भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee

दिनांक:10.01.2025

सेवा में : संरक्षण उप-समिति के सदस्य (सूची के अनुसार) ।
To: Members of Protection Sub-Committee (As per mail list)

विषय: संरक्षण उप-समिति की 55 वीं बैठक की कार्यवृत्त |
Subject: Minutes for 55th Protection Sub-Committee Meeting.

संरक्षण उप-समिति की **55 वीं बैठक, दिनांक 20.12.2024 को 10:30 बजे** से **एनआरपीसी सचिवालय, कटवारिया सराय, नई दिल्ली** में आयोजित की गयी थी | उक्त बैठक की कार्यवृत्त संलग्न है । यह उत्तर क्षेत्रीय विद्युत् समिति की वेबसाइट (http://164.100.60.165/) पर भी उपलब्ध है |

The **55th meeting** of Protection Sub-Committee was held on **20.12.2024** at **10:30 Hrs** at **NRPC Secretariat, Katwaria Sarai, New Delhi**. The minutes of the meeting is attached herewith. The same is also available on NRPC website (http://164.100.60.165/).

Signed by Dharmendra
Kumar Meena
Date: 10-01-2025 15:30:25

(डी.के. मीना)
(D.K. Meena)
निदेशक (संरक्षण)

55th Protection Sub-Committee Meeting (20th December, 2024)-MoM

Contents

Minutes of 55th Meeting of Protection Sub-Committee (PSC) of Northern Regional Power Committee

Date and time of meeting	:	*20.12.2024 10.30 Hrs.*
Venue	:	*NRPC Secretariat, Katwaria Sarai, New Delhi*

MS, NRPC welcomed all the participants. List of participants is attached as **Annexure-P.**

Part-A: NRPC

A.1. Confirmation of minutes of 54th meeting of Protection Sub-Committee

A.1.1 AEE (P), NRPC apprised that the 54th PSC meeting was held on 25.11.2024. Minutes of the meeting were issued vide letter dtd. 06.12.2024. No comment has been received till the date.

Decision taken by Forum:

Forum approved the minutes of 54th PSC meeting as issued.

A.2. Status of action taken on decisions of 54th Protection Sub-Committee meeting (agenda NRPC Secretariat)

A.2.1 Status of action taken on the decisions of 54th PSC meeting were informed to the Forum.

A.2.2 Concerned utilities submitted the status of action taken and the same has been complied as **Annexure-A.I.**

A.2.3 Forum noted the action taken status reported by concerned utilities and requested utilities to expedite the actions.

Decision taken by Forum

Forum noted the action taken status reported.

A.3. Submission of protection performance indices along with reason and corrective action taken for indices less than unity to NRPC Secretariat on monthly basis (agenda by NRPC Secretariat)

A.3.1 AEE (P), NRPC apprised that as per clause 15 (6) of IEGC 2023;

- *Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 kV and above (132 kV and above in NER) system, which shall be reviewed by the RPC:*

  *a) The **Dependability Index** defined as* $D = Nc / Nc + Nf$

  *b) The **Security Index** defined as* $S = Nc / Nc + Nu$

  *c) The **Reliability Index** defined as* $R = Nc / Nc + Ni$

  where,

  Nc is the number of correct operations at internal power system faults,

  Nf is the number of failures to operate at internal power system faults,

  Nu is the number of unwanted operations,

  Ni is the number of incorrect operations and is the sum of Nf and Nu

Further, as per clause 15 (7) of IEGC 2023;

- *Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.*

A.3.2 In earlier PSC meetings, it was decided that each utility shall submit the Performance indices of previous month by 7th day of next month.

A.3.3 Further, the status of the indices reported for the month of November-2024 was presented and concerned who have not submitted were asked to submit the same at the earliest.

A.3.4 BBMB representative conveyed that indices will be submitted shortly.

A.3.5 PSTCL has not sent the performance indices for the October & November, 2024 months. PSTCL was requested to send the performance indices timely. PSTCL representative agreed to ensure the same.

A.3.6 It was noted that HPGCL submitted the performance indices for its one plant RGTPP, Khedar. Forum requested HVPN to communicate with SLDC and HPGCL to send the performance indices of all plants timely.

A.3.7 NTPC was again requested to communicate Meja Urja Nigam Limited for submitting the protection performance indices.

A.3.8 SLDCs were directed to share the compiled data of all utilities (GENCOs, & TRANSCOs) under their jurisdiction. They may take regular follow ups with other utilities who are not members of NRPC and arrange the protection performance indices.

A.3.9 MS, NRPC emphasized that protection is of utmost requirement for our system to operate smoothly and uninterruptedly.

A.3.10 Further, he highlighted that all the concerned utilities need to stream line the performance indices submission in pursuance to the IEGC 2023 for each month.

A.3.11 The current status of the indices reported for the month of Novemer-2024 is attached as **Annexure-A.II**.

A.3.12 Further, the summary of events, reported prior to this meeting which caused indices less than unity was discussed. The concerned utilities were supposed to submit the reason for the same and corrective action taken to resolve the related issue. Accordingly, concerned utilities were asked about the reason and remedial action taken for unwanted, incorrect operation and failure of operation.

A.3.13 Based on detailed discussion and submission of information by utilities, the reason and corrective action taken for Performance Indices less than Unity related to events of November 2024 are attached as **Annexure- A.III.**

A.3.14 MS, NRPC emphasized that repetitive tripping due to same causes may be avoided and review of protection settings may be done timely.

A.3.15 Subsequently, MS, NRPC highlighted that utilities may submit the performance indices of previous month by 7th day of next month element wise along with the reason for indices less than unity and corrective action taken. He directed all concerned utilities to send their reasons within a week via email along with corrective action taken for indices less than unity. SLDCs may send the compiled data of all utilities (GENCOs & TRANSCOs) under their jurisdiction.

Decision taken by Forum:

Concerned utilities were requested to submit the Protection performance indices of previous month by 7th day of next month element wise along with corrective action taken for indices less than unity.

A.4. Annual protection audit plan for FY 2024-25 and third-party protection audit plan (agenda by NRPC Secretariat)

Annual Internal Audit Plan:

A.4.1 AEE (P), NRPC apprised that under as per clause 15 of IEGC 2023;

- *Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.*

A.4.2 In the 48th, 49th, 50th, 51st, 52nd, 53rd & 54th PSC meetings, all utilities were requested to submit the annual protection audit plan.

A.4.3 Some utilities have submitted their annual audit plans and others were requested to submit annual audit plan for FY 2024-25.

A.4.4 HPGCL representative intimated that Internal Protection audit will be completed by next month. Accordingly, plan will be shared to NRPC.

Third party protection audit:

A.4.5 As per clause 15 of IEGC 2023:

All users shall also conduct third party protection audit of each sub-station at 220 kV and above (132 kV and above in NER) once in five years or earlier as advised by the respective RPC.

A.4.6 Some utilities have submitted their third-party protection audit plans and other remaining were requested submit the same.

A.4.7 PPGCL & NPL were asked about the status of third-party protection audit as it was planned to be conducted in December, 2024.

A.4.8 Revised third-party protection audit plan have been shared by ADHPL and MEIL Anpara Energy Ltd.

A.4.9 MS, NRPC directed that concerned SLDCs shall send the internal annual audit plan for FY 2024-25 and third protection audit plan of all utilities in its control area. The status of audit as per submitted schedule, audit report and compliance of observations shall also to be updated by SLDCs of all utilities (Genco, Transco) in its control area.

A.4.10 Utilities may send the 3rd party protection audit plan. Subsequently, the audit reports along with compliance status may be submitted to NRPC Secretariat regularly.

A.4.11 As on date the status of Internal Protection Audit plan for FY 2024-25 and third-party protection audit plan is attached as **Annexure-A.IV** & **Annexure-A.V**.

A.4.12 Forum highlighted that it is serious concern to not comply the IEGC. All utilities must comply the IEGC regulations timely and take care of same in future also.

A.4.13 It was gathered that a letter may be sent to all concerned utilities who have not submitted internal protection audit plan for FY 2024-25 yet.

Decision taken by Forum:

Utilities were requested to submit the Annual Internal Protection Audit plan for FY 2024-25 and third-party protection audit plan at the earliest and comply the same timely. Audit report along with action plan for deficiency detected, if any may be submitted.

A.5. Annual protection audit plan for FY 2025-26 (agenda by NRPC Secretariat)

A.5.1 AEE (P), NRPC apprised that as per clause 15 of IEGC 2023;

- *Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.*

A.5.2 In view of above, all utilities were requested to submit the annual protection audit plan for FY-2025-26 latest by 31st October 2024 in the 53rd PSC meeting. Further, concerned utilities were requested to submit the same at the earliest in the 54th PSC meeting.

A.5.3 POWERGRID NR-3 representative informed that Protection audit plan has been prepared and will be forwarded to NRPC after due approval from higher authorities.

A.5.4 BBMB representative conveyed that annual audit plan for FY 2025-26 will be sent shortly.

A.5.5 Accordingly, some utilities have submitted their annual audit plans (enclosed as **Annexure- A.VI**) and others were requested to submit annual audit plan for FY 2025-26 at the earliest in order to comply IEGC regulations.

A.5.6 It was gathered that a letter may be sent to all concerned utilities who have not submitted internal protection audit plan for FY 2025-26 yet.

Decision taken by Forum:

A letter may be sent to all concerned utilities who have not submitted internal protection audit plan for FY 2025-26 yet.

A.6. Observations and Compliance of recommendations of protection audit (agenda by NRPC Secretariat)

A.6.1 AEE (P), NRPC apprised that as per clause 15 of IEGC 2023*;*

- *All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 kV and above (132 kV and above in NER).*

- *All users shall also conduct third party protection audit of each sub-station at 220 kV and above (132 kV and above in NER) once in five years or earlier as advised by the respective RPC.*

- *The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.*

A.6.2 Utilities have submitted the internal audit report based on the audit done at their substations. After the 54th Protection Sub- Committee meeting, received internal Protection Audit report from LPGCL is attached as **Annexure-A.VII** and received reports of 3rd Party audit from HPSEBL (Kunihar), PTCUL, RVUNL (400kV Sub-station of Generating Station at SSCTPS – Suratgarh) & UJVNL (Khodri & Chibro) are attached as **Annexure-A.VIII.**

A.6.3 However, compliance of audit recommendations has not been reported to NRPC Secretariat. HPSEBL has submitted the compliance reports of third-party audit along with report. UJVNL has submitted the status of compliance action plan (enclosed as

Annexure-A.IX)

A.6.4 The internal and external reports were presented and discussed. All members and concerned utilities were asked to share their findings and observations based on audit report.

A.6.5 NRLDC representative highlighted that as per observations of third-party audit of Kunihar substation, there are multiple actions that require to be expedited to align the protection philosophy.

A.6.6 Similarly, He requested UJVNL to expedite the compliance actions against the observations pointed out during third-party audit of Khodri & Chibro. Multiple events have been reported in past due to breaker struck during unit synchronization which requires immediate solutions.

A.6.7 LPGCL was requested to submit the compliance report of internal Protection audit. PTCUL and RVUNL were also requested to submit the compliance report/action plan of third-party Protection audits.

Decision taken by Forum:

Utilities were requested to submit action taken or compliance of observations/recommendations of audit. Forum directed all utilities to ensure that audit reports (internal and external) should be in proper sequence along with annexures, if any, while sharing with NRPC.

A.7. Provisional protection clearance during FTC in November 2024 (agenda by NRPC Secretariat)

A.7.1 AEE (P), NRPC apprised that provisional protection clearance during FTC in November 2024 allowed by NRLDC is attached as **Annexure-A.X**.

A.7.2 NRLDC representative informed that almost all the utilities have put up the agenda for final approval from NRPC PSC forum. Only PSTCL (for FTC of ICT at Nakodar) and ACME (RE station) have not put up the agenda for approval of NRPC PSC forum. Members were requested to put up the agenda in NRPC PSC forum for final approval of protection settings of newly charged elements in stipulated time.

A.7.3 NRLDC representative highlighted different issues faced during processing of FTC applications. Majorly non-compliances were related to submission of protection setting not in line with the approved protection philosophy for NR, submission of non-standardised DR/EL. Summary of compliance required during the FTC also attached as **Annexure-XI.**

A.7.4 EE (P), NRPC suggested NRLDC to mention that agenda is to be put up in PSC meeting for final approval of settings during provisional FTC approval. However, it has been observed that Solar Generators are not sending the agenda for final approval of settings. Since, all RE companies are not members of NRPC. During grant of FTC, NRLDC may mention condition of putting agenda for approval of settings in upcoming PSC by concerned RE company.

A.7.5 NRLDC representative stated that the same was already discussed in 54th PSC meeting, wherein, it was decided as:

Quote

***NRLDC shall give provisional protection clearance during FTC on conditional basis subject to submission of agenda in next Protection Sub-Committee meetings (not later than 2nd next PSC meeting). If utility does not put up the agenda within time, further FTC clearance would not be granted to the concerned*.**

Unquote

A.7.6 MS, NRPC stressed upon final approval of provisionally cleared FTCs and requested utilities to submit the agenda timely.

Decision taken by Forum:

Forum directed all concerned utilities to submit the agenda for final approval of Protection settings in the upcoming PSC meeting.

A.8. Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously (agenda by RVPN)

A.8.1 AEE (P), NRPC apprised that RVPN vide letter dated 28.10.2024 submitted that “Protection Philosophy/ Protocol of Northern Region” has been incorporated with “Protection for broken conductor” as Alarm indication for transmission line and cable.

A rider has been provided that tripping may be considered for radial lines to protect single phasing of transformers.

A.8.2 Further, RVPN has mentioned that at the substations which operate radially, it provides us liberty to enable the tripping of line with broken conductor alarm to prevent single phasing of transformers but in case of substation fed by two or more transmission lines, this setting is to be kept on alarm mode only.

A.8.3 For example, in case of a substation connected with two lines (i.e. it is in ring), if one line is out due to fault or by the direction of SLDC, the substation becomes radially connected and setting for the Broken Conductor remains on Alarm. This may lead to single phasing of transformer if conductor of remaining line breaks. The same may be applied to the cases with more lines.

A.8.4 Therefore, RVPN proposed to have tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously.

A.8.5 The above agenda was discussed in the 54th PSC meeting wherein Forum requested all the members to share the comments on the proposal of RVPN and deferred the agenda to next PSC meeting for deliberation based on the inputs of members.

A.8.6 In view of above, comments/inputs/observations/suggestions on the above proposal of RVPN were sought from all PSC members vide email dated 02.12.2024. UPPTCL, LPGCL (enclosed as **Annexure-A.XII)** submitted the comments.

A.8.7 NPCIL vide letter dated 06.12.2024 intimated that NPCIL have implemented the tripping on broken conductor for 220kV and 400kV substations since 2013. The same was noted by Forum.

A.8.8 POWERGRID NR-2 representative mentioned that during broken conductor, transformer may be allowed to trip by earth fault protection to avoid single phasing of transformer. RVPN representative replied that sufficient loading on transformer is required to trip on earth fault during broken conductor. Even in case of low load, single phasing of transformer may increase losses and hot spot in the transformer.

A.8.9 POWERGRID NR-3 representative added that ICT tripping on negative sequence current may be explored along with earth fault operation.

A.8.10 HVPN representative conveyed that alarm setting may be changed to trip logic manually in this scenario of double circuit line to radial conversion due to shutdown of one feeder. RVPN representative replied that tripping should be done automatically by using logic instead of manual intervention.

A.8.11 IPGCL representative mentioned that there are two lines at Bawana and by tripping of second line using this logic in case of outage of first line will make plant to operate as an island. Plant will finally trip which is not suitable option for a generating plant.

A.8.12 EE (P), NRPC mentioned that this proposal of RVPN is suitable for them as they are using Bus CVT and Line CVT for two different relays. However, most of the utilities use line CVTs only. Therefore, RVPN may go ahead with its proposed logic and may implement for identified substations having two or more lines which gets converted into radial frequently. Philosophy needs not to be changed as it will be burden for other utilities.

A.8.13 Further, it was also gathered that this suggested logic should not be implemented for lines at generator end.

Decision taken by Forum:

Forum allowed RVPN to implement the proposed logic of tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously. Lines emanating from generating end may not be provided with this proposed logic.

A.9. Tripping of line reactors due to ferro-resonance (agenda by POWERGRID)

A.9.1 POWERGRID NR-1 representative apprised that they are facing critical problem of LC Ferro-Resonance in several 765kV & 400kV Lines of Rajasthan.

A.9.2 As per POWERGRID Guidelines, Relay Scheme (at One end of Transmission Line) needs to be modified for all such cases to achieve removal of one end Line Reactor during condition of 1-phase AR cycle / any Line Fault in order to avoid occurrence of LC Ferro-Resonance.

A.9.3 POWERGRID also mentioned that similar relay scheme is already approved in 129th Protection Coordination Meeting (in 2017) of WRPC due to Ferro-resonance seen in other regions such as 765 kV Indore-Bhopal line.

A.9.4 POWERGRID further submitted that for implementation of above modification in relay scheme, shutdown of several elements is required.

A.9.5 Accordingly, POWERGRID requested that all necessary shutdown of following listed elements may be approved under ***"System Constraints"*** head, without loss of availability of POWERGRID / PBTSL:

Name of Line	**Location where TRIPPING Scheme of Line Reactor is implemented to avoid LC Ferro-Resonance**	**Owner of Asset**
400kV Bikaner-2 Khetri Ckt-1 Line	**Bikaner-2** for 400kV, 80 MVAR Line Reactor	**PBTSL**
400kV Bikaner-2 Khetri Ckt-2 Line	**Bikaner-2** for 400kV, 80 MVAR Line Reactor	**PBTSL**
400kV Bikaner-2 Khetri Ckt-3 Line	**Bikaner-2** for 400kV, 80 MVAR Line Reactor	**PBTSL**
400kV Bikaner-2 Khetri Ckt-4 Line	**Bikaner-2** for 400kV, 80 MVAR Line Reactor	**PBTSL**
765kV Chittorgarh-Banaskatha Ckt-1 Line	**Chittorgarh** for 765kV , 240 MVAR Line Reactor	**PGCIL**

A.9.6 POWERGRID NR-1 representative informed that these lines are over compensated due to availability of more charging MVAr. During Auto reclose operation, line energization, the voltage of lines goes up to 2 Pu due to ferro resonance. There are chances of lines to get tripped on over voltage stage-2.

A.9.7 Therefore, he proposed that one end line reactor may be tripped during auto recloser. After line charging the reactor will be charged.

A.9.8 NLDC representative enquired about the over compensation. POWERGRID representative replied that in four lines out of the above-mentioned five lines, there are approx. 65 % over compensation and in reaming one line, there is more than 70% over compensation.

A.9.9 NLDC representative conveyed that we can analyse cases of over compensation more than 70%. He also requested POWERGRID to arrange DRs of such trippings showing rise of voltage.

A.9.10 NRLDC representative stated that unplanned outage (during A/R) of reactors would be a concern during high voltage scenario specifically in winter season when there is significant high voltage condition in night hours. Therefore, comprehensive study and analysis is to be done before adopting such philosophy. In view of this, POWERGRID was requested to share the simulation study of this case and disturbance recorder files of such ferro-resonance cases. This issue may be intimated to CTU also for considering this point in planning.

A.9.11 EE (P), NRPC also suggested that simulation studies may be conducted taking possible scenarios.

Decision taken by Forum

Forum directed POWERGRID to do simulation studies and share the results accordingly. NRLDC, NLDC and CTUIL may also draw the inputs from the studies for safe operation and planning of transmission system.

A.10. Frequent faults in 220kV downstream feeders and need for review of Auto-Reclosure settings in these 220kV lines (agenda by POWERGRID)

A.10.1 POWERGRID NR-1 representative apprised that frequent faults are being observed in the downstream (220kV) lines fully owned by state utilities or the 220kV lines having major portion maintained by state utilities. The details of these lines are as mentioned below:

Sr. No.	Name of the line	Line Ownership	No. of faults in last two years
1	220kV Baghpat (PG)-Shamli (UP) Line	UPPTCL	84
2	220kV Baghpat (PG)-Mandola Vihar (UP) Line	UPPTCL	38
3	220kV Baghpat (PG)-Baghpat(UP) Ckt-I	UPPTCL	8
4	220kV Baghpat (PG)-Baghpat(UP) Ckt-II	UPPTCL	23
5	220kV Baghpat (PG)-Modipuram(UP) Ckt-I	UPPTCL	31
6	220kV Baghpat (PG)-Modipuram(UP) Ckt-II	UPPTCL	18
7	220kV Meerut (PG)-Nara(UP)	UPPTCL/PG	56
8	220kV Hisar (PG)-Fatehabad lines (HVPNL)	HVPNL	60
9	220kV Hisar (PG)-Fatehabad lines	HVPNL	45

	(HVPNL)		
10	220 Saharanpur (PG)- Shamli (UP)	UPPTCL	60
11	220 Saharanpur (PG)- Khara (UP)	UPPTCL	40

A.10.2 All these lines, except the 220kV Meerut-Nara lines, are fully owned by state utilities. As evident from the aforementioned tables, these lines experience frequent faults, which place significant stress on the switchyard equipment as well as the interconnecting transformers at the POWERGRID substations. These recurring faults have already resulted in the failure of GIS at the Baghpat Substation and the failure of a circuit breaker at the Meerut Substation.

A.10.3 Notably, all 56 faults in the 220kV Meerut- Nara line over the past two years occurred in the UPPTCL portion. Considering the high number of faults in the aforesaid 220kV lines, it is proposed to implement adaptive AR for these lines at the POWERGRID end.

A.10.4 Copy of various communications with UPPTCL and HVPN is attached as **Annexure-A.XIII.**

A.10.5 POWERGRID NR-1 representative raised the concern of large no. of trippings of these mentioned lines. He conveyed that state utilities are used to tell the reason for large no. of trippings as insulator problem and tower footing resistance issue. Corrective actions are taken by them after issues are flagged with them. But these corrective actions do not remain longer in practice which again causes line trippings.

A.10.6 UPSLDC representative mentioned that the no. of trippings occurred since June 2024 have been tabulated as **Annexure-A.XIV**. It has been found that most of the faults are transient in nature and maximum times lines got auto reclosed from UP end.

A.10.7 Further, he highlighted that 3 trippings in 2 months (regarding 220kV Mandolavihar - Baghpat (PG) line) on average cannot be considered under severe condition.

A.10.8 220kV Khara - Saharanpur (PG) line has electromechanical relays and their replacement with numerical relay are under progress. Due to which faults which are out of the zone, maloperates the line distance protection and causes large no. trippings.

A.10.9 For, 220kV Nara - Meerut (PG) line, he also mentioned that out of 5 faults since June, 2024, there are 2 bus faults at Nara and 3 line faults which are quite less.

A.10.10 Finally, he submitted that most of the faults occurred are transient in nature and line has been successfully getting auto reclosed form UP end. He added that the no. of trippings in the months of November & December are also less.

A.10.11 He suggested that POWERGRID may communicate to higher officials of UPPTCL to take up the matter if proper response is not being received from the fields.

A.10.12 HVPN representative briefed the corrective actions taken by them in the 220kV Hisar (PG)-Fatehabad lines (HVPNL). He informed that all suspension insulators have been replaced excepts pilot strings which will be completed within two months. Earth wire replacement work is also under progress which will also be completed within two months.

A.10.13 NRLDC representative stated that as informed by SLDC-UP and HVPNL, corrective actions are being taken and number of tripping have also reduced in recent months. UPPTCL and HVPNL were requested to take all necessary actions to minimise the fault incidents and frequent tripping of lines. POWERGRID was requested to highlight the issue with UPPTCL's higher officials and request them to take all necessary corrective actions. The proposal of adaptive auto reclosing may be discussed again after observation of 2-3 months.

A.10.14 Forum was of view that UP and Haryana may look into the highlighted issues and take appropriate actions to reduce the no of trippings. After two months, POWERGRID may put up the agenda again with history of faults of 2-3 months' period.

Decision taken by Forum

Forum directed UPPTCL and HVPNL to expedite remedial actions, including thorough patrolling of the affected lines, rectify defects and maintain system reliability. POWERGRID may approach higher officials of UPPTCL and HVPN, if problem is not addressed by field offices. POWERGRID may put up the agenda again after observing the faults frequency in the upcoming two months.

A.11. Review of Zone-2 & Zone-3 time delay settings at Mandola (PG) substation for 220kV Mandola (PG)-Gopalpur (DTL) lines (agenda by POWERGRID)

A.11.1 POWERGRID NR-1 representative apprised that 220kV Mandola (PG)-Gopalpur

(DTL) lines are experiencing faults that are often cleared in Zone 2/Zone 3 from the Mandola end due to the failure of the protection system at the Gopalpur Substation. These delayed fault clearances are causing stress on the ICTs at Mandola Substation, as these faults are being fed by the ICTs installed at Mandola. Most of the switchgear in the 220 kV bays has aged, and such frequent and prolonged fault feeding increases the risk of switchgear failure.

A.11.2 As a stop-gap arrangement, DTL has implemented IDMT O/C & E/F protection for the Mandola-Gopalpur Line-1 and Line-2. However, this protection will only trip after a time delay in cases where faults are not cleared from the Gopalpur end. In light of the above, it is proposed that the Zone-2 and Zone-3-time delay settings of the Mandola-Gopalpur lines at the Mandola end to operate instantaneously, rather than with a time delay, in order to prevent further stress on the system.

A.11.3 Copy of various communications of POWERGRID with DTL is attached as **Annexure-A.XV.**

A.11.4 DTL representative informed that earlier there was tripping due to unhealthy communications and Bus isolator issues. These issues have been resolved as of now. Recently, there has been no tripping observed.

A.11.5 CGM, NRLDC asked POWERGRID about no. of trippings. POWERGRID representative informed that 4 nos. of trippings were observed. After the June, 2024 no fault has been reported also.

A.11.6 NRLDC representative stated that as stated by DTL, corrective actions have been taken already to ensure the proper operation of protection system at their end. Therefore, there is no need for reducing time delay of Z-2/3**.**

A.11.7 DTL representative ensured that all protections are going to operate properly as per philosophy in future.

A.11.8 Accordingly, Forum instructed POWERGRID to observe the protection operation in nearby future and bring the agenda again in case of failure of the protection system at the Gopalpur Substation is observed.

Decision taken by Forum

Forum noted the action taken by DTL regarding proper operation of protection system *and fault clearance as per philosophy. Forum directed POWERGRID to observe the scenario for future tripping and put up the agenda in upcoming PSC accordingly.*

A.12. Review of Zone-2 & Zone-3 time delay settings at Sonipat (PG) substation for 220kV Sonipat (PG)-Mohana (HVPNL) lines (agenda by POWERGRID)

A.12.1 POWERGRID NR-1 representative apprised the protection system at the Mohana (HVPNL) substation is not clearing faults in the downstream feeders as well as the faults in the 220kV Sonipat (PG)-Mohana (HVPNL) line. These lines frequently trip in Zone-2 and Zone-3. The non-operation of the protection system at the Mohana substation causes delayed fault clearance from the Sonipat (PG) substation. This delayed fault clearance places unnecessary stress on the transformers and other switchyard equipment at the Sonipat (PG) end, which is undesirable from a system reliability perspective.

A.12.2 In view of this, it is proposed to revise the Zone-2 and Zone-3-time delay settings at the Sonipat (PG) substation for the 220kV Sonipat (PG)-Mohana (HVPNL) lines to operate instantaneously, rather than with a time delay, to prevent further stress on the system.

A.12.3 Copy of various communications of POWERGRID with HVPNL is attached as **Annexure-A.XVI**.

A.12.4 POWERGRID representative stressed upon that the fault has been continuously occurring in these lines and not getting cleared which is matter of concern.

A.12.5 HVPN representative mentioned that earlier there were identical relays available for both main 1 and main 2. Further, in December, 2023, main 1 relay was replaced with different make to have different relays for main 1 and main 2.

A.12.6 Later, 2 trippings were observed. Out of these, one was due to CT burst. Second tripping was due to fault in downstream line i.e. Mohana Sapla line due to PT selection problem.

A.12.7 POWERGRID NR-1 representative also added that fault of downstream networks of HVPN have also not been getting cleared many times. Due to this, Sonipat end clears the fault in zone-2 & 3.

A.12.8 HVPN representative highlighted that special audit may be conducted by HVPN for Mohana substation.

A.12.9 EE (P), NRPC suggested that HVPN may conduct the internal audit for Mohana substation with associated feeder such as Sapla and submit the audit report in next PSC meeting.

A.12.10 RVPN representative highlighted that main cause of stressing in transformer is the magnitude of fault as compared to frequency of faults. The fault in zone-2 & 3 cause less fault current than short circuit current of ICT. POWERGRID representative commented that short circuit current stresses the ICT but frequent faults cause the ageing of ICT.

Decision taken by Forum

Forum suggested HVPN to conduct internal audit of Mohana Substation and audit report may be submitted along with observations, recommendations. Based on which HVPN may do compliance and ensure fault clearance from Mohana end.

A.13. Tripping of Rihand Stage-3 Units, during Monopole Ground Return Mode Operation of Rihand Dadri HVDC line (agenda by NTPC)

A.13.1 AEE (P), NRPC apprised that as per submission of NTPC, the problem of abnormal noise & excessive vibrations in GTs of Rihand Stage-III and Vindhyachal Stage-IV during monopole operation of HVDC Rihand – Dadri link was earlier discussed, and it was decided in 45th TCC meeting (27th & 28th August 2020) and 48th NRPC Meeting (2nd September 2020) to limit HVDC line loading to 300MW during monopole ground return operation.

A.13.2 During such monopole ground return operation, Stage-3 units of 2 X 500 MW (Unit-05 & 06) tripped on 11.11.2024 at NTPC-Rihand. Rihand Unit # 5 tripped on Buchholz relay protection in GT-5Y at 01:13:27 hrs & Rihand Unit # 6 tripped in GT-6R & 6B transformers at 01:16:40 hrs. After units tripping, DC current in GT/ST neutral were found significantly high at 300 MW HVDC power flow, so same was reduced to 200 MW and finally to 100 MW as mentioned in below table to minimize the DC current.

Sr No.	Date	Unit	DC Current at 300MW	DC current at 200MW HVDC	DC current at 100MW HVDC

			HVDC flow	flow	flow
1	11.11.2024	GT-1 (400/20 kV)	16.1 Amp	9.5 Amp	0.2 Amp
2	11.11.2024	GT-2(400/20 kV)	16.3 Amp	9.6 Amp	1.6 Amp
3	11.11.2024	GT-3(400/21 kV)	15.1 Amp	8.3 Amp	0.5 Amp
4	11.11.2024	GT-4(400/21 kV)	15.0 Amp	10.0 Amp	0.6 Amp
5	11.11.2024	ST-5 (400/11/11 kV)	37.1 Amp	24.0 Amp	0.6 Amp
6	11.11.2024	ST-6 (400/11/11 kV)	37.5 Amp	24.6 Amp	0.5 Amp

A.13.3 The unwarranted unit outages, causing heavy loss of revenue to NTPC and which is having detrimental impact to the health and life of these critical & costly assets installed at Rihand.

A.13.4 In view of above, NTPC has proposed to make a detailed study in respect of the following aspects:

i. Establish root causes for high DC current in flow via neutral, during monopole operation with ground return.

ii. Establish a safe operation procedure of HVDC system in different modes, especially with load-limiting features during monopole operation in different situations/ operations

A.13.5 MS, NRPC updated members that agenda has already been discussed in the 226th OCC meeting held on 16.12.2024 wherein a committee has been formed after detailed deliberation.

Decision taken by Forum

Forum was of view that there is no further deliberation required as a committee has been formed.

A.14. Approval of scope/ objective of Centralized Database for Protection Settings in Northern Region to be implemented under PSDF (agenda by NRPC Secretariat)

A.14.1 AEE (P), NRPC apprised that in 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 kV and above. The scope was already approved in the above meeting.

A.14.2 Further, a meeting was held on 08.01.2024 with POWERGRID to deliberate on tendering, wherein POWERGRID desired number of sub-stations and elements for which relay details shall be modelled in Centralized Database for preparation of estimate of work for implementation of the portal.

A.14.3 In view of above, it was requested vide letter dtd. 23.01.2024 to NRLDC/NLDC and SLDCs of Northern region to furnish the details of all elements connected at 220 kV and above, in respective control area latest by 30.01.2024. A reminder mail dtd. 06.02.2024 was also sent for the same.

A.14.4 Based on the received data, compiled status was presented in the 50th PSC meeting held on 29.04.2024. Subsequently, Utilities were requested to send pending data for no. of relays and substations within a week. It was also decided to consider tentative/ average data if details are not submitted by utilities within a week.

A.14.5 Compilation of numbers for sub-station, relay and licensee for calculation tool has been done. After considering assumption, the presented numbers were as below:

S.N.	Number of substations (220 kV and above in Northern Region)	Number of relays	Number of licenses of protection calculation tool
1	965	39380	87 (Already approved in 49th PSC meeting)

A.14.6 UPSLDC representative commented that Lanco Anpara is an IPP whose data need not to be considered under UPRVUNL.

A.14.7 Subsequently, all members were of view that 10% extra addition is not sufficient as RE penetration and augmentation of transmission system is at fast pace which will also be added in this database in future.

A.14.8 Therefore, Forum decided that 20% extra addition may be done in the no. of Substations and Relays. Accordingly, followings were finalized as below-

S.N.	Number of substations (220 kV and above in Northern Region)	Number of relays	Number of licenses of protection calculation tool
1	1050	42818	87 (Already approved in 49th PSC meeting)

A.14.9 The finalized details are attached as **Annexure- A.XVII**.

A.14.10 Further, PSDF Secretariat vide letter dated 04.12.2024 has intimated that now PSDF fund has been opened which was blocked for some time. Accordingly, NRPC Secretariat is putting up agenda in upcoming TCC/NRPC meeting for approval of DPR for this project.

A.14.11 POWERGRID was requested to submit the DPR before 52nd TCC/77th NRPC meeting scheduled on 27-28 December.

A.14.12 The scope of database portal was approved in 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023) as attached as **Annexure- A.XVIII.**

A.14.13 EE (P), NRPC highlighted that there is need for discussion on point no. D of approved scope as procedure for approval of protection setting has been recently approved in 75th NRPC meeting as attached as **Annexure-A.XIX.** He added that reporting of performance indices, audit report submission, audit report compliance status tracking may be integrated with the already approved scope.

A.14.14 Forum agreed with this proposal and accepted that required changes may be done in the scope of project including finalized procedure of protection setting approval. A separate dashboard may be created for the approval of protection settings having configurations of all steps of procedure. The same dashboard may be integrated with FTC portal of NRLDC.

A.14.15 Accordingly, Forum approved the scope of project attached as **Annexure-A.XX.**

Decision taken by Forum:

After detailed deliberation, Forum decided the followings as below-

i. The finalized details of number of sub-station and relays for the project attached as **Annexure-A.XVII.**

ii. The finalized scope of the project attached as **Annexure-A.XX.**

A.15. Use of line VT/CVT for Main-1 and Bus VT/CVT for Main-2 Distance Protection Scheme on 220kV lines (agenda by RVPN)

A.15.1 RVPN representative apprised that Main -1 & Main-2 are two independent high speed protection groups used to safeguard section of the power system against short circuit faults/ abnormal system conditions, i.e., over voltage, broken conductor etc.

A.15.2 He further added that during the discussion in the 54th Protection Sub-Committee meeting, it was observed that many utilities are using line VT/CVT for both Main-1 & Main -2 Distance Protection Schemes.

A.15.3 RVPN proposed the following as below-

i. The Main-1 & Main -2 protection shall be numerical relays of different makes or employ different fault detection algorithm. The logic behind above is that every type of fault should be detected by either relay, i.e. no fault should remain undetected by protection schemes.

ii. Normally, two different CT cores are used for current input to Main-1 and Main-2 DPS but as mentioned above, if only line VT/CVT is used for both Main-1 and Main-2 DPS, then in case of loss of output from line CT/CVT or error in measurement by line VT/CVT, it would lead to either non operative or mal-operation of both Main-1 & Main -2 DPS.

iii. In view of above, RVPN has suggested to use line CT/CVT for Main-1 and Bus VT/CVT for Main-2 Distance Protection Scheme.

A.15.4 IPGCL representative highlighted that two separate cores are being used for main -1 & main -2 of line CVT to provide two different inputs. RVPN representative replied that CVT comprises of capacitive units, failure of which leads to failure of both cores. Ultimately, line distance protection gets affected by using line CVT input only for main-1 & main -2.

A.15.5 IPGCL representative added that by using bus CVT, system is going to be more complex as isolator status/contacts and voltage selection relay (75) are required to be proper. However, this issue does not come during use of voltage from line CVT. UPPTCL and POWERGRID representative were also of same view.

A.15.6 UPPTCL representative also added that PT selection switch will be required to be provided everywhere in such case. Erratic tripping of line may occur whenever there are change of bus.

A.15.7 He commented that Bus CVT will get over burdened due to more no. of connections of feeders in large switchyard. POWERGRID agreed with the same also.

A.15.8 NHPC representative mentioned that bus CVT/PT are not available for all three phases at generator end. Synchronization issue may arise.

A.15.9 RVPN representative emphasized that RVPN has been using this scheme successfully since long years back. He added that distance protection works properly even after failure of one CVT, either bus or line.

A.15.10 POWERGRID NR-3 representative conveyed that during shutdown of any Bus, Bus CVT will automatically get disconnected from the protection scenario. By this, Main-2 of all feeders connected to that bus will be blocked.

A.15.11 HVPN representative conveyed that Bus PT/CVT are being used in HVPN for protection purpose in both Main-1 & 2. In this way, every utility is using its practice.

A.15.12 AGEL representative commented that in case of use of Line CVT and Bus CVT, main -1 will get voltage at an early stage as compared to main-2 while charging the line from remote end. That may lead to more complications in the system.

A.15.13 NLDC representative mentioned that voltage profile will more accurately be available in case of line CVT/PT instead of Bus CVT/PT.

A.15.14 After detailed deliberation, Forum was of view that utilities may go ahead with its implemented practices regarding use of line or bus CVT.

Decision taken by Forum:

Forum decided that utilities may keep their implemented practices regarding use of line or bus CVT. There is no need to make it mandatory for any one option as it may lead lot of outages in changing configuration.

Part-B: NRLDC

B.1 Status of remedial actions recommended during previous PSC meetings (agenda by NRLDC)

B.1.1 NRLDC representative apprised that as per the discussion in pervious PSC meetings, necessary remedial actions were recommended based on the analysis and discussion of the grid events. It is expected that necessary actions would have taken place. In view of the same, constituents were requested to share the status of remedial actions taken. List of points discussed in 55th PSC meeting is attached as **Annexure-B.I.** During the meeting constituents were requested to apprise the status of the same. Discussion during the meeting were as follows:

a) Frequent multiple elements tripping at 220kV Kunihar, Baddi, Upperla Nangal complex and load loss event in HP control area

PSC (51, 52 & 53) recommendations: PSC Forum requested HP to complete the protection audit as per mentioned timelines (protection audit of 220kV Kunihar has been awarded and it would be completed within next 15-20 days. In next phase, by 15th September, protection audit of substations in downstream and upstream of 220kV Kunihar S/s would be completed.) and resolve the protection related issues. HP was also requested to share the reports of protection audit to NRPC & NRLDC after completion of audits.

During 54th PSC meeting, HPSEBL informed that Protection audit of 220kV Kunihar was conducted by POWERGRID on 19th October 2024. Protection audit of rest of the stations (Bhabha, Upperla Nangal, Baddi etc.) shall be conducted in near future and will be completed by December 2024. HPSEBL also submitted protection audit and its compliance report (attached as **Annexure-A.VIII**).

Compliance report submitted by HPSEBL was discussed during the 55th PSC meeting. NRLDC representative highlighted that there are number of protection related non-compliance mentioned in 3rd party protection audit report. HPSEBL was requested to share the timeline for rectification of all the issues. HPSEBL representatives were not present in the meeting. SLDC-HP was requested to further follow-up with HPSEBL for expedited corrective actions at their end.

Protection audit of other remaining stations (Baddi, Upperla Nangal etc) also need to be completed on priority.

b) Multiple elements tripping at 220kV Hissar(BBMB) 07th May 2024, 11:16 hrs

PSC (51 & 52) recommendations: Expedite the implementation of differential protection in short lines to avoid undesired operation of distance protection.

During 53rd PSC meeting, HVPNL representative stated that matter has been taken up with HVPNL and is pending at their end. HVPNL representative informed that design team has compiled all such requirements in Haryana control area and is now working on the further process.

During 54th PSC meeting, HVPNL representative informed that existing earth wire is normal earth wire which is to be replaced with OPGW. Process of the same has been started. After this, process of implementation of differential protection will be started.

During 55th PSC meeting, HVPNL was requested to apprise the present status.

HVPNL representative informed that availability of OPGW has been confirmed. Design team of HVPNL shall put up the case for purchase of differential relay.

NRLDC representative requested HVPNL to expedite the process.

PSC Forum recommended HVPNL to expedite the implementation of differential protection in short lines.

c) Multiple elements tripping at 400/220kV Akal(RS) on 02nd Jan 2024, 07:28 hrs:

PSC 51 recommendations:

- Bus bar protection at 220kV bus at 400/220kV Akal shall be made operational by June 2024.
- Time synchronization of recording instruments (DR/EL) need to be ensured.

During 52nd PSC meeting, RVPNL representative informed that three faulty PU were replaced from the future bay and one PU is still unhealthy which is in warranty period. Process is getting delayed due to lack of response from the

OEM. Process will be expedited and will try to resolve the bus bar protection issue on priority.

During 53rd PSC meeting, RVPNL representative stated that correspondence with the firm is still going on and as an alternative, possibility of replacing healthy PU from any other station is being explored. Issue of time sync will be able to resolve only if bus bar protection get operational.

During 54th PSC meeting, RVPNL representative stated that issue not resolved yet, continuous follow-ups are being done.

During 55th PSC meeting, RVPNL was asked to apprise the forum about the present status.

RVPNL representative stated that work hasn't completed yet due to manpower issue because of parallel work at Pachpadra S/s (newly commissioned) and issue of bus bar at Akal S/s shall be resolved by the end of January 2025.

NRLDC representative requested Rajasthan to expedite the process.

PSC Forum recommended RVPNL to expedite the process and make bus bar protection at Akal S/s healthy & operational at the earliest.

d) Multiple elements tripping at 400kV Sainj (HP), 400kV Parbati2 & Parbti3 (NHPC) Stations on 07th May 2024, 16:17 hrs:

PSC 51 recommendations:

- NHPC shall follow up with the relay engineer and taken necessary remedial actions to ensure proper operation of A/R scheme at Parbati2 end.
- NHPC and HPPTCL shall review the healthiness of PLCC at Parbati3 and Sainj end and take necessary actions to ensure their proper operation.
- Expedite the implementation of differential protection in 400kV Parbati2-Sainj line.
- Standardisation of recording instruments (DR/EL) need to be ensured.

NHPC representative informed following during 52nd PSC meeting:

- Shutdown has been planned in 1st week of November 2024, testing of A/R scheme and implementation of differential protection will be done during that period.
- PLCC card at Parabti3 end will be replaced by the end of September 2024. For dual test of PLCC operation, PLCC at Sainj end also need to be healthy. Sainj HEP representative was not present in the meeting. HPPTCL was requested to intimate concerned person of HPPCL to taken necessary corrective actions and ensure healthiness of PLCC at Sainj end.

Further in 53rd PSC meeting, NHPC representative informed following:

- Due to unavailability of OEM, shutdown plan has been now rescheduled in last week of November or 1st week of December. Testing of A/R scheme and implementation of differential protection will be done during that period.
- PLCC card at Parabti3 end has been replaced and made functional. However, for dual test, PLCC at Sainj end also need to be functional.

During 54th PSC meeting, NHPC representative informed that status is same. Implementation of differential protection & testing of A/R in 400kV Parbati2-Sainj line will be completed by December end. Further, PLCC at Sainj HEP end also need to be healthy for testing of PLCC at Parbati3 end and proper operation of carrier communication in line.

During 55th PSC meeting, NHPC & Sainj HEP were requested to apprise the forum about the present status.

NHPC representative informed that they will receive differential relay in January 2025 and laying of OPGW on 400kV Parbati2-Sainj line (length 700-800m) will take ~2 months. Visit of GE engineer is also scheduled in January 2025.

Representatives of Sainj HEP were not present in the meeting.

NRLDC representative requested SLDC-HP to follow up with the HPPCL to ensure their attendance in PSC meeting and necessary actions at Sainj HEP.

PSC Forum recommended NHPC to expedite the process at their end and SLDC-HP was requested to follow up with HPPCL for necessary actions required at Sainj HEP.

e) Multiple elements tripping at 400kV Khedar(RGTPS) Station at 10th May 2024, 19:35 hrs

PSC 51 recommendations: Revised corrected protection settings of Main-2 Micom P442 distance protection relay and A/R scheme at Khedar(RGTPS) end need to be implemented at the earliest.

During 52nd PSC meeting, HVPNL representative informed that Khedar(RGTPS) have conducted 3rd party protection audit. Status of corrective action taken yet to be confirmed.

During 53rd PSC meeting, Khedar RGTPS representative informed that issues with the settings of the Micom relays has been resolved however in REL 670 relay installed at Khedar end, only 1-ph A/R option is not available. 3-ph A/R has been disabled now and it has been kept as 1-ph/2-ph A/R.

On this, NRLDC representative stated that 2-ph A/R is not desirable as most of the 2-ph fault will be of permanent nature only and being a generating station, keeping 2-ph A/R is not healthy. RGTPS representative was suggested to consult with the OEM and ensure only 1-ph A/R. In case option is not there then option of replacement of relay may be explored.

Khedar(RGTPS) representative agreed to take up the issue with OEM.

During 54th PSC meeting, RGTPS representative informed that OEM has agreed to revise the logic of A/R function in relay and issue related to A/R operation will be resolved at the earliest.

During 55th PSC meeting, HVPNL and RGTPS were requested to apprise the forum about the present status.

RGTPS representative informed that shutdown is planned in January 2025, issue will be resolved during that period.

PSC Forum requested RGTPS & HVPNL to ensure the desired correction in logic of A/R function at Khedar TPS at the earliest.

f) Multiple elements tripping at 400kV Koteshwar(PG) on 17th May 2024, 17:21 hrs

PSC 51 recommendation: In view of short line length of 400KV Koteshwar(PG)-Tehri D/C, POWERGRID shall plan for the differential protection in the line on priority in near future to avoid overreach of distance protection.

During 53rd PSC meeting, POWERGRID (NR-1) representative informed that order for the material of differential protection has been placed. It is estimated that materials will get delivered in next 3-months. In addition, to avoid delayed fault clearance in case of high resistive fault, time delay of DEF protection and carrier aided DEF operation has been implemented.

During 54th PSC meeting, POWERGRID(NR-1) representative informed that, material for differential protection is expected to be arrived by the end of December 2024 and the same will be implemented by the end of January 2025.

During 55th PSC meeting, POWERGID(NR-1) was requested to apprise the forum about the present status.

POWERGRID(NR-1) representative informed that, materials have been received and work has been started. It will get completed by the end of January 2024.

PSC Forum requested POWERGRID(NR-1) to expedite the process of implementation of differential protection at Koteshwar HEP.

g) Multiple elements tripping at 220kV Sarna (PS) on 04th May 2024, 07:10 hrs

PSC 51 recommendations:

- Punjab shall expedite the commissioning of new bus scheme.
- POWERGRID shall revise the Z-4 time delay setting of Kishenpur lines at Sarna (PS) end as 160msec till bus bar get operational.

During 52nd PSC meeting, Punjab representative informed that tender of bus bar protection has been processed, bus bar protection at 220kV Sarna will be commissioned within 4-5 months tentatively.

During 53rd PSC meeting, PSTCL representative informed that tender of bus bar scheme is in process and POWERGID(NR-2) representative informed that Z-4 time delay setting of lines of their control area has been revised.

During 54th PSC meeting, PSTCL representative stated that process is still at the tender stage. It will be commissioned in next 3 months.

During 55th PSC meeting, PSTCL was requested to apprise the forum about the present status.

PSTCL representatives were not present in the meeting.

NRLDC representative stated that necessary follow up actions may be taken to ensure attendance of members from all the organisations in PSC meeting.

h) Multiple elements tripping at 400/132kV Masoli(UP) on 29th May 2024, 15:57 hrs

PSC 51 recommendations: UP shall implement the bus bar protection at 132kV level at 400/132kV Masoli S/s.

During 52nd & 53rd PSC meeting, UP representative informed that this case has been communicated to design team. Design team is compiling all such requirements and further process will be initiated within 1-2 months.

During 54th PSC meeting, UPPTCL representative informed that process is still at the design team stage. Continuous follow ups are being done for expeditious implementation of bus bar protection at such stations.

During 55th PSC meeting, UPPTCL was requested to apprise the forum about the present status.

UPPTCL representative informed that bus bar protection has been arranged for Masoli(UP) station. Shutdown has been planned after 24th February (after Kumbh Mela) and it is expected that bus bar commissioning at 132kV Masoli(UP) will get completed by the end of March 2025.

PSC Forum requested UPPTCL to expedite the process of bus bar protection implementation at 400/132kV Masoli(UP) and such other stations.

i) Multiple elements tripping at 220kV KTPS (RVUN) on 21st June 2024, 11:37 hrs

PSC 51 recommendations: Commissioning of bus coupler between 220kV Bus-3 & 5 need to be expedited.

During 52nd PSC meeting, RVUNL representative informed that informed that tender for the same has been floated.

During 53rd PSC meeting RVUNL representative informed that process is at same stage. It will take around 01 year to complete all the process and implementation of bus coupler.

During 54th PSC meeting, RVUNL representative stated that whole process will take time. Tender process is completed, and review meeting is scheduled on 25th December 2024.

During 55th PSC meeting, RVUNL representative was requested to apprise the present status.

RVUNL representatives were not present in the meeting.

NRLDC representative requested RVPNL to follow up with the SLDC-HP & RVUNL to ensure their attendance in PSC meeting and necessary actions at their end.

j) Frequent tripping of 220 KV Anta(NT)-Sakatpura(RS) (RS) Ckt-1 : Non operation of A/R in line

PSC 52 recommendations: RVPN was requested to expedite the process of relay replacement and rectification of issues related to A/R operation.

During 53rd PSC meeting, RVPNL representative informed that request of relay panel has been floated however DI of the same is yet to be issued.

During 54th PSC meeting, RVPNL representative informed that existing panels are of simplex type which have to be replaced with duplex panels. Panels have been issued however civil work is required for installation of the same. Delay is due to civil work.

During 55th PSC meeting, RVPNL representative was requested to apprise the present status.

RVPNL representative informed that civil work has not been completed yet. Implementation of duplex panels will be started after completion of civil work.

NRLDC representative requested RVPNL to take necessary follow-up actions to ensure expeditious completion of work.

PSC Forum requested RVPNL to expedite the process.

k) Frequent tripping of 220 KV Khara(UP)-Saharanpur(PG) (UP) Ckt-1

PSC 52 recommendations:

- UP was requested to expedite the process of relay replacement at Khara end.
- POWERGRID shall review and ensure the A/R operation at their end.

Discussion during 53rd PSC meeting:

UPPTCL representative informed that status is same and follow up is being done to ensure the relay replacement in Nov-Dec 2024.

NRLDC representative highlighted the issue of non-operation of A/R in this line also at Saharanpur end and requested POWERGRID (NR-1) to review the healthiness of A/R operation in all the lines at Saharanpur(PG). Issue in A/R operation at Khara end in case of Y-ph fault is observed. 2*ph A/R is occurring in this scenario. UPPTCL may review the same.

UPPTCL representative stated that remedial actions are been taken to rectify the cause of faults such as replacement of old insulators etc. Further necessary actions will also be initiated to minimise the occurrence of faults in line.

During 54th PSC meeting, POWERGRID(NR-1) representative informed that, A/R function in the line has been reviewed and it is healthy and operational. He further raised concern over frequent faults in line. Further, UPPTCL representative informed that all the line protection relays at Khara(UP) are of electromechanical type. Relays will be replaced with numerical relays by the end of December 2024.

During 55th PSC meeting, UPPTCL were requested to apprise the forum about present status.

UPPTCL representative informed that work of relay replacement has been started and all the line protection electromechanical relays at Khara(UP) will be replaced with numerical relays by th e end of December 2024.

PSC Forum requested UPPTCL to expedite the replacement of relay at Khara(UP) end.

l) Multiple elements tripping event at Patiala (PG)

PSC 52 recommendation: Implementation of new bus bar relay at Patial(PG).

During 54th PSC meeting, POWERGRID(NR-2) representative informed that materials have been arrived. Presently, team is working at Nallagarh(PG) S/s, thereafter work will start at Patiala(PG). Implementation of new bus bar protection at Patiala(PG) will be completed by the end of January 2025.

During 55th PSC meeting, POWERGRID(NR-2) representative was requested to apprise the present status.

POWERGRID(NR-2) representative informed that status is same and implementation of new bus bar protection at Patiala(PG) will be completed by the end of January 2025.

PSC forum requested POWERGRID(NR-2) to expedite the process.

m) Frequent tripping of 220 KV Nara(UP)-Roorkee(UK) (UP) Ckt-1

PSC 53 recommendation: PTCUL was requested to analyse the tripping events and take necessary remedial action to avoid undesired tripping.

During 54th PSC meeting, discussion was as follows:

- PTCUL representative stated that this line is being operated in radial mode due to which issue of single phasing of transformers observed many a times during fault. To avoid this, A/R has been kept off.
- With the reference of similar case in Rajasthan control area, RVPNL representative suggested that some changes in protection settings can help in avoiding such issues.
- NRLDC representative raised concern over disabling the A/R without intimation to the forum. PTCUL was requested to enable the A/R in line and any issues may first be intimate to forum for necessary recommendation / actions. Further, PTCUL was requested to thoroughly analyse the tripping incidents and identify the root cause which will help in taking necessary remedial actions. PTCUL was also requested to on the A/R PTCUL may also discuss with RVPNL in reference to Rajasthan case study.
- PSC Forum recommended following actions to PTCUL:
  - ✓ A/R shall be enabled in the line. Any issues may be put up in the PSC forum.
  - ✓ Root causes analysis of the frequent tripping of line need to be submitted.
  - ✓ Necessary remedial actions need to be taken to avoid frequent tripping of the line.

During 55th PSC meeting, PTCUL was requested to apprise the forum about analysis and remedial action w.r.t. frequent tripping of this line.

PTCUL representatives were not present in the meeting.

NRLDC representative stated that necessary follow up actions may be taken to ensure attendance of members from all the organisations in PSC so that issues may be discussed and necessary action plan may be decided.

n) Frequent tripping of 400 KV Agra-Unnao (UP) Ckt-1

PSC 53 recommendation: UPPTCL shall share the DR of overvoltage tripping of 400kV Agra-Unnao ckt-1 and analyse the root cause of tripping.

During 54th PSC meeting, UPPTCL representative informed that overvoltage relay at Unnao (UP) is of electromechanical type. Binary output ports in existing distance protection relay is exhausted. Solutions are being explored, issue will be resolved shortly.

During 55th PSC meeting, UPPTCL was requested to apprise the forum about present status.

UPPTCL representative informed that one binary output port was available in Main-2 relay and OV function has been configured in that. Now, DR file can be extracted through Main-2 relay(numerical).

PSC forum requested UPPTCL to take necessary remedial action to resolve the issue.

o) Multiple elements tripping at 220kV Khodri HEP & Chibro HEP on 5th, 11th & 19th September 2024

PSC 53 recommendation:

- Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.
- HPPTCL shall take necessary actions to rectify the protection related issue in 220kV Khdori-Majri ckt-2.
- OV protection needs to be disabled in 220kV lines at the earliest.
- Over frequency and over current protection operation in units at Khodri HEP need to be reviewed.
- A/R should be made operational in Sarsawan line at the earliest.
- UJVNL shall share the CPRI audit report and details of remedial action taken within one week.
- Replacement of Units breakers need to be expedited.

During 54th PSC meeting, UJVUNL representative informed following during the meeting:

- Timely submission of DR/EL & tripping reports for the tripping incidents are being ensured.
- Overvoltage setting in all the lines at Khodri HEP has been disabled. However, 220kV Khodri-Mazri ckt-2 is in jurisdiction of HPSEBL.

- Over frequency & overcurrent protection in generating units have been proposed to review.
- Audit report of the CPRI conducted in October 2023 has already been submitted by mail.
- A/R operation in Sarsawan line and replacement of Unit breakers has been proposed. Follow ups are being done with OEM.
- Time delay setting of Z-4 in distance protection in all the lines at Khodri has been revised from 1sec to 160msec.

During 55th PSC meeting, UJVUNL was requested to apprise the forum about status of remedial actions.

UJVUNL representative informed following during the meeting:

- Over frequency & overcurrent protection in generating units are yet to be reviewed. It will be done at the earliest.
- There are wiring related issues which have to be corrected to enable the A/R operation in Sarsawan line. Visit of OEM is being planned as per shutdown availability.
- Replacement of Unit breakers is also planned. Follow ups are being done with OEM.
- Isolator selection relay is also planned to be replaced within next 2 months. After this, bus bar protection will be made operational.

HPSEBL representatives were not present in the meeting.

NRLDC representative requested UJVUNL to expedite the implementation of bus bar protection at Khodri HEP and submit the action plans w.r.t. all the desired remedial actions at Khodri HEP.

PSC Forum recommended following actions to UJVUNL:

- Expedite the necessary corrective actions to ensure all the protection compliance mentioned in CPRI audit report.
- Submit the action plans w.r.t. all the desired remedial actions at Khodri HEP
- HPSEBL shall take corrective actions to ensure proper operation of protection system in 220kV Khodri-Mazri ckt-2.

p) Multiple elements tripping at 400/220kV Jaisalmer(RS) on 20th September 2024

PSC 53 recommendation: RVPNL shall share the detailed analysis of the event within one week.

During 54th PSC meeting, RVPNL representative stated that multiple elements tripping occurred during this event on operation of LBB relay. However, LBB relay is not communicating due to which DRs couldn't be extracted. Therefore, analysis of the events hasn't submitted yet. OEM has been requested to update the software of relay.

During 55th PSC meeting, RVPNL was requested to share the analysis and status of remedial action taken.

RVPNL representative informed that issue is not resolved yet. Continuous follow is being done with OEM however no response is received from OEM. Relay will have to be replaced if no support from OEM will receive. Necessary actions will be taken on priority.

NRLDC representative requested RVPNL to resolve the issue with the LBB relay at the earliest so that proper analysis of the grid event could be done.

PSC Forum requested RVPNL to resolve the issue with the LBB relay at Akal S/s at the earliest.

q) Frequent tripping of 220 KV Nanauta(UP)-Saharanpur(PG) (UP) Ckt-1 & 220 KV Sarsawan(UP)-Khodri(UK) (UP) Ckt-1:

PSC 54 recommendation: PSC forum requested UPPTCL to ensure resolution of issue with the Main-2 relay configuration at Nanauta(UP) & Sarsawan(UP) at the earliest.

During 55th PSC meeting, UPPTCL was requested to share the present status.

UPPTCL representative informed that issue hasn't been resolved yet. As a precautionary measure Z-1 time delay in Main-2 relay has been kept 100msec. In case of Ph-N fault, Main-1 relay would be able to facilitate A/R operation. Issue in relay configuration will be resolved during next available shutdown.

NRLDC representative requested UPPTCL to resolve the issue in the relay configuration in Main-2 relay at both the stations at the earliest.

PSC Forum requested UPPTCL for expedited corrective actions.

r) Multiple elements tripping at 220kV Obra_A(UP) on 9th October 2024

PSC 54 recommendation:

I. UPPTCL & Obra_A(UP) shall ensure the implementation of LBB protection at the earliest at 220kV side.
II. GPS scheme shall be implemented at Obra_B(UP) by the end of January 2025 and time sync of recording devices will be ensured.

During 55th PSC meeting, UPPTCL was requested to share the present status.

UPPTCL representative informed that Bus bar protection relay is of electromechanical type, and it has to be replaced with numerical relay. Around 6-month (till June 2025) time will be required for this work. Issue of time sync will be resolved by the end of January 2025.

NRLDC representative requested UPPTCL to take necessary follow up actions for expeditious completion of work.

PSC Forum requested UPPTCL for expedited corrective actions.

s) Multiple elements tripping at 220/132kV Obra_A(UP) on 9th October 2024

PSC 54 recommendation: Commissioning and Implementation of numerical relays in 132kV ICT-1&2 at Obra_A(UP) need to be expedited. Timely commissioning of the same need to be ensured.

During 55th PSC meeting, UPPTCL was requested to share the present status.

UPPTCL representative informed that Commissioning and Implementation of numerical relays in 132kV ICT-1&2 at Obra_A(UP) is expected to get completed by 1st week of February 2025.

NRLDC representative requested UPPTCL to take necessary follow up actions for expeditious completion of work.

PSC forum requested UPPTCL for expedited corrective actions.

t) Multiple elements tripping at 400kV Muradnagar_2(UP) on 17th October 2024

PSC 54 recommendation:

i. UPPTCL shall ensure the necessary correction in ZIV make bus bar protection at 400kV Muradnagar_2(UP) by the end of December 2024.
ii. Time synchronisation and standardisation of recording instrument need to be ensured.

During 55th PSC meeting, UPPTCL was requested to share the present status.

UPPTCL representative informed that work of correction in ZIV make bus bar relay will get completed within next one week and testing of the same will be done at the earliest.

NRLDC representative requested to resolve the issue of time synchronisation also.

PSC forum requested UPPTCL for expedited corrective actions.

u) Multiple elements tripping at 400kV Aligarh (UP) on 23rd October 2024

PSC 54 recommendation: Issues related to bus bar protection at 400kV Aligarh (UP) need to be resolved at the earliest.

During 55th PSC meeting, UPPTCL was requested to share the present status.

UPPTCL representative informed that necessary changes in relay at Aligarh end has been done and further testing is also completed.

v) Multiple elements tripping at 400/220kV Kashipur(Utt) on 10th October 2024

PSC 54 recommendation:

i. PTCUL shall review the SPS scheme at 400/220kV Kashipur S/s.

ii. Overcurrent protection setting (IDMT) need to be revised in line with the approved protection philosophy.

During 55th PSC meeting, PTCUL was requested to share the present status.

PTCUL representatives were not present in the meeting.

NRLDC representative stated that necessary follow up actions may be taken to ensure attendance of members from all the organisations in PSC so that issues may be discussed and necessary action plan may be decided.

w) Multiple elements tripping at 220kV Dausa(RS) on 21st October 2024

PSC 54 recommendation:

i. RVPNL will expedite the replacement of all the static relays at 220kV Dausa S/s with numerical relays.
ii. Time synchronization of all the recording instruments need to be ensured.

During 55th PSC meeting, RVPNL was requested to share the present status.

RVPNL representative informed that total 5 electromechanical have to be replaced with numerical relays. 3 no. of relays have been allotted, remaining 2 relays will get allotted in next phase. It is expected that work of relay replacement will get completed by the end of January 2025.

NRLDC representative requested RVPNL to take necessary follow up actions for expeditious completion of work.

PSC Forum requested UPPTCL for expedited corrective actions.

x) Multiple elements tripping at 400kV Alwar(RS) on 30th October 2024

PSC 54 recommendation: RVPNL shall design a suitable SPS for 400/220kV Alwar S/s a propose the same in next OCC/PSC meeting for discussion.

During 55th PSC meeting, RVPNL was requested to share the present status.

RVPNL representative informed that proposal of SPS at Alwar has been sent to planning team and agenda of the same is expected to be submitted in next meeting.

NRLDC representative suggested to submit the proposed scheme by mail for preliminary review further it can be put up in OCC for discussion.

PSC Forum requested RVPNL to share the proposed SPS at 400/220kV Alwar S/s.

y) **Frequent tripping of 220 KV Auraiya(NT)-Mehgaon(MP) (MPSEB) Ckt-1**

PSC 54 recommendation: NTPC shall take necessary actions to minimise the tripping and ensure proper operation of A/R in line.

During 55th PSC meeting, NTPC was requested to share the present status.

NTPC representative stated that as informed by the site there are no protection related issues at Auraiya end.

NRLDC representative stated that DR files submitted from Auraiya end shows A/R block after few msec of A/R start. Reason of the same need to be identified. NTPC was requested to further review the tripping incidents.

B.2 Multiple element tripping events in Northern region in the month of November'24 (agenda by NRLDC)

B.2.1 NRLDC representative apprised that a total of 10 grid events occurred in the month of **November'24** of which **01** are of GD-1 category, **04** are of GI-2 Category and **05** are of GI-1 Category. The tripping report of all the events have been issued from NRLDC. A list of all these events is attached at **Annexure-B.II**.

B.2.2 Maximum delayed clearance of fault observed in event of multiple elements tripping at 400/220/132kV Merta (RS) on 11th November, 2024 (As per PMU at Merta(RS), R-Y-B phase to phase fault was observed with delayed fault clearance time of 720 msec is observed).

B.2.3 Delayed clearance of fault (more than 100ms for 400kV and 160ms for 220kV system) observed in total **03** events out of **10** grid events occurred in the month. In 02 (no.) of grid event, there was no fault in the grid.

B.2.4 NRLDC representative presented the reporting status of DR/EL & tripping reports w.r.t. grid events occurred in November 2024. It was highlighted that detailed report of majority of the tripping events have not received. Utilities were requested to start preparing the detailed report of the tripping events as per timeline mentioned in IEGC 2023 and share the report with NRLDC, NRPC and PSC forum. Remedial actions taken by constituents to avoid such multiple elements tripping may also be included in the detail report.

B.2.5 RVPNL & UPPTCL representative stated that delay occurred due to non-submission of DR/EL & tripping details from site however they are taking continuous follow up actions to ensure timely completion of tripping analysis within stipulated timeline.

B.2.6 As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event and as per IEGC clause 37.2 (e), the user shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to RLDC and RPC.

Decision taken by Forum:

Forum requested members to take necessary preventive measures to avoid such grid incidents / disturbances in future and report actions taken by respective utilities in OCC & PSC forum. Moreover, utilities may impress upon all concerned for providing the Preliminary Report, DR/EL & detailed report of the events to RLDC in line with the regulations.

B.3 Analysis of the tripping events occurred during November-2024 and status of remedial action taken (agenda by NRLDC)

B.3.1 The following was discussed-

a) Frequent elements tripping during November 2024:

The following transmission elements were frequently tripped during the month of **November’24**:

S. NO.	Element Name	No. of forced outages	Utility/ SLDC
1	220 KV RAPS_A(NP)-Sakatpura (RS) (RS) Ckt-1	5	Raj/NPCIL

2	220 KV RAPS_A(NP)-Sakatpura (RS) (RS) Ckt-2	4	Raj/NPCIL
3	400 KV Agra-Unnao (UP) Ckt-1	4	UP
4	400 KV Aligarh-Shamli (UP) Ckt-2	3	UP
5	400 KV Aligarh-Sikandrabad (UP) Ckt-1	3	UP
6	400 KV Amritsar(PG)-Makhu(PS) (PSTCL) Ckt-1	3	PG/PS
7	400 KV Anpara_B(UPUN)-Mau (UP) (UP) Ckt-1	3	UP
8	400 KV Bareilly-Unnao (UP) Ckt-1	4	UP
9	400 KV Talwandi Saboo(PSG)-Nakodar (PSG) (PS) Ckt-1	3	PS

List of tripping is attached as **Annexure-B.III**.

NRLDC representative highlighted that frequent tripping of such elements affects the reliability and security of the grid. In view of the same, utilities were requested to analyse the root cause of the tripping and share the remedial measures taken/being taken in this respect.

Discussion during the meeting:

- **220 KV RAPS_A(NP)-Sakatpura (RS) (RS) Ckt-1 &2:** NRLDC representative raised concern over frequent incidents of faults and non-operation of A/R. RVPNL representative stated that this line passes through forest area due to which this line is prone to frequent faults and shutdown also get available for short period of time as forest is reserved forest area. However, remedial actions are being taken to avoid frequent tripping of line. Installation of bird guard throughout the line, re-placement of earth wire throughout the line and replacement of damaged disc in-sulators are being done in lines evacuating from Sakatpura(RS). Work is almost completed in line connected to RAPP_A and in line connected to RAPP_B, it will get completed within next 35-40 days.

  NRLDC representative requested to take expeditious corrective actions to minimise frequent faults in line.

  PSC Forum requested to take necessary remedial actions.

- **400 KV Agra-Unnao (UP) Ckt-1:** NRLDC representative raised concern over frequent faults in line. UPPTCL representative informed that in all the three incidents fault occurred due to stubble burning underneath the line, there is no other issue.

- **400 KV Aligarh-Shamli (UP) Ckt-2:** NRLDC representative raised concern over frequent tripping of line and asked the status of A/R operation. UPPTCL representative informed that A/R is healthy in line, faults occurred due to bird beet. Further, it was informed that patrolling, disc insulator cleaning was done on 28th November by availing planned shutdown.

- **400 KV Aligarh-Sikandrabad (UP) Ckt-1:** NRLDC representative raised concern over frequent tripping of line. UPPTCL representative informed that faults occurred due to puncture of disc insulators. On query of NRLDC regarding type of insulators, it was informed that insulators are of polymer type.

  NRLDC representative requested UPPTCL to take necessary actions to minimise the fault incidents in line.

- **400 KV Amritsar(PG)-Makhu(PS) (PSTCL) Ckt-1 & 400 KV Talwandi Saboo(PSG)-Nakodar (PSG) (PS) Ckt-1:** NRLDC representative raised concern over frequent faults in line. PSTCL representative informed that faults occurred during fog time. On query of NRLDC regarding type of insulators, it was informed that insulators are of porcelain type. PSTCL was requested to plan replacement of insulators with polymer type.

- **400 KV Anpara_B(UPUN)-Mau (UP) (UP) Ckt-1:** NRLDC representative raised concern over frequent tripping of line and delayed clearance of fault during two (no.) of the incidents. UPPTCL representative informed that during patrolling bird nest was found at fault location. There are no other protection related issues, however they will further.

- **400 KV Bareilly-Unnao (UP) Ckt-1:** NRLDC representative raised concern over frequent tripping of line and non-operation of A/R in line. UPPTCL representative informed that A/R doesn't operate consistently in all the ph-N fault. One observation found is that when the pulse of A/R is for less than 30msec then A/R don't operate. For this, pulse drop off time has been set as 40 msec. Necessary follow up are also being done to arrest the root cause of frequent fault in line.

NRLDC representative emphasized that A/R (auto re-closer) issue was found in many of these tripping. He sensitized all the utilities to ensure healthiness/in service of A/R in 220 kV and above transmission lines in compliance to CEA Grid Standards. He further informed that most of the tripping are transient in nature but due to non-operation of A/R, it resulted into tripping of the transmission element thus reducing the reliability of the grid. All the utilities shall endeavour to keep auto re-closer in service and healthy condition of 220 kV and above voltage level transmission line. The issue of time syncing of DR/EL at many of the stations was highlighted, constituents were requested to ensure the time syncing of DR/EL. In addition, necessary actions also need to be taken to ensure the Right of Way and other operation & maintenance issues to minimize the frequent faults in the line. All utilities agreed for the same.

PSC Forum reiterated that frequent outages of such elements affect the reliability and security of the grid. Members were requested to investigate such frequent outages and share the suitable remedial measures taken/being taken in this respect.

b) Protection related issues in multiple elements tripping, detailed analysis of the events and status of remedial measures:

The list of major tripping events occurred during November 2024 is attached as **Annexure-B.IV**. Concerned constituents/utilities were requested to share the detailed analysis of the tripping elements along with status of remedial action taken/to be taken.

Utilities were requested to prepare detailed analysis report and present the event details during 55th PSC meeting. Events involving more than one utility may be jointly prepared and presented.

Discussion during the meeting:

Tripping Events

A. Multiple element tripping event at 400kV Aligarh(UP) at 01:51 hrs on 02nd November, 2024

<u>Discussion during the meeting:</u>

i. Brief of the event shared by NRLDC representative based on detail available is as follows:

- 400/220kV Aligarh (UP) has one and half breaker scheme at 400kV level and double main and transfer bus scheme at 220kV level.
- As reported, at 01:51 hrs, 400 KV Aligarh-Muradnagar_1 (UP) Ckt tripped on B-N phase to earth fault with fault current of 2.912kA from Muradnagar_1 end and 18.916kA from Aligarh end; fault sensed in zone-1 at Aligarh end and zone-2 at Muradnagar_1 end. As per DR at Muradnagar_1 end, fault clearing time was ~377ms (delay in fault clearing at Muradnagar_1, carrier not received). As per DR at Aligarh end, unsuccessful A/R was observed with A/R dead time of 840 ms (less A/R dead time observed).
- During the same time, 400 KV Aligarh-Shamli (UP) Ckt-1 & 2 also tripped on over-voltage at Aligarh end (as per EL of Main-1 at Aligarh). As per DR, R-ph voltage reached upto ~1.35 p.u. at Aligarh end of 400 KV Aligarh-Shamli (UP) Ckt-1 and B-N phase to earth fault with fault current of 642 A from Aligarh end is observed in 400 KV Aligarh-Shamli (UP) Ckt-2. Time sync issue is observed in Main-2 relay at Aligarh end of both 400 KV Aligarh-Shamli (UP) Ckt-1 & 2. As reported, DT received at Shamli end for both the lines.
- As per PMU at Mainpuri (PG), B-N phase to earth fault with unsuccessful A/R is observed with fault clearing time of 80ms.
- As per SCADA, change in demand of approx. 130 MW is observed in UP control area.
- Major observations:
  - Exact reason, nature and location of fault need to be shared.
  - Reason of delay in fault clearance at Muradnagar_1 end need to be analysed. It is suspected that carrier is not received at Muradnagar_1 end. Healthiness of PLCC communication need to be ensured.
  - Time sync issue in DR of Main-2 relay at Aligarh end of 400 KV Aligarh-Shamli (UP) Ckt-1 & 2 need to be resolved.
  - As reported, 400 KV Aligarh-Shamli (UP) Ckt-2 tripped from both the ends, but still voltage is showing in DR, hence CVT error is suspected. The same need to be analysed and shared.
  - DR of Shamli end and Main-1 relay at Aligarh end of 400 KV Aligarh-Shamli (UP) Ckt-1 & 2 need to be shared.

- Remedial action taken report to be shared.

ii. UPPTCL representative and others informed the following:

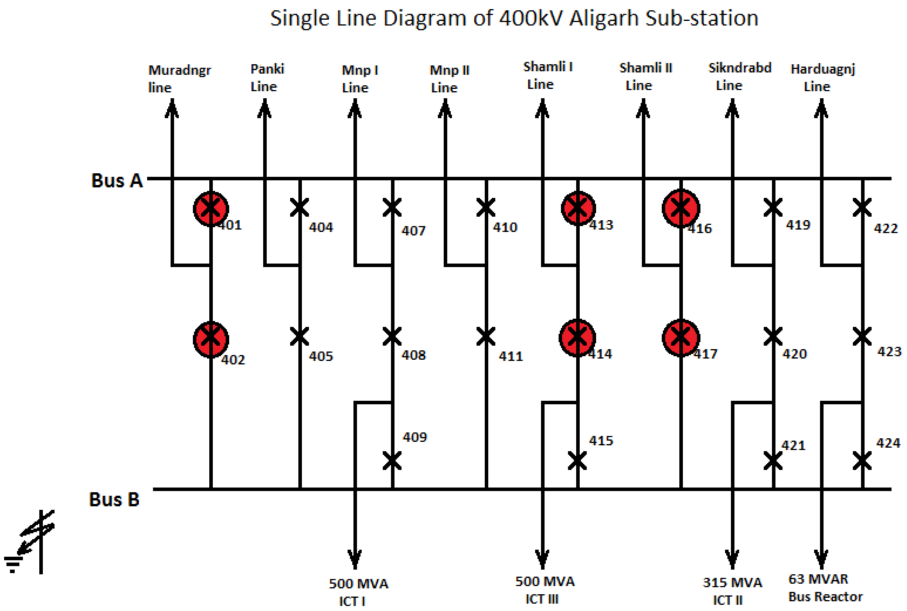

Fig: SLD of 400kV Aligarh(UP)

- DR of 400kV Aligarh-Shamli D/C was submitted showing high voltage in line.
- NRLDC representative highlighted that overvoltage was for small period of time and it dropped to ~1.05 pu within 1 sec. Drop off to pick up value may be reviewed.
- UPPTCL representative informed that drop off to pick up ration value was 95% and same has been revised to 99%.
- NRLDC representative raised concern over delayed clearance and A/R non-operation at Muradnagar_I(UP) end and suggested to review the carrier communication healthiness.
- UPPTCL representative informed that there is issue related to carrier communication at Muradnagar_I(UP) end. They will take necessary actions and resolve the issue.
- UPPTCL was also requested to review dead time setting at Aligarh (UP) end, it is ~840 msec. It may be set as standard value 1 sec.

NRLDC representative requested UPPTCL to review the carrier scheme at Muradnagar(UP) end and ensure proper A/R operation. Dead time at Aligarh(UP) end also may be reviewed.

PSC Recommendations:

- UPPTCL shall ensure the healthiness of carrier communication and A/R operation at Muradnagar_1(UP) end.
- Healthiness of protection system and their proper operation need to be ensured.
- Dead time setting at Aligarh end may be reviewed and set as standard 1sec.

B. Multiple element tripping event at 765/400kV Jawaharpur(UP) at 15:56 hrs on 11th November, 2024

Discussion during the meeting:

i. Brief of the event shared by NRLDC representative based on details available is as follows:

- During antecedent condition, 400 kV Firozabad–Jawaharpur Ckt 2 (28 MW) and 400/220 kV 500 MVA ICT 4 (27 MW) were connected to 400 kV Bus 2. 400 kV Firozabad–Jawaharpur Ckt 1 (26 MW), 125 MVAR bus reactor, and 400/220 kV 500 MVA ICT 3 (27 MW) were connected to 400 kV Bus 1. The 765/400 KV ICT 1 and 2 were not in service at that point of time.
- As reported at 15:56:14:463 hrs, R-N fault occurred at TEED portion of bay 401 & 402. On this fault, bus bar protection of 400KV Bus-2 at 400 KV JAWAHARPUR_TPS(UP) operated. This led to tripping of breakers 410, 407 & 401 bay connected to 400KV Bus 2. At the same time (with the gap of 20msec), TEED protection operated which tripped Bay 402 (Tie Bay of 400/220KV ICT 3 & 4). This led to tripping of 400/220KV ICT 4. Further after ~30msec, 400KV Bay No 403 breaker opened led to the tripping 400/220 KV ICT 3 at Jawaharpur(UP). Exact reason of opera-

tion of bus bar protection along with TEED protection is yet to be received from UP. DR/EL of the tripping events also yet to be received.

- After further 60msec, 125 MVAR Bus Reactor No 1 at 400 KV Jawaharpur_TPS(UP) also tripped on back up impedance protection operation. DR of the tripping is yet to be received.
- As per PMU at Mainpuri (PG), R-N fault which cleared within 100msec is observed.
- As per SCADA, no load loss is observed in UP control area.
- **Major observations:**
  - Exact reason of the fault needs to be shared.
  - Sequence of tripping of elements need to be shared.
  - Exact reason for tripping of 400/220 KV ICT-3 needs to be shared.
  - Exact reason of operation of bus bar protection along with TEED protection is yet to be received from UP
  - DR/EL (.dat/.cfg) file along with detailed tripping report need to be shared from both the ends.
  - Remedial action taken report to be shared.

UPPTCL representative stated that final conclusive analysis of this grid event couldn't be done yet. Jawaharpur TPS has intimated that they will conduct third party protection audit. DR files w.r.t. this event received yesterday only. Further follow-ups will be done and analysis of this event will be shared.

NRLDC representative raised concern over major protection related issue at Jawaharpur(UP) S/s which is new thermal power generating station and requested UPPTCL to take necessary follow-ups with Jawaharpur TPS for complete analysis of the event and to ensure healthiness of protection system.

Forum Recommendations:

- *UPPTCL shall submit the root cause analysis of the grid event before next PSC meeting.*
- *Healthiness of protection system and proper operation of protection system also needs to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Re-*

corder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.

C. Multiple element tripping event at 400/220kV Merta(RS) at 12:22 hrs on 11th November, 2024

Discussion during the meeting:

i. Brief of the event shared by NRLDC representative based on detail available is as follows:

- During antecedent condition, loading of 400/220 kV 315 MVA ICT 1 & 2 and 220/132kV 100MVA ICT-1, 2 & 3 at Merta(RS) were 171 MW, 177 MW, 62 MW, 62 MW and 56 MW respectively as per SCADA. 220kV Merta(RS)-Makrana(RS) Ckt was not in service.
- As reported, at 12:22hrs, R-phase jumper of 220 kV Merta-Jethana snapped, and this broken jumper conductor fell on both 220 kV Bus-A and Bus-B at Merta. Because of this, Bus Bar protection operated at 400/220/132kV Merta S/s.
- As a result, both 220KV Bus 1 & 2, along with all the elements connected to them i.e., 400/220 ICT-1 & 2, 220KV MERTA-JETHANA(RS), 220KV MERTA-BHOPALGARH (RS), 220KV MERTA-KUCHERA (RS), 220/132 KV 100 MVA ICT 1, ICT 2 & ICT 3 AT MERTA(RS) tripped.
- As per PMU at Merta(RS), R-Y-B fault is observed with delayed fault clearance time of 720 msec.
- As per SCADA, change in demand of approx. 635 MW is observed in Rajasthan control area.
- Major observations:
    - The healthiness of the protection system and equipment need to be ensured.
    - DR/EL along with tripping report need to be submitted from both the ends.
    - SCADA data of 220/132KV ICT 1 and 2 freezes at Merta substation after the tripping. Availability of SCADA data needs to be ensured.
    - Tripping of elements not recorded in SCADA SOE. Availability of all the breaker status in SCADA SOE need to be ensured.
    - Remedial actions taken and reports need to be shared.

ii. RVPNL representative and others informed the following:

- DR files got flushed due to memory issue and due to unavailability of DR files, complete analysis of the event couldn't be done. Schnieder (relay OEM) has been contacted for this issue.
- From the bus bar relay DR, it is observed that there was not delayed operation of bus bar protection. 220kV Bhopalgarh feeder tripped in Z-2 and Z-4 at Merta end also didn't start. Therefore, nature of fault throughout the event couldn't be ascertained.

NRLDC representative requested RVPNL to resolve the issue of DR extraction and ensure timely analysis of the event.

Forum Recommendations:

- *RVPNL shall share the further analysis of this grid event within one week.*
- *RVPNL shall take necessary remedial actions to ensure timely collection of DRs from site after any grid incidents.*
- *Proper operation of protection system needs to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

D. Multiple elements tripping at 400/220kV Hinduan(RS) on at 05:21 hrs on 16th November, 2024

Discussion during the meeting:

i. Brief of the event shared by NRLDC representative based on detail available is as follows:

- As reported, at 05:21 hrs, interrupter of CB Pole (R-Ph.) blasted at the time of opening of CB of 125MVAR Bus Reactor at Hindaun (RS) on voltage regulation.
- During the same time, 400 KV Hindaun(RS)-Chhabra(RVUN) (RS) Ckt, 400 KV Heerapura-Hindaun (RS) Ckt, and 400 KV Alwar(ATIL)-

Hindaun(RS) (ATIL) Ckt at Hindaun(Raj) also tripped (exact reason of tripping yet to be shared).

- As per DR of 400 KV Hindaun(RS)-Chhabra(RVUN) (end) (RS) Ckt, zone-2 distance protection operated at Chhabra end. R-N phase to earth fault was observed with fault current of 1.676kA and delayed fault clearance time of ~350ms. (DR nomenclature & time sync issue in DR need to be corrected.)
- As per PMU at Heerapura (RS) and DR of Chhabra end, R-N fault is observed with delayed fault clearance time of 360 ms.
- As per SCADA, load loss of approx. 325 MW in Rajasthan control area was observed.
- **Major observations:**
  - Exact location and nature of fault?
  - Reason of delayed clearance of fault need to be shared.
  - Details of all the protection operation need to be shared.
  - DR/EL along with tripping report of all the elements need to be shared from both the ends.
  - DR uploaded on tripping portal are not time synced. Time syncing of DR & EL needs to be ensured and DR nomenclature of the elements needs to be corrected.
  - Remedial action taken report to be shared.

ii. RVPNL representative and others informed the following:

- Members suggested that as the fault occurred outside of bus bar zone and line protection zone then it should come under TEED or STUB protection zone.
- RVPNL noted the point and stated that they will further review the protection scheme at Hinduan S/s. Necessary remedial action will be taken to ensure healthiness of all the protection system.

  coordination

NRLDC representative requested RVPNL to review the protection system (TEED, STUB) at Hinduan(RS) and take necessary corrective actions to rectify the shortcoming in protection system.

***Forum Recommendations*:**

- *RVPNL shall share the further analysis of this grid event within one week.*
- *RVPNL shall review the protection system at Hinduan S/s (specifically TEED protection) and take necessary remedial actions to ensure proper operation of protection system.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

E. Multiple elements tripping at 400/220kV Bhadla(PG) at 22:11 hrs on 23rd November, 2024

Discussion during the meeting:

i. Brief of the event shared by NRLDC representative based on detail available is as follows:

- During antecedent condition, 400 KV Bhadla-Merta (RS) Ckt-1, 400 KV Bikaner-Bhadla (RS) Ckt-1 and 400 KV Bikaner-Bhadla (RS) Ckt-2 were connected to 400KV Bus-I and were carrying 13MW, 86MW and 87MW of load respectively.
- As reported at 22:11hrs, 400 KV Bhadla-Merta (RS) Ckt-1 tripped on R-N fault. At the same time, 400 KV Bikaner-Bhadla (RS) Ckt-1 and 400 KV Bikaner-Bhadla (RS) Ckt-2 also tripped. 400 KV Bikaner-Bhadla (RS) Ckt-2 tripped due to DT received from Bhadla end. (Exact reason of fault, DT received from Bhadla end and tripping of 400 KV Bikaner-Bhadla (RS) Ckt-2 yet to be shared).
- As per DR of 400 KV Bikaner-Bhadla (RS) Ckt-2, Bikaner (end), the circuit tripped at due to DT received at Bikaner end from Bhadla. (DR nomenclature & time sync issue in DR need to be corrected.)
- As per PMU at Bikaner (PG) and DR of Bikaner (RS) end, R-N fault is observed which cleared within 100 ms.

- As per SCADA, no change in demand is observed in Rajasthan control area
- **Major observations:**
  - Exact location and nature of fault needs to be shared
  - Reason of DT sent from Bhadla end need to be shared.
  - Details of all the protection operation need to be shared.
  - DR/EL along with tripping report of all the elements need to be shared from both the ends.
  - DR uploaded on tripping portal are not time synced. Time syncing of DR & EL needs to be ensured and DR nomenclature of the elements needs to be corrected.
  - Remedial action taken report to be shared.

ii. RVPNL representative and others informed the following:

- DT sent due to operation of back up impedance protection at Bhadla(RS) end.
- NRLDC representative raised concern over operation of reactor back up protection as there is some delay kept in this protection.
- RVPNL informed that they have kept 100 msec time delay.
- POWERGRID representative informed that they keep ~1.2 sec time delay and keep only one zone. Some utilities shared that they keep two zone with different time delay.
- RVPNL noted the point and stated that they will review the backup impedance protection settings.

NRLDC representative also raised concern over submission of incorrect DR files and requested to review the DR files before submission. Further, RVPNL was requested to review the protection setting of Back up impedance protection of reactor at Bhadla end and take necessary corrective actions to rectify the shortcoming in protection system.

Forum Recommendations:

- *RVPNL shall review the backup impedance protection settings at Bhadla end and take necessary remedial actions to ensure proper operation of protection system.*

- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

F. Multiple element tripping event at 220kV Pong(BB) at 20:45 hrs on 06th November, 2024

Discussion during the meeting:

i. Brief of the event shared by NRLDC representative based on detail available is as follows:

- During antecedent condition, 66MW Unit-2, 3, 5 & 6 at Pong HEP were running and generating approx. 66MW, 66MW, 64MW and 56MW respectively (as per SCADA). 66MW Unit-1 & 4 at Pong HEP were not in service.
- As reported, at 20:45 hrs, while stopping 66 MW Unit-6 at Pong (BB), the Relay MICOM P643- CB Head Flashover operated. As informed by the site, the Earth Fault relay connected to Unit-06 GT neutral operated, and the CB of Unit-6 opened. However, the Earth Fault current did not reduce to 0 A immediately. As a result, due to the AND operation logic (where the CB is open and the Earth Fault remains active), the CB Head Flashover was initiated, causing simultaneous tripping of 220 kV Bus-2 at Pong (BB).
- As 220 KV Jalandhar-Pong (BB) Ckt-2, 220 KV Jessore(HP)-Pong(BB) (PG) Ckt-1, 220 KV Pong(BB)-Dasuya(PS) (BBMB) Ckt-2 and 66 MW Pong HPS - UNIT 2 were connected to 220 kV Bus-2 at Pong(BB), all these elements tripped from Pong end along with Bus-2.
- As discussed with BBMB personnel, a delay of 15 ms is kept for reduction of earth fault current to 0 A (in case of CB open condition) in CB Head Flashover protection logic to avoid overlapping conditions.
- As per PMU at Jalandhar (PG), no fault is observed in the system. However, fluctuation in voltage is observed.
- As per SCADA, generation loss of approx. 125 MW at Pong HEP (BB) and no load loss is observed in HP control area

- **Major observations:**
  - The healthiness of protection system and equipment's need to be ensured
  - Remedial action taken to avoid such tripping need to be shared.

BBMB representative couldn't able to share the detailed analysis of the event and stated that they will share the analysis within one week.

NRLDC representative requested BBMB to share the analysis by mail within a week.

Forum Recommendations:

- *BBMB shall share the event analysis and details of remedial action taken within one week.*
- *Healthiness of electrical & mechanical equipment's at stations need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

B.3.2 Grid event analysis details of all the aforementioned grid incidents is attached as **Annexure-B.V**.

B.4 Details of tripping of Inter-Regional lines from Northern Region for November' 24 (agenda by NRLDC)

B.4.1 NRLDC representative apprised that a total of 4 inter-regional lines tripping occurred in the month of November'24. The list is attached at **Annexure-B.VI.** The status of receipt of preliminary reports, DR/EL within 24hrs of the event and fault clearing time as per PMU data has also been mentioned in the table. The non-receipt of DR/EL & preliminary report within 24hrs of the event from SLDCs / ISTS licensees / ISGSs is in violation of regulation 37.2(c) of IEGC and regulation 15(3) of CEA Grid Standards. As per regulations, all the utilities shall furnish the DR/EL, flag details & preliminary report to RLDC/RPC within 24hrs of the event. They shall also furnish the detailed investigation report within 7 days of the event if fault clearance time is higher than that mandated by CEA (Grid Standard) Regulations.

B.4.2 NRLDC representative highlighted the frequent tripping of 220 KV Auraiya(NT)-Mehgaon(MP) (MPSEB) Ckt-1 and issue of non-operation of A/R in line. NTPC was requested to apprise the forum about the cause of frequent tripping and remedial action taken to avoid the trippings.

B.4.3 NTPC representative stated that as informed by the site there are no protection related issues at Auraiya end.

B.4.4 NRLDC representative stated that DR files submitted from Auraiya end shows A/R block after few msec of A/R start. Reason of the same need to be identified. NTPC was requested to further review the tripping incidents.

B.4.5 Regarding tripping of 800 KV HVDC Kurukshetra (PG) Pole-03, POWERGRID (NR-1) stated that this tripping occurred during replacement of failed card at Chmapa end. Exact root cause behind this tripping incident will be shared.

B.4.6 Regarding tripping of 500 KV HVDC Mahindergarh(APL)-Adani Mundra(APL) (ATIL) Ckt-2, ADANI representative stated that they will communicate the HVDC wing regarding the same and intimate to submit analysis at the earliest.

B.4.7 NLRDC representative requested all the members to note and advise the concerned for taking corrective action to avoid such tripping as well as timely submission of the information.

Decision taken by Forum:

Forum recommended members to take necessary actions to minimise the tripping on inter regional line and ensure proper operation of protection system.

B.5 Status of Bus bar protection (agenda by NRLDC)

B.5.1 NRLDC representative apprised that Clause - 4 in schedule - V of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022 reads as

"Bus bar protection and local breaker backup protection shall be provided in 220kV and higher voltage interconnecting sub- stations as well as in all generating station switchyards".

B.5.2 During analysis of many grid incidents/disturbances, it has been found that the Busbar protection at the affected substation was **not present or non-operational** which resulted in considerably increasing both the number of affected elements and fault clearance time. Accordingly, it becomes critical to monitor and keep Busbar protection at all the 220 kV and above voltage level substations healthy and operational.

B.5.3 NRLDC representative stated that continuous follow-ups is being been done at OCC & PSC forum to expedite the commissioning of bus bar protection at 220kV & above stations and to ensure their healthiness. On the basis of details received till date, it is observed that status of bus bar protection has been improved however, further improvement is desired.

B.5.4 Constituent wise status of bus bar protection where bus bar protection is either not installed or installed but not operational along with present status as per detail received from constituents is attached as **Annexure-B.VII**.

B.5.5 Further. constituents were requested to share the present status of remedial action taken/to be taken regarding commissioning and healthiness of bus bar protection at 220kV & above substations and also expedite the implementation of bus bar protection.

B.5.6 NRLDC representative requested all the members to appraise the status of bus bar protection in their respective control areas.

B.5.7 Further, in the meeting UP, Haryana, Punjab and Rajasthan shared the updated status of bus bar protection in their control area. State wise summary of status of bus bar protection is attached as **Annexure-B.VIII**.

B.5.8 NRLDC representative requested all the members to share the updated status of their control area and take necessary actions to expedite the commissioning of bus bar schemes wherever required.

Decision taken by Forum:

PSC forum requested all the constituents to update the status of bus bar protection at S/s of their control area and expedite the commissioning and implementation work of bus bar protection system. Members agreed for the same.

B.6 Replacement of electromechanical relays with numerical relays (agenda by NRLDC)

B.6.1 NRLDC representative apprised that Clause-37.2(c) of IEGC, clause-15(4) of CEA Grid standards and clause-48(4) of CEA Construction Standards 2022 mandates that *''each line or transformer or reactor or any other bay shall be provided with facility for disturbance recording, event logging and time synchronizing equipment''.*

B.6.2 NRLDC representative stated that during analysis of grid incidents/disturbances, it has been found that there are few stations where electromechanical relays are still in use and thus disturbance recorder are not available there which accounts for violation of Clause-37.2(c) of IEGC, clause-15(4) of CEA Grid Standards and clause 48(4) CEA Construction Standards 2022.

B.6.3 In addition, clause-3 in part III (Grid Connectivity Standards applicable to Transmission Line and Sub-Station) of Standards for Connectivity to the Grid, 2007 reads as

''Two main numerical Distance Protection Schemes shall be provided on all the transmission lines of 220 kV and above for all new sub-stations. For existing sub-stations, this shall be implemented in a reasonable time frame''

B.6.4 Further NRLDC highlighted the importance of Disturbance recorder (DR)s for analysis of grid incidents/disturbances. Its non-availability eventually affects the proper analysis of grid incidents/disturbances and monitoring of protection system.

B.6.5 Continuous follow-ups is being done at OCC & PSC forum. During the meeting, all the constituents/SLDC/STU were requested to review the same in their control area and take expeditious actions to replace electromechanical relays with numerical relays.

B.6.6 Constituent wise details of static/electromechanical type protection relays at their respective substations along with its present status per detail received from constituents is attached as **Annexure-B.IX**.

B.6.7 NRLDC representative requested all the constituents to share the status of remedial action taken/to be taken regarding replacement of static/electromechanical relay with numerical relays at 220kV & above substations and expedite the process of replacement of static/electromechanical relay with numerical relays.

Decision taken by Forum:

Forum requested all the constituents to update the status of type of protection relays at S/s of their control area and expedite the replacement work of static/electromechanical type protection relays with numerical relays. Members agreed for the same.

B.7 Availability and Standardization of recording instrument (Disturbance recorder and Station Event Logger) and status of work regarding undertaking submitted during First Time Charging of elements (agenda by NRLDC)

B.7.1 NRLDC representative apprised that as per IEGC clause 17

1) *All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.*
2) *The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals.*

B.7.2 IEGC clause 37.2 (c) also mandates the submission of Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) within 24 hrs of the event.

B.7.3 NRLDC representative highlighted that during FTC process, cases of non-availability of station event logger and non-standardisation of recording instruments have been observed. Data of recording instruments (DR/EL) are very helpful in grid event analysis and is being used in availability verification of transmission lines. Complete and conclusive analysis of any grid event is not possible without these recording instruments and thus their standardisation is very important.

B.7.4 Therefore, availability of disturbance recorder with standardisation, time sync and correct nomenclature and station event logger need to be ensured by users at the station of their respective control area.

B.7.5 Deliberation on this subject was done during 50th, 51st & 52nd PSC meeting. Details were received from Rajasthan, UP, Uttarakhand & Haryana only. Details received is attached as **Annexure-B.X.**

B.7.6 NRLDC representative requested all the constituents to share the updated details w.r.t. availability and standardisation of disturbance recorder and event logger at the station of their respective control area in format attached as **Annexure-B.X.**

Decision taken by Forum:

PSC forum requested all the members to share the status of their control area and ensure the standardisation of recording instruments at all the stations of their control area.

B.8 Corrective action for healthiness of 500kV Mundra-Mahindergarh SPS (agenda by NRLDC)

B.8.1 NRLDC representative apprised that on 17th May 2024 on outage of both pole (carrying total ~1500MW), SPS of 500kV HVDC Mundra-Mahindergarh inter regional link didn’t operate. This issue was discussed during 51st PSC meeting and ADANI was requested to share the details w.r.t. SPS operation during the meeting.

B.8.2 Further, NRLDC in coordination with NLDC conducted an online discussion meeting with concerned stakeholders (SLDCs, ADANI, POWERGRID) on 12th August 2024, for further remedial actions required to make this SPS healthy.

B.8.3 Following actions were decided during the meeting:

i. POWERGRID, ADANI and concerned states were requested to identify the issue in communication links and take expeditious actions to make the all the communication link healthy. POWERGRID & ADANI shall review the healthiness of SPS system at different load centres and communication path between them in coordination with the SLDCs.

ii. States were requested to go through the details of load feeders mentioned in SPS document and share the changes / modifications as per present scenario and share the inputs w.r.t. unavailability in identified load feeders and load shedding. SLDCs shall share the revised updated feeder details (radial) along with expected average/peak load relief through respective feeders.

iii. SLDCs in coordination with their transmission and protection team shall share the status and healthiness of existing SPS system along with details of availability of communication path for incorporation of proposed revised/additional feeders.

B.8.4 Load end details have been received from UP, Haryana, Punjab Rajasthan & Delhi. Details are attached as **Annexure-B.XI**.

B.8.5 ADANI has submitted the status of healthiness of communication network and hardware system at different locations on the basis of preliminary inspection. As per details submitted, counter status was found OFF at Alwar, Ratangarh, Gobindgarh, Malerkotla, Bamnauli, Shamli and Dhanonda.

B.8.6 Details of nodal officer of different substation involved in SPS scheme has already been shared with ADANI team for coordination and further remedial actions.
During 53rd PSC meeting, ADANI was requested to coordinate with the respective states to rectify the issues in the SPS system and share the status of remedial action taken / planned to be taken. Desired remedial actions need to be expedited.
ADANI agreed for the same and stated that update would be given within 01 week. However, no detail received yet from ADANI.

B.8.7 During discussion in 54th PSC meeting also there was no further update received from ADANI team.

B.8.8 During 55th PSC meeting, NRLDC representative requested PSC forum to discuss the issue and propose action plan for necessary remedial action plans needed for making SPS scheme of HVDC Mundra-Mahindergarh healthy & operational.

B.8.9 ADANI was requested to apprise the forum about the present status of remedial actions.

B.8.10 ADANI representative stated that there are basically communication related issues at various location involved in this scheme. OEM / vendor has been assigned and instructed to inspect all the stations and list out the different issues. After compilation of all the issues comprehensive action plan would be shared. Further, issue related to coordination & communication with the state nodal officers was highlighted by ADANI representative.

B.8.11 NRLDC representative emphasized that ADANI shall take lead as this SPS scheme was commissioned by them and further stated that details of nodal officers will be provided. States were also requested to ensure proper coordination from their end. Further, states were also requested to ensure incorporation of revised decided feeders during work at their stations.

B.8.12 States representative assured to provide all necessary coordination from their end.

Decision taken by Forum:

Forum emphasized the importance of 500kV Mundra-Mahindergarh SPS and its healthiness is important to ensure secure & reliable operation of grid. ADANI was requested to take the lead, coordinate with the respective states to rectify the issues in the SPS system and share action plan along with the status of remedial action taken / planned to be taken. Desired remedial actions need to be expedited.

Part C: Final Protection Settings Approval by PSC Forum for FTCs which have been provisionally allowed by NRLDC/SLDCs

C.1. Approval of protection settings in compliance of IEGC 2023 (agenda by AGEL)

C.1.1 AEE (P), NRPC apprised that AGEL vide email dated 10.12.2024 submitted the Adani Green Energy Twenty-Four Limited (AGE24L) has charged the electrical equipment of the 500 MW Solar Plant at Bhimsar, Rajasthan on 28.11.2024.

C.1.2 AGEL representative mentioned that the settings (available at NRPC website link http://164.100.60.165/meetings/PCC/PCC55/Bhimsar.zip) have been provisionally approved by NRLDC on 26.11.2024.

C.1.3 Further, as per protection setting procedure finalized in 75th NRPC meeting, utility has to get final approval of settings in PSC meeting, therefore, AGEL has put up the implemented settings (available at NRPC website link http://164.100.60.165/meetings/PCC/PCC55/Bhimsar.zip) for approval of Forum.

C.1.4 NRLDC representative mentioned that it has been observed several times that many utilities are submitting protection settings, deviating from the approved philosophy.

C.1.5 He added that Recently, RVPN submitted over flux settings different from the philosophy which delayed FTC approval to get them corrected. Channel Configuration should be proper in DR. Nomenclature in event logger should be proper.

C.1.6 He suggested that internal teams/wings of utilities may check the protection settings before submission to FTC.

C.1.7 NRLDC representative mentioned that recently, line of AGEL 24 got tripped on over voltage due to less drop off to pick up ratio. AGEL representative commented that OEM Siemens was contacted after this event and revised to 0.99.

C.1.8 NRLDC representative conveyed that there is no other observation in the settings and recommended for final approval of Forum.

Decision taken by Forum:

Forum approved the protection settings (available at NRPC website link http://164.100.60.165/meetings/PCC/PCC55/Bhimsar.zip).

C.2. Approval of protection settings in compliance of IEGC 2023 (agenda by Rajasthan SLDC)

C.2.1 AEE (P), NRPC apprised that Rajasthan SLDC vide letter dated 10.12.2024 submitted the details of First Time Charging (FTC) of elements as below: -

S. No.	Element Name	Relevant Protection Setting available at
1	400 kV Bay No. 412A (434) of 400 kV Jaisalmer 2-Corneight Parks Pvt. Ltd. transmission line.	http://164.100.60.165/meetings/PCC/PCC55/Annexure_I.pdf
2	400 kV Bay No. 412T (435) of 400 kV Jaisalmer2-Corneight Parks Pvt. Ltd. transmission line and future transmission bay at Jaisalmer.	
3	400 kV S/C line from 400 kV GSS Jaisalmer 2 to Corneight Parks Pvt. Ltd. alongwith main bay No. 401	http://164.100.60.165/

	and Tie bay No. 402 at Corneight Parks Private Limited	meetings/PCC/PCC55/Annexure_II.pdf
4	400/33 kV, 200 MVA, Shirdi Sai make ICT-1, Sr. No. 100023/01 alongwith Main bay No. 403 at Corneight Parks Private Limited.	
5	400/33 kV, 200 MVA, Shirdi Sai make ICT-2, Sr. No.100023/02 alongwith Main bay No. 406 and Tie bay No. 405 at Corneight Parks Private Limited.	

C.2.2 Further, as per protection setting procedure finalized in 75th NRPC meeting, utility has to get final approval of settings in PSC meeting, therefore, Rajasthan SLDC has put up these settings for approval of Forum.

C.2.3 Members were requested to share their observations and comments, if any.

C.2.4 Members did not find any objection in the proposed settings.

Decision taken by Forum:

Forum approved the protection settings available at http://164.100.60.165/meetings/PCC/PCC55/Annexure_I.pdf & http://164.100.60.165/meetings/PCC/PCC55/Annexure_II.pdf).

C.3. Approval of protection settings in compliance of IEGC 2023 (agenda by HVPNL)

C.3.1 AEE (P), NRPC apprised that HVPN vide email dated 11.12.2024 intimated that 220/132 KV 100 MVA T-4 T/F commissioned at 220 KV S/Stn., Masudpur on 28.11.2024.

C.3.2 Accordingly, HVPN has submitted the settings (enclosed as **Annexure- C.I**) for approval.

C.3.3 HVPN representative submitted that Haryana SLDC has already approved these proposed settings. In line with finalized procedure, the agenda has been put up for final approval of Forum.

C.3.4 Members were requested to share their observations and comments, if any.

C.3.5 Members did not find any objection in the proposed settings.

Decision taken by Forum:

*Forum approved the protection settings enclosed at **Annexure-C.I.***

C.4. Post-facto Approval of Transmission Line Protection Scheme for LILO of one ckt of 220kV Sector-72 (PG) – Sector-72 (HVPN) Gurugram at 220kV substation Sector-15 HVPN Gurugram (agenda by HVPNL)

C.4.1 HVPN representatvie apprised that the work of construction of LILO of one ckt of 220kV Sector-72 (PG) – Sector-72 (HVPN) Gurugram (200 mtr) at 220kV substation Sector-15 HVPN Gurugram was awarded on Turnkey basis to M/s Bajel Projects Limited vide CE/PD&C, HVPNL, Panchkula office memo no. P.O. No. HDP-34/PD&C/EPC-D-17/PD&C/XenProjects (TL) dated 06.06.2022.

C.4.2 The construction work of this project was completed and the loop-out section of the said line i.e. 220kV Sector-72 (HVPN) – Sector-15 (HVPN) Gurugram (8 Km) was charged on dated 04.12.2024.

C.4.3 HVPN representative mentioned that commissioning of the line was approved for 05.09.2023 but the commissioning got delayed due to ROW issues in construction of the line. Commissioning of this line was of utmost priority in Gurugram area due to restrictions imposed by NGT in NCR area & to give relief in power cuts-imposed downline.

C.4.4 The line differential relay was earlier provided (additional) on 220kV Sector-72 (PG) – Sector-72 Gurugram line being very short line (200 mtr) through hard wired CT. However, C&R panels for the said line were provisioned for distance protection relay (Main-I and Main-II) with backup O/C + E/F and commissioned in the year 2011 both at PGCIL end and HVPNL end.

C.4.5 The settings of distance protection relay (Main-I and Main-II) are available at NRPC website (http://164.100.60.165/meetings/PCC/PCC55/HVPNL_Lilo.zip) and SLD of the LILO line is attached as **Annexure-C.II.**

C.4.6 The protection scheme for 220kV Sector-72 (PG) – Sector-15 Gurugram line (8 km) was freezed in the year 2022 and accordingly distance protection relays viz ZIV & GE P442 as Main-I and Main-II protections already installed were finalized.

C.4.7 However, as per latest Protection Philosophy approved this year by Northern Region Protection Committee; for very short line (less than 10 km), line differential protection with distance protection as backup (built in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II.

C.4.8 As the protection schemes was finalized by HVPNL much before NRPC's notification of latest protection philosophy, equipment hardware was already provided, and since the protection scheme being implemented by HVPNL technically fulfills all the basic protection requirements for the transmission line; HVPNL has requested to approve the same in relaxation to the protection philosophy in force.

C.4.9 Further, HVPNL has undertaken that HVPNL will strictly adhere to the NRPC's protection Philosophy in all of its future transmission lines.

C.4.10 HVPN representative submitted that after one year, distance relays will be replaced by differential relays for the 220kV Sector-72 (HVPN) Gurugram to 220kV Sector-15 (HVPN) Gurugram. He also submitted that differential protection would be installed at 220kV Sector-72 (PG) to 220kV Sector-15 (HVPN) Gurugram.

C.4.11 Members were of view that zone-1 settings may be modified to 100% to 110%. HVPN representative commented that the 220kV Sector-72 (HVPN) Gurugram to 220kV Sector-15 (HVPN) Gurugram line is radial line.

C.4.12 However, as per the finalized philosophy, zone- 1 setting may be kept at 110% of the protected line (In case of radial lines) with Time Setting: Instantaneous.

C.4.13 Accordingly, Forum directed HVPN to align the protection settings as per approved philosophy.

Decision taken by Forum:

Forum approved the proposed protection settings available at at NRPC website (http://164.100.60.165/meetings/PCC/PCC55/HVPNL_Lilo.zip) provided that the settings align with approved protection philosophy. Forum directed HVPN to replace the distance relays with differential relays at both ends after one year.

C.5. Approval of protection settings in compliance of IEGC 2023 (agenda by POWERGRID)

C.5.1 AEE (P), NRPC apprised that POWERGRID has submitted that First Time Charging of following transmission lines/Bays/Transformer/Reactor have been done in the month of Nov-2024.

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Bay No	Bay Type	Substation
1	1119271	Oct - 2024	400kV Main Bay 427 of 400/220 kV, 500 MVA ICT-5 at Bikaner_2 (PBTSL)	PBTSL	400kV	427	Main Bay	Bikaner_2 (PBTSL)
2	1119271	Oct - 2024	400kV Tie Bay 426 of 400/220 kV, 500 MVA ICT-5 and Future Line at Bikaner_2 (PBTSL)	PBTSL	400kV	426	Tie Bay	Bikaner_2 (PBTSL)
3	1119271	Oct - 2024	220kV Main Bay 210 of 400/220 kV, 500 MVA ICT-5 at Bikaner_2 (PBTSL)	PBTSL	220kV	210	Main Bay	Bikaner_2 (PBTSL)
4	1119300	Nov - 2024	220kV Main Bay 240(A210) of 220 kV Adani Renewable Energy Holding Four Ltd ckt-I at Fatehgarh_II(PG)	POWERGRID	220kV	240(A210)	Main Bay	Fatehgarh_II(PG)
5	1119300	Nov - 2024	220kV Main Bay 239(A209) of 220 kV Adani Renewable	POWERGRID	220kV	239(A209)	Main Bay	Fatehgarh_II(PG)

			Energy Holding Four Ltd ckt-II at Fatehgarh_II(PG)					
6	1119271	Oct - 2024	400/220/33kV, 500 MVA MVA, 3-Phase, T & R, ICT - 5 at Bikaner_2 (PBTSL)	PBTSL	400/220/33kV	500 MVA	ICT	Bikaner_2 (PBTSL)

C.5.2 Further, as per protection setting procedure finalized in 75th NRPC meeting, utility has to get final approval of settings in PSC meeting, therefore, POWERGRID has put up the settings (available at NRPC website link http://164.100.60.165/meetings/PCC/PCC55/POWERGRID.zip) for approval of Forum.

C.5.3 Members were requested to share their observations and comments, if any.

C.5.4 Members did not find any objection in the proposed settings.

Decision taken by Forum:

Forum approved the protection settings available at NRPC website link (http://164.100.60.165/meetings/PCC/PCC55/POWERGRID.zip).

Meeting ended with a vote of thanks to the chair.

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Members of Protection Sub-Committee (FY 24-25)

S. No.	NRPC Member Organization	Designation	Email-ID
1	Member (GO&D), CEA	Director, NPC Division	skdotancea@nic.in
2	Member (PS), CEA	Chief Engineer, PSPA-I Division	i.sharan@nic.in
3	CTUIL	Sr.GM	schakraborty@powergrid.in
4	PGCIL	GM	gunjan.agrawal@powergrid.in
5	NLDC*	Executive Director	scsaxena@grid-india.in
6	NRLDC	CGM(SO)	somara.lakra@grid-india.in
7	NTPC	GM(OS-NR)	dmandal@ntpc.co.in
8	BBMB	Director (P&C)	dirpc@bbmb.nic.in
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10	SJVN	General Manager	sjvn.cso@sjvn.nic.in
11	NHPC	General Manager (O&M)	hod-om-co@nhpc.nic.in
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14	Haryana SLDC	Chief Engineer (SO&C)	cesocomml@hvpn.org.in
15	Rajasthan SLDC	Chief Engineer (LD)	ce.ld@rvpn.co.in
16	Uttar Pradesh SLDC	Superintending Engineer (R&A)	sera@upsldc.org
17	Uttarakhand SLDC	Chief Engineer	anupam_singh@ptcul.org
18	Punjab SLDC	Chief Engineer	ce-sldc@punjabsldc.org
19	Himachal Pradesh SLDC	Chief Engineer	cehpsldc@gmail.com
20	DTL	AGM-Protection	bharatgujardtl@gmail.com
21	HVPNL	Chief Engineer (TS)	cetspkl@hvpn.org.in
22	RRVPNL	CE (M&P)	ce.mps@rvpn.co.in
23	UPPTCL*	Managing Director	md@upptcl.org
24	PTCUL	SE(T&C)	setandchld@gmail.com
25	PSTCL	Chief Engineer (P&M)	ce-pm@pstcl.org
26	HPPTCL*	Managing Director	md.tcl@hpmail.in
27	IPGCL	DGM (Protection)	arif.ipgcl@gmail.com
28	HPGCL	SE/M&T RGTPP	semt.rgtpp@hpgcl.org.in
29	RRVUNL*	CMD	cmd@rrvun.com
30	UPRVUNL	Chief Engineer, (L-2)	ce.ppmm@uprvunl.org
31	UJVNL*	Managing Director	mdujvnl@ujvnl.com
32	HPPCL*	Managing Director	md@hppcl.in
33	PSPCL	Chief Engineer/GHTP	ce-ghtp@pspcl.in
34	UHBVN	Managing Director	md@uhbvn.org.in
35	Jodhpur Vidyut Vitran Nigam Ltd.	Managing Director	MD.JDVVNL@RAJASTHAN.GOV.IN
36	Paschimanchal Vidyut Vitaran Nigam Ltd.	Managing Director	md@pvvnl.org
37	UPCL*	Managing Director	md@upcl.org
38	HPSEB*	Managing Director	md@hpseb.in
39	Prayagraj Power Generation Co. Ltd.*	Head (Commercial & Regulatory), DGM - Elect	sanjay.bhargava@tatapower.com, dhananjay.singh@ppgcl.co.in
40	Aravali Power Company Pvt. Ltd*	CEO	brahmajig@ntpc.co.in
41	Apraava Energy Private Limited*	GM-Electrical	navin.chaturvedi@apraava.com
42	Talwandi Sabo Power Ltd. *	COO	Vibhav.Agarwal@vedanta.co.in
43	Nabha Power Limited*	CEO	sk.narang@larsentoubro.com
44	MEIL Anpara Energy Ltd	COO & WTD, Executive Director	anandkumar.singh@meilanparapower.com arun.tholia@meilanparapower.com
45	Rosa Power Supply Company Ltd	GM-ELECTRICAL	kesarinandan.pandey@relianceada.com
46	Lalitpur Power Generation Company Ltd	Head of Maintenance, GM Electrical	alokkumar.ltp@lpgcl.com, aupadhyay.ltp@lpgcl.com
47	MEJA Urja Nigam Ltd.	AGM-EMD	SPSPUNDIR@NTPC.CO.IN
48	Adani Power Rajasthan Limited*	GM	Ashish.Baviskar@adani.com
49	JSW Energy Ltd. (KWHEP)*	Head Regulatory & Power Sales	jyotiprakash.panda@jsw.in
50	TATA POWER RENEWABLE*	Zonal Head, NR	dhmahabale@tatapower.com
51	UT of J&K*	Chief Engineer, JKPCL	cejkpcl2@gmail.com
52	UT of Ladakh*	Chief Engineer, LPDD	cepdladakh@gmail.com
53	UT of Chandigarh	Executive Engineer	elop2-chd@nic.in
54	Noida Power Company Limited	Head – Power Purchase	ssrivastava@noidapower.com
55	Fatehgarh Bhadla Transmission Limited	Head-Protection, AESL	Sunil.Raval@adani.com
56	NTPC Vidyut Vyapar Nigam Ltd.	CEO	ceonvvn@ntpc.co.in
57	ReNew Power Private Limited*	CEO	sumant@renew.com
58	NTPC Green Energy Limited*	CEO, Sr. Mgr	rajivgupta@ntpc.co.in, sandeepdahiya@ntpc.co.in
59	Azure Power India Pvt. Limited*	CEO	sunil.gupta@azurepower.com
60	Avaada Energy Private Limited*	CEO	kishor.nair@avaada.com
61	Adani Green Energy Limited	AVP	sanjay.bhatt@adani.com
*	*Organizations from where nominations are not received for PSC, memebers of NRPC have been mentioned. Nomination for PSC forum may be sent at the earliest.*		

Annexure-P

55th Protection Sub-Committee Meeting on 20.12.2024 (10:30 AM)					
S. No.	**Name**	**Designation**	**Organization**	**E-mail**	**Mobile No.**
1	V.K. Singh	MS, NRPC	NRPC	ms-nrpc@nic.in	9810177609
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4	Lokesh Agarwal	AEE	NRPC	lokesh.cea@gov.in	7976753220
5	Naresh Pal	AE	UJVNL	naresh.pal18@yadav.com	9456590070
6	Deepak Joshi	EE	UJVNL	eetestgv@gmail.com	9456590410
7	Paritosh Joshi	Sr. Manager(T)	DTL	paritosh.joshi@dtl.gov.in	9999533933
8	Rakesh Bairwa	AD	NPC, CEA	rakeshbairwa.cea@gov.in	9116713834
9	Arvind bahuguna	AE	UJVNL	arvind.anvi222@gmail.com	9456590273
10	Uma Shankar	EE	UJVNL	atestdharasu@gmail.com	9456590326
11	Hunny Kalia	Manager	JSWHEL (KWHEP)	hunny.kalia@jsw.in	7018091548
12	Anil Saini	Manager	SJVN	anil.saini@sjvn.nic.in	9418185517
13	Atul Nigam	General Manager	RPSCL	atul.v.nigam@relianceada.com	9305421854
14	Pankaj Kumar Jha	Chief Manager	POWERGRID NR-I	pankaj.jha@powergrid.in	9634440125
15	Abhay Kumar Tiwari	Chief Manager	POWERGRID NR-III	abhay.tiwari@powergrid.in	8874982777
16	Sushil	Deputy General Manager	POWERGRID NR-II	sushil.sharma@powergrid.in	9419210437
17	Arif Rahman	DGM (T)	IPGCL	arifipgcl@gmail.com	9717694928
18	Sudhir Kumar	DY. GM(T)	IPGCL-PPCL	sudhirkumar.ipgpp@nic.in	9717694789
19	Manas R. Chand	DGM (SO)	NLDC	manas@grid-india.in	8328864023
20	B R Meena	DGM	NRLDC	brmeena@grid-india.in	9599333502
21	Mahair Prasad Singh	SR. DGM	NRLDC	mahavir@grid-india.in	9729872327
22	Somara Lakra	Chief GM	NRLDC / Grid-India	somara.lakra@grid-india.in	9910953317
23	Deepak Kumar	Dy. Manager	NRLDC / Grid-India	deepakkumar@gmail.com	9519446110
24	Er. Lalit Kumar	Assistan Engineer (E)	HPPTCL	er.lalit.tcl@hpmail.in	8219585115
25	Jaganath Pani	SR. Manager	NHPC LTD.	jaganathpani@nhpc.co.in	8800021271
26	Amit Maan	Executive Engineer	HVPNL	xenmpccggn@hvpn.org.in	9315315619
27	Sumeet Sharma	VP	AESL	sumeet.sharma@adani.com	9099005648
28	Neeraj Chomeha Patel	DGM	AGEC	neerajv.patel@adani.com	9687660325
29	Bimlesh Sharma	Assistant Director / P & T	BBMB	bimleshsharma86@gmail.com	9817449323
30	Pradeep Kohar	AEE	HPGCL	xensyd.rgtpp@hpgcl.org.in	8222023613
31	P.K. Mishra	SE	UPPTCL	setncmrt@upptcl.org	9412749817
32	Anuj Kumar	EE	UPSLDC	aeprotection@upsldc.org	8005402892
33	Arvind Kumar	SE T&C Agra	UPPTCL	setncagra@upptcl.org	7080547555
34	Ashok K Sharma	AEE (MPTS)	RRVPNL	EE.mpts.afr@rvpn.co.in	9414061436
35	D.K. Jain	SE (Protection)	RVPN	se.prot.engg@rvpn.co.in	9530043259
36	Vijay Pal	XEN (MPT&S)	RVPN	xen.prot.alwar@rvpn.co.in	9414061407

Annexure-A.I

Status of action taken on decision 54th PSC meeting

S.N.	Agenda	Decision of 54th PSC	Status of action taken
A.3	Submission of protection performance indices along with reason and corrective action taken for indices less than unity to NRPC Secretariat on monthly basis (agenda by NRPC Secretariat)	i) Forum directed HPGCL to submit the protection performance indices from April, 2024 to October, 2024	HPGCL has not submitted indices yet. HPGCL may submit the reason for non-submission of protection performance indices. HVPN was requested to take up the matter with HPGCL.
A.4	Annual protection audit plan for FY 2024-25 and third-party protection audit plan (agenda by NRPC Secretariat)	Third Party Protection Audit report is to be submitted by RPSCL, Adani Power Ltd, SEUPPTCL. ADHPL was requested to update the current status of third-party protection audit. As per submitted plan, third party audit was scheduled to be done by September, 2024.	Audit report is awaited. RPSCL updated that within 10 days report will be submitted. ADHPL submitted the revised third-party protection audit plan.
A.6	Observations and Compliance of recommendations of protection audit (agenda by NRPC Secretariat)	THDC, UJVNL, RVUNL, UPSLDC and UPRVUNL were also requested to submit the compliance report of internal	Compliance report is awaited. UJVNL, RVUNL, UPSLDC and UPRVUNL were requested to send the same.

		Protection audits.	
A.10	Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously (agenda by RVPN)	MS, NRPC stated to ask the comments of utilities on the proposal of RVPN via email and the same may be again discussed in the next PSC meeting based on received inputs.	An email dated 02.12.2024 were sent to all PSC members to send the comments. UPPTCL, LPGCL and NPCIL have submitted comments. Agenda was discussed in the 55th PSC meeting.
A.13	Review of protection setting of Thermal, Hydro, IBR based generations/HVDC and FACTS (agenda by NLDC)	1. Forum requested all generating members to share the inputs for protection settings for conventional generators. 2. Forum directed NLDC to seek the inputs on protection philosophy of IBR based RE generations/HVDC and FACTS from RE generators, HVDC owners, NRLDC, other RPCs & RLDCs and compile the received inputs. Accordingly, a meeting a may be called by NRPC for discussion	NLDC updated that meetings are being conducted and will provide the draft inputs.

		and philosophy may be finalized.	
A.33	Constitution of Protection System Analysis Group (PSAG) (agenda by NRPC Secretariat)	Forum approved the constitution of Protection System Analysis Group (PSAG) having members from NRPC, NPC, NLDC, NRLDC, PGCIL, NTPC and a Protection Expert from the region along with the entity under whose jurisdiction GD/GI occurred to analyse any critical or specific Grid Disturbances/Grid Incidents recommended by NRPC Secretariat and NRLDC.	Letter dated 17.12.2024 sent to seek the nominations for PSAG.

Annexure-A.II

Status of perfomance indices report of November 2024		
S. No.	Utility	Status of Protection Performance indices
1	PGCIL	Recevied (NR-1, 2, 3)
2	NTPC	Recevied (unchahar, Tanda, Singrauli, Rihand)
3	BBMB	
4	THDC	Recevied (Tehri, Koteshwar)
5	SJVN	Recevied (NJHPS, RHPS)
6	NHPC	Recevied
7	NPCIL	Recevied (RAP-5&6, RAP-3&4, NAP-1&2, RAP-1 & 2)
8	Delhi SLDC	
9	Haryana SLDC	
10	Rajasthan SLDC	
11	Uttar Pradesh SLDC	Received (WUPPTCL, Vishnuprayag, SEUPPTCL, Ghatampur)
12	Uttarakhand SLDC	
13	Punjab SLDC	
14	Himachal Pradesh SLDC	
15	DTL	Recevied
16	HVPNL	Recevied
17	RRVPNL	Recevied
18	UPPTCL	Recevied (All Zones)
19	PTCUL	Recevied
20	PSTCL	
21	HPPTCL	Recevied
22	IPGCL	Recevied (PPS-I, III)
23	HPGCL	Recevied (RGTPP
24	RRVUNL	Recevied
25	UPRVUNL	Recevied (DTPS Anpara, Obra 220kV,400kV, Khara, Parichha, Obra-C, Parcihha extension, Anpara-B, Harduaganj E)
26	UJVNL	Recevied (Dharshu, Tiloth, Khodri, Chibro, Vyasi)
27	HPPCL	
28	PSPCL	Recevied (RSD, GHTP, GATP, GGSSTP)
29	HPSEBL	Recevied
30	Prayagraj Power Generation Co. Ltd.	Recevied
31	Aravali Power Company Pvt. Ltd	Recevied
32	Apraava Energy Private Limited	Recevied
33	Talwandi Sabo Power Ltd.	Recevied
34	Nabha Power Limited	Recevied
35	MEIL Anpara Energy Ltd	Recevied
36	Rosa Power Supply Company Ltd	Recevied
37	Lalitpur Power Generation Company Ltd	Recevied
38	MEJA Urja Nigam Ltd.	
39	Adani Power Rajasthan Limited	Recevied
40	JSW Energy Ltd. (KWHEP)	Recevied
41	AESL	Recevied (ATIL, ATSCL, BKTL, FBTL, GTL, HPTSL, MTSCL, OCBTL)
42	Tata Power Renewable Energy Ltd.	Recevied (TPGEL, TPREL, Tata Power Sourya)
43	UT of J&K	
44	UT of Ladakh	
45	UT of Chandigarh	
46	INDIGRID	Recevied
47	POWERLINK	
48	ADHPL	Recevied
49	Sekura Energy Limited	

Reasons and Corrective actions taken by concerned utility for Performance Indices less than Unity- November 2024

PSPCL

Case-1 Tripping of 220 kV feeder GGSSTP to Gulal-1 & Jadla-2

No. of unwanted operation-

Reason for failure to operate – Tripping in zone-2 due to carrier unhealthiness.

Corrective action taken- Not received from utility.

UPPTCL

Case-1 Tripping of 160MVA ICT-II at 220kV Substation Gajokhar (Prayagraj Zone)

No. of correct operation-0
No. of unwanted operation-1
No. of operations failure to operate-0

Reason for unwanted operation- tripped in DC earth fault due to damaged control cable.
Corrective action taken- Attended.

Case-2 Tripping of 400kV Fatehabad-Agra (PG) 400kV Fatehabad-Firozabad (Agra Zone)

No. of correct operation-0
No. of unwanted operation-1
No. of operations failure to operate-0

Reason for unwanted operation- Due to relay malfunctioning.
Corrective action taken- Shutdown proposed for relay testing.

Case-3 Tripping of 400kV Fatehabad-Firozabad (Agra Zone)

No. of correct operation-0

No. of unwanted operation-1

No. of operations failure to operate-0

Reason for unwanted operation- Due to relay malfunctioning.

Corrective action taken- Shutdown proposed for relay testing.

Case-4 Tripping of 400kV Panki- Rewa road line (Agra Zone)

No. of correct operation-0

No. of unwanted operation-1

No. of operations failure to operate-0

Reason for unwanted operation- other end trip.

Corrective action taken- Not received from Utility.

RVPN

Case-1 220 KV Bus Bar Protection at 220KV GSS BALI on 03.11.2024

No. of Unwanted operation – 6

Reason of unwanted operation – Spurious current observed in one PU.

Corrective Action taken – The problem had occurred on 02.05.2024 also, the CT core was changed at that time. Again, this incident happened on 03.11.2024, no justified reason for Bus bar protection operation could be found. It was thought that the particular PU may be defective, hence, the same has been replaced and the relay is under observation.

Case-2 220/132 KV, 160 MVA TRF-II at 220 KV GSS SWAIMADHOPUR on 15.11.2024

No. of Unwanted operation – 1

Reason of unwanted operation – Tripping occurred on Buchholz relay indication

Corrective Action taken – TCIV of NIFPES found in closed position, the same has been put in normal position.

Case-3 220 KV BARMER - MPT LINE at Barmer on 24.11.2024

No. of Unwanted operation – 1

Reason of unwanted operation – Due to defect in VT selection relay.

Corrective Action taken – VT selection relay defect rectified.

SJVN (Rampur HPS)

Case-1 Stopping of 68.67 MW generating unit no. 5 of Rampur HPS on 23.11.2024.

Number of unwanted operations -1

Reason for unwanted operation – Generating unit stopped due to o ring damaged causes major oil leakage observed in governor pipeline.

Corrective action taken –Damaged o ring was replaced.

HPTSL (AESL)

Case-1 Tripping of 220/132kV 160 MVA Power Transformer at Ranpur

Number of correct operation -1

Number of unwanted operation-1

<u>Reason for unwanted operation</u>- 160MVA Power transformer tripped on false operation during Tap changing operation.

<u>Corrective action taken</u>- Settings have been modified.

<u>DTL</u>

Case-1 Tripping of 315MVA ICT-IV (400/220kV) at 400kV S/s Bawana

Number of correct operation -0

Number of unwanted operation-1

<u>Reason for unwanted operation-</u> Buchholz relay tripped during testing of pumps.

<u>Corrective action taken</u>- Manual error will be avoided in future.

<u>POWERGRID NR-2</u>

Case-1 Tripping of WAGOORA 315MVA ICT-IV

No. of unwanted operation-1

<u>Reason for unwanted operation-</u> due to maloperation of AREVA make overflux relay.

<u>Corrective action taken -</u> Defective overfluf relay replaced at wagoora (PG).

<u>UPRVUNL</u>

Case-1 Tripping of 400KV PARICHHA-ORAI CIRCUIT 1

Number of correct operation -1

Number of unwanted operation-1

Reason for unwanted operation- During a single-phase transient fault, Auto reclose lockout shot recorded at Parichha end.

Corrective action taken - Testing of Distance relay at Parichha end has been planned to rectify the issue in auto reclose.

Annexure-A.IV

Status of Internal Protection Audit Plan for FY 2024 -25

S. No.	NRPC Member	Category	Status
1	PGCIL	Central Government owned Transmission Company	Received
2	NTPC	Central Generating Company	Received
3	BBMB		Received
4	THDC		Received
5	SJVN		Received
6	NHPC		Received
7	NPCIL		
8	Delhi SLDC	SLDC	
9	Haryana SLDC		
10	Rajasthan SLDC		
11	Uttar Pradesh SLDC		Vishnuprayag, WUPPTCL
12	Uttarakhand SLDC		
13	Punjab SLDC		
14	Himachal Pradesh SLDC		
15	DTL	State Transmission Utility	Received
16	HVPNL		Received
17	RRVPNL		Received
18	UPPTCL		Received for Jhansi, Lucknow, Meerut, Gorakhpur, Prayagraj, Agra zone)
19	PTCUL		Received
20	PSTCL		Received
21	HPPTCL		Received
22	IPGCL	State Generating Company	Received (PPCL-I,III)
23	HPGCL		
24	RRVUNL		Received
25	UPRVUNL		Received (obra -B, Anpara-B,D switch yard, Harduganj-C,D,E))
26	UJVNL		Received (Khodri, Chibro, Vyasi, Dharasu , Tiloth)
27	HPPCL		
28	PSPCL	State Generating Company & State owned Distribution Company	Received (Ranjet sagar dam, GHTP, GGSSTP, GATP)
29	HPSEBL	Distribution company having Transmission connectivity ownership	Received
30	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Received
31	Aravali Power Company Pvt. Ltd		Received
32	Apraava Energy Private Limited		Received
33	Talwandi Sabo Power Ltd.		
34	Nabha Power Limited		Received
35	MEIL Anpara Energy Ltd		Received
36	Rosa Power Supply Company Ltd		Received
37	Lalitpur Power Generation Company Ltd		Received
38	MEJA Urja Nigam Ltd.		
39	Adani Power Rajasthan Limited		Received
40	JSW Energy Ltd. (KWHEP)		Received
41	AESL	Other transmission licensee	Received (ATIL -400kV Mohindergarh S/s, OBTL, FBTL, MTSCL, ATSCL, HPTSL, BKTL, GTL)
42	Tata Power Renewable Energy Ltd.		Recevied (TPGEL, BTPSL)
43	UT of J&K	UT of Northern Region	
44	UT of Ladakh		
45	UT of Chandigarh		
46	INDIGRID		Received
47	ADHPL		Received
48	Sekura Energy Limited		

Annexure-A.V

Status of 3rd Party Protection Audit Plan

S. No.	NRPC Member	Category	Status	Schedule submitted as per utililty	Present Status Comlpleted (yes/no)
1	PGCIL	Central Government owned Transmission Company	Received (7 S/s of NR-1, 1 S/s of NR-2, 4 S/s of Nr-3)	By Jan 2025	
2	NTPC	Central Generating Company	Received (Singrauli, Rihand, Unchahar, Dadri, Dadri Gas, Auraiya Gas, Faridabad Gas, Anta Gas Power Station)	By Oct 2028	
			Received (Tanda)	By 17.07.2025	
3	BBMB				
4	THDC		Received	March 2026-Tehri, F.Y. 2025-26- Koteshwar	
5	SJVN		Received	Nov-Dec 2025 for RHPS, Nov 24- March 25 for NJHPS	
6	NHPC		Received	FY-2025-26	
7	NPCIL				
8	Delhi SLDC	SLDC			
9	Haryana SLDC				
10	Rajasthan SLDC				
11	Uttar Pradesh SLDC		Alaknanda	March 2025	
			Received (Tanda extension)	17.07.2025	
			Received (Tanda)	17.07.2025	
			SEUPPTCL	Conducted (Oct 2024)	
12	Uttarakhand SLDC				
13	Punjab SLDC				
14	Himachal Pradesh SLDC				
15	DTL	State Transmission Utility	Received		
16	HVPNL				
17	RRVPNL				
18	UPPTCL				
19	PTCUL		Received	By Jan 2025	
20	PSTCL				
21	HPPTCL				
22	IPGCL	State Generating Company	Received (PPS-III)	FY 25-26	
23	HPGCL				
24	RRVUNL		Received		
25	UPRVUNL		Received (Obra-B)	2026-27	
26	UJVNL				
27	HPPCL				
28	PSPCL	State Generating Company & State owned Distribution Company	Reeceived (GHTP)	Dec. 2025	
			Received (GATP)	May 2025	
			GGSSTP		
			RSD/ Sahapur Kandi		
29	HPSEBL	Distribution company having Transmission connectivity ownership			
30	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Received	Dec-24	
31	Aravali Power Company Pvt. Ltd				
32	Apraava Energy Private Limited		Received	By May, 2025	
33	Talwandi Sabo Power Ltd.				
34	Nabha Power Limited		Received	By December, 2025	
35	MEIL Anpara Energy Ltd		Received	* Feb 2025	
36	Rosa Power Supply Company Ltd		Conducted	By 30.09.2024	Report is to be submitted
37	Lalitpur Power Generation Company Ltd		Conducted	26.03.2024	
38	MEJA Urja Nigam Ltd.				
39	Adani Power Rajasthan Limited		Conducted	November, 2024	
40	JSW Energy Ltd. (KWHEP)		Received	December 2024 to March 2025	
41	AESL	Other Transmission Licensee	Received (ATIL -400kV Mohindergarh S/s,)	400kV Mohindergarh SS- Q2 , FY 2025-26	
			Received (OBTL)	OBTL-Q1 , FY 2025-26	
			Received (FBTL)	FBTL-Q3 , FY 2025-26	
			Received (MTSCL)	MTSCL-Q4 , FY 2025-26	
			Received (ATSCL)	ATSCL-Q1 , FY 2026-27	
			Received (HPTSL)	HPTSL- Q2 , FY 2026-27	
			Received (BKTL)	BKTL-Q3 , FY 2026-27	
			Received (GTL)	GTL- Q3 & Q4, FY 2026-27	
42	Tata Power Renewable Energy Ltd.	IPP having less than 1000 MW installed capacity (alphabetical rotaional basis)			
43	UT of J&K	UT of Northern Region			
44	UT of Ladakh				
45	UT of Chandigarh				
46	INDIGRID		Received (NRSS 29)	FY 24-25	
47	ADHPL		Received	* September 2026	
48	Sekura Energy Limited				

* Revised Schedule

Annexure-A.VI

Status of Internal Protection Audit Plan for FY 2025 -26

S. No.	NRPC Member	Category	Status
1	PGCIL	Central Government owned Transmission Company	Received (NR-1,2
2	NTPC	Central Generating Company	Received
3	BBMB		
4	THDC		Received (Tehri)
5	SJVN		Received (NJHPS)
6	NHPC		
7	NPCIL		
8	Delhi SLDC	SLDC	
9	Haryana SLDC		
10	Rajasthan SLDC		
11	Uttar Pradesh SLDC		Received (Jaypee Vishnuprayag, WUPPTCL, SEUPPTCL)
12	Uttarakhand SLDC		
13	Punjab SLDC		
14	Himachal Pradesh SLDC		
15	DTL	State Transmission Utility	Received
16	HVPNL		Received
17	RRVPNL		Received
18	UPPTCL		Received (All zones)
19	PTCUL		
20	PSTCL		
21	HPPTCL		Received
22	IPGCL	State Generating Company	Received (PPS-III, I)
23	HPGCL		
24	RRVUNL		Received
25	UPRVUNL		Received (Obra- A, B)
26	UJVNL		Received (Dharashu, Tiloth)
27	HPPCL		
28	PSPCL	State Generating Company & State owned Distribution Company	Received (GHTP, GGSSTP, GATP, RSD)
29	HPSEBL	Distribution company having Transmission connectivity ownership	Received
30	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Received
31	Aravali Power Company Pvt. Ltd		
32	Apraava Energy Private Limited		
33	Talwandi Sabo Power Ltd.		
34	Nabha Power Limited		Received
35	MEIL Anpara Energy Ltd		
36	Rosa Power Supply Company Ltd		Received
37	Lalitpur Power Generation Company Ltd		Received
38	MEJA Urja Nigam Ltd.		
39	Adani Power Rajasthan Limited		
40	JSW Energy Ltd. (KWHEP)		
41	AESL	Other transmission licensee	
42	Tata Power Renewable Energy Ltd.		
43	UT of J&K	UT of Northern Region	
44	UT of Ladakh		
45	UT of Chandigarh		
46	INDIGRID		
47	ADHPL		
48	Sekura Energy Limited		

LAITPUR POWER GENERATION COMPANY LIMITED

(3X660MW GENERATING STATION WITH 765kV/220kV SWITCHYARD)

INTERNAL PROTECTION AUDIT REPORT
CONDUCTED IN OCT-NOV 2024 AS PER IEGC INTERNAL PROTECTION AUDIT COMPLIANCE
FY-2024-25
FINAL REPORT RELEASED ON 30TH NOV 2024

TEAM ELECTRICAL
Internal Protection Audit

Sr No	Input Required	Details of Substation
1	Name of Sub-station	765/220KV LPGCL Switchyard
2	Date of first commissioning	2015
3	Type of Bus Switching Scheme	765KV-One -and -half & 220kV-Double bus with transfer bus
4	Whether SLD collected or Not	Yes

Internal Audit Team			
Name	**Designation**	**Role & Responsibility**	**Signature**
Mr. A.N SAR	**Chief Executive Officer**	Final Approval	30/11/2024 ANSar
Mr. Alok Kumar Srivastava	**Head- Maintenance**	Final Reviewer	30/11/2024
Mr. Abhimanyu Upadhyay	**GM and Head-Electrical**	Reviewer	30/11/2024.
Mr. Sushant Gaurav	**AGM-Electrical**	Lead Protection Audit	S. Gaurav 30/11/2024.
Mr. Ritesh Rai	**Sr. Engineer**	Field Auditor	Ritesh Rai 30/11/2024

5	LBB Protection of 765kV Ckt#02 is in out of service as per logic & scheme, logic is configured as per 708-Tie LBB. The Binary input configuration which are using for IN/OUT not as per scheme. IN-OUT switch actually in IN position but in relay it was configured for LBB inhibit.	765kV Line #02	P141 LBB	Binary input and output configuration to be corrected in PSL logic and setting files which shall be done in shutdown.	Open	
6	STUB protection found disable in 765kV Ckt #02 21M2 Relay which should be enable as per NRPC guidelines.	765kV Line #02	P545	STUB protection made Enable as per NRPC guideline.	Closed	During relay testing, it might be possible to make it OFF to check the other Zone protection. Now protection is enabled.
7	In line Reactor 1, LBB protection logic was not considered for tripping, and it was configured in reactor differential protection (P642_87R-1). LBB protection should be taken separately with DC changeover scheme.	765kV LR#01	P642 87R1	PSL logic to be modified and configuration to be downloaded into relays. This will be done in shutdown or bypassing LBB and Bus bar protection.	Open	As per approved scheme, LBB protection has been considered in 87R1 relay. Protection should be enabled & it should send DT & Tripping to Main & TIE CB.
8	In line Reactor 2, LBB protection logic was not considered for tripping, and it was configured in reactor differential protection (P642_87R-1). LBB protection should be taken separately with DC changeover scheme.	765kV LR#02	P642 87R1	PSL logic to be modified and configuration to be downloaded into relays. This will be done in shutdown or bypassing LBB and Bus bar protection.	Open	As per approved scheme, LBB protection has been considered in 87R1 relay. Protection should be enabled & it should send DT & Tripping to Main & TIE CB.

9	ICT #02 LBB Current and 87OH primary current value not matching because of CT ration of LBB set on 1000/1A Instead of 2000/1A.	765kV ICT #02	P141 LBB	CT ratio to be corrected by passing LBB and bus bar protection.	Open	Loop in-loop out ratio should be same. 87OH and LBB relay ratio should be same as same CT core & ratio are used for both relays.
10	ICT #01 P141 LBB relay and Bus Bar PUA (P743) & PUB (P743) relay measured primary current value is not matching as CT connection and setting checked in relay and yard also, everything found ok as per scheme.	765kV ICT #01	P743 PUA & PUB	Relay calibration is required with secondary injection kit which will be performed in bus bar shutdown.	Open	During Audit 50-60A differential current observed in bus bar relay. After detail investigation, discrepancy observed in ICT-2 bay.
11	DT Send CH-01 ckt for Agra line#01 to be verify for 21M2, LBB, PUA & PUB2 relay protection operated, as per bay-709 CRP as build and old drawing no-3269PP660-S-04, DT send via CH-01 when protection operated at 21M2, LBB, PUA & PUB2 output not connected with DT send signal.	765kV Line #01	CRP Drawing	DT send logic to be verified during line shutdown.	Open	The observation came during scheme drawing checking. In scheme one loop is missing, same need to be verified during shutdown.
12	Adopted & connected CT ratio in Bay-706 CRP drawing No-3269PP552-S-27 shows 1000/1A for 706 CTT in Core-1, Core 2 & Core-3 and 705 CTDA Core-1, Core 2 & Core-3. But actual 2000/1A for 706 CTT in Core-1, Core 2 & Core-3 and 705 CTDA Core-1, Core 2 & Core-3 are connected.	765kV Bay-706	CRP Drawing	As built drawing to be corrected as per physical CT connection	Open	As built drawing was not as per actual CT connection.

13	Fault locator setting was found wrong and not matching with line parameters. Fault locator parameters (RFLO) changed in 21M1 Relays of 220kV all Lines and 765kV Agra Ckt #02.	220kV all lines & 765kV ckt #02	REL670, P444 & P545	Fault locator setting modified as per line parameters.	Closed	
14	Bay 206 PUB 89A Isolator Close feedback input not getting High.	220kV Bay-206	P743 PUB	The isolator status to be provided in bus bar as per scheme which could be possible only either bus bar shutdown or by passing bus bar protection.	Open	Bus Bar Main-1 & Main-2 Current are not showing same due to Isolator status missing in PU.
15	Bay 203 PUB 89B Isolator Close feedback input not getting High.	220kV Bay-203	P743 PUB	The isolator status to be provided in bus bar as per scheme which could be possible only either bus bar shutdown or by passing bus bar protection.	Open	Bus Bar Main-1 & Main-2 Current are not showing same due to Isolator status missing in PU.
16	Bay 203 PUB 89C Isolator Open feedback input not getting High.	220kV Bay-203	P743 PUB	The isolator status to be provided in bus bar as per scheme which could be possible only either bus bar shutdown or by passing bus bar protection.	Open	Bus Bar Main-1 & Main-2 Current are not showing same due to Isolator status missing in PU.
17	Bay 202 PUB 89C Isolator Open feedback input not getting High.	220kV Bay-202	P743 PUB	The isolator status to be provided in bus bar as per scheme which could be possible only either bus bar shutdown or by passing bus bar protection.	Open	Bus Bar Main-1 & Main-2 Current are not showing same due to Isolator status missing in PU.

18	Broken conductor protection was enabled for tripping in 220kV kalyanpura Ckt #01 & ckt#02. It should be Alarm as per NRPC guideline.	220kV kalyanpura Ckt #01 & ckt#02.	P444 21M2	BRC Protection trip made disable and kept for DR purpose only.	Closed	As per NRPC, BRC should be considered trip only in case of radial feeder to avoid transformer single phasing.
19	DR Configuration of prefault time, post fault time, DR time & post retriggering setting all line changed except Agra Ckt#01.	220kV all lines & 765kV ckt #02	REL670, P444 & P545	For Viewing main & tie CB status in single DR, Pre fault kept 0.5 Sec, Post fault kept 3.5 Sec and total fault duration kept-4 Sec.	Closed	As per NRPC guidelines, Pre-Fault-0.5Sec Post fault-2.5 Sec Total Fault-3 Sec.
20	Over current Protection was enabled in 220kV Kalyanpura Ckt #01 M12 Relay. It should be disable as per NRPC guideline.	220kV Bay-202	P444 21M2	O/C protection made disable.	Closed	As per NRPC guidelines, over current protection to be made disable for 220KV and above lines.
21	Over current Protection was enabled in 220kV Kalyanpura Ckt #01 21M1 Relay. It should be disable as per NRPC guideline.	220kV Bay-202	REL670	O/C protection made disable.	Closed	As per NRPC guidelines, over current protection to be made disable for 220KV and above lines.
22	Over current Protection was enabled in 220kV Kalyanpura Ckt #02 M12 Relay. It should be disable as per NRPC guideline.	220kV Bay-203	P444 21M2	O/C protection made disable.	Closed	As per NRPC guidelines, over current protection to be made disable for 220KV and above lines.
23	Over current Protection was enabled in 220kV Kalyanpura Ckt #02 21M1 Relay. It should be disable as per NRPC guideline.	220kV Bay-203	REL670	O/C protection made disable.	Closed	As per NRPC guidelines, over current protection to be made disable for 220KV and above lines.
24	Over current Protection was enabled in 220kV Dunara Ckt 21M1 Relay. It should be disable as per NRPC guideline.	220kV Dunara Line	REL670	O/C protection made disable.	Closed	As per NRPC guidelines, over current protection to be made disable for 220KV and above lines.

25	Over current Protection was enabled in 220kV Dunara Ckt 21M2 Relay. It should be disable as per NRPC guideline.	220kV Bay-208	P444 21M2	O/C protection made disable.	Closed	As per NRPC guidelines, over current protection to be made disable for 220KV and above lines.
26	Over current Protection was enabled in 220kV Babina Ckt 21M1 Relay. It should be disable as per NRPC guideline.	220kV Babina Line	REL670	O/C protection made disable.	Closed	As per NRPC guidelines, over current protection to be made disable for 220KV and above lines.
27	Over current Protection was enabled in 220kV Babina Ckt 21M2Relay.It should be disable as per NRPC guideline.	220kV Bay-207	P444 21M2	O/C protection made disable.	Closed	As per NRPC guidelines, over current protection to be made disable for 220KV and above lines.
28	Over voltage setting in dunara circuit found P-N in measurement mode but set voltage of V>1 & V>2 was PH-PH.	220kV Dunara Line	P444	Voltage measurement mode changed from P-N to PH-PH	Closed	
29	Some 765kV & 220kV relay Communication with Scada is not stabilised.	SCADA		Ethernet port not working properly which need to be replaced.	Open	
30	In 220kV Lines of Babina & Dunara Ckt REL670 Relay communication issue with SCADA persisting, no any signal is reporting to Scada from above mention Relays.	SCADA		Relay is communicating with SAS, only issue in ICD file. ICD files are not matching as per SAS configuration.	Open	
31	During relay testing of ST #01 it was observed that the REF CT link was found shorted at panel end which was bypassing the REF current to relay.	ST #01	P141 OC/EF Relay	REF CT link made operational & REF protection taken in service	Closed	During commissioning it might be bypassed to check the circulating current in secondary.

