kV CT was found failed.
xix.	Details of protection operated	:	Differential Protection Operated
xx.	Details of tests done after failure	:	LT testing, AC/DC testing done
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Nil
xxii.	Probable cause of failure	:	Insulation failure

46. Failure report of 400 kV CT at Chandrapur Substation of MSETCL

i.	Name of Substation	:	HVDC Terminal Station, Chandrapur
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	400 kV BHEL make Y-ph C.T. of 400 kV incomer Pole-1 bay
iv.	Rating (Voltage/ current/ current-ratio/ capacitance/ MCOV etc., as applicable)	:	400 kV, 7 Core, 2000/1, 2800 Amp C.T.
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	BHEL make
vii.	Serial No.	:	6160911
viii.	Date and time of occurrence of fault	:	29.09.2023 @ 11:23 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	1996
xii.	Date of commissioning	:	1999
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not Available as commissioning in 1997
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Already contacted OEM after failure and reply is awaited.
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) Whether any abnormality observed in these tests. If yes, attach the test reports. What steps were taken to address the abnormality?	:	28.11.2022, no abnormalities were observed.
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	On date 29.09.2023 at 11:23 Hrs, Fire incidence occurred on P1 400 kV Incomer Bay CT. Power ramp down at 11:27 Hrs & Breaker hand tripped at 11:29 Hrs
xix.	Details of protection operated	:	NIL
xx.	Details of tests done after failure	:	Tests cannot be carried out as CT burnt.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CT burnt
xxii.	Probable cause of failure	:	Suspected insulation failure due to aging. Note: Fire observed on CT Stud therefore 400 kV Chandrapur GCR HVDC Pole 1 Converter CB Hand tripped, to avoid further tripping.

47. Failure report of 220 kV CT at Koradi -II Substation of MSETCL

i.	Name of Substation	:	400 kV Koradi -II
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Buttibori Ckt-2, CT
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 800/1A.
v.	Short circuit withstand current and duration	:	40 kA for 1 sec
vi.	Make (Original equipment manufacturer)	:	BHEL
vii.	Serial No.	:	2454864
viii.	Date and time of occurrence of fault	:	Date 30.09.2024 at 00:34hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Not Applicable
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	clear
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	28.03.2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Commissioned under project.
xiv.	If OEM was contacted after failure, its recommendation / remark / report / MOM	:	No.
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Burnt completely
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Tan delta measurement carried out on dated 26.10.2023. (b) Abnormality is not observed (c) Not applicable
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil.

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Insulation failure, which resulted in burst of CT.
xix.	Details of protection operated	:	Distance protection operated
xx.	Details of tests done after failure	:	100% Burnt, it is not possible to carry out the tests.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Other switchyard equipment damaged due to failure
xxii.	Probable cause of failure	:	Insulation failure

48. Failure Report of 220 kV CT at Airoli Knowledge Park Substation of MSETCL

i.	Name of Substation	:	220/22 kV Airoli Knowledge Park
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Kalwa Line Y phase CT
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	40 kA/ 1 Sec
vi.	Make (Original equipment manufacturer)	:	Areva T&D India Ltd.
vii.	Serial No.	:	42090600798
viii.	Date and time of occurrence of fault	:	03.11.2024 at 19:25Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	At the time of line CB OFF of 220 kV AKP Nashik Line at AKP Substation, 220 kV AKP Kalwa line Y ph CT to line Isolator conductor snapped at 220 kV AKP substation along with heavy sparking observed at Y ph CT
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2008
xii.	Date of commissioning	:	22.03.2010
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Physically Damaged. CT replaced with new CT.
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) CT tan delta & IR was taken on 08.01.2024 and results found within prescribed limit. (b) No abnormalities observed in previous testing. (c) NA

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	1) Outage taken on 220 kV AKP NASHIK line by EHV Line maintenance Padgha in 19:25 hrs as per LD code 50. 2) At the time of line CB OFF at AKP Substation, 220 kV AKP Kalwa line Y ph CT to line Isolator conductor snapped due to hot spot at 220 kV AKP substation along with heavy sparking observed at Y ph CT. At the same time 220 kV AKP KALWA line tripped at kalwa end only and the CB remained ON at AKP end. Thus, 220 kV AKP Substation went into dark in 19:25hrs. Further, 220 kV AKP Kalwa Line CB hand tripped immediately. Busbar protection was out of service.
xix.	Details of protection operated	:	Distance protection operated at another end i.e. at Kalwa end (Distance-0.9 km from Kalwa end)
xx.	Details of tests done after failure	:	IR taken on 05.11.2024 and found normal
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	During 220 kV Yard inspection carried out & found the 220 kV Kalwa line Y phase CT to line isolator conductor snapped, CB operated at Kalwa end & AkP end CB was on 'ON' condition.
xxii.	Probable cause of failure	:	CT Physically damaged due to snapping jumper from CT to line.

49. Failure report of 220 kV CT at Apta Substation of MSETCL

i.	Name of Substation	:	220 kV Apta
ii.	Utility	:	220 kV Y ph Bus Sectionalizer CT
iii.	Faulty Equipment and the associated feeder	:	200 kV Bus sectionalizer
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	800-400/1, 5C, 0.2S
v.	Short circuit withstand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	MEHRU
vii.	Serial No.	:	OC-2064/2/204/01
viii.	Date and time of occurrence of fault	:	25.11.2024 20 :45 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	20:45
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Normal/ Dry, clean
xi.	Year of manufacturing	:	2008
xii.	Date of commissioning	:	07.02.2009
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation / remark / report / MOM	:	The failed CT was not in Guaranty period hence not contacted to Mehru.
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Ok
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) On date 20.3.2023 CT tan delta measurement done, TAN DELTA (0.344%), CAPACITANCE (539.5 pf) (b) No Abnormality found
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	
xix.	Details of protection operated	:	W/I :- Bus bar protection zone A operated & Bus Bar Protection Zone B operated R/I :- Bus Bar relay operated; Master trip relay operated
xx.	Details of tests done after failure	:	NA Due to equipment burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Visual inspection done while checking the CT was found burning
xxii.	Probable cause of failure	:	Ageing
xxiii.	Remark	:	220 kV Apta Substation dark due to Y-ph CT of 220 kV Bus sectionalizer burst.

50. Failure Report of 400 kV CT at Chakan Substation of MSETCL

i.	Name of Substation	:	400 kV Chakan
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	400 kV Lonikand Bay B-ph CT
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	400 kV (2000 - 1000 - 500 A/1A)
v.	Short circuit withstand current and duration	:	40 kV for 1 Sec
vi.	Make (Original equipment manufacturer)	:	AREVA T&D INDIA LTD.
vii.	Serial No.	:	200808125
viii.	Date and time of occurrence of fault	:	23.12.2024 at 23:39 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	CT burst
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2008
xii.	Date of commissioning	:	29.12.2009
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation / remark/ report/ MOM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	CT completely burst hence beyond repair.
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) CT cleaning and Tightening work done during periodic maintenance. CT Tan delta & Capacitance testing carried out on dated 19.01.2023. (b) No abnormality observed. (c) NA
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No any failure seen before of this CT in substation.

xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	Distance Protection operated
xx.	Details of tests done after failure	:	Not Applicable as CT burst.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Secondary turret tank burst, oil spread out
xxii.	Probable cause of failure	:	As the CT got burst so cause of failure could not be determined.
xxiii.	Remark	:	AREVA T&D INDIA LTD make B Phase CT of 400 kV Chakan-Lonikand-1 line bay at Chakan substation got burst and caught fire on dated 23.12.2024 at 23:39 hrs and same is replaced by another one. Line charged & taken in service on dated 24.12.2024 at 8.10 hrs.

51. Failure report of 220 kV B-phase CT of Pedhambe Substation of MSPGCL

i.	Name of Substation	:	220 kV Pedhambe Substation, KGSC Pophali.
ii.	Utility	:	MSPGCL
iii.	Faulty Equipment and the associated feeder	:	'B' Phase CT of 220 kV Pedhambe - Oni line feeder.
iv.	Rating (Voltage/ Current/ Current-ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV, 1200 - 600 - 300 / 1 A
v.	Short circuit withstand current and duration	:	40 kV / 3 Sec.
vi.	Make (Original equipment manufacturer)	:	High Volt Trans
vii.	Serial No.	:	0-42/I/8/3
viii.	Date and time of occurrence of fault	:	23.08.2023, 18:31 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	1991
xii.	Date of commissioning	:	1996
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Kept Vertically in shed.
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	----
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair.
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Previous Maintenance was carried out on date 12.08.2023. All CT's oil level checked; its connection checking done. CT's Testing carried out on date 20.04.2023 found normal. Periodicity of maintenance activity - Every six monthly. (b) Nil (c) Nil
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil.

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	B phase CT burst at 18:31 Hrs.
xix.	Details of protection operated	:	Relays: 301, 307, 313, Back UP O/C T Phase protection. Window Indication- 1) Distance protection, 2) Carrier received.
xx.	Details of tests done after failure	:	Nil
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	B phase CT found burst, smoke & fire observed,
xxii.	Probable cause of failure	:	Ageing

52. Failure report of 220 kV Y-phase CT of Pedhambe Substation of MSPGCL

i.	Name of Substation	:	220 kV Pedhambe Substation, KGSC Pophali.
ii.	Utility	:	MSPGCL
iii.	Faulty Equipment and the associated feeder	:	'Y' Phase CT of 220 kV Pedhambe - Nerale line feeder.
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV, 1200 - 600 - 300 / 1 A
v.	Short circuit withstand current and duration	:	40 kV / 3 Sec.
vi.	Make (Original equipment manufacturer)	:	HBB
vii.	Serial No.	:	IB 069651
viii.	Date and time of occurrence of fault	:	12.11.2023 at 20:16 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	-
xii.	Date of commissioning	:	-
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair.
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Previous Maintenance was carried out on date 23.05.2023. All CT's oil level checked; its connection checking done. CT's Testing carried out on date 24.12.2022 found normal. Periodicity of maintenance activity - Every six monthly. (b) Nil. (c) Nil.
xvii.	Details of previous failure	:	Nil.

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	Y phase CT burst at 20:16 Hrs.
xix.	Details of protection operated	:	Relays: 86 OPT Distance protection. E/F & OC relay operated. Window Indication- 1) Trip Circuit faulty, 2) Distance protection, 2) CB gas pressure low.
xx.	Details of tests done after failure	:	Nil
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Y phase CT found burst; smoke & fire observed. Secondary damages-phase B pole interrupter found damaged.
xxii.	Probable cause of failure	:	Insulation failure due to high power surges.

53. Failure report of 220 kV CT Katapali Substation of OPTCL

i.	Name of Substation	:	220/132/33 kV Grid Substation Katapali
ii.	Utility	:	OPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV, Y-phase CT of 100 MVA Auto Transformer II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	Ratio -1200-600-300/1-1-1-1
v.	Short circuit withstand current and duration	:	--
vi.	Make (Original equipment manufacturer)	:	ALSTOM
vii.	Serial No.	:	37994010128/ 2016
viii.	Date and time of occurrence of fault	:	On 27.12.2023 at 5:58 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	--
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	CLEAR
xi.	Year of manufacturing	:	2016
xii.	Date of commissioning	:	
xiii.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Replaced with new CT of GE Make on 29.12.2023
xiv.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	NA
xv.	Probable cause of failure	:	Oil leakage

54. Failure Report of 220 kV CT at, SEZ-I, Jaipur Substation of RRVPNL

i.	Name of Substation	:	220 kV GSS, RRVPNL, SEZ-I, Jaipur
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment and the associated feeder	:	245 kV CT of 220 kV SEZ-PGCIL (Jaipur South) feeder
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 800-400/1A, 5C
v.	Short circuit withstand current and duration	:	40 kA for 1 sec
vi.	Make (Original equipment manufacturer)	:	Mehru Electrical and Mechanical Engineers(P) Ltd.
vii.	Serial No.	:	05120/1/34/13
viii.	Date and time of occurrence of fault	:	20.10.2023 at 22:16 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	-
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	clear sky
xi.	Year of manufacturing	:	2013
xii.	Date of commissioning	:	17.05.2016
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	beyond repair

55. Failure Report of 220 kV CT at Khushkhera Substation of RRVPNL

i.	Name of Substation	:	220 kV GSS Khushkhera
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment and the associated feeder	:	Current Transformer, 220 kV PG (Neemrana) bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV, Ratio: 400-800/1A, 5C
v.	Short circuit withstand current and duration	:	Not visual due to Burnt of CT
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	665
viii.	Date and time of occurrence of fault	:	21.09.2023/ 23:15 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	2009
xii.	Date of commissioning	:	01.09.2017
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Not contacted to OEM
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Periodical maintenance carried out (b) No any abnormality observed (c) Not Applicable
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No any

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Internal Fault
xix.	Details of protection operated	:	Not Operated, only Master Relay 86 operated
xx.	Details of tests done after failure	:	No any test Done; CT Burst fully
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CT Burst Fully
xxii.	Probable cause of failure	:	As the CT got burst so cause of failure could not be determined.

56. Failure Report of 220 kV CT at ALWAR Substation of RRVPNL

i.	Name of Substation	:	220 kV GSS RRVPNL, MIA, ALWAR
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment and the associated feeder	:	Current Transformer of 220 kV MIA GMR Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV/ 800/1 Amp
v.	Short circuit withstand current and duration	:	40 kA (RMS) / 1 Sec.
vi.	Make (Original equipment manufacturer)	:	SCT LTD.
vii.	Serial No.	:	2009/629
viii.	Date and time of occurrence of fault	:	22.09.2023 / 13:02 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2009
xii.	Date of commissioning	:	08.02.2011
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Not contacted to OEM
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) 18.06.2023 (Maintenance as per ISO schedule on date 18.06.2023) (b) No any abnormality observed
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No any

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Oil leakage observes from oil level indicator, and heavy smoke observed.
xix.	Details of protection operated	:	M/T
xx.	Details of tests done after failure	:	Burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Burst
xxii.	Probable cause of failure	:	As the CT got burst so cause of failure could not be determined.

57. Failure Report of 230 kV CT at Veeranam Substation of TANTRANSCO

i.	Name of Substation	:	230 kV Veeranam
ii.	Utility	:	TANTRANSCO
iii.	Faulty Equipment and the associated feeder	:	230 kV CT of Power Transformer-II
iv.	Rating (Voltage/current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV Ratio :1600-1200-800-300/1 A (5 Core)
v.	Short circuit with stand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	ABB
vii.	Serial No.	:	2105314
viii.	Date and time of occurrence of fault	:	26.8.23 / 10.04 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2005
xii.	Date of commissioning	:	25.04.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	To be condemned the Equipment
xv.	Present condition of equipment (Repaired/To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Maintenance done 20.04.2023 (b) No (c) No
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NIL
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	--

xix.	Details of protection operated	:	Trip differential protection operated, RYB, Transformer HV & LV breaker tripped.
xx.	Details of tests done after failure	:	-
xxi.	Observations	:	CT burst out with heavy sound
xxii.	Probable cause of failure	:	As the CT got burst so cause of failure could not be determined.

58. Failure report of 220 kV CT at Tenughat Thermal Power Station of TVNL

i.	Name of Substation	:	Tenughat Thermal Power Station, Lalpania
ii.	Utility	:	TVNL
iii.	Faulty Equipment and the associated feeder	:	CT; Bihar Sharif Feeder
iv.	Rating (Voltage / Current/ Current ratio/ Capacitance/ MCOV etc., as applicable)	:	1600/2-2-1-2-2 245/220 kV
v.	Short circuit withstand current and duration	:	31.5/3 KA/sec
vi.	Make (Original equipment manufacturer)	:	ALSTOM
vii.	Serial No.	:	20030154/2003
viii.	Date and time of occurrence of fault	:	21.12.2024 at 08:53 hrs.
ix.	Fault discovered during (Operation or periodic testing / maintenance)	:	Normal Operation
x.	Weather conditions at the time of failure (clear sky / rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2003
xii.	Date of commissioning	:	04.05.2014
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired / To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Oil BDV checking
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	-
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	CT Explosion at 08:53 hrs



xix.	Details of protection operated	:	Distance TnpZ1
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	--
xxii.	Probable cause of failure	:	As the CT got burst so cause of failure could not be determined

59. Failure report of 220 kV CT at Boner Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Boner
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CT Aligarh-II Ckt
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV 800/1
v.	Short circuit withstand current and duration	:	40.0/3.0 kA
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	1408
viii.	Date and time of occurrence of fault	:	14.07.2023, 09:30 hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Maintenance
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2007
xii.	Date of commissioning	:	15.08.2015
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Routine test normal
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	-

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Core saturated
xix.	Details of protection operated	:	-
xx.	Details of tests done after failure	:	Ratio Test
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Visibly damaged
xxii.	Probable cause of failure	:	Core Saturation

60. Failure report of 220 kV CT at C.B. Ganj Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s C.B. Ganj, Bareilly
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CT, Bus Coupler
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 1000-800-500-300/1
v.	Short circuit withstand current and duration	:	31.5 kA (rms) for 1 sec.
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	2014/ 1588
viii.	Date and time of occurrence of fault	:	12.08.2023 9:30 A.M
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Maintenance
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2014
xii.	Date of commissioning	:	14.02.2015
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Net & clean condition of storage
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	To be repaired
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Preventive maintenance was done on dated 02.07.2023 and no abnormality found.
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No



xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	E/F
xix.	Details of protection operated	:	-
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Abnormal sound & rapid oil leakage from CT
xxii.	Probable cause of failure	:	-

61. Failure report of 220 kV CT at Hafizpur Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Hafizpur, Azamgarh
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	CT (Y-Phase) of BC BT
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	11000/1
v.	Short circuit withstand current and duration	:	31.5 kA/ 1 sec
vi.	Make (Original equipment manufacturer)	:	Hepta care
vii.	Serial No.	:	KN 744
viii.	Date and time of occurrence of fault	:	11.09.23 at 05:36 hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Raining operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	09.03.2016
xii.	Date of commissioning	:	03.03.2020
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Open yard
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Damaged and Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	-
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	-
xix.	Details of protection operated	:	Bus bar protection operated
xx.	Details of tests done after failure	:	Equipment was completely damaged no test could be performed
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NA
xxii.	Probable cause of failure	:	Insulation failure

62. Failure report of 220 kV CT at Muradnagar Substation of UPPTCL

i.	Name of Substation	:	400 kV S/s-I, Muradnagar
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	245 kV CT 01 No. (220 kV Muradnagar Inter Connector-I CB 83)
iv.	Rating (Voltage/ current/ current-ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV/ 1000-800-500-300/ 1 A
v.	Short circuit with stand current and duration	:	31.5 kA/ 1 Sec.
vi.	Make (Original equipment manufacturer)	:	Heptacare
vii.	Serial No.	:	KN531
viii.	Date and time of occurrence of fault	:	30.10.2023
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Maintenance
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	01.03.2019
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	N/A
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Tan Delta test carried out during routine maintenance Results:- 5 kV- 0.1728 10 kV – 0.1504
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NO
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	



xix.	Details of protection operated	:	NO
xx.	Details of tests done after failure	:	Tan Delta Test
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Tan Delta Test results were not satisfactory
xxii.	Probable cause of failure	:	Insulation Failure

63. Failure report of 220 kV CT at Ghazipur Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Ghazipur
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	245 kV CT feeder-160 MVA /T/F-I 220/132 kV
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV
v.	Short circuit withstand current and duration	:	31.5 kA/1.05
vi.	Make (Original equipment manufacturer)	:	Hepta case power Ltd.
vii.	Serial No.	:	KN 749
viii.	Date and time of occurrence of fault	:	27.12.2023 at 05:00 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Sudden insulation failure
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Heavy fog & Mist
xi.	Year of manufacturing	:	2017
xii.	Date of commissioning	:	10 Feb-2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	No
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Oil tapped done on 29.11.2023
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Event logger not installed
xix.	Details of protection operated	:	220 kV Bus bar operated flags diff-87, Zone-I, LBB
xx.	Details of tests done after failure	:	NIL
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Oil spilled & Tap over on Easter.
xxii.	Probable cause of failure	:	Insulation failure

64. Failure report of 220 kV CT at Fatehpur Substation UPPTCL

i.	Name of Substation	:	220 kV S/s Fatehpur
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	245 kV Y CT, 220 kV Sirathu bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 1000-800-500-300/ 1 A
v.	Short circuit with stand current and duration	:	31.5 kA (RMS) for 1 sec
vi.	Make (Original equipment manufacturer)	:	SCT limited Ghaziabad, UP, India
vii.	Serial No.	:	2014/1619
viii.	Date and time of occurrence of fault	:	11.04.2024 at 20:49 hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	N/A
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2014
xii.	Date of commissioning	:	15.05.2017
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Good condition
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	N/A
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	09.04.2024 (Tightening work) No
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	

xix.	Details of protection operated	:	Bus bar protection operated trip B-Phase ICD 10.94 kA, 1.10 kA at Sirathu-trip
xx.	Details of tests done after failure	:	Nil, Complete damage
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	N/A
xxii.	Probable cause of failure	:	Due to dielectric/Insulation failure

65. Failure report of 220 kV CT at Greater Noida of UPPTCL

i.	Name of Substation	:	400 kV S/s Greater Noida
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CT (Y phase), 220 kV Side of 315 MVA ICT 2 (BHEL)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV,1000-800-500/1-1-1 A
v.	Short circuit with stand current and duration	:	40 kA for 1 Sec
vi.	Make (Original equipment manufacturer)	:	BHEL
vii.	Serial No.	:	2239732
viii.	Date and time of occurrence of fault	:	11.04.2024, 00:32 Hrs.
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Normal
xi.	Year of manufacturing	:	2003
xii.	Date of commissioning	:	06.05.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	Nil
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Routine Testing was done of bay by T&C team. (b) NIL (c) NIL
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NIL
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	

xix.	Details of protection operated	:	CP- Diff. Prot. Operated, Group A, Group B, RP- Diff. Relay Operated, Master Trip
xx.	Details of tests done after failure	:	NIL
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NIL
xxii.	Probable cause of failure	:	NA

66. Failure report of 400 kV CT at Sarh, Kanpur Substation UPPTCL

i.	Name of Substation	:	220 kV S/s Sarh, Kanpur under ETD-II, Kanpur
ii.	Utility	:	Rural
iii.	Faulty Equipment and the associated feeder	:	245 kV CT, 160 MVA Transformer-I
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 1000-800-500/300/1A
v.	Short circuit with stand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	Heptacare
vii.	Serial No.	:	KN-849
viii.	Date and time of occurrence of fault	:	21.04.2024 at 08.08 Hrs, 3320A
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	After tripping of the 160 MVA Transformer-I
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	clear sky
xi.	Year of manufacturing	:	2017
xii.	Date of commissioning	:	22.05.2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	Open Store
xiv.	If OEM was contacted after failure, its recommendation /remark / report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Previous maintenance date- 04.03.2024, Previous periodic testing date- 21.04.2023. (b) No (c) No
xvii.	Details of previous failure	:	No

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	160 MVA Transformer-I tripped at 08.08 Hrs. Flags-Y-phase Diff Trip, 186, 286 operated, Ir=234 A, Iy=3320 A ,Ib= 314 A, Ig= 2776 A
xix.	Details of protection operated	:	Differential Protection Operated
xx.	Details of tests done after failure	:	
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No
xxii.	Probable cause of failure	:	Internal fault

67. Failure report of 220 kV CT at Jolly Road-Muzaffarnagar Substation of UPPTCL

i.	Name of Substation	:	400 kV S/s Jolly Road-Muzaffarnagar
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CT -Muzaffarnagar- Badhai Kala Feeder
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV 100/800/500/300/1 A
v.	Short circuit with stand current and duration	:	31.5 kA/ 1 sec
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	2009/3087
viii.	Date and time of occurrence of fault	:	07.05.2024 at 16:19 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	03.03.2011
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	--
xiv.	If OEM was contacted after failure, its recommendation /remark / report/ MoM	:	--
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) CT Ratio, Polarity test, IR valve, tan delta, tightening work (b) No abnormality observed (c) --
xvii.	Details of previous failure	:	No failure in past

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	CB Open Flag: C/P—DPO, DPS P,R/P-Z-1,Z-2,Z-3,Z-4 Trip, PSB operated ,86B RYB, R phase, Y-phase, B phase & Bus-A Bus bar protection operated
xx.	Details of tests done after failure	:	Replace by new CT
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CT was running in normal condition, CT was 14-year-old & failed due to insulation failure
xxii.	Probable cause of failure	:	Insulation failure

68. Failure report of 220 kV CT at S/s Jolly Road-Muzaffarnagar of UPPTCL

i.	Name of Substation	:	400 kV S/s Jolly Road-Muzaffarnagar
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	400 kV CT-B phase of ICT-I 315 MVA
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	2000/1000/500/1 A
v.	Short circuit with stand current and duration	:	40 kA/ 1 Sec
vi.	Make (Original equipment manufacturer)	:	TELK
vii.	Serial No.	:	240048017
viii.	Date and time of occurrence of fault	:	10.5.2024 at 13:15 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Oil leakage & internal fault
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2002
xii.	Date of commissioning	:	31.12.2005
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	--
xiv.	If OEM was contacted after failure, its recommendation /remark / report/ MoM	:	--
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) CT Ratio, Polarity test, IR valve, tan delta (b) No abnormality found (c) --
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No failure in past

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	CB Open manually
xx.	Details of tests done after failure	:	Replaced by new CT
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CT was running in normal condition, CT was 14-year-old & failed due to insulation failure
xxii.	Probable cause of failure	:	Insulation failure

69. Failure report of 220 kV CT at Greater Noida of UPPTCL

i.	Name of Substation	:	400 kV S/s Greater Noida
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CT (Y phase), 220 kV Side of 315 MVA ICT 2(BHEL)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV, 1000-800-500/1-1-1 A
v.	Short circuit with stand current and duration	:	40 kA for 1 Sec
vi.	Make (Original equipment manufacturer)	:	BHEL
vii.	Serial No.	:	2239732
viii.	Date and time of occurrence of fault	:	11.04.2024 at 00:32 Hrs.
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Normal
xi.	Year of manufacturing	:	2003
xii.	Date of commissioning	:	06.05.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	
xiv.	If OEM was contacted after failure, its recommendation/ remark / report/ MoM	:	
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Routine Testing was done of bay by T&C team. (b) NIL (c) NIL
xvii.	Details of previous failure	:	NIL

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	
xix.	Details of protection operated	:	CP- Diff. Prot. Operated, Group A, Group B, RP- Diff. Relay Operated, Master Trip
xx.	Details of tests done after failure	:	NIL
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NIL
xxii.	Probable cause of failure	:	

70. Failure report of 220 kV CT at Atrauli Substation UPPTCL

i.	Name of Substation	:	220 kV Atrauli S/s
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	245 kV CT (R-ph), 220 kV Akrabad, Aligarh (400)-Atrauli (220)-I circuit line Bay at Atrauli (220)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 1000-800-500-300/1 A, 5 Core
v.	Short circuit with stand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	2004/784
viii.	Date and time of occurrence of fault	:	19.05.2024 at 03:50
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	-
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2004
xii.	Date of commissioning	:	27.08.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	-
xiv.	If OEM was contacted after failure, its recommendation /remark / report/ MoM	:	-
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	No abnormality found
xvii.	Details of previous failure	:	-

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	
xix.	Details of protection operated	:	186 relay, 286 Relay, A/R, M1 relay, M2 relay, Bus Bar protection. Relay R, Y, B phase operated
xx.	Details of tests done after failure	:	Meggering
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Nil
xxii.	Probable cause of failure	:	Insulation failure

71. Failure report of 220 kV CT at Sikandrara Substation of UPPTCL

i.	Name of Substation	:	220 kV Sikandrara
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	245 kV CT (R-ph), 220 kV Harduaganj-Sikandrara line Bay at Sikandrara (220)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV CT, 1000-800-500-300/1 A 5C
v.	Short circuit with stand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	Heptacare
vii.	Serial No.	:	BN-433
viii.	Date and time of occurrence of fault	:	20.05.2024 at 06:15 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	-
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2016
xii.	Date of commissioning	:	04.06.2016
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation /remark / report/ MoM	:	-
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	No abnormality found
xvii.	Details of previous failure	:	-

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	
xix.	Details of protection operated	:	General trip ABC, Z-1, A-G, SOTF
xx.	Details of tests done after failure	:	Meggerring
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	
xxii.	Probable cause of failure	:	Insulation Failure

72. Failure report of 220 kV CT at Jahangirabad Substation of UPPTCL

i.	Name of Substation	:	220 kV Substation Jahangirabad
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	245 kV CT of 160 MVA Transformer-2
iv.	Rating (Voltage/ current/ current-ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 800/400-1 A
v.	Short circuit withstand current and duration	:	211 A
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	2007/2025
viii.	Date and time of occurrence of fault	:	20.05.2024 at 17.05 Hrs.
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2007
xii.	Date of commissioning	:	30.06.2010
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Open Store
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	NO
xv.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	NA
xvi.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xvii.	Sequence of events/ Description of fault (SOE with time stamp)	:	--
xviii.	Details of protection operated	:	Diff Trip R Phase 86 A, 86 B
xix.	Details of tests done after failure	:	Nil
xx.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Nil
xxi.	Probable cause of failure	:	--
xxii.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond Repair

73. Failure report of 220 kV CT at Sahibabad Substation of UPPTCL

i.	Name of Substation	:	220 kV Sahibabad
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	200 MVA Transformer -I HV B Ph side CT
iv.	Rating (Voltage/ current/ current-ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit with stand current and duration	:	31.5 kA (RMS) for 1-Sec
vi.	Make (Original equipment manufacturer)	:	SCT MAKE
vii.	Serial No.	:	2014/1632
viii.	Date and time of occurrence of fault	:	22.05.2024 at 00:00 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	200 MVA Transformer-I B PH CT was in operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2014
xii.	Date of commissioning	:	21.05.2015
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not Available
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond Repair (Damaged)
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	ON dated 22.12.2023 last maintenance of Transformer & HV SIDE/LV Side Bay done including Tightening, Cleaning of all points.
xvii.	Details of previous failure	:	NIL

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	(i) 200 MVA Transformer -I Trip at 00:00 Hrs due to B-phase CT Damaged. (ii) 132 kV Vaishali – Sahibabad trip at SPS
xix.	Details of protection operated	:	74B Diff protection 86 HV, 86 LV operated
xx.	Details of tests done after failure	:	CT in Damaged condition.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Found damaged & Burnt
xxii.	Probable cause of failure	:	Could not be determined

74. Failure report of 220 kV CT at Rampur Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Rampur
ii.	Utility	:	—
iii.	Faulty Equipment and the associated feeder	:	CT
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit with stand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	2012/1199
viii.	Date and time of occurrence of fault	:	22.05.2024 at 08:03 Hrs.
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2012
xii.	Date of commissioning	:	26.09.2014
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	NA
xiv.	If OEM was contacted after failure, its recommendation /remark / report/ MoM	:	NA
xv.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	NA
xvi.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xvii.	Sequence of events/ Description of fault (SOE with time stamp)	:	NA
xviii.	Details of protection operated	:	NA
xix.	Details of tests done after failure	:	NA
xx.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	—
xxi.	Probable cause of failure	:	—
xxii.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond Repair

75. Failure report of 400 kV CT at Bansi Siddharth Nagar Substation UPPTCL

i.	Name of Substation	:	220 kV S/S Bansi Siddharth Nagar
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	HV side B phase CT of 160 MVA Transformer-I
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV CT
v.	Short circuit withstand current and duration	:	994.9 A
vi.	Make (Original equipment manufacturer)	:	Hepta care Power Industries (P) Ltd
vii.	Serial No.	:	MN-737
viii.	Date and time of occurrence of fault	:	19.05.2024 at 07:28 hrs.
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Tripping
x.	Weather conditions at the time of failure (Clear sky/rainy/thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2016
xii.	Date of commissioning	:	19.07.2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	OK
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	During previous maintenance/ testing, no abnormality has been found
xvii.	Details of previous failure	:	Since commissioning no failure.

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	IR -135.3 Amp. IY -135.5 KA IB -994.9 Amp.
xix.	Details of protection operated	:	Differential operated/ LB initiation, master trip
xx.	Details of tests done after failure	:	Equipment completely damaged.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	-
xxii.	Probable cause of failure	:	No probable cause found.

76. Failure report of 400 kV CT at Basti Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Basti
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	Y phase CT of 220 kV Bhaurkhari bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV CT (1000/800/500/300/1 A)
v.	Short circuit withstand current and duration	:	2.5 kA
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	2008/879
viii.	Date and time of occurrence of fault	:	29.05.2024.
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Tripping
x.	Weather conditions at the time of failure (Clear sky/rainy/thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2008
xii.	Date of commissioning	:	08.11.2015
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	OK
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	During previous maintenance/testing, no abnormality has been found
xvii.	Details of previous failure	:	Since commissioning no failure

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	IR -300 Amp. IY -2.5 KA IB -310 Amp.
xix.	Details of protection operated	:	G, trip, Y phase Neutral zone-I, E/F 86A, 86 B
xx.	Details of tests done after failure	:	Equipment completely damaged.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	-
xxii.	Probable cause of failure	:	As the CT got completely damaged so cause of failure could not be determined

77. Failure report of 220 kV CT at Sarh, Kanpur Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Sarh, Kanpur under ETD-II, Kanpur
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	245 kV CT, 160 MVA Transformer-II
iv.	Rating (Voltage/current/current ratio/capacitance / MCOV etc., as applicable)	:	245 kV, 1000-800-500/300/1 A
v.	Short circuit with stand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	Heptacare
vii.	Serial No.	:	KN-850
viii.	Date and time of occurrence of fault	:	29.05.2024 at 06.05 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	After tripping of the 160 MVA Transformer-II
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2017
xii.	Date of commissioning	:	26.12.2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	Open Store
xiv.	If OEM was contacted after failure, its recommendation /remark / report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Previous maintenance date -27.04.2024, Previous periodic testing date- 25.09.2023 (b) No (c) No

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NO
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	160 MVA Transformer-I tripped at 06.05 Hrs. Flags- Y-phase Diff Trip, 186, 286 operated, Ir=434 A, Iy=2675 A ,Ib= 434 A, Ig= 1808 A
xix.	Details of protection operated	:	Differential Protection Operated
xx.	Details of tests done after failure	:	
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No
xxii.	Probable cause of failure	:	Internal fault

78. Failure report of 220 kV CT at Bhelupur Substation UPPTCL

i.	Name of Substation	:	220 kV S/s Bhelupur
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	CT (220 kV BHP -SHP Circuit-I)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 300 A, 1000/800/500/300/I A, Class A
v.	Short circuit with stand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	Heptacare power industries Pvt. Ltd
vii.	Serial No.	:	KN/186
viii.	Date and time of occurrence of fault	:	30.05.2024 at 13:48hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	CB Trip, Trip coil Operated, Gen trip Zone-I, Master trip relay OPTD, O/C & E/F)
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2013
xii.	Date of commissioning	:	24.05.2016
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	N/A
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	N/A
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	N/A
xvii.	Details of previous failure	:	

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		N/A
xviii.	Sequence of events / Description of fault (SOE with time stamp)	:	CB Trip, Trip coil operated, gen trip Zone-I, Master trip relay operated, O/C & E/F)
xix.	Details of protection operated	:	CB Trip, Trip coil operated, gen trip Zone-I, Master trip relay OPTD, O/C & E/F))
xx.	Details of tests done after failure	:	No
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CT blast during operation due to insulation failure
xxii.	Probable cause of failure	:	Insulation Failure

79. Failure report of 220 kV CT at Pahadi, Chitrakoot Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Pahadi, Chitrakoot
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV R ph CT of 220 kV Banda Pahadi ckt-II Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	1000/800/500/300/1 A
v.	Short circuit withstand current and duration	:	40 kA (RMS)/ 3 sec
vi.	Make (Original equipment manufacturer)	:	M/s Electrical Stampings
vii.	Serial No.	:	2017/ESM/587
viii.	Date and time of occurrence of fault	:	31.05.2024 at 16:49 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2017
xii.	Date of commissioning	:	10.04.2019
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	N/A
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Not under warranty period
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Routine testing and maintenance done on 27.08.2023 (b) Nil, no abnormality found

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	31.05.2024, 16:49 220 kV Banda Pahadi ckt-tripped on distance Protection Zone-I, distance 00.0781 Km.
xix.	Details of protection operated	:	M-I relay/distance protection operated & backup protection on E/F trip.
xx.	Details of tests done after failure	:	Replacement of CT and current ratio test done
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CT caught fire with 220 kV Banda Pahadi ckt-I tripped.
xxii.	Probable cause of failure	:	As the CT got completely damaged so cause of failure could not be determined

80. Failure report of 400 kV CT at Kasara, Mau Substation of UPPTCL

i.	Name of Substation	:	400 kV S/s Kasara, Mau
ii.	Utility	:	Current Transformer
iii.	Faulty Equipment and the associated feeder	:	B Phase CT of 400 kV Azamgarh Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	420 kV Ratio-2000/1000/500/1 A
v.	Short circuit withstand current and duration	:	30 kA 60 ms 2.74 kA 500 ms
vi.	Make (Original equipment manufacturer)	:	BHEL
vii.	Serial No.	:	6156404
viii.	Date and time of occurrence of fault	:	07.07.2024 at 11:45 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	1992
xii.	Date of commissioning	:	19.12.1993
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not available
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Not contacted
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Tan Delta Test (Yearly) (b) No (c) NIL
xvii.	Details of previous failure	:	No

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	On dated 07.07.2024 at 11:45 hrs., B Phase CT, 400 kV Mau-Azamgarh Line got damaged as per the DR/ EL Zone-1 Protection of main-1 relay and Bus Bar Differential Protection Operated (Operating Current 6 pu) and elements connected through Bus-1 Got tripped in 60 ms (ICT-III, PGCIL Ballia). At the time of fault B Phase current of core -2 (Used for Main-II and LBB Protection as per scheme) is negligible and B Phase current of core-I (Used for Main-I protection) is about 30 kA, after 280 ms Y Phase Fault 6 kA created and LBB Protection operated in 480 ms
xix.	Details of protection operated	:	M-1 (REL670) – Zone-1 B Phase Distance 0 Km, Gr-A Trip M-2 (Siprotec)- B phase Pickup, Raica Protection Operated Bus Bar Operation Relay (SEL-487B)- Trip, 87 Differential, Zone-1, LBB operated, BKR Fail, 96 Operated
xx.	Details of tests done after failure	:	CT got damaged so test after failure not performed.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	During visual inspection CT found Burnt and damaged.
xxii.	Probable cause of failure	:	Ageing

81. Failure report of 220 kV CT at Bhadaura Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Bhadaura
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	Current Transformer
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV
v.	Short circuit with stand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	Heptacare
vii.	Serial No.	:	KN860
viii.	Date and time of occurrence of fault	:	05.09.2024 at 19:30 hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Heavy thunderstorm
xi.	Year of manufacturing	:	2017
xii.	Date of commissioning	:	2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Ok
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Not repairable
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	No