2) Instrument Transformer

A.1 Current transformer (CT-765kV)

Location of CT : Bay 701 MCTG
Ratio Test Date: 20.03.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 28.11.2023

Sr No	**R-PH (Sl. No-37994004132)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.21	-0.20	NA	NA	NA
iv	Knee point voltage	Spare	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-37994004120)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.18	-0.19	NA	NA	NA
Iv	Knee point voltage	Spare	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-37994004131)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.19	-0.21	NA	NA	NA
iv	Knee point voltage	Spare	NA	NA	NA	NA	NA

A.2 Current transformer (CT-765kV)

Location of CT: Bay 701 PCTG
Ratio Test Date: 03.02.2015
Balance Testing (Tan-delta, IR & Winding Resistance) date: 24.11.2023

Sr No	R-PH (Sl. No-37994002370)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.51	-0.14	-0.28	Spare	-0.24	-0.16
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH (Sl. No-37994002161)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.19	-0.14	-0.22	Spare	-0.14	-0.13
Iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH (Sl. No-37994002367)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.17	-0.2	-0.3	Spare	-0.15	-0.13
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.3 Current transformer (CT-765kV)

Location of CT: Bay 702 CTDA
Ratio Test Date: 30.01.2015
Balance Testing (Tan-delta, IR & Winding Resistance) date : 29.11.2023

Sr No	R-PH (Sl. No-37994002355)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.37	-0.28	-0.21	Spare	Spare	Spare
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**Y-PH (Sl. No-37994002353)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.29	-0.43	-0.33	Spare	Spare	Spare
Iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**B-PH (Sl. No-37994002366)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.39	-0.25	-0.24	Spare	Spare	Spare
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare

A.4 Current transformer (CT-765kV)

Location of CT: Bay 702 CTDB
Ratio Test Date: 04.02.2015
Balance Testing (Tan-delta, IR & Winding Resistance) date : 29.11.2023

Sr No	R-PH(Sl. No-37994003472)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.80	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.27	-0.26	-0.22	Spare	Spare	Spare
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**Y-PH(Sl. No-37994003725)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.80	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.27	-0.25	-0.21	Spare	Spare	Spare
Iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**B-PH(Sl. No-37994003635)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.80	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.28	-0.25	-0.22	Spare	Spare	Spare
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare

A.5 Current transformer (CT-765kV)

Location of CT : Bay 703 PCTT
Ratio Test Date : 02.02.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 29.11.2023

Sr No	R-PH(Sl. No-37994003178)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.26	-0.25	-0.25	Spare	-0.24	-0.24
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994003473)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.22	-0.24	-0.21	Spare	-0.24	-0.23
Iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994003721)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.22	-0.22	-0.19	Spare	-0.21	-0.21
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.6 Current transformer (CT-765kV)

Location of CT : Bay 703 MCTT
Ratio Test Date : 03.06.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 29.11.2023

Sr No	R-PH(Sl. No-37994004210)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	250/1A	250/1A	NA	NA	NA	NA
ii	Ratio measured	250	250	NA	NA	NA	NA
iii	error calculated	-0.45	-0.29	NA	NA	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA	NA
Sr No	**Y-PH(Sl. No-37994004205)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	250/1A	250/1A	NA	NA	NA	NA
ii	Ratio measured	250	250	NA	NA	NA	NA
iii	error calculated	-0.44	-0.46	NA	NA	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA	NA
Sr No	**B-PH(Sl. No-37994004208)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	250/1A	250/1A	NA	NA	NA	NA
ii	Ratio measured	250	250	NA	NA	NA	NA
iii	error calculated	-0.32	-0.29	NA	NA	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA	NA

A.7 Current transformer (CT-765kV)

Location of CT : Bay 704 CTR
Ratio Test Date : 06.02.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 06.06.2023

Sr No	R-PH(Sl. No-37994003274)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.27	-0.21	-0.22	Spare	-0.24	-0.24
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994002352)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.24	-0.26	-0.18	Spare	-0.26	-0.24
Iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994002376)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.21	-0.26	-0.3	Spare	-0.24	-0.22
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.8 Current transformer (CT-765kV)

Location of CT : Bay 705 CTDA
Ratio Test Date : 06.02.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 07.01.2023

Sr No	R-PH(Sl. No-37994002361)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.37	-0.37	-0.25	Spare	Spare	Spare
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**Y-PH(Sl. No-37994002354)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.16	-0.14	-0.21	Spare	Spare	Spare
Iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**B-PH(Sl. No-37994002377)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.4	-0.22	-0.2	Spare	Spare	Spare
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare

A.9 Current transformer (CT-765kV)

Location of CT : Bay 705 CTDB
Ratio Test Date : 07.02.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 07.01.2023

Sr No	R-PH(Sl. No-37994003173)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.3	-0.31	-0.24	Spare	Spare	Spare
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**Y-PH(Sl. No-37994003471)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.31	-0.3	-0.37	Spare	Spare	Spare
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**B-PH(Sl. No-37994003634)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.26	-0.26	-0.22	Spare	Spare	Spare
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	Spare	Spare

A.10 Current transformer (CT-765kV)

Location of CT : Bay 706 PCTT
Ratio Test Date : 09.02.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 07.01.2023

Sr No	R-PH(Sl. No-37994003726)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.26	-0.26	-0.23	Spare	-0.25	-0.25
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994002365)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.38	-0.36	-0.33	Spare	-0.31	-0.32
Iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994003633)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.27	-0.24	-0.21	Spare	-0.23	-0.19
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.11 Current transformer (CT-765kV)

Location of CT : Bay 706 MCTT
Ratio Test Date : 20.05.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 07.01.2023

Sr No	R-PH(Sl. No-37994004207)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	250/1A	250/1A	NA	NA	NA	NA
ii	Ratio measured	250	250	NA	NA	NA	NA
iii	error calculated	-0.29	-0.43	NA	NA	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA	NA
Sr No	**Y-PH(Sl. No-37994004206)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	250/1A	250/1A	NA	NA	NA	NA
ii	Ratio measured	250	250	NA	NA	NA	NA
iii	error calculated	-0.34	-0.2	NA	NA	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA	NA
Sr No	**B-PH(Sl. No-37994004209)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	250/1A	250/1A	NA	NA	NA	NA
ii	Ratio measured	250	250	NA	NA	NA	NA
iii	error calculated	-0.4	-0.27	NA	NA	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA	NA

A.12 Current transformer (CT-765kV)

Location of CT : Bay 707 MCTG
Ratio Test Date : 14.07.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 06.02.2023

Sr No	R-PH(Sl. No-37994004122)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.16	-0.15	NA	NA	NA
iv	Knee point voltage	Spare	NA	NA	NA	NA	NA
Sr No	**Y-PH(Sl. No-37994004123)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.18	-0.16	NA	NA	NA
Iv	Knee point voltage	Spare	NA	NA	NA	NA	NA
Sr No	**B-PH(Sl. No-37994004134)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.18	-0.18	NA	NA	NA
iv	Knee point voltage	Spare	NA	NA	NA	NA	NA

A.13 Current transformer (CT-765kV)

Location of CT : Bay 707 PCTG
Ratio Test Date : 04.05.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 09.02.2023

Sr No	R-PH(Sl. No-37994003723)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.21	-0.2	-0.28	Spare	-0.2	-0.2
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994003474)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.2	-0.19	-0.22	Spare	-0.17	-0.16
Iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994003470)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.18	-0.18	-0.3	Spare	-0.17	-0.16
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.14 Current transformer (CT-765kV)

Location of CT : Bay 708 CTDA
Ratio Test Date : 15.05.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 09.02.2023

Sr No	R-PH(Sl. No-37994003200)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	Spare	Spare
ii	Ratio measured	1699.60	1699.60	1699.60	Spare	Spare	Spare
iii	error calculated	-0.21	-0.15	-0.16	Spare	Spare	Spare
iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	Spare	Spare
Sr No	**Y-PH(Sl. No-37994002854)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	Spare	Spare
ii	Ratio measured	1699.60	1699.60	1699.60	Spare	Spare	Spare
iii	error calculated	-0.19	-0.2	-0.16	Spare	Spare	Spare
Iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	Spare	Spare
Sr No	**B-PH(Sl. No-37994002856)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	Spare	Spare
ii	Ratio measured	1699.60	1699.60	1699.60	Spare	Spare	Spare
iii	error calculated	-0.22	-0.22	-0.23	Spare	Spare	Spare
iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	Spare	Spare

A.15 Current transformer (CT-765kV)

Location of CT : Bay 708 CTDB
Ratio Test Date : 05.05.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 10.02.2023

Sr No	R-PH(Sl. No-37994003202)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.8	1799.60	1799	Spare	Spare	Spare
iii	error calculated	-0.24	-0.21	-0.17	Spare	Spare	Spare
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**Y-PH(Sl. No-37994002855)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.8	1799.60	1799.60	Spare	Spare	Spare
iii	error calculated	-0.21	-0.17	-0.15	Spare	Spare	Spare
Iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**B-PH(Sl. No-37994003176)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.8	1799.60	1799.60	Spare	Spare	Spare
iii	error calculated	-0.22	-0.17	-0.12	Spare	Spare	Spare
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare

A.16 Current transformer (CT-765kV)

Location of CT : Bay 709 PCTL
Ratio Test Date : 20.06.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 03.03.2021

Sr No	R-PH(Sl. No-37994003118)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.29	-0.28	-0.29	Spare	-0.26	-0.25
iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994003177)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core I**	**Core II**
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.23	-0.21	-0.18	Spare	-0.21	-0.21
Iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994007246)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core I**	**Core II**
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.18	-0.18	-0.16	Spare	-0.17	-0.16
iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.17 Current transformer (CT-765kV)

Location of CT : Bay 709 MCTL
Ratio Test Date : 13.07.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 26.11.2020

Sr No	R-PH(Sl. No-37994004119)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	Spare	NA	NA	NA
ii	Ratio measured	1599.60	1599.60	Spare	NA	NA	NA
iii	error calculated	-0.17	-0.14	Spare	NA	NA	NA
iv	Knee point voltage	NA	NA	Spare	NA	NA	NA
Sr No	**Y-PH(Sl. No-37994004128)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	Spare	NA	NA	NA
ii	Ratio measured	1599.60	1599.60	Spare	NA	NA	NA
iii	error calculated	-0.17	-0.16	Spare	NA	NA	NA
Iv	Knee point voltage	NA	NA	Spare	NA	NA	NA
Sr No	**B-PH(Sl. No-37994004125)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	Spare	NA	NA	NA
ii	Ratio measured	1599.60	1599.60	Spare	NA	NA	NA
iii	error calculated	-0.14	-0.13	Spare	NA	NA	NA
iv	Knee point voltage	NA	NA	Spare	NA	NA	NA

A.18 Current transformer (CT-765kV)

Location of CT : Bay 710 MCTG
Ratio Test Date : 13.07.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 05.01.2023

Sr No	R-PH(Sl. No-37994004126)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.21	-0.21	NA	NA	NA
iv	Knee point voltage	Spare	NA	NA	NA	NA	NA
Sr No	**Y-PH(Sl. No-37994004129)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.21	-0.21	NA	NA	NA
Iv	Knee point voltage	Spare	NA	NA	NA	NA	NA
Sr No	**B-PH(Sl. No-37994004121)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	Spare	1000/1A	1000/1A	NA	NA	NA
ii	Ratio measured	Spare	999.80	999.80	NA	NA	NA
iii	error calculated	Spare	-0.2	-0.21	NA	NA	NA
iv	Knee point voltage	Spare	NA	NA	NA	NA	NA

A.19 Current transformer (CT-765kV)

Location of CT : Bay 710 PCTG
Ratio Test Date : 06.05.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 04.01.2023

Sr No	R-PH(Sl. No-37994003120)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.19	-0.2	-0.16	Spare	-0.13	-0.16
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994003117)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.23	-0.22	-0.16	Spare	-0.18	-0.18
Iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994003172)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	999.80	1999.60	1999.60	Spare	1999.6	1999.6
iii	error calculated	-0.25	-0.24	-0.18	Spare	-0.19	-0.12
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.20 Current transformer (CT-765kV)

Location of CT : Bay 711 CTDA
Ratio Test Date : 12.05.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 06.01.2023

Sr No	R-PH(Sl. No-37994003199)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.25	-0.27	-0.21	Spare	Spare	Spare
iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	Spare	Spare
Sr No	**Y-PH(Sl. No-37994002362)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.22	-0.2	-0.19	Spare	Spare	Spare
Iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	Spare	Spare
Sr No	**B-PH(Sl. No-37994003201)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	Spare	Spare
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.25	-0.24	-0.24	Spare	Spare	Spare
iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	Spare	Spare

A.21 Current transformer (CT-765kV)

Location of CT : Bay 711 CTDB
Ratio Test Date : 11.05.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 06.01.2023

Sr No	R-PH(Sl. No-37994002328)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.80	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.26	-0.23	-0.27	Spare	Spare	Spare
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**Y-PH(Sl. No-37994003179)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.80	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.2	-0.19	-0.15	Spare	Spare	Spare
Iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare
Sr No	**B-PH(Sl. No-37994003724)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	1000/1A	2000/1A	2000/1A	Spare	Spare	Spare
ii	Ratio measured	999.80	1999.60	1999.60	Spare	Spare	Spare
iii	error calculated	-0.23	-0.25	-0.18	Spare	Spare	Spare
iv	Knee point voltage	KVP 1000V at 120mA	KVP 2000V at 30mA	NA	NA	Spare	Spare

A.22 Current transformer (CT-765kV)

Location of CT : Bay 712 PCTL
Ratio Test Date : 14.06.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 23.01.2021

Sr No	R-PH(Sl. No-37994007245)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.24	-0.23	-0.19	Spare	-0.22	-0.22
iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994002368)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core I**	**Core II**
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.26	-0.26	-0.25	Spare	-0.23	-0.25
Iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994002373)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core I**	**Core II**
i	Ratio Adopted	3000/1A	3000/1A	3000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.11	-0.11	-0.14	Spare	-0.12	-0.1
iv	Knee point voltage	KVP 3000V at 20mA	KVP 3000V at 20mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.23 Current transformer (CT-765kV)

Location of CT : Bay 712 MCTL
Ratio Test Date : 11.07.2015
Balance Testing (Tan-delta , IR & Winding Resistance) date : 25.01.2021

Sr No	R-PH(Sl. No-37994004130)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	Spare	NA	NA	NA
ii	Ratio measured	1599.60	1599.60	Spare	NA	NA	NA
iii	error calculated	-0.13	-0.13	Spare	NA	NA	NA
iv	Knee point voltage	NA	NA	Spare	NA	NA	NA
Sr No	**Y-PH(Sl. No-37994004127)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	Spare	NA	NA	NA
ii	Ratio measured	1599.60	1599.60	Spare	NA	NA	NA
iii	error calculated	-0.18	-0.17	Spare	NA	NA	NA
Iv	Knee point voltage	NA	NA	Spare	NA	NA	NA
Sr No	**B-PH(Sl. No-37994004133)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	2000/1A	2000/1A	Spare	NA	NA	NA
ii	Ratio measured	1599.60	1599.60	Spare	NA	NA	NA
iii	error calculated	-0.17	-0.15	Spare	NA	NA	NA
iv	Knee point voltage	NA	NA	Spare	NA	NA	NA

A.24 Current transformer (CT-765kV)

Location of CT : Bay 713 CTR
Ratio Test Date : 05.02.2016
Balance Testing (Tan-delta , IR & Winding Resistance) date : 14.12.2021

Sr No	R-PH(Sl. No-37994007243)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.58	-0.18	-0.28	Spare	-0.24	-0.16
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994007244)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core I**	**Core II**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.16	-0.14	-0.22	Spare	-0.14	-0.13
Iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994007239)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core I**	**Core II**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1999.60	1999.60	1999.60	Spare	1999.60	1999.60
iii	error calculated	-0.16	-0.2	-0.3	Spare	-0.15	-0.13
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.25 Current transformer (CT-765kV)

Location of CT : Bay 714 CTD
Ratio Test Date : 04.02.2016
Balance Testing (Tan-delta , IR & Winding Resistance) date : 14.12.2021

Sr No	R-PH(Sl. No-37994002371)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1799.60	1799.60	1799.60	Spare	1999.60	1999.60
iii	error calculated	-0.26	-0.21	-0.17	Spare	-0.16	-0.14
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**Y-PH(Sl. No-37994002373)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core I**	**Core II**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1799.60	1799.60	1799.60	Spare	1999.60	1999.60
iii	error calculated	-0.23	-0.17	-0.15	Spare	-0.16	-0.17
Iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA
Sr No	**B-PH(Sl. No-37994008752)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core I**	**Core II**
i	Ratio Adopted	2000/1A	2000/1A	2000/1A	Spare	3000/1A	3000/1A
ii	Ratio measured	1799.60	1799.60	1799.60	Spare	1999.60	1999.60
iii	error calculated	-0.18	-0.17	-0.12	Spare	-0.15	-0.16
iv	Knee point voltage	KVP 2000V at 30mA	KVP 2000V at 30mA	NA	NA	KVP 3000V at 20mA	KVP 3000V at 20mA

A.26 Current transformer (CT-220kV)

Location of CT : Bay 201 CT1T (PCT)
Ratio Test Date : 24.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 07.01.2023

Sr No	R-PH (Sl. No-1302F5045)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	1.27	0.88	0.13	SPARE	1.39	1.01
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-1302F5040)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0.63	0.63	-0.25	SPARE		
Iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-1302F5038)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0.25	0.5	0.13	SPARE	0.5	0.63
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.27 Current transformer (CT-220kV)

Location of CT : Bay 201 CT2T (MCT)
Ratio Test Date : 24.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 07.01.2023

Sr No	R-PH (Sl. No-1302F50867)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0	0.13	0.25	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-1302F5076)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0	0.13	0.25	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-1302F5075)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.25	0.13	0	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA

A.28 Current transformer (CT-220kV)

Location of CT : Bay 202 CT1T (PCT)
Ratio Test Date : 24.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 18.04.2024

Sr No	R-PH (Sl. No-1302F5052)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0.63	0.63	0.5	SPARE	0.25	0.5
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-1302F5058)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0	-0.12	-0.12	SPARE	0.71	-1.39
Iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-1302F5057)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	-0.25	0	0	SPARE	-0.23	-0.36
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.29 Current transformer (CT-220kV)

Location of CT : Bay 202 CT2T (MCT)
Ratio Test Date : 20.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 18.04.2024

Sr No	R-PH (Sl. No-1302F5081)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	-0.25	-0.12	-0.25	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-1302F5083)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	-0.25	-0.74	0	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-1302F5084)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.13	-0.25	-0.12	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA

A.30 Current transformer (CT-220kV)

Location of CT : Bay 203 CT1T (PCT)
Ratio Test Date : 24.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 16.04.2024

Sr No	R-PH (Sl. No-1302F5046)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	-0.12	0	-0.25	SPARE	0	0
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-1302F5048)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	1.01	0.5	0	SPARE	0.25	0.25
Iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-1302F5049)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	-0.25	0.63	0.25	SPARE	0.5	-0.12
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.31 Current transformer (CT-220kV)

Location of CT : Bay 203 CT2T (MCT)
Ratio Test Date : 23.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 16.04.2024

Sr No	R-PH (Sl. No-1302F5069)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0	0.13	0.25	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-1302F5068)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0	-0.12	0	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-1302F5082)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.13	0.25	0	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA

A.32 Current transformer (CT-220kV)

Location of CT : Bay 204 CT1T (PCT)
Ratio Test Date : 23.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 22.11.2023

Sr No	R-PH (Sl. No-1302F5053)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0.25	0.63	0.25	SPARE	0.5	-0.12
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-1302F5039)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0	-0.12	0.13	SPARE	0.63	0.63
Iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-1302F5044)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	-0.12	0	-0.25	SPARE	0	0
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.33 Current transformer (CT-220kV)

Location of CT : Bay 204 CT2T (MCT)
Ratio Test Date : 22.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 22.11.2023

Sr No	R-PH (Sl. No-1302F5070)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.13	0	-0.25	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-1302F5079)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.13	-0.25	0.63	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-1302F5078)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0	-0.25	0.25	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA

A.34 Current transformer (CT-220kV)

Location of CT : Bay 205 CT (PCT)
Ratio Test Date : 19.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 28.02.2024

Sr No	R-PH (Sl. No-1302F5042)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	SPARE	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	SPARE	640	SPARE	960	960
iii	error calculated	0.76	SPARE	0.25	SPARE	0.63	0.38
iv	Knee point voltage	KVP 800V at 45mA	SPARE	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-1302F5047)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	SPARE	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	SPARE	640	SPARE	960	960
iii	error calculated	-0.12	SPARE	-0.25	SPARE	0.63	0.25
Iv	Knee point voltage	KVP 800V at 45mA	SPARE	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-1302F5043)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	SPARE	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	SPARE	640	SPARE	960	960
iii	error calculated	-0.25	SPARE	-0.5	SPARE	1.01	1.14
iv	Knee point voltage	KVP 800V at 45mA	SPARE	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.35 Current transformer (CT-220kV)

Location of CT : Bay 206 CT1BC (PCT)
Ratio Test Date : 18.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 25.11.2023

Sr No	R-PH (Sl. No-1302F5063)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	1600/1A	2000/1A	1600/1A	2000/1A	2000/1A
ii	Ratio measured	960	1000	960	1000	1000
iii	error calculated	0.5	-0.2	-0.66	-0.2	-0.4
iv	Knee point voltage	KVP: 1600V at 32mA	KVP: 2000V at 20mA	NA	KVP: 2000V at 20mA	KVP: 2000V at 20mA
Sr No	**Y-PH (Sl. No-1302F5059)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	1600/1A	2000/1A	1600/1A	2000/1A	2000/1A
ii	Ratio measured	960	1000	960	1000	1000
iii	error calculated	0	-0.79	-0.5	-0.4	-0.2
Iv	Knee point voltage	KVP: 1600V at 32mA	KVP: 2000V at 20mA	NA	KVP: 2000V at 20mA	KVP: 2000V at 20mA
Sr No	**B-PH (Sl. No-1302F5060)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	1600/1A	2000/1A	1600/1A	2000/1A	2000/1A
ii	Ratio measured	960	1000	960	1000	1000
iii	error calculated	0	-0.2	-0.33	0	-0.4
iv	Knee point voltage	KVP: 1600V at 32mA	KVP: 2000V at 20mA	NA	KVP: 2000V at 20mA	KVP: 2000V at 20mA

A.36 Current transformer (CT-220kV)

Location of CT : Bay 206 CT2BC (PCT)
Ratio Test Date :
Balance Testing (Tan-delta , IR & Winding Resistance) date : 25.11.2023

Sr No	R-PH (Sl. No-1302F5061)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	1600/1A	2000/1A	1600/1A	2000/1A	2000/1A
ii	Ratio measured	960	1000	960	1000	1000
iii	error calculated	0.17	-0.99	-0.66	-0.99	0
iv	Knee point voltage	KVP: 1600V at 32mA	KVP: 2000V at 20mA	NA	KVP: 2000V at 20mA	KVP: 2000V at 20mA
Sr No	**Y-PH (Sl. No-1302F5064)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	1600/1A	2000/1A	1600/1A	2000/1A	2000/1A
ii	Ratio measured	960	1000	960	1000	1000
iii	error calculated	-0.66	-0.4	-0.5	0.2	-0.4
Iv	Knee point voltage	KVP: 1600V at 32mA	KVP: 2000V at 20mA	NA	KVP: 2000V at 20mA	KVP: 2000V at 20mA
Sr No	**B-PH (Sl. No-1302F5062)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	1600/1A	2000/1A	1600/1A	2000/1A	2000/1A
ii	Ratio measured	1100	1000	1100	1000	1000
iii	error calculated	-0.36	0.4	-0.65	-0.99	-1.19
iv	Knee point voltage	KVP: 1600V at 32mA	KVP: 2000V at 20mA	NA	KVP: 2000V at 20mA	KVP: 2000V at 20mA

A.37 Current transformer (CT-220kV)

Location of CT : Bay 207 CT1T (PCT)
Ratio Test Date : 14.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 08.10.2018

Sr No	R-PH (Sl. No-1302F5054)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0.63	0.76	0.63	SPARE	0.76	0.76
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-1302F5056)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated		0.76	0.38	SPARE	0.25	0.13
Iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-1302F5051)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	-0.12	-0.25	-0.37	SPARE	0.63	0.5
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.38 Current transformer (CT-220kV)

Location of CT : Bay 207 CT2T (MCT)
Ratio Test Date : 14.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 08.10.2018

Sr No	R-PH (Sl. No-37994000669)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	-0.62	0	0.13	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-1302F5073)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.38	0.25	0.76	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-1302F5072)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.13	0.13	0	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA

A.39 Current transformer (CT-220kV)

Location of CT : Bay 208 CT1T (PCT)
Ratio Test Date : 09.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 12.11.2021

Sr No	R-PH (Sl. No-1302F5041)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0.88	0.76	0.25	SPARE	0	0
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-1302F5050)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0.21	1.39	1.39	SPARE	1.01	1.14
Iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-1302F5055)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	800/1A	800/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	640	640	SPARE	960	960
iii	error calculated	0.63	0.13	-0.62	SPARE	1.39	1.39
iv	Knee point voltage	KVP 800V at 45mA	KVP: 800V at 45mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.40 Current transformer (CT-220kV)

Location of CT : Bay 208 CT2T (MCT)
Ratio Test Date : 15.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 12.11.2021

Sr No	R-PH (Sl. No-1302F5085)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.63	0.63	0.63	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-1302F5066)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	0.76	0.25	0.63	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-1302F5074)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	800/1A	800/1A	800/1A	NA	NA
ii	Ratio measured	640	640	640	NA	NA
iii	error calculated	1.27	1.39	1.39	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA

A.41 Current transformer (CT-220kV)

Location of CT : Bay 209 CT1T (PCT)
Ratio Test Date : 09.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 05.03.2018

Sr No	R-PH (Sl. No-37994000958)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	300/1A	300/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	240	240	SPARE	960	960
iii	error calculated	-0.12	-0.5	0	SPARE	2.3	1.39
iv	Knee point voltage	KVP 800V at 45mA	KVP: 300V at 120mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-37994000954)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	300/1A	300/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	240	240	SPARE	960	960
iii	error calculated	0	0	-0.74	SPARE	0	0.61
Iv	Knee point voltage	KVP 800V at 45mA	KVP: 300V at 120mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-37994000953)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	300/1A	300/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	240	240	SPARE	960	960
iii	error calculated	0.63	1.39	1.01	SPARE	-1.48	-1.48
iv	Knee point voltage	KVP 800V at 45mA	KVP: 300V at 120mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.42 Current transformer (CT-220kV)

Location of CT : Bay 209 CT2T (MCT)
Ratio Test Date : 09.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 05.03.2018

Sr No	R-PH (Sl. No-37994000678)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	300/1A	300/1A	SPARE	NA	NA
ii	Ratio measured	240	240	SPARE	NA	NA
iii	error calculated	1.01	0.5	SPARE	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-37994000680)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	300/1A	300/1A	SPARE	NA	NA
ii	Ratio measured	240	240	SPARE	NA	NA
iii	error calculated	-0.25	0.88	SPARE	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-37994000677)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	300/1A	300/1A	SPARE	NA	NA
ii	Ratio measured	240	240	SPARE	NA	NA
iii	error calculated	-0.62	-0.25	SPARE	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA

A.43 Current transformer (CT-220kV)

Location of CT : Bay 210 CT1T (PCT)
Ratio Test Date : 09.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 26.02.2018

Sr No	R-PH (Sl. No-37994000956)	Core I	Core II	Core III	Core IV	Core V	Core VI
i	Ratio Adopted	800/1A	300/1A	300/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	240	240	SPARE	960	960
iii	error calculated	0.13	0.13	-0.62	SPARE	-0.12	0.31
iv	Knee point voltage	KVP 800V at 45mA	KVP: 300V at 120mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**Y-PH (Sl. No-37994000955)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	300/1A	300/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	240	240	SPARE	960	960
iii	error calculated	0.25	-0.62	-0.12	SPARE	1.44	1.44
Iv	Knee point voltage	KVP 800V at 45mA	KVP: 300V at 120mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA
Sr No	**B-PH (Sl. No-37994000957)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**	**Core VI**
i	Ratio Adopted	800/1A	300/1A	300/1A	SPARE	1200/1A	1200/1A
ii	Ratio measured	640	240	240	SPARE	960	960
iii	error calculated	0.63	-1.11	-1.11	SPARE	1.29	1.29
iv	Knee point voltage	KVP 800V at 45mA	KVP: 300V at 120mA	NA	NA	KVP: 1200V at 30mA	KVP: 1200V at 30mA

A.44 Current transformer (CT-220kV)

Location of CT : Bay 210 CT2T (MCT)
Ratio Test Date : 09.01.2014
Balance Testing (Tan-delta , IR & Winding Resistance) date : 26.02.2018

Sr No	R-PH (Sl. No-37994000681)	Core I	Core II	Core III	Core IV	Core V
i	Ratio Adopted	300/1A	300/1A	SPARE	NA	NA
ii	Ratio measured	240	240	SPARE	NA	NA
iii	error calculated	1.01	0.5	SPARE	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**Y-PH (Sl. No-37994000679)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	300/1A	300/1A	SPARE	NA	NA
ii	Ratio measured	240	240	SPARE	NA	NA
iii	error calculated	-0.25	0.88	SPARE	NA	NA
Iv	Knee point voltage	NA	NA	NA	NA	NA
Sr No	**B-PH (Sl. No-37994000675)**	**Core I**	**Core II**	**Core III**	**Core IV**	**Core V**
i	Ratio Adopted	300/1A	300/1A	SPARE	NA	NA
ii	Ratio measured	240	240	SPARE	NA	NA
iii	error calculated	-0.62	-0.25	SPARE	NA	NA
iv	Knee point voltage	NA	NA	NA	NA	NA

A.45 Current transformer (CT-220kV)

Location of CT : ST #01 (HVBCT)
Ratio Test Date : 28.02.2014

Sr No	R-PH	Core I	Core II	Core III	Core IV
I	Ratio Adopted	600/1A	600/1A	600/1A	NA
Ii	Ratio measured	480	480	480	NA
Iii	error calculated	-0.1	-0.5	-0.1	NA
Iv	Knee point voltage	KVP : 600 at 100ma	KVP : 600 at 100ma	KVP : 600 at 100ma	NA
Sr No	**Y-PH**	**Core I**	**Core II**	**Core III**	**Core IV**
I	Ratio Adopted	600/1A	600/1A	600/1A	
Ii	Ratio measured	480	480	480	236
Iii	error calculated	0.4	-0.2	-0.1	-0.3
Iv	Knee point voltage	KVP : 600 at 100ma	KVP : 600 at 100ma	KVP : 600 at 100ma	NA
Sr No	**B-PH**	**Core I**	**Core II**	**Core III**	**Core IV**
I	Ratio Adopted	600/1A	600/1A	600/1A	NA
Ii	Ratio measured	480	480	480	NA
Iii	error calculated	-0.4	-0.4	-0.4	NA
iv	Knee point voltage	KVP : 600 at 100ma	KVP : 600 at 100ma	KVP : 600 at 100ma	NA

A.46 Current transformer (CT-220kV)

Location of CT : ST #02 (HVBCT)
Ratio Test Date : 28.05.2015

Sr No	R-PH	Core I	Core II	Core III	Core IV
i	Ratio Adopted	600/1A	600/1A	600/1A	NA
ii	Ratio measured	480	480	480	NA
iii	error calculated	-0.25	-0.375	-0.25	NA
iv	Knee point voltage	KVP : 600 at 100ma	KVP : 600 at 100ma	KVP : 600 at 100ma	NA
Sr No	**Y-PH**	**Core I**	**Core II**	**Core III**	**Core IV**
i	Ratio Adopted	600/1A	600/1A	600/1A	
ii	Ratio measured	480	480	480	236
iii	error calculated	-0.25	-1	-0.125	1.597
Iv	Knee point voltage	KVP : 600 at 100ma	KVP : 600 at 100ma	KVP : 600 at 100ma	NA
Sr No	**B-PH**	**Core I**	**Core II**	**Core III**	**Core IV**
i	Ratio Adopted	600/1A	600/1A	600/1A	NA
ii	Ratio measured	480	480	480	NA
iii	error calculated	-0.125	-0.75	-0.125	NA
iv	Knee point voltage	KVP : 600 at 100ma	KVP : 600 at 100ma	KVP : 600 at 100ma	NA

A.47 Current transformer (CT-765kV)

Location of CT : ICT #01 (BCT)

Ratio Test Date : May-2015

Sr No	R-PH	1.1 Core I	1.1 Core II	1.1 Core III	1.2 Core I	1.2 Core II	2.1 Core I	2.1 Core II	2.1 Core III	3.1 Core 1
i	Ratio Adopted	2000/1A	2000/1A	1000/1A	1000/1A	1000/1A	1000/1A	1000/1A	1000/1A	200/1
ii	Ratio measured	250	250	250	1000	1000	800	800	800	160
iii	error calculated	0.81	-0.79	0	-0.99	-1.15	-0.62	-1.98	-0.25	-1.69
iv	Knee point voltage	KVP : 2000 at 30mA	KVP : 2000 at 30mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 200 at 250mA
Sr No	**Y-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.2 Core I**	**1.2 Core II**	**2.1 Core I**	**2.1 Core II**	**2.1 Core III**	**3.1 Core 1**
i	Ratio Adopted	600/1A	600/1A	600/1A	1000/1A	1000/1A	1000/1A	1000/1A	1000/1A	200/1
ii	Ratio measured	250	250	250	1000	1000	800	800	800	160
iii	error calculated	1.59	1.59	1.59	0.1	0.3	-0.12	-0.12	0	-0.25
Iv	Knee point voltage	KVP : 2000 at 30mA	KVP : 2000 at 30mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 200 at 250mA
Sr No	**B-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.2 Core I**	**1.2 Core II**	**2.1 Core I**	**2.1 Core II**	**2.1 Core III**	**3.1 Core 1**
i	Ratio Adopted	600/1A	600/1A	600/1A	1000/1A	1000/1A	1000/1A	1000/1A	1000/1A	200/1
ii	Ratio measured	250	250	250	600	600	800	800	800	160
iii	error calculated	-0.8	-0.8	-1.2	0.099	0.299	0.49	0.624	0.49	-1.53
iv	Knee point voltage	KVP : 2000 at 30mA	KVP : 2000 at 30mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 200 at 250mA

A.48 Current transformer (CT-765kV)

Location of CT : ICT #02 (BCT)
Ratio Test Date : July-2015

Sr No	R-PH	1.1 Core I	1.1 Core II	1.1 Core III	1.2 Core I	1.2 Core II	2.1 Core I	2.1 Core II	2.1 Core III	3.1 Core 1
i	Ratio Adopted	2000/1A	2000/1A	1000/1A	1000/1A	1000/1A	1000/1A	1000/1A	1000/1A	200/1
ii	Ratio measured	250	250	250	1000	1000	800	800	800	160
iii	error calculated	0.397	0	0.398	-0.1	0	0.249	0.249	0.125	-0.1
iv	Knee point voltage	KVP : 2000 at 30mA	KVP : 2000 at 30mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 200 at 250mA
Sr No	**Y-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.2 Core I**	**1.2 Core II**	**2.1 Core I**	**2.1 Core II**	**2.1 Core III**	**3.1 Core 1**
i	Ratio Adopted	600/1A	600/1A	600/1A	1000/1A	1000/1A	1000/1A	1000/1A	1000/1A	200/1
ii	Ratio measured	250	250	250	1000	1000	800	800	800	160
iii	error calculated	-0.4	-0.4	0	0	0.1	0.249	0.124	-0.125	0.873
Iv	Knee point voltage	KVP : 2000 at 30mA	KVP : 2000 at 30mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 200 at 250mA
Sr No	**B-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.2 Core I**	**1.2 Core II**	**2.1 Core I**	**2.1 Core II**	**2.1 Core III**	**3.1 Core 1**
i	Ratio Adopted	600/1A	600/1A	600/1A	1000/1A	1000/1A	1000/1A	1000/1A	1000/1A	200/1
ii	Ratio measured	250	250	250	600	600	800	800	800	160
iii	error calculated	-0.403	-0.403	0.4	0.331	0.331	1.356	0.99	1.235	1.062
iv	Knee point voltage	KVP : 2000 at 30mA	KVP : 2000 at 30mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 1000 at 60mA	KVP : 200 at 250mA

A.49 Current transformer (CT-765kV)

Location of CT : BR #01 (BCT)
Ratio Test Date : Mar-2016

Sr No	R-PH	1.1 Core I	1.1 Core II	1.1 Core III	1.1 Core IV	1.N Core II	1.N Core III	1.N Core IV	1.N Core V
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	Spare	2000/1A	2000/1A
ii	Ratio measured	300	300	300	300	273	Spare	276	2000
iii	error calculated	0.2	0.1	0.5	0.74	0.11	Spare	0.72	0.36
iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA
Sr No	**Y-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.1 Core IV**	**1.N Core II**	**1.N Core III**	**1.N Core IV**	**1.N Core V**
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	Spare	2000/1A	2000/1A
ii	Ratio measured	300	300	300	300	271	Spare	271	271
iii	error calculated	-0.81	-0.3	-1.27	-1.27	1.38	Spare	-1.12	0.37
Iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA
Sr No	**B-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.1 Core IV**	**1.N Core II**	**1.N Core III**	**1.N Core IV**	**1.N Core V**
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	Spare	2000/1A	2000/1A
ii	Ratio measured	298	298	298	298	270	Spare	270	270
iii	error calculated	1.06	0.96	1.16	0.91	-0.9	Spare	0.74	0.74
iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA

A.50 Current transformer (CT-765kV)

Location of CT : BR #02 (BCT)
Ratio Test Date : Dec-2021

Sr No	R-PH	1.1 Core I	1.1 Core II	1.1 Core III	1.1 Core IV	1.N Core II	1.N Core III	1.N Core IV	1.N Core V
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	Spare	2000/1A	2000/1A
ii	Ratio measured	300	300	600	600	300	Spare	1200	1200
iii	error calculated	-0.301	-0.2	-0.629	-0.503	-0.402	Spare	-0.334	-0.334
iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA
Sr No	**Y-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.1 Core IV**	**1.N Core II**	**1.N Core III**	**1.N Core IV**	**1.N Core V**
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	Spare	2000/1A	2000/1A
ii	Ratio measured	300	300	500	500	271	Spare	1200	1200
iii	error calculated	-0.4	0	-0.25	-0.1	-0.9	Spare	-0.33	-0.33
Iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA
Sr No	**B-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.1 Core IV**	**1.N Core II**	**1.N Core III**	**1.N Core IV**	**1.N Core V**
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	Spare	2000/1A	2000/1A
ii	Ratio measured	300	300	600	600	300	Spare	1200	1200
iii	error calculated	0.17	0.01	0.05	0.05	0.2	Spare	0.16	0.17
iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA

A.51 Current transformer (CT-765kV)

Location of CT : LR #01 (BCT)
Ratio Test Date : Mar-2016

Sr No	R-PH	1.1 Core I	1.1 Core II	1.1 Core III	1.1 Core IV	1.N Core II	1.N Core III	1.N Core IV	1.N Core V
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	300/1A	2000/1A	2000/1A
ii	Ratio measured	301	301	299	299	270	270	270	270
iii	error calculated	1.15	1.25	0.83	0.33	0.99	0.99	0.74	-1.5
iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA
Sr No	**Y-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.1 Core IV**	**1.N Core II**	**1.N Core III**	**1.N Core IV**	**1.N Core V**
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	300/1A	2000/1A	2000/1A
ii	Ratio measured	299	299	299	299	271	271	271	271
iii	error calculated	1.42	1.22	0.83	0.33	-1.73	-1.61	0.37	1.81
Iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA
Sr No	**B-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.1 Core IV**	**1.N Core II**	**1.N Core III**	**1.N Core IV**	**1.N Core V**
i	Ratio Adopted	300/1A	300/1A	750/1A	750/1A	300/1A	300/1A	2000/1A	2000/1A
ii	Ratio measured	303	303	303	303	269	269	269	269
iii	error calculated	0.59	0	0.49	0.25	0.44	-0.11	-1.13	0.37
iv	Knee point voltage	KVp :300 at 200mA	KVp :300 at 200mA	NA	NA	KVp :300 at 200mA	KVp :300 at 200mA	KVp :3000 at 20mA	KVp :3000 at 20mA

A.52 Current transformer (CT-765kV)

Location of CT : GT #02 (BCT)

Ratio Test Date : Dec-2015

Sr No	R-PH	1.1 Core I	1.1 Core II	1.1 Core III	1.2 Core I	1.2 Core II	2.1 Core I	2.2 Core I
i	Ratio Adopted	1000/1A	1000/1A	2000/1A	1000/1A	1000/1A	15000/5A	15000/5A
ii	Ratio measured	1006	1006	2000	1000	1000	2996	2996
iii	error calculated	0.399	0.399	-0.399	0.1	-0.1	-1.891	-1.891
iv	Knee point voltage	VK/2 : 50Rct +110 at 30mA	VK/2 : 10Rct +50 at 30mA	KVP : 1000 at 60mA	-	VK/2 : 10Rct +50 at 30mA	VK/2 : 250Rct +500 at 150mA	VK/2 : 250Rct +500 at 150mA
Sr No	**Y-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.2 Core I**	**1.2 Core II**	**2.1 Core I**	**2.2 Core I**
i	Ratio Adopted	1000/1A	1000/1A	2000/1A	1000/1A	1000/1A	15000/5A	15000/5A
ii	Ratio measured	1006	1006	2000	1000	1000	2996	2996
iii	error calculated	0.38	0.37	-0.390	0.1	-0.1	0.891	-0.99s
Iv	Knee point voltage	VK/2 : 50Rct +110 at 30mA	VK/2 : 10Rct +50 at 30mA	KVP : 1000 at 60mA	-	VK/2 : 10Rct +50 at 30mA	VK/2 : 250Rct +500 at 150mA	VK/2 : 250Rct +500 at 150mA
Sr No	**B-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.2 Core I**	**1.2 Core II**	**2.1 Core I**	**2.2 Core I**
i	Ratio Adopted	1000/1A	1000/1A	2000/1A	1000/1A	1000/1A	15000/5A	15000/5A
ii	Ratio measured	1002	998	2000	996	996	2390	2398
iii	error calculated	0.29	2.25	-0.3	0.7	0.7	0.91	0.91
iv	Knee point voltage	VK/2 : 50Rct +110 at 30mA	VK/2 : 10Rct +50 at 30mA	KVP : 1000 at 60mA	-	VK/2 : 10Rct +50 at 30mA	VK/2 : 250Rct +500 at 150mA	VK/2 : 250Rct +500 at 150mA

A.53 Current transformer (CT-765kV)

Location of CT : GT #03 (BCT)

Ratio Test Date : Dec-2015

Sr No	R-PH	1.1 Core I	1.1 Core II	1.1 Core III	1.2 Core I	1.2 Core II	2.1 Core I	2.2 Core I
i	Ratio Adopted	1000/1A	1000/1A	2000/1A	1000/1A	1000/1A	15000/5A	15000/5A
ii	Ratio measured	994	994	2000	1004	1004	2996	2970
iii	error calculated	-0.501	-0.799	0.2	-0.1	0	-2.187	3.06
iv	Knee point voltage	VK/2 : 50Rct +110 at 30mA	VK/2 : 10Rct +50 at 30mA	KVP : 1000 at 60mA	-	VK/2 : 10Rct +50 at 30mA	VK/2 : 250Rct +500 at 150mA	VK/2 : 250Rct +500 at 150mA
Sr No	**Y-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.2 Core I**	**1.2 Core II**	**2.1 Core I**	**2.2 Core I**
i	Ratio Adopted	1000/1A	1000/1A	2000/1A	1000/1A	1000/1A	15000/5A	15000/5A
ii	Ratio measured	996	996	2000	1000	1000	2996	2970
iii	error calculated	-0.698	-0.797	-1.588	0.2004	0.2	-2.187	3.06
Iv	Knee point voltage	VK/2 : 50Rct +110 at 30mA	VK/2 : 10Rct +50 at 30mA	KVP : 1000 at 60mA	-	VK/2 : 10Rct +50 at 30mA	VK/2 : 250Rct +500 at 150mA	VK/2 : 250Rct +500 at 150mA
Sr No	**B-PH**	**1.1 Core I**	**1.1 Core II**	**1.1 Core III**	**1.2 Core I**	**1.2 Core II**	**2.1 Core I**	**2.2 Core I**
i	Ratio Adopted	1000/1A	1000/1A	2000/1A	1000/1A	1000/1A	15000/5A	15000/5A
ii	Ratio measured	1002	998	2000	1000	1000	2406	2400
iii	error calculated	0.29	0.9	-0.3	0.39	0.29	1.77	0.31
iv	Knee point voltage	VK/2 : 50Rct +110 at 30mA	VK/2 : 10Rct +50 at 30mA	KVP : 1000 at 60mA	-	VK/2 : 10Rct +50 at 30mA	VK/2 : 250Rct +500 at 150mA	VK/2 : 250Rct +500 at 150mA

B.1 Potential transformer (CVT-765kV)

Location of PT : Bay 701 CVTG Ratio Test Date : 18.03.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 28.11.2023

Sr No	R-PH (Sl. No-37992003169)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.23	0.28	0.18
Sr No	**Y-PH (Sl. No-37992003168)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.48	0.53	0.53
Sr No	**B-PH (Sl. No-37992003167)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.33	0.28	0.33

B.2 Potential transformer (CVT-765kV)

Location of PT : Bay 703 CVTT Ratio Test Date : 09.05.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 29.11.2023

Sr No	R-PH (Sl. No-37992002895)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.694	-0.906	Spare
Sr No	**Y-PH (Sl. No-37992002893)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.623	-0.906	Spare
Sr No	**B-PH (Sl. No-37992002894)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	0.0064	-0.906	Spare

B.3 Potential transformer (CVT-765kV)

Location of PT : Bay 706 CVTT Ratio Test Date : 09.05.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 14.01.2023

Sr No	R-PH (Sl. No-37992002891)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.694	-0.906	Spare
Sr No	**Y-PH (Sl. No-37992002892)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.623	-0.906	Spare
Sr No	**B-PH (Sl. No-37992002890)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.694	-0.906	Spare

B.4 Potential transformer (CVT-765kV)

Location of PT : Bay 707 CVTG Ratio Test Date : 13.07.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 06.02.2023

Sr No	R-PH (Sl. No-37992003214)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.482	-0.482	-0.412
Sr No	**Y-PH (Sl. No-37992003215)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.272	-0.412	-0.482
Sr No	**B-PH (Sl. No-37992003221)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.482	-0.412	-0.342

B.5 Potential transformer (CVT-765kV)

Location of PT : Bay 709 CVTL Ratio Test Date : 01.08.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 27.11.2020

Sr No	R-PH (Sl. No-37992002704)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.481	-0.482	-0.412
Sr No	**Y-PH (Sl. No-37992003194)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.273	-0.412	-0.482
Sr No	**B-PH (Sl. No-37992003192)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.482	-0.412	-0.341

B.6 Potential transformer (CVT-765kV)

Location of PT : Bay 709 MCVTL Ratio Test Date : 31.07.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 27.11.2020

Sr No	R-PH (Sl. No-37992002889)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.553	-0.482	Spare
Sr No	**Y-PH (Sl. No-37992002896)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.272	-0.412	Spare
Sr No	**B-PH (Sl. No-37992002886)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.482	-0.412	Spare

B.7 Potential transformer (CVT-765kV)

Location of PT : Bay 710 CVTG   Ratio Test Date : 13.07.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 17.01.2023

Sr No	R-PH (Sl. No-37992003219)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.482	-0.342	-0.412
Sr No	**Y-PH (Sl. No-37992003220)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.342	-0.412	-0.482
Sr No	**B-PH (Sl. No-37992003218)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.482	-0.412	-0.342

B.8 Potential transformer (CVT-765kV)

Location of PT : Bay 712 CVTL   Ratio Test Date : 01.08.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 25.11.2020

Sr No	R-PH (Sl. No-37992002703)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.482	-0.482	-0.412
Sr No	**Y-PH (Sl. No-37992003193)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.272	-0.412	-0.482
Sr No	**B-PH (Sl. No-37992000016)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	-0.482	-0.412	-0.342

B.9 Potential transformer (CVT-765kV)

Location of PT : Bay 712 MCVTL Ratio Test Date : 01.08.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 25.11.2020

Sr No	R-PH (Sl. No-37992002884)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.482	-0.482	Spare
Sr No	**Y-PH (Sl. No-37992002887)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.412	-0.482	Spare
Sr No	**B-PH (Sl. No-37992002888)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	Spare
iii	Error Calculated	-0.482	-0.412	Spare

B.10 Potential transformer (CVT-765kV)

Location of PT : 7BB1 CVT Ratio Test Date : 17.03.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 09.12.2021

Sr No	R-PH (Sl. No-37992003217)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.28	0.28	0.28
Sr No	**Y-PH (Sl. No-37992003170)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.43	0.38	0.43
Sr No	**B-PH (Sl. No-37992003216)**	**Core Is**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.33	0.28	0.33

B.11 Potential transformer (CVT-765kV)

Location of PT : 7BB2 CVT   Ratio Test Date : 18.03.2015

Balance Testing (Tan-delta , IR & Winding Resistance) date : 08.12.2021

Sr No	R-PH (Sl. No-37992003164)	Core I	Core II	Core III
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.33	0.28	0.33
Sr No	**Y-PH (Sl. No-37992003165)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.28	0.33	0.28
Sr No	**B-PH (Sl. No-37992003166)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
ii	Ratio Measured	765kV/√3/110V/√3	765kV/√3/110V/√3	765kV/√3/110V/√3
iii	Error Calculated	0.63	0.43	0.53

B.12 Potential transformer (CVT-220kV)

Location of PT : 202 CVT   Ratio Test Date : 21.01.2014

Balance Testing (Tan-delta , IR & Winding Resistance) date : 08.04.2024

Sr No	R-PH (Sl. No-1303A0398)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.4	0.2	0
Sr No	**Y-PH (Sl. No-1303A0392)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0.4	0.2
Sr No	**B-PH (Sl. No-1303A0381)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0	0.4

B.13 Potential transformer (CVT-220kV)

Location of PT : 203 CVT Ratio Test Date : 21.01.2014

Balance Testing (Tan-delta , IR & Winding Resistance) date : 16.04.2024

Sr No	R-PH (Sl. No-1303A0387)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0
Sr No	**Y-PH (Sl. No-1303A0397)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0
Sr No	**B-PH (Sl. No-1303A0395)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0

B.14 Potential transformer (CVT-220kV)

Location of PT : 207 CVT Ratio Test Date : 16.01.2014

Balance Testing (Tan-delta , IR & Winding Resistance) date : 08.10.2018

Sr No	R-PH (Sl. No-1303A0384)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0.2	0.4
Sr No	**Y-PH (Sl. No-1303A0383)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0.2	0.2
Sr No	**B-PH (Sl. No-1303A0389)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0	0

B.15 Potential transformer (CVT-220kV)

Location of PT : 208 CVT Ratio Test Date : 16.01.2014

Balance Testing (Tan-delta , IR & Winding Resistance) date : 12.11.2021

Sr No	R-PH (Sl. No-1303A0394)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	-0.2	0
Sr No	**Y-PH (Sl. No-1303A0388)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	-0.2	-0.2	0
Sr No	**B-PH (Sl. No-1303A0390)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0.4	0.2

B.16 Potential transformer (CVT-220kV)

Location of PT : 2BB1 CVT Ratio Test Date : 20.01.2014

Balance Testing (Tan-delta , IR & Winding Resistance) date : 16.01.2023

Sr No	R-PH (Sl. No-1303A0399)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0
Sr No	**Y-PH (Sl. No-1303A0369)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0
Sr No	**B-PH (Sl. No-1303A0385)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0

B.17 Potential transformer (CVT-220kV)

Location of PT : 2BB2 CVT   Ratio Test Date : 20.01.2014

Balance Testing (Tan-delta , IR & Winding Resistance) date : 25.11.2023

Sr No	R-PH (Sl. No-1303A0391)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0
Sr No	**Y-PH (Sl. No-1303A0382)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0
Sr No	**B-PH (Sl. No-1303A0393)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0

B.18 Potential transformer (EMVT-220kV)

Location of PT : 201 EMVT   Ratio Test Date : 30.01.2014

Balance Testing (Tan-delta , IR & Winding Resistance) date : 30.01.2014

Sr No	R-PH (Sl. No-OP4712/1R/21/13)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0
Sr No	**Y-PH (Sl. No-OP4712/1R/23/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	-0.2	-0.2
Sr No	**B-PH (Sl. No-OP4712/1R/13/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	-0.2	0	-0.4

B.19 Potential transformer (EMVT-220kV)

Location of PT : 202 EMVT Ratio Test Date : 30.01.2014

Balance Testing (Tan-delta , IR & Winding Resistance) date : 30.01.2014

Sr No	R-PH (Sl. No-OP4712/1R/18/13)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	0	-0.2	Spare
Sr No	**Y-PH (Sl. No-OP4712/1R/15/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	0	-0.2	Spare
Sr No	**B-PH (Sl. No-OP4712/1R/02/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	-0.2	-0.2	Spare

B.20 Potential transformer (EMVT-220kV)

Location of PT: 203 EMVT Ratio Test Date: 30.01.2014

Balance Testing (Tan-delta, IR & Winding Resistance) date: 30.01.2014

Sr No	R-PH (Sl. No-OP4712/1R/20/13)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	0	0	Spare
Sr No	**Y-PH (Sl. No-OP4712/1R/25/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	-0.2	-0.4	Spare
Sr No	**B-PH (Sl. No-OP4712/1R/04/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	-0.2	0	Spare

B.21 Potential transformer (EMVT-220kV)

Location of PT: 204 EMVT Ratio Test Date: 22.01.2014

Balance Testing (Tan-delta, IR & Winding Resistance) date: 23.11.2023

Sr No	R-PH (SI. No-OP4712/1/14/13)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	-0.4	-0.6
Sr No	**Y-PH (SI. No-OP4712/1/24/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0
Sr No	**B-PH (SI. No-OP4712/1/11/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	-0.2	0

B.22 Potential transformer (EMVT-220kV)

Location of PT: 207 EMVT Ratio Test Date: 18.01.2014

Balance Testing (Tan-delta, IR & Winding Resistance) date: 16.01.2014

Sr No	R-PH (SI. No-OP4712/1/08/13)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	0.2	0.2	Spare
Sr No	**Y-PH (SI. No-OP4712/1/17/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	0	0.4	Spare
Sr No	**B-PH (SI. No-OP4712/1/05/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	-0.2	0	Spare

B.23 Potential transformer (EMVT-220kV)

Location of PT: 208 EMVT — Ratio Test Date: 15.01.2014

Balance Testing (Tan-delta, IR & Winding Resistance) date: 15.01.2014

Sr No	R-PH (Sl. No-OP4712/1/07/13)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	0.67	0.33	Spare
Sr No	**Y-PH (Sl. No-OP4712/1/06/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	-0.33	-0.67	Spare
Sr No	**B-PH (Sl. No-OP4712/1/01/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	Spare
iii	Error Calculated	0	0.33	Spare

B.24 Potential transformer (EMVT-220kV)

Location of PT: 209 EMVT — Ratio Test Date: 14.01.2014

Balance Testing (Tan-delta, IR & Winding Resistance) date: 14.01.2014

Sr No	R-PH (Sl. No-OP4712/1/09/13)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	YES	YES	YES
Sr No	**Y-PH (Sl. No-OP4712/1/10/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0	0.2
Sr No	**B-PH (Sl. No-OP4712/1/12/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0.2	0.2

B.25 Potential transformer (EMVT-220kV)

Location of PT: 210 EMVT Ratio Test Date: 14.01.2014

Balance Testing (Tan-delta, IR & Winding Resistance) date: 14.01.2014

Sr No	R-PH (Sl. No-OP4712/1/22/13)	Core I	Core II	Core III
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0.2	0	0
Sr No	**Y-PH (Sl. No-OP4712/1/19/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	-0.2	0
Sr No	**B-PH (Sl. No-OP4712/1/16/13)**	**Core I**	**Core II**	**Core III**
i	Ratio Adopted	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
ii	Ratio Measured	220kV/√3/110V/√3	220kV/√3/110V/√3	220kV/√3/110V/√3
iii	Error Calculated	0	0	0

3) Availability of Protection System

A) Bus Bar relay

Sr No.		765kV	220kV
i)	Make and Model of Bus Bar relay	Make- Schneider, Model -P743 & P741	Make- Schneider, Model -P743 & P741
ii)	Whether stability checks done or not	Done	Done
iii)	Date of testing	May-2016	Feb-2014
iv)	Remarks (if any)	Tested During Commissioning Only.	Tested During Commissioning Only.

B) Sub-station protection and monitoring Equipment

Sr No.	System	LBB (Make & Model)	Functional (Yes / No)	Date of last testing	Event Logger (Make & Model)	Functional (Yes / No)	Syn. Facility Available or not	Syn. Check Relay (Make and Model)	Setting of Syn. check Relay
i)	GT Bay	Make-Schneider, Model -P141	Yes	Feb-2015	Each protection Relay is having own Event logger as inbuilt function. However common Event logger is having in SAS.	Yes	Yes	Make-Schneider, Model -C264	1.) Voltage Threshold: 10% 2.)Phase Angle Threshold: 20 Degree 3.)Frequency Threshold: 0.45%
II)	ICT Bay	Make-Schneider, Model -P141	Yes	Feb-2015	Each protection Relay is having own Event logger as inbuilt function. However common Event logger is having in SAS.	Yes	Yes	Make-Schneider, Model -C264	1.) Voltage Threshold: 10% 2.)Phase Angle Threshold: 20 Degree 3.)Frequency Threshold: 0.45%
iii)	Bus Reactor Bay	Make-Schneider, Model -P141	Yes	Feb-2015	Each protection Relay is having own Event logger as inbuilt function. However common Event logger is having in SAS.	Yes	Yes	Make-Schneider, Model -C264	1.) Voltage Threshold: 10% 2.)Phase Angle Threshold: 20 Degree 3.)Frequency Threshold: 0.45%

IV)	Line Reactor Bay	Make-Schneider, Model -P643	Yes	Feb-2015	Each protection Relay is having own Event logger as inbuilt function. However common Event logger is having in SAS.	Yes	Yes	Make-Schneider, Model -C264	1.) Voltage Threshold: 10% 2.)Phase Angle Threshold: 20 Degree 3.)Frequency Threshold: 0.45%
V)	765kV Line Bay	Make-Schneider, Model -P141	Yes	Feb-2015	Each protection Relay is having own Event logger as inbuilt function. However common Event logger is having in SAS.	Yes	Yes	Make-Schneider, Model -C264	1.) Voltage Threshold: 10% 2.)Phase Angle Threshold: 20 Degree 3.)Frequency Threshold: 0.45%
VI)	Tie Bay	Make-Schneider, Model -P141	Yes	Feb-2015	Each protection Relay is having own Event logger as inbuilt function. However common Event logger is having in SAS.	Yes	Yes	Make-Schneider, Model -C264	1.) Voltage Threshold: 10% 2.)Phase Angle Threshold: 20 Degree 3.)Frequency Threshold: 0.45%
VII)	220kV all Bay	Make-Schneider, Model -P141	Yes	Jan-2014	Each protection Relay is having own Event logger as inbuilt function. However common Event logger is having in SAS.	Yes	Yes	Make-Schneider, Model -C264	1.) Voltage Threshold: 10% 2.)Phase Angle Threshold: 20 Degree 3.)Frequency Threshold: 0.45%

C) Transmission Line Protection

Sr No.	Name of Line	LBB Protection (Make and Model)	Functional (Yes / No)	Date of testing	PLCC/ Protection coupler/FOTE (Make and Model)	Functional (Yes / No)	DR (Make & Model)	Functional (Yes / No)
i)	Line-1 220kV (Kalyanpura Ckt #01)	Make-Schneider, Model -P141	Yes	Jan-2014	FOTE Make- Commtel with SDH and PDH unit	Yes	Available in respective protection Relay (i.e. ABB-REL670 & Micom-P444)	Yes
ii)	Line-2 220kV (Kalyanpura Ckt #02)	Make-Schneider, Model -P141	Yes	Jan-2014	FOTE Make- Commtel with SDH and PDH unit	Yes	Available in respective protection Relay (i.e. ABB-REL670 & Micom-P444)	Yes
iii)	Line-3 220kV (Dunara Ckt)	Make-Schneider, Model -P141	Yes	Jan-2014	FOTE Make- Commtel with SDH and PDH unit	Yes	Available in respective protection Relay (i.e. ABB-REL670 & Micom-P444)	Yes
iv)	Line-4 220kV (Babina Ckt)	Make-Schneider, Model -P141	Yes	Jan-2014	FOTE Make- Commtel with SDH and PDH unit	Yes	Available in respective protection Relay (i.e. ABB-REL670 & Micom-P444)	Yes
v)	Line-5 765kV (Agra Ckt #01)	Make-Schneider, Model -P141	Yes	Feb-2015	PLCC Make-ABB, Model-ETL-81 & NSD-50	Yes	Available in respective protection Relay (i.e. ABB-REL670 & Micom-P545)	Yes
vi)	Line-6 765kV (Agra Ckt #02)	Make-Schneider, Model -P141	Yes	Feb-2015	PLCC Make-ABB, Model-ETL-81 & NSD-50	Yes	Available in respective protection Relay (i.e. ABB-REL670 & Micom-P545)	Yes

Sr No	Name of Line	Main-I Protection (Make and Model)	Functional (Yes / No)	Date of testing	Main-II Protection (Make and Model)	Functional (Yes / No)	Date of testing
i)	Line-1 220kV (Kalyanpura Ckt #01)	Make- ABB, Model- REL670	Yes	Feb-2014	Make- Schneider, Model - P444	Yes	Feb-2014
ii)	Line-2 220kV (Kalyanpura Ckt #02)	Make- ABB, Model- REL670	Yes	Feb-2014	Make- Schneider, Model - P444	Yes	Feb-2014
iii)	Line-3 220kV (Dunara Ckt)	Make- ABB, Model- REL670	Yes	Feb-2014	Make- Schneider, Model - P444	Yes	Feb-2014
iv)	Line-4 220kV (Babina Ckt)	Make- ABB, Model- REL670	Yes	Feb-2014	Make- Schneider, Model - P444	Yes	Feb-2014
v)	Line-5 765kV (Agra Ckt #01)	Make- ABB, Model- REL670	Yes	May-2016	Make- Schneider, Model - P545	Yes	May-2016
vi)	Line-6 765kV (Agra Ckt #02)	Make- ABB, Model- REL670	Yes	May-2016	Make- Schneider, Model - P545	Yes	May-2016

D) Transformer Protection

Sr No	Name of ICT	Diff. Prot. (Make & Model)	REF Pro. (Make & Model)	Back-up OC Prot. (Make & Model)	Over Flux Prot. (Make & Model)	OTI/WTI Indication working or not	Bucholtz / PRD	Other prot.	Date of last testing	LA Rating HV Side	LA Rating IV Side
i)	ICT-1	Make-Schneider, Model-P642	Make-Schneider, Model -P141	Make-Schneider, Model-P642	Make- Schneider, Model-P643	Working	Yes	87OH, 87OA, SEF & LBB	Feb-2015	624KV	198KV
ii)	ICT-2	Make-Schneider, Model-P642	Make-Schneider, Model -P141	Make-Schneider, Model-P642	Make- Schneider, Model-P643	Working	Yes	87OH, 87OA, SEF & LBB	Feb-2015	624KV	198KV

E) Reactor Protection

Sr No	Name of Reactor	Differential Protection (Make & Model)	REF Prot. (Make & Model)	Back-up Impedance Prot. (Make & Model)	OTI/WTI Indication working or not	Bucholtz / PRD	Other Prot.	Date of testing	LA Rating HV Side
i)	765kV Line -1 Reactor	Make- Schneider, Model-P642	Make- Schneider, Model-P642	No	Working	Yes	LBB, OC & EF	Feb-2015	624KV
ii)	765kV Line -2 Reactor	Make- Schneider, Model-P642	Make- Schneider, Model-P642	No	Working	Yes	LBB, OC & EF	Feb-2015	624KV
iii)	765kV Bus Reactor-1	Make- Schneider, Model-P643	Make- Schneider, Model-P643	No	Working	Yes	LBB, OC & EF	Feb-2015	624KV
iv)	765kV Bus Reactor-2	Make- Schneider, Model-P643	Make- Schneider, Model-P643	No	Working	Yes	LBB, OC & EF	Feb-2015	624KV

4) Line Parameter

Sr No		Line 1	Line 2	Line 3	Line 4	Line 5	Line 6
i)	Name of Line	Line-1 220kV (Kalyanpura Ckt #01)	Line-2 220kV (Kalyanpura Ckt #02)	Line-3 220kV (Dunara Ckt #01)	Line-4 220kV (Babina Ckt #01)	Line-5 765kV (Agra Ckt #01)	Line-6 765kV(Agra Ckt #02)
ii)	Line Length	18.52 KM	18.52 KM	92.30 KM	60.33 KM	336.5 KM	335 KM
iii)	Line Parameters (In Ohms/Per KM/ Per Phase Primary value)						
	R1	0.08	0.08	0.08	0.08	0.0114	0.0114
	X1	0.4002	0.4002	0.4002	0.4002	0.2855	0.2855
	Ro	0.2401	0.2401	0.2401	0.2401	0.1898	0.1898
	Xo	1.201	1.201	1.201	1.201	0.7671	0.7671
	RoM	0.138	0.138	0.138	0.138		
	XoM	0.536	0.536	0.536	0.536		
iv)	Present Relay setting						
a	Adopted Relay setting	Enclosed as Annexure -I (Please enclose the settings for all lines, transformers, Reactors and Bus Bars)					
b	Recommended Relay setting	Enclosed as Annexure -II (Please enclose the settings for all lines, transformers, Reactors and Bus Bars)					

5) DC supply

Sr No		220 /110 V DC-I	220 /110 V DC-II	48 V DC-I	48 V DC-II
a	Measured voltage (to be measured at further set Panel				
i)	Positive to Earth	110V DC	110V DC	48V DC	48V DC
ii)	Negative to Earth	110V DC	110V DC	NA	NA
b	No. of Cells Per Bank	107	107	24	24
c	Availability of Battery Charger	Yes/No	Yes/No	Yes/No	Yes/No

6) Circuit Breaker

Sr No		Make and Model	Status of Breaker Available or Not	No. of trip/close coil & healthiness	PIR (Available or Not)	Date of Last Timing taken	Remarks (If any)
A)	**765 kV System**						
1	701 GT#1 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	24.11.2023	
2	702 Tie Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	28.11.2023	
3	703 ICT#2 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	30.11.2023	
4	704 BR#1 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	05.06.2023	
5	705 Tie Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	09.01.2023	
6	706 ICT#1 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	10.01.2023	
7	707 GT#2 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	07.02.2023	
8	708 Tie Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	PIR	11.02.2023	
9	709 Line#1 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	PIR	03.03.2021	
10	709 LR#1 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	06.03.2021	
11	710 GT#3 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	05.01.2023	
12	711 Tie Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	PIR	07.01.2023	
13	712 Line #2 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	PIR	23.01.2021	
14	712 LR #2 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	16.03.2021	
15	713 BR#2 Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	NOT	30.11.2021	
16	714 Tie Bay	ALSTOM-GL318	Available	Healthy: CC: 6 Nos.&TC: 12 Nos.	PIR	01.12.2021	

B	220kV System						
1	201 ICT#1 Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	13.01.2023	
2	202 Line#1 Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	18.04.2024	
3	203 Line#2 Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	19.04.2024	
4	204 ICT#1 Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	23.11.2023	
5	205 TBC Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	28.02.2024	
6	206 BC Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	16.01.2023	
7	207 Line#3 Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	22.03.2021	
8	208 Line#4 Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	11.11.2021	
9	209 ST#2 Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	09.11.2021	
10	210 ST#1 Bay	ALSTOM-GL314	Available	Healthy: CC: 3 Nos.&TC: 6 Nos.	NOT	19.03.2022	

7) Availability of Auxiliary System

i)	Auxiliary Supply	Source of Supply	Reliability of Supply	Average tripping per month
	Supply-I	PMCC (Switchyard)	24X7	0
	Supply-II	NEPMCC (T.G)	24X7	0
ii)	DG Set Make Rating	Caterpillar, 2MVA (Total -04 Nos)		
	Whether Dg set on Auto or manual Fuel level	Auto		

8) Availability of UFR relay

Make -

Setting – Not applicable

9) Availability of df/dt relay

Make - P141

Setting - Not applicable

10) Special Protection Scheme (SPS)

Available **(Yes**/No): **Yes**

Verification -Mock testing done jointly with UPPTCL in May 2024.

11) Status of Corrective action based On Tripping analysis

It was observed during L-G fault in Z-1 of Dunara-LPGCL Ckt, both Permissive & Direct trip signals were received at LPGCL end and AR got failed on 1ph fault , After detail analysis and site visit at UPPTCL Dunara station, it was found the Zone-1, 1ph tripping connected in DT send logic. Same was also confirmed by simulating the 1Ph fault. The case was discussed with UPPTCL official and BO cable removed temporary until logic correction inside the relay. M/s UPPTCL confirmed to correct the logic with the help of OEM/T&C team and normalised & reconnect the BO cable for operation.

INTERNAL PROTECTION CHECKLISTS

bajaj ENERGY	220kV Circuit Breakers			Remarks
Sr No	Check Points	Yes	No	
1	Is breaker fail protection (LBB / BFR) provided for all the Circuit Breakers at 220kV Voltage rating	☑	☐	
2	For Circuit Breaker connected to line feeder / transformer feeder, whether operation of LBB / BFR sends direct trip signal to trip remote end breaker ?	☑	☐	
3	For lines employing single phase auto reclosing, Is start signal from protection trip to LBB / BFR relay is given on single phase basis?	☑	☐	
4	Is separate relay provided for each breaker and the relay has to be connected from the secondary circuit of the CTs associated with that particular breaker?	☑	☐	
5	Is LBB relay provided with separate DC circuit independent from Group-A and Group-B Protections?	☐	☑	
6	Is the LBB initiation provided with initiating contact independent of CB trip relay contact?	☑	☐	
7	Is Separation maintained between protective relay and CB trip coil DC circuit so that short circuit or blown fuse in the CB circuit will not prevent the protective relay from energizing the LBB scheme?	☑	☐	
8	Is LBB relay initiated by Bus bar protection in addition to other fault sensing relays, since failure of CB to clear a bus fault would result in the loss of entire station if BFP relay is not initiated?	☑	☐	
9	Is tripping logic of the bus bar protection scheme used for LBB protection also?	☑	☐	
10	Are the special considerations provided to ensure proper scheme operation by using Circuit Breaker contact logic in addition to current detectors in cases breaker-fail relaying for low energy faults like buchholz operation?	☐	☑	Current detector only use for LBB protection in all bays with 20% setting as per CT ratio.
11	Are the Current level detectors set as sensitive as the main protection? (Generally setting of 0.2 A is commonly practiced for lines and transformers)	☑	☐	
12	Is timer set considering breaker interrupting time, current detector reset time and a margin? (Generally a timer setting of 200ms has been found to be adequate)	☑	☐	
13	Is the back-up fault clearance time is shorter than the operating time of the remote protections (distance relay Zone-2) ?	☐	☑	
14	Is the breaker failure protection provided with two steps (First stage – retrip own CB, Second stage- Trip all associated CBs) . This mitigates unwanted operation of breaker failure protection during maintenance and fault tracing.	☐	☑	Only 1 stage is provided with 200ms Time delay to operate bus bar and sent DT based on tie CB status.
15	Is the breaker failure protection hardware provided is separate from line /transformer feeder protection?	☑	☐	

bajaj ENERGY	765kV Circuit Breakers			Remarks
Sr No	Check Points	Yes	No	
1	Is breaker fail protection (LBB / BFR) provided for all the Circuit Breakers at 765kV Voltage rating	☑	☐	
2	For Circuit Breaker connected to line feeder / transformer feeder, whether operation of LBB / BFR sends direct trip signal to trip remote end breaker ?	☑	☐	
3	For lines employing single phase auto reclosing, Is start signal from protection trip to LBB / BFR relay is given on single phase basis?	☑	☐	
4	Is separate relay provided for each breaker and the relay has to be connected from the secondary circuit of the CTs associated with that particular breaker?	☑	☐	Except 765kV Line reactor, LBB protection provided in Separate relays
5	Is LBB relay provided with separate DC circuit independent from Group-A and Group-B Protections?	☐	☑	
6	Is the LBB initiation provided with initiating contact independent of CB trip relay contact?	☑	☐	
7	Is Separation maintained between protective relay and CB trip coil DC circuit so that short circuit or blown fuse in the CB circuit will not prevent the protective relay from energizing the LBB scheme?	☑	☐	
8	Is LBB relay initiated by Bus bar protection in addition to other fault sensing relays, since failure of CB to clear a bus fault would result in the loss of entire station if BFP relay is not initiated?	☑	☐	
9	Is tripping logic of the bus bar protection scheme used for LBB protection also?	☑	☐	
10	Are the special considerations provided to ensure proper scheme operation by using Circuit Breaker contact logic in addition to current detectors in cases breaker-fail relaying for low energy faults like buchholz operation?	☐	☑	Current detector only use for LBB protection in all bays with 20% setting as per CT ratio.
11	Are the Current level detectors set as sensitive as the main protection? (Generally setting of 0.2 A is commonly practiced for lines and transformers)	☑	☐	
12	Is timer set considering breaker interrupting time, current detector reset time and a margin? (Generally a timer setting of 200ms has been found to be adequate)	☑	☐	
13	Is the back-up fault clearance time is shorter than the operating time of the remote protections (distance relay Zone-2) ?	☐	☑	
14	Is the breaker failure protection provided with two steps (First stage – retrip own CB, Second stage- Trip all associated CBs) . This mitigates unwanted operation of breaker failure protection during maintenance and fault tracing.	☐	☑	Only 1 stage is provided with 200ms Time delay to operate bus bar and sent DT based on tie CB status.
15	Is the breaker failure protection hardware provided is separate from line /transformer feeder protection?	☑	☐	In Line reactor LBB function provided in differntial protection (P642).

bajaj ENERGY	Communication Systems			Remarks
Sr No	Check Points	Yes	No	
1	a) Do you use PLCC for tele-protection of distance relays at 765 & 220kV feeders	☑	☐	PLCC is used in 765klV & FOTE is used for 220kV
	b) Specify type of coupling	Ph-G	~~Ph-Ph~~	
	c) Whether redundant PLCC channels provided for 765kV lines	☑	☐	
	d) Specify number of PLCC channels per circuit :	2		
	e) Whether dependability & security of each tele-protection channel measured & record kept ?	☑	☐	
2	a) In case you use OPGW for tele-protection, are they on geographically diversified route for Main-I and Main-II relay?	☐	☑	
	b) Whether dedicated fibre is being used for Main-I / Main-II relay or multiplexed channel are being used.	Dedicated	multiplexed	
3	765kV Ckt #01 PLCC Chanel Used for protection & communication Healthyness Condition			
	Chanel #01 (Healthy)	☑	☐	
	Chanel #02 (Healthy)	☑	☐	
4	765kV Ckt #02 PLCC Chanel Used for protection & communication Healthyness Condition			
	Chanel #01 (Healthy)	☑	☐	
	Chanel #02 (Healthy)	☑	☐	
6	PLCC Carrier Chanel Healthyness Condition (Healthy)	☑	☐	
7	PLCC DT Chanel Healthyness Condition (Healthy)	☑	☐	
8	220kV Kalyanpura Ckt #01 FOTE Chanel Used for protection & communication Healthyness Condition (Healthy)	☑	☐	
9	220kV Kalyanpura Ckt #02 FOTE Chanel Used for protection & communication Healthyness Condition (Healthy)	☑	☐	
10	220kV Babina Ckt FOTE Chanel Used for protection & communication Healthyness Condition (Healthy)	☑	☐	
11	220kV Dunara Ckt FOTE Chanel Used for protection & communication Healthyness Condition (Healthy)	☑	☐	
12	FOTE Chanel DB Losses within permissable limit	☑	☐	
13	FOTE Carrier Chanel Healthyness Condition (Healthy)	☑	☐	
14	FOTE DT Chanel Healthyness Condition (Healthy)	☑	☐	

bajaj ENERGY	Bus Bar 220kV			Remarks
Sr No	Check Points	Yes	No	
1	Bus Bar protection for 220kV buses is provided	☑	☐	
2	Duplicated Bus bar protection is provided for 220kV buses	☑	☐	
3	CBIP guideline for Protection (274 and 296) settings is followed	☑	☐	
4	In an existing substation if CTs are of different ratios, is biased type bus protection provided.	☑	☐	
5	In stations where single bus bar protection is provided, is backup provided by reverse looking elements of distance relays or by second zone elements of remote end distance relays?			Not Applicable as dual bus bar protection provided for 220kV Bus.
6	In case of GIS where burn through time of SF6 is shorter than remote back up protection is the bus bar protection duplicated irrespective of voltage level?			Not Applicable
7	Since it is difficult to get shutdowns to allow periodic testing of bus protection, numerical bus protections with self-supervision feature is an answer. Is this followed?	☑	☐	

bajaj ENERGY	Bus Bar 765kV			Remarks
Sr No	Check Points	Yes	No	
1	Bus Bar protection for 765kV buses is provided	☑	☐	
2	Duplicated Bus bar protection is provided for 765kV buses	☑	☐	
3	CBIP guideline for Protection (274 and 296) settings is followed	☑	☐	
4	In an existing substation if CTs are of different ratios, is biased type bus protection provided.	☑	☐	
5	In stations where single bus bar protection is provided, is backup provided by reverse looking elements of distance relays or by second zone elements of remote end distance relays?			Not Applicable as dual bus bar protection provided for 765kV Buses.
6	In case of GIS where burn through time of SF6 is shorter than remote back up protection is the bus bar protection duplicated irrespective of voltage level?			Not Applicable
7	Since it is difficult to get shutdowns to allow periodic testing of bus protection, numerical bus protections with self-supervision feature is an answer. Is this followed?	☑	☐	

Sr No	Disturbance Recorder (DR) and Event Logger (EL) Check Points	Yes	No	Remarks
1	a) Is the Disturbance recorder and Fault locator provided on all line feeder of 765 & 220kV substations?	☑	☐	
	b) Whether standalone or built in Main relay	Standalone	built-in	Standalone DR recorder system provided along with in-built DR captured facility in relay for all 765kV and 220kV Lines.
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether Central PC for DR , EL are powered by Inverter (fed from station DC)	☑	☐	
2	Whether DR is having the following main signals for lines: Analogue signals: • From CT: IA, IB, IC, IN • From VT: VAN, VBN, VCN • From Aux. VT: V0 Digital Signals • Main 1 Carrier receive • Main 1 Trip • Line O/V Stage I / Stage II • Reactor Fault Trip • Stub Protection Operated. • Main II Trip • Main II Carrier Receive • Direct Trip CH I / II • CB I Status (PH-R, Y & B) • CB II Status (PH R, Y & B) • Bus bar trip • Main / Tie CB LBB Operated • Main / Tie Auto-reclose operated. DR for Transformer / Reactor feeder should contain analog channel like input currents & voltage. Binary signal include all protection trip input, Main & Tie CB status, LBB trip	☑	☐	
3	Whether substation (765, 220kV) is having Event logger facility (standalone or built-in-SAS)	☑	☐	Built in SAS
4	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	☑	☐	

bajaj ENERGY	Performance Indices		
Sr No	Check Points	Yes	No
1	Is there a system of periodically measuring Dependability & Security of Protection system (as given in CBIP manual 296) and recorded	☑	☐
2	Is there a system of periodically measuring Dependability of switchgear associated with Protection system and recorded	☑	☐
3	Is there a process of Root cause analysis of unwanted tripping events	☑	☐
4	Are improvement action like revision of relay setting, better maintenance practices, modernising & retrofitting of switching & protection system taken based on above data.	☑	☐
5	Is attention also given to DC supply system, tele-protection signalling, healthiness of tripping cables, terminations etc. in order to improve the performance of fault clearance system	☑	☐

bajaj ENERGY	Station DC supply system		
Sr No	Check Points	Yes	No
1	Do you have two separate independent DC system (220V /110V) (Source-A and Source-B)	☑	☐
2	Do you have two independent DC system (48V) for PLCC (source-A and source-B)	☑	☐
3	There is no mixing of supplies from DC source-A and DC source-B	☑	☐
4	Whether the protection relays and trip circuits are segregated into two independent system fed through fuses from two different DC source	☑	☐
5	Whether Bay wise distribution of DC supply done in the following way: a) Protection b) CB functions c) Isolator / earth switch functions d) Annunciation / Indications e) Monitoring functions	☑	☐
6	Whether following has been ensured in the cabling: a) Separate cables are used for AC & DC circuits b) Separate cables are used for DC-I & DC-II circuits c) Separate cables are used for different cores of CT and CVT outputs to enhance reliability & security	☑	☐
7	Is guidelines prescribed in CBIP manual 274 & 296 followed in general	☑	☐

bajaj ENERGY	Shunt Reactor- BR#01 (3X110MVAr)			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for reactor	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of reactor	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for reactor at 765kV	☑	☐	
4	Do you classify reactor protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up impedance Protection Or Direction O/C & E/F relay	☑	☐	Impedance relay not provided separetely,however backup protection provided
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main & back-up protection relays provided for Reactor are of numerical design.	☑	☐	
8	Is Fire protection system (HVW type) provided for Reactor and functioning	☑	☐	
9	a) Is the Disturbance recorder and Fault locator provided on all the Shunt Reactors used in 765 kV substations?	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	

bajaj ENERGY	Shunt Reactor- BR#02 (3X110MVAr)			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for reactor	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of reactor	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for reactor at 765kV	☑	☐	
4	Do you classify reactor protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up impedance Protection Or Direction O/C & E/F relay	☑	☐	Impedance relay not provided separetely,however backup protection provided
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main & back-up protection relays provided for Reactor are of numerical design.	☑	☐	
8	Is Fire protection system (HVW type) provided for Reactor and functioning	☑	☐	
9	a) Is the Disturbance recorder and Fault locator provided on all the Shunt Reactors used in 765 kV substations?	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	

bajaj ENERGY	Shunt Reactor- LR#01 (3X110MVAr)			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for reactor	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of reactor	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for reactor at 765kV	☑	☐	
4	Do you classify reactor protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up impedance Protection Or Direction O/C & E/F relay	☑	☐	Impedance relay not provided separetely,however backup protection provided
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main & back-up protection relays provided for Reactor are of numerical design.	☑	☐	
8	Is Fire protection system (HVW type) provided for Reactor and functioning	☑	☐	
9	a) Is the Disturbance recorder and Fault locator provided on all the Shunt Reactors used in 765 kV substations?	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	

bajaj ENERGY	Shunt Reactor- LR#02 (3X110MVAr)			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for reactor	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of reactor	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for reactor at 765kV	☑	☐	
4	Do you classify reactor protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up impedance Protection Or Direction O/C & E/F relay	☑	☐	Impedance relay not provided separetely,however backup protection provided
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main & back-up protection relays provided for Reactor are of numerical design.	☑	☐	
8	Is Fire protection system (HVW type) provided for Reactor and functioning	☑	☐	
9	a) Is the Disturbance recorder and Fault locator provided on all the Shunt Reactors used in 765 kV substations?	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	

bajaj ENERGY	Power Transformer-765kV/220kV (3X105MVA)ICT Bank # 01			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for power transformers	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 765kV and 400kV levels	☑	☐	
4	Do you classify transformer protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up Protection(HV) Back up Protection(MV) • Overfluxing protection(HV) Overfluxing protection(MV)	☑	☐	
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main protection relays provided for transformer are of numerical design.	☑	☐	
8	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design.	☑	☐	Harmonic restrain for OC & EF setting not available in P642/643, However it is possible to block its trip timer through PSL logic.
	b) Do the back-up earth fault relays have harmonic restrain feature	☐	☑	
9	Is Fire protection system (HVW type) provided for power transformer and functioning	☑	☐	
10	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	

bajaj ENERGY	Power Transformer-765kV/220kV (3X105MVA)ICT Bank # 02			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for power transformers	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 765kV and 400kV levels	☑	☐	
4	Do you classify transformer protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up Protection(HV) Back up Protection(MV) • Overfluxing protection(HV) Overfluxing protection(MV)	☑	☐	
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main protection relays provided for transformer are of numerical design.	☑	☐	
8	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design.	☑	☐	Harmonic restrain for OC & EF setting not available in P642/643, However it is possible to block its trip timer through PSL logic.
	b) Do the back-up earth fault relays have harmonic restrain feature	☐	☑	
9	Is Fire protection system (HVW type) provided for power transformer and functioning	☑	☐	
10	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	

Generator Transformer (765KV /21KV, 3X275MVA) Bank # 01				Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for power transformers	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 765kV levels	☑	☐	
4	Do you classify transformer protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up Protection(HV) Back up Protection(MV) • Overfluxing protection(HV) Overfluxing protection(MV)	☑	☐	
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	Only OH differential protection is used in Switchyard balance Protection is used in GRP Relay.
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main protection relays provided for transformer are of numerical design.	☑	☐	
8	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design.	☑	☐	Backup Protection is available in GRP Panel Relay.
	b) Do the back-up earth fault relays have harmonic restrain feature	☐	☑	
9	Is Fire protection system (HVW type) provided for power transformer and functioning	☑	☐	
10	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	

bajaj ENERGY	Generator Transformer (765KV /21KV, 3X275MVA) Bank # 02			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for power transformers	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 765kV levels	☑	☐	
4	Do you classify transformer protections as below in groups: Group A — Group B • Biased differential relay — Restricted earth fault (REF) relay • PRD , WTI — Buchholz Protection, OTI • Back up Protection(HV) — Back up Protection(MV) • Overfluxing protection(HV) — Overfluxing protection(MV)	☑	☐	
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	Only OH differential protection is used in Switchyard balance Protection is used in GRP Relay.
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main protection relays provided for transformer are of numerical design.	☑	☐	
8	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design.	☑	☐	Backup Protection is available in GRP Panel Relay.
	b) Do the back-up earth fault relays have harmonic restrain feature	☐	☑	
9	Is Fire protection system (HVW type) provided for power transformer and functioning	☑	☐	
10	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	

bajaj ENERGY	Generator Transformer (765KV /21KV, 3X275MVA) Bank # 03			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for power transformers	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 765kV levels	☑	☐	
4	Do you classify transformer protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up Protection(HV) Back up Protection(MV) • Overfluxing protection(HV) Overfluxing protection(MV)	☑	☐	
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	Only OH differential protection is used in Switchyard balance Protection is used in GRP Relay.
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main protection relays provided for transformer are of numerical design.	☑	☐	
8	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design.	☑	☐	Backup Protection is available in GRP Panel Relay.
	b) Do the back-up earth fault relays have harmonic restrain feature	☐	☑	
9	Is Fire protection system (HVW type) provided for power transformer and functioning	☑	☐	
10	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	

bajaj ENERGY	Station Transformer-1 (100MVA, 220KV/11.5KV/11.KV)			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for power transformers	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 220kV levels	☐	☐	Not Applicable
4	Do you classify transformer protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up Protection(HV) Back up Protection(MV) • Overfluxing protection(HV) Overfluxing protection(MV)	☑	☐	
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	Only OH differential protection is used in Switchyard balance Protection is used in GRP Relay.
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main protection relays provided for transformer are of numerical design.	☑	☐	
8	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design.	☑	☐	Backup Protection is available in GRP Panel Relay.
	b) Do the back-up earth fault relays have harmonic restrain feature	☐	☑	
9	Is Fire protection system (HVW type) provided for power transformer and functioning	☑	☐	
10	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	

bajaj ENERGY	Station Transformer-2 (100MVA, 220KV/11.5KV/11.KV)			Remarks
Sr No	Check Points	Yes	No	
1	Do you use Group A and Group B protections connected to separate DC sources for power transformers	☑	☐	
2	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	☑	☐	
3	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 220kV levels	☐	☐	Not Applicable
4	Do you classify transformer protections as below in groups: Group A Group B • Biased differential relay Restricted earth fault (REF) relay • PRD , WTI Buchholz Protection, OTI • Back up Protection(HV) Back up Protection(MV) • Overfluxing protection(HV) Overfluxing protection(MV)	☑	☐	
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	☑	☐	Only OH differential protection is used in Switchyard balance Protection is used in GRP Relay.
6	Is Restricted earth fault (REF) protection used a high impedance type	☑	☐	
7	Are Main protection relays provided for transformer are of numerical design.	☑	☐	
8	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design.	☑	☐	Backup Protection is available in GRP Panel Relay.
	b) Do the back-up earth fault relays have harmonic restrain feature	☐	☑	
9	Is Fire protection system (HVW type) provided for power transformer and functioning	☑	☐	
10	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	~~Standalone~~	built-in	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	

bajaj ENERGY	Transmission lines OHL-220KV Kalyanpura Ckt #01			Remarks
Sr No	Check Points	Yes	No	
1	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	☑	☐	
2	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	☑	☐	
3	Is the Distance protection (Non-switched type, suitable for 1-ph & 3-ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	☑	☐	
4	Is both main-I & Main-II distance relay are numerical design having Quadrilateral or Polygon operating characteristic	☑	☐	
5	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	☑	☐	Z-1 cover 80%
6	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	☑	☐	Z-2 cover 150%
7	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	☑	☐	Z-3 cover-120% (PL + Longest line at remote)
8	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistance & tower footing resistance. (In case, It is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	☑	☐	
9	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	☑	☐	
10	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	☐	☐	Not applicable
11	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds ? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	☑	☐	500 ms
12	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	☑	☐	1500 ms
13	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar fault resistance, when allowing for multiple in feeds from other circuits?	☑	☐	
14	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	☑	☐	
15	Is Switch on to fault (SOTF) function provided in distance relay to take care of line energisation on fault?	☑	☐	
	Whether SOTF initiation has been implemented using hardwire logic In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB	☑	☐	
16	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	☑	☐	
17	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	☑	☐	Built in Main-1 &2
18	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	☐	☐	Not Applicable
19	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	☐	☐	Not Applicable
20	Are the line parameters used for setting the relay verified by field testing	☑	☐	
21	Is Two stages Over-Voltage protection provided for 220 kV Lines?	☑	☐	U>1 110% @ 3.0Sec U>2 140% @ 0.1Sec
	Do you apply grading in over-voltage setting for lines at one station. Please specify the setting values adopted for: Stage-I : (typical value - 106 to 112 % , delay : 4-7 Sec) Stage-II: (typical value - 140 to 150%, delay: 0 to 100msec.)	☑	☐	
22	Is 1-ph Auto –reclosing provided on 765, 400 & 220kV lines? Please specify the set value: Dead time: (typical 1 Sec) Reclaim time: (typical 25 Sec)	☑	☐	Dead Time 850 ms
23	Is the Distance communication. Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines? If any other communication scheme has been applied, please provide the detail with justification thereof.	☑	☐	
24	Is the Current reversal guard logic for POR scheme provided on Double circuit lines?	☐	☑	
25	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether week end-infeed feature has been enabled in respective distance relay or not	☐	☐	Not applicable
26	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	☐	☐	Not applicable
27	What line current , Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment. (In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)			Not Active
28	a) What are the Zones blocked on Power swing block function:	Z1	Z2 / Z3 / Z4	Trip provided in Zone-1, All higher zones are blocked.
	b) Setting for Unblock timer: (typical 02 second)	02 Sec		
	c) Out of Step trip enabled	☐	☑	
29	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	☐	☑	
30	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	Standalone	~~built-in~~	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	
	e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage.	☑	☐	
	f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.	☑	☐	

	Transmission lines OHL-220KV Kalyanpura Ckt #02			Remarks
Sr No	Check Points	Yes	No	
1	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	☑	☐	
2	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	☑	☐	
3	Is the Distance protection (Non-switched type, suitable for 1-ph & 3-ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	☑	☐	
4	Is both main-I & Main-II distance relay are numerical design having Quadrilateral or Polygon operating characteristic	☑	☐	
5	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	☑	☐	Z-1 cover 80%
6	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	☑	☐	Z-2 cover 150%
7	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	☑	☐	Z-3 cover-120%(PL + Longest line at remote)
8	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistance & tower footing resistance. (In case, It is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	☑	☐	
9	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	☑	☐	
10	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	☐	☐	Not applicable
11	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds ? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	☑	☐	500 ms
12	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	☑	☐	1500 ms
13	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar fault resistance, when allowing for multiple in feeds from other circuits?	☑	☐	
14	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	☑	☐	
15	Is Switch on to fault (SOTF) function provided in distance relay to take care of line energisation on fault?	☑	☐	
	Whether SOTF initiation has been implemented using hardwire logic In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB	☑	☐	
16	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	☑	☐	
17	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	☑	☐	Built in Main-1 &2
18	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	☐	☐	Not Applicable
19	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	☐	☐	Not Applicable
20	Are the line parameters used for setting the relay verified by field testing	☑	☐	
21	Is Two stages Over-Voltage protection provided for 220 kV Lines?	☑	☐	U>1 110% @ 3.0Sec U>2 140% @ 0.1Sec
	Do you apply grading in over-voltage setting for lines at one station. Please specify the setting values adopted for: Stage-I : (typical value - 106 to 112 % , delay : 4-7 Sec) Stage-II: (typical value - 140 to 150%, delay: 0 to 100msec.)	☑	☐	
22	Is 1-ph Auto –reclosing provided on 765, 400 & 220kV lines? Please specify the set value: Dead time: (typical 1 Sec) Reclaim time: (typical 25 Sec)	☑	☐	Dead Time 850 ms
23	Is the Distance communication. Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines? If any other communication scheme has been applied, please provide the detail with justification thereof.	☑	☐	
24	Is the Current reversal guard logic for POR scheme provided on Double circuit lines?	☐	☑	
25	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether week end-infeed feature has been enabled in respective distance relay or not	☐	☐	Not applicable
26	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	☐	☐	Not applicable
27	What line current , Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment. (In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)			Not Active
28	a) What are the Zones blocked on Power swing block function:	Z1	Z2 / Z3 / Z4	Trip provided in Zone-1, All higher zones are blocked.
	b) Setting for Unblock timer: (typical 02 second)	02 Sec		
	c) Out of Step trip enabled	☐	☑	
29	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	☐	☑	
30	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	Standalone	~~built-in~~	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	
	e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage.	☑	☐	
	f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.	☑	☐	

bajaj ENERGY	Transmission lines OHL-220KV Babina Ckt			Remarks
Sr No	Check Points	Yes	No	
1	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	☑	☐	
2	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	☑	☐	
3	Is the Distance protection (Non-switched type, suitable for 1-ph & 3-ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	☑	☐	
4	Is both main-I & Main-II distance relay are numerical design having Quadrilateral or Polygon operating characteristic	☑	☐	
5	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	☑	☐	Z-1 cover 80%
6	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	☑	☐	Z-2 cover 150%
7	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	☑	☐	Z-3 cover-120%(PL + Longest line at remote)
8	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistance & tower footing resistance. (In case, It is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	☑	☐	
9	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	☑	☐	
10	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	☐	☐	Not applicable
11	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds ? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	☑	☐	500 ms
12	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	☑	☐	1500 ms
13	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar fault resistance, when allowing for multiple in feeds from other circuits?	☑	☐	
14	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	☑	☐	
15	Is Switch on to fault (SOTF) function provided in distance relay to take care of line energisation on fault?	☑	☐	
	Whether SOTF initiation has been implemented using hardwire logic In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB	☑	☐	
16	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	☑	☐	
17	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	☑	☐	Built in Main-1 &2
18	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	☐	☐	Not Applicable
19	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	☐	☐	Not Applicable
20	Are the line parameters used for setting the relay verified by field testing	☑	☐	
21	Is Two stages Over-Voltage protection provided for 220 kV Lines?	☑	☐	U>1 110% @ 3.0Sec U>2 140% @ 0.1Sec
	Do you apply grading in over-voltage setting for lines at one station. Please specify the setting values adopted for: Stage-I : (typical value - 106 to 112 % , delay : 4-7 Sec) Stage-II: (typical value - 140 to 150%, delay: 0 to 100msec.)	☑	☐	
22	Is 1-ph Auto –reclosing provided on 765, 400 & 220kV lines? Please specify the set value: Dead time: (typical 1 Sec) Reclaim time: (typical 25 Sec)	☑	☐	Dead Time 850 ms
23	Is the Distance communication. Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines? If any other communication scheme has been applied, please provide the detail with justification thereof.	☑	☐	
24	Is the Current reversal guard logic for POR scheme provided on Double circuit lines?	☐	☑	
25	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether week end-infeed feature has been enabled in respective distance relay or not	☐	☐	Not applicable
26	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	☐	☐	Not applicable
27	What line current , Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment. (In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)			Not Active
28	a) What are the Zones blocked on Power swing block function:	Z1	Z2 / Z3 / Z4	Trip provided in Zone-1, All higher zones are blocked.
	b) Setting for Unblock timer: (typical 02 second)	02 Sec		
	c) Out of Step trip enabled	☐	☑	
29	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	☐	☑	
30	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	Standalone	~~built-in~~	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	
	e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage.	☑	☐	
	f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.	☑	☐	

bajaj ENERGY	Transmission lines OHL-220KV Dunara Ckt			Remarks
Sr No	Check Points	Yes	No	
1	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	☑	☐	
2	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	☑	☐	
3	Is the Distance protection (Non-switched type, suitable for 1-ph & 3-ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	☑	☐	
4	Is both main-I & Main-II distance relay are numerical design having Quadrilateral or Polygon operating characteristic	☑	☐	
5	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	☑	☐	Z-1 cover 80%
6	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	☑	☐	Z-2 cover 150%
7	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	☑	☐	Z-3 cover-120%(PL + Longest line at remote)
8	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistance & tower footing resistance. (In case, It is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	☑	☐	
9	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	☑	☐	
10	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	☐	☐	Not applicable
11	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds ? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	☑	☐	500 ms
12	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	☑	☐	1500 ms
13	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar fault resistance, when allowing for multiple in feeds from other circuits?	☑	☐	
14	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	☑	☐	
15	Is Switch on to fault (SOTF) function provided in distance relay to take care of line energisation on fault?	☑	☐	
	Whether SOTF initiation has been implemented using hardwire logic In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB	☑	☐	
16	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	☑	☐	
17	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	☑	☐	Built in Main-1 &2
18	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	☐	☐	Not Applicable
19	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	☐	☐	Not Applicable
20	Are the line parameters used for setting the relay verified by field testing	☑	☐	
21	Is Two stages Over-Voltage protection provided for 220 kV Lines?	☑	☐	U>1 110% @ 3.0Sec U>2 140% @ 0.1Sec
	Do you apply grading in over-voltage setting for lines at one station. Please specify the setting values adopted for: Stage-I : (typical value - 106 to 112 % , delay : 4-7 Sec) Stage-II: (typical value - 140 to 150%, delay: 0 to 100msec.)	☑	☐	
22	Is 1-ph Auto –reclosing provided on 765, 400 & 220kV lines? Please specify the set value: Dead time: (typical 1 Sec) Reclaim time: (typical 25 Sec)	☑	☐	Dead Time 850 ms
23	Is the Distance communication. Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines? If any other communication scheme has been applied, please provide the detail with justification thereof.	☑	☐	
24	Is the Current reversal guard logic for POR scheme provided on Double circuit lines?	☐	☑	
25	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether week end-infeed feature has been enabled in respective distance relay or not	☐	☐	Not applicable
26	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	☐	☐	Not applicable
27	What line current , Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment. (In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)			Not Active
28	a) What are the Zones blocked on Power swing block function:	Z1	Z2 / Z3 / Z4	Trip provided in Zone-1, All higher zones are blocked.
	b) Setting for Unblock timer: (typical 02 second)	02 Sec		
	c) Out of Step trip enabled	☐	☑	
29	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	☐	☑	
30	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	Standalone	~~built-in~~	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	
	e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage.	☑	☐	
	f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.	☑	☐	

bajaj ENERGY	Transmission line OHL-765KV Fatehabad Ckt #01			Remarks
Sr No	Check Points	Yes	No	
1	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	☑	☐	
2	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	☑	☐	
3	Is the Distance protection (Non-switched type, suitable for 1-ph & 3-ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	☑	☐	
4	Is both main-I & Main-II distance relay are numerical design having Quadrilateral or Polygon operating characteristic	☑	☐	
5	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	☑	☐	Z-1 cover 80%
6	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	☑	☐	Z-2 cover 120%
7	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	☑	☐	Z-3 cover-120%(PL + Longest line at remote)
8	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistance & tower footing resistance. (In case, It is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	☑	☐	
9	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	☑	☐	
10	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	☐	☐	Not applicable
11	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds ? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	☑	☐	350 ms
12	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	☑	☐	1500 ms
13	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar fault resistance, when allowing for multiple in feeds from other circuits?	☑	☐	
14	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	☑	☐	
15	Is Switch on to fault (SOTF) function provided in distance relay to take care of line energisation on fault?	☑	☐	
	Whether SOTF initiation has been implemented using hardwire logic In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB	☑	☐	
16	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	☑	☐	
17	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	☑	☐	Built in Main-1 &2
18	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	☐	☐	Not Applicable
19	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	☐	☐	Not Applicable
20	Are the line parameters used for setting the relay verified by field testing	☑	☐	
21	Is Two stages Over-Voltage protection provided for 220 kV Lines?	☑	☐	U>1 109% @ 4.0Sec U>2 140% @ 0.1Sec
	Do you apply grading in over-voltage setting for lines at one station. Please specify the setting values adopted for: Stage-I : (typical value - 106 to 112 % , delay : 4-7 Sec) Stage-II: (typical value - 140 to 150%, delay: 0 to 100msec.)	☑	☐	
22	Is 1-ph Auto –reclosing provided on 765, 400 & 220kV lines? Please specify the set value: Dead time: (typical 1 Sec) Reclaim time: (typical 25 Sec)	☑	☐	Dead Time 850 ms
23	Is the Distance communication. Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines? If any other communication scheme has been applied, please provide the detail with justification thereof.	☑	☐	
24	Is the Current reversal guard logic for POR scheme provided on Double circuit lines?	☐	☑	
25	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether week end-infeed feature has been enabled in respective distance relay or not	☐	☐	Not applicable
26	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	☐	☐	Not applicable
27	What line current , Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment. (In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)			Not Active
28	a) What are the Zones blocked on Power swing block function:	Z1	Z2 / Z3 / Z4	Trip provided in Zone-1, All higher zones are blocked.
	b) Setting for Unblock timer: (typical 02 second)	02 Sec		
	c) Out of Step trip enabled	☐	☑	
29	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	☐	☑	
30	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	Standalone	~~built in~~	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	
	e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage.	☑	☐	
	f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.	☑	☐	

Transmission line OHL-765KV Fatehabad Ckt #02				Remarks
Sr No	Check Points	Yes	No	
1	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	☑	☐	
2	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	☑	☐	
3	Is the Distance protection (Non-switched type, suitable for 1-ph & 3-ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	☑	☐	
4	Is both main-I & Main-II distance relay are numerical design having Quadrilateral or Polygon operating characteristic	☑	☐	
5	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	☑	☐	Z-1 cover 80%
6	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	☑	☐	Z-2 cover 120%
7	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	☑	☐	Z-3 cover-120%(PL + Longest line at remote)
8	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistance & tower footing resistance. (In case, It is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	☑	☐	
9	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	☑	☐	
10	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	☐	☐	Not applicable
11	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds ? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	☑	☐	350 ms
12	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	☑	☐	1500 ms
13	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar fault resistance, when allowing for multiple in feeds from other circuits?	☑	☐	
14	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	☑	☐	
15	Is Switch on to fault (SOTF) function provided in distance relay to take care of line energisation on fault?	☑	☐	
	Whether SOTF initiation has been implemented using hardwire logic In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB	☑	☐	
16	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	☑	☐	
17	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	☑	☐	Built in Main-1 &2
18	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	☐	☐	Not Applicable
19	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	☐	☐	Not Applicable
20	Are the line parameters used for setting the relay verified by field testing	☑	☐	
21	Is Two stages Over-Voltage protection provided for 220 kV Lines?	☑	☐	U>1 109% @ 4.0Sec U>2 140% @ 0.1Sec
	Do you apply grading in over-voltage setting for lines at one station. Please specify the setting values adopted for: Stage-I : (typical value - 106 to 112 % , delay : 4-7 Sec) Stage-II: (typical value - 140 to 150%, delay: 0 to 100msec.)	☑	☐	
22	Is 1-ph Auto –reclosing provided on 765, 400 & 220kV lines? Please specify the set value: Dead time: (typical 1 Sec) Reclaim time: (typical 25 Sec)	☑	☐	Dead Time 850 ms
23	Is the Distance communication. Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines? If any other communication scheme has been applied, please provide the detail with justification thereof.	☑	☐	
24	Is the Current reversal guard logic for POR scheme provided on Double circuit lines?	☐	☑	
25	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether week end-infeed feature has been enabled in respective distance relay or not	☐	☐	Not applicable
26	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	☐	☐	Not applicable
27	What line current , Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment. (In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)			Not Active
28	a) What are the Zones blocked on Power swing block function:	Z1	Z2 / Z3 / Z4	Trip provided in Zone-1, All higher zones are blocked.
	b) Setting for Unblock timer: (typical 02 second)	02 Sec		
	c) Out of Step trip enabled	☐	☑	
29	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	☐	☑	
30	a) Is the Disturbance recorder provided for Transformer feeder	☑	☐	
	b) Whether standalone or built in Main relay	Standalone	~~built in~~	
	c) Whether DR is having automatic fault record download facility to a central PC	☐	☑	
	d) Whether DR is time synchronised with the GPS time synchronising equipment	☑	☐	
	e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage.	☑	☐	
	f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.	☑	☐	

THIRD PARTY PROTECTION SYSTEM CHECKING & VALIDATION FOR 220/132/33 kV HPSEB KUNIHAR SUBSTATION

A	**General Information**		
1	Substation name:		HPSEBL Kunihar Substation
2	Name of Owner Utility		HPSEBL
3	Voltage Level (s) or highest voltage level		220/132kV: 400 MVA
4	Short circuit current rating of all equipment (for all voltage level)		Annexure Short circuit
		220 kV	40kAmp
		132 kV	40kAmp
5	Date of commissioning of the substation		1989
6	Date of Audit		18/19.10.2024
7	Previous one-year tripping details		Annexure Tripping
8	Relay Test Reports		Not available, however last testing done in 2021.
9	SLD of SS		Annexure_ SLD
10	AC aux SLD		Not available
11	DC aux SLD		Not available
12	SAS architecture		Not available

B The preliminary report shall inter-alia contain the following:

S. No.	Issues	Remarks
1	Recommendation of last protection checking/audit	Available. Last protection audit done on 03.07.2021
2	Review of existing settings at substation	Reviewed
3	Disturbance Recorder for last 6 month trippings	Reviewed
4	Chronic reason of tripping, if any	Most tripping was done due to Vegetation/Tree falling
5	Major non-conformity/deficiency observed	220KV Bus bar protection needs to be taken in service.

C) The relay configuration checklist for available power system elements at station:

S.No	Name of Element	Remarks
i	Transmission Line	AVAILABLE
ii	Bus Reactor/Line Reactor	NOT APPLICABLE
iii	Inter-connecting Transformer	AVAILABLE
iv	Busbar Protection Relay	Not Available
v	AC auxiliary system	Not Available
vi	DC auxiliary system	Not Available
vii	Communication system	Not Available
viii	Circuit Breaker Details	Annexure_CB details
ix	Current Transformer Details	Annexure_CT details
x	Capacitive Voltage Transformers Detail	Annexure_PT details
xi	Any other equipment/system relevant for protection system operation	NA

(d) Minimum set of Points for Checking and Validation:

Detailed list to be prepared by validation team in consultation with concerned entities, RLDC, and RPC.

(i) Transmission Line Distance Protection/Differential Protection:

S.No	Item	Remarks
a	Name and Length of Line	Mentioned in below table (Sr. 3A and 3B)
b	Series compensated or not	NO
c	Mode of communication used (PLCC/OPGW)	OPGW
d	Relay Make and Model for Main-I and Main-II	Mentioned in below table (Sr. 2D and 2E)
e	List of all active protections & settings	Attached
f	Carrier aided scheme if any	Not-implemented
g	Status of Power Swing/ Out of Step/ SOTF/Breaker Failure/ Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.	Already covered in relay settings except Auto reclose and over voltage.
h	Relay connected to Trip Coil-1 or 2 or both	BOTH
i	CT ratio and PT ratio	Covered in CT/PT Annexure
j	Feed from DC supply-1 or 2	YES
k	Connected to dedicated CT core (mention name)	Covered in CT/PT Annexure
l	Other requirements for protection checking and validation	NIL

(ii) Shunt Reactor & Inter-connecting Transformer Protection:

S.No	Item	Remarks
a	Whether two groups of protections used (Group A and Group B)	YES
b	Do the groups have separate DC sources	YES
c	Relay Make and Model	Mentioned in below table (Sr. 2D and 2E)
d	List of all active protections along with settings	ATTACHED
e	Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure	Already covered in relay settings
f	Status of Oil Temperature Indicator/Winding Temperature Indicator/Bucholz/Pressure Release Device etc.	ALL HEALTHY
g	Relay connected to Trip Coil-1 or 2 or both	BOTH
h	CT ratio and PT ratio	Covered in CT/PT Annexure
i	Feed from DC supply-1 or 2	YES
j	Connected to dedicated CT core (mention name)	YES
k	Other requirements for protection checking and validation	NIL

(iii) Busbar Protection Relay:

S.No	Item	Remarks
a	Busbar and redundant relay make and model	REB 670

b	Type of Busbar arrangement	DOUBLE MAIN BUSBAR SCHEME
c	Zones	2
d	Dedicated CT core for each busbar protection (Yes/No)	YES
e	Breaker Failure relay included (Yes/No), if additional then furnish make and model	YES
f	Trip issued to both Busbar protection in case of enabling	YES
g	Isolator indication and check relays	YES
h	Other requirements for protection checking and validation	NIL

(iv) AC auxiliary system:

S.No	Item	Remarks
a	Source of AC auxiliary system	2 NOS. SERVICE TRANSFORMERS
b	Supply changeover between sources (Auto/Manual)	AUTO
c	Diesel generator (DG) details	125 KVA
d	Maintenance plan and supply changeover periodicity in DG	WEEKLY
e	Single Line Diagram	Already attached
f	Other requirements for protection checking and validation	NIL

(v) DC auxiliary system:

S.No	Item	Remarks
a	Type of Batteries (Make, vintage, model)	LEAD ACID TUBULAR BATTERIES (Bank-I-Make-AAJCO, MODEL-5TBS-400). (Bank-II-Make-HBL, MODEL-6OPZS-400).
b	Status of battery Charger	HEALTHY
c	Measured voltage (positive to earth and negative to earth)	MENTIONED IN TABLE-4
d	Availability of ground fault detectors	YES
e	Protection relays and trip circuits with independent DC sources	YES
f	Other requirements for protection checking and validation	NIL
g	Communication system	NOT AVAILABLE
i	Mode of communication for Main-1 and Main-2 protection	NOT AVAILABLE
ii	Mode of communication for data and speech communication	
iii	Status of PLCC channels	
iv	Time synchronization equipment details	
v	OPGW on geographically diversified paths for Main-1 and main-2 relay	
vi	Other requirements for protection checking and validation	

(vi) Circuit Breaker Details

S.No	Item	Remarks
a	Details and Status	Covered in CB Annexure
b	Healthiness of Tripping Coil and Trip circuit supervision relay	
c	Single Pole/Multi pole operation	
d	Pole Discrepancy Relay available(Y/N)	
e	Monitoring Devices for checking the dielectric medium	
f	Other requirements for protection checking and validation	

(vii) Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details:

S.No	Item	Remarks
a	CT/CVT ID name and voltage level	Covered in CT/CVT Annexure
b	CT/CVT core connection details	
c	Accuracy Class	
d	Whether Protection/Metering	
e	CT/CVT ratio available and ratio adopted	
f	Details of last checking and validation of CT/CVT healthiness	
g	Other requirements for protection checking and validation	
h	Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.	AVAILABLE

2)	**Availability of Protection System**	
A)	**Bus Bar relay (220 KV)**	
i)	Make and Model of Bus Bar relay	ABB-REB 670
ii)	Whether stability checks are done or not	Done during initial commissioning, but record not available
iii)	Date of testing	NA
iv)	Remarks (if any)	Working stable, No mal-operation since commissioning.
B)	**Bus Bar relay (132 KV)**	
i)	Make and Model of Bus Bar relay	Not Available
ii)	Whether stability checks are done or not	NA
iii)	Date of testing	NA
iv)	Remarks (if any)	

(c) Sub-station protection and monitoring Equipment

	System	Time synchr-onizing system (GPS) (Make & Model)	Availability (in service or not)	Date of testing	Event Logger (Make & Model)	Availability (in service or not)	Synchro ni zing Facility Availabl e or not	Synchro Check Relay (Make and Model)	The setting of Synchro check Relay
01	220 KV	Signal India BHMS_1007S	Available	Not Available	BCU	Available	Available	Yes, In BCU	Angle: 35 ° Lockout V-90 % of nominal voltage Time setting: 2 Sec
02	132 KV	NA	NA	NA	NA	NA	NA	NA	NA

D)	Transmission Line Protection-I									
	Name of Line	Main-I Prot. (Make and Model)	Availability (in service or not)	Date of testing	Main-II Protection (Make and Model)	Availability (in service or not)	Date of testing	LBB Protection (Make and Model)	Availability (in service or not)	Date of testing
	220 KV									
i)	220KV KUNIHAR BHABA WANGTOO CKT1	ABB-REL-670	Available	NA	MICOM P-444	Available	NA	REB 670	Available	NA
ii)	220KV KUNIHAR KOTLA CKTM 2	ABB-REL-670	Available	NA	MICOM P-444	Available	NA	REB 670	Available	NA
iii)	220 KV KUNIHAR BADDI CKT NO 1	ABB-REL-670	Available	NA	MICOM P-444	Available	NA	REB 670	Available	NA
iv)	220 KV KUNIHAR BADDI CKT NO 2	ABB-REL-670	Available	NA	MICOM P-444	Available	NA	REB 670	Available	NA
	132 kV									
i)	132 KV KUNIHAR KANGOO D/C CKT 1	NIL	NIL	NIL	NIL	NIL	NIL	NA	Available	NA
ii)	132 KV KUNIHAR DARLA KANGOO CKT 2	NIL	NIL	NIL	NIL	NIL	NIL	NA	Available	NA
iii)	132 KV KUNIHAR KANGOO S/C	NIL	NIL	NIL	NIL	NIL	NIL	NA	Available	NA
iv)	132 KV KUNIHAR SOLAN CKT 1	NIL	NIL	NIL	NIL	NIL	NIL	NA	Available	NA
v)	132 KV KUNIHAR SOLAN CKT 2	NIL	NIL	NIL	NIL	NIL	NIL	NA	Available	NA
vi)	132 KV KUNIHAR SHIMLA CKT1	ABB-REL-670	Available	NA	NIL	NIL	NIL	NA	Available	NA
vii)	132 KV KUNIHAR MALAYANA CKT2	ABB-REL-670	Available	NA	NIL	NIL	NIL	NA	Available	NA
viii)	132 KV BROTI-WALA CKT 1	NIL	NIL	NIL	NIL	NIL	NIL	NA	Available	NA
ix)	132 KV BROTI-WALA CKT 2	NIL	NIL	NIL	NIL	NIL	NIL	NA	Available	NA

Transmission Line Protection-II

	Name of Line	PLCC/Protection coupler (Make and Model)	Availability (in service or not)	Date of testing	Disturbance Recorder (DR) (Make and Model)	Details of OC/EF Protection	Availability (in service or not)	Date of testing
	220 kV							
i)	220KV KUNIHAR BHABA WANGTOO CKT1	Not-Available	NA	NA	In M1/M2	ABB-REF-615	In service	24.05.21
ii)	220KV KUNIHAR KOTLA CKTM 2	Not-Available	NA	NA	In M1/M2	ABB-REF-615	In service	24.05.21
iii)	220 KV KUNIHAR BADDI CKT NO 1	Not-Available	NA	NA	In M1/M2	ABB-REF-615	In service	24.05.21
iv)	220 KV KUNIHAR BADDI CKT NO 2	Not-Available	NA	NA	In M1/M2	ABB-REF-615	In service	24.05.21
	132 kV							
i)	132 KV KUNIHAR KANGOO D/C CKT 1	Not-Available	NA	NA	NA	ABB-REL-650	In service	24.05.21
ii)	132 KV KUNIHAR DARLA KANGOO CKT 2	Not-Available	NA	NA	NA	ABB-REL-650	In service	24.05.21
iii)	132 KV KUNIHAR KANGOO S/C	Not-Available	NA	NA	NA	MICOM-P-442	In service	24.05.21
iv)	132 KV KUNIHAR SOLAN CKT 1	Not-Available	NA	NA	NA	MICOM-P-442	In service	NA
v)	132 KV KUNIHAR SOLAN CKT 2	Not-Available	NA	NA	NA	ASHIDA-ADR141A	In service	NA
vi)	132 KV KUNIHAR SHIMLA CKT1	Not-Available	NA	NA	NA	ABB-REL-670	In service	NA
vii)	132 KV KUNIHAR MALAYANA CKT2	Not-Available	NA	NA	NA	ABB-REL-670	In service	NA
viii)	132 KV BROTIWALA CKT 1	NA	NA	NA	NA	MICOM-P143	In service	NA
ix)	132 KV BROTIWALA CKT 2	NA	NA	NA	NA	MICOM-P14D	In service	NA

E) **Transformer Protection**

	Name of ICT	Differential Protection (Make & Model)	REF Protection (Make & Model)	Back-up Over Current Protection (Make & Model)	Over Flux Protection (Make & Model)	OTI/WTI Indication working or not	Buchholz/PRD	Any Other protection	Date of testing	LA Rating HV Side	LA Rating IV Side
i)	ICT-1	MICOM P633	ER-DCD414A	MICOM-P127	In built in P633	Working	Working	NA	Data not available	198 KV	120KV
ii)	ICT-2	ABB-RET670	ABB-RET670	ABB-REF615	In built in RET670	Working	Working	NA	Data not available	198KV	120KV

3) A	Line Parameters	220 kV System				Remarks
i)	Name of Line	BHABA	KOTLA	BADDI 1	BADDI 2	
ii)	Line Length (kM)	136	106	26	26	
iii)	Line Parameters (In Ohms/Per KM/Per Phase Primary value)	1 zebra	1 zebra	1 zebra	1 zebra	
	R1	0.0695	0.0695	0.0695	0.0695	
	X1	0.3973	0.3973	0.3973	0.3973	
	Ro	0.2543	0.2543	0.2543	0.2543	
	Xo	1.2453	1.2453	1.2453	1.2453	
	RoM					
	XoM					
iv)	Present Relay setting	Reviewed.				
a	Adopted Relay setting	Reviewed				
b	Recommended relay setting	NA				

3) B	Line Parameters	132 kV System								
i)	Name of Line	KANGOO 1&2	KANGOO-3	DARLAGATH	SOLAN 1	SOLAN 2	SHIMLA 1	MALYANA 2	BROTIWALA 1	BROTIWALA 2
ii)	Line Length	46	46	47	22	22.6	15	34	26	26
iii)	Line Parameters (In Ohms/Per KM/Per Phase Primary value)	1 Panthar	1 Panthar	1 Panthar	1 Panthar	1 Panthar	1 Panthar	1 Panthar	1 Panthar	1 Panthar
iv)	Present Relay setting		Reviewed.							
a	Adopted Relay setting		Reviewed							
b	Recommended relay setting		NA							

4) DC supply

		220 /110 V DC-I	220 /110 V DC-II	48 V DC-I	48 V DC-II
a	Measured voltage (to be measured at farthest Panel	242.3	248.9	NIL	NIL
i)	Positive to Earth	140.0	75	NIL	NIL
ii)	Negative to Earth	105.0	170.6	NIL	NIL
b	No .of Cells Per Bank	110	110	NIL	NIL
c	Availability of Battery Charger	Yes	Yes	NIL	NIL

5)	Circuit Breaker						
		Make and Model	Status of Breaker Available or Not	No. of trip/close coil & healthiness	PIR (Available or Not)	Date of Last Timing taken	Remarks (If any)
A.	220 kV System						
i).	220 kV Bhaba	ABB, LTB245 E-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
ii).	220 kV Kotla	ABB, LTB245 E-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
iii).	220 kV Baddi 1	ABB, LTB245 E-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
iv).	220 kV Baddi 2	ABB, LTB245 E-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
v)	ICT-1	AREVA, FK 3-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
vi)	ICT-2	ABB, LTB245 E-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
B	132kV System						
i).	132 kV Kangoo D/C	ABB, ELF SF2-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
ii).	132 kV Kangoo	ABB, LTB245 E-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
iii).	132 kV Darlagath	ABB, LTB245 E-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
iv).	132 kV Shimla -1	ABB, LTBD-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
v).	132 kV Malyana-2	ABB, LTBD-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
vi).	132 kV Solan-1	ABB, LTB245 E-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
vii).	132 kV Solan-2	ABB, ELF SF2-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
viii).	132 kV Barotiwala-1	ABB, LTBD-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
ix).	132 kV Barotiwala-2	ABB, LTBD-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
x).	132 kV ICT-1	CGL, 120-SFM-32A	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	
xi).	132 kV ICT-2	ABB, LTBD-1	AVAILABLE	02 T.C, 01 CLOSING COIL	NA	Not Available	

6)	**Availability of auxiliary System**			
i)	**Auxiliary Supply**	**Source of Supply**	**Reliability of Supply**	**Average tripping per month**
	Supply-I	33/0.415 KV, 630 KVA	GOOD	01
		TRANSFORMER		
	Supply-II	33/0.415 KV, 630 KVA TRANSFORMER	GOOD	01
ii)	**DG Set**			
	Make	CUMMINS LTD./ SUDHIR LTD		
	Rating	125 KVA		
	Whether DG set on Auto or manual	AUTO	GOOD	
7)	**Availability of UFR relay**	132 KV BROTIWALA CKT 2		
	Make	ALSTOM, P14D		
	Setting	48.60/ 100ms		
8)	**Availability of df/dt relay**	132 KV BROTIWALA CKT 1		
	Make	AREVA, P143		
	Setting	Avg Cycle 10-2HZ/S-500ms		
9)	**Special Protection Scheme (SPS)**	NA		
	Available (Yes/No)	NO		
	Verification	NA		
10)	**Status of Corrective action based on Tripping analysis**			
		All tripping reports along with analysis report sent to NRPC on regular basis.		
11)	**Any Other Observation/ Comments**			

1. 220 kV both Bus Bars protections are kept out of service, the same needs to be taken in.
2. 132 kV Bus Bas protection is not available/installed, the same needs to be implemented for reliable operation of protection scheme and clearing of faults.
3. In all MICOM P444 relays all the tripping outputs settings needs to be changed to DWELL with pickup value 100ms in PSL logic.
4. In all 220 kV line feeders Auto reclose function is available but not in service. Same needs to be taken into service as per latest guidelines.
5. In both ABB and MICOM relays circuit breaker open status is to be added in DR for proper analysis of the fault.
6. In all 220kV and 132 kV line feeders, there is no PLCC /DTPC available/installed. As the communication is through OPGW, DTPC needs to be installed for implementation of Auto-reclose function.
7. In 132 KV Distance protection is to be implemented in Barotiwala Ckt-1 & 2 and Solan 1 & 2 feeders.
8. In 132 kV feeders there is no LBB protection available, same needs to be implemented.
9. In 132 kV line C&P panels, most of the aux relays are installed but are not healthy such as there is no

provision of alarm in case of tripping or trouble in other feeders. Non-reporting of tripping and important alarms like CB lockout, SF6 low, Air pressure low etc result in poor monitoring and delay in restoration/rectification, so the panels/relays needs to be replaced/modified.

10. In all 132 kV line feeders Auto reclose function needs to be implemented as per latest guidelines
11. SLD of ACDB and DCDB shall be made available.
12. Time Synchronization of all IEDs of 220 kV and 132 kV found to fail. There is no GPS signal available in GPS clock due to this all IED's are not time synced. This has to be rectified.
13. No protection testing record available at the site (Pre-commissioning /Routine testing). It is observed that there is no practice of testing the protection system functions. Proper SOP for testing, monitoring and record-keeping of protection system needs to adopt for the betterment of the protection system.
14. Protection spares are not available at sites. Heathy relays need to be kept in a suitable, so that same can be utilized during contingencies. Consumable spares e.g FO patch cords, Indication lamps, semaphores, indicating meters etc need to be kept at the site.
15. Trip circuit supervision is a very important monitoring mechanism same need to be implemented in all 132-kV systems on a priority basis.
16. DC Earth fault in sources 01 and 02 needs to be removed, present DC system condition is
    a. DC -1: +Ve to -Ve- 242.3 V, +Ve to E- 140.0 V, -Ve to E- 105.0 V
    b. DC -2: +Ve to -Ve- 248.9V, +Ve to E- 75.0 V, -Ve to E- 170.6 V., there is DC earth fault in DC-2, which needs to be rectified.

Document Referred:

c. *Report of Subcommittee on relay /protection under task force for power system analysis under contingencies-March 2014.*
d. *NRPC guidelines.*
e. *CBIP guidelines /Manual 274 & 296*

Signature

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ANNEXURE_TRIPPING DETAILS

DETAIL OF TRIPPING BETWEEN 01.01.2024 TO 15.10.2024

Sr. No.	Date	Element	Voltage level	Tripping time	Tripping Duration	Tripping reason
1	19-01-2024	220KV Bhaba CKT I	220 KV	02:50	01:06	B phase Earth fault IB= 814.20 IN =841.34 Amp
2	08.02.2024			10:42	01:25	B phase Earth fault
3	11.02.2024			00:22	01:14	B & Y phase Earth fault
4	18.05.2024			21:32	00:30	CT Blast at 220 KV S/St. Baddi R phase earth fault IR = 1379.21 IN= 1727.81 Amp
5	20.05.2024			13:39	01:24	B phaseEarth Fault IB= 3658Amp In=3861 amp
6	29.05.2024			10:22	00:46	B phaseEarth Fault IB= 2343Amp In=2530amp
7	19.06.2024			18:25	00:40	Y phaseEarth fault Iy=6593 Amp In= 6905 Amp
8	18.09.2024			11:16	00:56	B phaseEarth Fault IB= 1116Amp In=1540amp
9	06.10.2024			02:56	06:14	Y phase, Bphase Fault Iy=1581.93 IB= 1735.84 Amp
10	16.02.2024	220KV Kotla CKT II	220 KV	11:30	00:41	R phase Earth fault
11	18.05.2024			21:32	00:30	CT Blast at 220 KV S/St. Baddi R phase earth fault IR = 1379.21 IN= 1727.81 Amp
12	20.05.2024			13:39	00:36	R phase Earth fault IR=3549 Amp In=3326 amp
13	14.06.2024			23:17	01:45	CT blast at 220 KV S/St. Kunihar
14	02.02.2024	220kv Baddi CKT I	220 KV	15:28	00:45	
15	16.02.2024			11:33	00:03	
16	02.02.2024	220 KV Baddi CKT II	220 KV	15:28	00:40	
17	16.02.2024			11:33	00:03	
18	18.05.2024			21:32	01:35	R Phase Earth Fault IR=1379.21`In=1727.81 Amp
19	14.06.2024	220/132 KV Bank I	220/132 KV	23:17	07:53	CT Blast R phase HV Side Bank I
20	14.06.2024	220/132 KV Bank II	220/132 KV	23:17	00:15	CT Blast R phase HV Side Bank I
21	12.01.2024	132 KV Shimla CKT I	132 KV	12:03	00:21	CT blast at 132 KV S/Stn. Jutog
22	27.04.2024			17:42	00:28	IR=6766.21 Amp IN=5961.29 Amp
23	18.05.2024			21:50	00:14	
24	01.06.2024			09:12	00:18	Y phase earth fault due to CT Blast at Jutog s/stn.
25	02.02.2024	132 KV Shimla CKT II	132 KV	15:28	01:00	Main supply failed from Baddi S/stn.
26	28.06.2024			16:06	00:17	RB Earth fault IR=3442.31 AMP IB=4277.52 Amp In=3026.17 amp
27	01.02.2024	132 KV solan CKT I	132 KV	12:58	00:18	Ir=1745 IY=1860 I=1820 Amp
28	02.02.2024			15:28	00:53	Due to main supply fail
29	05.02.2024			00:40	00:04	Iy=1820 Amp Ib=2110 Amp In=1270 amp
30	02.03.2024			01:02	00:08	Ir=1825 Amp In=1270 amp
31	30.03.2024			06:01	00:23	Ir=2105 In=915 amp
32	21.05.2024			13:48	00:11	Ir=3110 amp In=650 amp
33	15.05.2024	132 KV solan CKT II	132 KV	13:43	00:10	Ir=2700 In=1230 Amp
34	21.05.2024			13:48	00:15	Ir=2700 In=1230 Amp
35				14:34	00:28	Ir=2240 In=1083 Amp
36	19.06.2024	132 KV Kangoo S/C	132 KV	18:16	00:34	
37	26.05.2024	132Kv Kangoo Kunihar D/C I	132 KV	18:18	00:26	Ib=1211.82 in=1061.47 amp
38	06.10.2024	132 KV Barotiwala CKT I	132 Kv	02:43	00:04	Iy=523 In=2.432 Amp
39	08.10.2024			14:47	00:17	R phase Earth Fault
40	14.10.2024			13:33	00:09	Ir=3479 In=2590 Amp
41	15.10.2024			10:57	00:28	Ir=3395 In=2528 Amp
42	20.02.2024	132 KV Barotiwala CKT II	132 KV	09:11	00:07	B phas earth fault

Details of Circuit Breakers Installed in Kunihar Sub-station

Sr no	Element	Voltage Level	Make	Type	Rating	
					Normal current rating	Short Circuit Current
1	220KV Bhaba CKT I	245 KV	Abb	LTB245E1	2000 Amp	3S 31.5 KAmp
2	220KV Kotla CKT II	245Kv	Abb	LTB245E1	2000 Amp	3S 31.5 KAmp
3	220kv Baddi CKT I	245 KV	Abb	LTB245E1	2000 Amp	3S 31.5 KAmp
4	220 KV Baddi CKT II	245Kv	Abb	LTB245E1	2000 Amp	3S 31.5 KAmp
5	160MVA 220 KV ICT- I	245Kv	AREVA	GL314	2000 Amp	3S 31.5 KAmp
6	160MVA 220 KV ICT- II	245Kv	Abb	LTB245E1	2000 Amp	3S 31.5 KAmp
7	220 KV Baddi CKT II	245Kv	Abb	LTB245E1	2000 Amp	3S 31.5 KAmp
5	160MVA 132KV ICT- I	145 KV	CGL	120-SFM-32B	1600 Amp	3S 40 KAmp
6	160MVA 132KV ICT- II	145 Kv	Abb	LTBD1	1600 Amp	3S 31.5 KAmp
8	132 KV Shimla CKT I	145 KV	Abb	LTBD1	1600 Amp	3S 31.5 KAmp
9	133 KV Shimla CKT II	145 Kv	Abb	LTBD1	1600 Amp	3S 31.5 KAmp
10	132 KV solan CKT I	145 KV	Siemens	LTBD1	1600 Amp	3S 31.5 KAmp
11	132 KV solan CKT II	145 KV	Abb	LTBD1	1600 Amp	3S 31.5 KAmp
12	132Kv Kangoo Kunihar S/C	145 KV	Abb	LTBD1	1600 Amp	3S 31.5 KAmp
13	132Kv Kangoo Kunihar D/C I	145 KV	Siemens	LTBD1	1600 Amp	3S 31.5 KAmp
14	132Kv Kangoo Darla KuniharD/c II	145 KV	Abb	LTBD1	1600 Amp	3S 31.5 KAmp
15	132 KV Barotiwala CKT I	145 KV	Abb	LTBD1	1600 Amp	3S 31.5 KAmp
16	132 KV Barotiwala CKT II	145 KV	Abb	LTBD1	1600 Amp	3S 31.5 KAmp

Annexure_CT_Details

Details of Current Transformers Installed in Kunihar Sub-station

Sr no	Element	Voltage Level	Make	Rating	Core
1	220KV Bhaba CKT I	220 KV	Mehru	600-300/1-1-1-1-1	5
2	220KV Kotla CKT II	220Kv	Mehru	600-300/1-1-1-1-1	5
3	220kv Baddi CKT I	220KV	Mehru	600-300/1-1-1-1-1	5
4	220 KV Baddi CKT II	220 KV	Mehru	600-300/1-1-1-1-1	5
5	132 KV Shimla CKT I	132KV	Mehru	600-300/1-1-1-1-1	5
6	132 KV Shimla CKT I	132KV	Mehru	500-250/1-1-1	3
7	132 KV solan CKT I	132KV	HEPTACARE Power Industries	500-250/1-1-1-1-1	5
8	132 KV solan CKT II	132KV	Mehru	500-250/1-1-1	3
9	132Kv Kangoo Kunihar S/C	132KV	Mehru	600-300/1-1-1-1-1	5
10	132Kv Kangoo Darla Kunihar D/C I		Mehru	500-250/1-1-1-1-1	5
11	132Kv Kangoo Kunihar D/C I		Mehru	500-250/1-1-1-1-1	5
12	132 KV Barotiwala CKT I	132KV	Mehru	500-250/1-1-1	3
13	132 KV Barotiwala CKT II	132KV	Mehru	600-300/1-1-1-1-1	5

Annexure_CVT_Details

Details of Current Transformers Installed in Kunihar Sub-station

Sr no	Element	Voltage Level	Make	Rating
1	220KV Bhaba CKT I	220 KV	Crompton greeves	245KV
2	220KV Kotla CKT II	220Kv	Crompton greeves	245KV
3	220kv Baddi CKT I	220KV	Crompton greeves	245KV
4	220 KV Baddi CKT II	220 KV	Crompton greeves	245KV
5	132 KV Shimla CKT I	132KV	Crompton greeves	145Kv
6	132 KV Shimla CKT I	132KV	Crompton greeves	145 Kv
7	132 KV solan CKT I	132KV	Crompton greeves	145Kv
8	132 KV solan CKT II	132KV	Crompton greeves	145 Kv
9	132Kv Kangoo Kunihar S/C	132KV	Crompton greeves	145Kv
10	132Kv Kangoo Darla Kunihar D/C I	132KV	Crompton greeves	145 Kv
11	132Kv Kangoo Kunihar D/C I		Crompton greeves	145Kv
12	132 KV Barotiwala CKT I	132KV	Crompton greeves	145 Kv
13	132 KV Barotiwala CKT II	132KV	Crompton greeves	145Kv

~~Annexure A.VIII~~

Third Party Production Audit Product and Compliance in r/o 220/132/33kV Sub Station, Sub-Division, HPSEBL, Kunihar.	
1	220 Kv both Bus Bars Protectors aree kept out of service, the same needs to be taken in.
Reply	The Bus Bars Protection Panels is not commisioned. The matter is take up with the higher authorities of HPSEBl & ABB India Ltd. And the Commissioning of panel will be done soon.
2	132 Kv bus Bars protection is not available/installed, the same needs to be implemented for reliable operation of protection scheme and clearing of faults.
Reply	A Scheme for replacement of all 132 kv cntrol and relay panels is submitted to higher authorities in PSDF - II scheme in which 132 kv bus bars protection panel is also available.
3	In all MICOM P444 relays all the tripping outputs settiungs needs to be changed to DWELL with pickup value 100ms in PSL logic
Reply	All the suggested setting will be changed during Protection ans testing to be planned for 11.12.2024 with proper shut down.
4	In all 220 kv line feeders auto release function is available but not in service. Same needs to be taken into service as per latest guidelines.
Reply	The auto reclosure function is available in 220 kv line feeders and same is activatedfor protection purpose
5	In both ABB and MICOM relays circuit breaker open status is to be added in DR for proper analysis of the Fault.
Reply	Matters has been taken up with Protection and Testing Unit , Soon it will be resolved.
6	In all 220 kv and 132 kv line feeders, there is no PLCC /DTPC available/installed. As the communication is through OPGW, DTPC needs to be installed for implementation of auto-reclose function.
Reply	Matters has been taken up with Protection and Testing Unit , Soon it will be resolved.
7	In 132 kv Distance protection is to be implemented in Barotiwala Ckt - 1 & 2 and Solan 1 & 2 feeders.
Reply	A Scheme for replacement of all 132 kv cntrol and relay panels is submitted to higher authorities in PSDF - II scheme.
8	In 132 Kv feeders there is no LBB protection available, same needs to be implemented.
Reply	A Scheme for replacement of all 132 kv cntrol and relay panels is submitted to higher authorities in PSDF - II scheme.
9	In 132 kv line C&P panels, most of the aux relays are installed but are not healthy such there is no provision of alarm in case of tripping or trouble in other feeders. Non-reporting of tripping, and important alarms like CB lockout, SF6 low, Air pressure low etc. result in poor monitoring and delay in restoration/rectification , so the panels/relays needs to be replaced/modified.
Reply	All 132 kv control and relay panel installed at 220 kv sub-station Kunihar are old and A Scheme for replacement of all 132 kv cntrol and relay panels is submitted to higher authorities in PSDF - II scheme.
10	In all 132 kv line feeders Auto reclose function needs to be implemented as per latest guidelines
Reply	All 132 kv control and relay panel installed at 220 kv sub-station Kunihar are old and A Scheme for replacement of all 132 kv cntrol and relay panels is submitted to higher authorities in PSDF - II scheme.
11	SLD of ACDB and DCDB shall be made available.
Reply	Prepared.

Sr. Executive Engineer,
220 KV ES Division,
HPSEBL Kunihar.

12	Time Synchronization of all IEDs of 220 kv and 132 kv found to fail. There is no GPS signal available in GPS clock due to this all IED's are not time synced. This has to be rectified.
Reply	Matters has been taken up with ABB and soon it will be rectified.
13	No protection testing record available at the site (Pre-Commissioning/Route testing). It is observed that there is no practice of testing the protection system functions. Proper SOP for testing, monitoring and record-keeping of protection system needs to adopt for the betterment of the protection system.
Reply	The testing of relays of ICT - I and ICT - II were done during the periodical testing of Transformers and the matter of testing all the feeder relays during the periodical testing of sub-station is take up with protection and testing team of HPSEBl
14	Protection spares are not available at sites. Healthy relay needs to be kept in a suitable, so that same can be utilizedb during contingencies. Consumable spares eg. FO patch cords, indication lamps, semaphores, indicating meters etc need to be kept at site.
Reply	Few protection spares procured and rest of raise the matter to higher Authorities.
15	Trip Circuit supervision is a very important monitoring mechanism same need to be implemented in all 132 kv systems on a priority basis.
Reply	The panels and wiring of 132 kv system is old and the relays installed these panels are electromechanical type which are not in healthy condition. A Scheme for replacement of all 132 kv cntrol and relay panels is submitted to higher authorities in PSDF - II scheme.
16	DC Earth fault in sources 01 and 02 needs to be removed, present DC system condition is. (A) DC - 1: +ve to -ve 242.3 V, +Ve to E- 140.0 V, -Ve to E- 105.0 V (B) DC- 2: +Ve to -Ve- 248.9V, +Ve toE- 75.0 V, -Ve to E- 170.6 V, there is DC Earth Fault in DC-2, which needs to be rectified.
Reply	For rectification of DC Earth fault the sub-station maintenance team is performing regular duties such as replacement of old DCMCB's Dc fuse and also replacing the old damage terminal blocks.

Sr. Executive Engineer,
220 KV ES Division,
HPSEBL Kunihar

Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

220/132KV Pantnagar Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल

CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

25th June 2024

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 220/132 KV PANTNAGAR SUBSTATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
EE	Executive Engineer
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
JE	Junior Engineer
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee

PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System
SE	Superintendent Engineer
SCADA	Supervisory Control & Data Acquisition
SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
T&C	Testing & Commissioning
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

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While every effort is made to ensure the accuracy and completeness of information contained, CBIP takes no responsibility and assumes no liability for any error/ omission or accuracy of the information. Recipients of this material should rely on their own judgments and conclusions from relevant sources before taking any decision.

1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400KV and 8 nos. 220KV substations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered to. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred.

As a part of audit process, Utility was asked to provide a set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan & Mr. Rounak Sen visited 220/132KV Pantnagar Substation during 26^{th} – 29^{th} December 2023 and preliminary audit report was submitted on the spot. The representatives of Utility were present during this process. Additional information was also sought from the Utility.

Based on the data made available by the Utility, the final report is being submitted to Utility. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220kV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on "Draft O&M Manual" of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Annexure - 1. Also, a list of switchyard maintenance equipment is placed at annexure -3. It is recommended that the necessary testing and maintenance equipment at substation/Sub-division/Division be arranged for regular testing and maintenance of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC-2023.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru' third party for implementing the best practices in the sub-station.
10. It is suggested that the existing draft O&M manual be updated to take care of latest developments.

Observations and Recommendations for 220/132KV Pantnagar Substation

01. From analysis of the tripping for last one year, no significant abnormal protection operation was noticed.
02. Bus-Bar protection is installed but not commissioned till date for 220KV bus. It is understood that PTCUL is in the process of inviting tender for getting the Bus-bar Protection installed. This needs to be expedited.
03. DC earth fault is observed in both DC systems. It was observed that both 220V battery banks were having earth faults. The necessary corrective action needs to be taken asap.
04. The SAS needs to be updated for the new elements introduced in the substation post-commissioning and kept functional.
05. GPS based Time Synchronisation of the relays is installed at the substation., However, the same is not synched with relay clock. Needs to be checked for missing GPS communication.
06. Based on inputs provided by utility and analysis of data a list of suggested switchyard and maintenance equipment for replacement is provided in Annexure – 2.
07. Updated SLD of Aux AC and DC system needs to be made available at Sub-station
08. Existing DG set needs to be replaced with suitable capacity DG Set
09. 2^{nd} 48V DC Battery set needs to be provided.

2.0. Introduction

2.1. Background

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400 KV and 08 Nos. 220 KV Substations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following substations is to be carried out

1. *400KV Rishikesh*
2. *400KV Kashipur*
3. *220KV Chamba*
4. *220KV Rishikesh*
5. *220KV Roorkee*
6. *220KV Haridwar (SIDCUL)*
7. *220KV Jhajra*
8. *220KV Pantnagar*
9. *220KV Haldwani*
10. *220KV Mahuakheraganj*

2.2. Scope of Work

Review of the implemented protection schemes/philosophy for 400/220 KV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.
b. Availability/healthiness of PLCC communication links used for protection systems.
c. Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.
d. Availability/healthiness of GPS system and time synchronization facility used for protection.
e. Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.
f. Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.
g. Field inspection of protection device for obsolescence of technology, suitability and healthiness.
h. Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.
i. Checking of availability of DG Set / auxiliary DC supply at substations.

2.3. Audit Rationale

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipment under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) "All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC".
c. As per Para – 15 (4) of said Code, "The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC".
d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71^{st} NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per Annexure -1 of IEGC-2023.

2.4. *Audit Process*

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets.
  b. Latest relay settings adopted and calculations for respective substations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP.
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each substation, PTCUL to provide the check-list, which shall be verified during field visit.

- The minimum set of points, on which checking and validation to be carried out, is attached as per annexure – 4, for the following available power system elements at station, as per attached formats:

S. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-Connecting Transformer [ICT]
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL

- A calibrated multi-meter shall be provided at substation for checking AC and DC voltages and currents online, wherever feasible, without impacting the substation operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity / deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**

  - The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna-committee guidelines or CBIP manual based).
  - The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - All the major general deficiencies shall be listed in detail along with remedial recommendations.
  - The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. *About Power Transmission Corporation of Uttarakhand Ltd. (PTCUL)*

The State of Uttarakhand's Power Transmission Utility, PTCUL, was formerly known as Power Transmission Company of Uttaranchal Ltd. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttarakhand in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For Generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttarakhand Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. About Central Board of Irrigation & Power (CBIP)

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 97 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of Pantnagar Substation

3.1. General Information about Substation

Sl. No.	Particulars	Details
1	**Substation Name**	220/132/33 KV Pantnagar Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	220/132/33 KV
4	**Short circuit current rating of all equipment (for all voltage level)**	40kA and 50kA
5	**Date of commissioning of the substation**	4th October 2006
6	**Checking and validation date**	26th – 29th December 2023

3.2. Audit Team

Audit Team (CBIP)

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Rounak Sen

PTCUL Representative

- Mr. Asim Baig - Executive Engineer
- Mr. Ashutosh Pokhriyal - Assistant Engineer
- Ms. Nikita Darmwal - Junior Engineer

3.3. Recommendation of last protection checking and validation

As per the information received, previous protection audit was carried out by NRPC, dated: 27th July 2015.

a. **Following observation were recorded during previous audit**

Sl. No.	Observation	Current Status
1	220 KV Bus bar protection is out of service for the last more than two years after it tripped. Bus bar protection relay P633 is defective showing error code.	Bay Units are pending to be installed.
2	All 220 KV lines except 220KV Bareilly line, the main-1 & main-2 protection has same make & type of relay i.e. ALSTOM make P442. As per NRPC guide line main-1 & main-2 protection relay should be preferably of different make.	In the process of being replaced.
3	HMI of Bareilly line main-1protection relay, HV side of- 2x160 MVA, 220/132 KV and 2 x 80 MVA, 132/33 KVA transformers-differential-relay is not working, due to which relay settings cannot be changed.	The relay is replaced.
4	Battery of main-1 & main-2 distance relay type P442 of 220 KV TATA motors line have been taken out a year back which may be put back for services for time synchronising.	Synchronization has taken place
5	GPS clock is not installed due to which time synchronization of relay is not there.	GPS Clock installed.
6	No PLCC is installed on 220 KV Pantnagar-Bareilly line. Other PLCC	PLCC is in the process of being installed.

Sl. No.	Observation	Current Status
	panels available with or without protection coupler at substation be commissioned	
7	Incoming supply from 400 KV Kashipur and 400 KV Bareilly not running in synchronism. Both sources are connected on separate 220 KV buses.	Both sources are synchronized.
8	About 60 nos. Ampere meters and volt meters are not working. Meters for replacement are available same be replaced at the earliest.	Meters have been replaced.
9	All the protection relays installed are numerical. For better operation of these relays, air conditioning be provided in the control room.	Air Conditioning has been provided.
10	DG set of suitable capacity be made available at Substation as a back-up source.	DG set if 25kVA is installed at site. However, it is not of sufficient capacity.

3.4. Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.
b. The record of different relay setting calculations is not available at the substation level.
c. All relays are numeric, therefore, as per internal protocol of utility relays are tested only at the time of commissioning/change in setting.
d. Copy of test reports not available at substation level.

3.5. Disturbance Recorder availability for the last 6 trippings

a. Utility is submitting Disturbance Recorder data for Inter-State Line 220KV Rudrapur-Bareilly Line to NRLDC Portal. The record is not maintained at substation level.

b. For transformers and Intra-state lines, DR data is taken at station level, for analysis purpose, utility shall be submitting same with tripping analysis report.

3.6. Chronic reason of tripping, if any

a. Based on list of tripping submitted by utility for last 12 months, ***no major tripping*** for 220/132KV Substation was observed. Most of the faults observed were transient in nature.
b. During earthquakes in January & October 2023, 80 MVA Transformers tripped. Utility informed that due to loose Mercury Contact on WTI indicator, this problem was encountered. This was rectified by replacing the contact on 05/11/2023.
c. 220KV Pantnagar – Bareilly Line gets auto-reclosed at Pantnagar but fails from the Bareilly end. The carrier-based tripping needs to be activated for successful auto-reclosure. PLCC panel installation for this line is being processed.

d. The 33KV feeders are showing frequent trippings. As 2 nos. transformers are directly connecting 220KV Bus to 33KV switchyard, any failure of protection to operate at 33KV level, may result in fault clearing at 220KV level. Utility has explained that these tripping may be due to fault at downstream 11KV network, therefore, fault may not impact 220kV level.

3.7. Major non-conformity/deficiency observed

a. Bus Bar Protection on 220KV Bus is not functional. Utility explained that the central unit of the busbar protection system is currently defective. The newly procured busbar relay, implemented through the PSDF scheme, is not compatible with the old bay units. The procurement of a compatible central unit is underway and is expected to be functional before March 31, 2024.
b. No Bus Bar Protection is provided for 132KV.
c. Some of the numerical relays are not provided with Time Sync Input and Communication Port. Therefore, these relays cannot be time synchronized and their information cannot be shared with SAS.

S. No.	Feeder name	Relay	Relay make
1	220KV Haldwani Line (LRPA)	Distance relay	MICOM P442
2	220KV Haldwani Line (LRPB)	Distance relay	MICOM P442
3	220KV Tata Motor (LRPA)	Distance relay	MICOM P442
4	220KV Tata Motor (LRPB)	Distance relay	MICOM P442
5	220KV Jafarpur Line (LRPB)	Distance relay	MICOM P442
6	132KV HZL	Distance relay	MICOM P442
7	132KV Rudrapur	Distance relay	MICOM P442
8	220KV B/B Protection	Peripheral unit	MICOM P742
9	TBC	LBB protection	MICOM P821
10	160MVA-I(HV)	O/C & E/F relay	MICOM P127
11	160MVA-II(HV)	O/C & E/F relay	MICOM P127
12	160MVA-I(LV)	O/C & E/F relay	MICOM P127
13	160MVA-II(LV)	O/C & E/F relay	MICOM P127
14	220KV Bus Coupler	O/C & E/F relay	MICOM P122
15	132KV Haldwani Line	O/C & E/F relay	MICOM P127
16	132KV Rudrapur Line	O/C & E/F relay	MICOM P127
17	132KV TBC	O/C & E/F relay	MICOM P821
18	80MVA T/F-I(HV)	O/C & E/F relay	MICOM P127
19	80MVA T/F-II(HV)	O/C & E/F relay	MICOM P127

d. SAS has been commissioned. However, it was observed that it is not in regular use and therefore, some of the inputs are not available. Further, no historical data could be extracted.

e. Both the 220V DC systems are showing severe earth-fault.

f. Only one no. 48V battery Bank is provided.

g. The Auxiliary DG set capacity is only 25 KVA, therefore, the backup provided by DG set, in case of emergency, is not sufficient.

h. 2 nos. GPS Time Synchronization Systems are provided in the substation. While one system caters to SAS, the other caters to relays & other equipment of the substation. Time difference of more than 1.8 secs is observed.

i. The events are recorded from individual relays. No separate Event Logger is provided. The SAS has the event logging capability but is NOT in regular use.

j. Recommended relay settings with supporting calculations / parameters needs to be kept at substation.
k. All the isolators are operated manually.
l. The AC and DC system needs to be checked during maintenance to avoid earth faults in auxiliary system.
m. Single line diagrams [SLDs] of Aux AC and DC supplies to be made available at substations for ready reference.

4.0. List of Trippings

Name of Feeder/TF	Relay	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Analysis of tripping	Category Code	Action Taken
80 MVA T/F I	Micom P643	24-01-2023 14:30 Hrs	24-01-2023 14:45 Hrs	Breaker Auto Trip, Breaker Trouble, Master Trip Relay Operated	NIL	T/F trip due to earthquake	NA	NA
220 KV PANTNAGAR -JAFARPUR LINE TRIP	Micom P442	33-01-2023 16:21 Hrs	30-01-2023 17:45 Hrs	Distance Prot. Operated, Distance trip, Fault Location - 5.065 Km, zone - 1 trip, IL1-6.176 kA, IL2-6.218 kA, IL3-144 A, VAN-65.05 KV, VBN-62.3 KV, VCN-126.31 KV	NIL	Transient Fault	NA	NA
CB-73,132 KV KATHGODAM LINE	Siemens	17-05-2023 15:44 Hrs	17-05-2023 16:02 Hrs	CP- Breaker Auto Trip, Distance protection operated, RP-Z1 trip, R, Y Trip, IL1-0.15 kA, IL2-2.08 kA, IL3-0.12 kA, Distance-13.15 Km.	Main Relay distance protection operated, Y Phase trip, loop L2-Earth, L1-0.01kA, L2-1.25kA, DISTANCE-34 Km.	Transient Fault	LEFT	NA

Name of Feeder/TF	Relay	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Analysis of tripping	Category Code	Action Taken
CB-82,220 KV JAFARPUR LINE	Micom	21-05-2023 14:15 Hrs	21-05-2023 14:35 Hrs	CP-distance Relay Trip, RP-Any Trip, Fault Distance-4.185 Km, Fault loop L3-N, Z1 Trip, IR-444.8Amp, IY-586.5 Amp, IB-4.017kA	CP-distance Relay Trip, RP-Any Trip, Fault Distance-14.70 Km, Fault loop L3-N, Z2 Trip, IR-430.5Amp IY-563.8 Amp IB-2.094 Kamp	CP-distance Relay Trip, RP-Any Trip, Fault Distance-4.185 Km, Fault loop L3-N, Z1 Trip, IR-444.8Amp, IY-586.5 Amp, IB-4.017KAmp	LEFT	NA
CB-73, 132 KV KATHGODAM LINE	Siemens	23-05-2023 23:09 Hrs	24-05-2023 02:45 Hrs	CP-Distance protection Start, Distance Protection trip, R.P-Z1, Distance Pick Up L2 E, Distance loop, Fault current-IL1-0.01 Kk, IL2-2.17 kA, IL3-0.01 kA, Distance-30.3 Km,	NIL	Transient Fault	LEFT	NA
160 MVA T/F -II	Micom P643	25-05-2023 08:16 HRS	25-05-2023 08:42 HRS	Over Current Fault, Ia-267 amp, Ib-273.7 amp, Ic-489.7 amp, In-266.7 Amp, Vab-213.6 KV, Vbc-215.8 KV, Vca-212.0 KV	NIL	NA	NA	NA

Name of Feeder/TF	Relay	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Analysis of tripping	Category Code	Action Taken
CB-88,220 KV PANTNAGAR LINE	ABB REL 650	25-05-2023 15:56 HRS	25-05-2023 16:10 HRS	Distance protection operated, R Phase trip, zone 1, IL1-4946.48 Amp, Il2-252.27 Amp, Il3-542.23 Amp	Not Tripped	Transient Fault	LEFT	NA
CB-88,220 KV PANTNAGAR LINE	ABB REL 650	25-05-2023 16:10 HRS	25-05-2023 19:18 HRS	Fault loop L1-L2, Fault Distance-1.8 Km, IL1-4945.90 Amp, IL2-3132.67 Amp, IL3-172.03-amp, Zone 1 trip, SOTF trip	Not Tripped	R phase jumper broken	NA	NA
220 KV HALDWANI LINE	NA	14-07-2023 14:01 Hrs	14-07-2023 14:17 Hrs	**Flags-** Distance Trip zone 1, Fault loop-L3N, Fault Location-19.37 Km, Fault current - IL1-223.5 Amp, IL2-222.9 Amp, IL3-2.895 Kamp, Voltage-Van-129.1 KV, Vbn-121.7 KV, Vcn-90.03 KV	**Flags-** Distance trip Zone1, Fault loop L3N, Distance-21.2 Km, Fault current-IL3-1.33 KA	Transient fault	LEFT	NA
220 KV BAREILLY LINE	NA	06-08- 2023 00:19 Hrs	06-08-2023 01:06 Hrs	Started Phase BN, Zone -1 trip, distance-20.30 Km, Ia-26.33 Amp, Ib-3.504Kamp, Ic-26 Amp	DPT G3.43 Kaen trip, Y phase trip, Zone-1 Distance -45.3 Km, fault current-3.43 kA	Transient fault	LEFT	NA

Name of Feeder/TF	Relay	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Analysis of tripping	Category Code	Action Taken
KASHIPUR LINE	NA	18-08- 2023 3:15 Hrs	18-08-2023 3:35 Hrs	Distance relay trip zone-1, R-phase trip, distance =4.229km, fault current IA=5419.54A, IB=241.41A, IC=324.98A, IN=5902.27A, VA=24.18KV, VB=132.41KV, VC=132.51KV,	Fault loop-RN, Distance trip zone-1, Distance - 55.94 Km, Fault current - IL1-2.419 kA, IN-1.909 kA.	Transient fault	LEFT	NA
220KV BAREILLY LINE	NA	01-09-2023 03:22hr	01-09-2023 04:44Hrs	Distance trip zone-1, started phase A-N, fault location=13.89km , IA=4.212KA, IB=256A, IC=703.6 A, VAN=45.78KV, VB=133.7KV, VCN=129.1 KV 1, started phase A-N, fault	IA-3207.88 Amp,Fault Loaction-49.93 Km.	Supply Fail from another end	LEFT	Line patrolling done by O&M Wing.
220KV BAREILLY LINE	NA	14-09-2023 15:11 Hrs	14-09-2023 15:51 Hrs	Distance trip zone-1, started phase B-N fault location=43.02 km, IA=632.7 A, IB=1.206KA, IC=609.1 A, VAN-120.5 KV, VBN-98.6 KV, VCN-125.4KV B=133.7KV, VCN=129.2 KV.	IB-3.788 KA, Fault Location - 33.1Km	Transient fault	LEFT	Line patrolling done by O&M Wing.

Name of Feeder/TF	Relay	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Analysis of tripping	Category Code	Action Taken
220KV BAREILLY LINE	NA	14-09-2023 20:29Hrs	14-09-2023 21:27 Hrs	Distance trip zone-1, started phase A-N fault location=14.30 km, IA=3.921 KA, IB= 392.5A, IC=838.5 A, VAN-44.09 KV, VBN-129.6KV, VCN-124.8KV B=133.7KV, VCN=129.2 KV.	NA	Transient fault	LEFT	Line patrolling done by O&M Wing.
220 KV KASHIPUR LINE	NA	27-09-2023 11:18Hrs	27-09-2023 11:52 HRs	Distance Protection start, Distance protection trip, Fault loop-L3N, distance-62.4km, IL1-21.5A, IL2-24.09A, IL3-2249.28A, IN-2262.60A,	IL3-3.71 KA, Distance-16.5 KM	Transient fault	LEFT	Line patrolling done by O&M Wing.
220 KV BAREILLY LINE	NA	03-10-2023 00:28hr	03-10-2023 01:24hr	Distance trip zone-1, started phase A-N, A/R Operated successfully. Tripped phase A, fault location= 3.874km, fault duration= 69.92ms, IA=5.725KA, IB=307.1A, IC=920.9A, VAN=16.31KV, VBN=136.2KV, VCN=131.4KV.	Fault location=61.05km, 86.23%, R-Phase current = 2.881KA.	Supply fail from other end.	LEFT	NA

Name of Feeder/TF	Relay	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Analysis of tripping	Category Code	Action Taken
80 MVA T/F I&II CB NO-	NA	03-10-2023 14:52 Hrs	03-10-2023 15:06 Hrs	Breaker Auto Trip, OTI/WTI Trip, Transformer Trouble Alarm	NA	T/F tripped due to earthquake	NA	NA
220 KV BAREILLY LINE	NA	15-10-2023 04:23hr	15-10-2023 06:04hr	Distance trip zone-1, started phase A-N, A/R operated successfully, Tripped phase A, fault location=7.149km , fault duration=69.98ms , IA=5.113KA, IB=316.8A, IC=930.9A, VAN=29.29KV, VBN=134.9KV, VCN=131.6KV.	Fault location =56.81km , R-Phase current=3. 109KA.	Supply fail from other end.	LEFT	NA
132 KV HALDWANI LINE	NA	16-10-2023 13:13 Hrs	16-10-2023 13:38 Hrs	Distance trip zone-1, started phase C-N, Tripped phase C, fault location=20.3 km, IA=0.01KA, IB=0.01KA, IC=1.22KA,	NA Open From other End	Transient Fault	LEFT	NA
132 KV HALDWANI LINE	NA	16-10-2023 13:38 Hrs	17-10-2023 13:32 Hrs	Distance trip zone-1, started phase C-N, fault location=17.8 Km, IA=0.01KA, IB=0.01KA, IC=1.28KA,	NA Open From other End	Tree was found fallen on C Phase conductor	NA	NA

Name of Feeder/TF	Relay	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Analysis of tripping	Category Code	Action Taken
132 KV HALDWANI LINE	NA	22-10-2023 22:21 Hrs	22-10-2023 22:36 Hrs	Distance trip zone-1, RYB Trip, Distance pick-up L1, fault location=5.5 Km, IA=5.25 KA, IB=0.01KA, IC=0.01KA,	NA Open From other End	Transient Fault	NA	NA
132 KV HALDWANI LINE	NA	24-10-2023 5:20 Hrs	24-10-2023 5:30 Hrs	Distance trip zone-1, Distance Pickup L1, RYB trip, fault location=5.6 Km, IA=5.12 KA, IB=0.01KA, IC=0.01 KA,	NA Open From other End	Transient Fault	NA	NA
132 KV HALDWANI LINE	NA	07/11/2023 19:52 hrs	07/11/2023 20:12 hrs	Distance trip zone-1, fault Loop-L2-E, IA=0.00 KA, IB=2.11KA, IC=0.01KA.	N/A	Transient fault	LEFT	NA

5.0. Observations and Recommendations

5.1. Reporting of all the Tripping with DR/EL

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System "http://103.7.128.184/Account/Login.aspx" within 24 hours of the events. These are being submitted by substation to NRLDC portal, however the record of the same is not kept at substation level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	DR, EL & Tripping report need to be submitted
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
Total in NR Region		520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at substations

c. It is recommended that each substation to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. Development of centralized database of relay settings

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 KV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220KV are to be calculated by SLDC and/or central level. The relays are tested by substation officials as per need basis, but the record of recommended settings/ calculation is not kept at substation level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220KV & above and by SLDC below 220KV along with setting calculations & parameters used for all the relays be kept at substation level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. *Review of test results of relay and equipment*

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".

b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.

c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. *Availability of Testing Kits*

a. The availability of testing equipment is limited at each substation. For comprehensive testing of equipment, as per above para, sufficient testing kits at each substation/Sub-division/ Division level are required.

b. Based on the O&M manual, it is recommended that sufficient quantity of testing instruments be made available at sites for regular testing of equipment. A suggested list of Testing Equipment is attached at Annexure – 1.

5.5. *Up-dation of PTCUL Protection Philosophy*

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. *Simulation based study of protection system*

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. *Capacity Building of protection team*

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. *Updated Fault Level/ Short Circuit Level and Network information*

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. *General Protection related observations*

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. *O&M Manual*

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. Bus Bar Protection on 220KV Bus is not functional. Utility explained that the central unit of the busbar protection system is currently defective. The newly procured busbar relay, implemented through the PSDF scheme, is not compatible with the old bay units. The procurement of a compatible central unit is underway and is expected to be functional before March 31, 2024. PTCUL needs to expedite.
b. Some of the numerical relays are not provided with Time Sync Input and Communication Port. Therefore, these relays cannot be time synchronized and their information cannot be shared with SAS.
c. SAS has been commissioned. However, it was observed that it is not in regular use and therefore, some of the inputs are not available. Further, no historical data could be extracted. The events are recorded from individual relays. No separate Event Logger is provided. The SAS has the event logging capability but is NOT in regular use, as new elements after commissioning of SAS are not incorporated. The SAS needs to be updated for the new elements introduced in the substation post-commissioning and kept functional.
d. Both the 220V DC systems are showing severe earth-fault. The necessary corrective action needs to be taken asap to avoid any unwanted tripping in future.
e. 2 nos. GPS Time Synchronization Systems are provided in the substation. While one system caters to SAS, the other caters to relays & other equipment of the substation. Time difference of more than 1.8 secs is observed. Many relays are not synched with either of the clocks.

6.2. Equipment related observations and recommendations

PTCUL has submitted a list of switchyard equipments to be replaced under PSDF funding, as per Annexure - 2. In view of the need of modern sub-stations, where automation of sub-station is of paramount importance, these replacements are required. Based on the specifications and healthiness of existing equipments, the list may be reviewed by PTCUL.

In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of **Maintenance Equipment is attached at Annexure – 3.**

6.3. Auxiliary Equipment related observations and recommendations

a. Single line diagrams [SLDs] of Aux AC and DC supplies to be made available at substations for ready reference.

b. Only one no. 48V battery Bank is provided. Second set to be arranged for PLCC and SCADA operations.

c. The **Auxiliary DG set** capacity is only 25 KVA, therefore, the backup provided by DG set, in case of emergency, is **not sufficient**.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

The suggested list of Substation Equipments keeping in mind the necessity for the modernization and upgradation of substations.

Sl. No.	Equipment	Unit	Quantity
A	**220 kV Equipment**		
1	245 kV Isolator 3Ph, Single Pole (Standard)	Nos	3
B	**132 kV Equipment**		
1	145 kV Isolator 3Ph	Nos	2
C	**33 kV Equipment**		
1	33 kV Isolator 3Ph	Nos	2

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
   a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
   b) to have a repository of protection system, settings and events at regional level;
   c) specifying timelines for submission of data;
   d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
   e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 KV and above (132 KV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132 KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 KV and above (132 KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220 KV and above (132 KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31^{st} October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 KV and above (132 KV and above in NER) system, which shall be reviewed by the RPC:
   a. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

b. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

c. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

    a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.

    b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:

        i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.

        ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

    a. The protection system checklist shall contain information as per this Regulation.

        i. General Information (to be provided prior to the checking as well as to be included in final report):

        - Substation name
        - Name of Owner Utility
        - Voltage Level (s) or highest voltage level
        - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
        - Checking and validation date
        - Record of previous tripping's (in last one year) and details of protection operation
        - Previous Relay Test Reports
        - Overall single line diagram (SLD) (x) AC aux SLD
        - DC aux SLD
        - SAS architecture diagram
        - SPS scheme implemented (if any)

    b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	**Recommendation of last protection checking and validation**	Status of works &pending issues if any
2	**Review of existing settings at substation**	Recommended Action
3	**Disturbance Recorder out/ available for last 6 trippings (Y/N)**	Recommended Action
4	**Chronic reason of tripping, if any**	Recommended Action
5	**Major non-conformity/deficiency observed**	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection;

- Name and Length of Line
- Whether series compensated or not
- Mode of communication used (PLCC/OPGW)
- Relay Make and Model for Main-I and Main-II
- List of all active protections & settings

- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays
- Other requirements for protection checking and validation

iv. AC auxiliary system;

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. DC auxiliary system;

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
  - Mode of communication for Main-1 and Main-2 protection
  - Mode of communication for data and speech communication
  - Status of PLCC channels
  - Time synchronization equipment details
  - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
  - Other requirements for protection checking and validation

vi. Circuit Breaker Details;

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
  - CT/CVT ID name and voltage level
  - CT/CVT core connection details
  - Accuracy Class

- Whether Protection/Metering
- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).
b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
c) All the major general deficiency shall be listed in detail along with remedial recommendations.
d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.
e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	220KV and above: Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme. 132KV and below: One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines) Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect.
		Time setting: i. 0.35 second *(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)* ii. 0.5-0.6 second *(For a long line followed by a short line)*

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series compensated double circuit lines may be kept higher at 113%.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220 KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220 KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220 KV LINES: No over-voltage protection shall be used. FOR 220 KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be done for multi circuit lines/cable.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400 KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email: sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

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कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

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Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

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(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	**GST**	:	GST shall be paid extra as per applicable Government rules.
3	**Tax**	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	**Date of Start of work**	:	Order shall be considered as having come in to force from the date of issue of order.
5	**Supply Completion**	:	NA
6	**Work completion**	:	The work should be completed within 24 months from the date of issue of order.
7	**Engineer of the contract**		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	**Engineer in-charge**		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	**Liquidity damages**	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	**Dispute**		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	**Payment terms**	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	**Payement unit**		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	**Warranty period**	:	NA.
14	**Billing Address**	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135—2646000 फैक्स नं0 0135—2643460 वेबसाइटwww.ptcul.org

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(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital.,
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
   Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालय:–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
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Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause						Modified Clause					
		Sr. No	Description	Unit	Qty	Amount	Total Amount	Sr. No	Description	Unit	Qty	Unit rate (Rs.)	Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.					1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.					
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.					2. Requisite data shall be collected in stancard format from PTCUL grid substations by an experienced auditor.					
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.					3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.					
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus					4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to					

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S. No.	Clause of PO	Existing Clause	Modified Clause
		couplers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DG Set/auxiliary DC supply at substations.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g) Field inspection of protection device for obsolescence of technology, suitability and healthiness. h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

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S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum**.
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

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S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

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Annexure – 8: Data Sheets

Contents

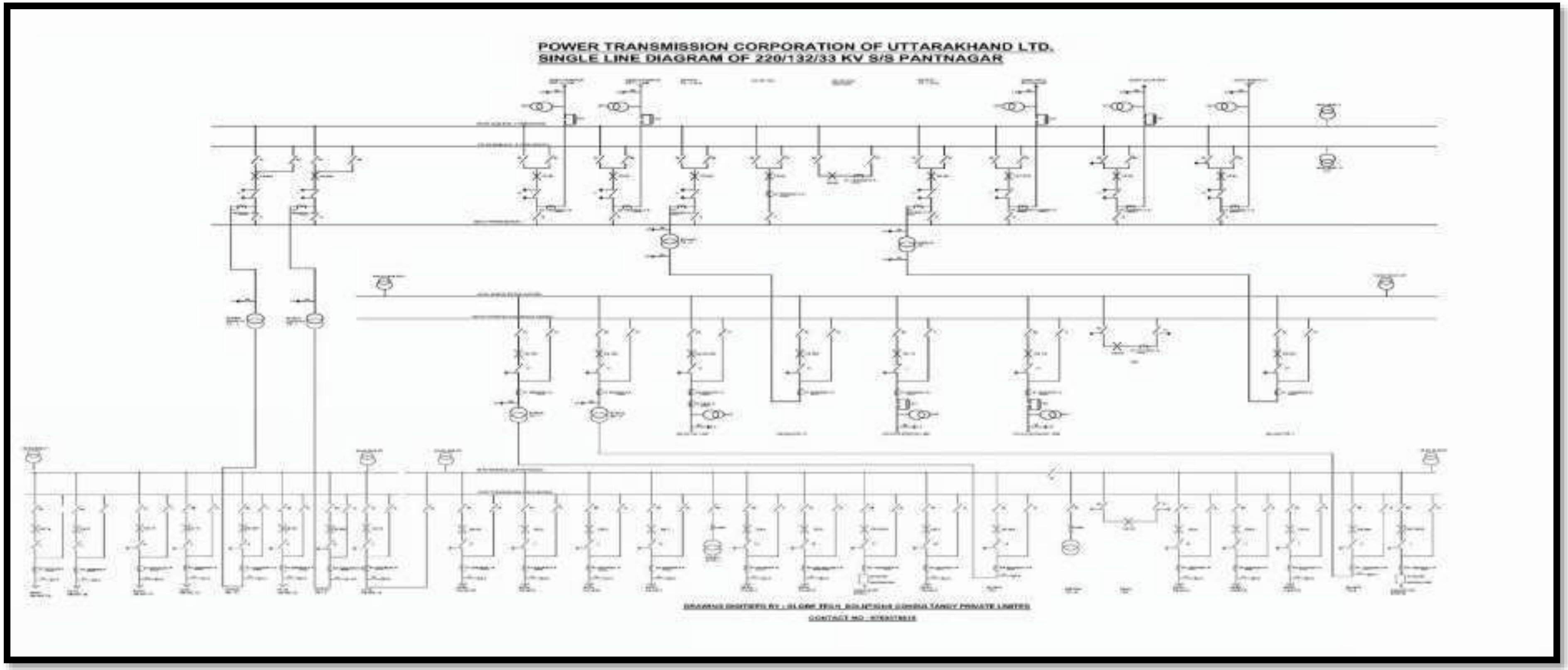
Protection Audit of 220/132/33kV Pantnagar Substation

Annexure - 8

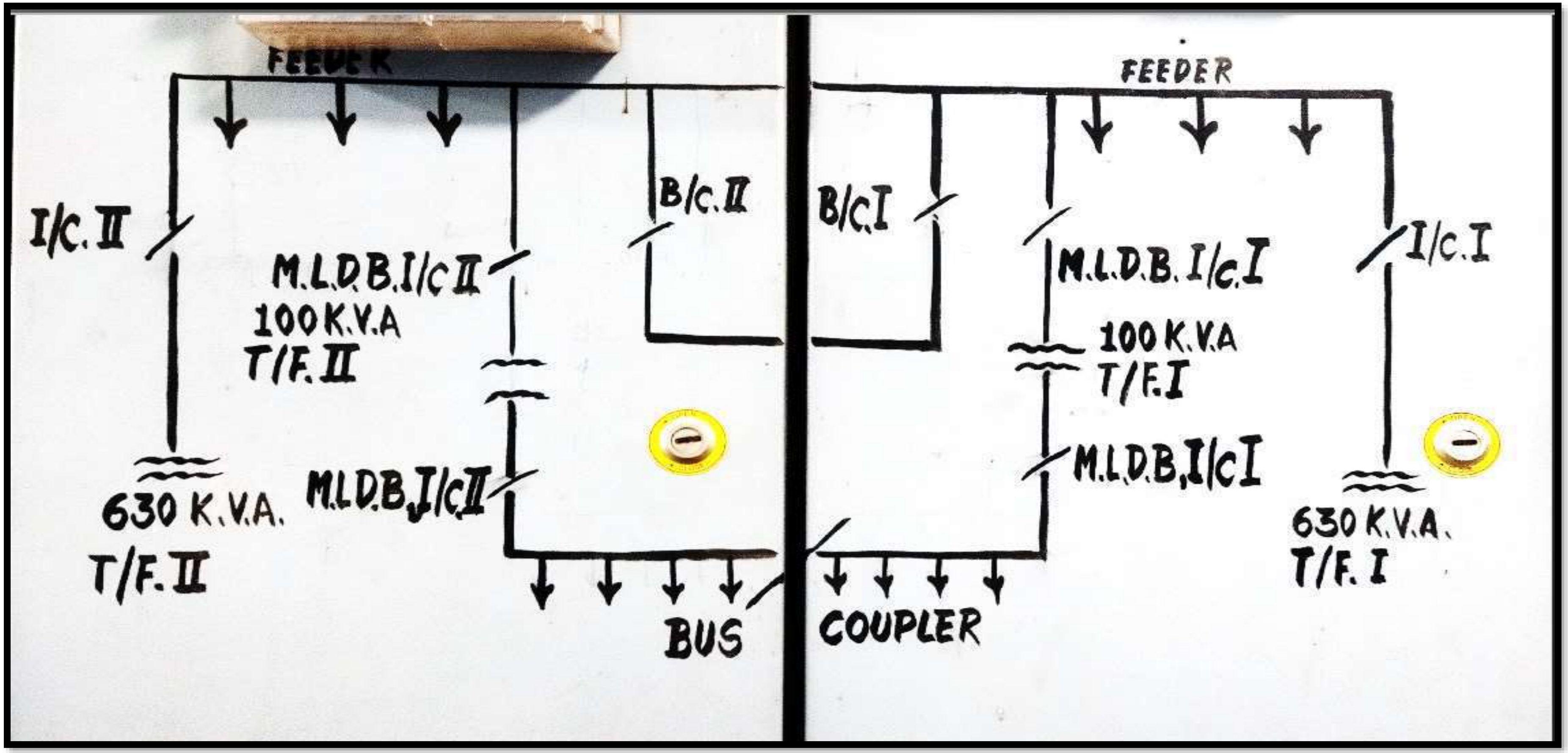
Data Sheets

Single Line Diagrams

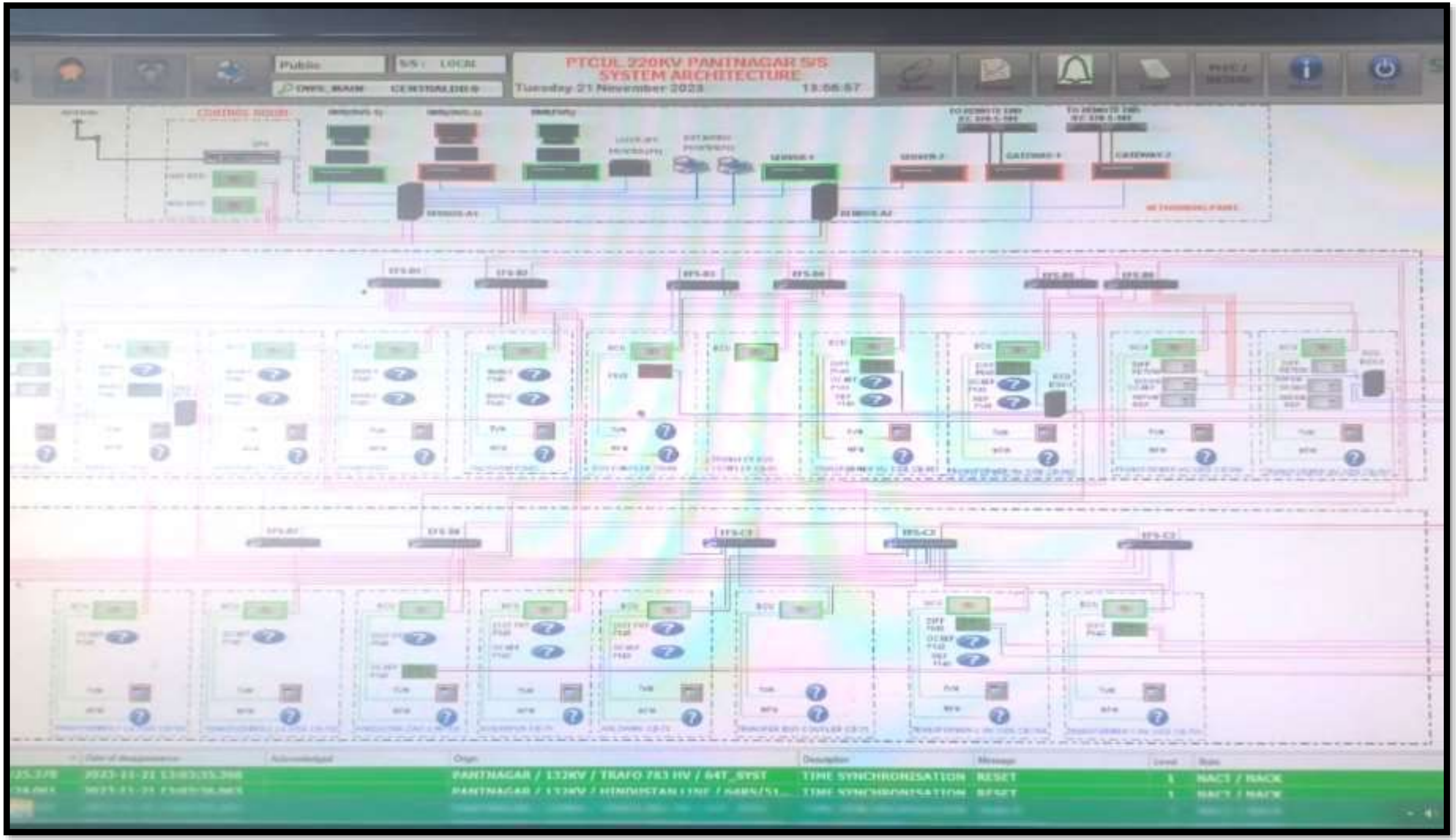
Substation Single Line Diagram



AC Auxiliary System



SAS Architecture diagram



Transmission Lines

		Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
Name of Tr Line		220KV Bareilly line	220KV Jafarpur line	220KV TATA line	220KV Kashipur line	220KV Haldwani line
Length of Line		70.70km	16.65km	1.710km	64.6km	37.32km
Series Compensated (Yes/No)		NO	NO	NO	NO	NO
Connected to dedicated CT core (mention name)		CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering, CORE-4 for busbar protection, CORE-5 SPARE.	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering, CORE-4 for busbar protection, CORE-5 SPARE.	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering, CORE-4 for busbar protection, CORE-5 SPARE.	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering, CORE-4 for busbar protection, CORE-5 SPARE.	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering, CORE-4 for busbar protection, CORE-5 SPARE.
CT Ratio		1600:1	800:1	400:1	1600:1	1600:1
Connected to dedicated PT core (mention name)		CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering.	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering.	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering.	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering.	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering.
PT Ratio		220KV:110v	220KV:110v	220KV:110v	220KV:110v	220KV:110v
Relay connected to Trip Coil-1 or 2 or both		Both	Both	Both	Both	Both
Feed from DC supply-1 or 2		Both	Both	Both	Both	Both
i	Main-I Protection (Make and	Siemens SIPROTEC7SA52	Siemens SIPROTEC7SA52	MICOM P442	ABB REL650	MICOM P442

		Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
	Model)					
	Functional (Yes/No)	Yes	Yes	Yes	Yes	Yes
	Date of testing	NA	NA	NA	NA	NA
ii	Main-II Protection (Make and Model)	MICOM P442	MICOM P442	MICOM P442	ABB REL650	MICOM P442
	Functional (Yes/No)	Yes	Yes	Yes	Yes	Yes
	Date of testing	NA	NA	NA	NA	NA
iii	LBB Protection (Make and Model)	MiCOM Areva P821	MiCOM Areva P821	MiCOM Areva P821	MiCOM Areva P821	MiCOM Areva P821
	Functional (Yes/No)	NO	NO	NO	NO	NO
	Date of testing	NA	NA	NA	NA	NA
iv	PLCC/ Protection coupler (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA	NA	NA
v	DR (Make &Model) (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA	NA	NA

		Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
vi	Time Synch. Unit (Make and Model)	SANDS	SANDS	SANDS	SANDS	SANDS
	Functional (Yes/No)	YES	YES	YES	YES	YES
Other Protections						
1	Status of Power Swing	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
2	Out of Step	1	1	1	1	1
3	SOTF	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
4	Breaker Failure	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
5	Broken Conductor	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
6	STUB	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
7	Fault Locator	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
8	Disturbance Recorder	VISIBLE	VISIBLE	VISIBLE	VISIBLE	VISIBLE
9	VT fuse fail	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
10	Overvoltage Protection	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
11	Trip Circuit supervision	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
12	Auto-reclose	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
13	Load encroachment	-	-	-	-	-

132KV:

		Tr Line 1	Tr Line 2	Tr Line 3
Name of Tr Line		132KV Haldwani line	132KV Rudrapur line	132KV HZL line
Length of Line		22km	7.6km	6.2km
Series Compensated (Yes/No)		NO	NO	NO
Connected to dedicated CT core (mention name)		CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering, CORE-4 SPARE	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering, CORE-4 SPARE	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering, CORE-4 SPARE
CT Ratio		800:1	800:1	800:1
Connected to dedicated PT core (mention name)		CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering	CORE-1 for main-1, CORE-2 for main-2, CORE-3 for metering
PT Ratio		132KV:110V	132KV:110V	132KV:110V
Relay connected to Trip Coil-1 or 2 or both		Both	Both	Both
Feed from DC supply-1 or 2		Both	Both	Both
i	Main-I Protection (Make and Model)	Siemens SIPROTEC7SA52	MICOM P442	MICOM P442
	Functional (Yes/No)	Yes	Yes	Yes
	Date of testing	-	-	-
ii	Main-II Protection (Make and Model)	MICOM P127	MICOM P127	MICOM P143

		Tr Line 1	Tr Line 2	Tr Line 3
	Functional (Yes/No)	Yes	Yes	Yes
	Date of testing	-	-	-
iii	LBB Protection (Make and Model)	Micom Areva P821	Micom Areva P821	Micom Areva P821
	Functional (Yes/No)	NO	NO	NO
	Date of testing	-	-	-
iv	PLCC/ Protection coupler (Make and Model)	-	-	-
	Functional (Yes/No)	NA	NA	NA
v	DR (Make &Model) (Make and Model)	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA
vi	Time Synch.Unit (Make and Model)	SANDS	SANDS	SANDS
	Functional (Yes/No)	YES	YES	YES
1	Status of Power Swing	ENABLE	ENABLE	ENABLE
2	Out of Step	1	1	1
3	SOTF	ENABLE	ENABLE	ENABLE
4	Breaker Failure	ENABLE	ENABLE	ENABLE
5	Broken Conductor	ENABLE	ENABLE	ENABLE

		Tr Line 1	Tr Line 2	Tr Line 3
6	STUB	ENABLE	ENABLE	ENABLE
7	Fault Locator	ENABLE	ENABLE	ENABLE
8	Disturbance Recorder	VISIBLE	VISIBLE	VISIBLE
9	VT fuse fail	ENABLE	ENABLE	ENABLE
10	Overvoltage Protection	DISABLE	DISABLE	DISABLE
11	Trip Circuit supervision	ENABLE	ENABLE	DISABLE
12	Auto-reclose	DISABLE	DISABLE	DISABLE
13	Load encroachment	-	-	-

Bus-Bar Protection

220KV System:

S. No.	Particulars	Observations
1	Busbar and redundant relay make and model	Alstom
2	Type of Busbar arrangement	2 main and transfer
3	Zones	Three (Bus-1, Bus-2 and Check)
4	Dedicated CT core for each busbar protection	Yes
5	Breaker Failure relay included, if additional then furnish make and model	In case of any BFR operating in substation, the relevant zone will be tripped.
6	Trip issued to both Busbar protection in case of enabling	Not applicable
7	Isolator indication and check relays	This is part of Bay Unit
8	Other requirements for protection checking and validation	The Bus-bar protection relay was replaced, but is not compatible with Bay Units. Therefore, bus bar protection system is out of service. Utility has informed that zone IV of all distance protection is set in reverse direction and 160 ms (less than zone 2 time), in the absence of bus-bar protection.

132KV System: NA

AC Auxiliary System

Sl. No.	Particulars	Observations
1	Source of AC auxiliary system	2 nos. 630KVA Station Transformers connected with 33KV Busbar.
2	Supply changeover between sources (Auto/Manual)	Load is distributed between two transformers. The emergency load is connected to separate distribution board.
3	Diesel generator (DG) details	Make: Sonalika Rating: 25KVA
4	Maintenance plan and supply changeover periodicity in DG	a. The DG set operation is automatic, however, load manually connected, as DG is not capable of catering full emergency loads. b. As the auxiliary supply is quite reliable, DG operation is almost negligible. For testing purpose, DG is operated once a week.
5	Single Line Diagram	Attached
6	Other requirements for protection checking and validation	NA

DC Auxiliary System

Sl. No.	Particulars	Observations			
		220 V DC - I	220 V DC – II	48 V DC-I	48 V DC-II
1	Make	NA	NA	NA	NA
2	Model/Rating	400Ah	400Ah	400Ah	NA
3	Vintage	NA	NA	NA	NA
4	Measured voltage				
A	Positive to Earth	0	0	NA	NA
B	Negative to Earth	-220	-220	48	NA
5	No. of Cells Per Bank	NA	NA	NA	NA
6	Availability of Battery Charger	Yes	Yes	Yes	Yes

Circuit Breakers

Sl. No.	Particulars	Make and Model	No. of trip/close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
A	**220KV System**						
1	220 KV BAREILLY	MAKE- CGL TYPE-200-SFM-40S	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	ENABLE	-
2	220 KV KASHIPUR,50 MVA T/F I&II (HV SIDE)	MAKE-ABB TYPE-LTB245E1	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	-
3	220 KV HALDWANI, TATA MOTOR, JAFARPUR,160 MVA I&II HV (SIDE)	MAKE-CGL TYPE-200-SFM-50AA	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	-
B	**132KV System**						
1	132 KV RUDRAPUR, HINDUSTAN ZINC,160 MVA T/F I&II LV,80 MVA T/F I&II (HV SIDE)	MAKE-CGL, TYPE-120-SFM-32B	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	-

Current Transformer

a	**Location of CT**	**220 KV BARIELLY**				
b	Date of CT ratio Test Testing	NA				
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING	MW, MVAR, AMMETER	BUS-BAR PROTECTION
e	Test Results					
i	Ratio Adopted	1600	1600	800	1600	1600
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**220 KV HALDWANI**				
b	Date of CT ratio Test Testing	NA				
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	21M1 PROTECTION	21 M2 PROTECTION	METERING	BUS-BAR PROTECTION	SPARE
e	Test Results					
i	Ratio Adopted	1600	1600	800	1600	1600
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**220 KV KASHIPUR**				
b	Date of CT ratio Test Testing	27/09/2021				
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	21M1 PROTECTION	21M2 PROTECTION	METERING	BUS BAR PROTECTION	SPARE
e	Test Results					
i	Ratio Adopted	1600	1600	800	1600	1600
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**220 KV TATA MOTOR**				
b	Date of CT ratio Test Testing	NA				
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	21 M1 PROTECTION	21M2 PROTECTION	METERING	BUS BAR PROTECTION	SPARE
e	Test Results					
i	Ratio Adopted	1600	1600	100	1600	1600
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**132 KV HALDWANI**				
b	Date of CT ratio Test Testing	NA				
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	PS	-
d	Purpose	21 M1 PROTECTION	67/67N PROTECTION	METERING	SPARE	-
e	Test Results					
i	Ratio Adopted	800:1	800:1	800:1	800:1	
ii	Ratio measured	800:1	800:1	800:1	800:1	

a	**Location of CT**	**220 KV JAFARPUR**				
b	Date of CT ratio Test Testing	27/09/2021				
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING	BUS BAR PROTECTION	SPARE
e	Test Results					
i	Ratio Adopted	1600	1600	800	1600	1600
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**132 KV RUDRAPUR**				
b	Date of CT ratio Test Testing	NA				
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	PS	-
d	Purpose	21 M1 PROTECTION	67/67N PROTECTION	METERING	SPARE	-
e	Test Results					
i	Ratio Adopted	800	800	800	800	
ii	Ratio measured	NA	NA	NA	NA	

a	**Location of CT**	**132 KV HZL**				
b	Date of CT ratio Test Testing	04/10/2021				
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	PS	-
d	Purpose	21 M1 PROTECTION	67/67N PROTECTION	METERING	SPARE	-
e	Test Results					
i	Ratio Adopted	800:1	800:1	800:1	800:1	-
ii	Ratio measured	800:1	800:1	800:1	800:1	-

Capacitive Voltage Transformer/Potential Transformer

a	**Location of CVT/PT**	**220 KV BAREILLY**		
b	Date of CVT/PT ratio Test Testing	NA		
		Core I	**Core II**	**Core III**
c	Accuracy Class	3P	3P	0.5
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING
e	Test Results			
i	Ratio Adopted	2000	2000	2000
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**220 KV HALDWANI**		
b	Date of CVT/PT ratio Test Testing	NA		
		Core I	**Core II**	**Core III**
c	Accuracy Class	3P	3P	0.5
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING
e	Test Results			
i	Ratio Adopted	2000	2000	2000
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**220 KV JAFARPUR**		
b	Date of CVT/PT ratio Test Testing	NA		
		Core I	**Core II**	**Core III**
c	Accuracy Class	3P	3P	0.5
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING
e	Test Results			
i	Ratio Adopted	2000	2000	2000
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**220 KV KASHIPUR**
b	Date of CVT/PT ratio Test Testing	NA

		Core I	Core II	Core III
c	Accuracy Class	3P	3P	0.5
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING
e	Test Results			
i	Ratio Adopted	2000	2000	2000
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**220 KV TATA MOTOR**		
b	Date of CVT/PT ratio Test Testing	NA		
		Core I	**Core II**	**Core III**
c	Accuracy Class	3P	3P	0.5
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING
e	Test Results			
i	Ratio Adopted	2000	2000	2000
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**132 KV RUDRAPUR**		
b	Date of CVT/PT ratio Test Testing	NA		
		Core I	**Core II**	**Core III**
c	Accuracy Class	3P	3P	0.5
d	Purpose	21 M1 PROTECTION	67/67N PROTECTION	METERING
e	Test Results			
i	Ratio Adopted	1200	1200	1200
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**132 KV HALDWANI**		
b	Date of CVT/PT ratio Test Testing	NA		
		Core I	**Core II**	**Core III**
c	Accuracy Class	3P	3P	0.5
d	Purpose	21 M1 PROTECTION	67/67N PROTECTION	METERING
e	Test Results			
i	Ratio Adopted	1200	1200	1200
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**132 KV HZL**		
b	Date of CVT/PT ratio Test Testing	NA		
		Core I	**Core II**	**Core III**
c	Accuracy Class	3P	3P	0.5
d	Purpose	21 M1 PROTECTION	67/67N PROTECTION	METERING
e	Test Results			
i	Ratio Adopted	1200	1200	1200
ii	Ratio measured	NA	NA	NA

Disturbance Recorder (DR) & Event Logger (EL)

Sl. No.	Particulars	220KV	132KV
1	a) Is the Disturbance recorder and Fault locator provided on all line feeders?	Yes	Yes
	b) Whether standalone or built in Main relay	Built-In	Built-In
	c) Whether DR is having automatic fault record download facility to a central PC	No	No
	d) Whether Central PC for DR, EL are powered by Inverter (fed from station DC)	NA	NA
2	Whether substation is having Event logger facility	Yes	Yes
	If Yes (standalone or built-in-SAS)	Built-In	Built-In
3	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	Yes 2 Nos. (one for SAS & one for Relays/Equipment)	

Communication System

Sl. No.	Name of Line Feeder	PLCC/OPGW/none	If PLCC for protection(y/n)	Coupling type & no. Of channel	If OPGW for protection(y/n)	Geographically distributed for main-1 & main-2 dedicated/multiplexed
1	220KV Pantnagar-Kashipur Line	PLCC & OPGW both	No	Ph-Ph	Yes	No, Dedicated
2	220KV Pantnagar-Jafarpur Line	PLCC	NA at other end	Ph-Ph	No	NA
3	220KV Pantnagar-Haldwani Line	PLCC & OPGW both	No	Ph-Ph	Yes	No, Dedicated
4	220KV Tata Motors Line	PLCC	No	Ph-Ph	No	NA
5	220KV Pantnagar-Bareilly Line	PLCC UNDER PROCESS	No	NA	No	NA
6	132KV HZL Line	PLCC	No	Ph-N	No	NA
7	132KV Pantnagar-Rudarpur Line	PLCC&OPGW both	No	Ph-N	Yes	No, Dedicated
8	132KV Pantnagar-Haldwani Line	PLCC	No	Ph-N	No	NA

Transformer Protection

Particulars	TF-1	TF-2	TF-3	TF-4	TF-5	TF-6
Name of ICT	220/132KV 160 MVA T/F-I	220/132KV 16 0MVA T/F-II	220/33KV 50MVA T/F-I	220/33KV 50MVA T/F-II	132/33KV 80MVA T/F-I	132/33KV 80MVA T/F-II
Make	BHEL	BHEL	IMP	IMP	BHEL	BHEL
Connected to dedicated CT core (HV Bay)						
Core-1	Differential Protection	Differential Protection	Differential Protection	Differential Protection	Differential Protection	Differential Protection
Core-2	Over Current Protection	Over Current Protection	Over Current Protection	Over Current Protection	Over Current Protection	Over Current Protection
Core-3	Metering	Metering	Metering	Metering	Metering	Metering
Core-4	Busbar protection	Busbar protection	Busbar protection	Busbar protection	Spare	Spare
Core-5	Spare	Spare	Spare	Spare	NA	NA
CT ratio	600:1	600:1	200:1	200:1	400:1	400:1
Connected to dedicated Bus CVT core (HV Bay)						
Core-1	Metering	Metering	Metering	Metering	Metering	Metering
Core-2	Directional Over Current Protection	Directional Over Current Protection	Directional Over Current Protection	Directional Over Current Protection	Directional Over Current Protection	Directional Over Current Protection
Core-3	Differential protection	Differential protection	Differential protection	Differential protection	Differential protection	Differential protection
CVT ratio	220KV:110V	220KV:110V	220KV:110V	220KV:110V	132KV:110V	132KV:110V
Relay connected to Trip Coil-1 or 2 or both (HV)	Both	Both	Both	Both	Both	Both
Feed from DC supply-1 or 2(LV)	Both	Both	Both	Both	Both	Both
Connected to dedicated CT core (LV Bay)						
Core-1	Differential Protection	Differential Protection	Differential Protection	Differential Protection	Differential Protection	Differential Protection

Particulars	TF-1	TF-2	TF-3	TF-4	TF-5	TF-6
Core-2	Over Current Protection	Over Current Protection	Over Current Protection	Over Current Protection	Over Current Protection	Over Current Protection
Core-3	Metering	Metering	Metering	Metering	Metering	Metering
Core-4	Busbar protection	Busbar protection	Busbar protection	Busbar protection	Spare	Spare
Core-5	Spare	Spare	Spare	Spare	NA	NA
CT ratio	1200:1	1200:1	1200:1	1200:1	1600:1	1600:1
Connected to dedicated Bus CVT core (LV Bay)						
Core-1	Metering	Metering	Metering	Metering	Metering	Metering
Core-2	Directional Over Current Protection	Directional Over Current Protection	Directional Over Current Protection	Directional Over Current Protection	Directional Over Current Protection	Directional Over Current Protection
Core-3	Differential protection	Differential protection	Differential protection	Differential protection	Differential protection	Differential protection
CVT ratio	132KV:110V	132KV:110V	33KV:110V	33KV:110V	33KV:110V	33KV:110V
Relay connected to Trip Coil-1 or 2 or both (HV)	Both	Both	Both	Both	Both	Both
Feed from DC supply-1 or 2(LV)	Both	Both	Both	Both	Both	Both
LA Rating/ HV Side	Rated voltage= 198KV, Discharge current=10KA	Rated voltage= 198KV, Discharge current=10KA	Rated voltage= 198KV, Discharge current=10KA	Rated voltage= 198KV, Discharge current=10KA	Rated voltage=60KV, Discharge current=10KA	Rated voltage=60KV, Discharge current=10KA
LA Rating/ LV Side	Rated voltage=60KV, Discharge current= 10KA	Rated voltage=60KV, Discharge current= 10KA	Rated voltage=30KV, Discharge current= 10KA	Rated voltage=30KV, Discharge current= 10KA	Rated voltage=30KV, Discharge current= 10KA	Rated voltage=30KV, Discharge current=10KA
Date of last testing of	5/11/2023	5/11/2023	5/11/2023	5/11/2023	5/11/23023	5/11/2023

Particulars		TF-1	TF-2	TF-3	TF-4	TF-5	TF-6
Protection							
Group A Protection							
1	Differential Protection (Make & Model)	AREVA MiCOM P643	AREVA MiCOM P643	ABB RET 650	ABB RET 650	AREVA MiCOM P643	AREVA MiCOM P643
2	PRV	OK	OK	OK	OK	OK	OK
3	WTI Indication working	YES	YES	YES	YES	YES	YES
4	Back-up Over Current Protection HV (Make & Model)	AREVA MICOM P127	AREVA MICOM P127	ABB REF615	ABB REF615	AREVA MICOM P127	AREVA MICOM P127
5	Over Flux Protection (Make & Model) HV	NA	NA	NA	NA	NA	NA
Group B Protection							
1	REF Protection (Make & Model)	MAKE-ABB	MAKE-ABB	HV=ABB REF615, LV=MICOM ALSTOMP14DB	HV=ABB REF615, LV=MICOM ALSTOMP14DB	-	-
2	Bucholtz	Status healthy	Status healthy	Status healthy	Status healthy	Status healthy	Status healthy
3	Back-up Over Current Protection LV (Make & Model)	AREVA MICOM P127	AREVA MICOM P127	AREVA MICOM P14NB16A6 C0540A	AREVA MICOM P127	AREVA MICOM P143	AREVA MICOM P143
4	Over Flux Protection (Make & Model) LV	NA	NA	NA	NA	NA	NA
5	OTI Indication working	YES	YES	YES	YES	YES	YES

Special Protection Scheme (SPS)

SPS FOR GRID STABILITY THROUGH LOAD SHEDDING FROM VARIOUS SUBSTATION AT IN KUMAON REGION

Kumaon region has one of the largest 400 KV substation having transformation capacity of 2 X 315 MVA and is also connected through four Nos. POWERGRIDlines which caters approximately 60 % load of Kumaon and partial load of Garhwal region also. It is also connected to 400 KV Moradabad and 400 KV Nehtaur substations of Uttar Pradesh. It is also connected to two Gas based generators through 220 KV Lines having capacity of 110 MW and 225 mW capacity. In view of the above it acts as a gateway of chunk power for Kumaon region. This substation meets the power demand of Kashipur, Bazpur, Mahuakheraganj, Ramnagar and Jaspur. This substation also supplies the power to industrial area of SIDCUL Pantnagar, Haldwani and Kamaluaganja, Bhowali and portion of Kichha region also through two Nos 220 KV lines. One of them is directly connected to Pantnagar substation and another is connected to Pantnagar substation through 220 KV substation Jafarpur.

Another very important source of power is available at 220 KV substation Pantnagar from 220 KV substation Bareilly which compliments the power demand in Kumaon region together with the power available from 400 KV substation Kashipur.

Another source of power is available at 132 KV substation Pithoragarh and 132 KV substation Almora from PGCIL Chandak substation. This substation also compliments in maintaining the grid stability by providing the additional power supply required to meet the power demand of hilly region of Kumaon Zone.

There is another very important source of power supply available at 132 KV substation Sitarganj and ELDECO Sitarganj which meets the power demand of Sitarganj, ELDECO Sitarganj, Khatima, Kichha region and other nearby areas.

In view of the above it can be identified that at present there are four major source of power supply in Kumaon region which makes the interconnecting lines very crucial and important through which these sources cater the power supply to other region and also the lines which meets the N-1 contingency for these lines means acts as an alternate source of power in case these lines or sources goes off.
The total transformation capacity of Kumaon Region is 2542 MVA (total avg. loading 1644 MVA) and total load connected to transmission network is 138.5 MVA however the total power which can be supplied through various networks depends on following transmission elements-

- The two Nos. Transformers of 2 X 315 MVA capacity i.e., 630 MVA
- One No. 220 KV Bareilly-Pantnagar Line having single moose conductor of approximate 250 MVA capacity.
- One No. 220 KV Kashipur-Pantnagar Line and another line connecting 400 KV Kashipur to 220 KV substation Pantnagar through 220 KV substation Jafarpur.
- 132 KV Almora Chandak line in case of direction of power flow from Chandak to Almora.

- 132 KV Kathgodam-Bhowali line in case of direction of power flow from Bhowali to Almora.

Note- These constraints have been taken without considering the generation received from two large gas power generators having generation capacity approx. 107 MVA and 225 MVA and various other small solar generators connected at 33 KV voltage level.

The single line diagram of whole of the Kumaon region is enclosed for getting clear picture and understanding of the network and contingency.

The need of implementing the SPS in Kumaon region has arisen to avoid the occurrence of grid failure and black out situation in Kumaon region. The various cases of failure of grid are being discussed hereinbelow along with the solution through SPS to avoid grid failure.

Case-1

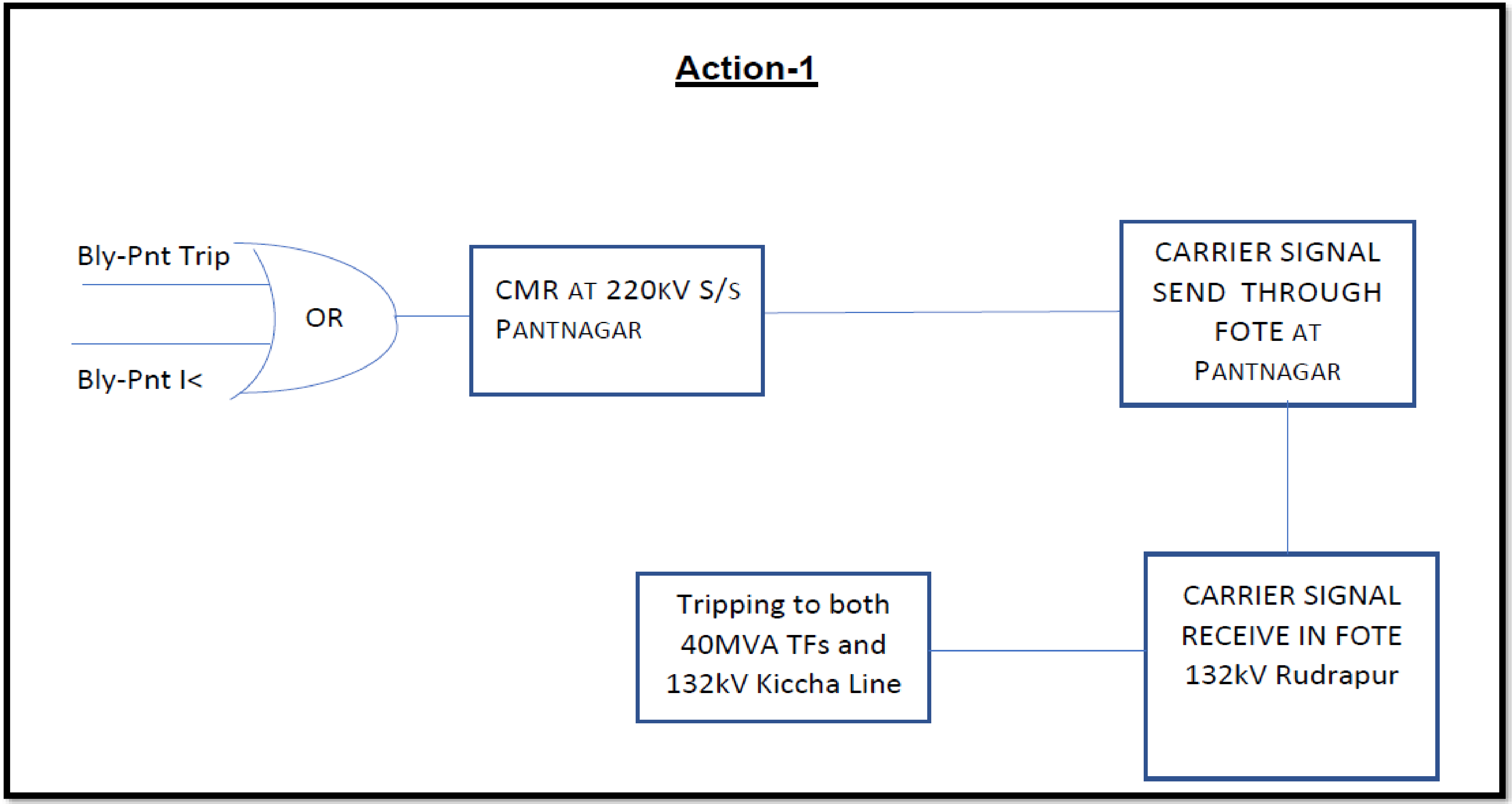
When 220KV Pantnagar-Bareilly line goes off and rest of the network remains intact.
Generally, the average load on 220 KV Pantnagar-Bareilly line is approx. 230 MW. In case of failure of this line all the load is immediately shifts on both 220 KV line from 400 KV Kashipur to Pantnagar thereby putting an extra load of approx. 230 MW on 2 X 315 MVA transformers. The load on single 315 MVA transformer in general remains approximately 250 MVA i.e., both the transformers together cater 500 MVA load in normal conditions. If we consider to load these transformers for 100%, a window of only 130 MVA surplus loading on these transformers is available. Whereas in above situation extra load of approx. 230 MW takes place which trips the both 2X 315 MVA transformers at 400 KV substation Kashipur.
SPS Scheme:

Contingency: Tripping of 220KV Pantnagar- Bareilly Line carrying approx. 230 MW
Total load shift observed due to tripping of 220 KV Pantnagar - Bareilly on 2 x315 MVA transformer is 230 MVA

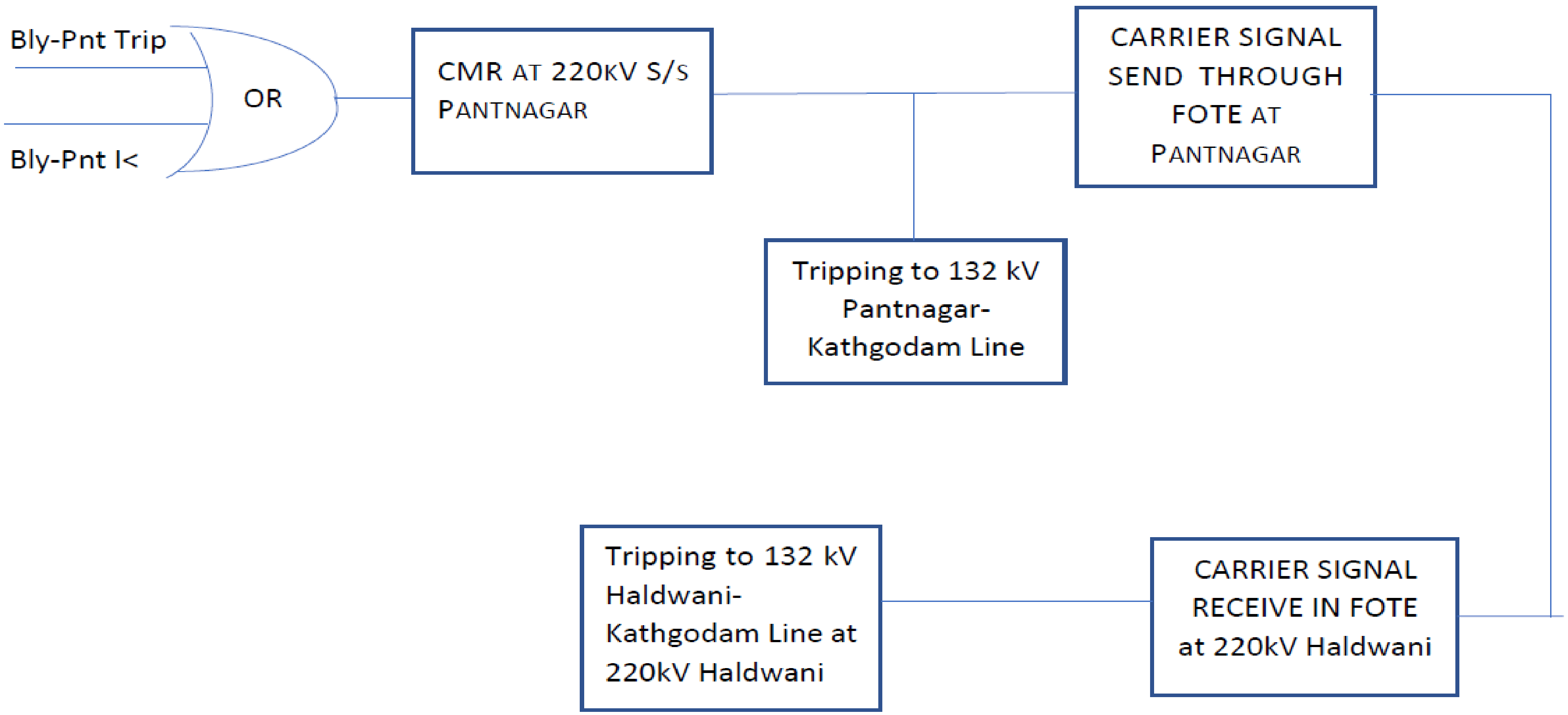
Available surplus loading on 2 X 315 MVA transformers at 400 KV = 130 MVA as well as approx. 30 MW load can be transfer to Chandak-Almora Line.

Action 1: - Required load shedding from Rudrapur and Kichcha is approx. load 70 MW to save both transformers from tripping. 70 MW load shedding shall be done by tripping of both 40 MVA Transformer at 132 KV Rudrapur and disconnection of 132 KV Rudrapur-Kichcha Line. This will be done by reading zero currents from relay installed on 220 KV Bareilly line send Carrier Signal to 132 KV Rudrapur s/s through FOTE.

Action 2: - With tripping of 220KV Pantnagar-Bareilly Line, 132 KV Pantnagar Kathgodam as well as 132 KV Kamaluaganja-Kathgodam disconnected so as to create Islanding at 132 KV Kathgodam to avoid overloading of 132 KV Chandak-Almora Line. This will give approx. 30 MW load relaxation on 315 MVA ICTs.



Action-2



Bly-Pnt Trip
Bly-Pnt I<
OR
CMR AT 220KV S/S PANTNAGAR
CARRIER SIGNAL SEND THROUGH FOTE AT PANTNAGAR
Tripping to 132 kV Pantnagar-Kathgodam Line
Tripping to 132 kV Haldwani-Kathgodam Line at 220kV Haldwani
CARRIER SIGNAL RECEIVE IN FOTE at 220kV Haldwani

Case Discription	Peak load of Element tripped	Total Load Shedding Required	Name of Substation	Load Shedding at substation	Remark
220kV Pantnagar-Bareilly line trip and other lines are normal	230MW	70MW	132kV Rudrapur	50MW	To save 315MVA TFs at 400kV Kashipur from overloading
			132kV Kiccha	20MW	

Case 2:

When one of 315 MVA ICTs at 400 KV S/s Kashipur tripped.

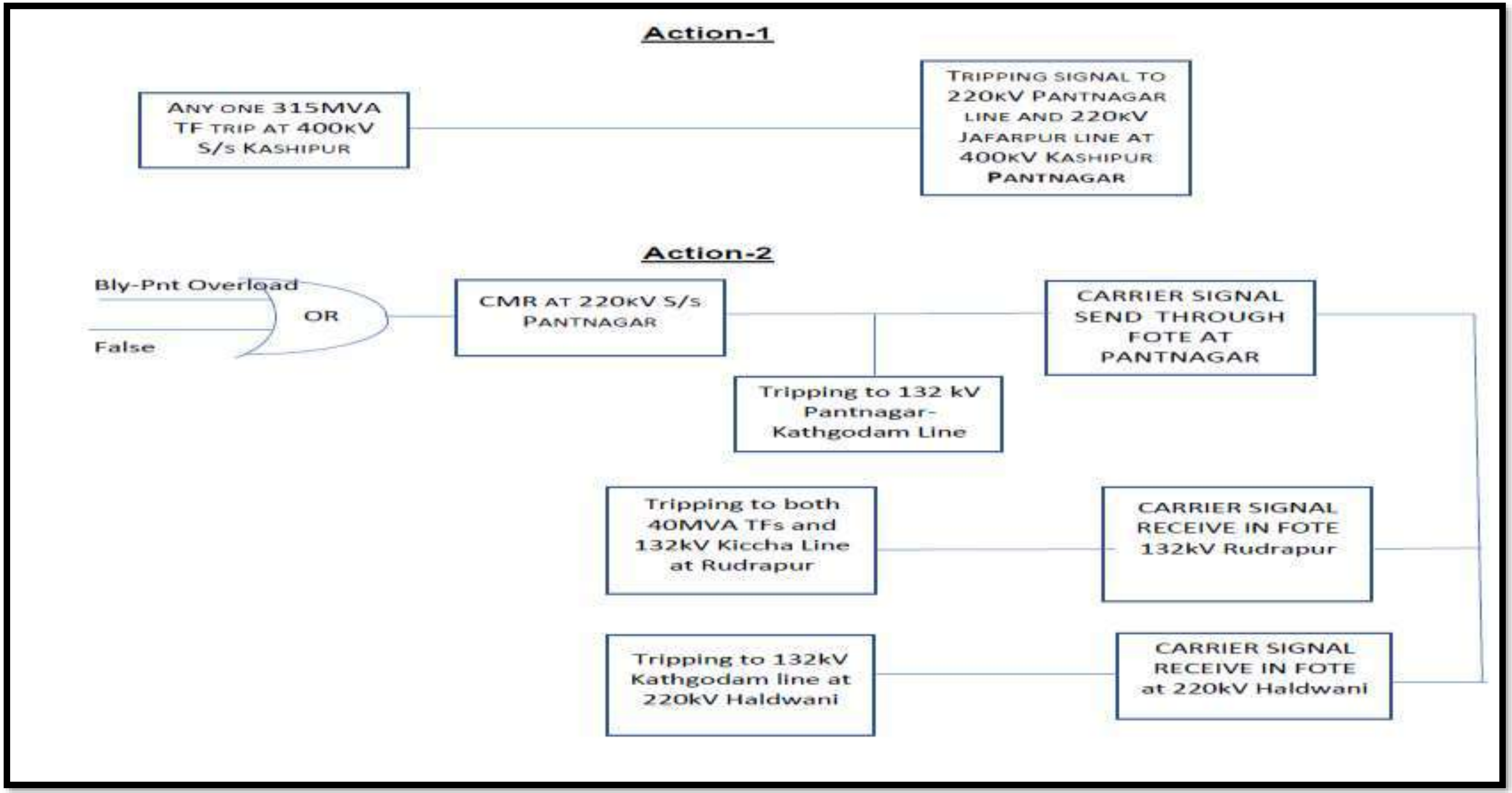
Generally, the average load on each 315MVA transformer is approx. 250MVA when there is no generation available from the two Gas based generators at Mahuakheraganj region. In case of tripping of any one of 315MVA Transformer, all the load is immediately shifts on other 315MVA transformer thereby putting an extra load of approx. 250MVA on 1 X 315MVA transformer. If we consider to load the transformer for 100%, a window of only 65MVA surplus loading on single transformer is available. Whereas in above situation extra load of approx. 250MVA takes place which also trips the other 315 MVA transformer at 400 KV substation Kashipur.

SPS Scheme:

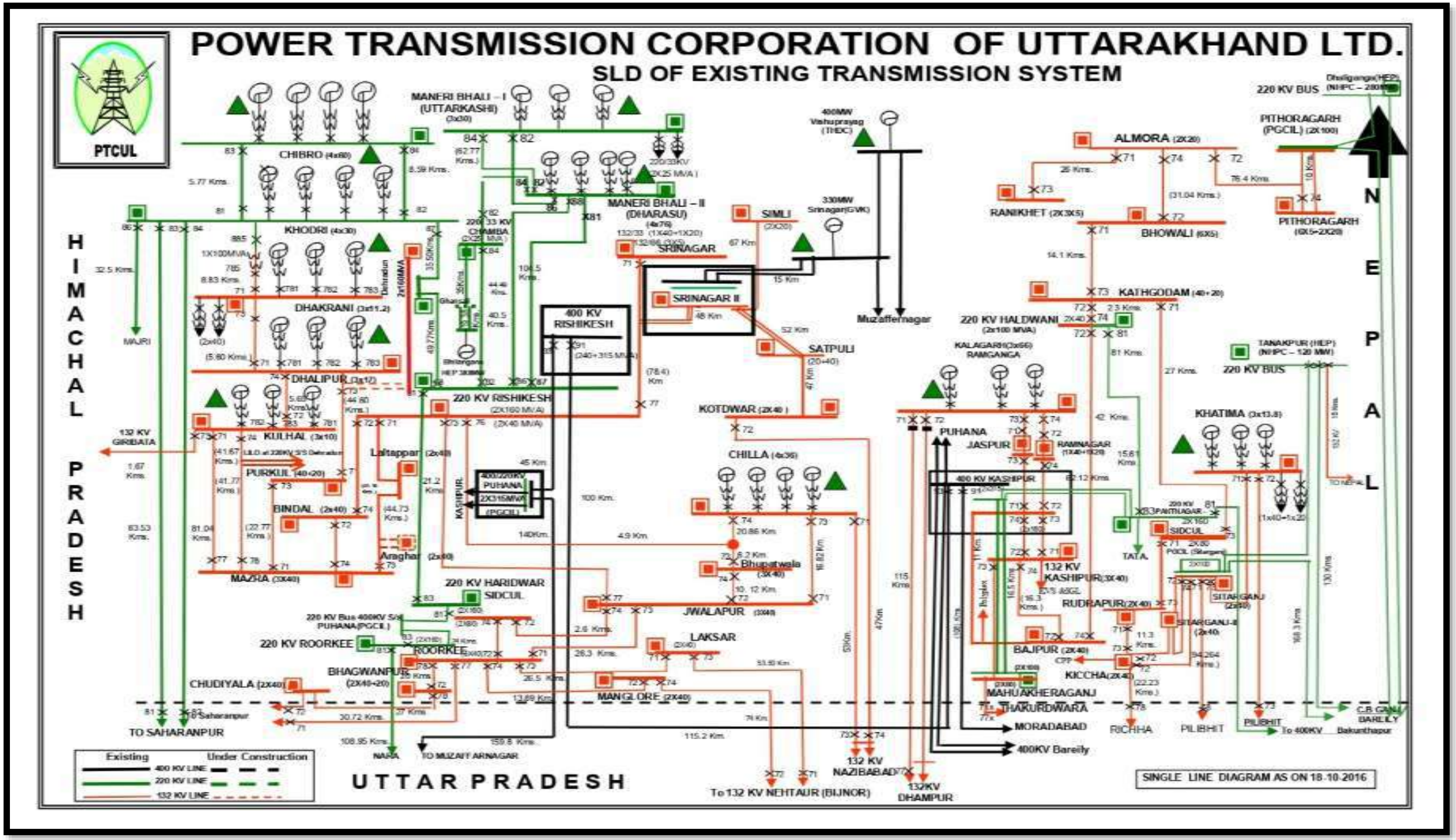
Contingency: - Tripping of any one 315MVA transformer carrying approx. 250MVA
Total load shift observed due to tripping of one 315MVA transformer on other 315 MVA transformer is =250MVA
Available surplus loading on 1X 315MVA transformer at 400 KV Kashipur=65MVA.

Action 1: - Required load shedding at 400KV S/s Kashipur is approx. 185 MW to save other transformer shall be done by tripping 220KV Kashipur-Pantnagar line and 220KV Kashipur-Jafarpur line at 400KV S/s Kashipur thus making Kashipur region a separate island. After this all load of Pantnagar region and Kamalwaganja region shifted to 220KV Pantnagar-Bareilly line, due to this load shifting 220KV Pantnagar-Bareilly line may get overload.

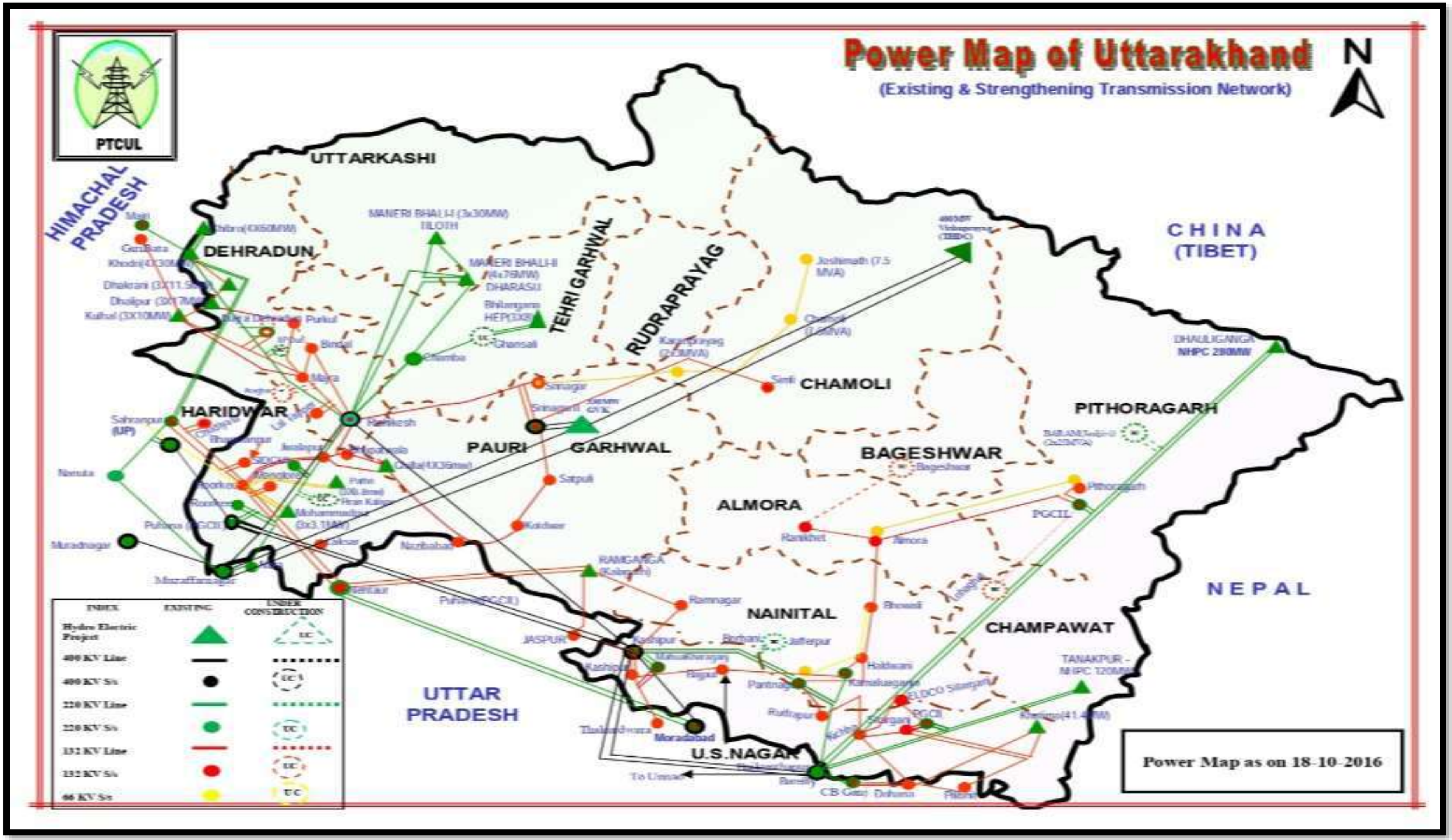
Action 2: - To avoid overloading of 220KV Pantnagar- Bareilly line some load relief is being done by tripping 132KV Kathgodam feeder at 220KV S/s Kamalwaganja and both 40MVA Transformers at 132KV S/s Rudrapur using PLCC/FOTE communication.



Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

400/220KV Kashipur Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल
CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 400/220/132 KV KASHIPUR SUB-STATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee
PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System

SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

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1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400KV and 8 nos. 220KV sub-stations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan & Mr. Rounak Sen visited 400/220/132KV Kashipur Substation during 27th – 29th January 2024 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220KV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on "Draft O&M Manual" of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Point 5.4. It is recommended that the necessary testing equipment at substation/Sub-division/Division be arranged for regular testing of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru' third party for implementing the best practices in the sub-station. In addition, the existing draft O&M manual also be updated to take care of latest developments.

Observations and Recommendations for 400/220/132KV Kashipur Substation

01. Last protection audit was carried out on 27 July 2015. Updated compliance status of previous audit(s) needs to be maintained.
02. The tripping of 132 kV Kashipur-Kashipur line requires detailed investigation and it is recommended that record of remote end relay flags be maintained and necessary modifications in relay settings for 132 kV Kashipur-Kashipur line be carried out.
03. Bus Bar Protection panels for all 3 levels i.e. 400KV, 220KV and 132KV are installed. The status of commissioning of 400kV bus Bar protection needs to be updated. For 220 kv and 132 kV commissioning work to be expedited.
04. The SAS is not updated for new elements and not fully functional. It is recommended that SAS be updated as and when any change occurs and kept functional.
05. Relay REL551 for SEPL line is not connected to time synchronization due to non-availability of port. It is recommended to take necessary Corrective action.
06. Based on inputs provided by utility and analysis of data a list of suggested switchyard and maintenance equipment for replacement is provided in Annexure – 2.
07. Earth Fault in both 220V battery bank was observed. It is recommended to take necessary corrective action.
08. Emergency DG set operation is in manual mode. It is suggested to keep the DG set in Auto mode.

2.0. Introduction

2.1. Background

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400KV and 08 Nos. 220KV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following sub-stations is to be carried out:

1. *400KV Rishikesh*
2. *400KV Kashipur*
3. *220KV Chamba*
4. *220KV Rishikesh*
5. *220KV Roorkee*
6. *220KV Haridwar (SIDCUL)*
7. *220KV Jhajra*
8. *220KV Pantnagar*
9. *220KV Haldwani*
10. *220KV Mahuakheraganj*

2.2. Scope of Work

Review of the implemented protection schemes/philosophy for 400/220KV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. *Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.*
b. *Availability/healthiness of PLCC communication links used for protection systems.*
c. *Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.*
d. *Availability/healthiness of GPS system and time synchronization facility used for protection.*
e. *Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.*
f. *Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.*
g. *Field inspection of protection device for obsolescence of technology, suitability and healthiness.*
h. *Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.*
i. *Checking of availability of DG Set / auxiliary DC supply at substations.*

2.3. Audit Rationale

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipments under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) "All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC".
c. As per Para – 15 (4) of said Code, "The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC".
d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per IEGC-2023 Annexure-1.

2.4. *Audit Process*

- **PTCUL shall provide the following documents:**
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each substation, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

Sl. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-connecting Transformer
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL

- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**

  - The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
  - The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - All the major general deficiency shall be listed in detail along with remedial recommendations.
  - The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. *About Power Transmission Corporation of Uttarakhand (PTCUL)*

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. *About Central Board of Irrigation & Power (CBIP)*

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of Kashipur Substation

3.1. General Information about Substation

Sl. No.	Particulars	Details
1	**Substation Name**	400/220/132/33KV Kashipur Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	400/220/132KV
4	**Short circuit current rating of all equipment (for all voltage level)**	400KV = 50KA/3 secs, 220KV = 40KA/sec, 132KV = 31.5KA/sec
5	**Date of commissioning of the substation**	13th November 2006
6	**Checking and validation date**	27th – 29th January 2024

3.2. Audit Team

Audit Team (CBIP):

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Rounak Sen

PTCUL Representative:

- Mr. Asim Baig – Executive Engineer
- Mr. Ashutosh Pokhriyal – Assistant Engineer
- Mr. Naveen Chandra Pandey – Junior Engineer

3.3. Recommendation of last protection checking and validation

As per the information received, previous protection audit was carried out by NRPC, dated: 27th July 2015.

a. **Following observation were recorded during previous audit**

Sl. No.	Observations	Recommended action
1	67N protection is not available / enabled in the lines / relays (except for 400KV Roorkee and Bareilly lines) as mentioned in General Remarks.	As per Model Relay Setting Guidelines, it is recommended to enable 67N in Main-1 & Main-2 relays.
2	VT fuse failure is disabled for 220KV Pantnagar-2 line	It is recommended to activate the VT fuse failure function in order to block distance protection from operating falsely.
3	Carrier aided scheme is not active for 220KV Pantnagar-2 and Mahuakheraganj lines	It is recommended to rectify faults in the carrier scheme operation by replacing proper PLCC equipment.
4	It is observed that only single stage CBF protection is used for tripping of boundary breakers in case of all line feeders except 400KV Roorkee and Bareilly feeders.	As per model relay setting guidelines it is recommended to provide two stage CBF protection first for re-tripping own CB and second for boundary CBs.
5	220KV Busbar protection is defective.	It is recommended for 220KV busbar protection should be replaced by duplicate busbar numerical relays as per CBIP guidelines.
6	Remote indication of WTI and OTI for certain ICT is defective (refer "general remarks" section point 3 and 7 for more details)	It is recommended to replace faulty Digital Winding temperature indicators so as to ensure proper monitoring of operation of transformers from the control room itself.

Sl. No.	Observations	Recommended action
7	Only single source of LVAC supply is available via 33KV feeder for the auxiliary load consumption in the substation.	It is recommended that two sources shall be made available for LVAC system.
8	Fire protection trip for ICTs	As per CBIP 296, where fire protection is provided the contacts of emulsifier system shall be used to trip main breakers of ICTs. Such scheme is not present here and is necessary.
9	Pole discrepancy timer settings for ICT feeders are kept quite high.	The minimum settings of 0.5 sec is advisable in case of transformer feeders for adequate protection from system unbalancing.

3.4.Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.
b. The record of different relay setting calculations is not available at the substation level.
c. All relays are numeric, therefore, as per internal protocol of utility relays are tested only at the time of commissioning/change in setting. Copy of test reports not available at sub-station level.

3.5.Disturbance Recorder availability for the last 6 tripping's

a. Utility is submitting Disturbance Recorder data for Inter-State Line 220KV Rudrapur-Bareilly Line to NRLC Portal. The record is not maintained at substation level.
b. For transformers and Intra-state lines DR data is taken at station level for analysis purpose, utility shall be submitting same with tripping analysis report.

3.6. Chronic reason of tripping, if any

a. Based on list of tripping submitted by utility for last 12 months, it is noticed that 2 spurious trippings have taken place.
   - On 27/12/2022, 400 kV Bareilly – I tripped due to malfunction of 86 relay due to rebooting of distance protection at Kashipur and sending the direct trip to remote sub-station.
   - On 29/08/23, 220/132 kV Transformer – 1 tripped due to gantry flashover. At that time a drone operation was noticed in nearby area and is suspected that some identified activity due to drone operation has caused this tripping.

b. For 132 kV lines, remote end flags are generally not recorded.

c. On 12/01/2023, the conductor of wave trap at 132 kV Kashipur-Kashipur Circuit -2 tripped. No tripping observed at remote end, but 132 kV Kashipur-Kashipur Circuit -1 tripped from this end on zone 3 to isolate the fault.

d. In most of the cases, Transient Earth Faults are reported.

3.7. Major non-conformity/deficiency observed

a. Bus Bar Protection on all 3 levels i.e. 400KV, 220KV and 132KV level is installed recently and commissioning is underway. For 400KV stability test is to be done, while for other 2, CT cabling from switchyard is pending.

b. REL551 for SEPL line is not connected to time synchronization due to non-availability of port.

c. SAS has been commissioned. 220 /132KV transformer -3 data is not integrated with SAS. Also, the upcoming line, for which bay is ready, needs to be incorporated.

d. Both the 220V DC systems are showing earth-fault.

e. Emergency DG set operation is in manual mode

f. The events are recorded from individual relays either directly or thru SAS. no separate Event Logger is provided. SAS output is not accessible either on printer or network or external disks. The output is taken as photographic image.

g. Recommended relay settings with supporting calculations/ parameters needs to be kept at sub-station.

h. All the isolators are operated manually. The AC and DC system needs to be checked during maintenance to avoid earth faults in auxiliary system.

i. 132KV breakers are of old vintage and cause problem during operations.
j. In case of successful auto reclosures, the information is recorded in log book, but no listing/ analysis is kept.
k. For switchyard protection, lightening masts are provided for 220KV and 132KV area, along with shielding wires. For 400KV area, only shielding wire is provided.

4.0. List of Trippings

Name of Feeder/TF	Type of relay/scheme	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Affected load/generation	Analysis of tripping	Action Taken
132 KV Ramnagar	Schneider P645	11.10.23 at 03.43 Hrs	11.10.23 at 04.14Hrs	Dist-9.329 Kms, Zone1, Fault Loop L2-N, IL2= 6.102KA, In= 5.749KA.	No trip at other end	NIL	TLF	NIL
	Schneider P645	24.10.23 at 02.50 Hrs	24.10.23 at 03.03 Hrs	Dist- 3.75 Kms, Zone1,Fault Loop L1-N, IL1= 9.37 KA, In= 9.09 KA.	No trip at other end	NIL	TLF	NIL
	Schneider P645	27.10.23 at 01.57 Hrs	27.10.23 at 02.05 Hrs	Dist- 5.428Kms,zone 1, Fault Loop L2-N, IL2= 8.135 KA, In= 7.824 KA.	No trip at other end	NIL	TLF	NIL
220 Mahuakheraganj	Siemens 7SA522	06-09-2023 10:56hrs	06-09-2023 11:28hrs	Distance trip, distance - 14.28km, fault current-IL1-4594.79A, IN-2491.9A	NA	NIL	Tripped due to Ct burst of TBC at Mahukhera s/s and Busbar operated at Mahuakhera ganj s/s.	NIL
400KV Roorkee ckt 1st	Micom p444	07-09-2023 3:27hrs	07-09-2023 14:50hrs	Distance trip zone 1, R phase fault, fault distance- 14.93km, fault current IR-10.93KA.	NA	NIL	TLF	NIL
132KV Jaspur line	Micom P545	11-09-2023 6:18hrs	11-09-2023 19:27hrs	Distance trip zone 1, R phase fault, fault distance-	Distance trip zone1, R phase fault, fault	NIL	line R phase LA Burst at jaspur S/s end.	NIL

Name of Feeder/TF	Type of relay/scheme	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Affected load/generation	Analysis of tripping	Action Taken
				14.29km, fault current IR-4.734KA, IN-4.738KA.	location-1.005km, fault current Ia-476A, Ib-534.2A, Ic-279.9A, In-1.111KA			
220KV Pantnagar line	Micom P545/ABBR EL670	27-09-2023 1:17hrs	27-09-2023 11:52hrs	Distance trip zone1, fault loop-L3N, fault distance-15.59km, fault current IL1-144.7A, IL2-169.4A, IL3-3.797KA, IN-3.776KA,	Distance trip zone2, fault loop-L3N, fault distance-62.4km, fault current IL1-21A, IL2-2,49A, IL3-2.25KA, IN-2.26KA,	NIL	TLF	NIL
132KV Ramnagar line (line length-23.5km)	Micom p545	11-08-2023 09:53hrs	11-08-2023 10:28hrs	Circuit breaker auto trip,C.B. pole discrepancy trip, zone 1 trip, R phase trip, distance-6.960km,fault current IL1-6.798KA,IN-6.801KA.Va-43.90KV,Vb-74.91KV,Vc-74.19KV,Vn-28.86KV.	other end open.	NIL	TLF	NIL
220KV Pantnagar line (line length-61.94km)	Siemens 7SA522	18-08-2023 3:15hrs	18-08-2023 03:36hrs	Distance trip zone-1, fault loop-L1N, fault location=55.94km, fault current	Distance trip zone-1, fault loop-L1N, fault location=4.2 km, fault	NIL	TLF	NIL

Name of Feeder/TF	Type of relay/scheme	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Affected load/generation	Analysis of tripping	Action Taken
				IL1=2.419KA, IN-1.909KA	current IL1-5419A, IL2-241A, IL3-324A, IN-5902A.			
	Siemens 7SA522	22-08-2023 1:42hrs	22-08-2023 01:58hrs	Distance trip zone-1, fault loop-L1N, fault location=15.21km, fault current IL1=6.187KA, IN-6.207KA.	Fault loopL1N, Distance-26.12km, fault current IL1-2.514KA.	NIL	TLF	NIL
132KV Ramnagar line (line length-23.5km)	Micom p545	27-08-2023 5:22hrs	27-08-2023 04:34hrs	Distance trip zone 1, fault loop L1N, Distance-7.58km, IL1-6.465KA, IL2-6.468KA.	other end open.	NIL	TLF	NIL
160MVA T/F 1st	micom p643, micomP143	29-08-2023 8:51hrs	29-08-2023 14:23hrs	Diff protection bias HS1 trip,Ia diff-7.945pu,Ib diff-15.89pu,Ic diff-7.941pu,Ia bias-3.980pu,Ib bias-7.943pu,Ic bias-3.980pu.HV fault current Ia-273.4A,Ib-2.159KA,Ic-134.5A,LV fault current-Ia-451.0A,Ib-13.08KA,Ic-233.3A.	Not applicable	NIL	Trippig due to suspected drone.	Stability test of t/f done and results found satisfactory
132KV Ramnagar line	NA	06-07-2023 5:26hrs	06-07-2023 08:45hrs	Distance trip zone-1, fault loop-L1N, fault location=3.5km,	Other End Open	NIL	Disc broken with conductor	NIL

Name of Feeder/TF	Type of relay/scheme	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Affected load/generation	Analysis of tripping	Action Taken
				fault current IL1=9.7KA, IN-9.7KA				
220KV Pantnagar line	NA	09-07-2023 2:12hrs	09-07-2023 12:39hrs	Distance trip zone-1, fault loop-L2N, fault location=24.62km, fault current IL1=171A, IL2-4.603KA, IL3-129A, IN-4.472KA	Distance trip zone-1, fault loop-L2N, fault location=23.252km, fault current IL2-2722A.	NIL	TLF	NIL
132KV RAMNAGAR	NA	12-06-2023 01:30:00	12-06-2023 01:55:00	Distance trip zone-1, B-phase trip, fault location=107km , fault current IB=842.5A, IN=859.1A	NIL	NIL	TLF	NIL
400kV Bareilly 1	NA	07.05.23/14:55hrs	07.05.23/ 16:12hrs	Flags: distance trip, Zone 1 Trip, fault loop-L1L2, Fault distance-89.93kms, IA=2574.71A IB=3081.59A IC=39.40A	Flags: distance trip, fault loop-L1L2, Fault distance-0km IA=27.30KA IB=26.83KA	NIL	From Bareilly s/s end at tower number 1 flash over seen b/w phase 'R' and 'Y'.	NIL
132KV Ramnagar ckt	Micom 543	12-03-2023 10:58HRS	12-03-2023 11:15HRS	Distance trip zone Z1, Distance-13.1km, fault current IL1-0.96KA, IL2-0.11KA,IL3-0.14KA.	Distance trip, Zone- 1 trip, distance-8.66km, fault current IL1-5.85KA, IL2-139A, IL3-107A.	NIL	TLF	LEFT

Name of Feeder/TF	Type of relay/scheme	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Affected load/generation	Analysis of tripping	Action Taken
132KV Kashipur ckt-1	Micom 543	31-03-2023 12:17 HRS	31-03-2023 19:28HRS	Broken conductor trip, fault current IL1-205.8A, IL2-0.00A, IL3-205.9A, IN-139.5A, Va fault-78.29KV, Vb-76.85KV, Vc-78.15KV, Vn-2.802KV.	Broken Conductor Trip	NIL	Broken conductor trip	LEFT
400KV Bareilly ckt-2	ABB, Schneider	12-02-2023 11:55 Hrs	12-02-2023 12:52 Hrs	Distance trip, Fault Loop-L2-L3, Distance -87.18Km, Fault Current IL1-650.04A, IL2-3485.05A, IL3-3827.82A	Distance trip, Fault Loop-L2-L3, Distance -8.2Km, Fault Current IL2-21.5KA, IL3-20.9KA	NIL	T/F	NA
132KV Kashipur ckt-1	Schneider	17-01-2022 13:23 HRS	17-01-2022 13:59HRS	Distance trip, fault loop-L1-N, Zone- 3 trip, fault current IL1-63.88A, IL2-384.5A, IL3-263.1A, IN-277.6A.	NA	NIL	T/F	NA
132KV Kashipur ckt-2	Schneider	17-01-2022 13:23 HRS	17-01-2022 17:55HRS	distance trip, fault loop-L1-N, Zone- 1 trip, fault distance-1.198km, fault current IL1-8.705KA, IL2-335.5A, IL3-304.1A, IN-8.682A.	NA	NIL	Conductor broken from wave trap at 132KV Kashipur S/s switchyard.	NA

Name of Feeder/TF	Type of relay/scheme	Date and Time of tripping	Date and Time of closing	Flag observed	Other end flags	Affected load/generation	Analysis of tripping	Action Taken
132KV Kashipur ckt-1	Schneider	19-12-2022 05:43 HRS	19-12-2022 08:33HRS	Distance trip, Zone- 1 trip, distance-836.9m, fault current IL1-8.8909KA, IN-8.860KA	Distance trip, Zone- 2 trip, distance-2.674km, fault current IL1-3874.6A, IL2-282.56A, IL3-247.11A	NIL	T/F	NA
132KV Kashipur ckt-2	Schneider	19-12-2022 06:12 HRS	19-12-2022 06:28HRS	O/C&E/F trip, fault current IA-382A, IB-392A, IC-398A	NA	NIL	T/F	NA
400KV ckt-1	Schneider	27-12-2022 23:57 HRS	28-12-2022 22:14HRS	Faul current IL1-.95A, IL2-1.02A, IL3-340A, IN-6.80A	DT trip	NA	Tripping due rebooting of distance relay& malfunctioning and 86 relay faulty	NA
400KV Barielly ckt-1	Schneider	30-12-2022 12:19 HRS	Line is still in breakdown	Distance trip, Zone- 1 trip, distance-996.6m, fault loop-L2-L3, fault current IL1-1.39KA, IL2-11.24KA, IL3-12.47KA	NA	NIL	Broken conductor	NA

5.0. Observations and Recommendations

5.1. Reporting of all the Tripping with DR/EL

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System "http://103.7.128.184/Account/Login.aspx" within 24 hours of the events. These are being submitted by sub-station to NRLDC portal, however the record of the same is not kept at sub-station level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	DR, EL & Tripping report need to be submitted
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
Total in NR Region		520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at sub-stations

c. It is recommended that each sub-station to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. Development of centralized database of relay settings

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 KV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220KV are to be calculated by SLDC and/or central level. The relays are tested by sub-station officials as per need basis, but the record of recommended settings/ calculation is not kept at sub-station level. This makes it difficult to validate the settings and test results, in case of relay testing.
c. It is recommended that latest recommended relay settings, as decided by RLDC for 220KV & above and by SLDC below 220KV along with setting calculations & parameters used for all the relays be kept at sub-station level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. *Review of test results of relay and equipment*

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".
b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.
c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. *Availability of Testing Kits*

a. The availability of testing equipment is limited at each substation. For comprehensive testing of equipment, as per above para, sufficient testing kits at each substation/Sub-division/ Division level are required.
b. Based on the O&M manual, it is recommended that sufficient quantity of testing instruments be made available at sites for regular testing of equipment. A suggested list of Testing Equipment is attached at Annexure – 1.

5.5. *Up-dation of PTCUL Protection Philosophy*

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. Simulation based study of protection system

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. Capacity Building of protection team

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. Updated Fault Level/ Short Circuit Level and Network information

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. General Protection related observations

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. O&M Manual

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. Last protection audit was carried out on 27 July 2015. Many of the observations are not complied so far or has reoccurred since then. It is recommended to keep the previous audit report(s) and compliance status updated.

b. Based on analysis of line tripping during last 12 months, it is observed that in most of the cases, the cause of tripping is Transient Earth Fault. For tripping at 132kV side, remote end flags are not recorded. On 12.01.2023, 132 kV Kashipur – Kashipur -2 tripped on zone 1 and 132 kV Kashipur – Kashipur - 1 tripped on zone 3 for fault at wave trap of Kashipur-Kashipur-2 at this end. No tripping was observed at remote end. The record of relay flag operation for remote end needs to be maintained and this tripping needs to be investigated for proper relay settings at 132 kV side.

c. Bus Bar Protection panels for all 3 levels i.e. 400KV, 220KV and 132KV level is installed recently and commissioning is underway. For 400KV stability test is pending. For 220kV and 132 KV Cables from CT in the switchyard are to be laid. The status of commissioning of 400kV bus Bar protection needs to be updated and for 220 kv and 132 kV commissioning work to be expedited.

d. The events are recorded from individual relays either directly or thru SAS. no separate Event Logger is provided. SAS output is not accessible either on printer or network or external disks. The output is taken as photographic image. SAS has been commissioned. 220 /132KV transformer -3 data is not integrated with SAS. Also, the upcoming line, for which bay is ready, needs to be incorporated. It is recommended that SAS be updated as and when any change occurs and kept functional.

e. REL551 for SEPL line is not connected to time synchronization due to non-availability of port. Corrective action needs to be taken.

6.2. Equipment related observations and recommendations

PTCUL has submitted a list of switchyard equipments to be replaced under PSDF funding, as per Annexure - 2. In view of the need of modern sub-stations, where automation of sub-station is of paramount importance, these replacements are required. Based on the specifications and healthiness of existing equipments, the list may be reviewed by PTCUL.

In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of **Maintenance Equipment is attached at Annexure – 3.**

6.3. Auxiliary Equipment related observations and recommendations

a. Both the 220V DC systems are showing severe earth-fault. The necessary corrective action needs to be taken asap to avoid any unwanted tripping in future.
b. Emergency DG set operation is in manual mode. Necessary action may be taken to keep the DG set in Auto mode.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

The suggested list of Substation Equipments keeping in mind the necessity for the modernization and upgradation of substations.

Sl. No.	Equipment	Unit	Quantity
A	**400KV Equipment**		
1	420KV Current Transformer 1 phase	Nos	30
2	420KV CVT 1 phase	Nos	15
B	**220KV Equipment**		
1	245KV Current Transformer (5 Core), Class 0.2s (1ph) 1000/500/1	Nos	12
2	245KV Current Transformer (5 Core), Class 0.2s (1ph) 1600/800/1	Nos	30
3	245KV CVT 1 Ph	Nos	18
C	**132KV Equipment**		
1	145KV Circuit Breaker 3PH	Nos	8
2	145KV Current Transformer 1Ph	Nos	30
3	145KV CVT	Nos	18
4	145KV HYBRID Plug and switch system (PASS) Including breaker and disconnector at both end for 132 kV Main &Transfer Bus	Nos	2
D	**33KV Equipment**	Nos	0
1	33KV Circuit Breaker	Nos	2
2	33KV Isolator 3Ph	Nos	6
3	33KV Surge Arrestor 1 Ph (polymer)	Nos	6

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
   a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
   b) to have a repository of protection system, settings and events at regional level;
   c) specifying timelines for submission of data;
   d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
   e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220KV and above (132KV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220KV and above (132KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220KV and above (132KV and above in NER) system, which shall be reviewed by the RPC:

   a. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

b. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

c. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

   a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.
   b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:
      i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.
      ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

   a. The protection system checklist shall contain information as per this Regulation.
      i. General Information (to be provided prior to the checking as well as to be included in final report):
         - Substation name
         - Name of Owner Utility
         - Voltage Level (s) or highest voltage level
         - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
         - Checking and validation date
         - Record of previous tripping's (in last one year) and details of protection operation
         - Previous Relay Test Reports
         - Overall single line diagram (SLD) (x) AC aux SLD
         - DC aux SLD
         - SAS architecture diagram
         - SPS scheme implemented (if any)

b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works &pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 trippings (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection;

- Name and Length of Line
- Whether series compensated or not
- Mode of communication used (PLCC/OPGW)

- Relay Make and Model for Main-I and Main-II
- List of all active protections & settings
- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays

- Other requirements for protection checking and validation

iv. **AC auxiliary system;**

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. **DC auxiliary system;**

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
    - Mode of communication for Main-1 and Main-2 protection
    - Mode of communication for data and speech communication
    - Status of PLCC channels
    - Time synchronization equipment details
    - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
    - Other requirements for protection checking and validation

vi. **Circuit Breaker Details;**

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
    - CT/CVT ID name and voltage level

- CT/CVT core connection details
- Accuracy Class
- Whether Protection/Metering
- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. Summary of checking:

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).

b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.

c) All the major general deficiency shall be listed in detail along with remedial recommendations.

d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.

e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

<table>
<tr><th>S.N.</th><th>Protection Setting/Protocol</th><th>Mandated Setting for transmission lines</th></tr>
<tr><td>1</td><td>Protection Scheme</td><td>220KV and above:
Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme.

132KV and below:
One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.</td></tr>
<tr><td>2</td><td>Distance Protection Zone-1</td><td>Reach:
80% of the protected line;
110% of the protected line (In case of radial lines)
Time Setting: Instantaneous.</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Distance Protection Zone-2</td><td>Reach:
Single Circuit Line: 120% of length of principle line section.
Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect.</td></tr>
<tr><td>Time setting:
i. 0.35 second
(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)
ii. 0.5-0.6 second
(For a long line followed by a short line)</td></tr>
</table>

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series compensated double circuit lines may be kept

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		higher at 113%.
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220KV LINES: No over-voltage protection shall be used. FOR 220KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		done for multi circuit lines/cable.
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email: sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	**GST**	:	GST shall be paid extra as per applicable Government rules.
3	**Tax**	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	**Date of Start of work**	:	Order shall be considered as having come in to force from the date of issue of order.
5	**Supply Completion**	:	NA
6	**Work completion**	:	The work should be completed within 24 months from the date of issue of order.
7	**Engineer of the contract**		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	**Engineer in-charge**		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	**Liquidity damages**	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	**Dispute**		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	**Payment terms**	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	**Payement unit**		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	**Warranty period**	:	NA.
14	**Billing Address**	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135—2646000 फैक्स नं0 0135—2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
   Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालय:–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाश नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause						Modified Clause					
		Sr. No	Description	Unit	Qty	Amount	Total Amount	Sr. No	Description	Unit	Qty	Unit rate (Rs.)	Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.						1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.				
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.						2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.				
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.						3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.				
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus						4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to				

2

S. No.	Clause of PO	Existing Clause	Modified Clause
		couplers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DG Set/auxiliary DC supply at substations.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g) Field inspection of protection device for obsolescence of technology, suitability and healthiness. h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

3

S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum**.
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

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S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

5

Annexure – 8: Data Sheets

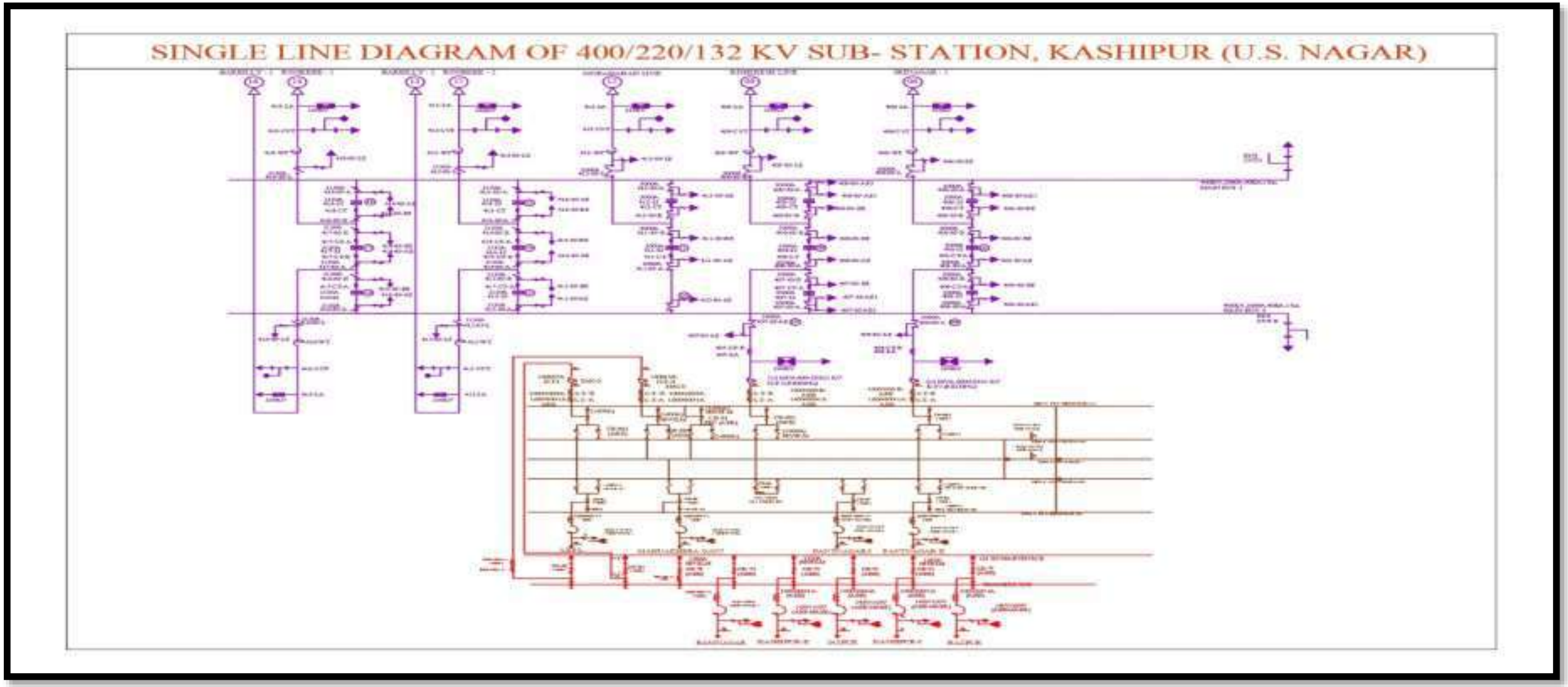
Contents

Annexure - 8

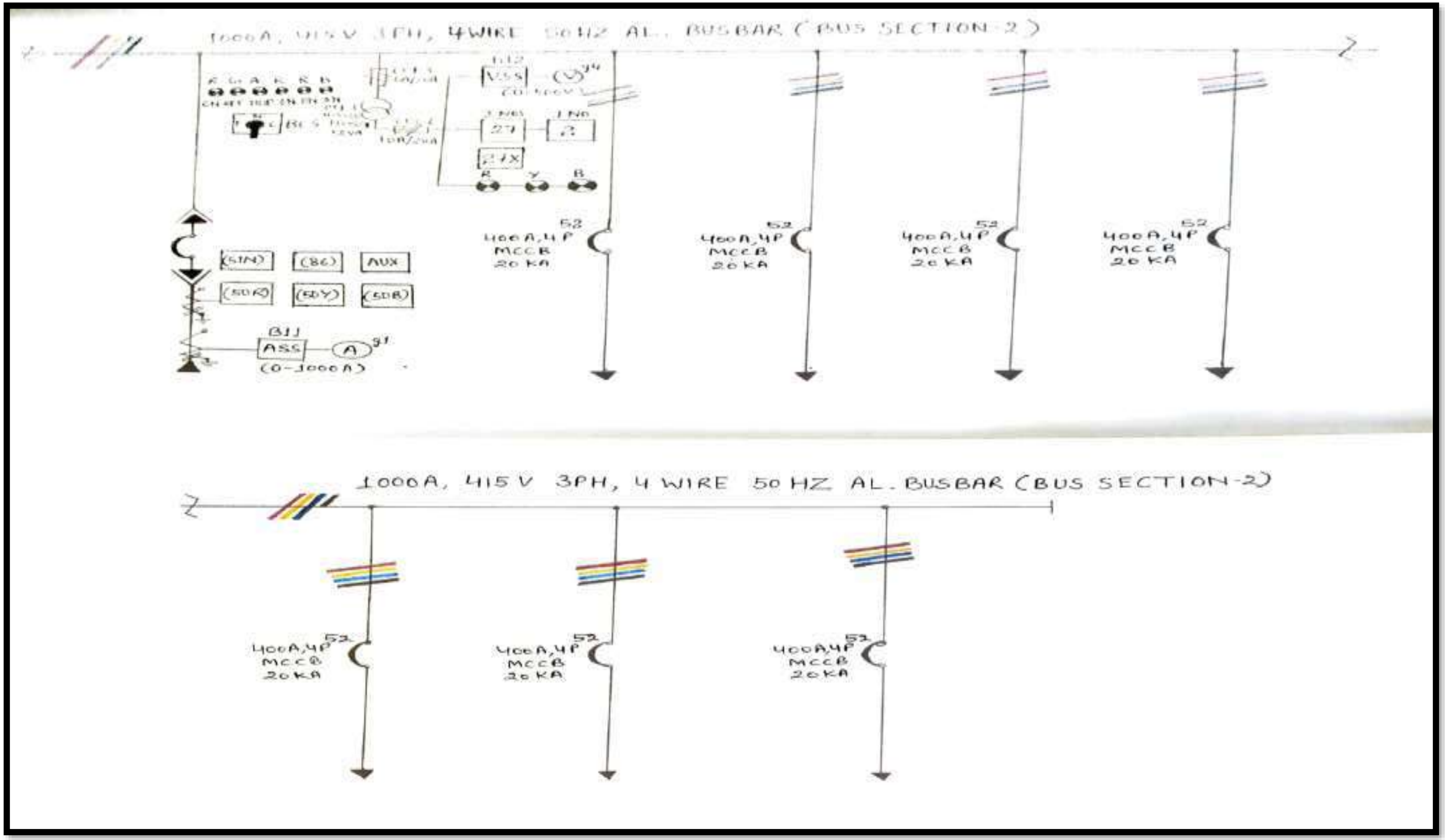
Data Sheets

Single Line Diagrams

Substation Single Line Diagram



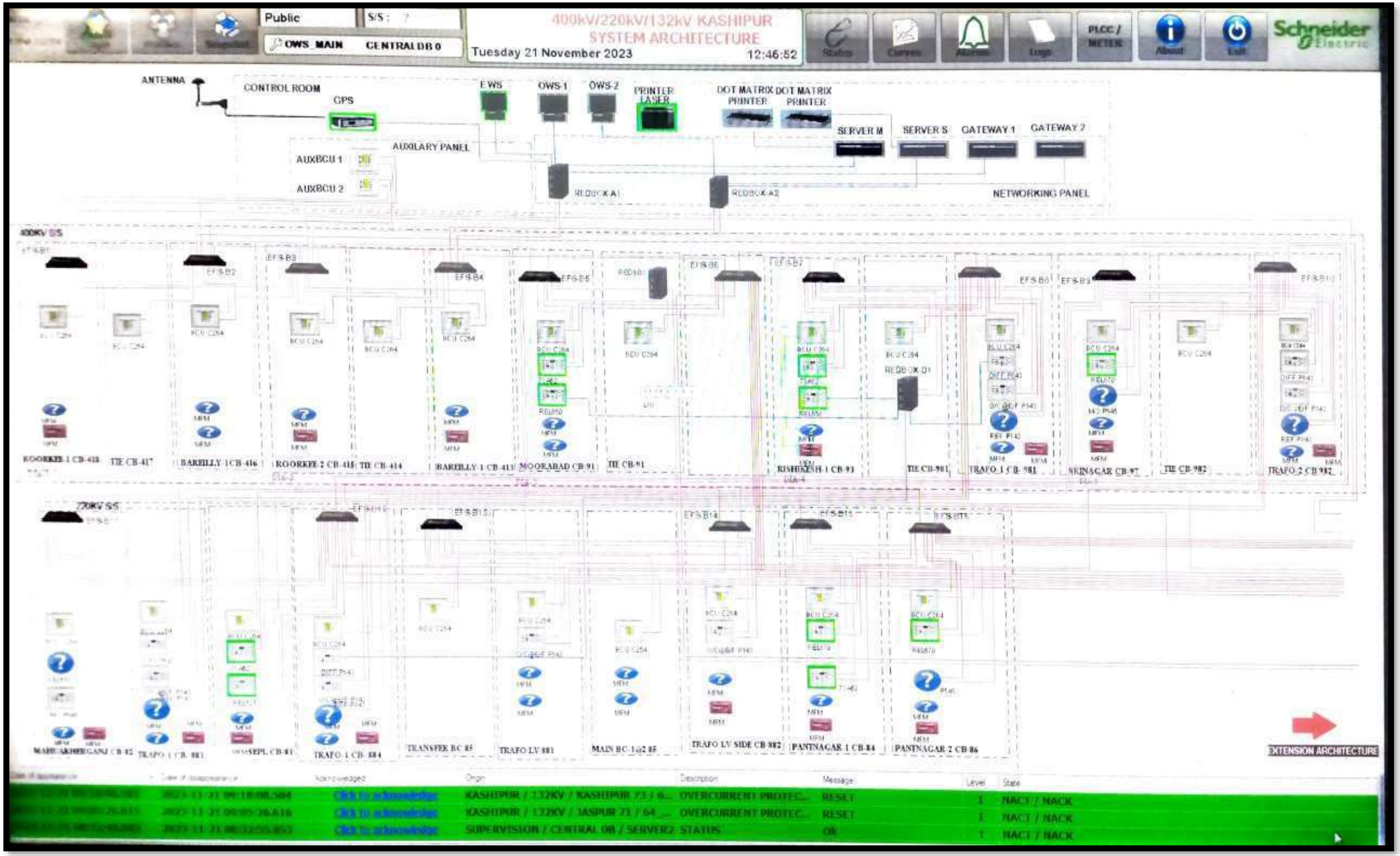
AC Auxiliary System



DC Auxiliary System

Not Available

SAS Architecture diagrams


Public
S/S :
OWS_MAIN
CENTRAL DB 0
400kV/220kV/132kV KASHIPUR
SYSTEM ARCHITECTURE
Tuesday 21 November 2023
12:46:52
PLCC / METER
Schneider Electric
ANTENNA
CONTROL ROOM
GPS
EWS
OWS 1
OWS 2
PRINTER LASER
DOT MATRIX PRINTER
DOT MATRIX PRINTER
SERVER M
SERVER S
GATEWAY 1
GATEWAY 2
AUXILARY PANEL
AUXBCU 1
AUXBCU 2
NETWORKING PANEL
400KV S/S
220KV S/S
ROORKEE 1 CB 418
TIE CB 417
BAREILLY 1 CB 416
ROORKEE 2 CB 415
TIE CB 414
BAREILLY 1 CB 413
MOORABAD CB 91
TIE CB 91
RISHIKESH 1 CB 93
TIE CB 981
TRAFO 1 CB 981
SRINAGAR CB 97
TIE CB 982
TRAFO 2 CB 982
TRANSFER BC 83
TRAFO LV 881
MAIN BC 1-G2 85
TRAFO LV SIDE CB 882
PANTNAGAR 1 CB 84
PANTNAGAR 2 CB 86
EXTENSION ARCHITECTURE
Click to acknowledge
KASHIPUR / 132KV / KASHIPUR 73 / 6... OVERCURRENT PROTEC... RESET
KASHIPUR / 132KV / JASPUR 71 / 64 ... OVERCURRENT PROTEC... RESET
SUPERVISION / CENTRAL DB / SERVER2 STATUS OK
NACT / NACK

Transmission Lines

400kV:

	Line-1	Line-2	Line-3
Name of Line	400KV Kashipur-Nehtaur Line	400KV Kashipur-Moradabad Line	400KV Kashipur-Srinagar Line
Line length (km)	110Km	107Km	Feeder not commissioned

Particulars	Tr Line 1	Tr Line 2	Tr Line 3
Series Compensated (Yes/No)	NOT	NOT	NOT
Connected to dedicated CT core (mention name) **LINE**	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.
Connected to dedicated CT core (mention name) **TIE**	CORE-1 Differential for X-former 1, CORE-2 O/C for X-former -1, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 spare, CORE-2 spare, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 Differential for X-former 2, CORE-2 O/C for X-former -2, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.
CT Ratio	2000:1	2000:1	-
Connected to dedicated PT core (mention name)	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.

Particulars		Tr Line 1	Tr Line 2	Tr Line 3
PT Ratio		400KV:110V	4000KV:110V	400KV:110V
Relay connected to Trip Coil-1 or 2 or both		BOTH	BOTH	BOTH
Feed from DC supply-1 or 2		BOTH	BOTH	BOTH
i	Main-I Protection (Make and Model)	Siemens 7SA52	ABB REL650	ABB REL670
	Functional (Yes/No)	YES	YES	YES
ii	Main-II Protection (Make and Model)	ABB REL650	Siemens 7SA52	NA
	Functional (Yes/No)	YES	YES	YES
iii	LBB Protection (Make and Model)	ABB(RAICA)	ABB(RAICA)	ABB(RAICA)
	Functional (Yes/No)	YES	YES	NA
	Date of testing	NA	NA	NA
iv	PLCC/ Protection coupler (Make and Model)	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA
v	DR (Make &Model) (Make and Model)	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA
vi	Time Synch. Unit (Make and Model)	SANDS	SANDS	SANDS

Particulars		Tr Line 1	Tr Line 2	Tr Line 3
	Functional (Yes/No)	YES	YES	YES
1	Status of Power Swing	ENABLE	ENABLE	ENABLE
2	Out of Step	1	1	1
3	SOTF	ENABLE	ENABLE	ENABLE
4	Breaker Failure	ENABLE	ENABLE	ENABLE
5	Broken Conductor	ENABLE	ENABLE	ENABLE
6	STUB	ENABLE	ENABLE	ENABLE
7	Fault Locator	ENABLE	ENABLE	ENABLE
8	Disturbance Recorder	VISIBLE	VISIBLE	VISIBLE
9	VT fuse fail	ENABLE	ENABLE	ENABLE
10	Overvoltage Protection	ENABLE	ENABLE	ENABLE
11	Trip Circuit supervision	Healthy	Healthy	Healthy
12	Auto-reclose	ENABLE	ENABLE	ENABLE
13	Load encroachment	NA	NA	NA

220 KV:

Particulars	Line-1	Line-2	Line-3	Line-4
Name of Line	220KV Kashipur-Pantnagar Line	220KV JAFARPUR LINE	220KV SEPL LINE	220KV Mahuakheraganj line
Line length (km)	61.5 Km	52.9 Km	19.05 Km	16.79km

Particulars	Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4
Series Compensated (Yes/No)	NOT	NOT	NOT	NOT
Connected to dedicated CT core (mention name)	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.
CT Ratio	800:1	800:1	800:1	800:1
Connected to dedicated PT core (mention name)	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.
PT Ratio	220KV:110V	220KV:110V	220KV:110V	220KV:110V
Relay connected to Trip Coil-1 or 2 or both	BOTH	BOTH	BOTH	BOTH
Feed from DC supply-1 or 2	BOTH	BOTH	BOTH	BOTH

	Particulars	Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4
i	Main-I Protection (Make and Model)	ABB REL670	ABB REL670	ABB REL621	Micom P442
	Functional (Yes/No)	YES	YES	YES	YES
	Date of testing				
ii	Main-II Protection Relay (Make and Model)	Siemens 7SA52	Siemens 7SA52	Siemens 7SA52	Micom P545
	Functional (Yes/No)	YES	YES	YES	YES
iii	LBB Protection (Make and Model)	ABB(RAICA)	ABB(RAICA)	ABB(RAICA)	ABB(RAICA)
	Functional (Yes/No)	YES	YES	YES	YES
iv	PLCC/ Protection coupler (Make and Model)	NA	NA	NA	NA
	Functional (Yes/No)	No	No	No	No
v	DR (Make &Model) (Make and Model)	NA	NA	NA	NA
	Functional (Yes/No)	No	No	No	No
vi	Time Synch.Unit (Make and Model)	SANDS	SANDS	SANDS	SANDS
	Functional (Yes/No)	YES	YES	YES	YES
1	Status of Power Swing	ENABLE	ENABLE	ENABLE	ENABLE

Particulars		Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4
2	Out of Step	1	1	1	1
3	SOTF	ENABLE	ENABLE	ENABLE	ENABLE
4	Breaker Failure	ENABLE	ENABLE	ENABLE	ENABLE
5	Broken Conductor	ENABLE	ENABLE	ENABLE	ENABLE
6	STUB	ENABLE	ENABLE	ENABLE	ENABLE
7	Fault Locator	ENABLE	ENABLE	ENABLE	ENABLE
8	Disturbance Recorder	VISIBLE	VISIBLE	VISIBLE	VISIBLE
9	VT fuse fail	ENABLE	ENABLE	ENABLE	ENABLE
10	Overvoltage Protection	ENABLE	ENABLE	ENABLE	ENABLE
11	Trip Circuit supervision	HEALTHY	HEALTHY	HEALTHY	HEALTHY
12	Auto-reclose	ENABLE	ENABLE	ENABLE	ENABLE
13	Load encroachment	NA	NA	NA	NA

132kV:

Particulars	Line-1	Line-2	Line-3	Line-4	Line-5
Name of Line	132KV Kashipur ckt-1	132KV Kashipur ckt-2	132KV Bajpur ckt-1	Jaspur line	Ramnagar line
Line length (km)	5.5km	6.046km	15.216km	17.71km	23.5km

Particulars	Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
Series Compensated (Yes/No)	NOT	NOT	NOT	NOT	NOT
Connected to dedicated CT core (mention name)	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.	CORE-1 for busbar Protection, CORE-2 for busbar protection, CORE-3 for metering, CORE-4 for main-2, CORE-5 for main-1.
CT Ratio	1000:1	1000:1	1000:1	1000:1	1000:1
Connected to dedicated PT core (mention name)	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.	CORE-1 for main-2, CORE-2 for main-1, CORE-3 for metering.

Particulars		Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
PT Ratio		132KV:110V	132KV:110V	132KV:110V	132KV:110V	132KV:110V
Relay connected to Trip Coil-1 or 2 or both		BOTH	BOTH	BOTH	BOTH	BOTH
Feed from DC supply-1 or 2		BOTH	BOTH	BOTH	BOTH	BOTH
i	Main-I Protection (Make and Model)	Micom P545	Micom P545	Micom P545	Micom P545	Micom P545
	Functional (Yes/No)	YES	YES	YES	YES	YES
ii	O/C&E/F Protection Relay (Make and Model)	Micom P143	Micom P143	Micom P143	Micom P143	Micom P143
	Functional (Yes/No)	YES	YES	YES	YES	YES
iii	LBB Protection (Make and Model)	In built feature in relay.	In built feature in relay.	In built feature in relay.	In built feature in relay.	In built feature in relay.
	Functional (Yes/No)	YES	YES	YES	YES	YES
	Date of testing	NA	NA	NA	NA	NA
iv	PLCC/ Protection coupler (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	No	No	No	No	No
v	DR (Make &Model) (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	No	No	No	No	No

	Particulars	Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
iv	Time Synch.Unit (Make and Model)	SANDS	SANDS	SANDS	SANDS	SANDS
	Functional (Yes/No)	YES	YES	YES	YES	YES
Other Protections						
1	Status of Power Swing	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
2	Out of Step	1	1	1	1	1
3	SOTF	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
4	Breaker Failure	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
5	Broken Conductor	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
6	STUB	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
7	Fault Locator	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
8	Disturbance Recorder	VISIBLE	VISIBLE	VISIBLE	VISIBLE	VISIBLE
9	VT fuse fail	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
10	Overvoltage Protection	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
11	Trip Circuit supervision	HEALTHY	HEALTHY	HEALTHY	HEALTHY	HEALTHY
12	Auto-reclose	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
13	Load encroachment	NA	NA	NA	NA	NA

Bus-Bar Protection

400kV System:

Sl. No.	Particulars	Observations
a	**Busbar and redundant relay make and model**	Siemens7SS52
b	**Type of Busbar arrangement**	One and half Breaker
c	**Zones**	Three (Bus-1, Bus-2 and Check)
d	**Dedicated CT core for each busbar protection**	Yes (core -1 for main and core 2 for check)
e	**Breaker Failure relay included, if additional then furnish make and model**	In case of any BFR operating in sub-station, the relevant zone will be tripped.
f	**Trip issued to both Busbar protection in case of enabling**	Not applicable
g	**Isolator indication and check relays**	NA
h	**Other requirements for protection checking and validation**	The Bus-bar protection relay was replaced, but kept out of service as stability test is pending. Utility has informed that zone IV of all distance protection is set in reverse direction and 160 ms (less than zone 2 time), in the absence of bus-bar protection.

220KV System:

Sl. No.	Particulars	Observations
a	**Busbar and redundant relay make and model**	Siemens7SS52
b	**Type of Busbar arrangement**	2 main and transfer
c	**Zones**	Single zone
d	**Dedicated CT core for each busbar protection**	One CT core to be used
e	**Breaker Failure relay included, if additional then furnish make and model**	In case of any BFR operating in sub-station, the relevant zone will be tripped.
f	**Trip issued to both Busbar protection in case of enabling**	Not applicable
g	**Isolator indication and check relays**	This is part of Bay Unit
h	**Other requirements for protection checking and validation**	Panels erected. Under commissioning.

132KV System:

Sl. No.	Particulars	Observations
a	**Busbar and redundant relay make and model**	Siemens7SS52
b	**Type of Busbar arrangement**	1 main and transfer
c	**Zones**	Single
d	**Dedicated CT core for each busbar protection**	One CT core to be used
e	**Breaker Failure relay included, if additional then furnish make and model**	In case of any BFR operating in sub-station, the relevant zone will be tripped.
f	**Trip issued to both Busbar protection in case of enabling**	Not applicable
g	**Isolator indication and check relays**	This is part of Bay Unit
h	**Other requirements for protection checking and validation**	Panels erected. Under commissioning.

AC Auxiliary System

Sl. No.	Particulars	Observations
a	**Source of AC auxiliary system**	1 no. 630kVA Station Transformers connected with 33kV transmission line from 132 kV Kashipur S/s (approx. 7km away) and 1 no. 630kVA Station Transformers connected with 33kV transmission line from 132 kV Ram Nagar S/s (approx. 20 km away)
b	**Supply changeover between sources (Auto/Manual)**	Load is distributed between two transformers. The emergency load is connected to separate distribution board. DG is connected to Emergency Board.
c	**Diesel generator (DG) details**	Make: Cummins Rating: 250 kVA
d	**Maintenance plan and supply changeover periodicity in DG**	a. The DG set operation is manual and some load is disconnected at the time of DG operation from Emergency board. b. Although, the auxiliary supply is reliable, DG operation is approx. 25 times a year.
e	**Single Line Diagram**	Attached
f	**Other requirements for protection checking and validation**	NA

DC Auxiliary System

Sl. No.	Particulars	Observations			
		220 V DC - I	220 V DC - II	48 V DC-I	48 V DC-II
a	**Make**	Exide	HBL	HBL	HBL
b	**Model/Rating**	800Ah	800Ah	900Ah	900Ah
c	**Vintage**	2023	2006	2006	2006
d	**Measured voltage**				
i	**Positive to Earth**	0.297V	0.085V	NA	NA
ii	**Negative to Earth**	-237.9V	-237.9V	48	48
E	**No. of Cells Per Bank**	108	108	24	24
F	**Availability of Battery Charger**	Yes	Yes	Yes	Yes

Circuit Breakers

Sl. No	Particulars	Make and Model	No. of trip/ close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
A	**400kV System**						
1	400KV Nehtaur Moradabad, Srinagar Line,315MVA T/F I&II (Total 8 breakers)	MAKE-CGL	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	NA
2	Roorkee Bareilly D/C Line dia (Total 6 breakers)	MAKE-Siemens	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	Owned by PowerGrid Corp
B	**220kV System**						
1	220KV Pantnagar, Jafarpur, Mahuakheraganj, SEPL Line, 315 MVA T/F 1& 2,160MVA T/F I&II, TBC, BC (Total 10 breakers)	MAKE-CGL	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	NA
2	160MVA T/F -III (Total 1 breaker)	MAKE-ABB	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	NA
C	**132kv system**						
1	132KV Kashipur ckt-I&II, Jaspur, Ramnagar , Bazpur I Line, Transformer I,II , TBC(Total 8 breakers)	MAKE-ABB LTB 145D/B SPR	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	NA

Sl. No	Particulars	Make and Model	No. of trip/ close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
2	132 kV Bazpur II & X-former III (Total 2 breakers)	MAKE-ABB LTB 145D1/B SPR	2/1	HEALTHY	ENABLE TIME DELAY-200 ms	DISABLE	NA

Current Transformer

a	Location of CT	400 KV NEHTAUR				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	NA	NA	NA	NA	NA
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	400 KV MORADABAD				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	2000	2000	1000	2000	2000
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	400 KV SRINAGAR				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	2000	2000	1000	2000	2000
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV PANTNAGAR				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	800	800	800	800	800
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV JAFARPUR				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	800	800	800	800	800
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV SEPL				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	800	800	800	800	800
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV MAHUAKHERAGANJ				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	800:1	800:1	800:1	800:1	800:1
ii	Ratio measured	800:1	800:1	800:1	800:1	800:1

a	Location of CT	132 KV Kashipur ckt-I				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	1000:1	1000:1	1000:1	1000:1	1000:1
ii	Ratio measured	1000:1	1000:1	1000:1	1000:1	1000:1

a	Location of CT	132 KV Kashipur ckt-II				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	1000:1	1000:1	1000:1	1000:1	1000:1
ii	Ratio measured	1000:1	1000:1	1000:1	1000:1	1000:1

a	Location of CT	132 KV BAZPUR				
b	Date of CT ratio Test Testing	04/10/2021				
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	1000:1	1000:1	1000:1	1000:1	1000:1
ii	Ratio measured	1000:1	1000:1	1000:1	1000:1	1000:1

a	Location of CT	132 KV JASPUR				
b	Date of CT ratio Test Testing	04/10/2021				
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	1000:1	1000:1	1000:1	1000:1	1000:1
ii	Ratio measured	1000:1	1000:1	1000:1	1000:1	1000:1

a	Location of CT	132 KV RAMNAGAR				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	BUSBAR PROTECTION	BUSBAR PROTECTION	METERING	21 M2 PROTECTION	21 M1 PROTECTION
e	Test Results					
i	Ratio Adopted	1000:1	1000:1	1000:1	1000:1	1000:1
ii	Ratio measured	1000:1	1000:1	1000:1	1000:1	1000:1

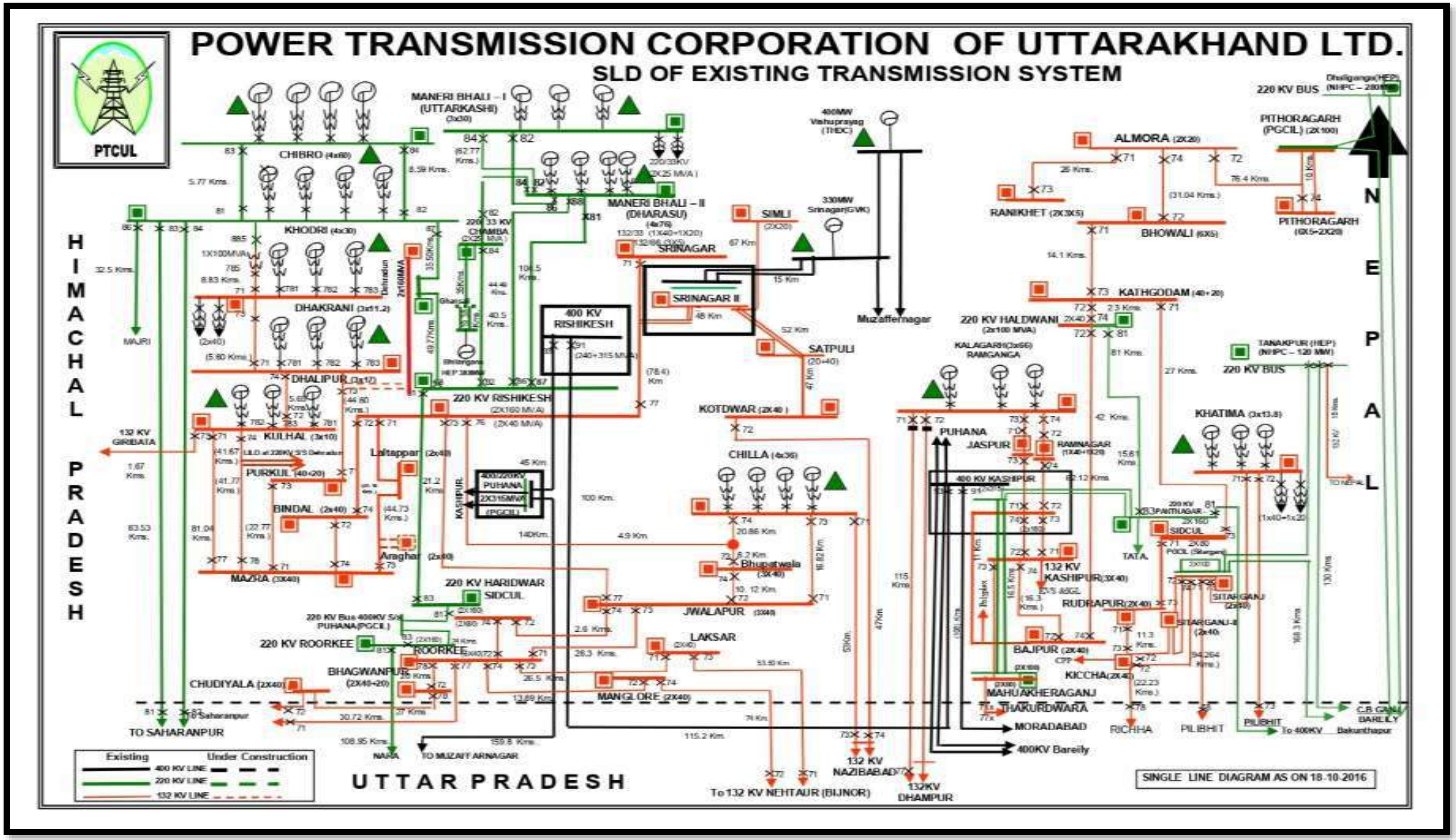
Disturbance Recorder (DR) & Event Logger (EL)

Sl. No.	Particulars	400kV	220kV	132kV
1	a) Is the Disturbance recorder and Fault locator provided on all line feeders?	Yes	Yes	Yes
	b) Whether standalone or built in Main relay	Built-In	Built-In	Built-In
	c) Whether DR is having automatic fault record download facility to a central PC	No	No	No
	d) Whether Central PC for DR, EL are powered by Inverter (fed from station DC)	NA	NA	NA
3	Whether substation is having Event logger facility	Yes	Yes	Yes
	If Yes (standalone or built-in-SAS)	Built-In	Built-In	Built-In
4	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	Yes 2 Nos. (one for SAS & one for Relays/Equipment)		

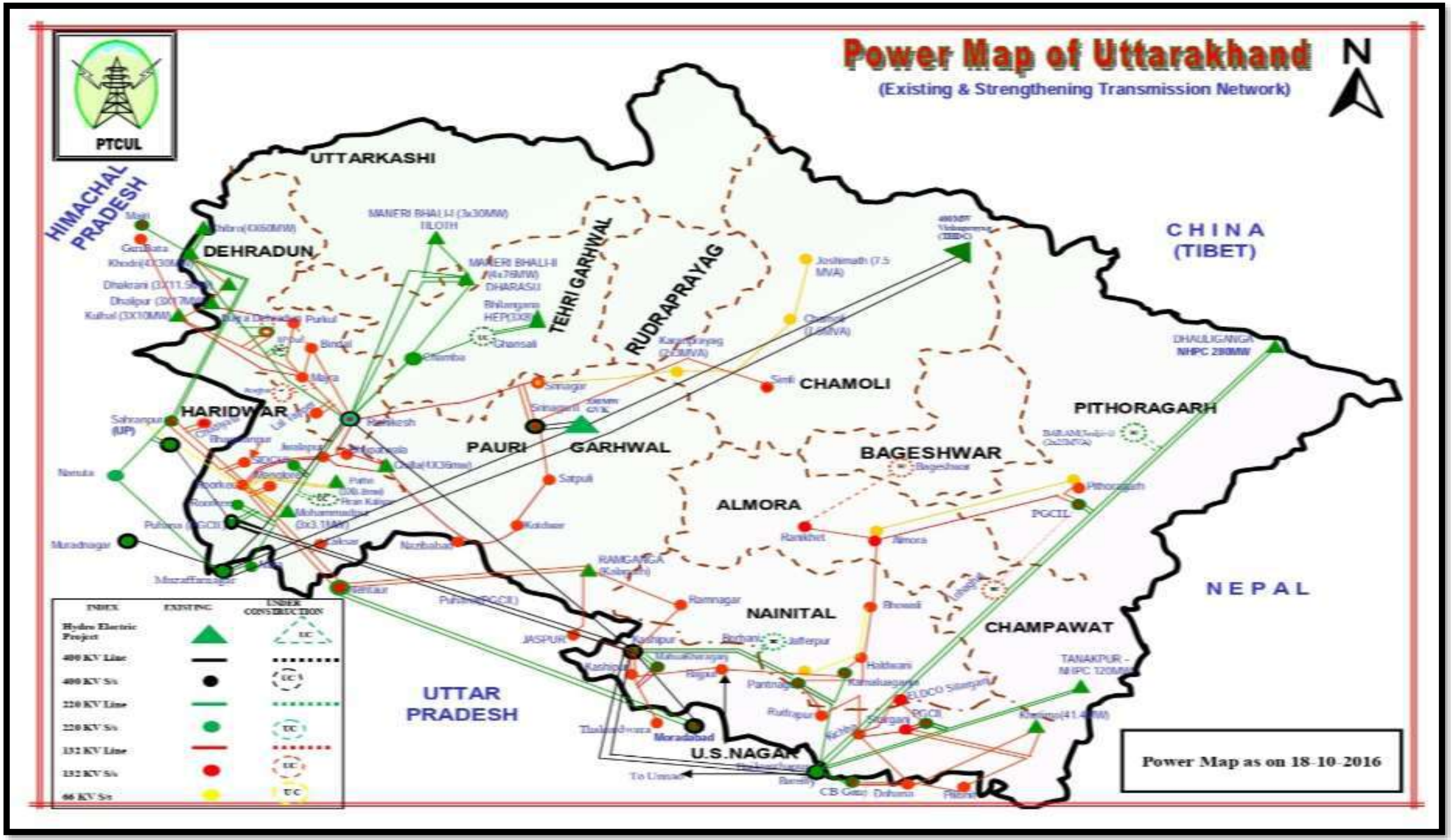
Communication System

Sl. No.	Name of Line Feeder	PLCC/OPGW /none	If PLCC for protection (y/n)	Coupling type & no. Of channel	If OPGW for protection (y/n)	Geographically distributed for main-1 & main-2 dedicated/ multiplexed
1	400KV Kashipur-Nehtaur Line	PLCC	Yes	Ph-Ph	No	NA
2	400KV Kashipur-Moradabad line	PLCC	Yes	Ph-Ph	No	NA
3	400KV Kashipur-Srinagar Line	NA	NA	NA	NA	NA
4	220KV Kashipur-Jafarpur Line	PLCC	Yes	Ph-Ph 2 channels	No	NA
5	220KV Kashipur-Pantnagar Line	PLCC & OPGW	No	Ph-Ph	Yes	Dedicated, Dedicated
6	220KV Kashipur-Mahuakheraganj Line	PLCC	Yes	Ph-Ph 2 channels	No	NA
7	220KV Kashipur-SEPL Line	PLCC	Yes	Ph-Ph 2 channels	No	NA
6	132KV Kashipur ckt-I Line	PLCC	No	Ph-G	No	NA
7	132KV Kashipur ckt-II Line	PLCC	No	Ph-G	No	NA
8	132kv Jaspur line	PLCC	No	Ph-G	No	NA
9	132KV Bazpur Line	PLCC	No	Ph-G	No	NA
10	132kv Ramnagar line	PLCC	No	Ph-G	No	NA

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

220/132KV Mahuakheraganj Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल
CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 220/132/33 KV MAHUAKHERAGANJ SUB-STATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
EE	Executive Engineer
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
JE	Junior Engineer
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee

PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System
SE	Superintendent Engineer
SCADA	Supervisory Control & Data Acquisition
SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
T&C	Testing & Commissioning
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

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1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400kV and 8 nos. 220kV sub-stations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan & Mr. Rounak Sen visited 220/132/33KV Mahuakheraganj Substation during 29th – 31st January 2024 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below under 2 heads.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220kV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on “Draft O&M Manual” of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Point 5.4. It is recommended that the necessary testing equipment at substation/Sub-division/Division be arranged for regular testing of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru’ third party for implementing the best practices in the sub-station.
10. In addition, the existing draft O&M manual also be updated to take care of latest developments.

Observations and Recommendations for 220/132/33 KV Mahuakheraganj Substation

01. This is a new Sub-station and first protection audit is being conducted.
02. SAS is fully functional. It is suggested that the connectivity of SAS with printer and/or network be ensured for accessing data outside SAS.
03. Bus-bar protection is not functional. It is recommended that Bus-bar protection be made functional.
04. Both the lines are operating in radial mode and Carrier aided protection is not provided. It is suggested that based on protection philosophy and importance of lines, PTCUL study the need of carrier aided protection.
05. Due to fault on 33kV Network, LV side of transformers tripped in multiple instances. It is recommended that Protection co-ordination with distribution company (UPCL) be carried out.
06. The SLD of DC system be kept easily accessible.
07. Earth Fault in one 220V battery bank was observed. It is recommended to take necessary corrective action.
08. Emergency DG set operation is in manual mode. It is suggested to keep the DG set in Auto mode.
09. It is suggested that the possibility of connecting the available spare transformer to 33kV system, as second auxiliary supply source be considered.

2.0. Introduction

2.1. Background

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400 kV and 08 Nos. 220 kV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following substations is to be carried out

1. *400kV Rishikesh*
2. *400kV Kashipur*
3. *220kV Chamba*
4. *220kV Rishikesh*
5. *220kV Roorkee*
6. *220kV Haridwar (SIDCUL)*
7. *220kV Jhajra*
8. *220kV Pantnagar*
9. *220kV Haldwani*
10. *220kV Mahuakheraganj*

2.2. *Scope of Work*

Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. *Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.*
b. *Availability/healthiness of PLCC communication links used for protection systems.*
c. *Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.*
d. *Availability/healthiness of GPS system and time synchronization facility used for protection.*
e. *Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.*
f. *Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.*
g. *Field inspection of protection device for obsolescence of technology, suitability and healthiness.*
h. *Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.*
i. *Checking of availability of DG Set / auxiliary DC supply at substations.*

2.3. *Audit Rationale*

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipment under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) "All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC".
c. As per Para – 15 (4) of said Code, "The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the

respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC".

d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per Annexure -1 of IEGC-2023.

2.4. Audit Process

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each sub-station, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

S. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-Connecting Transformer [ICT]
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system

S. No.	Elements
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL

- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity / deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**
  - The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
  - The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - All the major general deficiency shall be listed in detail along with remedial recommendations.

- The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. About Power Transmission Corporation of Uttarakhand (PTCUL)

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. *About Central Board of Irrigation & Power (CBIP)*

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of Mahuakheraganj Substation

3.1. *General Information about Substation*

Sl. No.	Particulars	Details
1	**Substation Name**	220/132/33 KV Mahuakheraganj Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	220/132/33 KV
4	**Short circuit current rating of all equipment (for all voltage level)**	50kA
5	**Date of commissioning of the substation**	24th November 2011
6	**Checking and validation date**	29th – 31st January 2024

3.2. *Audit Team*

Audit Team (CBIP):

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Rounak Sen

PTCUL Representative:

- Mr. Asim Baig – Executive Engineer
- Mr. Ashutosh Pokhriyal – Assistant Engineer
- Mr. Amit Goyal – Junior Engineer

3.3. *Recommendation of last protection checking and validation*

No Protection Audit was conducted previously

3.4. *Review of existing settings at substation*

a. Utility has provided relay settings adopted for various feeders and transformers.
b. The record of different relay setting calculations is not available at the substation level.
c. All relays are numeric, therefore, as per internal protocol of utility relays are tested only at the time of commissioning/change in setting. Copy of test reports not available at sub-station level.

3.5. *Disturbance Recorder availability for the last 6 tripping's*

a. Relays are connected to central PC and DR data and events can be accessed.
b. Complete sub-station is operated thru SAS system and Events can be recorded/ accessed.

3.6. *Chronic reason of tripping, if any*

a. At 220 and 132 kV level no significant trippings are noticed.
b. Few 33kV lines are showing very high number of tripping and in many cases 33kV Side of transformers are also tripping, due to non-directional O/C & E/F relay operations, when 33kV lines trip.

3.7. *Major non-conformity/deficiency observed*

a. One 220V DC systems is showing earth-fault.
b. Emergency DG set operation is in manual mode
c. SAS output is not accessible either on printer or network or external disks. The output is taken as photographic image.
d. One 33kV/440 V station transformer, to be used as 2nd source of Aux AC, is kept back charged near 100 MVA 220/132/33 transformer. It can be connected to tertiary end for improving the reliability.
e. Recommended relay settings with supporting calculations/ parameters needs to be kept at sub-station.
f. PLCC is not functional.

4.0. List of Trippings

Sl. No	Name of Feeder/TF& CB	Type of relay/Scheme	Date & Time of tripping	Date & Time of closing	Flags observed	Other End flags	Affected Generation /Load	Tripping Analysis/Action taken Report
1	132kV Kashipur Line	GE	17-10-2023 05:28 HRS	17-10-2023 11:15 HRS	Zone 1 trip, Dist-5 Km, Fault Loop-A-N, Fault Current- Ia-4676.105 A, Ib-44.693 A, Ic-141.516 A, In-4491.693 A	Other End not tripped	NA	Due to R phase Jumper broken
2	132KV Thakurdwara line	GE D60	18-05-2023 04:00 HRS	18.03.2023, 11.15 hrs	R, Y, B, O/C E/F 86A, 86B Ia -5.204 KA, Ib-5.204 KA, Ic -4 A,In- 8 A, Vab-70.272 KV, Vbc-126.048KV, Vc-135.744 Kv	No Flag, Circuit breaker is opened at other end i.e. 132 KV Thakurdwara , and Line is charged from PTCUL end.	Not Affected	TLF, Due to heavy storm, distance not tripped. It was blocked by VT fuse fail and PSB
3		GE D60	18.03.2023, 10:02 Hrs	18.03.2023, 12:00 Hrs	R, Y, B, O/C E/F 86A, 86B Ia -4.393 A, Ib 7178.345 A, Ic -7179.408 A, In-5.884 A, Va-75.886 KV, Vb 44.169KV, Vc-38.182 KV, dist-4.7 km, Zone 1 trip	No Flag, Circuit breaker is opened at other end i.e. 132 KV Thakurdwara , and Line is charged from our end.	Not Affected	TLF

5.0. Observations and Recommendations

5.1. Reporting of all the Tripping with DR/EL

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System "http://103.7.128.184/Account/Login.aspx" within 24 hours of the events. These are being submitted by sub-station to NRLDC portal, however the record of the same is not kept at sub-station level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	DR, EL & Tripping report need to be submitted
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
	Total in NR Region	520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at sub-stations

c. It is recommended that each sub-station to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. Development of centralized database of relay settings

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 kV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220kV are to be calculated by SLDC and/or central level. The relays are tested by sub-station officials as per need basis, but the record of recommended settings/ calculation is not kept at sub-station level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220kV & above and by SLDC below 220kV along with setting calculations & parameters used for all the relays be kept at sub-station level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. Review of test results of relay and equipment

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".
b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.
c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. Availability of Testing Kits

a. The availability of testing equipment is limited at each sub-station is limited. For comprehensive testing of equipment, as per above para, sufficient testing kits at each sub-station/Sub-division/Division level are required.
b. It is recommended that based on approved O&M manual, station, Sub-division, Division wise testing instruments be arranged for regular testing of equipment.

5.5. Up-dation of PTCUL Protection Philosophy

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. Simulation based study of protection system

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. Capacity Building of protection team

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. Updated Fault Level/ Short Circuit Level and Network information

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. General Protection related observations

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. O&M Manual

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. Complete sub-station is operated thru SAS system and Events can be recorded/ accessed on SAS terminal. SAS output is not accessible either on printer or network or external disks. The output is takenas photographic image. Necessary Connectivity of SAS terminals to network/ printer may be arranged.
b. For both 220kV and 132 kV, the Bus-bar protection relays were replaced, but are not compatible with Bay Units. Therefore, bus bar protection system is out of service. Utility has informed that zone IV of all distance protection is set in reverse direction and 160 ms (less than zone 2 time), in the absence of bus-bar protection.
c. Carrier based protection is not functional in any line, as PLCC is not functional. It is recommended that Carrier aided protection be made functional in 220kV lines.
d. At 220 and 132 kV level no significant trippings are noticed. Few 33kV lines are showing very high number of tripping and in many cases 33kV Side of transformers are also tripping. The 33kV system beyond the 33kV side of transformers is owned by distribution company, i.e. UPCL. Any fault in 33kV and/or 11kV, if not cleared in time, can cause tripping of LV side of transformer, as the non-directional Over current and Earth Fault protection is provided.

6.2. Equipment related observations and recommendations

This is a new sub-station and equipment are generally in good condition. Any requirement of spare equipment may be reviewed by PTCUL.

In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of Maintenance Equipment is attached at Annexure – 3.

6.3. Auxiliary Equipment related observations and recommendations

a. Single Line diagram of DC system not available. It is recommended to keep the SLD easily accessible.
b. One of the 220V DC system is showing severe earth-fault. The necessary corrective action needs to be taken asap to avoid any unwanted tripping in future.
c. Emergency DG set operation is in manual mode. Necessary action may be taken to keep the DG set in Auto mode.

d. One 33kV/440 V station transformer, to be used as 2nd source of Aux AC, is kept back charged near 100 MVA 220/132/33 transformer. It can be connected to tertiary end for improving the reliability.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

NIL

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
   a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
   b) to have a repository of protection system, settings and events at regional level;
   c) specifying timelines for submission of data;
   d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
   e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.
4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.

5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 kV and above (132 kV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.
   c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220kV and above (132 kV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.
5. The elements of network below 66kV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 kV and above (132 kV and above in NER).
2. All users shall also conduct third party protection audit of each sub-station at 220 kV and above (132 kV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 kV and above (132 kV and above in NER) system, which shall be reviewed by the RPC:
   a. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

Where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

b. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

Where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

c. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

Where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**
  1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
  2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock

testing for reviewing SPS parameters & functions, at least once in a year. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.

3. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
4. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction**
    a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.
    b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:
        i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.
        ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist**
    a. The protection system checklist shall contain information as per this Regulation.
        i. General Information (to be provided prior to the checking as well as to be included in final report):
            - Substation name
            - Name of Owner Utility
            - Voltage Level (s) or highest voltage level?
            - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
            - Checking and validation date
            - Record of previous tripping's (in last one year) and details of protection operation
            - Previous Relay Test Reports
            - Overall single line diagram (SLD) (x) AC aux SLD
            - DC aux SLD
            - SAS architecture diagram
            - SPS scheme implemented (if any)

    b. The preliminary report shall inter-alia contain the following:

TABLE A: FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

c. The relay configuration checklist for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The minimum set of points on which checking and validation shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection

- Name and Length of Line
- Whether series compensated or not
- Mode of communication used (PLCC/OPGW)
- Relay Make and Model for Main-I and Main-II

- List of all active protections & settings
- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer Protection

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays
- Other requirements for protection checking and validation

iv. AC auxiliary system

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. DC auxiliary system

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
  - Mode of communication for Main-1 and Main-2 protection
  - Mode of communication for data and speech communication
  - Status of PLCC channels
  - Time synchronization equipment details
  - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
  - Other requirements for protection checking and validation

vi. Circuit Breaker Details

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
  - CT/CVT ID name and voltage level
  - CT/CVT core connection details
  - Accuracy Class
  - Whether Protection/Metering

- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).

b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.

c) All the major general deficiency shall be listed in detail along with remedial recommendations.

d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.

e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	220kV and above: Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme. 132kV and below: One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines) Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect. Time setting: i. 0.35 second (considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms) ii. 0.5-0.6 second (For a long line followed by a short line)
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • over-voltage stage-I setting for series compensated double circuit lines may be kept higher at 113%.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
7	**Power Swing Blocking**	Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220kV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220kV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132kV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be **applied.**
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220 kV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • faults in cables

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		• Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220kV and above sub stations with the only exception of 220kV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220 kV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
17	**Over Voltage Protection**	FOR 765kV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400kV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220 KV LINES: No over-voltage protection shall be used. FOR 220 KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be done for multi circuit lines/cable.
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (Vmin) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400 kV and above) Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

<u>Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.</u>

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

<u>No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023</u>

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital.
4. Executive Engineer, T&C Division, Kashipur.
5. **Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email:** sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालय:–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइट www.ptcul.org

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(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

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Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

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(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	GST	:	GST shall be paid extra as per applicable Government rules.
3	Tax	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	Date of Start of work	:	Order shall be considered as having come in to force from the date of issue of order.
5	Supply Completion	:	NA
6	Work completion	:	The work should be completed within 24 months from the date of issue of order.
7	Engineer of the contract		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	Engineer in-charge		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	Liquidity damages	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	Dispute		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	Payment terms	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	Payement unit		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	Warranty period	:	NA.
14	Billing Address	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

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(उत्तराखण्ड सरकार का उपक्रम)
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कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाश नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause						Modified Clause					
		Sr. No	Description	Unit	Qty	Amount	Total Amount	Sr. No	Description	Unit	Qty	Unit rate (Rs.)	Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.						1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.				
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.						2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.				
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.						3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.				
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus						4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to				

2

S. No.	Clause of PO	Existing Clause	Modified Clause
		couplers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices. etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DG Set/auxiliary DC supply at substations.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g) Field inspection of protection device for obsolescence of technology, suitability and healthiness. h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

3

S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum**.
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

4

S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

5

Annexure – 8: Data Sheets

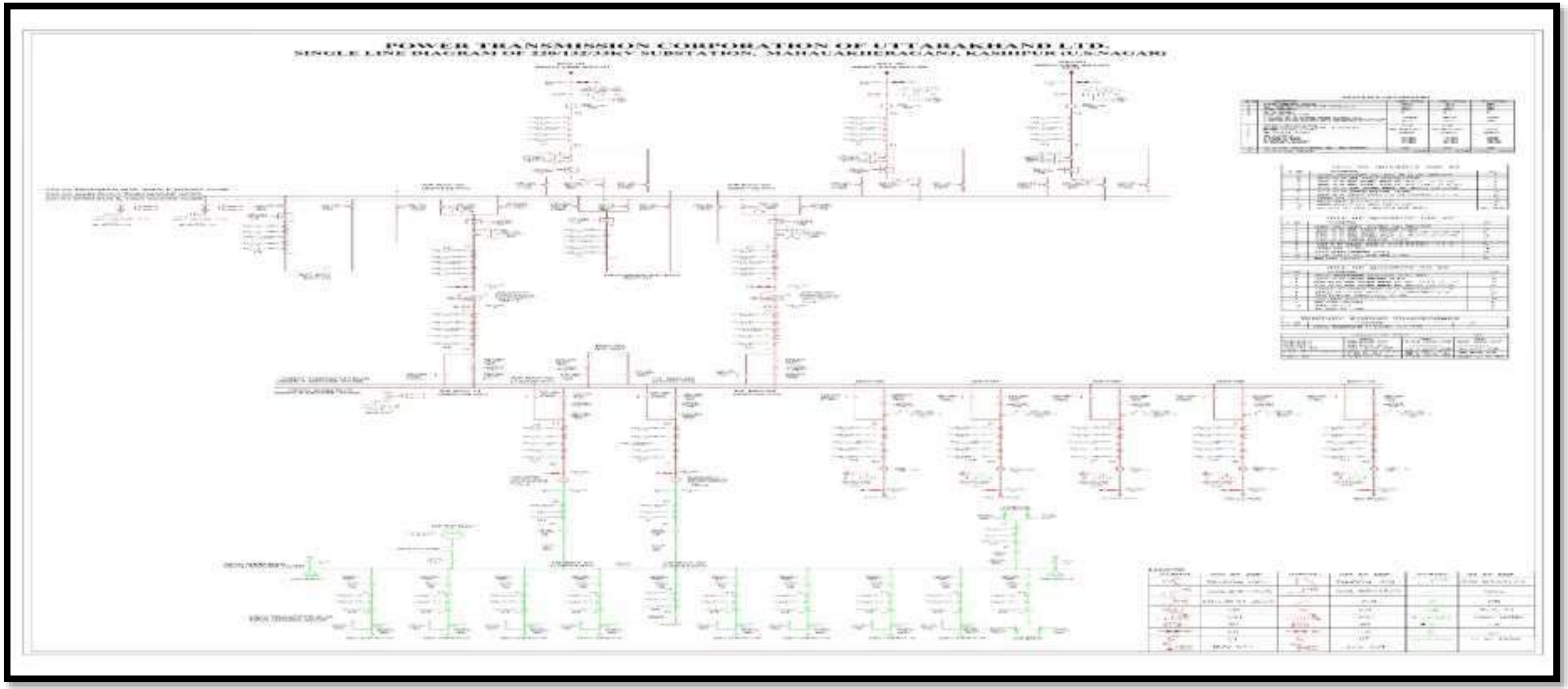
Contents

Annexure - 8

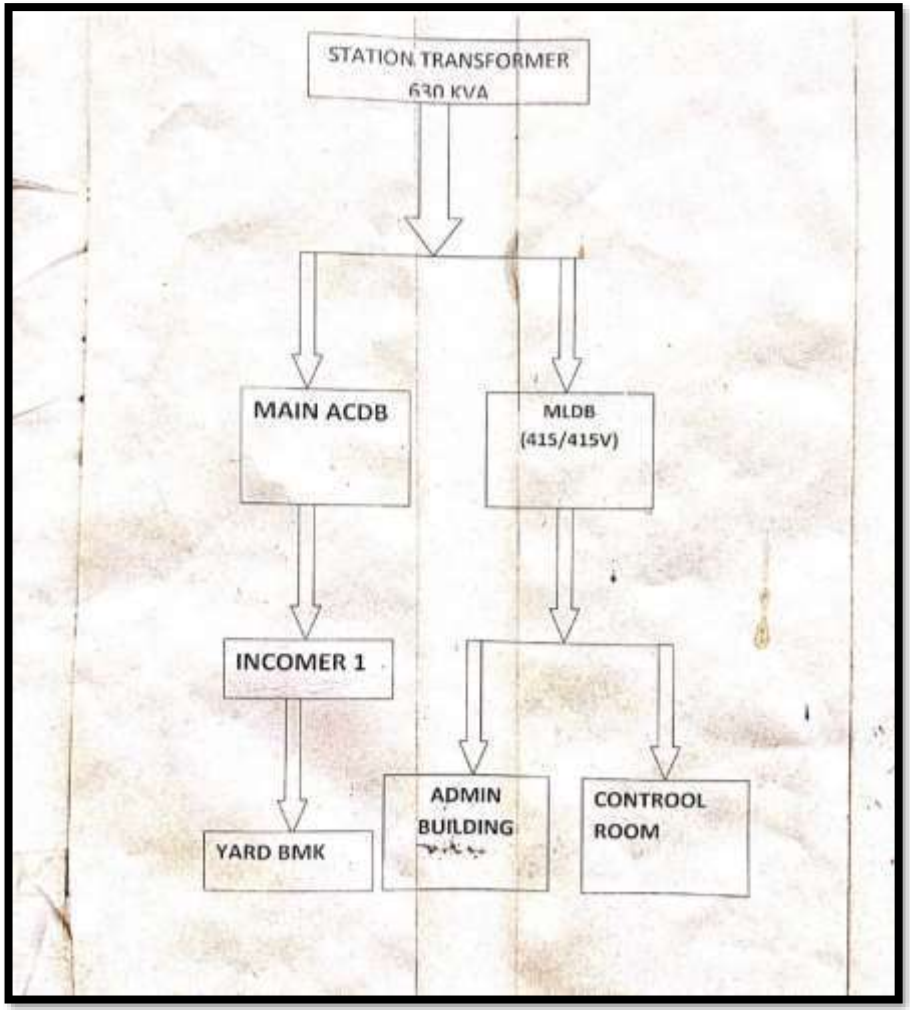
Data Sheets

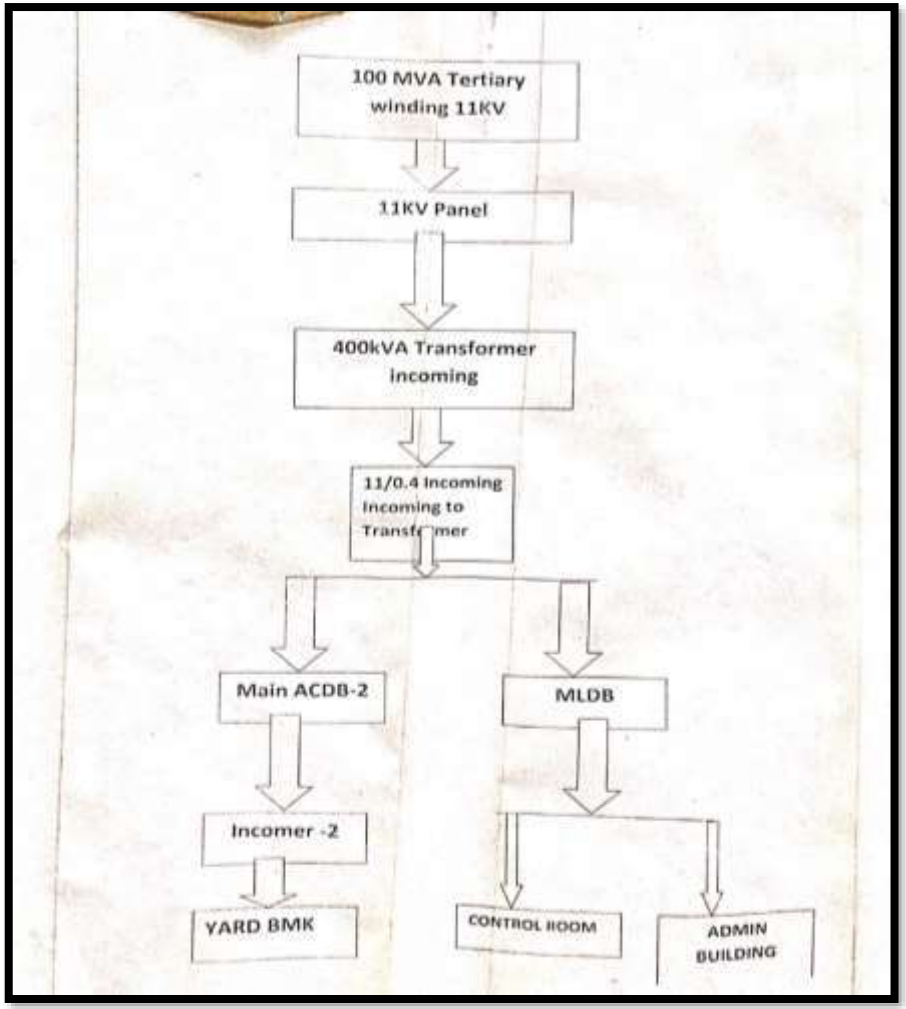
Single Line Diagrams

Substation Single Line Diagram



AC Auxiliary System





DC Auxiliary System

Not Available

Bus-Bar Protection

220KV System:

Sl. No.	Particulars	Observations
a	**Busbar and redundant relay make and model**	GE B90
b	**Type of Busbar arrangement**	2 main and transfer
c	**Zones**	Three (Bus-1, Bus-2 and Check)
d	**Dedicated CT core for each busbar protection**	Yes
e	**Breaker Failure relay included, if additional then furnish make and model**	In case of any BFR operating in sub-station, the relevant zone will be tripped.
f	**Trip issued to both Busbar protection in case of enabling**	Not applicable
g	**Isolator indication and check relays**	This is part of Bay Unit
h	**Other requirements for protection checking and validation**	The Bus-bar protection relay was replaced, but is not compatible with Bay Units. Therefore, bus bar protection system is out of service. Utility has informed that zone IV of all distance protection is set in reverse direction and 160 ms (less than zone 2 time), in the absence of bus-bar protection.

132KV System:

Sl. No.	Particulars	Observations
a	**Busbar and redundant relay make and model**	NA
b	**Type of Busbar arrangement**	1 main and transfer
c	**Zones**	(Bus-1 and Check)
d	**Dedicated CT core for each busbar protection**	Yes
e	**Breaker Failure relay included, if additional then furnish make and model**	In case of any BFR operating in sub-station, the relevant zone will be tripped.
f	**Trip issued to both Busbar protection in case of enabling**	Not applicable
g	**Isolator indication and check relays**	This is part of Bay Unit
h	**Other requirements for protection checking and validation**	The Bus-bar protection relay was replaced, but is not compatible with Bay Units. Therefore, bus bar protection system is out of service. Utility has informed that zone IV of all distance protection is set in reverse direction and 160 ms (less than zone 2 time), in the absence of bus-bar protection.

AC Auxiliary System

Sl. No.	Particulars	Observations
a	**Source of AC auxiliary system**	1 nos. 630KVA Station Transformers connected with 33kV Busbar.
b	**Supply changeover between sources (Auto/Manual)**	NA
c	**Diesel generator (DG) details**	Make: ZECKSON CUMMINS Rating: 250KVA
d	**Maintenance plan and supply changeover periodicity in DG**	a. The DG set operation is automatic, however, load manually connected, as DG is not capable of catering full emergency loads. b. As the auxiliary supply is quite reliable, DG operation is almost negligible. For testing purpose DG is operated once a week.
e	**Single Line Diagram**	Attached
f	**Other requirements for protection checking and validation**	NA

DC Auxiliary System

Sl. No.	Particulars	Observations			
		220 V DC - I	220 V DC - II	48 V DC-I	48 V DC-II
a	**Make**	NA	NA	NA	NA
b	**Model/Rating**	500Ah	510Ah	300Ah	300Ah
c	**Vintage**	NA	NA	NA	NA
d	**Measured voltage**				
i	**Positive to Earth**	0V	118V	1.03V	1.46V
ii	**Negative to Earth**	240V	124V	49.2V	51.6V
e	**No. of Cells Per Bank**	NA	NA	NA	NA
f	**Availability of Battery Charger**	Yes	Yes	Yes	Yes

Circuit Breakers

Sl. No.	Particulars	Make and Model	No. of trip/close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
A	**220KV System**						
1	220KV Kashipur, SEPL, GIPL line, 100MVA T/F I&II(HV&LV)	MAKE-AREVA	2/1	HEALTHY	ENABLE	DISABLE	NA
B	**132KV system**						
1	132KV Kashipur, Thakurdwara Line,80MVA T/F(I&II) HV&LV	MAKE-AREVA	2/1	HEALTHY	ENABLE	DISABLE	NA

Current Transformer

a	Location of CT	220KV, 400KV S/S KASHIPUR LINE				
b	Date of CT ratio Test Testing					
		Core I	**Core II**	**Core III**	**Core IV**	**Core V**
c	Accuracy Class	PS	PS	0.2	BCU	PS
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING	BCU	BUSBAR PROTECTION
e	Test Results					
i	Ratio Adopted	800	800	800	800	800
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220KV SEPL LINE				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	BCU	PS
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING	BCU	BUSBAR PROTECTION
e	Test Results					
i	Ratio Adopted	800	800	800	800	800
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**220KV GIPL LINE**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	BCU	PS
d	Purpose	21 M1 PROTECTION	21 M2 PROTECTION	METERING	BCU	BUSBAR PROTECTION
e	Test Results					
i	Ratio Adopted	800	800	800	800	800
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**132KV KASHIPUR LINE**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	BCU	-
d	Purpose	DISTANCE PROTECTION	O/C PROTECTION	METERING	BCU	SPARE
e	Test Results					
i	Ratio Adopted	400	400	400	400	400
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	132KV THAKURDWARA LINE				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	BCU	-
d	Purpose	DISTANCE PROTECTION	O/C PROTECTION	METERING	BCU	SPARE
e	Test Results					
i	Ratio Adopted	400	400	400	400	400
ii	Ratio measured	NA	NA	NA	NA	NA

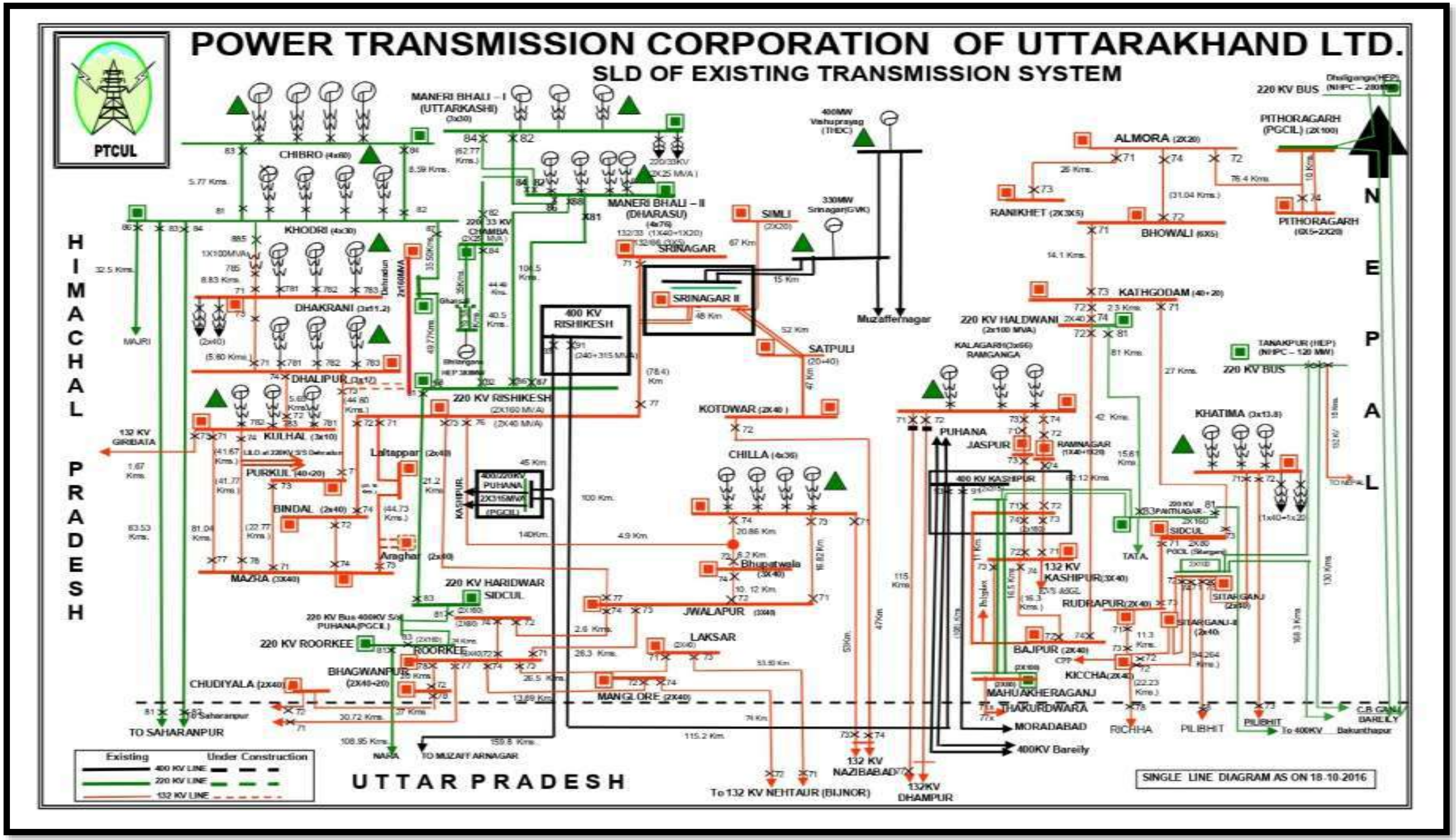
Disturbance Recorder (DR) & Event Logger (EL)

Sl. No.	Particulars	220kV	132Kv
1	a) Is the Disturbance recorder and Fault locator provided on all line feeders?	Yes	Yes
	b) Whether standalone or built in Main relay	Built-In	Built-In
	c) Whether DR is having automatic fault record download facility to a central PC	No	No
	d) Whether Central PC for DR, EL are powered by Inverter (fed from station DC)	NA	NA
2	Whether substation is having Event logger facility	Yes	Yes
	If Yes (standalone or built-in-SAS)	Built-In	Built-In
3	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	Yes 2 Nos. (one for SAS & one for Relays/Equipment)	

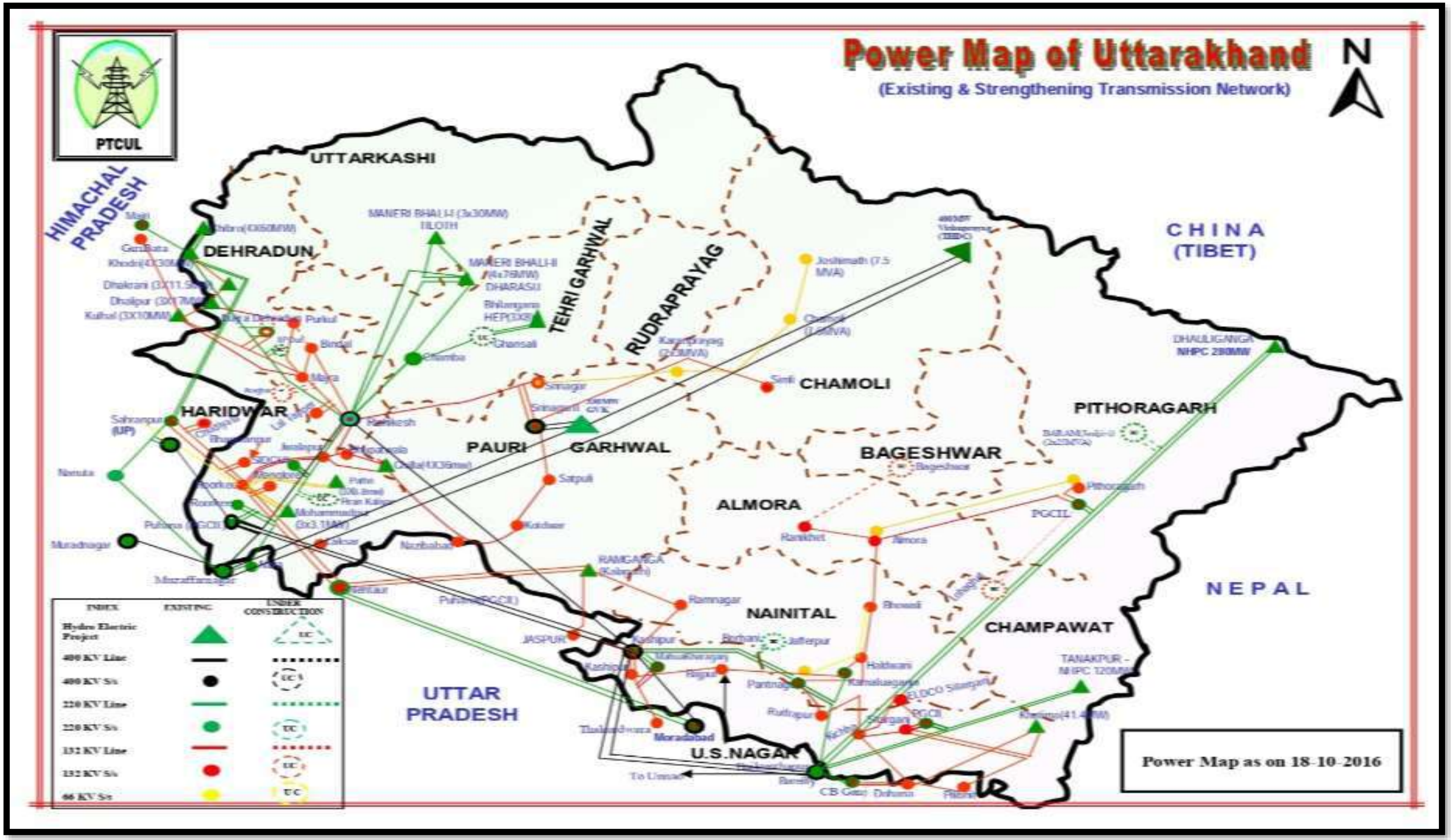
Communication System

Sl. No.	Name of Line Feeder	PLCC/OPGW /none	If PLCC for protection (y/n)	Coupling type & no. Of channel	If OPGW for protection (y/n)	Geographically distributed for main-1 & main-2 dedicated/multiplexed
1	220KV, 400KV S/S KASHIPUR LINE	PLCC	YES	NA	NO	Dedicated, Dedicated
2	220KV SEPL LINE	PLCC	YES	NA	NO	Dedicated, Dedicated
3	220KV GIPL LINE	PLCC	YES	NA	NO	Dedicated, Dedicated
4	132KV KASHIPUR LINE	PLCC	YES	NA	NO	Dedicated, Dedicated
5	132KV THAKURDWARA LINE	PLCC	YES	NA	NO	Dedicated, Dedicated

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

220/132KV Kamaluaganja Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल
CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 220/132/33 KV KAMALUAGANJA SUB-STATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
EE	Executive Engineer
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
JE	Junior Engineer
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee

PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System
SE	Superintendent Engineer
SCADA	Supervisory Control & Data Acquisition
SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
T&C	Testing & Commissioning
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

The report is not for public distribution and has been furnished solely for information and must not be reproduced or redistributed to others, except those concerned. No one can use the report as a base for any claim, demand or cause of action and, also no one is responsible for any loss incurred based upon the content of this report.

While every effort is made to ensure the accuracy and completeness of information contained, CBIP takes no responsibility and assumes no liability for any error/ omission or accuracy of the information. Recipients of this material should rely on their own judgments and conclusions from relevant sources before taking any decision.

1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400kV and 8 nos. 220kV sub-stations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan & Mr. Rounak Sen visited 220/132KV Kamaluaganja Substation during 30th January – 2nd February 2024 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below under 2 heads.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220kV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on "Draft O&M Manual" of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Annexure - 1. Also, a list of switchyard maintenance equipment is placed at annexure -3. It is recommended that the necessary testing and maintenance equipment at substation/Sub-division/Division be arranged for regular testing and maintenance of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC-2023.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru' third party for implementing the best practices in the sub-station.
10. It is suggested that the existing draft O&M manual be updated to take care of latest developments.

Observations and Recommendations for 220/132KV Kamaluaganja Substation

01. The station is named interchangeably as Haldwani and Kamaluaganga. The protection audit of substation is carried out for first time.
02. Considering the frequent tripping of 132KV Bazpur line on transient faults, to maintain uninterrupted operations, it is suggested that PTCUL to examine the possibility of auto-reclosure on this feeder.
03. It is suggested that possibility of 220kV Bus-bar protection be examined by PTCUL.
04. 132KV and 33KV buses are sectionalized for flexible operation. It is recommended that, the Station SLD is to be marked with all sections properly.
05. Emergency DG set operation is in manual mode. It is suggested to keep the DG set in Auto mode.
06. Based on inputs provided by utility and analysis of data a list of suggested switchyard and maintenance equipment for replacement is provided in Annexure – 2.

2.0. Introduction

2.1. *Background*

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400 kV and 08 Nos. 220 kV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following sub-stations is to be carried out

1. *400kV Rishikesh*
2. *400kV Kashipur*
3. *220kV Chamba*
4. *220kV Rishikesh*
5. *220kV Roorkee*
6. *220kV Haridwar (SIDCUL)*
7. *220kV Jhajra*
8. *220kV Pantnagar*
9. *220kV Haldwani*
10. *220kV Mahuakheraganj*

2.2. *Scope of Work*

Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. *Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.*
b. *Availability/healthiness of PLCC communication links used for protection systems.*
c. *Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.*
d. *Availability/healthiness of GPS system and time synchronization facility used for protection.*
e. *Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.*
f. *Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.*
g. *Field inspection of protection device for obsolescence of technology, suitability and healthiness.*
h. *Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.*
i. *Checking of availability of DG Set / auxiliary DC supply at substations.*

2.3. *Audit Rationale*

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipment under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) “All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC”.
c. As per Para – 15 (4) of said Code, “The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC”.
d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per Annexure -1 of IEGC-2023.

2.4. *Audit Process*

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each sub-station, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

Sl. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-connecting Transformer
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL
- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

Sl. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**

  - The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
  - The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - All the major general deficiency shall be listed in detail along with remedial recommendations.
  - The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. *About Power Transmission Corporation of Uttarakhand (PTCUL)*

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. *About Central Board of Irrigation & Power (CBIP)*

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of Kamaluaganja Substation

3.1. *General Information about Sub-station*

Sl. No.	Particulars	Details
1	**Substation Name**	220/132/33 kV Kamaluaganja Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	220/132/33 kV
4	**Short circuit current rating of all equipment (for all voltage level)**	220 kV = 50 kA, 132 kV = 40 kA
5	**Date of commissioning of the substation**	15th May 2002
6	**Checking and validation date**	30th January 2024 – 2nd February 2024

3.2. *Audit Team*

Audit Team (CBIP):

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Rounak Sen

PTCUL Representative:

- Mr. Asim Baig – Executive Engineer
- Mr. Ashutosh Pokhriyal – Assistant Engineer
- Mr. Mahesh Barolia – Junior Engineer

3.3. Recommendation of last protection checking and validation

No Protection Audit was conducted previously

3.4. Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.
b. All relays are numeric, testing is done using automatic test kits. Detailed test record is not kept.

3.5. Disturbance Recorder availability for the last 6 tripping's

a. DR and EL is taken from relays, as per requirement, but no central record is kept.
b. Relays are not Time synchronised.

3.6. Chronic reason of tripping, if any

a. 132KV Bazpur line faces frequent tripping, as it passes thru reserved forest area and path of migratory birds.

3.7. Major non-conformity/deficiency observed

a. No Bus-bar protection is provided.
b. Emergency DG set operation is in manual mode.
c. No carrier aided inter-tripping is provided.
d. All isolators are manually operated, due to old age.
e. Due to absence of PLCC system, 48V battery Chargers and Battery is not available. One stand-alone 48V system is being used for SCADA/ OPGW purpose.
f. 132 kV and 33kV buses are sectionalized for flexible operations. Same is not clearly visible in SLD at sub-station.
g. Separate 33kV transfer bus is provided, in case of exigencies, permanent jumpers are used for transferring the load on TBC.

4.0. List of Trippings

Name of Feeder/TF	Type of Relay/Scheme	Date & Time of Tripping	Date & Time of Closing	Flag Observed	Affected Load/Generation	Analysis of Tripping	Category Code
132KV Bazpur Line CB 72	Siemens	6-11-22 1:22 Hrs	6-11-22 1:38 Hrs	Flags – Zone 1, Fault Loop L2E Fault Current – IL1=0.07KA, IL2=2.37KA, IL3=0.05KA, distance-21.6km	NIL	Bird fault near tower no. 40	LEFT
		6-11-22 4:55 Hrs	6-11-22 5:08 Hrs	Flags – Zone 1, Fault Loop L2E Fault Current – IL1=0.06KA, IL2=2.36KA, IL3=0.04KA, distance - 21.6km			
100MVA T/F 1 CB – 881/781	Siemens	28-03-23 10:17 Hrs	28-03-23 17:36 Hrs	Flag – Differential Trip, Fault Current (HV) L1=0.10KA, L2=0.13KA, L3=0.89KA, Fault Current (LV) L1=0.16KA, L2=0.19KA, L3=6.33KA	NIL	Due to B-Phase LA (LV side) burst	SICT
132KV Bazpur CB 72	Siemens	16-05-23 21:12 Hrs	Under S/D	Flag – Zone 1, Trip, Fault Current – L1=3.78KA, L2=0.72KA, L3=1.92KA	NIL	Conductor Broken	LPPT
132KV Bazpur CB 72	Siemens	23-05-23 23:02 Hrs	24-05-23 00:35 Hrs Under S/D	Flag – Zone 1, Operated, Fault Loop L3E, Fault Current – IL1=0.20KA, IL2=0.35KA, IL3=2.58KA, distance – 10.8km	NIL	Due to bad weather condition & thunderstorm	LEFT
132KV Bazpur CB 72	Siemens	05-06-23 16:38 Hrs	05-06-23 17:13 Hrs	Flag – Distance Protection OPTD, Zone 1 Trip, Fault Loop L3L1, Fault Current – IL1=2.75KA, IL2=0.15KA, IL3=2.59KA, distance – 12.1km	NIL	TLF	LPPT
132KV Bazpur CB 72 (Line Length – 35.5km)	Siemens	14-07-23 14:01 Hrs	14-07-23 14:17 Hrs	Flag – Distance Protection OPTD, Zone 1 Trip, Fault Loop L3L1, Fault Current – IL1=2.75KA, IL2=0.15KA, IL3=2.59KA, distance – 12.1km	NIL	Due to Bird Fault at tower no. 29 as informed by O&M wing	LEFT
132KV Bazpur CB 72 (Line Length – 35.5km)	Siemens	07-09-23 22:50 Hrs	08-09-23 9:21 Hrs	Flag – Distance Protection OPTD, Zone 1 Trip, Fault Loop L3L1, Fault Current – L1=2.62KA, L2=0.13KA, L3=2.73KA, distance – 16km	NIL	Tree Fallen between at tower no. 56, 57 as informed by O&M wing	LPPT
40MVA T/F III	Siemens	05-10-23 18:10 Hrs	05-10-23 20:58 Hrs	Flag – Diff. Protection OPTD, Fault Current (HV) Ia=31.55A, Ib=32.74A, Ic=1.022KA (LV). Ia=2.547A, Ib=6.201A, Ic=3.919KA	NIL	Due to R-Phase LA (LV) Burst	NA
132KV Bazpur CB 72 (Line Length – 35.5km)	Siemens	06-10-23 23:40 Hrs	06-10-23 23:52 Hrs	Flag – Distance Protection OPTD, Zone 2 Trip, Fault Loop L2E, Fault Current – L1=0.01KA, L2=2.28KA, L3=0.01KA, distance – 30.9km	NIL	Due to Bird Fault between tower no. 10, 11 as informed by O&M wing	LEFT
132KV Bazpur CB 72 (Line Length – 35.5km)	Siemens	09-10-23 21:57 Hrs	09-10-23 22:17 Hrs	Flag – Distance Protection OPTD, Zone 2 Trip, Fault Loop L2E, Fault Current – L1=0.01KA, L2=2.22KA, L3=0.01KA, distance – 31.8km	NIL	Due to Bird Fault between tower no. 10, 11 as informed by O&M wing	LEFT
132KV Bazpur CB	Siemens	10-10-23 1:27 Hrs	10-10-23 1:44 Hrs	Flag – Distance Protection OPTD, Zone 2 Trip, Fault Loop	NIL	Due to Bird Fault	LEFT

Name of Feeder/TF	Type of Relay/Scheme	Date & Time of Tripping	Date & Time of Closing	Flag Observed	Affected Load/Generation	Analysis of Tripping	Category Code
72 (Line Length – 35.5km)				L1E, Fault Current – L1=2.18KA, L2=0.00KA, L3=0.01KA, distance – 33.3km		between tower no. 10, 11 as informed by O&M wing	
132KV Bazpur CB 72 (Line Length – 35.5km)	Siemens	15-10-23 21:30 Hrs	15-10-23 21:43 Hrs	Flag – Distance Protection OPTD, Zone 2 Trip, Fault Loop L2E, Fault Current – L1=0.01KA, L2=2.27KA, L3=0.01KA, distance – 30.8km	NIL	Y-Phase disc puncture at tower no. 38 due to bird fault, as informed by O&M wing	LEFT

5.0. Observations and Recommendations

5.1. *Reporting of all the Tripping with DR/EL*

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System "http://103.7.128.184/Account/Login.aspx" within 24 hours of the events. These are being submitted by substation to NRLDC portal, however the record of the same is not kept at substation level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	DR, EL & Tripping report need to be submitted
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
Total in NR Region		520	147	28	169	69	37	171	70	33	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at substations

c. It is recommended that each substation to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. *Development of centralized database of relay settings*

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 KV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220KV are to be calculated by SLDC and/or central level. The relays are tested by substation officials as per need basis, but the record of recommended settings/ calculation is not kept at substation level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220KV & above and by SLDC below 220KV along with setting calculations & parameters used for all the relays be kept at substation level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. Review of test results of relay and equipment

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".

b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.

c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. Availability of Testing Kits

a. The availability of testing equipment is limited at each substation. For comprehensive testing of equipment, as per above para, sufficient testing kits at each substation/Sub-division/ Division level are required.

b. Based on the O&M manual, it is recommended that sufficient quantity of testing instruments be made available at sites for regular testing of equipment. A suggested list of Testing Equipment is attached at Annexure – 1.

5.5. Up-dation of PTCUL Protection Philosophy

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. *Simulation based study of protection system*

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. *Capacity Building of protection team*

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. *Updated Fault Level/ Short Circuit Level and Network information*

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. *General Protection related observations*

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. *O&M Manual*

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. Based on analysis of line tripping during last 12 months, it is observed that 132KV Bazpur line faced 10 tripping in 12 months, as it passes thru reserved forest area and path of migratory birds. For uninterrupted operations, PTCUL may examine the possibility of providing auto-reclosure on this line.

b. No Bus-bar protection is provided. It is suggested that PTCUL may examine possibility of providing Bus-bar protection at 220KV level.

c. 132KV and 33kV buses are sectionalized at different places for flexible operations. Same is not properly updated in SLD at sub-station. It is recommended to keep the SLD updated.

6.2. Equipment related observations and recommendations

Many of the equipment are recently replaced. Any requirement of equipment and spares may be reviewed by PTCUL.

In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of Maintenance Equipment is attached at Annexure – 3.

6.3. Auxiliary Equipment related observations and recommendations

a. Emergency DG set operation is in manual mode. Necessary action may be taken to keep the DG set in Auto mode.

b. No carrier aided inter-tripping is provided. Due to absence of PLCC system, 48V battery Chargers and Battery are also not available. One stand-alone 48V system is being used for SCADA/ OPGW purpose. The SCADA is used to receive the trip signal for SPS scheme.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

The suggested list of Substation Equipments keeping in mind the necessity for the modernization and upgradation of substations.

Sl. No.	Equipment	Unit	Quantity
A	**400KV Equipment**		
1	420KV Current Transformer 1 phase	Nos	30
2	420KV CVT 1 phase	Nos	15
B	**220KV Equipment**	Nos	
1	245KV Current Transformer (5 Core), Class 0.2s (1ph) 1000/500/1	Nos	12
2	245KV Current Transformer (5 Core), Class 0.2s (1ph) 1600/800/1	Nos	30
3	245KV CVT 1 Ph	Nos	18
C	**132KV Equipment**		
1	145KV Circuit Breaker 3PH	Nos	8
2	145KV Current Transformer 1Ph	Nos	30
3	145KV CVT	Nos	18
4	145KV HYBRID Plug and switch system (PASS) Including breaker and disconnector at both end for 132 kV Main &Transfer Bus	Nos	2
D	**33KV Equipment**		
1	33KV Circuit Breaker	Nos	2
2	33KV Isolator 3Ph	Nos	6
3	33KV Surge Arrestor 1 Ph (polymer)	Nos	6

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
    a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
    b) to have a repository of protection system, settings and events at regional level;
    c) specifying timelines for submission of data;
    d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
    e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 KV and above (132 KV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132 KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 KV and above (132 KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220 KV and above (132 KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 KV and above (132 KV and above in NER) system, which shall be reviewed by the RPC:

   c. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

d. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

e. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

   a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.

   b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:

      i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.

      ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

   a. The protection system checklist shall contain information as per this Regulation.

      i. General Information (to be provided prior to the checking as well as to be included in final report):

         - Substation name
         - Name of Owner Utility
         - Voltage Level (s) or highest voltage level
         - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
         - Checking and validation date
         - Record of previous tripping's (in last one year) and details of protection operation
         - Previous Relay Test Reports
         - Overall single line diagram (SLD) (x) AC aux SLD
         - DC aux SLD
         - SAS architecture diagram
         - SPS scheme implemented (if any)

   b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	**Recommendation of last protection checking and validation**	Status of works &pending issues if any
2	**Review of existing settings at substation**	Recommended Action
3	**Disturbance Recorder out/ available for last 6 trippings (Y/N)**	Recommended Action
4	**Chronic reason of tripping, if any**	Recommended Action
5	**Major non-conformity/deficiency observed**	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection;

- Name and Length of Line
- Whether series compensated or not
- Mode of communication used (PLCC/OPGW)
- Relay Make and Model for Main-I and Main-II
- List of all active protections & settings

- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays
- Other requirements for protection checking and validation

iv. AC auxiliary system;

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. DC auxiliary system;

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
    - Mode of communication for Main-1 and Main-2 protection
    - Mode of communication for data and speech communication
    - Status of PLCC channels
    - Time synchronization equipment details
    - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
    - Other requirements for protection checking and validation

vi. Circuit Breaker Details;

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
    - CT/CVT ID name and voltage level
    - CT/CVT core connection details
    - Accuracy Class

- Whether Protection/Metering
- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).
b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
c) All the major general deficiency shall be listed in detail along with remedial recommendations.
d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.
e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71^{st} NRPC meeting held on 29.01.2024.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	220KV and above: Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme. 132KV and below: One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines) Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect.
		Time setting: i. 0.35 second *(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)* ii. 0.5-0.6 second *(For a long line followed by a short line)*

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series compensated double circuit lines may be kept higher at 113%.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220 KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220 KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as backup (built-

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220 KV LINES: No over-voltage protection shall be used. FOR 220 KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be done for multi circuit lines/cable.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400 KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. **Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email:** sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	**GST**	:	GST shall be paid extra as per applicable Government rules.
3	**Tax**	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	**Date of Start of work**	:	Order shall be considered as having come in to force from the date of issue of order.
5	**Supply Completion**	:	NA
6	**Work completion**	:	The work should be completed within 24 months from the date of issue of order.
7	**Engineer of the contract**		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	**Engineer in-charge**		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	**Liquidity damages**	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	**Dispute**		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	**Payment terms**	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	**Payement unit**		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	**Warranty period**	:	NA.
14	**Billing Address**	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
   Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
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Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

<table>
<tr><th rowspan="2">S. No.</th><th rowspan="2">Clause of PO</th><th colspan="6">Existing Clause</th><th colspan="6">Modified Clause</th></tr>
<tr><th>Sr. No</th><th>Description</th><th>Unit</th><th>Qty</th><th>Amount</th><th>Total Amount</th><th>Sr. No</th><th>Description</th><th>Unit</th><th>Qty</th><th>Unit rate (Rs.)</th><th>Total Amount (Rs.)</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Price Schedule</td><td>1</td><td>Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: -
1. 400kV S/s Rishikesh
2. 400 kV S/s Kashipur
3. 220kV S/s Chamba
4. 220kV S/s Rishikesh
5. 220kV S/s Roorkee
6. 220kV S/s Haridwar (SIDCUL)
7. 220kV S/s Jhajra.
8. 220 kV S/s Pantnagar.
9. 220 kV S/s Haldwani.
10. 220kV S/s Mahuakheraganj.</td><td>Job</td><td>1</td><td>36,25,000</td><td>36,25,000</td><td>1</td><td>Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: -
1. 400kV S/s Rishikesh
2. 400 kV S/s Kashipur
3. 220kV S/s Chamba
4. 220kV S/s Rishikesh
5. 220kV S/s Roorkee
6. 220kV S/s Haridwar (SIDCUL)
7. 220kV S/s Jhajra
8. 220 kV S/s Pantnagar
9. 220 kV S/s Haldwani
10. 220kV S/s Mahuakheraganj</td><td>Each</td><td>10</td><td>3,62,500</td><td>36,25,000</td></tr>
<tr><td></td><td>TOTAL</td><td></td><td></td><td></td><td>36,25,000</td><td></td><td>TOTAL</td><td></td><td></td><td></td><td>36,25,000</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Terms and Conditions
–
S. No. 1 – Scope</td><td colspan="6">1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.</td><td colspan="6">1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.</td></tr>
<tr><td colspan="6">2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.</td><td colspan="6">2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.</td></tr>
<tr><td colspan="6">3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.</td><td colspan="6">3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.</td></tr>
<tr><td colspan="6">4. Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus</td><td colspan="6">4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to</td></tr>
</table>

2

S. No.	Clause of PO	Existing Clause	Modified Clause
		couplers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices. etc.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:
		5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit.	a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures
		6. Review of availability/healthiness of PLCC communication links used for protection systems.	b) Availability/healthiness of PLCC communication links used for protection systems.
		7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application.	c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.
		8. Review of availability/healthiness of GPS system and time synchronization facility used for protection.	d) Availability/healthiness of GPS system and time synchronization facility used for protection.
		9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.	e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.
		10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.	f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.
		11. Field inspection of protection device for obsolescence of technology, suitability and healthiness.	g) Field inspection of protection device for obsolescence of technology, suitability and healthiness.
		12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.	h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.
		13. Checking of availability of DG Set/auxiliary DC supply at substations.	i) Checking of availability of DG Set / auxiliary DC supply at substations.
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

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S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum**.
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

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S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

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Annexure – 8: Data Sheets

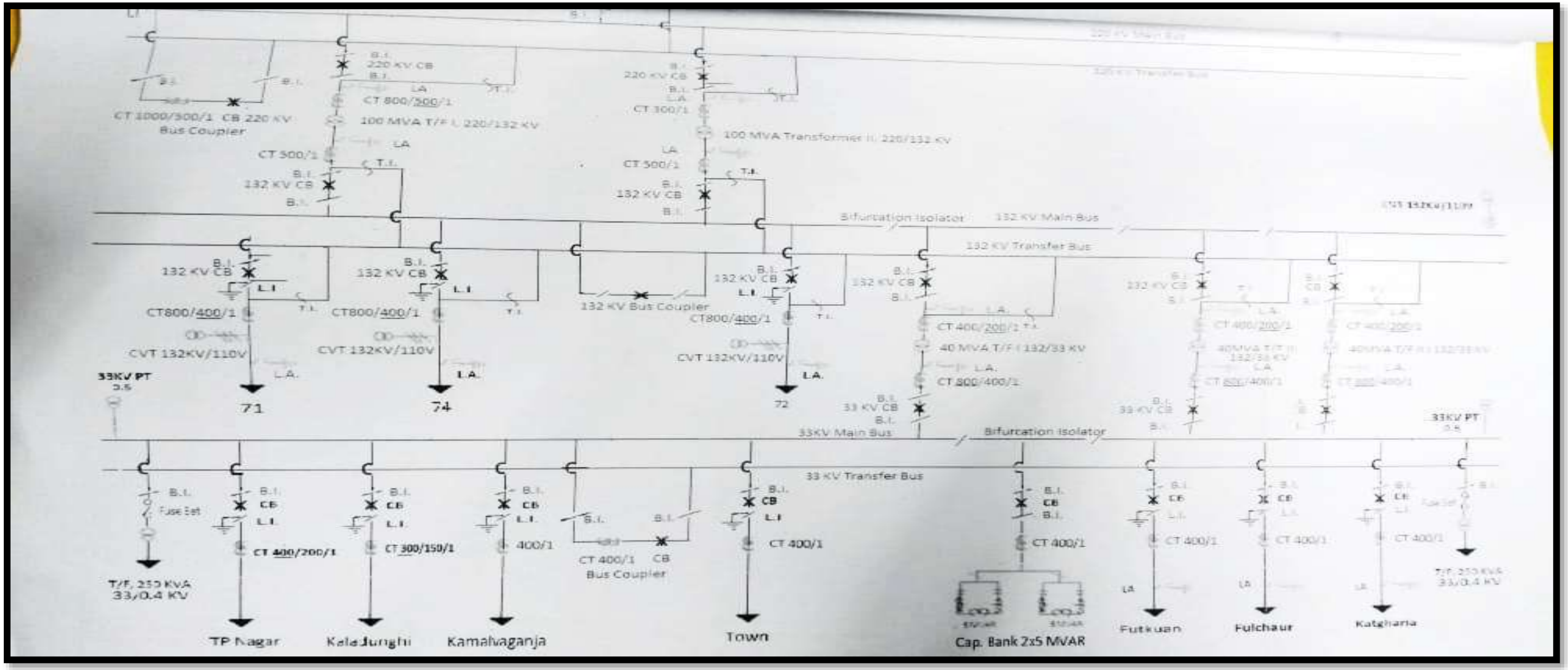
Contents

Annexure - 8

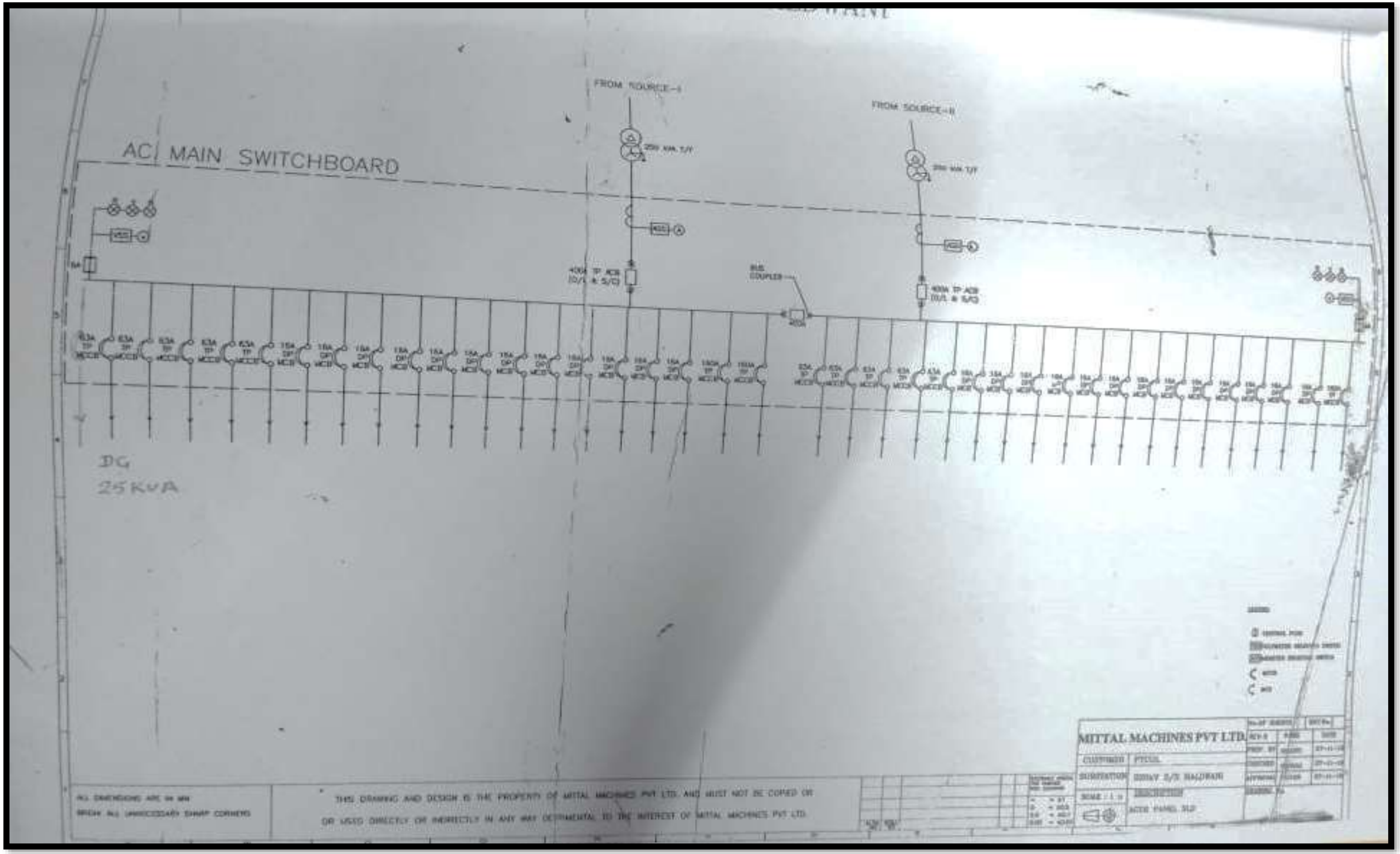
Data Sheets

Single Line Diagrams

Substation Single Line Diagram



AC Auxiliary System



DC Auxiliary System

Not Available

Transmission Lines

SL. No.	Particulars	Details
a	Name and Length of Line	220KV Pantnagar Line, 37.3Km
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	OPGW
d	Relay Make and Model for Main-I and Main-II	Seimens Siprotec 7SA522, 7SJ621
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	Carrier Inter-tripping
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	SOTF/ Broken Conductor / Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	800/1, 220KV/ 110V
j	Feed from DC supply-1 or 2	DC-1
k	Connected to dedicated CT core (mention name)	Core- 1 (Prot-1), 2-(B/U), 3-(Metering)
l	Other requirements for protection checking and validation	NA

SL. No.	Particulars	Details
a	Name and Length of Line	132KV Bazpur Line, 35.5Km
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	NA
d	Relay Make and Model for Main-I and Main-II	Seimens Siprotec 7SA522, 7SJ621
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	NA
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	SOTF/ Broken Conductor / Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	800/1, 132KV/ 110V
j	Feed from DC supply-1 or 2	DC-1
k	Connected to dedicated CT core (mention name)	Core- 1 (Prot-1), 2-(B/U), 3-(Metering)
l	Other requirements for protection checking and validation	NA

SL. No.	Particulars	Details
a	Name and Length of Line	132KV Kathgodam Line, 8.4Km
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	NA
d	Relay Make and Model for Main-I and Main-II	Seimens Siprotec 7SA522, Schneider P143
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	NA
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	SOTF/ Broken Conductor / Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	800/1, 220KV/ 110V
j	Feed from DC supply-1 or 2	DC-1
k	Connected to dedicated CT core (mention name)	Core- 1 (Prot-1), 2-(B/U), 3-(Metering)
l	Other requirements for protection checking and validation	NA

AC Auxiliary System

SL. No.	Equipment	AC auxiliary system
a	Source of AC auxiliary system	2X250KVA S/S Transformer
b	Supply changeover between sources (Auto/Manual	Auto
c	Diesel generator (DG) details	25KVA, Make- Gentec, Model-GP-25TAW
d	Maintenance plan and supply changeover periodicity in DG	NA
e	Single Line Diagram	Enclosed
f	Other requirements for protection checking and validation	NA

DC Auxiliary System

SL. No.	Equipment	DC auxiliary system
a	Type of Batteries (Make, voltage, model)	1- HBL VRLA/110V/TRIUMPH-HP2VF 300PP 2- Exide VRLA/110V / UPST12V 300AH
b	Status of battery Charger	Healthy
c	Measured voltage (positive to earth and negative to earth)	(+Ve to E) 58.4 V; (-Ve to E) 60.5 V
d	Availability of ground fault detectors	Available
e	Protection relays and trip circuits with independent DC sources	Available
f	Other requirements for protection checking and validation	NA

Circuit Breakers

220KV Pantnagar Line, 37.3km		
SL. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 200-SFM-50AA
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/ Multi pole operation	Single Pole
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	NA
f	Other requirements for protection checking and validation	NA

132KV Bazpur Line, 35.5km		
SL. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/ Multi pole operation	Multi Pole
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	NA
f	Other requirements for protection checking and validation	NA

132KV Kathgodam Line, 8.4km		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/ Multi pole operation	Multi Pole
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	NA
f	Other requirements for protection checking and validation	NA

100MVA T/F - I		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	(HV) Make-CGL, Sf6, 200-SFM-50AA (LV) Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/ Multi pole operation	(HV) Single Pole (LV) Multi Pole
d	Pole Discrepancy Relay available (Y/ N)	(HV) YES (LV) NA
e	Monitoring Devices for checking the dielectric medium	NA
f	Other requirements for protection checking and validation	NA

100MVA T/F-II		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	(HV) Make-CGL, Sf6, 200-SFM-50AA (LV) Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/ Multi pole operation	(HV) Single Pole (LV) Multi Pole
d	Pole Discrepancy Relay available (Y/ N)	(HV) YES (LV) NA
e	Monitoring Devices for checking the dielectric medium	NA
f	Other requirements for protection checking and validation	NA

40MVA T/F-I		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/ Multi pole operation	Multi pole operation
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	NA
f	Other requirements for protection checking and validation	NA

40MVA T/F-II		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/ Multi pole operation	Multi pole operation
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	NA
f	Other requirements for protection checking and validation	NA

40MVA T/F-III		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-40AA
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Healthy
c	Single Pole/ Multi pole operation	Multi pole operation
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	NA
f	Other requirements for protection checking and validation	NA

Current Transformer

220KV Pantnagar Line, 37.3km		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 Core, Core-1 (Prot-1), 2 (B/U), 3 (Metering)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	05.11.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

132KV Bazpur Line, 35.5km		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 Core, Core-1 (Prot-1), 2 (B/U), 3 (Metering)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	02.10.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

132KV Kathgodam Line, 8.4km		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 Core, Core-1 (Prot-1), 2 (B/U), 3 (Metering)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	07.08.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

100MVA T/F-I		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 Core, Core-1 (Prot-1), 2 (B/U), 3 (Metering)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	23.06.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Differential Protection/Direction earth fault, over current

100MVA T/F-II		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	(HV) Heptacare Power Industries (LV) Mehru Electrical
b	CT core connection details	5 Core, Core-1 (Prot-1), 2 (B/U), 5 (Metering)
c	Accuracy Class	PS, PS, PS, PS, 0.2
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	(HV) 1600/800/1, 800/1 (LV) 800/500/1, 500/1
f	Details of last checking and validation of CT healthiness	24.06.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Differential Protection/Direction earth fault, over current

40MVA T/F-I		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 Core, Core-1 (Prot-1), 2 (B/U), 3 (Metering)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	22.08.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Differential Protection/Direction earth fault, over current

40MVA T/F-II		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 Core, Core-1 (Prot-1), 2 (B/U), 3 (Metering)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	22.08.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Differential Protection/Direction earth fault, over current

40MVA T/F-III		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 Core, Core-1 (Prot-1), 2 (B/U), 3 (Metering)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	22.08.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Differential Protection/Direction earth fault, over current

Capacitive Voltage Transformer/Potential Transformer

220KV Pantnagar Line, 38.3km		
SL. No.	**Equipment**	**CVT**
a	CVT ID name and voltage level	Make-CGL, 245KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	220KV/ 110V
f	Details of last checking and validation of CVT healthiness	05.11.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

132KV Bazpur Line, 35.5km		
SL. No.	**Equipment**	**CVT**
a	CVT ID name and voltage level	Make-CGL, 145KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	132KV/ 110V
f	Details of last checking and validation of CVT healthiness	26.10.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Other protection, Direction earth fault, negative sequence

132KV Kathgodam Line, 8.4km		
SL. No.	**Equipment**	**CVT**
a	CVT ID name and voltage level	Make-CGL, 145KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	132KV/ 110V
f	Details of last checking and validation of CVT healthiness	07.08.2023 at Routine Testing
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Other protection, Direction earth fault, negative sequence

Communication System

Sl. No.	Particulars	Details
1	Mode of communication for Main- 1 and Main- 2 protection	Main-1 (OPGW), Main-2 (NA)
2	Mode of communication for data and speech communication	Speech communication- PLCC DATA communication- PLCC – NA
3	Status of PLCC channels	Active
4	Time synchronization equipment details	GPS Clock Make – SANDS
5	OPGW on geographically diversified paths for Main- 1 and Main- 2 relay	Main-1
6	Other requirements for protection checking and validation	NA

Transformer Protection

SL. No.	Equipment	100MVA T/F-I
a	Whether two groups of protections used (Group A and Group B)	Group A
b	Do the groups have separate DC sources	NA
c	Relay Make and Model	Siemens Siprotec 7UT61, 7SJ621
d	List of all active protections along with settings	Enclosed
e	Status of Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault/ Breaker Failure	Differential Protection/Back-up Directional Overcurrent/ Backup Earth Fault Active
f	Status of Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc.	Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc Active
g	Relay connected to Trip Coil-1 or 2 or both	Both
h	CT ratio and PT ratio	HV: 800/1, 220KV/110V, LV: 800/1, 132KV/110V
i	Feed from DC supply-1 or 2	DC-1
j	Connected to dedicated CT core (mention name)	Core- 1 (Diff. Prot), 2-(B/U), 3-(Metering)
k	Other requirements for protection checking and validation	NA

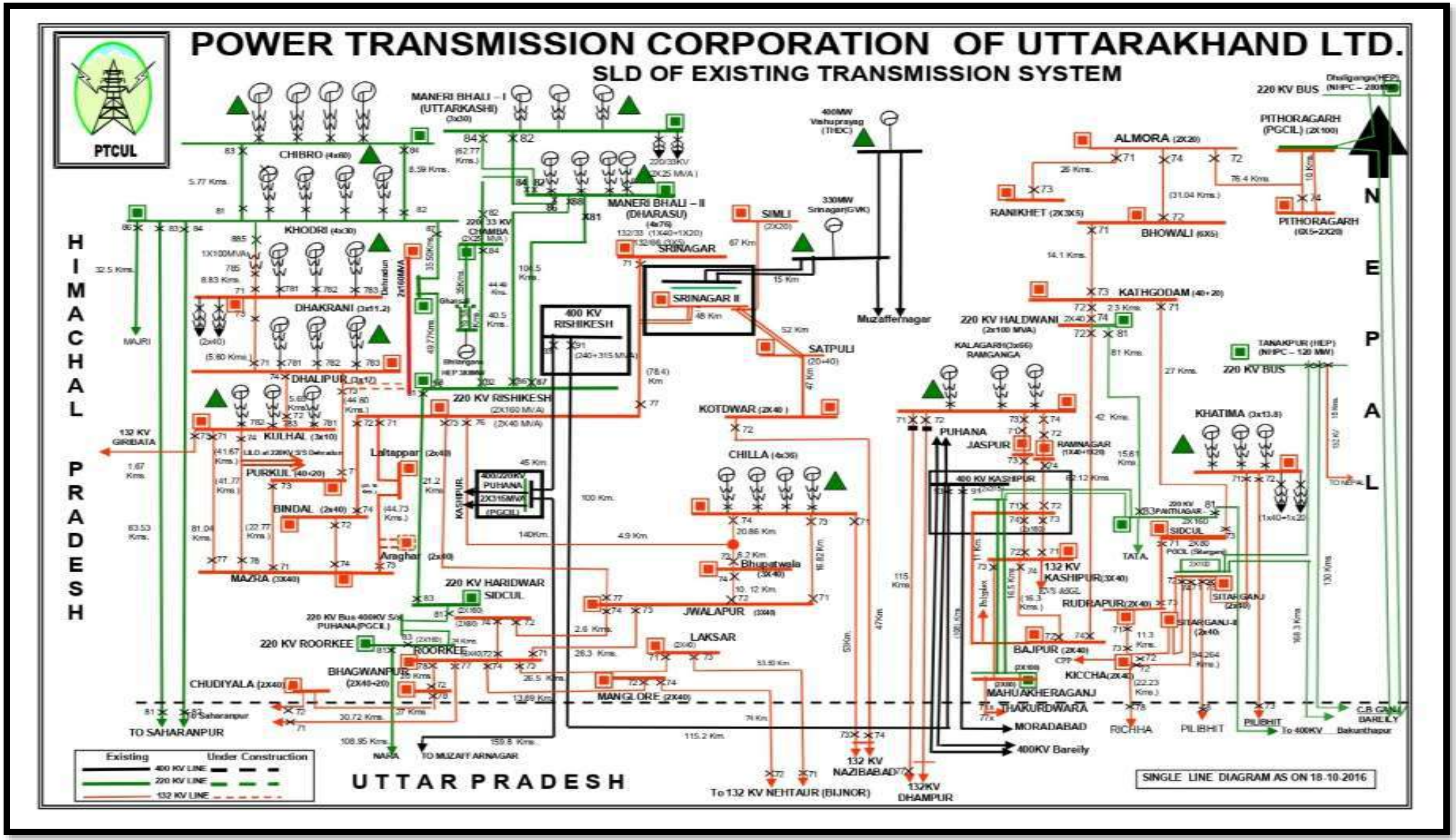
SL. No.	Equipment	100MVA T/F-II
a	Whether two groups of protections used (Group A and Group B)	Group A
b	Do the groups have separate DC sources	NA
c	Relay Make and Model	Siemens Siprotec 7UT61, 7SJ621
d	List of all active protections along with settings	Enclosed
e	Status of Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault/ Breaker Failure	Differential Protection/Back-up Directional Overcurrent/ Backup Earth Fault Active
f	Status of Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc.	Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc Active
g	Relay connected to Trip Coil-1 or 2 or both	Both
h	CT ratio and PT ratio	HV: 800/1, 220KV/110V, LV: 800/1, 132KV/110V
i	Feed from DC supply-1 or 2	DC-1
j	Connected to dedicated CT core (mention name)	Core- 1 (Diff. Prot), 2-(B/U), 3-(Metering)
k	Other requirements for protection checking and validation	NA

SL. No.	Equipment	40MVA T/F-I
a	Whether two groups of protections used (Group A and Group B)	Group A
b	Do the groups have separate DC sources	NA
c	Relay Make and Model	Siemens Siprotec 7UT61, 7SJ621
d	List of all active protections along with settings	Enclosed
e	Status of Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault/ Breaker Failure	Differential Protection/Back-up Directional Overcurrent/ Backup Earth Fault Active
f	Status of Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc.	Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc Active
g	Relay connected to Trip Coil-1 or 2 or both	Both
h	CT ratio and PT ratio	HV: 800/1, 132KV/110V, LV: 800/1, 33KV/110V
i	Feed from DC supply-1 or 2	DC-1
j	Connected to dedicated CT core (mention name)	Core- 1 (Diff. Prot), 2-(B/U), 3-(Metering)
k	Other requirements for protection checking and validation	NA

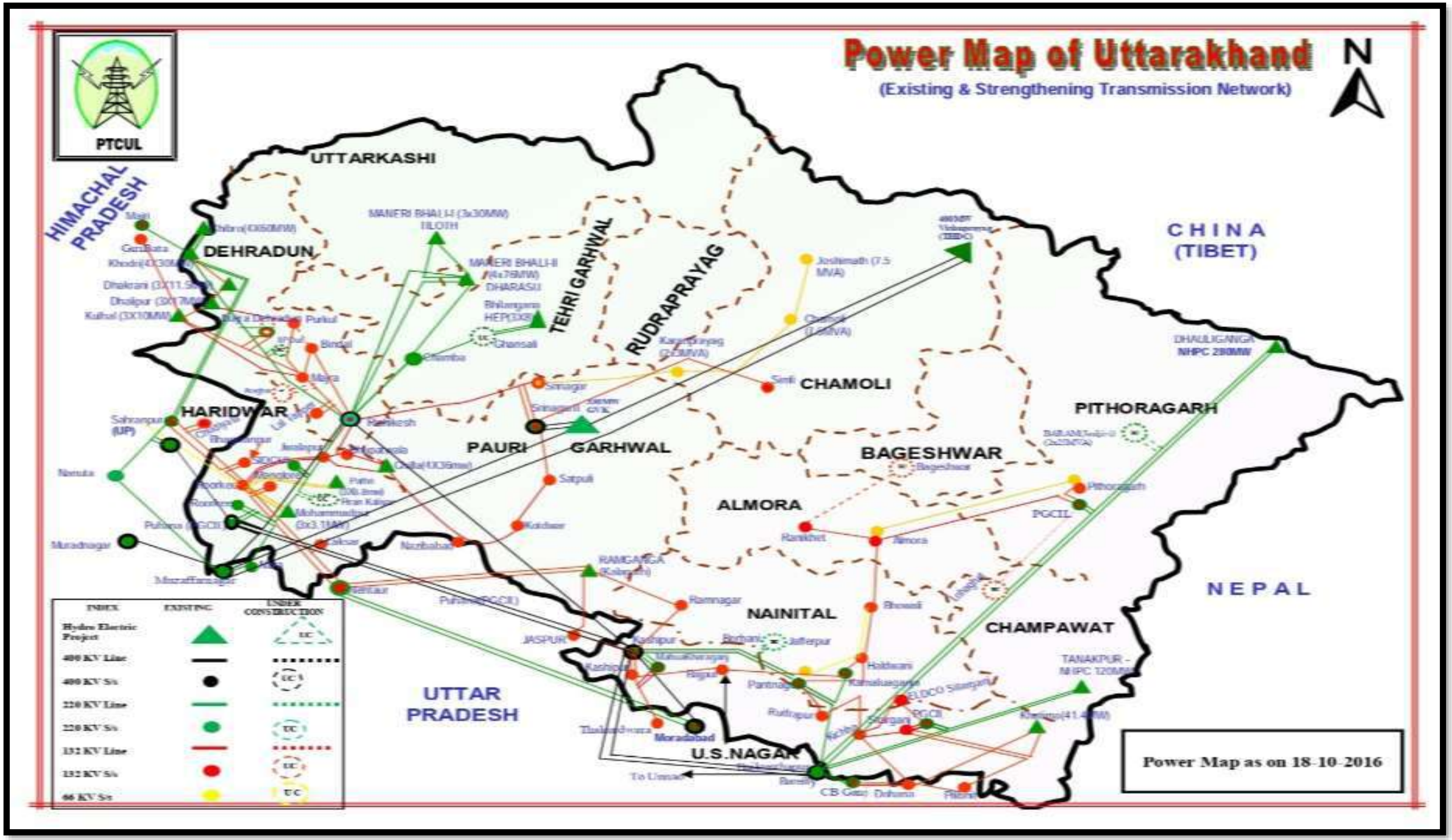
SL. No.	Equipment	40MVA T/F-II
a	Whether two groups of protections used (Group A and Group B)	Group A
b	Do the groups have separate DC sources	NA
c	Relay Make and Model	Siemens Siprotec 7UT61, 7SJ621
d	List of all active protections along with settings	Enclosed
e	Status of Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault/ Breaker Failure	Differential Protection/Back-up Directional Overcurrent/ Backup Earth Fault Active
f	Status of Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc.	Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc Active
g	Relay connected to Trip Coil-1 or 2 or both	Both
h	CT ratio and PT ratio	HV: 800/1, 132KV/110V, LV: 800/1, 33KV/110V
i	Feed from DC supply-1 or 2	DC-1
j	Connected to dedicated CT core (mention name)	Core- 1 (Diff. Prot), 2-(B/U), 3-(Metering)
k	Other requirements for protection checking and validation	NA

SL. No.	Equipment	40MVA T/F-III
a	Whether two groups of protections used (Group A and Group B)	Group A
b	Do the groups have separate DC sources	NA
c	Relay Make and Model	GE P40 Agile (P643), GE Multiline F650
d	List of all active protections along with settings	Enclosed
e	Status of Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault/ Breaker Failure	Differential Protection/Back-up Directional Overcurrent/ Backup Earth Fault Active
f	Status of Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc.	Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc Active
g	Relay connected to Trip Coil-1 or 2 or both	Both
h	CT ratio and PT ratio	HV: 200/1, 132KV/110V, LV: 800/1, 33KV/110V
i	Feed from DC supply-1 or 2	DC-1
j	Connected to dedicated CT core (mention name)	Core- 1 (Diff. Prot), 2-(B/U), 3-(Metering)
k	Other requirements for protection checking and validation	NA

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

400/220KV Rishikesh Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल
CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 400/220 KV RISHIKESH SUBSTATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
EE	Executive Engineer
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
JE	Junior Engineer
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee

PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System
SE	Superintendent Engineer
SCADA	Supervisory Control & Data Acquisition
SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
T&C	Testing & Commissioning
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

The report is not for public distribution and has been furnished solely for information and must not be reproduced or redistributed to others, except those concerned. No one can use the report as a base for any claim, demand or cause of action and, also no one is responsible for any loss incurred based upon the content of this report.