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No
xviii.	Sequence of events / Description of fault (SOE with time stamp)	:	
xix.	Details of protection operated	:	Differential
xx.	Details of tests done after failure	:	
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CT totally damaged during operation
xxii.	Probable cause of failure	:	Lightning

82. Failure report of 220 kV CT at Muradnagar Substation of UPPTCL

i.	Name of Substation	:	220 kV Muradnagar
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	Current Transformer (CT) 220 kV Sikandrabad bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV 1000-800-500/ 1-1-1-1-1 A
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	M/S Heptacare Power Industries Limited
vii.	Serial No.	:	BN-624
viii.	Date and time of occurrence of fault	:	06.10.2024 at 19:45 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2016
xii.	Date of commissioning	:	17.03.2017
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Damaged
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	-

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	-
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	-
xix.	Details of protection operated	:	CP:-Distance Prot. Trip RP- Z1, M1Rx, Bx, Yx, 86A, 86B M1 (relay)- R phase, Z-1, dist-4.4 kms. IR-3.988 kA, IR=51.399 kA, RB=740.3 kA
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	-
xxii.	Probable cause of failure	:	Could not be determined

83. Failure report of 220 kV PT at Ratlam Substation of MPPTCL

i.	Name of Substation	:	220 kV Substation MPPTCL Ratlam
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Main Bus R-Ph PT-II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	SCT
vii.	Serial No.	:	37
viii.	Date and time of occurrence of fault	:	01.10.2023 at 16:30 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
x.	Weather conditions at the time of failure (Clear sky/rainy/thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	1989
xii.	Date of commissioning	:	29.03.1993
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Nil
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	Routine maintenance and clamp tightening. No any abnormality observed during maintenance

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV main bus PT-II failed due to its insulation failure
xix.	Details of protection operated	:	Bus Bar protection operated
xx.	Details of tests done after failure	:	None
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	None
xxii.	Probable cause of failure	:	Due to insulation failure or ageing factor

84. Failure report of 220 kV PT at Niwaliphata Substation of MSETCL

i.	Name of Substation	:	220 kV Niwaliphata
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Bus PT, R Ph
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV/110V PT, 3 Core, 500 kVA 3P, 100 VA 3P, 100 VA 3P
v.	Short circuit withstand current and duration	:	Not available
vi.	Make (Original equipment manufacturer)	:	BHEL
vii.	Serial No.	:	2243620
viii.	Date and time of occurrence of fault	:	08.07.2023 at 12:43 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	In Service
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Cloudy
xi.	Year of manufacturing	:	2002
xii.	Date of commissioning	:	13.03.2007
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Yes. Wooden packing kept in dry place.
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	R Ph PT Blast & beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	(a) IR values of PTs were taken during bus outage i.e. on 05.06.2023 and found 1.35 Gohm also cleaning done during bus outage (b) Nil (c) NA

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	At 12:43 Hrs 245 kV R-Ph PT failed. With tripping of 220 kV Niwali New Koyna line and Niwali Pawas line from local end in reverse zone of DPS & 110 kV Niwali-Aarwali TSS line tripped on back up protection. Niwali substations went under dark for 29 mins. R Ph PT found busted and its 245 kV isolator for R Ph found damaged (2 support insulators broken and blade fallen on ground and got damage).
xix.	Details of protection operated	:	220 kV Niwali Pawas and Niwali New Koyna lines tripped in reverse zone in local end. 110 kV Niwali-Aarwali TSS line tripped on back up protection.
xx.	Details of tests done after failure	:	Not possible due to PT was completely damaged condition after failure
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	PT Blast during failure caught fire, isolator got mechanically damaged (broken in porcelain)
xxii.	Probable cause of failure	:	Ageing

85. Failure report of 220 kV PT at Dhamangaon Substation of MSETCL

i.	Name of Substation	:	220 kV Dhamangaon S/s
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Y-ph PT
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV 245/1050/50
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	Crompton Greaves
vii.	Serial No.	:	13053
viii.	Date and time of occurrence of fault	:	29.09.2023 at 16:30 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	PT Burst
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	1999
xii.	Date of commissioning	:	09.09.2000
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MOM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	The PT was commissioned on Date 09.09.2000 and as only single 220 kV PT set is available on 220 kV Bus, No diagnostic tests are carried out.

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No failure
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	At 16:30 Hrs 220 kV Bus Bar Protection Operated and simultaneously all the associated Lines and Transformers of 220 kV Main Bus tripped, during yard inspection, Y ph PT found burning and mechanically damaged at the oil tank hence extinguished by fire extinguishers and isolated the 220 kV PT.
xix.	Details of protection operated	:	At 16:30 Hrs Bus Bar protection Operated and simultaneously all the associated Lines and PTRs of 220 kV Main Bus Tripped. Window indications: - 1)Bus Bar-1 Operated 2) Bus Bar Yph Trip Relay indications: - 1)Bus Bar Operated 2) Bus Bar-1 operated 3) Y Phase Operated No Window and Relay Indications received on 220 kV Lines and PTRs
xx.	Details of tests done after failure	:	As PT burst and beyond repairable, no test carried out after failure.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Nothing found any abnormality.
xxii.	Probable cause of failure	:	Ageing

86. Failure report of 220 kV PT at Kharepatan Substation of MSETCL

i.	Name of Substation	:	220 kV Kharepatan
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Bus PT, Y Ph
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV/ 110 V PT, 3 Core, 200 VA 3P, 50 VA 3P, 50 VA 0.2
v.	Short circuit withstand current and duration	:	Not available
vi.	Make (Original equipment manufacturer)	:	TOSHIBA
vii.	Serial No.	:	552974
viii.	Date and time of occurrence of fault	:	08.10.2023, 20:03 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	In Service
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Cloudy
xi.	Year of manufacturing	:	2016
xii.	Date of commissioning	:	28.05.2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Yes. Wooden packing kept in dry place.
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Y Ph PT Blast and beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) IR values of PTs were taken during bus outage i.e. on 11.11.2022 and found 0.965 Gohm also cleaning done during bus outage. (b) Nil (c) NA

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	(1) On 08.10.2023 At 19:58 Hrs, VT fuse fail annunciation was observed on 220 kV Kharepatan- Pawas and 220 kV Kharepatan-Oni line distance relays at 220 kV Kharepatan S/s. (2) At the same time in energy meter, sudden voltage rise in Y ph -N bus voltage observed (approx. 230 kV) only at Kharepatan S/s; whereas the actual system voltages were normal at Pawas S/s. (3) On 08.10.2023 at 20:03 Hrs, 220 kV Pawas – Kharepatan line tripped on Distance protection (Z2, Y-N fault, IL2= 1.55 kA) (4) From the above events, it is observed that the fault on Y-ph 220 kV Bus PT got initiated at 19:58 hrs on 08.10.2023 & the 220 kV PT was burst at 20:03 hrs on 08.10.2023; this indicates that the fault has developed slowly due to which the RADSS type bus bar protection entered in Blocking mode. Hence the fault is cleared from Pawas S/s. (5) At 20:03 Hrs on 08.10.2023 220 kV Yph PT at 220 kV Kharepatan S/s burst and 220 kV Pawas-Kharepatan Line tripped at Pawas end on Distance Protection. Causing 220 kV Kharepatan S/s to go in dark with Load affected of 12.85 MW at 220 kV Oni S/s & 53.19 MW of 132 kV & 33 kV at Kharepatan S/s affected. (6) 220 kV Yph PT Bypassed and 220 kV Bus restored after charging of 220 kV Pawas Kharepatan Line on trial at 21:07 hrs on 08.10.2023. (7) 132 kV Bus charged at 21:09 Hrs on 08.10.2023 & 132 kV Kharepatan – Kankavli line made ON at 21:24 Hrs on 08.10.2023 & 132 kV Kharepatan –

			Talebazar line made ON at 21:22 Hrs on 08.10.2023. (8) 33 kV Bus restored at 21:10 Hrs on 08.10.2023. (9) 220 kV Oni-Kharepatan line charged on trial at 21:16 Hrs on 08.10.2023.
xix.	Details of protection operated	:	220 kV Pawas Kharepatan line tripped on Distance Protection at remote end.
xx.	Details of tests done after failure	:	Not possible due to PT in completely damaged condition after failure
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	PT Blast during failure caught fire, isolator blades got partially damaged and jaw was broken.
xxii.	Probable cause of failure	:	As the CT got completely damaged so cause of failure could not be determined

87. Failure report of 220 kV PT at Chinchwad1 Substation of MSETCL

i.	Name of Substation	:	220 kV Chinchwad1 S/s
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV PT Bay- Y Ph PT
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV. Insulation level: 460/1050 kV, 50 Hz. Class: 3P/3P/0.5 Ratio: 220 kV/110V
v.	Short circuit withstand current and duration	:	VF 1.2 Cont/1.5, 30 sec
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	15061
viii.	Date and time of occurrence of fault	:	07.01.2024 at 05:53 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation after 220 kV Bus section 7M4 and 7M5 outage during night hours.
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Moist and cold
xi.	Year of manufacturing	:	2000
xii.	Date of commissioning	:	23.02.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	220 kV PT received from Telco S/s in the year 2006. No record is found at 220kV Telco S/s regarding the storage of 220 kV PT.
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	On dated 04.07.2019 220 kV PTMB cables shifted to new PTMB. 220 kV PT bus isolator jumper both side palm pad N/B replaced. Insulator cleaning and Bus isolator maintenance done. No previous maintenance details available. Only single 220 kV PT set is available at chinchwad1s/s.
xvii.	Details of previous failure	:	No

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Partial Bus outage was averted Chinchwad-1 S/s for replacement of earth wire on gantry (above 220 kV bus) on 07.01.2024 at 00.20 Hrs. Load of 132 kV Ganeshkhind, 100 kV Pudumjee, local 22 kV at 60 MW was fed by reverse charging of 220/132 kV 200 MVA ICT-3 from ICT2 LV bay of Chinchwad-2 S/s. After completion of outage 220 kV Bus Section 7M4 charged at 05.51 hrs on 07.01.2024. 220 kV Y phase Bus PT burst at 05.53 hrs on 07.01.2024. This caused 220 kV Busbar Protection Zone3 (BB3) operation.
xix.	Details of protection operated	:	220 kV Busbar Protection Zone3 (BB3) operation.
xx.	Details of tests done after failure	:	No test carried out as PT got burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	220 kV Bus PT Y Phase Burst
xxii.	Probable cause of failure	:	Ageing

88. Failure report of 220 kV PT at Kharghar Substation of MSETCL

i.	Name of Substation	:	400 kV R.S Kharghar S/s
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV BUS PT Y Phase
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	24405
viii.	Date and time of occurrence of fault	:	04.02.2024
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	After Bus Bar Protection Operated
x.	Weather conditions at the time of Failure (clear sky/ rainy / thunderstorm etc.)	:	CLEAR
xi.	Year of manufacturing	:	2000
xii.	Date of commissioning	:	01.05.2000
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report / MOM	:	—
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Faulty equipment in SCRAP
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Testing Done on 01.03.2023 corrected capacitance: 462.4 pf, tan delta at 10 kV: 0.328 % (b) No abnormality observed during Testing (c) NIL
xvii.	Details of previous failure	:	NIL

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	After Y-phase PT flashover at primary side, bus bar protection operated correctly.
xix.	Details of protection operated	:	Bus Bar Protection
xx.	Details of tests done after failure	:	No Testing carried out as equipment was damaged.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Flashover observed at primary terminals
xxii.	Probable cause of failure	:	Due to PT primary Terminal Flash over

89. Failure Report of 220 kV PT at Panvel Substation of MSETCL

i.	Name of Substation	:	220 kV ONGC S/s Panvel
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Bus Section-2 R Ph PT
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	MEHRU
vii.	Serial No.	:	OP 12648/1/14/23
viii.	Date and time of occurrence of fault	:	28.08.2024 at 10:24
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	PT burst
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Normal
xi.	Year of manufacturing	:	2023
xii.	Date of commissioning	:	13.03.2024
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not Applicable
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report / MOM	:	Yes. The said PT is under guarantee period and OEM is contacted. They visited at 220 kV ONGC S/s and ready to give free replacement of PT.
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Burst and beyond repaired.
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	Tan Delta Value at 10 kV: - 0.114 % Capacitance: - 499.23 pf IR taken all values in Giga Ohm.

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Not Applicable
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Bus section-2 R ph PT Burst.
xix.	Details of protection operated	:	Bus Bar protection not available. 220 kV Bus section protection Operated. WI:- O/C Operated RI :- Master trip relay operated.
xx.	Details of tests done after failure	:	Not Applicable
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Low quality of paper insulation, small width of porcelain insulator, Aluminum rod used inside of PT.
xxii.	Probable cause of failure	:	Insulation Failure
xxiii.	Attach reports of tests during pre-commissioning, periodic maintenance and after failure photographs of the failed equipment etc.	:	Tan Delta Value: -10 kV: - 0.114 % Capacitance:- 499.23 pf IR Values:- P-E :- 323 GΩ P-C1 :- 152 GΩ P-C2 :- 170 GΩ P-C3 :- 219 GΩ C1-E :- 79.4 GΩ C2-E :- 61.6 GΩ C3-E :- 69 GΩ C1-C2 :- 55.6 GΩ C2-C3 :- 51.8 GΩ C1-C3 :- 95.3 GΩ

90. Failure report of 220 kV PT at Mahape Substation of MSETCL

i.	Name of Substation	:	220/22 kV Mahape
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Main Bus PT (Y-Ph), 220 kV Main Bus PT Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	Not Displayed on Name plate.
vi.	Make (Original equipment manufacturer)	:	Crompton Greaves Ltd.
vii.	Serial No.	:	10007
viii.	Date and time of occurrence of fault	:	22.11.2024, 17:55 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	In Service
x.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Normal & Clear
xi.	Year of manufacturing	:	2000
xii.	Date of commissioning	:	07.06.2001
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	No
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair (Burst and Failed)
xvi.	(a) Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Yearly Capacitance & tan delta along with I.R. values taken from 2016 to present date & the tan delta values found normal.
xvii.	Details of previous failure	:	NIL

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Main Bus Protection PT Y-Phase burst completely which caught fire with oil spillover and complete insulation breakdown resulting in tripping of all EHV Bays on 220 kV Main Bus Bar protection (ABB RADSS Make) with R, S, T & U Flag & fire incidence in Switch-yard so faulty 220 kV Main Bus PT Bay was isolated and fire was controlled & supply to the end consumers was restored immediately.
xix.	Details of protection operated	:	Bus Bar protection Operated (ABB RADSS Make)
xx.	Details of tests done after failure	:	Y-Phase PT Completely burst so no test taken after failure but healthiness of 245 kV R & B-Phase PT was checked by Tan delta test and I.R. Test (Primary to Earth)
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NO
xxii.	Probable cause of failure	:	Ageing

91. Failure report of 400 kV CVT at Chamera Substation of NHPC

i.	Name of Substation	:	Chamera Power Station-I
ii.	Utility	:	NHPC
iii.	Faulty Equipment and the associated feeder	:	CVT, 400 kV Chamera-I Jalandhar Ckt-1
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	400 kV (primary) 110/110/110V (secondary)
v.	Short circuit withstand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	Trench Electric
vii.	Serial No.	:	90278402
viii.	Date and time of occurrence of fault	:	04/08/2023, 05:28 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	1990
xii.	Date of commissioning	:	1994
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	Nil

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	PT fuse failure alarm and Zone 1 protection
xix.	Details of protection operated	:	PT fuse failure alarm and Zone 1 protection
xx.	Details of tests done after failure	:	IR
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Winding found damaged
xxii.	Probable cause of failure	:	Ageing

92. Failure report of 400 kV CVT at Switchyard STPS, Suratgarh of RVUNL

i.	Name of Substation	:	400 kV Switchyard STPS, Suratgarh
ii.	Utility	:	RVUNL
iii.	Faulty Equipment and the associated feeder	:	CVT of Interconnector-I (X-14), Y-Ph
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	4400 pF, (400/ $\sqrt{3}$) kV/ (110/ $\sqrt{3}$) V
v.	Short circuit with stand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	BHEL
vii.	Serial No.	:	6192045
viii.	Date and time of occurrence of fault	:	28.03.2024, 09:30 Hrs.
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2015
xii.	Date of commissioning	:	20.01.2017
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	---
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	No, Replaced by new CVT from Spare
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	To be repaired
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	---
xvii.	Details of previous failure	:	---

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	---
xix.	Details of protection operated	:	Not operated
xx.	Details of tests done after failure	:	Ratio test
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Voltage of Y-Ph CVT found higher side

93. Failure Report of 230 kV PT at Meelavittan Substation of TANTRASNCO

i.	Name of Substation	:	Meelavittan 230 kV S/s Sipcot, Tuticorin
ii.	Utility	:	TANTRANSCO
iii.	Faulty Equipment and associated feeder	:	230 kV BUS PT II, Y Phase in 230 kV Bus
iv.	Rating (Voltage/ Current/ Current Ratio/ Capacitance / MCOV etc., as applicable)	:	Voltage Ratio: 230/V3 kV / 110/V3V
v.	Short Circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	BHEL
vii.	Serial No	:	Y- 2234377
viii.	Date and time of occurrence of fault	:	22.11.2023 at 06.47 Hrs
ix.	Fault discovered during (Operation or periodic testing / maintenance)	:	NIL
x.	Weather conditions at the time of failure (clear sky / rainy / thunderstorm etc.	:	Rainy & Cloudy
xi.	Year of Manufacturing	:	1999
xii.	Date of Commissioning	:	19.09.2002
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not Known
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair. Since PT burst out
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) NIL (230 kV Bus LC not approved due to grid condition) (b) NIL (c) NA

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NIL
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Y phase PT Burst out and broken pieces damaged the R-phase PT and B phase PT also. Immediately, 230 kV Bus PT-II isolated from service by removing dropping jumpers at R, Y, B phase of 230 kV Bus PT II and then 230 kV Bus normalized. 230 kV Bus PT I is in service.
xix.	Details of protection operated	:	Bus bar protection acted.
xx.	Details of tests done after failure	:	Not applicable since the PT completely burst out.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NIL
xxii.	Probable cause of failure	:	Ageing

94. Failure report of 220 kV CVT at Badaun Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Badaun
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CVT, 220 kV Main bus
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV CVT
v.	Short circuit withstand current and duration	:	460 kV (1.2/50 microsec)
vi.	Make (Original equipment manufacturer)	:	WS Industries
vii.	Serial No.	:	24420122
viii.	Date and time of occurrence of fault	:	01.08.2023
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	--
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	NIL
xi.	Year of manufacturing	:	NIL
xii.	Date of commissioning	:	1992
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	No
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Checked by T & C team

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	N/A
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	N/A
xix.	Details of protection operated	:	N/A
xx.	Details of tests done after failure	:	Continuity found from CVT to panel
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Voltage not found from CVT to panel.
xxii.	Probable cause of failure	:	Ageing

95. Failure report of 220 kV CVT at Sahajahanpur Substation of UPPTCL

i.	Name of Substation	:	220 kV S/s Sahajahanpur
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CVT, Main Bus-II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV/ 110 V
v.	Short circuit withstand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	HBB
vii.	Serial No.	:	
viii.	Date and time of occurrence of fault	:	18.09.2023 at 14:30 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	--
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	1983
xii.	Date of commissioning	:	24.03.1983
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Finally damaged
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	Preventive maintenance done on dated 06.06.2023

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NO
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Main bus-II CVT damaged
xix.	Details of protection operated	:	Feeder tripped Z4, E/F
xx.	Details of tests done after failure	:	Complete damaged.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No abnormality found pair to fault
xxii.	Probable cause of failure	:	Ageing

96. Failure report of 400kV/110V CVT at Fatehabad, Agra Substation of UPPTCL

i.	Name of Substation	:	765 kV S/s Fatehabad, Agra
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	CVT, 416 bay, R phase
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	400 kV/110 V
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	BHEL
vii.	Serial No.	:	6193169
viii.	Date and time of occurrence of fault	:	11/10/2023
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2016
xii.	Date of commissioning	:	02/10/2017
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not applicable
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	-
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	Thermal scanning of CVT's connector Tightness & periodic maintenance, yearly basis.