While every effort is made to ensure the accuracy and completeness of information contained, CBIP takes no responsibility and assumes no liability for any error/ omission or accuracy of the information. Recipients of this material should rely on their own judgments and conclusions from relevant sources before taking any decision.

1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400kV and 8 nos. 220kV substations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan, Mr. Shivam Gupta & Mr. Avichal Panday visited 400/220KV Rishikesh Substation during 19th – 20th February 2024 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220kV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on “Draft O&M Manual” of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Annexure - 1. Also, a list of switchyard maintenance equipment is placed at annexure -3. It is recommended that the necessary testing and maintenance equipment at substation/Sub-division/Division be arranged for regular testing and maintenance of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC-2023.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru’ third party for implementing the best practices in the sub-station.
10. It is suggested that the existing draft O&M manual be updated to take care of latest developments.

Observations and Recommendations for 400/220KV Rishikesh Sub-Station

01. Previous protection audit was carried out by NRPC on dated: 2nd November 2012. The issues highlighted were complied.
02. Based on list of tripping submitted by utility for last 12 months, frequent trippings/ auto reclosures of 400 kV Rishikesh Nehtaur line are observed. All 4 tripping are due to (Bird fault) with AN fault (Red Phase) and Out of 7 auto reclosures 6 are due to bird fault in which 4 are on phase CN (Blue Phase) and 2 are on AN (Red Phase). It is suggested to analyse the trippings and take corrective action, wherever possible.
03. The SAS GUI time is not synchronised and displays time different from GPS. It is suggested to take necessary remedial measures for the same.
04. It is recommended that the status of 50 MVAR and 25 MVAR Shunt reactors be kept updated in the SLD.
05. The electromechanical differential relay on 50MVAr reactor) is under replacement. The status needs to be updated.
06. Earth Fault in both 220V battery bank was observed. It is recommended to take necessary corrective action.

07. Emergency DG set operation is not operational. It is recommended to keep the DG set in operation.
08. Based on inputs provided by utility and analysis of data a list of suggested switchyard and maintenance equipment for replacement is provided in Annexure – 2.

2.0. Introduction

2.1. *Background*

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400KV and 08 Nos. 220KV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following sub-stations is to be carried out

1. *400kV Rishikesh*
2. *400kV Kashipur*
3. *220kV Chamba*
4. *220kV Rishikesh*
5. *220kV Roorkee*
6. *220kV Haridwar (SIDCUL)*
7. *220kV Jhajra*
8. *220kV Pantnagar*
9. *220kV Haldwani*
10. *220kV Mahuakheraganj*

2.2. *Scope of Work*

Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. *Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.*
b. *Availability/healthiness of PLCC communication links used for protection systems.*
c. *Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.*
d. *Availability/healthiness of GPS system and time synchronization facility used for protection.*
e. *Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.*
f. *Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.*
g. *Field inspection of protection device for obsolescence of technology, suitability and healthiness.*
h. *Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.*
i. *Checking of availability of DG Set / auxiliary DC supply at substations.*

2.3. Audit Rationale

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipment under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) “All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC”.
c. As per Para – 15 (4) of said Code, “The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC”.
d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per Annexure -1 of IEGC-2023.

2.4. Audit Process

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each sub-station, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

Sl. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-connecting Transformer
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL.

- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**
  - ➢ The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
  - ➢ The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - ➢ All the major general deficiency shall be listed in detail along with remedial recommendations.
  - ➢ The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. *About Power Transmission Corporation of Uttarakhand (PTCUL)*

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. *About Central Board of Irrigation & Power (CBIP)*

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of 400kV Rishikesh Substation

3.1. General Information about Substation

Sl. No.	Particulars	Details
1	**Substation Name**	400/220 kV Rishikesh Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	400/220 kV
4	**Short circuit current rating of all equipment (for all voltage level)**	400 kV = 50kA/3 secs, 220 kV = 40 kA/sec,
5	**Date of commissioning of the substation**	16th February 1983
6	**Checking and validation date**	19th – 20th February 2024

3.2. Audit Team

Audit Team (CBIP)

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Shivam Gupta
- Mr. Avichal Pandey

PTCUL Representative

- Er. Harsh Verma, Executive Engineer (T&C)
- Er. Sarika Thakur, Executive Engineer (O&M)
- Er. Vikas Basant, Assistant Engineer (T&C)
- Er. Abhinav Kumar, Assistant Engineer (O&M)

3.3. Recommendation of last protection checking and validation

As per the information received, previous protection audit was carried out by NRPC, dated: 2nd November 2012.

a. **Following observation were recorded during previous audit:**

Sl. No.	Observation	Compliance action
1	Inspected switchyard and found no leaks in BHEL ICT which was commissioned in 1983. The maintenance has been outstanding.	Done
2	ICT- 2 got burned. A new ICT is being planned and after receipt of this ICT depending on turret CT ratio, the relay setting of ICT – 2 will be adopted.	Done
3	There is no GPS available. The same to be procured and ensure the time sync of all relays which have time sync port.	Done
4	There is no event logger available.	Done
5	The numerical relays are to be connected using a serial/optical/ethernet port to a common PC to enable downloading of DR files.	Done
6	Observed DC fault on both 220V source-I & II. This is to be attended on top priority.	Done

3.4. Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.
b. The record of different relay setting calculations is not available at the substation level.
c. All relays are numeric, therefore, as per internal protocol of utility relays are tested only at the time of commissioning/change in setting. Copy of test reports not available at sub-station level.

3.5. Disturbance Recorder availability for the last 6 tripping's

a. No independent DR/EL is provided. The DR and EL data are taken from the individual numerical relays and SAS.
b. The inputs from the DR reports from numerical relays are available in the server.
c. Utility is submitting Disturbance Recorder data for all lines to NRLC Portal.
d. The record of DR/EL is available for previous tripping.

3.6. Chronic reason of tripping, if any

a. Based on list of tripping submitted by utility for last 12 months, it is noticed that 400 kV Rishikesh Nehtaur line tripped 4 times all 4 tripping are due to (Bird fault) with AN fault (Red Phase). Out of 7 auto reclosures 6 are due to bird fault in which 4 are on phase CN (Blue Phase) and 2 are on AN (Red Phase).

3.7. Major non-conformity/deficiency observed

a. SAS is in operation and being used. At times synchronization is provided through 2 GPS systems one for SAS and other for relays and panels. Both GPS are found in sync.
b. The SAS GUI takes the time from window operating system therefor the time synchronization of windows OS needs to be done at proper interval.
c. The 400 KV bus is provided with double main and transfer scheme.
d. The 50 MVR shunt reactor is not provided with circuit breaker which is shown in SLD and in under process for procurement/installation. The TBC breaker and transfer bus is used for switching in and switching out the bus reactor.
e. For 400 kV Rishikesh Roorkee line both protection P442 and P444 are of same make and same characteristics but different model is present.

f. For 400 kV Rishikesh - Nehtaur line both protection P442 and P444 are of same make and same characteristics but different model is present.
g. 25 MVAr shunt reactor on tertiary side of both transformer is obsolete and not in use although shown in SLD.
h. 1 Nos electromechanical relay (differential relay on 50MVAr reactor) under replacement.
i. DC earth fault noticed in both the systems.
j. The auxiliary supply is received from two sources i.e. 132 kV IDPL and 33 kV S/S Rishikesh. One 312.5 KVA DG set is provided as back-up.

4.0. List of Trippings

Trippings

Name of Line	Date	Tripping Time	Closing Time	Outage time (hrs.)	Flags Observed	Remark
400KV O&M Division, Virbhadra, Rishikesh						
400 KV Rishikesh-Nehtaur Line	03-04-2023	00:51	01:59	01:08	**Control Panel-** Main -1 D.P. Start, main-2 D.P. start, Main -I & 2 Prot. trip, **Relay Panel- Main-1:-** Active group-1, started phase A-N, Trip Phase A, start element Distance, E/F start 1N-1, TOC Start, Distance Trip, Date & Time 03/04/23 00:50:40:167hrs, fault duration 55.07ms, relay trip time 80.04ms **Fault Location :-** 53.73Km, IA=3.987KA, IB=337.2A, IC=339.0A, VAN= 128.8KV, VBN= 244.4KV, VCN=237.10KV, Fault Resistance =3.096 Ohm fault in Zone = 1 86 AX, 86A1, 86A2 & 27R **Main-2:-** Active group-1, started phase, A-N, Trip Phase A, start element Distance ,E/F start 1N-1, TOC Start, Distance Trip, Date & Time 03/04/23, 00:50:40:166hrs, fault duration 56.69ms, relay trip time 80.04ms **Fault Location :-** 53.90Km, IA=4.015KA, IB=339.7A, IC=340.2A, VAN= 128.9KV, VBN= 244.8KV, VCN=237.0KV, Fault Resistance =3.178 Ohm fault in Zone = 1, 86AX,86A1,86A2 & 27R	Due to Bird's Fualt
	03-04-2023	18:40	20:28	01:48	**Control Panel-** Main -1 D.P. Start, main-2 D.P. start,Main -I & 2 Prot. trip, **Relay Panel- Main-1:-** Active group-1, started phase A-N, Trip Phase A,start element Distance ,E/F start 1N-1,TOC Start, Distance Trip ,Date & Time 03/04/23 18:40:12:8047hrs , fault duration 58.53ms, relay trip time 80.27ms **Fault Location :-** 53.30Km, IA=4.011KA, IB=274.6A, IC=369.9A, VAN= 129.4KV, VBN= 240.1KV, VCN=233.50KV, Fault Resistance =3.309 Ohm fault in Zone =1 **Main-2:-** Active group-1, started phase A-N, Trip Phase A,start element Distance ,E/F start 1N-1,TOC Start, Distance Trip, Date & Time 03/04/23 18:40:12:803hrs , fault duration 56.86ms, relay trip time 80.27ms **Fault Location :-**53.38Km, IA=4.010KA, IB=273.2A, IC=368.9KV, VAN= 129.3KV, VBN= 241.0KV, VCN=233.5KV, Fault Resistance = 3.343 Ohm fault in Zone = 1, 86 AX,86A1,86A2 & 27R	Due to Bird's Fualt
	23-07-2023	13:25	17:01	03:36	C.P.- Main -1 D.P. Start, main-2 D.P. start, Main -I & 2 Prot. trip, Auto Reclose Lock out RP:- Main-1:- Active group-1, started phase A-N, Trip Phase -A B.C,start Element Distance ,E/F start 1N-1,TOC Start, SOTF -TOR Trip,Distance Trip ,Date & Time 23/07/23 15:27:48:017hrs ,A/R Lockout Shot >, fault duration 58.55ms, relay trip time 80.30ms Fault Location :-12.75Km, IA=6.407KA, IB=84.66A, IC=80.21A, VAN=108.6KV,	Due to Bird's Fualt

Name of Line	Date	Tripping Time	Closing Time	Outage time (hrs.)	Flags Observed	Remark
					VBN= 260.8KV, VCN=240.1KV, Fault Resistance = 14.56 Ohm fault in Zone = 1 Main-2:- Active group-1, started phase A-N, Trip Phase -A B.C,start Element Distance ,E/F start 1N-1,TOC Start, SOTF -TOR Trip,Distance Trip, Date & Time 23/07/23, 15:27:48:017hrs, A/R Lockout Shot >, fault duration 58.55ms, relay trip time 80.29ms Fault Location :-12.83Km, IA=6.375KA, IB=89.33A, IC=80.65A, VAN=108.2KV, VBN= 260.0KV, VCN= 239.8KV 86AX,86BX,86CX,86T1,86T2,186AX,186BX ,186CX,27R,27Y, SOTF TRIP A/R Lockout C/S,C/R, A/R Lockout	
400 KV Rishikesh-Nehtaur Line	18-08-2023	15:54	20:21	04:13	Control Panel- Main 1 trip ,Main 2 trip,A/R Operated alarm. Relay Panel- START PH a-n, trip ph A,B,C, START ELEMENT DISTANCE, E/F start in 1, toc start, A/R L/O Trip, FD-91.70Ms, rtt-80mS Fault Location-10.66 KM. Ia-6.88KA, Ib-84.14A, Ic-81.33A, VAN-81KV, VBN-259.4KV, VCN, 241.3KV, ZONE 1, C/S, A/R OPTD., A/R L/O.C/R, 86A1, 86B1, 86C1, 86T1, 86T2, 186 AX, 86A2, 86B2, 86C2, 86AX, 86BX, 86CX ., 186 CX.	Due to Bird's Fualt

Auto Reclose

Name of Line	Date	Tripping Time	Closing Time	Outage time (hrs.)	Flags Observed	Remark
400 kV O&M Division, Virbhadra, Rishikesh						
Rishikesh - Nehtaur Line	04-05-2023	03:04	03:04	00:00	**CP-** Main -1 , 2 Distance Protection Start, Main -1,2,Distance Protection ,Trip A/R OPTD Alarm **R.P.-** Main -1 Active Group -1 Start Phase C-N, Trip Phase-C, Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-60.06ms, Relay Trip Time-80.08ms, **Fault Location :-34**.96Km, IC=5.025KA, VCN=110.1KV, Fault Resistance in Ohm -3.266Ohm Main -2 Start Phase C-N, Trip Phase-C,Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-60.01ms, Relay Trip Time-80.00ms, Fault Location :-35.04Km, IC-5.026KAmp, VCN-110.3KV, Fault Resistance in Ohm -3.235Ohm	Due to Bird's Fault
	20-06-2023	03:54	03:54	00:00	**CP-** Main -1 , 2 Distance Protection Start, Main -1,2, Distance Protection ,Trip A/R OPTD Alarm **R.P.-** Main -1 Active Group -1 Start Phase A-	Due to Bird's Fault

Name of Line	Date	Tripping Time	Closing Time	Outage time (hrs.)	Flags Observed	Remark
					N, Trip Phase-A, Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-59.96ms, Relay Trip Time-79.95ms, **Fault Location : 55**.06Km, IA=4.005KA, VAN=130.4.KV, Fault Resistance in Ohm -3.006Ohm Main -2 Start Phase A-N, Trip Phase-A,Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-58.3ms, Relay Trip Time-79.95ms, Fault Location :-55.02Km, IA-4.009KAmp, VAN-130.5KV, Fault Resistance in Ohm -2.987Ohm	
	27-06-2023	05:03	05:03	00:00	**CP-** Main -1 , 2 Distance Protection Start, Main -1,2,Distance Protection ,Trip A/R OPTD Alarm **R.P.-** Main -1 Active Group -1 Start Phase C-N, Trip Phase-C, Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-54.95ms, Relay Trip Time-79.92ms, **Fault Location :-34**.55Km, IC=4.988KA, VCN=108.0KV, Fault Resistance in Ohm -3.127Ohm Main -2 Start Phase C-N, Trip Phase-C, Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-56.61ms, Relay Trip Time-79.92ms, Fault Location :-34.62Km, IC-5.121KAmp, VCN-108.2KV, Fault Resistance in Ohm -3.078Ohm	Due to Bird's Fault
	15-07-2023	09:02	09:02	00:00	**CP-** Main -1 , 2 Distance Protection Start, Main -1,2, Distance Protection ,Trip A/R OPTD Alarm **R.P.-** Main -1 Active Group -1 Start Phase A-N, Trip Phase-A, Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-54.88ms, Relay Trip Time-79.82ms, **Fault Location : 58**.49Km, IA=3.821KA, VAN=132.1.KV, Fault Resistance in Ohm -3.415Ohm Main -2 Start Phase A-N, Trip Phase-A,Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-56.54ms, Relay Trip Time-79.82ms, Fault Location :-58.52Km, IA-3.829KAmp, VAN-131.9KV, Fault Resistance in Ohm -3.400Ohm	Due to Bird's Fault
Rishikesh - Nehtaur Line	23-07-2023	13:23	13:23	00:00	**CP-** Main -1 , 2 Distance Protection Start, Main -1,2, Distance Protection ,Trip A/R OPTD Alarm**R.P.-** Main -1 Active Group -1 Start Phase A-N, Trip Phase-A, Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-70.09ms, Relay Trip Time-80.10ms, **Fault Location : 14**.57Km, IA=5.922KA, VAN=117.4KV, Fault Resistance in Ohm -17.11Ohm Main -2 Start Phase A-N, Trip Phase-A,Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -	Due to Tree

Name of Line	Date	Tripping Time	Closing Time	Outage time (hrs.)	Flags Observed	Remark
					1, Fault Duration-52.4ms, Relay Trip Time-80.10ms, Fault Location :-11.15Km, IA-6.316KAmp, VAN-114KV, Fault Resistance in Ohm -11.23Ohm	
	08-09-2023	01:01	01:01	00:00	**CP-** Main -1 ,2 Distance Protection Start,Main -1,2,Distance Protection ,Trip A/R OPTD Alarm **R.P.-** Main -1 Active Group -1 Start Phase C-N,Trip Phase-C,Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-58.41ms,Relay Trip Time-80.11ms, **Fault Location :-**60.24Km, IA-373.2Amp, IB-373.1Amp, IC-3.500KAmp,VAN-234.2KV, BN-234.3KV, VCN-147.9KV, Fault Resistance in Ohm -17.29Ohm Main -2 Start Phase C-N,Trip Phase-C,Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-58.42ms,Relay Trip Time-80.11ms, Fault Location :-60.45Km, IA-371.2Amp, IB-368.2Amp, IC-3.498KAmp,VAN-233.9KV, VBN-234.6KV,VCN-149.0KV, Fault Resistance in Ohm -17.44Ohm, Z1 ,C/S,C/R, A/R OPTD,86C1,86C2,86CX	Due to Bird's Fault
	28-09-2023	11:08	11:08	00:00	CP- Main -1, 2 Distance Protection Start,Main -1,2,Distance Protection ,Trip A/R OPTD Alarm R.P.- Main -1 Active Group -1 Start Phase C-N,Trip Phase-C,Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-55.02ms,Relay Trip Time-80.02ms, Fault Location :-35.07Km, IA-242.1Amp,IB-373.1Amp, IC-4.720KAmp,VAN-229.6KV, VBN-232.4KV,VCN-104.1KV, Fault Resistance in Ohm -3.206Ohm Main -2 Start Phase C-N,Trip Phase-C,Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-56.68ms,Relay Trip Time-80.02ms, Fault Location :-35.02Km, IA-231.04Amp, IB-294.2Amp, IC-3.498KAmp,VAN-230.1KV, VBN-232.2KV,VCN-103.8KV, Fault Resistance in Ohm -3.255Ohm, Z1 , C/S, C/R, A/R OPTD, 86C1, 86C2, 86CX	Due to Bird's Fault
Rishikesh-Roorkee Line	23-05-2023	21:05	21:05	00:00	**CP-** Main -1 , 2 Distance Protection Start, Main -1,2,Distance Protection ,Trip A/R OPTD Alarm **R.P.-** Main -1 Active Group -1 Start Phase C-N, Trip Phase-C, Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-56.66ms, Relay Trip Time-79.98ms, **Fault Location :-37**.11Km, IC=2.408KA, VCN=84.21KV, Fault Resistance in Ohm -3.822Ohm	Due to Bird's Fault
	14-06-2023	14:22	14:22	00:00	**CP-** Main -1 , 2 Distance Protection Start, Main -1,2, Distance Protection ,Trip A/R OPTD Alarm **R.P.-** Main -1 Active Group -1 Start Phase C-N, Trip Phase-C, Start Element Distance,	Due to land human cutting the tree

Name of Line	Date	Tripping Time	Closing Time	Outage time (hrs.)	Flags Observed	Remark
					Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-51.79ms, Relay Trip Time-80.19ms, **Fault Location :-6**.81Km, IC=3.910KA, VCN=126.KV, Fault Resistance in Ohm -36.09Ohm	
	11-08-2023	06:31	06:31	00:00	**CP-** Main -1 , 2 Distance Protection Start, Main -1, 2, Distance Protection ,Trip A/R OPTD Alarm **R.P.-** Main -1 Active Group -1 Start Phase B-N, Trip Phase-B, Start Element Distance, Earth Fault Start :IN-1, TOC-Start, Distance Trip Zone -1, Fault Duration-51.66ms, Relay Trip Time-0.00ms, IB=1.59KA, VBN=137.3.KV	Rkee-Mzn line Auto Reclosed and flage observed same time this line

5.0. Observations and Recommendations

5.1. Reporting of all the Tripping with DR/EL

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System "http://103.7.128.184/Account/Login.aspx" within 24 hours of the events. These are being submitted by sub-station to NRLDC portal, however the record of the same is not kept at sub-station level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	DR, EL & Tripping report need to be submitted
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
	Total in NR Region	520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at sub-stations

c. It is recommended that each sub-station to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. Development of centralized database of relay settings

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 kV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220kV are to be calculated by SLDC and/or central level. The relays are tested by sub-station officials as per need basis, but the record of recommended settings/ calculation is not kept at sub-station level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220kV & above and by SLDC below 220kV along with setting calculations & parameters used for all the relays be kept at sub-station level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. Review of test results of relay and equipment

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".
b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.
c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. Availability of Testing Kits

a. The availability of testing equipment is limited at each substation. For comprehensive testing of equipment, as per above para, sufficient testing kits at each substation/Sub-division/ Division level are required.
b. Based on the O&M manual, it is recommended that sufficient quantity of testing instruments be made available at sites for regular testing of equipment. A suggested list of Testing Equipment is attached at Annexure – 1.

5.5. Up-dation of PTCUL Protection Philosophy

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. *Simulation based study of protection system*

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. *Capacity Building of protection team*

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. *Updated Fault Level/ Short Circuit Level and Network information*

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. *General Protection related observations*

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. *O&M Manual*

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. Based on list of tripping submitted by utility for last 12 months, frequent trippings/ auto reclosures of 400 kV Rishikesh Nehtaur line are observed. All 4 tripping are due to (Bird fault) with AN fault (Red Phase) and Out of 7 auto reclosures 6 are due to bird fault in which 4 are on phase CN (Blue Phase) and 2 are on AN (Red Phase). It is suggested to analyse the trippings and take corrective action, wherever possible.

b. SAS is in operation and being used. At times synchronization is provided through 2 GPS systems one for SAS and other for relays and panels. Both GPS are found in sync. The SAS GUI takes the time from window operating system. As the system is not connected to internet, the window time is not synchronised, therefor the time synchronization of windows OS needs to be done at regular interval, otherwise clock of SAS GUI shows different time. It is suggested to take necessary remedial measures for the same.

c. The 50 MVR shunt reactor is not provided with circuit breaker which is shown in SLD and in under process for procurement/installation. The TBC breaker and transfer bus is used for switching in and switching out the bus reactor. 25 MVAr shunt reactor on tertiary side of both transformer is obsolete and not in use although shown in SLD. It is recommended that SLD be kept updated.

d. 1 Nos electromechanical relay (differential relay on 50MVAr reactor) under replacement. The status needs to be updated.

6.2. Equipment related observations and recommendations

Many of the equipment are recently replaced. Any requirement of equipment and spares may be reviewed by PTCUL.

In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of Maintenance Equipment is attached at Annexure – 3.

6.3. *Auxiliary Equipment related observations and recommendations*

a. Both the 220V DC systems are showing severe earth-fault. The necessary corrective action needs to be taken asap to avoid any unwanted tripping in future.

b. The auxiliary supply is received from two sources i.e. 132 kV IDPL and 33 kV S/S Rishikesh and is quite reliable. One 312.5 KVA DG set is provided as back-up, but is not operational. Necessary action may be taken to keep the DG operational.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

NIL

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
   a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
   b) to have a repository of protection system, settings and events at regional level;
   c) specifying timelines for submission of data;
   d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
   e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 KV and above (132 KV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132 KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 KV and above (132 KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220 KV and above (132 KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 KV and above (132 KV and above in NER) system, which shall be reviewed by the RPC:

   b. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

c. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

d. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

    a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.
    b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:
        i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.
        ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

    a. The protection system checklist shall contain information as per this Regulation.
        i. General Information (to be provided prior to the checking as well as to be included in final report):
            - Substation name
            - Name of Owner Utility
            - Voltage Level (s) or highest voltage level
            - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
            - Checking and validation date
            - Record of previous tripping's (in last one year) and details of protection operation
            - Previous Relay Test Reports
            - Overall single line diagram (SLD) (x) AC aux SLD
            - DC aux SLD
            - SAS architecture diagram
            - SPS scheme implemented (if any)

    b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	**Recommendation of last protection checking and validation**	Status of works &pending issues if any
2	**Review of existing settings at substation**	Recommended Action
3	**Disturbance Recorder out/ available for last 6 trippings (Y/N)**	Recommended Action
4	**Chronic reason of tripping, if any**	Recommended Action
5	**Major non-conformity/deficiency observed**	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:
   - Transmission Line
   - Bus Reactor/Line Reactor
   - Inter-connecting Transformer
   - Busbar Protection Relay
   - AC auxiliary system
   - DC auxiliary system
   - Communication system
   - Circuit Breaker Details
   - Current Transformer details
   - Capacitive Voltage Transformers Details
   - Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.
   i. Transmission Line Distance Protection/Differential Protection;
   - Name and Length of Line
   - Whether series compensated or not
   - Mode of communication used (PLCC/OPGW)
   - Relay Make and Model for Main-I and Main-II
   - List of all active protections & settings

- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays
- Other requirements for protection checking and validation

iv. **AC auxiliary system;**

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. **DC auxiliary system;**

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
  - Mode of communication for Main-1 and Main-2 protection
  - Mode of communication for data and speech communication
  - Status of PLCC channels
  - Time synchronization equipment details
  - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
  - Other requirements for protection checking and validation

vi. **Circuit Breaker Details;**

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
  - CT/CVT ID name and voltage level
  - CT/CVT core connection details
  - Accuracy Class

- Whether Protection/Metering
- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).

b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.

c) All the major general deficiency shall be listed in detail along with remedial recommendations.

d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.

e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	220KV and above: Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme. 132KV and below: One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines) Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect.
		Time setting: i. 0.35 second *(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)* ii. 0.5-0.6 second *(For a long line followed by a short line)*

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series compensated double circuit lines may be kept higher at 113%.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220 KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220 KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220 KV LINES: No over-voltage protection shall be used. FOR 220 KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be done for multi circuit lines/cable.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400 KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. **Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email:** sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालय:–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	**GST**	:	GST shall be paid extra as per applicable Government rules.
3	**Tax**	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	**Date of Start of work**	:	Order shall be considered as having come in to force from the date of issue of order.
5	**Supply Completion**	:	NA
6	**Work completion**	:	The work should be completed within 24 months from the date of issue of order.
7	**Engineer of the contract**		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	**Engineer in-charge**		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	**Liquidity damages**	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	**Dispute**		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	**Payment terms**	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	**Payement unit**		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	**Warranty period**	:	NA.
14	**Billing Address**	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
   Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालयः-विद्युतभवन, नजदीक-आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून-248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135-2646000 फैक्स नं0 0135-2643460 वेबसाइटwww.ptcul.org

Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause: Sr. No	Existing Clause: Description	Existing Clause: Unit	Existing Clause: Qty	Existing Clause: Amount	Existing Clause: Total Amount	Modified Clause: Sr. No	Modified Clause: Description	Modified Clause: Unit	Modified Clause: Qty	Modified Clause: Unit rate (Rs.)	Modified Clause: Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.						1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.				
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.						2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.				
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.						3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.				
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus						4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to				

2

S. No.	Clause of PO	Existing Clause	Modified Clause
		couplers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DG Set/auxiliary DC supply at substations.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c] Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g] Field inspection of protection device for obsolescence of technology, suitability and healthiness. h] Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

3

S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum.**
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

4

S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

5

Annexure – 8: Data Sheets

Contents

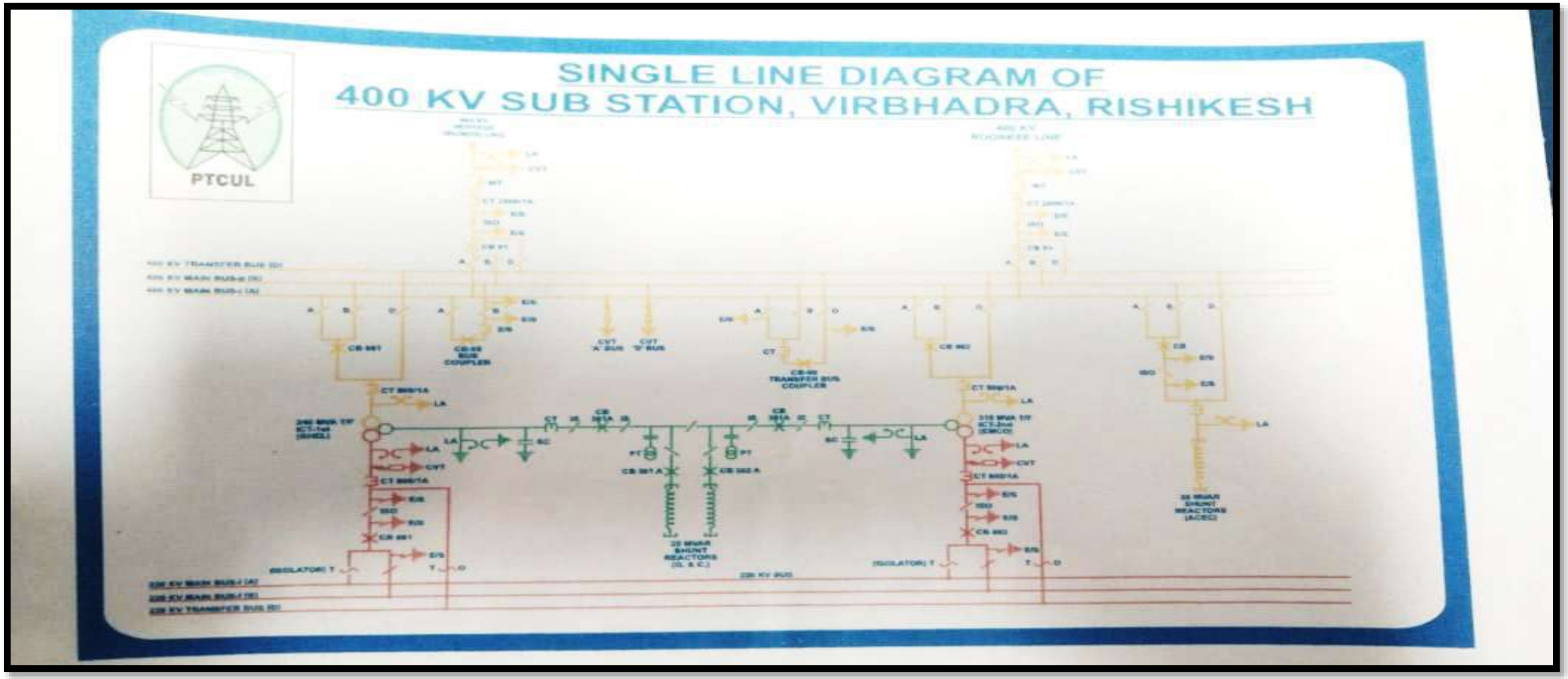
Protection Audit of 400/220KV Rishikesh Substation

Annexure - 8

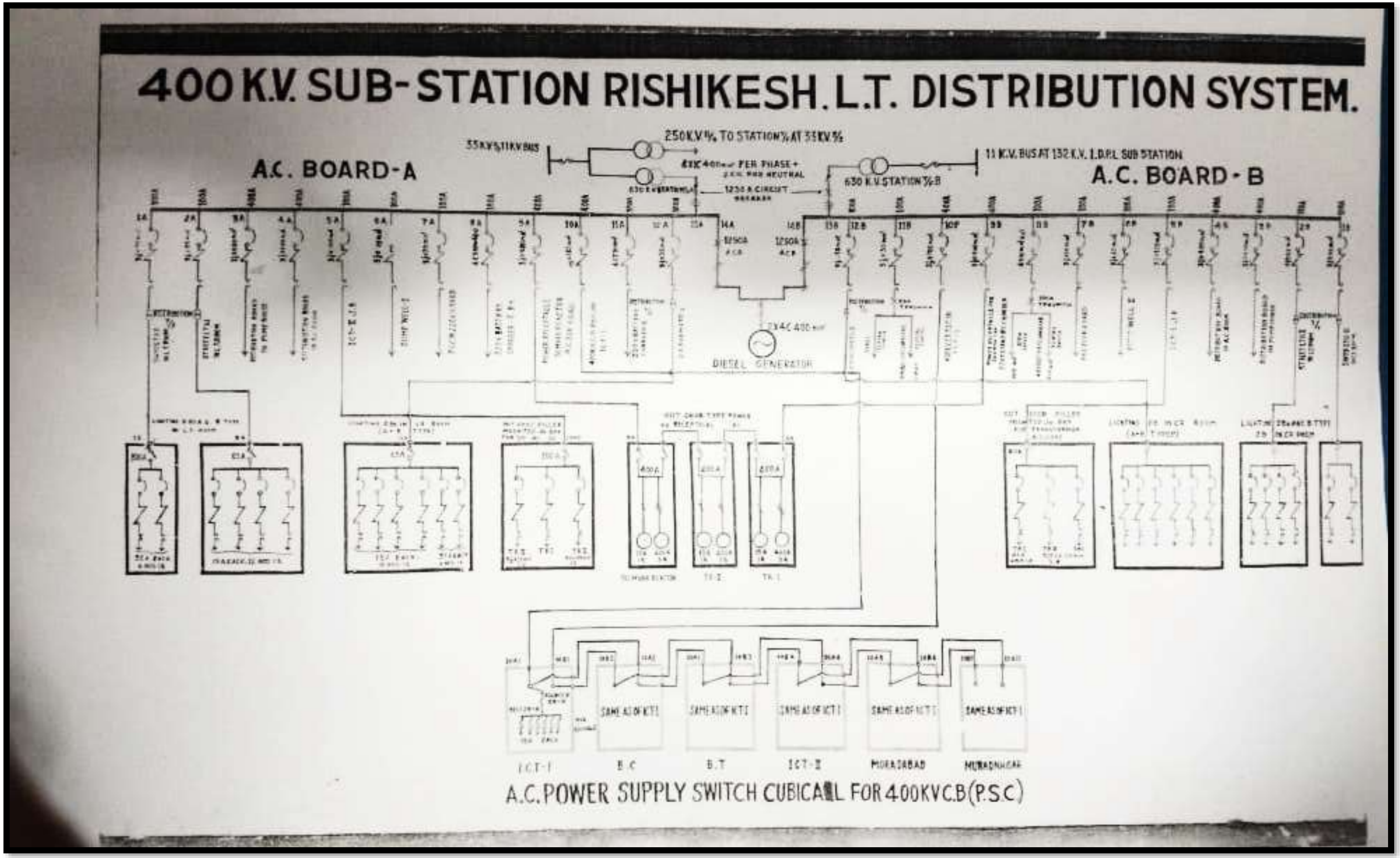
Data Sheets

Single Line Diagrams

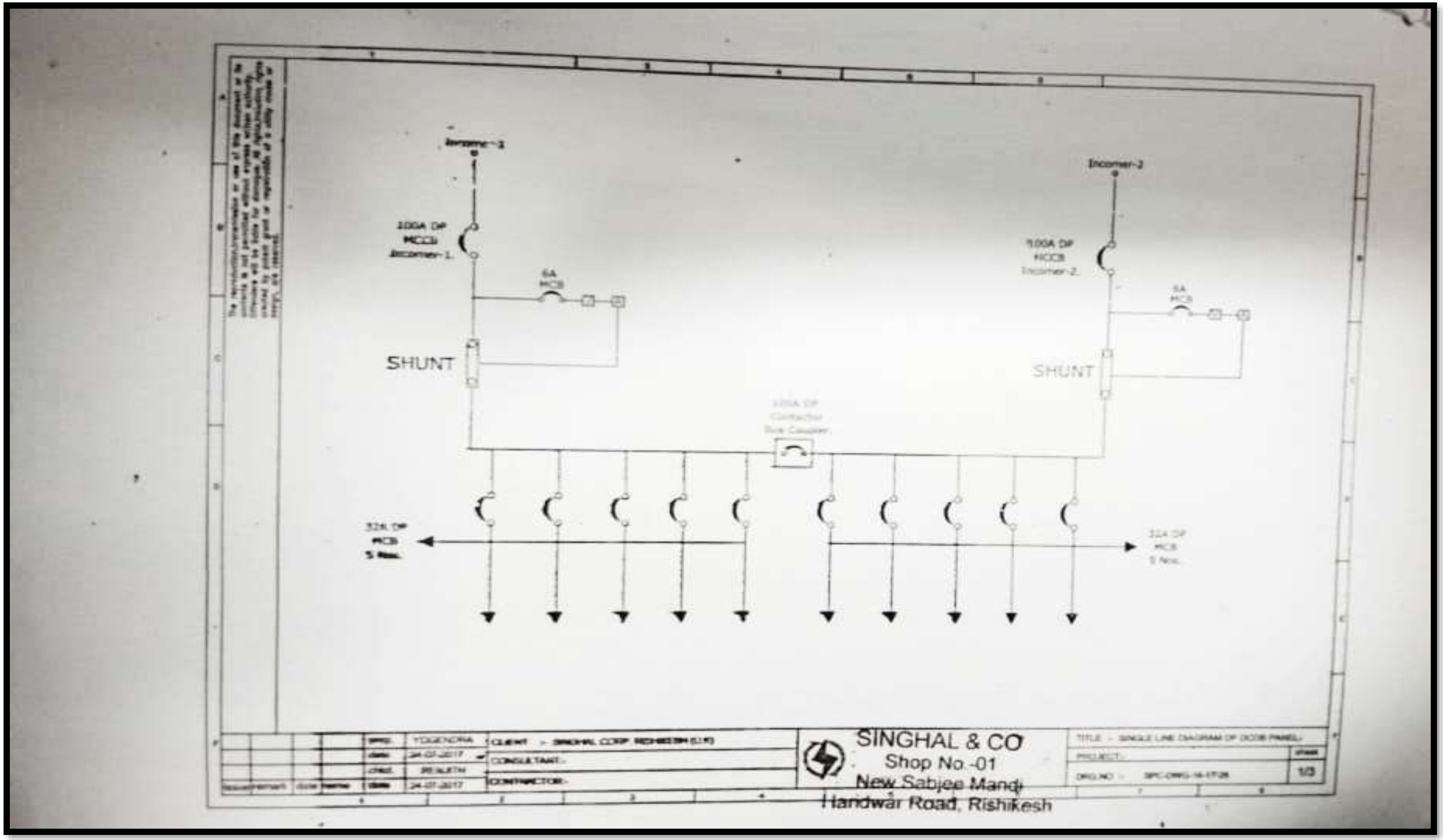
Substation Single Line Diagram

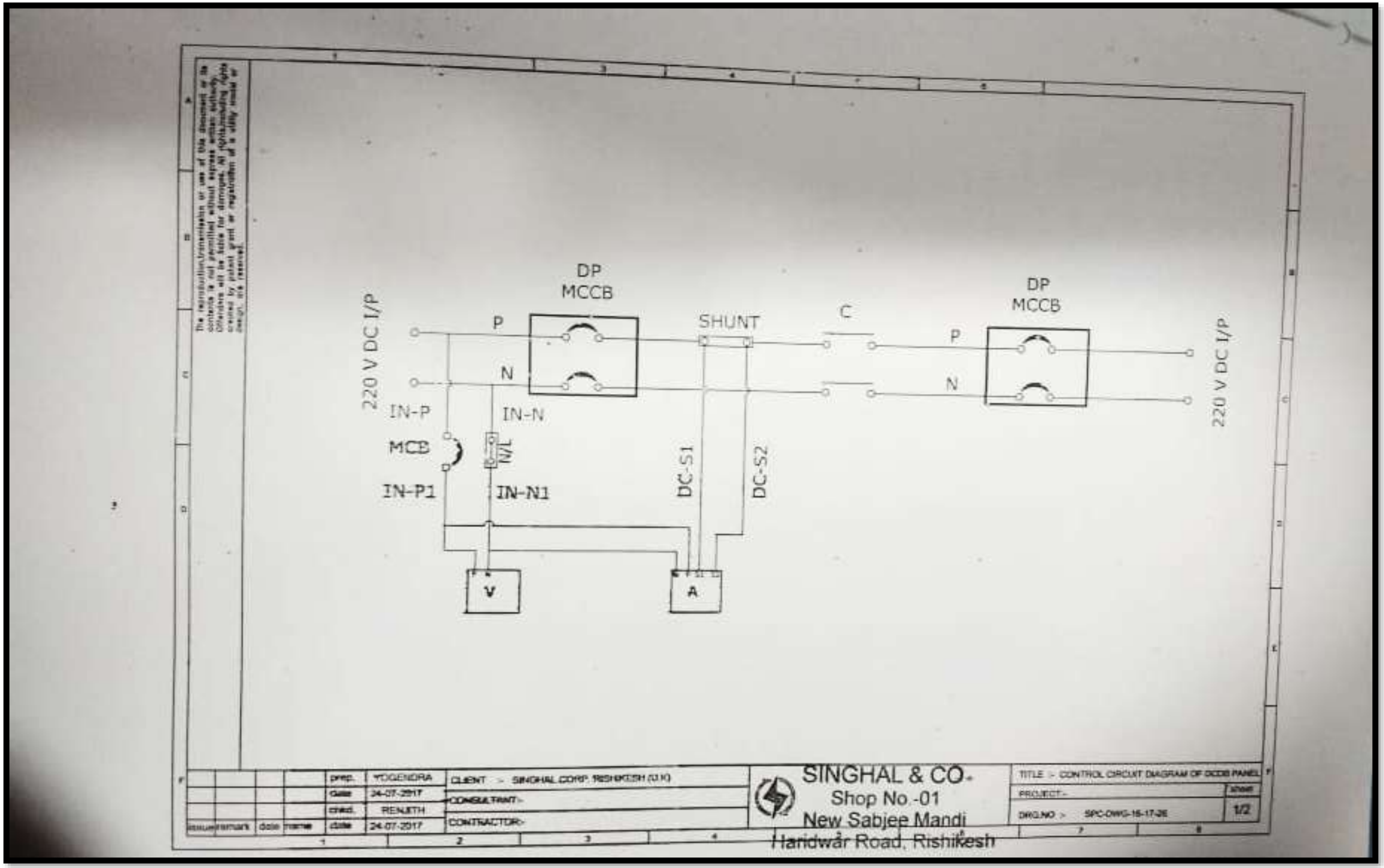


AC Auxiliary System

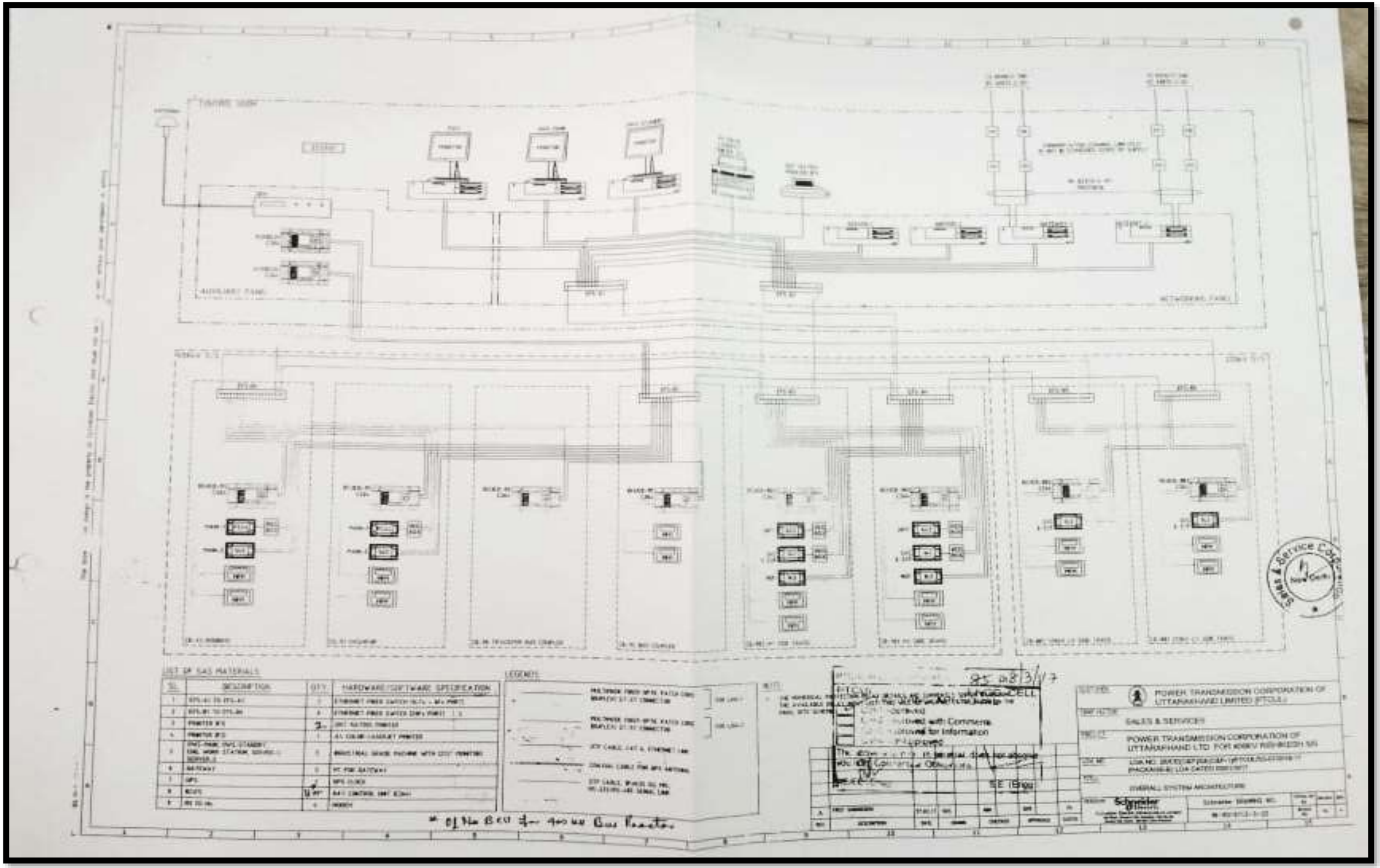


DC Auxiliary System




DP
MCCB
SHUNT
C
P
N
220 V DC I/P
IN-P
IN-N
MCB
N/L
IN-P1
IN-N1
DC-S1
DC-S2
V
A
SINGHAL & CO.
Shop No.-01
New Sabjee Mandi
Haridwar Road, Rishikesh
prep. YOGENDRA
date 24-07-2017
chkd. RENJITH
date 24-07-2017
CLIENT :- SINGHAL CORP. RISHIKESH (U.K)
CONSULTANT:-
CONTRACTOR:-
TITLE :- CONTROL CIRCUIT DIAGRAM OF DCDB PANEL
PROJECT:-
DRG.NO :- SPC-DWG-16-17-26
1/2

SAS Architecture diagram



Transmission Lines

400kV:

Particulars		Tr Line 1	Tr Line 2
Name of Tr Line		RKSH-NEHTOR	RKSH-PUHANA
Length of Line		89KM	50KM
Series Compensated (Yes/No)		NA	NA
Connected to dedicated CT core (mention name)		YES	YES
CT Ratio		2000/1	2000/1
Connected to dedicated PT core (mention name)		YES	YES
PT Ratio		400/110	400/110
Relay connected to Trip Coil-1 or 2 or both		BOTH	BOTH
Feed from DC supply-1 or 2		BOTH	BOTH
i	Main-I Protection (Make and Model)	P444	P442
	Functional (Yes/No)	YES	YES
	Date of testing	31.07.2023	17.08.2023
ii	Main-II Protection (Make and Model)	P141	P141
	Functional (Yes/No)	Y	Y

Particulars		Tr Line 1	Tr Line 2
	Date of testing	31.07.2023	17.08.2023
iii	LBB Protection (Make and Model)	INBUILT	INBUILT
	Functional (Yes/No)	Y	Y
	Date of testing	31.07.2023	17.08.2023
iv	PLCC/ Protection coupler (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
v	DR (Make &Model) (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
iv	Time Synch.Unit (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
Other Protections			
1	Status of Power Swing	NA	NA
2	Out of Step	NA	NA
3	SOTF	Y	Y
4	Breaker Failure	Y	Y
5	Broken Conductor	NA	NA
6	STUB	Y	Y

Particulars		Tr Line 1	Tr Line 2
7	Fault Locator	NA	NA
8	Disturbance Recorder	Y	Y
9	VT fuse fail	Y	Y
10	Overvoltage Protection	Y	Y
11	Trip Circuit supervision	Y	Y
12	Auto-reclose	NA	NA
13	Load encroachment	NA	NA

132kV: NA

Bus-Bar Protection

400kV

Sl. No.	Particulars	Observations
a	**Busbar and redundant relay make and model**	Siemens
b	**Type of Busbar arrangement**	Two main bus and Transfer
c	**Zones**	Three (Bus-1, Bus-2 and Check)
d	**Dedicated CT core for each busbar protection**	Yes
e	**Breaker Failure relay included, if additional then furnish make and model**	In case of any Breaker failure Relay Operating in sub-station, the relevant zone will be tripped
f	**Trip issued to both Busbar protection in case of enabling**	NA
g	**Isolator indication and check relays**	Particular bay indicates that
h	**Other requirements for protection checking and validation**	This Bus bar protection need to be tested

132 kV: NA

AC Auxiliary System

Sl. No.	Particulars	Observations
a	**Source of AC auxiliary system**	02 nos. 630KVA Station transformers 11KV/0.4V
b	**Supply changeover between sources (Auto/Manual)**	Load is distributed between two transformers
c	**Diesel generator (DG) details**	Make- NA Rating-312.5KVA
d	**Maintenance plan and supply changeover periodicity in DG**	DG is not working. DG operation is negligible.
e	**Single Line Diagram**	To be attached
f	**Other requirements for protection checking and validation**	NA

DC Auxiliary System

Sl. No.	Particulars	Observations			
		220 V DC - I	220 V DC - II	48 V DC-I	48 V DC-II
a	**Make**	Martin burn ltd	Statcon Electronics India Ltd.	M/s Kolkata Battery Supply Pvt ltd.	Nicco Corporation Ltd Noida
b	**Model/Rating**	400AH	400AH	500AH	300AH
c	**Vintage**				
d	**Measured voltage**				
	i. Positive to Earth	110	110	0	-48
	ii. Negative to Earth	-110	-110	0	-48
e	**No. of Cells Per Bank**	110	110	0	-48
f	**Availability of Battery Charger**	NA	NA	NA	NA

Circuit Breakers

Sl. No.	Particulars	Make and Model	No. of trip/close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
A	**400kV System**						
1	400kv line1	ABB/2009	2/1	YES	NA	NA	NA
2	Line2	CGL/2014	2/1	YES	NA	NA	NA
3	Transformers	CGL/2014	2/1	YES	NA	NA	NA

Current Transformer

a	Location of CT	400 KV LINE				
b	Date of CT ratio Test Testing	LINE1-4-04-2023, LINE2- 21-09-2023				
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	PROT.	PROT.	METERING	PROT	PROT
e	Test Results					
i	Ratio Adopted	2000/1	2000/1	2000/1	2000/1	2000/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	240MVA TF, 315MVA TF				
b	Date of CT ratio Test Testing	ICT1-31-07-2023, ICT2- 17-08-2023				
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	PROT.	PROT.	METERING	PROT	PROT
e	Test Results					
i	Ratio Adopted HV	2000/1	2000/1	500/1	500/1	500/1
ii	Ratio Adopted LV	800/1	800/1	800/1	800/1	800/1
iii	Ratio measured	NA	NA	NA	NA	NA

Capacitive Voltage Transformer/Potential Transformer

a	**Location of CVT/PT**	**CVT**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	PROT.	PROT.	METERING
e	Test Results			
I	Ratio Adopted	400/110	400/110	400/110
ii	Ratio measured	NA	NA	NA

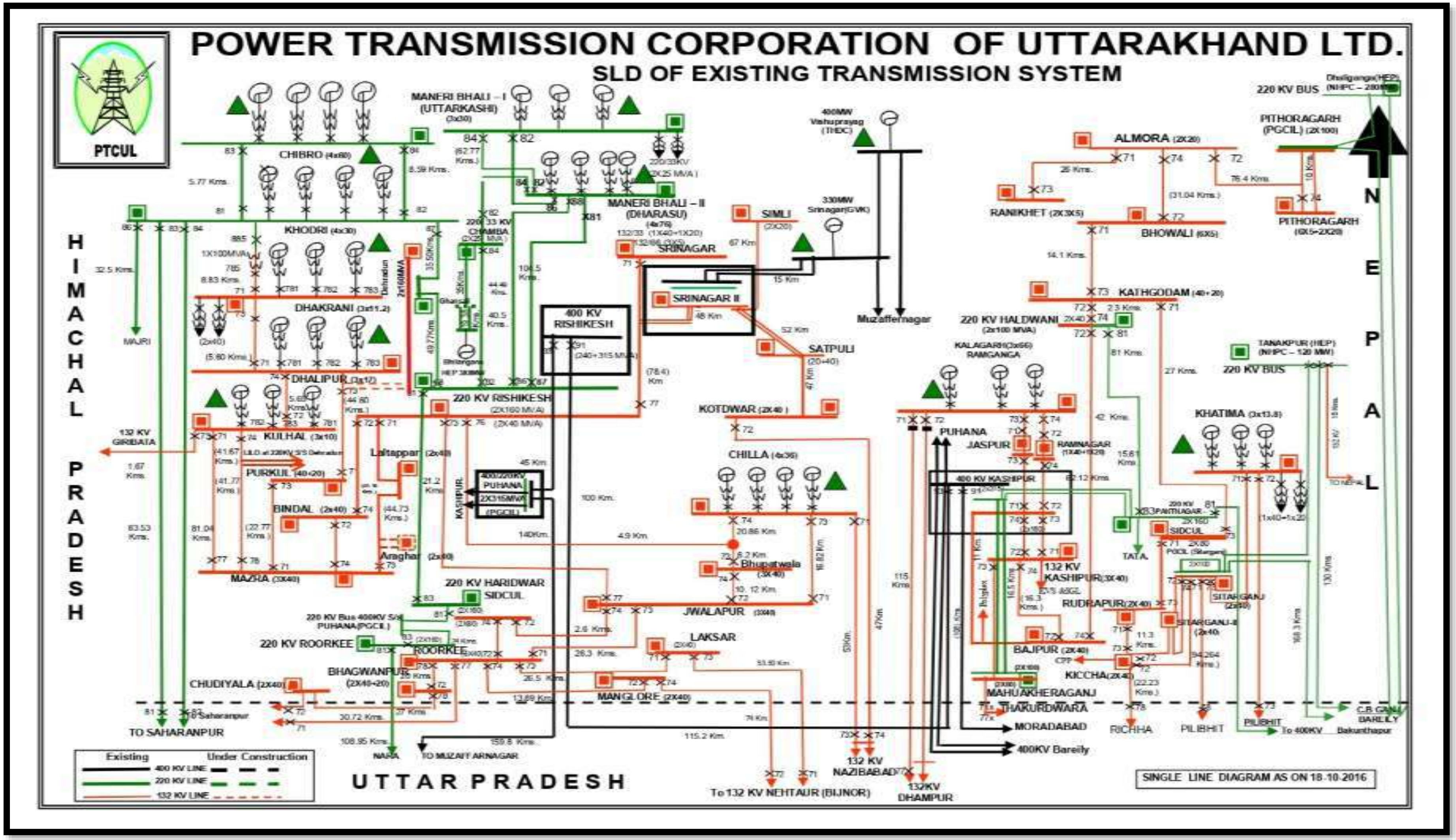
Disturbance Recorder (DR) & Event Logger (EL)

Sl. No.	Particulars	400kV	132kV
1	a) Is the Disturbance recorder and Fault locator provided on all line feeders?	Yes	NA
	b) Whether standalone or built in Main relay	In built	NA
	c) Whether DR is having automatic fault record download facility to a central PC	Yes	NA
	d) Whether Central PC for DR, EL are powered by Inverter (fed from station DC)	Yes	NA
2	Whether substation is having Event logger facility	Yes	NA
	If Yes (standalone or built-in-SAS)	In Built	NA
3	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	02(One for SAS and one for Relay)	

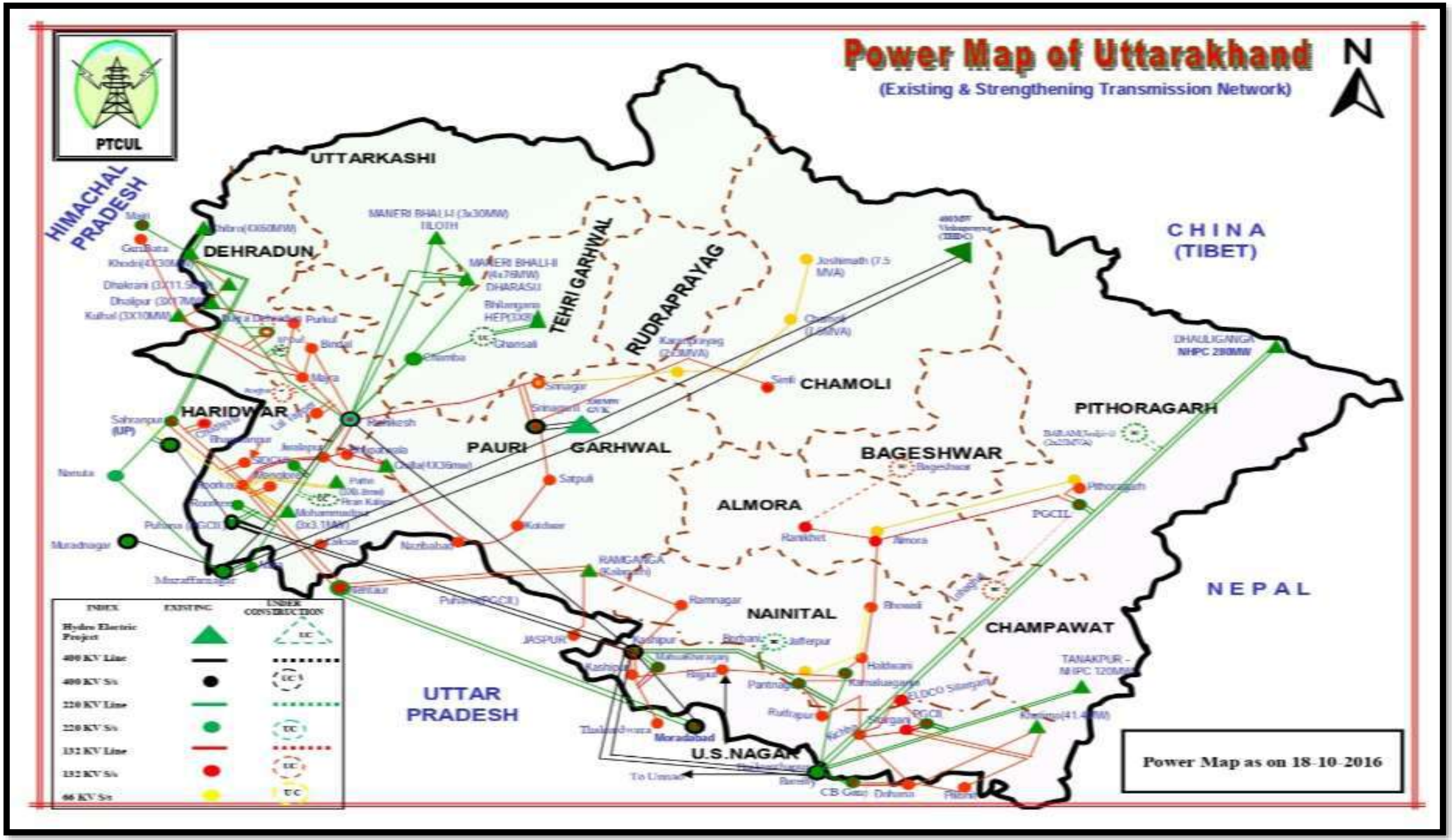
Communication System

Sl. No.	Name of Line Feeder	PLCC/OPGW/none	If PLCC for protection(y/n)	Coupling type & no. Of channel	If opgw for protection(y/n)	Geographically distributed for main-1 & main-2 dedicated/multiplexed
1	RKSH-PUHANA	BOTH	YES	Ph-n /2	YES	Dedicated
2	RKSH-NAHTOUR	BOTH	YES	Ph-n/2	YES	Dedicated

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

220/132KV Rishikesh Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल

CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 220/132/33 KV RISHIKESH SUBSTATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
EE	Executive Engineer
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
JE	Junior Engineer
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee

PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System
SE	Superintendent Engineer
SCADA	Supervisory Control & Data Acquisition
SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
T&C	Testing & Commissioning
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

The report is not for public distribution and has been furnished solely for information and must not be reproduced or redistributed to others, except those concerned. No one can use the report as a base for any claim, demand or cause of action and, also no one is responsible for any loss incurred based upon the content of this report.

While every effort is made to ensure the accuracy and completeness of information contained, CBIP takes no responsibility and assumes no liability for any error/ omission or accuracy of the information. Recipients of this material should rely on their own judgments and conclusions from relevant sources before taking any decision.

1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400KV and 8 nos. 220KV sub-stations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan, Mr. Shivam Gupta & Mr. Avichal Pandey visited 220/132KV Rishikesh Substation during 19th – 21st February 2024 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below under 2 heads.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220KV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on "Draft O&M Manual" of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Annexure - 1. Also, a list of switchyard maintenance equipment is placed at annexure -3. It is recommended that the necessary testing and maintenance equipment at substation/Sub-division/Division be arranged for regular testing and maintenance of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC-2023.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru' third party for implementing the best practices in the sub-station.
10. It is suggested that the existing draft O&M manual be updated to take care of latest developments.

Observations and Recommendations for 220/132KV Rishikesh Substation

1.0. The Protection audit is carried out for the first time. The SLD includes the adjoining 132/33/11KV IDPL sub-station, but the station is managed separately and not integrated with SAS. Accordingly, 132/33/11KV sub-station is not covered under present audit.
2.0. 220KV bus-bar protection is not provided and procurement process is initiated. It is recommended to expedite the process.
3.0. One single breaker is provided for Bus-coupler and Transfer Bus Coupler function, therefore, both buses are hard coupled thru isolators and backup over current and earth fault protection is provided for this breaker. It is suggested that this operation philosophy be reviewed at the time of designing/commissioning of bus-bar protection.
4.0. For 220KV Dharashu line II and 220KV SIDCUL Line, the back-up protection needs to be replaced with distance protection, in line with protection philosophy.
5.0. 220KV side of 400/220KV Transformer are not connected through Transfer Bus. It is suggested to explore the possibility of connecting them thru Transfer bus.
6.0. 132 KV BINDAL line BCU is not working. This needs to be rectified.
7.0. It is recommended to update/Upgrade the SAS to include the missing inputs.

8.0. The SAS GUI time is not synchronised and displays time different from GPS. It is suggested to take necessary remedial measures for the same.

9.0. The 110V DC system is designed for single source. 2 nos. of 110V DC systems are provided. IT is suggested that PTCUL examines the possibility of dual source DC supply to protection system.

10.0. Emergency DG set operation is not operational. It is recommended to keep the DG set in operation.

2.0. Introduction

2.1. Background

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400 KV and 08 Nos. 220 KV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following sub-stations is to be carried out

1. *400kV Rishikesh*
2. *400kV Kashipur*
3. *220kV Chamba*
4. *220kV Rishikesh*
5. *220kV Roorkee*
6. *220kV Haridwar (SIDCUL)*
7. *220kV Jhajra*
8. *220kV Pantnagar*
9. *220kV Haldwani*
10. *220kV Mahuakheraganj*

2.2. Scope of Work

Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. *Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.*
b. *Availability/healthiness of PLCC communication links used for protection systems.*
c. *Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.*
d. *Availability/healthiness of GPS system and time synchronization facility used for protection.*
e. *Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.*
f. *Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.*
g. *Field inspection of protection device for obsolescence of technology, suitability and healthiness.*
h. *Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.*
i. *Checking of availability of DG Set / auxiliary DC supply at substations.*

2.3. Audit Rationale

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipment under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) "All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC".
c. As per Para – 15 (4) of said Code, "The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC".
d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per Annexure -1 of IEGC-2023.

2.4. *Audit Process*

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each sub-station, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

Sl. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-connecting Transformer
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL.

- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**

    - ➢ The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
    - ➢ The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
    - ➢ All the major general deficiency shall be listed in detail along with remedial recommendations.
    - ➢ The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. *About Power Transmission Corporation of Uttarakhand (PTCUL)*

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. *About Central Board of Irrigation & Power (CBIP)*

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of 220KV Rishikesh Substation

3.1. *General Information about Substation*

Sl. No.	Particulars	Details
1	**Substation Name**	220/132/33 kV Rishikesh Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	220/132/33KV
4	**Short circuit current rating of all equipment (for all voltage level)**	220KV = 40KA/sec, 132KV = 40KA/sec 33KV = 25KA/sec
5	**Date of commissioning of the substation**	12th December 1974
6	**Checking and validation date**	19th – 21st February 2024

3.2. *Audit Team*

Audit Team (CBIP):

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Shivam Gupta
- Mr. Avichal Pandey

PTCUL Representative:

- Er. Harsh Verma, Executive Engineer (T&C)
- Er. Manoj Bahuguna, Executive Engineer (O&M)
- Er. Pankaj Kailkura, Assistant Engineer (T&C)
- Er. Ajit Pal, Assistant Engineer (O&M)

3.3. Recommendation of last protection checking and validation

The Protection Audit of 220/132KV and 132/33KV is done for the first time.

3.4. Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.
b. The record of different relay setting calculations is not available at the substation level.
c. All relays are numeric, therefore, as per internal protocol of utility relays are tested only at the time of commissioning/change in setting. Copy of test reports not available at sub-station level.

3.5. Disturbance Recorder availability for the last 6 tripping's

a. No separate DR/ EL is provided. The DR and EL data are taken from individual numerical relays and SAS.
b. The inputs from DR reports from numerical relays are available in the server and can be downloaded using LAN cable.
c. For each tripping data is sent to head office for records.
d. The Utility has shown data for last 6 trippings.

3.6. Chronic reason of tripping, if any

a. The S/S has five 220 kV lines, five 132 kV lines and Four Transformers. Total 44 trippings during the last year were observed, most if which are either Transient E/F or Overloading
b. No chronic/ severe trippings are observed.

3.7. Major non-conformity/deficiency observed

a. The SAS is working partially, some analog and digital signal are not appearing.
b. For 220 kV, Bus Bar Protection is available but not in use due to being obsolete and defective. Currently, the Zone 4 settings are kept at 0.25 secs in Reverse Zone. The process for procurement has been initiated.
c. Bus Bar Protection for 132 kV is not provided. SAS System needs to be upgradation/ updation.

d. 132 kV switchyard is provided with double Main and Transfer Bus scheme For Bus Coupler and TBC single breaker is provided and therefore TBC is used as Bus Coupler also.
e. Both the Main Buses are hard coupled using two isolators (A and B) of Main Bus. Buses can also be coupled through the TBC breakers, for that O/C +E/F relay is provided for protection.
f. 220 kV switchyard is provided with double Main and Transfer Bus scheme For Bus Coupler and TBC single breaker is provided and therefore TBC is used as Bus Coupler also.
g. Both the Main Buses are hard coupled using two isolators (A and B) of TBC. Buses can also be coupled through the TBC breakers, for that O/C +E/F relay is provided for protection.
h. The whole system is designed for single DC source; therefore, both the DC system cater to different relays and systems.
i. 220 kV side of 400/220 kV Transformer are not connected through Transfer Bus.
j. For 220 kV Dharashu II, Micom P442 is provided as distance protection. In addition, Siemens 7SJ62 is provided as back up O/C + E/F Protection. This need to be replaced.
k. For 220 kV SIDCUL, Micom P444 is provided as distance protection. In addition, relay Siemens 7SJ62 is provided as back up O/C + E/F Protection. This need to be replaced.
l. Auto reclose is kept blocked for IIP feeder and Dharashu I feeder.
m. 132 kV BINDAL line BCU is not working, 220 /132 kV ICT 3 has been removed but BCU is ok.
n. All the relays and SAS are time synchronised. However, the GUI for SAS is taking time display from Windows OS of individual PC therefore regular time updation of Windows OS server need to be done.
o. Auxiliary Supply is provided from two sourced:
    i. 132 kV IDPL S/S.
    ii. 33 kV IDPL S/S.
p. No standby DG set is provided.
q. 2 nos 110 V DC auxiliary supply is provided and no earth fault is noticed
r. Two 48V DC system is provided.
s. The SLD shows the adjoining 132 kV IDPL S/S. However, same is not managed by 220/132 kV Rishikesh Control room. Accordingly, it not integrated with SAS.

4.0. List of Trippings

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
220 KV Rishikesh-Dharashu I	Siemens Siprotec	05-01-23 15:50 hrs	05-01-23 20:47 hrs	C.P. : main I ,main II dist. Prot operated R.P. : Gen trip , O/C Pick up L3 on , dist. Trip 3 P on, definite trip on , zone 2 operated , fault location= 72.80 km IL1= 0.03 Kamp IL2= 0.03 Kamp IL3= 2.01 Kamp 3 phase trip relay 863A, 863B	line under S/D by maintenance work at 220 KV S/S Rishikesh from 11:44 hrs line S/D return & try given from 220 KV S/S Rishikesh end at 15:50 hrs	Dharshu power House Line B phase lighning arrester brust	LHWT	faulty L.A. Replace by Dharashu power house Concern person's
Rishikesh-Dharashu I (79Km)	Siemens Siprotec	09-01-2023 13:29 hrs	09-01-23 13:54 hrs	C.P. : main I ,main II dist. Prot operated R.P. : Gen trip , O/C Pick up L2 on , dist. Trip 3 P on, definite trip on , zone 2 operated , fault location= 78.90 km IL1= 0.22 Kamp IL2= 1.92 Kamp IL3= 0.52 Kamp 3 phase trip relay 863A, 863B	at Dharashu power house Generation machine trip,220 Kv tiloth-dharashu line's trip on Tiloth power house end grid supply failt at Dharashu power house (no tripping at dharashu-rishikesh line at dharashu power house end)	according to dharashu power house shift persons heavy spark observed at 220 KV Bus of dharshu power house	LEFT	NA
220 KV Rishikesh-Dharashu II	Micom P444	09-01-2023 13:29 hrs	09-01-23 13:55 hrs	C.P. : DPS , DPT R.P. : Gen trip , start pahse B-N, triap phase ABC , Distance start, distance trip zone 2 , fault location=79.20 km ia=473A Ib=2.08Ka Ic=503A van=123Kv Vbn=97Kv Vcn=124Kv trip relay 86				
220 KV Rksh-Dharashu I	Siemens	22-01-2023 14:56 hrs	22-01-2023 15:16 hrs	C.P. : Main 1, Main 2 prot.optd. R.P. : Gen trip , start phase L2, I>> on , definite trip on , dist. Trip 3 P on , fault loop L2-E, fault location =23.60 km	Dist. Trip zone 1 , fault loop L2-E, fault location= 52.60 Km	Transiesnt Line fault	LEFT Y phase-Earth fault	Line patroling required inform concern persons

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
				IL1= 0.04 Ka IL2=4.24Ka IL3=0.02 Ka 3phase trip relay 863A, 863B				
132 KV Rishikesh-Bindal Line	ABB REL 511	14-02-23 14:45 hrs	14-02-23 15:55 hrs	C.P. : DPS ,DPT, Final trip R.P. : Gen trip , O/C pick up L1, TOC-STL1, STN , zone 2 start, zone 2 trip , IL1=2367A IL2= 215A IL3=512A In=1669 A Van= 66.40 Kv Vbn= 75.60 kV Vcn= 75.75 kV	R phase pick up, zone 1 trip , fault location = 5.81 km Ia= 4.11 ka Ib= 227 A Ic= 512A Van=24 kv Vbn=81.65 kV Vcn=79.18 kV	according to concern line person's steel wire peace was struck on line (by bird)	LEFT	line patroling done by concern line staff
160 MVA T/F-1 220/132 KV (BHEL make)	Diff. Prot. Micom P643	03-03-2023 16:11 hrs	03-03-2023 21:55hrs	C.P. : Diff. Prot. Operated R.P. : Active group 1, Diif. Prot. Start, Diff. Prot. Trip, relay trip time=0.00 s IA1=163 A IB1= 267A IC1=12.73 Kamp IA3=508A IB3=84A IC3= 2.53 Kamp Iadiff=11.45pu Ib=11.49 Icdiff=22.94pu Iabias=5.74 Ib= 5.75 Icbias=11.47 pu tripping relay 86	NA	T/F 220 KV Side B phase Lightning arrester fail	SEFT	Defected Lightning Arrester & surge counter replaced by O&M concern person
132 KV Rksh-Dharashu-I	Siemens	12-03-2023 17:38 hrs	12-03-2023 17:53 hrs	C.P. : Main 1,main 2 prot. Optd. R.P.: Gen trip , O/C start L1 on , A/R lock , def. Trip on , dist. Trip 3 P on, zone-1 trip IL1= 2.24 Ka IL2= 0.26 Ka IL3=0.27Ka fault location =60.60 km triping relay 863A,863B	Gen trip , zone 1 trip, O/C pick up L1 on , fault location= 15.90 km	Bad weather	LEFT	Line patroling required inform concern person's 220 KV Chamba
132 KV Rksh-	Micom P442	14-03-2023 16:04 hrs	14-03-2023 16:14 hrs	C.P. : DPS, DPT, R.P. : Active group 1 ,start phase A-N , A/R lock , trip phase ABC, Dist. Trip	Disc Pick up L1-E, R phase pick up , zone 1 trip ,	Bad weather	LEFT	Line patroling required inform to concern person's 220

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
				zone-1 , Fault location= 50.75 km Ia=2.57 Kamp Ib=186A Ic=57 A Van=96Kv Vbn=128Kv Vcn= 127 Kv tripping relay 86				KV S/S Chamba
132 KV Rksh-Dharashu-I	Siemens	19-03-2023 16:03 hrs	19-03-2023 17:29 hrs	C.P. : main 1,main 2 prot. Optd. R.P. : Gen trip , O/C pick up L3 on , dis pick up 3p on, A/R lock , definite trip on , zone 1 trip , IL1=0.13 Ka IL2=0.13Ka IL3=5.29Ka fault location= 21.90 km tripping relay 86,863	Gen trip , Dis pick up L3-E, zone1 trip , fault location=54.10 km IL3= 1.20 Ka	Bad weather (Transient Line fault)	LEFT	Line patroling required inform concern line persons 220 KV S/S Chamba
132 KV Bindal	Distance relay ABB REL 511	24-03-2023 19:33 hrs	24-03-2023 19:53 hrs	C.P. : DPS , DPT , Final trip R.P. : Gen trip, start phase B, neutral , TOC-STL3,STN , zone 1 start , zone 1 trip , fault location= 8.30 km Ia= 96 A Ib=52A Ic= 7988 A In= 7994A Van=70 KV Vbn= 76 KV Vcn= 54 KV	Gen trip, Start phase C, distance strat, distance trip zone-1 , fault location= 35.25km Ia= 100A Ib= 61A Ic= 1.43 Kamp Van= 75.6 KV Vbn= 76.89 Kv Vcn= 50.43 KV	NA	LEFT	Line patrolling required
132 KV Bindal	Distance relay ABB REL 511	24-03-2023 20:41 hrs	24-03-2023 22:07 hrs	C.P. : DPS , DPT , Final trip R.P. : Gen trip, start phase B, neutral , TOC-STL3,STN , zone 1 start , zone 1 trip , fault location= 8.30 km Ia= 94 A Ib=41 A Ic= 8112 A In= 8129 A Van=71 KV Vbn= 78 KV Vcn= 54 KV	Gen trip, Start phase C, distance strat, distance trip zone-1 , fault location= 35.35km Ia= 99.6 A Ib= 50 A Ic= 1.47 Kamp Van= 75.9 KV Vbn= 76.96 Kv Vcn= 50.75 KV	NA	LEFT	Line againt trip 25-03-23 00:12hrs according to concern line staf line cross arm damage on tower no. 127 (approx 9 km from 220 KV Rishikesh)
132 KV Bindal	Distance relay ABB REL 511	25-03-2023 00:12 hrs	25-03-2023 15:44 hrs	C.P. : DPS , DPT , Final trip R.P. : Gen trip, start phase B, neutral , TOC-STL3,STN , zone	Gen trip, Start phase C, distance strat, distance trip zone-1 , fault location= 35.53km	NA	LHWT	Line againt trip 25-03-23 00:12hrs according to concern line staf line

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
				1 start , zone 1 trip , fault location= 8.5 km Ia= 74.28 A Ib=22.37A Ic= 7937 A In= 8013A Van=72.15 KV Vbn= 79.14 KV Vcn= 55.30 KV	Ia= 76.69A Ib= 31A Ic= 1.46 Kamp Van= 75.6 KV Vbn= 76.89 Kv Vcn= 50.43 KV			cross arm damage on tower no. 127 (approx 9 km from 220 KV Rishikesh) / CROSS ARM CHANGED BY LINE STAFF
40MVA T/F-1 (132/33KV)	Schneider P143	16-04-2023 19:12 hrs	16-04-2023 20:25 hrs	C.P. : O/C & E/F prot. Optd R.P. : Active group 1, start phase ABCN, trip phase ABC , O/C start, E/F start, O/C Trip IA= 1.03Ka Ib=884 A Ic=1.13 Ka In=265 A	NA	33 KV Barrage feeder Y phase CT Blast feeder trip on O/C & E/F protection, burning C.T. & oil fall between 33 KV Barrage feeder C.B. Pole contact flashing observe at C.B. Contacet creating 33 KV Bus Fault	LEFT	33 KV Barrage feeder C.T replaced , C.B. & feeder protection checked , after work barrage feeder energise at 17-04-2023 05:35 hrs
40MVA T/F-2 (132/33KV)	Schneider P143	16-04-2023 19:12 hrs	16-04-2023 19:40 hrs	C.P. : O/C & E/F prot. Optd R.P. : Active group 1, start phase ABCN, trip phase ABC , O/C start, E/F start, O/C Trip IA= 1.13Ka Ib=895 A Ic=1.17 Ka In=268 A	NA		LEFT	
132 kv Srinagar	Micom	21-04-2023 00:11 hrs	21-04-2023 00:49 hrs	C.P. : DPS , DPT R.P. : active group 1, start phase A-N, trip phase ABC , distance statrt , distance trip zone 1, fault location- 7.40 km Ia=7.89 Ka Ib= 0.01 Ka Ic= 0.01 Ka tripping relay 86	NA	Transient line fault	LEFT	Line patoling required informed concern line person
132 KV SRINAGAR	Siemens	09-05-2023 15:52 hrs	09-05-2023 16:13 hrs	C.P. : final trip. DPT,DPS R.P. : Power system fault ,fault event , pickup AG, Trip phase ABC, fault location =19 km IA= 4.31Ka , IB=0.01Ka IC=0.01 Ka	NA	Transient Line Fault		Line patroling required inform concern persons
132 KV Laltap	ABB REL 511 Micom P143	17-05-2023 20:25 hrs	17-05-2023 20:57 hrs	O/C start R,Y,B phase , I>1 start , I> 1 trip, Ia=855 Amp , Ib= 935	NA	160 MVA (220/132 KV) transsformer	Over Load	NA

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
				Amp , Ic= 925 Amp, In=13 Amp Van=71.3Kv Vbn=71.7 Kv Vcn=71.8 Kv ,		trip at 220 KV S/S Jhajhara , due to this line trip on over load		
220KV Rishikesh-Dharashu I	Siemens Siprotec 7SA512	18-05-2023 07:07 hrs	18-05-2023 07:33 hrs	C.P. : main I , main II port. Operated R.P. : Dis. Pick up L3-E, dist. Loop L3-E, A/R lock , Definite trip on , dist trip 3 P on, zone-1 trip , fault location=11.90 km Ia=0.17 ka Ib=0.12 ka Ic=7.02 Ka tripping relay 86	main I ,Main II port. Operated	Transient Line Fault	B phase-Earth fault	Line patroling required inform to concern line person(220 KV S/S Chamba)
220 KV RKSH- Dharashu - II	Micom P444	23-05-2023 17:25 hrs	23-05-2023 17:37 hrs	C.P. : DPS ,DPT, Final trip R.P. : Active group 1, start phae B-N, dsitance trip zone-1 , fault location= 65.75km ia=29A Ib= 2.44 Ka Ic=30 A Van=126Kv Vbn=110 Kv Vcn=127 tripiping relay 86	(try given from 220 KV RishikeshSide at 17:25 hrs)	Transient Line Fault	Phase-Earth	NA
220KV Rishikesh-Dharashu I	Siemens 7SA612	23-05-2023 17:33 hrs	23-05-2023 17:57 hrs	C.P. : Main1 .Main 2 prot. Operated R.P. : Dis pick up L2,L3, definite trip, zone -1 trip , IL1-0.23 Ka IL2=3.72Ka IL3=3.74 ka Distanse=11.00 km tripping relay 86	Dis pick up L2,L3, fault location=26.50 km	Transient Line Fault	Phase-Earth fault	Line patroling required inform to concern line person
132 KV Bindal	ABB REL511	23-05-2023 21:15 hrs	23-05-2023 21:53 hrs	C.P. : DPS, DPT, final trip R.P. : Gen trip , start R pahse , Nuetral, TOC-STL1,STN , zone 2 start , zone 2 trip , IL1=2783A IL2=260A IL3=270 A Van=68.3Kv Vbn=81KV Vcn=80.70 KV	start phase A, zone-1 trip , fault location= 8.69 km	Transient Line Fault	Phase-Earth fault	Line patroling required inform to concern line person

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
132 KV Srinagar	Siemens	23-05-2023 21:41 hrs	24-05-2023 01:43 hrs	C.P. DPS ,DPT, R.P. : Gen trip, start phase A-N, trip phase ABC ,Distanse trip zone-1 , fault location= 7.40 km Ia=6.96 Ka Ib=0.01Ka Ic=0.01Ka , tripping relay 86	Line half section charged from Rishikesh end (other section under S/D for tower Work)	Transient Line Fault	Phase-Earth fault	Line patroling required inform to concern line person
132 KV Srinagar	Siemens	25-05-2023 17:06hrs	25-05-2023 17:27 hrs	C.P. : DPS,DPT,Final trip R.P. : Active group 1, start phase A-N, trip phase ABC, distance trip zone-1 , Ia=7.45Ka Ib= 0.01 Ka Ic=0.1ka Fault location= 7.4 km tripping relay 86	NA	NA	phase-Earth fault	Line patroling required
C.B. 73 JAWALAPUR (22.97 KM)	ABB REL511	16-06-2023 02:30 hrs	16-06-2023 02:46 hrs	C.P:- Dis.prot.start,Dist. Prot. Trip. R.P:- Gen trip , start R phase, start B phase, zone 1 trip, TOC - STL 1, TOC- STL 3, active group 1 , IA= 8577A , IB= 189.8A , IC =8713 A, In=27A, U1= 39.60 KV , U2= 76.04 KV , U3= 43.69 KV, U4=0.00Kv	Active Group 1 Start phase R, B, Zone 1 Trip Fault location 17.90 KM, IA=3.88 Ka Ib=0.18 Ka, Ic=3.75 Ka	transient line fault	LPPT	Line Petroling Required inform concern line person
40MVA T/F-1 132/33 KV 33KV .	Micom P143	24-06-2023 12:02 hrs	24-06-2023 12:23 hrs	L.V. O/C & E/F Protection operated , Ia=72 A, Ib= 1.09 Ka ,Ic= 137 A , Ie= 1.14 Ka	NA	33 KV GIS feeder Y phase C.T. Clamp broken berfore feeder C.T. Create 33 KV Bus Fault	LEFT	NA
.40MVA T/F-2 132/33	Micom P143	24-06-2023 12:02 hrs	24-06-2023 12:23 hrs	L.V. O/C & E/F Protection operated , Ia=79 A, Ib= 1.04 Ka ,Ic= 134 A , Ie= 1.19 Ka	NA		LEFT	NA
220 kv rksh-	Siemens Siprotec 7SA612	25-06-2023 16:50 hrs		C.P. : Main 1 , main 2 prot. Operated R.P. : Gen trip , Dis pick up L31,	Dharashu P/H (C.B. 88) Main 1,main 2 prot. Operated , zone-1 trip ,	220 KV Rishikesh - Dharashu Line 'R' phase	LPPT	line under shutdown fault attending

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
				O/C pick up L1, L3, A/R block , definite trip on , zone-1 trip , IL1= 8.54 Kamp Il2=0.28 Kamp IL3=8.29 Kamp , fault location= 13.10 km tripping relay 86 , 863	fault location= 59.70 km , IL1= 1.76 Ka IL2= 0.30 Ka IL3= 2.05 Ka	conductor wire was broken & Touch 'B' Phase Conductor		work on progress
132kv Srinagar	Siemens	17-07-23 13:18 hrs	17-07-23 13:31 hrs	start phase C-N, trip phase ABC, distanse trip zone-1 , Ia=0.01 Ka Ib=0.01 Ka Ic= 6.73 Ka fault location= 3.10 Km tripping relay 86	NA	Transient Line Fault	LEFT	line patroling required inform concern line person.
132 KV Lal Tapeer	ABB REL 511 Micom P143	19-07-2023 14:25 hrs	19-07-2023 14:58 hrs	Gen trip , start phase B, O/C start , O/C I>1 trip , Ia= 301 A Ib= 485 A Ic= 388 A In= 80 A	NA	Line trip on over load	CMST	NA
132 KV Bindal	ABB REL 511	19-07-2023 14:27 hrs	19-07-2023 14:53 hrs	Gen Trip , O/C start , O/C Trip , Ia= 453 A , Ib= 484 A Ic= 473 A In= 4 A	NA	Line trip on over load	CMST	NA
220 KV Chamba	Micom P444	30-07-2023 18:55 hra	line under Shut down	C.P. : DPS,DPT,Final trip R.P. : Active group -1, start phase C-N, trip phase ABC, distanse trip zone-1, Ia=341A Ib=408A Ic=14.13Kamp Van=109Kv Vbn=117Kv Vcn=60Kv Fault Location= 5.62 Km tripping relay 86	O/E : 220 KV S/S Chamba CB84 Active group-1, start phase C-N, trip phase ABC , distanse trip zone-2 , Ia=339A Ib=408A Ic=1.45Kamp Van=124Kv Vbn=125Kv Vcn=41Kv fault location= 39Km tripping relay 86	220 KV Rishikesh-Chamba line "B" phase conductor wire broken from tower clamp fitting(tower number 9 approx 3.00 km from 220 KV Rishikesh)	LHWT	NA
220 KV IIP	Siemens 7SA612 7SA52	08-09-2023 18:01 hrs	09-09-2023 04:36 hrs	C.P. : main 1, main 2 prot. Operated R.P. : Dis pick up L1-E , def. Trip on , dist. Trip 3 P on ,zone-1 trip , IL1= 13.15 ka IL2=0.52 Ka IL3= 0.20 Ka fault location= 2.30km three phase trip relay 863 A, 863 B	NA	Rishikesh - IIP line R phase conductor suspension disc string was broken approx 2.5 km from 220 KV S/S Rishikesh	LEFT	Fault remove by concern line person

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
220 KV IIP	Siemens siprotec 7SA612 7SA52	05-09-2023 13:33 hrs	05-09-2023 15:38 hrs	C.P. : main 1 , main 2 prot. Operated R.P. : O/C pick up L3 on, I>> on, dis. Pick up L2,L3 on, def. Trip on. Dis. Trip 3 P on , zone-1 trip , IL1= 0.01 Ka IL2= 7.08 Ka IL3=6.19Ka fault location = 16.90 trhee phase trip relay 863A, 863 B	fault loop C-G, Ia= 257A Ib=246 A , Ic= 801 A Ie=969A , Van= 128Kv Vbn=122Kv Vcn= 113Kv fault location= 28.20 Km	NA	LEFT	NA
220 KV SIDCUL	Micom P444	15-09-2023 02:06 hrs	15-09-2023 03:22 hrs	C.P. : DPS ,DPT R.P. :Active group-1 , start phase A-N , distanse trip zone-1, fault location=7.76 km Ia=8.11 Kamp Ib=710 A Ic=587 A Van=46.84KV Vbn=125.5KV Vcn=124KV tripping relay 86	Dsitance trip zone-1 , fault location= 11.94 Km Ia=4.73 Ka Ib=612 A Ic=606A	Transient line fault bed weather rain & lightning	LEFT	line patroling required inform to concern line person's
220 KV IIP	Siemens Siprotec 7SA612 7SA52	15-09-2023 01:41 hrs	15-09-2023 02:30 hrs	C.P. : main 1, main 2 prot. Operated R.P. : Dis. Pick up L2-E, Dis. Trip 3P on, definite trip on , IL1=0.13Ka IL2=5.66Ka IL3=0.05Ka fault location= 19.90 km tripping relay 863A,863B	start phase B-N, distanse trip zone-1 , fault location=8.46 KM Ia=128 A Ib=4.16 Ka Ic=41 A Van=136KV Vbn=31.6KV Vcn=141.7KV	Transient line fault bed weather rain & lightning	LEFT	line patroling required inform to concern line person's
132 KV bhopatwla-chilla	Distanse Protection Micom P444	25-09-2023 11:30 hrs	25-09-2023 18:26 hrs	C.P. : DPS, DPT R.P. : Active group-1, start phase B-N ,dsitanse trip zone-1 , fault duration=76.8 m.sec , fault location=10.28km Ia= 709 A Ib= 5.11 Kamp Ic= 931 A Van=77.2KV Vbn=34.3Kv Vcn= 73.7Kv tripping relay 86	132KV S/S Bhopatwala: Rishikesh-chila line trip zone-1 ,Yphase fault, fault location=6.7 km Chila Power house: no tripping at line, all machine triped	Some obstrect comse in line Y phase conductor	LEFT	line patroling by concern line persons

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
220 KV Jwalapur	Distance Protection ABB REL-511	25-09-2023 11:30 hrs	25-09-2023 11:52 hrs	C.P. : DPS,DPT R.P. : Gen trip , start Y phase, B phase ,TOC-STL,STL2,STN , zone 3 trip Ia=552 A Ib=3009A Ic=2544 A In=1289A U1=73.6KV U2=60.46 KV U3=60.8KV	no tripping at 132 KV S/S Jwalapur , at jwalapur S/S Rishikesh & chila feeder on same bus	Chila power house all machines trip at 11:30 hrs	NA	NA
220 KV IIP Harawala	Siemens 7SA612 7SA52	25-09-2023 13:58hrs	25-09-2023 15:32 hrs	C.P. : Main-1 , Main-2 prot operated R.P. : Gen trip, Dis. Pick up L2-L3, def trip, dist trip 3P , zone-1 trip IL1=0.17Ka IL2=11.38Ka IL3=11.11Ka Distance= 4.2 km	Y-B phase Pick up , zone-2 trip , IA=185.1A, IB=2.90KA, Ic= 3.07 Ka fault location =25.28 Km	NA	LEFT	line patroling by concern line persons
Name of	Type of Relay/CB No	Date and Time of Tripping	Date and Time of Closing	Flags Observed	Other Element Flags	Analysis of Tripping	Category Code	Action Taken
76 Rishikesh-Bhopatwala-Chila P/H	Micom	09-10-2023 13:46 hrs	09-10-2023 15:26 hrs	C.P. : DPS ,DPT R.P. : active group-1 , start phase A-N , distanse trip zone-1 , fault location = 1.518 km Ia= 8.22 Ka Ib=198 A Ic= 122 A Van=39.38 Kv Vbn=88.20Kv Vcn=80.43Kv tripping relay 86	132 KV S/S Bhopatwala: no tripping 132 KV grid supply fail (radial fedding , Bhopatwala-Jwalapur line opened) Chila power House: no tripping on line , running 03 machine's trip & supply fail at power house .	accoding to concern person's loud sound was oberved near line approx. 2.0 km from 220 KV Rishikesh S/S	LEFT (Rphase-Earth fault)	Line patroling by concern line persons
81 SIDCUL Haridwar	Micom P444	07-11-2023 13:38 hrs	07-11-2023 17:52 hrs	C.P. : DPS,DPT, A/R Lock , Final trip R.P. : Active group-1 , start phase B-N , distanse trip zone-1 , fault location=517 meter Ia= 101 Amp Ib=12.40 Kamp Ic=508A Van=128.3 Kv Vbn=15.32Kv Vcn=128.3Kv tripping relay 186 ,86	O/E : 220 KV S/S Sidcul : Active group-1, start phase B-N, distanse trip zone-2 , Ia= 463A Ib=4.42 Ka Ic=823 A fault location= 15.94 Km	According to concern line persons during house construction work bamboo stick from labour hand comes in line range	LEFT Phase-EARTH fault	Line patrolling by concern line person

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
72 Bindal	ABB REL511	07-02-2024 14:59 hrs	07-02-2024 15:34 hrs	C.P. : DPS ,DPT R.P. : Gen trip , start R,Y phase , TOC-STL1, STL2, STN , zone-1 start , zone-1 trip, fault loop L1-L2, fault location=0.300 km Van=38.22 KV Ia= 11966 Amp Vbn=34.33 KV Ib= 13459 Amp Vcn= 80.08 KV Ic= 254 Amp In= 2033 Amp	132 KV S/S Bindal : zone-2 trip, fault location=46.63km Ia=2.13 Ka Van=57.66 KV Ib= 2.13 Ka Vbn=57.22 KV Ic = 10A Vcn= 76.85 KV	according to concern person Loud blast sound observe outside 220 KV S/S Rishikesh switch yard (Eagle's & Birds observe at spot)	Phase-Phase fault R-Y phase	after confirmation line try given line hold OK
73 Rishikesh-jwalapur line 22.97 km	ABB REL511	23-03-2024 13:37 hrs	23-03-2024 13:54 hrs	C.P. : DPS, DPT R.P. : Gen trip , start phase B, start neutral , zone-1 start , zone-1 trip , TOC-STL3 , STN Fault Loop L3-N , Location= 10.40 km Van= 76.26 KV Vbn=76.36 KV Vcn=44.67 KV Ia=367 A Ib=203 A Ic=5020 A In=4490 A	zone-1 operated , B phase pick up ,IL1=0.31 Ka IL2=0.18 Ka IL3=5.59 Ka fault location = 9.20 km	acording to concern line person during building construction work, labour work with iron rod comes in line range	LEFT	NA
C.B. 72 Bindal (44.70 Km)	ABB REL 511 & Schneider P143	15-04-2024 21:12 hrs	15-04-2024 21:33 hrs	C.P. : DPS , DPT, Final Trip R.P. : Gen trip , start R phase , Neutral , zone-1, zone-2 start , zone-1 trip , Fault loop L1-N, fault location = 8.60 km Van= 53.48 KV Vbn=70.22 KV Vcn=76.24 Kv I1= 7749 A I2=85 A I3=52 A I4=7764 A	Active group-1 , start phase A-N , distanse trip zone-1 , fault location= 35.37 km Ia=1.41 Ka Ib=84 A Ic= 55 A Van=49.4 Kv Vbn=76 Kv Vcn=76.4 Kv	According to concern line person during line patroling Line 'R' phase disc found puncture at tower number 27	NA	Line shutdown taken for removing fault 16-04-2024 09:30 hrs
C.B. 72 Bindal (44.70 Km)	ABB REL 511 & Schneider P143	16-04-2024 03:20 hrs	16-04-2024 03:41 hrs	C.P. : DPS , DPT, Final Trip R.P. : Gen trip , start R phase , Neutral , zone-1, zone-2 start , zone-1 trip , Fault loop L3-N, fault location = 8.60 km Van= 71.35 KV Vbn=78.48 KV	Active group-1 , start phase A-N , distanse trip zone-1 , fault location= 35.11 km Ia=52A Ib=42 A Ic= 1.51Ka Van=77.4 Kv Vbn=78.2 Kv Vcn=50.22 Kv	According to concern line person during line patroling Line 'B' phase disc found puncture at tower number 27	NA	NA

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
				Vcn=53.53 Kv I1= 51 A I2=35 A I3=7933 A I4=7972 A				
C.B. 73 JAWALAPUR	ABB REL511	19-04-24 18:23 hrs	19-04-2024 21:59 hrs	C.P.:- Dis.prot.start,Dist. Prot. Trip. R.P.:- Gen trip , start R phase,Y phase , zone-1 start, zone-1 trip, fault loop L1-L2 , Fault location = 1.30 km Il1=11445A IL2=11414A IL3=50A Van=44.95 Kv Vbn=35.91 Kv Vcn=79.78 Kv	Dist. Pick up L1-L2, O/C & E/F prot. Trip , IL1= 4.70 Ka IL2=4.68 Ka IL3= 0.01 Ka (Line charge at 21:59 hrs from 220 KV S/S Rishikesh end 132 KV Jwalapur S/S Line C.B. Not close)	Due to heavy storm one tree is broken it's braches comes in line R & Y phase conductor range	PHASE TO PHASE	fault remove by concern line persons
83 IIP(31.00 Km) Dehradun	Siemens 7SA52	22-04-2024 10:24 hrs	22-04-2024 11:59 hrs	C.P. : main-1 , main-2 prot. Optd, A/R Block R.P. : O/C pick up L3 on,I>on, I>>on, definite trip on, dist. Trip 3P on, zone-2 trip , fault loop L3-E, fault location =26.70 km IL1=0.01 ka IL2=0.01ka IL3=4.00Ka three phase trip relay 863A,863B	Dist. Trip zone-1 , fault location=2.17 km Ia= 10 A Ib=182 A Ic= 4.00 ka tripping relay 86-1, 86-2	According to concern line persons during construction work bellow line labour comes line "B" phase conductor range	NA	After patrolling line try given line hold
87 Rksh-Dharashu-II 79.40 Km	Micom P442	18-05-2024 17:51 hrs	18-05-2024 18:16 hrs	C.P. : DPS,DPT, Final trip R.P. : Active group-1, start phase A-N , distanse trip zone-1 , fault location=50.71 km Ia= 2.67 Ka Ib=477 A Ic= 124 A Van= 95 KV Vbn=123 KV Vcn=123.4KV tripping relay 86	Dis. pick Up L1-E, dist. Trip zone-1, fault location=30.30 km	NA	NA	NA
72 Rishikesh-Bindal feeder	ABB REL-511 Schneider P143	27-05-24 11:06 hrs	27-05-2024 11:21 hrs	C.P. : DPS ,DPT, Final trip R.P. : Gen trip , start R phase, start B phase, Neutral , TOC-STL1,STL3,STN , zone-2 start, zone-2 trip ,	O/E : R phase pick up, zone-1 trip ,	Transient Line fault	R phase-Earth fault	Line patroling by concern line persons

Name of Feeder/TF	Type of Relay / Scheme	Date & Time of Tripping	Date& Time of closing	Flags observed	Other end flage	Tripping Analysis / Action taken report	Category Code	Action Taken
				fault location = 44.80 km, Van=57.59 KV Vbn=69.83 KV Vcn= 70.49 Kv IL1=2954 A IL2= 353 A IL3=641 A IL4= 2318 A				
72 Rishikesh-Bindal	ABB REL 511 Schneider P143	30-05-2024 12:27 hrs	30-05-2024 13:09 hrs	C.P. : DPS ,DPT , Final trip R.P. : Gen trip , start R,Y phase , Neutral , TOC-STL1 , STL2 , STN , Zone-1, zone-2 start, zone-1 trip , fault location =9.60 km Van=65.84 Kv Vbn= 24.92 Kv Vcn=58.14 Kv Ia= 481 A Ib= 7639 A Ic=375 A In=7292 A	no tripping at 132 KV S/S Bindal , 132 KV Grid supply fail at 132 KV S/S Bindal (radial feeding from 220 KV S/S Rishikesh)	NA	NA	NA

5.0. Observations and Recommendations

5.1. *Reporting of all the Tripping with DR/EL*

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System “http://103.7.128.184/Account/Login.aspx” within 24 hours of the events. These are being submitted by sub-station to NRLDC portal, however the record of the same is not kept at substation level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	DR, EL & Tripping report need to be submitted
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
	Total in NR Region	520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at sub-stations

c. It is recommended that each sub-station to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. *Development of centralized database of relay settings*

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220KV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220KV are to be calculated by SLDC and/or central level. The relays are tested by sub-station officials as per need basis, but the record of recommended

settings/ calculation is not kept at sub-station level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220KV & above and by SLDC below 220KV along with setting calculations & parameters used for all the relays be kept at sub-station level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. Review of test results of relay and equipment

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".
b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.
c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. Availability of Testing Kits

a. The availability of testing equipment is limited at each substation. For comprehensive testing of equipment, as per above para, sufficient testing kits at each substation/Sub-division/ Division level are required.
b. Based on the O&M manual, it is recommended that sufficient quantity of testing instruments be made available at sites for regular testing of equipment. A suggested list of Testing Equipment is attached at Annexure – 1.

5.5. Up-dation of PTCUL Protection Philosophy

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. *Simulation based study of protection system*

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. *Capacity Building of protection team*

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. *Updated Fault Level/ Short Circuit Level and Network information*

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. *General Protection related observations*

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. *O&M Manual*

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. For 220 KV, Bus Bar Protection is available but not in use due to being obsolete and defective. Currently, the Zone 4 settings are kept at 0.25 secs in Reverse Zone. The process for procurement has been initiated. The process needs to be expedited.

b. For both 220KV and 132KV switchyards, double Main and Transfer Bus scheme is provided. Single breaker acts as Bus Coupler (BC) and Transfer Bus coupler (TBC). Both the Main Buses are hard coupled using two isolators (A and B) of Main Bus, to keep TBC breaker free, although, buses can also be coupled through the TBC breakers, for this purpose, O/C +E/F relay is provided for protection. This philosophy needs to be reviewed, at the time of commissioning of bus-bar protection.

c. For 220KV Dharashu line 2 II, Micom P442 and for 220KV SIDCUL line, Micom P444 is provided as distance protection. In addition, relay Siemens 7SJ62 is provided as back up O/C + E/F Protection for both feeders. The back-up protection needs to be replaced with distance protection, in line with protection philosophy.

d. 220KV side of 400/220KV Transformer are not connected through Transfer Bus. Possibility of connecting them thru Transfer bus be explored for ease of testing and maintenance of 220KV circuit breakers.

e. 132 KV BINDAL line BCU is not working. This needs to be rectified.

f. The SAS is working partially, some analog and digital signal are not appearing. SAS System needs to be updated/upgraded.

g. The SAS GUI takes the time from window operating system. As the system is not connected to internet, the window time is not synchronised, therefor the time synchronization of windows OS needs to be done at regular interval, otherwise clock of SAS GUI shows different time. It is suggested to take necessary remedial measures for the same.

6.2. Equipment related observations and recommendations

a. PTCUL has submitted a list of switchyard equipments to be replaced under PSDF funding, as per Annexure - 2. In view of the need of modern sub-stations, where automation of sub-station is of paramount importance, these replacements are required. Based on the specifications and healthiness of existing equipments, the list may be reviewed by PTCUL. In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of **Maintenance Equipment is attached at Annexure – 3.**

6.3. *Auxiliary Equipment related observations and recommendations*

a. The auxiliary supply is received from two sources i.e. 132KV IDPL and 33KV S/S Rishikesh and is quite reliable. No standby DG set is provided. Necessary action may be taken for emergency auxiliary supply.

b. The whole system is designed for single DC source; therefore, 110V DC supply to different Relays /Buses/SAS is distributed among both DCDBS on single source basis. Possibility of dual source DC for protection be examined by PTCUL.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 KV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

The suggested list of Substation Equipments keeping in mind the necessity for the modernization and upgradation of substations.

Sl. No.	Equipment	Unit	Quantity
A	**220KV Equipment**		
1	245KV Current Transformer (5 Core), Class 0.2 (1 ph) 800/400/1	Nos	6
2	245KV Current Transformer (5 Core), Class 0.2 (1ph) 1000/500/1	Nos	3
3	245KV CVT 1 Ph	Nos	14
4	216KV Surge Arrestor 1Ph (Polymer)	Nos	15
B	**132KV Equipment**		
1	145KV Circuit Breaker 3PH	Nos	2
2	145KV. 1250A, (3 Phase) HDB Isolator without E/s (Mettalic & Insulator)	Nos	6
3	145KV. 1250A, (3 Phase) HDB Isolator with one E/s (Mettalic & Insulator)	Nos	5
4	145KV Current Transformer 1Ph	Nos	4
5	145KV CVT	Nos	3
6	132KV Surge Arrestor 1Ph (polymer)	Nos	6
C	**33KV Equipment**		
1	33KV Circuit Breaker	Nos	2
2	33KV Isolator 3Ph	Nos	4
3	33KV Current Transformer 1 Ph	Nos	15
4	33KV PT	Nos	2
5	33KV Surge Arrestor 1 Ph (polymer)		18

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
   a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
   b) to have a repository of protection system, settings and events at regional level;
   c) specifying timelines for submission of data;
   d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
   e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 KV and above (132 KV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132 KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 KV and above (132 KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220 KV and above (132 KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 KV and above (132 KV and above in NER) system, which shall be reviewed by the RPC:
   a. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

b. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

c. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

   a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.

   b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:

      i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.

      ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

   a. The protection system checklist shall contain information as per this Regulation.

      i. General Information (to be provided prior to the checking as well as to be included in final report):

         - Substation name
         - Name of Owner Utility
         - Voltage Level (s) or highest voltage level
         - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
         - Checking and validation date
         - Record of previous tripping's (in last one year) and details of protection operation
         - Previous Relay Test Reports
         - Overall single line diagram (SLD) (x) AC aux SLD
         - DC aux SLD
         - SAS architecture diagram
         - SPS scheme implemented (if any)

b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	**Recommendation of last protection checking and validation**	Status of works &pending issues if any
2	**Review of existing settings at substation**	Recommended Action
3	**Disturbance Recorder out/ available for last 6 trippings (Y/N)**	Recommended Action
4	**Chronic reason of tripping, if any**	Recommended Action
5	**Major non-conformity/deficiency observed**	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection;

- Name and Length of Line
- Whether series compensated or not
- Mode of communication used (PLCC/OPGW)
- Relay Make and Model for Main-I and Main-II

- List of all active protections & settings
- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays
- Other requirements for protection checking and validation

iv. **AC auxiliary system;**

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. **DC auxiliary system;**

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
  - Mode of communication for Main-1 and Main-2 protection
  - Mode of communication for data and speech communication
  - Status of PLCC channels
  - Time synchronization equipment details
  - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
  - Other requirements for protection checking and validation

vi. **Circuit Breaker Details;**

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
  - CT/CVT ID name and voltage level
  - CT/CVT core connection details
  - Accuracy Class

- Whether Protection/Metering
- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).

b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.

c) All the major general deficiency shall be listed in detail along with remedial recommendations.

d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.

e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

<table>
<tr><th>S.N.</th><th>Protection Setting/Protocol</th><th>Mandated Setting for transmission lines</th></tr>
<tr><td>1</td><td>Protection Scheme</td><td>220KV and above:
Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme.

132KV and below:
One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.</td></tr>
<tr><td>2</td><td>Distance Protection Zone-1</td><td>Reach:
80% of the protected line;
110% of the protected line (In case of radial lines)
Time Setting: Instantaneous.</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Distance Protection Zone-2</td><td>Reach:
Single Circuit Line: 120% of length of principle line section.
Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect.</td></tr>
<tr><td>Time setting:
i. 0.35 second
(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)
ii. 0.5-0.6 second
(For a long line followed by a short line)</td></tr>
</table>

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series compensated double circuit lines may be kept higher at 113%.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220 KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220 KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220KV LINES: No over-voltage protection shall be used. FOR 220KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be done for multi circuit lines/cable.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email: sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

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कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

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Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइट www.ptcul.org

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कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	GST	:	GST shall be paid extra as per applicable Government rules.
3	Tax	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	Date of Start of work	:	Order shall be considered as having come in to force from the date of issue of order.
5	Supply Completion	:	NA
6	Work completion	:	The work should be completed within 24 months from the date of issue of order.
7	Engineer of the contract		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	Engineer in-charge		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	Liquidity damages	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	Dispute		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	Payment terms	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	Payement unit		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	Warranty period	:	NA.
14	Billing Address	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाश नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

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कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
   Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालय:–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause						Modified Clause					
		Sr. No	Description	Unit	Qty	Amount	Total Amount	Sr. No	Description	Unit	Qty	Unit rate (Rs.)	Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.						1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.				
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.						2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.				
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.						3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.				
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus						4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to				

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S. No.	Clause of PO	Existing Clause	Modified Clause
		coupliers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices. etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DG Set/auxiliary DC supply at substations.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g) Field inspection of protection device for obsolescence of technology, suitability and healthiness. h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

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S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum**.
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

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S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

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Annexure – 8: Data Sheets

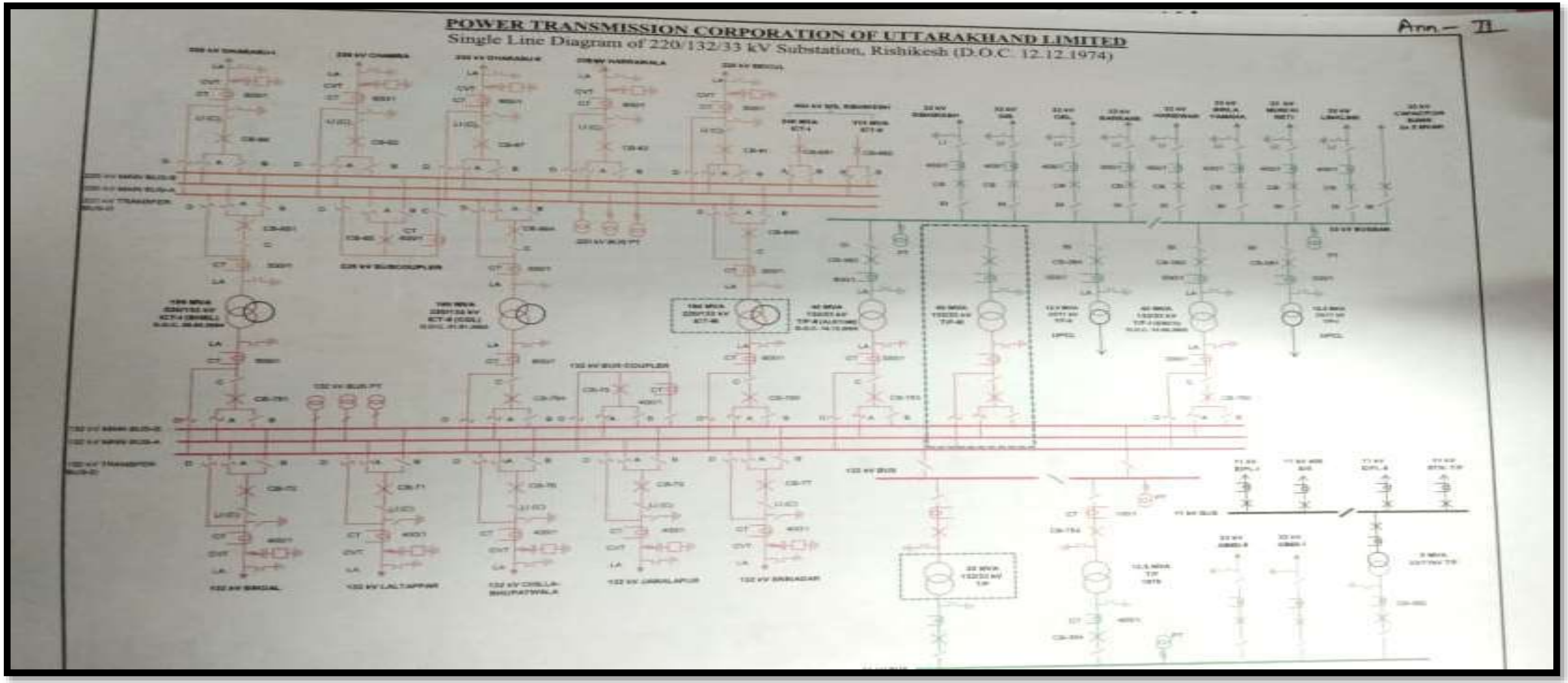
Contents

Annexure - 8

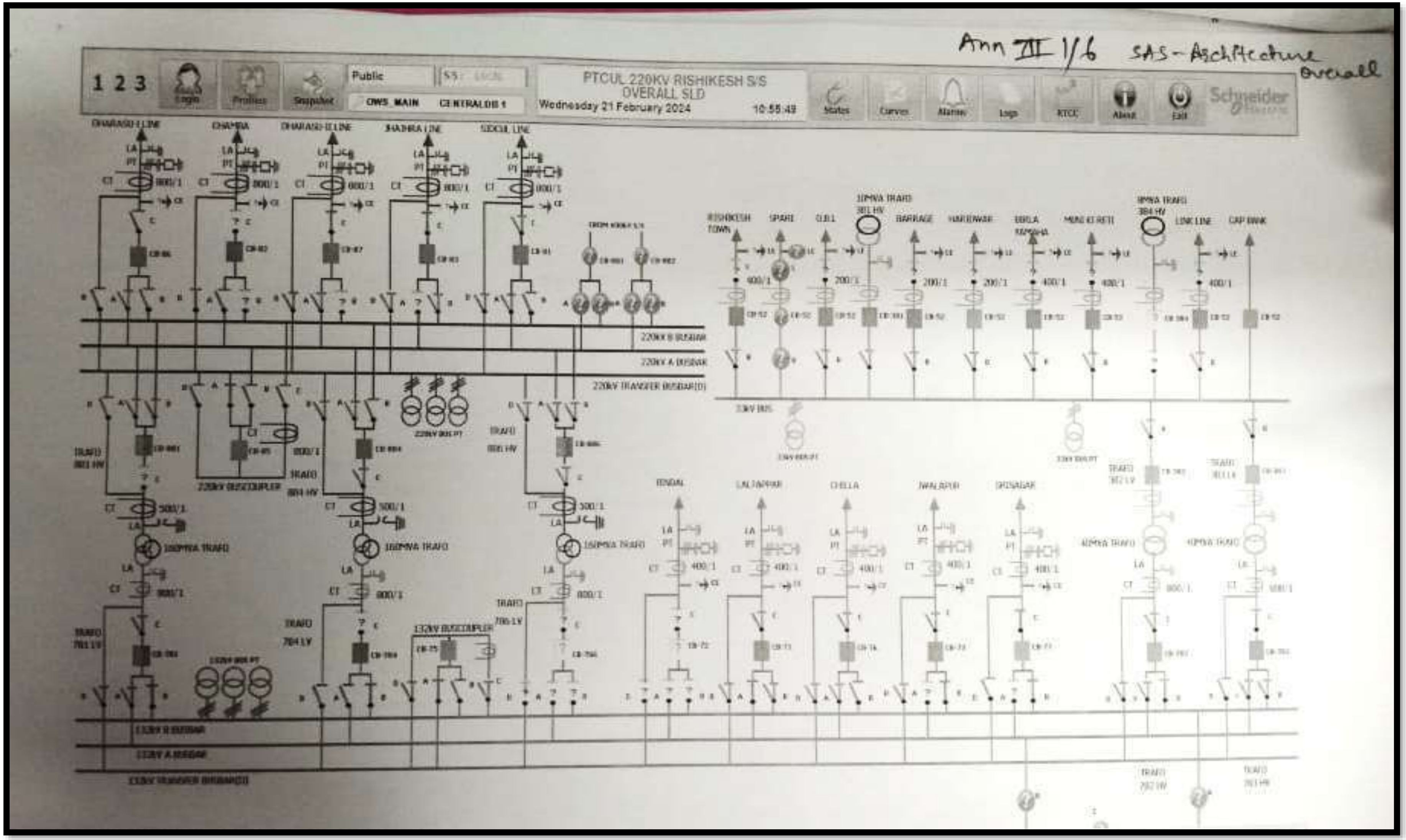
Data Sheets

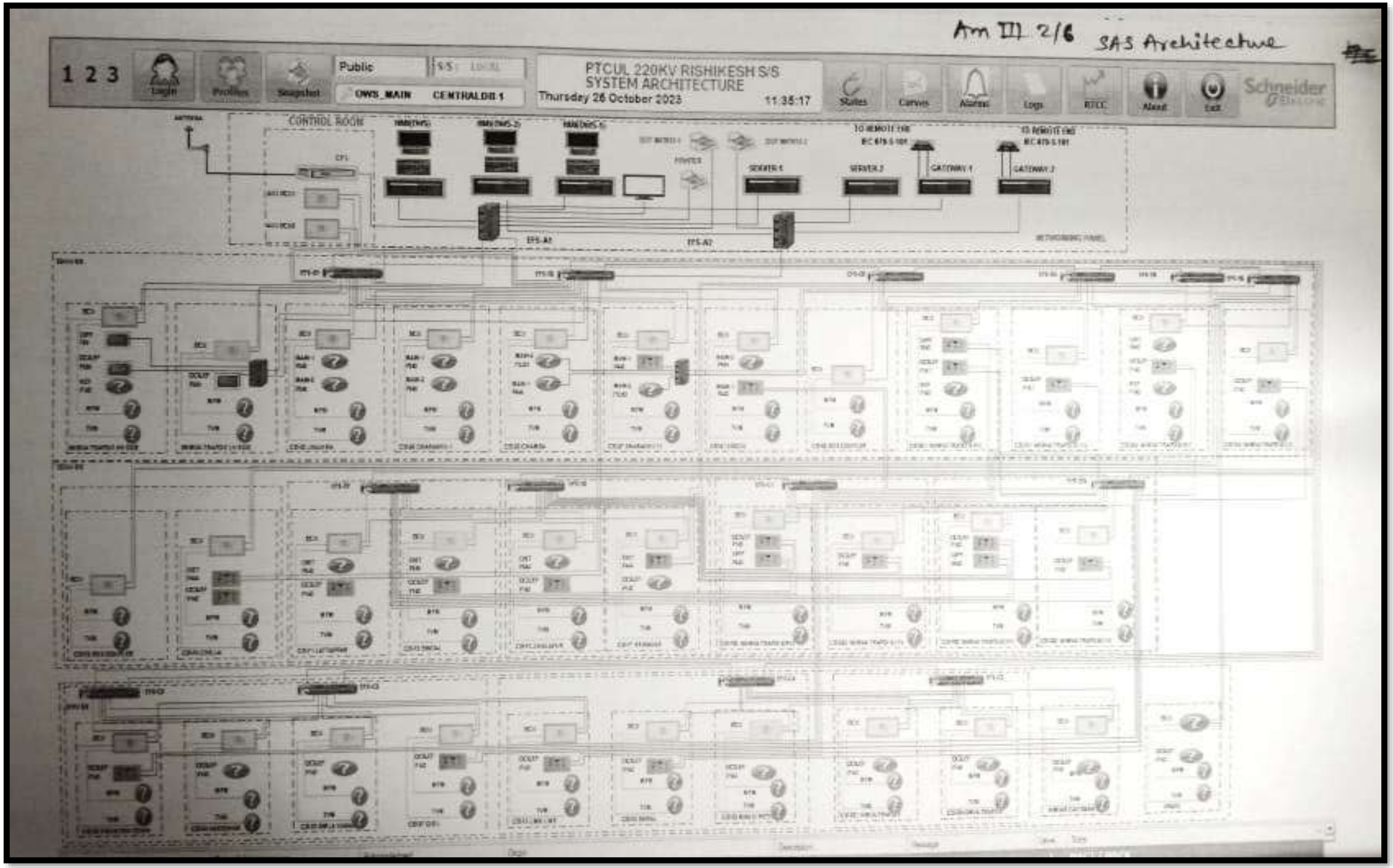
Single Line Diagrams

Substation Single Line Diagram



SAS Architecture diagram




Ann III 2/6
SAS Architecture
1 2 3
Login
Profiles
Snapshot
Public
OWS_MAIN
CENTRALDB 1
PTCUL 220KV RISHIKESH S/S
SYSTEM ARCHITECTURE
Thursday 26 October 2023
11:35:17
States
Curves
Alarms
Logs
RTCC
About
Exit
Schneider
CONTROL ROOM
SERVER 1
SERVER 2
GATEWAY 1
GATEWAY 2

Transmission Lines

220KV:

Particulars		Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
Name of Tr Line		CB81 SIDCUL	CB82 Chamba	CB83 IIP	CB86 DharashuI	CB87 Dharashu II
Length of Line		23.97 km	40.00 km	31.00 km	79.50 km	80.40 km
Series Compensated (Yes/No)		No	No	No	No	No
Connected to dedicated CT core (mention name)		Core1: Dist. Prot Core2: Dir O/C & E/F	Core1: Dist. Prot Core2: Dir O/C & E/	Core1: Dist. Prot. Main I Core2: Dist. Prot. Main II	Core1: Dist. Prot Core2: Dir O/C & E/	Core1: Dist. Prot. Main I Core2: Dist. Prot. Main II
CT Ratio		800/1	800/1	800/1	800/1	800/1
Connected to dedicated PT core (mention name)		Core1: Dist. Prot Core2: Dir O/C & E/F	Core1: Dist. Prot Core2: Dir O/C & E/	Core1: Dist. Prot. Main I Core2: Dist. Prot. Main II	Core1: Dist. Prot Core2: Dir O/C & E/	Core1: Dist. Prot. Main I Core2: Dist. Prot. Main II
PT Ratio		220 KV/ 110V	220 KV/ 110V	220 KV/ 110V	220 KV/ 110V	220 KV/ 110V
Relay connected to Trip Coil-1 or 2 or both		Both	Both	Both	Both	Both
Feed from DC supply-1 or 2		Both	Both	Both	Both	Both
i	Main-I Protection (Make and Model)	Micom P444	Micom P444	Siemens7SA52	Siemens7SA52	Micom P442

	Particulars	Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
	Functional (Yes/No)	Yes	Yes	Yes	Yes	Yes
	Date of testing	03-11-2023	01-11-2023	25-10-2023	04-11-2023	04-11-2023
ii	Main-II Protection (Make and Model)	Siemens7SJ62	Siemens7SJ62	Siemens7SA612	Siemens7SA612	Siemens7SJ62
	Functional (Yes/No)	Yes	Yes	Yes	Yes	Yes
	Date of testing	03-11-2023	01-11-2023	25-10-2023	04-11-2023	04-11-2023
iii	LBB Protection (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA	NA	NA
	Date of testing	NA	NA	NA	NA	NA
iv	PLCC/ Protection coupler (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA	NA	NA
v	DR (Make &Model) (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA	NA	NA
vi	Time Synch.Unit (Make and Model)	SANDS GPS	SANDS GPS	SANDS GPS	SANDS GPS	SANDS GPS
	Functional (Yes/No)	Yes	Yes	Yes	Yes	Yes
Other Protections						
1	Status of Power Swing	Enable	Enable	Enable	Enable	Enable
2	Out of Step	Enable	Enable	Enable	Enable	Enable
3	SOTF	Enable	Enable	Enable	Enable	Enable
4	Breaker Failure	NA	NA	NA	NA	NA
5	Broken Conductor	Alarm	Alarm	Alarm	Alarm	Alarm

	Particulars	Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
6	STUB	NA	NA	NA	NA	NA
7	Fault Locator	Enable	Enable	Enable	Enable	Enable
8	Disturbance Recorder	Enable	Enable	Enable	Enable	Enable
9	VT fuse fail	Alarm	Alarm	Alarm	Alarm	Alarm
10	Overvoltage Protection	NA	NA	NA	NA	NA
11	Trip Circuit supervision	Stand Alone Relay	Stand Alone Relay	Stand Alone Relay	Stand Alone Relay	Stand Alone Relay
12	Auto-reclose	Enable	Enable	Enable	Enable	Enable
13	Load encroachment	NA	NA	NA	NA	NA

132KV:

Particulars		Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
Name of Tr Line		CB71 Laltapper	CB72 Bindal	CB 73 Jwalapur	CB 76 Bhopatwala	CB77 Srinagar
Length of Line		27.00 km	44.77km	22.97km	15.00km	66.40km
Series Compensated (Yes/No)		No	No	No	No	No
Connected to dedicated CT core (mention name)		Core1: Dist. Prot Core2: Dir O/C & E/	Core1: Dist. Prot Core2: Dir O/C & E/	Core1: Dist. Prot Core2: Dir O/C & E/	Core1: Dist. Prot Core2: Dir O/C & E/	Core1: Dist. Prot Core2: Dir O/C & E/
CT Ratio		400/1	400/1	400/1	400/1	400/1
Connected to dedicated PT core (mention name)		Core1: Dist. Prot Core2: Dir O/C & E/F	Core1: Dist. Prot Core2: Dir O/C & E/F	Core1: Dist. Prot Core2: Dir O/C & E/F	Core1: Dist. Prot Core2: Dir O/C & E/F	Core1: Dist. Prot Core2: Dir O/C & E/F
PT Ratio		132 KV/ 110V	132 KV/ 110V	132 KV/ 110V	132 KV/ 110V	132 KV/ 110V
Relay connected to Trip Coil-1 or 2 or both		Both	Both	Both	Both	Both
Feed from DC supply-1 or 2		Both	Both	Both	Both	Both
i	Main-I Protection (Make and Model)	ABB REL511	ABB REL511	ABB REL511	Micom P444	Siemens7SA52
	Functional (Yes/No)	Yes	Yes	Yes	Yes	Yes

Particulars		Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
	Date of testing	26-10-2023	26-10-2023	28-10-2023	28-10-2023	02-11-2023
ii	Main-II Protection (Make and Model)	SchneiderP143	SchneiderP143	SchneiderP143	SchneiderP143	Siemens7SJ62
	Functional (Yes/No)	Yes	Yes	Yes	Yes	Yes
	Date of testing	26-10-2023	26-10-2023	28-10-2023	28-10-2023	02-11-2023
iii	LBB Protection (Make and Model)	Not Available	Not Available	Not Available	Not Available	Not Available
	Functional (Yes/No)	NA	NA	NA	NA	NA
	Date of testing	NA	NA	NA	NA	NA
iv	PLCC/ Protection coupler (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA	NA	NA
v	DR (Make &Model) (Make and Model)	NA	NA	NA	NA	NA
	Functional (Yes/No)	NA	NA	NA	NA	NA
vi	Time Synch.Unit (Make and Model)	SANDS GPS	SANDS GPS	SANDS GPS	SANDS GPS	SANDS GPS
	Functional (Yes/No)	NA	NA	NA	NA	NA
Other Protections						
1	Status of Power Swing	Enable	Enable	Enable	Enable	Enable
2	Out of Step	Enable	Enable	Enable	Enable	Enable
3	SOTF	Enable	Enable	Enable	Enable	Enable
4	Breaker Failure	NA	NA	NA	NA	NA
5	Broken Conductor	Alarm	Alarm	Alarm	Alarm	Alarm
6	STUB	NA	NA	NA	NA	NA

	Particulars	Tr Line 1	Tr Line 2	Tr Line 3	Tr Line 4	Tr Line 5
7	Fault Locator	Enable	Enable	Enable	Enable	Enable
8	Disturbance Recorder	Enable	Enable	Enable	Enable	Enable
9	VT fuse fail	Alarm	Alarm	Alarm	Alarm	Alarm
10	Overvoltage Protection	NA	NA	NA	NA	NA
11	Trip Circuit supervision	Stand-alone relay	Stand-alone relay	Stand-alone relay	Stand-alone relay	Stand-alone relay
12	Auto-reclose	NA	NA	NA	NA	NA
13	Load encroachment	NA	NA	NA	NA	NA

Bus-Bar Protection

220kV

Sl. No.	Particulars	Observations
a	**Busbar and redundant relay make and model**	220 KV Bus Bar Electrostatic Asea make Very old & not working condition
b	**Type of Busbar arrangement**	NA
c	**Zones**	NA
d	**Dedicated CT core for each busbar protection**	NA
e	**Breaker Failure relay included, if additional then furnish make and model**	NA
f	**Trip issued to both Busbar protection in case of enabling**	NA
g	**Isolator indication and check relays**	NA
h	**Other requirements for protection checking and validation**	NA

132KV: NA

AC Auxiliary System

Sl. No.	Particulars	Observations
a	**Source of AC auxiliary system**	01 number 630 KVA (33/0.4KV) & 01 number 250 KVA (33/0.4 KV)
b	**Supply changeover between sources (Auto/Manual)**	Manual
c	**Diesel generator (DG) details**	NA
d	**Maintenance plan and supply changeover periodicity in DG**	NA
e	**Single Line Diagram**	Copy attached
f	**Other requirements for protection checking and validation**	NA

DC Auxiliary System

Sl. No.	Particulars	Observations			
		110 V DC - I	110 V DC - II	48 V DC-I	48 V DC-II
a	**Make**	Exide VRLA	HBL Lead acid	Exide Led acid	Amarraja VRLA
b	**Model/Rating**	OPZS 500 AH	300 Ah	300 Ah	300 Ah
c	**Vintage**	NA	NA	NA	NA
d	**Measured voltage**				
	i. Positive to Earth	+60V	+60V	NA	NA
	ii. Negative to Earth	-60V	-60V	48V	48V
e	**No. of Cells Per Bank**	55 Cell	55 Cell	24 Cell	24 Cell
f	**Availability of Battery Charger**	Mahamai Eng.	Mahamai Eng.	Uptron Power	JSK Power

Circuit Breakers

Sl. No.	Particulars	Make and Model	No. of trip/close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
A	**220kV System**						
1	C.B. 81 SIDCUL	CGL 200-SFM-40AA	02/01	Healthy	NA	NA	NA
2	C.B. 82 Chamba	CGL 200-SFM-40S	02/01	Healthy	NA	NA	NA
3	C.B. 83 IIP	CGL 200-SFM-50AA	02/01	Healthy	NA	NA	NA
4	CB 86 Dharashu-I	CGL 200-SFM-40S	02/01	Healthy	NA	NA	NA
5	CB 87 Dharashu II	CGL 200-SFM-40S	02/01	Healthy	NA	NA	NA
6	CB 85 Buscoupler	CGL 200-SFM-40S	02/01	Healthy	NA	NA	NA
7	CB 881 160 MVA T/F-1	CGL 200-SFM-40S	02/01	Healthy	NA	NA	NA
8	C.B. 884 160 MVA T/F-II	CGL 200-SFM-40S	02/01	Healthy	NA	NA	NA
B	**132kV System**						
1	C.B. 71 132KV Rksh-Laltapper	ABB LTB145	02/01	Healthy	NA	NA	NA
2	C.B. 72 132KV Rksh-Bindal	CGL 120 SFM-32B	02/01	Healthy	NA	NA	NA
3	C.B. 73 132KV Rksh-Jwalapur	CGL 120 SFM-32B	02/01	Healthy	NA	NA	NA
4	C.B. 76 132KV Rksh-Bhopatwala	CGL 120 SFM-32B	02/01	Healthy	NA	NA	NA
5	C.B. 77 132 KV Rksh-Srinagar	ABB LTB	02/01	Healthy	NA	NA	NA
6	C.B. 75 132 KV Bus-Coupler	CGL 120 SFM-32B	02/01	Healthy	NA	NA	NA

Sl. No.	Particulars	Make and Model	No. of trip/close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
7	C.B. 781 132KV 160 MVA T/F-I	NA	02/01	Healthy	NA	NA	NA
8	C.B. 782 132KV 40MVA T/F-1	CGL	02/01	Healthy	NA	NA	NA
9	C.B. 783 132 KV 40MVA T/F-2	CGL	02/01	Healthy	NA	NA	NA
10	CB784 132KV 160 MVA T/F-II	NA	02/01	Healthy	NA	NA	NA

Current Transformer

a	Location of CT	220 KV SIDCUL C.B. 81				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	PS	PS	0.2
d	Purpose	Main I Prot.	Main II Prot.	Bus Bar	Bus Bar	Metering
e	Test Results					
i	Ratio Adopted	800/1	800/1	1600/800/1	1600/800/1	800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV Chamba C.B. 82				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Bus bar	Bus Bar
e	Test Results					
i	Ratio Adopted	800/1	800/1	800/1	1600/800/1	1600/800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV IIP C.B. 83				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Bus bar	Bus Bar
e	Test Results					
i	Ratio Adopted	800/1	800/1	800/1	1600/800/1	1600/800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV Dharashu I C.B. 86				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Bus bar	Bus Bar
e	Test Results					
i	Ratio Adopted	800/1	800/1	800/1	1600/800/1	1600/800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV Dharashu II C.B. 87				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Bus bar	Bus Bar
e	Test Results					
i	Ratio Adopted	800/1	800/1	800/1	1600/800/1	1600/800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV CB 881 (160 MVA T/F-1)				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	PS	PS	0.5
d	Purpose	Main I Prot.	Main II Prot.	Bus bar	Bus Bar	Metering
e	Test Results					
i	Ratio Adopted	500/1	500/1	1600/800/1	1600/800/1	500/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV CB 884 (160 MVA T/F-2)				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	PS	PS	0.5
d	Purpose	Main I Prot.	Main II Prot.	Bus bar	Bus Bar	Metering
e	Test Results					
i	Ratio Adopted	500/1	500/1	1600/800/1	1600/800/1	500/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	132 KV C.B. 71 Rishikesh-Majra				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	400/1	400/1	400/1	400/1	400/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**132 KV C.B. 72 Rishikesh-Bindal**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	400/1	400/1	400/1	400/1	400/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**132 KV C.B. 73 Rishikesh-Jwalapur**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	800/1	800/1	400/1	1600/800/1	1600/800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**132 KV C.B. 76 Rishikesh-Bhopatwala**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	800/1	800/1	400/1	1600/800/1	1600/800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**132 KV C.B. 77 Rishikesh-Srinagar**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	Main II Prot.	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	400/1	400/1	400/1	400/1	400/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	CB 781 160 MVA T/F-1 L.V.				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	O/C & E/F	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	800/1	800/1	800/1	800/1	800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	C.B. 784 160 MVA T/F-II L.V.				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	O/C & E/F	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	800/1	800/1	800/1	800/1	800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	C.B. 782 40 MVA T/F-I				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	O/C & E/F.	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	800/1	800/1	400/1	1600/800/1	1600/800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	C.B. 783 40 MVA T/F-II				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Main I Prot.	O/C & E/F	Metering	Not used	Not used
e	Test Results					
i	Ratio Adopted	800/1	800/1	400/1	1600/800/1	1600/800/1

Capacitive Voltage Transformer/Potential Transformer

a	**Location of CVT/PT**	**C.B. 81**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	Main II	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110 V	220 KV/110 V	220 KV/110 V
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**C.B. 82**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	Main II	Metering
e	Test Results			
I	Ratio Adopted	220 KV/110 V	220 KV/110 V	220 KV/110 V
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**C.B. 83**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	Main II	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110 V	220 KV/110 V	220 KV/110 V
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**C.B. 86**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	Main II	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110 V	220 KV/110 V	220 KV/110 V
ii	Ratio measured	NA	NA	NA

a	Location of CVT/PT	C.B. 87		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	Main II	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110 V	220 KV/110 V	220 KV/110 V
ii	Ratio measured	NA	NA	NA

a	Location of CVT/PT	220 KV Bus I CVT		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	NA	NA	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110 V	220 KV/110 V	220 KV/110 V
ii	Ratio measured	NA	NA	NA

a	Location of CVT/PT	220 KV Bus II CVT		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	NA	NA	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110 V	220 KV/110 V	220 KV/110 V
ii	Ratio measured	NA	NA	NA

a	Location of CVT/PT	C.B. 71 Rishikesh-Laltapper		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	O/C &E/F	Metering
e	Test Results			
i	Ratio Adopted	132 KV/110 V	132 KV/110 V	132 KV/110 V
ii	Ratio measured	NA	NA	NA

a	Location of CVT/PT	C.B. 72 Rishikesh-Bindal		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	O/C &E/F	Metering
e	Test Results			
i	Ratio Adopted	132 KV/110 V	132 KV/110 V	132 KV/110 V
ii	Ratio measured	NA	NA	NA

a	Location of CVT/PT	C.B. 73 Rishikesh-Jwalapur		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	O/C &E/F	Metering
e	Test Results			
i	Ratio Adopted	132 KV/110 V	132 KV/110 V	132 KV/110 V
ii	Ratio measured	NA	NA	NA

a	Location of CVT/PT	C.B. 76 Rishikesh-Bhopatwala		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	O/C &E/F	Metering
e	Test Results			
I	Ratio Adopted	132 KV/110 V	132 KV/110 V	132 KV/110 V
ii	Ratio measured	NA	NA	NA

a	Location of CVT/PT	C.B. 77 Rishikesh-Srinagar		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	Main I	O/C &E/F	Metering
e	Test Results			
i	Ratio Adopted	132 KV/110 V	132 KV/110 V	132 KV/110 V
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**132 KV Bus CVT**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	PS	PS	0.2
d	Purpose	NA	NA	Metering
e	Test Results			
I	Ratio Adopted	132 KV/110 V	132 KV/110 V	132 KV/110 V
ii	Ratio measured	NA	NA	NA

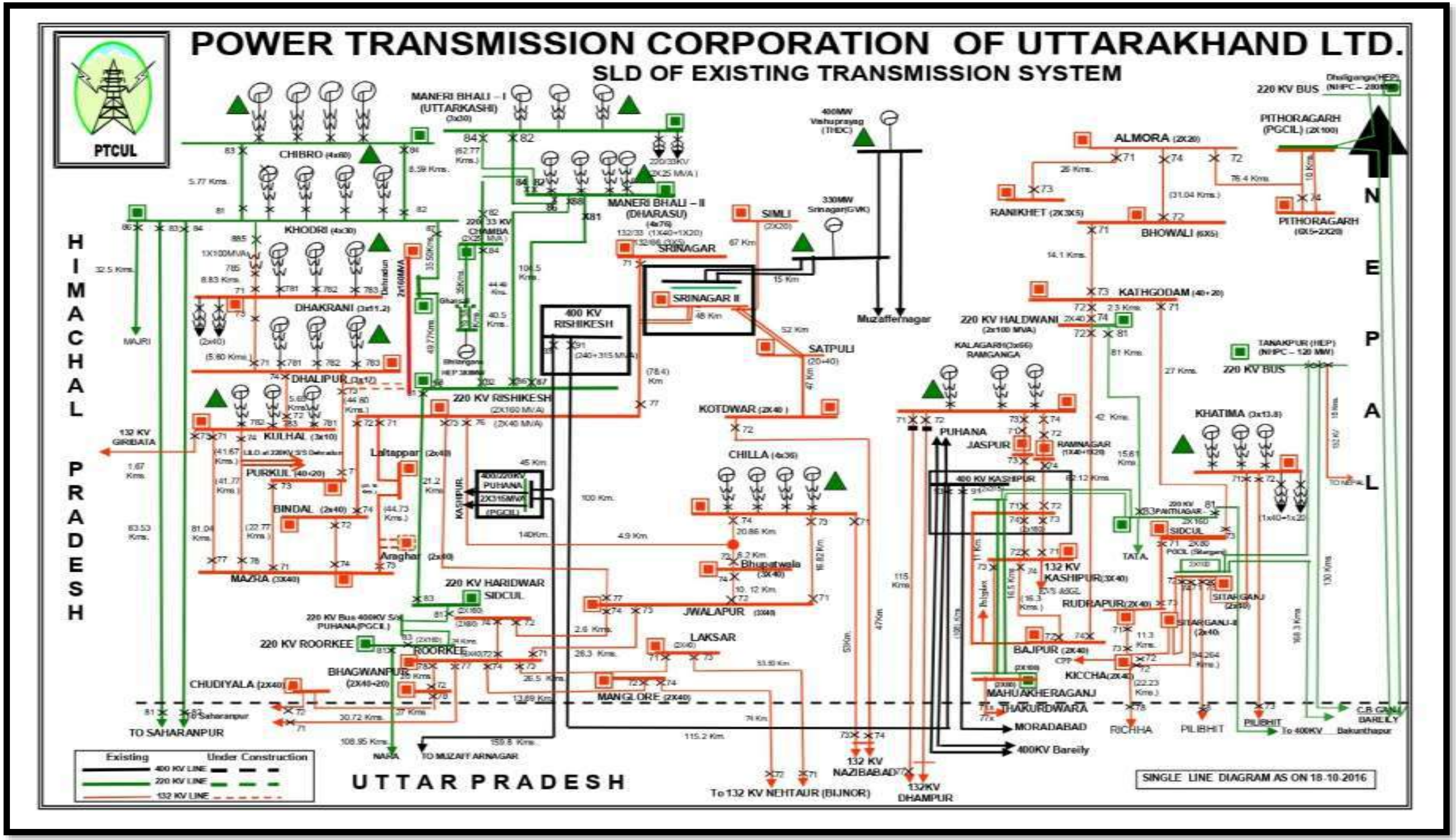
Transformer Protection

Particulars	TF-1	TF-2	TF-3	TF-4
Name of ICT	160 MVA 220/132KV	160 MVA 220/132KV	40 MVA 132/33KV	40 MVA 132/33 KV
Make	BHEL	CGL	ALSTOM	EMCO
Connected to dedicated CT core (HV Bay)				
Core-1	Diff. Prot.	Diff. Prot.	Diff. Prot.	Diff. Prot.
Core-2	O/C &E/F	O/C &E/F	O/C &E/F	O/C &E/F
Core-3	Bus bar	Bus bar	Metering	Metering
Core-4	Bus bar	Bus bar	Not used	Not used
Core-5	Metering	Metering	Not used	Not used
CT ratio	500/800/1	500/800/1	1600/800/1 800/400/1 Met	1600/800/1 800/400/1 Met
Connected to dedicated Bus CVT core (HV Bay)				
Core-1	PS	PS	PS	PS
Core-2	PS	PS	PS	PS
Core-3	0.2	0.2	0.2	0.2
CVT ratio	220KV/110V	220KV/110V	132KV/110V	132KV/110V
Relay connected to Trip Coil-1 or 2 or both (HV)	Both	Both	Both	Both

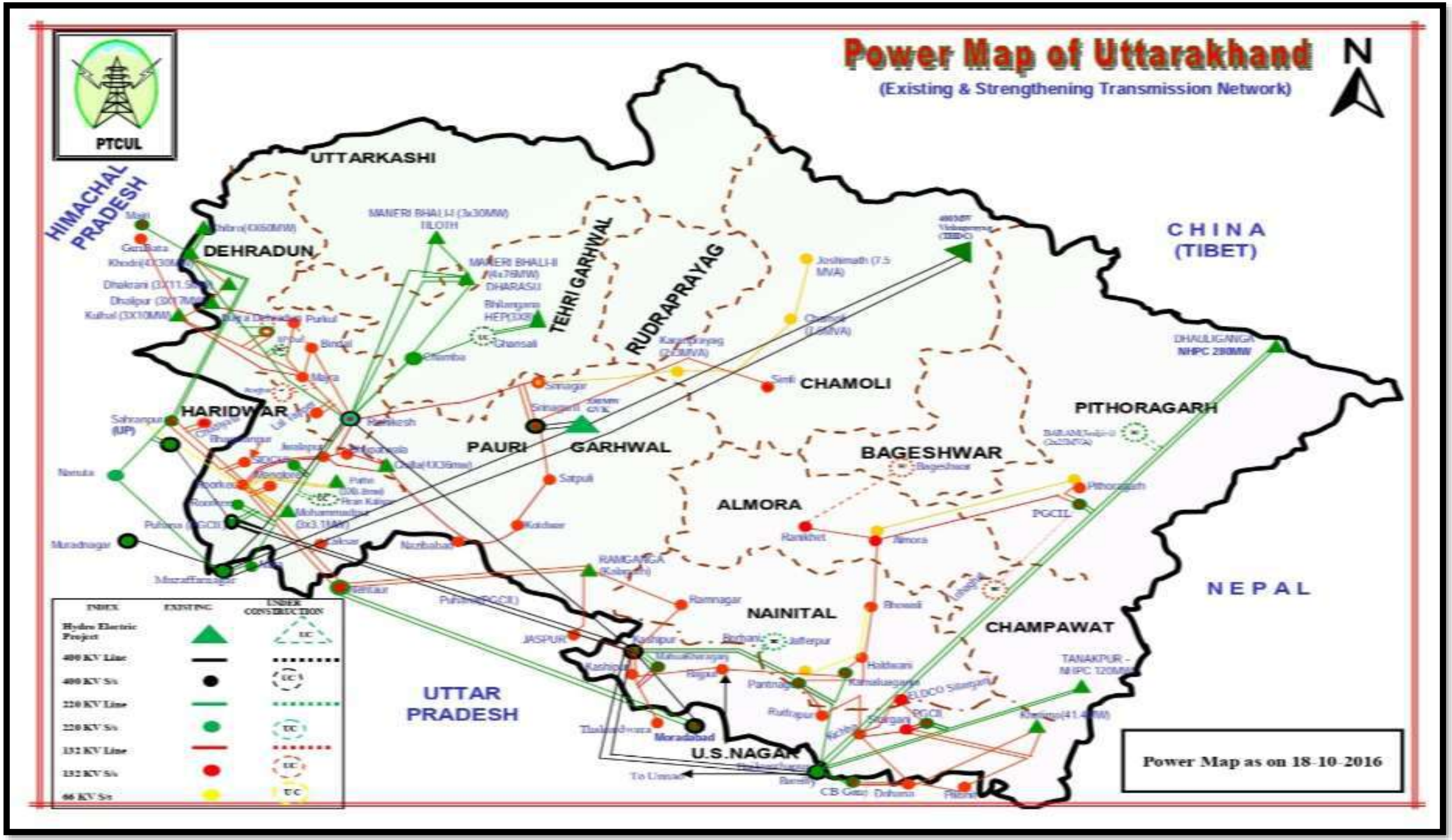
Particulars	TF-1	TF-2	TF-3	TF-4
Feed from DC supply-1 or 2(LV)	Both	Both	Both	Both
Connected to dedicated CT core (LV Bay)				
Core-1	Diff. Prot.	Diff. Prot.	Diff. Prot.	Diff. Prot.
Core-2	O/C & E/F	O/C & E/F	O/C & E/F	O/C & E/F
Core-3	Metering	Metering	Metering	Metering
Core-4	Bus Bar	Bus Bar	Not used	Not used
Core-5	Bus Bar	Bus Bar	Not used	Not used
CT ratio	1600/800/1	1600/800/1	1600/800/1	1600/800/1
Connected to dedicated Bus CVT core (LV Bay)				
Core-1	PS	PS	PS	PS
Core-2	PS	PS	PS	PS
Core-3	0.2	0.2	0.2	0.2
CVT ratio	220KV/110V	220KV/110V	132KV/110V	132KV/110V
Relay connected to Trip Coil-1 or 2 or both (HV)	Both	Both	Both	Both
Feed from DC supply-1 or 2(LV)	Both	Both	Both	Both
LA Rating/ HV Side	NA	NA	NA	NA
LA Rating/ LV Side	NA	NA	NA	NA

Particulars		TF-1	TF-2	TF-3	TF-4
Date of last testing of Protection		02-11-2023	27-10-2023	02-11-2023	02-11-2023
Group A Protection					
1	Differential Protection (Make & Model)	Micom P633	Gee Multilin T-60	Schneider P643	Schneider P643
2	PRV	OK	OK	OK	OK
3	WTI Indication working	OK	OK	OK	OK
4	Back-up Over Current Protection HV (Make & Model)	Micom P141	Schneider P143	Schneider P143	Schneider P143
5	Over Flux Protection (Make & Model) HV	Feature used in Differential Relay	Feature used in Differential Relay	Feature used in Differential Relay	Feature used in Differential Relay
Group B Protection					
1	REF Protection (Make & Model)	E.E. CAG14AF12A	E.E. CAG14AF12A	NA	NA
2	Bucholtz	OK	OK	OK	OK
3	Back-up Over Current Protection LV (Make & Model)	Micom P141	Schneider P143	Schneider P143	Schneider P143
4	Over Flux Protection (Make & Model) LV	NA	NA	NA	NA
5	OTI Indication working	Ok	Ok	Ok	Ok

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

220/33KV Chamba Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल

CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 220/33 KV CHAMBA SUBSTATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee
PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System

SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

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1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400kV and 8 nos. 220kV sub-stations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan, Mr. Shivam Gupta & Mr. Avichal Pandey visited 220/33KV Chamba Substation during 20th – 21st February 2024 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220KV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on “Draft O&M Manual” of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Point 5.4. It is recommended that the necessary testing equipment at substation/Sub-division/Division be arranged for regular testing of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru’ third party for implementing the best practices in the sub-station. In addition, the existing draft O&M manual also be updated to take care of latest developments.

Observations and Recommendations for 220/33KV Chamba Substation

1. The protection audit of sub-station is carried out for first time.
2. It is suggested that possibility of 220KV Bus-bar protection be examined by PTCUL.
3. The station is directly connected to 24 MW BHP and 304 MW Dhrashu Hydro Plant at 220KV level and distributed solar plant on 33KV side. It is recommended that whenever new solar plant is added on 33KV side of UPCL system, relay settings be co-ordinated with UPCL.
4. Some analogue and digital signal are not appearing in the SAS. It is recommended that SAS system be updated.
5. The slave display clock in the control room be rectified.
6. The SAS GUI time is not synchronised and displays time different from GPS. It is suggested to take necessary remedial measures for the same.
7. The sub-station is very old and availability of land is a constraint. The operation of transformer thru Auxiliary bus and switching thru TBC creates operation and maintenance constraints. It is suggested that PTCUL get the studies carried out for connecting both transformer on separate auxiliary buses and thru TBC for the purpose of reliability and ease of maintenance.
8. Some of the switchyard equipments need replacement due to obsolesce. It is recommended to expedite the same after due testing and study/recommendations.
9. Second station transformer for auxiliary supply is being planned. It is recommended to expedite the installation of 2nd auxiliary source.

10. The 110V DC system is designed for single source. 2 nos. of 110V DC systems are provided. IT is suggested that PTCUL examines the possibility of dual source DC supply to protection system.
11. Single 48V DC system is provided and chargers are not operating satisfactorily. It is recommended to take corrective actions in this regard.

2.0. Introduction

2.1. Background

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400 kV and 08 Nos. 220 kV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following sub-stations is to be carried out:

1. *400kV Rishikesh*
2. *400kV Kashipur*
3. *220kV Chamba*
4. *220kV Rishikesh*
5. *220kV Roorkee*
6. *220kV Haridwar (SIDCUL)*
7. *220kV Jhajra*
8. *220kV Pantnagar*
9. *220kV Haldwani*
10. *220kV Mahuakheraganj*

2.2. Scope of Work

Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. *Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.*
b. *Availability/healthiness of PLCC communication links used for protection systems.*
c. *Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.*
d. *Availability/healthiness of GPS system and time synchronization facility used for protection.*
e. *Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.*
f. *Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.*
g. *Field inspection of protection device for obsolescence of technology, suitability and healthiness.*
h. *Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.*
i. *Checking of availability of DG Set / auxiliary DC supply at substations.*

2.3. Audit Rationale

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipments under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) "All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC".
c. As per Para – 15 (4) of said Code, "The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC".
d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per IEGC-2023 Annexure-1.

2.4. Audit Process

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each sub-station, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

Sl. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-connecting Transformer
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL.

- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**

  - The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
  - The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - All the major general deficiency shall be listed in detail along with remedial recommendations.
  - The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. About Power Transmission Corporation of Uttarakhand (PTCUL)

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.
The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. About Central Board of Irrigation & Power (CBIP)

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of 220/33 kV Chamba Substation

3.1. *General Information about Sub-station*

Sl. No.	Particulars	Details
1	**Substation Name**	220/33 kV Chamba Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	220/33 kV
4	**Short circuit current rating of all equipment (for all voltage level)**	220 kV = 40 kA/sec, 33 kV = 25 kA/sec
5	**Date of commissioning of the substation**	23rd September 1980
6	**Checking and validation date**	20th – 21st February 2024

3.2. *Audit Team*

Audit Team (CBIP):

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Shivam Gupta
- Mr. Avichal Pandey

PTCUL Representative:

- Er. Harsh Verma, Executive Engineer (T&C)
- Er. L.P Purohit, Executive Engineer (O&M)
- Er. Pankaj Kailkura, Assistant Engineer (T&C)
- Er. Vinod Purohit, Assistant Engineer (O&M)

3.3. Recommendation of last protection checking and validation

The Protection Audit of 220/33kV is done for the first time.

3.4. Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.
b. The record of different relay setting calculations is not available at the substation level.
c. All relays are numeric, therefore, as per internal protocol of utility relays are tested only at the time of commissioning/change in setting. Copy of test reports not available at sub-station level.

3.5. Disturbance Recorder availability for the last 6 tripping's

a. No separate DR/ EL is provided. The DR and EL data are taken from individual numerical relays and SAS.
b. The inputs from DR reports from numerical relays are available in the server and can be downloaded using LAN cable.
c. For each tripping data is sent to head office for records.
d. The Utility has shown data for last 6 trippings.

3.6. Chronic reason of tripping, if any

e. Based on list of tripping submitted by utility for last 7 months (April 2023 to October 2023), it is noticed that multiple tripping of 25 MVA transformer either alone or along with 50 MVA transformer have been noticed on HV/LV O/C +C/F protection, due to the fault in 33 kV feeders/Bus bars. The relay settings of Transformers, Feeders were reused and coordinated. Now no trippings were observed from November 2023 onwards.
f. The tripping timings of CBs was got tested from the third party. In case the 33 kV breakers operation time is high the necessary remedial measures may be planned.

3.7. Major non-conformity/deficiency observed

a. The SAS is working partially, some analog and digital signal are not appearing. SAS System requires updation and upgradation.
b. All the relays and SAS are time synchronised. However, the GUI for SAS is taking time display from Windows OS of individual PC therefore regular time updation of Windows OS server need to be done.
c. The display clock in the control room, which is slave of the GPS system is defective and showing time error of more than half hour.
d. No Bus bar protection has been provided.
e. 220 kV switchyard is provided with one Main Bus and one Transfer Bus. Both the transformers are connected to one 220 kV Auxiliary Bus. This Auxiliary Bus can be connected to either Main Bus or Transfer Bus through isolator. Therefore, if there is any fault in Auxiliary Bus. Both the transformers would bear idle. Also the TBC breaker cannot feed individual transformers.
f. Two 220 kV Circuit breakers (Dharashu and Rishikesh) are having pneumatic control and facing operational problems. Utility has done detail testing of all 220 Circuit Breakers through third party and reports are pending. Based on the report suitable action for replacement of Circuit Breakers may be taken.
g. 24 MW BHP and 304 MW Dhrashu Hydro Plant at 220 kV level. In addition, multiple distributed solar plant of more than 10 MW capacity are connected at different feeders of 33 kV site.
h. Currently auxiliary supply is provided by 250 kVA station Transformer and 15 kVA DG set is provided as back up. In order to provide reliability, the station Transformer can be fed from two sections of 33 kV Bus bar. Utility is planning to install second Station Transformer.
i. There are two Nos of 110 V DC auxiliary supply is provided and no earth fault is noticed.
j. Only one 48V DC system is provided along with two set of chargers but both chargers are not working satisfactorily.
k. The whole system is designed for single DC source; therefore, DC supply to different Relays /Buses/SAS is distributed among both DCDBS on single source basis.

4.0. List of Trippings

Name of Feeder/TF	CB No.	Type of Relay /	Date Time of Tripping	Date& Time of closing	flags observed	Other end flag	affected generation/	Tripping Analysis / Action taken report	Category Code	Action Taken
25 MVA T/F (220/33 KV)	882/382	Argus	30-03-2023 18:30 hrs	30-03-2023 18:53 hrs	C.P. : H.V. & L.V. O/C & E/F Prot. Operated R.P.: H.C O/C & E/F Prot. Optd. Ia=6.13xIn Ib= 5.68xIn Ic= 0.31xIn Ie= 5.15xIn Tripping relay 86	NA	Nil	33KV Thatur feeder "R phase" C.T. Blast on feeder fault thatur feeder triped on O/C & E/F prot.	SICT	33 KV Thatur feeder R phase C.T. Replacement & Testing work in progress
50 MVA T/F (220/33 KV)	881/381	Micom P143	30-03-2023 18:30 hrs	30-03-2023 18:51 hrs	C.P : L.V. O/C & E/F prot. Optd. R.P.: Active group 1, start phase ABN, trip phase AN , O/C trip ,E/F trip Ia=5.43 Kamp Ib=313 A Ic= 130 A In=5.62 Kamp	NA	Nil	33KV Thatur feeder "R phase" C.T. Blast on feeder fault thatur feeder triped on O/C & E/F prot.	SICT	33 KV Thatur feeder R phase C.T. Replacement & Testing work in progress
25 MVA T/F (220/33 KV)	882/382	Argus	19-04-2023 20:51 hrs	19-04-2023 21:15 hrs	C.P. : H.V. /L.V. O/C & E/F prot. Operated R.P. :O/C & E/f protection operated, tripping relay 86	NA	Nil	Transformer trip with heavy jerk tripping on 33 KV NTT-2 feeder	LEFT	NA
50 MVA T/F (220/33 KV)	881/381	Argus	21-04-2023 03:56 hrs	21-04-2023 04:24 hrs	C.P.: O/C E/F protection operated R.P.: H.V./L.V. Over current & earth fault protection operated, tripping relay 86	Nil	nil	Tranformer trip with heavy zerk tripping on NTT2 feeder	LEFT	33 KV NTT2 feeder C.B. Take time to clear fault, feeder tripping circuit time & C.B. Operation's check
25 MVA	882/382	Micom	21-04-2023	21-04-2023 04:23 hrs	C.P. : L.V. O/C & E/F prot.optd.	Nil	nil	Tranformer trip with	LEFT	NA

Name of Feeder/TF	CB No.	Type of Relay /	Date Time of Tripping	Date& Time of closing	flags observed	Other end flag	affected generation/	Tripping Analysis / Action taken report	Category Code	Action Taken
T/F (220/33 KV)			03:56 hrs		R.P.: Active group 1, stat phase A,B, trip phase ABC , O/C Trip, E/F trip Ia=5.08 Ka Ib=5.04Ka Ic=96 A			heavy zerk tripping on NTT2 feeder		
50 MVA 220/33 kv T/F	881/381	Micom	03.05.23 15:38 hrs	03.05.23 16:11 hrs	C.P.: L.V. O/C & E/F Protection operated R.P.: Active group 1, start phase BC , Trip phase ABC, O/C start, O/C I>> Trip, Ia=216A Ib=5.77kA Ic= 5.54 Kamp	nil	nil	Due to blast in UPCL Metering cubical at 33 kv switch yard while given try to 33 kv B.P. I feeder	NA	NA
25 MVA 220/33 kv T/F	881/381	Easun	03.05.23 15:38 hrs	03.05.23 16:10 hrs	C.P.:H.V./L.V. O/C Protection operated R.P.: Ia=1.90* In Ib=6.22*In Ic=5.90*In	nil	nil		NA	NA
220 KV RKSH-Dharashu-1	82	Siemens 7SA 612	23-05-2023 17:33 hrs	23-05-2023 17:57 hrs	C.P. : Main1 .Main 2 prot. Operated R.P. : Dis pick up L2,L3, definite trip, zone -1 trip , IL1-0.23 Ka IL2=3.72Ka IL3=3.74 ka Distanse=11.00 km tripping relay 86	Dis pick up L2,L3, fault location=26.50 km	NA	Transient Line Fault	Phase-Earth fault	Line patroling required inform to concern line person
220 KV BHP-Ghuttu	81	Micom & GEE	23-05-2023 17:35 hrs	23-05-2023 18:19 hrs	start phae B-N, trip phase ABC, distanse trip zone-2, fault location=46.59km Ia=275 A Ib=158 A Ic=2.49 ka Van=134 Kv Vbn=133.9Kv Vcn=40.28kv	27 MW 17:30 hrs BHP P/H generation affected	Bad Weather heavy storm & rain	Phase-Earth fault	Line patroling required inform to concern line person	NA
220 KV B.H.P. Ghutu line	81	Micom & GEE	29-05-2023 15:10 hrs	29-05-2023 15:29 hrs	Active group-1, start phase A-N, trip phase ABC, Ia=2.91 Kap Ib=10 A Ic=5 A tripping relay 86	active group 1, start phase A-N ,trip phase ABC, distanse trip zone-1 , fault	27.3 MW BHP P/H generation affected	NA	NA	NA

Name of Feeder/TF	CB No.	Type of Relay /	Date Time of Tripping	Date& Time of closing	flags observed	Other end flag	affected generation/	Tripping Analysis / Action taken report	Category Code	Action Taken
						location= 18.6 km Ia= 260 Amp tripping relay 86				
220 kv Dharashu	81	MICOM	08-06-2023 14:23 hrs	S/D	Active group 1, start phase B-N distance trip zone 1 IA = 19A, IB = 1.39KA, IC = 21 A Van = 123kv , Vbn = 109kv , Icn = 129.6 kv Fault Location= 37.96 Km Tripping relay 86	Dir. o/c & E/F prot. optd up	24 mw bhp p/h	Transient Line Fault	LEFT	line petroling by concern line person
220 kv Dharashu	81	MICOM	08-06-2023 14:36 hrs	08-06-2023 18:10 hrs	,active grpoup 1, start phase B-N SOTF trip , IA= 18A, IB= 1.25KA , IC=21A , Van = 122.6kv Vbn = 112kv, Vcn = 129kv Tripping relay 86	NA	NA			
220 kv Dharashu	82	Siemens	13-06-2023 10:41 hrs	13-06-2023 14:24 hrs	O/C pick up L1-E, Dir. E/F pick up , E/F trip , fault loop L1-E, IL1= 2.26 Ka, IL2= 0.01 Ka IL3=0.01Ka Fault Location= 37.9 Km Tripping relay 863A, 863B	Dir. E/F Prot. Operated	NA	L.A burst Dharasu end	LEFT	L. A change by concern person
25 MVA T/F 220/33 KV	882/382	Argus	08-09-2023 02:10 hrs	08-09-2023 02:36 hrs	C.P. : H.V. /L.V. O/C & E/F prot. Operated R.P. : O/C prot. Operated IA=6.15xIn IB=6.17xIn IC= 6.03xIn Ie= 0.22 x In tripping relay 86, inter trip relay 86 operated	NA	load at 0.2:00 hrs 12.8 amp	33 KV B.P.1 feeder UPCL metering cubical 33 KV P.T. Blast at 33 KV Switch yard T/F trip along with 33 KV B.P. I feeder	LEFT	33 KV B.P. Feeder under shut down for testing & cubical replacement work by UPCL
220 KV Dharashu	82	Siemens	19-09-2022 14:27 hrs	19-09-2022 19:19 hrs	O/C pick up L3-E, Dir. E/F pick up, E/F trip , fault loop L3-E,	Dir. E/F Prot. Operated		Due to land slide tree comes in	phase-Earth fault	Fault remove by concer

Name of Feeder/TF	CB No.	Type of Relay /	Date Time of Tripping	Date& Time of closing	flags observed	Other end flag	affected generation/	Tripping Analysis / Action taken report	Category Code	Action Taken
					IL1= 0.01 Ka IL2= 0.01Ka IL3=0.90Ka fault Loc= 41.40 km tripping relay 863			Line Range create fault		n Line persons
50 MVA T/F 220/33KV C.B. 381 (33KV)	881/381	Micom P143	08-09-2023 02:10 hrs	08-09-2023 02:38 hrs	C.P. : L.V. O/C & E/F prot. Operated R.P.: Active group 1, start phase ABC, tripped phase BC , I>> trip , Ia=372A Ib=5.72Ka Ic=5.38Ka In=8A	NA	load at 0.2:00 hrs 25.4 amp	33 KV B.P.1 feeder UPCL metering cubical 33 KV P.T. Blast at 33 KV Switch yard T/F trip along with 33 KV B.P. I feeder	LEFT	33 KV B.P. Feeder under shut down for testing & cubical replacement work by UPCL
25 MVA T/F 220/33 KV C.B.882 /382	882/382	Argus	10-09-2023 14:18 hrs	10-09-2023 14:31 hrs	C.P. : H.V /L.V O/C & E/F protection operated R.P.: O/C & E/F Protection operated IA= 5.99 x In IB= 6.05 x In IC=5.97 x In Ie= 1.22 x In tripping relay 86 , inter trip relay 86	NA	NA			
25 MVA T/F 220/33 KV	882/382	Argus	11-09-2023 13:26 hrs	11-09-2023 13:40 hrs	C.P.: H.V /L.V O/C & E/F protection operated R.P.: O/C & E/F Protection operated IA= 5.70 x In IB= 6.04 x In IC=5.37 x In Ie= 0.99 x In tripping relay 86 , inter trip relay 86	NA	NA	33 KV B.P. II UPCL metering cubical blast at 33 switch yard at 220 KV S/S transformer trip along with B.P. II feeder	LEFT	metering cubical replacement work by UPCL
220 KV Dharashu	82	Siemens	19-09-2022 14:27 hrs	19-09-2022 19:19 hrs	O/C pick up L3-E, Dir. E/F pick up , E/F trip , fault loop L3-E, IL1= 0.01 Ka IL2= 0.01Ka IL3=0.90Ka fault Loc= 41.40 km tripping relay 863	Dir. E/F Prot. Operated	NA	Due to land slide tree comes in Line Range create fault	phase-Earth fault	Fault remove by concern Line persons
50 MVA T/F	881/381	Micom P143	11-09-2023 13:26 hrs	11-09-2023 13:40 hrs	C.P.: L.V E/F protection operated R.P.: O/C & E/F	NA	NA	NA	LEFT	NA

Name of Feeder/TF	CB No.	Type of Relay /	Date Time of Tripping	Date& Time of closing	flags observed	Other end flag	affected generation/	Tripping Analysis / Action taken report	Category Code	Action Taken
220/33 KV					Protection operated IA= 4.8ka, IB= 1.715ka, IC=6.19ka Ie= 4.217ka tripping relay 86 , inter trip relay 86					
220 KV BHP Ghutu	81	Micom P442 GEE Multilin	15-09-2023 04:53 hrs	15-09-2023 05:14 hrs	C.P.: DPT R.P.: Active group-1 , distanse trip, Ia-3.3 Ka Ib= 317 A Ic= 208 A Van=70.26 KV Vbn=136 KV Vcn=132 KV tripping relay 86	NA	NA	Transient line fault bed weather rain & lightning		line patrolling required inform to concern line person's
25 MVA T/F 220/33 KV C.B.882 /382	Argus		15-10-2023 20:45 hrs	15-10-2023 21:17 hrs	C.P. : H.V O/C protection operated LV. O/C protection operated R.P:- Ia-862.9A, Ib-14.31A, Ic-25.32A Foult duration -281.0 ms, C.B operate time -45.0ms, Relay trip time -321.0ms, Vac-215.5KV. Vbc-230.3KV, Vca-209.7KV, In-1450A,Van-107.2KV, Vbn-136.6KV, Vcn-134.5 KV. A= 5.70 x In IB= 6.04 x In . IC=5.37 x In Ie= 0.99 x In tripping relay 86 , inter trip relay 86	NA	NA	Due to Monkey came in range of 33 KV Bus side.	NA	NA
50 MVA T/F 220/33 KV C.B.381	Micom P143		15-10-2023 20:45 hrs	15-10-2023 21:21 hrs	C.P.: HV. DIR O/C & E/F Protection Operated, DIR O/C & E/F Protection Operated R.P. Ia-8.67xIn, Ib-0.43XIn, Ic-0.43xIn, E/F Ie-5.75xIn	NA	NA	Due to Monkey came in range of 33 KV Bus side.	NA	NA

Name of Feeder/TF	CB No.	Type of Relay / Date Time of Tripping	Date& Time of closing	flags observed	Other end flag	affected generation/	Tripping Analysis / Action taken report	Category Code	Action Taken
C.B. 882/382	Argus	17-10-2023 16:23 hrs	17-10-2023 16:10 hrs	C.P. : O/C & E/F Prot. Operated R.P. : I>>trip , Ia= 5.80 x In Ib=5.95xIn Ic= 5.80xIn , Ie= 1.68 x In Tripping relay 86 , Inter trip relay 86IT		NA			
82 Dharashu (38.00 km)	Siemens siprotec 7SA612 7SA52	27-04-2024 19:16 hrs	27-04-2024 23:40 hrs	C.P. : main 1 , main 2 prot. Operated R.P. : Gen trip , R phase Pick up , zone-1 trip, fault location=0.50 km IL1=4.00 Ka IL2=0.21 Ka IL3=0.31 Ka tripping relay 86	Dis. Pick up L1-e, Dis trip 3p on, Def. Trip one , zone-2 trip , fault location=38.00km	NA	NA	NA	NA
50 MVA T/F (220/33 KV) 881/381	Schneider P143	16-05-2024 12:52 hrs	16-05-2024 13:16 hrs	C.P. : O/C & E/F Prot. Operated <u>H.V. Relay :</u> active group-1, start phase C-N , trip phase ABC, O/C I>>trip, E/F In>> trip, IA=63A IB=35A IC=889A IN=940 A <u>L.V. Relay :</u> active group-1, start phase C-N , trip phase ABC, O/C I>>trip, E/F In>> trip, Ia=484 A Ib=229 A IC=5.93KA IN=6.41 KA	NA	NA	NA	NA	NA
82 220KV Chamba - Dharashu Line	Siemens 7SA52 & Siemens 7SA612	20-05-2024 16:51 hrs	20-05-2024 17:11 hrs	O/C pick up on, O/C trip I>1, IL1=0.32 Ka IL2=0.30 Ka IL3=1.15 Ka tripping relay 86	No tripping at Dharshu P/H	Line trip on B phase O/C cascadding effect of Chamba	NA	NA	Reviewing Chamba-Dharashu line settings

Name of Feeder/TF	CB No.	Type of Relay /	Date Time of Tripping	Date& Time of closing	flags observed	Other end flag	affected generation/	Tripping Analysis / Action taken report	Category Code	Action Taken
							- BHP line high resistanse fault			

5.0. Observations and Recommendations

5.1. Reporting of all the Tripping with DR/EL

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System "http://103.7.128.184/Account/Login.aspx" within 24 hours of the events. These are being submitted by sub-station to NRLDC portal, however the record of the same is not kept at substation level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	
37	SLDC-RS	130	12	9	23	11	19	23	9	15	33	0	30	DR, EL & Tripping report need to be submitted
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
	Total in NR Region	520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at sub-stations

c. It is recommended that each sub-station to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. Development of centralized database of relay settings

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 kV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220kV are to be calculated by SLDC and/or central level. The relays are tested by sub-station officials as per need basis, but the record of recommended

settings/ calculation is not kept at sub-station level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220kV & above and by SLDC below 220kV along with setting calculations & parameters used for all the relays be kept at sub-station level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. Review of test results of relay and equipment

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".

b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.

c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. Availability of Testing Kits

a. The availability of testing equipment is limited at each substation. For comprehensive testing of equipment, as per above para, sufficient testing kits at each substation/Sub-division/ Division level are required.

b. Based on the O&M manual, it is recommended that sufficient quantity of testing instruments be made available at sites for regular testing of equipment. A suggested list of Testing Equipment is attached at Annexure – 1.

5.5. Up-dation of PTCUL Protection Philosophy

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. Simulation based study of protection system

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. Capacity Building of protection team

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. Updated Fault Level/ Short Circuit Level and Network information

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. General Protection related observations

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. O&M Manual

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. The station is directly connected to 24 MW BHP and 304 MW Dhrashu Hydro Plant at 220 kV level. In addition, PTCUL officials estimated that multiple distributed solar plant of more than 10 MW capacity are connected at different feeders of 33 kV site. Based on the tripping during April 2023 to October 2023, it is noticed that multiple tripping of 25 MVA transformer either alone or along with 50 MVA transformer have been noticed on HV/LV O/C +C/F protection, due to the fault on 33 kV feeders/Bus bars. PTCUL has revised and co-ordinated the relay settings of Transformers and no trippings were reported from November 2023 onwards. It is recommended that whenever new solar plant is added on 33kV side of UPCL system, relay settings be co-ordinated with UPCL.

b. No Bus-bar protection is provided. It is suggested that PTCUL may examine possibility of providing Bus-bar protection at 220kV level.

c. The SAS is working partially, some analogue and digital signal are not appearing. SAS System requires up-dation and upgradation.

d. The display clock in the control room, which is slave of the GPS system is defective and showing time error of more than half hour. This needs to be rectified/ replaced.

e. All the relays and SAS are time synchronised. However, the GUI for SAS is taking time display from Windows OS of individual PC therefore regular time up-dation of Windows OS server need to be done.

6.2. Equipment related observations and recommendations

a. The sub-station is very old and availability of land is a constraint. 220KV switchyard is provided with one Main Bus and one Transfer Bus. Both the transformers are connected to one 220KV Auxiliary Bus. This Auxiliary Bus can be connected to either Main Bus or Transfer Bus through isolator. The TBC breaker cannot feed individual transformers. This creates problem in maintenance of single transformer. Also, in case of fault in in Auxiliary Bus, both the transformers, and in turn the whole sub-station, would become idle. PTCUL may get the studies carried out for connecting both transformer on separate auxiliary buses and thru TBC for the purpose of reliability and ease of maintenance.

b. Two 220KV Circuit breakers (Dharashu and Rishikesh) are having pneumatic control and facing operational problems. PTCUL has done detail testing of all 220KV and 33KV Circuit Breakers through third party. The reports of some 33KV breakers have been received and operation time is high. For 220KV breakers reports are pending. Based on the report suitable action for replacement of Circuit Breakers may be taken.

c. PTCUL has submitted a list of switchyard equipments to be replaced under PSDF funding, as per Annexure - 2. In view of the need of modern sub-stations, where automation of substation is of paramount importance, these replacements are required. Based on the specifications and healthiness of existing equipments, the list may be reviewed by PTCUL.

d. In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of Maintenance Equipment is attached at Annexure – 3.

6.3. Auxiliary Equipment related observations and recommendations

a. Currently auxiliary supply is provided by 250KVA station Transformer and 15KVA DG set is provided as back up. In order to provide reliability, the station Transformer can be fed from two sections of 33KV Bus bar. Utility is planning to install second Station Transformer.

b. Only one 48V DC system is provided. Currently, no PLCC/ carrier aided tripping is provided, therefore, second 48V DC battery is not required. The existing bank is provided with two set of chargers but both chargers are not working satisfactorily. Necessary action for rectification needs to be taken.

c. The whole system is designed for single DC source; therefore, 110V DC supply to different Relays /Buses/SAS is distributed among both DCDBS on single source basis. Possibility of dual source DC for protection be examined by PTCUL.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

The suggested list of Substation Equipments keeping in mind the necessity for the modernization and upgradation of substations.

Sl. No.	Equipment	Unit	Quantity
A	**220 kV Equipment**		
1	245 kV Cicuit Breaker 3PH	Nos	3
2	245 kV. 1600A,40KA, (3 Phase) HDB Isolator with one E/s (Mettalic & Insulator)	Nos	3
3	245kV Current Transformer (150/75/1)	Nos	3
4	245kV Current Transformer (5 Core), Class 0.2 (1 ph) 800/400/1	Nos	3
5	245 kV CVT 1 Ph	Nos	3
6	216 kV Surge Arrestor 1Ph (Polymer)	Nos	3
B	**33 kV Equipment**		
1	33 kV Circuit Breaker	Nos	6
2	33 kV Isolator 3Ph with earth switch (800 Amp)	Nos	3
3	33 kV Isolator 3Ph without earth switch (800 Amp)	Nos	3
4	33 kV Current Transformer (3 Core), Class 0.2s (1ph) 800/400/1	Nos	3
5	33 kV Current Transformer (3 Core), Class 0.2s (1ph) 1000/500/1	Nos	3
6	33 kV Current Transformer (3 Core), Class 0.2s (1ph) 400/200/1	Nos	3
7	33 kV PT, 33 kV/110V,50 VA, Class-0.2s	Nos	3
8	33 kV Surge Arrestor 1 Ph (polymer)	Nos	9
9	Construction of 33 kV Jack Bus feeder	Set	1
10	CB Relay Panel with AR	Nos	1
11	Transformer Protection Panel (HV & LV Sides)	Nos	1

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
   a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
   b) to have a repository of protection system, settings and events at regional level;
   c) specifying timelines for submission of data;
   d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
   e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220KV and above (132KV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220KV and above (132KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220KV and above (132KV and above in NER) system, which shall be reviewed by the RPC:

   a. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

b. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

c. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

   a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.

   b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:

      i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.

      ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

   a. The protection system checklist shall contain information as per this Regulation.

      i. General Information (to be provided prior to the checking as well as to be included in final report):

         - Substation name
         - Name of Owner Utility
         - Voltage Level (s) or highest voltage level
         - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
         - Checking and validation date
         - Record of previous tripping's (in last one year) and details of protection operation
         - Previous Relay Test Reports
         - Overall single line diagram (SLD) (x) AC aux SLD
         - DC aux SLD
         - SAS architecture diagram
         - SPS scheme implemented (if any)

b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works &pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 trippings (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection;

- Name and Length of Line
- Whether series compensated or not
- Mode of communication used (PLCC/OPGW)

- Relay Make and Model for Main-I and Main-II
- List of all active protections & settings
- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays

- Other requirements for protection checking and validation

iv. AC auxiliary system;

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. DC auxiliary system;

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
    - Mode of communication for Main-1 and Main-2 protection
    - Mode of communication for data and speech communication
    - Status of PLCC channels
    - Time synchronization equipment details
    - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
    - Other requirements for protection checking and validation

vi. Circuit Breaker Details;

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
    - CT/CVT ID name and voltage level

- CT/CVT core connection details
- Accuracy Class
- Whether Protection/Metering
- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).
b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
c) All the major general deficiency shall be listed in detail along with remedial recommendations.
d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.
e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	220KV and above: Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme. 132KV and below: One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines) Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect. Time setting: i. 0.35 second *(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)* ii. 0.5-0.6 second *(For a long line followed by a short line)*

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series compensated double circuit lines may be kept

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		higher at 113%.
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220KV LINES: No over-voltage protection shall be used. FOR 220KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		done for multi circuit lines/cable.
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email: sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
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पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	**GST**	:	GST shall be paid extra as per applicable Government rules.
3	**Tax**	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	**Date of Start of work**	:	Order shall be considered as having come in to force from the date of issue of order.
5	**Supply Completion**	:	NA
6	**Work completion**	:	The work should be completed within 24 months from the date of issue of order.
7	**Engineer of the contract**		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	**Engineer in-charge**		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	**Liquidity damages**	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	**Dispute**		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	**Payment terms**	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	**Payement unit**		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	**Warranty period**	:	NA.
14	**Billing Address**	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
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पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause						Modified Clause					
		Sr. No	Description	Unit	Qty	Amount	Total Amount	Sr. No	Description	Unit	Qty	Unit rate (Rs.)	Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.						1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.				
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.						2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.				
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.						3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.				
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus						4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to				

2

S. No.	Clause of PO	Existing Clause	Modified Clause
		couplers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, etc.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g) Field inspection of protection device for obsolescence of technology, suitability and healthiness. h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit.	
		6. Review of availability/healthiness of PLCC communication links used for protection systems.	
		7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application.	
		8. Review of availability/healthiness of GPS system and time synchronization facility used for protection.	
		9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.	
		10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.	
		11. Field inspection of protection device for obsolescence of technology, suitability and healthiness.	
		12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.	
		13. Checking of availability of DG Set/auxiliary DC supply at substations.	
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

3

S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum**.
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

4

S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

5

Annexure – 8: Data Sheets

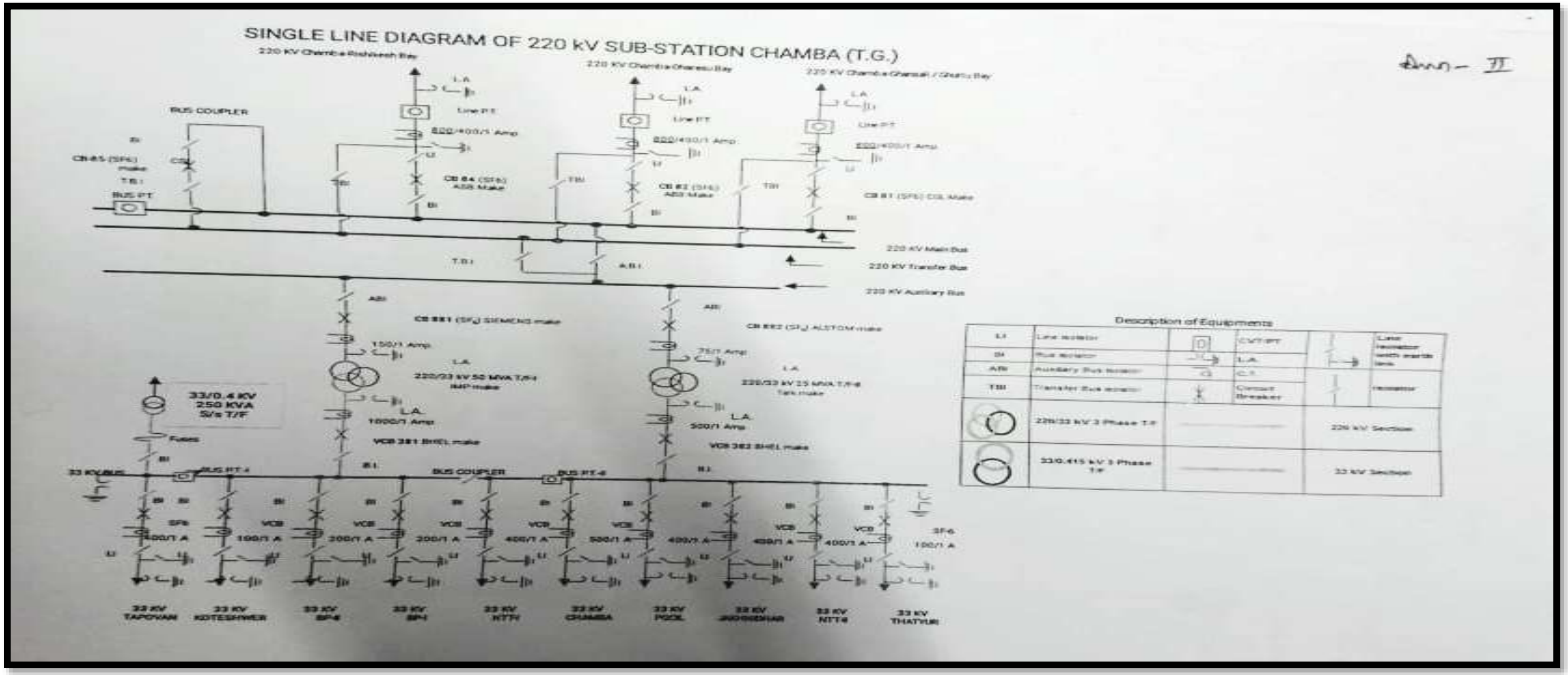
Contents

Annexure - 8

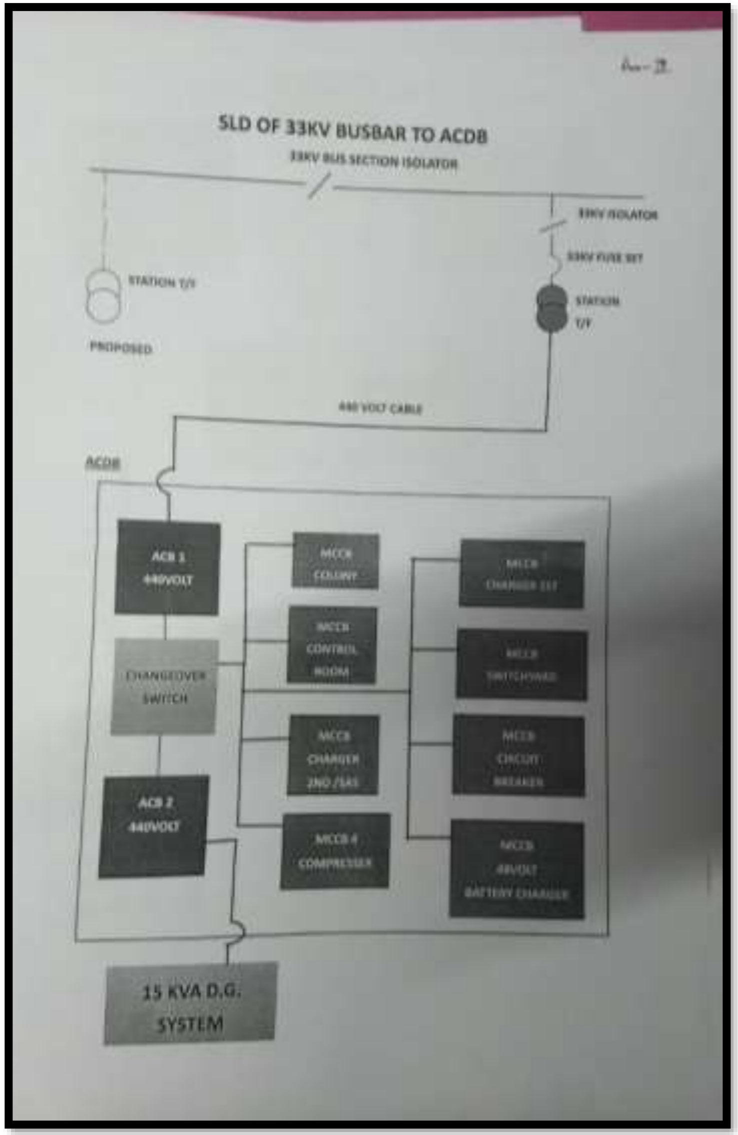
Data Sheets

Single Line Diagrams

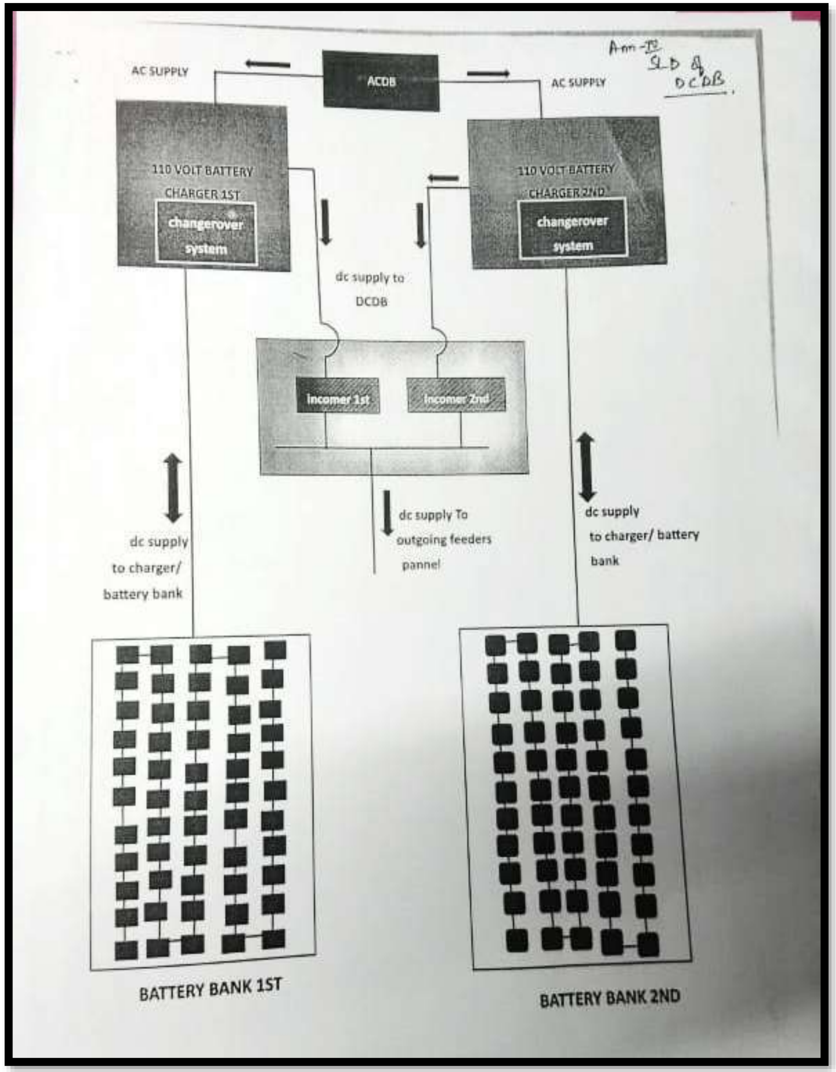
Substation Single Line Diagram



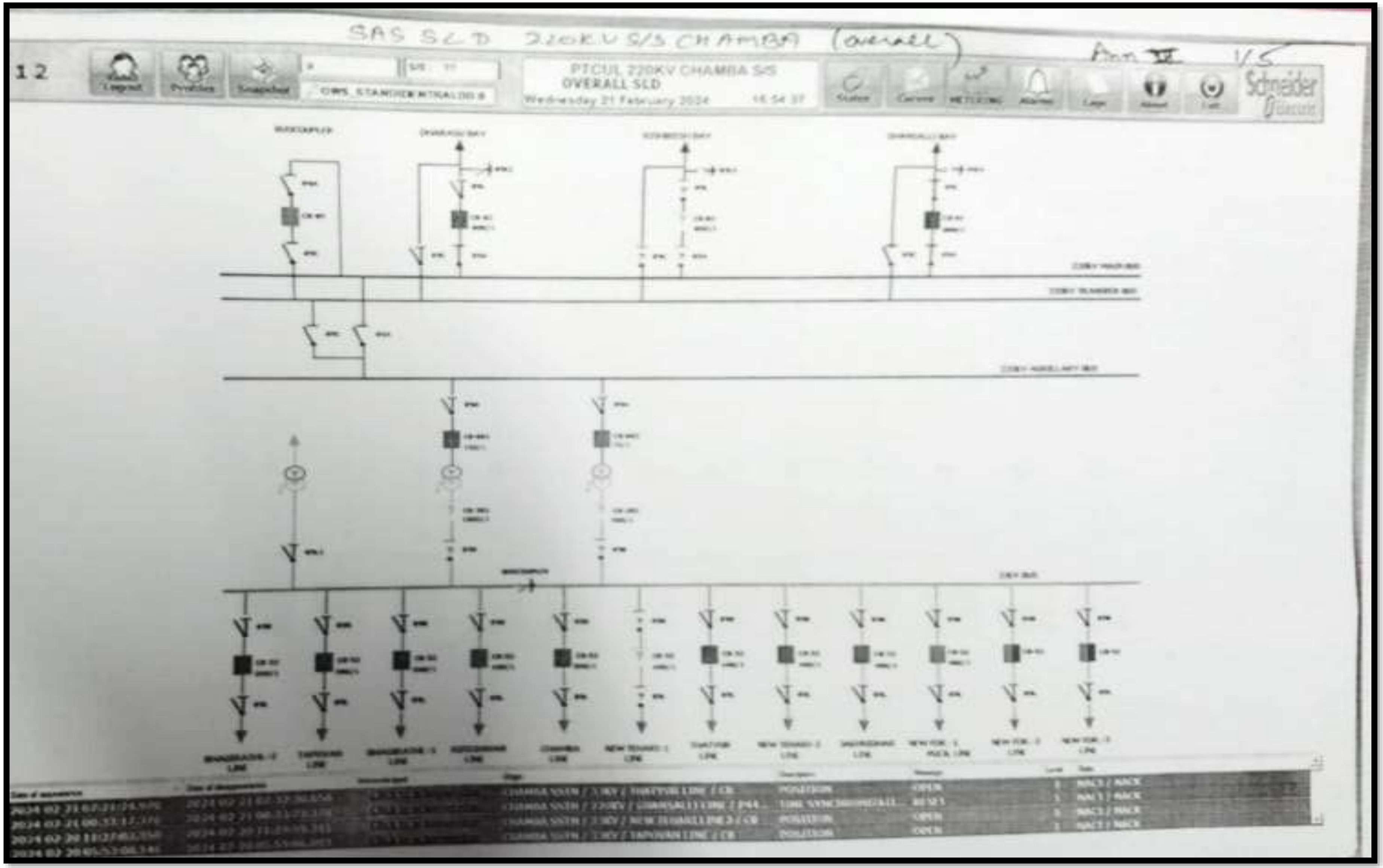
AC Auxiliary System



DC Auxiliary System



SAS Architecture diagram



Transmission Lines

220kV:

Particulars		Tr Line 1	Tr Line 2	Tr Line 3
Name of Tr Line		BHP	Dharashu	Rishikesh
Length of Line		55.00 km	37.90 km	40.00km
Series Compensated (Yes/No)		No	No	No
Connected to dedicated CT core (mention name)		Core1 –main 1 Core-2 main II	Core1 –main 1 Core-2 main II	Core1 –main 1 Core-2 Backup Dir. O/C & E/F
CT Ratio		800/1	800/1	800/1
Connected to dedicated PT core (mention name)		Core1-Main1 Core2-Main 2	Core1-Main1 Core2-Main 2	Core1-Main1 Core2-Backup
PT Ratio		220 KV /110V	220 KV /110V	220 KV /110V
Relay connected to Trip Coil-1 or 2 or both		Both	Both	Both
Feed from DC supply-1 or 2		Both	Both	Both
i	Main-I Protection (Make and Model)	Gee Multilin D-60	Siemens 7SA52	Micom P44
	Functional (Yes/No)	Yes	Yes	Yes
	Date of testing	08/02/2023	19/10/2023	30/10/2023

Particulars		Tr Line 1	Tr Line 2	Tr Line 3
ii	Main-II Protection (Make and Model)	Micom P442	Siemens 7SA612	Siemens 7SJ62
	Functional (Yes/No)	Yes	Yes	Yes
	Date of testing	08/02/2023	19/10/2023	30/10/2023
iii	LBB Protection (Make and Model)	Not available	Not available	Not available
	Functional (Yes/No)	No	No	No
	Date of testing	NA	NA	NA
iv	PLCC/ Protection coupler (Make and Model)	NA	NA	NA
	Functional (Yes/No)	No		
v	DR (Make &Model) (Make and Model)	NA	NA	NA
	Functional (Yes/No)	No	No	No
vi	Time Synch.Unit (Make and Model)	SANDS	SANDS	SANDS
	Functional (Yes/No)	Yes	Yes	Yes
	Other Protections			
1	Status of Power Swing	Enable	Enable	Enable
2	Out of Step	Enable	Enable	Enable
3	SOTF	Enable	Enable	Enable
4	Breaker Failure	NA	NA	NA

Particulars		Tr Line 1	Tr Line 2	Tr Line 3
5	Broken Conductor	Alarm	Alarm	Alarm
6	STUB	NA	NA	NA
7	Fault Locator	Enable	Enable	Enable
8	Disturbance Recorder	Enable	Enable	Enable
9	VT fuse fail	Enable	Enable	Enable
10	Overvoltage Protection	NA	NA	NA
11	Trip Circuit supervision	Enable stand alone relay	Enable stand alone relay	Enable stand alone relay
12	Auto-reclose	Enable	Enable	Enable
13	Load encroachment	NA	NA	NA

Bus-Bar Protection

220kV

Sl. No.	Particulars	Observations
a	Busbar and redundant relay make and model	Bus bar Scheme is not available at 220 KV S/S Chamba
b	Type of Busbar arrangement	NA
c	Zones	NA
d	Dedicated CT core for each busbar protection	NA
e	Breaker Failure relay included, if additional then furnish make and model	NA
f	Trip issued to both Busbar protection in case of enabling	NA
g	Isolator indication and check relays	NA
h	Other requirements for protection checking and validation	NA

AC Auxiliary System

Sl. No.	Particulars	Observations
a	**Source of AC auxiliary system**	250 KVA Station transformer (33/0.4 KV)
b	**Supply changeover between sources (Auto/Manual)**	Maual
c	**Diesel generator (DG) details**	15 KVA (14.3HP) Gentek Power (Sonalika)
d	**Maintenance plan and supply changeover periodicity in DG**	DG set manually operated & checked once in a month
e	**Single Line Diagram**	To be attached
f	**Other requirements for protection checking and validation**	NA

DC Auxiliary System

Sl. No.	Particulars	Observations			
		110 V DC - I	**110 DC - II**	**48 V DC-I**	**48 V DC-II**
a	**Make**	Exide (UPST)	Exide	Exide	Not available
b	**Model/Rating**	VRLA 300AH	Lead Acid 300AH	VRLA 300AH	NA
c	**Vintage**	NA	NA	NA	NA
d	**Measured voltage**				
	i. Positive to Earth	+60V	+60V	NA	NA
	ii. Negative to Earth	-60V	-60V	48V	NA
e	**No. of Cells Per Bank**	55	55	24	NA
f	**Availability of Battery Charger**	Statcon make float:30A Boost:60A	Statcon make float:21A Boost:40A	HIRECT Make	Amar Raja Make

Circuit Breakers

		Make and Model	No. of trip/close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
A	**220kV System**						
1	C.B. 81 BHP	CGL 200SFM-40S	02 Trip/01 Close coil	Healthy	NA	NA	NA
2	C.B. 82 Dharashu	ABB, ELF SL4-1	02 Trip/01 Close coil	Healthy	NA	NA	NA
3	C.B. 84 Rishikesh	ABB, ELF SL4-1	02 Trip/01 Close coil	Healthy	NA	NA	NA
4	C.B. 85 Bus Coupler	CGL 200SFM-40S	02 Trip/01 Close coil	Healthy	NA	NA	NA
5	50 MVA 220/33KV T/F	Siemens 3AP/F1	02 Trip/01 Close coil	Healthy	NA	NA	NA
6	25 MVA 220/33 KV T/F	Alstom GL314	02 Trip/01 Close coil	Healthy	NA	NA	NA

Current Transformer

a	Location of CT	220 KV Chamba-BHP C.B. 81				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	P.S.	P.S.	0.2	P.S.	P.S.
d	Purpose	Main 1 prot.	Main II prot.	Metering	Not in use	Not in use
e	Test Results					
i	Ratio Adopted	800/1	800/1	800/1	NA	NA
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV Chamba-Dharashu C.B. 82				
b	**Date of CT ratio Test Testing**					
		Core I	Core II	Core III	Core IV	Core V
c	**Accuracy Class**	P.S.	P.S.	P.S.	P.S.	0.2
d	**Purpose**	Main 1 prot.	Main II prot.	Not in use	Not in use	Metering
e	**Test Results**					
i	**Ratio Adopted**	800/1	800/1	NA	NA	800/1
ii	**Ratio measured**	NA	NA	NA	NA	NA

a	**Location of CT**	**220 KV Chamba-Rishikesh C.B. 84**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	P.S.	P.S.	P.S.	P.S.	0.2
d	Purpose	Main 1 prot.	Main II prot.	Not in use	Not in use	Metering
e	Test Results					
i	Ratio Adopted	800/1	800/1	NA	NA	800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**220 KV (50 MVA T/F H.V.) C.B.881**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Diff. Prot.	Backup O/C & E/F	0.2	Not in use	Not in used
e	Test Results					
i	Ratio Adopted	150/1	150/1	150/1	NA	NA
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**220 KV (25 MVA T/F) C.B. 882**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	Diff. Prot.	Backup O/C & E/F	0.2	Not in use	Not in used
e	Test Results					
i	Ratio Adopted	75/1	75/1	75/1	NA	NA
ii	Ratio measured	NA	NA	NA	NA	NA

Capacitive Voltage Transformer/Potential Transformer

a	**Location of CVT/PT**	**C.B. 81 Chamba-BHP**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	3P	3P	0.2
d	Purpose	Main 1 Prot.	Main II Prot.	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110V	220 KV/110V	220 KV/110V
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**C.B. 82 Chamba-Dharashu**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	3P	3P	0.2
d	Purpose	Main 1 Prot.	Main II Prot.	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110V	220 KV/110V	220 KV/110V
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**C.B. 84 Chamba-Rishikesh**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	3P	3P	0.2
d	Purpose	Main 1 Prot.	Main II Prot.	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110V	220 KV/110V	220 KV/110V
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**220 KV Bus CVT**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	3P	3P	0.2
d	Purpose	HV O/C & E/F prot..	NA	Metering
e	Test Results			
i	Ratio Adopted	220 KV/110V	NA	220 KV/110V
ii	Ratio measured	NA	NA	NA

Disturbance Recorder (DR) & Event Logger (EL)

Sl. No.	Particulars	220kV
1	a) Is the Disturbance recorder and Fault locator provided on all line feeders?	Yes
	b) Whether standalone or built in Main relay	Built In
	c) Whether DR is having automatic fault record download facility to a central PC	SAS engineering Workstation PC
	d) Whether Central PC for DR, EL are powered by Inverter (fed from station DC)	UPS
2	Whether substation is having Event logger facility	Yes
	If Yes (standalone or built-in-SAS)	Built In
3	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	Yes (SAS GPS)

Communication System

Sl. No.	Name of Line Feeder	PLCC/OPGW /none	If PLCC for protection(y/n)	Coupling type & no. Of channel	If opgw for protection(y/n)	Geographically distributed for main-1 & main-2 dedicated/multiplexed
1	220 KV Chamba- BHP Line (C.B. 81)	PLCC	Yes	Ph-Ph	No	Not Dedicated
2	220 KV Chamba-Dharshu Line (C.B.82)	PLCC	No	Ph-Ph	no	NA
3	220 KV Chamba- Rishikesh Line (C.B.84)	PLCC	No	Ph-Ph	no	NA

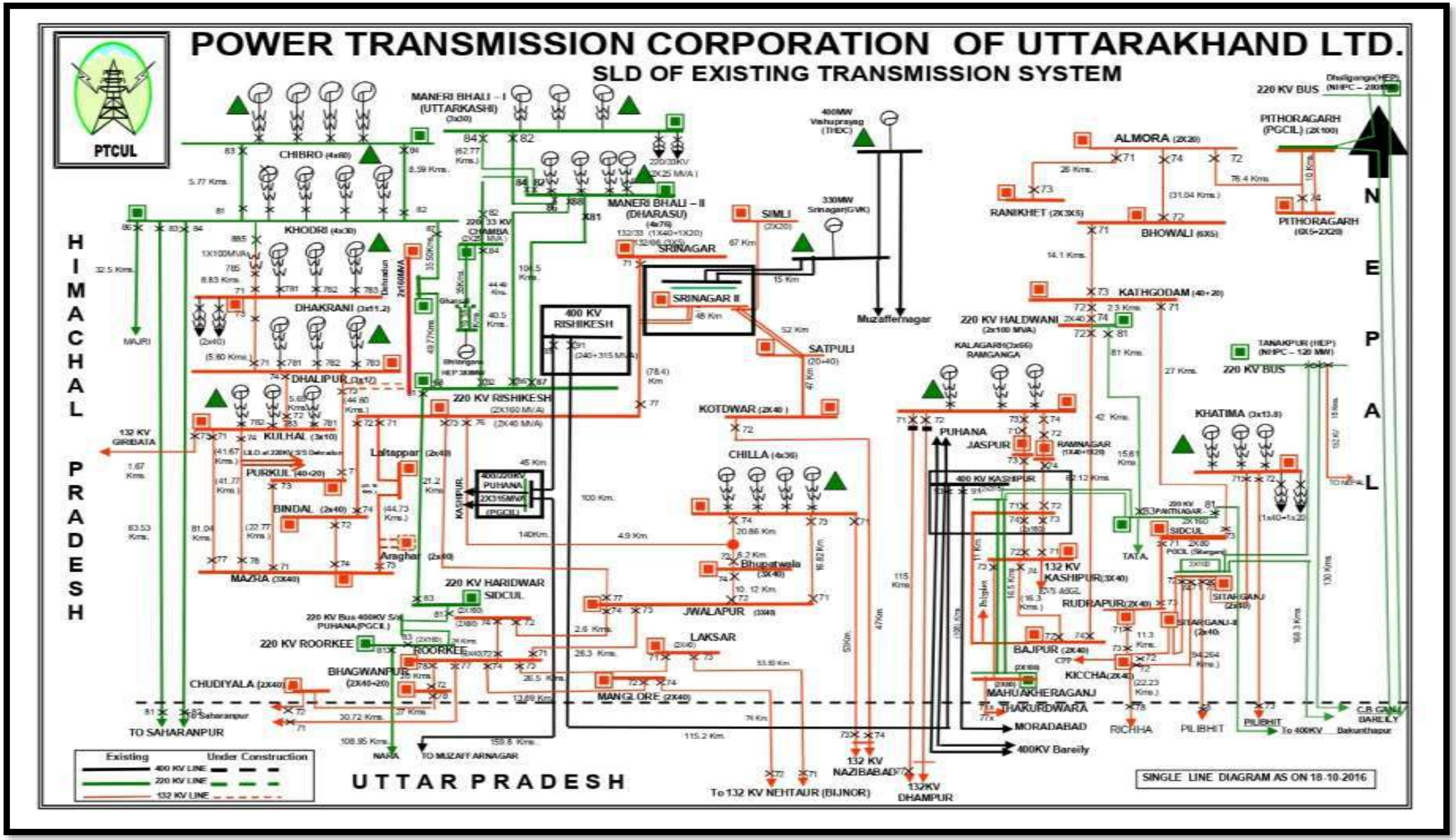
Transformer Protection

Particulars	TF-1	TF-2
Name of ICT	220/33KV 50 MVA T/F	220/33 KV 25MVA T/F
Make		
Connected to dedicated CT core (HV Bay)		
Core-1	Differential Prot.	Differential Prot.
Core-2	O/C & E/F Prot.	O/C & E/F Prot.
Core-3	Metering	Metering
Core-4	Not in use	Not in use
Core-5	Not in use	Not in use
CT ratio	150/1	75/1
Connected to dedicated Bus CVT core (HV Bay)		
Core-1	HV O/C & E/F	HV O/C & E/F
Core-2	NA	NA
Core-3	Metering	Metering
CVT ratio	220 KV/110V	220 KV/110V
Relay connected to Trip Coil-1 or 2 or both (HV)	Both	Both
Feed from DC supply-1 or 2(LV)	DC Supply-1	DC Supply-1
Connected to dedicated CT core (LV Bay)33 KV		
Core-1	Differential Prot.	Differential Prot.
Core-2	O/C & E/F Prot.	O/C & E/F Prot.

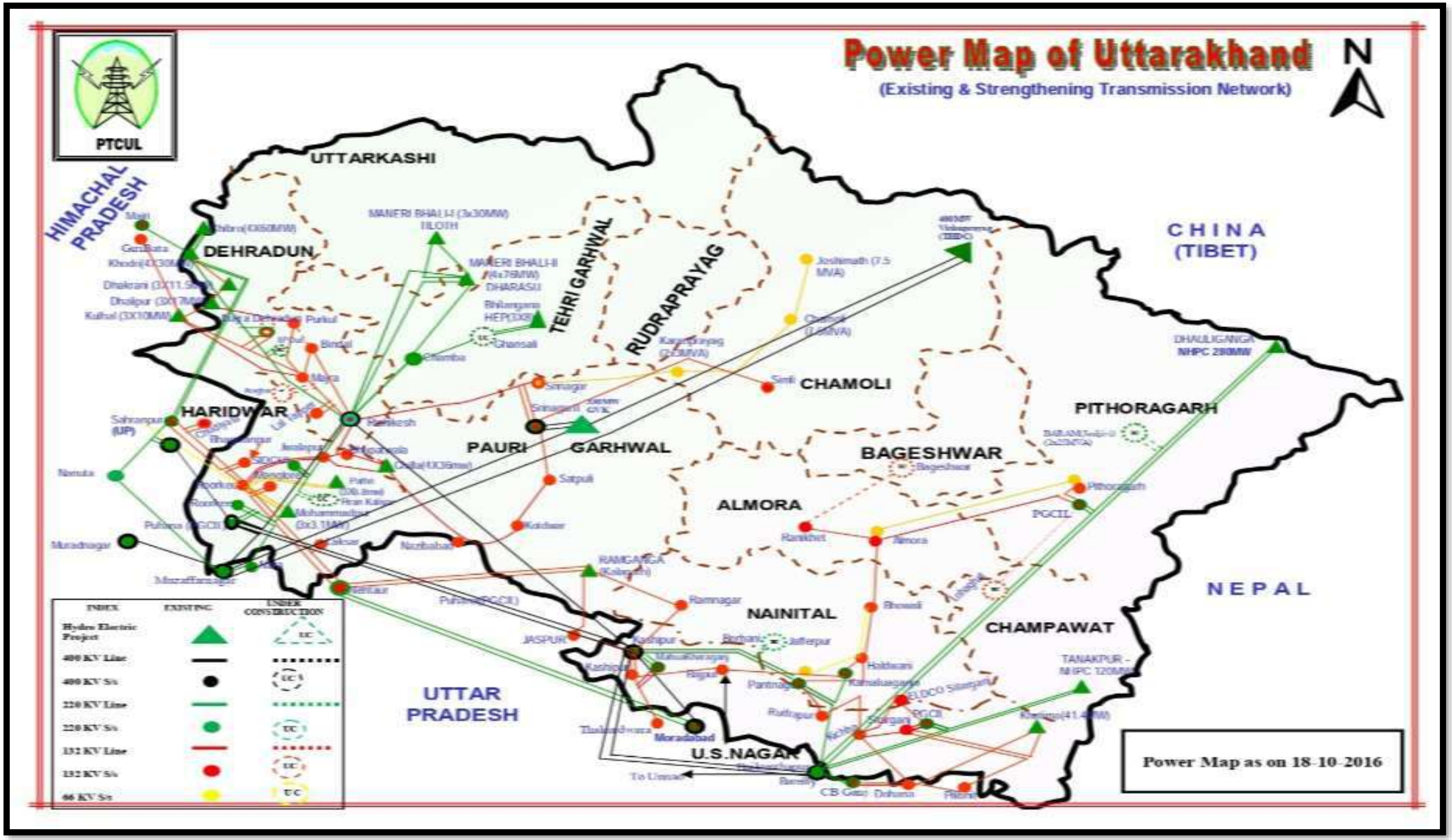
Particulars		TF-1	TF-2
Core-3		Metering	Metering
Core-4		Not in use	Not in use
Core-5		Not in use	Not in use
CT ratio		1000/1	500/1
Connected to dedicated Bus CVT core (LV Bay)			
Core-1		NA	NA
Core-2		NA	NA
Core-3		NA	NA
CVT ratio		NA	NA
Relay connected to Trip Coil-1 or 2 or both (HV)		NA	NA
Feed from DC supply-1 or 2(LV)		NA	NA
LA Rating/ HV Side		NA	NA
LA Rating/ LV Side		NA	NA
Date of last testing of Protection		NA	NA
Group A Protection			
1	Differential Protection (Make & Model)	Schneider Micom P643	Easun Reyrole Duobias-M
2	PRV	Ok	OK
3	WTI Indication working	OK	OK
4	Back-up Over Current Protection HV (Make & Model)	Schneider P143	Argus-Reyrole
5	Over Flux Protection (Make & Model) HV	Feature used in Differential Relay	No

Particulars		TF-1	TF-2
Group B Protection			
1	REF Protection (Make & Model)	E.E. Inst. E/F	E.E. Inst. E/F
2	Bucholtz	Ok	Ok
3	Back-up Over Current Protection LV (Make & Model)	Shneider P143	Argus-Reyrole
4	Over Flux Protection (Make & Model) LV	NA	NA
5	OTI Indication working	ok	ok

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

220/132KV SIDCUL Haridwar Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल

CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 220/132KV SIDCUL HARIDWAR SUB-STATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
EE	Executive Engineer
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
JE	Junior Engineer
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee

PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System
SE	Superintendent Engineer
SCADA	Supervisory Control & Data Acquisition
SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
T&C	Testing & Commissioning
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

The report is not for public distribution and has been furnished solely for information and must not be reproduced or redistributed to others, except those concerned. No one can use the report as a base for any claim, demand or cause of action and, also no one is responsible for any loss incurred based upon the content of this report.

While every effort is made to ensure the accuracy and completeness of information contained, CBIP takes no responsibility and assumes no liability for any error/ omission or accuracy of the information. Recipients of this material should rely on their own judgments and conclusions from relevant sources before taking any decision.

1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400kV and 8 nos. 220kV sub-stations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan, Mr. Avichal Pandey & Mr. Shivam Gupta visited 220/132 SIDCUL Substation during 22nd – 23rd February 2023 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below under 2 heads.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220kV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on “Draft O&M Manual” of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Annexure - 1. Also, a list of switchyard maintenance equipment is placed at annexure -3. It is recommended that the necessary testing and maintenance equipment at substation/Sub-division/Division be arranged for regular testing and maintenance of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC-2023.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru’ third party for implementing the best practices in the sub-station.
10. It is suggested that the existing draft O&M manual be updated to take care of latest developments.

Observations and Recommendations for 220/132KV SIDCUL Haridwar Substation

01. The protection audit of this sub-station was carried out recently on 12-13 Oct 2022 by NRPC/Power Grid Corporation. The few actions are initiated and compliance is pending so far. It is recommended to take necessary action for compliance and maintain record of the same.
02. Bus Bar Protection on 220KV Bus is not functional after addition of the new elements with the 220KV bus. It is recommended to make it functional.
03. in the absence of Event Logger, SAS acts as Event logger also. After malfunctions of Contact Multiplier Relay(s) of SAS on 25th June 2023, SAS has been disabled and is not in service. It is recommended that SAS to be put back into service after detailed analysis and corrective actions.
04. 22 (Twenty-Two) nos. of Back-up protection relays are not provided with time-sync and communication ports. It is suggested that modification/upgradation be done, based on protection philosophy applicable for respective voltage level.
05. Both of the GPS time synchronisation is not functional. Recommanded for early corrective action.

06. PLCC is unhealthy, therefore, tele protection is out of service for both the 220KV circuits. It is suggested to commission carrier aided protection.
07. It is suggested that possibility of extending the 220KV transfer bus to 220KV side of 220/33KV transfer needs to be explored.
08. Both the 220V DC systems are showing earth-fault. It is recommended to take corrective actions to avoid any untoward tripping.
09. Based on inputs provided by utility and analysis of data a list of suggested switchyard and maintenance equipment for replacement is provided in Annexure – 2.

2.0. Introduction

2.1. Background

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400 kV and 08 Nos. 220 kV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following sub-stations is to be carried out:

1. *400kV Rishikesh*
2. *400kV Kashipur*
3. *220kV Chamba*
4. *220kV Rishikesh*
5. *220kV Roorkee*
6. *220kV Haridwar (SIDCUL)*
7. *220kV Jhajra*
8. *220kV Pantnagar*
9. *220kV Haldwani*
10. *220kV Mahuakheraganj*

2.2. Scope of Work

Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. *Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.*
b. *Availability/healthiness of PLCC communication links used for protection systems.*
c. *Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.*
d. *Availability/healthiness of GPS system and time synchronization facility used for protection.*
e. *Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.*
f. *Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.*
g. *Field inspection of protection device for obsolescence of technology, suitability and healthiness.*
h. *Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.*
i. *Checking of availability of DG Set / auxiliary DC supply at substations.*

2.3. Audit Rationale

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipment under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) "All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC".
c. As per Para – 15 (4) of said Code, "The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC".
d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per Annexure -1 of IEGC-2023.

2.4. Audit Process

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each sub-station, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

Sl. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-connecting Transformer
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL

- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**

  - The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
  - The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - All the major general deficiency shall be listed in detail along with remedial recommendations.
  - The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. *About Power Transmission Corporation of Uttarakhand (PTCUL)*

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. About Central Board of Irrigation & Power (CBIP)

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of 220/132/33 kV SIDCUL Haridwar Substation

3.1. General Information about Substation

Sl. No.	Particulars	Details
1	**Substation Name**	220/132/33 kV SIDCUL Haridwar Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	220/132/33KV
4	**Short circuit current rating of all equipment (for all voltage level)**	220KV = 50KA/sec, 132KV = 40KA/sec 33KV = 25KA/sec
5	**Date of commissioning of the substation**	6th November 2006
6	**Checking and validation date**	22nd – 23rd February 2024

3.2. Audit Team

Audit Team (CBIP):

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Shivam Gupta
- Mr. Avichal Pandey

PTCUL Representative:

- Er. Ashwini Kumar, Executive Engineer (T&C)
- Er. Vipin Kumar, Executive Engineer (O&M)
- Er. Virendra Singh Mehra, Assistant Engineer (T&C)
- Er. Amrish Kumar, Assistant Engineer (O&M)

3.3. Recommendation of last protection checking and validation

Last Protection Audit was carried out on 12th and 13th October 2022.

Following observation were recorded:

Deficiencies/Non conformity observed in last Protection Audit	Compliance Status
Only one distance protection relay (Main-1) is available on both 220kV feeders. It is recommended to install main-2 relay for the backup of Main-1 distance protection.	To be analyzed and implemented based on new guidelines from NRPC
DEF (67N) function although available in main-1 relays yet it is disabled. As per Model Relay Setting Guidelines, it is recommended to enable 67N in both Main-1 & Main-2 relays. However, separate Over current and earth fault relay is provided in place of Main-2	
There is no separate relay for over voltage protection. Overvoltage function in distance relay is disable in both the lines. As per guideline relay settings two stage overvoltage protection shall be provided. Low set stage (Stage-I) may be set in the range of 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II) may be set in the range 140% - 150% with a time delay of 100milliseconds.	
It is observed that only single stage CBF protection is used for tripping of boundary breakers. As per model relay setting guidelines it is recommended to provide two stage CBF protection first for re tripping own CB and second for boundary CBs.	
It is found that reverse zone reach setting for Rishikesh line is 12.5% of zone 1 reaching M1 distance relay and Piran Kaliyar is 20% of zone 1 reach. As per NRPC protection philosophy setting the Reverse zone shall be 25% of the zone-1 reach with time setting of 1s. The same may be checked.	
Busbar protection is out of service. Presently there is no protection available for busbar protection. It is recommended to replaced old busbar protection with numerical relays.	No changes observed
Fire protection system for 50MVA transformer is out of service. Recommended to rectify the fire protection system and put in service.	

Deficiencies/Non conformity observed in last Protection Audit	Compliance Status
Both 220V DC battery bank has -ve earthed, need to rectify. One 50V Battery bank and Chargers not in service.	
Earth Leakage Relay in DCDC-1 not in service. In 50V system earth leakage relay not available.	
Earth Fault observed in both the DC sources at charger end. DC voltage from positive to earth at source-1 & 2 is observed to be inadvertently high for 220V DC system.	
Two sources of LVAC supply are available via 33kV/415V substation transformer for the auxiliary load consumption in the substation.	For information only
DG kept in manual mode	
No record of Circuit Breaker testing available.	
No record of CVT testing available.	
SAS and DR available but not in service. At present there is no system for the event log and DR extract DR from the relay.	
PLCC not used for tele protection.	

3.4. Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.
b. The record of different relay setting calculations is not available at the substation level.
c. All relays are numeric, therefore, as per internal protocol of utility relays are tested only at the time of commissioning/change in setting. Copy of test reports not available at sub-station level.
d. Based on the Protection Audit held on 12th and 13th October 2022, the Utility is in the process of up-dation relay settings as per the recommendations.

3.5. Disturbance Recorder availability for the last 6 tripping’s

a. For transformers and Intra-state lines DR data is taken at station level for analysis purpose from individual relays. No centralised record of such data is kept at Substation level.

3.6. Chronic reason of tripping, if any

a. On 25th June 2023 in SIDCUL, Haridwar S/S, SAS CMR relay malfunction observed at 7:00 hrs, 7:43 hrs and 19:50 hrs for 160MVA Transformer, 50MVA Transformer and 160MVA Transformer respectively.

3.7. Major non-conformity/deficiency observed

a. The status of previous Audit report and its compliance is provided in previous paragraphs.
b. Bus Bar Protection on 220kV Bus is not functional, after addition of new elements in the 220 kV Bus.
c. No provision for Bus Bar Protection is available at 132kV level.
d. Both the 220/33 KV T/Fs cannot be connected through TBC as Transfer Bus arrangement was not extended for these two T/Fs.
e. After malfunctions of SAS on 25th June 2023, SAS has been disabled and is not in service
f. Two nos. of GPS Time Sync are provided one for SAS and other caters for relays and other equipments of S/S. Both GPS are not functional.
g. Following 22 No(s) numerical relays are not provided with Time Sync Input and Communication Port. These relays are been used as backup relays-

Relay	No(s)
P127	11
P821	2
P122	9

h. Both the 220V DC systems are showing earth-fault.
i. PLCC is unhealthy and therefore tele protection is out of service.
j. Only one set of 48 V DC system is available.
k. The events are recorded from individual relays, no separate Event Logger is provided.
l. Recommended relay settings with supporting calculations/ parameters needs to be kept at S/S level.
m. All the isolators are operated manually. The AC and DC system needs to be checked during maintenance to avoid earth faults in auxiliary system.
n. The record for equipment testing is not been maintained at S/S level.

4.0. List of Trippings

Name of Feeder/TF & CB No.	Type of Relay / Scheme	Date&Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
160 MVA 1 CB-881/781	Areva	16.08 hrs 18.04.2023	17.09 hrs 18.04.2023	CP- OTI/WTI temp RP- I> phase ABC trip,Trip Relay 86D, Trip relay 86M		nil	WTI meter found faulty	LHWT	Infromed to O&M wing for required action
132KV CB NO 74	Micom	18-05-2023/2:11	18-05-2023/3:12	CP-O/CTRIP EF RELAY OPTD RP- TRIP 50/51 TRIP, NAF, Ia=0.92, Ib= 0 ,Ic==0	CP- DIST PROTN OPTD ,DIST PROTN START, MTR OPTD RP-DIST PROTN RELAY LED 1,2,5,9 DIST=3.9KM,DIST PICKUP L1E	nil	Due to bad weather	TLF	Informed to O&M wing for required action
CB NO.78 (SIDCUL-JWAPUR)	MICOM	25.06.23 06:53	25:06:23 14:28	CP-BREAKER PD TRIP BREAKER AUTO TRIP BREAKER TROUBLE BREAKER FAIL 30X PLCC CHANNEL FAIL OUT BREAKER FAULT 30X RP-MILTIPLIER TO 21M1 21M1X MUX86B TRIP RELAY 86B	NA	NIL	Breaker fault	SEMT	Informed to O&M wing fpr required action
CB NO.881/781 160MVA T/F 1	AREVA	25.06.23 07:00	25:06:23 11:23	CP-881-BREAKER PD TRIP BREAKER AUTO TRIP T/F TROUBLE ALAR, BREAKER TROUBLE RP-TRIP RELAY 86B/86M BREAKER FAULT 30X ,101-MAIN BHCH/WTW ALARM 30, G1/2 ,107-OTI PRV ALARM, 107 PD TRIP 30B ,301-N2 L/O/CB AUTO TRIP 30D 307-	NA	NIL	DUE TO MALFUNCTIONING OF SAS CMR RELAY	EUIPMENT MALOPERATION (SEMT)	Informed to O&M wing fpr required action

Name of Feeder/TF & CB No.	Type of Relay / Scheme	Date&Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
				CB BC 2 FAIL/OIL PRESSURE TROUBLE 30 E 781-TRIP RELAY 86					
50 MVA T/F 1	GE	25.06.23 07:43	25:06:23 13:18	CP-T/F OSR TRIP RP-MTR HV/LV MTR-1 86-1/86-2 MTR 86-3	NA	NIL	DUE TO MALFUNCTIONING OF SAS CMR RELAY	EUIPMENT MAL OPERATION (SEMT)	Informed to O&M wing fpr required action
CB NO.881/781 160MVA T/F 1	AREVA	25.06.23 19:50	25:06:23 20:42	CP-BREAKER PD TRIP BREAKER TROBLE ALARM RP-TRIP 86B/86M BREAKER FAULT 30X TRIP RELAY 86B 781-CP- TRIP RELAY COIL UNHEALTHY RP-TRIP RELAY 86	NA	NIL	DUE TO MALFUNCTIONING OF SAS CMR RELAY	EUIPMENT MAL OPERATION (SEMT)	Informed to O&M wing fpr required action
50 MVA T/F 1	GE	27.06.23 13:02	27:06:23 18:20	50 MVA T/F TRIP WITH 33KV CB NO.10 BREAKER TRIP CKT 1/2 FAULTY	NA	NIL	TRIPPED WITH CB NO. 10(CT BLAST)	SEFT	Informed to O&M wing fpr required action
CB NO 72 JWALAPUR	MICOM	08.07.23 09:30	08.07.23 09:48	CP-BREAKER AUTO TRIP,DIST TRIP RP-R PHASE DIST TRIP 86 MTR ,DP I>PHASE AB1/2 BREAKER FAULTY 30Y DIST START Z1 Z3 DIST TRIP Z3 DIST=4.157KM IA=4.13KA IB=4.214KA IC 53.93A	BACKUP RELAY DIR E/F OPTD DIST START RP -MTR 86-1 86-2	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
25 MVA T/F	AREVA	11.07.23 14:50	11.07.23 16:08	CP-MTR HV MTR LV 27 PICKUP RELAY	NA	NIL	LA BLAST (EQUIPMENT FAILURE)	SEFT	Informed to O&M

Name of Feeder/TF & CB No.	Type of Relay / Scheme	Date&Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
				STARTED PHASE ABC TRIPPED PHASE ABC F=49.98HZ IA(HV)=218.6 IB(HV)=508.4A IC(HV)=115A IA(LV)=287.1A IB(LV)=535.9A IC(LV)=713.6A					wing fpr required action
50 MVA T/F	GE	12-07-23 18:01	12-07-23 19:55	CP-PRV TRIP BREAKER TRIP CKT1/2 FAULTY RP-R PHASE TRIP CKT 2 SUPVN RELAY(95-Y) MTR86-1(HV) 86-3(LV) PRV TRIP 80 MTR 86-2 DC SUPVN RELAY80	NA	NIL			Informe d to O&M wing fpr required action
CB NO.72 ROORKEE	SIEME NS	06-08-2023 21:26	06-08-2023 22:21	DIST PROTN OPTD DIST=100KM IA=0.14KA IB=0.24KA IC=4.16KA MAIN 3 PHASE 86-1	DIFF PROTN OPTD MTR OPTD DIST PROTN STARTED LED=1,3,5,9 DIST=5.3KM IA=0.36KA IB=5.58KA IC=0.29KA MTR-186	NIL	TRANSIENT LINE FAULT	TLF	Informe d to O&M wing fpr required action
50MVA T/F	GE	19-08-2023 17:58	19-08-2023 18:37	CP-50/51G TRIP RP-MTR-1,2,3	NA	NA	**TRIPPED WITH CB NO. 10 DUE TO OVER CURRENT**	TLF	Informe d to O&M wing fpr required action
CB NO 74 ROORKEE LINE	MICO M	26-08-2023 23:27	26-08-2023 23:45	CP-BACKUP RELAY DIR O/C OPTD RP-MAIN RELAY 86-1 86-2 67/67N TRIP 50/51 P TRIP IA-0.61A IB=0.62A IC=0.61A	NA	NIL	TRANSIENT LINE FAULT	TLF	Informe d to O&M wing fpr required action
80 MVA T/F-1 CB 783/383	AREV A	02-09-2023 06:45	02-09-2023 7:54	BREAKER AUTO TRIP RP-TRIP RELAY 86M TRIP	NA	NIL	**CB NO. 1 BREAKER DAMAGE DUE TO**	SEFT	Informe d to O&M wing fpr

Name of Feeder/TF & CB No.	Type of Relay / Scheme	Date&Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
				RELAY 86Y BREAKER FAULTS 30X 30Y			**HEAVY FAULT CURRENT**		required action
CB NO. 881,882/ 781,782 160 MVA T/F-1,2	AREVA	05-09-2023 12:40	05-09-2023 12:55	DIR O/C EF TRIP I PHASE ABC-1/2 IC>EARTH 2/3 EI PHASE 3/3 T/P RELAY 86B 86M 882-DIR O/C E/F T/P I>PHASE ABC-1/2 EI>PHASE C 2/2 T/P RELAY 86B 781/782-BREAKER FAULT 30Y 30X T/P RELAY 86	NA	NIL	DUE TO HERO MOTOR'S MTR FAULTY		Informed to O&M wing fpr required action
CB NO. 881/781 882/782	AREVA	30-09-2023 00:40	30-09-2023 01:08	881- CP-0/C E/F OPTD RP-86M 86B I>PHASE ABC IE>EARTH I> PHASE C 781-RP- 86 BREAKER FAULT 30X 882-CP-DIR O/C E/F OPTD RP-86M 86B I>PHASE ABC Ti>PHASE C	NA	NIL	OVERLOADING	CMST	Informed to O&M wing fpr required action
CB NO 78 JWALAPUR	MICOM	16-10-2023 12:33	16-10-2023 12:52	CP-POLE BREAKER AUTO TRIP DIST START DIST TRIP RP-DIST START Z1 Z2 Z3 DIST TRIP Z1 FD=45ms CB=40ms RTT=0ms DIST=435.7m IA=422.3A IB=12.55KA IC=4119A 27R 27Y 27B	CP-ANY TRIP Y PHASE TRIP Z1 TRIP 86-1,2 DIST=3.4KM IA=IC=0 IB=11.09KA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO 78 JWALAPUR	MICOM	16-10-2023 13:02	16-10-2023 15:03	CP-POLE BREAKER AUTO TRIP DIST START	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr

Name of Feeder/TF & CB No.	Type of Relay / Scheme	Date&Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
				DIST TRIP RP-DIST START Z1 Z2 Z3 DIST TRIP Z1 FD=45ms CB=40ms RTT=0ms DIST=435.7m IA=422.3A IB=12.55KA IC=4119A 27R 27Y 27B					required action

5.0. Observations and Recommendations

5.1. Reporting of all the Tripping with DR/EL

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System “http://103.7.128.184/Account/Login.aspx” within 24 hours of the events. These are being submitted by sub-station to NRLDC portal, however the record of the same is not kept at sub-station level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	DR, EL & Tripping report need to be submitted
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
	Total in NR Region	520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at sub-stations

c. It is recommended that each sub-station to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. Development of centralized database of relay settings

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 kV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220kV are to be calculated by SLDC and/or central level. The relays are tested by sub-station officials as per need basis, but the record of recommended settings/ calculation is not kept at sub-station level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220kV & above and by SLDC below 220kV along with setting calculations & parameters used for all the relays be kept at sub-station level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. *Review of test results of relay and equipment*

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".
b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.
c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. *Availability of Testing Kits*

a. The availability of testing equipment is limited at each substation. For comprehensive testing of equipment, as per above para, sufficient testing kits at each substation/Sub-division/ Division level are required.
b. Based on the O&M manual, it is recommended that sufficient quantity of testing instruments be made available at sites for regular testing of equipment. A suggested list of Testing Equipment is attached at Annexure – 1.

5.5. *Up-dation of PTCUL Protection Philosophy*

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. *Simulation based study of protection system*

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. *Capacity Building of protection team*

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. *Updated Fault Level/ Short Circuit Level and Network information*

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. *General Protection related observations*

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. *O&M Manual*

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. The major observations and recommendations of the previous audit report dated are to be complied with.

b. Bus Bar Protection on 220KV Bus is not functional after addition of the new elements with the 220KV bus. It is recommended to make it functional.

c. The events are recorded from individual relays, no separate Event Logger is provided. The SAS has the event logging capability. On 25th June 2023 in SIDCUL, Haridwar S/S, SAS Contact Multiplier Relay(s) malfunction observed at 7:00 hrs, 7:43 hrs and 19:50 hrs for 160MVA Transformer, 50MVA Transformer and 160MVA Transformer respectively. After malfunctions, SAS has been disabled and is not in service. Therefore, after detailed analysis and corrective actions, SAS needs to be put back into service ASAP.

d. Following 22 No(s) numerical relays, being used as back-up protection are not provided with Time Sync Input and Communication Port. Necessary action for modification/ upgradation needs to be taken, as per applicable protection philosophy.

Relay	No(s)
P127	11
P821	2
P122	9

e. Two nos. of GPS Time Sync are provided one for SAS and other caters for relays and other equipments of S/S. Both GPS are not functional.

f. PLCC is unhealthy and therefore tele protection is out of service and both the 220kV circuits are operating without carrier protection. Carrier aided protection is needed for successful auto-reclosures.

6.2. Equipment related observations and recommendations

a. PTCUL has submitted a list of switchyard equipments to be replaced under PSDF funding, as per Annexure - 2. In view of the need of modern sub-stations, where automation of sub-station is of paramount importance, these replacements are required. Based on the specifications and healthiness of existing equipments, the list may be reviewed by PTCUL. In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of **Maintenance Equipment is attached at Annexure – 3.**

b. Both the 220/33 KV T/Fs cannot be connected through TBC as Transfer Bus arrangement is not extended for these two T/Fs. For the testing/ maintenance of associated circuit breakers of transformers, transformer shut down is required. In order to maintain reliability, the charging of 220kV side of transformer using TBC needs to be explored.

6.3. Auxiliary Equipment related observations and recommendations

a. Both the 220V DC systems are showing earth-fault. Corrective actions need to be taken.
b. Only one 48V battery system is provided. In case carrier aided tripping is extended using PLCC in future, second battery bank would be required.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

The suggested list of Substation Equipments keeping in mind the necessity for the modernization and upgradation of substations.

Sl. No.	Equipment	Unit	Quantity
A	**220KV Equipment**		
1	245KV Current Transformer (5 Core), Class 0.2s (1ph), 1600/800/1, (Protection Core)800/400/1 (merering Core)	Nos	6
2	245KV Bus PT	Nos	6
B	**132KV Equipment**		
1	145KV Isolator 3Ph (with Earth Swich)	Nos	2
2	145KV Isolator 3Ph (without Earth Swich)	Nos	1
3	145KV Current Transformer 1Ph (5 Core), Class 0.2s (1ph) 800/400/1	Nos	6
4	145KV PT	Nos	3
C	**33KV Equipment**		
1	33KV Circuit Breaker	Nos	3
2	33KV Isolator 3Ph with earth switch (1600 Amp)	Nos	12
3	33KV Current Transformer 1 Ph	Nos	9

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
    a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
    b) to have a repository of protection system, settings and events at regional level;
    c) specifying timelines for submission of data;
    d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
    e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 KV and above (132 KV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132 KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 KV and above (132 KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220 KV and above (132 KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 KV and above (132 KV and above in NER) system, which shall be reviewed by the RPC:

   a. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

b. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

c. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

   a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.
   b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:
      i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.
      ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

   a. The protection system checklist shall contain information as per this Regulation.
      i. General Information (to be provided prior to the checking as well as to be included in final report):
         - Substation name
         - Name of Owner Utility
         - Voltage Level (s) or highest voltage level
         - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
         - Checking and validation date
         - Record of previous tripping's (in last one year) and details of protection operation
         - Previous Relay Test Reports
         - Overall single line diagram (SLD) (x) AC aux SLD
         - DC aux SLD
         - SAS architecture diagram
         - SPS scheme implemented (if any)

b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	**Recommendation of last protection checking and validation**	Status of works &pending issues if any
2	**Review of existing settings at substation**	Recommended Action
3	**Disturbance Recorder out/ available for last 6 trippings (Y/N)**	Recommended Action
4	**Chronic reason of tripping, if any**	Recommended Action
5	**Major non-conformity/deficiency observed**	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection;

- Name and Length of Line
- Whether series compensated or not
- Mode of communication used (PLCC/OPGW)
- Relay Make and Model for Main-I and Main-II

- List of all active protections & settings
- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays
- Other requirements for protection checking and validation

iv. AC auxiliary system;

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. DC auxiliary system;

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
    - Mode of communication for Main-1 and Main-2 protection
    - Mode of communication for data and speech communication
    - Status of PLCC channels
    - Time synchronization equipment details
    - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
    - Other requirements for protection checking and validation

vi. Circuit Breaker Details;

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
    - CT/CVT ID name and voltage level
    - CT/CVT core connection details
    - Accuracy Class

- Whether Protection/Metering
- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).

b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.

c) All the major general deficiency shall be listed in detail along with remedial recommendations.

d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.

e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	220KV and above: Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme. 132KV and below: One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines) Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect.
		Time setting: i. 0.35 second *(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)* ii. 0.5-0.6 second *(For a long line followed by a short line)*

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series compensated double circuit lines may be kept higher at 113%.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220 KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220 KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220 KV LINES: No over-voltage protection shall be used. FOR 220 KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be done for multi circuit lines/cable.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400 KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. **Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email:** sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइट www.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड़, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	**GST**	:	GST shall be paid extra as per applicable Government rules.
3	**Tax**	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	**Date of Start of work**	:	Order shall be considered as having come in to force from the date of issue of order.
5	**Supply Completion**	:	NA
6	**Work completion**	:	The work should be completed within 24 months from the date of issue of order.
7	**Engineer of the contract**		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	**Engineer in-charge**		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	**Liquidity damages**	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	**Dispute**		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	**Payment terms**	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	**Payement unit**		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	**Warranty period**	:	NA.
14	**Billing Address**	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाश नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
   Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालय:-विद्युतभवन, नजदीक-आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून-248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135-2646000 फैक्स नं0 0135-2643460 वेबसाइटwww.ptcul.org

Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause						Modified Clause					
		Sr. No	Description	Unit	Qty	Amount	Total Amount	Sr. No	Description	Unit	Qty	Unit rate (Rs.)	Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.						1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.				
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.						2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.				
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.						3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.				
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus						4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to				

2

S. No.	Clause of PO	Existing Clause	Modified Clause
		coupliers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices. etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DG Set/auxiliary DC supply at substations.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g) Field inspection of protection device for obsolescence of technology, suitability and healthiness. h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

3

S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum.**
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

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S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

5

Annexure – 8: Data Sheets

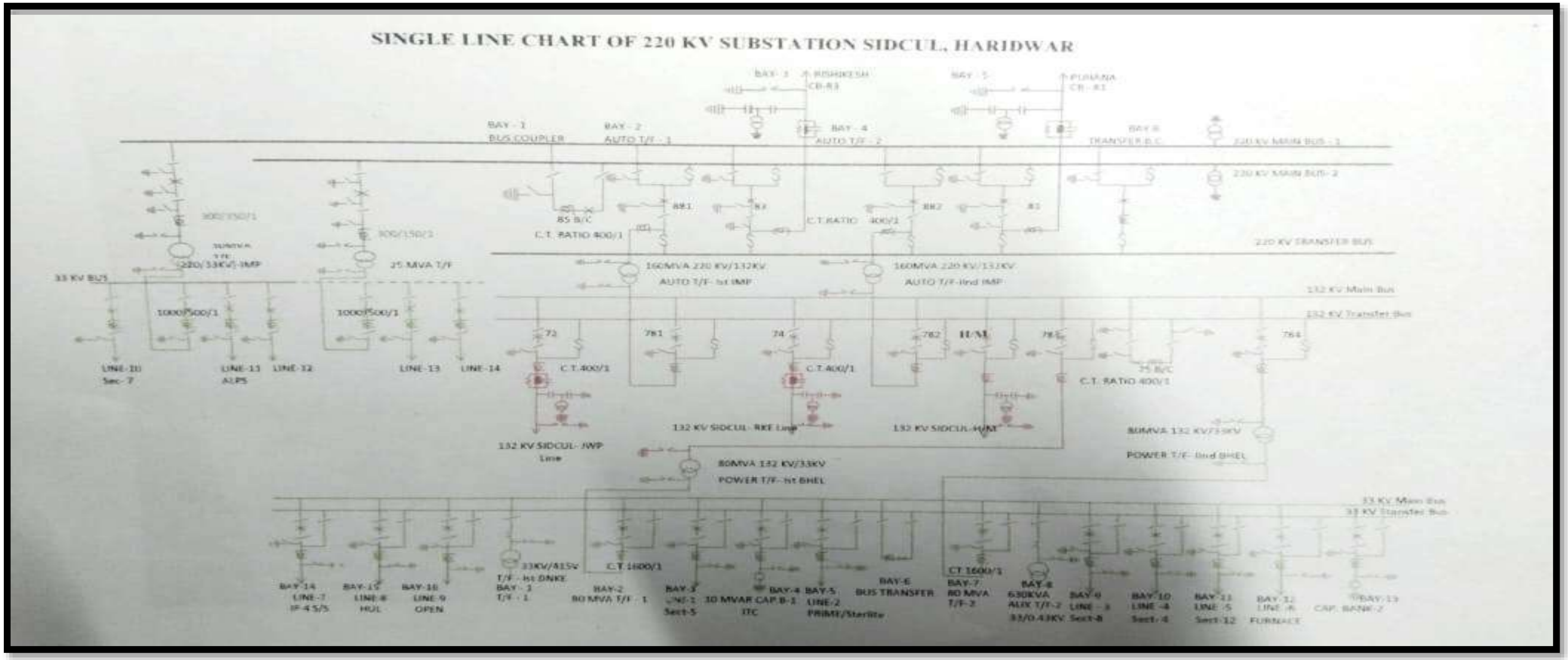
Contents

Annexure - 8

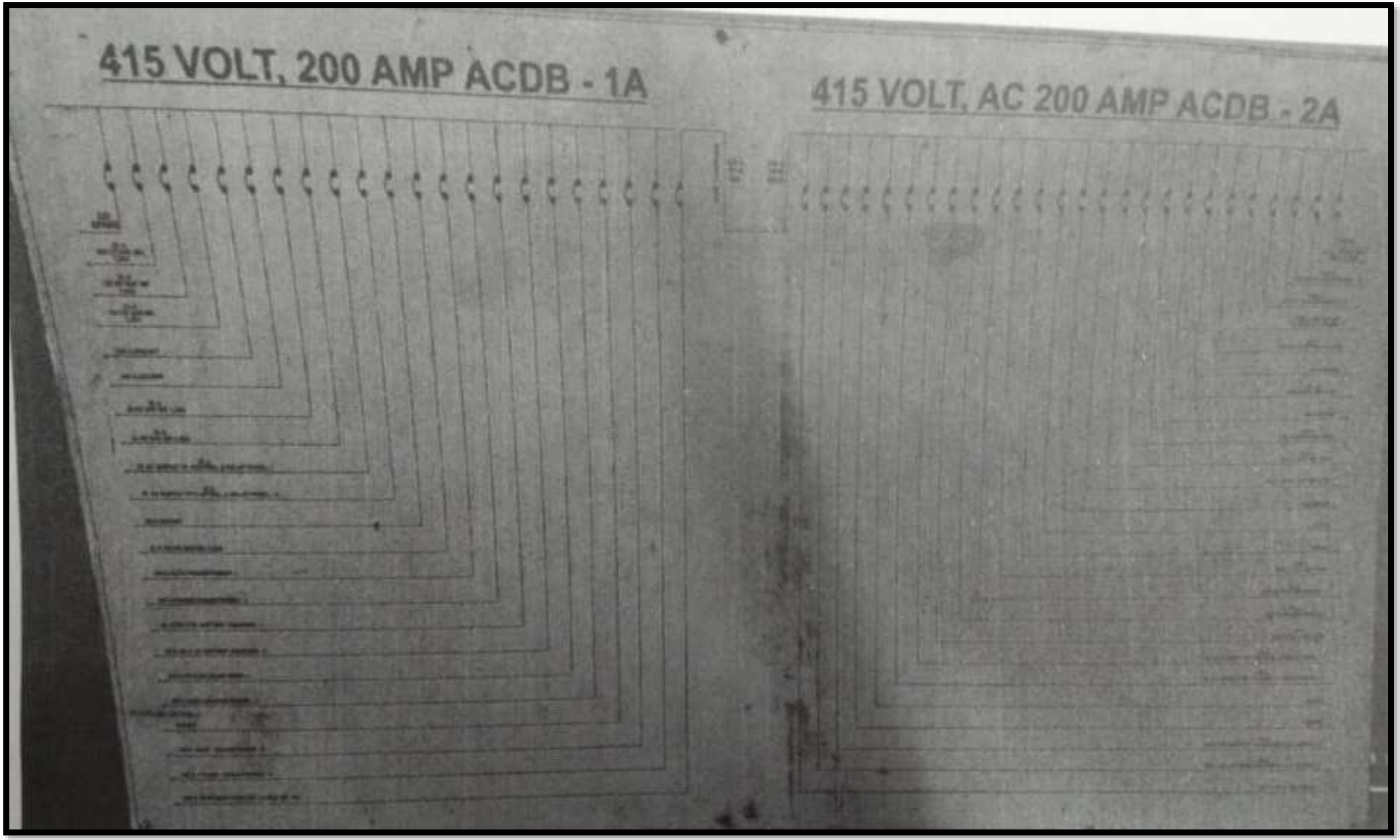
Data Sheets

Single Line Diagrams

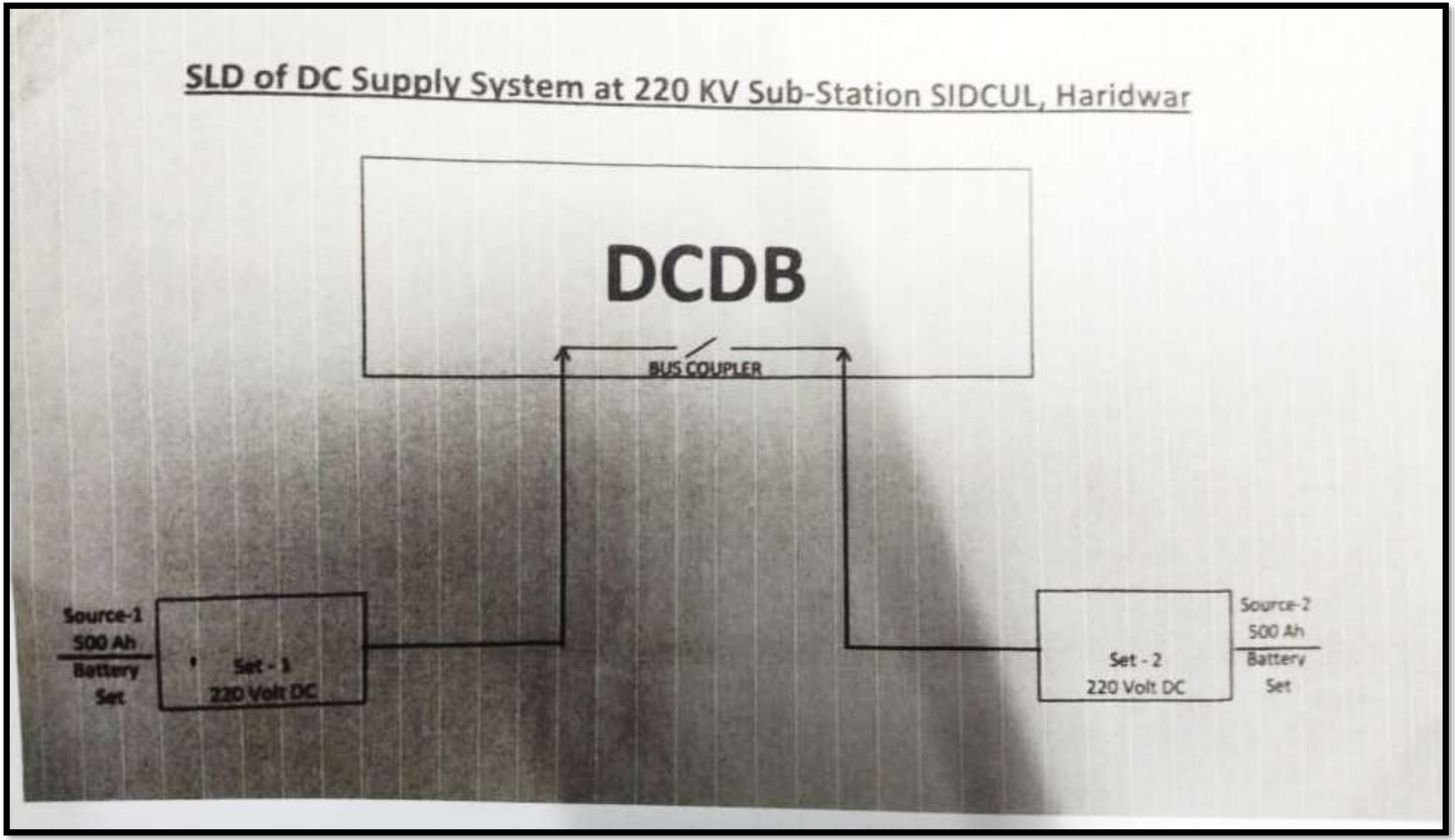
Substation Single Line Diagram



AC Auxiliary System



DC Auxiliary System



SAS Architecture diagram

Not Available

Transmission Lines

220kV:

	Particulars	Tr Line 1	Tr Line 2
Name of Tr Line		220 Imlikheda	220 Rishikesh
Length of Line		18.94	23.98
Series Compensated (Yes/No)		No	No
Connected to dedicated CT core (mention name)		Yes, PS	Yes, PS
CT Ratio		1600-800/1	1600-800/1
Connected to dedicated PT core (mention name)		Yes, 3P	Yes, 3P
PT Ratio		220KV/110V	220KV/110V
Relay connected to Trip Coil-1 or 2 or both		Both	Both
Feed from DC supply-1 or 2		1	1
i	Main-I Protection (Make and Model)	Schneider P545	Schneider P545
	Functional (Yes/No)	Yes	Yes
	Date of testing		
ii	Main-II Protection (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
	Date of testing	NA	NA

Particulars		Tr Line 1	Tr Line 2
iii	LBB Protection (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
	Date of testing	NA	NA
iv	PLCC/ Protection coupler (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
v	DR (Make &Model) (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
iv	Time Synch.Unit (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
Other Protections			
1	Status of Power Swing	Block in Zone 1	Block in Zone 1
2	Out of Step	NA	NA
3	SOTF	NA	NA
4	Breaker Failure	Yes	Yes
5	Broken Conductor	No	No
6	STUB	No	No
7	Fault Locator	Yes	Yes
8	Disturbance Recorder	Yes	Yes
9	VT fuse fail	Yes	Yes
10	Overvoltage Protection	No	No

Particulars		Tr Line 1	Tr Line 2
11	Trip Circuit supervision	Yes	Yes
12	Auto-reclose	Yes	Yes
13	Load encroachment	No	No

Bus-Bar Protection

Bus-Bar Protection:

220kV

Sl. No.	Particulars	Observations
a	Busbar and redundant relay make and model	Electromechanical bus bar protection
b	Type of Busbar arrangement	Main 1-2 & Transfer
c	Zones	Three
d	Dedicated CT core for each busbar protection	Yes
e	Breaker Failure relay included, if additional then furnish make and model	NA
f	Trip issued to both Busbar protection in case of enabling	NA
g	Isolator indication and check relays	NA
h	Other requirements for protection checking and validation	NA

AC Auxiliary System

Sl. No.	Particulars	Observations
a	Source of AC auxiliary system	01 No. 630 kVA 33/0.4 kV
b	Supply changeover between sources (Auto/Manual)	Auto
c	Diesel generator (DG) details	50 KVA
d	Maintenance plan and supply changeover periodicity in DG	
e	Single Line Diagram	
f	Other requirements for protection checking and validation	

DC Auxiliary System

Sl. No.	Particulars	Observations			
		220 V DC - I	**220 V DC - II**	**48 V DC-I**	**48 V DC-II**
a	Make	NA	NA	NA	NA
b	Model/Rating	NA	NA	NA	NA
c	Vintage	3 Year	9 Year	6 Year	18 Year
d	Measured voltage				
	i. Positive to Earth	199 V	199 V	0 V	NA
	ii. Negative to Earth	42 V	42 V	47 V	NA
e	No. of Cells Per Bank	110	110	24	24
f	Availability of Battery Charger	Yes	Yes	Yes	yes

Circuit Breakers

	Particulars	Make and Model	No. of trip/close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
A	**220kV System**						
1	220 kV SIDCUL-RKSH	CGL, type-200-SFM-40S	6/3	Healthy		NA	
2	220kV SIDCUL-PIRANKALIYAR	CGL, type-200-SFM-50AA	6/3	Healthy		NA	
3	160 MVA ICT-1	CGL, type-200-SFM-50AA	6/3	Healthy		NA	
4	160 MVA ICT-2	CGL, type-200-SFM-50AA	6/3	Healthy		NA	
5	50 MVA	ABB, LTB245E1, 40KA	6/3	Healthy		NA	
6	25 MVA	CGL, type-200-SFM-50AA	6/3	Healthy		NA	

Current Transformer

a	**Location of CT**	**220 KV SIDCUL-RKSH**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
I	Ratio Adopted	1600-800/1	1600-800/1	1600-800/1	1600-800/1	1600-800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**220 KV SIDCUL-PIRANKALIYAR**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
I	Ratio Adopted	1600-800/1	1600-800/1	1600-800/1	1600-800/1	1600-800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**160 MVA-I**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	1600-400/1	1600-400/1	1600-400/1	1600-400/1	1600-400/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**160 MVA-II**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	1600-400/1	1600-400/1	1600-400/1	1600-400/1	1600-400/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**50 MVA**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	1600-300/1	1600-300/1	1600-300/1	1600-300/1	1600-300/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**25 MVA**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	150-75/1	150-75/1	150-75/1	150-75/1	150-75/1
ii	Ratio measured	NA	NA	NA	NA	NA

Capacitive Voltage Transformer/Potential Transformer

a	Location of CT	220 KV SIDCUL-RKSH				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	1600-800/1	1600-800/1	1600-800/1	1600-800/1	1600-800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	Location of CT	220 KV SIDCUL-PIRANKALIYAR				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	1600-800/1	1600-800/1	1600-800/1	1600-800/1	1600-800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**160 MVA-I**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	1600-400/1	1600-400/1	1600-400/1	1600-400/1	1600-400/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**160 MVA-II**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	1600-400/1	1600-400/1	1600-400/1	1600-400/1	1600-400/1
ii	Ratio measured					

a	**Location of CT**	**50 MVA**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	1600-300/1	1600-300/1	1600-300/1	1600-300/1	1600-300/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**25 MVA**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
i	Ratio Adopted	150-75/1	150-75/1	150-75/1	150-75/1	150-75/1
ii	Ratio measured					

Disturbance Recorder (DR) & Event Logger (EL)

Sl. No.	Particulars	220kV	132kV
1	a) Is the Disturbance recorder and Fault locator provided on all line feeders?	Yes	Yes
	b) Whether standalone or built in Main relay	Built in	Built in
	c) Whether DR is having automatic fault record download facility to a central PC	No	No
	d) Whether Central PC for DR, EL are powered by Inverter (fed from station DC)	Yes	Yes
2	Whether substation is having Event logger facility	Yes	Yes
	If Yes (standalone or built-in-SAS)	Built in	Built in
3	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	Yes	

Communication System

Not Available

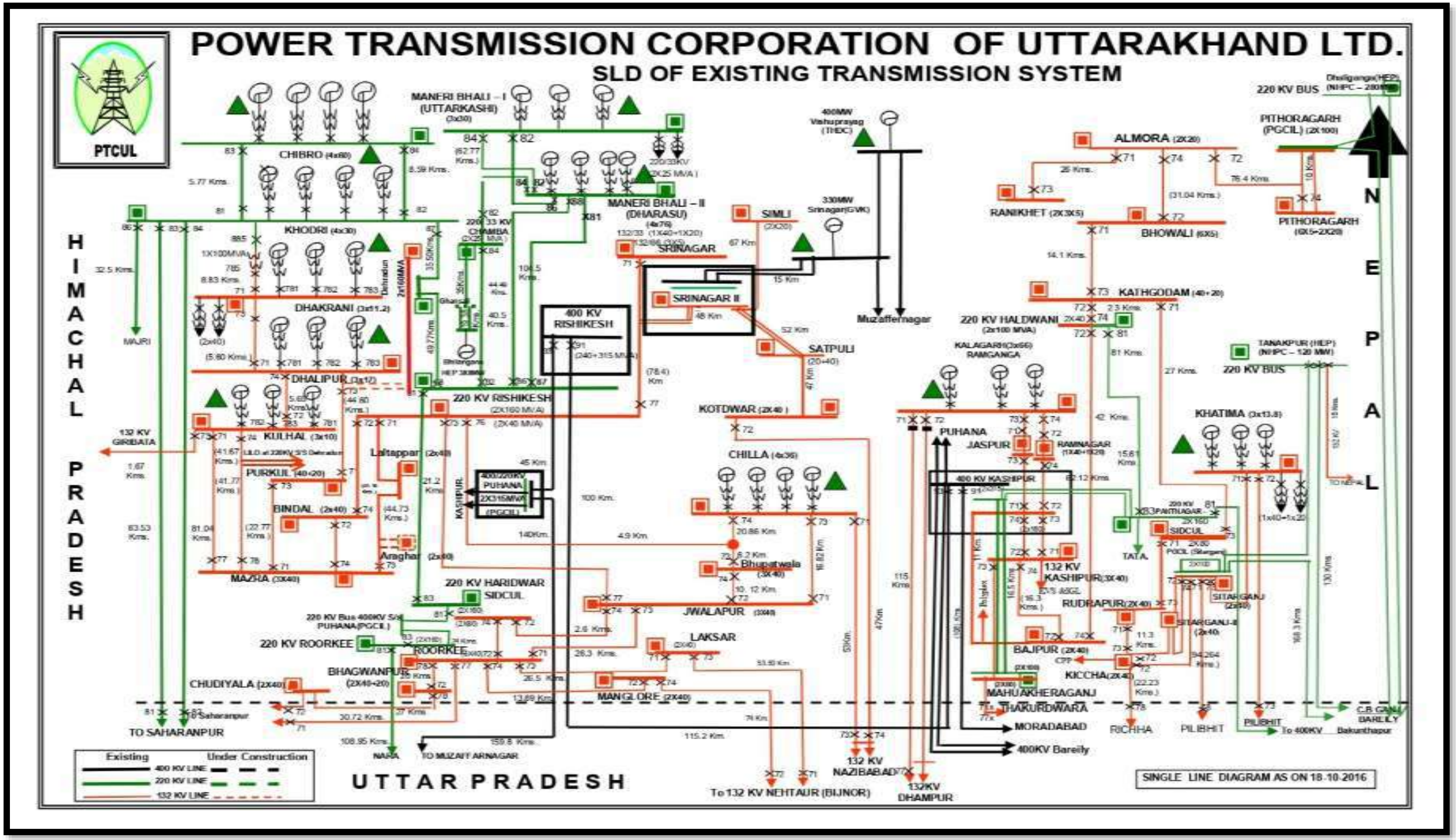
Transformer Protection

Particulars	TF-1	TF-2	TF-3	TF-4
Name of ICT	160 MVA I	160 MVA II	50 MVA	25 MVA
Make	IMP	IMP		
Connected to dedicated CT core (HV Bay)				
Core-1	Protection	Protection	Protection	Protection
Core-2	Protection	Protection	Protection	Protection
Core-3	Metering	Metering	Metering	Metering
Core-4	Protection	Protection	Not in use	Not in use
Core-5	Protection	Protection	Not in use	Not in use
CT ratio	1600-400/1	1600-400/1	1600-300/1	150-75/1
Connected to dedicated Bus CVT core (HV Bay)				
Core-1	Protection	Protection	Protection	Protection
Core-2	Protection	Protection	Protection	Protection
Core-3	Metering	Metering	Metering	Metering
CVT ratio	220 KV/110V	220 KV/110V	220 KV/110V	220 KV/110V
Relay connected to Trip Coil-1 or 2 or both (HV)	Both	Both	Both	Both
Feed from DC supply-1 or 2(LV)	Both	Both	Both	Both
Connected to dedicated CT core (LV Bay)				
Core-1	Protection	Protection	Protection	Protection
Core-2	Protection	Protection	Protection	Protection

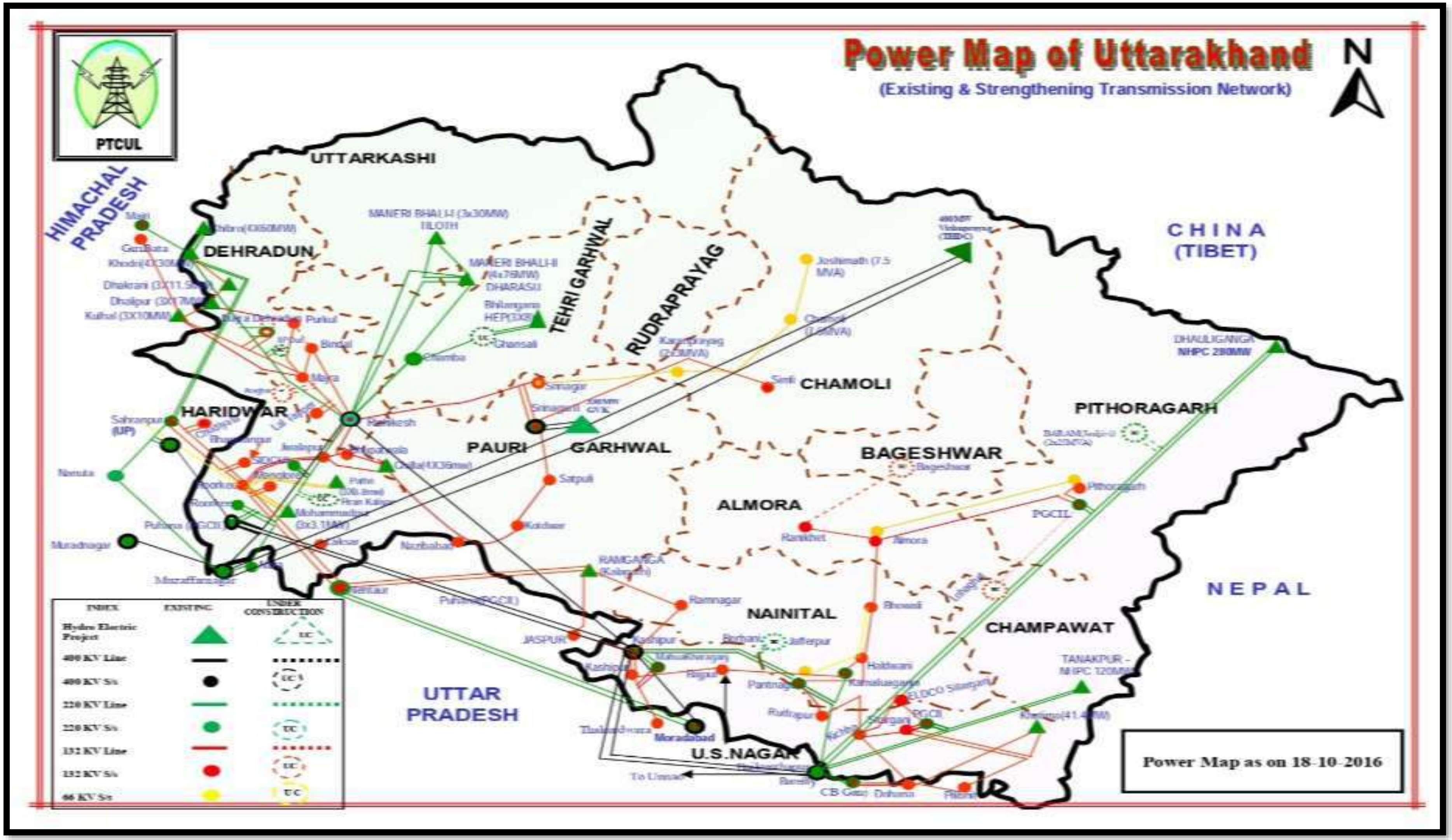
Particulars		TF-1	TF-2	TF-3	TF-4
Core-3		Metering	Metering	Metering	Metering
Core-4		Protection	Protection	NA	NA
Core-5		Protection	Protection	NA	NA
CT ratio		1000-500/1 800-400/1	1000-500/1 800-400/1	1000-500/1	1000-500/1
Connected to dedicated Bus CVT core (LV Bay)					
Core-1		Protection	Protection	Protection	Protection
Core-2		Protection	Protection	Protection	Protection
Core-3		Metering	Metering	Metering	Metering
CVT ratio		132KV/110V	132KV/110V	33KV/110V	33KV/110V
Relay connected to Trip Coil-1 or 2 or both (HV)		Both	Both	Both	Both
Feed from DC supply-1 or 2(LV)		2	2	2	2
LA Rating/ HV Side		NA	NA	NA	NA
LA Rating/ LV Side		NA	NA	NA	NA
Date of last testing of Protection		NA	NA	NA	NA
Group A Protection					
1	Differential Protection (Make & Model)	ALSTOM P633	Schneider P643	GE T60	Schneider P643
2	PRV	YES	YES	YES	YES
3	WTI Indication working	YES	YES	YES	YES
4	Back-up Over Current Protection HV (Make & Model)	P127	P127	F650	F650

Particulars		TF-1	TF-2	TF-3	TF-4
5	Over Flux Protection (Make & Model) HV	NA	NA	NA	NA
Group B Protection					
1	REF Protection (Make & Model)	NA	NA	ALSTOM CAG14	ALSTOM P14NB
2	Bucholtz	YES	YES	YES	YES
3	Back-up Over Current Protection LV (Make & Model)	P127	P127	F650	F650
4	Over Flux Protection (Make & Model) LV	NA	NA	NA	NA
5	OTI Indication working	YES	YES	YES	YES

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

220/132KV Roorkee Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल
CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 220/132KV ROORKEE SUBSTATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance
OCC	Operation Coordination Sub Committee
PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee

SAS	Substation Automation System
SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

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While every effort is made to ensure the accuracy and completeness of information contained, CBIP takes no responsibility and assumes no liability for any error/ omission or accuracy of the information. Recipients of this material should rely on their own judgments and conclusions from relevant sources before taking any decision.

1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400kV and 8 nos. 220kV sub-stations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan, Mr. Shivam Gupta & Mr. Avichal Pandey visited 220/132KV Roorkee Substation during 23rd – 24th February 2024 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below under 2 heads.

General Observations and Recommendations for Utility scale implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220KV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on "Draft O&M Manual" of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Point 5.4. It is recommended that the necessary testing equipment at substation/Sub-division/Division be arranged for regular testing of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru' third party for implementing the best practices in the sub-station. In addition, the existing draft O&M manual also be updated to take care of latest developments.

Observations and Recommendations for 220/132/66 KV Roorkee Substation

01. The Roorkee substation is internally divided into 2 parts. Old 132/66/33KV substation and new 220/132/66KV substation. The protection audit of new 220/132/66KV substation was carried out. The protection audit of this sub-station was recently on 11 Oct 2022 by NRPC/Power Grid Corporation. The few actions are initiated and compliance is pending so far. It is recommended to take necessary action for compliance and maintain record of the same.
02. Multiple high resistance earth faults are observed on 220KV Roorkee Nara line. It is suggested to analyse and take corrective actions during line maintenance.
03. 50 MVA 220/33KV Transformer tripping due to transient fault on 33 kV line were observed. It is recommended to take up protection co-ordination with distribution company (UPCL)
04. Bus Bar Protection on 220KV Bus is not functional after addition of the new elements with the 220KV bus. It is recommended to make it functional.
05. Auto reclosure on both the 220KV circuits is functional without carrier protection, due to unhealthy PLCC. It is recommended to keep record of successful auto-reclosures along with tripping reports.
06. The SAS has the event logging capability but is not in regular use. Also, some of the inputs are not available at SAS. It is recommended to keep SAS updated in regular use.

07. 3 nos. GPS Time Synchronization Systems are provided in the substation. However, presently no relays are time synchronised. It is recommended to take necessary corrective actions for time synchronization of all protective gear.
08. Both the 110V DC systems are showing earth-fault. It is recommended to take corrective actions to avoid any untoward tripping.
09. Necessary action for avoiding water logging and consequential maloperation of protective system needs to be taken.

2.0. Introduction

2.1. Background

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400 kV and 08 Nos. 220 kV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following sub-stations is to be carried out:

1. *400kV Rishikesh*
2. *400kV Kashipur*
3. *220kV Chamba*
4. *220kV Rishikesh*
5. *220kV Roorkee*
6. *220kV Haridwar (SIDCUL)*
7. *220kV Jhajra*
8. *220kV Pantnagar*
9. *220kV Haldwani*
10. *220kV Mahuakheraganj*

2.2. Scope of Work

Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. *Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.*
b. *Availability/healthiness of PLCC communication links used for protection systems.*
c. *Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.*
d. *Availability/healthiness of GPS system and time synchronization facility used for protection.*
e. *Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.*
f. *Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.*
g. *Field inspection of protection device for obsolescence of technology, suitability and healthiness.*
h. *Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.*
i. *Checking of availability of DG Set / auxiliary DC supply at substations.*

2.3. Audit Rationale

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipments under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.
b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) "All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC".
c. As per Para – 15 (4) of said Code, "The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC".
d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per IEGC-2023 Annexure-1.

2.4. Audit Process

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each sub-station, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

Sl. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-connecting Transformer
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL

- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.

- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**

  - The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
  - The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - All the major general deficiency shall be listed in detail along with remedial recommendations.
  - The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. *About Power Transmission Corporation of Uttarakhand (PTCUL)*

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. About Central Board of Irrigation & Power (CBIP)

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of 220/132KV Roorkee Substation

3.1. General Information about Substation

Sl. No.	Particulars	Details
1	**Substation Name**	220/132/33 kV Roorkee
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	220/132/33 kV
4	**Short circuit current rating of all equipment (for all voltage level)**	40KA & 50KA
5	**Date of commissioning of the substation**	10th February 2005
6	**Checking and validation date**	23rd – 24th February 2024

3.2. Audit Team

Audit Team (CBIP):

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Shivam Gupta
- Mr. Avichal Pandey

PTCUL Representative:

- Er. Ashwini Kumar, Executive Engineer (T&C)
- Er. Vipin Kumar, Executive Engineer (O&M)
- Er. Virendra Singh Mehra, Assistant Engineer (T&C)
- Er. Amrish Kumar, Assistant Engineer (O&M)

3.3. Recommendation of last protection checking and validation

Last protection audit was carried out by NRPC on 11 Oct 2022 by NRPC along with Power Grid Corporation.

Protection/Element/ Equipment/ System audited	Deficiencies/Nonconformity observed	Status
Distance protection for following feeders: i) Main-1 Nara line ii) Main-1 Puhana line iii) Main-1 Railway lines	Only one distance protection relay (Main-1) is available on both 220kV feeders. It is recommended to install main-2 relay for the backup of main-1 distance protection.	To be analysed & implemented, based on new guidelines from NRPC
Directional Earth Fault(67N) for following feeders: i) Main-1 Nara line ii) Main-1 Puhana line iii) Main-1 Railway lines	DEF (67N) function although available in main-1 relays yet it is disabled. As per Model Relay Setting Guidelines, it is recommended to enable 67N in both Main-1 & Main-2 relays. However, separate Over current and earth fault relay is provided in place of Main-2	
Power swing function for following feeders: i) Main-1 Nara line ii) Main-1 Puhana line iii) Main-1 Railway lines	i) Power swing is kept enabled except zone-3 in Puhana line. ii) Power swing is disabled in railway line and Nara line. As per protection Philosophy of Northern region, the block tripping in all zones, all lines. out of step tripping to be applied on all inter regional tie lines (Deblock time delay=2s) but if Out -of step function is not activated then Power swing shall be blocked for Zone-2 and above and Zone-1 shall be unblocked.	

Protection/Element/ Equipment/ System audited	Deficiencies/Nonconformity observed	Status
Overvoltage protection for following feeders: i) Main-1 Nara line ii) Main-1 Puhana line iii) Railway Line	Overvoltage function is disable in all lines. As per guideline relay settings two stage overvoltage protection shall be provided. Low set stage (Stage-I) may be set in the range of 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II) may be set in the range 140% - 150% with a time delay of 100milliseconds.	
Auto-reclose function for following feeders: i) Main-1 Nara line ii) Main-1 Puhana line iii) Railway Line	Auto-Reclose enabled in 220kV Nara and Puhana Line except Railway Line. 1) Dead Time and Reclaim Time Setting of Auto Reclosure relays (Dead time = 1sec, Reclaim Time =25 sec) are not found as per Model Relay Setting / CBIP Guidelines (i.e. Dead Time = 1 sec, Reclaim Time = 25 sec). It is recommended to adopt AR settings as per the recommendation.	
Broken Conductor function for following feeders: i) Mi) Main-1 Nara line ii) Main-1 Puhana line iii) Railway Line	Broken conductor function is not enabled in Railway Line and Nara Line. It is advised to keep broken conductor function active as per model relay setting guidelines.	
Breaker failure function for following feeders: i) Main-1 Nara line ii) Main-1 Puhana	It is observed that only single stage CBF protection is used for tripping of boundary breakers. As per model relay setting guidelines it is recommended to provide two stage CBF protection first for re-tripping own CB and second for boundary CBs.	

Protection/Element/ Equipment/ System audited	Deficiencies/Nonconformity observed	Status
line iii) Railway Line		
Distance protection Zone-1 settings for following feeders: i) Railway Line	The time settings is 100% of the line length. As per model relay settings it shall be 80% of line length. It is advised to review the settings for zone-1.	
Distance protection Zone-2 settings for following feeders:i) Puhana Line	Zone-2 time setting for Puhana line is 400ms.As per model relay settings it shall be 350ms for short line (<100km)	
Distance protection reverse zone settings for following feeders: i) Main-1 Puhana line ii) Railway Line	It is found that zone reach setting for Puhana line is 36% of zone 1 reach and time setting is 2s of reverse zone of M1 distance relay. For Railway line reverse zone reach setting found 12.73% of zone 1 reach. As per NRPC protection philosophy setting the Reverse zone shall be 25% of the zone-1 reach with time setting of 1s. The same may be checked.	
Busbar protection Main-1, Main-2 and Transfer bus	Busbar protection is out of service due to mismatching of CTs ratio. It is recommended for 220kV busbar protection to be replaced with numerical relays.	No Change
WTI for MV and LV winding Cooling Fan Fire Protection System FOTC	i) ICT-1 WTI (HV), ICT-2 WTI (IV) and WTI (LV) temperature indicator not operational in the RTCC panel. It is recommended to replace faulty Winding temperature indicators so as to ensure proper monitoring of transformers from the control room itself. ii) Cooling fan of ICT-1 not in service. iii) NIFPS for ICT-1 and 2 kept in manual mode.	

Protection/Element/ Equipment/ System audited	Deficiencies/Nonconformity observed	Status
	Fire protection system should be kept in auto mode for the protection of transformer in case of fire.	
Surge counter FOTC WTI/OTI Fire Protection System	i) leakage current being recorded as “0 mA” for all phases of 50MVA-1 is defective. Same needs to be replaced with new one. ii) FOTC for Transformer-1 & 2 not working. iii) OTI temperature indicator for transformer-1 & 2 in RTCC panel not in operation. iv) Fire protection system for transformer-1 is out of service. Recommended to rectify the fire protection system and put in service.	
DC charger for 110V and 50V	Both 110V DC battery bank have +ve earthed, Need to rectify. Both 50V Battery bank and Chargers not in service.	
DC source	Earth Fault observed in both the DC sources at charger end. DC voltage from negative to earth at source-1 & 2 is observed to be inadvertently high for 110V DC system.	
Earth leakage relay for 220V and 50V system	Not available.	For info only
Source of AC supply	Two individual sources of LVAC supply is available for the auxiliary load consumption in the substation.	
DG and AMF panel	DG in Auto mode	
SF6 gas quality CRM, DCRM and	No record of Circuit Breaker testing available.	

Protection/Element/ Equipment/ System audited	Deficiencies/Nonconformity observed	Status
Time check Testing of CB		
CVTs	No record of CVT testing available.	
SAS & DR	DR PC available but not in service due to some connectivity issue. Some signals are not properly displays on SLD of SAS PC.	
PLCC	PLCC not used for tele protection.	
Synchro-Check	Synchronisation trolly available but not in service.	
Panel Meters	most of the panel meter (Ammeter, Voltmeter, wattmeter etc.) are not working. Recommend to replace the defective meters for proper monitoring.	In process

3.4. Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.

b. The record of different relay setting calculations is not available at the substation level.

c. All relays are numeric, as per internal protocol of utility relays are tested on yearly basis and at the time of commissioning/change in setting. Copy of test reports not available at sub-station level.

d. Based on the protection audit held on 11th October 2022, the utility is in the process of updating the recommendation related to the relay settings.

3.5. Disturbance Recorder availability for the last 6 tripping's

a. Utility is submitting Disturbance Recorder data for both Inter-State Lines(Pohana and Nara) to NRLDC Portal. The record is not maintained at substation level.

b. For transformers and other lines DR data is taken at station level for analysis purpose, no centralized record of such data is kept at substation level.

3.6. *Chronic reason of tripping, if any*

a. Based on list of tripping submitted by utility for last 12 months, 220kV Roorkee Nara line tripped 11 times due to transient earth fault. In almost all cases the fault current is not very high indicating high resistance fault.
b. On 29/08/2023 at 10:44 due to 132kV bus fault multiple tripping took placed.
c. 50 MVA 220/33 kV Trf-2 tripped on 06/07/2023 and 15/07/2023 due to transient fault on 33 kV line at high current on transformer.
d. Some tripping are recorded due to switch yard water logging.

3.7. *Major non-conformity/deficiency observed*

a. The status of major non confirmatory as pointed out in the previous audit report and its compliance is provided in previous paragraphs.
b. Bus Bar Protection on 220kV Bus is not functional after addition of the new elements with the 220kV bus.
c. No provision for Bus Bar Protection is available at 132kV level.
d. PLCC is unhealthy and therefore tele protection is out of service.
e. SAS has been commissioned. It is observed that SAS is not in regular use and therefore, some of the inputs are not available. The effectiveness of SAS can be improved by using SAS regularly.
f. Both the 110V DC systems are showing earth-fault.
g. Both the 220kV circuits are operating without carrier protection, however the auto reclosure is enabled.
h. 3 nos. GPS Time Synchronization Systems are provided in the substation. One system caters to SAS and other two caters to relays and other equipment's of the respective substation i.e. old 132 kV. Only one GPS associated with 220kV site is functional, but the relays are connected to SAS GPS, therefore presently no relay is time synchronised.
i. The events are recorded from individual relays, no separate Event Logger is provided. The SAS has the event logging capability but is not in regular use.
j. Recommended relay settings with supporting calculations/ parameters needs to be kept at sub-station.
k. All the isolators are operated manually. The AC and DC system needs to be checked during maintenance to avoid earth faults in auxiliary system.
l. The record of equipment testing is not maintained at substation level.

m. Necessary action for avoiding water logging and consequential maloperation of protective system needs to be taken.
n. Currently the successful auto reclosures are being recorded in the log book however no separate analysis record is being maintained.

4.0. List of Trippings

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
40MVA 1	Siemens	01.47 hrs 30.01.2023	02.02 hrs 30.01.2023	CP-HV O/C & E/F optd, 186 H/L trip relay optd, Led 1,2,3,5	NA	NIL	Tripped with 33 kv Himalayan Guest House	LEFT	Informed to O&M wing for reqiured action
20MVA 2		01.47 hrs 30.01.2023	02.02 hrs 30.01.2023	RP- 186H/L optd	NA	NIL			
40MVA 3		01.47 hrs 30.01.2023	02.02 hrs 30.01.2023	CP-HV O/C & E/F optd, 186 H/L trip relay optd, Led 1,2,3,5	NA	NIL			
132kV Roorkee-Sidcul line CB-72	Siemens	17:46 hrs 14/01/2023	20:18 hrs 14/01/2023	NA	CP-back relay dir o/c optdoptd, , RP- mtr-86-1, 86-2 optd, dir oc e/f, 67/67N trip, 50/51trip, led grp 2, dist-0.5km L1-13908A, L2-207.8A,L3-367.4A,	NA	trip due to overload	CMST	Informed to O&M wing for required action
220kV Roorkee-Puhana line CB-	Alstom, Micom	17:46 hrs 14/01/2023	20:04 hrs 14/01/2023	CP- Dir trip R phase OPTD, RP- 27 R,Y,B phase, dist carrier recieved,dist trip ABC, Trip relay 86, 86X, Z1 OPTD, Distance-1.325 km L1-2.616kA, L2-5900A,L3-1.078kA,	NA	All accociated lines	Transient earth fault	TLF	Informed to O&M wing for required action
40MVA 1 132/33kV	Siemens	03:10 hrs 20/01/2023	03:30 hrs 20/01/2023	CP- HV OC & EF optd, 186H & 186L trip relay, RP- LBB protn relay 50Z LED -1,2 L1-0.66kA, L2-0.03kA, L3-0.03kA, MTR-186	NA	nil	Both T/F trip with 33kv Himalayan guest house feeder	TLF	Informed to O&M wing for required action
20MVA 2	Siemen	03:10 hrs 20/01/2023	03:30 hrs 20/01/2023	MTR 186H & 186L trip					

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
132kV Roorkee-Jwalapur line CB-71	Siemens	18.48 hrs 09.03.2023	19.10 hrs 09.03.2023	MTR optd, Dist protn optd, Led no.5, MTR 86, L1-190.5A, L2-3.039kA, L3-141.30 A	CP- Back up relay, dir o/c optd, E/F optd, RP-Tirp 50/51 p trip, 50/51 G trip, main 3 phase trip relay (86-1 86-2), cb gas low trip lockout GA, GL spare relay	nil	Transient earth fault	LEFT	Informed to O&M wing for required action
20M VA	Siem	4.48 hrs 19.04.2023	5.22 hrs 19.04.2023	Led 1,5,6 MTR 86H 86L Ia-2.438kA,	NA	nil	Both trnasformer Tripped with 66kV C/B-63	TLF	Informed to O&M wing for required action
20MVA 2 132/66kV	GE	4.48 hrs 19.04.2023	5.22 hrs 19.04.2023	O/c E/f protn optd Led-1,5 Ia-1.633kA	NA				
132kV Roorkee-	Siemens	01.05.2023 12.10 hrs	01.05.2023 21.41 hrs	CP- MTR optd, Dist prot optd, Dist prot strt, RP- Dist protn relay, Led-1,3,5,9 Dist pickup L2-E, Dist loop L2-E, L1-0.21kA,L2-10.15kA,L3-0.13kA	Dist protn stsrt, MTR optd, Dist prot strt,MTR optd,	nil	Transient Earth Fault	TLF	Inform to O&M for required action
CB NO.77 (L.S.M)	Siemens	11-05-2023/04:48	11-05-2023/05:01	CP:-DISTANCE PROTECTION RELAY OPERATED MASTER TRIP RELAY OPERATED . RP:- DISTANCE PROTECTION RELAY DISTANCE PICKUP L1E, DISTANCE 2.2KM, D%=29.4% IL1=6.22KA,IL2=0.06KA,IL3=0.02KA, MTR-186.	NA	Nil	Transient Earth Fault	TLF	Informed to O&M wing for required action
132V JWALAPUR CB NO.71	SIEMENS	18-05-2023/02:11	18-05-2023/03:04	CP-DIST OPTD, DIST PROTN START,MTR PRTD RP-DIST PROTN REAL LED 1,4,5 , IA=148.3A ,IB=25.60A IC=23.91A, DIST=38.68KM MTR-186	CP-PICKUPP RELAY DIST. O/C OPERATED, EARTH FAULT OPERATED RP-50/51 TRIP, Ia=5.48, Ib=0 Ic=0 MTR(86-1) MTR (86-2)	nil	Due to bad weather	TLF	Informed to O&M wing for required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
20 MVA T/F 1 CB NO. 783/683	SIEMENS	18-05-2023/02:07	18-05-2023/8.26	CP-DIST PROTN RELAY LED 1,3 RP-TRIP PHASE AN,START I>134 O/C I>4 E/F-1, START IN1>134, E/F-2, TRIP IN1>34, IA=2.274KA IB=75.82A IC=265.6A IN MEASURED =2.609KA IN DERIVED=2.606KA	NA	nil	Transient Earth Fault	TLF	Informed to O&M wing for required action
132kV Chudiyala-Roorkee line CB-78	GE	19/05/2023 10:56 hrs	19/05/2023 11:41 hrs	CP-MTR OPTD, DIST PROTN START, DIST PROTN OPTD. RP-DIST PROTN RELAY 21 LED 1,2,5,9 FAULT EVENT ON, DIST PICKUP L1E ON, DIST LOOP L1EF ON, DIST TRIP 1PL1 ON, DIST TRIP Z1/1P ON, DEFINITIVE TRIP ON DIST T SEND ON, AR TRIP 3 POLE ON, IL1-9.07KA, IL2-0.29KA, IL3-0.23KA DIST TRIP 3P, DISTANCE=0.7KM D%=4.6%	NA	nil	Transient Earth Fault	TLF	Inform to O&M wing for required
CB NO. 81 NARA LINE	Micom	13.10 hrs 08.06.2023	NA	CP-A/R LOCKOUT BREAKER AUTO TRIP RP- Z1 27RYB 86ABC 21X TRIP RELAY 86 FAULT DURATION 40 ms CB OPERATE TIME 35 ms RELAY TIME 0 ms IA=175A IB=353.3A IC=199A VA=137.2KV VB=137.9KV VC=8.858KV	NA	Nil	**Transient Earth Fault**	TLF	Informed to O&M wing for required action
CB NO. -81 (NARA)	Micom P545	10-06-2023 07:45HRS	10-06-2023 10:37HRS	CP- POLE DEAD, CB AUTO TRIP, RP- 86A, 27 RYB, CB AUTO TRIP Z1, FAULT DURATION-36MS, FAULT LOCATION=4.670KM, IA=248.4A, IB=160.4A, IC=353.2A	NA	Nil	Transient Earth Fault	TLF	Informed to O&M for required action
CB NO.67 SAHARANPUR	SIEMENS	18.06.23 05:49	18.06.23 19:02	TRIPPED ON O/C E/F, MTR DISTANCE PROTN START LED 4 IA=33.7A IB=2.676A IC=2.920A	NA		TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.67 (SAHARANPUR)	SIEMENS	19.06.23 03:01	19.06.23 03:10	DISTANCE RELAY=LED 1,2,5,6 IL1=1.01KA IL2=0.04KA IL3=0.04KA DIST=40.7KM O/C E/F RELAY=LED 1,5,6 IL1=1.029KA IL2=44.4A IL3=3.23A	NA	Nil	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.781/381 40MVA T/F 1	SIEMENS	19.06.23 12:45	19.06.23 13:11	CP-186H TRIP RELAY OPTD 186 L TRIP OPTD RP- O/C E/F (LV) TRIPPED PHASE N, TRIP IN1>3 IA=3.419 KA IB=561.8A IC=342.1A IN=3.548KA (HV)=RELAY TRIP ON DIR O/C TRIP ON IE>DIR TRIP ON IL1=0.86KA IL2=0.14KA IL3=0.13KA	NA	Nil	DUE TO PROBLEM IN CAPACITOR BANK BAY	LH WT	Informed to O&M wing fpr required action
CB NO.786/386 40MVA T/F 3	SIEMENS	19.06.23 12:45	19.06.23 13:11	CP-HV O/C E/F LV O/C E/F RP-(HV) RELAY TRIP ON DIR O/C TRIP ON IE>DIR TRIP ON IL1=0.93KA IL2=0.14KA IL3=0.15KA (LV)- TRIPPED PHASE N TRIP IN1>3 IA=3.743 KA IB=551.2A IC=363.1A	NA	Nil	DUE TO PROBLEM IN CAPACITOR BANK BAY	LH WT	Informed to O&M wing fpr required action
CB NO.782/382 20MVA T/F 2	SIEMENS	19.06.23 12:45	19.06.23 13:11	CP-LED 6 MTR 86 RP-(HV) RELAY TRIP ON DIR O/C TRIP ON IE> DIR TRIP ON IL1=0.6KA IL2=0.07KA IL3=0.08KA (LV)- TRIPPED PHASE N E/F TRIP IN 1>3 IA=1.834KA IB=277.6A IC=168.2A IN=1.912KA	NA	Nil	DUE TO PROBLEM IN CAPACITOR BANK BAY	LH WT	Informed to O&M wing fpr required action
CB NO. 72 ROORKEE-SIDCUL	SIEMENS	22.06.2023 05:52	22:06:23 06:16	TRIPPED ON MTR OPTD DIST PROTN START DIST PROTN OPTD LED=1,4,5,9 MTR-86 IA=0.14KA IB=0.20KA IC=3.32KA DIST=16.2KM	CP-BACKUP RELAY DIR E/F OPTD BACKUP REALY DIR. O/C OPTD RP-50/51 TRIP 50/51G TRIP DIST=0.5 KM IA=.13A IB=0.18A IC=5.38KA	NIL	TRANIENT LINE FAULT	TFL	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.73 (RKE-LAKSAR)	SIEMENS	25.06.23 08:34	25:06:23 08:57	CP-MTR OPTD DIST PROTN START RP-LED 1,3,7 DIST LOOP L2-E IL1=0.13KA IL2=3.63KA IL3=0.11KA FL LOOP L2-E MTR 186	CP-DIST PROTN OPTD DIST PROTN START A/R BLOCKED MTR OPTD RP-86 86 L2-E IL1=0.41KA IL2=1.89KA IL3=0.25KA DIST=6.6 KM	NIL	DUE TO BAD WEATHER	TLF	Informed to O&M wing fpr required action
CB NO.71 JWALAPUR	SIEMENS	26.06.23 23:07	26:06:23 23:30	CP-MTR OPTD DIST PROTN OPTD RP-DIST PROTN RELAY LED-3,4,5 Z3 MTR 186 50Z/LBB PROTN RELAY LED-1,2 DIST=63.7KM IA=64.55A IB=84.70A IC=1.606KA	BACKUP RELAY DIR OC OPTD IA=0.05 IB=0.07 IC=5.8 VAB=130.84 VBC=108 VCA=102.04	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.72 SIDCUL	SIEMENS	28.06.23 03:53	28:06:23 04:34	MTR OPTD DIST PROTN START DIST PROTN OPTD LED-1,4,5,9 DIST=19.9KM ILA=0.18KA IB=0.14KA IC=2.84KA MTR86	BACKUP RELAY DIR O/C OPTD BACKUP RELAY EARTH FAULT OPTD RP-TRIP 50/51 TRIP MAIN3 PHASE TRIP RELAY-1 (88-1) MAIN 3 PHASE TRIP RELAY-2(86-2) DIST=0.5 KM	NIL	Transient Line Fault	TLF	Informed to O&M wing for required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.72 SIDCUL	SIEMENS	28.06.23 06:08	28.06.23 13:57	MTR OPTD DIST PROTN START DIST PROTN OPTD LED-1,4,5,9 DIST=19.9KM ILA=0.14KA IB=0.01KA IC=2.88KA MTR86 DIST=19.9KM	CP-BACKUP RELAY DIR O/C OPTD BACKUP RELAY DIR EARTH FAULT OPTD CARRIER FAILED RP-50/51 TRIP 50/51 G TRIP MAIN 3 PHASE TRIP RELAY-1(88-1) MAIN 3 PHASE TRIP RELAY-2 (86-2) DIST=0.5 KM	NIL	Transient Line Fault	TLF	Informed to O&M wing fpr required action
CB NO. 67 SAHARANPUR	SIEMENS	01.07.23 08:01	01.07.23 08:20	CP-DIST PROTN RELAY RELAY LED-1,2,5,6 DIST PICKUP L1E DIST=41.2KM IL1=1.17KA IL2=0.04 KA IL3=0.03KA O/C E/F RELAYED=1,5,6 MTR	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.78 CHUDIYALA	GE	05.07.23 6:00	05.07.23 6:14	CP-MTR OPTD DIST PROTN OPT DIST PROTN START RP-DIST PROTN RELAY LED-1,4,5,9 DIST PICKUP L3E DIST LOOP L3-E DIST=2.7KM DIST TRIP Z1/1P IL1=0.22KA IL2=0.15KA IL3=5.84KA MTR 186	MAIN RELAY DIST PROTN OPTD RP- MAIN PROTN (86-1) FOR BACKUP PROTN (86-2) DIST=9.2 KM IL1=0A IL2=OA IL3=3322.1A LED GROUP 1 GND DIST Z1 OPTD, LED GRP-2 A/R BLOCKED TRIP OTHR PHASE-C	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
50MVA T/F 1	ABB	06.07.23 04:07	06.07.23 7:35	CP-MTR GROUP A,B OPTD TERFO TROUBLE ALARM MTR GRP A,B RP-TERFO DIFFERANCIAL PROTN LED-1,2 AUX RELAY BUCHHOLZ ALARM WTI ALARM OTI ALARM OTI TRIP 86B SPRING CHARGE 8A ACTIVE GRP 1 FAULT DURATION=35ms CB OPT TIME=30ms	NA	NIL	DUE TO WATER IN MARSHALLING BOX	SEMT	Informed to O&M wing fpr required action
CB NO.67 SAHARANPUR	SIEMENS	06.07.23 11:33	06.07.23 11:41	O/C E/F LED 1,5,6 21 FDR DIST=8.5KM IL1=0.04KA IL2=1.88KA IL3=0.04KA 67,50 BF RELAY IL1=46.95A IL2=2.146KA IL3=46.02A MTR 186	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
50 MVA T/F 2	ABB	06.07.23 15:05	06.07.23 15:36	HV TRIP CP-MTR GRP-A,B RP-86A 86B	NA	NIL	TRANSIENT Earth FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO 71 JWALAPUR	SIEMENS	08.07.23 09:31	08.07.23 09:54	MTR OPTD LED-1,2,3,4 MTR86 IA=1.199KA IB=1.314KA IC=167.7 A	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
50MVA T/F 2	ABB	10.07.23 15:31	10.07.23 15:38	CP-MTR GRP A&B OPTD RP-86A 86B	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.67 SAHARANPUR	SIEMENS	10.07.23 11:46	10.07.23 11:55	O/C & E/F DIST=29.4KM IA=1.469KA IB=50.42A IC=29.39A DIST PICKUP L1E ON DIST 3P ON IL1=1.45KA IL2=0.05KA IL3=0.04KA	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.67 SAHARANPUR	SIEMENS	11.07.23 05:50	11.07.23 05:57	DIST PICKUP L1E ON DIST TRIP3P ON IL1=1.88KA IL2=0.02KA IL3=0.01KA DIST=17.21KM IA=2.137KA IB=19.53A IC=12.87A	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.67 SAHARANPUR	SIEMENS	11.07.23 06:58	11.07.23 07:35	OC & E/F DIST=17.1KM IA=2.48KA IB=21.86A IC=12.62A MTR 186 IL1=2.08KA IL2=0.0KA IL3=0.01KA	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.72 SIDCUL	SIEMENS	11.07.23 21:07	11.07.23 21:29	CP-MTR DIST PROTN START DIST PROTN OPTD LED=1,4,9 DIST=11.7KM MTR 86 IL1=0.18KA IL2=0.15KA IL3=0.38KA	CP-BACKUP RELAY DIR O/C OPTD BACKUP RELAY DIR E/F OPTD CARRIER FAILED RP-MAIN 3PHASE TRIP RELAY-1 86-1 MAIN 3 PHASE TRIP RELAY-2 86-2 TRIP 50/51P TRIP DIST=0.5 KM IA=13908.7A IB=207.8A IC=367.4A	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO 73 LAKSAR LINE	SIEMENS	12-07-23 18:08	12-07-23 19:41	CP-MTR OPTD DIST PROT OPTD DIST PROT START RP-DIST PROT RELAY LED-1,4,7 DIST PICKUP L3E IL1=0.11KA IL2=0.14KA IL3=3.46KA DIST=103.3KM	NT	NIL			Informed to O&M wing fpr required action
CB NO 63 THITHKI 1	SIEMENS	12-07-23 11:15	12-07-23 12:10	CP-MTR OPTD MTR UNHEALTHY RP-DIST PROT LED-1,2,3 DIST PICKUPL1E DIST TRIP Z1/1P IL1=0.88KA DIST=15.8 KM	NT	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO 67 SAHARANPUR	SIEMENS	12-07-23 15:05	12-07-23 15:28	DIST PROT RELAY LED-1,3,5,6 DIST PICKUP L2E DIST TRIP 3P Z1SF IL1=0.02KA IL2=1.44KA IL3=0.04KA DIST=23KM OC/EF LED-2,5,6	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO 64 THITHKI 2	SIEMENS	13-07-23 5:35	13-07-23 6:28	CP-DIST PROTN OPTD MTR OPTD ,SOTF OPTD DIST PROTN DIST PROT START RP-LED-1,3,5,6,11 DIST PICKUP L2E DIST TRIP 3P Z1SF DIST=3.2KM MTR 8 IL1=0.17KA IL2=1.22KA IL3=0.16KA	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
40MVA T/F 1ST	MICOM	13-07-23 05:41	13-07-23 18:40	CP-186H TRIP RELAY OPTD 186L TRIP RELAY OPTD OSR/PRV TRIP RP-TRAFO TROUBLE MULTI RELAY OSR TRIP 186H/186L	NA	NIL	TRIPPED WITH 12.5 MVA T/F	CMS T	Informed to O&M wing fpr required action
CB NO 67 SAHARANPUR	SIEMENS	15-07-23 08:40	15-07-23 09:07	DIST PICKUP L1E ON DIST TRIP3P ON IL1=2.95KA IL2=0.04KA IL3=0.03KA DIST=3.9KM	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
40MVA T/F 1ST	MICOM	15-07-23 06:32	15-07-23 07:15	CP-HV AND LV O/C RELAY OPTD ,186H,L OPTD RP-LED-1,2,3,5 IL1=1.17KA IL2=1.13KA IL3=0.15KA	NA	NIL	TRIPPED WITH 12.5 MVA T/F	CMS T	Informed to O&M wing fpr required action
20MVA T/F 2ND	MICOM	15-07-23 06:32	15-07-23 07:15	RP-LED-1,2,3,5 IL1=0.05KA IL2=0.52KA IL3=0.04KA	NA	NIL	TRIPPED WITH 12.5 MVA T/F	CMS T	Informed to O&M wing fpr required action
40MVA T/F 3RD	MICOM	15-07-23 06:32	15-07-23 07:15	CP-HV AND LV O/C RELAY OPTD ,186H,L OPTD RP-IL1=0.11KA IL2=1.04KA IL3=0.06KA	NA	NIL	TRIPPED WITH 12.5 MVA T/F	CMS T	Informed to O&M wing fpr required action
CB NO. 77 LSM	SIEMENS	15-07-23 11:57	15-07-23 12:11	CP-MTR OPTD DIST PROTN OPTD DIST PROTN START RP-LED-1,2,5,9 MTR 86 DIST TRIP3P IL1=5.89KA IL2=0.04KA IL3=0.03KA DIST=2.3KM	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.73 LAKSAR LINE	SIEMENS	19-07-23 14:47	19-07-23 15:05	CP-DIST PROTN OPTD DIST PROTN START MTR OPTD RP=DIST TRIP 3 POLE DIST TRIP Z3/T3 IL1=0.14KA IL2=3.29KA IL3=0.10KA DIST=12.1KM FL LOOP L2E	CP-DIST PROTN OPTD MTR OPTD MTR OPTD DIST PROTN START AR BLOCK RP-G-T Y PHASE PICKUP Z1 FAULTY AR BLOCK IL1=0.46KA IL2=2.02KA IL3=0.35KA MT86 186 DIST=5.1 KM	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.78 CHUDIYALA LINE	SIEMENS	21-07-2023 17:13	21-07-23 17:22	CP-MTR OPTD DIST PROTN OPTD RP-LED-1,4,5,9 DIST=6.3KM IL1=0.34KA IL2=0.18KA IL3=4.27KA 50Z/LBB PROTN OPTD	DIST PROTN OPTD RP- MTR 86-1 MTT 86-2 TRIP IA=IB=0 IC=2991.7 A TRIP OTHER PHASE C NEUTRAL GND LED GRP-1 GND DIST Z1 OPTD LED GRP-2 A/R BLOCK	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.77 LSM	SIEMENS	22-07-2023 13:18	22-07-23 13:33	CP-MTR OPTD DIST PROTN START DIST PROTN OPTD RP-DIST PROTN RELAY LED-1,2,5,9 DIST=2.3KM IL1=6.05KA IL2=0.05KA IL3=0.04KA POLE OPEN L1 MTR 186	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
20MVA T/F 1ST 783/683	SIEMENS	24-07-2023 12:00	24-07-23 12:21	O/C E/F OPTD LED=1,5 IL1=731A IL2=100.9A IL3=60.83A 86-1,86-2 LBB TRIPPING 50ZX 83DC	NA	NIL	DUE TO HEAVY CURRENT	TLF	Informed to O&M wing fpr required action
20MVA T/F 2ND 784/684	SIEMENS	24-07-2023 12:00	24-07-23 12:21	O/C E/F OPTD LED=1,5 IA=703A IB=99.1A IC=59.80A 86-1 86-1 LBB TRIPPING 50ZX 80DC	NA	NIL	DUE TO HEAVY CURRENT	TLF	Informed to O&M wing fpr required action
CB NO. 72 SIDCUL	SIEMENS	02-08-2023 05:52	02-08-2023 05:52	CP- DIST PROTN OPTD MTR OPTD DIST PROTN START RP-DIST PROTN LED-1,4,5,9 DIST PICKUP L3 E DIST=11.8% IL1=0.15KA IL2=0.26KA IL3=4KA	CP-BACKUP RELAY DIR. O/C OPTD E/F OPTD RP-MAIN 3 PHASE TRIP RELAY 86-1 MAIN 3 PHASE TRIP RELAY 2 86-2	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.71 JWALAPUR	SIEMES	03-08-2023 18:09	03-08-2023 18:25	CP-MTR OPTD DIST PROTN OPTD RP-50Z/LBB PROTN RELAY LED-1,2 DIST=43.22KM IA=0 IB=4.173A IC=2.44KA MTR 186	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
785/685 20 MVA T/F 3	SIEMENS	14-08-2023 16:01	14-08-2023 16:11	CP-LV BACKUP PROTN OPTD RP-O/C PU ON O/C E/F PU ON RELAY TRIP ON O/C TRIP ON IL1=0.06KA IL2=0.05KA IL3=1.24KA	NA	NA	CB 67 66KV SAHARANPUR BREAKER DOESN’T TRIP DUE TO BREAKER PROBLEM	SEMT	Informed to O&M wing fpr required action
CB NO.74 MANGLORE LINE	SIEMENS	22-08-2023 11:02	22-08-2023 11:17	CP-MTR OPTD DIR O/C E/F PROTN OPTD DIST PROTN START RP-DIST PROTN RELAY LED-1,4 DIST PICKUP L3E DIST LOOP L3-E DIST=39KM IA=263.7A IB=98.01A IC=6.122KA MTR186	CP-DIST RELAY TRIP DIST PROTN RELAY START	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.71 JWALAPUR	SIEMENS	22-08-2023 20:11	22-08-2023 20:42	CP-DIST PROTN START MTR OPTD DIR O/C E/F PROTN OPTD RP-DIST PROTN RELAY LED-3,4 ZONE 1 DIST=44.09KM MTR 186 IA=3.580A IB=6.05A IC=2.527KA IN=2.52KA	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.78 CHUDIYALA	SIEMENS	25-08-2023 02:30	25-08-2023 11:57	NO FLAG OBSERVED	NA	NIL	DUE TO PROBLEM IN CABLE (REMOTE TRIPPING CONTINUOUSLY)	SEFT	Informed to O&M wing fpr required action
160MVA T/F-2 CB NO. 888	ALSTOM	26-08-2023 23:24	27-08-2023 01:35	CP-BREAKER TROUBLE TRANS F TROUBLE ALARM RP-BUCHHOLZ WTI ALARM 30 1/2 OTI/ PRV ALARM H1/2 CB TRIP L/O OIL PR SF-6 OIL/ 1/2 30 A 1/2 CB AUTO TRIO BUS SEL INCORRECT 30 D 1/2 CB DC 1/2	NA	NA	Water logged in the trench caused cable fault	SEMT	Informed to O&M wing fpr required action
160MVA T/F-2 CB NO. 889	ALSTOM	27-08-2023 02:07	27-08-2023 03:20	BREAKER PD TRIP ALARM	NA	NIL	Water logged in the trench caused cable fault	SEMT	Informed to O&M wing fpr required action
CB NO.72 SIDCUL LINE	SIEMENS	29-08-2023 10:44	29-08-2023 11:07	MTR OPTD DIST PROTN START DIR O/C E/F PROTN OPTD LED=2,3 DIST=2KM IA=1.99KA IB=351.4A IC=426.7A MTR 186 LED=4	NA	NIL	BUS FAULT AT 132KV BUS	SEMT	Informed to O&M wing fpr required action
160 MVA T/F 1,2 887/787 888/788	ALSTOM	29-08-2023 10:44	29-08-2023 11:08	CP-BREAKER TC 1/2 787- IA=3.659kA IB=523.2A IC=206.3A VAN=4.038KV VB=70.77KV VCN=69.02KV 788- IA=3.560kA IB=522.3A IC=210.9A IN=3.797A MTR 86 ACTIVE GRP-1	NA	NIL	BUS FAULT AT 132KV BUS	SEMT	Informed to O&M wing fpr required action
CB NO.788 160MVA T/F-2	ALSTOM	05-09-2023 12:41	05-09-2023 12:55	CP-BREAKER T/C FAULTY O/C E/F 86 OPTD RP-86OPTD AUTO TRIP IA=480.3A IB=624.6A IC=1.285KA FD=2.729ms	NA	NIL	DUE TO BUS FAULT AT SIDCUL		Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB. NO 71 JWALAPUR	SIEMENS	05-09-2023 12:42	05-09-2023 13:02	CP-MTR OPTD DIR O/C E/F PROTN OPTD RP-LED 3 IA=35.10A IB=69.57A IC=243.4A 50Z/LBB RELAY TRIP MTR 186 TRIPPED	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.72 SIDCUL LINE	SIEMENS	06-09-2023 19:38	06-09-2023 19:59	CP-DIST PROTN OPTD DIST PROTN START MTR OPTD RP-IA=0.08KA IB=0.10KA IC=3.20KA DIST=15.3KM D=57.5% LED=1,4,5,9 MTR 186 OPTD 50Z/LBB RELAY OPTD	RP=BACK UP RELAY DIR O/C OPTD MAIN 3 PHASE TRIP RELAY OPTD 86-1,2 IA=0.07KA IB=0.08KA IC=4.37KA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.83 PUHANA LINE	ALSTOM	08-09-2023 2:25	08-09-2023 2:47	CP-BREAKER AUTO TRIP DIRECT TRIP RECEIVED RP-27R 27Y 27B DIST /DT CARRIER RCVD 85 X/Z 3PH PRTON TRIP THROUGH-21 DIST TRIP 86A 86B 86C CB AUTO TRIP TRIP 86 A SPARE AUX RELAY 30E 1/2 AUX TO 50ZX 86X ACTIVE GRP1 STARTED PHASE C TRIP PHASE ABC DIST TRIP Z2 DIST=9.641KM IA=4.556A IB=4.066A IC=2.916KA FAULT IN Z2	NA	NIL	TREE CAME IN THE RANGE	TLF	Informed to O&M wing fpr required action
CB NO.83 PUHANA LINE	ALSTOM	08-09-2023 02:47	08-09-2023 09:08	CP-BREAKER AUTO TRIP DIRECT TRIP RECEIVED RP-27R 27Y 27B DIST /DT CARRIER RCVD 85 X/Z 3PH PRTON TRIP THROUGH-21 DIST TRIP 86A 86B 86C CB AUTO TRIP TRIP 86 A SPARE AUX RELAY 30E 1/2 AUX TO 50ZX 86X ACTIVE GRP1 STARTED PHASE C TRIP PHASE ABC DIST TRIP Z2 DIST=8.922KM IA=4.231A IB=0A IC=2.966KA FAULT IN Z2	NA	NIL	TREE CAME IN THE RANGE	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.71 JWALAPUR LINE	SIEMENS	09-09-2023 22:54	09-09-2023 23:11	CP-MTR DIST PROTN OPTD MTR 186 LED=2,4 IA=75.60A IB=2.393KA IC=52.41A	CP-DIST PROTN OPTD CARRIER FAIL RP-3 PHSE TRIP RELAY-1 86-1 3 PHASE TRIP RELAY-2(86-2) DIST=17.9 KM IA=0.15KA IB=3.16KA IC=0.09KA PICKUP TIME=86 ms	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.71 JWALAPUR LINE	SIEMENS	11-09-2023 20:20	11-09-2023 20:32	CP-MTR OPTD DIST PROTN OPTD RP-Z1 TRIPPED IA=1.79KA IB=37.95A IC=40.15A LED=1,4 DIST=50.71KM 50Z/LBB	MAIN RELAY DIST PROTN OPTD BACKUP RELAY DIR. O/C OPTD RP-DIST PICKUP L1E-2 PICKUP TIME=70 ms TRIP TIME=1ms DIST=13KM IA=3.81KA IB=0.07KA IC=0.08KA MAIN 3 PHASE TRIP RELAY 86-1,2	NIL		TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO.71 JWALAPUR LINE	SIEMENS	12-09-2023 01:22	12-09-2023 01:35	CP-MTR OPTD DIST PROTN OPTD RP-Z1 TRIPPED IA=1.79KA IB=36.92A IC=439.40A LED=1,4 DIST=50.86KM 50Z/LBB	MAIN RELAY DIST PROTN OPTD BACKUP RELAY DIR. O/C OPTD RP-1,4,5,6 ANY TRIP B PHASE TRIP Z1 TRIP Z2 TRIP DIST=13KM IA=3.82KA IB=0.07KA IC=00.007KA 50/51 P TRIP 50/51 G TRIP 86-1 ,2 (MAIN 3 PHASE TRIP RELAY)	NIL	NA	TLF	Informed to O&M wing fpr required action
CB NO 81 NARA	MICOM	16-09-2023 15:47	16-09-2023 16:42	CP-A/R LOCKOUT POLE DEAD BREAKER AUTO TRIP RP-86A 86B 86C MTR 86 86X CB AUTO TRIP Z1 FL=948m IN=639.4A IA=250.9A IB=170.2A IC=343A	NA	NIL	NA	NA	Informed to O&M wing fpr required action
CB NO 72 SIDCUL LINE	SIEMENS	17-09-2023 12:36	17-09-2023 12:51	MTR OPTD DIST PRTN START DIST PROTN OPTD LED=1,3,4,9 MTR-186 IA=0.29A IB=3.35KA IC=0.27KA DIST=12.1KM	BACKUP RELAY DIST O/C DIR E/F OPTD RP-TRIP 86-1 86-2 50/51 P TRIP 50/51 G TRIP BACKP 67/67N IA=0.27A IB=4.44KA IC=2.7A	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO 81 NARA LINE	ALSTOM	18-09-2023 03:35	18-09-2023 04:32	CP-A/R LOCKOUT POLE DEAD BREAKER AUTO TRIP RP-86A 86B 86C MTR 86 86X CB AUTO TRIP Z1 F.L=20.43mm	NA	NIL			Informed to O&M wing fpr required action
CB NO.72 SIDCUL LINE	SIEMENS	22-09-2023 05:52	22-09-2023 06:20	MTR OPTD DIST PROTN OPTD LED=1,3,9 MTR- 186 IA=0.18KA IB=3.56KA IC=0.11KA DIST=13.7KM	CP-BACKUP RELAY DIR O/C OPTD BACKUP RELAY DIR E/F CB OPEN TRIP 50/51 R TRIP 50/51G TRIP RP-MAIN 3 PHASE TRIP RELAY-1 (86-1) MAIN 3PHASE TRIP RELAY-2 (86-2) DIS=20.4 KM IA=IC=0 KA IB=3.87KA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO. 81 NARA LINE	MICOM	22-09-2023 18:09	22-09-2023 19:06	CP-A/R LOCKOUT POLE DEAD BREAKER AUTO TRIP RP-Z1 YN TRIP R TRIP CARRIER SEND DIST 86A 86B 86C PROTN TRIP 21X VA=7.59KV VN=181.1KV MTR-86 TRIP CB AUTO TIP SPARE AUX RELAY FD=6.2KM IN=608.4A IA=251.4A IB=160.3A IC=350.7A	NA	NIL	NA	NA	Informed to O&M wing fpr required action
CB NO. 67 SAHARANPUR	SIEMENS	22-09-2023 10:51	22-09-2023 11:01	DIST PROTN RELAY LED=1,3,5 DIST PICKUP L2E DIST LOOP L2E DIST=57.31KM DIST=132.6% O/C E/F RELAY LED=2,5,6 IA=34.89A IC=53.37A IB=1.175KA MTR 86	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO. 71 JWALAPUR	SIEMENS	30-09-2023 00:25	30-09-2023 00:50	CP-MTR OPTD DIR O/C PROTN OPTD LBB OPTD RP-LED-3 IA=75.78A IB=52.68A IC=410.4A MTR 86	NA	NIL	Transient earth fault	Tlf	Informed to O&M wing fpr required action
CB NO. 72 SIDCUL	SIEMENS	30-09-2023 00:25	30-09-2023 01:14	CP-MTR OPTD DIST PROTN OPTD DIST PROTN START RP-12.9KM LED=1,4,5,9 DIST RELAY	NA	NIL	Transient earth fault	Tlf	Informed to O&M wing fpr required action
CB NO. 72 SIDCUL LINE	SIEMENS	02-10-2023 19:07	02-10-2023 19:30	CP-LED 1, 4,5,9 IA=0.15KA IB=0.19KA IC=3.51KA DIST=12.9KM DEFINITIVE TRIP	CP-BACKUP RELAY DIR O/C OPTD RP-50/51P TRIP 50/51G TRIP TRIP RELAY 86-1,2 IA=0.14KA IB=0.18KA IC=3.86KA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO. 73 ROORKEE	SIEMENS	04-10-2023 03:44	04-10-2023 04:02	MTR DIST PROTN START DIST PROTN OPTD LED=1,4,2 DIST=15.4KM IA=0.10KA IB=3.40KA IC=0.09KA	CP-BACKUP ELAY DIR O/C OPTD DIR E/F OPTD RP-MAIN 3 PHASE TRIP 86-1 86-2 50/51 TRIP 50/51 G TRIP IA=0.08KA IB=4.50KA IC=0.08KA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO. 81 NARA LINE	MICOM	04-10-2023 23:44	05-10-2023 00:58	CP-A/R LOCKOUT POLE DEAD BREAKER AUTO TRIP RP-R PHASE U/V FOR 27R XB A PHASE DIST TRIP 86ABC DIST RELAY LED 1,2,3,4 ACTIVE GRP 1 FD=40ms RTT=00 DIST=3.353mm IA=133.5A IB=325.7A IC=238.8A IN=608.1A VA=144.1KV VB=146.4KV VC=5.611KV MTR 86 CB AUTO TRIP	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
40MVA T/F 3RD	SIEMENS	04-10-2023 15:18	04-10-2023 15:30	CP-HV O/C E/F PROTN RELAY OPTD 186 HL TRIPPED RP-67/67N(HV) LED=1,4,5 50Z/LBB HV 186 LV SIDE 186 TRIPPED	NA	NIL	TRIPPED WITH 33KV FEEDER HG HOUSE	TLF	Informed to O&M wing fpr required action
CB NO.783/683 20MVA 1ST	SIEMENS	07-10-2023 16:23	07-10-2023 16:35	DIFF PICKUP 30C RELAY OPTD MTR 86H/L	NA	NIL	TRIPPED WITH CB N0.62	SEFT	Informed to O&M wing fpr required action
CB NO 72 SIDCUL LINE	SIEMENS	12-10-2023 07:57	12-10-2023 08:18	CP-MTR OPTD DIST PROTN START DIST PROTN OPTD LED=1,3,5,9 DIST=10.5KM MTR 186 IA=0.22KA IB=4.34KA IC=0.18KA	CP-BACKUP RELAY DIR O/C OPTD BACKUP DIST E/F OPTD RP-50/51P TRIP 50/51G TRIP DIST=100 TRIP RELAY-2 IA=0.20KA IB=4.02KA IC=0.18KA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO 73 LAKSAR LINE	SIEMENS	14-10-2023 04:56	14-10-2023 05:23	CP-MTR OPTD DIST PROTN START DIST PROTN OPTD RP-DIST LOOP L3-E ON DIST TRIP 3P ON DIST TRIP Z3/T3 ON IA=0.09KA IB=0.12KA IC=3.45KA POLE OPEN L3 ON DIST=124.2KM MTR	CP-DIST PROTN OPTD MTR OPTD DIST PROTN START A/R BLOCKED RP-G TRIP B PHASE PICKUP Z1 FAULT A/R BLOCK 186,86	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO 72 SIDCUL LINE	SIEMENS	17-10-2023 10:34	17-10-2023 10:57	CP-MTR OPTD DIST PROTN OPTD DIST PROTN START DIST RELAY LED=1,4,5,9 IA=0.17KA IB=0.18KA IC=3.90KA DIST=11.5KM 50Z/LBB OPTD 186 OPTD	CP-BACKUP RELAY DIR O/C OPTD BACKUP DIR E/F OPTD IA=0.17KA IB=0.17KA IC=4.10KA 50/51P TRIP 50/51 G TRIP MAIN 3PHASE 1,2 TRIP	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.72 SIDCUL	SIEMENS	05-11-2023 00:05	05-11-2023 00:25	CP-MTR OPTD DIST PROTN OPTD DIST PROTN START RP-DIST PROTN RELAY LED=1,4,5,9 DIST=15.4KM DIST LOOP L3-E DIST PICKUP L3E IA=0.11KA IB=0.17KA IC=3.52KA DIST=57.9% 50Z/LBB PROTN RELAY LED=1,2 MTR 186	CP-BACKUP RELAY DIR O/C OPTD BACKUP DIR E/F OPTD IA=0.12KA IB=0.15KA IC=5.38KA MAIN 3PHASE RELAY 1,2	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CB NO 74 MANGLORE	SIEMENS	10-11-2023 14:15	10-11-2023 16:26	CP-FLAG MTO DPO PPS RP-DIST=8.2KM IA=9.19KA IB=0.24KA IC=0.40KA 50Z/LBB Z1 TRIPPED	CP-DIST RELAY TRIP DIST PROTN RELAY STARTED RP-REX 511 Z1,2,3,4 START TOC STL-1 DIST=7.6 KM IA=2146A IB=1.94KA IC=2.27KA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO 73 LAKSAR	SIEMENS	12-11-2023 18:21	12-11-2023 18:35	TRIPPED ON MTR DIST PROTN START DIST PROTN OPTD DIST=142.9KM LED=1,3,7 IA=0.11KA IB=3.10KA IC=0.08KA MTR86	CP-DIST PROTN OPTD START A/R BLOCKED MTR OPTD RP-86,186 B PHASE START LOOP L2E DIST=4.1 KM IA=0.52KA IB=2.13KA IC=0.43KA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CBNO.83 PUHANA	MICOM	05-12-2023 12:30	05-12-2023 20:15	CP-DIR TRIP CB AUTO TRIP RP-DIST R,Y,B DIST CARRIER R,B DIST=11.03KM IA=4.219A IB=0 IC=3.309KA VAN=125.1KV VBN=101.7KV VCN=33.88KV Z2 86 TRIP	NA	NIL	Y PHASE LA DAMAGE (FROM OTHER END)	SEFT	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CBNO.81 NARA	MICOM	06-12-2023 03:47	06-12-2023 04:47	CP-A/R LOCKOUT BREAKER AUTO TRIP RP-R PHASE U/V FOR E/S INTERLOCKING 27R 3 PHASE PROTN TRIP 21X DIST PROTN 21 LED=5 RYB PHASE Z1 DIST TRIP Z1 A/R STATE TRIP FD=31ms DIST=2.402KM CBOT=26ms IA=250.4A IB=151.5A IC=279.9A IN=650A VA=4.876KA VB=153KV VC=147.3KB APHASE DIST TRIP 86A 86B 86C CB AUTO TRIP	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CBNO.81 NARA	MICOM	06-12-2023 06:36	06-12-2023 08:23	CP-A/R LOCKOUT BREAKER AUTO TRIP RP-R PHASE U/V FOR E/S INTERLOCKING 27R 3 PHASE PROTN TRIP 21X DIST PROTN 21 LED=5 RYB PHASE Z1 DIST TRIP Z1 A/R STATE TRIP FD=35ms DIST=3.705KM CBOT=30ms IA=237.9A IB=149.2A IC=325.1A IN=644.3A VA=5.271KV VB=152.4KV VC=145.3KV VN=191.2KV A PHASE DIST TRIP 86A 86B 86C CB AUTO TRIP	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CBNO.81 NARA	MICOM	13-12-2023 02:05	13-12-2023 03:16	CP-A/R LOCKOUT BREAKER AUTO TRIP RP-27R 27Y 27B 3 PHASE PROTN TRIP THROUGH 21 CB AUTO TRIP SPARE AUX RELAY 30 E 1/2 RIGHT TRIP RELAY 86 86X DIST TRIP Z1 FD=11ms DIST=3.228mm IA=125.3A IB=275.5A IC=240.3A VA=145.8KV VB=149.4KV VC=6.385KV VN=183.4KV	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CBNO.81 NARA	MICOM	14-12-2023 01:09	14-12-2023 02:23	CP-A/R LOCKOUT BREAKER AUTO TRIP 86A 86B 86C B PHASE U/V E/S INTER LOCKING 27B 3 PHASE PROTN TRIP 21X TRIP 86 CB AUTO TRIP DIST PROTN 21 LED=1,2,,3,4 DIST TRIP Z1 FD=20ms CBOT=15ms RTT=0 DIST=3.828Mm IA=127.8A IB=286.5A IC=241.5A IN=617.9A VA=146.7KV VB=150KV VC=6.468KV VN=183.7KV	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action

Name of Feeder/TF	Type of	Date Time of Tripping	Date& Time of closing	flags observed	Other end flage	affected generation/ load	Tripping Analysis / Action taken report	Category Code	Action Taken
CBNO.81 NARA	MICOM	22-12-2023 05:44	22-12-2023 06:53	CP-A/R LOCKOUT POLE DEAD BREAKER AUTO TRIP RP-DIST TRIP 86A 86B 86C 3 PHASE PRTON TRIP THROUGH 21 21X BUS SELECTION INCORRECT 30D 1/2 SPARE AUX RELAY 30 E 1/2 TRIP RELAY 86,86X DIST PROTN Z1 IA=121.5A IB=309.6A IC=231.1A IN=608.9A VA=143.8KV VB=147.1KV VC=5.028KV VN=181.8KV	NA	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CB NO.71 JWALAPUR	SIEMENS	23-12-2023 01:14	23-12-2023 01:26	CP-MTR OPTD DIST PROTN OPTD RP-DIST TRIP Z1 DIST=28.98KM LED=3,4 MTR 186 FD=55ms CBOT=50ms RTT=0sec IA=233.5A IB=190.3A IC=3.494KA VA=87.77KV VB=52.32KV VC=83.29KV	CP-BACKUP RELAY DIR O/C E/F OPTD RP-DIST LOOP L3E EF TRIP BLOCK B 50/51 P TRIP 50/51G TRIP IA=00 IB=00 IC=3.75 86	NIL	TRANSIENT LINE FAULT	TLF	Informed to O&M wing fpr required action
CBNO 781/381 782/382 786/386	SIEMENS	01-02-2024 02:55	01-02-2024 03:31	781/381-HV O/C E/F OPTD 186H TRIP RELAY OPTD 186L TRIP RELAY OPTD RP-MT1 R86 782/382-CP-LV TC/TC2 FAULTY RP-RELAY PICKUP OK IA=0.06KA IB=0.22KA IC=0.01KA HV 186 LV 186 786/386-CP-HV O/C E/F OPTD 186H TRIP RELAY OPTD 186L TRIP RELAY OPTD RP-IA=0.11KA IB=0.42KA IC=0.01KA HV 186 LV 186	NA	NIL	TRIPPED WITH BEHEDHKI (BLAST IN CABLE BOX OF BEHDHKI)	SEMT	Informed to O&M wing for required action

5.0. Observations and Recommendations

5.1. Reporting of all the Tripping with DR/EL

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System “http://103.7.128.184/Account/Login.aspx” within 24 hours of the events. These are being submitted by sub-station to NRLDC portal, however the record of the same is not kept at substation level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	DR, EL & Tripping report need to be submitted
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
	Total in NR Region	520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at sub-stations

c. It is recommended that each sub-station to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. Development of centralized database of relay settings

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 kV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220kV are to be calculated by SLDC and/or central level. The relays are tested by sub-station officials as per need basis, but the record of recommended

settings/ calculation is not kept at sub-station level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220kV & above and by SLDC below 220kV along with setting calculations & parameters used for all the relays be kept at sub-station level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. Review of test results of relay and equipment

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".
b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.
c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. Availability of Testing Kits

a. The availability of testing equipment is limited at each substation. For comprehensive testing of equipment, as per above para, sufficient testing kits at each substation/Sub-division/ Division level are required.
b. Based on the O&M manual, it is recommended that sufficient quantity of testing instruments be made available at sites for regular testing of equipment. A suggested list of Testing Equipment is attached at Annexure – 1.

5.5. Up-dation of PTCUL Protection Philosophy

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. Simulation based study of protection system

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. Capacity Building of protection team

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. Updated Fault Level/ Short Circuit Level and Network information

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. General Protection related observations

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. O&M Manual

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

a. The major observations and recommendations of the previous audit report are to be complied with.

b. Bus Bar Protection on 220kV Bus is not functional after addition of the new elements with the 220kV bus. It is recommended to make it functional.

c. PLCC is unhealthy and therefore tele protection is out of service and both the 220kV circuits are operating without carrier protection, however the auto reclosure is enabled. Currently the successful auto reclosures are being recorded in the log book however no separate analysis record is being maintained. Record of successful auto-reclosures be maintained along with tripping reports.

d. The events are recorded from individual relays, no separate Event Logger is provided. The SAS has the event logging capability but is not in regular use. It is observed that some of the inputs are not available at SAS. The effectiveness of SAS can be improved by using SAS regularly. Therefore, update and upkeep of SAS is recommended.

e. 3 nos. GPS Time Synchronization Systems are provided in the substation. One system caters to SAS and other two caters to relays and other equipment's of the respective substation i.e. old 132 kV. Only one GPS associated with 220kV site is functional, but the relays are connected to SAS GPS, therefore presently no relay is time synchronised. Necessary corrective actions need to be taken.

6.2. Equipment related observations and recommendations

a. The switchyard equipments are generally in good condition. Any requirement of spare equipment may be reviewed by PTCUL.

b. In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of Maintenance Equipment is attached at Annexure– 3.

6.3. Auxiliary Equipment related observations and recommendations

a. Both the 110V DC systems are showing earth-fault. Corrective actions need to be taken.

b. Protection maloperations due to waterlogging in switchyard are observed. Necessary action for avoiding water logging and consequential maloperation of protective system needs to be taken.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

NIL

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
   a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
   b) to have a repository of protection system, settings and events at regional level;
   c) specifying timelines for submission of data;
   d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
   e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220KV and above (132KV and above in NER). RLDCs shall also maintain such database.
   b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220KV and above (132KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.
5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220KV and above (132KV and above in NER) system, which shall be reviewed by the RPC:

   e. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

N_c is the number of correct operations at internal power system faults and

N_f is the number of failures to operate at internal power system faults.

f. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

N_c is the number of correct operations at internal power system faults

N_u is the number of unwanted operations.

g. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

N_c is the number of correct operations at internal power system faults

N_i is the number of incorrect operations and is the sum of N_f and N_u

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

   a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.

   b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:

      i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.

      ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

   a. The protection system checklist shall contain information as per this Regulation.

      i. General Information (to be provided prior to the checking as well as to be included in final report):

      - Substation name
      - Name of Owner Utility
      - Voltage Level (s) or highest voltage level
      - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
      - Checking and validation date
      - Record of previous tripping's (in last one year) and details of protection operation
      - Previous Relay Test Reports
      - Overall single line diagram (SLD) (x) AC aux SLD
      - DC aux SLD
      - SAS architecture diagram
      - SPS scheme implemented (if any)

b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works &pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 trippings (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection;

- Name and Length of Line
- Whether series compensated or not
- Mode of communication used (PLCC/OPGW)

- Relay Make and Model for Main-I and Main-II
- List of all active protections & settings
- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model
- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays

- Other requirements for protection checking and validation

iv. AC auxiliary system;

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. DC auxiliary system;

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
    - Mode of communication for Main-1 and Main-2 protection
    - Mode of communication for data and speech communication
    - Status of PLCC channels
    - Time synchronization equipment details
    - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
    - Other requirements for protection checking and validation

vi. Circuit Breaker Details;

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium
- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
    - CT/CVT ID name and voltage level

- CT/CVT core connection details
- Accuracy Class
- Whether Protection/Metering
- CT/CVT ratio available and ratio adopted
- Details of last checking and validation of CT/CVT healthiness
- Other requirements for protection checking and validation
- Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).

b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.

c) All the major general deficiency shall be listed in detail along with remedial recommendations.

d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.

e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	220KV and above: Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme. 132KV and below: One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines) Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect.
		Time setting: i. 0.35 second *(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)* ii. 0.5-0.6 second *(For a long line followed by a short line)*

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series compensated double circuit lines may be kept

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		higher at 113%.
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220KV LINES: No over-voltage protection shall be used. FOR 220KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		done for multi circuit lines/cable.
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.
Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email: sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0

(उत्तराखण्ड सरकार का उपक्रम)

अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय

कुमांयु मण्डल हल्द्वानी

मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	**GST**	:	GST shall be paid extra as per applicable Government rules.
3	**Tax**	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	**Date of Start of work**	:	Order shall be considered as having come in to force from the date of issue of order.
5	**Supply Completion**	:	NA
6	**Work completion**	:	The work should be completed within 24 months from the date of issue of order.
7	**Engineer of the contract**		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	**Engineer in-charge**		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	**Liquidity damages**	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	**Dispute**		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	**Payment terms**	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	**Payement unit**		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	**Warranty period**	:	NA.
14	**Billing Address**	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
   Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause						Modified Clause					
		Sr. No	Description	Unit	Qty	Amount	Total Amount	Sr. No	Description	Unit	Qty	Unit rate (Rs.)	Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.						1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.				
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.						2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.				
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.						3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.				
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus						4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to				

2

S. No.	Clause of PO	Existing Clause	Modified Clause
		coupiers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DG Set/auxiliary DC supply at substations.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g) Field inspection of protection device for obsolescence of technology, suitability and healthiness. h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

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S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum**.
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

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S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

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Annexure – 8: Data Sheets

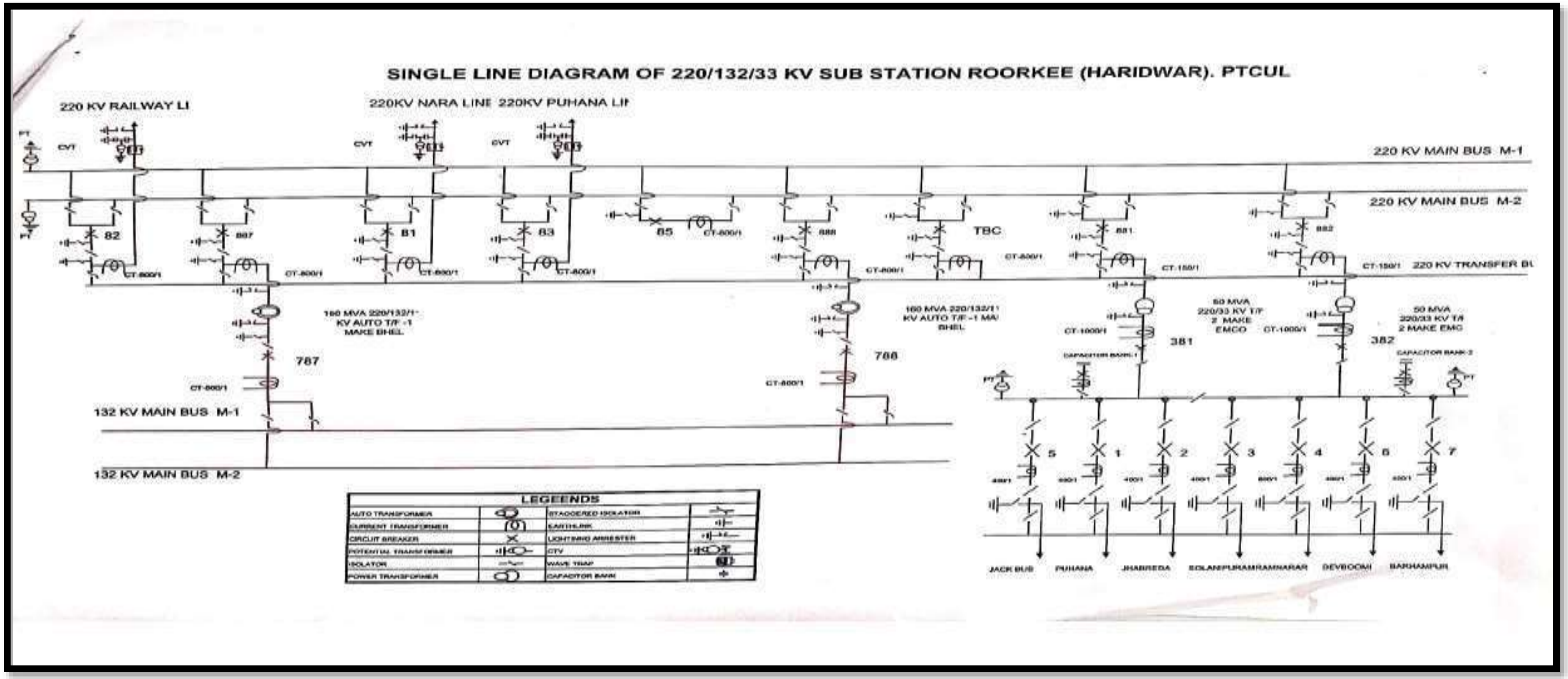
Contents

Annexure - 8

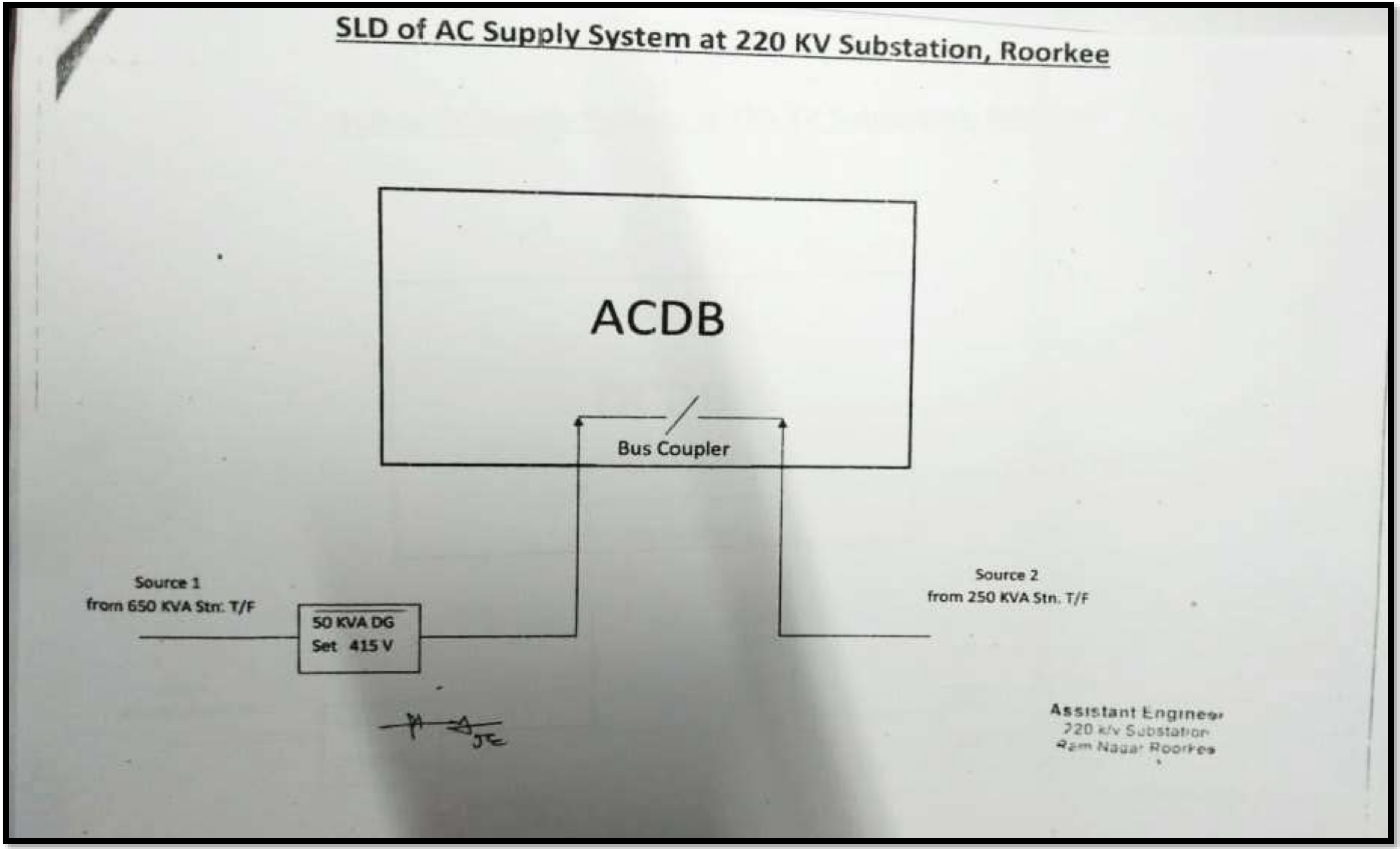
Data Sheets

Single Line Diagrams

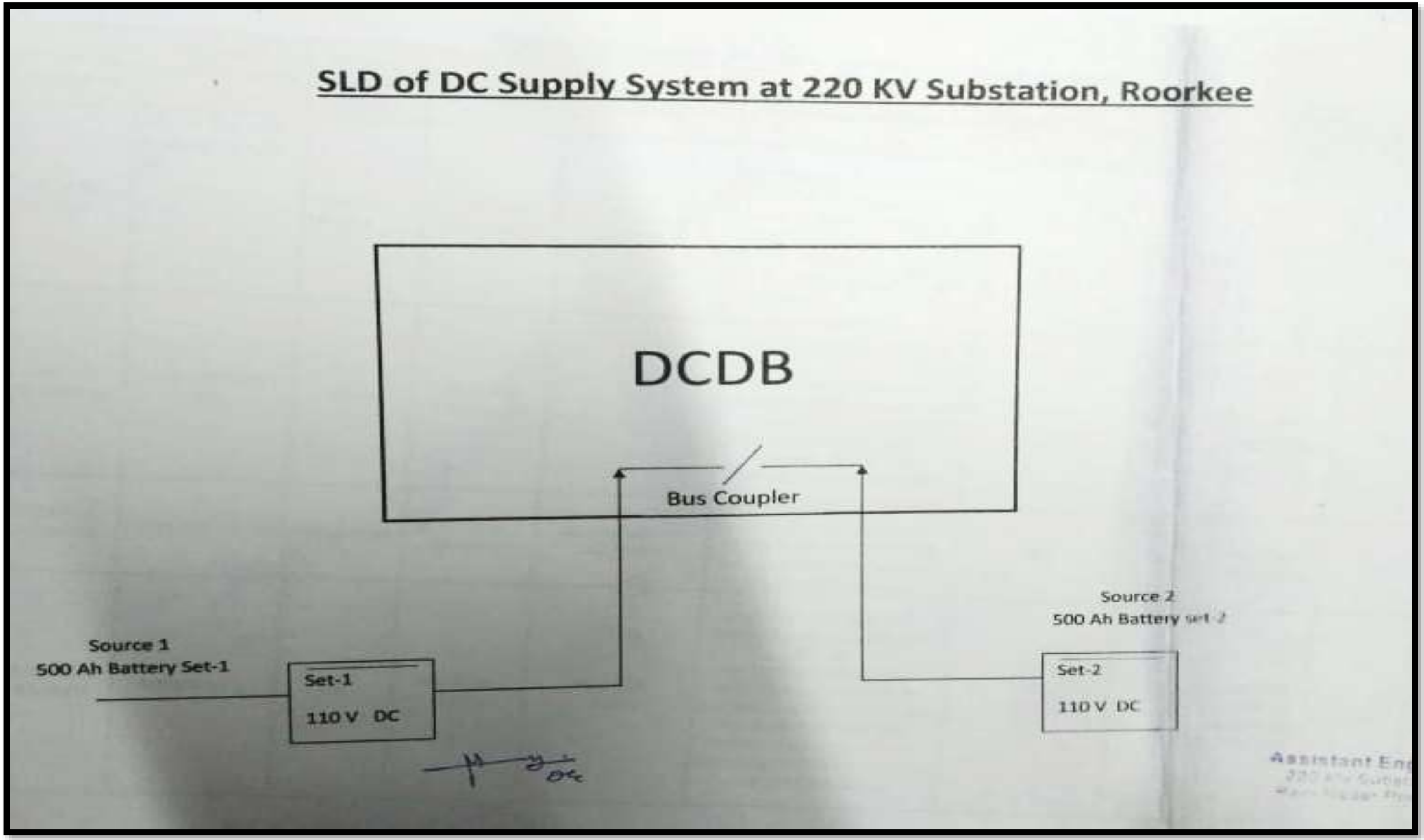
Substation Single Line Diagram



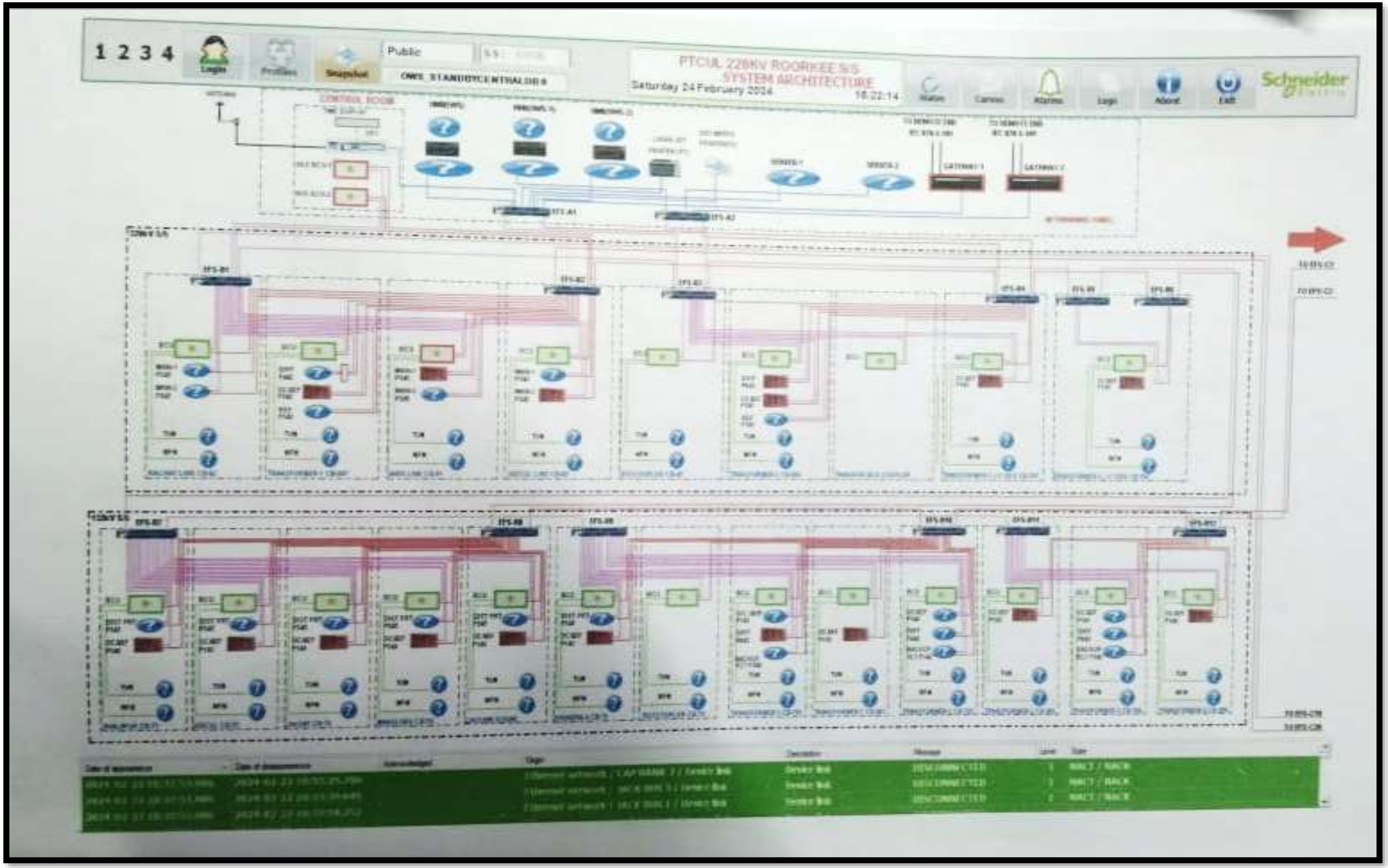
AC Auxiliary System



DC Auxiliary System



SAS Architecture diagram



Transmission Lines

220kV:

	Particulars	Tr Line 1	Tr Line 2
Name of Tr Line		220 Imlikheda	220 Rishikesh
Length of Line		18.94	23.98
Series Compensated (Yes/No)		No	No
Connected to dedicated CT core (mention name)		Yes, PS	Yes, PS
CT Ratio		1600-800/1	1600-800/1
Connected to dedicated PT core (mention name)		Yes, 3P	Yes, 3P
PT Ratio		220KV/110V	220KV/110V
Relay connected to Trip Coil-1 or 2 or both		Both	Both
Feed from DC supply-1 or 2		1	1
i	Main-I Protection (Make and Model)	Schneider P545	Schneider P545
	Functional (Yes/No)	Yes	Yes
	Date of testing		
ii	Main-II Protection (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
	Date of testing	NA	NA

	Particulars	Tr Line 1	Tr Line 2
iii	LBB Protection (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
	Date of testing	NA	NA
iv	PLCC/ Protection coupler (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
v	DR (Make &Model) (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
iv	Time Synch.Unit (Make and Model)	NA	NA
	Functional (Yes/No)	NA	NA
1	Status of Power Swing	Block in Zone 1	Block in Zone 1
2	Out of Step	NA	NA
3	SOTF	NA	NA
4	Breaker Failure	Yes	Yes
5	Broken Conductor	No	No
6	STUB	No	No
7	Fault Locator	Yes	Yes
8	Disturbance Recorder	Yes	Yes
9	VT fuse fail	Yes	Yes
10	Overvoltage Protection	No	No
11	Trip Circuit supervision	Yes	Yes

Particulars		Tr Line 1	Tr Line 2
12	Auto-reclose	Yes	Yes
13	Load encroachment	No	No

Bus-Bar Protection

220kV

Sl. No.	Particulars	Observations
a	Busbar and redundant relay make and model	Electromechanical bus bar protection
b	Type of Busbar arrangement	Main 1-2 & Transfer
c	Zones	Three
d	Dedicated CT core for each busbar protection	Yes
e	Breaker Failure relay included, if additional then furnish make and model	NA
f	Trip issued to both Busbar protection in case of enabling	NA
g	Isolator indication and check relays	NA
h	Other requirements for protection checking and validation	NA

AC Auxiliary System

Sl. No.	Particulars	Observations
a	Source of AC auxiliary system	01 No. 630 kVA 33/0.4 kV
b	Supply changeover between sources (Auto/Manual)	Auto
c	Diesel generator (DG) details	50 KVA
d	Maintenance plan and supply changeover periodicity in DG	NA
e	Single Line Diagram	NA
f	Other requirements for protection checking and validation	NA

DC Auxiliary System

Sl. No.	Particulars	Observations			
		220 V DC - I	220 V DC - II	48 V DC-I	48 V DC-II
a	Make				
b	Model/Rating				
c	Vintage	3 Year	9 Year	6 Year	18 Year
d	Measured voltage				
	i. Positive to Earth	199 V	199 V	0 V	
	ii. Negative to Earth	42 V	42 V	47 V	
e	No. of Cells Per Bank	110	110	24	24
f	Availability of Battery Charger	Yes	Yes	Yes	yes

Circuit Breakers

	Particulars	Make and Model	No. of trip/close coil	Trip Coil Supervision relay and healthiness of coils	LBB Setting Stage 1	LBB Setting Stage 2	Remarks (If any)
A	**220kV System**						
1	220 kV SIDCUL-RKSH	CGL, type-200-SFM-40S	6/3	Healthy	NA	NA	NA
2	220kV SIDCUL-PIRANKALIYAR	CGL, type-200-SFM-50AA	6/3	Healthy	NA	NA	NA
3	160 MVA ICT-1	CGL, type-200-SFM-50AA	6/3	Healthy	NA	NA	NA
4	160 MVA ICT-2	CGL, type-200-SFM-50AA	6/3	Healthy	NA	NA	NA
5	50 MVA	ABB, LTB245E1, 40KA	6/3	Healthy	NA	NA	NA
6	25 MVA	CGL, type-200-SFM-50AA	6/3	Healthy	NA	NA	NA

Current Transformer

a	**Location of CT**	**220 KV SIDCUL-RKSH**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
I	Ratio Adopted	1600-800/1	1600-800/1	1600-800/1	1600-800/1	1600-800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**220 KV SIDCUL-PIRANKALIYAR**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
I	Ratio Adopted	1600-800/1	1600-800/1	1600-800/1	1600-800/1	1600-800/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**160 MVA-I**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
I	Ratio Adopted	1600-400/1	1600-400/1	1600-400/1	1600-400/1	1600-400/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**160 MVA-II**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
I	Ratio Adopted	1600-400/1	1600-400/1	1600-400/1	1600-400/1	1600-400/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**50 MVA**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
I	Ratio Adopted	1600-300/1	1600-300/1	1600-300/1	1600-300/1	1600-300/1
ii	Ratio measured	NA	NA	NA	NA	NA

a	**Location of CT**	**25 MVA**				
b	Date of CT ratio Test Testing					
		Core I	Core II	Core III	Core IV	Core V
c	Accuracy Class	PS	PS	0.2	PS	PS
d	Purpose	MAIN	Back up	Metering	Protection	Protection
e	Test Results					
I	Ratio Adopted	150-75/1	150-75/1	150-75/1	150-75/1	150-75/1
ii	Ratio measured	NA	NA	NA	NA	NA

Capacitive Voltage Transformer/Potential Transformer

a	**Location of CVT/PT**	**220 kV SIDCUL-RKSH**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	3P	3P	0.2
d	Purpose	Main	Backup	Metering
e	Test Results			
I	Ratio Adopted	220 kV/110 V	220 kV/110 V	220 kV/110 V
ii	Ratio measured	NA	NA	NA

a	**Location of CVT/PT**	**220 kV SIDCUL-PIRANKALIYAR**		
b	Date of CT/PT ratio Test Testing			
		Core I	Core II	Core III
c	Accuracy Class	3P	3P	0.2
d	Purpose	Main	Backup	Metering
e	Test Results			
I	Ratio Adopted	220 kV/110 V	220 kV/110 V	220 kV/110 V
ii	Ratio measured	NA	NA	NA

Disturbance Recorder (DR) & Event Logger (EL)

Sl. No.	Particulars	220kV	132kV
1	a) Is the Disturbance recorder and Fault locator provided on all line feeders?	Yes	Yes
	b) Whether standalone or built in Main relay	Built in	Built in
	c) Whether DR is having automatic fault record download facility to a central PC	No	No
	d) Whether Central PC for DR, EL are powered by Inverter (fed from station DC)	Yes	Yes
2	Whether substation is having Event logger facility	Yes	Yes
	If Yes (standalone or built-in-SAS)	Built in	Built in
3	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	Yes	

Communication System

Not Available

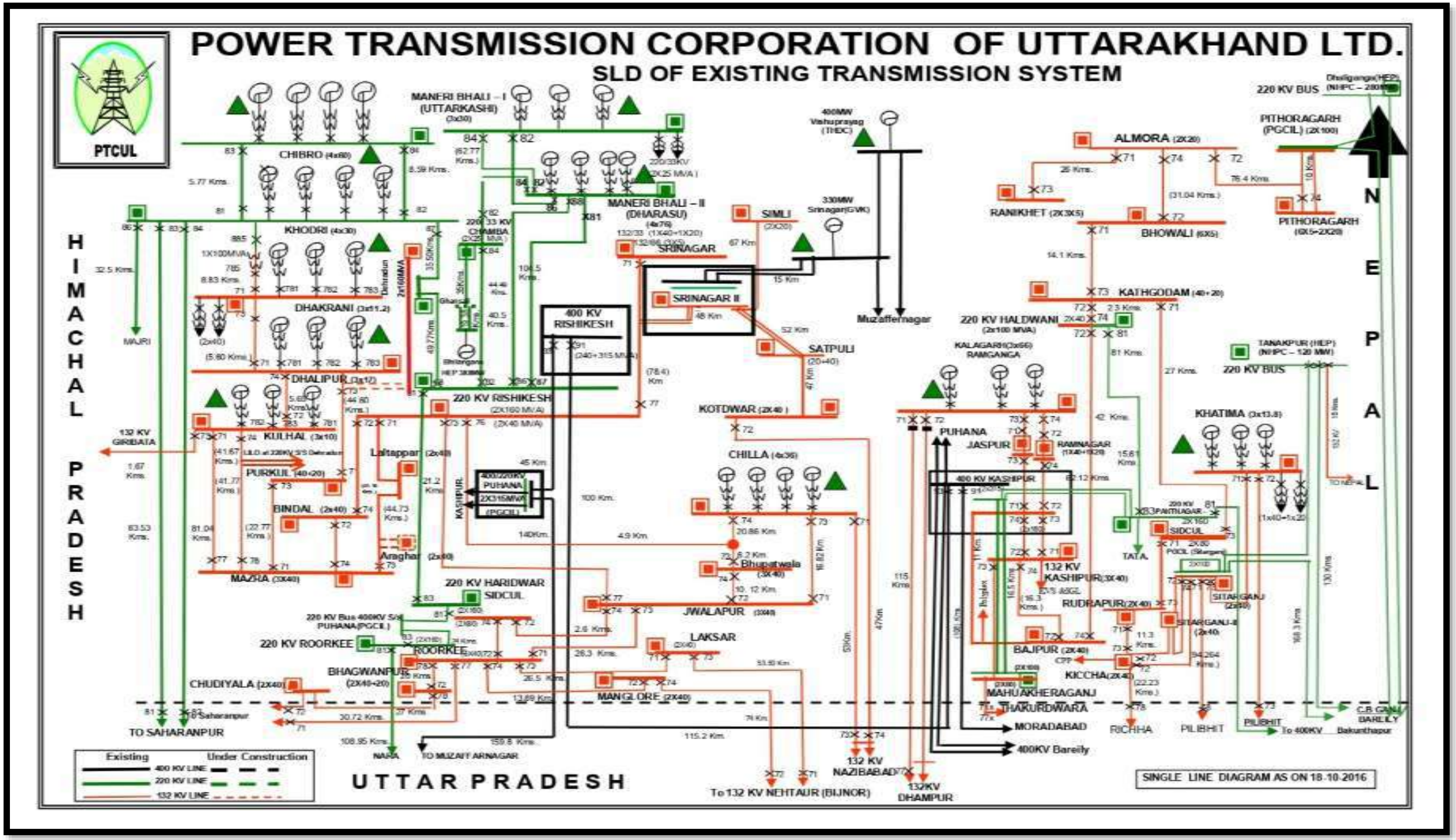
Transformer Protection

Particulars	TF-1	TF-2	TF-3	TF-4
Name of ICT	160 MVA I	160 MVA II	50 MVA	25 MVA
Make	IMP	IMP		
Connected to dedicated CT core (HV Bay)				
Core-1	Protection	Protection	Protection	Protection
Core-2	Protection	Protection	Protection	Protection
Core-3	Metering	Metering	Metering	Metering
Core-4	Protection	Protection	Not in use	Not in use
Core-5	Protection	Protection	Not in use	Not in use
CT ratio	1600-400/1	1600-400/1	1600-300/1	150-75/1
Connected to dedicated Bus CVT core (HV Bay)				
Core-1	Protection	Protection	Protection	Protection
Core-2	Protection	Protection	Protection	Protection
Core-3	Metering	Metering	Metering	Metering
CVT ratio	220 KV/110V	220 KV/110V	220 KV/110V	220 KV/110V
Relay connected to Trip Coil-1 or 2 or both (HV)	Both	Both	Both	Both
Feed from DC supply-1 or 2(LV)	Both	Both	Both	Both
Connected to dedicated CT core (LV Bay)				

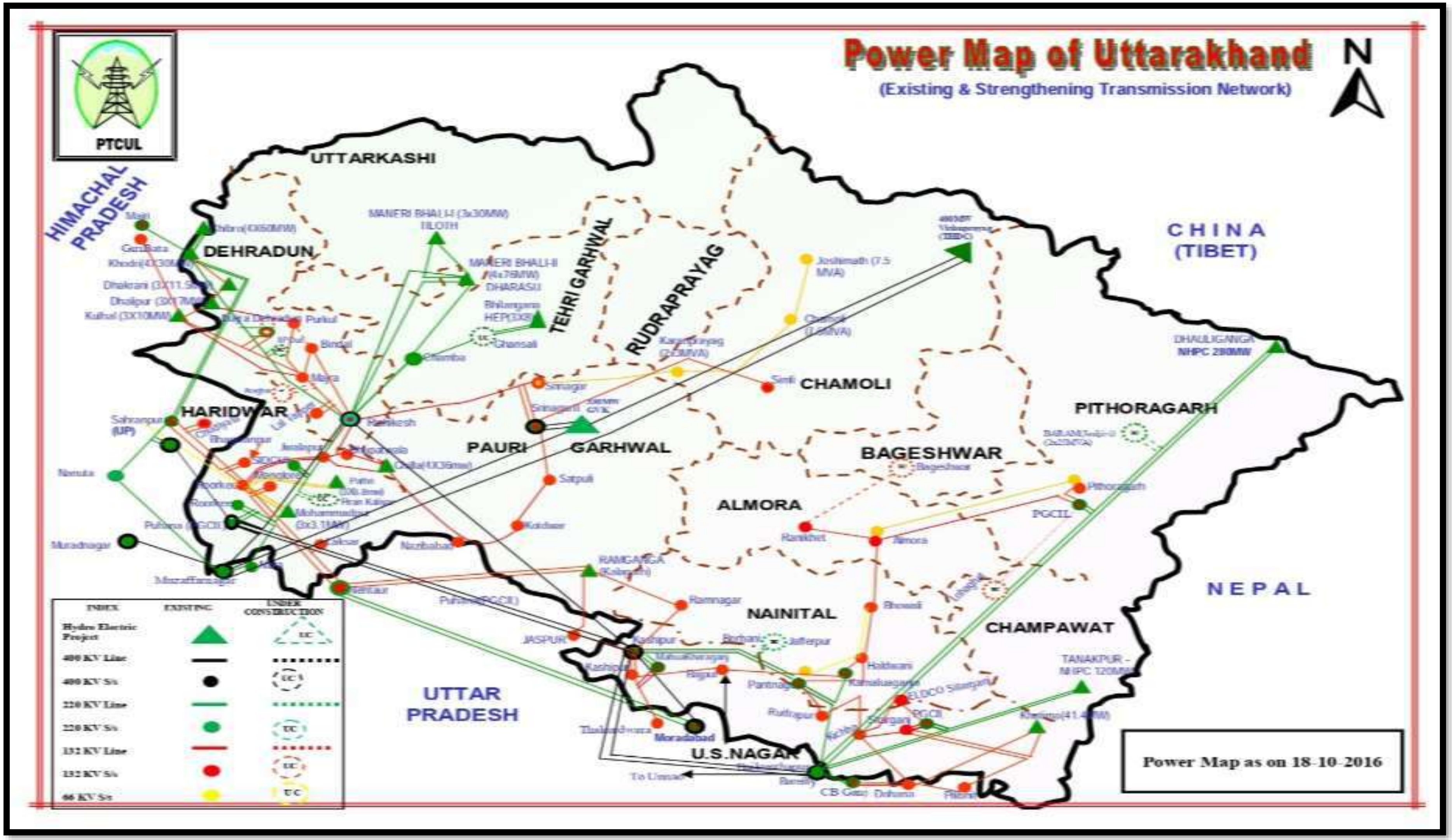
Particulars		TF-1	TF-2	TF-3	TF-4
Core-1		Protection	Protection	Protection	Protection
Core-2		Protection	Protection	Protection	Protection
Core-3		Metering	Metering	Metering	Metering
Core-4		Protection	Protection	NA	NA
Core-5		Protection	Protection	NA	NA
CT ratio		1000-500/1 800-400/1	1000-500/1 800-400/1	1000-500/1	1000-500/1
Connected to dedicated Bus CVT core (LV Bay)					
Core-1		Protection	Protection	Protection	Protection
Core-2		Protection	Protection	Protection	Protection
Core-3		Metering	Metering	Metering	Metering
CVT ratio		132KV/110V	132KV/110V	33KV/110V	33KV/110V
Relay connected to Trip Coil-1 or 2 or both (HV)		Both	Both	Both	Both
Feed from DC supply-1 or 2(LV)		2	2	2	2
LA Rating/ HV Side		NA	NA	NA	NA
LA Rating/ LV Side		NA	NA	NA	NA
Date of last testing of Protection		NA	NA	NA	NA
Group A Protection					
1	Differential Protection (Make & Model)	ALSTOM P633	Schneider P643	GE T60	Schneider P643
2	PRV	YES	YES	YES	YES

Particulars		TF-1	TF-2	TF-3	TF-4
3	WTI Indication working	YES	YES	YES	YES
4	Back-up Over Current Protection HV (Make & Model)	P127	P127	F650	F650
5	Over Flux Protection (Make & Model) HV	NA	NA	NA	NA
Group B Protection					
1	REF Protection (Make & Model)	NA	NA	ALSTOM CAG14	ALSTOM P14NB
2	Bucholtz	YES	YES	YES	YES
3	Back-up Over Current Protection LV (Make & Model)	P127	P127	F650	F650
4	Over Flux Protection (Make & Model) LV	NA	NA	NA	NA
5	OTI Indication working	YES	YES	YES	YES

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Power Transmission Corporation of Uttarakhand Limited

(A Govt. of Uttarakhand Undertaking)

Corporate ID No.: U40101UR2004SGC028675

FINAL REPORT

Protection Audit

220/132KV Jhajhra Substation

Submitted

By

CENTRAL BOARD OF IRRIGATION & POWER

NEW DELHI

केन्द्रीय सिंचाई व शक्ति मंडल
CENTRAL BOARD OF IRRIGATION AND POWER

NEW DELHI
ISO 9001 : 2015

25th June 2024

Order No.: 376/SE (T&C)/PTCUL/(H). dated: 29.09.2023

Protection Audit Report

FINAL PROTECTION AUDIT REPORT OF 220/132KV JHAJHRA SUB-STATION UNDER POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED (PTCUL), UTTARAKHAND.

Submitted To

PTCUL

Power Transmission Corporation of Uttarakhand Limited
(A Govt. of Uttarakhand Undertaking)
Corporate ID No.: U40101UR2004SGC028675

Contents

ACRONYMS

A	Ampere
AC	Alternating Current
AMP	Annual Maintenance Plan
CBIP	Central Board of Irrigation and Power
CT	Current Transformer
CVT	Capacitive Voltage Transformer
DC	Direct Current
DG	Diesel Generator
DPR	Detailed Project Report
DR	Disturbance Recorder
EL	Event Logger
EMTP	Electromagnetic Transient Program
EE	Executive Engineer
GPS	Global Positioning System
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
JE	Junior Engineer
KA	Kilo Ampere
KV	Kilo Volt
LBB	Local Breaker Backup
LEFT	Earth Fault
MVA	Mega Volt Ampere
NA	Not Available
NRPC	Northern Regional Power Committee
O&M	Operation & Maintenance

OCC	Operation Coordination Sub Committee
PLCC	Power Line Carrier Communication
PSC	Power System Sub Committee
PSDF	Power System Development Fund
PT	Potential Transformer
PTCUL	Power Transmission Corporation of Uttarakhand Limited.
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committee
SAS	Substation Automation System
SE	Superintendent Engineer
SCADA	Supervisory Control & Data Acquisition
SLD	Single Line Diagram
SLDC	State Load Dispatch Centre
SOTF	Switch On-To Fault
SPS	Special Protection Scheme
T&C	Testing & Commissioning
UJVNL	Uttarakhand Jal Vidyut Nigam Ltd
UPCL	Uttarakhand Power Corporation Ltd
WTI	Winding Temperature Indicator

Disclaimer

The protection audit has been carried out based on the guidelines provided under various documents mentioned in the report. For the purpose of audit, the auditor(s) have relied upon the data made available by the client and information & clarifications made available, in the written or verbal form, by the officials of clients during site visit and later.

The report is not for public distribution and has been furnished solely for information and must not be reproduced or redistributed to others, except those concerned. No one can use the report as a base for any claim, demand or cause of action and, also no one is responsible for any loss incurred based upon the content of this report.

While every effort is made to ensure the accuracy and completeness of information contained, CBIP takes no responsibility and assumes no liability for any error/ omission or accuracy of the information. Recipients of this material should rely on their own judgments and conclusions from relevant sources before taking any decision.

1.0. Executive Summary

PTCUL awarded the work of Third-Party Protection Audit of 2 nos. 400kV and 8 nos. 220kV substations of PTCUL ("Utility") to CBIP. CBIP planned the audit as per Audit process provided under Protection Code within Indian Electricity Grid Code 2023. In addition, the guidelines of Ramakrishna Committee for checking and validation and NRPC guidelines for Third Party Audit were also adhered too. The CBIP manual on protection (manual no 247-Revised), NPRC protection philosophy were also referred too.

As a part of audit process, utility was asked to provide set of information before start of audit. Team from CBIP consisting of Mr. Vijay Barthwal, Mr. M.R. Chauhan & Mr. Rounak Sen visited 220/132KV Jhajhra Substation during 29th February – 1st March 2024 and preliminary audit report was submitted on the spot. The representatives of utility were present during this process. Some more information was sought from the Utility.

Based on the data made available by Utility, draft of final report was submitted to Utility and after discussions, report was finalized. The details of audit process, data made available by Utility, observations from preliminary report and detailed observations and recommendations are provided in this report. Key observations and recommendations are summarized below under 2 heads.

General Observations and Recommendations for Organization Level implementation

01. It is recommended that each substation to have a central repository for tripping reports, along with Time Synchronized DR/EL reports and analysis. A dedicated PC can be provided at each substation for the purpose.
02. The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC too, if needed, and implement the same.
03. It is recommended that latest recommended relay settings, as per the NRPC protocol for 220KV & above Substations, along with setting calculations & parameters used for all the relays, be kept at each substation. This will help in proper fault analysis and ascertaining relay healthiness. Similarly, Relay settings for sub-stations below 220kV, based on any such protocol by SLDC, along with setting calculations and line parameters also needs to be maintained.
04. It is recommended that the detailed reports of test results for the relays and switchyard equipments be maintained at sub-station level.

05. Based on "Draft O&M Manual" of PTCUL and discussions with their officials, a list of testing equipment is suggested and enclosed at Annexure - 1. Also, a list of switchyard maintenance equipment is placed at annexure -3. It is recommended that the necessary testing and maintenance equipment at substation/Sub-division/Division be arranged for regular testing and maintenance of equipment at substations.
06. Simulation based studies or EMTP Studies should be carried out by the Utility, as per the requirement of IEGC-2023.
07. For the protection system and SAS, PTCUL may undertake capacity building exercise for the officials involved in these activities.
08. It is recommended that the updated network information and short circuit level should be periodically reviewed and maintained at central level for revising the setting as per requirement.
09. It is suggested that utility may carry out exhaustive safety and technical audit of sub-stations apart from protection audit, either internally or thru' third party for implementing the best practices in the sub-station.
10. It is suggested that the existing draft O&M manual be updated to take care of latest developments.

Observations and Recommendations for 220/132KV Jhajhra Substation:

01. Among all the 10 nos. 220KV and above sub-stations of PTCUL, record keeping at Jhajhra sub-station is best.
02. After a major breakdown at 33KV level on 19.07.2023, a committee of PGCIL had visited substation. The suggestion/ recommendation of committee needs to be complied with.
03. Bus Bar Protection on 220kV Bus is commissioned, but due to non-availability of shut-down, stability test could not be carried out. It is recommended to get it commissioned at the earliest.
04. Multiple tripping at remote end due to over voltage at Vyasi generating plant and Zone -2 at Khodri Power House were observed. The remote end is a generating station; therefore, it is recommended that necessary protection co-ordination, based on latest NRPC guidelines be carried out with the generating company.
05. Due to fault on 33KV Network, LV side of transformers tripped in multiple instances. It is recommended that Protection co-ordination with distribution company to be carried out.
06. PLCC aided protection is not functional on important transmission lines. It is recommended to be taken up on priority for 220kV Khodri Line.

07. The sub-station is designed for single source DC, but fed using 2 sources using automatic changeover switches to maintain redundancy. It is suggested to carryout comprehensive review of DC distribution system and its philosophy.
08. Second station transformer connected to 33kV bus needs to be commissioned immediately for maintaining auxiliary supply.

2.0. Introduction

2.1. Background

The work has been awarded to the Central Board of Irrigation & Power (CBIP) vide Work Order Number: 376/SE (T&C)/PTCUL/(H), dated: 29.09.2023 for Protection Audit of 02 Nos. 400 kV and 08 Nos. 220 kV Sub-Stations at Uttarakhand, for Power Transmission Corporation of Uttarakhand Limited (PTCUL) in reference to the offer submitted by CBIP to PTCUL vide ref. no. P-1/CBIP/PTCUL/Audit/2023, dated: 11.09.2023. A Kick-Off Meeting was held between PTCUL and CBIP at the office of SE (T&C), PTCUL, Kathgodam, Haldwani on 26th October 2023. Detailed discussions were held regarding process and methodology of Execution and Submission of reports of Protection Audit. As per the above-mentioned meeting, a corrigendum was released by PTCUL vide ref. no. 394/SE (T&C)/PTCUL/(H), dated: 26.10.2023.

As per the given order, the protection audit of following sub-stations is to be carried out

1. *400kV Rishikesh*
2. *400kV Kashipur*
3. *220kV Chamba*
4. *220kV Rishikesh*
5. *220kV Roorkee*
6. *220kV Haridwar (SIDCUL)*
7. *220kV Jhajra*
8. *220kV Pantnagar*
9. *220kV Haldwani*
10. *220kV Mahuakheraganj*

2.2. Scope of Work

Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc. with respect to tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following:

a. Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures.

b. Availability/healthiness of PLCC communication links used for protection systems.

c. Healthiness/adequacy of 220/110/50V DC system available at substations for protection application.

d. Availability/healthiness of GPS system and time synchronization facility used for protection.

e. Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.

f. Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.

g. Field inspection of protection device for obsolescence of technology, suitability and healthiness.

h. Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.

i. Checking of availability of DG Set / auxiliary DC supply at substations.

2.3. Audit Rationale

a. PTCUL (Utility) has submitted a DPR for Replacement of certain equipment under PSDF scheme to Grid-India. Grid-India has asked PTCUL to carry out protection audit of certain substations.

b. In addition, as per CERC IEGC 2023 Chapter-04 (Protection Code) Para - 15 (2) “All users shall also conduct third party protection audit of each substation at 220KV and above (132KV and above in NER) once in 5 years or earlier as advised by the respective RPC”.

c. As per Para – 15 (4) of said Code, “The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC”.

d. Subsequently NRPC issued protection philosophy for Northern region developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024. Accordingly, protection audit of 220KV and above Substations is being carried out by CBIP, as per Annexure -1 of IEGC-2023.

2.4. *Audit Process*

- PTCUL shall provide the following documents:
  a. The Network Diagram, covering the relevant assets
  b. Latest relay settings adopted and calculations for respective sub-stations and transmission lines.
  c. Annual maintenance plan (AMP), including the schedule and activities covered under AMP
  d. Any specific issues covered under OCC and/or PSC of NRPC for relevant assets.

- For each sub-station, check-list shall be provided by PTCUL. During field visit, the information shall be verified.

- The minimum set of points on which checking and validation shall be carried out is provided as per annexure - 4 for the following available power system elements at station, as per attached formats:

S. No.	Elements
1	Transmission Line
2	Bus Reactor/Line Reactor
3	Inter-Connecting Transformer [ICT]
4	Busbar
5	AC auxiliary system
6	DC auxiliary system
7	Communication system
8	Circuit Breaker Details
9	Current Transformer Details
10	Capacitive Voltage Transformers Details
11	Any other equipment/system relevant for protection system operation

- During field visit, no testing of equipment and relay shall be carried out. The visual inspection, operational log shall be considered for audit purpose, apart from the documents provided by PTCUL.
- A calibrated multi-meter shall be provided at sub-station for checking AC and DC voltages and currents online, wherever feasible, without impacting the sub-station operations.
- The preliminary report shall be prepared on the site and shall be signed by all the parties present, as given below:

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out/ available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

- **The Final summary shall specifically mention minimum following points:**
  - ➢ The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g., Ramakrishna guidelines or CBIP manual based).
  - ➢ The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
  - ➢ All the major general deficiency shall be listed in detail along with remedial recommendations.
  - ➢ The cases of protection maloperation (last 1 year) shall be analysed from tripping reports and the causes of failure along with corrective actions and recommendations based on the findings.

2.5. *About Power Transmission Corporation of Uttarakhand (PTCUL)*

The State of Uttarakhand's power transmission utility, PTCUL, was formerly known as Uttaranchal. According to the Uttar Pradesh State Reorganization Act 2000, this 27th state of the republic of India was formed on November 9, 2000, by dividing the Himalayan and surrounding North-Western districts of Uttar Pradesh.

The State of Uttaranchal in exercise of the power granted to it under section 63(4) of the State Re-Organization Act, 2000, formed two separate companies in power sector:

- Uttaranchal Jal Vidyut Nigam Ltd. (UJVNL) – For generation of Hydro-Electricity in the State.
- Uttaranchal Power Corporation Ltd. (UPCL) – For Transmission and Distribution of Electricity in the state.

Enactment of the Electricity Act 2003, a distinct watershed in the Indian Power Sector, made it mandatory for all the States to restructure their SEBs. As per the provisions of Electricity Act 2003, the State Government separated power transmission business from UPCL which was left only with distribution of electricity.

In order to manage Power Transmission Operations, a new company called Power Transmission Corporation of Uttaranchal Ltd. was established. On 27th May, 2004, the firm was formed as a Government Company in accordance with section 617 of the Companies Act, 1956. It began operating from 1st June, 2004.

The company's corporate and registered office is located in Vidyut Bhawan, Saharanpur Road, Majra, Dehradun, next to the ISBT Crossing.

2.6. About Central Board of Irrigation & Power (CBIP)

The Government of India established the Central Board of Irrigation and Power in 1927, making it a Premier Institution. For the past 93 years, CBIP has provided committed services to the nation's professional associations, engineers, and individuals involved in the power, water resources, and renewable energy sectors. While serving the country equally and to great honour, CBIP has developed into an esteemed institution of international significance. CBIP is Indian chapter for 10 international organizations related to Power & Water resources sectors.

CBIP is involved in executing various activities such as, International Conferences, Technical Documents Publications, Training Activities, Research & Development, Consultancy Services including Technical, Protection & Safety Audits.

3.0. Preliminary Audit of 220/132KV Jhajhra Substation

3.1. General Information about Substation

Sl. No.	Particulars	Details
1	**Substation Name**	220/132 kV Jhajhra Substation
2	**Name of Owner Utility**	Power Transmission Corporation of Uttarakhand Limited (PTCUL)
3	**Voltage Level (s) or highest voltage level**	220/132/33KV
4	**Short circuit current rating of all equipment (for all voltage level)**	220KV level: 40KA 132 KV level: 31.5KA
5	**Date of commissioning of the substation**	30th January 2014
6	**Checking and validation date**	29th February 2024 – 1st March 2024

3.2. Audit Team

Audit Team (CBIP):

- Mr. Vijay Barthwal
- Mr. M.R. Chauhan
- Mr. Rounak Sen

PTCUL Representative:

- Er. Ravindra Kumar Saini, Executive Engineer (T&C)
- Er. Kanchan Nautiyal, Assistant Engineer (T&C)

3.3. Recommendation of last protection checking and validation

a. No Protection Audit was carried out earlier.
b. After a major breakdown at 33KV level happened on 19.07.2023, a committee of PGCIL had visited substation.

3.4. Review of existing settings at substation

a. Utility has provided relay settings adopted for various feeders and transformers.
b. The relay settings are done at station level and record of different relay setting calculations is kept at substation.
c. All relays are numeric and tested annually.

3.5. Disturbance Recorder availability for the last 6 tripping's

a. Utility is submitting Disturbance Recorder data for Inter-State Line 220kV Jhajhra-Sherpur (PGCIL) Line to NRLC Portal.
b. For transformers and Intra-state lines DR data is taken at station level for analysis purpose.
c. Utility shall be submitting copy of DR/EL reports subsequently.

3.6. Chronic reason of tripping, if any

a. Based on list of tripping submitted by utility of 220 & 132 kV system for last 12 months, following is observed
b. Most of the feeders are passing thru urban area/ forest area and trippings are happening due to encroachment of line clearance by kite, birds and construction near transmission lines. Protection system is found to be working ok during these cases.
c. On 30/05/2023, 23/7/2023 and 27/8/2023 multiple LV side of transformers tripped due to fault on 33kV system.
d. During this period 220kV Vyasi- Jhajhra line tripped 14 times, out of which 10 times it was due to over voltage on remote side. Setting at remote end need to be updated as per latest NRPC guidelines.

e. During this period 2 nos. tripping from remote end on zone 2 was observed for 220kV khodri line from remote. Settings at remote end needs to be reviewed.
f. On 17/5/2023 220kV bus-coupler tripped on over current, due to unbalanced load. Setting modified by utility.

3.7. Major non-conformity/deficiency observed

a. Bus Bar Protection on 220kV Bus is not functional. Protection is commissioned, but due to non-availability of shut-down, stability test could not be carried out. Expected date for putting in service is 31.03.2024
b. No Bus Bar Protection is provided for 132kV.
c. 220kV Khodri line PLCC protection not operational due to issue at other end.
d. 220kV IIP line PLCC protection is not functional, as protection coupler is not commissioned.
e. The sub-station is fully operated thru SAS system.
f. Both the 220V DC systems are replaced recently.
g. The 220V DC system is configured for single Source DC. Therefore, both the DC sources are connected thru changeover relays at individual bay level to maintain redundancy.
h. The events are recorded from individual relays, no separate Event Logger is provided. All relays are centrally connected for downloading the DR and EL.
i. The 2nd Auxiliary supply source is currently from 220/132/33 kV transformer tertiary, but not in use. 2nd station transformer connected to 33kV bus is under commissioning.

4.0. Tripping Statements

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
Dhakrani PH	GE-D60	06.12.22 / 06.03	06.12.22/ 06.20	Flags: DIR O/C E/F PROT OPTD, 86 OPTD, 50/51 Trip, AC supply fail	Dir O/C & E/F OPTD. Power supply fail at Dhakrani PH.	NA	NA	Setting of Dir. O/C & E/F relay @ Dhakrani PH should be reviewed.
Dhalipur PH	GE-D60	06.12.22 /	06.12.22/	NA		NA	NA	
Dhakrani PH	GE-D60	06.12.22 / 06.03	06.12.22/ 07.25	Flags: DIR O/C E/F PROT OPTD, 86 OPTD, 50/51 Trip, AC supply fail	Dir O/C & E/F OPTD. Power supply fail at Dhakrani PH.	NA	NA	Setting of Dir. O/C & E/F relay @ Dhakrani PH should be reviewed.
Khodri PH	GE-D60	06.12.22 /	06.12.22/	NA		NA	NA	
Dhakrani PH	GE-D60	07.12.22 / 13.12	07.12.22/ 15.51	Flags: DIR O/C E/F PROT OPTD, 86 OPTD, 50/51 Trip	Dir O/C & E/F OPTD. Power supply fail at Dhakrani PH.	NA	NA	Setting of Dir. O/C & E/F relay @ Dhakrani PH should be reviewed.
Khodri PH	GE-D60	07.12.22 /	07.12.22/	NA		NA	NA	
Kulhal PH	GE-D60	07.12.22 / 13.13	07.12.22/ 13.40	Flags: DIR O/C E/F PROT OPTD, 86 OPTD, 50/51 Trip,B phase O/C Trip	Dir O/C & E/F OPTD. Power supply fail at Kulhal PH.	NA	NA	Setting of Dir. O/C & E/F relay @Dhalipur should be reviewed.
Dhal ipur PH	GE-D60	07.12.22 /	07.12.22/	NA		NA	NA	
220KV S/S Jhajhra	GE-D60	25.12.22 / 11.20	25.12.22/ 14.15	Flags: N/G,86A/B, Zone-1, starting AN, trip ABC, Fault timing- 61.45msec, RTT,	LEFT	NA	Ia=11.62 KA Ib=94.64 A Ic=33.72 A	Frequently Line patrolling required by O&M concern.

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
				111.3msec, FL-4.065Km, FR-378.7mohm.				
Vyasi PH		25.12.22 / 11.20	25.12.22/ 14.20	O/C & E/F trip, Group-1, Trip relay 86A,86MIR,86MIY,86MIB, Group-B,trip relay86B,86M2R, 86M2Y,86M2B, 8541/ z1, 21M2-3Px, 85y2/z2,21M1-3Px			Ia=1.426 K Ib=81.32 A Ic=16.56 A	
220KV Jhajhra	GE Multilin D60/ Alastom P442	18.01.23 / 16:21	18.01.23/ 17:31	Flags: Active Grp 1, Started Phase AN, Tripped Phase ABC, Start Element Dist, DIST Trip Z1, Fault Record-AR, Lock Out Start, Freq: 49.90 Hz, FD: 61.79ms, RTT: 110.2ms, FL: 4.036Km, Resistance: 409.9ohm CB No.80 Bus Coupler tripped. Flags: Phase IOC1 Trip OP, Phase A IOC1 Trip OP.	LEFT, a bird came near the range of line results tripping of line.		Ia: 12.08KA Ib: 264.1 A Ic: 236.59A Van: 27.33 KV Vbn: 129.5KV Vcn: 127.6KV	NA
Vyasi PH	GE D-60	18.01.23 / 16.25	18.01.23/	Flags: Trip Relay 86 A & 86 B OPTD, E/F start			IA: 47.29A IB:	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
				in 1, FL: 69.14km, FR: 2.469 Ohm, Fault in Zone 3			47.25A IC: 44.17A VAN: 131.5KV VBN: 134.9KV VCN: 132.4KV	
220KV Jhajhra	GE Multilin D60/ Alastom P442	18.01.23	18.01.23	Tripping not observed.		NA	NA	
Khodri PH	GE D-60	18.01.23 /16.25	18.01.23	Flags: DIR. O/C & E/F OPTD, AC Supply fail. Main 2: DIST PROT OPTD, 86 A& B OPTD, VT fuse fail, FD: 86.84ms, FL: 44.45KM, FR: 1.960 Ohm, Fault in Zone 3.		NA	IA: 2.27 KA IB: 609.0 A IC: 191.0 A VAN: 65.83 KV VBN: 125.7 KV VCN: 123.6 KV	Setting of relay should be reviewed at Khodri end.
220KV IIP	Alstom P-442 and GE D-60	26.01.23 / 13.58 Tried to close line but not hold.	26.01.23/ 14.37 26.01.23/ 15.30	Flags: Master trip relay 1/2 OPTD, Fault in Z1, FD: 8.937 KM, , Freq: 50.13Hz, FD: 51.54 ms, RTT: 79.80 ms, Main PROT & Back up PROT Master trip relay OPTD.	A kite came in the range of Line.	81 A 8.12 MW(E)	IA: 81.50A IB: 4.32KA IC: 4.271KA VA: 132.3KV VB: 69.86KV VC: 65.31KV	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
		26.01.23 / 14.37		Flags: Master trip relay 1/2 OPTD, Fault in Z1, FD: 8.979 KM, Freq: 49.94Hz, FD: 61.74 ms, RTT: 80.10 ms, FR: 258.2 Ohm. Main PROT & Back up PROT Master trip relay OPTD.Under Voltage Relay Flag on B&C fuse.			IA: 10.87A IB: 4.413KA IC: 4.413KA VA: 131.8KV VB: 69.67KV VC: 65.7KV	
220KV Jhajhra	GE Multilin D60/ Alastom P442	26.01.23 / 14.01	26.01.23/ 15.31	Flags: Active Grp1, Start Phase BC, Tripped Phase ABC,Start Dist, Trip Zone 1, FD: 71.49 ms,RTT: 79.80 ms,FL: 15.31KM, FR: 187 ohm, 86 A trip,		79 A 12.1 MW(I)	IA: 62.79A IB: 7.219KA IC: 7.267 KA, VAN: 133.4KV VBN: 85.45KV VCN: 75.60KV	NA
220KV Jhajhra	GE Multilin D60/ Alastom P442	26.01.23 / 14.01	26.01.23/ 15.58	Flags: 86 A .	LEFT, Due to Over Voltage Breaker tripped at other end.	NA	NA	NA
Vyasi PH	GE D-60	26.01.23 / 13.58	26.01.23/	Flags: Grp 1: Tripping relay 86 A, ABC Phase Dist. Trip. Grp 2: Tripping		NA	IA: 18 A IB: 18 A C: 18 A VAN: 138.8KV	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
				relay 86 B, ABC Phase Dist. Trip.			VBN: 138.8KV VCN: 138.8KV	
220KV Jhajhra	GE Multilin D60/ Alastom P442	30.01.23 / 01.44	30.01.23	Flags: 86 A & 86 B trip.	Due to Over Voltage Breaker tripped at other end.	NA	NA	NA
Vyasi PH	GE D-60	30.01.23 / 1.48	30.01.23	Flags: Overvoltage GRP 86 A/86B.	NA	NA	NA	NA
220KV Jhajhra	GE Multilin D60/ Alastom P442	30.01.23 / 2.14 tried to charge line from Vyasi end	30.01.23	Flags: 86 A & 86 B trip.	NA	NA	NA	NA
Vyasi PH	GE D-60	30.01.23 / 2.18	30.01.2/	Flags: Overvoltage GRP 86 A/86B.	NA	NA	NA	NA
220KV Jhajhra	GE Multilin D60/ Alastom P442	30.01.23 / 03.00	30.01.23/ 10.57	Flags: 86 A & 86 B trip.	NA	NA	NA	NA
Vyasi PH	GE D-60	30.01.23 / 03.00	30.01.23/ 11.00	Flags: Overvoltage GRP 86 A/86B.	NA	NA	NA	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
220 KV S/S Jhajhra	GE Multiline D60/ Alstom P442	21.02.23 / 20.03	21.02.23/ 20.07	86- A&B, Phase BC, LBB In-ON, Zone-2, AR Block, Started Phase BC, Tripped Phase ABC, Dist Z2, Gr-A 3 Phase Trip relay, FD: 462.5ms, RTT: 79.86 5ms, FL: 21.23 km, FR: 118.5 mohm	Line was tripped due to Hail storm with raining.	92 A 14 MW	IA=116.8 A IB= 6.008 KA IC= 5.976 KA VAN=131 .5 KV VBN: 88.22 KV VCN=83. 77 KV	NA
220 KV S/S IIP	Alstom P-442 and GE D-60	21.02.23 / 20.07	21.02.23/ 21.38	DIST Relay -1- Fault Phase B&C. Dist Relay -2- Freq: 50.09Hz, FD: 59.89 ms, FL: 2.945 km, R.T.T: 79.86 ms, FR: 443.6 m ohm, Fault ion Zone 1.		105 A -10 MW	IA=126.1 A IB= 4.706 KA IC= 4.788 KA VAN=130 KV VBN: 67.2 KV VCN=62. 4 KV	NA
220KV Jhajhra	GE Multiline D60/ Alstom P442	08.03.23 / 20:25	08.03.23/ 20:51	86 A & 86 B.	Due to Over Voltage Breaker tripped at other end.	(-8 MW) (-40 Amp)		NA
Vyasi PH	GE D60	08.03.23 / 20:25	08.03.23/ 20:56	GRP 1: Trip relay 86 A . Main 1- R phase DIST trip 86 M1R, Y phase DIST trip 86 M1Y, B phase DIST trip 86		NA	NA	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
				M1B. GRP 2: Trip relay 86 B . Main 2- R phase DIST trip 86 M2R, Y phase DIST trip 86 M2Y, B phase DIST trip 86 M2B.				
220KV Jhajhra	GE Multiline D60/ Alstom P442	09.03.23 / 00:27	09.03.23/ 05:45	86 A & 86 B.	Due to Over Voltage Breaker tripped at other end.	(-4.2 MW) (-35 Amp)	NA	NA
Vyasi PH	GE D60	09.03.23 / 00:27	09.03.23/ 05:51	GRP 1: Trip relay 86 A . Main 1- R phase DIST trip 86 M1R, Y phase DIST trip 86 M1Y, B phase DIST trip 86 M1B. GRP 2: Trip relay 86 B . Main 2- R phase DIST trip 86 M2R, Y phase DIST trip 86 M2Y, B phase DIST trip 86 M2B.		NA	NA	NA
220KV Jhajhra	GE Multilin D60/ Alastom P442	11.03.23 / 12:36	11.03.23/ 13:55	3 Phase trip, Zone 1, FL: 7.642 KM, FD: 70.10ms, RTT: 80.12ms, FR: 404.4 mohm	A kite came in the range of line cause line trip.	340 A 114 MW	IA= 262.9 A IB= 3.349 KA IC= 3.50	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
							KA VAN=122 .6 KV VBN=70. 59 KV VCN=63. 91 KV	
Khodri PH		11.03.23 / 12:36	11.03.23/ 14:01	Main DIST PROT OPTD, Auto recloser Unsuccessful, AC Supply fail. Main 2 DIST PROT OPTD, 86 A & B OPTD, Dist Trip Z1, fd: 60.09 ms, RTT: 80.12ms, FL: 18.80KM, FR: 988.5 m ohm		(-96 MW)	IA= 265.6 A IB=8.83 KA IC=8.69 KA VAN=124 .9 KV VBN=71. 43 KV VCN=63. 57 KV	NA
220KV Jhajhra	GE Multiline D60/ Alstom P442	18.03.23 / 03:37	18.03.23/ 06:56	Grp A, 3 Phase trip relay, 86 A & 86 B.	Due to Over Voltage Breaker tripped at other end.	(-11.3 MW) (-43 Amp)	NA	NA
Vyasi PH	GE D60	18.03.23 / 03:38	18.03.23/ 07:01	GRP 1: Trip relay 86 A . Main 1- R phase DIST trip 86 M1R, Y phase DIST trip 86 M1Y, B phase DIST trip 86 M1B. GRP 2: Trip relay 86 B . Main 2- R phase DIST trip 86		10.59 MW 28.54 Amp	NA	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
				M2R, Y phase DIST trip 86 M2Y, B phase DIST trip 86 M2B.				
220KV Jhajhra	GE Multiline D60/ Alstom P442	21.03.23 / 02:20	21.03.23/ 06:38	Grp A, 3 Phase trip relay, 86 A & 86 B.	Due to Over Voltage Breaker tripped at other end.	(-11.9 MW) (-43 Amp)	NA	NA
Vyasi PH	GE D60	21.03.23 / 02:25	21.03.23/ 06:44	86 A & 86 B OPTD.		11.38 MW 30.28 Amp	NA	NA
220KV Jhajhra	GE Multiline D60/ Alstom P442	30.03.23 / 20:13	30.03.23/ 23:48	86 A& B.	Due to Over Voltage Breaker tripped at other end.	(-80A) (-30.5 MW)	NA	NA
Vyasi PH	GE D60	30.03.23 / 20:14	30.03.23/ 23:48	86 A& B. Main 1 R phase Dist. Trip 861MR, 862MR. Y Phase MIY, 86 M2Y. B Phase- 86 M1B, 86 M2B. 86A trip relay coin supervision 74A & 74B.		NA	NA	NA
220KV Jhajhra	GED-60, F 650	30.03.23 / 20:22 tried to close breaker @ Jhajhra	31.03.23/ 00:07	B & C Phase O/C, Phase DIST Z1, 86 A , 86 B, F.D: 7.8 KM, Active Grp A.	Line was tripped due to falling of tree in Jhajhra-Majra Line.	132 A 30.5 MW	IA=139 A IB=5.5 KA IC=5.4 KA VAN = 81.81 KV VBN =	NA

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		end but not hold tripped @ 21:05		B & C, Phase O/C, Phase DIST Z1, 86 A , 86 B, F.D: 7.8 KM, Active setting Grp A.			50.1 KV VCN = 43.1 KV IA=000A IB=6.6KA IC=6.7 KA	
132 KV Majra		30.03.23 / 20:23	31.03.23/ 00:08	Main Relay-DIST PROT OPTD, DIST start. CP: Master trip relay 86-1 & 2. DIST PROT relay 1,3,4,5, Fault event, DIST PU, L2-3 ON, DIST trip 3P ON, Definitive trip ON, EF Trip block ON, Dist 5.7 KM. Backup Relay- 3,4,5 DIR O/C, PU-ON, DIR L2, L3 PU-ON.		(-31.6 MW) (-138 A)	I1=0.11 KA I2=4.79 KA I3=4.88 KA	NA
220KV S/S Jhajhra	GE Multiline F-650	10.04.23 / 12:01	10.04.23/ 12:01	B Phase , C Phase Tripped, Z1 trip, 86 OPTD, F.L: 19.9 KM	Line was trip due to the kite came in the range of line.	(-5.8 MW) 27 Amp	IA=0 IB=3.81 KA IC=3.83 KA	NA
Kulhal PH	GE- D 60	10.04.23 / 12:05	10.04.23/ 12:28	DIST PROT OPTD, B Phase , C phase Tripped, Z1 trip, 86 OPTD, F.L: 9.7 KM		(-5 MW) 27 Amp		NA
220 KV S/S	NA	20.04.23 /	21.04.23/ 00:47	86 B OPTD.	Line was trip due to the	40 MW	IA=4.83 KA	Breaker close from

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		23:47 21.04.23 / 00:47		Fault type BG, 86 A OPTD, F.L: 9.6 KM	damage of Y phase Jumper.	172 Amp	IB=4.83 KA IC=0 IA=0 KA IB=7882.8 A IC=0 IG=7886.45 A	Jhajhra but not close trip again.
132 KV S/S Purkul	NA	20.04.23 / 23:47	21.04.23/ 10:46	186, 86T,86T,86T OPTD. R. P: Active Grp 1, Started Phase A,B, Trip Phase ABC, Started element DIST, O/C>1, DIST Start-Z1, F.D: 73.40 ms, R.T.T: 80.08 ms, F.L: 2.088 KM, F.R: 80.7 mohm, Fault in Zone 1		178 Amp -40.8 MW	IA= 2.95 KA IB= 3.063 KA IC= 131.0A VAN= 40.37 KV VBN= 39.30 KV VCN = 80.07 KV	NA
220 KV S/S Jhajhra	GE-350	17.05.23 / 20:18	17.05.23/ 21:20	Phase TOC1 OPTD, 86.	Due to Over Current T/F I & II tripped with Bus Coupler. O/C setting was BDOA as per UPSEB norms. As B/C tripped both 220KV bus independent and 160 MVA T/F tripped.		IA= 773 AA IB=761.5 A IC= 793.5 A	O/C Setting has been reviewed and on 1600 A after checking capacity of CB, CT, Isolator and Jumper.
220 KV S/S Jhajhra	GE Multiline T-60/ F650 / 7SR350	17.05.23 / 20:20	17.05.23/ 21:15	86 A& B		124.3 MW 345 A		
220 KV S/S Jhajhra	F650	17.05.23 / 20:20	17.05.23/ 21:15	86 A& B , Phase TOC1 ABC high			Ia=0.767 KA Ib=0.775	

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				OPTD, Phase ABC O/C.			KA Ic=0.771 KA Ig=0.004 KA Vab=125.76 KV Vbc=126.72 KV Vca=125.95 KV	
220 KV S/S Jhajhra	GE-T 60/F650 /7SR350	17.05.23 / 20:19	17.05.23/ 20:57	86 A& B		109.7 MW 304 A		
220 KV S/S Jhajhra	F650	17.05.23 / 20:19	17.05.23/ 21:00	86 A& B, Phase TOC1 ABC high OPTD, Phase ABC O/C.			Ia=0.750 KA Ib=0.740 KA Ic=0.752 KA Ig=0.009 KA Vab=129.98 KV Vbc=130.08 KV Vca=129.98 KV	
Khodri PH	GE-D60	17.05.23 / 20:25	17.05.23/ 21:30	86 A, 80A, 80 B, 86 C, 86. SSR3V PROT. Trip, 132 KV Pole discrepancy trip, VT fuse Fail, CB CKT Faulty	Due to AC supply fail at Dhakrani PH. Tripped from Khori end due to O/L.	98 MW	NA	NA
Dhakrani PH	GE-D60	17.05.23 / 20:30	17.05.23/ 21:26	No Flag noted by Dhakrani PH		39 MW	NA	NA

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220 KV S/S Jhajhra	GE Multiline D60/ Alstom P442	18.05.23 / 02:23	18.05.23/ 08:04	GRP A, GRP B, 3 Phase Trip, 86 A& B.	Due to Over Voltage Breaker tripped at Vyasi PH end.	26.6 MW 79 A (I)		Action taken by UJVN Ltd. End setting of O/V relay shall be reviewed.
Vyasi PH	GE-D60	18.05.23 / 02:35 18.05.23 / 06:50	18.05.23/ Breaker closed @ Vyasi end at 06:50Hrs but not hold trip same time 18.05.23/ 14:38	Tripped on O/V.		19.30 MW 53.16 A		
220 KV S/S Jhajhra	GE Multiline T-60/ F650 / 7SR350	30.05.23 / 08:22	30.05.23/ 08:28	86 A, 86 B	Due to heavy current fault (Phase to Phase fault) in 33 KV feeder in Selaqui-I & Linde Near yard.		IA=0.65 KA IB= 7.812 KA IC= 1.132 KA VAB= 21.64 KV VBC= 19.72 KV VCA= 34.03 KV	Action taken by UPCL.
220 KV S/S Jhajhra	GE Multiline T-60/ F650 / 7SR350	30.05.23 / 08:22	30.05.23/ 08:28	86 A, 86 B, E/F	NA	NA	IA=0.688 KA IB= 7.748 KA IC= 1.043 KA VAB=	

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							21.96 KV VBC= 19.27 KV VCA= 33.76 KV	
220 KV S/S Jhajhra	GE Multiline T-60/ F650 / EE	30.05.23 / 08:22	30.05.23/ 08:40	86 A, 86 B	NA	NA	IA=0.683 KA IB= 7.659 KA IC= 1.113 KA VAB= 21.76 KV VBC= 19.58 KV VCA= 34.00 KV	Action taken by UPCL.
220 KV S/S Jhajhra	GE Multiline T-60/ F650 / EE	30.05.23 / 08:22	30.05.23/ 08:41	86 A, 86 B, E/F	NA	NA	IA=0.731 KA IB= 7.721 KA IC= 1.001 KA VAB= 21.868 KV VBC= 19.176 KV VCA= 33.67 KV	
220 KV S/S Jhajhra	GE Multiline T-60 / 7SR350	02.06.23 / 22:12	03.06.23/ 06:35	GR-A LBB, GR-B LBB, OLTC R Phase, 30 CD, 30GH, 86 A, 86 B, OSR Trip U-Phase	160 MVA T/F -II trip on OSR.	188 A 72.9 MW	NA	NA

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220 KV S/S Jhajhra	GE Multiline T-60/ F650	02.06.23 / 22:12	03.06.23/ 06:48	86 trip		NA	NA	
220KV S/S JHAJHRA	GE T-60/ F650	23.07.23 / 18:03	23.07.23/ 18:23	86A, 86B OPTD.	80mva T/F-2 CB. No.- 784/384 Tripped with 33kv CB. No.- 07 Selaqui-1 feeder	24 MW 102 A	Ia= 0.055K A Ib=0.058 K A Ic=0.065 KA Ig=0.002 KA	NA
220KV S/S JHAJHRA	F650	23.07.23 / 18:03	23.07.23/ 18:25	O/C & E/F on B-phase, 86A & 86B optd.		NA	Ia= 0.558KA Ib=0.531 KA Ic=8.480 KA Ig=8.326 KA	NA
220KV S/S JHAJHRA	Alstom P-442 and GE D-60	26.07.23 / 06:35	26.07.23/ 08:47	Main -1: Phase CN, GND Dist. Z2, OPTD LBB. Main-2: Started Phase CN, Tripped Phase ABC, Started element DIST, DIST Trip Z2, F.D: 442.3ms, R.T.T: 80.11 ms, F.L: 22.02km, F.R: 507.8-ohm, 86 A&B OPTD.	A branch of tree came in the range of line between Tower No.76-77.	96 A -0.4 MW	Ia=15.06 A Ib=152.7 A Ic=4.555 KA Van=146.8 KV Vbn=148.7 KV Vcn=13.93 KV	NA
220 KV IIP	Alstom P-442 and GE D-60	26.07.23 / 06:33	26.07.23/ 08:48	Master trip 1/2, Started Phase CN, Tripped Phase ABC, Dist. Trip		106 A - 3.61MW	Ia=15.06 A Ib=152.7 A	NA

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				Z1, F.D:60.09ms, R.T.T: 80.11 ms, F.L: 1.309 KM, F.R: 2.67-ohm, Fault in Zone 1.			Ic=4.555 KA Van=146.8 KV Vbn=148.7 KV Vcn=13.93 KV	
220KV S/S JHAJHRA	GE D-60/ Alstom P-442	26.07.23	26.07.23	No. tripping observed	NA	306 A 119.7 MW (Exp.)	NA	NA
Khodri P/H	NA	26.07.23 / 06:34	26.07.23/ 07:30	Feeder prot. Optd., no trip alarm, active group-1, Dir O/C & E/F prot. Optd., std. phase earth fault, start IN tripped Elts no, F.D:105.2ms, R.T.T: 0.00s, 86a & 86B, fault in zone none		124 MW(I)	Ia=409.6 A Ib=172.4 A Ic=9863 A Van=131.6 KV Vbn=132.5 KV Vcn=101 KV	NA
220 KV IIP	Alstom P-442 and GE D-60	26.07.23 6:33	26.07.23 8:48	Master trip 1/2 , Started Phase CN, Tripped Phase ABC, Dist. Trip Z1, F.D:60.09ms, R.T.T: 80.11 ms, F.L: 1.309 KM, F.R: 2.67 ohm, Fault in Zone 1.	A tree came in the range of line between tower no. 76-77.	106 A - 3.61MW	Ia=15.06 A Ib=152.7 A Ic=4.555 KA Van=146.8 KV Vbn=148.7 KV Vcn=13.93 KV	NA

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220 KV Jhajhra	GE Multilin D60/ Alastom P442	26.07.23 / 06:35	26.07.23/ 08:47	Main -1: Phase CN, GND Dist. Z2, OPTD LBB. Main-2: Started Phase CN, Tripped Phase ABC, Started element DIST, DIST Trip Z2, F.D: 442.3ms, R.T.T: 80.11 ms, F.L: 22.02km, F.R: 507.8-ohm, 86 A&B OPTD.	NA	96 A -0.4 MW	Ia=15.06 A Ib=152.7 A Ic=4.555 KA Van=146. 8 KV Vbn=148. 7 KV Vcn=13.9 3 KV	NA
220KV S/S JHAJHRA	GE D-60/ Alstom P-442	15.08.23 13:32	25.87.23 14:07	Phase A, N/G, Carrier send Zone - 01 Trip, R phase trip, tripped ABC, std. phase AN, dist. - Z1, F.D : 76.53ms, R.T.T : 79.86ms, F.L : 6.8km, F.R : 16.11 ohm fault in zone : 1	A bird came in the range of Line.	148 A 41MW 23mvr (Exp.)	Ia=5932 A Ib=85.12 A Ic=75.104 A Van=93 KV Vbn=132. 14 KV Vcn=130. 24 KV	NA
Khodri P/H	NA	15.08.23 13:33	25.87.23 14:11	Dir. O/C, E/F optd. Main - 2: Dist. Prot. Optd., Active group-1, std. phase AN, Earth fault std. IN-1, F.D: 139.7ms, R.T.T : 00s, F.L : 30.91km, F.R : 37.96 ohm, Failt		48 MW 25mvr (imp.)	Ia=1.835 KA Ib=88.6 A Ic=114.7 A Van=110. 1 KV Vbn=125. 7 KV Vcn=128 KV	NA

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				in zone : 3 86a & 86B optd.				
220KV S/S JHAJHRA	GE D-60/ Alstom P-442	16.08.23 / 15:01	The line is in S/D	Active group-1, Earth fault, F.D: 96.53ms, R.T.T: 00s, Fault zone none 86A & 86B optd., 3 Phase trip relay	Due to landslide at tower No.: 93	73 MW 195 Amp	Ia= 156.9 A Ib=90.61 A Ic=732.9 A Van=125. 2KV Vbn=128. 2 Vcn=123. 4KA	NA
Vyasi P/H		16.08.23 / 15:02		86A, 86B OPTD.		72.9MW 190.1amp	NA	
220KV S/S JHAJH	GE D-60/F650	27.08.23 / 08:34	27.08.23/ 09:02	E/F trip, 86A, 86B OPTD.	80mva T/F-1&2 CB. No.-784/384 &783/383 Tripped with 33kv CB. No.-09 AWHO (Future Bay) feeder due to heavy blast & LA damage of y phase on 33kv AWHO feeder	34 mw 151 A 9 mvr	NA	NA
220KV S/S JHAJHRA	F650	27.08.23 / 08:34	27.08.23/ 09:08	E/F trip, 86 optd.		Ia= 0.614KA Ib=8.24KA Ic=7.616KA Ig=7.84KA	Ia= 0.524KA Ib=8.10KA Ic=7.915 KA Ig=7.652 KA	
220KV S/S JHAJHRA	GE D-60/ Alstom P-442	27.08.23 / 08:34	27.08.23/ 09:01	E/F trip, 86A, 86B OPTD.		152 A 33MW	NA	NA
220KV S/S JHAJHRA	F650	27.08.23 / 08:34	27.08.23/ 09:06	E/F trip, 86 optd.		Ia= 0.571KA Ib=8.1	Ia= 0.497KA Ib=8.056 KA	

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						69KA Ic=7.97KA Ig=8.17KA	Ic=7.89KA Ig=7.69KA	
220KV S/S JHAJHRA	GE D-60/ Alstom P-442	05.09.23 / 00:34	05.09.23/13:21	Fault type-AG, N/G, Zone-1, 86A optd., F.L: 5.6KM	Due to the strom some object within the range of the conductor Tower No:26-27	130 A 29MW (I)	Ia=13859.16A Ib=7154 A Ic=102.67 A	NA
Dhalipur P/H	GE Multilin D-60/F650	05.09.23 00:35	05.09.23 13:20	Dist. Prot. Optd., phase A, GND Dist.-Z1, N/G optd., 86 optd.		88Amp 17MW (E)	NA	NA
220KV S/S JHAJHRA	GE D-60/ Alstom F650	15.09.23 / 02:37	15.09.23/ 03:25	R-phase, Y-phase, B-phase trip, 86 optd., F.L: 23km	Line was tripped due to lightning at Tower No :33-35	39 A 8 MW 1 mvr (Imp.)	Ia= 3459.155 A Ib= 3353.098 A Ic=3492.685A	NA
Kulhal P/H	GE D-60/ Alstom F650	15.09.23 / 02:40	15.03.23/ 09:27	Dist. Prot. Optd., Dir. O/C & E/F optd., Dist. Prot. Relay optd., trip a-phase, B-phase & C-phase, GND Z1 optd., Dir. O/C & E/F Relay trip A-phase, B-phase, c-phase, O/C trip, 86 optd.		41 A 9 MW -2 mvr (Exp.)	NA	NA
220 KV S/S IIP	Alstom P-442 and GE D-60	19.09.23 / 12:18	19.09.23/ 12:59	Started Phase ABC, Fault type CG, Fault in Zone 2, F.D.-393.7 ms,	A Monkey came in the range of the line between	125 A -22 MW	IA=10.6 A IB=11.28 A	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
				Fault freq.- 49.95 HZ,Fault resistance-25.59 ohm, R.T.T.- 80.08 ms, F.L.- 21.31 KM	Tower No: 17-18		IC=2.328 KA VAN=133.8 KV VBN=125 KV VCN=77.03 KV	
220 KV S/S Jhajhra	Alstom P444 / P143	19.09.23 / 12:18	19.09.23/ 12:59	86 A, start phase CN , tripped phase ABC, start element distance , Earth fault start IN 1, distance trip , Z1, F.D.- 80.08 ms , R.T.T.- 80.08 ms, F.R.-23.43 ohm,F.L.-12.07 km		93 A 8 MW(E)	IA=24.39 A IB=185.7 A IC=3.878 KA VAN=128.6 KV VBN=127.2 KV VCN=109.4 KV	NA
220KV S/S Jhajhra	GE Multiline D-60/F650	23.09.23 14:35	23.09.23 15:54	Gr-A, 3 Phase trip Relay, Dist. Z1, Carrier send Ph Dist. Z1, Main 86A/86B, A.R Block, fault AG, F.L: 3.8km, Element GND Dist Z1, Element-2 SRC 1 50DD	Due to children getting caught in the line tower No: 19-20	83 Amp 18 MW (I)	Ia=16447.586 A Ib=116.483 A Ic=131.915 A In=16666.907A Va=35703.684 V Vbn=75026.824V Vcn=74013.162V	NA
Dhalipur P/H	GE Multiline D-60/F650	23.09.23 14:35	23.09.23 15:56	Dist. Prot. Optd., 86 Optd.		16.6 Amp 71	NA	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
						MW (E)		
220KV S/S Jhajhra	GE Multiline D-60/Alstom P442	29.09.23 06:25	29.09.23 09:48	C.P- Y-phase trip, Zone-1 optd., 86A,86B optd. R.P- Active group-1, std. phase BN, Tripped phase B, Start element Distance, Earth fault start In-1, Dist. Trip Zone-1, F.D: 71.87ms, R.T.T: 80.23ms, F.L: 10. 52KMF.R: 972.2MOhm,	Line tripped due to vulture coming on cross arms tower no.-20	117 A -44 MW (I)	Ia= 349 A Ib= 10.10 KA Ic= 545.7 A Van=130. 2 KV Vbn 57.68 KV Vcn=130. 9KV	NA
Vyasi P/H	NA	29.09.23 06:25	29.09.23 09:53	GRP, 86A/86B optd., Zone-2 E/F trip, F.L: 47.48 KM		116.79 A 45 MW (E)	Ia= 114.0A Ib= 117.5 A Ic= 118.3 A	NA
220KV S/S Jhajhra	GE Multiline D-60/Alstom P442	29.09.23	29.09.23	No tripping observed		149 A 54 MW (E)		NA
Khodri P/H	GE Multiline D-60/Alstom P442	29.09.23 06:25	29.09.23 07:24	Dir. O/C & E/F prot. Optd., 86A/86B optd. Main-2: Dist. Optd., fault in Zone-2, Active geroup-1, std. phase-Bn, Std. element Dist., E/F	NA	52 MW	Ia= 243.01A Ib= 1.987 KA Ic= 402.7 A Van=126. 7 KV Vbn=91.4	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
				start in 1, F.D: 76.89ms, R.T.T: 00.0s, F.L: 66.57km			0 KV Vcn=125.2 KV	
220KV S/S Jhajhra	GE Multiline D-60/Alstom P442	30.09.23 / 12:56	30.09.23/ 16:14	General alarm, cos alarm, Active group-1, Start phase CN, Tripped phase ABC, Start element Dist., E/F start In 1, Dist. Trip Z1, F.D:79.95ms, R.T.T:79.95ms, F.L: 6.156KM, F.R:11.18ohm, Fault in Z1	During line patrolling fault was not found	402 A 145 MW	Ia=368.3 A Ib=341.2 A Ic=6.725 KA Van= 127.9KV Vbn=125.6KV Vcn= 87.41KV	NA
Khodri P/H	GE Multiline D-60/Alstom P442	30.09.23 12:56	30.09.23/ 16:14	Dir. O/C & E/F prot. Optd. Main-2: Dist. Prot. Optd., fault in Zone-3, F.D: 131.6ms, F.L: 26.35km, F.R: 35.04ohm, 86A/86B optd.		139 MW (I)	Ia=378A Ib= 339.9A Ic=1.690 KA Van= 121.4KV Vbn=123.7KV Vcn= 95.06KV	NA
220KV S/S Jhajhra	GE Multiline D-60/F650	11.10.23 / 13:56	11.10.23/ 16:42	Fault type AG, GND Dist. Z1, N/G, F.L:8.9km	Line was tripped due to kite coming on tower no. 82	16 A 03 MW 02 MVR (Imp.)	Ia=7177.386A Ib=57.486 A Ic=82.986 A Ig=7313.873	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
Kulhal P/H	GE Multiline D-60/F650	11.10.23 13:55	11.10.23/ 16:42	Dist. prot. optd., Main dist. relay trip other phase A, N/G, CB Open, 86 optd.		21Amp 2 MW - 4MVR (Exp.)	NA	NA
220KV S/S Jhajhra	GE Multiline D-60/F650	19.10.23 / 13:26	19.10.23/ 13:59	GND Dist. Z2, 86 optd, F.L: 26.7km	Patrolling done by O&M team but fault not fount	20A 04MW 03 MVR (Imp.)	Ia=3.45kA Ib=3.44kA Ic=0A Ig=0	NA
Kulhal P/H	GE Multiline D-60/F650	19.10.23 13:28	19.10.23/ 14:01	Dist. prot. optd., Main dist. relay trip other, phase A, phase B, phase dist. Z1 optd.		29Amp 4 MW - 4MVR (Exp.)	NA	NA
220KV S/S Jhajhra	GE Multiline D-60/F650	19.10.23 / 13:26	19.10.23/ 13:58	GND Dist. Z1 optd.	Patrolling done by O&M team but fault not fount	38 A 08MW 05 MVR (Imp.)	Ia=2.77kA Ib=1.4kA Ic=21A Ig=1.355kA	NA
Dhalipur P/H	GE Multiline D-60/F650	19.10.23	19.10.23	No tripping observed		NA	NA	NA
220KV S/S Jhajhra	GE Multiline D-60/F650	25.10.23 / 09:28	25.10.23/ 11:45	Active Group-1, fault type AG, GND Dist. Z1, F.L: 10.2km	the line trip due to the laying of cable by a labour	152A 33MW 09 MVR (Exp.)	Ia=142.477A Ib=191.974A Ic=8031.142A In=7863.928A	NA
132KV S/S Purkul	micome P545/micome P143	25.10.23 / 09:28	25.10.23/ 11:47	86T, 86T, 86T, 186, B-phase trip, active group-1, std. phase CN,		156Amp 33.9 MW	Ia=146.5A Ib=186.5A	NA

NAME OF SUBSTATION	TYPE OF RELAY	TRIPPING DATE/ TIME	CLOSING DATE/ TIME	FLAGS & INDICATION OBSERVED	ANALYSIS WITH DISCREPENCY IN FLAGS	PRE-FAULT Load	POST FAULT	REMARK
				tripped phase C, std. element dist. O/C std. I>1, E/F std. IN1, dist. trip Z1, F.D: 71.64ms, R.T.T: 79.97ms, F.L: 11.39km, F.R: 9.304ohm, fault in Zone 1		9.2MVR (imp.)	Ic=1.581 KA Van=73.96kv Vbn=73.86kv Vcn=24.7kv	
220KV S/S Jhajhra	GE Multiline D-60/Alstom P442	04.11.23 /11:14	04.11.23/ 18:50	Std. phase BCN, tripped phase ABC, tripped Zone-2, F.D: 463.1ms, R.T.T: 79.96ms, F.L: 25.13KM,F.R: 106.9 ohm, 86A, 86B	During patrolling it was found that 220kv jhajhra-khodri line was tripped due to breakage of Y phase jumper at tower no. -06	347 A 117 MW 58 MVR (Exp.)	Ia=545.8 A Ib=4.563 KA Ic=428.5 A Van= 124.6KV Vbn=81.39KV Vcn= 125.8KV	NA
Khodri P/H	GE Multiline D-60/Alstom P442	04.11.23 11:15	04.11.23/ 18:52	Main-1 Dist. Prot. Optd., Dir. O/C & E/F prot. Optd., Main-2 dist. Prot. Optd. 86A & 86B optd. Backup dist. Prot. Relay- Earth fault start IN-1, trip phase ABC, Dist. Trip Z-1, F.D: 81.64ms, R.T.T: 113.3ms, F.L: 1.502KM, F.R: 4950-ohm, Fault in Zone -1		98 MW 45 MVR (Imp.)	Ia=573A Ib=5.262 KA Ic=448.8 A Van=134.3KV Vbn=26.07KV Vcn=132.4KV	NA

5.0. Observations and Recommendations

5.1. Reporting of all the Tripping with DR/EL

a. For the interstate lines, as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard, all the DR/EL reports shall be uploaded on Web Based Tripping Monitoring System "http://103.7.128.184/Account/Login.aspx" within 24 hours of the events. These are being submitted by sub-station to NRLDC portal, however the record of the same is not kept at substation level.

Status of submission of FIR/DR/EL/Tripping Report on NR Tripping Portal

Time Period: 1st January 2024 - 31st January 2024

S. No.	Utility	Total No. of tripping	First Information Report (Not Received)		Disturbance Recorder (Not Received)	Disturbance Recorder (NA) as informed by utility	Disturbance Recorder (Not Received)	Event Logger (Not Received)	Event Logger (NA) as informed by utility	Event Logger (Not Received)	Tripping Report (Not Received)	Tripping Report (NA) as informed by utility	Tripping Report (Not Received)	Remark
			Value	%	Value		%	Value		%	Value		%	
36	SLDC-PS	29	2	7	13	6	57	13	5	54	16	0	55	DR, EL & Tripping report need to be submitted
37	SLDC-RS	130	12	9	23	11	19	23	9	19	39	0	30	
38	SLDC-UK	6	0	0	0	4	0	0	4	0	1	3	33	
39	SLDC-UP	80	10	13	11	9	15	12	10	17	11	1	14	
40	STERLITE	1	0	0	0	0	0	0	0	0	0	1	0	Details received
41	TANAKPUR-NH	4	1	25	1	0	25	1	0	25	1	0	25	DR, EL & Tripping report need to be submitted
42	UNCHAHAR-NT	1	0	0	0	0	0	0	1	0	0	0	0	Details received
	Total in NR Region	520	147	28	169	69	37	171	70	38	185	17	37	

As per the IEGC provision under clause 37.2 (c), detailed tripping report along with DR & EL has to be furnished within 24 hrs of the occurrence of the event

Ref: NRPC 216 OCC Agenda (Annexure B.VIII)

b. For the tripping of intra-state lines, the brief tripping reports are submitted to Divisional office. The DR/EL reports are downloaded by respective officials and forwarded, as per need basis. The record of these DR/EL is not kept at sub-stations

c. It is recommended that each sub-station to have a central repository of such tripping reports, along with DR/EL reports and analysis. A dedicated PC can be kept for this.

5.2. Development of centralized database of relay settings

a. In 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 kV and above. Portal shall have other features including protection setting calculation tool. A nodal officer shall be providing this data at central portal.

b. The relay settings for below 220kV are to be calculated by SLDC and/or central level. The relays are tested by sub-station officials as per need basis, but the record of recommended

settings/ calculation is not kept at sub-station level. This makes it difficult to validate the settings and test results, in case of relay testing.

c. It is recommended that latest recommended relay settings, as decided by RLDC for 220kV & above and by SLDC below 220kV along with setting calculations & parameters used for all the relays be kept at sub-station level. This will help in proper fault analysis and ascertaining relay healthiness.

5.3. Review of test results of relay and equipment

a. Testing of most of the equipment is carried out, as per availability of shut-down and testing equipment. After testing, the test records are summarily recorded in testing register, with remarks as "tested. OK".

b. For the numeric relay testing, the testing is carried out by supplier at the time of installation and subsequently as per need basis, including at the time of change in settings.

c. A draft O&M manual is available at PTCUL web-site, which includes various tests and their frequency, along with results. This manual is based on CERC/SERC regulations of 2004-2008. It is recommended that this manual may be updated and implemented and record of test values may be kept for future reference.

5.4. Availability of Testing Kits

a. The availability of testing equipment is limited at each sub-station is limited. For comprehensive testing of equipment, as per above para, sufficient testing kits at each sub-station/Sub-division/Division level are required.

b. It is recommended that based on approved O&M manual, station, Sub-division, Division wise testing instruments be arranged for regular testing of equipment.

5.5. Up-dation of PTCUL Protection Philosophy

The protection philosophy adopted by Utility, in general, is in alignment with protection philosophy adopted by NRPC. As the NRPC has recently updated the protection philosophy, PTCUL in consultation with SLDC may update protection philosophy for network not covered by NRPC, if needed, and implement the same.

5.6. Simulation based study of protection system

As per IEGC, protection code, during audit the relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report. The current scope of audit was excluding these studies, therefore, Simulation based or EMTP Studies should be carried out by the Utility, as per the requirement of Grid Code.

5.7. Capacity Building of protection team

During the discussions with officials at site, it was observed that the teams responsible for the protection system and SAS, needs to be updated on current trends on protection system, communication schemes and Sub-station automation. Utility may undertake capacity building exercise for the officials involved in these activities.

5.8. Updated Fault Level/ Short Circuit Level and Network information

The fault level/ short circuit level for each substation is being calculated at central level. Such studies are carried out, as and when new elements are added in the network. This has impact on relay settings parameters and equipment ratings. It is recommended that the updated network information and short circuit level be maintained at central level for revising the setting as per requirement.

5.9. General Protection related observations

The study of Fire protection system/ Nitrogen Injection Fire Protection System, Lightning Protection system, Earthing Mat/ Earthing Protection are not covered under protection audit. Utility may get a comprehensive technical and safety audit carried out internally or thru third party and corrective action for any discrepancy be taken up accordingly.

5.10. O&M Manual

The Utility has a draft O&M manual uploaded on its website, which is being referred by working level officials as a guideline for regular O&M and testing functions. This manual needs to be updated to incorporate recent developments and approved for regular use in all sub-stations to bring uniformity in O&M and testing practices across the utility.

6.0. Station Specific Observation and Recommendations

6.1. Protection related observations and recommendations

6.1.1. The sub-station is well kept:

a. All the records of SLD, protection setting, equipment testing and tripping is well kept.

b. The sub-station is fully operated thru SAS system.

c. The events are recorded from individual relays, no separate Event Logger is provided. All relays are centrally connected for downloading the DR and EL.

d. Both the 220V DC systems are replaced recently.

6.1.2. Based on analysis of line tripping during last 12 months, following were observed:

a. Most of the feeders are passing thru urban area/ forest area and trippings are happening due to encroachment of line clearance by kite, birds and construction near transmission lines. Protection system is found to be working ok during these cases.

b. During this period 220kV Vyasi- Jhajhra line tripped 14 times, out of which 10 times it was due to over voltage on remote side. The remote end is a generating station, relay co-ordination and setting at remote end need to be updated as per latest NRPC guidelines.

c. During this period 2 nos. tripping from remote end on zone 2 was observed for 220kV khodri line from remote. The remote end is a generating station, relay co-ordination and setting at remote end need to be updated as per latest NRPC guidelines.

d. On 30/05/2023, 23/7/2023 and 27/8/2023 multiple LV side of transformers tripped due to fault on 33kV system. The 33kV system beyond the 33kV side of transformers is owned by distribution company, i.e. UPCL. Any fault in 33kV and/or 11kV, if not cleared in time, can cause tripping of LV side of transformer, as the non-directional Over current and Earth Fault protection is provided.

e. On 17/5/2023 220kV bus-coupler tripped on over current, due to unbalanced load. Setting modified by utility.

6.1.3. Bus Bar Protection on 220kV Bus is not functional. Protection is commissioned, but due to non-availability of shut-down, stability test could not be carried out. Utility had informed that expected date for putting in service is 31.03.2024. Status to be updated. If not commissioned so far, to be carried out ASAP.

6.1.4. PLCC aided protection is not functional on important transmission lines. It is recommended to be taken up on priority:

j. 220kV Khodri line PLCC protection not operational due to issue at other end.

k. 220kV IIP line PLCC protection is not functional, as protection coupler is not commissioned.

6.2. *Equipment related observations and recommendations*

Many of the equipment are recently replaced. Any requirement of equipment and spares may be reviewed by PTCUL.
In addition, it is recommended that sufficient quantity of maintenance equipments be made available at sites. A suggested list of Maintenance Equipment is attached at Annexure – 3.

6.3. *Auxiliary Equipment related observations and recommendations*

a. The 220V DC system is configured for single Source DC. Therefore, both the DC sources are connected thru changeover relays at individual bay level to maintain redundancy. In case of delay in switchover, relays may shutdown and start rebooting. It is suggested that a comprehensive review of this philosophy and DC distribution system may be carried out.
b. The 2^{nd} Auxiliary supply source is from 220/132/33 kV transformer tertiary is not in use currently. A 2^{nd} station transformer is connected to 33kV bus for, which is under commissioning. This needs to be expedited.

Annexure – 1: Suggested List of Testing Instruments

CBIP suggests the following list of testing instruments based on the approved O&M manual

Sl. No.	Testing Instruments
1	DCRM for Circuit Breaker
2	DC Earth Fault Locator
3	SF6 Gas Density Monitor
4	SF6 Gas Leakage detector/ Imaging Camera
5	CB Analyser
6	Earth Resistance Tester
7	Portable Digital Selective Level Meter cum Level Generator
8	Selective Level Generator
9	LA Leakage Current Analyser
10	Digital Multi-meter
11	Tong Tester
12	Tan Delta Test Kit
13	Digital Leakage Clamp Meter
14	Phase Sequence Indicator
15	Megger (5 kV)
16	Digital Capacitance Meter
17	CT Polarity Tester
18	PT Test Set

Annexure – 2: Suggested List of Substation Equipments

The suggested list of Substation Equipments keeping in mind the necessity for the modernization and upgradation of substations.

Sl. No.	Equipment	Unit	Quantity
A	**220 kV Equipment**		
1	245 kV. 1600A,40KA, (3 Phase) HDB Isolator with one E/s (Metallic & Insulator)	Nos	14
2	245 kV. 2500A,40KA, (3 Phase) HDB Isolator with two E/s (Metallic & Insulator)	Nos	7
3	245 kV. 1600A,40KA, (3 Phase) HDB tandem Isolator (Metallic & Insulator)	Nos	20
4	245 kV Current Transformer (5 Core), Class 0.2s (1ph), 1600/800/1, (Protection Core)800/400/1 (metering Core)	Nos	15
5	242 kV Current Transformer (5 Core), Class 0.2 (1ph) 600/400/1	Nos	6
6	243 kV Current Transformer (5 Core), Class 0.2 (1ph) 400/200/1	Nos	6
7	244 kV Current Transformer (5 Core), Class 0.2 (1ph) 150/50/1	Nos	3
8	245 kV Bus PT	Nos	6
9	245 kV CVT 1 Ph	Nos	6
10	216 kV Surge Arrestor 1Ph	Nos	6
B	**132 kV Equipment**		
1	145 kV Circuit Breaker 3PH	Nos	8
2	145 kV. 1250A, (3 Phase) HDB Isolator without E/s (Metallic & Insulator)	Nos	7
3	145 kV. 1250A, (3 Phase) HDB Isolator with one E/s (Metallic & Insulator)	Nos	8

Sl. No.	Equipment	Unit	Quantity
4	145 kV. 1250A, (3 Phase) HDB Tandem Isolator (Metallic & Insulator)	Nos	7
5	145 kV Current Transformer 1Ph (5 Core), Class 0.2s (1ph) 800/400/1	Nos	12
6	145 kV Current Transformer 1Ph (5 Core), Class 0.2s (1ph) 1200/800/1	Nos	6
7	145 kV Current Transformer 1Ph (5 Core), Class 0.2s (1ph) 200/100/1	Nos	3
8	145 kV PT	Nos	6
9	132 kV Surge Arrestor 1Ph (polymer)	Nos	15
C	**33kV Equipment**		
1	33 kV Circuit Breaker	Nos	15
2	33 kV Isolator 3Ph with earth switch (800 Amp)	Nos	12
3	33 kV Isolator 3Ph with earth switch (1600 Amp)	Nos	3
4	33 kV Isolator 3Ph without earth switch (800 Amp)	Nos	24
5	33 kV Isolator 3Ph without earth switch (1600 Amp)	Nos	5
6	33 kV Current Transformer (3 Core), Class 0.2s (1ph) 1600/800/1	Nos	6
7	33 kV Current Transformer (3 Core), Class 0.2s (1ph) 800/400/1	Nos	36
8	33 kV PT	Nos	6

Annexure – 3: Suggested List of Maintenance Equipments

Sl. No.	Equipment
1	Oil Filter Machine
2	SF6 Gas Handling Plant
3	SF6 Gas Density Monitor
4	Thermo-Vision Camera Lines and Sub-Station
5	Binocular Vision Camera
6	SF6 Gas Leakage Imaging Camera
7	LA Leakage Current Analyser
8	Online DGA
9	Oil BDV Kit
10	Hydraulic Crimping Tool for different Types of ACSR Conductor
11	Hydraulic Conductor Cutter
12	Fork Lift 5 Ton Capacity
13	Digital Leakage Clamp Meter

A mobile van with test kits can be kept for optimizing the resources at various substations

Annexure – 4: Protection Code (IEGC 2023 Chapter 4)

- **General**

1. This chapter covers the protection protocol, protection settings and protection audit plan of electrical systems.
2. There shall be a uniform protection protocol for the users of the grid:
   a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;
   b) to have a repository of protection system, settings and events at regional level;
   c) specifying timelines for submission of data;
   d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and
   e) to provide for periodic audit of protection system.

- **Protection protocol**

1. All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
2. Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
3. RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures

relating to Safety and Electric Supply) Regulations, 2010, and any other CEA standards specified from time to time.

4. The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.
5. Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.

- **Protection settings**

1. RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPCs. The data including base case (peak and off-peak cases) files for carrying out studies shall be provided by RLDC and CTU to the RPCs:
2. All users connected to the grid shall:
   a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;
   b) obtain approval of the concerned RPC for,
      i. any revision in settings, and,
      ii. implementation of new protection system;
   c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;
   d) ensure correct and appropriate settings of protection as specified by the concerned RPC.
   e) ensure proper coordinated protection settings.

3. RPCs shall:
   a) maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 KV and above (132 KV and above in NER). RLDCs shall also maintain such database.

b) carry out detailed system studies, once a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions. The data required to carry out such studies shall be provided by RLDCs and CTU.

c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

4. The changes in the network and protection settings of grid elements connected to 220KV and above (132 KV and above in NER) shall be informed to RPCs by CTU and STUs, as the case may be.

   The elements of network below 66KV and radial in nature which do not impact the National Grid may be excluded as finalized by the respective RPC.

- **Protection audit plan**

1. All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 KV and above (132 KV and above in NER).
2. All users shall also conduct third party protection audit of each substation at 220 KV and above (132 KV and above in NER) once in five years or earlier as advised by the respective RPC.
3. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
4. The third-party protection audit report shall contain information sought in the format enclosed as Annexure–1. The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC or SLDC, as the case may be, within a month of submission of third-party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the respective RPC.

5. Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.
6. Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 KV and above (132 KV and above in NER) system, which shall be reviewed by the RPC:

c. The Dependability Index defined as

$$D = \frac{Nc}{Nc+Nf}$$

where,

Nc is the number of correct operations at internal power system faults and

Nf is the number of failures to operate at internal power system faults.

d. The Security Index defined as

$$S = \frac{Nc}{Nc+Nu}$$

where,

Nc is the number of correct operations at internal power system faults

Nu is the number of unwanted operations.

e. The Reliability Index defined as

$$R = \frac{Nc}{Nc+Ni}$$

where,

Nc is the number of correct operations at internal power system faults

Ni is the number of incorrect operations and is the sum of Nf and Nu

7. Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.
8. In case any user fails to comply with the protection protocol specified by the RPC or fails to undertake remedial action identified by the RPC within the specified timelines, the concerned RPC may approach the Commission with all relevant details for suitable directions.

- **System Protection Scheme (SPS)**

  1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.
  2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year.
  3. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.
  4. The users and SLDCs shall report about the operation of SPS immediately and detailed report shall be submitted within three days of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.
  5. The performance of SPS shall be assessed as per the protection performance indices specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a detailed report on the corrective actions taken to the concerned RPC within a fortnight.

- **Recording instruments**

  1. All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.

2. The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals which shall be included in the guidelines issued by the respective RPCs.
3. The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

Annexure – 5: Third Party Protection System Checking & Validation Template for a Substation (IEGC 2023 Annexure – 1)

1. **Introduction:**

   a. The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.

   b. The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:

      i. Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.

      ii. Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. **Checklist:**

   a. The protection system checklist shall contain information as per this Regulation.

      i. General Information (to be provided prior to the checking as well as to be included in final report):

         - Substation name
         - Name of Owner Utility
         - Voltage Level (s) or highest voltage level
         - Short circuit current rating of all equipment (for all voltage level) (v) Date of commissioning of the substation
         - Checking and validation date
         - Record of previous tripping's (in last one year) and details of protection operation
         - Previous Relay Test Reports
         - Overall single line diagram (SLD) (x) AC aux SLD
         - DC aux SLD
         - SAS architecture diagram
         - SPS scheme implemented (if any)

b. The preliminary report shall inter-alia contain the following:

FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	**Recommendation of last protection checking and validation**	Status of works &pending issues if any
2	**Review of existing settings at substation**	Recommended Action
3	**Disturbance Recorder out/ available for last 6 trippings (Y/N)**	Recommended Action
4	**Chronic reason of tripping, if any**	Recommended Action
5	**Major non-conformity/deficiency observed**	Recommended Action

c. The **relay configuration check-list** for available power system elements at station:

- Transmission Line
- Bus Reactor/Line Reactor
- Inter-connecting Transformer
- Busbar Protection Relay
- AC auxiliary system
- DC auxiliary system
- Communication system
- Circuit Breaker Details
- Current Transformer details
- Capacitive Voltage Transformers Details
- Any other equipment/system relevant for protection system operation

d. The **minimum set of points on which checking & validation** shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.

i. Transmission Line Distance Protection/Differential Protection;

- Name and Length of Line
- Whether series compensated or not

- Mode of communication used (PLCC/OPGW)
- Relay Make and Model for Main-I and Main-II
- List of all active protections & settings
- Carrier aided scheme if any
- Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
- Relay connected to Trip Coil-1 or 2 or both i. CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

ii. Shunt Reactor & Inter-connecting Transformer (ICT) Protection;

- Whether two groups of protections used (Group A and Group B)
- Do the groups have separate DC sources
- Relay Make and Model
- List of all active protections along with settings
- Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- Status of Oil Temperature Indicator/Winding-Temperature Indicator/Bucholz/Pressure Release Device etc.
- Relay connected to Trip Coil-1 or 2 or both
- CT ratio and PT ratio
- Feed from DC supply-1 or 2
- Connected to dedicated CT core (mention name)
- Other requirements for protection checking and validation

iii. Busbar Protection Relay;

- Busbar and redundant relay make and model
- Type of Busbar arrangement
- Zones
- Dedicated CT core for each busbar protection (Yes/No)
- Breaker Failure relay included (Yes/No), if additional then furnish make and model

- Trip issued to both Busbar protection in case of enabling
- Isolator indication and check relays
- Other requirements for protection checking and validation

iv. AC auxiliary system;

- Source of AC auxiliary system
- Supply changeover between sources (Auto/Manual)
- Diesel generator (DG) details
- Maintenance plan and supply changeover periodicity in DG
- Single Line Diagram
- Other requirements for protection checking and validation

v. DC auxiliary system;

- Type of Batteries (Make, vintage, model)
- Status of battery Charger
- Measured voltage (positive to earth and negative to earth)
- Availability of ground fault detectors
- Protection relays and trip circuits with independent DC sources
- Other requirements for protection checking and validation
- Communication system
  - Mode of communication for Main-1 and Main-2 protection
  - Mode of communication for data and speech communication
  - Status of PLCC channels
  - Time synchronization equipment details
  - 7OPGW on geographically diversified paths for Main-1 and main-2 relay
  - Other requirements for protection checking and validation

vi. Circuit Breaker Details;

- Details and Status
- Healthiness of Tripping Coil and Trip circuit supervision relay
- Single Pole/Multi pole operation
- Pole Discrepancy Relay available (Y/N)
- Monitoring Devices for checking the dielectric medium

- Other requirements for protection checking and validation
- Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details
  - CT/CVT ID name and voltage level
  - CT/CVT core connection details
  - Accuracy Class
  - Whether Protection/Metering
  - CT/CVT ratio available and ratio adopted
  - Details of last checking and validation of CT/CVT healthiness
  - Other requirements for protection checking and validation
  - Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. **Summary of checking:**

The summary shall specifically mention minimum following points:

a) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).

b) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.

c) All the major general deficiency shall be listed in detail along with remedial recommendations.

d) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.

e) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

Annexure – 6: Protection Philosophy/Protocol of Northern Region

The Protection Philosophy/Protocol of Northern Region is developed in compliance of IEGC 2023, Version 2.0 which was approved in 71st NRPC meeting held on 29.01.2024.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	220KV and above: Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided with carrier aided scheme. 132KV and below: One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines) Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line to take care of under reaching due to mutual coupling effect.
		Time setting: i. 0.35 second *(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)* ii. 0.5-0.6 second *(For a long line followed by a short line)*

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken up to 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance. Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Lines with Series and other compensations in the vicinity of Substation**	• Zone-1: FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • Over-voltage stage-I setting for series

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		compensated double circuit lines may be kept higher at 113%.
7	**Power Swing Blocking**	• Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regional tie lines. Deblock time delay = 2s
8	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I2/I1 \geq 0.2$) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protect single phasing of transformers.
9	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault.
10	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.
11	**Carrier Protection**	To be applied on all 220KV and above lines with the only exception of radial feeders.
12	**Back up Protection**	1. On 220KV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to be provided. • No Over current protection to be applied. 2. At 132KV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
13	**Auto Reclosing with dead time.**	AR shall be enabled for 220 KV and above lines for single pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: • Faults in cables • Breaker Fail Relay • Line Reactor Protections • O/V Protection • Received Direct Transfer trip signals • Busbar Protection • Zone 2/3 of Distance Protection • Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec; for tie breaker: 2.5 sec
14	**Busbar protection**	To be applied on all 220KV and above sub stations with the only exception of 220KV radial fed bus bars.
15	**Local Breaker Backup (LBB)**	For 220 KV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.
16	**Line Differential**	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		differential protection with distance protection as backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.
17	**Over Voltage Protection**	FOR 765KV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400KV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220 KV LINES: No over-voltage protection shall be used. FOR 220 KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97%

S.N.	Protection Setting/Protocol	Mandated Setting for transmission lines
		Grading: Voltage as well as time grading may be done for multi circuit lines/cable.
18	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (V min) to be considered as 0.85pu (85%).
19	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400 KV and above) vi. Cable Fault (in composite lines)
20	**Permissive Inter-trip**	To be sent on operation of Distance Protection

Annexure – 7: Work Order & Corrigendum

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
अधीक्षण अभियन्ता (परीक्षण एवं परिचालन एवं स्काडा) कार्यालय
कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Subject:- Order for Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to your offer submitted vide Ref No: P-1/CBIP/PTCUL/PTCUL/Audit/2023 dated: 11.09.2023 through email against Email enquiry dated 05.09.2023, an order is hereby placed in favour of your firm for the work of **"Protection Audit of 02 Nos 400kV and 08 Nos 220 kV substations of PTCUL"** The detail of material, price schedule and terms & conditions is here as under:-

Sr.No	Description	Unit	Qty	Amount	Total Amount
1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL :- 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000
	TOTAL				36,25,000

Total value of order is Rs.36,25,000 (Rupees Thirty Six Lakh Twenty Five Thousand only) Plus GST Extra.

Encl: 1. Terms & Conditions.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

No.376 /SE (T&C)/PTCUL/ (H)/ Date:29.09.2023

Copy forwarded to the following for information and necessary action:-

1. Director (Operation), PTCUL, Dehradun.
2. Superintending Engineer (A) MD, PTCUL, Dehradun.
3. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
4. Executive Engineer, T&C Division, Kashipur.
5. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021 Email: sanjeev@cbip.org

(D.P Singh)
Superintending Engineer (T&C), Haldwani

मुख्यालय एवंपजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाश नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्राँसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
(उत्तराखण्ड सरकार का उपक्रम)
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कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

Terms & Conditions:-

1	Scope	:	The detailed Scope work is as under: 1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP. 2. Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor. 3. The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor. 4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines,interconnecting transformers, line/busreactors, bus bar, bus couplers etc.as per latest guidelines of Ramakrishna committee/CBIP/NRPC/Intenational best practices.etc. 5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where evernon compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit. 6. Review of availability/healthiness of PLCC communication links used for protection systems. 7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application. 8. Review of availability/healthiness of GPS system and time synchronization facility used for protection. 9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. 10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. 11. Field inspection of protection device for obsolescence of technology, suitability and healthiness. 12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. 13. Checking of availability of DGset/auxiliary DC supply at substations. 14. Site visits for onsite protection audit, review and inspection of substations will be performed. 15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations. 16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipments will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection. 17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS 18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.

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कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135—2646000 फैक्स नं0 0135—2643460 वेबसाइटwww.ptcul.org

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(उत्तराखण्ड सरकार का उपक्रम)
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कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

			19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done **Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021** 20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted. 21. The safety guidelines prevalent in PTCUL must be followed.
2	**GST**	:	GST shall be paid extra as per applicable Government rules.
3	**Tax**	:	Tax shall be deducted at source as per applicable Government rules. A certificate to this effect may be given to the Contractor if required.
4	**Date of Start of work**	:	Order shall be considered as having come in to force from the date of issue of order.
5	**Supply Completion**	:	NA
6	**Work completion**	:	The work should be completed within 24 months from the date of issue of order.
7	**Engineer of the contract**		Superintending Engineer (T&C), Haldwani is the **"Engineer of the contract"** who shall be placing the order for the work with the contractor and signing the contract agreement and who has been inherently vested with such powers by corporation in this behalf and shall act as Engineer for the purpose of the contract.
8	**Engineer in-charge**		**Respective Executive Engineer (T&C) shall be "Engineer in charge"** for the subject work.
9	**Liquidity damages**	:	If the contract is delayed beyond the stipulated period mentioned in the contract. The liquidity damages shall be levied @ 0.5 % per week and maximum up to 10% of contract value.
10	**Dispute**		All Dispute arising out of this case under the jurisdiction local court at Kashipur and Honable High Court, Nainital.
11	**Payment terms**	:	**1.** 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. **2.** 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. **3.** 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ.
12	**Payement unit**		Test & Commissioning Division, Kashipur shall be the payment unit and all units where is to be work done shall record the measurement and duly passed bills along with measurement book shall be submitted to payment unit.
13	**Warranty period**	:	NA.
14	**Billing Address**	:	Executive Engineer Test & Commissioning Division, PTCUL 400 KV Substation Campus, Kashipur (Uttarakhand)-244713, GSTIN No. (05AAECM1785FCZ9)

All other term and condition of this order shall be governed by the General conditions of the contract prevalent in PTCUL.

(D.P Singh)
Superintending Engineer(T&C), Haldwani

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

पावर ट्रॉंसमिशन कारपोरेशन ऑफ उत्तराखण्ड लि0
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कुमांयु मण्डल हल्द्वानी
मोबाइल नं0 9412089275, ईमेल dp_singh@ptcul.org

PTCUL

No. 394 /SE (T&C)/PTCUL/ (H)/ Date:26.10.2023

Subject:- Corrigendum for the Order for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL.

Joint Advisor
Central Board of Irrigation and Power
Malcha Marg Chanakyapuri,
New Delhi-110021
Email: mrchauhan@cbip.org.

Dear Sir,

In reference to above mentioned subject, please refer to kick off meeting held on dated 26.10.2023 for the work of Protection Audit of 02 Nos 400 kV and 08 Nos 220KV sub-stations in PTCUL against order no.376 dated 29.09.2023.

In this regard, kindly find enclosed herewith corrigendum of order no.376 dated 29.09.2023 (Annexure-1) with necessary amendements as discussed in afforementioned meeting.

This is for your kind information and necessary action.

Please acknowledge the receipt and acceptance of order.

(D.P Singh)
Superintending Engineer (T&C), Haldwani

Copy forwarded to the following for information and necessary action:-

1. Chief Engineer, T&C PTCUL, 132kV Substation Campus, Kathgodam Nainital..
2. Executive Engineer, T&C Division, Roorkee/Dehradun/Haldwani/Kashipur/Rishikesh with request to provide assistance and information to CBIP for the above work.
3. Director (Energy), Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021
   Email: sanjeev@cbip.org

मुख्यालय एवंपंजीकृत कार्यालयः–विद्युतभवन, नजदीक–आई0एस0बी0टी0 क्रासिंग, सहारनपुररोड़, माजरा, देहरादून–248002
कारपोरेटआईडी नं0: U40101UR2004GOI028675 दूरभाष नं0 0135–2646000 फैक्स नं0 0135–2643460 वेबसाइटwww.ptcul.org

Annexure -1 – Work order corrigendum

Scope: The detailed Scope work is as under:

S. No.	Clause of PO	Existing Clause						Modified Clause					
		Sr. No	Description	Unit	Qty	Amount	Total Amount	Sr. No	Description	Unit	Qty	Unit rate (Rs.)	Total Amount (Rs.)
1	Price Schedule	1	Protection Audit to be carried out for the following 10 nos. of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra. 8. 220 kV S/s Pantnagar. 9. 220 kV S/s Haldwani. 10. 220kV S/s Mahuakheraganj.	Job	1	36,25,000	36,25,000	1	Protection Audit to be carried out for the following 10 nos of the 400/220kV substations of PTCUL: - 1. 400kV S/s Rishikesh 2. 400 kV S/s Kashipur 3. 220kV S/s Chamba 4. 220kV S/s Rishikesh 5. 220kV S/s Roorkee 6. 220kV S/s Haridwar (SIDCUL) 7. 220kV S/s Jhajra 8. 220 kV S/s Pantnagar 9. 220 kV S/s Haldwani 10. 220kV S/s Mahuakheraganj	Each	10	3,62,500	36,25,000
			TOTAL				36,25,000		TOTAL				36,25,000
2	Terms and Conditions – S. No. 1 – Scope	1.	There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.						1. There must be a kick off meeting for discussion on project plan before start of the work in field and the detailed plan of performance shall be submitted by CBIP.				
		2.	Requisite data shall be collected in standard format from PTCUL grid substations by authorized and experienced auditor.						2. Requisite data shall be collected in standard format from PTCUL grid substations by an experienced auditor.				
		3.	The site surveys and audit of grid substations of PTCUL shall be done by authorized and experienced auditor.						3. The site surveys and audit of grid substations of PTCUL shall be done by an experienced auditor.				
		4.	Review of the implemented protection schemes/ philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus						4. Review of the implemented protection schemes/philosophy for 400/220 kV substations which includes protection of transmission lines, interconnecting transformers, line/bus reactors, bus bar, bus couplers etc with respect to				

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S. No.	Clause of PO	Existing Clause	Modified Clause
		couplers etc.as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, etc.	tripping in last one year as per latest guidelines of Ramakrishna committee/ CBIP/NRPC/International best practices, which includes review of the following: a) Adequacy of primary and backup protection settings for protected equipment and suggest corrective measures b) Availability/healthiness of PLCC communication links used for protection systems. c) Healthiness/adequacy of 220/110/50V DC system available at substations for protection application. d) Availability/healthiness of GPS system and time synchronization facility used for protection. e) Availability/healthiness of recording instruments like DRs /ELs for transmission lines protection. f) Test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites. g) Field inspection of protection device for obsolescence of technology, suitability and healthiness. h) Prepare recommendation for replacement of obsolescence relays with compatible numerical relays will be provided. i) Checking of availability of DG Set / auxiliary DC supply at substations.
		5. Review the adequacy of primary and backup protection settings for protected equipment and suggest corrective measures where everyone compliance with respect to Ramakrishna committee/ CBIP/NRPC is found during the protection audit.	
		6. Review of availability/healthiness of PLCC communication links used for protection systems.	
		7. Review the healthiness/adequacy of 220/110/50V DC system available at substations for protection application.	
		8. Review of availability/healthiness of GPS system and time synchronization facility used for protection.	
		9. Review of availability/healthiness of recording instruments like DRs /ELs for transmission lines protection.	
		10. Review of test reports for assessing the healthiness of circuit breakers, CT & CVT based upon available test reports at sites.	
		11. Field inspection of protection device for obsolescence of technology, suitability and healthiness.	
		12. Directory of the protection system & recommendation for replacement of obsolescence relays with compatible numerical relays will be provided.	
		13. Checking of availability of DG Set/auxiliary DC supply at substations.	
		14. Site visits for onsite protection audit, review and inspection of substations will be performed.	5. Site visits for onsite protection audit, review and inspection of substations will be performed
		15. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.	6. Submission of the detailed report for the protection audit including the protection philosophy, reviewed settings and protection audit observations.
		16. The performance of above protection equipment like relays, circuit breaker, CT, CVT, DC battery bank, synchro facility, communication facility used for protection will be also checked through physical inspection and provided test reports/documents. These protection equipment's will be recommended for renovation and upgradation based on their performance accessed during protection audit and physical inspection.	Deleted as it is covered in point 4 above.

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S. No.	Clause of PO	Existing Clause	Modified Clause
		17. Review the availability healthiness of • Event recorders/ loggers' operation history • CT, CVT, CB • DC power supply • Auxiliary supply • Communication links • Time synchronization/ GPS	
		18. Review of Testing and Maintenance records of all protective relays, Circuit Breakers CT, CVT etc. Review of protection philosophy.	
		19. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done Central Board of Irrigation and Power Malcha Marg Chanakyapuri, New Delhi-110021	7. Anything which is left to be mentioned here but required for successful completion of the aforementioned subject work shall be done by Central Board of Irrigation and Power.
		20. CBIP Delhi shall submit a report on detailed points in four sets of hard copy duly spiraled binding as well as soft copy shall be submitted.	8. CBIP Delhi shall submit a protection report on detailed points in four sets of hard copy duly spiraled binding and in soft copy as well.
		21. The safety guidelines prevalent in PTCUL must be followed.	9. The safety guidelines prevalent in PTCUL must be followed.
3	Terms and Conditions – S. No. 6 - Work Completion	The work should be completed within 24 months from the date of issue of order	The work should be completed within **24 weeks from the date of issue of corrigendum**.
4	Terms and Conditions – S. No. 8 - Engineer-in-charge	Respective Executive Engineer (T&C) shall be "Engineer in charge" for the subject work.	The following Executive Engineers (T&C) shall be "Engineer in charge" for the subject work: a) 400KV Rishikesh, 220KV Rishikesh,220 kV Chamba – Mr. Harsh Verma (Ph. No.9412074038 & Email: ee_tandc_rsh@ptcul.org). b) 400KV Kashipur, 220KV Pantnagar, 220KV Haldwani & 220KV Mahuakheraganj – Mr. Asim Baig (Ph. No. 9412087885 & Email: ee_tandc_ksp@ptcul.org). c) 220KV SIDCUL Haridwar, 220 kV Roorkee – Mr. Ashwini Kumar (Ph. No.7088117301 & Email: ee_tandc_rke@ptcul.org). d) 220KV Jhajra – Mr. Ravindra Kumar (Ph. No. 9927744222 & Email: ee_tandc_ddun@ptcul.org).

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S. No.	Clause of PO	Existing Clause	Modified Clause
5	Terms and Conditions – S. No. 11 - Payment Terms	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ	1. 25% Payment will be made within 30 days after finalization of Audit plan, subject to availability of funds from PTCUL HQ. 2. 35% Payment will be made within 30 days after submission of preliminary reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ. 3. 40 % Payment will be made within 30 days after submission of final reports **on prorata basis** verified by Executive Engineer of respective division, subject to availability of funds from PTCUL HQ 4. The local travel, lodging & boarding shall be arranged by PTCUL on free-of-cost basis for CBIP team visiting the substation

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Annexure – 8: Data Sheets

Contents

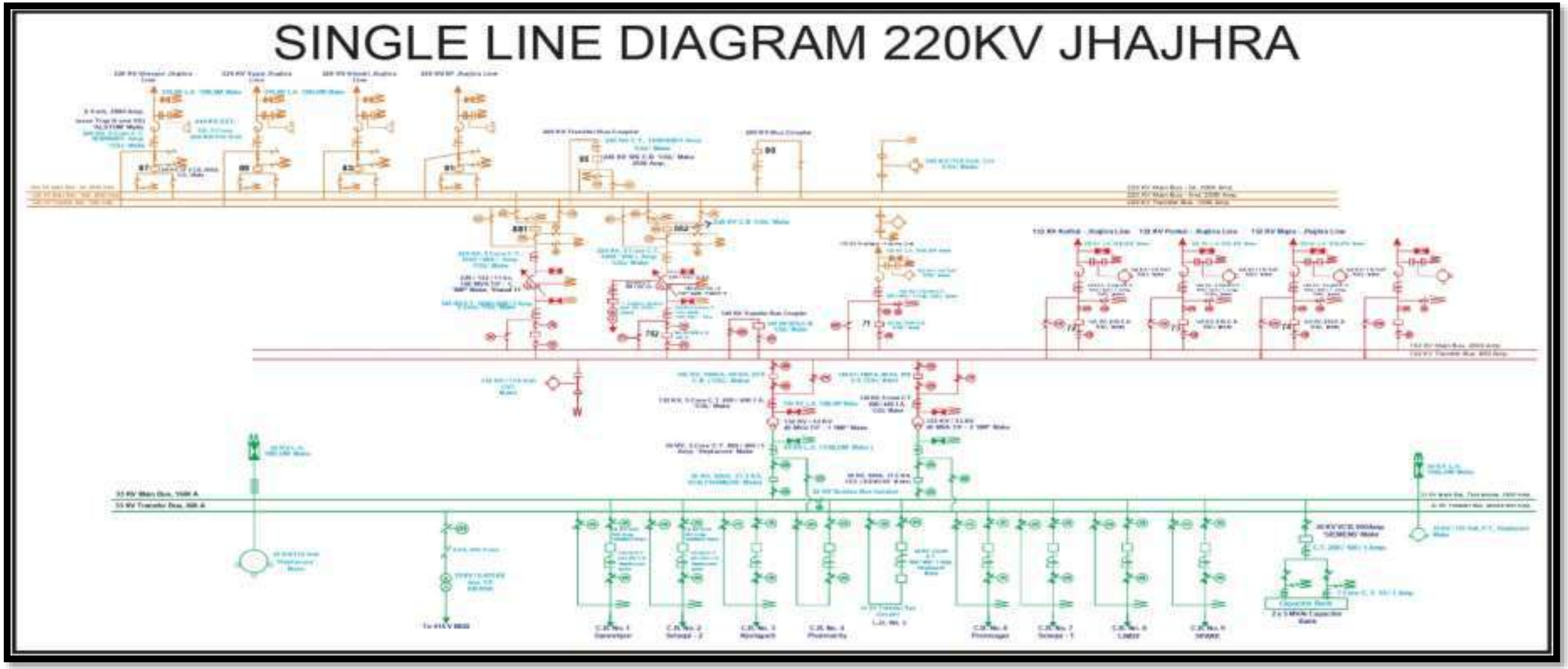
Protection Audit of 220/132/33kV Jhajhra Substation

Annexure - 8

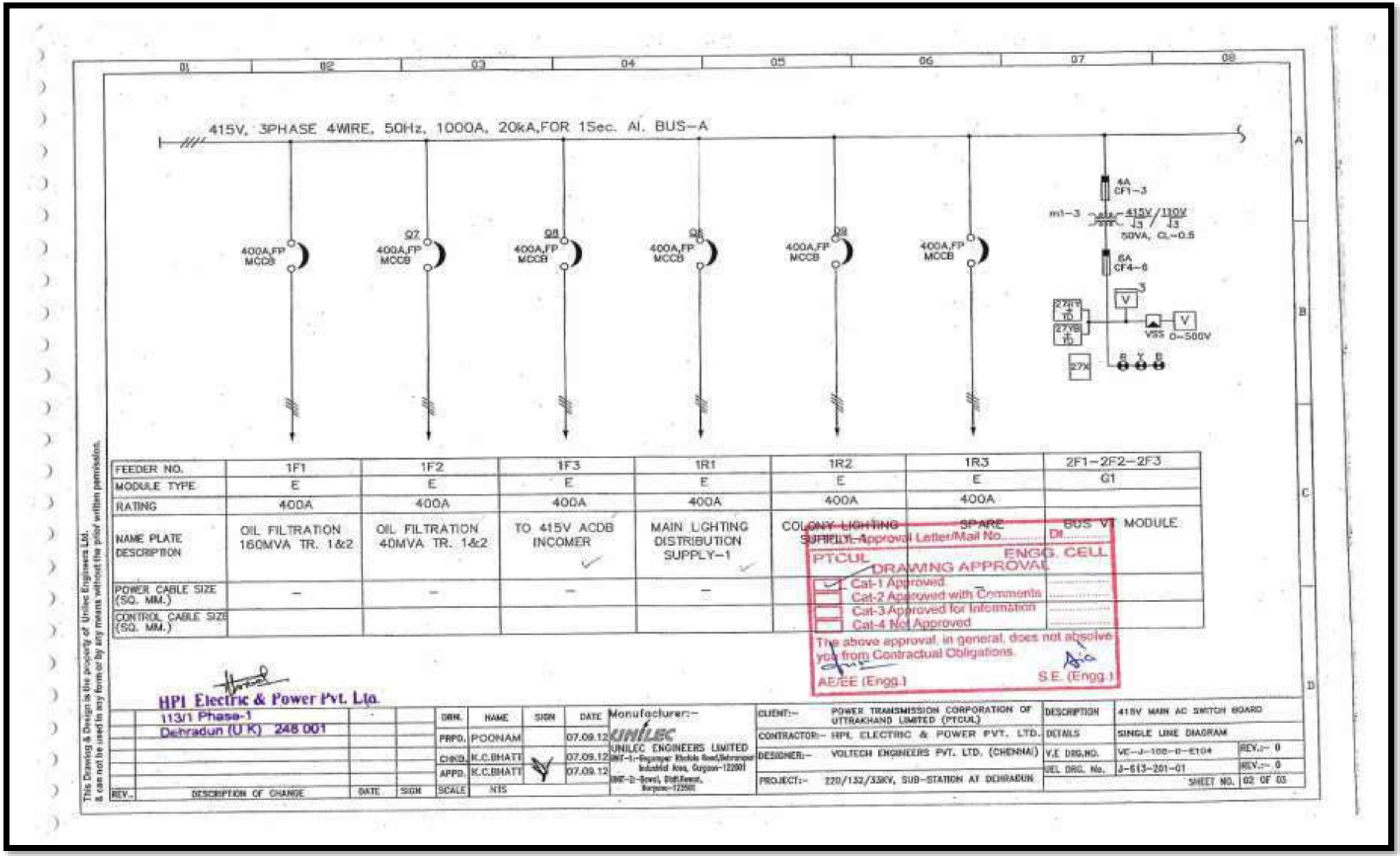
Data Sheets

Single Line Diagrams

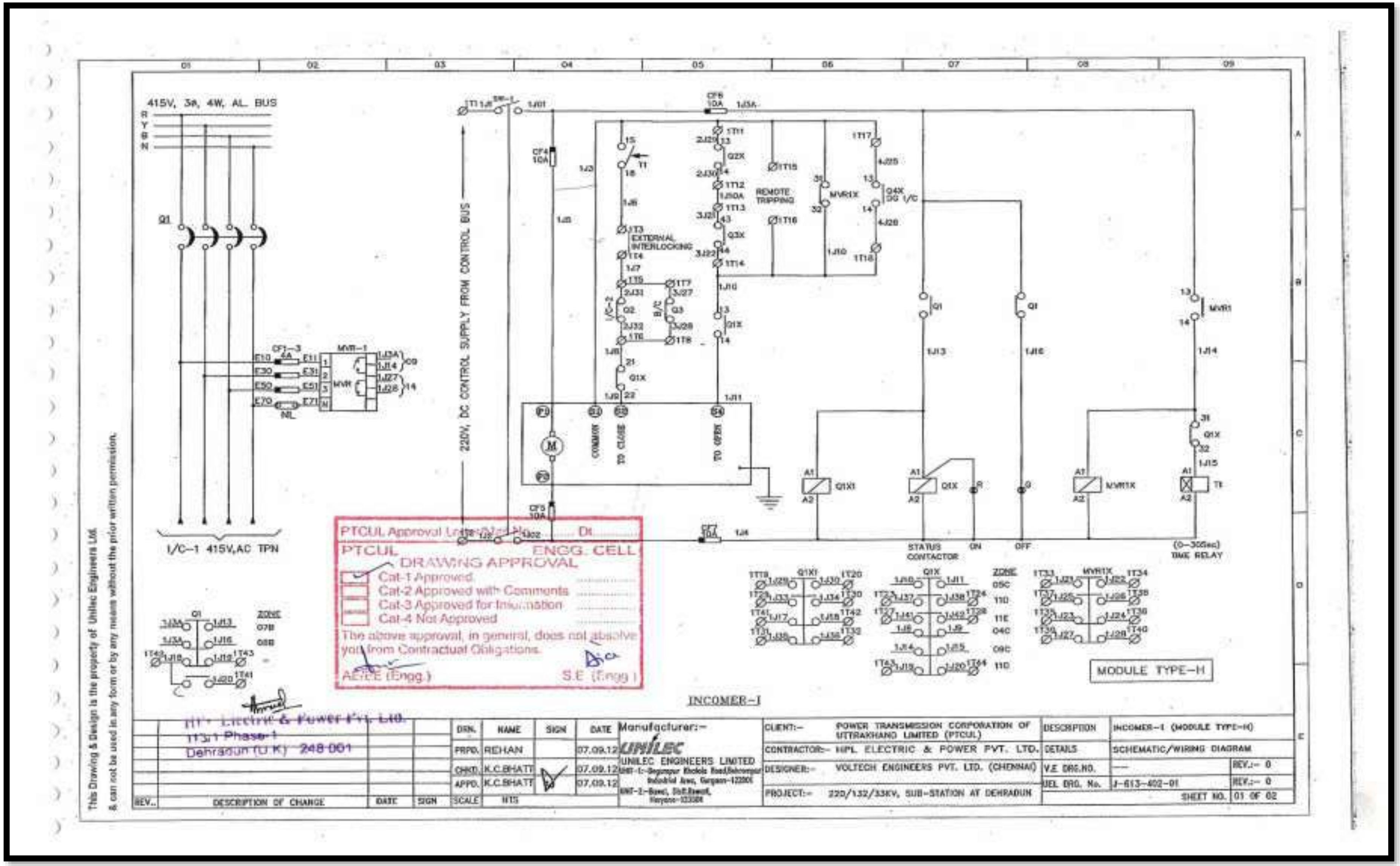
Substation Single Line Diagram



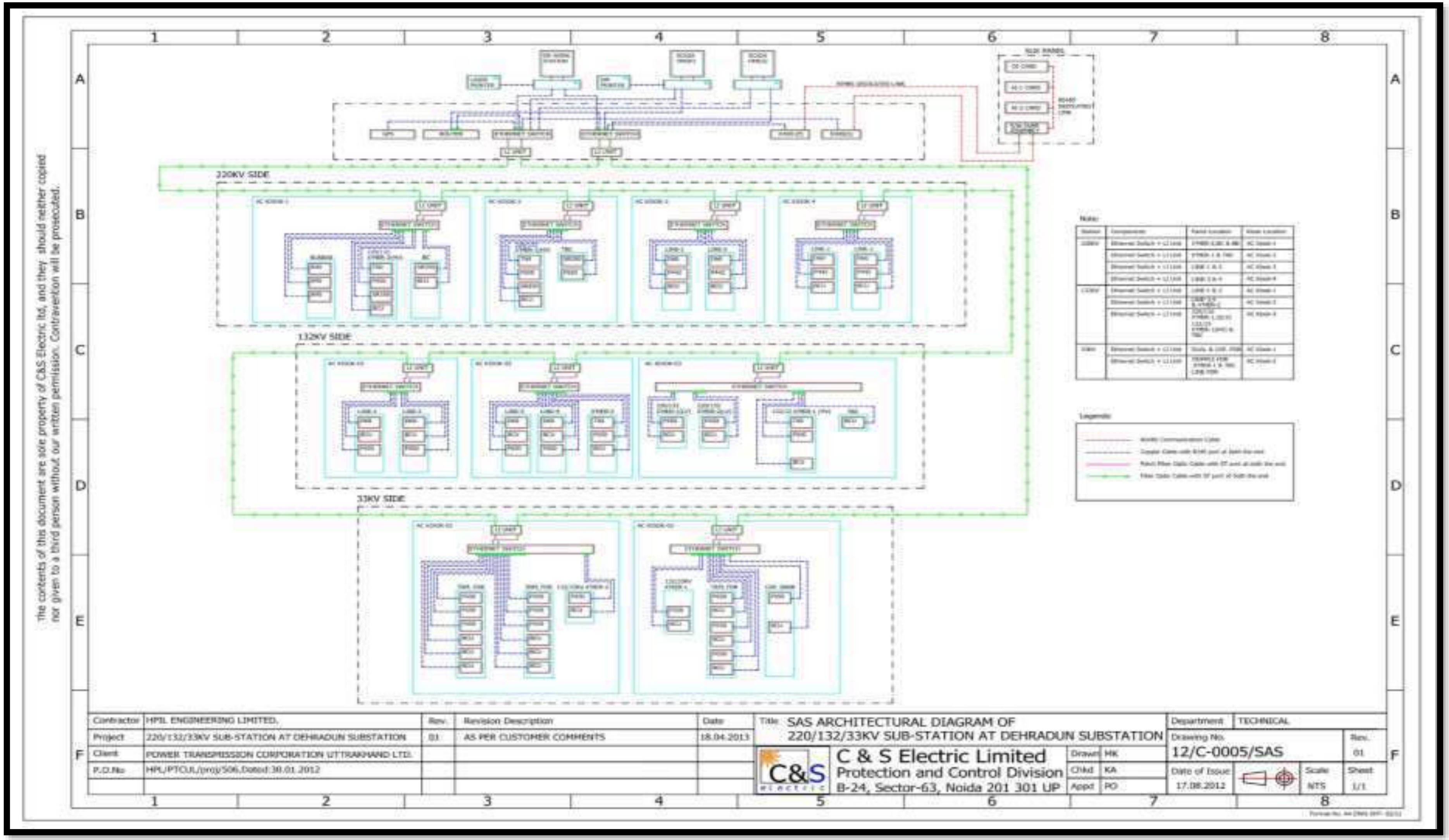
AC Auxiliary System



DC Auxiliary System



SAS Architecture diagram



Transmission Lines

SL. No.	Particulars	Details
a	Name and Length of Line	220 KV Jhajhra-IIP Line, 26 KM
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	PLCC
d	Relay Make and Model for Main-I and Main-II	GE Multiline D60 and Alstom P442
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	No
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	Power Swing/ SOTF/ Broken Conductor/ Breaker Failure/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	1600/1, 220KV/ 110V
j	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
k	Connected to dedicated CT core (mention name)	Core- 1 (Prot Main-1), Core- 2 (Prot Main-2), Core-3 (BCU & Metering), Core-4 Spare, Core-5 (Busbar Prot)
l	Other requirements for protection checking and validation	NA

SL. No.	Equipment	Details
a	Name and Length of Line	220 KV Jhajhra-Khodri Line, 27.53 Km.
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	PLCC
d	Relay Make and Model for Main-I and Main-II	GE Multiline D60 and Alstom P442
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	N/A
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	Power Swing/ SOTF/ Broken Conductor/ Breaker Failure Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	1600/1, 220KV/ 110V
j	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
k	Connected to dedicated CT core (mention name)	Core- 1 (Prot Main-1), Core- 2 (Prot Main-2), Core-3 (BCU & Metering), Core-4 Spare, Core-5 (Busbar Prot)
l	Other requirements for protection checking and validation	NA

SL. No.	Equipment	Details
a	Name and Length of Line	220 KV Jhajhra-PGCIL Line, 6.11 Km.
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	PLCC
d	Relay Make and Model for Main-I and Main-II	GE Multiline D60 and Alstom P442
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	Carrier inter-tripping
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	Power Swing/ SOTF/ Broken Conductor/ Breaker Failure Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	1600/1, 220KV/ 110V
j	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
k	Connected to dedicated CT core (mention name)	Core- 1 (Prot Main-1), Core- 2 (Prot Main-2), Core-3 (BCU & Metering), Core-4 Spare, Core-5 (Busbar Prot)
l	Other requirements for protection checking and validation	NA

SL. No.	Equipment	Details
a	Name and Length of Line	220 KV Jhajhra-Vyasi Line, 40.31 Km.
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	PLCC
d	Relay Make and Model for Main-I and Main-II	GE Multiline D60 and Alstom P442
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	Carrier inter-tripping
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	Power Swing/ SOTF/ Broken Conductor/ Breaker Failure Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	1600/1, 220KV/ 110V
j	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
k	Connected to dedicated CT core (mention name)	Core- 1 (Prot Main-1), Core- 2 (Prot Main-2), Core-3 (BCU & Metering), Core-5 (Busbar Prot)
l	Other requirements for protection checking and validation	NA

SL. No.	Particulars	Details
a	Name and Length of Line	132 KV Jhajhra-Dhalipur Line, 26.47 KM
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	NA
d	Relay Make and Model for Main and Backup Prot	GE Multilin D60 and F650
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	No
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	Power Swing/ SOTF/ Broken Conductor/ Breaker Failure Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	800/1, 132KV/ 110V
j	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
k	Connected to dedicated CT core (mention name)	Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
l	Other requirements for protection checking and validation	NA

SL. No.	Equipment	Details
a	Name and Length of Line	132 KV Jhajhra-Kulhal Line, 31.97
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	N/A
d	Relay Make and Model for Main and Backup Prot	GE Multiline D60 and F650
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	No
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	Power Swing/ SOTF/ Broken Conductor/ Breaker Failure Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	800/1, 132KV/ 110V
j	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
k	Connected to dedicated CT core (mention name)	Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
l	Other requirements for protection checking and validation	NA

SL. No.	Equipment	Details
a	Name and Length of Line	132 KV Jhajhra-Majra Line, 15.98 KM
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	N/A
d	Relay Make and Model for Main and Backup Prot	GE Multiline D60 and F650
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	No
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	Power Swing/ SOTF/ Broken Conductor/ Breaker Failure Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	800/1, 132KV/ 110V
j	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
k	Connected to dedicated CT core (mention name)	Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
l	Other requirements for protection checking and validation	NA

SL. No.	Equipment	Details
a	Name and Length of Line	132 KV Jhajhra-Purkul Line, 21.29 KM
b	Whether series compensated or not	No
c	Mode of communication used (PLCC/ OPGW)	N/A
d	Relay Make and Model for Main and Backup Prot	GE Multiline D60 and F650
e	List of all active protections & settings	Enclosed
f	Carrier aided scheme, if any	No
g	Status of Power Swing/ Out of Step/ SOTF/ Breaker Failure/ Broken Conductor/ STUB/ Fault Locator/ Disturbance Recorder/ VT fuse fail/ Overvoltage Protection/ Trip Circuit supervision/ Auto-reclose/ Load encroachment etc.	Power Swing/ SOTF/ Broken Conductor/ Breaker Failure Fault Locator/ Disturbance Recorder/ VT fuse fail/ Trip Circuit supervision/ Auto-reclose Active
h	Relay connected to Trip Coil-1 or 2 or both	Both
i	CT ratio and PT ratio	800/1, 132KV/ 110V
j	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
k	Connected to dedicated CT core (mention name)	Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
l	Other requirements for protection checking and validation	NA

Bus-Bar Protection

SL. No.	Equipment	Busbar Protection Relay
a	Busbar and redundant Relay make and model	GE make Model B90
b	Type of Busbar arrangement Relay make and model	GE make Model B90
c	Zones	Zone 1, Zone 2 and Zone 3
d	Dedicated CT core for each Busbar protection (Yes/No)	Yes (Core-5)
e	Breaker Failure Relay included (Yes/No) if additional then furnish make and model	Yes (LBB)
f	Trip issued to both Busbar Protection in case of enabling	Yes
g	Isolator indication and check relays	Yes
h	Other requirements for protection checking and validation	NA

AC Auxiliary System

SL. No.	Equipment	AC auxiliary system
a	Source of AC auxiliary system	2X630 KVA S/S Transformer
b	Supply changeover between sources (Auto/Manual	Auto
c	Diesel generator (DG) details	250 KVA, Make- Jackson, Model-
d	Maintenance plan and supply changeover periodicity in DG	Quarterly
e	Single Line Diagram	Enclosed
f	Other requirements for protection checking and validation	NA

DC Auxiliary System

SL. No.	Equipment	DC auxiliary system
a	Type of Batteries (Make, voltage, model)	1- HBL VRLA/220V/ 500AH- 02 Set 2- HBL VRLA/48V / 300AH - 02 Set
b	Status of battery Charger	Healthy
c	Measured voltage (positive to earth and negative to earth)	(+Ve to E) 117 V; (-Ve to E) 116 V
d	Availability of ground fault detectors	Available
e	Protection relays and trip circuits with independent DC sources	Available
f	Other requirements for protection checking and validation	NA

Circuit Breakers

220KV Jhajhra-IIP Line		
SL. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 200-SFM-40S
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Single Pole
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	YES
f	Other requirements for protection checking and validation	NA

220KV Jhajhra-Khodri Line		
SL. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 200-SFM-40S
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Single Pole
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	Yes
f	Other requirements for protection checking and validation	NA

220KV Jhajhra-PGCIL Line		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 200-SFM-40S
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Single Pole
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	Yes
f	Other requirements for protection checking and validation	28.05.2023 at Routine testing

220 KV Jhajhra-Vyasi Line		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 200-SFM-40S
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Single Pole
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	YES
f	Other requirements for protection checking and validation	NA

220/132 KV, 160MVA TF-1		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 200-SFM-40S
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Single Pole (HV), Multi pole operation (LV)
d	Pole Discrepancy Relay available (Y/ N)	YES, Available on HV Side, Not Available at LV
e	Monitoring Devices for checking the dielectric medium	Yes
f	Other requirements for protection checking and validation	NA

220/132 KV, 160MVA TF-2		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 200-SFM-40S
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Single Pole (HV), Multi pole operation (LV)
d	Pole Discrepancy Relay available (Y/ N)	YES, Available on HV Side, Not Available at LV
e	Monitoring Devices for checking the dielectric medium	Yes
f	Other requirements for protection checking and validation	NA

132 KV Jhajhra-Dhalipur Line		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Three Pole Gang operated
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	YES
f	Other requirements for protection checking and validation	NA

132 KV Jhajhra-Kulhal Line		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Three Pole Gang operated
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	Yes
f	Other requirements for protection checking and validation	NA

132 KV Jhajhra-Majra Line		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Three Pole Gang operated
d	Pole Discrepancy Relay available (Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	Yes
f	Other requirements for protection checking and validation	NA

132 KV Jhajhra-Purkul Line		
S. No.	**Equipment**	**Circuit Breaker**
a	Details and Status	Make-CGL, Sf6, 120-SFM-32B
b	Healthiness of Tripping Coil and Trip circuit supervision relay	Operational and Healthy
c	Single Pole/ Multi pole operation	Three Pole Gang operated
d	Pole Discrepancy Relay available(Y/ N)	YES
e	Monitoring Devices for checking the dielectric medium	Yes
f	Other requirements for protection checking and validation	-

Current Transformer

220KV Jhajhra-IIP Line		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 No. Core: Core- 1 (Prot Main-1), Core- 2 (Prot Main-2), Core-3 (BCU & Metering), Core-5 (Busbar Prot)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, Prot: 1600/1 ; Met : 800/1
f	Details of last checking and validation of CT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

220KV Jhajhra-Khodri Line		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	Core- 1 (Prot Main-1), Core- 2 (Prot Main-2), Core-3 (BCU & Metering), Core-4 Spare, Core-5 (Busbar Prot)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, Prot : 1600/1 ; Met : 800/1
f	Details of last checking and validation of CT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	-
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

220KV Jhajhra-PGCIL Line		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	Core- 1 (Prot Main-1), Core- 2 (Prot Main-2), Core-3 (BCU & Metering), Core-4 Spare, Core-5 (Busbar Prot)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, Prot: 1600/1 ; Met : 1600/1
f	Details of last checking and validation of CT healthiness	10.06.2022 at Commissioning of New CT
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

220 KV Jhajhra-Vyasi Line		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	Core- 1 (Prot Main-1), Core- 2 (Prot Main-2), Core-3 (BCU & Metering), Core-4 Spare, Core-5 (Busbar Prot)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, Prot 1600/1 , Met 800/1
f	Details of last checking and validation of CT healthiness	13.04.2022 at commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

220/132 KV, 160MVA TF-1		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 No. Core: Core- 1 (Diff Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-5 (Busbar Prot)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

220/132 KV, 160MVA TF-2		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	0	5 No. Core: Core- 1 (Diff Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-5 (Busbar Prot)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	1600/800/1, 800/1
f	Details of last checking and validation of CT healthiness	01.02.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

132 KV Jhajhra-Dhalipur Line		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 No. Core: Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	800/400/1, Prot 800/1, Met 400
f	Details of last checking and validation of CT healthiness	24.02.2017 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction Over current & earth fault

132 KV Jhajhra-Kulhal Line		
SL. No.	**Equipment**	**Current Transformer**
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 No. Core: Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	800/400/1, Prot 800/1, Met 400
f	Details of last checking and validation of CT healthiness	28.07.2015 at Commissioning
g	Other requirements for protection checking and validation	-
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction Over current & earth fault

132 KV Jhajhra-Majra Line		
SL. No.	**Equipment**	Current Transformer
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 No. Core: Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	800/400/1, Prot 400/1, Met 400
f	Details of last checking and validation of CT healthiness	28.07.2015 at Commissioning
g	Other requirements for protection checking and validation	-
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction Over current & earth fault

132 KV Jhajhra-Purkul Line		
SL. No.	**Equipment**	Current Transformer
a	CT ID name and voltage level	Heptacare Power Industries
b	CT core connection details	5 No. Core: Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
c	Accuracy Class	PS, PS, 0.2, PS, PS
d	Whether Protection/ Metering	Both
e	CT ratio available and ratio adopted	800/400/1, Prot 800/1, Met 400
f	Details of last checking and validation of CT healthiness	04.02.2017 at Commissioning
g	Other requirements for protection checking and validation	-
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction Over current & earth fault

Capacitive Voltage Transformer/Potential Transformer

220KV Jhajhra-IIP Line		
CVT Details		CVT: CBE-245/1050/50
SL. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 245KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	PS, PS, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	220KV/ 110V
f	Details of last checking and validation of CVT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

220KV Jhajhra-Khodri Line		
CVT Details		CVT: CBE-245/1050/50
S. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 245KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P,0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	220KV/ 110V
f	Details of last checking and validation of CVT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

220KV Jhajhra-PGCIL Line		
CVT Details		CVT: CBE-245/1050/50
S. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 245KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P,0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	220KV/ 110V
f	Details of last checking and validation of CVT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

220KV Jhajhra-Vyasi Line		
CVT Details		CVT : CBE-245/1050/50
S. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 245KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P,0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	220KV/ 110V
f	Details of last checking and validation of CVT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault

220/132 KV, 160MVA TF-1		
CVT Details		CVT: CBE-245/1050/50
S. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 245KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	220KV/ 110V
f	Details of last checking and validation of CVT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault,over current

220/132 KV, 160MVA TF-2		
CVT Details		CVT: CBE-245/1050/50
S. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 245KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	220KV/ 110V
f	Details of last checking and validation of CVT healthiness	30.01.2014 at Commissioning
g	Other requirements for protection checking and validation	NA
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault,over current

132 KV Jhajhra-Dhalipur Line		
CVT Details		CVT: CBE-145/650/50
SL. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 145KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	HV: 132KV/ 110V
f	Details of last checking and validation of CVT healthiness	24.02.2017 at Commissioning
g	Other requirements for protection checking and validation	-
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

132 KV Jhajhra-Kulhal Line		
CVT Details		CVT: CBE-145/650/50
SL. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 145KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	HV: 132KV/ 110V
f	Details of last checking and validation of CVT healthiness	28.07.2015 at Commissioning
g	Other requirements for protection checking and validation	-
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

132 KV Jhajhra-Majra Line		
CVT Details		CVT: CBE-145/650/50
S. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 145KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	HV: 132KV/ 110V
f	Details of last checking and validation of CVT healthiness	28.07.2015 at Commissioning
g	Other requirements for protection checking and validation	-
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

132 KV Jhajhra-Purkul Line		
CVT Details		CVT: CBE-145/650/50
S. No.	**Equipment**	CVT
a	CVT ID name and voltage level	Make-CGL, 145KV
b	CVT core connection details	110/√3, 3Core
c	Accuracy Class	3P, 3P, 0.2
d	Whether Protection/ Metering	Both
e	CVT ratio available and ratio adopted	HV: 132KV/ 110V
f	Details of last checking and validation of CVT healthiness	04.02.2017 at Commissioning
g	Other requirements for protection checking and validation	-
h	Other protection: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/ power swing, HVDC protection etc.	Direction earth fault, over current

Communication System

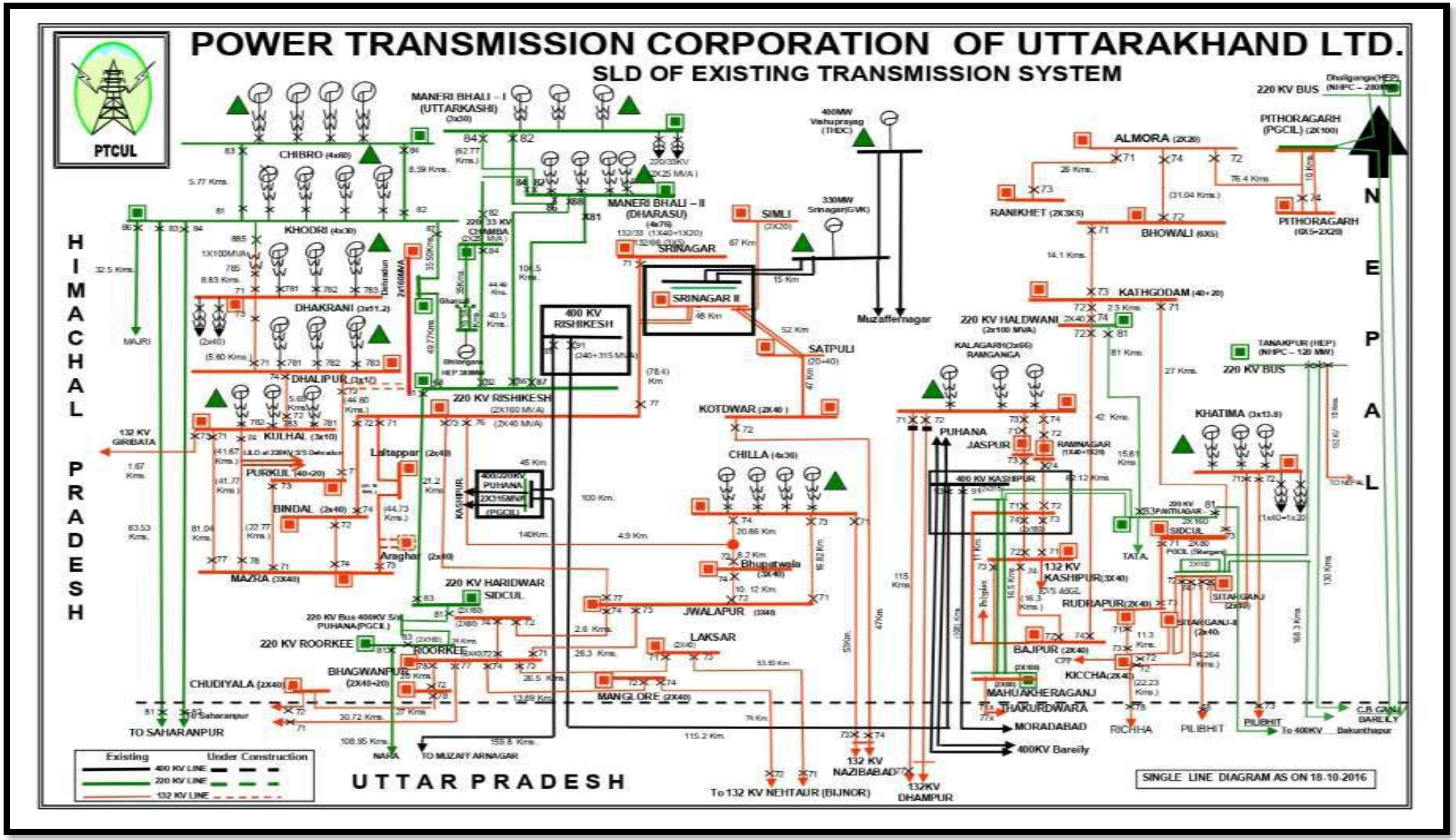
Sl. No.	Particulars	Details
1	Mode of communication for Main- 1 and Main- 2 protection	Main-1 (PLCC), Main-2 (PLCC)
2	Mode of communication for data and speech communication	Speech communication- PLCC DATA communication- PLCC/Modem
3	Status of PLCC channels	Active
4	Time synchronization equipment details	GPS Clock Make - Masibus
5	OPGW on geographically diversified paths for Main- 1 and Main- 2 relay	Main-1
6	Other requirements for protection checking and validation	NA

Transformer Protection

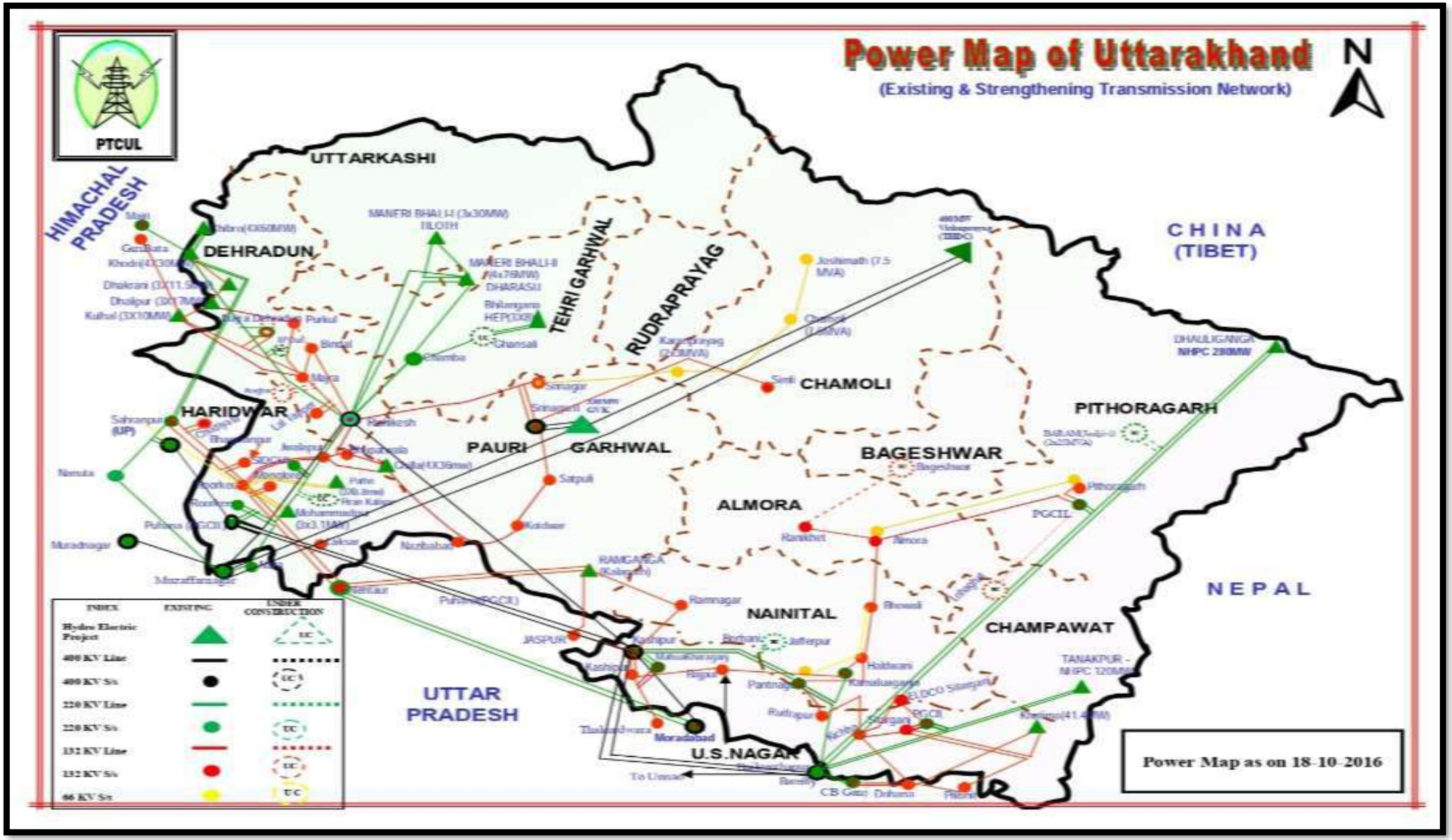
SL. No.	Equipment	132/33 KV, 80MVA TF-1
a	Whether two groups of protections used (Group A and Group B)	Group A
b	Do the groups have separate DC sources	NA
c	Relay Make and Model	GE Multiline T60, F650, Alstom CAG14
d	List of all active protections along with settings	Enclosed
e	Status of Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault/ Breaker Failure	Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault Active
f	Status of Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc.	Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc Active
g	Relay connected to Trip Coil-1 or 2 or both	Both
h	CT ratio and PT ratio	HV: 400/1, 132KV/110V, LV: 1600/1, 33KV/110V
i	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
j	Connected to dedicated CT core (mention name)	Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
k	Other requirements for protection checking and validation	NIFPS

SL. No.	Equipment	132/33 KV, 80MVA TF-2
a	Whether two groups of protections used (Group A and Group B)	Group A
b	Do the groups have separate DC sources	NA
c	Relay Make and Model	GE Multiline T60, F650, Alstom CAG14
d	List of all active protections along with settings	Enclosed
e	Status of Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault/ Breaker Failure	Differential Protection/ Restricted Earth Fault Protection/ Back-up Directional Overcurrent/ Backup Earth Fault Active
f	Status of Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc.	Oil Temperature Indicator/ Winding Temperature Indicator/ Bucholz/ Pressure Release Device etc Active
g	Relay connected to Trip Coil-1 or 2 or both	Both
h	CT ratio and PT ratio	HV: 400/1, 132KV/110V, LV: 1600/1, 33KV/110V
i	Feed from DC supply-1 or 2	DC-1 and Auto changeover at DC-2
j	Connected to dedicated CT core (mention name)	Core- 1 (Dist Prot), Core- 2 (Backup Prot), Core-3 (BCU & Metering), Core-4 & 5 (Spare)
k	Other requirements for protection checking and validation	NIFPS

Network Diagram of Uttarakhand



Power Map of Uttarakhand



Electrical Research And Development Association




Particulars:	*Report on Third Party Protection Audit of 400kV Sub-station of Generating Station at SSCTPS – Suratgarh, Rajasthan*
Location:	*Suratgarh, Rajasthan, India*
Customer:	*Suratgarh Super Critical Thermal Power Station (SSCTPS)*
WO & Date:	*RVUN/STPS/SE(Elect.)/XEN-I/TN-2703(E)/D.380, dtd. 06.09.22*
Submitted to	*Superintending Engineer (S.E.) (Elect.), RRVUNL, SSCTPS Service Building, Prabhat Nagar, Suratgarh, Rajasthan. se1.ssctps@rrvun.com*
Submitted by	*Mr. Shailesh B. Modi (Sr. Manager), ERDA Road, Industrial Estate, G.I.D.C., Vadodara, Gujarat. Email:- shailesh.modi@erda.org*

INDEX

FORWARD

Electrical apparatus operates at various voltage levels and under abnormal operating conditions; protection is necessary for Safety of electrical equipments & Safety of human personnel under any abnormal conditions and for rapid restoration of the system.

The objectives of electrical system protection are improvement in system stability, system reliability, limit the extent & duration of interruption in service, enhancement of equipment life and safety of personnel. Protective relays has major role to play in this regards. Protective relays sense the status of power system and if any abnormality is detected due to some faulty operation they send the signal to the switching devices to operate and isolate the faulty section, if the protection system is designed properly.

Protection audit is required to determine the adequacy, healthiness, appropriateness of protection settings & schemes of individual elements associated with system protection. The protection audit is necessary to ensure the continuity of service.

It is very essential to ensure the continuity of the service & prevent the equipment failure due to abnormal system performance by adequate protection schemes in the system.

In view of the above; Rajasthan Rajya Vidyut Utpadan Nigam Limited (RRVUNL), Suratgarh Super Critical Thermal Power Station (SSCTPS) has appointed M/s. Electrical Research and Development Association (ERDA), Vadodara for ***"Carrying out the Protection Audit of 400kV Sub-station of Suratgarh Super Critical Thermal Power Generating Station, Suratgarh, Rajasthan".***

This report gives the observations/verification of protective schemes and relay settings provided for electrical system of Suratgarh Super Critical Thermal Power Plant of Rajasthan Rajya Vidyut Utpadan Nigam Limited (RRVUNL), Suratgarh.

ACKNOWLEDGEMENT

We are greatly indebted to Rajasthan Rajya Vidyut Utpadan Nigam Limited (RRVUNL), Suratgarh Super Critical Thermal Power Station (SSCTPS) for having entrusted to us the job to carry out this study.

We heartily acknowledge the support received from concerned officers of Suratgarh Super Critical Thermal Power Plant (SSCTPS) during the study.

EXECUTIVE SUMMARY

Electrical power is vital important for the growth & development of country & hence it is very essential to ensure the continuity of the service & prevent the equipment failure due to abnormal system performance by adequate protection schemes in the system.

The protection system is required for the detection and prompt isolation of the affected portion of the system whenever any faults or abnormality occurs.

Protection audit is required to determine the adequacy, healthiness, appropriateness of protection settings & schemes of individual elements associated with system protection. The protection audit is necessary to ensure the continuity of service.

In view of the above, SSCTPS-Suratgarh have awarded the work of 'Protection Audit of 2 X 660 MW generating units with 400kV substation, SSCTPS-Suratgarh' to M/s. Electrical Research and Development Association (ERDA), Vadodara. The SSCTPS-Suratgarh, a wholly owned subsidiary of Rajasthan Government and is under the management of Rajasthan Rajya Vidyut Utpadan Nigam Limited.

ERDA has carried out the protection audit study and reviewed the implemented protection schemes & setting of relays considering philosophy agreed for Northern Region and guidelines of CBIP.

SALIENT FEATURES:

1	Tender No.	TN-63 (E)
2	Name of Customer	Rajasthan Rajya Vidyut Utpadan Nigam Limited
3	Name of work	Third Party Protection Audit of 400kV Sub-station of Generating Station at Suratgarh Super Critical Thermal Power Station (SSCTPS), Suratgarh
4	Name of Agency	Electrical Research and Development Association (ERDA), Vadodara
5	Letter of Intent No.	RVUN/SSCTPP/SE (Elect.) F./D. 335, dated 22.08.2022
6	Work Order No.	RVUN/STPS/SE (Elect.)/XEN-I/TN-2703 (E)/D. 380, dated 06.09.2022

SSCTPS-Suratgarh comprises of 2 nos. of 660 MW generators and its associated switchyard of 400kV with power evacuated through 1 nos. of 400kV feeder to Grid along with 2 nos. of 400kV interconnections.
List of various studies that have been carried out by ERDA on overall network are as listed under:

- Protection Audit of 400 kV switchyard and all protection equipments
- Relay Co-ordination study of network
- Checking of healthiness of DC system

The study carried out by ERDA team includes review of existing protection schemes of Power station equipment's like Generator Transformer, Unit Transformer, Station transformers, 400kV switchyard along with its Transmission lines network. The scope includes adequacy and verification of supply system with reference to regulatory guidelines, review of relay settings as per standards, Relay co-ordination, checking the healthiness of DC system etc. ERDA has suggested changes for improvement (if any) based on study of the existing network.

This report gives the observations/verification of protective schemes and relay settings provided for electrical system of Suratgarh Super Critical Thermal Power Plant (SSCTPS).

1 INTRODUCTION:

The function of protection system may be defined as the detection of the fault and prompt isolation of the affected portion of the system whenever a short circuit or other abnormality occurs that might cause damage to, or adversely affect the operation of any portion of the system or the load that it supplies. The isolation of short circuits and overloads requires the application of protective equipment that senses when an abnormal current flow exists and then removes the affected portion from the system.

Protection system is required to be selective and sensitive so that the faults are quickly identified and cleared. However, in a well-designed system the protection system may operate very infrequently. Therefore, protective relays are rarely required to go into operation. However, these relays should maintain their integrity under normal system operating conditions and be ready for fault detection and isolation whenever required. Therefore, to assess the healthiness of the protection system the relays are required to be tested periodically.

Relay Co-ordination is the selection and/or setting of protective devices in order to isolate only the portion of the system where the abnormality occurs. Coordination is a basic ingredient of a well-designed electrical network protection system. This involves periodic fault studies followed by relay setting, checking and co-ordination studies. This study is essential in order to ensure that various relays function correctly with proper discrimination to provide reliable, sensitive and selective isolation of faulty power system equipment.

In this Protection Audit, the healthiness and adequacy of the various protection equipment's shall be checked and suitable recommendations are provided in order to improve the overall protection system performance. The purpose of carrying out this type of study is mainly to identify possible gaps if available in the protection system of the entire plant at various voltage levels.

The protection audit of Suratgarh Super Critical Thermal Power Plant has been carried out by Electrical Research and Development Association (ERDA) and this report showing the various outcomes and recommendations observed by ERDA during the Audit.

2 BACKGROUND:

Two major grid disturbances took place in the Indian grid on the last two consecutive days of July 2012. The first disturbance took place in the Northern Region in the early hours of 30th July 2012 which resulted in failure of the Northern Regional Grid which was at that time meeting a load of around 36,000 MW. Subsequently, there was another grid disturbance in the Noon of 31st July 2012 resulting in failure of the Northern, Eastern and the North Eastern Regional grids. Ministry of Power constituted an Enquiry Committee headed by Chairman, CEA to analyze the causes of these disturbances and to suggest measures to avoid recurrence of such disturbances. The Committee recommended constitution of a Task Force to study the grid security issues.

The Task Force had discussed in detailed the various issues affecting the operation of the grid in a secure manner. The Task Force constituted two Sub-Committees – Study Sub-Committee for carrying out the system simulation studies corresponding to various extreme operation conditions in the grid both under normal and faulted conditions; and Protection Sub-Committee to examine the philosophy of relay and protection coordination adopted by the various utilities and also to evolve a common philosophy for relay and protection coordination in the integrated grid and also methodology for auditing and revision of protective relay setting at frequent intervals.

Accordingly, a sub-committee was constituted which has deliberated on the philosophy of relay and protection coordination and has come out with detailed recommendations on methodology for relay settings, audit of Protection system. As per the Task Force for proper protection coordination, all utilities should follow the guide lines and get their protection system audited from time to time as per the recommended methodology for relay settings, data format and checklist as recommended by the Protection Sub-Committee.

A data base of the settings of various relays also needs to be created, kept updated and verified during the audit. Data regarding settings of relays in their network should be compiled by the CTU and STUs and furnished to the RLDC and SLDC respectively and a copy should also submitted to RPC for maintaining the data base. Report of every audit should be submitted to RPC and also the RLDC/NLDC by the CTU and to the SLDCs by the STU's. Audit of protection system should be made mandatory by the CERC and SERC's in their regulations. This should be specified by the regulatory commissions in their Grid Code.

The Task Force has also observed that many of the utilities do not possess well trained and dedicated group to carry out studies for calculations for relay settings. The Task force strongly recommends that a dedicated group is required to be constituted and train them to carry out computer aided studies for relay settings.

There is also a need for periodic review of protection coordination and relay settings to take care of changes in network topology due to addition of new system elements – generating units, transmission lines, etc.

In view of above; SSCTPS decided for "Carrying out the Protection Audit of 400kV Sub-station of Suratgarh Super Critical Thermal Power Generating Station, Suratgarh, Rajasthan".