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Not available
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	-
xix.	Details of protection operated	:	-
xx.	Details of tests done after failure	:	Voltage ratio Tan Delta
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Low voltage observed during regular O&M.

97. Failure report of 220 kV CVT at Manth, Mathura Substation of UPPTCL

i.	Name of Substation	:	220 kV Manth, Mathura
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	R-Ph CVT of 220 kV Manth Line
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV/110 V
v.	Short circuit with stand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	ABB
vii.	Serial No.	:	2218306
viii.	Date and time of occurrence of fault	:	10.12.2024 at 06:00 Hrs.
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	While taking the 06:00 Hrs. reading.
x.	Weather conditions at the time of failure (Clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	June, 2018
xii.	Date of commissioning	:	31.12.2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	To be repaired
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	NA
xvii.	Details of previous failure	:	

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events /Description of fault (SOE with time stamp)	:	NA
xix.	Details of protection operated	:	NO
xx.	Details of tests done after failure	:	NO
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Voltage not produce in all secondary core of CVT.

98. Failure report of 245 kV CB at Kopili Power Station of NEEPCO

i.	Name of Substation	:	Kopili Power Station
ii.	Utility	:	NEEPCO
iii.	Faulty Equipment and the associated feeder	:	CB, UNIT # 3
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 3150 A
v.	Short circuit withstand current and duration	:	50 kA for 3 Sec
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	Y-phase, 57749C
viii.	Date and time of occurrence of fault	:	14.12.2023 at 16:31 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2021
xii.	Date of commissioning	:	02.09.2023
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Stored as per OEM Recommendation
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Yes, Pole Replacement
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Repaired
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) As newly commissioned, no previous maintenance done. (b) No abnormality observed during commissioning tests (c) Y-phase pole replaced

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	Unit tripped on O/C, Out of Step CBF and Busbar Operated on LBB Back trip
xx.	Details of tests done after failure	:	DCRM, Time Analyzer, IR
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No Visual Damage, however, DCRM signature was found abnormal
xxii.	Probable cause of failure	:	Burnt Internal Contacts

99. Failure report of 220 kV CB at Dhauliganga Power Station of NHPC

i.	Name of Substation	:	220 kV Dhauliganga Power Station
ii.	Utility	:	NHPC LTD.
iii.	Faulty Equipment and the associated feeder	:	(i) U#3-Y Phase Circuit Breaker (ii) Isolator-G2, U#3 Y-Phase (iii) Common Point Assembly, U#3 Y-Phase
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	---
vi.	Make (Original equipment manufacturer)	:	GE T&D (ALSTOM)
vii.	Serial No.	:	--
viii.	Date and time of occurrence of fault	:	16.09.2023 at 17:52 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2003
xii.	Date of commissioning	:	2004
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) SF6 gas purity, Dew point, SO2 content and compartment pressure were checked. (b) NO (c) NIL
xvii.	Details of previous failure	:	

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		NIL
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	--.
xix.	Details of protection operated	:	Bus bar protection.
xx.	Details of tests done after failure	:	SF6 gas purity, Dew point, SO2 content and compartments pressure.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No observation or visual fault point observed.
xxii.	Probable cause of failure	:	Ageing

100. Failure report of 400 kV CB of Suratgarh Substation of RRVUNL

i.	Name of Substation	:	400 kV, 6 x 250 MW, STPS, Suratgarh
ii.	Utility	:	RRVUNL
iii.	Faulty Equipment and the associated feeder	:	TIE CB of 400 kV RTGH CKT-I&II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	420 kV, 2000 A
v.	Short circuit withstand current and duration	:	40 kA for 3 sec
vi.	Make (Original equipment manufacturer)	:	Crompton Greaves Limited
vii.	Serial No.	:	13413 C
viii.	Date and time of occurrence of fault	:	31.10.2023 at 15:28 hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation (while tripping of 400 kV STPS Rtgh Ckt-II Line)
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2000
xii.	Date of commissioning	:	2001
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	N/A
xiv.	If OEM was contacted after failure, its recommendation /remark/ report/ MoM	:	
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	To be Repaired
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	Mechanism Overhauling of circuit Breaker was carried out in Dec 2021. Test report enclosed

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	N/A
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	Tie CB got damaged during tripping of 400 kV STPS- RTGH Ckt-II. Operator manually tripped the 400 kV STPS- RTGH Ckt-I from the control room immediately.
xx.	Details of tests done after failure	:	None
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	--
xxii.	Probable cause of failure	:	--

101. Failure Report of 220 kV CB at Beawar Substation of RRVPNL

i.	Name of Substation	:	XEN (220 kV GSS), RRVPNL, Beawar
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment and the associated feeder	:	220 kV Beawar - Bhilwara bay CB
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV
v.	Short circuit withstand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	HBB
vii.	Serial No.	:	IB/105364/1
viii.	Date and time of occurrence of fault	:	30.09.2023
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	1987-88
xii.	Date of commissioning	:	28.06.1990
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	good
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Completely Damaged Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	As the Circuit Breaker is very old and completed its useful life (26 years). Operating mechanism requires frequent maintenance and is unsafe for interruption/breaking of Capacitive current.

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	As the Circuit Breaker is very old and completed its useful life (26 years). Operating mechanism requires frequent maintenance and is unsafe for interruption/breaking of Capacitive current.
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Operating mechanism failure
xix.	Details of protection operated	:	PD operated
xx.	Details of tests done after failure	:	NA (Completely DAMAGED)
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Leakage of air from poles
xxii.	Probable cause of failure	:	Ageing

102. Failure Report of 220 kV CB at Sanganer Substation of RRVPNL

i.	Name of Substation	:	220 kV GSS Sanganer
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment and the associated feeder	:	220/245 kV SF6 CB (220 V DC) CB and 220/132 kV, 100 MVA Tr.-I (TELK-Make) Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220/245 kV (220 V DC)
v.	Short circuit withstand current and duration	:	40 kA 3 sec
vi.	Make (Original equipment manufacturer)	:	ABB
vii.	Serial No.	:	NJ96012DD003
viii.	Date and time of occurrence of fault	:	16.10.2023 at 10:15 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	1998
xii.	Date of commissioning	:	31.03.1998
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Quarterly Maintenance Carried out on dated 07.08.2023
xvi.	Details of previous failure	:	NA

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xvii.	Sequence of events/ Description of fault (SOE with time stamp)	:	NA
xviii.	Details of protection operated	:	NA
xix.	Details of tests done after failure	:	Physically checked and pneumatic system of said CB found defective.
xx.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Physically checked and pneumatic system of said CB found defective
xxi.	Probable cause of failure	:	Ageing
xxii.	Present Condition of Equipment	:	Beyond Repair

103. Failure report of 400 kV CB at Bhensara Substation of RRVPNL

i.	Name of Substation	:	400 kV GSS, JSL-2, Bhensara
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment and the associated feeder	:	01 No. Pole of main CB & 01 No. Pole of TIE CB of 400 kV Bus Reactor
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	400 kV
v.	Short circuit withstand current and duration	:	50 kA
vi.	Make (Original equipment manufacturer)	:	SIEMENS
vii.	Serial No.	:	19264 & 19473
viii.	Date and time of occurrence of fault	:	15.11.2023 at 08:30 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2017
xii.	Date of commissioning	:	06.03.2019
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Normal
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	To be repaired
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	General maintenance carried out 08.10.2023. No, any test was carried out by service provider.

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NIL
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	The reactor was switched ON on date 16.07.23 & while switching off the Main C.B. vide LD Message the rupturing unit got damaged. In the same manner the TIE C.B. breaker which was already ON on dt. 14.11.23 & while switching off on Date. 15.11.23 the rupturing unit got damaged.
xix.	Details of protection operated	:	No any protection operated
xx.	Details of tests done after failure	:	No
xxi.	Probable cause of failure	:	As the CT got completely damaged so cause of failure could not be determined

104. Failure report of 220 kV CB at Gorakhpur Substation of UPPTCL

i.	Name of Substation	:	400 kV Gorakhpur Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	CB of R phase, 220 kV Gorakhpur-II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV
v.	Short circuit withstand current and duration	:	40.0 kA/ 3 sec
vi.	Make (Original equipment manufacturer)	:	Siemens
vii.	Serial No.	:	IB 111145
viii.	Date and time of occurrence of fault	:	11.01.2024, 14:21 hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Running Operation
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2005
xii.	Date of commissioning	:	25.08.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Open yard
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ to be repaired/ beyond repair)	:	Damaged (Beyond repair)
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	—
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	—
xix.	Details of protection operated	:	N.A.
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	During observation of breaker was found mechanically damaged.
xxii.	Probable cause of failure	:	Spring damaged

105. Failure report of 400 kV CB at Gorakhpur Substation of UPPTCL

i.	Name of Substation	:	400 kV Substation Gorakhpur
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	400 kV bus coupler CB, Bus coupler bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	420 kV
v.	Short circuit withstand current and duration	:	40.0 kA/ 3 sec
vi.	Make (Original equipment manufacturer)	:	ABB
vii.	Serial No.	:	45000006
viii.	Date and time of occurrence of fault	:	19.08.2024 at 09:00 hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Running Operation
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2002
xii.	Date of commissioning	:	15.03.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	—
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Damaged (Beyond repair)
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	—
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/Description of fault	:	—

	(SOE with time stamp)		
xix.	Details of protection operated	:	N.A.
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	During observation of breaker Air pressure chamber found damaged.
xxii.	Probable cause of failure	:	Ageing

106. Failure report of 220 kV CB at Jolly Road-Muzaffarnagar of UPPTCL

i.	Name of Substation	:	400 kV Jolly Road-Muzaffarnagar substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CB - BADHAI KALA FEEDER
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 1250 A
v.	Short circuit with stand current and duration	:	40 kA & 3 sec
vi.	Make (Original equipment manufacturer)	:	SIEMENS
vii.	Serial No.	:	2010/02/7171
viii.	Date and time of occurrence of fault	:	21.08.2024 at 09:02 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	03.03.2011
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	--
xiv.	If OEM was contacted after failure, its recommendation / remark / report/ MoM	:	--
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Timing test, IR valve & Protection Testing (b) No abnormality observed (c) --
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No failure in past

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	CB Open Flags: C/P-- DPO, DPSPU, CB trip circuit 1/2 faulty R/P-- R, Y, B-ph trip, A/R lockout, Z-1, CS, 86B, K86R, loc-3.839 km, Ir-12.18 kA.
xx.	Details of tests done after failure	:	Replaced by new breaker
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CB was running in normal condition, CB was 14 year old & failed due to insulation failure
xxii.	Probable cause of failure	:	Insulation failure

107. Failure report of 400 kV CB at Unnao Substation of UPPTCL

i.	Name of Substation	:	400 kV Unnao Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	400 kV SF6 CB of TBC bay (400 kV Unnao-Agra feeder was energized)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	420 kV/2000 A
v.	Short circuit withstand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	Crompton Greaves Ltd.
vii.	Serial No.	:	6724 C
viii.	Date and time of occurrence of fault	:	23.09.2024, 19:52hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	—
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	1995
xii.	Date of commissioning	:	22.09.1998
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	—
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	—
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Timing test and IR value, Protection Testing (b) No any abnormality seen
xvii.	Details of previous failure	:	—

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	–
xix.	Details of protection operated	:	CB open
xx.	Details of tests done after failure	:	Replaced by new breaker
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	CB was running in normal condition. CB was 26 years old and failed due to insulation failure.
xxii.	Probable cause of failure	:	Insulation failure

108. Failure report of 220 kV LA at Sangrur Substation of BBMB

i.	Name of Substation	:	220 kV Substation Sangrur
ii.	Utility	:	BBMB
iii.	Faulty Equipment and the associated feeder	:	198 kV Red Phase L.A Crompton Greaves
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	Crompton Greaves
vii.	Serial No.	:	51888
viii.	Date and time of occurrence of fault	:	20.08.2023 at 16:13 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (Clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2006
xii.	Date of commissioning	:	16.10.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Commissioned within six months
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MOM	:	NIL
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	LA Burst /Damaged
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Last scheduled Yearly maintenance Carried out on 14.04.2023 and Test of LA (MOSA) done on 25.04.2023 which is 95 micro Ampere (b) Found nothing abnormal (c) N.A
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No any of previous failure occurred since its commissioning)

xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	On 220 kV Sangrur Jamalpur Ckt-1, 198 kV LA of Red Phase got Damaged due to some internal fault on 20.08.2023. The damaged LA has been replaced with new one of Elektrolites make Sr.No.76 and commissioned on dated 21.08.2023 at 17:36 Hrs.
xix.	Details of protection operated	:	Main-I A ,Z-1, 212.7 Meter Main -II L1N, Z-1, 0.236 K.M
xx.	Details of tests done after failure	:	No test was possible as the LA was completely damaged.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	The working of LA was satisfactory
xxii.	Probable cause of failure	:	As LA got burs therefore cause of failure could not be determined

109. Failure report of 220 kV LA at Jamalpur Substation of BBMB

i.	Name of Substation	:	220 kV GSS Jamalpur
ii.	Utility	:	BBMB
iii.	Faulty Equipment and the associated feeder	:	198 kV LA, 220 kV Jamalpur- Sangrur Circuit No.-1 ON DT. 21.08.2023
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV B phase
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	51886
viii.	Date and time of occurrence of fault	:	21.08.2023 at 18:07 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (Clear sky/ rainy / thunderstorm etc.)	:	Partial Cloudy
xi.	Year of manufacturing	:	2006
xii.	Date of commissioning	:	18.10.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MOM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) IR Value-7.48 GW on date 06.04.2023 (b) NA (c) NA
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No
xviii.	Sequence of events/ Description of fault	:	Busted/ fused

	(SOE with time stamp)		
xix.	Details of protection operated	:	Trip, ABC, St. Ph- CN, Z-1, F. Loc.-121.0 Mtr.
xx.	Details of tests done after failure	:	NA
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Smoke Observed
xxii.	Probable cause of failure	:	As LA got burs therefore cause of failure could not be determined

110. Failure report of 220 kV LA at Jalandhar Substation of BBMB

i.	Name of Substation	:	220 kV Jalandhar Substation
ii.	Utility	:	BBMB
iii.	Faulty Equipment and the associated feeder	:	198 kV (Rad phase) CGL make ZnO type LA installed on 220 kV Jalandhar-Jamalpur No.2
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	Sr No 51986
viii.	Date and time of occurrence of fault	:	29.10.2023/17.55hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (Clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2006
xii.	Date of commissioning	:	21.08.2009
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Stored in company packing kit
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MOM	:	NIL
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Last scheduled Yearly maintenance Carried out on 14.10.2023. The IR value was taken during yearly maintenance and details is as under:- Ist Stack:- 60 Gohm IInd Stack:- 33 Gohm. Overall:- 80 Gohm MOSA as on 27.03.23 was 25 Micro Amp. (b) Found nothing abnormal (c) N.A
xvii.	Details of previous failure	:	No previous failure occurred since its commissioning.

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	On 29.10.2023, 17:55 hrs. Red phase LA of 220 kV Jalandhar-Jamalpur Ckt 2 burst with heavy noise and Caught fire.
xix.	Details of protection operated	:	MICOM P-442 Started Phase-AN, Tripped phase- ABC, Zone-1 Fault Location – 93.57 meter REL-650 –Loop L1-N Zone -1
xx.	Details of tests done after failure	:	No test was possible as the LA was completely damaged.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	The working of LA was satisfactory
xxii.	Probable cause of failure	:	Ageing

111. Failure report of 220 kV SA at Mehrauli Substation of DTL

i.	Name of Substation	:	Mehrauli Substation
ii.	Utility	:	DTL
iii.	Faulty Equipment and the associated feeder	:	220 kV Surge Arrestor (Y-Phase) of 220 kV MLI -Vasant Kunj Ckt-II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV (rms), Nominal Discharge current-10 kA
v.	Short circuit with stand current and duration	:	40 kA, 3 Sec
vi.	Make (Original equipment manufacturer)	:	Elpro Industries (India)
vii.	Serial No.	:	12.89.127
viii.	Date and time of occurrence of fault	:	31.01.2024 at 21:05Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	During transient fault on line
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	Not Available
xii.	Date of commissioning	:	Not Available
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	Not Available
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ to be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	All PMS activities had been done as per DTL practice. No abnormalities observed in PMS activities.
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	NA
xix.	Details of protection operated	:	Distance protection Z1
xx.	Details of tests done after failure	:	No surge arrestor physically got damaged.
xxi.	Observations (Any relevant observation made by the fields officer during visual inspection)	:	Surge arrestor physically found damaged.
xxii.	Probable cause of failure	:	Insulation Failure

112. Failure report of 220 kV SA at Okhla Substation of DTL

i.	Name of Substation	:	220 kV Okhla Substation
ii.	Utility	:	DTL
iii.	Faulty Equipment and the associated feeder	:	Surge Arrestor (R-Phase) of 220 kV Tughlakabad- Okhla Ckt-II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV (rms), Nominal Discharge current-10 kA
v.	Short circuit with stand current and duration	:	40 kA, 3 Sec
vi.	Make (Original equipment manufacturer)	:	W.S Industries (India) Limited, Madras
vii.	Serial No.	:	9268
viii.	Date and time of occurrence of fault	:	01.10.2024 at 15:02 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During transient fault on line
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	1992
xii.	Date of commissioning	:	1992
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not Available
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) All preventative maintenance activities were carried out as per PMS schedule. All results were within limit. (b) No abnormality observed (c) NA
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	NA

xix.	Details of protection operated	:	Distance protection Z1
xx.	Details of tests done after failure	:	No test conducted as Surge Arrestor physically damaged
xxi.	Observations (Any relevant observation made by the fields staff or during visual inspection)	:	Surge arrestor physically found damaged.
xxii.	Probable cause of failure	:	Ageing

113. Failure report of 198 kV LA at Parulia Substation of DVC

i.	Name of Substation	:	220/33 kV Parulia Substation
ii.	Utility	:	DVC
iii.	Faulty Equipment and the associated feeder	:	Line#257 R Phase LA
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	40 kA, 3Sec
vi.	Make (Original equipment manufacturer)	:	MOGARD (Station Zinc Oxide Arrester)
vii.	Serial No.	:	59 (R Phase)
viii.	Date and time of occurrence of fault	:	09.07.2024, 12.41 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	No Fault Observed.
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Cloudy
xi.	Year of manufacturing	:	1990
xii.	Date of commissioning	:	11.04.1994
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Placed inside Store
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	No.
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) IR Test- Overall- 12.5GOhm (b) No. (c) NA
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NIL

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Line#257 AR opted on dated 09.07.2024 at 12.41 hrs and heavy sound observed from switchyard. On inspection, R phase LA found broken and suspended.
xix.	Details of protection operated	:	Relay Details- Distance Protection Operated- 21M1, 21M2, R phase, Zone-1, Fd-0.10 km
xx.	Details of tests done after failure	:	Failed LA was beyond Repair.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NIL
xxii.	Probable cause of failure	:	Ageing

114. Failure report of 198 kV LA at Barjora Substation of DVC

i.	Name of Substation	:	220/132/33 kV DVC Barjora Substation
ii.	Utility	:	DVC
iii.	Faulty Equipment and the associated feeder	:	L#231 (220 kV MTPS-Barjora Line) R-Phase LA
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV, 10 kA
v.	Short circuit withstand current and duration	:	40 kA for 3 sec
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	34069
viii.	Date and time of occurrence of fault	:	13/07/2024 12:57 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	No
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2004
xii.	Date of commissioning	:	01-06-2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Inside store
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) 3rd harmonics result and megger value where normal during maintenance (b) No (c) NA

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NO Failure occurred previously
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	13/07/2024 at 12:57 Hrs L#231 tripped with loud sound and after yard inspection it was found that R-Phase LA of said line found busted zone-1opted 12.57.246 sec
xix.	Details of protection operated	:	21M1-R, Y phase operated, Zone-1 Operated, PSB detected 21M2- -R,Y phase operated, Zone-1 Operated, F.D-0.1 86A,86B, 86L/O,
xx.	Details of tests done after failure	:	Not done (As LA Got Busted Completely)
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No
xxii.	Probable cause of failure	:	Ageing

115. Failure report of 400 kV LA at Astha Substation of MPPTCL

i.	Name of Substation	:	400 kV Astha Substation
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	Lighting Arrester (220 kV Bairagharh)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	Oblum Electrical Industries Pvt Ltd
vii.	Serial No.	:	4
viii.	Date and time of occurrence of fault	:	21-07-2023 at 19:25 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	NO
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	--
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	25-08-2011
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Crack on Top & Bottom Stack/not usable
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	--
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NO

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Tripping on feeder on B-phase and Fault Current observe 23.238 kA. After that yard round taken LA found damage. Heavy raining with thundering & lightening.
xix.	Details of protection operated	:	
xx.	Details of tests done after failure	:	IR Value Taken found 0.22 Mega ohm.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Its Top & Bottom Stack crack therefore LA is not usable.