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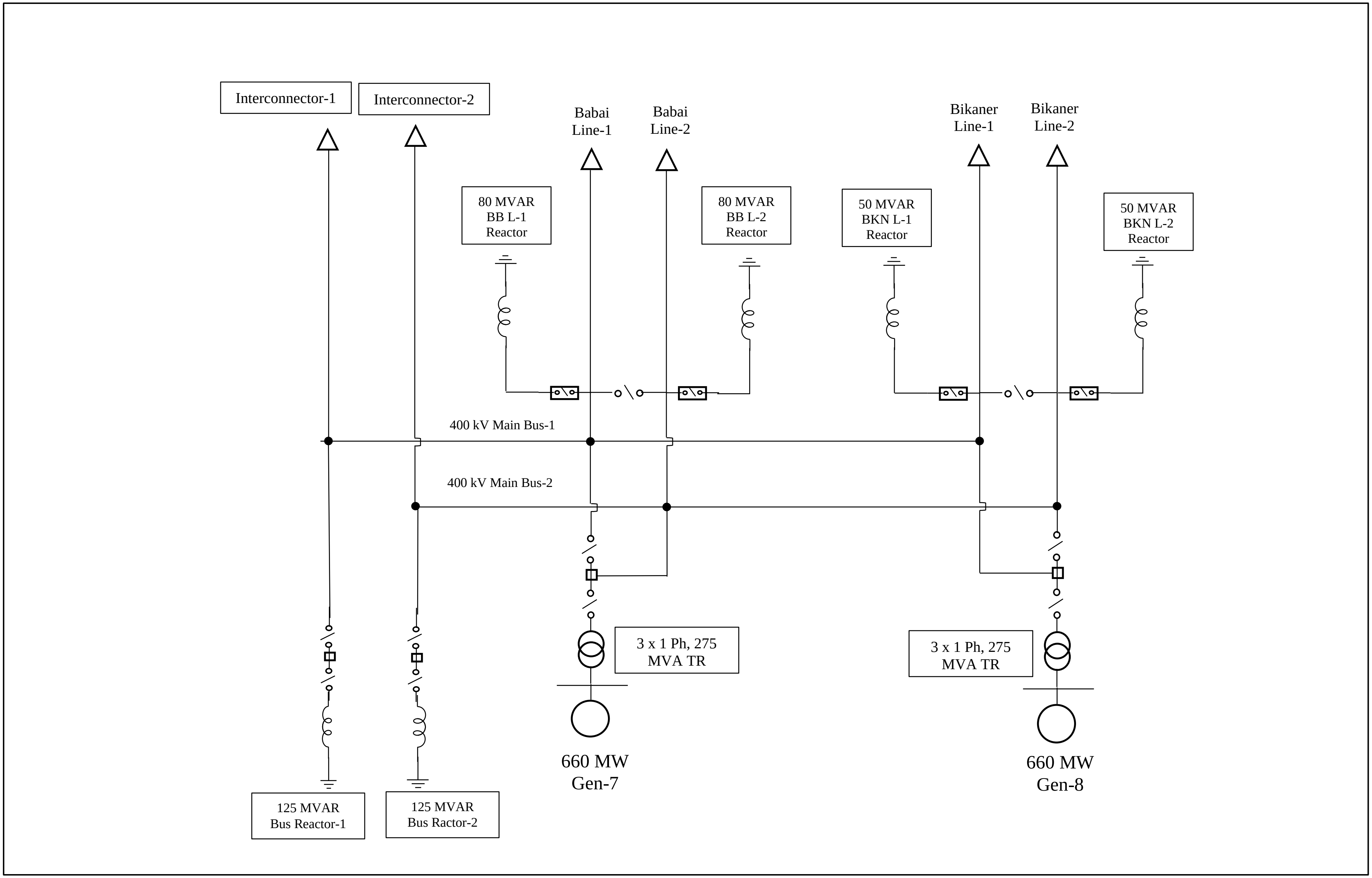
Suratgarh Super Critical Thermal Power Plant is Steam based power station having 2 nos. of units 660 MW with installed capacity of 1320 MW.



The above diagram showing the Single Line Diagram of complete 400 kV power system network of Suratgarh Super Critical Thermal Power Plant.

It has an installed capacity of 1320 MW (2 x 660MW) and is situated approximately 27 kms from the Suratgarh in the Sriganganagar district. Presently, there are 2 generators having capacity of 660 MW each and they are running and producing electric power on need basis. The total power generated from the 2 units are evacuated by 400kV Bikaner line (Double Circuit) & 2 nos. of 400kV interconnections connected to Suratgarh Super Thermal Power Plant (SSTP).

The electrical system comprise of following:

Sr. No.	Electrical Component	Installed Quantity
1	660 MW Generator, 21kV	2 Nos.
2	3 X 275 MVA, 420/√3/21kV Generating Transformer	2 Nos.
3	400 kV Double Circuit Transmission line	4 Nos.
4	400kV Interconnectors	2 Nos.
5	400kV Tie	5 Nos.
6	40 MVA, 21/11.5 kV Unit Transformer	4 Nos.
7	125/62.5/62.5 MVA 21/11.5/11.5 kV Station Transformers	2 Nos.
8	400kV 50 MVAR Line Reactor	2 Nos.
9	400kV 80 MVAR Line Reactor	2 Nos
10	400kV 125 MVAR Bus Reactor	2 Nos.

In this Power plant, the 2 nos. of generators generating voltage at 21 kV level. This voltage is step up to 400 kV with the help of 2 set of 3 x 275 MVA Generating Transformer. The power is evacuated to 400 kV Bikaner line (Double Circuit) and 2 nos. of 400 kV interconnectors.

Suratgarh Super Critical Thermal Power Station operated by Rajasthan Rajya Vidyut Utpadan Nigam which is a state enterprise & hence it is very essential to ensure the continuity of the service & prevent the equipment failure due to abnormal system performance by inadequate protection schemes in the system.

In view of the above; Rajasthan Rajya Vidyut Utpadan Nigam has assigned the work to M/s. Electrical Research and Development Association (ERDA), Vadodara for Carrying out the Protection Audit of 400kV switchyard of Suratgarh Super Critical Thermal Power Plant, Suratgarh, Rajasthan.

3 SCOPE OF WORK:

The scope of work is to carry out the Protection Audit of 2 X 660 MW generating units with 400 kV switchyard at Suratgarh Super Critical Thermal Power Plant as per Work Order No. RVUN/STPS/SE (Elect.)/XEN-I/TN-2703 (E)/D. 380, dtd. 06.09.2022.

The glimpses of Scope of Work are as shown below:

1) Protection audit of 400kV with interconnectors, Reactors, GTs etc.
2) Review of the implemented protection scheme/philosophy and setting in the 400kV substations & its major equipments as per CBIP publication no. 274 etc.
3) To carry out relay co-ordination studies for the different protection schemes
4) To check the adequacy / healthiness of primary and backup protection schemes and settings and recommend the corrective action
5) Checking healthiness / adequacy and proper load distribution on DCDB 220kV DC and suggest corrective measures in case of any problem.
6) Review of availability / healthiness of communication links like PLCC/Optical Fibre & recording instruments namely DR & event loggers along with time synchronization unit.
7) Review of test reports of relays & circuit breakers
8) Field inspection of existing protection devices for obsolescence of technology, suitability, healthiness

4 OBJECTIVE:

ERDA is assigned to carry out the Protection Audit of 2 X 660 MW generating units with 400 kV switchyards at Suratgarh Super Critical Thermal Power Plant.

Following major activities are covered under this assignment:

1) Protection Audit of 400 kV switchyards covering all protection equipments
2) Checking healthiness of DC system
3) Carrying out the Power system studies on 400 kV Suratgarh Super Critical Thermal Plant network etc.

The objectives of electrical system protection are improvement in system stability, system reliability, limit the extent & duration of interruption in service, enhancement of equipment life and safety of personnel. Protective relays has major role to play in this regards. Protective relays sense the status of power system and if any abnormality is detected due to some faulty operation they send the signal to the switching devices to operate and isolate the faulty section, if the protection system is designed properly.

Protection Audit of 400 kV switchyard and all protection equipments

ERDA has carried out the Protection Audit on 400kV switchyard & control room of Suratgarh Super Critical Thermal Power Plant. During this activity, the protection equipments like CT, CVT, PT, Circuit Breaker, Transformer, Lightning Arrestor details have been captured. The details of the relays installed in the control room have been captured and recorded. ERDA has also reviewed the various protections given in the relays and recorded the same.

Checking Healthiness of the DC system

General healthiness of DC system Voltage is checked with regard to 'Earth fault' in 220 V DC system of C&R Panel supply, at 220 kV switchyard. In the 220kV switchyard, the DC voltage in the both sources require to be checked and recorded. The DC voltage in the chargers having automatically switchover from float to boost required to be checked and recorded. The condition of the battery checked along with the battery room.

Carrying out the various Power System Studies of 400 kV Suratgarh network:

Short circuit study is being carried out on entire system in order to check adequacy of the protective equipments in the event of fault. SSCTPS-Suratgarh system simulated in the various fault conditions like:

a) Single phase to ground fault

b) Phase to Phase fault

c) Three phase fault

The simulation will give us the fault current against each conditions which then compared with the protection equipment in order to check its adequacy. If breaker operates in all the aforesaid fault effectively then system is stable and if not then breaker rating needs to be optimized. To find out the magnitude of currents flow during an electrical fault. Comparing these calculated values against the protective device rating in order to find system is safely protected. Each interrupting device is analyzed to determine whether it is appropriately designed and sized to interrupt circuit in the event of short circuit.

Short Circuit studies are carried out to evaluate steady state and transient state behavior of the system after the addition various loads. Based on the full load current and fault level calculation, ratings of the protective scheme are decided.

Relay Co-ordination Study is being carried out in order to find the required operation to be performed by desired relay & co-ordination schemes must guarantee fast, selective & reliable relay operation to isolate the power system from the faulted conditions. This study is done in order to prevent nuisance tripping in the power system. In the event of fault, desired relay shall operate immediately & isolate the faulty part from the network. There should not be any nuisance tripping in the system. Relay Co-ordination is useful in order to have smooth and reliable operation of entire network during normal & abnormal condition.

ERDA conducted the aforesaid studies on the entire SSCTPS-Suratgarh network with the help of suitable software. The entire system as provided by the SSCTPS-Suratgarh personnel simulated in the software and system data i. e. voltage level, transformer rating, relay settings, breaker capacity etc. is entered in the software.

This report provides the observations found by ERDA during the Protection audit activities of various equipments installed at SSCTPS-Suratgarh along with verification of protective scheme and relay settings of entire SSCTPS-Suratgarh electric network.

5 METHODOLOGY:

The entire Protection Audit on Suratgarh Power Plant is conducted based on the Northern Region Protection Committee (NRPC) etc. guidelines. The same is as shown below:

Protection Philosophy agreed for implementation in Northern Region (NRPC)

Sr. No.	Protection Setting	Reach & Time
1.	**Long linesZone-1**	80% of the Protected line, Instantaneous
	Zone-2	100% of the Protected line + 50% of the shortest line emanating from the far end bus bar or 120% of the Protected line whichever is higher. Time Setting: 350ms for short lines (≤ 100km) and 500ms for long lines > 100km.
	Zone-3	120% of the protected line + 100% of the longest line emanating from the far end bus bar or 100% of the Protected line + 100% of the longest line emanating from the far end bus bar + 25% of the longest line emanating from the far end of the second line considered, whichever is lower. The zone setting to be limited such that it will not reach into the next voltage level. Time Setting: 1000m sec.
	Zone- 3R	25% of the Zone-1 reach. Time Setting: 1000m sec.
2.	**Lines with Series and other compensations in the vicinity of Substation**	70% of the Protected line. 100ms-time delay for allowing correct distance measurement after the series capacitor is bypassed.
3.	**Power Swing Blocking**	Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter regional tie lines Deblock time delay = 2s
4.	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2($I2/I1 \geq 0.2$) Only for alarm: Time delay = 3-5 sec
5.	**Carrier Protection**	To be applied on all 400kV and 220 kV lines with the only exception of Radial feeders.
6.	**Back up Protection**	1) On 400 & 220 kV lines with 2 Main Protections, back up Earth Fault protections alone to be provided. No Over current protection to be applied. 2) On 220 kV and lower voltage lines with only one Main protectionBack up protection by IDMT O/C and E/F to be applied.
7.	**Auto Re-closing with dead time.**	Single pole trip and re-closing Dead time = 1.0s. Reclaim time = 25.0s
8.	**LBB Protection and busbar protection**	To be applied on all 400kV and 220 kV sub stations with the only exception of 220 kV radial fed bus bars. LBB Current sensor I > 20% InLBB time delay = 200ms

6

PROTECTION AUDIT OF SWITCHYARD & SUBSTATION

OBSERVATIONS & STATUS		
Item No	**Issues**	**Remark**
1	**Recommendation of last Protection Audit**	**Status of works & Reason for Pending/ Suggestion**
	Not Applicable	Not Applicable
2	**Review of Existing Setting at Substations**	
	ERDA has collected the existing relay settings of relays.	Yes
3	**Disturbance recorder - list of 3 trappings in last 6 months**	**Recommended Action(s)**
	No disturbance recorder tripping details maintained by SSCTPS	It is recommended to maintain the DR data in proper way
3.a	DR as well as EL records for the trappings available (Yes / No)	EL Not Available, DR records available
3.b	Records available for tripping analysis and corrective action taken	Yes
3.c	Time Synch Matched Between EL signals and DR signals (Yes/No)	Yes
3.d	Digital Signal of DR named properly (main CB Trip, Z1 Trip etc) (Yes/No)	Yes
4	**Chronic Reason of tripping, if any**	
	Not Applicable	Not Applicable
5	**Existing process for records of changes incorporated in the relay settings**	**Attach Correspondence if any**
	SSCTPS has maintained the settings of all the relays as provided by M/s. BHEL	Existing settings are already mentioned in this report.
6	**Overvoltage grading for parallel line (time & peak up grading, provided or not)**	**Recommended Action(s)**
	Nil	Nil
7	**Other deficiencies / Nonconformity observed (including the major non-conformities mentioned in the audit format. Ex. Single Ac source etc.)**	**Recommended Action(s)**
	Nil	Nil

Line Distance Protection - Check List (Bikaner Line 1)					
Audited data					
No.	**Relay configuration - Line distance protection**				
1	Name and length of line	Bikaner Line 1, 142 kms.			
2	Series compensated Y/N	No			
3	Is this a cable feeder/line feeder/composite feeder (Line + cable)	No			
4	Which mode of communication is used (PLCC/OPGW)	Both			
5	**Details of Relays**		**Main-1 Relay**	**Main-2 Relay**	**Other relays (Back up Relay, DR, FL etc.)**
	Details of composite type numerical relay		Siemens 7SA52	MiCOM P442	SIPROTEC 7VK61
	Relay Make and model		Siemens	Schneider	Siemens
	Whether the relay is functional	Yes/No	Yes	Yes	Yes
	Date of testing		January, 2017	January, 2017	January, 2017
	Mention all the active protections out of-21,87L,67,67N,51,51N	21/87L/67/67N/51/51N	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Broken Conductor, Distance, Directional O/C, Directional E/F etc.	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Broken Conductor, Distance, Directional O/C, Directional E/F etc.	R/Y/B ph INITIATION, LINE 86 A/B INITIATION, BUS 96 A/B INITIATION, LBB OPTD. etc.
	Mode of carrier aided scheme for 21 (If POR Scheme is used whether current reversal Guard logic implemented?)	Accelerated under reach/ Permissive under reach/ Intercropping under reach/ permissive under reach/ Blocking over reach/ Phase comparison protection (for PLCC)	Permissive Under Reach	Permissive Under Reach	-
	Carrier aided scheme active for 67/67N		Yes	Yes	-

	Mode of Carrier aided scheme for 67/67N	Directional comparison Protection (Permissive) / Directional Comparison Protection (Blocking)	Directional Comparison Protection (Blocking)	Directional Comparison Protection (Blocking)	-
	For 87L which scheme is used? (Pilot wire communication / digital communication)		N. A.	N. A.	N. A.
	Power swing/out of step active?	Yes/No	Yes	Yes	-
	SOTF Active ?	Yes/No	Yes	Yes	-
	Auto reclose (79) active?	Yes/No	Yes	Yes	-
	Breaker failure active	Yes/No	-	-	Yes
	Load Encroachment active	Yes/No	Yes	Yes	-
	Stub protection active	Yes/No	Yes	Yes	-
	Fault Locator active?	Yes/No	Yes	Yes	-
	Disturbance recorder active?	Yes/No	Yes	Yes	-
6	Relay connected to trip coil-1/Trip coil-2 or both?		Both	Both	Both
7	Feed from DC supply 1/DC supply-2		DC Supply 1	DC Supply 2	DC Supply 2
8	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 6	Core 5	Core 2
9	CT ratio selected		3000/1	3000/1	3000/1
10	VT ratio selected		400kV/110V	400kV/110V	-
11	VT Fuse failure protection	Yes/No	Yes	Yes	-
12	Overvoltage protection available	Yes/No	Yes	Yes	-
	Functional with two stage protection	Yes/No	Yes	Yes	-
13	Are all the auxiliary relays (94) considered for Line protection (Main-1/Main-2/Backup) provided with supervision Relays (74/94)?	Yes/No	Yes	Yes	-
14	Do the line protection panels have supervision relay for DC supply-1 and DC supply-2 (74/DC-1 & 74/DC2)?	Yes/No	Yes	Yes	-

Line Distance Protection - Check List (Bikaner Line 2)					
Audited data					
No.	**Relay configuration - Line distance protection**				
1	Name and length of line	Bikaner Line 2, 142 kms.			
2	Series compensated Y/N	No			
3	Is this a cable feeder/line feeder/composite feeder (Line+cable)	No			
4	Which mode of communication is used (PLCC/OPGW)	Both			
5	**Details of Relays**		**Main-1 Relay**	**Main-2 Relay**	**Other relays (Back up relay, DR, FL etc.)**
	Details of composite type numerical relay		Siemens 7SA52	MiCOM P442	SIPROTEC 7VK61
	Relay Make and model		Siemens	Schneider	Siemens
	whether the relay is functional	Yes/No	Yes	Yes	Yes
	Date of testing		January, 2017	January, 2017	January, 2017
	Mention all the active protections out of-21,87L,67,67N,51,51N	21/87L/67/67N/51/51N	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Directional O/C, Directional E/F, Broken Conductor, Distance etc.	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Directional O/C, Directional E/F, Broken Conductor, Distance etc.	R/Y/B ph INITIATION, LINE 86 A/B INITIATION, BUS 96 A/B INITIATION, LBB etc
	Mode of carrier aided scheme for 21 (If POR Scheme is used whether current reversal Guard logic implemented?)	Accelerated under reach/ Permissive under reach/ Intercropping under reach/ permissive under reach/ Blocking over reach/ Phase comparison protection (for PLCC)	Permissive Under Reach	Permissive Under Reach	-
	Carrier aided scheme active for 67/67N		Yes	Yes	-

Line Distance Protection - Check List (Bikaner Line 2)					
	Mode of Carrier aided scheme for 67/67N	Directional comparison Protection (Permissive) / Directional Comparison Protection (Blocking)	Directional Comparison Protection (Blocking)	Directional Comparison Protection (Blocking)	-
	for 87L which scheme is used? (Pilot wire communication /digital communication)		N. A.	N. A.	N. A.
	Power swing/out of step active?	Yes/No	Yes	Yes	-
	SOTF Active ?	Yes/No	Yes	Yes	-
	Auto reclose (79) active?	Yes/No	Yes	Yes	-
	Breaker failure active	Yes/No	-	-	Yes
	Load Encroachment active	Yes/No	Yes	Yes	-
	Stub protection active	Yes/No	Yes	Yes	-
	Fault Locator active?	Yes/No	Yes	Yes	-
	Disturbance recorder active?	Yes/No	Yes	Yes	-
6	Relay connected to trip coil-1/Trip coil-2 or both?		Both	Both	Both
7	Feed from DC supply 1/DC supply-2		DC Supply 1	DC Supply 2	DC Supply 2
8	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 6	Core 5	Core 2
9	CT ratio selected		3000/1	3000/1	3000/1
10	VT ratio selected		400kV/110V	400kV/110V	-
11	VT Fuse failure protection	Yes/No	Yes	Yes	-
12	Overvoltage protection available	Yes/No	Yes	Yes	-
	Functional with two stage protection	Yes/No	Yes	Yes	-
13	Are all the auxiliary relays (94) considered for Line protection (Main-1/Main-2/Backup) provided with supervision Relays (74/94)?	Yes/No	Yes	Yes	-

Line Distance Protection - Check List (Bikaner Line 2)					
14	Do the line protection protection panels have supervision relay for DC supply-1 and DC supply-2 (74/DC-1 & 74/DC2)?	Yes/No	Yes	Yes	-

Line Distance Protection - Check List (Babai Line 1)					
Audited data					
No.	**Relay configuration - Line distance protection**				
1	Name and length of line	Babai Line 1, 245 kms.			
2	Series compensated Y/N	No			
3	Is this a cable feeder/line feeder/composite feeder (Line+cable)	No			
4	Which mode of communication is used (PLCC/OPGW)	Both			
5	**Details of Relays**		Main-1 Relay	Main-2 Relay	Other relays (Back up relay, DR, FL etc)
	Details of composite type numerical relay		Siemens 7SA52	MiCOM P442	SIPROTEC 7VK61
	Relay Make and model		Siemens	Schneider	Siemens
	whether the relay is functional	Yes/No	Yes	Yes	Yes
	Date of testing		January, 2017	January, 2017	January, 2017
	Mention all the active protections out of-21,87L,67,67N,51,51N	21/87L/67/67N/51/51N	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Directional O/C, Directional E/F, Broken Conductor, Distance etc.	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Directional O/C, Directional E/F, Broken Conductor, Distance etc.	R/Y/B ph INITIATION, LINE 86 A/B INITIATION, BUS 96 A/B INITIATION, LBB etc

Line Distance Protection - Check List (Babai Line 1)					
	Mode of carrier aided scheme for 21 (If POR Scheme is used whether current reversal Guard logic implemented?)	Accelerated under reach/ Permissive under reach/ Intercropping under reach/ permissive under reach/ Blocking over reach/ Phase comparison protection (for PLCC)	Permissive Under Reach	Permissive Under Reach	-
	Carrier aided scheme active for 67/67N		Yes	Yes	-
	Mode of Carrier aided scheme for 67/67N	Directional comparison Protection (Permissive) / Directional Comparison Protection (Blocking)	Directional Comparison Protection (Blocking)	Directional Comparison Protection (Blocking)	-
	for 87L which scheme is used? (Pilot wire communication /digital communication)		N. A.	N. A	N. A.
	Power swing/out of step active?	Yes/No	Yes	Yes	-
	SOTF Active?	Yes/No	Yes	Yes	-
	Auto reclose (79) active?	Yes/No	Yes	Yes	-
	Breaker failure active	Yes/No	-	-	Yes
	Load Encroachment active	Yes/No	Yes	Yes	-
	Stub protection active	Yes/No	Yes	Yes	-
	Fault Locator active?	Yes/No	Yes	Yes	-
	Disturbance recorder active?	Yes/No	Yes	Yes	-
6	Relay connected to trip coil-1/Trip coil-2 or both?		Both	Both	Both
7	Feed from DC supply 1/DC supply-2		DC Supply 1	DC Supply 2	DC Supply 2
8	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 6	Core 5	Core 2
9	CT ratio selected		3000/1	3000/1	3000/1
10	VT ratio selected		400kV/110V	400kV/110V	-
11	VT Fuse failure protection	Yes/No	Yes	Yes	-

Line Distance Protection - Check List (Babai Line 1)					
12	Overvoltage protection available	Yes/No	Yes	Yes	-
	Functional with two stage protection	Yes/No	Yes	Yes	-
13	Are all the auxiliary relays (94) considered for Line protection (Main-1/Main-2/Backup) provided with supervision Relays (74/94)?	Yes/No	Yes	Yes	-
14	Do the line protection panels have supervision relay for DC supply-1 and DC supply-2 (74/DC-1 & 74/DC2)?	Yes/No	Yes	Yes	-

Line Distance Protection - Check List (Babai Line 2)					
Audited data					
No.	**Relay configuration - Line distance protection**				
1	Name and length of line	Babai Line 2, 245 kms.			
2	Series compensated Y/N	No			
3	Is this a cable feeder/line feeder/composite feeder (Line + Cable)	No			
4	Which mode of communication is used (PLCC/OPGW)	Both			
5	**Details of Relays**		Main-1 Relay	Main-2 Relay	Other relays (Back up Relay, DR, FL etc.)
	Details of composite type numerical relay		Siemens 7SA52	MiCOM P442	SIPROTEC 7VK61
	Relay Make and model		Siemens	Schneider	Siemens
	Whether the relay is functional	Yes/No	Yes	Yes	Yes
	Date of testing		January, 2017	January, 2017	January, 2017

Line Distance Protection - Check List (Babai Line 2)					
	Mention all the active protections out of-21,87L,67,67N,51,51N	21/87L/67/67N/51/51N	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Directional O/C, Directional E/F, Broken Conductor, Distance etc.	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Directional O/C, Directional E/F, Broken Conductor, Distance etc.	R/Y/B ph INITIATION LINE 86 A/B INITIATION BUS 96 A/B INITIATION LB*B etc
	Mode of carrier aided scheme for 21 (If POR Scheme is used whether current reversal Guard logic implemented?)	Accelerated under reach/ Permissive under reach/ Intertripping under reach/ permissive under reach/ Blocking over reach/ Phase comparison protection (for PLCC)	Permissive Under Reach	Permissive Under Reach	-
	Carrier aided scheme active for 67/67N		Yes	Yes	-
	Mode of Carrier aided scheme for 67/67N	Directional comparison Protection (Permissive) / Directional Comparison Protection (Blocking)	Directional Comparison Protection (Blocking)	Directional Comparison Protection (Blocking)	-
	for 87L which scheme is used? (Pilot wire communication /digital communication)		N. A.	N. A.	N. A.
	Power swing/out of step active?	Yes/No	Yes	Yes	-
	SOTF Active ?	Yes/No	Yes	Yes	-
	Auto reclose (79) active?	Yes/No	Yes	Yes	-
	Breaker failure active	Yes/No	-	-	Yes
	Load Encroachment active	Yes/No	Yes	Yes	-
	Stub protection active	Yes/No	Yes	Yes	-
	Fault Locator active?	Yes/No	Yes	Yes	-
	Disturbance recorder active?	Yes/No	Yes	Yes	-
6	Relay connected to trip coil-1/Trip coil-2 or both?		Both	Both	Both

Line Distance Protection - Check List (Babai Line 2)					
7	Feed from DC supply 1/DC supply-2		DC Supply 1	DC Supply 2	DC Supply 2
8	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 6	Core 5	Core 2
9	CT ratio selected		3000/1	3000/1	3000/1
10	VT ratio selected		400kV/110V	400kV/110V	-
11	VT Fuse failure protection	Yes/No	Yes	Yes	-
12	Overvoltage protection available	Yes/No	Yes	Yes	-
	Functional with two stage protection	Yes/No	Yes	Yes	-
13	Are all the auxiliary relays (94) considered for Line protection (Main-1/Main-2/Backup) provided with supervision Relays (74/94)?	Yes/No	Yes	Yes	-
14	Do the line protection panels have supervision relay for DC supply-1 and DC supply-2 (74/DC-1 & 74/DC2)?	Yes/No	Yes	Yes	-

Line Distance Protection - Check List (Interconnector 1 & 2)					
Audited data					
No.	**Relay configuration - Line distance protection**				
1	Name and length of line	Interconnector Line 1 & 2, 2.5 kM.			
2	Series compensated Y/N	No			
3	Is this a cable feeder/line feeder/ composite feeder (Line+cable)	No			
4	Which mode of communication is used (PLCC/OPGW)	Both			
5	**Details of Relays**		Main-1 Relay	Main-2 Relay	Other relays (Back up relay, DR, FL etc)

Line Distance Protection - Check List (Interconnector 1 & 2)					
	Details of composite type numerical relay		Siemens 7SD5	Siemens 7SD5	SIPROTEC 7VK61
	Relay Make and model		Siemens 7SD5	Siemens 7SD5	Siemens
	whether the relay is functional	Yes/No	Yes	Yes	Yes
	Date of testing		October, 2016	October, 2016	October, 2016
	Mention all the active protections out of-21,87L,67,67N,51,51N	21/87L/67/67N/51/ 51N	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Directional O/C, Directional E/F, Broken Conductor, Distance etc.	Overvoltage, SOTF, STUB,O/C, E/F, VT fuse fail, Directional O/C, Directional E/F, Broken Conductor, Distance etc.	LBB INIT – R/Y/B PH LBB INIT – 3 PH LBB etc.
	Mode of carrier aided scheme for 21 (If POR Scheme is used whether current reversal Guard logic implemented?)	Accelerated under reach/ Permissive under reach/ Intertripping under reach/ permissive under reach/ Blocking over reach/ Phase comparison protection (for PLCC)	N. A.	N. A.	-
	Carrier aided scheme active for 67/67N		N. A.	N. A.	-
	Mode of Carrier aided scheme for 67/67N	Directional comparison Protection (Permissive) / Directional Comparison Protection (Blocking)	N. A.	N. A.	-
	For 87L which scheme is used? (Pilot wire communication /digital communication)		Digital Communication (via OPGW)	Digital Communication (via OPGW)	
	Power swing/out of step active?	Yes/No	No	No	
	SOTF Active ?	Yes/No	Yes	Yes	
	Auto reclose (79) active?	Yes/No	No	No	-
	Breaker failure active	Yes/No	-	-	Yes

Line Distance Protection - Check List (Interconnector 1 & 2)					
	Load Encroachment active	Yes/No	N. A.	N. A.	-
	Stub protection active	Yes/No	No	No	-
	Fault Locator active?	Yes/No	N. A.	N. A.	-
	Disturbance recorder active?	Yes/No	Yes	Yes	-
6	Relay connected to trip coil-1/Trip coil-2 or both?		Both	Both	Both
7	Feed from DC supply 1/DC supply-2		DC Supply 1	DC Supply 2	DC Supply 2
8	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 1	Core 2	Core 2
9	CT ratio selected		2000/1	2000/1	3000/1
10	VT ratio selected		400kV/110V	400kV/110V	400kV/110V
11	VT Fuse failure protection	Yes/No	N. A.	N. A.	-
12	Overvoltage protection available	Yes/No	N. A.	N. A.	-
	Functional with two stage protection	Yes/No	N. A.	N. A.	-
13	Are all the auxiliary relays (94) considered for Line protection (Main-1/Main-2/Backup) provided with supervision Relays (74/94)?	Yes/No	Yes	Yes	-
14	Do the line protection panels have supervision relay for DC supply-1 and DC supply-2 (74/DC-1 & 74/DC2)?	Yes/No	Yes	Yes	-

Transformer Protection Audit - Check list (GT 07)							
	Audited data						
No.	**Relay configuration - Power Transformer Protection**						
1	Name, Voltage, Power rating		GT - 7, 21 kV / 420 kV, 3 X 275 MVA				
2	Are 2 groups of Protections used (Group A and Group B) for transformer Protection?	Yes/No	Yes				
3	Are Group A and Group B Protections connected to separate DC source for Power transformer	Yes/No	Yes				
4	Do the group A and Group B protections have separate Lockout relays?	Yes/No	Yes				
5	**Details of Type relay**		**Main-1**		**Main-2/Back up**		**Other Protections**
			A	**B**	**A**	**B**	
	Details of composite type Numerical relays						1. Overall Differential Protn. Relay 2.Overhang Diff. Protn. 3.LBB Protn. Etc.
	Relay Make and Model		Siemens 7UT63	Siemens 7SJ8022	Siemens 7UT63	Siemens 7SJ8022	1.SIPROTEC 7UT63 2.SIPROTEC 7UT61 3.SIPROTEC 7VK61
	whether the relay is functional	Yes/No	Yes	Yes	Yes	Yes	Yes
	Date of testing		January, 2017	January, 2017	January, 2017	January, 2017	January, 2017
	Mention all the active protection		Under frequency, GT SPR, PRV A, WTI etc.	HV REF	Buch, OTI, PRV B, GT FR	HV REF	Diff. R/Y/B ph TRIP Diff. Pick up LBB etc
	Differential protection		Yes		Yes		-

Transformer Protection Audit - Check list (GT 07)							
	REF protection			Yes		Yes	-
	Backup Directional OC + EF Protection		Yes		Yes		-
	Over fluxing Protection		Yes		Yes		-
	Connected to trip coil 1/Trip coil 2/Both		Both	Both	Both	Both	Both
	feed from DC supply 1 Dc supply 2		DC Supply 1	DC Supply 1	DC Supply 2	DC Supply 2	DC Supply 2
	Breaker failure active	Yes/No	Yes	Yes	Yes	Yes	1.No 2.No 3.Yes
	Disturbance report active	Yes/No	Yes	Yes	Yes	Yes	Yes
	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 1	Core 2	Core 1	Core 2	Core 2
	CT ratio selected	Yes/No	14000/5	1250/1	14000/5	1250/1	1.2000/1 2.2000/1 3.3000/1
	Is CT supervision enabled or not in case of Transformer differential protection ?	Yes/No	Yes	Yes	Yes	Yes	Yes
6	Are all the lockout relays (86) considered for Transformer protection provided with supervision relays (74/86) ?	Yes/No	Yes	Yes	Yes	Yes	Yes
7	Do the Transformer Protection panels have supervision relays for DC supply 1 and DC supply 2 (74/DC -1 & 74/DC-2) ?	Yes/No	Yes	Yes	Yes	Yes	Yes
8	OTI/WTI working	Yes/No	Yes		Yes		-
9	Bucholz / PRD working	Yes/No	Yes		Yes		-
10	LA rating on switchyard side	Yes/No	-	-	-	-	Yes, 360kV

Transformer Protection Audit - Check list (GT-08)			
	Audited data		
No.	**Relay configuration - Power Transformer Protection**		

Transformer Protection Audit - Check list (GT-08)							
1	Name, Voltage, Power		GT - 8, 21kV/420 kV, 3 X 275 MVA				
2	Are 2 groups of Protections used (Group A and Group B) for transformer Protection?	Yes/No	Yes				
3	Are Group A and Group B Protections connected to separate DC source for Power transformer	Yes/No	Yes				
4	Do the group A and Group B protections have separate Lockout relays?	Yes/No	Yes				
5	**Details of Type relay**		**Main-1**		**Main-2/Back up**		**Other Protections**
			A	**B**	**A**	**B**	
	Details of composite type Numerical relays						1. Overall Differential Protn. Relay 2.Overhead Diff. Protn. 3.LBB Protn. Etc.
	Relay Make and Model		Siemens 7UT63	Siemens 7SJ8022	Siemens 7UT63	Siemens 7SJ8022	1.SIPROTEC 7UT63 2.SIPROTEC 7UT61 3.SIPROTEC 7VK61
	Whether the relay is functional	Yes/No	Yes	Yes	Yes	Yes	Yes
	Date of testing		2018	2018	2018	2018	2018
	Mention all the active protection		Under frequency, GT SPR, PRV A, WTI etc.	HV REF	Buch, OTI, PRV B, GT FR	HV REF	Diff. R/Y/B ph TRIP, Diff. Pick up, LBB etc
	Differential protection		Yes		Yes		-
	REF protection			Yes		Yes	-
	Backup Directional OC + EF Protection		Yes		Yes		-
	Over fluxing Protection		Yes		Yes		-

Transformer Protection Audit - Check list (GT-08)							
	Connected to trip coil 1/Trip coil 2/Both		Both	Both	Both	Both	Both
	feed from DC supply 1 Dc supply 2		DC Supply 1	DC Supply 1	DC Supply 2	DC Supply 2	DC Supply 2
	Breaker failure active	Yes/No	Yes	Yes	Yes	Yes	1.No 2.No 3.Yes
	Disturbance report active	Yes/No	Yes	Yes	Yes	Yes	Yes
	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 1	Core 2	Core 1	Core 2	Core 2
	CT ratio selected	Yes/No	14000/5	1250/1	14000/5	1250/1	1.2000/1 2.2000/1 3.3000/1
	Is CT supervision enabled or not in case of Transformer differential protection?	Yes/No	Yes	Yes	Yes	Yes	Yes
6	Are all the lockout relays (86) considered for Transformer protection provided with supervision relays (74/86) ?	Yes/No	Yes	Yes	Yes	Yes	Yes
7	Do the Transformer Protection panels have supervision relays for DC supply 1 and DC supply 2 (74/DC -1 & 74/DC-2) ?	Yes/No	Yes	Yes	Yes	Yes	Yes
8	OTI/WTI working	Yes/No	Yes		Yes		-
9	Bucholz / PRD working	Yes/No	Yes		Yes		-
10	LA rating on switchyard side	Yes/No	-	-	-	-	Yes, 360kV

Synchro-Check Protection Audit Check list			
Audited data			
Sr. No.	**Relay configuration Synchro check protections**		
	Details of Relay		
1	Relay Make and Model		Alstom SKDIIBF80D3BCH
2	Whether the relay is functional	Yes/No	Yes
3	Date of testing		-

4	Voltage Measurement	P-P or P-N	P-N
5	What is the set value of voltage Difference (ΔU) ?	%	90%
6	What is the set value of Phase Angle Difference (Δφ) ?	°	35
7	What is the set value of frequency slip (Δf) ?	mHz	0.08%
8	What is the time delay of output relay ? (DELAY)	sec	5
9	setting value for dead bus line	%	

Shunt Reactor Protection - Checklist (Bikaner Line 1 Reactor)							
Audited data							
No.	**Relay configuration - Shunt Reactor Protections**						
1	Are 2 groups (Group A and Group B) used for Shunt Reactor protection?	Yes/No	Yes				
2	Are Group A and Group B protections connected to separate DC sources for shunt reactors?	Yes/No	Yes				
3	Do the Group A and Group B protections have separate lockout relays?	Yes/No	Yes				
4	**Details of type Relays**		**Main**		**Back-up**		**Other Protections**
			A	**B**	**A**	**B**	
	Details of composite type numerical relay						
	Relay Make and model		Siemens 7UT63	Siemens 7UT63	Siemens 7SA52		Siemens SIPROTEC 7VK61
	Whether the relay is functional?	Yes/No	Yes	Yes	Yes		Yes
	Date of testing		January, 2017	January, 2017	January, 2017		January, 2017
	Mention all the active protections			Buch. OTI, WTI	Backup Impedan ce		LBB Protn. etc
	Differential Protection		Yes	Yes	-		-
	REF Protection		Yes	-	-		-
	Back-up directional O/c + E/f protection				-		-
	Overfluxing protection				-		-
	Connected to Trip Coil 1/Trip Coil 2/Both		Both	Both	Both		Both
	Feed from DC supply 1/DC supply 2/Auto changeover		DC Supply 1	DC Supply 2	DC Supply 2		DC Supply 2
	Breaker Failure active	Yes/No					Yes
	Disturbance recorder active	Yes/No	Yes	Yes	Yes		YES
	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 2	Core 1	Core 3		Core 3

Shunt Reactor Protection - Checklist (Bikaner Line 1 Reactor)							
	CT ratio selected		3000/1	3000/1	200/1		200/1
	Is CT supervision enabled or not in case of Reactor Differential protection?	Yes/No	Yes	Yes	Yes		-
5	Are all the lock out relays (86) considered for reactor protection provided with supervision relays (74/86)?	Yes/No	Yes	Yes	Yes		Yes
6	Do the reactor protection panels have supervision relays for DC supply-1 & DC-supply-2 (74/DC-1 & 74/DC-2)?	Yes/No	Yes	Yes	Yes		Yes
7	OTI/WTI Indications working?	Yes/No	Yes	Yes	-		-
8	Buchholz / PRD working?	Yes/No	Yes	Yes	-		-
9	LA rating HV side?	Yes/No	Yes, 360KV				

Shunt Reactor Protection - Checklist (Bikaner Line 2 Reactor)							
Audited data							
No.	**Relay configuration - Shunt Reactor Protections**						
1	Are 2 groups (Group A and Group B) used for Shunt Reactor protection?	Yes/No	Yes				
2	Are Group A and Group B protections connected to separate DC sources for shunt reactors?	Yes/No	Yes				
3	Do the Group A and Group B protections have separate lockout relays?	Yes/No	Yes				
4	**Details of type Relays**		**Main**		**Back-up**		**Other Protections**
			A	**B**	**A**	**B**	
	Details of composite type numerical relay						
	Relay Make and model		Siemens 7UT63	Siemens 7UT63	Siemens 7SA52		Siemens SIPROTEC 7VK61
	Whether the relay is functional?	Yes/No	Yes	Yes	Yes		Yes
	Date of testing		January, 2017	January, 2017	January, 2017		January, 2017

Shunt Reactor Protection - Checklist (Bikaner Line 2 Reactor)							
	Mention all the active protections			Buchhoiz ,OTI, WTI	Backup Impedance		LBB Protn. etc
	Differential Protection		Yes	Yes	-		-
	REF Protection		Yes	-	-		-
	Back-up directional O/c + E/f protection				-		-
	Overfluxing protection				-		-
	Connected to Trip Coil 1/Trip Coil 2/Both		Both	Both	Both		Both
	Feed from DC supply 1/DC supply 2/Auto changeover		DC Supply 1	DC Supply 2	DC Supply 2		DC Supply 2
	Breaker Failure active	Yes/No	No	No	No		Yes
	Disturbance recorder active	Yes/No	Yes	Yes	Yes		YES
	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 2	Core 1	Core 3		Core 3
	CT ratio selected		3000/1	3000/1	200/1		200/1
	Is CT supervision enabled or not in case of Reactor Differential protection?	Yes/No	Yes	Yes	Yes		-
5	Are all the lock out relays (86) considered for reactor protection provided with supervision relays (74/86)?	Yes/No	Yes	Yes	Yes		YES
6	Do the reactor protection panels have supervision relays for DC supply-1 & DC-supply-2 (74/DC-1 & 74/DC-2)?	Yes/No	Yes	Yes	Yes		YES
7	OTI/WTI Indications working?	Yes/No	Yes	Yes	-		-
8	Buchholz / PRD working?	Yes/No	Yes	Yes	-		-
9	LA rating HV side?	Yes/No	Yes, 360KV				

Bus Reactor 1 Protection							
Audited data							
No.	**Relay configuration - Shunt Reactor Protections**						
1	Are 2 groups (Group A and Group B) used for Shunt Reactor protection?	Yes/No	Yes				
2	Are Group A and Group B protections connected to separate DC sources for shunt reactors?	Yes/No	Yes				
3	Do the Group A and Group B protections have separate lockout relays?	Yes/No	Yes				
4	**Details of type Relays**		**Main**		**Back-up**		**Other Protections**
			A	**B**	**A**	**B**	
	Details of composite type numerical relay						
	Relay Make and model		Siemens 7UT63	Siemens 7UT63	Siemens 7SA52		Siemens SIPROTEC 7VK61
	Whether the relay is functional?	Yes/No	Yes	Yes	Yes		Yes
	Date of testing		February-2017	February-2017	February-2017		February, 2017
	Mention all the active protections			Buchhoiz ,OTI, WTI	Backup Impedance		LBB Protn. etc
	Differential Protection		Yes	Yes	-		-
	REF Protection		Yes	-	-		-
	Back-up directional O/c + E/f protection		No	No	-		-
	Overfluxing protection		No	No	-		-
	Connected to Trip Coil 1/Trip Coil 2/Both		Both	Both	Both		Both
	Feed from DC supply 1/DC supply 2/Auto changeover		DC Supply 1	DC Supply 2	DC Supply 2		DC Supply 2
	Breaker Failure active	Yes/No	No	No	No		Yes
	Disturbance recorder active	Yes/No	Yes	Yes	Yes		-
	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 6	Core 5	Core 3		Core 2
	CT ratio selected		500/1	500/1	200/1		3000/1

Bus Reactor 1 Protection							
	Is CT supervision enabled or not in case of Reactor Differential protection?	Yes/No	No	No	-		-
5	Are all the lock out relays (86) considered for reactor protection provided with supervision relays (74/86)?	Yes/No	Yes	yes	Yes		Yes
6	Do the reactor protection panels have supervision relays for DC supply-1 & DC-supply-2 (74/DC-1 & 74/DC-2)?	Yes/No	Yes	Yes	Yes		Yes
7	OTI/WTI Indications working?	Yes/No	Yes	Yes	-		-
8	Buchholz / PRD working?	Yes/No	Yes	Yes	-		-
9	LA rating HV side?	Yes/No	Yes, 360KV				

Bus Reactor 2 Protection							
Audited data							
No.	**Relay configuration - Shunt Reactor Protections**						
1	Are 2 groups (Group A and Group B) used for Shunt Reactor protection?	Yes/No	Yes				
2	Are Group A and Group B protections connected to separate DC sources for shunt reactors?	Yes/No	Yes				
3	Do the Group A and Group B protections have separate lockout relays?	Yes/No	Yes				
4	**Details of type Relays**		**Main**		**Back-up**		**Other Protections**
			A	**B**	**A**	**B**	
	Details of composite type numerical relay						
	Relay Make and model		Siemens 7UT63	Siemens 7UT63	Siemens 7SA52		Siemens SIPROTEC 7VK61
	Whether the relay is functional?	Yes/No	Yes	Yes	Yes		Yes
	Date of testing		January, 2017	January, 2017	January, 2017		February, 2017

Bus Reactor 2 Protection							
	Mention all the active protections			Buchhoiz ,OTI, WTI	Backup Impedance		LBB Protn. etc
	Differential Protection		Yes	Yes	-		-
	REF Protection		Yes	-	-		-
	Back-up directional O/c + E/f protection		No	No	-		-
	Overfluxing protection		No	No	-		-
	Connected to Trip Coil 1/Trip Coil 2/Both		Both	Both	Both		Both
	Feed from DC supply 1/DC supply 2/Auto changeover		DC Supply 1	DC Supply 2	DC Supply 2		DC Supply 2
	Breaker Failure active	Yes/No	No	No	No		Yes
	Disturbance recorder active	Yes/No	Yes	Yes	Yes		-
	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 6	Core 5	Core 3		Core 2
	CT ratio selected		500/1	500/1	200/1		3000/1
	Is CT supervision enabled or not in case of Reactor Differential protection?	Yes/No	No	No	-		-
5	Are all the lock out relays (86) considered for reactor protection provided with supervision relays (74/86)?	Yes/No	Yes	Yes	Yes		Yes
6	Do the reactor protection panels have supervision relays for DC supply-1 & DC-supply-2 (74/DC-1 & 74/DC-2)?	Yes/No	Yes	Yes	Yes		Yes
7	OTI/WTI Indications working?	Yes/No	Yes	Yes	-		-
8	Buchholz / PRD working?	Yes/No	Yes	Yes	-		-
9	LA rating HV side?	Yes/No	Yes, 360KV				

Shunt Reactor Protection - Checklist (Babai Line 1 Reactor)							
Audited data							
No.	**Relay configuration - Shunt Reactor Protections**						
1	Are 2 groups (Group A and Group B) used for Shunt Reactor protection?	Yes/No	Yes				
2	Are Group A and Group B protections connected to separate DC sources for shunt reactors?	Yes/No	Yes				
3	Do the Group A and Group B protections have separate lockout relays?	Yes/No	Yes				
4	**Details of type Relays**		**Main**		**Back-up**		**Other Protections**
			A	**B**	**A**	**B**	
	Details of composite type numerical relay		Yes	Yes	Yes		
	Relay Make and model		Siemens 7UT63	Siemens 7UT63	Siemens 7SA52		Siemens SIPROTEC 7VK61
	Whether the relay is functional?	Yes/No	Yes	Yes	Yes		Yes
	Date of testing		January, 2017	January, 2017	January, 2017		January, 2017
	Mention all the active protections			Buchhoiz ,OTI, WTI	Backup Impedance		LBB Protn. etc
	Differential Protection		Yes	Yes	-		-
	REF Protection		Yes	-	-		-
	Back-up directional O/c + E/f protection		No	No	-		-
	Overfluxing protection		No	No	-		-
	Connected to Trip Coil 1/Trip Coil 2/Both		Both	Both	Both		both
	Feed from DC supply 1/DC supply 2/Auto changeover		DC Supply 1	DC Supply 2	DC Supply 2		DC Supply 2
	Breaker Failure active	Yes/No	No	No	No		Yes
	Disturbance recorder active	Yes/No	Yes	Yes	Yes		YES
	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 2	Core 1	Core 3		Core 2
	CT ratio selected		3000/1	3000/1	200/1		200/1

Shunt Reactor Protection - Checklist (Babai Line 1 Reactor)							
	Is CT supervision enabled or not in case of Reactor Differential protection?	Yes/No	Yes	Yes	Yes		-
5	Are all the lock out relays (86) considered for reactor protection provided with supervision relays (74/86)?	Yes/No	Yes	Yes	Yes		YES
6	Do the reactor protection panels have supervision relays for DC supply-1 & DC-supply-2 (74/DC-1 & 74/DC-2)?	Yes/No	Yes	Yes	Yes		YES
7	OTI/WTI Indications working?	Yes/No	Yes	Yes	-		-
8	Buchholz / PRD working?	Yes/No	Yes	Yes	-		-
9	LA rating HV side?	Yes/No	Yes, 360KV				

Shunt Reactor Protection - Checklist (Babai Line 2 Reactor)							
Audited data							
No.	**Relay configuration - Shunt Reactor Protections**						
1	Are 2 groups (Group A and Group B) used for Shunt Reactor protection?	Yes/No	Yes				
2	Are Group A and Group B protections connected to separate DC sources for shunt reactors?	Yes/No	Yes				
3	Do the Group A and Group B protections have separate lockout relays?	Yes/No	Yes				
4	**Details of type Relays**		**Main**		**Back-up**		**Other Protections**
			A	**B**	**A**	**B**	
	Details of composite type numerical relay		Yes	Yes	Yes		
	Relay Make and model		Siemens 7UT63	Siemens 7UT63	Siemens 7SA52		Siemens SIPROTEC 7VK61
	Whether the relay is functional?	Yes/No	Yes	Yes	Yes		Yes
	Date of testing		March-2017	March-2017	March-2017		January, 2017

Shunt Reactor Protection - Checklist (Babai Line 2 Reactor)							
	Mention all the active protections			Buchhoiz ,OTI, WTI	Backup Impedance		LBB Protn. etc
	Differential Protection		Yes	Yes	-		-
	REF Protection		Yes	-	-		-
	Back-up directional O/c + E/f protection		No	No	-		-
	Overfluxing protection		No	No	-		-
	Connected to Trip Coil 1/Trip Coil 2/Both		Both	Both	Both		Both
	Feed from DC supply 1/DC supply 2/Auto changeover		DC Supply 1	DC Supply 2	DC Supply 2		DC Supply 2
	Breaker Failure active	Yes/No					Yes
	Disturbance recorder active	Yes/No	Yes	Yes	Yes		Yes
	Connected to dedicated CT core? Define CT core no. to which the relay is connected		Core 2	Core 1	Core 3		Core 2
	CT ratio selected		3000/1	3000/1	200/1		200/1
	Is CT supervision enabled or not in case of Reactor Differential protection?	Yes/No	Yes	Yes	Yes		-
5	Are all the lock out relays (86) considered for reactor protection provided with supervision relays (74/86)?	Yes/No	Yes	Yes	Yes		YES
6	Do the reactor protection panels have supervision relays for DC supply-1 & DC-supply-2 (74/DC-1 & 74/DC-2)?	Yes/No	Yes	Yes	Yes		YES
7	OTI/WTI Indications working?	Yes/No	Yes	Yes	-		-
8	Buchholz / PRD working?	Yes/No	Yes	Yes	-		-
9	LA rating HV side?	Yes/No	Yes, 360KV				

	Details of Bus-bar Protection System			
	BB and BF Protection		**400 kV**	
	BUSBAR PROTECTION			
1	Main BB available or not?	Yes / No	Yes	
2	Back-up busbar protection to be provided by either of the following:			
	- Remote end distance relay overreaching elements (second zone)	Yes / No	Yes	
	- Reverse looking element of the local distance relay	Yes / No	Yes	
	- Directional back-up overcurrent relays at remote end	Yes / No	Yes	
3	Redundant BBP available or not?	Yes / No	Yes	
4	Type of Bus Bar arrangement: 1 and 1/2 breaker scheme/ Single Busbar/ Double Busbar/ Main-1, Main-2 and Transfer		1 and 2 breaker scheme	
			Busbar 1 (BB1)	**Busbar 2 (BB2)**
5	Main 1 Relay Make		SIPROTEC 7SS85 Siemens	SIPROTEC 7SS85 Siemens
	Main 1 Relay Functional?	Yes / No	Yes	Yes
	Main 1 Relay Type	Low / High Impedance	Low Impedance	Low Impedance
	Connected to Trip Coil 1 / Trip Coil 2		Both	Both
	Feed from DC Supply 1 / DC Supply 2		DC Supply 1	DC Supply 1
6	Main 2 Relay Make		Siemens 7SS85	Siemens 7SS85
	Main 2 Relay Functional?	Yes / No	Yes	Yes
	Main 2 Relay Type	Low / High Impedance	Low Impedance	Low Impedance
	Connected to Trip Coil 1 / Trip Coil 2		Both	Both
	Feed from DC Supply 1 / DC Supply 2		DC Supply 2	DC Supply 2

	Details of Bus-bar Protection System					
7	Trip to both coils in case of one BBP	Yes / No	Yes		Yes	
			BB1Main -1	**BB1Main -2**	**BB2Main -1**	**BB2Main -2**
8	Dedicated CT core for each BB protection	Yes / No	Yes	Yes	Yes	Yes
9	*For High Impedance Busbar Protection*					
	a) Is the high impedance protection used for simple busbar arrangement like 1 and 1/2 breaker scheme or single busbar arrangement?	Yes / No	No	No	No	No
	b) Whether the CT ratios and characteristics are same (V_k etc.)	Yes / No	No	No	No	No
	c) Whether stability check has been conducted?	Yes / No	No	No	No	No
	d) Is CT supervision relay provided or not?	Yes / No	No	No	No	No
	e) In case of busbar protection where CT selection contacts are used for zone selectivity / CT selection, please fill below items:					
	- Is check zone enabled or not?	Yes / No	No	No	No	No
	- Is check zone measurement connected to separate CT cores?	Yes / No	No	No	No	No
	- If check zone is not enabled, is the relay setting increased to value higher than the heaviest loaded feeder current?	Yes / No	No	No	No	No
10	*For Low Impedance Busbar Protection*					
	a) Centralized BBP	Yes / No	Yes	Yes	Yes	Yes
	b) Or decentralized BBP with peripheral units	Yes / No				
	c) Whether stability check has been conducted?	Yes / No	Yes	Yes	Yes	Yes
	d) Is CT supervision enabled or not?	Yes / No	Yes	Yes	Yes	Yes
10	e) In case of busbar protection where CT selection contacts are used for zone selectivity / CT					

	Details of Bus-bar Protection System					
	selection, please fill below items:					
	- Is checkzone enabled or not?	Yes / No	Yes	Yes	Yes	Yes
	- If check zone is not enabled, is the relay setting increased to value higher than the heaviest loaded feeder current?	Yes / No				
11	One zone for one bus	Yes / No	Yes			
12	Are all the Busbar protection Lockout relays (86 BB) provided with supervision relays (74 / 86BB) ?	Yes / No	Yes			
13	Do all the busbar protection panels have supervision relays for DC supply-1 and DC supply-2 (74/DC-1 & 74 DC-2) ?	Yes / No	Yes			
	BREAKER FAILURE PROTECTION					
14	Breaker failure included in BB protection	Yes / No	No			
15	Breaker failure included in Line/Transformer protection	Yes / No	No			
16	Separate BFP provided	Yes / No	Yes			
17	If separate BFP is provided, furnish Make/model	Yes / No	Yes Siemens 7VK61			
18	BFP relay functional	Yes / No	Yes			
19	BFP conditions: Current presence	Yes / No	Yes			
20	BFP conditions: CB closed position	Yes / No	Yes			
21	BFP retrip active (first stage)	Yes / No	Yes			
22	Tripping time for BFP (second stage) 0.2 s < t < 0.3 s	Yes / No	0.2 S			
23	Are Breaker Failure protection auxiliary relay for Stage-1 (94BF) and Lock out relay for Stage-2 (86BF) provided with supervision relays (74/94BF & 74/86BF)	Yes / No	Yes			
24	Do all the Breaker Failure protection panels have supervision relays for DC Supply-1 & DC Supply-2 (74/DC-1 and 74/DC-2)	Yes / No	Yes			

Details of CVT / CC / PT

Sr. No.	Feeder Name	CVT / CC / PT	Phase	Make	Serial No.	Prot. / Met	Capacitance / Ratio	Ratio	Standard	Accuracy Class		Win-1 & 2 Burden (VA)	Win-3 & 4 Burden (VA)	Connected to Which relays	Relay setting calc. and configuration files based on VT Ratio? (For VTs connected to Distance prot. / synchro check relays)	For Synchrocheck relays, VT I/p connected Ph-Ph OR Ph-N (Which Phase?)	Date of Commisioning
										Core-1 Core-2	Core-3 Core-4						
1	Y1 IC 1	CVT	R	BHEL	6192039	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
		CVT	Y	BHEL	6192040	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
		CVT	B	BHEL	6192041	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
2	Y2 IC 2	CVT	R	BHEL	6192042	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
		CVT	Y	BHEL	6192043	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
		CVT	B	BHEL	6192044	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
3	Y5 BABAI 1	CVT	R	BHEL	6194262	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2		R-N	2023
		CVT	Y	BHEL	6192048	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2	Only Bay Commissioned & Line Not Erected	R-N	2023
		CVT	B	BHEL	6194264	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2		R-N	2023
4	Y6 BABAI 2	CVT	R	BHEL	6192025	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2		R-N	2023
		CVT	Y	BHEL	6194263	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2	Only Bay Commissioned & Line Not Erected	R-N	2023
		CVT	B	BHEL	6194257	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2		R-N	2023
5	Y9 BIKANER 1	CVT	R	BHEL	6194256	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2	Attached	R-N	2017
		CVT	Y	BHEL	6194259	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2	Attached	R-N	2017
		CVT	B	BHEL	6197230	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2	Attached	R-N	2017
6	Y10 BIKANER 2	CVT	R	BHEL	6194266	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2	Attached	R-N	2017
		CVT	Y	BHEL	6194258	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2	Attached	R-N	2017
		CVT	B	BHEL	6192029	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21M1/M2	Attached	R-N	2017
7	Y7 GT 07	CVT	R	BHEL	6192036	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
		CVT	Y	BHEL	6192037	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
		CVT	B	BHEL	6192038	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2016
8	BUS 02	CVT	R	BHEL	6192033	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21R	NA	R-N	2016
		CVT	Y	BHEL	6192034	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21R	NA	R-N	2016
		CVT	B	BHEL	6192035	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21R	NA	R-N	2016
9	BUS 01	CVT	R	BHEL	6192030	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21R	NA	R-N	2017
		CVT	Y	BHEL	6192031	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21R	NA	R-N	2017
		CVT	B	BHEL	6192032	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP/21R	NA	R-N	2017
10	Y12 GT 08	CVT	R	BHEL	6194261	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2017
		CVT	Y	BHEL	6192028	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2017
		CVT	B	BHEL	6194265	Both	4400 pF	400kV/√3/110 v/ √3	IS:3156	3P	0.2	50	15	BCU/CP	NA	R-N	2017

Details of Circuit Breaker																				
Sr. No.	Parameter / Details	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Feeder / Bay Name	IC-1	IC-2	BABAI TIE	BABAI -1 REACT OR	BABAI -2 REACT OR	BIKANE R-1 RECTO R	BIKANE R-2 REACT OR	BIKANER TIE	Bikaner- 2	Bikaner- 1	Babai-2	Babai-1	Bus- 1 React or	Bus-1 & 2 Reactor Tie	Bus- 2 React or	GT-07	GT-07 Tie	GT-08 Tie	GT-08
2	CB Rated Voltage in kV	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420
3	Type of CB	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A	400-SFM-40A
4	Breaker Healthy? (Yes / No)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Continous Rated Current	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA	40kA
6	Rated Breaking Current (kA)	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA	50kA
7	Number of Closing Coils	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	Healthiness of Closing Coils	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
9	Number of Tripping Coils	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	Healthiness of Tripping Coils	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
11	Trip circuit supervision relay available for monitoring Trip Circuit-1 & Trip Circuit-2 with breaker in both open and closed condition (Yes / No)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	Are the trip circuit supervision relays healthy?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	One / Three Pole Operation	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three	Three
14	For breakers with three poles, is pole discrepancy relay provided?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Does the pole discrepancy relay have facility for Stage-1 (own breaker tripping) & Stage-2 (Boundary breaker tripping)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	What monitoring devices are provided for checking the dielectric medium of the breaker? (e.g. Gas Pressure Low etc.)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	What action is initiated by each of different Stages of these devices (Alarm / Block Tripping)	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
18	PIR (Available / Not)?	No	No	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes

Details of Communication System				
No.	**No.**	**Communication System**		**400 kV**
1	a	Type of Communication for Main-1 Protection	PLCC / OPGW	Both OPGW & PLCC
	b	Type of Communication for Main-2 Protection	PLCC / OPGW	Both OPGW & PLCC
	c	Mode used for Data Communication	Mono / Bi Directional	Bi Directional
	d	Mode used for Speech Communication		Both OPGW & PLCC
2	**PLCC Details**			
	a	Do you use PLL for teleprotection of Distance relays	Yes / No	Yes
	b	Specify type of coupling	Ph-Ph/ Ph-G/ Inter-circuit	Ph-Ph
	c	Whether redundant PLCC channels provided for 400 kV and 765 kV lines	Yes / No	Yes
	d	Specify number of PLCC channels per circuit	One / Two	Two
	e	No. of protection channels No. of data channels No. of speech channels		Two Two Two
	f	Whether dependability & security of each tele-protection channel measured and record kept?	Yes / No	No
	g	Is the PLCC equipment and channels healthy & functional	Yes / No	Yes
3	**OPGW Details**			
	a	Redundancy maintained by providing two sets of Fibre optic Equipment	Yes / No	No
	b	Card level redundancy (Power supply card, protection card, CPU board) maintained in each fibre of optic equipment	Yes / No	No
	c	Separate DC battery supply or common DC battery supply separately fused for each fibre optic equipment	Yes / No	Yes
	d	Are the Fibre Optic equipment and channels healthy & functional	Yes / No	Yes
4	**Time Synchronization Equipment Details**			
	a	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main Relays/ DR/ Event Logger/ SAS/ PMU/ Line Current Differential Relays	Yes / No	Yes

Details of Communication System				
No.	**No.**	**Communication System**		**400 kV**
	b	Are Time Synchronization Equipment (TSE) complete with antenna, all cables, processing equipments etc. provided to receive synchronizing pulse through Global Positioning System (GPS) compatible for synchronization of event logger, disturbance recorder and SCADA/ automation system.	Yes / No	Yes
	c	Are the Main Relays/ DR/ Event Logger/ SAS/ PMU/ Line current differential relays time synchronized?	Yes / No	Yes
5	**Disturbance Recorder (DR) and Event Logger (EL) Details**			
	a	Is DR provided on all feeders?	Yes / No	Yes
	b	Is the Fault locator provided on all line feeders?	Yes / No	Yes
	c	Whether DR is standalone or part of main relay?	Yes / No	Yes
	d	Whether DR functional?	Yes / No	No
	e	Whether DR is having automatic fault record download facility to a central PC?	Yes / No	No
	f	Whether substation is having EL facility?	Standalone / Built-in SAS	Built-in SAS
	g	EL functional?	Yes / No	Yes

Details of Plant AC Supply System			
No.	**AC Supply System**		**Supply - 1**
1	Source of AC HT Supplies	Name of Source	ST 07 & ST 08
	In case of two AC HT supplies, the supplies are arranged from independent sources	Yes / No	Yes
	Voltage of supply		11kV
	Supply changeover method between Supply 1 & 2	Auto / Manual	Bus Coupler
2	**DG**		
	DG Available?	Yes / No	Yes
	Make and Rating		3 X 1750 kVA (Super Nova)
	What loads are supplied by DG?		Emergency MCC (EMCC), 6 - DC motors (JOP, EOP, SOP, TDBFP-EOPs, Scanner fan etc.)
	Starting operation and sequence Automatic / Manual?		Automatic
	Supply changeover method between Normal AC supply and DG	Auto / Manual	Auto
3	The SS to furnish the supply changeover scheme / SLD		N.A.
4	**Maintenance / Testing Plan**		
	What is maintenance plan/ schedule followed by the utility for maintenance of DG?		Maintenance is to be done according to the requirement i. e. daily, routine and preventive etc.
5	Remark		

Details of DC System						
No.	**DC Supply Systems**		**Voltage - 220 V**	**Voltage - 220 V**	**Voltage - 48 V**	**Voltage - 48 V**
1	Type of Batteries		Exide YHP 15	Exide YHP 15	Exide YHP 13	Exide YHP 13
2	Number of Cells per bank		108	108	24	24
3	Date of procurement / commissioning of Battery Bank					
4	Is the Battery functional and in Good Condition?	Yes / No	Yes	Yes	Yes	Yes
5	Availability of Battery Charger	Yes / No	Yes	Yes	Yes	Yes
6	Date of procurement / commissioning of the charger					
7	Is the charger functional?	Yes / No	Yes	Yes	Yes	Yes
8	Used combination of charging	(a) Two sets of Battery and charger, (b) Single battery with charger, (c) One battery with two chargers	Two sets of Battery and Charger	Two sets of Battery and Charger	Two sets of Battery and Charger	Two sets of Battery and Charger
9	Measure Voltage at Farthest Panel		243.8 V	243.8 V	53.1 V	53.4 V
	Positive to Earth		119.57 V	119.3 V	0 V	0 V
	Negative to Earth		124.24 V	124.7 V	53.1 V	53.4 V
10	Availability of Battery Ground Fault Detectors?	Yes / No	Yes	Yes	Yes	Yes
11	The protection relays and trip circuits are segregated into two independent system feed through fuses from Two different sources?	Yes / No	Yes	Yes	Yes	Yes
12	Maintenance / Testing Plan					
	What is maintenance plan/ schedule followed by the utility for maintenance of battery and charger?		Maintenance is to be done according to the requirement i. e. daily, routine and preventive etc.			

	Lightning Arrester								
Sl. No.	**Feeder Name**	**Physical Check and damages in the porcelain skirt**	**Earthing of Counter**	**Leakage Current of LA (in mA)**			**Counter Reading**		
				RΦ	**YΦ**	**BΦ**	**RΦ**	**YΦ**	**BΦ**
1	Interconnector- 1	OK	Yes	0.85	0.8	0.8	41	17	17
2	Interconnector- 2	OK	Yes	0	0.8	0.6	9	8	9
3	Babai Line-1	OK	Yes	0.6	0.8	0.8	8	10	7
4	Babai Line- 1 Reactor	OK	Yes	0.9	0.8	0.8	8	8	10
5	Babai Line- 2	OK	Yes	0.8	0.7	0.9	8	9	13
6	Babai Line- 2 Reactor	OK	Yes	0.7	0.9	0.8	9	10	9
7	Bikaner Line 1 Rector	OK	Yes	0.85	0.85	0.7	7	9	10
8	Bikaner Line 1	OK	Yes	0.85	0.75	0.8	8	7	8
9	Bikaner Line 2	OK	Yes	0.85	0.8	0.8	8	13	7
10	Bikaner Line 2 Reactor	OK	Yes	0.95	0.8	0.75	8	9	9
11	Bus Reactor- 1	OK	Yes	0.9	0.8	0.8	11	19	8
12	Bus Reactor- 2	OK	Yes	0.3	0.3	0.3	7	7	8

<table>
<tr><th>Sr. No</th><th>Particular</th><th>Available (Yes/NO)</th><th>Verification done (Yes/NO)</th><th colspan="6">Detail of SPS Scheme</th><th>Remark</th></tr>
<tr><td>1</td><td>Special protection scheme</td><td>NO</td><td>---</td><td colspan="6">Scheme not finalized as this has to be finalized by RRVUNL.</td><td>---</td></tr>
<tr><td>2</td><td>Status of corrective actions based on tripping analysis</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
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3	Any othe observations /comments	---	---	---	---	---	---	---	---	---

CHECK-LIST

Check list for different protected objects & elements in fault clearance system are as under:

A. Transmission Lines (OHL and Cables)

1	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	Yes
2	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	Yes
3	Is the Distance protection (Non-switched type, suitable for 1-ph & 3- ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	Yes
4	Is both main-I & Main-II distance relay are numerical design having Quadrilateral or Polygon operating characteristic	Yes
5	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	Yes
6	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	Yes (100% OF PL + 50% OF ASL)
7	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	Yes
8	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistance & tower footing resistance. (In case, it is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	Yes
9	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	Yes
10	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	N.A.
11	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	0.4 S Settings recommended by M/s. BHEL
12	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	Yes 1 S
13	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar	Yes

	fault resistance, when allowing for multiple in feeds from other circuits?	
14	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	NO
15	Is Switch on to fault (SOTF) function provided in distance relay to take care of line energization on fault? Whether SOTF initiation has been implemented using hardwire logic In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB	Yes IN BUILT IN RELAY Yes (MAIN & TIE BREAKER)
16	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	Yes
17	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	Yes (DT settings provided)
18	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	Yes
19	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	N. A.
20	Are the line parameters used for setting the relay verified by field testing	Yes
21	Is Two stages Over-Voltage protection provided for ~~765 &~~ 400kV Lines? Do you apply grading in over-voltage setting for lines at one station. Please specify the setting values adopted for: Stage-I : Stage-II:	Yes Yes 110% 130%
22	Is 1-ph Auto - reclosing provided on ~~765,~~ 400 ~~& 220~~kV lines? Please specify the set value: Dead time: Reclaim time:	Yes 1 S 25 S
23	Is the Distance communication. Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines? If any other communication scheme has been applied, please provide the detail with justification thereof.	Permissive Under Reach (PUR) N. A.
24	Is the Current Reversal Guard logic for POR scheme provided on Double circuit lines?	N. A.
25	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether week end-infeed feature has been enabled in respective distance relay or not	N. A.

26	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	N. A.
27	What line current, Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment. (In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)	85 degrees 400kV
28	a) What are the Zones blocked on Power swing block function: b) Setting for Unblock timer: (typical 02 second) c) Out of Step trip enabled	ZONE 2, 3, 4 Yes
29	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	Yes
30	a) Is the Disturbance recorder and Fault locator provided on all line feeder? b) Whether standalone or built in Main relay c) Whether DR is having automatic fault record download facility to a central PC d) Whether DR is time synchronized with the GPS based time synchronizing equipment e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage. f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.	Yes Built in No Yes
31	Does the setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be blocked / Disabled)? Are all default settings validated or revised settings are given in the setting document?	Yes

B. Power Transformers

1	Do you use Group A and Group B protections connected to separate DC sources for power transformers	Yes
2	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	Yes
3	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at ~~765kV and~~ 400kV levels	No
4	Do you classify transformer protections as below in groups: Group A / Group B • Biased differential relay / Restricted earth fault (REF) relay • PRD , WTI / Buchholz Protection, OTI • Back up Protection(HV) / Back up Protection(MV) • Over fluxing protection(HV) / Over fluxing protection(MV)	Yes
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	Yes
6	Is Restricted earth fault (REF) protection used a high impedance type	Yes
7	Are Main protection relays provided for transformer are of numerical design?	Yes
8	a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design. b) Do the back-up earth fault relays have harmonic restrain feature	Yes
9	Is Fire protection system (HVW type) provided for power transformer and functioning	Yes
10	a) Is the Disturbance recorder provided for Transformer feeder b) Whether standalone or built in Main relay c) Whether DR is having automatic fault record download facility to a central PC d) Whether DR is time synchronised with the GPS time synchronising equipment	Yes Built in No Yes
11	Does the setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be blocked / Disabled)? Are all default settings validated or revised settings are given in the setting document?	Yes

C. Shunt Reactors

1	Do you use Group A and Group B protections connected to separate DC sources for reactors	Yes
2	Do you follow CBIP guideline (274 and 296) for protection setting of reactors	Yes
3	Do you use duplicated PRD and Bucholtz initiating contact for Reactors at ~~765kV and~~ 400kV levels	No
4	Do you classify Reactor protections as below in groups: Group A / Group B • Biased differential relay / R.E.F Protection • PRD , WTI / Buchholz Protection, OTI • Back up impedance Protection Or Direction O/C & E/F relay	Yes
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	Yes
6	Is Restricted earth fault (REF) protection used a high impedance type	Yes
7	Are Main & back-up protection relays provided for Reactor are of numerical design.	Yes
8	Is Fire protection system (HVW type) provided for Reactor and functioning	Yes
9	a) Is the Disturbance recorder and Fault locator provided on all the Shunt Reactors used in 765 kV, 400 kV substations? b) Whether standalone or built in Main relay c) Whether DR is having automatic fault record download facility to a central PC	Yes BUILT IN No
10	Does the setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be blocked / Disabled)? Are all default settings validated or revised settings are given in the setting document?	Yes

D. Bus Bars

1	Bus Bar protection for 765, 400 & 220kV buses is provided	Yes
2	Duplicated Bus bar protection is provided for 765kV and 400kV buses	Yes
3	CBIP guideline for Protection (274 and 296) settings is followed	Yes
4	In an existing substation if CTs are of different ratios, is biased type bus protection provided.	N.A
5	In stations where single bus bar protection is provided, is backup provided by reverse looking elements of distance relays or by second zone elements of remote end distance relays?	N.A
6	In case of GIS where burn through time of SF6 is shorter than remote back up protection is the bus bar protection duplicated irrespective of voltage level?	N.A
7	Since it is difficult to get shutdowns to allow periodic testing of bus protection, numerical bus protections with self-supervision feature is an answer. Is this followed?	Yes
8	Does the setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be blocked / Disabled)? Are all default settings validated or revised settings are given in the setting document?	Yes

E. Disturbance Recorder (DR) and Event Logger (EL)

1	a) Is the Disturbance recorder and Fault locator provided on all line feeder of 765, 400 & 220kV substations? b) Whether standalone or built in Main relay c) Whether DR is having automatic fault record download facility to a central PC d) Whether Central PC for DR , EL are powered by Inverter (fed from station DC)	Yes Built In No Yes

2	Whether DR is having the following main signals for lines: <u>Analogue signals</u>: • From CT: IA, IB, IC, IN • From VT: VAN, VBN, VCN • From Aux. VT: V0 <u>Digital Signals</u> • Main 1 Carrier receive • Main 1 Trip • Line O/V Stage I / Stage II • Reactor Fault Trip • Stub Protection Operated. • Main II Trip • Main II Carrier Receive • Direct Trip CH I / II • CB I Status (PH-R, Y & B) • CB II Status (PH R, Y & B) • Busbar trip • Main / Tie CB LBB Operated • Main / Tie Auto-reclose operated. DR for Transformer / Reactor feeder should contain analog channel like input currents & voltage. Binary signal include all protection trip input, Main & Tie CB status, LBB trip	
3	Whether substation (765, 400 , 220kV) is having Event logger facility (standalone or built-in-SAS)	Yes (Built In Relay)
4	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	Yes

F. Circuit Breakers

1	Is breaker fail protection (LBB / BFR) provided for all the Circuit Breakers at 220kV , 400kV & 765kV rating	Yes
2	For Circuit Breaker connected to line feeder / transformer feeder, whether operation of LBB / BFR sends direct trip signal to trip remote end breaker ?	Yes

3	For lines employing single phase auto reclosing, Is start signal from protection trip to LBB / BFR relay is given on single phase basis?	Yes
4	Is separate relay provided for each breaker and the relay has to be connected from the secondary circuit of the CTs associated with that particular breaker?	Yes
5	Is LBB relay provided with separate DC circuit independent from Group-A and Group-B Protections?	No
6	Is the LBB initiation provided with initiating contact independent of CB trip relay contact?	Yes
7	Is Separation maintained between protective relay and CB trip coil DC circuit so that short circuit or blown fuse in the CB circuit will not prevent the protective relay from energizing the LBB scheme?	Yes
8	Is LBB relay initiated by Bus bar protection in addition to other fault sensing relays, since failure of CB to clear a bus fault would result in the loss of entire station if BFP relay is not initiated?	Yes
9	Is tripping logic of the bus bar protection scheme used for LBB protection also?	Yes
10	Are the special considerations provided to ensure proper scheme operation by using Circuit Breaker contact logic in addition to current detectors in cases breaker-fail relaying for low energy faults like buchholz operation?	Yes
11	Are the Current level detectors set as sensitive as the main protection? (Generally setting of 0.2 A is commonly practiced for lines and transformers)	Yes
12	Is timer set considering breaker interrupting time, current detector reset time and a margin? (Generally a timer setting of 200ms has been found to be adequate)	Yes
13	Is the back-up fault clearance time is shorter than the operating time of the remote protections (distance relay Zone-2)?	Yes
14	Is the breaker failure protection provided with two steps (First stage – retrip own CB, Second stage- Trip all associated CBs). This mitigates unwanted operation of breaker failure protection during maintenance and fault tracing.	Yes
15	Is the breaker failure protection hardware provided is separate from line /transformer feeder protection?	Yes

G. Communication Systems:

1	a) Do you use PLCC for tele-protection of distance relays at 765, 400 & 220kV feeders	PLCC & OPGW Both
	b) Specify type of coupling	Ph-Ph
	c) Whether redundant PLCC channels provided for 400 & 765kV lines	Yes
	d) Specify number of PLCC channels per circuit :	Two
	e) Whether dependability & security of each tele-protection channel measured & record kept ?	No

2	a) In case you use OPGW for tele-protection, are they on geographically diversified route for Main-I and Main-II relay? b) Whether dedicated fibre is being used for Main-I / Main-II relay or multiplexed channel are being used.	Yes

H. Station DC Supply Systems:

1	Do you have two separate independent DC system (220V or 110V) (Source-A and Source-B)	Yes 220 V
2	Do you have two independent DC system (48V) for PLCC (source-A and source-B)	Yes
3	There is no mixing of supplies from DC source-A and DC source-B	Yes
4	Whether the protection relays and trip circuits are segregated into two independent system fed through fuses from two different DC source	Yes
5	Whether Bay wise distribution of DC supply done in the following way: a) Protection b) CB functions c) Isolator / earth switch functions d) Annunciation / Indications e) Monitoring functions	Yes
6	Whether following has been ensured in the cabling: a) Separate cables are used for AC & DC circuits b) Separate cables are used for DC-I & DC-II circuits c) Separate cables are used for different cores of CT and CVT outputs to enhance reliability & security	Yes
7	Is guidelines prescribed in CBIP manual 274 & 296 followed in general	Yes

I. **Performance Indices:**

1	Is there a system of periodically measuring Dependability & Security of Protection system (as given in CBIP manual 296) and recorded	No
2	Is there a system of periodically measuring Dependability of switchgear associated with Protection system and recorded	No
3	Is there a process of Root cause analysis of unwanted tripping events	No
4	Are improvement action like revision of relay setting, better maintenance practices, modernising & retrofitting of switching & protection system taken based on above data.	Record on log book Maintained & implement based on same

		implemented
5	Is attention also given to DC supply system, tele-protection signalling, healthiness of tripping cables, terminations etc. in order to improve the performance of fault clearance system	No

G	Line Parameters										
Sr. No.	Name of line	Type of Conductor	Line parameters (In ohms /per km/per phase /primary value)							Relay Settings Enclose setting file	
			Line Length (km)	R1	X1	R0	X0	R0M	X0M	Adopted	Recommended
1	400 KV STPS NEW-BIKANER-1 Line	Twin Moose	142	0.0288	0.30768	0.16192	1.24	0	0	*Settings are as shown in rep	
2	400 KV STPS NEW-BIKANER-2 Line	Twin Moose	142	0.0288	0.30768	0.16192	1.24	0	0		

7

SHORT CIRCUIT STUDY & ANALYSIS

SHORT CIRCUIT STUDY AND ANALYSIS:

7.1 Introduction

This section of report describes the Objectives and Outcomes of Short circuit study and also discusses the methodology adopted by ERDA for Short circuit study and analysis. This includes as under:

- Objective of Short circuit study
- Outcomes of Short circuit study
- Glossary for Short circuit study
- Methodology for Short circuit study

7.2 Objective of Short circuit study

The basic aim of the short circuit study is to verify the duty of electrical devices under fault condition and also to establish the fault levels of system at various voltage levels for various operating philosophy of plant. Fault duties are in compliance with the latest editions of the IEC- 60909.

The ETAP Short-Circuit Analysis program analyzes the effect of 3-phase, line-to-ground, line-to- line, and line-to-line-to-ground faults on electrical distribution systems. The program calculates the total short circuit currents as well as the contributions of individual motors, generators, and utility ties in the system.

7.3 Glossary for Short circuit study

- **3-Phase Faults - Device Duty (IEC 60909)**

  This study calculates initial symmetrical RMS, peak, symmetrical and asymmetrical breaking RMS, and steady-state RMS short circuit currents and their DC offset at faulted buses. ETAP checks the protective device for rated making and breaking capacities against the fault currents and flags inadequacy in devices if any. Generators and motors are modeled by their positive sequence sub-transient reactance.

- **LG, LL, LLG, & 3-Phase Faults (IEC 60909) (Relay Co-ordination Duty)**

  This study performs line-to-ground, line-to-line, line-to-line-to-ground, and 3-phase fault studies as per IEC 60909 Standard. This study calculates initial symmetrical RMS, peak and symmetrical breaking RMS, and steady-state RMS short circuit currents at faulted buses. Generators are modeled by their positive, negative, and zero sequence reactance, and motors are modeled by their locked-rotor impedance. It is assumed that the negative sequence impedance of a machine is equal to its positive sequence impedance. Generator, motor, and transformer grounding types, and winding connections are taken into consideration when constructing system positive, negative, and zero sequence networks.

- **Synchronous Machine Direct-Axis Sub-transient Reactance (Xd”) Adjustment**

  The direct-axis sub-transient reactance (Xd”) for a synchronous generator will always be adjusted by the Xd” tolerance value entered in the Impedance/Model page of the machine editor. The Short-Circuit module reduces the Xd” value by the specified percent tolerance resulting in smaller impedance and consequently a higher fault current. For example, if the Xd” value is 10% and its tolerance is 5%, then the adjusted Xd” value used in the short circuit calculation is 9.5%.

- **Initial Symmetrical Short circuit current (I”k)**

  This is the RMS value of the AC symmetrical component of an available short circuit current applicable at the instant of Short circuit if the impedance remains at zero time value.

- **Peak Short Circuit Current (ip)**

  This is the maximum possible instantaneous value of the available Short circuit current.

- **Symmetrical Short Circuit Breaking Current (Ib)**

  This is the RMS value of an integral cycle of the symmetrical AC component of the available Short circuit current at the instant of contact separation of the first pole of a switching device.

- **Steady-State Short Circuit Current (Ik)**

  This is the RMS value of the short circuit current, which remains after the decay of the transient phenomena.

- **Sub-transient Reactance (Xd”) of a Synchronous Machine**

  This is the effective reactance at the moment of short circuit. For the calculation of Short circuit currents, the saturated value of (Xd”) is taken.

- **Minimum Time Delay (T_{min}) of a Circuit Breaker**

  This is the shortest time between the beginning of the short circuit current and the first contact separation of one pole of the switching device. The time delay (T_{min}) is the sum of the shortest possible operating time of an instantaneous relay and the shortest opening time of a circuit breaker.

Minimum time delay does not include the adjustable time delays of tripping devices.

- **Comparison of Device Rating and Short-Circuit Duty**

  In the 3-phase Device Duty calculation, ETAP compares the protective device rating against bus Short circuit current duty for the devices that are checked as complying with IEC Standard and also have device rating entered.

  In case the Short circuit duty is greater than the device duty, ETAP will flag the device as underrated in both one-line diagram and output reports.

7.4 METHODOLOGY FOR SHORT CIRCUIT STUDY:

7.4.1 ETAP Model

ETAP provides three options to specify pre-fault voltage in terms of "c" factor as under:

- Maximum
- User-Defined c Factor
- Minimum

When the Max option is selected, values for c factor as defined in IEC 60909 Standard are used to calculate maximum fault current which are as under:

< 1001 V **c** Factor = 1.10

1001 to 35000 V **c** Factor = 1.10

> 35000 V **c** Factor = 1.10

When the User-Defined c Factor option is selected, ETAP uses the user specified c factor. The ranges for the c factors are as follows:

< 1001 V **c** Factor = 0.95 -- 1.10

1001 to 35000 V **c** Factor = 1.00 -- 1.10

> 35000 V **c** Factor = 1.00 -- 1.10

When the Min. option is selected, values for c Factor, as defined in IEC 60909 Standard, are used to calculate minimum fault current which are as under:

< 1001 V **c** Factor = 0.95

1001 to 35000 V **c** Factor = 1.00

> 35000 V **c** Factor = 1.0

For evaluating device duty of equipments c factor has been selected as maximum and for relay-coordination duty c factor has been selected as minimum

CALCULATION OF SHORT CIRCUIT CURRENT CLOSE TO TRANSFORMER:

If the MCCB is used as a main switch, whether for a transfer or for a distribution breaker close to the transformer, a rough estimate of the short-circuit current can be made. The percentage impedance of the transformer Z can be obtained from the nameplate. The short circuit current can be calculated with the help of the following simple formula:

$$I_{SC} = I_n \times 100/Z$$

Where,

I_{SC} = short-circuit current (A)

I_n = rated current of the transformer (Full load current)

Z = percentage impedance of the transformer

The rated current of the transformer(Δ/Y) is calculated as follows:

$I_n = S \times 1000/ (\sqrt{3} \times U_e)$

S = rating of transformer in kVA

U_e = rated voltage at the low voltage side

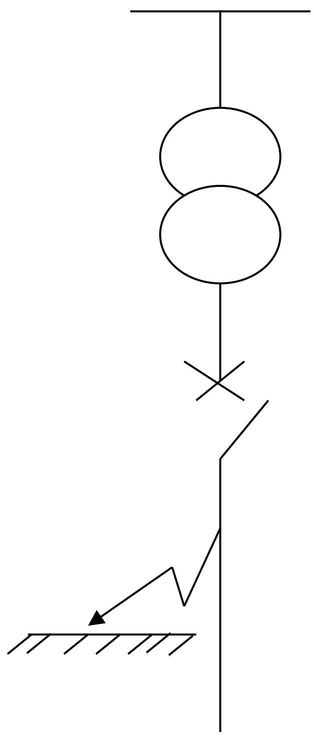
For example,

A transformer with S = 1000kVA, Z = 5% and U_e = 415 V

I_n = 1000 kVA × 1000/(√3 × 415 V) = 1393 A

I_{SC} = 1393 A × 100/5 = 27760 Amps

In this example, the short-circuit current for a fault close to the transformer is approximately 27 kA. The breaking capacity of the MCCB to be installed at this point should be higher than this value. This is applicable if a high breaking capacity MCCB with an ultimate short circuit breaking capacity Isc =35 kA or 50 kA is used here.



Source

It may be noted that a 100 kA fault at upstream side can be reduced to 5 kA levels at downstream.

Fault current at fault junction

In a supply system, if we move away from the source the impedance will be higher, resulting in lower the value for the short-circuit current. Each length of conductor or device in the circuit provides an impedance which reduces the short-circuit current. To calculate the maximum level of the short-circuit current, all the impedances between the transformer and the MCCB must be considered.

7.4.2 System parameters

Negative tolerance of Generator and Transformer parameters has been used for Short circuit study calculations.

- The voltage and frequency limits against which the study results are compared for satisfactory operation are taken as under:
- Switchgear is considered to be adequately rated for system faults if the maximum calculated fault level is less than 90% of the equipment rating. The 10% margin takes into account contribution from both sources & loads.

7.4.3 Short Circuit Study Configurations

ERDA has conducted Short circuit study under two separate headings viz. Device Duty and Relay Co-ordination. Whereas device duty report checks for the adequacy of ratings of switchgears, in relay co-ordination study ETAP gives minimum values of short circuit currents so that relay settings can be established.

- As suggested, Fault level of Grid is taken as per below:

Name of the Line	3-Phase (MVAsc)	1-Phase (MVAsc)
400kV Bikaner (1 & 2)	19494	12042

ETAP results of Short circuit study confirm the adequacy of system parameters and Equipment ratings for the reliable operation of the system.

7.5 Short Circuit Study Results:

This study has been conducted by using the suitable Power System simulation software. In this study, we can see the various faults e. g. a) 3 phase fault, b) Double Line to Ground fault, c) Double Line fault, d) Line to Ground fault have been imposed on the buses to check whether the breaker capacity is adequate to trip the bus or not.

In this study, each and every bus as formulated during the short circuit study has been covered. In case of higher current observed than the rating of the circuit breaker, the system show the overload and Protection Engineer required to increase the capacity of breaker post analysis of system.

7.6 ETAP crystal reports

Results observed from Short circuit study of the system have been summarized are as shown here under:

ETAP REPORT ALL FAULTS SUMMARY TABLE

FAULT LEVEL SUMMARY TABLE

ID	3Phase Fault (KA)	LG FAULT (kA)	LL FAULT (kA)	LLG FAULT (kA)
7CAT01 HT Bus	16.940	0.420	23.377	23.478
7CAT02 HT Bus	16.940	0.419	22.604	22.704
7DAT01 HT Bus	16.940	0.419	23.258	23.359
7DAT02 HT Bus	16.940	0.419	22.546	22.647
7DBT01 HT Bus	16.940	0.419	23.258	23.359
7DBT02 HT Bus	16.940	0.419	22.546	22.647
7DCT01 HT Bus	16.940	0.419	23.237	23.338
7DCT02 HT Bus	16.940	0.419	22.535	22.636
7DDT01 HT Bus	16.940	0.419	23.247	23.348
7DDT02 HT Bus	16.940	0.419	22.535	22.636
7DET01 HT Bus	16.940	0.419	23.247	23.348
7DET02 HT Bus	16.940	0.419	22.535	22.636
7DFT01 HT Bus	16.940	0.419	23.247	23.348
7DFT02 HT Bus	16.940	0.419	22.535	22.636
8CAT01 HT Bus	16.940	0.420	23.375	23.475
8CAT02 HT Bus	16.940	0.419	21.783	21.884
8DAT01 HT Bus	16.940	0.419	23.256	23.357
8DAT02 HT Bus	16.940	0.419	21.727	21.828
8DBT01 HT Bus	16.940	0.419	23.256	23.357
8DBT02 HT Bus	16.940	0.419	21.727	21.828
8DCT01 HT Bus	16.940	0.419	23.235	23.336
8DCT02 HT Bus	16.940	0.419	21.717	21.818
8DDT01 HT Bus	16.940	0.419	23.245	23.346
8DDT02 HT Bus	16.940	0.419	21.717	21.818
8DET01 HT Bus	16.940	0.419	23.245	23.346
8DET02 HT Bus	16.940	0.419	21.717	21.818
8DFT01 HT Bus	16.940	0.419	23.245	23.346
8DFT02 HT Bus	16.940	0.419	21.717	21.818
Bikaner S/s	28.311	17.705	24.661	25.576
BKL1R Bus	29.565	31.197	26.047	30.875
BKL2R Bus	29.565	31.196	26.046	30.874
Bus-1 CVT Bus	29.565	31.197	26.047	30.875
Bus-2 CVT Bus	29.565	31.196	26.046	30.874
Colony Load1 Bus	25.643	0.420	27.532	27.636
Colony Load2 Bus	25.643	0.420	26.603	26.707
CW-7A Bus	15.493	0.416	20.261	20.358
CW-7B Bus	15.511	0.416	20.298	20.395
CW-7C Bus	15.548	0.416	19.836	19.933
CW-7D Bus	15.586	0.416	19.906	20.003

ID	3Phase Fault (KA)	LG FAULT (kA)	LL FAULT (kA)	LLG FAULT (kA)
CW-8A Bus	15.341	0.416	19.959	20.056
CW-8B Bus	15.341	0.416	19.959	20.056
CW-8C Bus	15.323	0.416	18.828	18.925
FD-7A Bus	16.242	0.418	21.792	21.891
FD-7B Bus	15.736	0.417	20.190	20.288
FD-8A Bus	16.158	0.418	21.613	21.712
FD-8B Bus	15.717	0.417	19.517	19.615
GT-7 HT Bus	29.565	31.197	26.047	30.875
GT-8 Bus	29.565	31.196	26.046	30.874
IDF-7A Bus	15.868	0.417	21.126	21.224
IDF-7B Bus	15.586	0.416	20.030	20.127
IDF-8A Bus	15.815	0.417	21.020	21.118
IDF-8B Bus	15.548	0.416	19.343	19.441
MAIN BUS-I	29.565	31.197	26.047	30.875
MAIN BUS-II	29.565	31.196	26.046	30.874
MDBFP-7A Bus	26.351	0.420	28.518	28.622
MDBFP-8A Bus	25.447	0.420	29.471	29.575
OCAT01 HT Bus	25.643	0.420	29.303	29.408
OCAT02 HT Bus	25.643	0.420	30.239	30.343
OCBT01 HT Bus	25.643	0.420	27.578	27.682
OCBT02 HT Bus	25.643	0.420	26.647	26.752
OCCT01 HT Bus	25.643	0.420	27.554	27.658
OCCT02 HT Bus	25.643	0.420	26.624	26.728
OCDT01 HT Bus	25.643	0.420	27.697	27.801
OCDT02 HT Bus	25.643	0.420	26.762	26.866
ODAT01 HT Bus	25.643	0.420	27.563	27.667
ODAT02 HT Bus	25.643	0.420	26.633	26.737
ODBT01 HT Bus	25.643	0.420	27.563	27.667
ODBT02 HT Bus	25.643	0.420	26.633	26.737
ODCT01 HT Bus	25.643	0.420	27.550	27.654
ODCT02 HT Bus	25.643	0.420	26.620	26.724
ODDT01 HT Bus	25.643	0.420	27.534	27.638
ODDT02 HT Bus	25.643	0.420	26.604	26.709
ODET01 HT Bus	25.643	0.420	28.751	28.856
ODET02 HT Bus	25.643	0.420	29.669	29.773
PAF-7A Bus	15.944	0.417	21.205	21.304
PAF-7B Bus	15.773	0.417	20.297	20.395
PAF-8A Bus	16.054	0.417	21.429	21.528
PAF-8B Bus	16.112	0.418	20.250	20.349
SS-7C	26.465	0.421	29.963	30.068
SS-7D	26.465	0.421	28.662	28.767
SS-8C	26.465	0.421	30.967	31.071

ID	**3Phase Fault (KA)**	**LG FAULT (kA)**	**LL FAULT (kA)**	**LLG FAULT (kA)**
SS-8D	26.465	0.421	27.652	27.757
STPS	30.517	33.804	26.886	32.692
US-7A	17.290	0.420	24.045	24.147
US-7B	17.290	0.420	23.285	23.386
US-8A	17.290	0.420	24.043	24.144
US-8B	17.290	0.420	22.408	22.510

8 Relay Co-ordination Studies:

8.1 Protective Relaying Philosophy

In spite of all the precautions taken in the design and installation of such system (catering to various loads containing major components like Transformers, Cables etc.), there are bound to arise abnormal conditions or faults. For example short circuits may prove extremely damaging not only to the faulty components but to the neighboring components and to the power system as whole. It is of vital importance to limit the damage to a minimum by speedy isolation of the faulty section, without disturbing the healthy system.

8.1.1 REQUIREMENT OF PROTECTION SYSTEM:

Following important quality requirements are to be fulfilled by a good protective system:

1) RELIABILITY: Reliability is a qualitative term. Quantitatively it can be expressed as probability of failure. Failure is not confined to protective relay only but may also be due to breaker defects or unfaithful transformation of transducers or open circuit in control wiring. Therefore every component involved in protection must be regarded as a potential source of failure. Regular and thorough maintenance of protective equipment, quality of personnel operating the system and inherent design features and fabrication make the protective system reliable.

Reliability is the measure of the degree of certainty that the relay or relay system will perform correctly. Reliability denotes certainty of correct operation (dependability) together with assurance against incorrect operation from all extraneous cause (security).

2) SELECTIVITY: This is the property by which only the faulty element of the system is be isolated and the remaining healthy sections are left intact. Selectivity is absolute if the protection responds only to faults within its own zone and relative if it is obtained by grading the settings of the protection of several zones all of which may respond to a given fault. System of protection which, in principle, are absolutely selective are known as unit system. Systems in which selectivity is relative are known as non-unit systems. Differential protection is a unit protective system and current – time graded protection or distance protection are non-unit systems.

3) SPEED: It is obvious that faster the speed of operation of elements of protective system (relay & breaker), less is the damage to the equipment. As such, equipment are short time rated for high current and therefore there will be practically no damage to the equipment if the relays and breaker operate fast. The time setting of the relay has to be decided on the basis of this short time rating of the equipment to be protected.

4) DISCRIMINATION: Protective system should be able to discriminate between faults and load conditions even when the minimum fault current is less than the maximum load current. A relay should be able to distinguish between a fault and an overload. In the case of transformers; the inrush of magnetizing current may be comparable to the fault current. The relay should not operate for such inrush currents. In interconnected systems, there will be power swings, which should also be ignored by the distance relay protecting transmission lines.

5) SENSITIVITY: Sensitivity refers to the minimum level of fault current at which operation occurs. In other words, it is the fault setting and is usually expressed in operating quantity referred to the primary of transducer.

8.2 OVER CURRENT CO-ORDINATION

The co-ordination of protection system is very important to ensure that a fault is cleared with minimum disturbance to the system by isolating faulty portion quickly and safe guarding the integrity of the remaining system. This requires proper selectivity of the various relays located at different places in the system. In case of over current relaying system co-ordination; the operating times is provided through inverse time characteristics or definite time characteristics. The relay close to the fault has the lowest operating time and the one farthest from the fault has the largest operating time.

Reliability of power system operation mainly depends on the integrated performance of relays. The relays should operate for all faults in its own zone and also provide backup protection for faults in immediately adjoining system elements in the downstream, ensuring a minimum dislocation following a breakdown. The important features that protection scheme should possess reliability and selectivity. Protective system shall be ensured for reliability and selectivity.

In short (summary); the co-ordination study is carried out for:

(1) To determine characteristics, ratings & settings of overcurrent protective devices.

(2) To ensure that the minimum unfaulty load is interrupted when the protective device isolates a fault or overload anywhere in the system.

(3) The device and its settings selected should provide satisfactory protection against overloads on the equipment and interrupt short circuits as rapidly as possible.

(4) Minimize the equipment damage and process outage costs,

(5) To protect personnel from the effects of these failures

Protective relays plays an important role in the operation of power network. If they are correctly applied; they provide protection for both equipment & personnel together & ensure the best possible quality of electric power supply.

The detection & elimination of different faults require several types of protective relays.

Over current relays can be set in two manners. (1) Discrimination by time & (2) Discrimination by time & current. First category can be termed instantaneous overcurrent relay where relay operates on pre decided current & trip given by time. In second category; the timing of the tripping depends on how much higher the current is sensed by relay and timing will be taken accordingly. This is called Inverse over current relay.

PHASE INSTANTANEOUS OVERCURRENT (50P)

A high set instantaneous overcurrent intended to operate for close faults with high short circuit current. The setting applied is usually higher than the maximum short circuit current beyond the closest downstream device (breaker or fuse) and above the feeder inrush current.

PHASE INVERSE TIME OVERCURRENT (51P)

The settings of these elements must be coordinated with the downstream and upstream devices which should be above the feeder maximum load current and less than short circuit current.

TRANSFORMER PROTECTION:

The transformer is one of the most important links in a power system. Because of it's relatively simply construction, it is a highly reliable piece of equipment. Protection of such key elements in power system is very important. Being static, totally enclosed, it develops faults rarely but the consequences of even a rare fault may be serious unless the transformer is quickly disconnected from the system.

OVERLOAD PROTECTION FOR PHASE FAULTS [50, 51]

On the primary side of transformers, an overcurrent relay having a time-delayed low-set unit and an instantaneous high-set unit can be used. The low-set level is set to be selective ('graded') with the downstream protection, in order to provide back up and to eliminate internal faults of relatively low amplitude.

The use of an inverse-time relay is sometimes preferable under the following circumstances:

- The outgoing feeders on the transformer secondary side are protected by either ACB or another inverse time relay.
- The system operation gives the possibility of relatively high overloads of several seconds duration (for example motor re-accelerations).
- The magnetizing currents during transformer energization are of high amplitude and decrease slowly.

The high-set instantaneous unit is set slightly above the symmetrical three-phase short-circuit current on the secondary side (approximately + 20%) and also above the transformer inrush current. Set in this manner it remains insensitive to faults on the low-voltage side, ensuring that there is no possibility of a spurious instantaneous trip for a downstream fault.

However, this unit will operate very rapidly in the event of a heavy fault within the transformer, or a fault affecting the primary side feeder. Therefore use of a relay with a high-set instantaneous unit for transformer protection enables a considerable reduction in the operating times of upstream protection for heavy fault levels which are the most damaging. Due to this, it is also possible to reduce short-circuit withstand requirements for the transformer supply cables.

8.3 Existing & Recommended Protection Settings

Existing relay settings

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
US-7A IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.275			
US-7A IC Relay	2500:1	Neutral	OC1					0.080	200.00	0.5 s
7DAT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.320	11.400	1710.00	0.04 s
7DAT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DBT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.400	11.400	1710.00	0.04 s
7DBT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DCT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
7DCT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DDT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
7DDT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DET01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
7DET01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DFT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
7DFT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
PAF-7A Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	28.000	6.500	1625.00	0.04 s
PAF-7A Relay	50:1	Ground	OC1					0.390	19.50	0.1 s
IDF-7A Relay	300:1	Phase	OC1	Definite Time	1.500	450.000	30.400	6.500	1950.00	0.04 s
IDF-7A Relay	50:1	Ground	OC1					0.500	25.00	0.1 s
CW-7A Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	14.400	6.500	1300.00	0.04 s
CW-7A Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
CW-7B Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	14.400	6.500	1300.00	0.04 s
CW-7B Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
FD-7A Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	20.000	6.500	1300.00	0.04 s
FD-7A Relay	50:1	Ground	OC1					0.210	10.50	0.1 s
7CAT01 Relay	1000:1	Phase	OC1	IEC - Normal Inverse	1.000	1000.000	0.150	8.200	8200.00	0.04 s
7CAT01 Relay	50:1	Ground	OC1					0.400	20.00	0.2 s
US-7B IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.275			
US-7B IC Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
7DAT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.320	11.400	1710.00	0.04 s
7DAT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DBT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.400	11.400	1710.00	0.04 s
7DBT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
7DCT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
7DCT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DDT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
7DDT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DET02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
7DET02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
7DFT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
7DFT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
PAF-7B Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	28.000	6.500	1625.00	0.04 s
PAF-7B Relay	50:1	Ground	OC1					0.390	19.50	0.1 s
IDF-7B Relay	300:1	Phase	OC1	Definite Time	1.500	450.000	30.400	6.500	1950.00	0.04 s
IDF-7B Relay	50:1	Ground	OC1					0.500	25.00	0.1 s
CW-7C Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	14.400	6.500	1625.00	0.04 s
CW-7C Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
CW-7D Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	14.400	6.500	1625.00	0.04 s
CW-7D Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
FD-7B Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	20.000	6.500	1300.00	0.04 s
FD-7B Relay	50:1	Ground	OC1					0.210	10.50	0.1 s
7CAT02 Relay	1000:1	Phase	OC1	IEC - Normal Inverse	1.000	1000.000	0.150	8.200	8200.00	0.04 s
7CAT02 Relay	50:1	Ground	OC1					0.400	20.00	0.2 s
SS-7C IC Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.400			
SS-7C IC Relay	3500:1	Ground	OC1					0.080	280.00	0.9 s
OCAT01 Relay	2500:1	Phase	OC1	IEC - Normal Inverse	1.000	2500.000	0.330	9.100	22750.00	0.04 s
OCAT01 Relay	50:1	Ground	OC1					0.400	20.00	0.2 s
ODET01 Relay	75:1	Phase	OC1	IEC - Normal Inverse	1.000	75.000	0.210	11.400	855.00	0.04 s
ODET01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
SW SRV TRF1 Relay	50:1	Phase	OC1	IEC - Normal Inverse	1.000	50.000	0.270			
SW SRV TRF1 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
MDBFP-7A Relay1	250:1	Phase	OC1	Definite Time	1.500	375.000	20.800	6.500	1625.00	0.04 s
MDBFP-7A Relay1	50:1	Ground	OC1					2.090	104.50	0.1 s
MDBFP-7A Relay2	250:1	Phase	OC1	Definite Time	1.500	375.000	20.800	6.500	1625.00	0.04 s
MDBFP-7A Relay2	50:1	Ground	OC1					2.090	104.50	0.1 s
OCCT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.240	15.200	2280.00	0.04 s
OCCT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
OCDT01 Relay	800:1	Phase	OC1	IEC - Normal Inverse	1.000	800.000	0.300	10.700	8560.00	0.04 s
OCDT01 Relay	50:1	Ground	OC1					0.400	20.00	0.2 s
ODAT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.320	11.400	1710.00	0.04 s
ODAT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
Coln Fdr1 Relay	150:1	Phase	OC1	IEC - Extremely Inverse	0.100	15.000	0.050	4.000	600.00	0.04 s
Coln Fdr1 Relay	150:1	Neutral	OC1	IEC - Extremely Inverse	0.010	1.500	0.050	8.000	1200.00	0.1 s
Coln Fdr1 Relay	150:1	Ground	OC1	IEC - Extremely Inverse	0.005	0.750	0.050			
Coln Fdr1 Relay	150:1	Sensitive Ground	OC1	IEC - Extremely Inverse	0.010	1.500	0.050	8.000	1200.00	0.08 s
Coln Fdr1 Relay	150:1	Phase		Thermal Overload	0.500	75.000	2.000			
ODDT01 Relay	50:1	Phase	OC1	IEC - Normal Inverse	1.000	50.000	0.220	14.400	720.00	0.04 s
ODDT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
ODCT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.340	13.700	1370.00	0.04 s
ODCT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
ODBT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.390	11.400	1710.00	0.04 s
ODBT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
OCBT01 Relay	250:1	Phase	OC1	IEC - Normal Inverse	1.000	250.000	0.320	15.900	3975.00	0.04 s
OCBT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
OCAT02 Relay	2500:1	Phase	OC1	IEC - Normal Inverse	1.000	2500.000	0.330	9.100	22750.00	0.04 s
OCAT02 Relay	50:1	Ground	OC1					0.400	20.00	0.2 s
ODET02 Relay	75:1	Phase	OC1	IEC - Normal Inverse	1.000	75.000	0.210	11.400	855.00	0.04 s
ODET02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
SW SRV TRF2 Relay	50:1	Phase	OC1	IEC - Normal Inverse	1.000	50.000	0.270			
SW SRV TRF2 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
MDBFP-8A Relay1	250:1	Phase	OC1	Definite Time	1.500	375.000	20.800	6.500	1625.00	0.04 s
MDBFP-8A Relay1	50:1	Ground	OC1					2.090	104.50	0.1 s
MDBFP-8A Relay2	250:1	Phase	OC1	Definite Time	1.500	375.000	20.800	6.500	1625.00	0.04 s
MDBFP-8A Relay2	50:1	Ground	OC1					2.090	104.50	0.1 s
ODDT02 Relay	50:1	Phase	OC1	IEC - Normal Inverse	1.000	50.000	0.220	14.400	720.00	0.04 s
ODDT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
OCBT02 Relay	250:1	Phase	OC1	IEC - Normal Inverse	1.000	250.000	0.320	15.900	3975.00	0.04 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
OCBT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
Coln Fdr2 Relay	150:1	Phase	OC1	IEC - Extremely Inverse	0.100	15.000	0.050	4.000	600.00	0.04 s
Coln Fdr2 Relay	150:1	Neutral	OC1	IEC - Extremely Inverse	0.010	1.500	0.050	8.000	1200.00	0.1 s
Coln Fdr2 Relay	150:1	Ground	OC1	IEC - Extremely Inverse	0.005	0.750	0.050			
Coln Fdr2 Relay	150:1	Sensitive Ground	OC1	IEC - Extremely Inverse	0.010	1.500	0.050	8.000	1200.00	0.08 s
Coln Fdr2 Relay	150:1	Phase		Thermal Overload	0.500	75.000	2.000			
ODAT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.320	11.400	1710.00	0.04 s
ODAT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
ODCT02 Relay	800:1	Phase	OC1	IEC - Normal Inverse	1.000	800.000	0.340	13.700	10960.00	0.04 s
ODCT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
ODBT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.390	11.400	1710.00	0.04 s
ODBT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
OCCT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.240	15.200	2280.00	0.04 s
OCCT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
OCDT02 Relay	800:1	Phase	OC1	IEC - Normal Inverse	1.000	800.000	0.300	10.700	8560.00	0.04 s
OCDT02 Relay	50:1	Ground	OC1					0.400	20.00	0.2 s
SS-7D IC Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.350			
SS-7D IC Relay	3500:1	Ground	OC1					0.080	280.00	0.9 s
SS-8C IC Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.400			
SS-8C IC Relay	3500:1	Ground	OC1					0.080	280.00	0.9 s
SS-8D IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.350			
SS-8D IC Relay	2500:1	Ground	OC1					0.080	200.00	0.9 s
US-8A IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.275			
US-8A IC Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
8DAT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.320	11.400	1710.00	0.04 s
8DAT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DBT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.400	11.400	1710.00	0.04 s
8DBT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DCT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
8DCT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
8DDT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
8DDT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DET01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
8DET01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DFT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
8DFT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
PAF-8A Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	28.000	6.500	1625.00	0.04 s
PAF-8A Relay	50:1	Ground	OC1					0.390	19.50	0.1 s
IDF-8A Relay	300:1	Phase	OC1	Definite Time	1.500	450.000	30.400	6.500	1950.00	0.04 s
IDF-8A Relay	50:1	Ground	OC1					0.500	25.00	0.1 s
CW-8A Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	14.400	6.500	1625.00	0.04 s
CW-8A Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
CW-8B Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	14.400	6.500	1625.00	0.04 s
CW-8B Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
FD-8A Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	20.000	6.500	1300.00	0.04 s
FD-8A Relay	50:1	Ground	OC1					0.210	10.50	0.1 s
8CAT01 Relay	1000:1	Phase	OC1	IEC - Normal Inverse	1.000	1000.000	0.150	8.200	8200.00	0.04 s
8CAT01 Relay	50:1	Ground	OC1					0.400	20.00	0.2 s
US-8B IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.275			
US-8B IC Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
FD-8B Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	20.000	6.500	1625.00	0.04 s
FD-8B Relay	50:1	Ground	OC1					0.210	10.50	0.1 s
8CAT02 Relay	1000:1	Phase	OC1	IEC - Normal Inverse	1.000	1000.000	0.150	8.200	8200.00	0.04 s
8CAT02 Relay	50:1	Ground	OC1					0.400	20.00	0.2 s
PAF-8B Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	28.000	6.500	1625.00	0.04 s
PAF-8B Relay	50:1	Ground	OC1					0.390	19.50	0.1 s
IDF-8B Relay	300:1	Phase	OC1	Definite Time	1.500	450.000	30.400	6.500	1950.00	0.04 s
IDF-8B Relay	50:1	Ground	OC1					0.500	25.00	0.1 s
CW-8C Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	14.400	6.500	1300.00	0.04 s
CW-8C Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
8DDT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
8DDT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DET02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
8DET02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
8DFT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
8DFT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DAT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.320	11.400	1710.00	0.04 s
8DAT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DBT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.400	11.400	1710.00	0.04 s
8DBT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DCT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.350	13.700	1370.00	0.04 s
8DCT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
US7A SS8C Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
US7A SS8C Tie Relay	2500:1	Neutral	OC1					0.080	200.00	0.5 s
US8A SS7C Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
US8A SS7C Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
US7B SS8D Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
US7B SS8D Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
US8B SS7D Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
US8B SS7D Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS7C SS8C Tie Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.325			
SS7C SS8C Tie Relay	3500:1	Ground	OC1					0.080	280.00	0.7 s
SS7C US8A Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
SS7C US8A Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS8C US7A Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
SS8C US7A Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS8C SS7C Tie Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.325			
SS8C SS7C Tie Relay	3500:1	Ground	OC1					0.080	280.00	0.7 s
SS7D US8B Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
SS7D US8B Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS8D US7B Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
SS8D US7B Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS7D SS8D Tie Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.300			
SS7D SS8D Tie Relay	3500:1	Ground	OC1					0.080	280.00	0.7 s
SS8D SS7D Tie Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.300			
SS8D SS7D Tie Relay	3500:1	Ground	OC1					0.080	280.00	0.7 s
ST-7 LT-1 Relay	3500:1	Phase	OC1	IEC - Inverse	2.000	7000.000	0.500	1.500	5250.00	1.5 s
ST-7 LT-1 Relay	3500:1	Phase	OC2					5.000	17500.00	0.1 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
ST-7 LT-1 Relay	200:1	Ground	OC1					0.550	110.00	1.2 s
ST-7 LT-2 Relay	3500:1	Phase	OC1	IEC - Inverse	2.000	7000.000	0.500	1.500	5250.00	1.5 s
ST-7 LT-2 Relay	3500:1	Phase	OC2					5.000	17500.00	0.1 s
ST-7 LT-2 Relay	200:1	Ground	OC1					0.550	110.00	1.2 s
ST-8 LT-1 Relay	3500:1	Phase	OC1	IEC - Inverse	2.000	7000.000	0.500	1.500	5250.00	1.5 s
ST-8 LT-1 Relay	3500:1	Phase	OC2					5.000	17500.00	0.1 s
ST-8 LT-1 Relay	3500:1	Neutral	OC1					0.550	1925.00	1.2 s
ST-8 LT-2 Relay	3500:1	Phase	OC1	IEC - Inverse	2.000	7000.000	0.500	1.500	5250.00	1.5 s
ST-8 LT-2 Relay	3500:1	Phase	OC2					5.000	17500.00	0.1 s
ST-8 LT-2 Relay	200:1	Ground	OC1					0.550	110.00	1.2 s
UT-7A LT Relay	2500:1	Phase	OC1	IEC - Inverse	4.000	10000.000	0.500	1.500	3750.00	1.5 s
UT-7A LT Relay	2500:1	Phase	OC2					10.000	25000.00	0.1 s
UT-7A LT Relay	200:1	Ground	OC1	IEC - Inverse	4.000	800.000	0.500	0.550	110.00	1.5 s
UT-7A LT Relay	200:1	Ground	OC2					0.550	110.00	1.2 s
UT-7B LT Relay	2500:1	Phase	OC1	IEC - Inverse	4.000	10000.000	0.500	1.500	3750.00	1.5 s
UT-7B LT Relay	2500:1	Phase	OC2					10.000	25000.00	0.1 s
UT-7B LT Relay	200:1	Ground	OC1	IEC - Inverse	4.000	800.000	0.500	0.550	110.00	1.5 s
UT-7B LT Relay	200:1	Ground	OC2					0.550	110.00	1.2 s
UT-8B LT Relay	2500:1	Phase	OC1	IEC - Inverse	4.000	10000.000	0.500	1.500	3750.00	1.5 s
UT-8B LT Relay	2500:1	Phase	OC2					10.000	25000.00	0.1 s
UT-8B LT Relay	200:1	Ground	OC1	IEC - Inverse	4.000	800.000	0.500	0.550	110.00	1.5 s
UT-8B LT Relay	200:1	Ground	OC2					0.550	110.00	1.2 s
UT-8A LT Relay	2500:1	Phase	OC1	IEC - Inverse	4.000	10000.000	0.500	1.500	3750.00	1.5 s
UT-8A LT Relay	2500:1	Phase	OC2					10.000	25000.00	0.1 s
UT-8A LT Relay	200:1	Ground	OC1	IEC - Inverse	4.000	800.000	0.500	0.550	110.00	1.5 s
UT-8A LT Relay	200:1	Ground	OC2					0.550	110.00	1.2 s

Recommended Settings

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
US-7A IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.375			
US-7A IC Relay	2500:1	Neutral	OC1					0.100	250.00	0.4 s
7DAT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
7DAT01 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
7DAT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.300	15.000	0.100	2.000	100.00	0.2 s
7DBT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
7DBT01 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
7DBT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.300	15.000	0.100	2.000	100.00	0.2 s
7DCT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
7DCT01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
7DCT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
7DDT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
7DDT01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
7DDT01 Relay	100:1	Neutral	OC2					8.000	800.00	0.1 s
7DDT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
7DDT01 Relay	50:1	Sensitive Ground	OC2					8.000	400.00	0.08 s
7DET01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
7DET01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
7DET01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
7DFT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
7DFT01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
7DFT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
PAF-7A Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	28.000	6.500	1625.00	0.04 s
PAF-7A Relay	50:1	Ground	OC1					0.390	19.50	0.1 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
IDF-7A Relay	300:1	Phase	OC1	Definite Time	1.500	450.000	30.400	6.500	1950.00	0.04 s
IDF-7A Relay	50:1	Ground	OC1					0.500	25.00	0.1 s
CW-7A Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	14.400	6.500	1300.00	0.04 s
CW-7A Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
CW-7B Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	14.400	6.500	1300.00	0.04 s
CW-7B Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
FD-7A Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	20.000	6.500	1300.00	0.04 s
FD-7A Relay	50:1	Ground	OC1					0.210	10.50	0.1 s
7CAT01 Relay	1000:1	Phase	OC1	IEC - Normal Inverse	1.000	1000.000	0.220	4.800	4800.00	0.25 s
7CAT01 Relay	1000:1	Phase	OC2					8.200	8200.00	0.04 s
7CAT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	2.000	100.000	0.100	4.000	200.00	0.2 s
US-7B IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.350			
US-7B IC Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
7DAT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
7DAT02 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
7DAT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.300	15.000	0.100	2.000	100.00	0.2 s
7DBT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
7DBT02 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
7DBT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.300	15.000	0.100	2.000	100.00	0.2 s
7DCT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
7DCT02 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
7DCT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
7DDT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
7DDT02 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
7DDT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
7DET02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
7DET02 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
7DET02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
7DFT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
7DFT02 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
7DFT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
PAF-7B Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	28.000	6.500	1625.00	0.04 s
PAF-7B Relay	50:1	Ground	OC1					0.390	19.50	0.1 s
IDF-7B Relay	300:1	Phase	OC1	Definite Time	1.500	450.000	30.400	6.500	1950.00	0.04 s
IDF-7B Relay	50:1	Ground	OC1					0.500	25.00	0.1 s
CW-7C Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	14.400	6.500	1625.00	0.04 s
CW-7C Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
CW-7D Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	14.400	6.500	1625.00	0.04 s
CW-7D Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
FD-7B Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	20.000	6.500	1300.00	0.04 s
FD-7B Relay	50:1	Ground	OC1					0.210	10.50	0.1 s
7CAT02 Relay	1000:1	Phase	OC1	IEC - Normal Inverse	1.000	1000.000	0.220	4.800	4800.00	0.25 s
7CAT02 Relay	1000:1	Phase	OC2					8.200	8200.00	0.04 s
7CAT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	2.000	100.000	0.100	4.000	200.00	0.2 s
SS-7C IC Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.400			
SS-7C IC Relay	3500:1	Ground	OC1					0.080	280.00	0.9 s
OCAT01 Relay	2500:1	Phase	OC1	IEC - Normal Inverse	1.000	2500.000	0.330	4.200	10500.00	0.25 s
OCAT01 Relay	2500:1	Phase	OC2					9.100	22750.00	0.04 s
OCAT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	2.000	100.000	0.200	5.500	275.00	0.2 s
ODET01 Relay	75:1	Phase	OC1	IEC - Normal Inverse	1.000	75.000	0.210	4.000	300.00	0.25 s
ODET01 Relay	75:1	Phase	OC2					8.000	600.00	0.04 s
ODET01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.200	10.000	0.100	0.800	40.00	0.2 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
SW SRV TRF1 Relay	50:1	Phase	OC1	IEC - Normal Inverse	1.000	50.000	0.270			
SW SRV TRF1 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
MDBFP-7A Relay1	250:1	Phase	OC1	Definite Time	1.500	375.000	20.800	6.500	1625.00	0.04 s
MDBFP-7A Relay1	50:1	Ground	OC1					2.090	104.50	0.1 s
MDBFP-7A Relay2	250:1	Phase	OC1	Definite Time	1.500	375.000	20.800	6.500	1625.00	0.04 s
MDBFP-7A Relay2	50:1	Ground	OC1					2.090	104.50	0.1 s
OCCT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.240	4.200	630.00	0.25 s
OCCT01 Relay	150:1	Phase	OC2					9.000	1350.00	0.04 s
OCCT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	1.600	80.00	0.2 s
OCDT01 Relay	800:1	Phase	OC1	IEC - Normal Inverse	1.000	800.000	0.300	4.500	3600.00	0.25 s
OCDT01 Relay	800:1	Phase	OC2					10.700	8560.00	0.04 s
OCDT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	1.000	50.000	0.100	4.000	200.00	0.2 s
ODAT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
ODAT01 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
ODAT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.300	15.000	0.100	2.000	100.00	0.2 s
Coln Fdr1 Relay	150:1	Phase	OC1	IEC - Extremely Inverse	0.100	15.000	0.050	4.000	600.00	0.04 s
Coln Fdr1 Relay	150:1	Neutral	OC1	IEC - Extremely Inverse	0.010	1.500	0.050	8.000	1200.00	0.1 s
Coln Fdr1 Relay	150:1	Ground	OC1	IEC - Extremely Inverse	0.005	0.750	0.050			
Coln Fdr1 Relay	150:1	Sensitive Ground	OC1	IEC - Extremely Inverse	0.010	1.500	0.050	8.000	1200.00	0.08 s
Coln Fdr1 Relay	150:1	Phase		Thermal Overload	0.500	75.000	2.000			

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
ODDT01 Relay	50:1	Phase	OC1	IEC - Normal Inverse	0.800	40.000	0.220	4.000	200.00	0.25 s
ODDT01 Relay	50:1	Phase	OC2					14.400	720.00	0.04 s
ODDT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.140	7.000	0.100	0.600	30.00	0.2 s
ODCT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
ODCT01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
ODCT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
ODBT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
ODBT01 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
ODBT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.300	15.000	0.100	2.000	100.00	0.2 s
OCBT01 Relay	250:1	Phase	OC1	IEC - Normal Inverse	1.000	250.000	0.320	4.500	1125.00	0.25 s
OCBT01 Relay	250:1	Phase	OC2					15.900	3975.00	0.04 s
OCBT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.600	30.000	0.100	3.000	150.00	0.2 s
OCAT02 Relay	2500:1	Phase	OC1	IEC - Normal Inverse	1.000	2500.000	0.330	4.200	10500.00	0.25 s
OCAT02 Relay	2500:1	Phase	OC2					9.100	22750.00	0.04 s
OCAT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	2.000	100.000	0.200	5.500	275.00	0.2 s
ODET02 Relay	75:1	Phase	OC1	IEC - Normal Inverse	1.000	75.000	0.210	4.000	300.00	0.25 s
ODET02 Relay	75:1	Phase	OC2					8.000	600.00	0.04 s
ODET02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.200	10.000	0.100	0.800	40.00	0.2 s
SW SRV TRF2 Relay	50:1	Phase	OC1	IEC - Normal Inverse	1.000	50.000	0.270			
SW SRV TRF2 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
MDBFP-8A Relay1	250:1	Phase	OC1	Definite Time	1.500	375.000	20.800	6.500	1625.00	0.04 s
MDBFP-8A Relay1	50:1	Ground	OC1					2.090	104.50	0.1 s
MDBFP-8A Relay2	250:1	Phase	OC1	Definite Time	1.500	375.000	20.800	6.500	1625.00	0.04 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
MDBFP-8A Relay2	50:1	Ground	OC1					2.090	104.50	0.1 s
ODDT02 Relay	50:1	Phase	OC1	IEC - Normal Inverse	1.000	50.000	0.220	4.000	200.00	0.25 s
ODDT02 Relay	50:1	Phase	OC2					14.400	720.00	0.04 s
ODDT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.140	7.000	0.100	0.600	30.00	0.2 s
OCBT02 Relay	250:1	Phase	OC1	IEC - Normal Inverse	1.000	250.000	0.320	4.500	1125.00	0.25 s
OCBT02 Relay	250:1	Phase	OC2					15.900	3975.00	0.04 s
OCBT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.600	30.000	0.100	3.000	150.00	0.2 s
Coln Fdr2 Relay	150:1	Phase	OC1	IEC - Extremely Inverse	0.100	15.000	0.050	4.000	600.00	0.04 s
Coln Fdr2 Relay	150:1	Neutral	OC1	IEC - Extremely Inverse	0.010	1.500	0.050	8.000	1200.00	0.1 s
Coln Fdr2 Relay	150:1	Ground	OC1	IEC - Extremely Inverse	0.005	0.750	0.050			
Coln Fdr2 Relay	150:1	Sensitive Ground	OC1	IEC - Extremely Inverse	0.010	1.500	0.050	8.000	1200.00	0.08 s
Coln Fdr2 Relay	150:1	Phase		Thermal Overload	0.500	75.000	2.000			
ODAT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
ODAT02 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
ODAT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.300	15.000	0.100	2.000	100.00	0.2 s
ODCT02 Relay	800:1	Phase	OC1	IEC - Normal Inverse	1.000	800.000	0.300	5.100	4080.00	0.25 s
ODCT02 Relay	800:1	Phase	OC2					13.700	10960.00	0.04 s
ODCT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
ODBT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
ODBT02 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
ODBT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.300	15.000	0.100	2.000	100.00	0.2 s
OCCT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.240	4.200	630.00	0.25 s
OCCT02 Relay	150:1	Phase	OC2					15.200	2280.00	0.04 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
OCCT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	1.600	80.00	0.2 s
OCDT02 Relay	800:1	Phase	OC1	IEC - Normal Inverse	1.000	800.000	0.300	4.500	3600.00	0.25 s
OCDT02 Relay	800:1	Phase	OC2					10.700	8560.00	0.04 s
OCDT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	1.000	50.000	0.200	4.000	200.00	0.2 s
SS-7D IC Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.375			
SS-7D IC Relay	3500:1	Ground	OC1					0.080	280.00	0.9 s
SS-8C IC Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.400			
SS-8C IC Relay	3500:1	Ground	OC1					0.080	280.00	0.9 s
SS-8D IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.375			
SS-8D IC Relay	2500:1	Ground	OC1					0.080	200.00	0.9 s
US-8A IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.375			
US-8A IC Relay	2500:1	Ground	OC1					0.100	250.00	0.4 s
8DAT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.100	765.00	0.25 s
8DAT01 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
8DAT01 Relay	150:1	Neutral	OC2					8.000	1200.00	0.1 s
8DAT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DAT01 Relay	50:1	Sensitive Ground	OC2					8.000	400.00	0.08 s
8DBT01 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
8DBT01 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s
8DBT01 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DCT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
8DCT01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
8DCT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
8DDT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
8DDT01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
8DDT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
8DET01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
8DET01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
8DET01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
8DFT01 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
8DFT01 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
8DFT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
PAF-8A Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	28.000	6.500	1625.00	0.04 s
PAF-8A Relay	50:1	Ground	OC1					0.390	19.50	0.1 s
IDF-8A Relay	300:1	Phase	OC1	Definite Time	1.500	450.000	30.400	6.500	1950.00	0.04 s
IDF-8A Relay	50:1	Ground	OC1					0.500	25.00	0.1 s
CW-8A Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	14.400	6.500	1625.00	0.04 s
CW-8A Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
CW-8B Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	14.400	6.500	1625.00	0.04 s
CW-8B Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
FD-8A Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	20.000	6.500	1300.00	0.04 s
FD-8A Relay	50:1	Ground	OC1					0.210	10.50	0.1 s
8CAT01 Relay	1000:1	Phase	OC1	IEC - Normal Inverse	1.000	1000.000	0.220	4.800	4800.00	0.25 s
8CAT01 Relay	1000:1	Phase	OC2					8.200	8200.00	0.04 s
8CAT01 Relay	50:1	Ground	OC1	IEC - Normal Inverse	2.000	100.000	0.100	4.000	200.00	0.2 s
US-8B IC Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.350			
US-8B IC Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
FD-8B Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	20.000	6.500	1625.00	0.04 s
FD-8B Relay	50:1	Ground	OC1					0.210	10.50	0.1 s
8CAT02 Relay	1000:1	Phase	OC1	IEC - Normal Inverse	0.910	910.000	0.150	4.800	4800.00	0.25 s
8CAT02 Relay	1000:1	Phase	OC2					8.200	8200.00	0.04 s

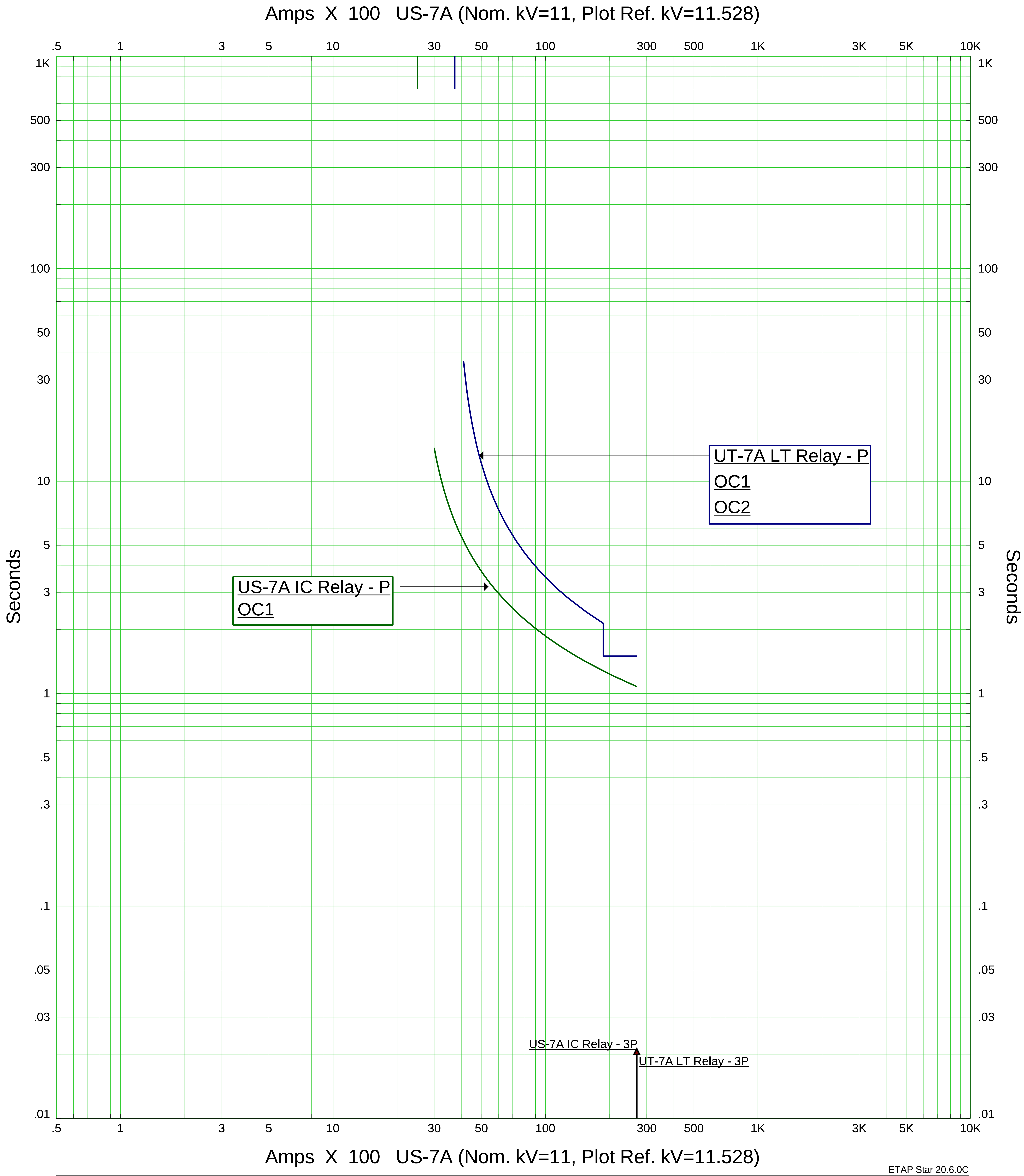
Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
8CAT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	2.000	100.000	0.100	4.000	200.00	0.2 s
PAF-8B Relay	250:1	Phase	OC1	Definite Time	1.500	375.000	28.000	6.500	1625.00	0.04 s
PAF-8B Relay	50:1	Ground	OC1					0.390	19.50	0.1 s
IDF-8B Relay	300:1	Phase	OC1	Definite Time	1.500	450.000	30.400	6.500	1950.00	0.04 s
IDF-8B Relay	50:1	Ground	OC1					0.500	25.00	0.1 s
CW-8C Relay	200:1	Phase	OC1	Definite Time	1.500	300.000	14.400	6.500	1300.00	0.04 s
CW-8C Relay	50:1	Ground	OC1					0.340	17.00	0.1 s
8DDT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
8DDT02 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
8DDT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
8DET02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
8DET02 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
8DET02 Relay	100:1	Neutral	OC2					8.000	800.00	0.1 s
8DET02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
8DET02 Relay	50:1	Sensitive Ground	OC2					8.000	400.00	0.08 s
8DFT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
8DFT02 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
8DFT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
8DAT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
8DAT02 Relay	150:1	Phase	OC2					4.000	600.00	0.04 s
8DAT02 Relay	150:1	Neutral	OC2					8.000	1200.00	0.1 s
8DAT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DAT02 Relay	50:1	Sensitive Ground	OC2					8.000	400.00	0.08 s
8DBT02 Relay	150:1	Phase	OC1	IEC - Normal Inverse	1.000	150.000	0.300	5.400	810.00	0.25 s
8DBT02 Relay	150:1	Phase	OC2					11.400	1710.00	0.04 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
8DBT02 Relay	150:1	Neutral	OC2					8.000	1200.00	0.1 s
8DBT02 Relay	50:1	Ground	OC1					0.200	10.00	0.2 s
8DBT02 Relay	50:1	Sensitive Ground	OC2					8.000	400.00	0.08 s
8DCT02 Relay	100:1	Phase	OC1	IEC - Normal Inverse	1.000	100.000	0.300	5.100	510.00	0.25 s
8DCT02 Relay	100:1	Phase	OC2					13.700	1370.00	0.04 s
8DCT02 Relay	50:1	Ground	OC1	IEC - Normal Inverse	0.400	20.000	0.100	2.400	120.00	0.2 s
US7A SS8C Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
US7A SS8C Tie Relay	2500:1	Neutral	OC1					0.100	250.00	0.4 s
US8A SS7C Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
US8A SS7C Tie Relay	2500:1	Neutral	OC1					0.100	250.00	0.4 s
US7B SS8D Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
US7B SS8D Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
US8B SS7D Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
US8B SS7D Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS7C SS8C Tie Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.325			
SS7C SS8C Tie Relay	3500:1	Ground	OC1					0.080	280.00	0.7 s
SS7C US8A Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
SS7C US8A Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s

Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
SS8C US7A Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
SS8C US7A Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS8C SS7C Tie Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.325			
SS8C SS7C Tie Relay	3500:1	Ground	OC1					0.080	280.00	0.7 s
SS7D US8B Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
SS7D US8B Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS8D US7B Tie Relay	2500:1	Phase	OC1	IEC - Standard Inverse	1.000	2500.000	0.325			
SS8D US7B Tie Relay	2500:1	Ground	OC1					0.080	200.00	0.5 s
SS7D SS8D Tie Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.300			
SS7D SS8D Tie Relay	3500:1	Ground	OC1					0.080	280.00	0.7 s
SS8D SS7D Tie Relay	3500:1	Phase	OC1	IEC - Standard Inverse	1.000	3500.000	0.300			
SS8D SS7D Tie Relay	3500:1	Ground	OC1					0.080	280.00	0.7 s
ST-7 LT-1 Relay	3500:1	Phase	OC1	IEC - Inverse	2.000	7000.000	0.500	5.000	17500.00	2 s
ST-7 LT-1 Relay	3500:1	Phase	OC2					10.500	36750.00	0.1 s
ST-7 LT-1 Relay	200:1	Ground	OC1					1.500	300.00	1.2 s
ST-7 LT-2 Relay	3500:1	Phase	OC1	IEC - Inverse	2.000	7000.000	0.500	5.000	17500.00	2 s
ST-7 LT-2 Relay	3500:1	Phase	OC2					10.500	36750.00	0.1 s
ST-7 LT-2 Relay	3500:1	Ground	OC1					1.500	5250.00	1.2 s
ST-8 LT-1 Relay	3500:1	Phase	OC1	IEC - Inverse	2.000	7000.000	0.500	5.000	17500.00	2 s

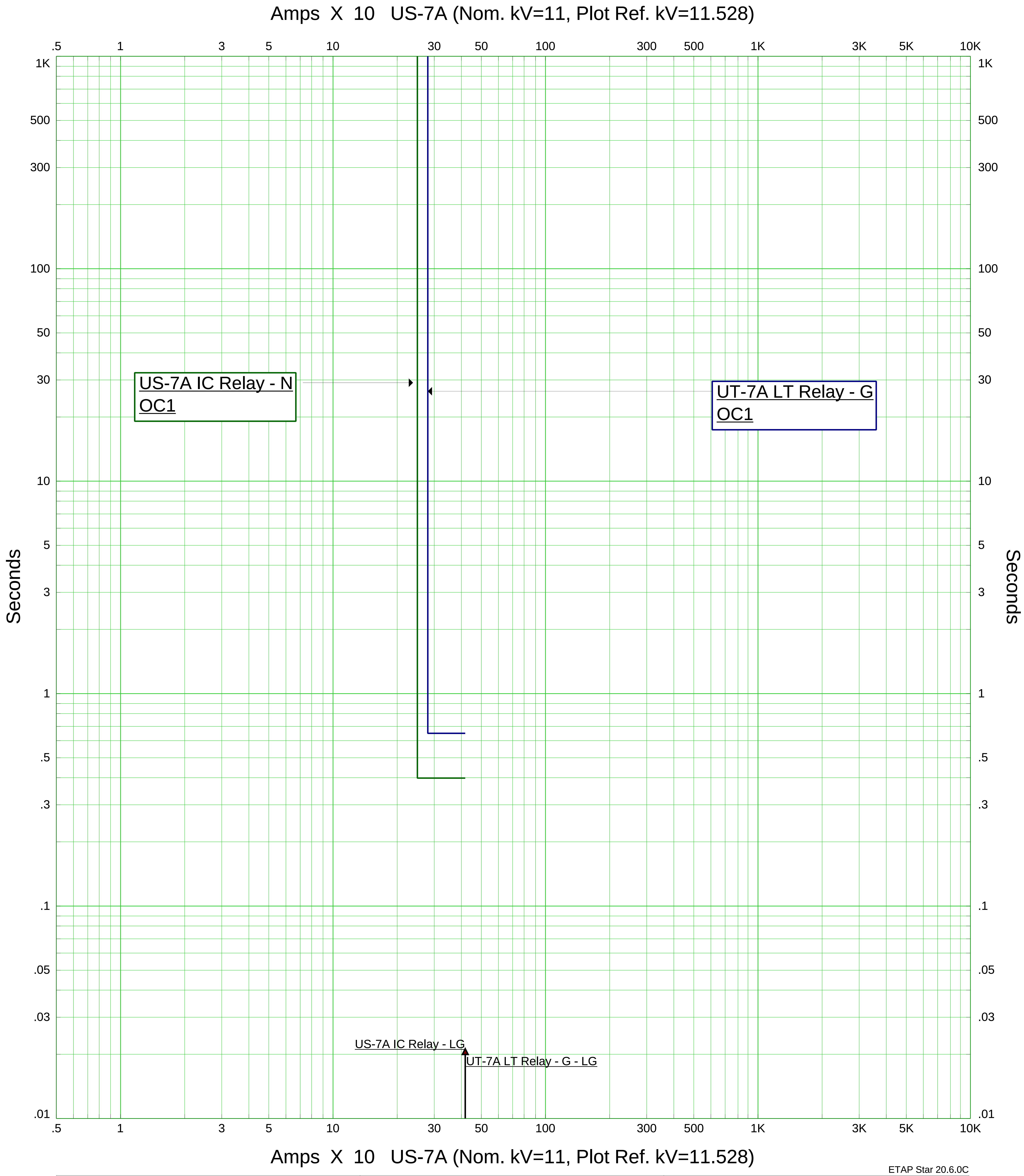
Relay ID	CT Ratio	Trip Element	Level	Curve	Tap (Pickup)		Time Dial / Mult.	Instantaneous		Inst. Delay
					Setting	Primary	Setting	Settings	Primary	Setting
ST-8 LT-1 Relay	3500:1	Phase	OC2					10.500	36750.00	0.1 s
ST-8 LT-1 Relay	200:1	Ground	OC1					1.500	300.00	1.2 s
ST-8 LT-2 Relay	3500:1	Phase	OC1	IEC - Inverse	2.000	7000.000	0.500	5.000	17500.00	2 s
ST-8 LT-2 Relay	3500:1	Phase	OC2					10.500	36750.00	0.1 s
ST-8 LT-2 Relay	3500:1	Ground	OC1					1.500	5250.00	1.2 s
UT-7A LT Relay	2500:1	Phase	OC1	IEC - Inverse	1.500	3750.000	0.500	7.500	18750.00	1.5 s
UT-7A LT Relay	2500:1	Phase	OC2					12.000	30000.00	0.1 s
UT-7A LT Relay	200:1	Ground	OC1					1.400	280.00	0.65 s
UT-7B LT Relay	2500:1	Phase	OC1	IEC - Inverse	1.500	3750.000	0.500	7.500	18750.00	1.5 s
UT-7B LT Relay	2500:1	Phase	OC2					12.000	30000.00	0.1 s
UT-7B LT Relay	200:1	Ground	OC1					1.400	280.00	0.65 s
UT-8B LT Relay	2500:1	Phase	OC1	IEC - Inverse	1.500	3750.000	0.500	7.500	18750.00	1.5 s
UT-8B LT Relay	2500:1	Phase	OC2					12.000	30000.00	0.1 s
UT-8B LT Relay	200:1	Ground	OC1					1.400	280.00	0.65 s
UT-8A LT Relay	2500:1	Phase	OC1	IEC - Inverse	1.500	3750.000	0.500	7.500	18750.00	1.5 s
UT-8A LT Relay	2500:1	Phase	OC2					12.000	30000.00	0.1 s
UT-8A LT Relay	200:1	Ground	OC1					1.400	280.00	0.65 s

8.4
TCC curves with respect to recommended settings



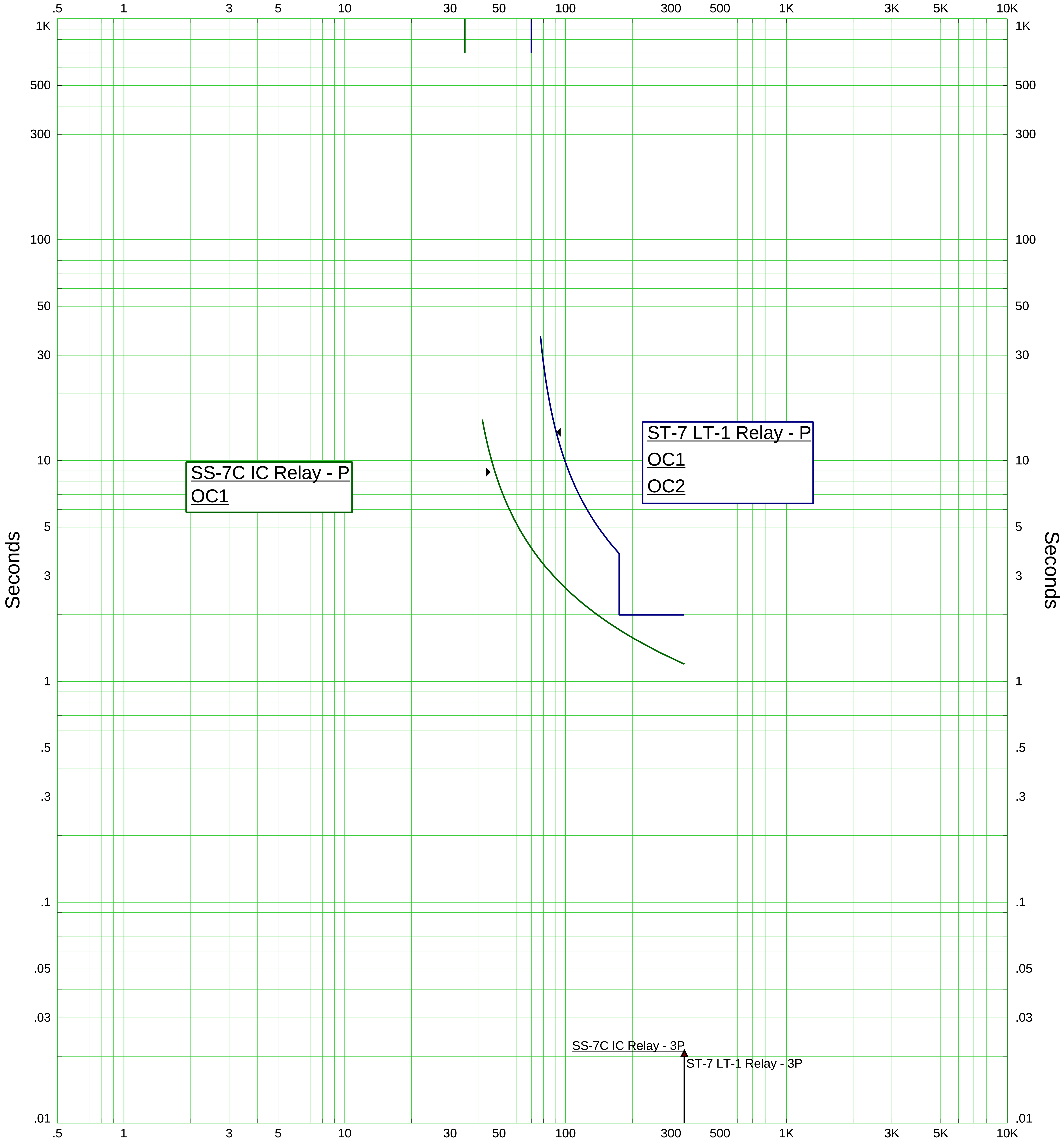
ETAP Star 20.6.0C

ERDA	**UT-7 LT TCC**	SSCTPS
		Rev: Base - RC1 Fault: Phase



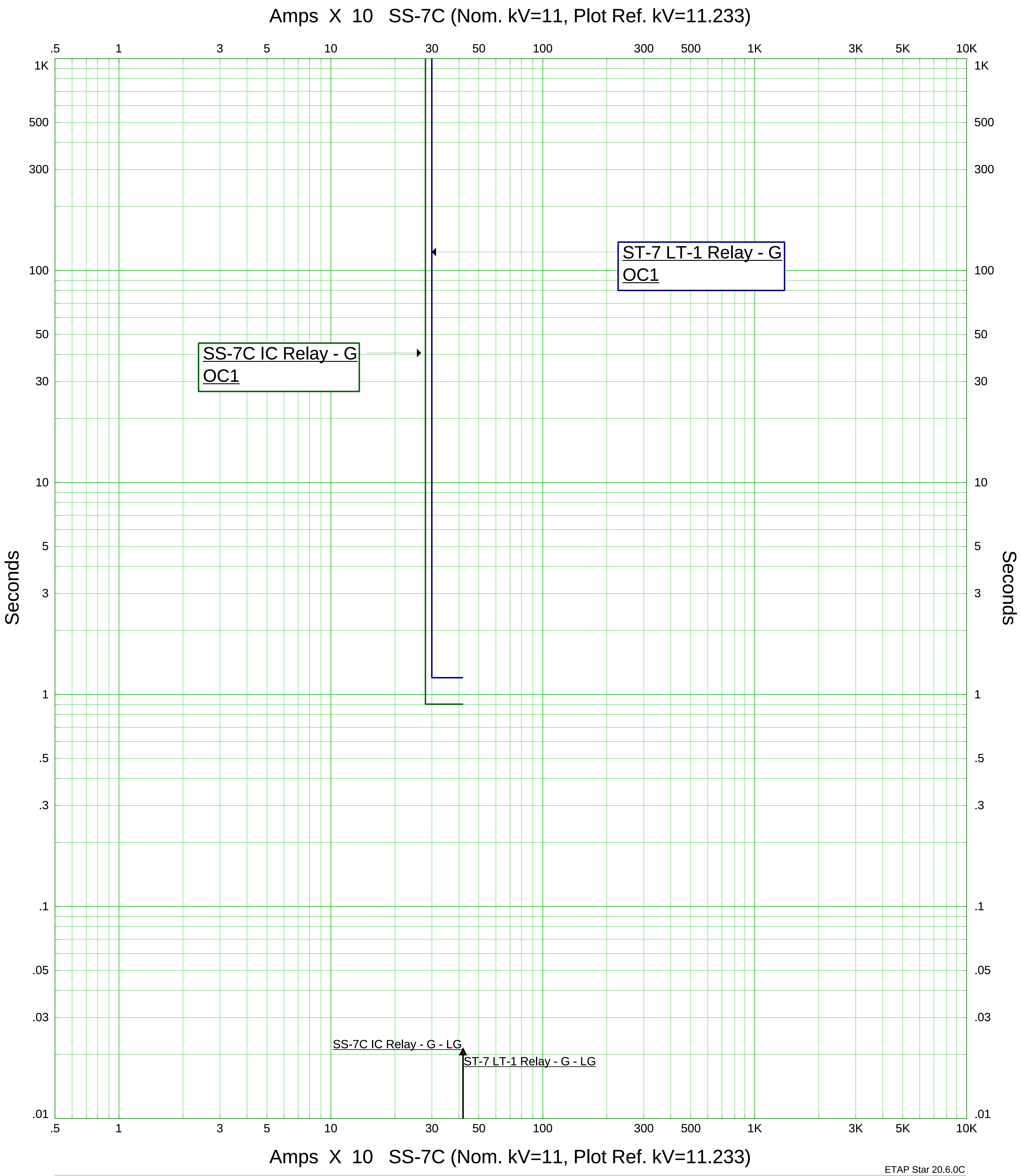
ETAP Star 20.6.0C

ERDA	**UT-7 LT TCC**	SSCTPS
		Rev: Base - RC1 Fault: Ground



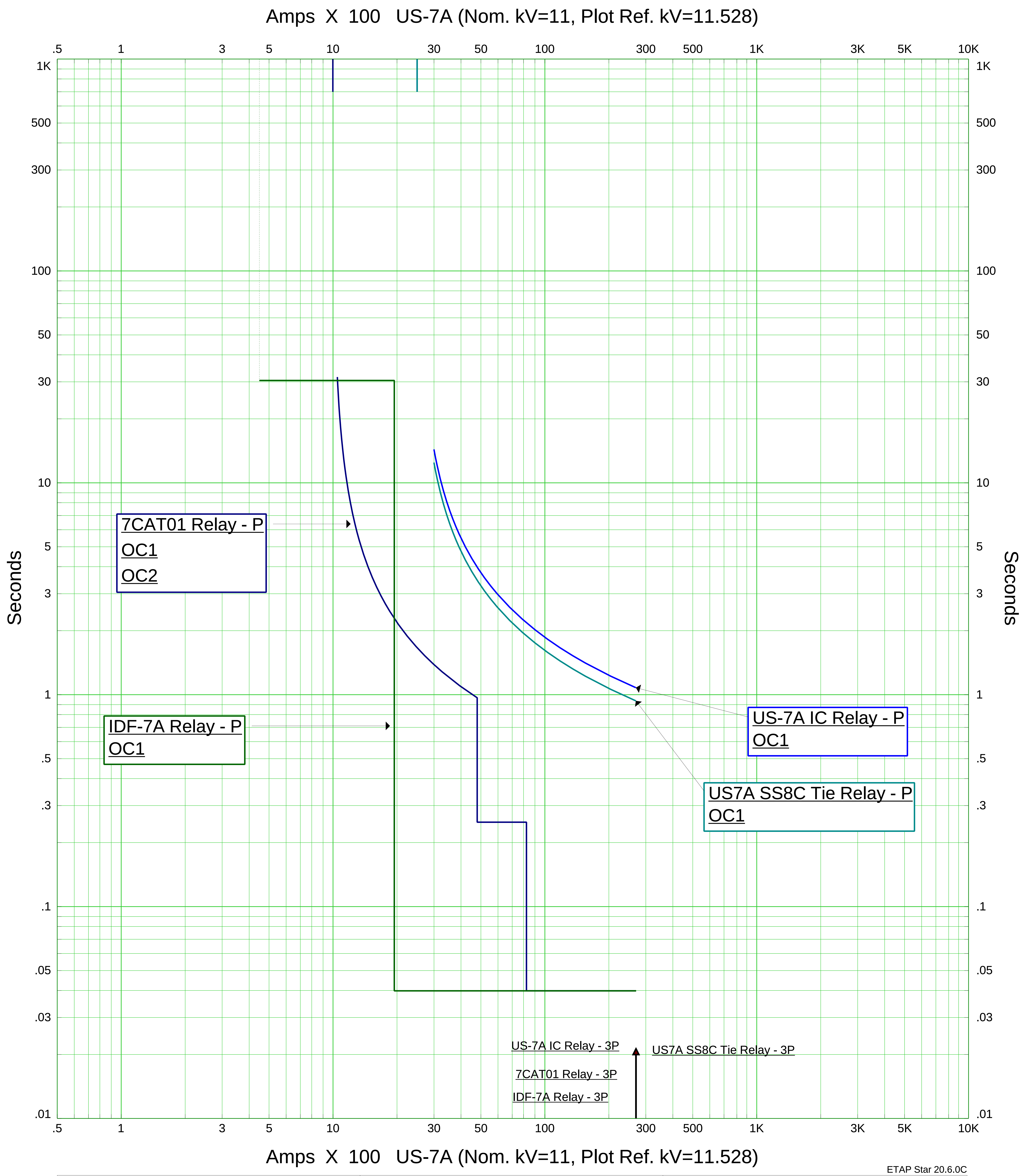
ETAP Star 20.6.0C

SSCTPS	**ST-7 LT-1 TCC**	ERDA
		Rev: Base - RC1 Fault: Phase



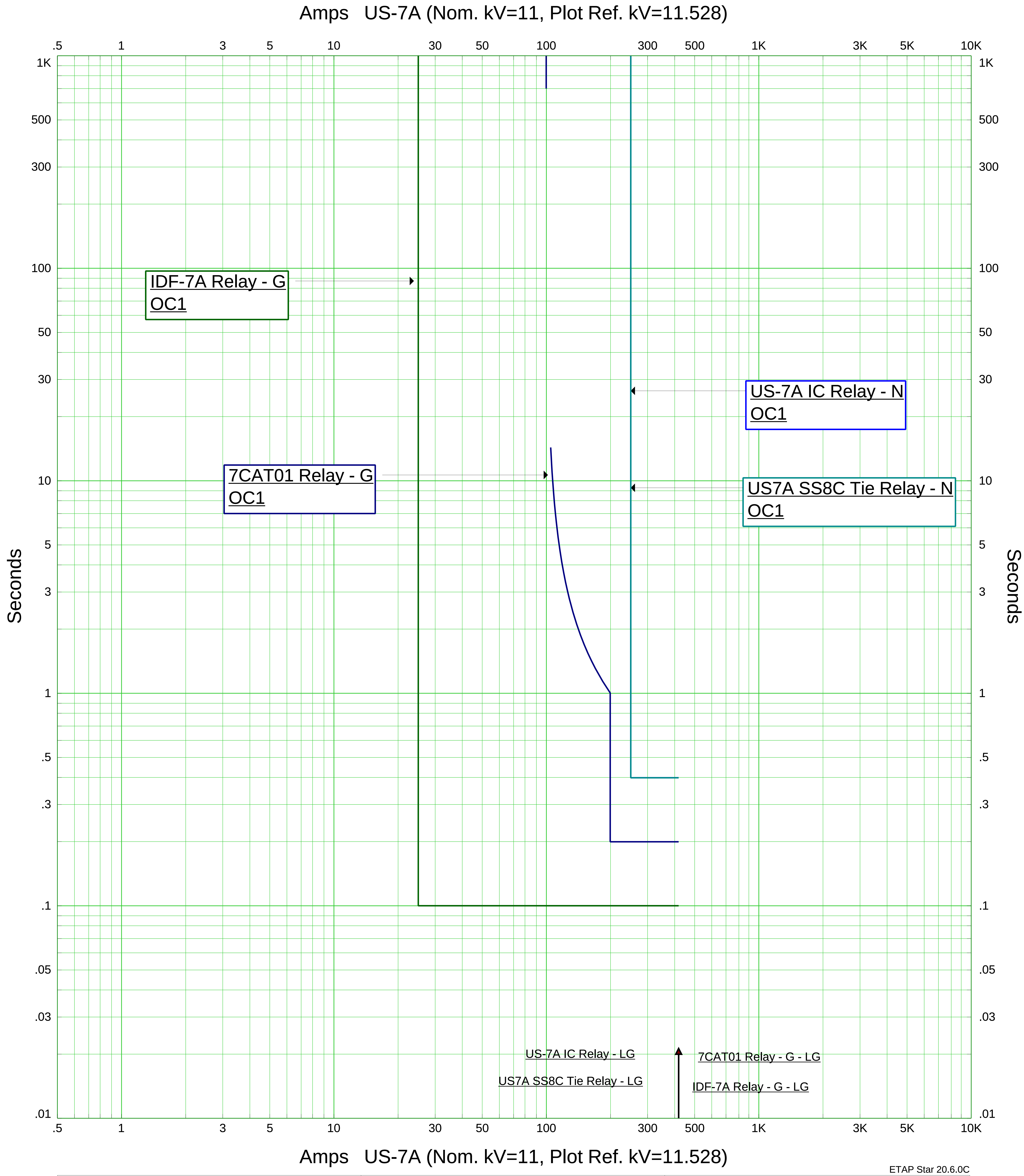
ETAP Star 20.6.0C

SSCTPS	**ST-7 LT-1 TCC**	ERDA
		Rev: Base - RC1 Fault: Ground



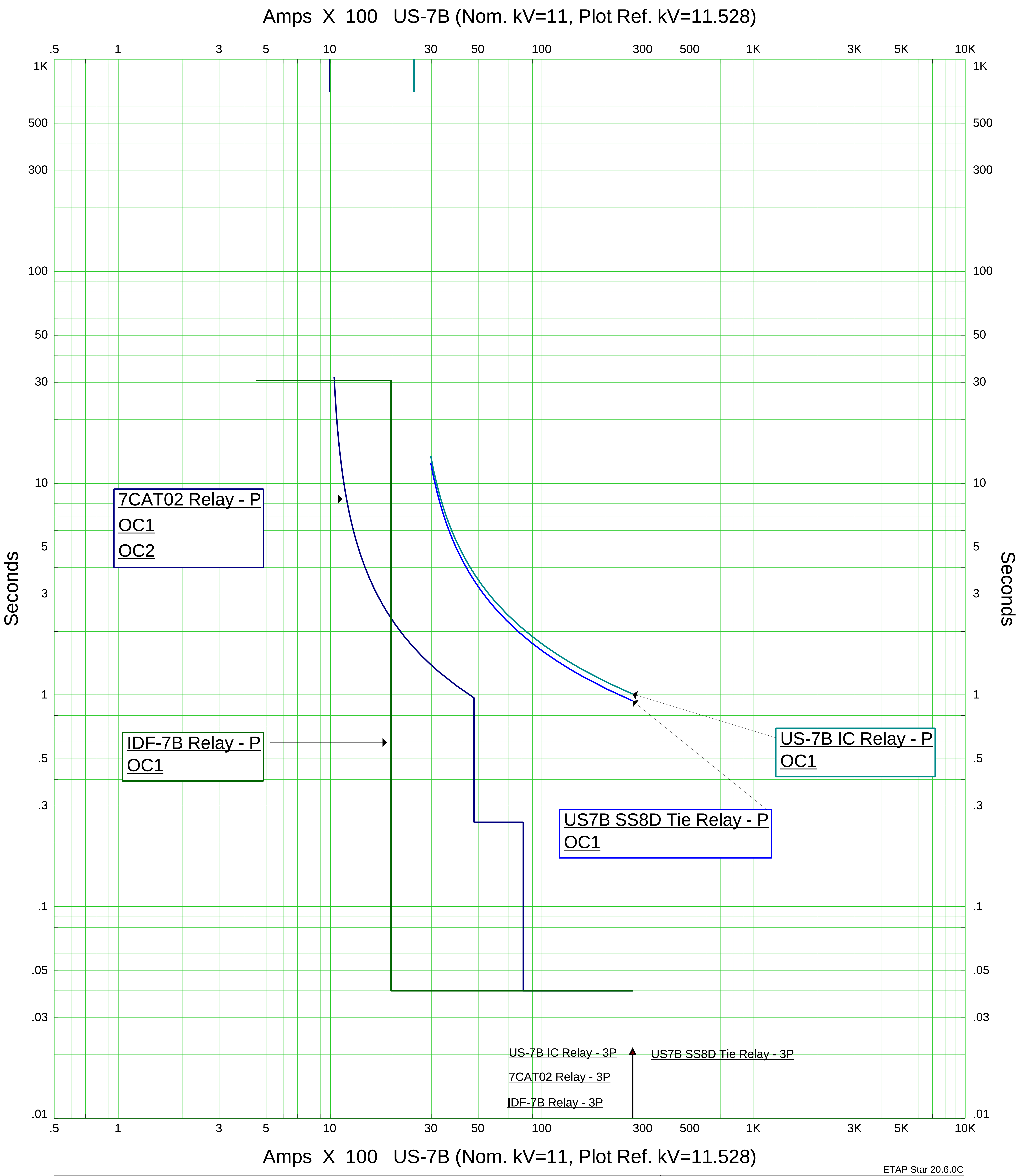
ETAP Star 20.6.0C

SSCTPS	**US-7A Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Phase

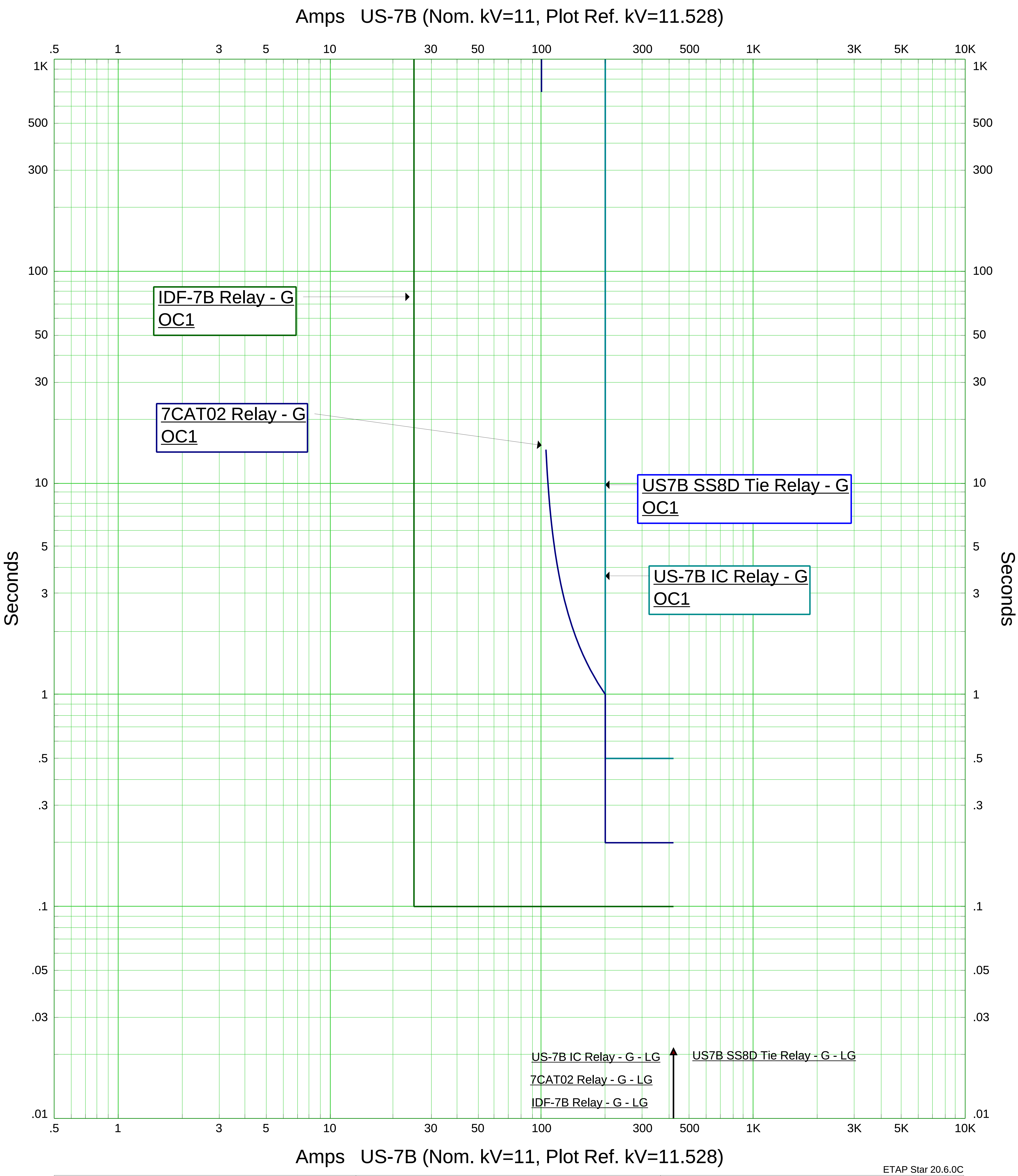


ETAP Star 20.6.0C

SSCTPS	**US-7A Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Ground

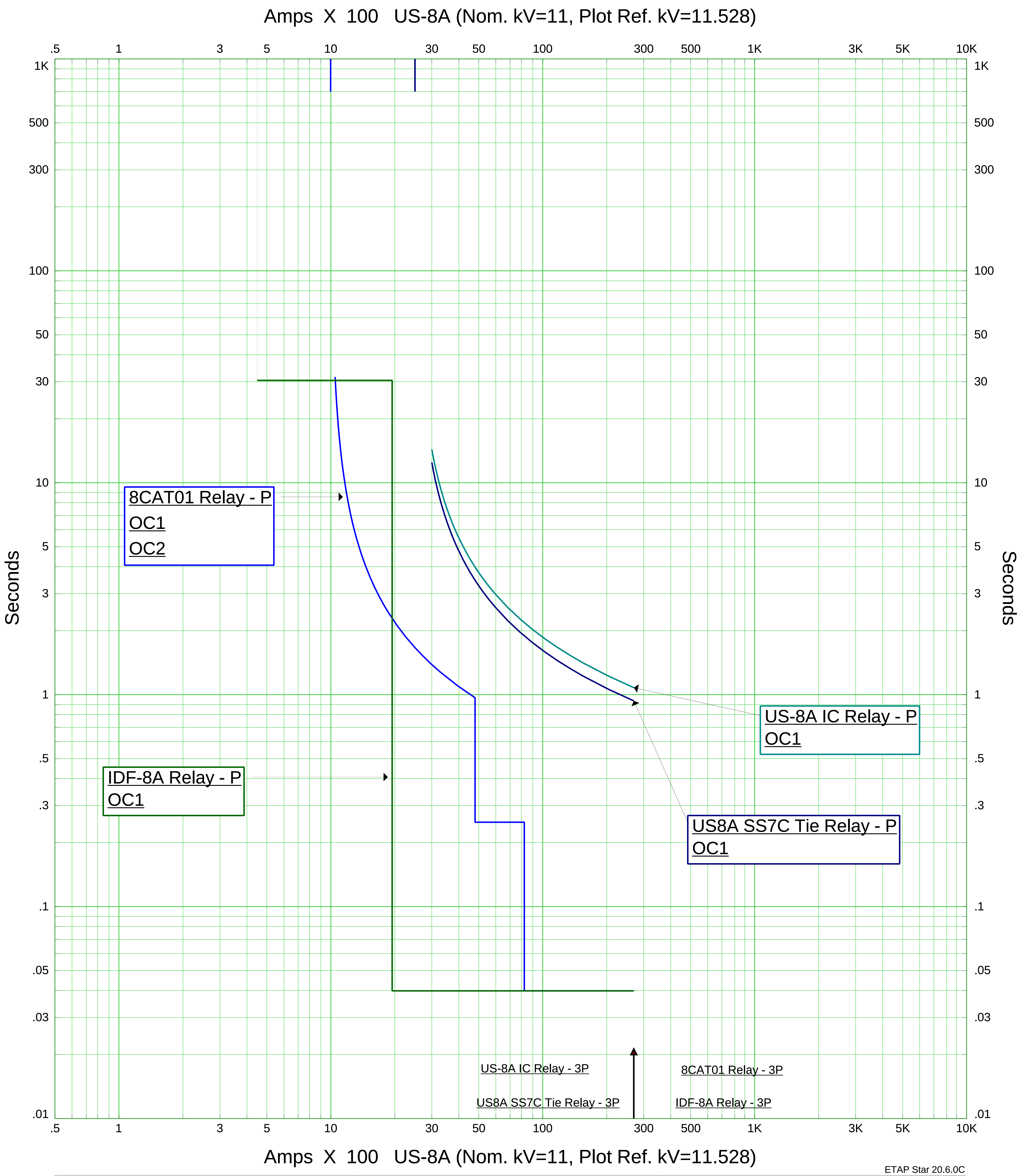


SSCTPS	**US-7B Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Phase



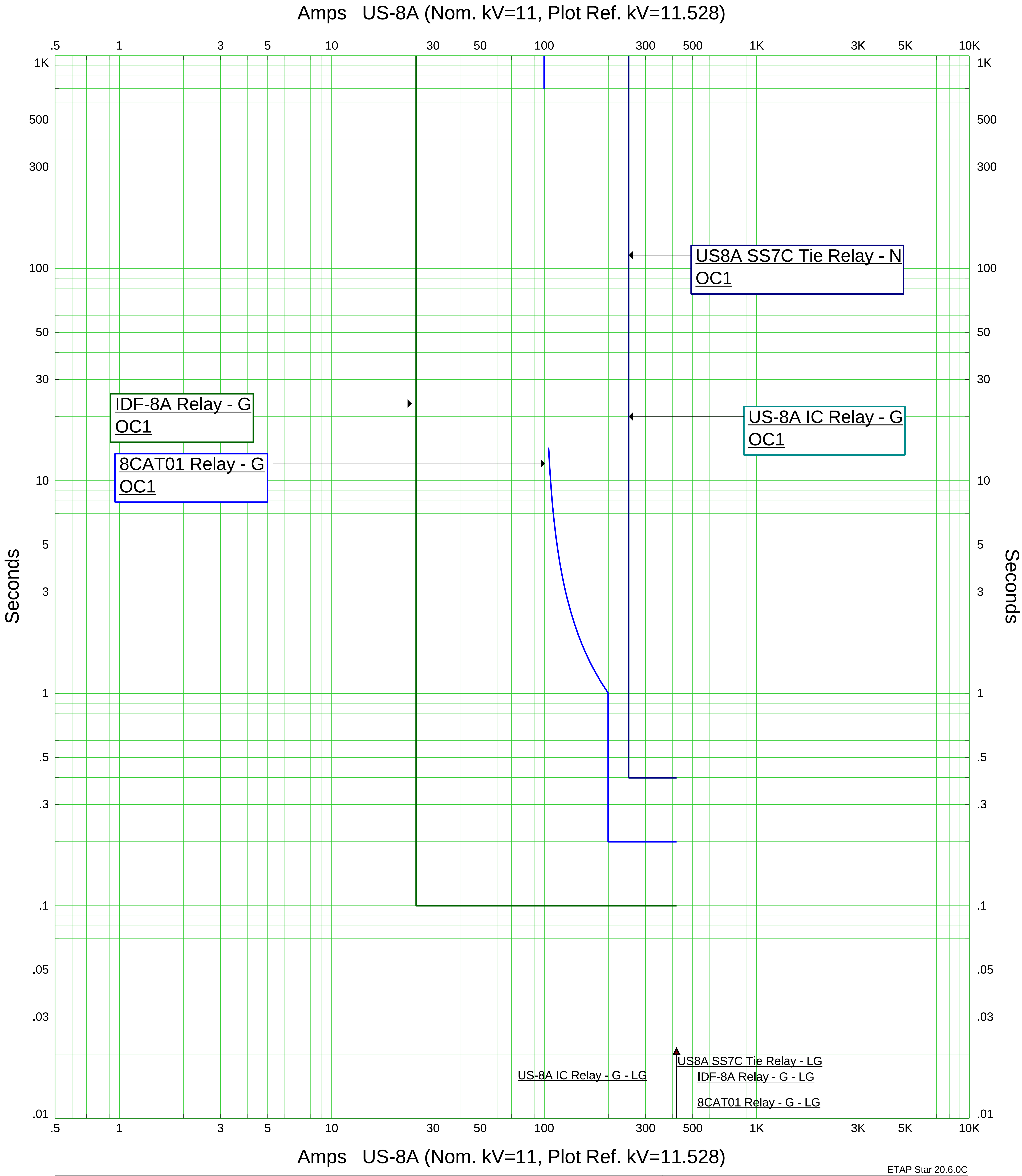
ETAP Star 20.6.0C

SSCTPS	**US-7B Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Ground



ETAP Star 20.6.0C

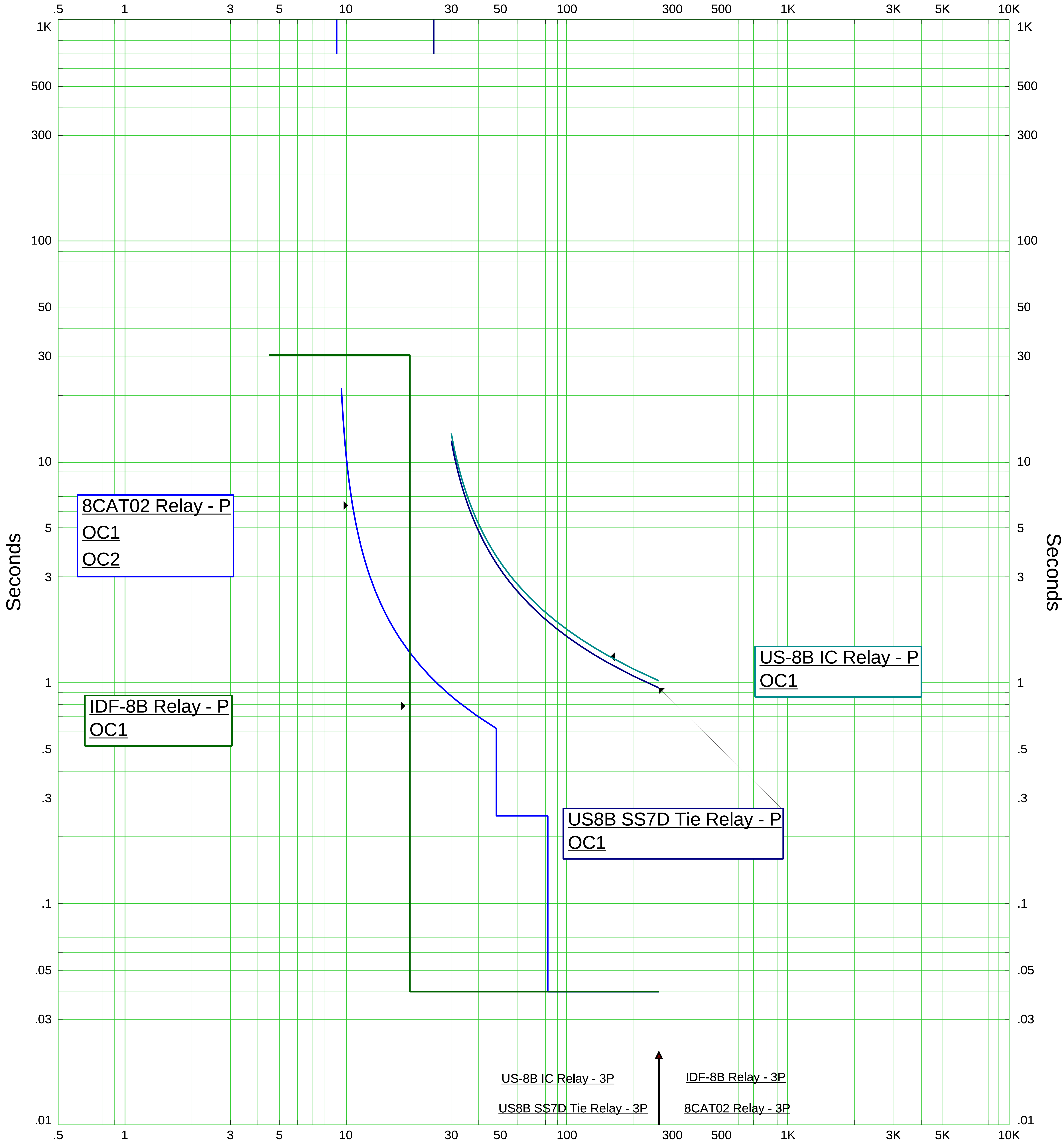
SSCTPS	**US-8A Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Phase