116. Failure report of 220 kV LA at Pithampur Substation of MPPTCL

i.	Name of Substation	:	220 kV Pithampur Sector-1
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Lightning Arrestor
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV, MCOV 168 kV
v.	Short circuit withstand current and duration	:	40 kA for 1 sec
vi.	Make (Original equipment manufacturer)	:	LAMCO
vii.	Serial No.	:	737A
viii.	Date and time of occurrence of fault	:	28.07.2023 at 06:11 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Discovered after tripping.
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Cloudy
xi.	Year of manufacturing	:	2012
xii.	Date of commissioning	:	16.03.2016
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NO
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Failed
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	IR Value taken. No Abnormalities observed
xvii.	Details of previous failure	:	NO

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	DPR Operated, MTR operated, CB Open
xix.	Details of protection operated	:	DPR Operated, ZI. R Ph. 0.8 km
xx.	Details of tests done after failure	:	IR value found zero.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	On Visual inspection after fault, LA top porcelain found damaged.
xxii.	Probable cause of failure	:	Moisture ingress

117. Failure report of 220 kV LA at Indore South Substation of MPPTCL

i.	Name of Substation	:	220 kV Indore South Substation
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	LA-R&Y ph (220 kV SZ-Indore-11)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	OBLEM
vii.	Serial No.	:	5
viii.	Date and time of occurrence of fault	:	05.09.2023 at 09:27hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	1990
xii.	Date of commissioning	:	14.09.1995
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NO
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	06.08.2018
xvii.	Details of previous failure	:	NO

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Only 220 kV SZ-IND -II Both end Trip dated: 05.09.2023
xix.	Details of protection operated	:	INDORE end-R&Y ph, Zone-II, FL-4.5 kM, FC-11.52KA, AR L/O, S/ZONE end- R&Y ph, Zone-I, FL-1.8 kM, AR L/O
xx.	Details of tests done after failure	:	LA Burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	LA Burst
xxii.	Probable cause of failure	:	Ageing

118. Failure report of 400 kV LA at Indore South Substation of MPPTCL

i.	Name of Substation	:	Indore South 400 kV Substation
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	LA
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	OBLEM
vii.	Serial No.	:	26
viii.	Date and time of occurrence of fault	:	23.09.2023
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	--
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	11.08.2011
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	13.10.2021
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Indore-Jetpura AR Successfully From both end
xix.	Details of protection operated	:	220 kV Indore-Jetpura AR Successfully From both end, Indication Indore end-Rph Z-1 Loc-5.5 km, Fc-16.975 kA Jetura end-Rph Z-1, Loc-29.2 km, FC-4.82 kA
xx.	Details of tests done after failure	:	LA Burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	LA Burst
xxii.	Probable cause of failure	:	Moisture Ingress

119. Failure report of 400 kV LA at Bhopal Substation of MPPTCL

i.	Name of Substation	:	400 kV Bhopal Substation
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	LA (B-phase) 400 kV Bhopal Itarsi
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	336 kV, Normal Discharge Current 10 kA, MCOV-NA
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	WSI
vii.	Serial No.	:	89/6/114
viii.	Date and time of occurrence of fault	:	25.09.2023 at 00.15 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	--
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	1989
xii.	Date of commissioning	:	1991
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	LA Burst
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) IR Value of LA DI-23.05.2023TOP-E-3.18 GI (b) NIL (c) NA
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	On 24.09.2023 @ 18.46 Hrs 400 kV Bhopal Itarsi-2 tripped ZONE 1, Y&B Phase/38.47 kM/ly-9.53 kA/169.59 kA. Line Declared Faulty on dated 25.09.2023 at 00.12 Hrs. Line Charged & again Tripped at 00.15 hrs With Failure B Phase L.A.
xix.	Details of protection operated	:	DPR Main 1 & 2 Operated
xx.	Details of tests done after failure	:	As the LA got completely burst, No Tests could be performed.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	LA Burst
xxii.	Probable cause of failure	:	Insulation Failure

120. Failure report of 220 kV LA at Badnera Substation of MSETCL

i.	Name of Substation	:	220 kV Badnera Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	R-Ph LA of 220 kV TSS-I Line
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV, 40 kA
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	LAMCO INDUSTRIES PVT. LTD. HYDERABAD
vii.	Serial No.	:	681C
viii.	Date and time of occurrence of fault	:	08/07/2023 at 13:00 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	LA burst
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	2008-09
xii.	Date of commissioning	:	14.08.2014
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	The LA was kept spare at 220 kV Badnera S/s
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MOM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities)	:	The said LA was commissioned on dated 14.08.2014 at 220 kV S/s Bandera.
	(b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	The LCM results are taken on dated 31/05/2023.
	(c) What steps were taken to address the abnormality?	:	Results found ok.
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No failure

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	: 1) At 11:55 Hrs On dated 08.07.2023, 220 kV TSS-I line CB R- Ph pole found off at 220 kV Badnera S/s, No indication is received on relay panel and on window. 2) At 12:00 Hrs on dated, 08.07.2023 above information is conveyed to LD Nagpur. 3) At 12: 45 Hrs on dated 08.07.2023 after permission from LD Nagpur, TSS-I line load is shifted on 220 kV TBC bay for testing of 220 kV TSS- I line breaker by Testing Unit, Amravati. 4) At 13:00 Hrs on Dated 08.07.2023 220 kV TSS- I bay R- Ph LA burst and 220 kV TBC bay CB tripped. 5) At 13:02 Hrs on Dated 08.07.2023 above tripping information is conveyed to LD Nagpur. 6) At 15:00 Hrs on Dated 08.07.2023 IR test of spare LA carried out at 220 kV SS Badnera and result found ok. 7) At 17:35 Hrs on Dated 08.07.2023 replacement work of 220 kV TSS- I line R-Ph LA is completed. 8) At 18:37 Hrs on Dated 08.07.2023 Undertaking to take 220 kV TSS- I line in service is submitted to LD Nagpur via Email. 9) At 18:38 Hrs on Dated 08.07.2023 Permission granted by LD Nagpur telephonically to Charge 220 kV TSS- I line. 10) At 18:42 Hrs on Dated 08.07.2023 220 kV TSS- I line is charged and stood ok. 11) At 18:43 Hrs on Dated 08.07.2023 220 kV TSS- I line charging time is conveyed to LD Nagpur.
xix.	Details of protection operated	: Before tripping of 220 kV TBC bay i.e. before bursting of R-ph LA:- No Indications on 220 kV TSS-I Line/Bay After tripping of 220 kV TBC bay i.e after bursting of R-ph LA:- Window indications at 220 kV Badnera S/s 1) Distance Protection operated 2) Zone I trip 3) R ph Trip Relay indications at 220 kV Badnera S/s :

			1) A Trip, N Z1, 2) Distance- 0.107 m, 3) R phase, Zone-1 4) Fault current $I_r - 10.29\text{kA}$, $I_c - 2.417\text{A}$ 5) Master Trip 863C
xx.	Details of tests done after failure	:	As LA burst and beyond repairable, no test carried out after failure.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Nothing found any abnormality.
xxii.	Probable cause of failure	:	Atmospheric Condition

121. Failure report of 220 kV LA at Flagship Substation of MSETCL

i.	Name of Substation	:	220 kV Flagship Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Chinchwad Line bay- B Ph Lightning Arrestor
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV/40 kA, 50 Hz long duration discharge class: 3
v.	Short circuit withstand current and duration	:	---
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	78650
viii.	Date and time of occurrence of fault	:	Date 28.07.2023 at 10:09 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	220 kV CB Overhauling work of same bay was going on during fault.
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	2008
xii.	Date of commissioning	:	23.02.2012
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	To be repaired in consultation with manufacturer. Stack wise IR values were taken for failed LA on dated 25.08.2023. & the IR values are found within limit. Hence, said LA can be reutilized by replacing damaged corona ring.
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	LCM test carried out 28.04.2023; LCM VALUES FOUND NORMAL; IR values taken on 22.06.2023; IR of B phase 2nd stack-9.27 GΩ

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Continuous Outage on Cinchwad line bay CB at Flagship S/s was going on from 27.07.2023 by opening Line & Bus Isolators for CB overhauling work. 220 kV Chinchwad I- Flagship line tripped at 10:09 Hrs. on dated 28.07.2023 with simultaneous flashover of 220 kV B-ph LA at Flagship S/s due to placing earth rod on 220 kV B-ph LA. Line was tripped at 220 kV Chinchwad I S/s end only. No indications were observed at 220 kV Flagship S/s end.
xix.	Details of protection operated	:	No protection was operated as CB was already off at Flagship S/s
xx.	Details of tests done after failure	:	LA IR values measured.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Flashover marks observed on second stack of B-phase LA. Also, corona ring failure occurred.
xxii.	Probable cause of failure	:	Human Error

122. Failure report of 220 kV SA at Satara MIDC Substation of MSETCL

i.	Name of Substation	:	220 kV Satara MIDC Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220/132 kV 100 MVA ICT-02 HV R ph LA
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	10 kA
vi.	Make (Original equipment manufacturer)	:	LAMCO
vii.	Serial No.	:	242A/B, 243C
viii.	Date and time of occurrence of fault	:	15.08.2023 at 20:20 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	NA
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2007
xii.	Date of commissioning	:	11.12.2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Nil
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	—
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repairs
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) In Quarterly maintenance, cleaning of LA carried out on dated 27.06.2023. (b) Further on dated 07.04.2023, LCM test carried out, result found within limit.
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	(i) On dated 15.08.2023, 20:20 Hrs, 220/132 kV 100 MVA ICT No. 2 tripped on Differential Protection Operated. (ii) At 20:20 Hrs. R-Ph LA of 100 MVA ICT No. 2 flashover. Faulty LA replaced and 220/132 kV 100 MVA ICT No.2 Charged on 16.08.2023 @ 02:20 hrs.
xix.	Details of protection operated		Differential protection operated Master trip HV Diff trip Diff R Y B Diff HS Master trip LV
xx.	Details of tests done after failure	:	Not taken as LA got burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No such observation during inspection. Might be due to LCM value increased.
xxii.	Probable cause of failure	:	Cause of failure could not be determined as LA got burst

123. Failure report of 220 kV LA at Kathapur Substation of MSETCL

i.	Name of Substation	:	220/132/33 kV Kathapur Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Kathapur-Lonikand Line Bay B ph LA
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	12568
viii.	Date and time of occurrence of fault	:	24.02.2024 at 12:55 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	B-Ph LA burst
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear weather condition
xi.	Year of manufacturing	:	2002/03
xii.	Date of commissioning	:	27.04.2002
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	LA was installed during Substation commissioning. (The gap between delivery at site and commissioning is within 6 months)
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No. As LA was not under Guarantee Period.
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	On dated 14.11.2023, LA LCM carried out & values were abnormal (402.9 micro A). 4 No's of LA received on dated 23.01.2024 and LA having higher results are to be replaced on priority. 03 No's of LA replaced due to higher LCM values and 220 kV Kathapur- Lonikand Line Bay B ph LA is planned for replacement on dated 28.02.2024. (Due to bursting of LA is replaced by new LA on dated 24.02.2024 & said line charged at 18:16 hrs stood ok)
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	LA burst. 220 kV Lonikand I line tripped on Distance protection from local and remote end.
xix.	Details of protection operated	:	Distance protection operated
xx.	Details of tests done after failure	:	As LA was burst, no tests done after failure.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	LA burst.
xxii.	Probable cause of failure	:	Failure might be due to ageing effect & LA was under observation.

124. Failure report of 220 kV LA at Bhosari-2 Substation of MSETCL

i.	Name of Substation	:	220 kV Bhosari-2 Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	EHV Lightning Arrestor (Rph, Yph, Bph) Name of Bay: - PTR 3 EHV Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	Voltage: -198 kV Discharge Current: -10 kA Rated Frequency: -48 to 62 Hz Discharge Class: -3 MCOV: -168 kV
v.	Short circuit withstand current and duration	:	NO
vi.	Make (Original equipment manufacturer)	:	OBLUM Electricals
vii.	Serial No.	:	R ph-1570; Y ph-1573; B ph-1597
viii.	Date and time of occurrence of fault	:	Dt 24.07.2024 at 23:02 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	R Ph,Y Ph & B Ph LA burst due to burning of TF
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Heavy Rain & wind.
xi.	Year of manufacturing	:	2011
xii.	Date of commissioning	:	28.03.2013
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) IR test carried out on dt:- 21.04.2024 (b) LA LCM test carried out on dt:-12.07.2024 (c) All test results found ok
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	1) 220/22 kV, 50 MVA EMCO (repaired by M/s Mahati) T/F 3 caught fire on Dated 24.07.2024 at 23:02 Hrs. & tripped on High Set Differential trip & REF trip. 86 A, 86 B operated.
xix.	Details of protection operated	:	TF No. 3 tripped on High Set Differential protection & REF trip. 86 A, 86 B operated.
xx.	Details of tests done after failure	:	Y ph and B ph LA test not done as LA burst. R ph LA IR value test carried out.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	LA caught fire due to burning of Transformer.
xxii.	Probable cause of failure	:	R Ph,Y Ph & B Ph LA burst due to Transformer fire.

125. Failure report of 400 kV LA at Dhule Substation of MSETCL

i.	Name of Substation	:	400 kV Dhule Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	400/220 kV ICT-3 Y-Ph LA
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	390 kV
v.	Short circuit withstand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	109430
viii.	Date and time of occurrence of fault	:	12.08.2024 at 05.12 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	In service
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	July-2005
xii.	Date of commissioning	:	01.01.2012
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	N.A.
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MOM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	LCM taken on dated 06.05.2024.
xvii.	Details of previous failure	:	NIL

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	On dated 12.08.2024 at 05:12 hrs. Y-ph. Bushing of 400/220 kV 501 MVA ICT-3 was burst; it also damaged the HV side LA.
xix.	Details of protection operated	:	Differential Protection
xx.	Details of tests done after failure	:	Due to bursting of HV bushing, collars of this LA are damaged. (Physically damaged).
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	The said LA found physically damaged.
xxii.	Probable cause of failure	:	Due to bursting of HV bushing of 400/220 kV Transformer, collars of this LA are damaged. (Physically damaged).

126. Failure Report of 220 kV LA at Warora Substation of MSETCL

i.	Name of Substation	:	220 kV Warora Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	B Ph HV LA of 50 MVA 220/66 kV PTR-2
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	Elpro International Ltd.
vii.	Serial No.	:	2034824
viii.	Date and time of occurrence of fault	:	On dated 20.10.2024 at 19:20 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	During operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Normal
xi.	Year of manufacturing	:	2004
xii.	Date of commissioning	:	2004
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation / remark/ report/ MOM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) LCM leakage current: 86 μ A (b) NA (c) NA
xvii.	Details of previous failure	:	NIL

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	On dated 20.10.2024 at 19:40 Hrs, 50 MVA 220/66 kV PTR-2 tripped on differential and REF protection operated. At the time of tripping huge sound was heard and after inspection it is found that B-PH HV LA of 50 MVA 220/66 kV PTR-2 burst. Hence, after tripping HV equipment isolator and LV bus isolator opened & LA replaced.
xix.	Details of protection operated	:	W.I.: Differential Protection Trip, HV REF trip R. I.: LED:Gen. trip, Rph diff, Yph diff, Bph diff, HS1, HS2. REF relay, Master trip relay
xx.	Details of tests done after failure	:	LA was burst hence test not carried out.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NA
xxii.	Probable cause of failure	:	Ageing

127. Failure report of 220 kV LA at Taloja Substation of MSETCL

i.	Name of Substation	:	220 kV Taloja Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	Y-ph Lightning Arrestor (220 kV Navi Mumbai- Taloja (PG) line)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	15504
viii.	Date and time of occurrence of fault	:	31.10.2024
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Burst
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2004/03
xii.	Date of commissioning	:	08.03.2004
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation / remark / report / MOM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Replaced by new LA
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	LCM was taken on dated 13.05.2024. LCM value: 102 μ A
xvii.	Details of previous failure	:	NA

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	LA Burst and line tripped on Distance protection.
xix.	Details of protection operated	:	Distance protection operated. W/I:- Distance protection operated, A/R Lockout R/I:- R ph, Y ph, B ph trip. Fault Current: - IL1-1.87 kA, IL2-5.42 kA, IL3-1.10 kA Fault Location- 0.1 km IR:- 20111308 ohm
xx.	Details of tests done after failure	:	LA Burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No
xxii.	Probable cause of failure	:	Ageing

128. Failure Report of 220 kV SA at Deogarh Substation of OPTCL

i.	Name of Sub station	:	220/33 kV GSS, Deogarh
ii.	Utility	:	OPTCL
iii.	Faulty equipment and the associated feeder	:	R-phase Surge arrester in 220 kV Transformer -II Feeder flashed over
iv.	Rating (Voltage/ current/ capacitance/ MCOV etc)	:	72 kV, 10 KA MCOV: 58.33 kV
v.	Short circuit withstand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	Lamco Industries Pvt Ltd
vii.	Serial No.	:	192 A/B/C
viii.	Date and time of occurrence of fault	:	12.08.2023 /11:00 HRS
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Normal
xi.	Year of manufacturing	:	2018
xii.	Date of commissioning	:	06.08.2021
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Reported to division office
xv.	Present condition of equipment (Repaired/To be repaired / beyond repair)	:	Flashed over
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) 06.08.2021 (b) NO
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	

xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	
xix.	Details of protection operated	:	DIR. O/C & E/F RELAY IL1=1.44 kA, IL2=1.02 kA, IL3=0.15 kA
xx.	Details of tests done after failure	:	Flashed over
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Earthing value found normal as per norm
xxii.	Probable cause of failure	:	Could not be determined

129. Failure report of 220/132/33 kV LA at Therubali Substation of OPTCL

i.	Name of Substation	:	220/132/33 kV Therubali Substation
ii.	Utility	:	OPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV LA of 100 MVA Auto Transformer-1 (B-Ph)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	Not available
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	9609038
viii.	Date and time of occurrence of fault	:	09.11.2023 at 16:59 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	LA burst
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	1996
xii.	Date of commissioning	:	Not available
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	N/A
xiv.	If OEM was contacted after failure, its Recommendation / remark/ report/ MoM	:	N/A
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	N/A

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	N/A
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	100 MVA auto Trf-1 tripped due to LA Burst
xix.	Details of protection operated	:	Differential protection and REF protection operated.
xx.	Details of tests done after failure	:	No
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No
xxii.	Probable cause of failure	:	Ageing

130. Failure report of 220 kV SA at Budhipadar Substation of OPTCL

i.	Name of Substation	:	220/132/33 kV GSS Budhipadar
ii.	Utility	:	OPTCL
iii.	Faulty Equipment and the associated feeder	:	Surge Arrester, Feeder - 220 kV Budhipadar - Lephripada.
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	Voltage-216 kV, Discharge current-10 kA
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	9609040
viii.	Date and time of occurrence of fault	:	Dt-29.12.2023 at 13:47
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	NA
xii.	Date of commissioning	:	NA
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	—
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair. Replaced with new one (Make-CGL).
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	During maintenance; tightening of jumper & clamp was done.
xvii.	Details of previous failure	:	---

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	---
xix.	Details of protection operated	:	Dp-1: Fault Location - Y-phase-E, zone1, Fault Duration- 59.96 ms, Ia- 105.3 A, Ib- 28.66 kA, Ic- 67.27 A, Fault Resistance- 2.95 ohm Dp-2: F.L- Y-phase-E, zone1, F.D- 0.2 km, Ia- 0.09 kA, Ib- 32.80 kA, Ic- 0.07 kA.
xx.	Details of tests done after failure	:	--
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	--
xxii.	Probable cause of failure	:	Insulator punctured of LA

131. Failure report of 400 kV SA at CTPP, Chhabra Substation of RRVUNL

i.	Name of Substation	:	Chhabra Thermal Power Station, Chhabra
ii.	Utility	:	RRVUNL
iii.	Faulty Equipment and the associated feeder	:	400 kV, R-phase Lightning Arrester of Generator Transformer -2
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	395 kV
v.	Short circuit withstand current and duration	:	20 kA,
vi.	Make (Original equipment manufacturer)	:	ELPRO INTERNATIONAL LTD. PUNE
vii.	Serial No.	:	56807
viii.	Date and time of occurrence of fault	:	17.11.2023 at 18:47 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	clear sky
xi.	Year of manufacturing	:	11/2007
xii.	Date of commissioning	:	2012
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-----
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	beyond repair
xxiii.	(d) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (e) Whether any abnormality observed in these tests. If yes, attach the test reports. (f) What steps were taken to address the abnormality?	:	(a) No abnormality observed during previous maintenance (b) No (c) No

xxiv.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	---
xxv.	Sequence of events/ Description of fault (SOE with time stamp)	:	Sudden Blast in 400 kV R-phase Lightning Arrester of Generator Transformer -2 and Generator Transformer -2 tripped on over current protection.
xxvi.	Details of protection operated	:	Generator Transformer -2 Over current fault protection Numerical relay read the 29.19 kA current in R-phase and Generator Transformer -2 Over current fault protection Numerical relay generated instantaneous Class-A trip command and Unit#2 Tripped on Generator electrical protection activated.
xxvii.	Details of tests done after failure	:	Equipment failed (Blasted) and replaced with new Lightning Arrester after checking IR value.
xxviii.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No any abnormal observations.
xxix.	Probable cause of failure	:	Cause of failure could not be determined as equipment got burst

132. Failure report of 400 kV LA at CTPP Chhabra Switchyard Phase – I of RRVUNL

i.	Name of Substation	:	400 kV CTPP Switchyard Phase – I, Chhabra
ii.	Utility	:	RRVUNL
iii.	Faulty Equipment and the associated feeder	:	400 kV Adani line – R phase - LA, Bay-411
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	360 kV, 20 kA
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	ELPRO
vii.	Serial No.	:	54 TOP, 54 MIDDLE-1, 54 MIDDLE-2, 54 BOT
viii.	Date and time of occurrence of fault	:	28.12.2024 at 04:33 AM
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Thunderstorm
xi.	Year of manufacturing	:	2007
xii.	Date of commissioning	:	2010
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Replaced with New Lightning Arrester
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Cleaning of porcelain portion of LA.
xvii.	Details of previous failure (Any failure which has led to a major repair	:	NA

	of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	On 28/12/2024, at 04:33 AM, the R-phase LA of the 400 kV Adani Line Switchyard (Bay 411) experienced a blast, resulting in the porcelain petty coat breaking into pieces. Following events took place : 400 kV CTPP-Adani Line tripped at earth fault on R-phase (If = 19.02 kA), due to which Tie Circuit Breaker also Tripped (Bay 410).
xix.	Details of protection operated	:	Distance Protection Operated
xx.	Details of tests done after failure	:	No test could be performed as LA was completely damaged. Therefore, exact condition of failure cannot be known.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	LA was found damaged.
xxii.	Probable cause of failure	:	Atmospheric Condition

133. Failure report of 220 kV SA at ALWAR Substation of RRVPNL

i.	Name of Substation	:	220 kV GSS ALWAR
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment and the associated feeder	:	Surge Arrester 220 kV Mia Alwar Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit withstand current and duration	:	10 KA
vi.	Make (Original equipment manufacturer)	:	OBLUM
vii.	Serial No.	:	35
viii.	Date and time of occurrence of fault	:	06.08.2023 at 18:02 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	2011
xii.	Date of commissioning	:	08.02.2011
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Not contacted to OEM
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repair
xvi.	Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) Whether any abnormality observed in these tests. If yes, attach the test reports. What steps were taken to address the abnormality?	:	(a) 14.06.2023 (Maintenance as per ISO schedule on dated 14.06.2023) (b) No any abnormality observed
xvii.	Details of previous failure (Any failure which has led to a major repair of the	:	No any

	equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Tripping On 220 kV Mia Alwar Line
xix.	Details of protection operated	:	M1 : Z1, B-N, DIST 556 MTR
xx.	Details of tests done after failure	:	Burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Burst
xxii.	Probable cause of failure	:	Internal fault

134. Failure Report of 220 kV SA at Kishangarh Substation of RRVPNL

i.	Name of Substation	:	220 kV GSS Kishangarh
ii.	Utility	:	RRVPNL
iii.	Faulty Equipment and the associated feeder	:	Surge Arrester of 220 kV Khushkhera Bay, Y-Ph
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220/198 kV, 10 kA LA
v.	Short circuit withstand current and duration	:	10 KA
vi.	Make (Original equipment manufacturer)	:	Oblum
vii.	Serial No.	:	17
viii.	Date and time of occurrence of fault	:	19.09.2023 at 11:14 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear Sky / rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2009
xii.	Date of commissioning	:	22.02.2012
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Not contacted to OEM
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Measurement of earth resistance & test result found within limit, check healthiness of the surge counter, during maintenance (b) No any abnormality observed

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No any
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Internal Fault
xix.	Details of protection operated	:	Distance Protection Operated Z2 , 38.3 Km at khuskhera End. No any protection operated at 220 kV GSS KGBAS end.
xx.	Details of tests done after failure	:	Burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No any abnormality observed
xxii.	Probable cause of failure	:	Internal fault

135. Failure report of 400 kV SA at PGCIL Navsari Substation of Torrent Power Limited

i.	Name of Substation	:	400 kV PGCIL Navsari (DASTAN)
ii.	Utility	:	Torrent Power Limited
iii.	Faulty Equipment and the associated feeder	:	Surge Arrester of DGEN Navsari Line 1
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	400 kV
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	CGL (Crompton Greaves Ltd.)
vii.	Serial No.	:	134249
viii.	Date and time of occurrence of fault	:	18.12.2023
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Periodic testing
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2012
xii.	Date of commissioning	:	2012
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Indore Store
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. No. If yes, attach the test reports. (c) What steps were taken to address the abnormality? Not applicable.	:	(a) TOP Stack Value < 1 G Ohms (23.0 M Ohms) observed during Periodic testing. (b) Yes, Measured Value = 23.0 M Ohms. (c) Surge arrester replaced on dt.22.12.2023 (Bay 409 R Ph)

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NIL
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	NA
xix.	Details of protection operated	:	NA
xx.	Details of tests done after failure	:	Fault observed during IR measured Testing
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NIL
xxii.	Probable cause of failure	:	Could not be determined

136. Failure report of 220 kV SA at Alamathy Substation of TANTRANSCO

i.	Name of Substation	:	400/230 kV Alamathy Substation.
ii.	Utility	:	TANTRANSCO
iii.	Faulty Equipment and the associated feeder	:	Surge Arrestor (LA) of 230 kV Alamathy-Manali-2 feeder at B phase.
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	230 kV /110 V
v.	Short circuit with stand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	Crompton Greaves
vii.	Serial No.	:	24622
viii.	Date and time of occurrence of fault	:	09.08.2024
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operational during in normal service.
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Heavy rain with thunder and lighting
xi.	Year of manufacturing	:	2005
xii.	Date of commissioning	:	2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not applicable
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Life served more than 17 years.
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond Repairable
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Insulator Cleaned
xvii.	Details of previous failure	:	Nil

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	230 kV Mosur -2 # got tripped at both the ends on 09.08.2024 at 17:32 Hrs due to Ro Jumper cut at location No. 162, declared by AE/Lines/Gummidipoondi. After the rectification of Jumper cut, Test charged at 22.21 Hrs. Observed that Y & line voltage was zero, immediately hand tripped on emergency basis.
xix.	Details of protection operated	:	Main 1 Relay Indications: PSB/ VT Fail/ BRC/SOTF Main 2 Relay Indications: VT fails. NIL
xx.	Details of tests done after failure	:	Ratio Test: Core 1: 0.168V, Core 2: 0.139V, Core 3: 0.168 V (Injected voltage - 10kV). Tan Delta value - Not measurable/ Beyond the limit.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NIL
xxii.	Probable cause of failure	:	Ageing

137. Failure report of 220 kV SA at Alamathy Substation of TANTRANSCO

i.	Name of Substation	:	400/230 kV Alamathy Substation
ii.	Utility	:	TANTRANSCO
iii.	Faulty Equipment and the associated feeder	:	Surge Arrestor (LA) of 230 kV Alamathy-MAnali-2 feeder at B phase
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	System voltage-220 kV Rated voltage – 216 kV MCOV-168 kV
v.	Short circuit with stand current and duration	:	40 kA
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	27210
viii.	Date and time of occurrence of fault	:	24.09.2024 at 14:39 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operational during in normal service.
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2003
xii.	Date of commissioning	:	2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not applicable since the equipment was in service.
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Life served more than 17 years.
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond Repairable
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Date of test: 12.09.2023 third harmonic leakage current 56 micro Amps. Insulator cleaned earth pit watered. (b) Nil (c) Nil
xvii.	Details of previous failure	:	Nil

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	230 kV manali-2 got tripped at both the ends on distance protection. On inspection of the yard blue phase LA found failed.
xix.	Details of protection operated	:	230 kV manali-2 feeders main 1: start C, Trip-ABC, Zone-1, and IC: 24.5 kA. Fault duration 50.01 ms LOC:00 mts Main 02 NIL
xx.	Details of tests done after failure	:	LA on stack flashed over. Hence no test was carried out
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Heavy sound and smoke observed in 230 kV Manali-2 feeders B phase 1.
xxii.	Probable cause of failure	:	Ageing

138. Failure report of 220 kV SA at Hafizpur Substation of UPPTCL

i.	Name of Substation	:	220 kV Hafizpur Substation Azamgarh
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	Surge Arrester (R-Phase of 220 kV Jaunpur line)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)		198 kV
v.	Short circuit withstand current and duration		-
vi.	Make (Original equipment manufacturer)		Oblum Electrical Industries Pvt. Ltd.
vii.	Serial No.		94
viii.	Date and time of occurrence of fault		09.09.2023 at 17:53 hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)		-
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)		Rainy
xi.	Year of manufacturing		01.08.2007
xii.	Date of commissioning		2010
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months		Open yard
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM		No
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)		Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	-
xvii.	Details of previous failure	:	Nil

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	-
xix.	Details of protection operated	:	Distance protection rely of 220 kV Jaunpur line operated.
xx.	Details of tests done after failure	:	-.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	-
xxii.	Probable cause of failure	:	-

139. Failure report of 220 kV LA at Bahraich Substation of UPPTCL

i.	Name of Substation	:	220 kV Bahraich Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	R-ph LA, 220 kV Bahraich, Sohawal (PGCIL) line
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV, 10A
v.	Short circuit withstand current and duration	:	40 kA, 3 cycle
vi.	Make (Original equipment manufacturer)	:	LAMCO industries Pvt. Ltd.
vii.	Serial No.	:	113 A, B, C
viii.	Date and time of occurrence of fault	:	11.09.2023, 09:32 AM
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Thunderstorm & Heavy raining
xi.	Year of manufacturing	:	2015
xii.	Date of commissioning	:	26.06.2016
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) 04.08.2023 (b) No

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	LA damaged & CB opened on both side
xix.	Details of protection operated	:	Bahraich end general tripped RO, Zone. 1, Distance-6.2 Km, 1.3.15 kA, 86 A Sohawal (PGCIL) end R, N, 86A MI- Relay distance 86.6 Km, IR 2:38 KA M2-Relay distance 89.9 Km, IR 1.8KA
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Not found
xxii.	Probable cause of failure	:	Atmospheric Condition

140. Failure report of 360 kV R-Phase LA at Unnao Substation of UPPTCL

i.	Name of Substation	:	765 kV Unnao Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	L.A, R-Phase 407-LA, 1000MVA-ICT-II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	360 kV
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	S-2011-0578
viii.	Date and time of occurrence of fault	:	On 14.09.23 at 06:45 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	-
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2011
xii.	Date of commissioning	:	24.01.2012
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Tan delta test done. (b) No

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	-
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	-
xix.	Details of protection operated	:	H.V. side flag-86A, 86AX, 86B, 86BX. Relay-Differential LV side flag-86A, 86B
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	-
xxii.	Probable cause of failure	:	Moisture Ingress

141. Failure report of 400 kV LA at Azamgarh Substation of UPPTCL

i.	Name of Substation	:	220 kV Azamgarh Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	198 kV LA of Y-phase (220 kV Azamgarh-Jaunpur line)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV Voltage
v.	Short circuit withstand current and duration	:	Discharge current 10 kV Pressure relief class 40 kV (rms)
vi.	Make (Original equipment manufacturer)	:	Oblum Electrical Industries Pvt. Ltd, Hyderabad
vii.	Serial No.	:	81
viii.	Date and time of occurrence of fault	:	24.02.2024, 11:18 hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	-
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2007
xii.	Date of commissioning	:	2010
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Outdoor
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	-
xvii.	Details of previous failure	:	-

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	-
xix.	Details of protection operated	:	Distance failure
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	-
xxii.	Probable cause of failure	:	Insulation failure

142. Failure report of 220 kV LA at Phulpur Prayagraj Substation of UPPTCL

i.	Name of Substation	:	220/132 kV Phulpur Prayagraj Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	198 kV LA of R&Y Phase of Jaunpur bay 198kV
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit with stand current and duration	:	--
vi.	Make (Original equipment manufacturer)	:	Oblum
vii.	Serial No.	:	--
viii.	Date and time of occurrence of fault	:	17.04.2024 at 15:05 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Breakdown (damaged).
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2009
xii.	Date of commissioning	:	31.03.2010
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Insulation resistance test (b) No any abnormality observed
xvii.	Details of previous failure	:	--

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events / Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	Feeder tripped and CB opened
xx.	Details of tests done after failure	:	Replaced by new LA
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	--
xxii.	Probable cause of failure	:	As the LA got completely damaged so cause of failure could not be determined

143. Failure report of 220 kV LA at Bhelupur Substation of UPPTCL

i.	Name of Substation	:	220 kV Bhelupur Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	LA (220 kV SHP-BHP Circuit-II)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV, 10 kA
v.	Short circuit with stand current and duration	:	N/A
vi.	Make (Original equipment manufacturer)	:	Oblum Electrical industries Pvt. Ltd
vii.	Serial No.	:	76
viii.	Date and time of occurrence of fault	:	17.07.2024 at 15:56 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Gen trip, zone-I, R-Phase trip, Neutral A/R lock 86AB (Trip contact multy relay)
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	24.05.2016
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	N/A
xiv.	If OEM was contacted after failur its recommendation/ remark/ report/ MoM	:	N/A
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	N/A
xvii.	Details of previous failure	:	N/A

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events / Description of fault (SOE with time stamp)	:	Gen trip, zone-I, R-Phase trip, Neutral A/R lock 86AB (Trip contact multi relay)
xix.	Details of protection operated	:	Gen trip, zone-I, R-Phase trip, Neutral A/R lock 86AB (Trip contact multi relay)
xx.	Details of tests done after failure	:	Replaced by new LA
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	LA blast due to lightening during rain
xxii.	Probable cause of failure	:	Insulation Failure

144. Failure report of 220 kV SA at Sec-62 of UPPTCL

i.	Name of Substation	:	220 kV Sec-62 (AIS)
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	198 kV Surge arrester of 160 MVA Transformer-II 220 kV
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	CGL
vii.	Serial No.	:	-
viii.	Date and time of occurrence of fault	:	31.07.2024 at 20:50 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Breakdown
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Thunderstorm
xi.	Year of manufacturing	:	2011
xii.	Date of commissioning	:	10.06.2012
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond Repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	NA

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	-
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Line to earth fault
xix.	Details of protection operated	:	Differential
xx.	Details of tests done after failure	:	Megger
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	NA
xxii.	Probable cause of failure	:	Atmospheric Condition

145. Failure report of 220 kV LA at Mainpuri Substation of UPPTCL

i.	Name of Substation	:	220 kV Mainpuri Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	198 kV LA and 220 kV Mainpuri- Mainpuri (PG) Line
iv.	Rating (Voltage/ current/ current ratio/ Capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit with stand current and duration	:	-----
vi.	Make (Original equipment manufacturer)	:	Metover Metal Oxide
vii.	Serial No.	:	--
viii.	Date and time of occurrence of fault	:	22/08/2024
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	----
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Rainy/thunderstorm
xi.	Year of manufacturing	:	2003
xii.	Date of commissioning	:	01/01/2004
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	----
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	----
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	NA
xvii.	Details of previous failure	:	NA

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Mainpuri-PG Mainpuri tripped at 20:57 hrs
xix.	Details of protection operated	:	Phase- YN, Zone-1, distance - 0.144 Km, fault current - Ia- 822 mA Ib- 2.715 A Ic- 432 mA Note- Y phase LA got damaged
xx.	Details of tests done after failure	:	N/A
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	N/A
xxii.	Probable cause of failure	:	Lighting/ Ageing

146. Failure report of 220 kV LA at Gajokhar Varanasi Substation of UPPTCL

i.	Name of Substation	:	220 kV Gajokhar Varanasi Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	198 kV LA of Sarnath-II bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit with stand current and duration	:	10 kA
vi.	Make (Original equipment manufacturer)	:	Oblum electrical industries Pvt. Ltd Hyderabad
vii.	Serial No.	:	3896 C
viii.	Date and time of occurrence of fault	:	29.08.2024 at 11:00 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	-
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	29.05.2012
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	NIL
xvii.	Details of previous failure	:	NIL

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events / Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	CB Auto Reclosed
xx.	Details of tests done after failure	:	Replaced by new LA
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No any abnormalities seen
xxii.	Probable cause of failure	:	Insulation Failure

147. Failure report of 220 kV SA at Atrauli Substation of UPPTCL

i.	Name of Substation	:	220 kV Atrauli
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	R-ph and B-phase 198 kV Surge Arrester 160 MVA Transformer-II HV Bay at Atrauli (220 kV)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit with stand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	OBLUM
vii.	Serial No.	:	-
viii.	Date and time of occurrence of fault	:	12.09.2024 at 00:10 Hrs
ix.	Fault discovered during (Operation or periodic testing/maintenance)	:	-
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Lightening and heavy rain
xi.	Year of manufacturing	:	2005
xii.	Date of commissioning	:	27.08.2006
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports.	:	No abnormality found

	(c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	-
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	-
xix.	Details of protection operated	:	86-Relay, differential backup, differential pickup, over current, earth fault.
xx.	Details of tests done after failure	:	Insulation testing
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	--
xxii.	Probable cause of failure	:	Atmospheric Condition

148. Failure report of 400 kV LA at Bithoor Substation of UPPTCL

i.	Name of Substation	:	220 kV Bithoor Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	198 kV LA, R-Phase 220 kV Metro-I Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	198 kV
v.	Short circuit with stand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	LAMCO
vii.	Serial No.	:	017C
viii.	Date and time of occurrence of fault	:	08.12.2024 at 10:14 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Testing
x.	Weather conditions at the time of failure (Clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2020
xii.	Date of commissioning	:	2021
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Damage
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	-
xvii.	Details of previous failure	:	--

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	--
xx.	Details of tests done after failure	:	Damage LA
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	-
xxii.	Probable cause of failure	:	Could not be determined

149. Failure report of LA at Sagardighi Thermal Power Project of WBDCL

i.	Name of Substation	:	Sagardighi Thermal Power Project (SgTPP)
ii.	Utility	:	WBDCL
iii.	Faulty Equipment and the associated feeder	:	R-ph LA of Generator Transformer -1
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	360 kV
v.	Short circuit with stand current and duration	:	10 kA (Nominal) & 50 kA (L.D)
vi.	Make (Original equipment manufacturer)	:	XI' AN XD Co. Ltd (China)
vii.	Serial No.	:	3886
viii.	Date and time of occurrence of fault	:	16.05.2024 at 17:21 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Thunderstorm
xi.	Year of manufacturing	:	2006
xii.	Date of commissioning	:	21.12.2007
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NA
xv.	Present condition of equipment (Repaired/To be repaired/beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Monthly checking of third harmonic resistive leakage current. No abnormality recorded and value was within limit i.e. 150 micro-Amps LA was replaced
xvii.	Details of previous failure	:	No Such

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	R-ph LA burst out, LA is not covered in SAS SOE
xix.	Details of protection operated	:	Gen. Transformer #1 Differential protection operated.
xx.	Details of tests done after failure	:	NA
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No such abnormality found during visual inspection
xxii.	Probable cause of failure	:	Huge Lightening surge

150. Failure report of 220 kV Wave Trap at Bina Substation of MPPTCL

i.	Name of Substation	:	400 kV Substation MPPTCL Bina
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	B- Phase wave trap of 220 V Sagar feeder-I
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	40 kA for 1 sec
vi.	Make (Original equipment manufacturer)	:	AREVA
vii.	Serial No.	:	111C2028
viii.	Date and time of occurrence of fault	:	24.07.2023 at 15:03 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	In service
x.	Weather conditions at the time of failure (Clear sky/rainy/thunderstorm etc.)	:	Rainy, Thunderstorm & Lighting
xi.	Year of manufacturing	:	2011
xii.	Date of commissioning	:	29.06.2016
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Commissioning of equipment done over 6 months of delivery.
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Beyond guarantee period.
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	(a) Pre monsoon maintenance done on dated 14.06.2023. (b) No any abnormality observed during maintenance
xvii.	Details of previous failure	:	NO

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	400 kV substation Bina end indication:- DPR operated, BN -Phase, Zone-1, Fault distance 1.5 Km, Fault current 24.01 kA. 400 kV substation Sagar end indication:- DPR operated. BN -Phase, Zone-1, Fault distance 89.7 Km, Fault current 1.755 kA.
xx.	Details of tests done after failure	:	-
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	It is observed that whenever the fault current is too high or near to the substation mechanical failure of wave trap occurs.
xxii.	Probable cause of failure	:	Insulation failure

151. Failure report of 220 kV Wave Trap at Indore South Substation of MPPTCL

i.	Name of Substation	:	220 kV Indore South
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	Wave Trap (220 kV SZ-Indore-11)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	4400 pF, 0.5 H, 150-500 kHz
v.	Short circuit withstand current and duration	:	—
vi.	Make (Original equipment manufacturer)	:	—
vii.	Serial No.	:	—
viii.	Date and time of occurrence of fault	:	05.09.2023 at 09:27 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	
x.	Weather conditions at the time of failure (Clear sky/rainy/thunderstorm etc.)	:	Rainy
xi.	Year of manufacturing	:	--
xii.	Date of commissioning	:	17.05.2018
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NO
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	beyond repair
xvi.	Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities)	:	06.08.2018

	Whether any abnormality observed in these tests. If yes, attach the test reports. What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	17.05.2018
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Only 220 kV SZ-IND -II Both end Trip dated: 05.09.2023 at 09:27
xix.	Details of protection operated	:	Indore end-R&Y ph, Zone-II, FL-4.5 Km , FC-11.52 kA, AR L/O, S/ZONE end- R&Y ph, Zone-I, FL-1.8 km, AR L/O
xx.	Details of tests done after failure	:	WT Burst
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	WT Burst
xxii.	Probable cause of failure	:	As the Wave trap got burst so cause of failure could not be determined

152. Failure report of 220 kV Wave Trap at Bina Substation of MPPTCL

i.	Name of Substation	:	400 kV Bina Substation
ii.	Utility	:	MPPTCL
iii.	Faulty Equipment and the associated feeder	:	220 kV R-PH Wave trap of 220kV Datiya feeder
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	40 kA for 1 Sec
vi.	Make (Original equipment manufacturer)	:	WS Bengaluru
vii.	Serial No.	:	L5838
viii.	Date and time of occurrence of fault	:	05.10.2023 at 13:00 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (Clear sky/ rainy/ thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	1991
xii.	Date of commissioning	:	28.05.1996
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	nil
xiv.	If OEM was contacted after failure, its recommendation/remark/report/MoM	:	No any
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?	:	Routine maintenance and clamp tightening, visual inspection done No any abnormality observed during maintenance.
xvii.	Details of previous failure	:	No any

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	R-ph Wave trap of 220 kV Datiya Feeder failed due to its insulation failure.
xix.	Details of protection operated	:	DPR operated from both the ends, Indication (i) At Bina End R-N PH, Zone-1, FD-8.193 km, Fault current -13.87 kA. (ii) At Datiya End R-N PH Zone-2, FD-171.84 km
xx.	Details of tests done after failure	:	None
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	None
xxii.	Probable cause of failure	:	Ageing

153. Failure report of 220 kV Wave Trap at Bareilly Substation of UPPTCL

i.	Name of Substation	:	400 kV Bareilly Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	Wave Trap-220 kV Dohna Circuit
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit withstand current and duration	:	-
vi.	Make (Original equipment manufacturer)	:	GE T&D
vii.	Serial No.	:	37993009306
viii.	Date and time of occurrence of fault	:	06.11.2023
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	-
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2019
xii.	Date of commissioning	:	07.06.2019
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	-
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	-
xvii.	Details of protection operated	:	Distance protection operated

154. Failure report of 220 kV Coupling Capacitor at Pusad Substation of MSETCL

i.	Name of Substation	:	220 kV Pusad Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Yavatmal-Pusad Line Y ph CC
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV, 6600 pf
v.	Short circuit withstand current and duration	:	NA
vi.	Make (Original equipment manufacturer)	:	W S INDUSTRIES INDIA LTD (WSI)
vii.	Serial No.	:	97040305
viii.	Date and time of occurrence of fault	:	31.08.2023 at 04:09 Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	NA
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Cloudy atmosphere.
xi.	Year of manufacturing	:	1981
xii.	Date of commissioning	:	20.10.1982
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	The CC completed more than 40 Years of service. The replacement is already proposed in LES scheme. The failure is due to ageing.
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	The outage for diagnostic testing of 220 kV Yavatmal Line Bay equipments was taken on date 21.06.2023. IR values, Capacitance & tan delta of the said CC carried out during the outage. No abnormality observed during the testing.
xvii.	Details of previous failure	:	NA

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Y-ph CC burst
xix.	Details of protection operated	:	220 kV Pusad-Yavatmal line tripped. Area interrupted- Nil.
xx.	Details of tests done after failure	:	NA
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Thermovision carried out on dated 28.08.2023, no hot spot detected on said CC.
xxii.	Probable cause of failure	:	Ageing

155. Failure report of 220 kV Coupling Capacitor at Jindal Substation of MSETCL

i.	Name of Substation	:	220 kV Jindal Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV Coupling Capacitor
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	NA
v.	Short circuit withstand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	NA
vii.	Serial No.	:	NA
viii.	Date and time of occurrence of fault	:	14.10.2023
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	In service
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	NA
xii.	Date of commissioning	:	25.12.1995
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation / remark / report / MOM	:	NA
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Failed
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	NA
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA

xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	Line hand tripped as soon as sound develop from Coupling Capacitor
xix.	Details of protection operated	:	NIL
xx.	Details of tests done after failure	:	NIL
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Cracks observed on Insulation
xxii.	Probable cause of failure	:	Ageing

156. Failure report of 220 kV Coupling Capacitor at Karad Substation of MSETCL

i.	Name of Substation	:	400/220 kV Karad Substation
ii.	Utility	:	MSETCL
iii.	Faulty Equipment and the associated feeder	:	220 kV CC of 220 kV Karad- Ogalewadi ckt II
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV
v.	Short circuit withstand current and duration	:	40 kA / 1 Sec
vi.	Make (Original equipment manufacturer)	:	Areva T&D Ltd
vii.	Serial No.	:	...
viii.	Date and time of occurrence of fault	:	29.03.2024 at 23:16Hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Tripped on Distance Protection. After yard inspection it is observed that, R ph CC burst.
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2007
xii.	Date of commissioning	:	31.03.2008
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation / remark/ report/ MOM	:	NO
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Beyond repair due to flash over & totally damaged
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	31.10.2023 Quarterly Maintenance of bay equipment carried out.
xvii.	Details of previous failure	:	NO

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	Not available
xix.	Details of protection operated	:	Distance protection operated, Zone 1 trip, R ph-E, Fault current IL1- 24.76 kA, Distance- 0.0 km
xx.	Details of tests done after failure	:	Faulty / damaged equipment is bypassed. For LA & CT IR Values taken & found in order.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	It is observed 220 kV Karad-Ogalewadi-II R Ph CC burst.
xxii.	Probable cause of failure	:	Ageing

157. Failure report of 220 kV GIS Disconnecter at Saki Substation of Adani Electricity Mumbai Ltd

i.	Name of Substation	:	220 kV Saki EHV Substation
ii.	Utility	:	Adani Electricity Mumbai Ltd – Transmission
iii.	Faulty Equipment and the associated feeder	:	220 kV GIS Bus-2 Disconnecter EDS of 220 kV Bay No.8 (Bus Coupler)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	Voltage Class - 252 kV, Type – ZFW20-252
v.	Short circuit withstand current and duration	:	50 kA for 3 Second
vi.	Make (Original equipment manufacturer)	:	M/s New Northeast Electric India Private Limited (NHVS)
vii.	Serial No.	:	NA
viii.	Date and time of occurrence of fault	:	03/12/2024 at 12:31 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear Sky
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	30.06.2011
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Yes.
xv.	Present condition of equipment (Repaired/ To be repaired / beyond repair)	:	Repaired
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality was observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	a) SF6 gas purity measurement was carried out during previous Preventive Maintenance 11.11.2024.(Periodicity – Once in a year) b) No abnormality observed in this test. c) NA

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	NA
xviii.	Sequence of events/Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	Busbar Protection Relay (Main-1 and Main-2)
xx.	Details of tests done after failure	:	Visual Inspection done under the supervision of OEM representative
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Flashover marks were observed on Y phase of disconnector module-EDS of 220 kV Bus coupler Bay No-08.

158. Failure report of 220 kV Isolator at Pratap Vihar Substation of UPPTCL

i.	Name of Substation	:	220 kV Hybrid Pratap Vihar Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	DS3 (line side) isolator of B phase Hybrid module of 220 kV Muradnagar-Pratapvihar line bay.
iv.	Rating (Voltage/ current/ current-ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV
v.	Short circuit with stand current and duration	:	50 kA, 3 sec
vi.	Make (Original equipment manufacturer)	:	Jiangsu Jingke Smart Electric Co Ltd
vii.	Serial No.	:	H217001F1
viii.	Date and time of occurrence of fault	:	15.11.2024 at 17:46 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Line was in operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2018
xii.	Date of commissioning	:	30.10.2019
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Not available
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	-
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Under Breakdown
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	a) 09.11.2024, Operation was checked of both isolator and breaker and damaged isolator drive of R phase was changed. b) No c) NA
xvii.	Details of previous failure	:	Nil

	(Any failure which has led to a major repair of the equipment in the past since its commissioning)		
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	220 kV Pratapvihar-Muradnagar line tripped with flags RP- Gen trip, R phase trip, Y phase trip, B phase trip, Z-2, IL1=0.82 KA , IL2=1.15 KA IL3=6.47 KA, distance=20 km. (Flags of other end breaker was opened manually at Pratap vihar end) Reason: DS3 isolator (Line side) of B phase hybrid unit got damaged. At the same time 220 kV Pratap vihar-Sahibabad line tripped with flags Z-2, Ia=473 A, Ib= 521 A, Ic=8.2 KA, Fault distance = 12.62 km Fault duration =399.7 ms (other end flags breaker was opened manually at Pratap vihar end) After isolating damaged hybrid unit 220 kV Pratap vihar-Sahibabad line charged at 18:45 hrs and 220 kV Pratapvihar- Muradnagar line is charged by using hybrid unit of 220 kV Indirapuaram–Pratapvihar line
xix.	Details of protection operated	:	220 kV Pratapvihar-Muradnagar line tripped with flags RP- Gen trip, R phase trip, Y phase trip, B phase trip, Z-2, IL1=0.82 KA , IL2=1.15 KA IL3=6.47 KA, distance=20 km. (Flags of other end breaker was opened manually at Pratap vihar end) Reason: DS3 isolator (Line side) of B phase hybrid unit got damaged. At the same time 220kV Pratapvihar-Sahibabad line tripped with flags Z-2, Ia=473A, Ib= 521 A, Ic=8.2 KA, Fault distance = 12.62 km Fault duration =399.7 ms (other end flags breaker was opened manually at Pratapvihar end) Both 220 kV line were charged on same bus
xx.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Manual inspection done. PRD of DSE3 section is damaged and there is no SF6 gas in the section.

159. Failure report of 220 kV Isolator at Kudankulam Nuclear Power Project of NPCIL

i.	Name of Substation	:	NPCIL, KKNPP-1&2
ii.	Utility	:	230 kV GIS Substation
iii.	Faulty Equipment and the associated feeder	:	Isolator (ADL14GS100- R-Phase) Feeder: Spare feeder, identified for tie line between KKNPP-1&2 to KKNPP-3&4.
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	V – 132 kV I – 3150 A
v.	Short circuit withstand current and duration	:	40KA Duration: 3Sec
vi.	Make (Original equipment manufacturer)	:	ZAO Elegaz konversiya (Russia)
vii.	Serial No.	:	Not available
viii.	Date and time of occurrence of fault	:	03/12/2024 13:24 hrs
ix.	Fault discovered during (Operation or periodic testing / maintenance)	:	Maintenance
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Equipment installed inside the room. (Clear sky)
xi.	Year of manufacturing	:	2005
xii.	Date of commissioning	:	Nov 2008
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6months	:	Indoor ware house
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	No OEM is not available and issue is being taken up with original equipment supplier i.e. JSC ASE
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Repaired
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	a) Midterm overhauling, Inspection, gasket replacement, contact resistance and HV test. b) No c) Nil

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	230 kV KKNPP ADA bus charged through ICT10 breaker at 13:22 Hrs dated on 03.12.2024. ICT10 Interconnecting transformer breaker got tripped at 13:24 Hrs due to 87BB (ADA) trip, because of ADL14GS100 R phase Disconnecter component failure.
xix.	Details of protection operated	:	Bus bar Differential protection (87BB)
xx.	Details of tests done after failure	:	Disconnecter compartment replaced with new one and HV test carried on 07.12.2024
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Nil
xxii.	Probable cause of failure	:	Failure of disconnecter drive connecting rod

160. Failure report of 220 kV Cable at Aarey EHV Substation of Adani Transmission Ltd

i.	Name of Substation	:	220 kV Aarey EHV Substation
ii.	Utility	:	Adani Transmission Ltd
iii.	Faulty Equipment and the associated feeder	:	220 kV Cable fault (Y Phase) on 220kV Aarey - Saki Line-2 (Fault located between Aarey GIS to JC-01)
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	220 kV 1C X 1200 Sq.mm. XLPE Cable, Copper conductor, Extruded Corrugated Aluminum sheath, Capacitance of cable - 0.191 pF i.e , Rated Current - 800A
v.	Short circuit withstand current and duration	:	40 kA for 1 Second
vi.	Make (Original equipment manufacturer)	:	XLPE Cable - M/s Taihan, Korea
vii.	Serial No.	:	NA
viii.	Date and time of occurrence of fault	:	07/05/2024 at 21:47 Hrs.
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Tripping of 220 kV Aarey - Saki Line-2
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Dry Atmosphere
xi.	Year of manufacturing	:	2010
xii.	Date of commissioning	:	14.04.2011
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	NA
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Yes.
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	Repaired (New Cable Piece laid with additional two joints)
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality was observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	a) Cable testing carried out on 15.06.2022 b) No abnormality observed in this test c) Not applicable

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No previous failure
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	--
xix.	Details of protection operated	:	220 kV Aarey - Saki Line-2 tripped on Y phase differential protection from both ends due to 220kV Cable fault between Aarey GIS to JC-01
xx.	Details of tests done after failure	:	(i) Physical Inspection of Cable route carried out (ii) Fault Pinpointing by TDR & Surging method (iii) Cable Insulation Resistance test after fault rectification work
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Fault Pre-location & Pinpointing carried out from Aarey EHV substation; Fault pinpointed between Aarey GIS to JC-01 on JVLR Road.

161. Failure report of 220 kV GIS bay at Ettumanoor Substation of KSEB

i.	Name of Substation	:	220 kV GIS Ettumanoor Substation
ii.	Utility	:	KSEB Ltd
iii.	Faulty Equipment and the associated feeder	:	GIS Bay of 220 kV Kottayam Ettumanoor 2 Feeder
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV GIS
v.	Short circuit withstand current and duration	:	40 kA for 1 Sec
vi.	Make (Original equipment manufacturer)	:	GE T&D India
vii.	Serial No.	:	B105-CB6/ 016 /GD174-013
viii.	Date and time of occurrence of fault	:	23/10/2023 12:16:10 hrs
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear sky
xi.	Year of manufacturing	:	2021
xii.	Date of commissioning	:	19.05.2022
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Good
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	Yes, OEM is doing the rectification work. During detailed inspection, the gas barrier insulation seen flashed.
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	To be repaired, the rectification work progressing
xvi.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	Nil

xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	Nil
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	12:16:10.805 401 BUS 2 BIASED PKP 12:16:10.805 401 BUS 2 OP 12:16:10.805 401 BUS 3 BIASED PKP 12:16:10.805 401 BUS 3 OP 12:16:10.805 401 ANY START 12:16:10.805 401 ANY TRIP 12:16:10.805 401 BC TRIP R 12:16:10.805 401 ICT-2 TRIP R 12:16:10.805 401 KTYM-2 TRIP R
xix.	Details of protection operated	:	Bus Differential Protection
xx.	Details of tests done after failure	:	A gas purity test detected high SO ₂ levels in the CB and Line isolator compartments, indicating a flashover had occurred.
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	No
xxii.	Probable cause of failure	:	Gas barrier insulation failure

162. Failure report of 245 kV PASS Module at Nirpura Substation of UPPTCL

i.	Name of Substation	:	220 kV Hybrid Nirpura Substation
ii.	Utility	:	UPPTCL
iii.	Faulty Equipment and the associated feeder	:	245 kV PASS (Plug and Switch System) Module (Hybrid Switchgear) at 220 kV Baraut Bay
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	245 kV
v.	Short circuit with stand current and duration	:	40 KA for 1 Sec.
vi.	Make (Original equipment manufacturer)	:	Hitachi Energy (ABB)
vii.	Serial No.	:	245D079
viii.	Date and time of occurrence of fault	:	01.10.2024
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	Operation
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	Clear
xi.	Year of manufacturing	:	2019
xii.	Date of commissioning	:	12.01.2021
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	Yes
xiv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	To be Repaired
xv.	a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) b) Whether any abnormality observed in these tests. If yes, attach the test reports. c) What steps were taken to address the abnormality?	:	NA
xvi.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	No

xvii.	Sequence of events/Description of fault (SOE with time stamp)	:	NA
xviii.	Details of protection operated	:	LBB Operated & Line Protection Operated at other end.
xix.	Details of tests done after failure	:	Physically Inspection & IR Test
xx.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	Powder form seen in Inspection window.
xxi.	Probable cause of failure	:	Ground Fault



Annexure – III

General Guidelines for Substation/ Switchyard Operation & Maintenance Activities by Transmission Utilities

Substation/ Switchyard Operation & Maintenance Activities

(Issued vide CEA letter no: CEA-PS-14-12/18/2022-PSETD Division dated 22.06.2023)

I. Transformer/Reactor/Neutral Grounding Reactor (NGR):

Sl. No.	Test Name/Maintenance Check	Frequency
1.	Capacitance/Tan Delta for a) Bushing & b) winding	Yearly (for Bushing) 10 Yearly/SOS (for Winding)
2.	Magnetizing current Test (Excitation Current Test)	SOS
3.	Magnetic Balance Test (Three Phase) on transformer	SOS
4.	Winding resistance (Resistance converted to 75 °C)	SOS
5.	Voltage Ratio (All Taps) on transformer	SOS
6.	IR Value of Winding	SOS
7.	Polarization Index (Ratio of IR values at 10 min to 1 min)	SOS
8.	Core Insulation Test (Between core to clamp; clamp to tank; & core to tank)	SOS
9.	Neutral Earth pit Resistance Value	Yearly
10.	Turret/ Neutral CT Ratio Errors	SOS
11.	Vibration Level for reactors	SOS
12.	Sweep Frequency Response Analysis Tests (20 Hz to 5 MHz)	SOS
13.	Insulation Condition Dry (at commissioning) Normal in operation Wet Extremely Wet	SOS
14.	Short Circuit Impedance of transformer	SOS
15.	Dissolved Gas Analysis (DGA) of tank oil & Onload Tap Changer (OLTC) oil	Half Yearly
16.	Oil parameters of tank oil	Yearly
17.	Thermo-vision Scanning	Half Yearly
18.	Other maintenance checks:	
	(a) Checking of bushing oil level	Monthly
	(b) Checking of oil level in conservator	Monthly
	(c) Checking of oil level in OLTC conservator	Monthly

	(d) Checking of oil leaks	Monthly
	(e) Checking condition of silica gel in breather	Monthly
	(f) Checking of oil level in oil seal of breather	Monthly
	(g) Manual actuation of cooler fans and oil pumps	Monthly
	(h) External cleaning of all bushings	Yearly
	(i) External cleaning of radiators	Yearly
	(j) Checking of marshalling box/control cubicles: cleaning, tightening of terminations, checking of contactors, space heater, lamps etc	Yearly
	(k) Maintenance of OLTC driving mechanism	Yearly
	(l) Checking/testing of buchholz relay by oil draining	Yearly
	(m) Electrical checking/testing of Pressure Relief Device (PRD), buchholz relay, rapid pressure rise relay, OLTC surge relay, checking of alarm/trip	Yearly
	(n) Checking of gaskets	Yearly
	(o) Checking of Oil Temperature Indicator (OTI)/Winding Temperature Indicator (WTI) and tap position indicator and top up of oil in pockets, if required	Yearly

II. Current Transformer:

Sl. No.	Test Name/Maintenance Check	Frequency
1.	Measurement of Tan Delta & Capacitance	Yearly
2.	Measurement of Insulation Resistance (IR) value	SOS
3.	Measurement of Current Transformer (CT) secondary resistance	2 Yearly
4.	Magnetization characteristics	SOS
5.	CT ratio test	SOS
6.	DGA and testing of other parameter of oil	SOS
7.	Thermo-vision scanning of CT and top dome	Quarterly
8.	Checking of bellow expansion	Monthly
9.	Visual inspection of CT for oil leakage and crack	Monthly

10.	Checking of healthiness of marshalling box gaskets	Yearly
11.	Checking of space heater and illumination	Yearly
12.	Checking the tightness of all connections including earthing	Yearly
13.	Cleaning of marshalling box and junction box	Monthly

III.SF6 circuit breakers:

Sl. No.	Test Name/Maintenance Check	Frequency
1.	Checking of SF6 gas pressure (wherever pressure gauges are provided)	Daily
2.	Checking of oil leaks form grading capacitor	Monthly
3.	Status of healthiness of CSD relay	Monthly
4.	Tan delta and capacitance of grading capacitor	2 Yearly
5.	SF6 gas leakage test	SOS
6.	Dew point measurement of SF6 gas	2 Yearly
7.	Operating timing of Circuit Breaker (CB)/Pre-insertion Resistance (PIR)]	Yearly
8.	Static contact resistance	Yearly
9.	Checking of pole discrepancy relay	Yearly
10.	Checking of all operation lockouts	Yearly
11.	Checking of all interlocks	Yearly
12.	Cleaning of breaker interrupter, support insulators, PIRs and grading capacitors	Yearly
13.	Checking of healthiness of operation counter	Yearly
14.	Checking of tightness of all cable's termination in Marshalling Box (MB)	Yearly
15.	Checking of door sealing gaskets and replacement, ift necessary	Yearly
16.	Repainting of metallic surfaces (if required)	2 Yearly

17.	Checking of space heater	Yearly
18.	Dynamic Contact Resistance Measurement (DCRM) test	2 Yearly

IV. Capacitor Voltage Transformer:

1.	Visual checking of earthing HF (high-frequency) point [(in case it is not being used for Power Line Career Communication (PLCC) system]	Yearly
2.	Checking for any breakage of cracks	Yearly
3.	Checking of oil leaks	Monthly
4.	Cleaning of Capacitive Voltage Transformer (CVT) capacitor stacks and tightness of terminal connections	Yearly
5.	Capacitance and tan-delta measurement	SOS
6.	Measurement of voltage ratio error	SOS
7.	Measurement of voltage at metering points in control room	Monthly
8.	Testing of EMU tank oil for Break Down voltage (BDV)	SOS
9.	Thermo vision scanning of capacitor stacks	Quarterly
10.	Checking of space heater and illumination	Yearly
11.	Checking and tightness of all connections including earth connections	Yearly
12.	Cleaning of marshalling box and junction box	Yearly
13.	Checking of healthiness of gaskets	Yearly

V. Isolators:

1.	Maintenance of linkages and transmission gears	Yearly
2.	Cleaning of auxiliary switch contacts with rustolene spray	Yearly
3.	Lubrication of operating mechanism, hinges, locks, joints on levers, bearings	Yearly

4.	Checking of all bolts for tightness	Yearly
5.	Cleaning and lubrication of main contacts	Yearly
6.	Alignment	Yearly
7.	Main contact resistance measurement	Yearly
8.	Tightness of bolts, nuts and pins etc	Yearly
9.	Cleaning of support insulators and checking of insulator cracks, if any	Yearly
10.	Thermo vision scanning of insulator hinges and contacts	Quarterly

VI. Earth Switch:

1.	Checking & alignment of earthing blades	Yearly
2.	Cleaning of contacts	Yearly
3.	Contact resistance	Yearly
4.	Operation of earthing switch	Yearly
5.	Checking of aluminum/copper flexible conductor	Yearly
6.	Checking of earth connections of structure and Manual Operating Mechanism (MOM) box	Yearly
7.	Visual check of auxiliary contacts	Yearly
8.	Cleaning and terminal tightness in MOM box	Yearly
9.	Checking of space heater and illumination	Yearly
10.	Checking of healthiness of marshalling box gaskets Surge Arresters	Yearly

VII. Surge arrester:

1.	Checking of leakage current	Monthly
2.	Reading of surge counter	Daily
3.	Testing of counters	Yearly

4.	Cleaning of Lightning Arrester (LA) insulator	Yearly
5.	Measurement of capacitance and tan-delta	SOS
6.	Measurement of IR value	SOS
7.	Stack meggering	SOS
8.	3rd harmonic resistive current measurement	4 Monthly

VIII. Wave Traps:

1.	Tightness and cleanliness	Yearly
2.	General inspection	Yearly

IX. Protection System:

1.	Testing of Disturbance Recorder and Event Logger	Monthly
2.	Calibration of panel meters (indicating / recording instruments along with the transducers)	Yearly
3.	Calibration of tariff/non-tariff energy meters	SOS
4.	Secondary injection test of individual protection schemes	5 Yearly
5.	Checking of voltage (in services) for relays	Half Yearly
6.	Checking of Direct Current (DC) logic circuits for trip and ammonization including timers and simulation	Yearly

X. Line Protection Distance Protection:

1.	Reach check for all four (4) zones	Yearly
2.	Time measurement	Yearly

XI. PLCC System:

1.	Power supply measurements	Yearly
2.	Checking of alarms	Yearly

XII. Miscellaneous:

1.	Measurement of station earth resistance	Yearly
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2.	Cleaning of insulator for cracks	Yearly
3.	De-weeding of switchyard	Monthly
4.	Repainting, rust removal of all structures, equipment's etc	SOS
5.	Checking of switchyard lighting	Daily

XIII. Thermal Imaging & Corona Scanning:

1.	Thermo vision scanning of all conductor joints, terminal connector/clamps	Quarterly
2.	Removal of hot spots	SOS
3.	Corona Scanning of Bay equipment	Yearly

XIV. Other Operational activities:

1.	Visual checking of the bay	Daily
2.	Isolation & restoration of bays as per LDC instruction	As required
3.	Mega Watt (MW)/Mega Volt Ampere Reactive (MVAR) meter reading (line flows)	Hourly
4.	Energy Meter readings	Daily
5.	PLCC counter readings	Daily
6.	Battery charger voltage and current	Daily
7.	Measurement of cell voltage	Monthly
8.	Healthiness of FF system	Daily
9.	Healthiness of SAS system/DR PC/Event Logger	Daily
10.	Providing trip related information/ documents to LDC/New TSP	As required
11.	Healthiness of AC plant system/KIOSK AC	Daily
12.	Defect Records	As required
13.	Healthiness of Emergency DC Lighting system	Monthly

SOS: as and when needed.



Annexure – IV
Format for report of failure of the Transformer/Reactors or
Other equipment

A. Proforma for reporting of failure of Transformer/ Reactor

i.	Name of Substation	:	
ii.	Utility	:	
iii.	Faulty Equipment (ICT/ Auto-transformer/ GT/ Reactor etc.)	:	
iv.	Rating (MVA/MVAR, Voltage ratio, 1-Phase/ 3- Phase)	:	
v.	Make (Original equipment manufacturer)	:	
vi.	Serial No.	:	
vii.	Date and time of occurrence of fault	:	
viii.	Fault discovered during (Operation or periodic testing/ maintenance)	:	
ix.	Year of Manufacturing	:	
x.	Date of Commissioning	:	
xi.	Sequence of events/ Description of fault (SOE with time stamp, Protection operated during fault)	:	
xii.	Details of Tests done after failure (What tests were conducted after the discovery of failure. If no tests were conducted, reasons for the same may be stated.)	:	
xiii.	Observations (Visual observations e.g. bulging of tank, fire, any leakage of oil, damage to various components of transformer and nearby equipment / material etc.)	:	
xiv.	Probable cause of failure	:	
xv.	If OEM representative had inspected the equipment or visited the site after failure, their remarks, MoM etc. may be attached.	:	
xvi.	Present condition of equipment (Whether repairable or beyond repair)	:	

xvii.	(d) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities) (e) Whether any abnormality observed in these tests. If yes, attach the test reports. (f) What steps were taken to address the abnormality?	:	
xviii.	Details of any previous failure on the same unit	:	
xix.	Is tertiary winding provided (Yes/ No)	:	
xx.	Tertiary loaded (Yes/ No) If yes, specify load on tertiary	:	
xxi.	Whether tertiary insulated terminals are bare/ insulated	:	
xxii.	Details of protection for Tertiary	:	
xxiii.	Whether relay time is synchronized with UTC	:	
xxiv.	Bushing details (OIP/ RIP/ RIS, Porcelain/ polymer housing)	:	
xxv.	On Load Tap Changer or Off Circuit Tap Changer	:	
xxvi.	Tap position of OLTC at the time of failure	:	
xxvii.	Past record of Operation of OLTC	:	
xxviii.	Tap Range	:	
xxix.	Details of Protection provided for ICT/ GT/ Reactor	:	
xxx.	Details of Protection operated	:	
xxxi.	Whether equipment is properly earthed	:	
xxxii.	Earth Resistance of Substation and date of its measurement	:	
xxxiii.	Surge arrester: (d) Is SA provided for protection (e) Whether healthiness of SA is monitored (f) Whether reading of SA counter changed during failure	:	
xxxiv.	Lightning Impulse and Switching Impulse Withstand Voltage of the bushings of all voltage level	:	

xxxv.	Lightning Impulse and Switching Impulse Withstand Voltage of the winding of all voltage level	:	
xxxvi.	Type of Fire protection provided (Emulsifier system Injection based fire Protection system/ for based protection etc.)	:	
xxxvii.	Weather conditions at the time of failure (clear sky/ rainy/ thunderstorm etc.)	:	
xxxviii.	Storage condition of equipment at site before Commissioning: (a) Period of storage (b) Idle charged or uncharged (c) Dry air filled/Nitrogen filled/ Oil filled	:	
xxxix.	Whether short circuit test was carried out on this transformer or same design transformer or short circuit with stand, capability was verified on the basis of calculation?	:	
xl.	Number of through faults the equipment was subjected to before failure	:	
xli.	Attach the following: (a) Single Line Diagram of the substation (b) Photographs of the failed equipment (c) Disturbance Recorder/Even Logger Data (d) Reports of tests conducted after failure (e) Factory test results (f) Pre-Commissioning test results (g) Protection schematic diagram	:	

B. Proforma for failure report of other substation equipment [Circuit Breaker, Instrument Transformers (CT/ PT/ CVT), Wave Trap, Isolator, Surge Arrester, Coupling Capacitor, Cable]

i.	Name of Substation	:	
ii.	Utility	:	
iii.	Faulty Equipment and the associated feeder	:	
iv.	Rating (Voltage/ current/ current ratio/ capacitance/ MCOV etc., as applicable)	:	
v.	Short circuit withstand current and duration	:	
vi.	Make (Original equipment manufacturer)	:	
vii.	Serial No.	:	
viii.	Date and time of occurrence of fault	:	
ix.	Fault discovered during (Operation or periodic testing/ maintenance)	:	
x.	Weather conditions at the time of failure (clear sky/ rainy / thunderstorm etc.)	:	
xi.	Year of manufacturing	:	
xii.	Date of commissioning	:	
xiii.	Storage condition of equipment if the gap between delivery at site and commissioning is over 6 months	:	
xiv.	If OEM was contacted after failure, its recommendation/ remark/ report/ MoM	:	
xv.	Present condition of equipment (Repaired/ To be repaired/ beyond repair)	:	
xvi.	(a) Details of previous maintenance (Activities carried out in previous maintenance including the tests conducted, periodicity of the maintenance activities)	:	

	(b) Whether any abnormality observed in these tests. If yes, attach the test reports. (c) What steps were taken to address the abnormality?		
xvii.	Details of previous failure (Any failure which has led to a major repair of the equipment in the past since its commissioning)	:	
xviii.	Sequence of events/ Description of fault (SOE with time stamp)	:	
xix.	Details of protection operated	:	
xx.	Details of tests done after failure	:	
xxi.	Observations (Any relevant observation made by the field staff or during visual inspection)	:	
xxii.	Probable cause of failure	:	
xxiii.	Attach reports of tests during pre-commissioning, periodic maintenance and after failure; Photographs of the failed equipment etc.	:	



Annexure- V

Office Order for constitution of the Standing Committee



Government of India
Central Electricity Authority
Office of Secretary
Sewa Bhawan, R.K. Puram
New Delhi- 110 066
Fax No. 011-26108476
Tel.No. 011-26105619



(ISO :9001-2008)

No. CEA/SETD/220-O/2012/1-80

01.01.2013

Subject:- Constitution of a Standing Committee of Experts to investigate the failure of equipment at 220 kV & above sub-stations.

In order to investigate the failure of equipment at 220 kV & above sub-stations, it has been decided to constitute a Standing Committee comprising experts in the field of design and operation of EHV substation from Central Electricity Authority(CEA), various power utilities and research/academic institutes under section 73, clause(1) of the Electricity Act, 2003.

2. The Committee shall consist of the following members:

- | | | |
|-------|---|-------------------|
| (i) | Chief Engineer (SETD), CEA | -Chairperson |
| (ii) | A representative from CPRI, Bangalore | -Member |
| (iii) | A representative from IIT, Hauz Khas, New Delhi | -Member |
| (iv) | A representatives from concerned State Utility/Generating Companies/Transmission Companies where Substation Equipment failure has taken place | -Member |
| (v) | Member Secretary of concerned RPC | -Member |
| (vi) | Director (SETD), CEA | -Member Secretary |

3. The terms of reference of the Committee shall be as follows:

- To investigate the causes of failure of substation equipment in service
- To recommend remedial measures to avert recurrences of such failures in future.

4. Every incident of substation equipment failure needs to be immediately reported to Chairperson of the Standing Committee by a designated officer of the concerned organization.

5. The Power Utility where failure of substation equipment has taken place will provide all assistance required by the Committee in carrying out the investigations.

6. The TA/DA and other expenses shall be borne by the respective organizations of the members of the Committee.



The Chairperson of the Committee will prepare compendium of the analysis of the failures and recommendations every six months and submit the same to the Authority and MoP.

0/c
(M.S. Puri)
Secretary, CEA

To:

1. Director General, Central Power Research Institute, Professor Sir C.V. Raman Road, P.O. Box- 8066, Bangalore- 560080.
2. Director, Indian Institute of Technology, Hauz Khas, New Delhi- 110016.
3. Chairman/CMDs of State Utility/ Generating Companies and Transmission Companies.

With a request to nominate their representative as member of the Committee along with an alternative member.

4. Member Secretaries, Regional Power Committees:

- a) NRPC, New Delhi
- b) WRPC, Mumbai
- c) SRPC, Bangalore
- d) ERPC, Kolkata
- e) NERPC, Shillong

5. Chief Engineer (SETD), CEA

6. Director (SETD), CEA.