ETAP Star 20.6.0C

SSCTPS	**US-8A Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Ground

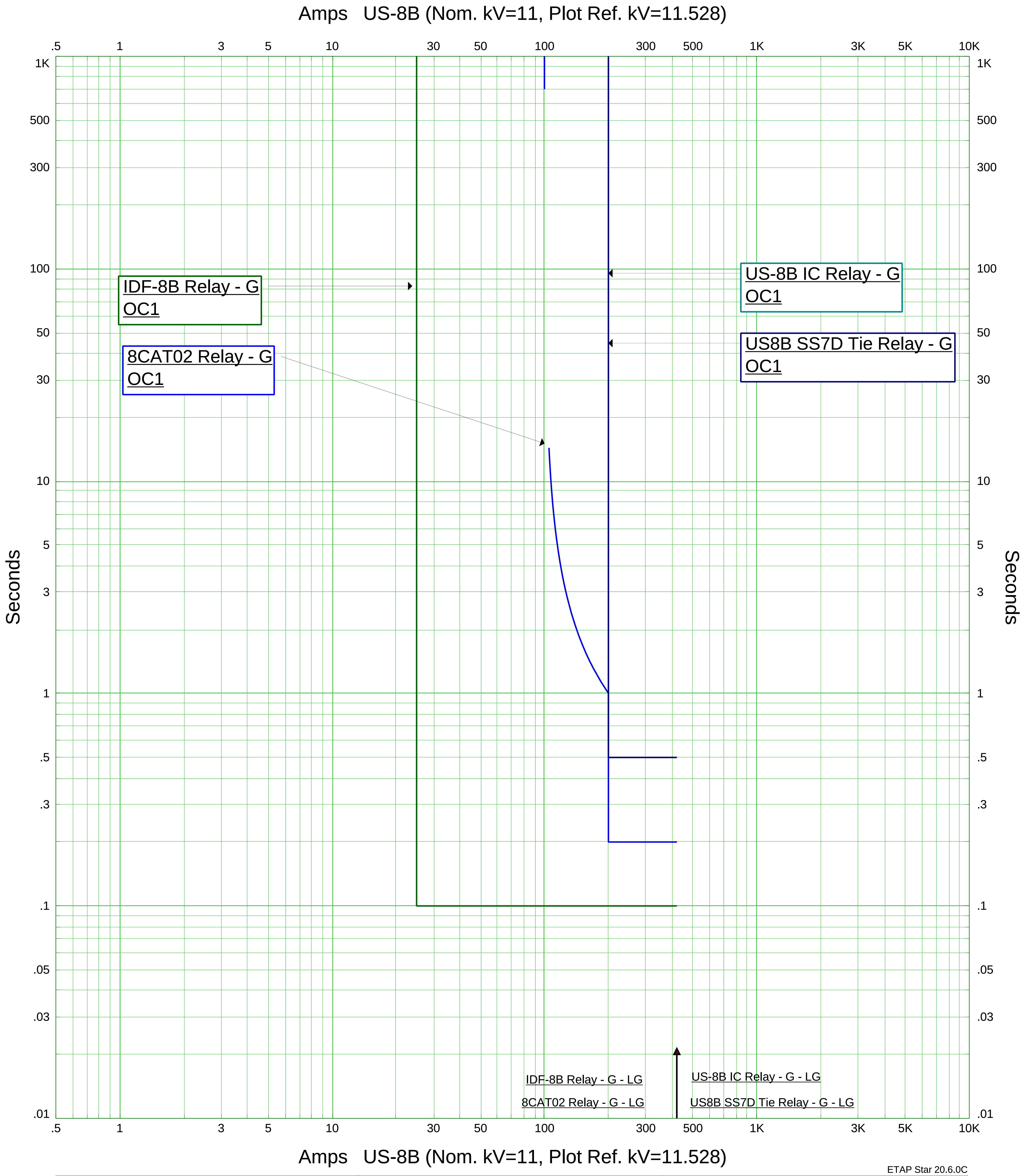
Amps X 100 US-8B (Nom. kV=11, Plot Ref. kV=11.528)



Amps X 100 US-8B (Nom. kV=11, Plot Ref. kV=11.528)

ETAP Star 20.6.0C

SSCTPS	US-8B Bus TCC	ERDA
		Rev: Base - RC1 Fault: Phase



SSCTPS	**US-8B Bus TCC**	ERDA
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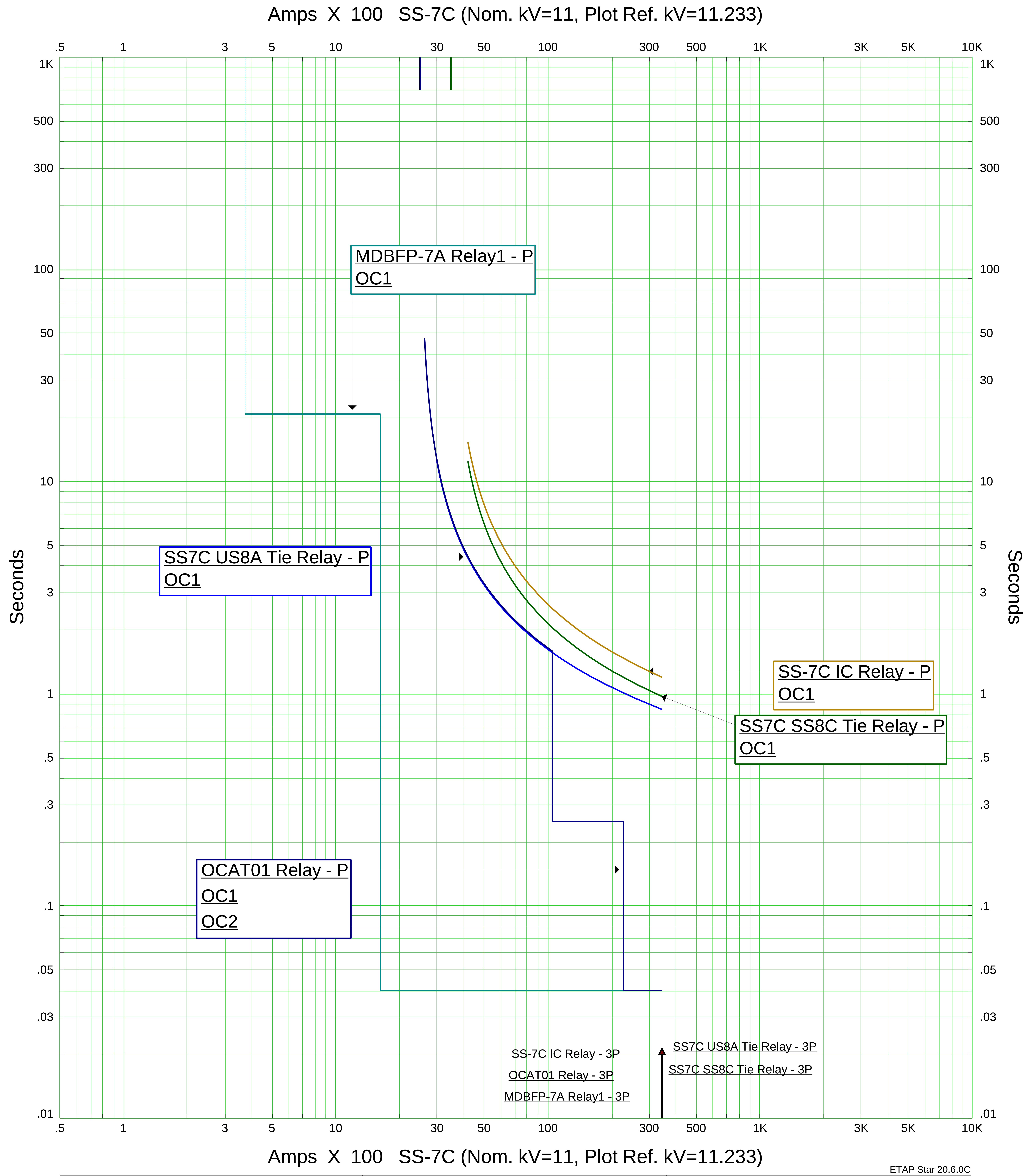
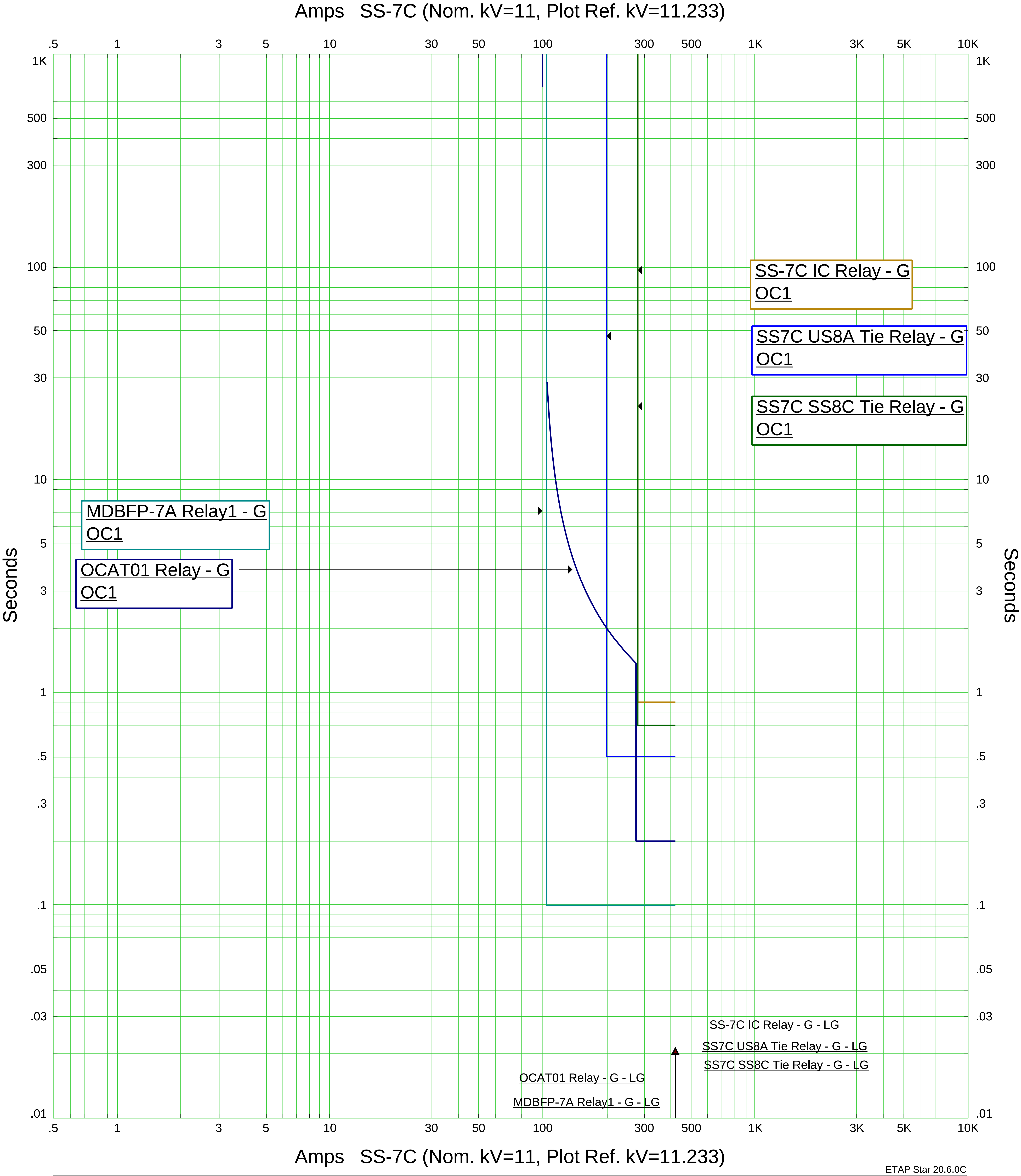


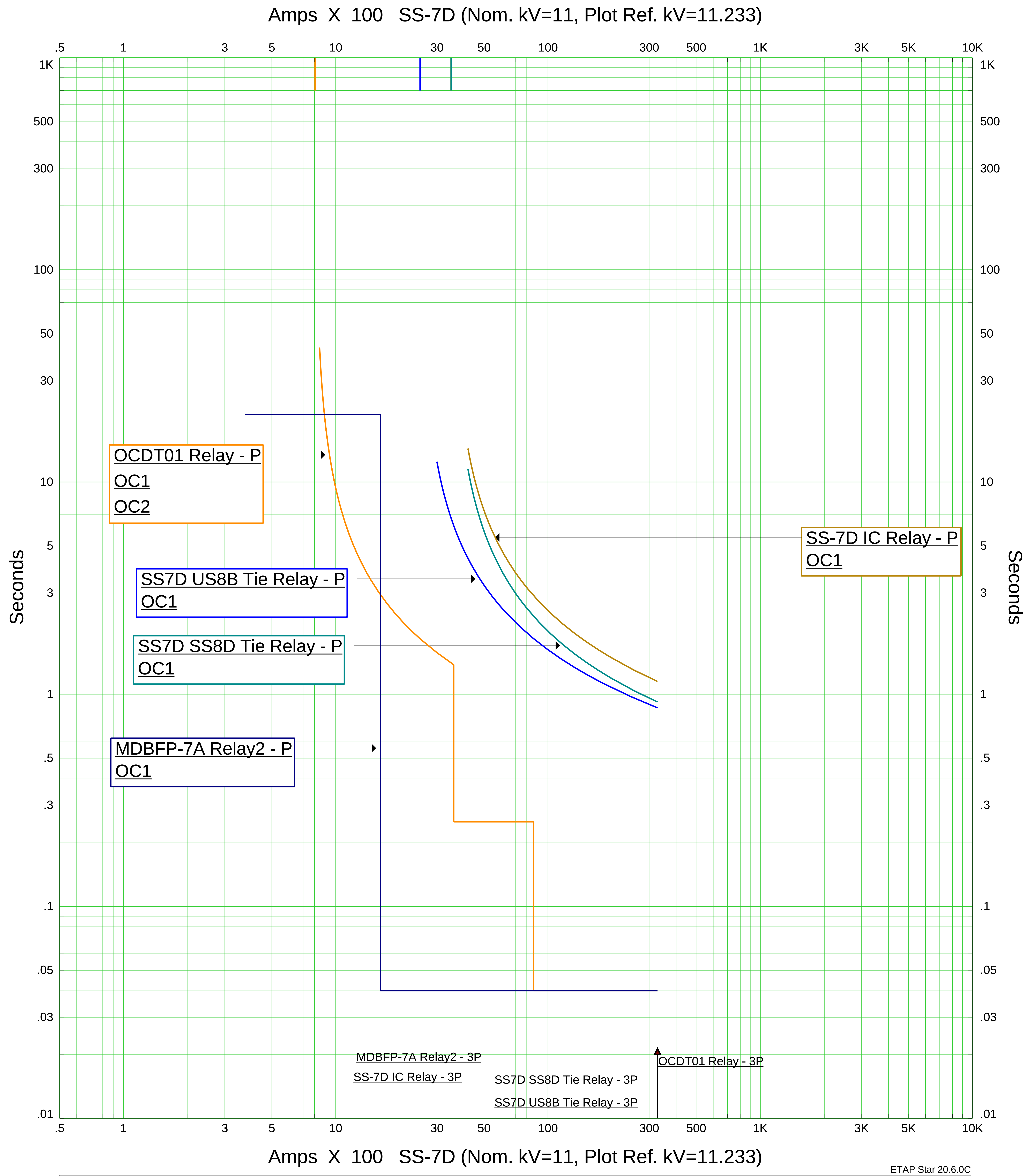
ETAP Star 20.6.0C

SSCTPS	**SS-7C Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Phase



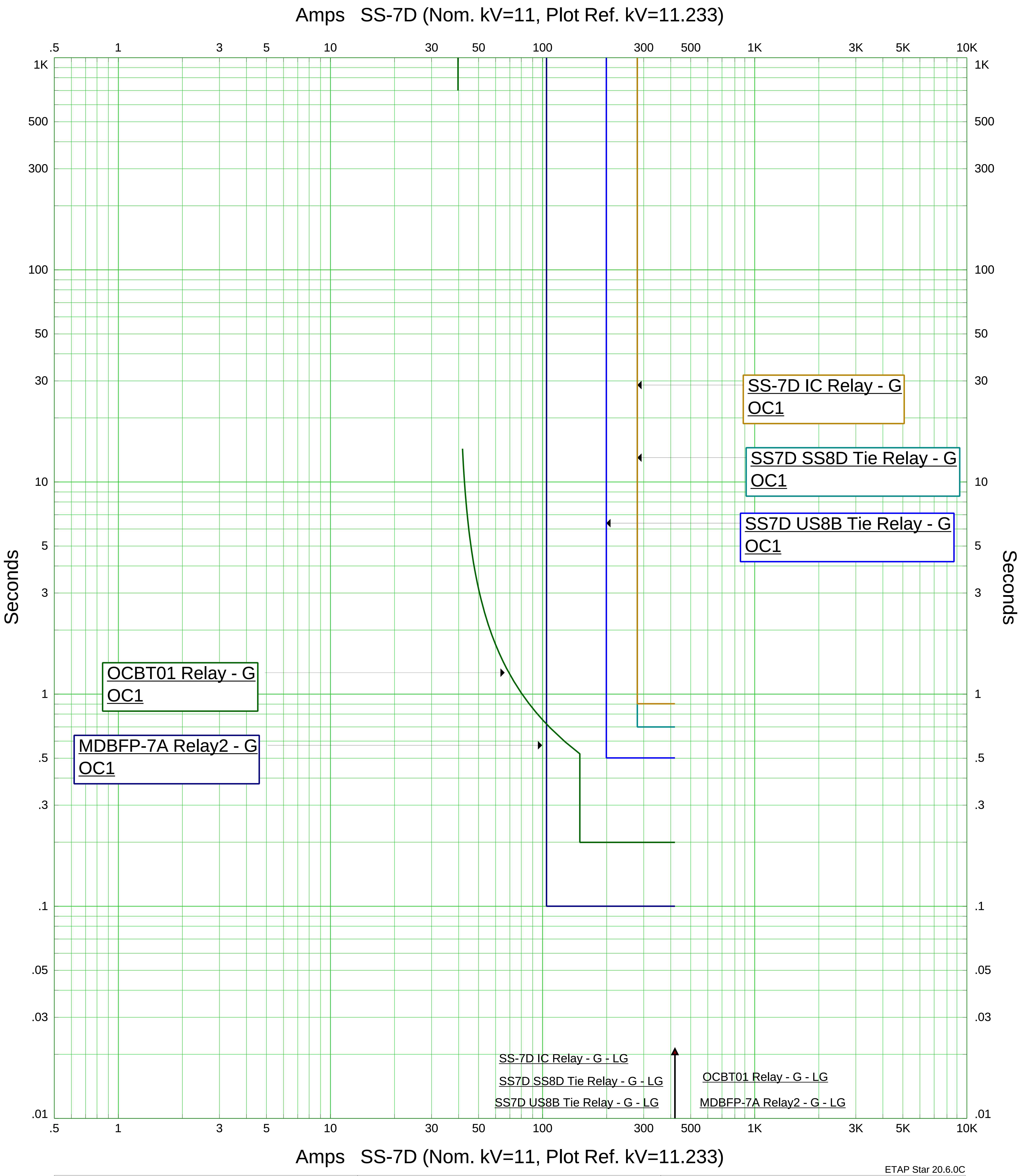
ETAP Star 20.6.0C

SSCTPS	**SS-7C Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Ground



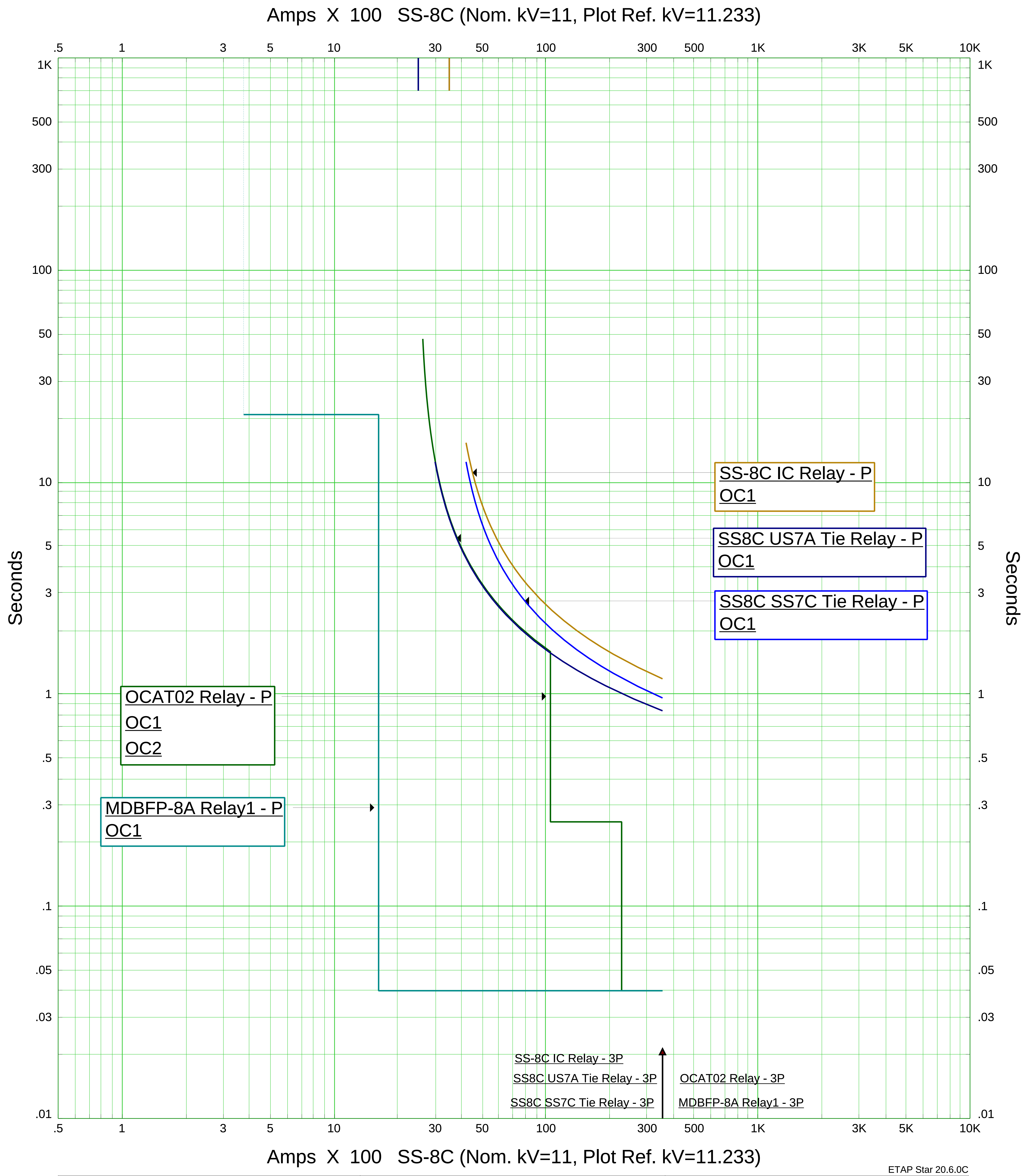
ETAP Star 20.6.0C

SSCTPS	**SS-7D Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Phase



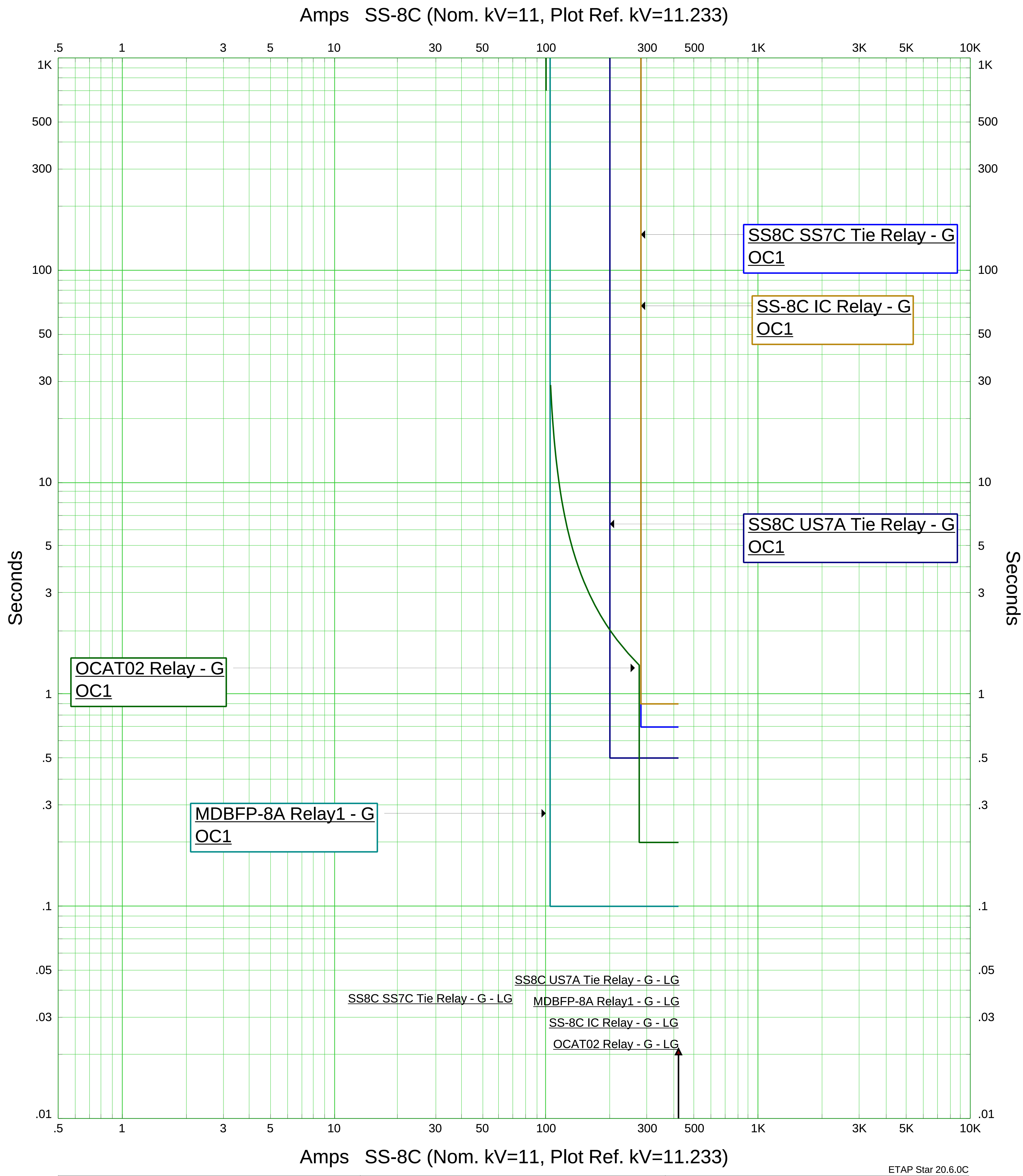
ETAP Star 20.6.0C

SSCTPS	**SS-7D Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Ground

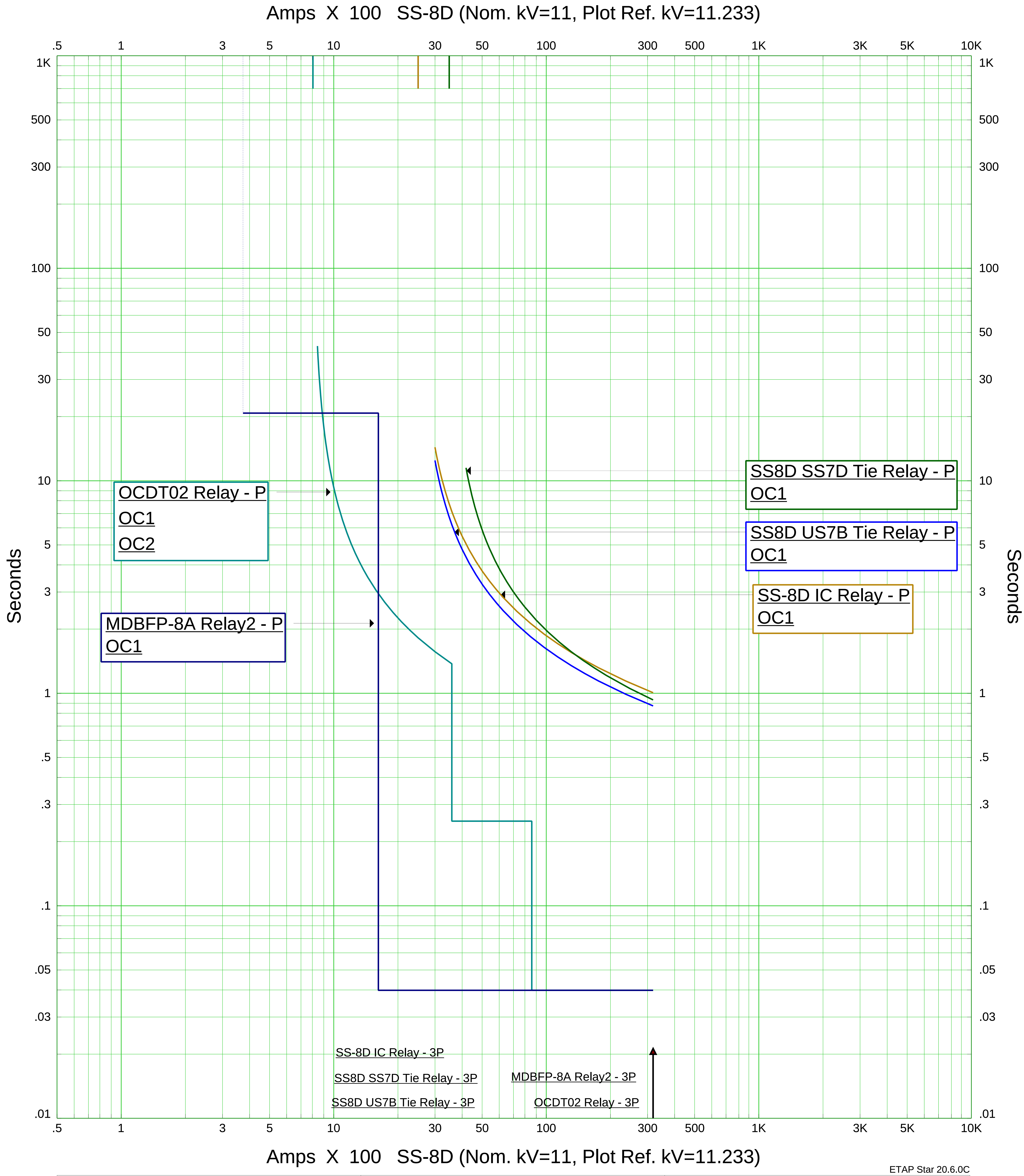


ETAP Star 20.6.0C

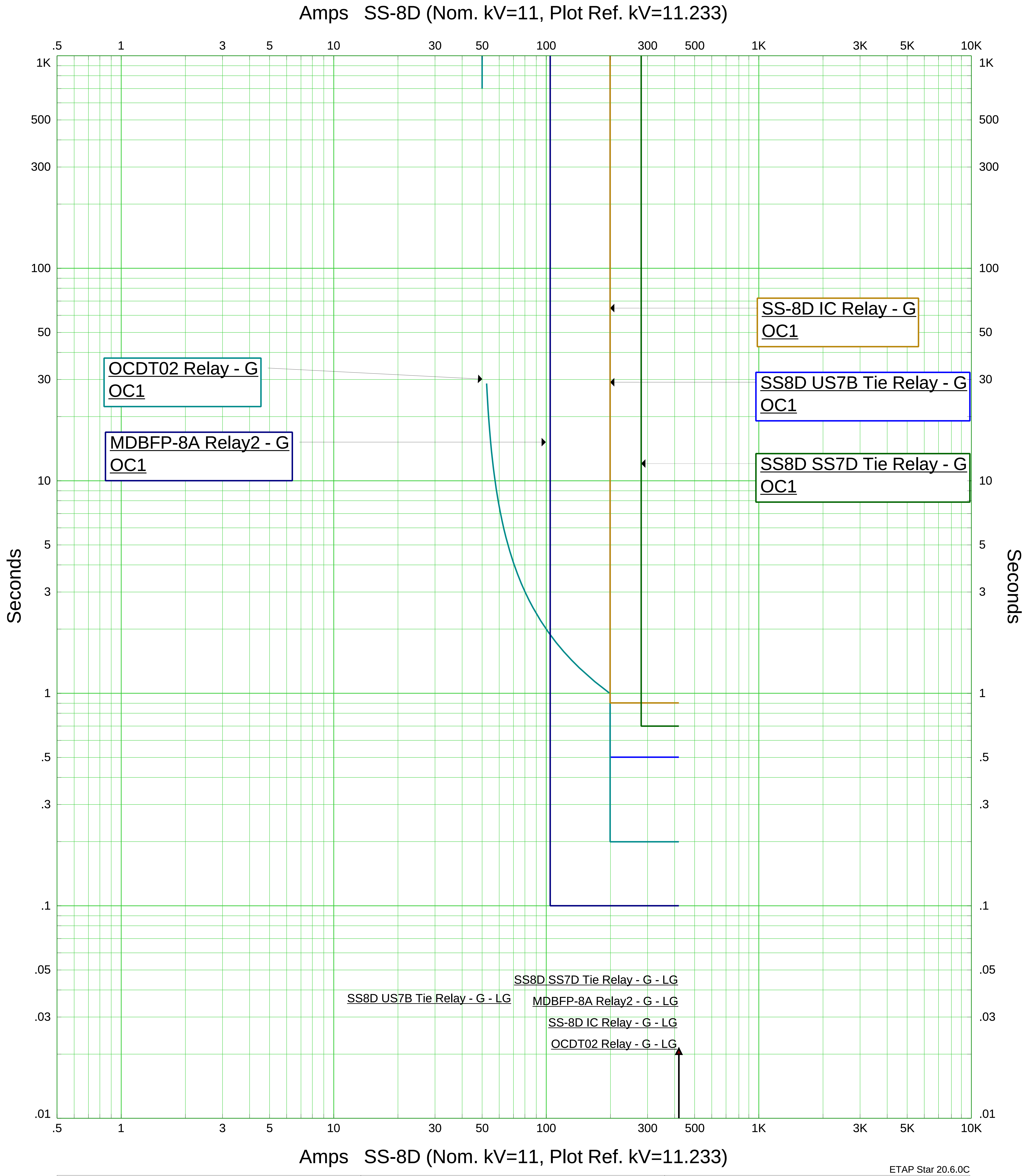
SSCTPS	**SS-8C Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Phase



SSCTPS	**SS-8C Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Ground



SSCTPS	**SS-8D Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Phase



SSCTPS	**SS-8D Bus TCC**	ERDA
		Rev: Base - RC1 Fault: Ground

9 Review of various protection schemes

9.1 Review Distance Relay Settings

9.1.1 400 kV Bikaner Line 1 & 2 Feeders Settings Review Details – Main-I Relay – Siemens 7SA522

Configuration	Adopted Settings	Recommended Settings	Remarks
Protected Line Length	142 kms.		
Adjacent Shortest Line Name & Length	400kV Bikaner to Deedwana (D/C) –129 kms.		
Adjacent Longest Line Name & Length	400kV Bikaner to Sikar (S/C) – 172 kms.		
R1	0.0288		
X1	0.30768		
R0	0.16192		
X0	1.24		
Fault MVA of Local Substation	21323		
Fault MVA of Remote End Substation	19494		
Voltage Rating (kV)	400kV		
Rating of Transformers (MVA)	315		
% Impedance	12.93		
CT Ratio	3000/1		
PT Ratio	400kV/110V		
CTR/PTR	0.825		
kZ1 Res Comp	1.02		
kZ1 Angle (Degree)	-3.16		
Z1	28.96 Ohm	28.84 Ohm	As per NRPC 80% of the Protected line
R(Z1) Resistance Ph-Ph	25.40 Ohm	32.86 Ohm	
R(Z1) Resistance Ph-E	33.87 Ohm	43.82 Ohm	
Zone 1 time	0 Sec	0 Sec	Setting is adequate

Configuration	Adopted Settings	Recommended Settings	Remarks
Z2	43.44 Ohm	53.71 Ohm	100% of the Protected line + 50% of the shortest line emanating from thefar end bus bar or 120% of the Protected line whichever is higher
R(Z2) Resistance Ph-Ph	25.40 Ohm	41.08 Ohm	
R(Z2) Resistance Ph-E	33.87 Ohm	54.77 Ohm	
Zone 2 time	0.4 Sec	0.5 Sec	Time Setting: 350ms for short lines (≤ 100km) and 500ms for long lines > 100km.
Z3	80.05 Ohm	86.91 Ohm	120% of the protected line + 100% of the longest line emanating from the far end bus bar or 100% of the Protected line + 100% of the longest line emanating from the far end bus bar + 25% of the longest line emanating from the far end of the second line considered, whichever is lower
R(Z3) Resistance Ph-Ph	25.40 Ohm	51.35 Ohm	
R(Z3) Resistance Ph-E	33.87 Ohm	68.46 Ohm	
Zone 3 time	1.2 Sec	1 sec	Setting is adequate
Z4	7.24 Ohm	7.21 Ohm	25% of the Zone-1 reach. Time setting: 1000 ms
Zone 4 time	1.2Sec	1 Sec	
Power Swing Blocking			
Power Swing Unblocking Timer	2 Sec	2 Sec	Setting is adequate
Auto Reclosing			
Dead Time after 1 pole trip	1 Sec	1 sec	Setting is adequate
Dead Time after 3 pole trip	0.6 Sec	0.6 Sec	Setting is adequate
Reclaim time	25 Sec	25 Sec	Setting is adequate
Overvoltage Protection			
Alarm - 1 Sec	105% i. e. 115.5 V	115 V	Settings is adequate
Stage-I trip - 5 Sec	110% i. e. 121 V	121 V	Settings are adequate (Time delay for Stage-1 set to 5 sec & for Stage-II 0.1 sec)
Stage-II trip - 0msec	130% i. e. 154 V	154 V	

9.1.2 400 kV Bikaner Line 1 & 2 Feeders Settings Review Details – Main-II

Relay Micom P442

400kV Bikaner D/c line - Line-I and II		
Parameter	**Main II (Micom P442)**	
	Existing settings	**Reviewed settings**
Line length (km)	142	142
Line Impedance (Ohm)	0.0288	0.0288
Line Angle (deg)	85	84.65
CT/PT Ratio	0.825	0.825
Zone - 1 setting		
kZ1 Res Comp	1.02	1.02
kZ1 Angle (Degree)	-3.16	-2.8
Z1 (Ohm)	28.96	28.96
R1G (Ohm)	33.87	43.65
R1Ph (Ohm)	25.40	33.38
tZ1 (sec)	0	0
Zone - 2 setting		
kZ2 Res Comp	1.016	1.02
kZ2 Angle (Degree)	-3.16	-2.8
Z2 (Ohm)	43.44	53.94
R2G (Ohm)	33.87	54.77
R2Ph (Ohm)	25.40	41.08
tZ2 (sec)	0.4	**0.5 (As per NRPC Guideline)**
Zone - 3 setting		
kZ3/4 Res Comp	1.02	1.02
kZ3/4 Angle (Degree)	-3.16	-2.8
Z3 (Ohm)	80.05	87.29
R3G- R4G (Ohm)	33.87	68.46
R3Ph- R4Ph (Ohm)	25.40	51.35
tZ3 (sec)	1	**1 (As per NRPC Guideline)**
Zone -4 setting		
Z4 (Ohm)	7.24	7.24
tZ4 (sec)	1	**1 (As per NRPC Guideline)**
Power Swing Blocking		
PSB R	27.94 Ohm	Both ΔR and ΔX band settings are typically set between 10 – 30% of Zone-3 phase resistive reach It should be calculated as i.e. 15.40 Ohm (30%*R3Ph)
PSB X	87.73 Ohm	
Power Swing Unblocking Timer	2 Sec	2 Sec
Fault Protection		
a) Over current starting		Setting is adequate

400kV Bikaner D/c line - Line-I and II		
Parameter	**Main II (Micom P442)**	
	Existing settings	**Reviewed settings**
1.2 x Max load current / CT ratio	1.2 Amp	
b) Under voltage starting		
80% of Vnom/1.732	50.81 V	Setting is adequate
c) Under impedance starting		
Xfw=1.3 to 2 x Zone 3 reach	103.68 Ohm	112.99 Ohm
Rfw PG = 1.3 to 2 x Zone 3 Res PG	44.03 Ohm	89 Ohm
Rfw PP = 1.3 to 2 x Zone 3 Res PP	33.03 Ohm	66.75 Ohm
Auto Re-closing with dead time		
Auto Reclosing		
Dead Time after 1 pole trip	1 Sec	1 sec
Dead Time after 3 pole trip	0.6 Sec	0.6 Sec
Reclaim time	25 Sec	25 Sec

Bikaner Line 1 & 2 Tie Siemens 7VK610		
Group 50BF Breaker Failure – Siemens 7VK610		
Function	**Existing Setting**	**Recommendations**
50BF Pickup current threshold	0.10 A	Setting is adequate, As per CBIP protection guideline publication no. 328
Minimum TRIP Command Duration	0.10 sec	Setting is adequate
Maximum Close Command Duration	0.10 sec	
Dead Time for CB test auto-reclosure	0.10 sec	
Delay after 1pole start for local trip	0.2 Sec	
Delay after 3pole start for local trip	0.2 Sec	
Delay of 2nd element for busbar trip	0.2 Sec	

9.1.3 400 kV Babai Line 1 & 2 Feeders Settings Review Details – Main-I Relay – Siemens 7SA522

Configuration	Adopted Settings	Recommended Settings	Remarks
Protected Line Length	245 kms.		
Adjacent Shortest Line Name & Length	400kV Babai to STPS New – 245 kms.		
Adjacent Longest Line Name & Length	400kV Babai to Neemrana (D/C) – 89 kms.		
R1 (protected line)	0.0146832		
X1 (protected line)	0.25312		
R0 (protected line)	0.24912		
X0 (protected line)	0.99936		
Fault MVA of Local Substation	18584		
Fault MVA of Remote End Substation	10928		
Voltage Rating (kV)	400kV		
Rating of Transformers (MVA)	315		
% Impedance	12.93		
CT Ratio	3000/1		
PT Ratio	400kV/110V		
CTR/PTR	0.825		
Z1	41 Ohm	40.93 Ohm	As per NRPC 80% of the Protected line
R(Z1) Resistance Ph-Ph	25.40 Ohm	32.86 Ohm	
R(Z1) Resistance Ph-E	33.87 Ohm	43.82 Ohm	
Zone 1 time	0 Sec	0 Sec	Setting is adequate
Z2	61.497 Ohm	62.46 Ohm	100% of the Protected line + 50% of the shortest line emanating from the far end bus bar or 120% of the Protected line whichever is higher
R(Z2) Resistance Ph-Ph	25.40 Ohm	41.08 Ohm	
R(Z2) Resistance Ph-E	33.87 Ohm	54.77 Ohm	
Zone 2 time	0.4 Sec	0.5 Sec	Time Setting: 350ms for short lines (≤ 100km) and 500ms for long lines > 100km.

Configuration	Adopted Settings	Recommended Settings	Remarks
Z3	102.496 Ohm	112.55 Ohm	120% of the protected line + 100% of the longest line emanating from the far end bus bar or 100% of the Protected line + 100% of the longest line emanating from the far end bus bar + 25% of the longest line emanating from the far end of the second line considered, whichever is lower
R(Z3) Resistance Ph-Ph	25.40 Ohm	51.35 Ohm	
R(Z3) Resistance Ph-E	33.87 Ohm	68.46 Ohm	
Zone 3 time	1 Sec	1 sec	Setting is adequate
Z4	10.25 Ohm	10.23 Ohm	25% of the Zone-1 reach. Time setting: 1000 ms
Zone 4 time	1 Sec	1 Sec	
Power Swing			
Power Swing Unblocking Timer	2 Sec	2 Sec	Setting is adequate
Auto Reclosing			
Dead Time after 1 pole trip	1 Sec	1 Sec	Setting is adequate
Dead Time after 3 pole trip	0.6 Sec	0.6 Sec	Setting is adequate
Reclaim time	25 Sec	25 Sec	Setting is adequate
Broken Conductor Protection			
I2 threshold	20%	20%	Setting is adequate
Time	30 Sec	3-5 sec	3-5 Sec for alarm (As per NRPC Protection Philosophy)
Overvoltage Protection			
Alarm - 1 Sec	105% i. e. 115.5 V	115 V	Settings is adequate
Stage-I trip - 5 Sec	110% i. e. 121 V	121 V	Settings are adequate (Time delay for Stage-1 set to 5 sec & for Stage-II 0.1 sec)
Stage-II trip - 0msec	130% i. e. 154 V	154 V	
Fault Protection			
a) Over current starting			Settings is adequate
1.2 x Max load current / CT ratio	1.2 Amp	1.2 Amp	
b) Under voltage starting			
80% of Vnom/1.732	50.81 V	50.81 V	Setting is adequate

Configuration	Adopted Settings	Recommended Settings	Remarks
Xfw=1.3 to 2 x Zone 3 reach	133.07 Ohm	112.99 Ohm	110% of maximum of all zone X1 settings
Rfw PG = 1.3 to 2 x Zone 3 Res PG	44.03 Ohm	89 Ohm	
Rfw PP = 1.3 to 2 x Zone 3 Res PP	33.03 Ohm	66.75 Ohm	

9.1.4 400 kV Babai Line 1 & 2 Feeders Settings Review Details – Main-II Relay Micom P442

400kV Bikaner D/c line - Line-I and II		
Parameter	**Main II (Micom P442)**	
	Existing settings	**Reviewed settings**
Line length (km)	245	245
Line Impedance (Ohm)	0.2496	0.0288
Line Angle (deg)	84.65	86.68
CT/PT Ratio	0.825	0.825
Zone - 1 setting		
kZ1 Res Comp	1	1.028
kZ1 Angle (Degree)	0	-14.128
Z1 (Ohm)	41	40.998
R1G (Ohm)	33.87	43.64
R1Ph (Ohm)	25.40	33.37
tZ1 (sec)	0	0
Zone - 2 setting		
kZ2 Res Comp	1	1.028
kZ2 Angle (Degree)	0	-14.128
Z2 (Ohm)	61.50	62.593
R2G (Ohm)	33.87	54.77
R2Ph (Ohm)	25.40	41.07
tZ2 (sec)	0.4	**0.5 (As per NRPC Guideline)**
Zone - 3 setting		
kZ3/4 Res Comp	1	1.028
kZ3/4 Angle (Degree)	0	-14.128
Z3 (Ohm)	102.50	112.745
R3G- R4G (Ohm)	33.87	68.46
R3Ph- R4Ph (Ohm)	25.40	51.35
tZ3 (sec)	1	**1 (As per NRPC Guideline)**
Zone -4 setting		
Z4 (Ohm)	10.25	25% of the Zone-1 reach i. e. 10.25. Time setting: 1000 ms
tZ4 (sec)	1	**1 (As per NRPC Guideline)**
Power Swing Blocking		
PSB R	27.94 Ohm	Both ΔR and ΔX band settings are typically set between 10 – 30% of Zone-3 phase resistive reach. It should be calculated as i.e. 15.40 Ohm (30%*R3Ph)
PSB X	112.59 Ohm	
Power Swing Unblocking Timer	2 Sec	2 Sec
Fault Protection		
a) Over current starting		Setting is adequate

400kV Bikaner D/c line - Line-I and II		
Parameter	**Main II (Micom P442)**	
	Existing settings	**Reviewed settings**
1.2 x Max load current / CT ratio	1.2 Amp	
b) Under voltage starting		
80% of Vnom/1.732	50.81 V	Setting is adequate
c) Under impedance starting		
Xfw=1.3 to 2 x Zone 3 reach	133.07 Ohm	146.32 Ohm
Rfw PG = 1.3 to 2 x Zone 3 Res PG	44.03 Ohm	89 Ohm
Rfw PP = 1.3 to 2 x Zone 3 Res PP	33.03 Ohm	66.75 Ohm
Auto Re-closing with dead time		
Auto Reclosing		
Dead Time after 1 pole trip	1 Sec	1 sec
Dead Time after 3 pole trip	0.6 Sec	0.6 Sec
Reclaim time	25 Sec	25 Sec

9.2 Review of Generator Transformer Protection Relay settings

There are six nos. of 1-phase 275 MVA, 21 kV/420 kV Generating Transformers available for unit 7 and 8 in the SSCTPS Plant. Protection provided for GT and required as per CBIP 274 revised guideline are as below:

Protection Type	Available Status in SSCTPS Plant
Differential Protection (87 GT)	Protection Provided in Siprotec 7UT635 Relay
Restricted Earth Fault (87NT)	Protection Provided in Siprotec 7SJ8022 Relay
Differential (87OH) GT Overhang Protection	Protection Provided in Siprotec 7U613 Relay

Parameter	**GT-7 and GT-8 2 X 21 kV/420 kV**	
Capacity	825 MVA	
% Impedance	16.00%	
LV CT ratio	14000/5	
HV CT ratio	1250/1	
Name of relay	Siprotec 7U635	
Differential Protection		
Function	Existing Setting	Observation
Pickup Value of Differential Curr.	0.2 I/InO	Recommended 20% setting
T I-DIFF> Time Delay	0.00 sec	Setting is adequate
Pickup Value of High Set Trip	8 I/InO	Setting is adequate
T I-DIFF>> Time Delay	0.00 sec	Setting is adequate
Restricted Earth Fault - Siprotec 7SJ8022		
Pick up value I-ref >	0.1 I/InS	Setting is adequate, As per CBIP manual current setting should be 0.1 to 0.4 I/In
T I-ref Time delay	0 sec	
Slope of charac I-ref>	0	
T IE>> Time Delay	0.00 sec	

Name of relay	Siemens 7UT613	
Differential (87OH) GT Overhang Protection		
Function	Existing Setting	Observation
50-2 Pickup	0.10 I/Ins	Settings are adequate, as per CBIP manual operating current shall be 0.1-0.4 In
50-2 Time Delay	0 Sec	Setting is adequate
50-1 Pickup	0 I/Ins	
50-1 Time Delay	1 Sec	
50/51 2nd harmonic in % of fundamental	10%	
50/51 Maximum Current for Inr. Rest.	8.6 I/Ins	

Group 50BF Breaker Failure – Siemens 7VK610		
Function	Existing Setting	Observation
50BF Pickup current threshold	0.05 A	It should be 0.1 Amp, As per CBIP protection guideline publication no. 328
Minimum TRIP Command Duration	0.10 sec	Settings are adequate
Maximum Close Command Duration	0.10 sec	
Dead Time for CB test-autoreclosure	0.10 sec	
Delay after 1pole start for local trip	0.2 Sec	
Delay after 3pole start for local trip	0.2 Sec	
Delay of 2nd element for busbar trip	0.2 Sec	

9.3 Review of Unit Transformer Protection Relay settings

There are four nos. of 21 kV/11.5 kV Unit Transformer provided in the SSCTPS Plant for Auxiliary load. Protection provided for Unit Transformer and required as per CBIP 274 revised guideline are as below:

Protection Type	Available Status in SSCTPS Plant
Unit Transformer Differential Protection (87 UAT)	Protection Provided in Siemens 7UT633 Relay
Over Excitation Protection	Protection Provided in Siemens 7UT633 Relay
Restricted Earth Fault (64 UAT)	Disabled

The details of setting and observation are as below:

Parameter	**Unit Transformer 7A-7B & 8A-8B 4 X 40 MVA 21 kV / 11.5 kV**	
Capacity	40 MVA	
% Impedance	12.00%	
LV CT ratio	2500/1	
HV CT ratio	1250/1	
Differential Protection		
	Siemens 7UT633	
Function	Existing Setting	Observation
Pickup Value of Differential Curr.	0.20 I/InO	Settings are adequate
T I-DIFF> Time Delay	0 Sec	
Pickup Value of High set trip	10 I/InO	

I-DIFF>> Time Delay	0 Sec	
2nd Harmonic Content in I-DIFF	15%	
Time for Cross-blocking 2nd Harm.	3 cycle	
nth Harmonic content in I-DIFF	30%	Settings are adequate
Time for Cross-blocking n-th Harm	0 cycle	Settings are adequate
Over excitation Protection		
U/f > Pickup	1.10	Settings is adequate
U/f > Time Delay	10 Sec	Recommended 5 sec Time delay continuously adjustable between 0.1 to 6.0 seconds at values of v/f between 100% to 130% of rated value.
U/f >> Pickup	1.40	Settings is adequate
T U/f >> Time Delay	0 Sec	Settings is adequate

9.4 Review of Station Transformer Protection Relay settings

There are two nos. of 21 kV/11.5 kV Station Transformer provided in the SSCTPS Plant for providing supply to station load. Protection provided for station transformer and required as per CBIP 274 revised guideline are as below:

Protection Type	Available Status in SSCTPS Plant
Unit Transformer Differential Protection (87 UAT)	Protection Provided in Siemens 7UT633 Relay
Over Excitation Protection	Protection Provided in Siemens 7UT633 Relay
Restricted Earth Fault (64 UAT)	Disabled

The details of setting and observation are as below:

Parameter	**Station Transformer 7 & 8 2 X 125 MVA 21 kV / 11.5 kV**	
Capacity	125 MVA	
% Impedance	24.00%	
LV CT ratio	4000/1	
HV CT ratio	3500/1	
Differential Protection		
	Siemens 7UT633	
Function	Existing Setting	Observation
Pickup Value of Differential Curr.	0.20 I/InO	Settings are adequate
T I-DIFF> Time Delay	0 Sec	
Pickup Value of High set trip	5 I/InO	

I-DIFF>> Time Delay	0 Sec	
2nd Harmonic Content in I-DIFF	15%	
Time for Cross-blocking 2nd Harm.	3 cycle	
nth Harmonic content in I-DIFF	30%	As per CBIP manual no. 328 for the 5th Harmonic restrain levels is 25% need to review the same
Time for Cross-blocking n-th Harm	0 cycle	Settings is adequate
Over excitation Protection		
U/f > Pickup	1.10	Settings is adequate
U/f > Time Delay	10 Sec	Recommended 5 sec Time delay continuously adjustable between 0.1 to 6.0 seconds at values of v/f between 100% to 130% of rated value.
U/f >> Pickup	1.40	Settings is adequate
T U/f >> Time Delay	0 sec	Settings is adequate

9.5 Review of Reactor Protection Relay settings

There are 2 nos. of 420 kV, 125 MVAR Bus Reactor in the SSCTPS Plant. Protection provided for Reactor and required as per CBIP 274 revised guideline are as below:

Protection Type	Available Status in SSCTPS Plant
Differential Protection	Protection Provided in Siemens 7UT633 Relay
Restricted Earth Fault Protection	Disabled
LBB Protection	Protection Provided in Siemens 7VK61 Relay

The details of setting and observation are as below:

Capacity	**BUS REACTOR 2 X 125 MVAR, 400 kV**	
Differential Protection		
Function	**Siemens 7UT633**	
	Existing Setting	Observation
Pickup value of Diff current	0.15 I/Ino	As per CBIP Publication no. 328 "operating current sensitivity of at least 10% of nominal current
Pickup value of Highest trip	6 I/Ino	As per CBIP Publication no. 328 “It should be possible to choose a setting of high level unrestrained different function as low as 200% to 400% of rated reactor current”
Inrush 2nd harmonic content in I-Diff	10%	Settings are adequate
Time for cross blocking 2nd Har.	100 ms	

Inrush 5th harmonic content in I-Diff	20%	
Time for cross blocking nth Har.	100 ms	
LBB Protection		
Function	**Siemens 7VK61**	
	Existing Setting	Observation
50BF Pickup current threshold	0.05 A	As per CBIP guide line it should be 0.1 A is recommended for lines and transformer
Minimum TRIP Command Duration	0.10 Sec	Setting are adequate.
Maximum Close Command Duration	0.10 Sec	
Dead Time for CB test-autoreclosure	0.10 Sec	
Delay after 1pole start for local trip	0.20 Sec	
Delay after 3pole start for local trip	0.20 Sec	
Delay of 2nd element for busbar trip	0.20 Sec	

Bus Reactor Tie Siemens 7VK610		
Group 50BF Breaker Failure – Siemens 7VK610		
Function	Existing Setting	
50BF Pickup current threshold	0.1 A	Settings are adequate
Minimum TRIP Command Duration	0.10 sec	
Maximum Close Command Duration	0.10 sec	
Dead Time for CB test-autoreclosure	0.10 sec	
Delay after 1pole start for local trip	0.2 Sec	
Delay after 3pole start for local trip	0.2 Sec	
Delay of 2nd element for busbar trip	0.2 Sec	

Capacity	**Bikaner Line-1 & 2 REACTOR 2 X 50 MVAR, 400 kV**	
Differential Protection (Main-1 & Main-2)		
Function	**Siemens 7UT633**	
	Existing Setting	Observation
Pickup value of Diff current	0.15 I/Ino	As per CBIP Publication no. 328 "operating current sensitivity of at least 10% of nominal current
Pickup value of Highest trip	6 I/Ino	As per CBIP Publication no. 328 "It should be possible to choose a setting of high level unrestrained different function as low as 200% to 400% of rated reactor current"
Inrush 2nd harmonic content in I-Diff	10%	Settings are adequate
Time for cross blocking 2nd Har.	100 ms	
Inrush 5th harmonic content in I-Diff	20%	
Time for cross blocking nth Har.	100 ms	
LBB Protection		
Function	**Siemens 7VK61**	
	Existing Setting	Observation
50BF Pickup current threshold	0.10 A	Setting are adequate.
Minimum TRIP Command Duration	0.10 Sec	
Maximum Close Command Duration	0.10 Sec	
Dead Time for CB test-autoreclosure	0.10 Sec	
Delay after 1pole start for local trip	0.20 Sec	
Delay after 3pole start for local trip	0.20 Sec	
Delay of 2nd element for busbar trip	0.20 Sec	

Capacity	**Babai Line-1 & 2 REACTOR 2 X 80 MVAR, 400 kV**	
Differential Protection (Main-1 & Main-2)		
Function	**Siemens 7UT633**	
	Existing Setting	Observation
Pickup value of Diff current	0.12 I/Ino	As per CBIP Publication no. 328 "operating current sensitivity of at least 10% of nominal current

Pickup value of Highest trip	4.8 I/Ino	As per CBIP Publication no. 328 "It should be possible to choose a setting of high level unrestrained different function as low as 200% to 400% of rated reactor current"
Inrush 2nd harmonic content in I-Diff	10%	Settings are adequate
Time for cross blocking 2nd Har.	100 ms	
Inrush 5th harmonic content in I-Diff	20%	
Time for cross blocking nth Har.	100 ms	
LBB Protection		
Function	**Siemens 7VK61**	
	Existing Setting	Observation
50BF Pickup current threshold	0.10 A	Setting are adequate.
Minimum TRIP Command Duration	0.10 Sec	
Maximum Close Command Duration	0.10 Sec	
Dead Time for CB test-autoreclosure	0.10 Sec	
Delay after 1pole start for local trip	0.20 Sec	
Delay after 3pole start for local trip	0.20 Sec	
Delay of 2nd element for busbar trip	0.20 Sec	

9.6 Review of 400 kV Interconnector Relay settings

Function	Existing Setting	Observation
Rated Primary voltage	400 kV	
Rated Secondary voltage	110 V	
CTR	2000/1A	
Differential Protection		
Settings	**Siemens 7SD5**	
I-DIFF>	0.1 A	Recommended 0.2 A
I-DIF>SWITCH ON	0.3 A	Setting is adequate as per relay manual
I-DIFF>>	1.2 A	

Function	Existing Setting	Observation
I-DIF>>SWITCHON	1.5 A	
Inst. High Speed/SOTF-O/C		
I>>> Pickup	1.5 A	
I>>>> Pickup	∞ A	
Backup Overcurrent Protection		
Iph>> Pickup	4.5 A	Setting is adequate as per relay manual
T Iph>> Time delay	0 sec	
3I0>> Pickup	0.1 A	
T 3I0>> Time delay	1.2 sec	
Iph> Pickup	1.5 A	
T Iph> Time delay	2 sec	
3I0> Pickup	0.1 A	
T 3I0> Time delay	1.2 sec	
Backup Overcurrent Protection- Group Inverse		
Ip> Pickup	0.5 A	Setting is adequate as per relay manual
T Ip Time Dial	0.10 sec	
3I0p Pickup	4 A	
T 3I0p Time Dial	∞ sec	
LBB Protection		
	Siemens 7VK61	
50BF Pickup current threshold	0.14 A	As per CBIP guide line it should be 0.1 A is recommended for lines and transformer
Minimum TRIP Command Duration	0.10 sec	Settings are adequate
Maximum Close Command Duration	0.10 sec	
Dead Time for CB test-autoreclosure	0.10 sec	
Delay after 1pole start for local trip	0.2 sec	
Delay after 3pole start for local trip	0.20 sec	
Delay of 2nd element for busbar trip	0.20 sec	

10 Review of Bus Bar protection relay settings

There one and Half Breaker scheme arrangement in SSCTPS Plant of 400 kV. Protection provided for Bus Bar arrangement and required as per CBIP 274 revised guideline are as below:

Protection Type	Available Status in SSCTPS Plant
400 kV Bus Bar Protection	Protection Provided in Siemens 7SS85 Relay

The details of setting and observation are as below:

400 kV Bus Bar		
Particulars	**Siemens 7SS85**	
DIFF PROTECTION	**Existing Settings**	**Observation**
ID>1 Current	1.5 I/Ir obj	Settings are adequate
Stabilization Factor k:	0.65	

11 Recommendations:

ERDA has conducted the comprehensive Protection Audit of 400kV switchyard & control room of Suratgarh Super Critical Thermal Power Station and found various recommendations in order to improve the reliability of power system and to avoid unwanted outages in the transmission of power at various levels.

Some of the Observations / Recommendations, based on technical audit carried out by ERDA are:

- **Observation and Recommendation**

1. **Line Protection**

   The settings are reviewed and tabulated in the report.
2. **Transformer Protection**

   The settings are reviewed and tabulated in the report.
3. **220 kV Circuit Breaker Testing:**

   All the tests as per IEC – 62271-100 (2017) should be performed for 400kV Circuit Breakers. The breakers should be tested at regular intervals. The tests to be conducted in the circuit breakers are contact resistance measurement, opening and closing time of all the 3 phases of the circuit breaker and check trip/closing circuit for delay operation etc. The interval for testing of breaker is around 3 to 5 years.
4. Transformer testing should be carried out at regular time intervals. Tan-delta test of transformer required to be carried out at regular intervals and necessary steps should be taken in case of testing results being unsatisfactory.
5. Regular testing and maintenance should be carried out for CT and PT. The accuracy test shall be done in every 3 years while all other tests required to be carried out within 1 year time duration. All the aforesaid tests to be conducted as per relevant IS.
6. Testing of relays should be carried out once every year to check its IR value, timing etc.
7. Relay coordination study is carried out considering the existing capacity of Power Plant. Relay settings has been recommended in the report. ERDA team has provided the recommended settings of phase and ground by checking the proper coordination between upstream and downstream.
8. For Zone-2 Distance protection as per NRPC guidelines, *"100% of the Protected line + 50% of the shortest line emanating from thefar end bus bar or 120% of the Protected line whichever is higher."* The existing setting is considered as whichever is less. ERDA has calculated the settings of Zone-2 based on the NRPC guideline and calculated settings is given in the report

9. For Zone-3 Distance protection as per NRPC guidelines, "*120% of the protected line + 100% of the longest line emanating from thefar end bus bar or 100% of the Protected line + 100% of the longest line emanating from the far end bus bar + 25% of the longest line emanating from the far end of the second line considered, whichever is lower.*" The existing setting is considered as 100% of the protected line + 100% of the longest line. ERDA has calculated the settings of Zone-3 with 120% of protected line + 100% of longest line and calculated settings is given in the report.

10. As per Ramkrishna committee report Main-1 and Main-2 relay should be connected to two DC source

Annexure-I

SINGLE LINE DIAGRAM

STPS Grid
9560.921 MVAsc
STPS Grid Switch
STPS
400 kV
IC-1
2.5 km
IC-2
2.5 km
IC-1 CB
IC-1 CB2
Babai Grid
18584 MVAsc
Babai Grid Switch
Open
Babai S/s
400 kV
Babai Line-1
245 km
Babai Line-2
245 km
BBL1R Bus
Open
BBL2R Bus
Babai L1 Reactor
80.1 MVA
BBL1 Reac CB
Babai Line Tie CB
BBL2 Reactor CB
Babai L2 Reactor
80.1 MVA
Babai Line-1 CB
Open
Babai Line-2 CB
Open
Bikaner Grid
10946.562 MVAsc
Bikaner Grid Switch
Bikaner S/s
400 kV
Bikaner Line-1
142 km
Bikaner Line-2
142 km
BKL1R Bus
Open
BKL2R Bus
Bkn L1 Reactor
50.063 MVA
BKL1 Reactor CB
Bikaner Line Tie CB
BKL2 Reactor CB
Bkn L2 Reactor
50.063 MVA
Bikaner Line-1 CB
Bikaner Line-2 CB
MAIN BUS-I
400 kV
MAIN BUS-II
400 kV
BR1 CB
Open
BR2 CB
Open
Open
BR1 Bus
BR2 Bus
BR-1-2 Tie CB
BUS REACTOR 1
125.157 MVA
BUS REACTOR 2
125.157 MVA
GT-7 CB
Bus-2 CVT Switch
GT-7 HT Bus
400 kV
Open
Bus-2 CVT Bus
400 kV
GT-7 - BusCVT-1 Tie CB
Bus-2 CVT
400/0.11
GT-7
Bus-1 CVT Switch
GT-8 CB
Bus-1 CVT Bus
400 kV
Open
GT-8 Bus
400 kV
GT-8 - BusCVT-2 Tie CB
Bus-1 CVT
400/0.11
GT-8

GT-7 HT Bus
GT-7
825 MVA
420/21 kV
16 %Z
YNd11
Gen-7 Bus Duct
Gen-7 Bus
21 kV
UT-7AB BD
Gen-7 BD
ST-7 HT BD
GCB-7
Gen-7
660.5 MW
UT-7AB Bus
21 kV
UT-7A HT BD
UT-7B HT BD
UT-7A
40 MVA
21/11.5 kV
12 %Z
Dyn1
UT-7B
40 MVA
21/11.5 kV
12 %Z
Dyn1
UT-7A LT CT
2500/1
UT-7A LT NCT
200/1
UT-7A LT Relay
UT-7B LT CT
2500/1
UT-7B LT NCT
200/1
UT-7B LT Relay
UT-7A LT BD
UT-7B LT BD
US-7A
US-7B
ST-7
125/62.5/62.5 MVA
21/11.5/11.5 kV
24/24/48 %Z
ST-7 LT-1 CT
3500/1
ST-7 LT-1 NCT
200/1
ST-7 LT-1 Relay
ST-7 LT-1 BD
ST-7 LT-2 CT
3500/1
ST-7 LT-2 NCT
200/1
ST-7 LT-2 Relay
ST-7 LT-2 BD
SS-7C
SS-7D
GT-8 Bus
GT-8
825 MVA
420/21 kV
16 %Z
YNd11
Gen-8 Bus Duct
Gen-8 Bus
21 kV
ST-8 HT BD
Gen-8 BD
UT-8AB BD
GCB-8
Gen-8
660.5 MW
UT-8AB Bus
21 kV
ST-8
125/62.5/62.5 MVA
21/11.5/11.5 kV
24/24/48 %Z
ST-8 LT-1 CT
3500/1
ST-8 LT-1 NCT
200/1
ST-8 LT-1 Relay
ST-8 LT-1 BD
ST-8 LT-2 CT
3500/1
ST-8 LT-2 NCT
200/1
ST-8 LT-2 Relay
ST-8 LT-2 BD
SS-8C
SS-8D
UT-8A HT BD
UT-8B HT BD
UT-8A
40 MVA
21/11.5 kV
12 %Z
Dyn1
UT-8B
40 MVA
21/11.5 kV
12 %Z
Dyn1
UT-8A LT CT
2500/1
UT-8A LT NCT
200/1
UT-8A LT Relay
UT-8B LT CT
2500/1
UT-8B LT NCT
200/1
UT-8B LT Relay
UT-8A LT BD
UT-8B LT BD
US-8A
US-8B

UT-7B
US-7B IC CT
2500/1
US-7B IC Relay
US-7B IC CB
Unit SWBD
7BB
Unit SWBD
7BB
US-7B
11 kV
7CAT02 CB
7CAT02 CT
1000/1
7CAT02 Relay
7CAT02 NCT
50/1
7CAT02 Cable
7CAT02 HT Bus
7CAT02
15 MVA
11/6.9 kV
12.5 %Z
Dyn11
UAT-7B
7CAT02 LT Bus
7CAT02 Load
15 MVA
FLA 787.3 A
FD-7B CB
FD-7B CT
200/1
FD-7B Relay
FD-7B NCT
50/1
FD-7B Cable
FD-7B Bus
FD Fan - 7B
2500 kW
CW-7D CB
CW-7D CT
250/1
CW-7D Relay
CW-7D NCT
50/1
CW-7D Cable
CW-7D Bus
CW Pump - 7D
2500 kW
CW-7C CB
CW-7C CT
250/1
CW-7C Relay
CW-7C NCT
50/1
CW-7C Cable
CW-7C Bus
CW Pump - 7C
2500 kW
IDF-7B CB
IDF-7B CT
300/1
IDF-7B Relay
IDF-7B NCT
50/1
IDF-7B Cable
IDF-7B Bus
ID Fan - 7B
4000 kW
PAF-7B CB
PAF-7B CT
250/1
PAF-7B Relay
PAF-7B NCT
50/1
PAF-7B Cable
PAF-7B Bus
PA Fan - 7B
3250 kW
7DFT02 CB
7DFT02 CT
100/1
7DFT02 Relay
7DFT02 NCT
50/1
7DFT02 Cable
7DFT02 HT Bus
7DFT02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
7DFT02 LT Bus
7DFT02 Load
1600 kVA
FLA 83.98 A
7DET02 CB
7DET02 CT
100/1
7DET02 Relay
7DET02 NCT
50/1
7DET02 Cable
7DET02 HT Bus
7DET02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
7DET02 LT Bus
7DET02 Load
1600 kVA
FLA 83.98 A
7DDT02 CB
7DDT02 CT
100/1
7DDT02 Relay
7DDT02 NCT
50/1
7DDT02 Cable
7DDT02 HT Bus
7DDT02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
7DDT02 LT Bus
7DDT02 Load
1600 kVA
FLA 83.98 A
7DCT02 CB
7DCT02 CT
100/1
7DCT02 Relay
7DCT02 NCT
50/1
7DCT02 Cable
7DCT02 HT Bus
7DCT02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
7DCT02 LT Bus
7DCT02 Load
1600 kVA
FLA 83.98 A
7DBT02 CB
7DBT02 CT
150/1
7DBT02 Relay
7DBT02 NCT
50/1
7DBT02 Cable
7DBT02 HT Bus
7DBT02
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Unit Boiler
Service Xmer
7DBT02 LT Bus
7DBT02 Load
2500 kVA
FLA 171.7 A
7DAT02 CB
7DAT02 CT
150/1
7DAT02 Relay
7DAT02 NCT
50/1
7DAT02 Cable
7DAT02 HT Bus
7DAT02
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Unit Turbine
Service Xmer
7DAT02 LT Bus
7DAT02 Load
2500 kVA
FLA 171.7 A
US7B SSBD Tie CB
Open
NO
US7B SSBD Tie CT
2500/1
US7B SSBD Tie Relay
US7B SSBD Tie BD
SS-BD
Tie to 0BD

Unit SWBD 7BA
US-7A
11 kV
UT-7A
US-7A IC CT
2500/1
US-7A IC Relay
US-7A IC CB
7DAT01 CB
7DAT01 CT
150/1
7DAT01 Relay
7DAT01 NCT
50/1
7DAT01 Cable
7DAT01 HT Bus
7DAT01
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Unit Turbine Service Xmer
7DAT01 LT Bus
7DAT01 Load
2500 kVA
FLA - 131.2 A
7DBT01 CB
7DBT01 CT
150/1
7DBT01 Relay
7DBT01 NCT
50/1
7DBT01 Cable
7DBT01 HT Bus
7DBT01
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Unit Boiler Service Xmer
7DBT01 LT Bus
7DBT01 Load
2500 kVA
FLA 131.2 A
7DCT01 CB
7DCT01 CT
100/1
7DCT01 Relay
7DCT01 NCT
50/1
7DCT01 Cable
7DCT01 HT Bus
7DCT01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP Service Xmer
7DCT01 LT Bus
7DCT01 Load
1600 kVA
FLA 83.98 A
7DDT01 CB
7DDT01 CT
100/1
7DDT01 Relay
7DDT01 NCT
50/1
7DDT01 Cable
7DDT01 HT Bus
7DDT01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP Service Xmer
7DDT01 LT Bus
7DDT01 Load
1600 kVA
FLA 83.98 A
7DET01 CB
7DET01 CT
100/1
7DET01 Relay
7DET01 NCT
50/1
7DET01 Cable
7DET01 HT Bus
7DET01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP Service Xmer
7DET01 LT Bus
7DET01 Load
1600 kVA
FLA 83.98 A
7DFT01 CB
7DFT01 CT
100/1
7DFT01 Relay
7DFT01 NCT
50/1
7DFT01 Cable
7DFT01 HT Bus
7DFT01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP Service Xmer
7DFT01 LT Bus
7DFT01 Load
1600 kVA
FLA 83.98 A
PAF-7A CB
PAF-7A CT
250/1
PAF-7A Relay
PAF-7A NCT
50/1
PAF-7A Cable
PAF-7A Bus
PA Fan - 7A
3250 kW
FLA 196.4 A
IDF-7A CB
IDF-7A CT
300/1
IDF-7A Relay
IDF-7A NCT
50/1
IDF-7A Cable
IDF-7A Bus
ID Fan - 7A
4000 kW
FLA 250.3 A
CW-7A CB
CW-7A CT
200/1
CW-7A Relay
CW-7A NCT
50/1
CW-7A Cable
CW-7A Bus
CW Pump - 7A
2500 kW
FLA 171.7 A
CW-7B CB
CW-7B CT
200/1
CW-7B Relay
CW-7B NCT
50/1
CW-7B Cable
CW-7B Bus
CW Pump - 7B
2500 kW
FLA 171.7 A
FD-7A CB
FD-7A CT
200/1
FD-7A Relay
FD-7A NCT
50/1
FD-7A Cable
FD-7A Bus
FD Fan - 7A
2500 kW
FLA 171.7 A
7CAT01 CB
7CAT01 CT
1000/1
7CAT01 Relay
7CAT01 NCT
50/1
7CAT01 Cable
7CAT01 HT Bus
7CAT01
15 MVA
11/6.9 kV
12.5 %Z
Dyn11
UAT-7A
7CAT01 LT Bus
7CAT01 Load
15 MVA
FLA 787.3 A
Unit SWBD 7BA
US7A SS8C Tie CB
Open
NO
US7A SS8C Tie CT
2500/1
US7A SS8C Tie Relay
US7A SS8C Tie BD
SS-8C
Tie to 0BC

Unit SWBD 8BB
UT-8B
US-8B IC CT
2500/1
US-8B IC Relay
US-8B IC CB
US-8B
11 kV
US8B SS7D Tie CB
Open
NO
US8B SS7D Tie CT
2500/1
US8B SS7D Tie Relay
US8B SS7D Tie BD
SS-7D
Tie to 0BB
8CAT02 CB
8CAT02 CT
1000/1
8CAT02 Relay
8CAT02 NCT
50/1
8CAT02 Cable
8CAT02 HT Bus
8CAT02
15 MVA
11/6.9 kV
12.5 %Z
Dyn11
UAT-8B
8CAT02 LT Bus
8CAT02 Load
15 MVA
FLA 787.3 A
FD-8B CB
FD-8B CT
250/1
FD-8B Relay
FD-8B NCT
50/1
FD-8B Cable
FD-8B Bus
FD Fan - 8B
2500 kW
CW-8C CB
CW-8C CT
200/1
CW-8C Relay
CW-8C NCT
50/1
CW-8C Cable
CW-8C Bus
CW Pump - 8C
2500 kW
IDF-8B CB
IDF-8B CT
300/1
IDF-8B Relay
IDF-8B NCT
50/1
IDF-8B Cable
IDF-8B Bus
ID Fan - 8B
4000 kW
PAF-8B CB
PAF-8B CT
250/1
PAF-8B Relay
PAF-8B NCT
50/1
PAF-8B Cable
PAF-8B Bus
PA Fan - 8B
3250 kW
8DFT02 CB
8DFT02 CT
100/1
8DFT02 Relay
8DFT02 NCT
50/1
8DFT02 Cable
8DFT02 HT Bus
8DFT02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
8DFT02 LT Bus
8DFT02 Load
1600 kVA
FLA 83.98 A
8DET02 CB
8DET02 CT
100/1
8DET02 Relay
8DET02 NCT
50/1
8DET02 Cable
8DET02 HT Bus
8DET02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
8DET02 LT Bus
8DET02 Load
1600 kVA
FLA 83.98 A
8DDT02 CB
8DDT02 CT
100/1
8DDT02 Relay
8DDT02 NCT
50/1
8DDT02 Cable
8DDT02 HT Bus
8DDT02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
8DDT02 LT Bus
7DDT02 Load1
1600 kVA
FLA 83.98 A
8DCT02 CB
8DCT02 CT
100/1
8DCT02 Relay
8DCT02 NCT
50/1
8DCT02 Cable
8DCT02 HT Bus
8DCT02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
8DCT02 LT Bus
8DCT02 Load
1600 kVA
FLA 83.98 A
8DBT02 CB
8DBT02 CT
150/1
8DBT02 Relay
8DBT02 NCT
50/1
8DBT02 Cable
8DBT02 HT Bus
8DBT02
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Unit Boiler
Service Xmer
8DBT02 LT Bus
8DBT02 Load
2500 kVA
FLA 131.2 A
8DAT02 CB
8DAT02 CT
150/1
8DAT02 Relay
8DAT02 NCT
50/1
8DAT02 Cable
8DAT02 HT Bus
8DAT02
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Unit Turbine
Service Xmer
8DAT02 LT Bus
8DAT02 Load
2500 kVA
FLA 131.2 A
Unit SWBD 8BB

UT-8A
US-8A IC CT
2500/1
US-8A IC Relay
US-8A IC CB
Unit SWBD
8BA
Unit SWBD
8BA
US-8A
11 kV
US8A SS7C Tie CB
NO
Open
US8A SS7C Tie CT
2500/1
US8A SS7C Tie Relay
US8A SS7C Tie BD
SS-7C
Tie to 0BA
8DAT01 CB
8DAT01 CT
150/1
8DAT01 Relay
8DAT01 NCT
50/1
8DAT01 Cable
8DAT01 HT Bus
8DAT01
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Unit Turbine
Service Xmer
8DAT01 LT Bus
8DAT01 Load
2500 kVA
FLA 131.2 A
8DBT01 CB
8DBT01 CT
150/1
8DBT01 Relay
8DBT01 NCT
50/1
8DBT01 Cable
8DBT01 HT Bus
8DBT01
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Unit Boiler
Service Xmer
8DBT01 LT Bus
8DBT01 Load
2500 kVA
FLA 131.2 A
8DCT01 CB
8DCT01 CT
100/1
8DCT01 Relay
8DCT01 NCT
50/1
8DCT01 Cable
8DCT01 HT Bus
8DCT01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
8DCT01 LT Bus
8DCT01 Load
1600 kVA
FLA 83.98 A
8DDT01 CB
8DDT01 CT
100/1
8DDT01 Relay
8DDT01 NCT
50/1
8DDT01 Cable
8DDT01 HT Bus
8DDT01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
8DDT01 LT Bus
8DDT01 Load
1600 kVA
FLA 83.98 A
8DET01 CB
8DET01 CT
100/1
8DET01 Relay
8DET01 NCT
50/1
8DET01 Cable
8DET01 HT Bus
8DET01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
8DET01 LT Bus
8DET01 Load
1600 kVA
FLA 83.98 A
8DFT01 CB
8DFT01 CT
100/1
8DFT01 Relay
8DFT01 NCT
50/1
8DFT01 Cable
8DFT01 HT Bus
8DFT01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
ESP
Service Xmer
8DFT01 LT Bus
8DFT01 Load
1600 kVA
FLA 83.98 A
PAF-8A CB
PAF-8A CT
250/1
PAF-8A Relay
PAF-8A NCT
50/1
PAF-8A Cable
PAF-8A Bus
PA Fan - 8A
3250 kW
IDF-8A CB
IDF-8A CT
300/1
IDF-8A Relay
IDF-8A NCT
50/1
IDF-8A Cable
IDF-8A Bus
ID Fan - 8A
4000 kW
CW-8A CB
CW-8A CT
250/1
CW-8A Relay
CW-8A NCT
50/1
CW-8A Cable
CW-8A Bus
CW Pump - 8A
2500 kW
CW-8B CB
CW-8B CT
250/1
CW-8B Relay
CW-8B NCT
50/1
CW-8B Cable
CW-8B Bus
CW Pump - 8B
2500 kW
FD-8A CB
FD-8A CT
200/1
FD-8A Relay
FD-8A NCT
50/1
FD-8A Cable
FD-8A Bus
FD Fan - 8A
2500 kW
8CAT01 CB
8CAT01 CT
1000/1
8CAT01 Relay
8CAT01 NCT
50/1
8CAT01 Cable
8CAT01 HT Bus
8CAT01
15 MVA
11/6.9 kV
12.5 %Z
Dyn11
UAT-8A
8CAT01 LT Bus
8CAT01 Load
15 MVA
FLA 787.3 A


Stn SWBD 0BB
Stn SWBD 0BB
ST-7
SS-7D IC CT
3500/1
SS-7D IC Relay
SS-7D IC CB
SS-7D
11 kV
MDBFP-7A CB2
MDBFP-7A CT2
250/1
MDBFP-7A Relay2
MDBFP-7A NCT2
50/1
MDBFP-7A Cable2
MDBFP-7A Bus
MDBFP-7A Cable1
MDBFP-7A Cable2
MDBFP-7A Bus
11 kV
MDBFP - 7A
3250 kW
OCCT01 CB
OCCT01 CT
150/1
OCCT01 Relay
OCCT01 NCT
50/1
OCCT01 Cable
OCCT01 HT Bus
OCCT01
2 MVA
11/6.9 kV
6 %Z
Dyn11
Raw Water Xmer AT-7
OCCT01 LT Bus
OCCT01 Load
2 MVA
FLA 104.97 A
OCDT01 CB
OCDT01 CT
800/1
OCDT01 Relay
OCDT01 NCT
50/1
OCDT01 Cable
OCDT01 HT Bus
OCDT01
12.5 MVA
11/6.9 kV
10 %Z
Dyn11
CHP Aux Xmer
OCDT01 LT Bus
OCDT01 Load
12.5 MVA
FLA 656.08 A
ODAT01 CB
ODAT01 CT
150/1
ODAT01 Relay
ODAT01 NCT
50/1
ODAT01 Cable
ODAT01 HT Bus
Coln Fdr1 CB
Coln Fdr1 CT
150/1
Coln Fdr1 Relay
Coln Fdr1 NCT
50/1
Coln Fdr1 Cable
Colony Load1 Bus
Colony Load-1
500 kVA
ODDT01 CB
ODDT01 CT
50/1
ODDT01 Relay
ODDT01 NCT
50/1
ODDT01 Cable
ODDT01 HT Bus
ODCT01 CB
ODCT01 CT
100/1
ODCT01 Relay
ODCT01 NCT
50/1
ODCT01 Cable
ODCT01 HT Bus
ODBT01 CB
ODBT01 CT
150/1
ODBT01 Relay
ODBT01 NCT
50/1
ODBT01 Cable
ODBT01 HT Bus
OCBT01 CB
OCBT01 CT
250/1
OCBT01 Relay
OCBT01 NCT
50/1
OCBT01 Cable
OCBT01 HT Bus
SS7D USBB Tie CB
NC
SS7D USBB Tie CT
2500/1
SS7D USBB Tie Relay
SS7D USBB Tie BD
US-BB
Tie to 8BB
SS7D SSBD Tie CB
Open
NO
SS7D SSBD Tie CT
3500/1
SS7D SSBD Tie Relay
SS7D SSBD Tie BD
SS-BD
Tie to 0BD
ODAT01 Cable
ODAT01 HT Bus
11 kV
ODAT01
2500 kVA
11/0.433 kV
10 %Z
Dyn11
STN Service Xmer
ODAT01 LT Bus
0.415 kV
ODAT01 Load
2500 kVA
FLA 131.2 A
ODDT01 Cable
ODDT01 HT Bus
11 kV
ODDT01
630 kVA
11/0.433 kV
6 %Z
Dyn11
Fuel Oil Unloading P/H Xmer
ODDT01 LT Bus
0.415 kV
ODDT01 Load
630 kVA
FLA 33.07 A
ODCT01 Cable
ODCT01 HT Bus
11 kV
ODCT01
1600 kVA
11/0.433 kV
8 %Z
Dyn11
CW P/H Xmer
ODCT01 LT Bus
0.415 kV
ODCT01 Load
1600 kVA
FLA 83.98 A
ODBT01 Cable
ODBT01 HT Bus
11 kV
ODBT01
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Fire Water/ Water Treatment Xmer
ODBT01 LT Bus
0.415 kV
ODBT01 Load
2500 kVA
FLA 131.2 A
OCBT01 Cable
OCBT01 HT Bus
11 kV
OCBT01
3.5 MVA
11/6.9 kV
6 %Z
Dyn11
RWT Xmer
OCBT01 LT Bus
6.6 kV
OCBT01 Load
3.5 MVA
FLA 183.7 A

Stn SWBD 0BA
Stn SWBD 0BA
SS-7C IC CT
3500/1
SS-7C IC Relay
SS-7C IC CB
SS-7C
11 kV
OCAT01 CB
OCAT01 CT
2500/1
OCAT01 Relay
OCAT01 NCT
50/1
OCAT01 Cable
OCAT01 HT Bus
ODET01 CB
ODET01 CT
75/1
ODET01 Relay
ODET01 NCT
50/1
ODET01 Cable
ODET01 HT Bus
SW SRV TRF1 CB
SW SRV TRF1 CT
50/1
SW SRV TRF1 Relay
SW SRV TRF1 Cable
SS7C SS8C Tie CB
Open
NO
SS7C SS8C Tie CT
3500/1
SS7C SS8C Tie Relay
SS7C SS8C Tie BD
SS-8C
Tie to 0BC
SS7C US8A Tie CB
NC
SS7C US8A Tie CT
2500/1
SS7C US8A Tie Relay
SS7C US8A Tie BD
US-8A
Tie to 8BA
MDBFP-7A CB1
Open
MDBFP-7A CT1
250/1
MDBFP-7A Relay1
MDBFP-7A NCT1
50/1
MDBFP-7A Cable1
MDBFP-7A Bus
MDBFP-7A Cable1
MDBFP-7A Cable2
MDBFP-7A Bus
11 kV
MDBFP - 7A
3250 kW
OCAT01 Cable
OCAT01 HT Bus
11 kV
OCAT01
40 MVA
11/6.9 kV
12 %Z
Dyn11
SAT-7
OCAT01 LT Bus
6.6 kV
OCAT01 Load
40 MVA
FLA 2099 A
ODET01 Cable
ODET01 HT Bus
11 kV
ODET01
1000 kVA
11/0.433 kV
8 %Z
Dyn11
Admin Bldg Xmer
ODET01 LT Bus
0.415 kV
ODET01 Load
1000 kVA
FLA 52.49 A

ST-8
SS-8D IC CT
2500/1
SS-8D IC Relay
SS-8D IC CB
Stn SWBD
0BD
SS-8D
11 kV
MDBFP-8A CB2
Open
MDBFP-8A CT2
250/1
MDBFP-8A Relay2
MDBFP-8A NCT2
50/1
MDBFP-8A Cable2
MDBFP-8A Bus
SS8D SS7D Tie CB
NC
SS8D SS7D Tie CT
3500/1
SS8D SS7D Tie Relay
SS8D SS7D Tie BD
SS-7D
Tie to 0BB
SS8D US7B Tie CB
NC
SS8D US7B Tie CT
2500/1
SS8D US7B Tie Relay
SS8D US7B Tie BD
US-7B
Tie to 7BB
ODDT02 CB
ODDT02 CT
50/1
ODDT02 Relay
ODDT02 NCT
50/1
ODDT02 Cable
ODDT02 HT Bus
OCBT02 CB
OCBT02 CT
250/1
OCBT02 Relay
OCBT02 NCT
50/1
OCBT02 Cable
OCBT02 HT Bus
Coln Fdr2 CB
Coln Fdr2 CT
150/1
Coln Fdr2 Relay
Coln Fdr2 NCT
50/1
Coln Fdr2 Cable
Colony Load2 Bus
Colony Load-2
500 kVA
ODAT02 CB
ODAT02 CT
150/1
ODAT02 Relay
ODAT02 NCT
50/1
ODAT02 Cable
ODAT02 HT Bus
ODCT02 CB
ODCT02 CT
800/1
ODCT02 Relay
ODCT02 NCT
50/1
ODCT02 Cable
ODCT02 HT Bus
ODBT02 CB
ODBT02 CT
150/1
ODBT02 Relay
ODBT02 NCT
50/1
ODBT02 Cable
ODBT02 HT Bus
OCDT02 CB
OCDT02 CT
800/1
OCDT02 Relay
OCDT02 NCT
50/1
OCDT02 Cable
OCDT02 HT Bus
OCDT02
12.5 MVA
11/6.9 kV
10 %Z
Dyn11
CHP Aux
Xmer
OCDT02 LT Bus
OCDT02 Load
12.5 MVA
FLA 656.08 A
OCCT02 CB
OCCT02 CT
150/1
OCCT02 Relay
OCCT02 NCT
50/1
OCCT02 Cable
OCCT02 HT Bus
OCCT02
2 MVA
11/6.9 kV
6 %Z
Dyn11
Raw Water
Xmer AT-7
OCCT02 LT Bus
OCCT02 Load
2 MVA
FLA 104.97 A
Stn SWBD
0BD
MDBFP-8A Cable1
MDBFP-8A Cable2
MDBFP-8A Bus
11 kV
MDBFP - 8A
3250 kW
ODDT02 Cable
ODDT02 HT Bus
11 kV
ODDT02
630 kVA
11/0.433 kV
6 %Z
Dyn11
Fuel Oil
Unloading
P/H Xmer
ODDT02 LT Bus
0.415 kV
ODDT02 Load
630 kVA
FLA 33.07 A
OCBT02 Cable
OCBT02 HT Bus
11 kV
OCBT02
3.5 MVA
11/6.9 kV
6 %Z
Dyn11
RWT
Xmer
OCBT02 LT Bus
6.6 kV
OCBT02 Load
3.5 MVA
FLA 183.7 A
ODAT02 Cable
ODAT02 HT Bus
11 kV
ODAT02
2500 kVA
11/0.433 kV
10 %Z
Dyn11
STN Service
Xmer
ODAT02 LT Bus
0.415 kV
ODAT02 Load
2500 kVA
FLA 131.2 A
ODCT02 Cable
ODCT02 HT Bus
11 kV
ODCT02
1600 kVA
11/0.433 kV
8 %Z
Dyn11
CW P/H
Xmer
ODCT02 LT Bus
0.415 kV
ODCT02 Load
1600 kVA
FLA 83.98 A
ODBT02 Cable
ODBT02 HT Bus
11 kV
ODBT02
2500 kVA
11/0.433 kV
10 %Z
Dyn11
Fire Water/
Water Treatment
Xmer
ODBT02 LT Bus
0.415 kV
ODBT02 Load
2500 kVA
FLA 131.2 A

SS-8C IC CT
3500/1
SS-8C IC Relay
SS-8C IC CB
Stn SWBD 0BC
Stn SWBD 0BC
SS-8C
11 kV
SS8C US7A Tie CB
NC
SS8C US7A Tie CT
2500/1
SS8C US7A Tie Relay
SS8C US7A Tie BD
US-7A
Tie to 7BA
OCAT02 CB
OCAT02 CT
2500/1
OCAT02 Relay
OCAT02 NCT
50/1
OCAT02 Cable
OCAT02 HT Bus
ODET02 CB
ODET02 CT
75/1
ODET02 Relay
ODET02 NCT
50/1
ODET02 Cable
ODET02 HT Bus
SS8C SS7C Tie CB
NC
SS8C SS7C Tie CT
3500/1
SS8C SS7C Tie Relay
SS8C SS7C Tie BD
SS-7C
Tie to 0BA
SW SRV TRF2 CB
SW SRV TRF2 CT
50/1
SW SRV TRF2 Relay
SW SRV TRF2 Cable
MDBFP-8A CB1
MDBFP-8A CT1
250/1
MDBFP-8A Relay1
MDBFP-8A NCT1
50/1
MDBFP-8A Cable1
MDBFP-8A Bus
MDBFP-8A Cable1
MDBFP-8A Cable2
MDBFP-8A Bus
11 kV
MDBFP - 8A
3250 kW
OCAT02 Cable
OCAT02 HT Bus
11 kV
OCAT02
40 MVA
11/6.9 kV
12 %Z
Dyn11
SAT-8
OCAT02 LT Bus
6.6 kV
OCAT02 Load
40 MVA
FLA 2099 A
ODET02 Cable
ODET02 HT Bus
11 kV
ODET02
1000 kVA
11/0.433 kV
8 %Z
Dyn11
Admin Bldg Xmer
ODET02 LT Bus
0.415 kV
ODET02 Load
1000 kVA
FLA 52.49 A

I/53324/2024

यूजेवीएन लिमिटेड
(उत्तराखण्ड सरकार का उपक्रम)

UJVN LIMITED

(A Govt. of Uttarakhand Enterprise)

कार्यालयः उप महाप्रबन्धक (सोलर, सामग्री प्रबन्धन एवं अनुबन्ध) गंगाभवन, यमुनाकालोनी, देहरादून–248001 दूरभाष–0135–2531762 फैक्ससं० 0135–2531762

Office of the Dy. General Manager (SOLAR, MM&CM), Ganga Bhawan, Yamuna Colony, Dehradun-248001 Phone–0135-2531762,Fax -0135-2531762

CIN No. U40101UR2001SGC025866

ISO 9001:2015, 14001 :2015, 45001 :2018 Certified

Dy. General Manager (HGC)
UJVN Ltd., Dakpathar,
Dehradun.

Subject :- A Report on Protection Audit conducted by CPRI.

Please find enclosed herewith the report on protection audit conducted by CPRI Bangalore with respect to Chibro Power House Dakpathar, Dehradun.

It is requested to provide comments on the above report and accordingly review the requirement of switchyard equipments etc. under PSDF scheme of GoI.

(S.K.Baunsiyal)
Dy. General Manager

Cc.

1. ED(O&M) UJVN Ltd., “Ujjwal” GMS Road, Dehradun for kind information.
2. GM(Yamuna Valley-I), UJVN Ltd., Dakpathar.
3. EE(IC&CM) UJVN Ltd. Dehradun in reference to his letter no . 51981 UJVN-D(P)0EDEM(EEIC)/4/2024-e-Office-UJVN Limited Dated 03/01/2024.

I/53324/2024

I/51981/2024

यूजेवीएन लिमिटेड
(उत्तराखण्ड सरकार का उपक्रम)

UJVN LIMITED

(A Govt. of Uttarakhand Enterprise)

कार्यालयः अधिशासी अभियन्ता(आई0सी० एण्ड सी०एम०), गंगाभवन, यमुनाकालोनी, देहरादून–248001 दूरभाष–0135–2531762 फैक्सस० 0135–2531762
Office of theExecutive Engineer (IC&CM), Ganga Bhawan, Yamuna Colony, Dehradun-248001 Phone–0135-2531762,Fax -0135-2531762
CIN No. U40101UR2001SGC025866

Executive Engineer (Gen/Test)
UJVN Ltd. Chibro Power
House, Dakhpathar.

Sub: - Draft report of CPRI Audit.

Please find herewith the attached document of draft Protection Audit report of CPRI for Chibro Power House Substation. It is request to provide your valuable comments/Suggestion at earliest. So that CPRI may summit their final Protection Audit Report.

Amit Ranjan
Executive Engineer

Copy:- Forwarded for kind information and necessary action.

1. DGM (Solar, MM&CM) Ganga Bhawan Yamuna Colony, Dehradun.
2. DGM Chibro Power House Dakhpathar.

CONSULTANCY REPORT

Protection audit of 220kV Substation at 240 MW Chibro Power House

VOLUME-II

Clients Reference: PO NO: 5300000132
CPRI Reference: No. 2/9/PSD/UJVNL/2022-23
CPRI Report: No. 2/9/PSD/RT99/2023

CUSTOMER

M/s UJVNL, Dehradun

CONSULTANT

POWER SYSTEMS DIVISION

CENTRAL POWER RESEARCH INSTITUTE

Sir. C.V.RAMAN ROAD, P.B. NO. 8066
SADASHIVANAGAR P.O
BANGALORE – 560 080.
Website : http://www.cpri.res.in

November 2023

POWER SYSTEMS DIVISION
CENTRAL POWER RESEARCH INSTITUTE
Sir. C.V. RAMAN ROAD P.B.No.8066, BANGALORE 560080
Website: https://cpri.res.in

Ref. File No.: 2/9/PSD/UJVNL/2022-23 Dated.13-12-2023

Title	**Third Party Protection audit at for 220kV Substation at 240 MW Chibro Power House**
Project Objectives	Review Of Protection Scheme, Relay Settings Of Various Element & Associated System Of for 220kV Substation at 240 MW Chibro, Power House
Name and Address of the Customer	M/S UJVNL, Dehradun
Client's Reference and Date	5300000132 Date :11.08.2023
CPRI report No:	2/9/PSD/RT99/2023
Name(s) of investigator(s) from CPRI	1. Dr J. Sreedevi, Joint Director & HOD 2. Mr. Ved Prakash Yadav, Engineering Officer
Name of UJVNL, Dehradun officers, associated in providing support to CPRI	1.Mr. Anup Deepak, Executive Engineer(test), Dakpather 2.Mr. Anand Kumar, Executive Engineer (Generation), KPS 3.Mr. Amit Ranjan, Executive Engineer(MM&C) 4. Mr. Arvind Bahuguna, Asst Engineer, M & FDR 5. Mr. Ajai Kumar Singh, Asst Engineer (test) 6. Mr. Sudhir Kumar, Asst Engineer (EM)
Report contains	Number of pages : 19
Report Reviewed by: Mr.Ved Prakash Yadav Engineering Officer Power Systems Division, CPRI Signature:	Report Approved by: Dr. J. Sreedevi Joint Director & HoD Power Systems Division, CPRI Signature:

ACKNOWLEDGEMENT

CPRI wishes to thank UJVNL, Dehradun, for awarding the contract of Third Party Protection audit of ***220kV Substation at 240 MW Chibro Power House*** PO No. 5300000132 Date :11.08.2023 to CPRI. CPRI wishes to thank all the Officers/Engineers of UJVNL Dehradun, who were associated in this work for their co-operation in providing the required data and for their interaction during the visit to the substation. CPRI Team specially thank the following personnel for their excellent co-operation without which this work would not have been possible,

1. Mr. Shri Anup Deepak, Executive Engineer(test), Dakpather
2. Mr. Mandeep Singh, Executive Engineer (Generation), KPS
3. Mr. Amit Ranjan, Executive Engineer(MM&C)
4. Mr. Arvind Bahuguna, Asst Engineer, M & FDR Prtn
5. Mr. Vedpal Arya, Asst Engineer (test)
6. Mr. Sharad Raghuvanshi, Asst Engineer (EM)

Minutes of Meeting

MOM Between	Date
CPRI, Bangalore & M/s UJVNL	11/10/2023

1. **Participants**:

Organization	Name
CPRI, Bangalore	Dr J.Sreedevi, Joint Director Shri Ved Prakash Yadav, Engineering Officer
UJVNL	Shri Anup Deepak, Executive Engineer(test), Dakpather Shri Anand Kumar, Executive Engineer (Generation), CPS Shri Amit Ranjan, Executive Engineer(MM&C) Shri Arvind Bahuguna, Asst Engineer, M&FDR Prtn Shri Ajai Kumar Singh, Asst Engineer (test) Shri Sudhir Kumar, Asst Engineer (EM)

2. **Meeting Details**:

Subject:	Visit for Protection Audit of M/s UJVNL Chibro Power House
Reference:	PO. No. 5300000132 dated: 11/08/2022

3. **Notes of Meeting**:

- CPRI officials visited Chibro substation on 11/10/2023 and briefed about the protection audit of the M/s UJVNL, Chibro Power House Switchyard.
- During the protection audit work, the existing setting of lines and GTs were taken for all the electro-mechanical type relay for setting calculations
- It is observed that following protections are electro-mechanical type which needs to be replaced/added with the latest numerical relays (IEDs) :
  - Bus bar protection:
    - Bus bar super vison relay type VTX 95A, 95B, 95CH;
    - Differential Protection 87A, 87B, 87CH,
    - Auxiliary relays 95AX, 95BX, 95CHX
    - Trip circuit supervision relays 95AY, 95BY, 95CHY
    - Interlock over current relay 51B1
    - Tripping Relay : 13 No.(96A, 96B, 96C to 96H)
  - Synchronizing relay
  - Bay control Unit is not available in the substation
  - Generator Transformer Protection:
    - HV standby earth fault relay 64GTS
    - HV & LV restricted earth fault relay 64GTR, 64UTR
    - Overall differential relay 87GT

- It is observed that SANDS make time synchronization unit is available for 220 kV system but all the available IEDs are not time synchronized due to lack of time sync provision in few relays such as ABB REL511 & ABB REL521 and EM type relays.
- CPRI Officers went around 220kV Switchyard to check the maintenance of the substation and measured the DC voltage (lead acid) in CB panel as below.

	Positive to Negative	Positive to Earth	Negative to Earth
DC Bank 1	232.50	+130.10	-102.10

- It is observed that two DC sources are available but only one source is extended to the switchyard. This needs to be attended at the earliest.
- It is observed that the PLCC on Khodri - Chibro lines for tandem operation of generators which was commissioned in 2005-06 is obsolete and spares are not available. It is very much important to have a healthy PLCC communication for tandem operation and needs to be replaced.
- It is observed that the testing of CT, CVT and PT was done during commissioning time.
- Testing of Electro mechanical protection relays and CBs have been done periodically. The test report of the same are available for 220 kV system and reviewed.
- It is recommended that Tan delta and Insulation resistance test shall be performed for the CT, CVT & PT during the routine test to analyze the healthiness of the equipment
- It is recommended that the all the Numerical Protection IEDs shall be tested once in 3/4/5 years as per the best practices adopted by the other organization such as PGCIL etc.
- Switchyard of 220 kV Chibro switchyard is being maintained properly and it is neat and clean.

The CPRI audit team thanked to the personnel of Chibro power house arranging the protection audit.

For CPRI

J. Sreedevi
11/10/23

For UJVNL

Anil
11-10-23

1. Executive Summary

Power Systems Division of Central Power Research Institute conducted the third party protection audit of 220kV Substation at 240MW Chibro Power House as per the PO No. 5300000132 Date :11.08.2023. The different protection that were covered under the audit are (i) Distance Protection (ii) ICT Protection and (iii) Bus bar Protection. It also included the checking of (i) DC Supply (ii) AC Supply with DG (iii) Communication system with DR (iv) Circuit Breaker (v) CT and (vi) CVT (vii) Synchro-Check. The audit format was provided by CPRI and the respective data was filled by the substation officers.

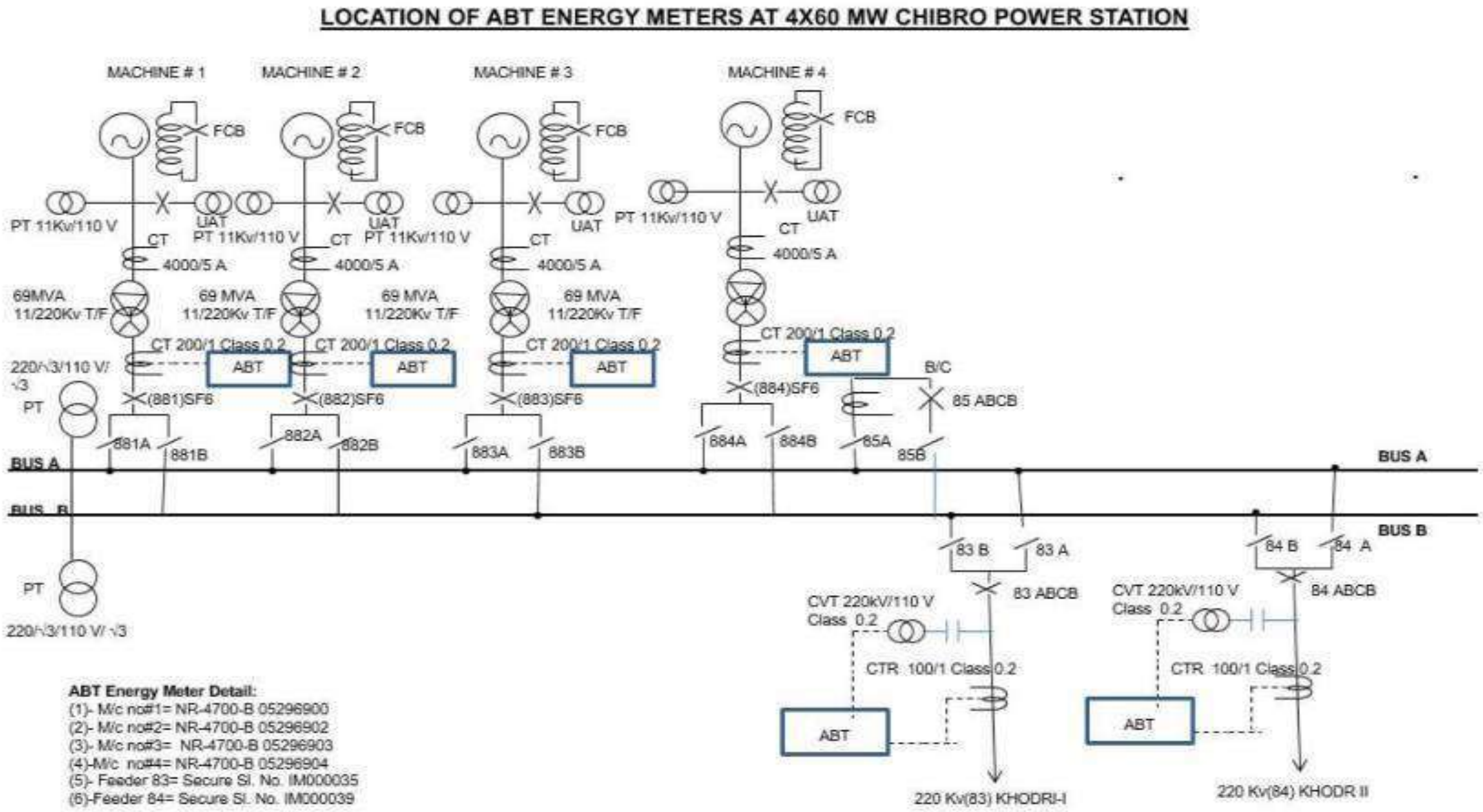
This report pertains to the audit carried out for ***220kV Substation at 240MW Chibro Power House***. The protection audit of the substation was carried out on 11-10-2023, have (a) Two 220 kV transmission lines (b) Four GT's After viewing the downloaded settings at substation for lines, transformer and busbar most of the settings are found to be in line with the recommended settings as per guidelines. However, some of the deviations found are given below:

1. The distance protection Main I & Main II, Zone 1 impedance reach setting for Chibro-Khodri I are properly set and some revisions are required in Zone 2 & Zone 3 impedance reach settings.
2. The distance protection Main-I & II of Zone 1 impedance reach setting for Chibro-Khodri II lines are properly set and some revisions are required in Zone 2 & Zone 3 impedance reach settings.
3. The earth fault protection is also protected to all line protection. Power swing, CB fail, and broken conductor is also provided on all lines. Minor changes in Power swing.
4. Resistive reach for Ph-Ph & Ph-Gnd to be reviewed for all the Lines. Since, For the calculation of resistive reach (Ph-Ph & Ph-Gnd), CPRI considered the Arc Resistance and Tower footing resistance as 28.864 Ω & 10 Ω respectively. If the Arc Resistance and Tower footing resistance values are different at the substation based on local substation condition, then all resistive reach (Ph-Ph & Ph-Gnd) same setting may be retained.

5. Other Protection functionality for lines like broken conductor Voltage supervision and Carrier communication are working satisfactory.
6. The differential protection setting for transformers are properly set and stable.
7. The differential protection setting for busbar are properly set and stable.
8. Relay coordination has been reviewed and some minor variation is required for few settings. The same has been provided in relay coordination sheet.
9. It is suggested to perform the third-party protection audit of substation/generating station periodically.

CONTENTS

1.0: LINE DIAGRAM OF 220kV CHIBRO POWER HOUSE (4X60 MW).



1.1: PROTECTION SYSTEM OVERALL REVIEW

220 kV SWITCHYARD CHIBRO POWER HOUSE, UJVNL		
DATE OF AUDIT BY CPRI TEAM : 11-10-2023		
Sl. No	**Title**	**Details**
1	**Name Of Grid Substation**	220 kV SWITCHYARD CHIBRO POWER HOUSE, UJVNL
2	**Highest Voltage Level**	220 kV
3	**Year Of Installation**	1975
4	**No Of Feeders**	Two 220 kV Feeder
5	**No of Transformers, Make and Capacity**	4*69 MVA, 220/11kV
6	**Busbar Arrangement**	Double Busbar Arrangement
7	**Present Busbar Switching Status**	Commissioned
8	**Busbar Protection**	Commissioned
9	**Relay System Status**	In Service
10	**DC Supply System**	[1] 220/110 V DC-I [2] 220/110 V DC-II [3] 50 V DC [4] 48 V DC-1 [5] 48 V DC-2
11	**DC Supply Capacity And Adequacy**	Battery is adequate for the station load.
12	**DC System Earth Fault Status**	Healthy condition.
13	**GPS Receiver Make & Model**	SANDS
14	**GPS Clock Receiver & Synchronization Of Relay Status**	Relays are synchronised
15	**Common Event Logger Status**	In-built feature in numerical relay is used
16	**Line Disturbance Recorder**	In-built feature in numerical relay is used
17	**Fault Locator in Line**	Provided
18	**Breaker Failure Relay Status**	Provided
19	**Circuit Breaker test reports**	Available
20	**Relay test reports**	Available
21	**General Observation of Relay And Protection System**	It is recommended that the all the Numerical Protection IEDs shall be tested once in 3 or 4 years as per the best practices.

Protection audit teams at site:

UJVNL, Chibro Team Members:

1	Mr. Mr. Anup Deepak	Executive Engineer(Test), Dakpather
2	Mr. Anand Kumar	Executive Engineer (Generation), CPS
3	Mr. Amit Ranjan	Executive Engineer(MM&C)

4	Mr. Arvind Bahuguna	Asst. Engineer, M & FDR Protection
5	Mr. Ajai Kumar Singh	Asst. Engineer (Test)
6	Mr. Sudhir Kumar	Asst. Engineer (EM)

CPRI Team Members:

1	Dr. J. Sreedevi	Joint Director, Hod
2	Mr. Ved Prakash Yadav	Engineering Officer

1.2: Relays Used for Transmission Line, Transformer, Reactor and Bus Bar Protection Substation

1.2.1: Relays used for Transmission Line Protection

Sl. No.	Name of the Feeder	Main-I	Main-II
1	Chibro - Khodri - I	ABB & REL511	ABB & REL521
2	Chibro - Khodri - II	ABB & REL511	ABB & REL521

1.2.2: Relays used for Transformer Protection:

Sl. No.	Transformer	Primary Protection	Back Up protection				
		Differential Protection	Inter Locked Over Current	UT over current	HV Standby Earth Fault	HV REF	LV REF
1	UNIT- 1	English Electric (CAG)	English Electric (CDG)	English Electric (SPEC)	English Electric (CDG)	English Electric (CAG)	English Electric (CAG)
2	UNIT- 2	English Electric (CAG)	English Electric (CDG)	English Electric (SPEC)	English Electric (CDG)	English Electric (CAG)	English Electric (CAG)
3	UNIT-3	English Electric (CAG)	English Electric (CDG)	English Electric (SPEC)	English Electric (CDG)	English Electric (CAG)	English Electric (CAG)
4	UNIT-4	English Electric (CAG)	English Electric (CDG)	English Electric (SPEC)	English Electric (CDG)	English Electric (CAG)	English Electric (CAG)

1.2.3: Relays used for BUS BAR Protection:

Sl. No.	Voltage level	Make	Model
1.	220kV	English Electrical	CAG

2.0 Input Data for Transmission Lines

2.1.Input Data for Transmission Lines Substation – Chibro - Khodri - I

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD CHIBRO POWER HOUSE, UJVNL**	
1	**Line Reference**	**Chibro - Khodri - I**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		Chibro-1
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		ABB REL 511
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		ABB REL 521
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	5.77
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0804
7.3	Positive seq. REACTANCE	Ohms/Km	0.41
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2814
7.5	Zero seq. REACTANCE	Ohms/Km	1.435
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Chibro-II**
8.2	Line Length of shortest adjacent line	Km	8.59
8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0804
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.41
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2814

8.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.435
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Khodri Station**
9.2	Line Length of longest adjacent line	Km	83.53
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0804
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.41
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2814
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.435
10	**Is there a transformer connected to the remote bus**	Yes/No	Yes
10.1	Number of Transformers		05
10.2	Voltage ratio of the Transformer	kV/kV	220/132
10.3	MVA of the transformers 1	MVA	1*100 MVA 4*34 MVA
10.4	% Impedance of the transformers1	%	13.7

2.2. Input Data for Transmission Lines Substation – Chibro - Khodri - II

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD CHIBRO POWER HOUSE, UJVNL**	
1	**Line Reference**	**Chibro - Khodri - II**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		Chibro-II
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		ABB REL 511
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		ABB REL 521
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	8.59
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0804
7.3	Positive seq. REACTANCE	Ohms/Km	0.41
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2814
7.5	Zero seq. REACTANCE	Ohms/Km	1.435
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**220kVChibro-Khodri II (84)**
8.2	Line Length of shortest adjacent line	Km	5.77
8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0804
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.41
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2814
8.6	Zero seq. REACTANCE of	Ohms/Km	1.435

	shortest adjacent line		
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Chibro-I**
9.2	Line Length of longest adjacent line	Km	83.53
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0804
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.41
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2814
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.435
10	**Is there a transformer connected to the remote bus**	Yes/No	Yes
10.1	Number of Transformers		05
10.2	Voltage ratio of the Transformer	kV	220/132
10.3	MVA of the transformers 1	MVA	1*100 MVA 4*34 MVA
10.4	% Impedance of the transformers1	%	13.7

3. Transmission line protective relay settings review:

Description	Existing Setting	Reviewed Setting	Existing setting	Reviewed setting
Line Name	**Khodri - Chibro-I**			
Main I/II	**Main-I**		**Main-II**	
Relay	**ABB REL 511**		**ABB REL 521**	
ZONE 1	Forward	Forward	Forward	Forward
R(Z1), Resistance for Ph-Ph faults	0.13	0.15	0.13	0.15
X(Z1), Reactance	0.76	0.76	0.76	0.76
RE(Z1), Resistance for ph-gnd	2.71	0.52	2.71	0.52
T1-1phase, delay for single phase	0	0	0	0
T1multi-ph, delay for multi-phase faults	0	0	0	0
ZONE 2	Forward	Forward	Forward	Forward
R(Z2), Resistance for Ph-Ph faults	0.69	0.22	0.69	0.22
X(Z2), Reactance	3.56	1.14	3.56	1.14
RE(Z2), Resistance for ph-gnd	2.08	0.78	2.08	0.78
T2-1phase, delay for single phase	0.4	0.35	0.4	0.35
T2multi-ph, delay for multi-phase	0.4	0.35	0.4	0.35
ZONE 3	Forward	Forward	Forward	Forward
R(Z3), Resistance for Ph-Ph faults	2.84	3.45	2.84	3.45
X(Z3), Reactance	14.56	17.57	14.56	17.57
RE(Z3), Resistance for ph-gnd	8.52	12.06	8.52	12.06
T3 delay	2	0.8	2	0.8
T3 Multi Phase	2	0.8	2	0.8
Dead Line Detection				
Operation	ON	ON	ON	ON
Fuse Failure				
Operation	ON	ON	ON	ON
Power Swing Settings				
Operation	ON	ON	ON	ON

Description	Existing Setting	Reviewed Setting	Existing setting	Reviewed setting
Line Name	**Khodri-Chibro-II**			
Main I/II	**Main-I**		**Main-II**	
Relay	**ABB REL 511**		**ABB REL 521**	
ZONE 1	Forward	Forward	Forward	Forward
R(Z1), Resistance for Ph-Ph faults	0.22	0.22	0.22	0.22
X(Z1), Reactance	1.22	1.13	1.12	1.13
RE(Z1), Resistance for ph-gnd	0.66	0.77	0.66	0.77
T1-1phase, delay for single phase	0	0	0	0
T1multi-ph, delay for multi-phase faults	0	0	0	0
ZONE 2	Forward	Forward	Forward	Forward
R(Z2), Resistance for Ph-Ph faults	0.78	0.33	0.33	0.33
X(Z2), Reactance	4.02	1.69	1.69	1.69
RE(Z2), Resistance for ph-gnd	2.35	1.16	0.99	1.16
T2-1phase, delay for single phase	0.4	0.35	0.6	0.35
T2multi-ph, delay for multi-phase	0.4	0.35	0.6	0.35
ZONE 3	Forward	Forward	Forward	Forward
R(Z3), Resistance for Ph-Ph faults	2.93	3.56	0.51	0.55
X(Z3), Reactance	15.02	18.13	2.63	2.83
RE(Z3), Resistance for ph-gnd	8.79	12.44	1.54	1.94
T3 delay	1.8	0.8	1.2	0.8
T3 Multi Phase	1.8	0.8	1.2	0.8
Dead Line Detection				
Operation	ON	ON	ON	ON
Fuse Failure				
Operation	ON	ON	ON	ON
Power Swing Settings				
Operation	ON	ON	ON	ON

4.0 Input Data for Transformer Protection

Sl. No.	Description	Units	Value
1	**Transformer Name**		GT-Unit 1,2,3 & 4
1.1	**Ratings**		
1.2	MVA	MVA	200
2	Voltage Ratio	kV/kV	230/11
3	**Impedance**	%	13.7
4	**Vector Group**		YNd11
`5	**NGR Data (if Present)**	Ohms	-
5.1	**OLTC Present**	Yes/No	No
5.2	OLTC Data		
5.3	Min Tap (%)	% (-)	-
5.4	Max Tap (%)	% (+)	-
6	No. of Steps		-
6.1	**Differential Protection provided**	Yes/No	Yes
6.2	Differential CT Ratio		
6.3	HV CT Ratio (Main & ICT)	A/A	800/1
7	LV CT Ratio (Main & ICT)	A/A	2090/19
7.1	**Differential Relay**		
7.2	Make		English Electric
8	Model		CAG

8.1	**HV REF provided**	Yes/No	Yes
8.2	REF Protection CTs Ratio **(Main & ICT)**	A/A	HV: 800/1 LV: NIL
8.3	Acc Class		-
8.4	RCT (Ω)	Ohms	-
8.5	Vk(V)	V	>2000
8.6	Im@Vk/2	mA	-
8.7	Longest sec. one way lead R Ω	Ohms	-
8.8	REF Relay		
8.9	Make		English Electric
8.10	Model		CAG
9	**LV REF provided**	Yes/No	Yes
9.1	REF Protection CTs Ratio **(Main & ICT)**	A/A	HV: 800/1 LV: NIL
9.2	Acc Class		PS
9.3	RCT (Ω)	Ohms	
10	Vk(V)	V	>2000
10.1	Im@Vk/2	mA	-
10.2	Longest sec. one way lead R Ω	Ohms	-
10.3	REF Relay		
10.4	Make		English Electric
10.5	Model		CAG
11	**Inter Locked Over Current**	Yes/No	Yes

11.1	Backup Over Current Protection Relay		
11.2	Make		English Electric
11.3	Model		CDG
11.4	Back-Up Over Current Protection CTs Ratio	A/A	-
12	**UT Over Current**	Yes/No	Yes
12.1	Backup Over Current Protection Relay		
12.2	Make		English Electric
12.3	Model		SPEC
12.4	Back-Up Over Current Protection CTs Ratio	A/A	-

4.1 Transformers Protection Relay Setting Review

Sl. No.	Protection	Name		GT-Unit 1, 2, 3 & 4	
		Type of Relay Used		**English Electric**	
		Line Voltage (kV)		11/220	
		Capacity in MVA		69	
		Description		**Existing Settings**	**Reviewed Settings**
1	**Transformer Differential**	Operation		On	On
		Pick-Up Current	R	5	5
			Y	5	5
			B	5	5
2	**HV Standby Earth Fault**	Operation		On	On
		Pick-Up Current		0.4 A	0.4 A
3	**HV REF Protection**	Operation		On	On
		Pick-Up Current		0.05A	0.05A
4	**LV REF Protection**	Operation		On	On
		Pick-Up Current		0.5A	0.5A
5	**Inter Locked Over Current**	Operation		On	On
		Pick-Up Current	R	0.3A	0.3A
			Y	0.3A	0.3A
			B	0.3A	0.3A
6	**UT Over Current**	Operation		On	On
		Pick-Up Current	R	5A	5A
			Y	5A	5A
			B	5A	5A

5 DC Measurements

DC battery and chargers are very important units as they are required to operate the protection relays. In this section, the details of the batteries and chargers are provided.

Following is the measurement of DC source which was taken during the site visit:

A. DC Supply

		Positive to Negative	Positive to Earth	Negative To Earth
1	DC Bank 1	232.50	+130.10	-102.10

6 Study results of field inspection of existing protection devices for obsolescence of technology, suitability, healthiness

Sl. No.	Protection	Suggested Numerical IEDs:
1	Transformer Differential	MiCOM P643, P645, Siemens 7UT612, 7UT613, ABB RET 670, SEL 787, ZIV 8IDB, 8IDV etc.
2	Restricted Earth Fault	MiCom P645, P141, Siemens 7SJ802, 7UT613, ABB RET 670, REL 670 etc.
3	Transformer Backup	MiCOM P645, P141, Siemens 7SJ804, 7SA611, ABB REF 615, ERL CSC 211, ZIV 7IRV, GE F650 etc.
4	Busbar Protection	MiCOM P740, ABB REF615, Siemens SIPROTEC 7SJ85, GE Multilin P40, Eaton Multilin P145 etc.

The installed relays for above mentioned protection is Electro-mechanical type and very old & obsolete. These protections may be replaced with any one of the latest numerical protection IEDs suggestions given in the table.

7 Protection Review and Recommendations:

In general, protection schemes and setting are in order. All the 220 kV lines, Transformers are protected through numerical based Protection schemes.

1. The distance protection Main I & Main II, Zone 1 impedance reach setting for Chibro-Khodri I are properly set and some revisions are required in Zone 2 & Zone 3 impedance reach settings.
2. The distance protection Main-I & II of Zone 1 impedance reach setting for Chibro-Khodri II lines are properly set and some revisions are required in Zone 2 & Zone 3 impedance reach settings.
3. The earth fault protection is also protected to all line protection. Power swing, CB fail, and broken conductor is also provided on all lines. Minor changes in Power swing.
4. Resistive reach for Ph-Ph & Ph-Gnd to be reviewed for all the Lines. Since, For the calculation of resistive reach (Ph-Ph & Ph-Gnd), CPRI considered the Arc Resistance and Tower footing resistance as 28.864 Ω & 10 Ω respectively. If the Arc Resistance and Tower footing resistance values are different at the substation based on local substation condition, then all resistive reach (Ph-Ph & Ph-Gnd) same setting may be retained.
5. Other Protection functionality for lines like broken conductor Voltage supervision and Carrier communication are working satisfactory.
6. The differential protection setting for transformers are properly set and stable.
7. The differential protection setting for busbar are properly set and stable.
8. Relay coordination has been reviewed and found satisfactory.
9. It is suggested to perform the third-party protection audit of substation/generating station periodically.

Note: Difference observed between existing settings and reviewed settings are given in bold font in respective protection.

8 Review of reports

Review of test reports of CTs & CVTs:

Pre-commissioning test reports were provided for all relays and CTs & CVT and these were reviewed. It is recommended that pre-commissioning reports of all relays, CTs and CVTs should be kept properly and they should be mandatorily provided whenever they are required to be reviewed. It is also recommended that routine testing of all relays should be carried out regularly in future.

Review of test reports of Circuit Breaker:

Test reports of all Circuit Breakers were provided and reviewed. It is recommended that pre-commissioning reports of all circuit breakers should be kept properly and they should be mandatorily being provided whenever they are required to be reviewed. It is also recommended that routine testing of all circuit breakers should be carried out regularly in future.

CONSULTANCY REPORT

Protection audit of 220kV Substation at 240 MW Chibro Power House

VOLUME-I

Clients Reference: PO NO: 5300000132
CPRI Reference: No. 2/9/PSD/UJVNL/2022-23
CPRI Report: No. 2/9/PSD/RT99/2023

CUSTOMER

M/s UJVNL, Dehradun

CONSULTANT

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November 2023

CT

Sl. no	Location	CT ratio	Make and model	CT serial no	Date of commissioning	Date of last testing	Serviceable/ Non Serviceable	Remarks
1	UNIT 1	200-100/1	ABB	2109556	2009	2022	Serviceable	The life span of CT is 25 years. Test reports show that Tan delta and accuracy are well within limit. The performance of CT is satisfactory
				2109558	2009	2022		
				2109557	2009	2022		
2	UNIT 2	200-100/1	ABB	2109551	2009	23.12.2022	Serviceable	
				2109554	2009	23.12.2022		
				2109561	2009	23.12.2022		
3	UNIT 3	200-100/1	ABB	2109553	2009	2022	Serviceable	
				2109560	2009	2022		
				2109562	2009	2022		
4	UNIT 4	200-100/1	ABB	2109555	2009	2022	Serviceable	
				2109552	2009	2022		
				2109559	2009	2022		
5	Feeder 83	800/1	ABB	46885	10/12/2015	10/12/2015	Serviceable	CTs commissioned in the year 2015-16 and all the tests were conducted during commissioning. Performance of the CTs is satisfactory.
				46886	10/12/2015	10/12/2015		
				46882	10/12/2015	10/12/2015		
6	Feeder 84	800/1	ABB	46881	22/01/2016	22/01/2016	Serviceable	
				46883	22/01/2016	22/01/2016		
				46884	22/01/2016	22/01/2016		
7	BUS COUPLER	800/1	ABB	46879	2016	2016	Serviceable	
				46880	2016	2016		
				46878	2016	2016		

<table>
<tr><th colspan="9">PT</th></tr>
<tr><th>Sl. no</th><th>Location</th><th>PT ratio</th><th>Make and model</th><th>PT serial no</th><th>Date of commissioning</th><th>Date of last testing</th><th>Serviceable/ Non Serviceable in case of Breakdown</th><th>Remarks</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Chibro Switch Yard</td><td rowspan="6">220kV/ 110V</td><td rowspan="3">-</td><td>2243704 / 2 CORE</td><td>21/01/2016</td><td>21/01/2016</td><td rowspan="3">Serviceable</td><td rowspan="6">PTs commissioned in the year 2016 and all the tests were conducted during commissioning. Performance of the PTs is satisfactory.</td></tr>
<tr><td>2243707 / 2 CORE</td><td>21/01/2016</td><td>21/01/2016</td></tr>
<tr><td>2243699 / 2 CORE</td><td>21/01/2016</td><td>21/01/2016</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Chibro Switch Yard</td><td rowspan="3">-</td><td>740373</td><td>-</td><td>-</td><td rowspan="3">Serviceable</td></tr>
<tr><td>740375</td><td>-</td><td>-</td></tr>
<tr><td>740374</td><td>-</td><td>-</td></tr>
</table>

CVT								
Sl. no	**Location**	**CVT ratio**	**Make and model**	**CVT serial no**	**Date of commissioning**	**Date of last testing**	**serviceable/ Non serviceable**	**Remarks**
1	Feeder 83	220kV/ 110 V	-	S-46874	15/01/2016	15/01/2016	serviceable	CVTs commissioned in the year 2016 and all the tests were conducted during commissioning. Performance of the CVTs is satisfactory.
				S-46873	15/01/2016	15/01/2016		
				S-46871	15/01/2016	15/01/2016		
2	Feeder 84	220kV/ 110 V	-	S-46870	1/25/2016	1/25/2016	serviceable	
				S-46869	1/25/2016	1/25/2016		
				S-46872	1/25/2016	1/25/2016		

CIRCUIT BREAKER

Sl. no	Location	Make and Model	Serial Number	Status of Breaker available or not	Number of Trip/close coil and healthiness	Date of commissioning	Date of Last timing taken	Operating time (ms)	Serviceable/ Non serviceable	Remarks
A	**220 kV System**									
1	220 kV Bay 1	ABB/PASS M0S (Feeder)	245S034	YES	Healthy	2019	2019	19	serviceable	CBs commissioned in the year 2019 and all the tests were conducted during commissioning. Performance of the CBs is satisfactory.
2	220 kV Bay 2	ABB/PASS M0S (Feeder)	245S035	YES	Healthy	2019	2019	19.8	serviceable	
3	220 kV Bay 3	ABB/PASS M0S (B/C)	245S036	YES	Healthy	2019	2019	20.2	serviceable	
4	220 kV Bay 4	CGL/200-SFM-40A (UNIT-1)	16471 C	YES	Healthy	2003	28/03/2023	21	serviceable	The opening time is well within the limit and performance of CB is satisfactory.
5	220 kV Bay 5	CGL/200-SFM-40A (UNIT-2)	16472 C	YES	Healthy	2003	25/03/2023	23	serviceable	
6	220 kV Bay 6	CGL/200-SFM-40A (UNIT-3)	16473 C	YES	Healthy	2003	28/03/2023	22	serviceable	
7	220 kV Bay 7	CGL/200-SFM-40A (UNIT-4)	16474 C	YES	Healthy	2003	28/03/2023	22	serviceable	

DC Supply

Sl. no	Name	Date of Commission	Last testing	Remarks
1	220V DC-1	5/5/2011	Testing has been performed weekly.	The Performance of battery is satisfactory. It is suggested to extend the both 220V DC source to the switchyard for breaker operation.
2	220V DC-2	21/03/2019		
3	50 V DC	25/10/2016		
4	48 V DC-1	5/5/2011		
5	48 V DC-2	20/07/2021		

Transmission Line Protection

Sl. no	Voltage	Name of Protection Line		Make & Model	Serial No	Functional	Date of last testing	Date of Commissioning	Serviceable/ Non serviceable	Remarks
1	220kV	Chibro - Khodri 1 (83)	MAIN 1	ABB & REL511-1N3	T0503157	YES	Not tested	08.02.2006	Serviceable	Since the available protection relay has no provision for communication and time sync facility. It is suggested to replace with the latest numerical IEDs.
2		Chibro - Khodri 2 (84)		ABB & REL511-1N3	T0507009	YES	Not tested	03.03.2006	Serviceable	

Sl. no	Voltage	Name of Protection Line		Make & Model	Serial No	Functional	Date of last testing	Date of Commissioning	Serviceable/ Non serviceable	Remarks
1	220kV	Chibro - Khodri 1 (83)	MAIN 2	ABB & REL521-1N3	T0449073	YES	Not tested	2005-2006	Serviceable	Since the available protection relay has no provision for communication and time sync facility. It is suggested to replace with the latest numerical IEDs.
2		Chibro - Khodri 2 (84)		ABB & REL521-1N3	T0449076	YES	10/5/2010	2005-2006	Serviceable	

Sl. no	Voltage	Name of Protection Line		Make & Model	Serial No	Functional	Date of last testing	Date of Commissioning	Serviceable/ Non serviceable	Remarks
1	220kV	Chibro - Khodri 1 (83)	LBB	Schneider P127	39803979	YES	22/05/2023	22/05/2023	Serviceable	The available protection is latest numerical IED. Performance is satisfactory.
2	220kV	Chibro - Khodri 2 (84)	LBB	Schneider P127	39820190	YES	22/05/2023	22/05/2023	Serviceable	

Transformer Protection

Sl. no	Transformer (ICT/GT/ST)	TYPE	Make	Model Number	Serial No	Functional	Date of Testing	Date of Commissioning	OTI/WTI Indicator	Bucholtz/ PDR	Remarks
1	GT - 1,2,3,4	Differential	BHEL	-	3371881 3371880 3371879	YES	NOT TESTED	1975	YES	M118302 (GT1)	The available protection is electro-mechanical type and very old & trouble prone. This needs to be upgraded with the latest numerical IED.
		Inter locked over current		CDG3198131CV	-	YES		1975		M118300 (GT2)	
		UT - Over Current		SPECMIEG 250H	-	YES		1975		M118301 (GT3)	
		HV standby Earth Fault		CDGIIAF228A5	-	YES		1975		M115016 (GT4)	
		HV REF		CAG14AF25A	-	YES		1975		-	
		LV REF		CAG14AF15A	-	YES		1975		-	

Sl. no	Transformer	Vector Group	MVA capacity in MVA	Percentage Impedance	Rated kV in kV		CT ratio			Remarks
					HV	LV	HV	LV	NCT	
1	GT-1	Yd11	69	13.7	230	11	800/1	2090/19	200/1	The data is used for the relay setting calculation and review.
2	GT-2	Yd11	69	13.7	230	11	800/1	2090/19	200/1	
3	GT-3	Yd11	69	13.7	230	11	800/1	2090/19	200/1	
4	GT-4	Yd11	69	13.7	230	11	800/1	2090/19	200/1	

Bus bar Protection

Sl no	Bus bar	Make and model	Serial number	Date of last tested	Date of Commissioning	Serviceable/ Non Serviceable	Stability check	Remarks
1	220	EE & CAG34AAF75A (B phase)	M118305, M118304, M118303	Not Tested	23/05/2023	Non Serviceable		The available protection is electro-mechanical type and very old & trouble prone. This needs to be upgraded with the latest numerical IED.

Auxiliary Systems

Sl. no	Auxiliary supply	Sources of Supply	Reliability of Supply	Average of Tripping Month	Remarks
1	33 kV Supply 1	Dhakrani substation	-	10	Performance is satisfactory.
2	33 kV Supply 2	Dhakrani substation	-	12	

Sl. no	DG set	Make and model	Serial Number	Rating	set Auto/Manual	Fuel Level	Date of last testing	Date of Commissioning	Serviceable/ Non Serviceable	Remarks
1	DG 1	Kirloskar	2516	500kVA	Manual	above 70%	23/08/2023	31/03/2017	Serviceable	Performance is satisfactory.
2	DG 2	Kirloskar	41K157	500kVA	Manual	above 90 %	23/08/2023	31/03/2021	Serviceable	

SUMMARY & RECOMMENDATION
Protection audit of 220kV Substation at 240 MW Chibro Power House

1	**DC Supply**	The Performance of battery is satisfactory. It is suggested to extend the both 220V DC source to the switchyard for breaker operation.
2	**220kV Chibro-Khodri 1 & Chibro- Khodri 2 (MAIN 1)**	Since the available distance protection relay has no provision for communication and time synchronization facility. It is recommended to replace with the latest numerical IEDs.
3	**220kV Chibro-Khodri 1 & Chibro- Khodri 2 (MAIN 2)**	Since the available distance protection relay has no provision for communication and time synchronization facility. It is recommended to replace with the latest numerical IEDs.
4	**GT- 1,2,3,4**	❖ The available protections are electro-mechanical type and very old & trouble prone. It is recommended to replace with the latest numerical IEDs. ❖ Generator Transformer Protection: ➢ HV standby earth fault relay 64GTS ➢ HV & LV restricted earth fault relay 64GTR, 64UTR ➢ Overall differential relay 87GT
5	**220 kV Bus bar**	The available protections are electro-mechanical type and very old & trouble prone. The following relays needs to be upgraded with the latest numerical IEDs ❖ Bus Bar Protection ➢ Bus bar super vison relay type VTX 95A, 95B, 95CH; ➢ Differential Protection 87A, 87B, 87CH, ➢ Auxiliary relays 95AX, 95BX, 95CHX ➢ Trip circuit supervision relays 95AY, 95BY, 95CHY ➢ Interlock over current relay 51B1 ➢ Tripping Relay: 13 No. (96A, 96B, 96C to 96H)

		❖ Synchronizing relay need to be installed. ❖ Bay control Unit is not available in the substation and need to be installed.
6	**Khodri – Chibro line**	It is recommended that the PLCC on Khodri - Chibro lines for tandem operation of generators which was commissioned in 2005-06 is obsolete and spares are not available. It is very much important to have a healthy PLCC communication for tandem operation and needs to be replaced.
7	**Testing**	It is recommended that all the CT, CVT, PT,CB and Numerical Protection IEDs shall be tested once in 3/4/5 years.

I/53062/2024

यूजेवीएन लिमिटेड

(उत्तराखण्ड सरकार का उपक्रम)

UJVN LIMITED

(A Govt. of Uttarakhand Enterprise)

कार्यालयः उप महाप्रबन्धक (सोलर, सामग्री प्रबन्धन एवं अनुबन्ध) गंगाभवन, यमुनाकालोनी, देहरादून–248001 दूरभाष–0135–2531762 फैक्ससं० 0135–2531762

Office of the Dy. General Manager (SOLAR, MM&CM), Ganga Bhawan, Yamuna Colony, Dehradun-248001 Phone–0135-2531762,Fax -0135-2531762

CIN No. U40101UR2001SGC025866

ISO 9001:2015, 14001 :2015, 45001 :2018 Certified

Dy. General Manager (HGC)
UJVN Ltd., Dakpather.

Subject :- A Report on Protection Audit conducted by CPRI.

Please find enclosed herewith the report on protection audit conducted by CPRI Bangalore with respect to Khodri Power House, Dakpather.

It is requested to provide comments on the above report and accordingly review the requirement of switchyard equipments etc. under PSDF scheme of GoI.

(S.K.Baunsiyal)
Dy. General Manager

Cc.

1. ED(O&M) UJVN Ltd., “Ujjwal” GMS Road, Dehradun for kind information.
2. EE(IC&CM) UJVN Ltd. Dehradun in reference to his letter no . 52147 UJVN-D(P)0EDEM(EEIC)/4/2024-e-Office-UJVN Limited Dated 04/01/2024.

I/53062/2024

पंजीकृतकार्यालयः ''उज्जवल'', महारानीबाग, जी0एम0एस0 रोड, देहरादून–248006 (उत्तराखण्ड), दूरभाषः 0135–2763808, फैक्सः 0315–2763508
Regd. Office: "UJJWAL", Maharani Bagh, G.M.S. Road, Dehradun – 248006 (Uttarakhand), Phone: 0135-2763808, Fax: 0135-2763508 Website: www.ujvnl.com

I/52147/2024

यूजेवीएन लिमिटेड
(उत्तराखण्ड सरकार का उपक्रम)
UJVN LIMITED
(A Govt. of Uttarakhand Enterprise)

कार्यालयः अधिशासी अभियन्ता(आई0सी० एण्ड सी०एम०), गंगाभवन, यमुनाकालोनी, देहरादून–248001 दूरभाष–0135–2531762 फैक्ससं० 0135–2531762
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CIN No. U40101UR2001SGC025866

ISO 9001:2008 Certified

**Executive Engineer (Gen/Test)
UJVN Ltd. Khodri Power
House, Dakhpathar.**

Sub: - Draft report of CPRI Audit.

Please find herewith the attached document of draft Protection Audit report of CPRI for Khodri Power House Substation. It is request to provide your valuable comments/Suggestion at earliest. So that CPRI may summit their final Protection Audit Report.

**Amit Ranjan
Executive Engineer**

Copy:- Forwarded for kind information and necessary action.

1. DGM (Solar, MM&CM) Ganga Bhawan Yamuna Colony, Dehradun.
2. DGM Khodri Power House Dakhpathar.

CONSULTANCY REPORT

Protection audit of 220kV Substation at 120MW Khodri Power House

VOLUME-II

Clients Reference: PO NO: 5300000132
CPRI Reference: No. 2/9/PSD/UJVNL/2022-23
CPRI Report: No. 2/9/PSD/RT99/2023

CUSTOMER

M/s UJVNL, Dehradun

CONSULTANT

POWER SYSTEMS DIVISION

CENTRAL POWER RESEARCH INSTITUTE

Sir. C.V.RAMAN ROAD, P.B. NO. 8066
SADASHIVANAGAR P.O
BANGALORE – 560 080.
Website : http://www.cpri.res.in

November 2023

POWER SYSTEMS DIVISION
CENTRAL POWER RESEARCH INSTITUTE
Sir. C.V. RAMAN ROAD P.B.No.8066, BANGALORE 560080
Website: https://cpri.res.in

Ref. File No.: 2/9/PSD/UJVNL/2022-23 Dated.07-12-2023

Title	**Third Party Protection audit at for 220kV Substation at 120MW Khodri Power House**
Project Objectives	Review Of Protection Scheme, Relay Settings Of Various Element & Associated System Of for 220kV Substation at 120MW Khodri Power House
Name and Address of the Customer	M/S UJVNL, Dehradun
Client’s Reference and Date	5300000132 Date :10.10.2023
CPRI report No:	2/9/PSD/RT99/2023
Name(s) of investigator(s) from CPRI	1. Dr J Sreedevi ,Joint Director & HOD 2. Mr. .Ved Prakash Yadav, Engineering Officer
Name of UJVNL, Dehradun officers, associated in providing support to CPRI	1.Mr. Anup Deepak, Executive Engineer(test), Dakpather 2.Mr. Mandeep Singh, Executive Engineer (Generation), KPS 3.Mr. Amit Ranjan, Executive Engineer(MM&C) 4. Mr. Arvind Bahuguna, Asst Engineer, M&FDR Prtn 5. Vedpal Arya, Asst Engineer (test) 6. Sharad Raghuvanshi, Asst Engineer (EM)
Report contains	Number of pages : 49
Report Reviewed by: Mr.Ved Prakash Yadav Engineering Officer Power Systems Division, CPRI Signature:	Report Approved by: Dr. J. Sreedevi Joint Director & HoD Power Systems Division, CPRI Signature:

ACKNOWLEDGEMENT

CPRI wishes to thank UJVNL, Dehradun , for awarding the contract of Third Party Protection audit of ***220kV Substation at 120MW Khodri Power House*** PO No. 2/9/PSD/UJVNL/2022-23to CPRI. CPRI wishes to thank all the Officers/Engineers of UJVNL Dehradun, who were associated in this work for their co-operation in providing the required data and for their interaction during the visit to the substation. CPRI Team specially thank the following personnel for their excellent co-operation without which this work would not have been possible,

1. Mr. Shri Anup Deepak, Executive Engineer(test), Dakpather
2. Mr.Mandeep Singh, Executive Engineer (Generation), KPS
3. Mr. Amit Ranjan, Executive Engineer(MM&C)
4. Mr. Arvind Bahuguna, Asst Engineer, M&FDR Prtn
5. Mr. Vedpal Arya, Asst Engineer (test)
6. Mr. Sharad Raghuvanshi, Asst Engineer (EM)

Minutes of Meeting

MOM Between	Date
CPRI, Bangalore & M/s UJVNL	10/10/2023

1. **Participants**:

Organization	Name
CPRI, Bangalore	Dr J.Sreedevi, Joint Director Shri Ved Prakash Yadav, Engineering Oficer
UJVNL	Shri Anup Deepak, Executive Engineer(test), Dakpather Shri Mandeep Singh, Executive Engineer (Generation), KPS Shri Amit Ranjan, Executive Engineer(MM&C) Shri Arvind Bahuguna, Asst Engineer, M&FDR Prtn Shri Vedpal Arya, Asst Engineer (test) Shri Sharad Raghuvanshi, Asst Engineer (EM)

2. **Meeting Details**:

Subject:	Visit for Protection Audit of M/s UJVNL Khodri & Chibro Power House
Reference:	PO. No. 5300000132 dated: 11/08/2022

3. **Notes of Meeting**:

- CPRI officials visited Khodri substation on 10/10/2023 and briefed about the protection audit of the M/s UJVNL, Khodri Power House Switchyard.
- During the protection audit work, the existing setting of Numerical protection IEDs of all lines were downloaded and taken for setting calculations
- It is observed that following protections are Electro-mechanical type which needs to be replaced/added with the latest numerical relays (IEDs) :
  - ➢ Bus bar protection:
    - Bus bar super vison relay type VTX 95A, 95B, 95CH;
    - Differential Protection 87A, 87B, 87CH,
    - Auxiliary relays 95AX, 95BX, 95CHX
    - Trip circuit supervision relays 95AY, 95BY, 95CHY
    - Interlock over current relay 51B1
    - Tripping Relay : 13 No.(96A, 96B, 96C to 96H)

  For the fault on 11.09.2022, the unit 3, R-phase CB bursted but Bus bar protection not operated, the breaker of far end got tripped. So it was found that bus bar protection is not healthy and tried to Rectify with OEM and found that spares are not available.
  - ➢ Synchronizing relay
  - ➢ Bay control Unit is not available in the substation
- It is also found that, the 132kV line side, breaker is not available and hence for any fault at 132kV side, the network of 33kV is getting isolated and solar power integrated at 33kV is not possible to evacuate resulting in generation loss. Also, in case of fault, shutdown and

maintenance, the breaker operation is being done from remote end, hence 132kV breaker is recommended.

- It is observed that SANDS make time synchronization unit is available for 220 kV system but all the available IEDs are not time synchronized due to lack of time sync provision in few relays such as ABB REL511 & ABB REL521.
- CPRI Officers went around 220kV and 132kV Switchyard to check the maintenance of the substation and measured the DC voltage (lead acid) in CB panel as below. It is found that high impedance earth fault persists which needs to be attended and rectify.

	Positive to Negative	Positive to Earth	Negative to Earth
DC Bank 1	237.60	+152.40	-84.60

- It is observed that two DC sources are available but only one source is extended to the switchyard. This needs to be attended at the earliest.
- It is observed that the oil leakage is present in the 100 MVA 220/132 kV transformer in switchyard and this needs to be attended at the earliest.
- It is observed that the PLCC on Khodri - Chibro lines for tandem operation of generators which was commissioned in 2005-06 is obsolete and spares are not available. It is very much important to have a healthy PLCC communication for tandem operation and needs to be replaced.
- It is observed that the routine testing of CT, CVT, Numerical Protection IEDs and CBs have been done periodically. The test report of CTs, CVTs, Numerical protection IEDs and CBs are available for 220 & 132 kV system and reviewed.
- It is recommended that the all the Numerical Protection IEDs shall be tested once in 3/4/5 years as per the best practices adopted by the other organization such as PGCIL etc.
- It is recommended that the testing equipment such as tan delta kit, secondary injection kit, leakage current tester, power analyzer, winding resistance, TTR meter, energy meter testing is required at Khodri power house site for periodic testing and fault analysis. The same may be utilized at Chibro & Dhakpathar Power houses.
- It is recommended that Relay Test System and other testing equipment must be calibrated from NABL Accreditated Laboratory & the calibration must include voltage, current, frequency, phase angle, power and time. The calibration point shall be decided as per the setting of Numerical Protection IEDs.
- Switchyard of 220 & 132 kV Khodri switchyard is being maintained properly and it is neat and clean.

The CPRI audit team thanked to the personnel of Khodri power house arranging the protection audit.

For CPRI

J. Sreedevi
10/10/23

For UJVNL

Amit
10-10-23

1. Executive Summary

Power Systems Division of Central Power Research Institute conducted the third party protection audit of of 220kV Substation at 120MW Khodri Power House as per the PO No. 2/9/PSD/UJVNL/2022-23 Dated 10/10/2023. The different protection that were covered under the audit are (i) Distance Protection (ii) ICT Protection and (iii) Bus bar Protection. It also included the checking of (i) DC Supply (ii) AC Supply with DG (iii) Communication system with DR (iv) Circuit Breaker (v) CT and (vi) CVT (vii) Synchro-Check. The audit format was provided by CPRI and the respective data was filled by the substation officers.

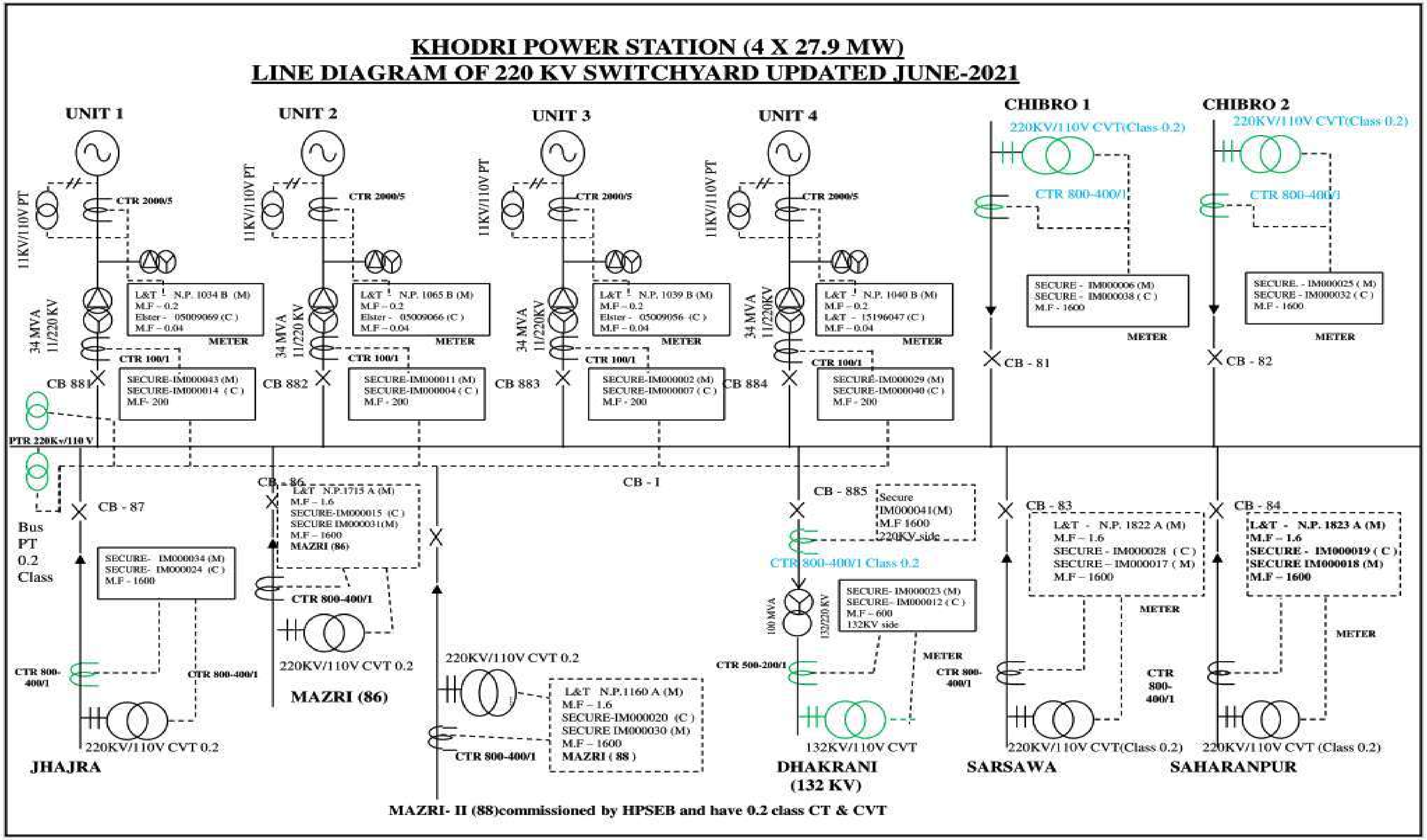
This report pertains to the audit carried out for ***220kV Substation at 120MW Khodri Power House***. The protection audit of the substation was carried out from 04/09/2023 to 07/09/2023. UJVNL, DEHRADUN have (a) Seven 220 kV transmission lines (b) One 132 kV transmission lines (c) Four ICT's After viewing the downloaded settings at substation for lines, transformer and busbar most of the settings are found to be in line with the recommended settings as per guidelines. However, some of the deviations found are given below:

1. The distance protection Main-I & II of all Zone impedance reach setting for Khodri - Chibro-I lines are properly set.
2. The distance protection Main-I & II of all Zone impedance reach setting for Khodri - Chibro-II lines are properly set.
3. The distance protection Main-I of all Zone impedance reach setting for Khodri-Sarsawa , Khodri-Saharanpur II , Khodri-Jhajhra & Khodri-Mazri I lines are properly set.
4. The distance protection Main-II, Zone 1 & Zone 3 impedance reach setting for Khodri-Sarsawa are properly set and some minor revisions are required in Zone 2 impedance reach settings.
5. The distance protection Main-II, Zone 1 impedance reach setting for Khodri-Saharanpur II are properly set and some minor revisions are required in Zone 2 & Zone 3 impedance reach settings.
6. The distance protection Main-II, Zone 1 impedance reach setting for Khodri-Mazri I properly set and some minor revisions are required in Zone 2 & Zone 3 impedance reach settings.
7. Some revisions are required in Zone 1,Zone 2 & Zone 3 impedance reach settings for Khodri-Mazri II.
8. The distance protection Main-I Zone 1 & Zone 2 impedance reach setting for Khodri-Dhakrani are properly set and some minor revisions are required in Zone 3 impedance reach settings.the available protection is electromechanical type. This needs to be upgraded with the latest numerical IED.

9. The earth fault protection is also protected to all line protection. Power swing, CB fail, and broken conductor is also provided on all lines. Minor changes in Power swing.
10. Resistive reach for Ph-Ph & Ph-Gnd may be reviewed for all the Lines. Since, For the calculation of resistive reach (Ph-Ph & Ph-Gnd), CPRI considered the Arc Resistance and Tower footing resistance as 28.864 Ω & 10 Ω respectively. If the Arc Resistance and Tower footing resistance values are different at the substation based on local substation condition, then all resistive reach (Ph-Ph & Ph-Gnd) same setting may be retained.
11. Other Protection functionality for lines like broken conductor Voltage supervision and Carrier communication are working satisfactory.
12. The differential protection setting for transformers are properly set and stable.
13. The differential protection setting for busbar are properly set and stable.
14. Relay coordination has been reviewed and some minor variation is required for few settings. The same has been provided in relay coordination sheet.
15. It is suggested to perform the third-party protection audit of substation/generating station periodically.

CONTENTS

1.0: LINE DIAGRAM OF 220kV KHODRI POWER STATION (4X27.9 MW).



1.1: PROTECTION SYSTEM OVERALL REVIEW

220 kV SWITCHYARD KHODRI POWER STATION UJVNL		
DATE OF AUDIT BY CPRI TEAM : 10-10-2023		
Sl. No	**Title**	**Details**
1	**Name Of Grid Substation**	220 kV SWITCHYARD KHODRI POWER STATION UJVNL
2	**Highest Voltage Level**	220 kV
3	**Year Of Installation**	1984
4	**No Of Feeders**	Seven 220 kV Feeder & One 132 kV Feeder
5	**No of Transformers, Make and Capacity**	4*34 MVA, 220/110 kV
6	**Busbar Arrangement**	Single Busbar Arrangement
7	**Present Busbar Switching Status**	Commissioned
8	**Busbar Protection**	Commissioned
9	**Relay System Status**	In Service
10	**DC Supply System**	[1] 220/110 V DC-1 [2] 220/110 V DC-2 [3] 48 V DC-1 [4] 48 V DC-2
11	**DC Supply Capacity And Adequacy**	Battery is adequate for the station load.
12	**DC System Earth Fault Status**	Healthy condition.
13	**GPS Receiver Make & Model**	SANDS
14	**GPS Clock Receiver & Synchronization Of Relay Status**	Relays are synchronised
15	**Common Event Logger Status**	In-built feature in numerical relay is used
16	**Line Disturbance Recorder**	In-built feature in numerical relay is used
17	**Fault Locator in Line**	Provided
18	**Breaker Failure Relay Status**	Provided
19	**Circuit Breaker test reports**	Available
20	**Relay test reports**	Available
21	**General Observation of Relay And Protection System**	It is recommended that the all the Numerical Protection IEDs shall be tested once in 3 or 4 years as per the best practices.

Protection audit teams at site:

UJVNL Team Members:

1	Mr. Mr. Anup Deepak	Executive Engineer(Test), Dakpather
2	Mr. Mandeep Singh	Executive Engineer (Generation), Kps
3	Mr. Amit Ranjan	Executive Engineer(Mm&C)
4	Mr. Arvind Bahuguna	Asst Engineer, M&Fdr Prtn
5	Mr. Vedpal Arya	Asst Engineer (Test)
6	Mr. Sharad Raghuvanshi	Asst Engineer (Em)

CPRI Team Members:

1	Dr. J.Sreedevi	Joint Director ,Hod
2	Mr. Ved Prakash Yadav	Engineering Officer

1.2: Relays Used for Transmission Line, Transformer, Reactor and Bus Bar Protection Substation

1.2.1: Relays used for Transmission Line Protection

Sl. No.	Name of the Feeder	Main-I	Main-II
1	Khodri - Chibro 1	ABB & REL511	ABB & REL511
2	Khodri - Chibro 2	ABB & REL521	ABB & REL521
3	Khodri - Sarawa	GE Multilin & D60	Alstom & P442
4	Khodri - Saharanpur 2	GE Multilin & D60	Alstom & P442
5	Khodri - Jhajhra	GE Multilin & D60	Alstom & P442
6	Khodri - Mazri 1	GE Multilin & D60	Alstom & P442
7	Khodri - Mazri 2	ABB & REL670	ABB & REL670
8	Khodri - Dhakrani	English Electric & SSRR3V71FF19ED	Electro Mechanical

1.2.2: Relays used for Transformer Protection:

Sl. No.	Transformer	Primary Protection	Back Up protection		
		Differential Protection	Over fluxing protection	Back up over current	Back Up REF
1	UNIT- 1	ABB & REG 670	ABB & REG 670	ABB & REG 670	ABB & REG 670
2	UNIT- 2	ABB & REG 670	ABB & REG 670	ABB & REG 670	ABB & REG 670
3	UNIT-3	ABB & REG 670	ABB & REG 670	ABB & REG 670	ABB & REG 670
4	UNIT-4	ABB & REG 670	ABB & REG 670	ABB & REG 670	ABB & REG 670

1.2.3: Relays used for BUS BAR Protection:

Sl. No.	Voltage level	Make	Model
1.	220kV	English Electrical	-

2.0 Input Data for Transmission Lines

2.1.Input Data for Transmission Lines Substation – Khodri - Chibro 1

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD KHODRI POWER STATION UJVNL**	
1	**Line Reference**	**Khodri - Chibro 1**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		**C**hibro-1
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		ABB REL 511
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		ABB REL 521
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	5.77
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0804
7.3	Positive seq. REACTANCE	Ohms/Km	0.41
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2814
7.5	Zero seq. REACTANCE	Ohms/Km	1.435
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Chibro-II**
8.2	Line Length of shortest adjacent line	Km	8.59
8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0804
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.41
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2814

8.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.435
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Chibro-II**
9.2	Line Length of longest adjacent line	Km	8.59
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0804
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.41
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2814
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.435
10	**Is there a transformer connected to the remote bus**	Yes/No	YES
10.1	Number of Transformers		3
10.2	Voltage ratio of the Transformer	kV	-
10.3	MVA of the transformers 1	MVA	3*69
10.4	% Impedance of the transformers1	%	12.10

2.2. Input Data for Transmission Lines Substation – Khodri - Chibro 2

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD KHODRI POWER STATION UJVNL**	
1	**Line Reference**	**Khodri - Chibro I1**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		**C**hibro-II
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		ABB REL 511
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		ABB REL 521
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	8.59
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0804
7.3	Positive seq. REACTANCE	Ohms/Km	0.41
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2814
7.5	Zero seq. REACTANCE	Ohms/Km	1.435
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Chibro-I**
8.2	Line Length of shortest adjacent line	Km	8.59
8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0804
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.41
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2814

8.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.435
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Chibro-I**
9.2	Line Length of longest adjacent line	Km	8.59
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0804
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.41
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2814
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.435
10	**Is there a transformer connected to the remote bus**	Yes/No	-
10.1	Number of Transformers		3
10.2	Voltage ratio of the Transformer	kV	-
10.3	MVA of the transformers 1	MVA	3*69
10.4	% Impedance of the transformers1	%	12.10

2.3.Input Data for Transmission Lines Substation – Khodri - Sarsawa

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD KHODRI POWER STATION UJVNL**	
1	**Line Reference**	**Khodri - Sarsawa**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		**Sarsawa**
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		GE Multilin & D60N03HKHF8LH6DM67P67U6UWXX
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		Alstom & P44231AB6M0550K
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	83.33
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0804
7.3	Positive seq. REACTANCE	Ohms/Km	0.41
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2814
7.5	Zero seq. REACTANCE	Ohms/Km	1.435
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Sarsawa-PGCIL Line**
8.2	Line Length of shortest adjacent line	Km	10.97

8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0793
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.3975
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2702
8.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.2936
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Sarsawa-Saharanpur Line**
9.2	Line Length of longest adjacent line	Km	14.49
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0804
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.41
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2814
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.435
10	**Is there a transformer connected to the remote bus**	Yes/No	N/A
10.1	Number of Transformers		N/A
10.2	Voltage ratio of the Transformer	kV	N/A
10.3	MVA of the transformers 1	MVA	N/A
10.4	% Impedance of the transformers1	%	N/A

2.4.Input Data for Transmission Lines Substation – Khodri - Saharanpur 2

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD KHODRI POWER STATION UJVNL**	
1	**Line Reference**	**Khodri-Saharanpur-II**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		**Saharanpur-II**
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		GE Multilin & D60N03HKHF8LH6DM67P67U6UWXX
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		Alstom & P44231AB6M0550K
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	81.05
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0804
7.3	Positive seq. REACTANCE	Ohms/Km	0.41
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2814
7.5	Zero seq. REACTANCE	Ohms/Km	1.435
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Saharanpur-PGCIL Line**

8.2	Line Length of shortest adjacent line	Km	9.08
8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0804
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.41
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2814
8.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.435
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Saharanpur-Behat Line**
9.2	Line Length of longest adjacent line	Km	35.03
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0793
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.3975
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2702
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.2936
10	**Is there a transformer connected to the remote bus**	Yes/No	N/A
10.1	Number of Transformers		N/A
10.2	Voltage ratio of the Transformer	kV	N/A
10.3	MVA of the transformers 1	MVA	N/A
10.4	% Impedance of the transformers1	%	N/A

2.5.Input Data for Transmission Lines Substation – Khodri - Jhajhra

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD KHODRI POWER STATION UJVNL**	
1	**Line Reference**	**Khodri-Jhajhra**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		**Jhajhra**
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		GE Multilin & D60N03HKHF8LH6DM67P67U6UWXX
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		Alstom & P44231AB6M0550K
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	27.53
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0804
7.3	Positive seq. REACTANCE	Ohms/Km	0.41
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2814
7.5	Zero seq. REACTANCE	Ohms/Km	1.435
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Jhajhra-PGCIL Line**

8.2	Line Length of shortest adjacent line	Km	6.11
8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0793
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.3975
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2702
8.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.2936
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Jhajhra-Vyasi Line**
9.2	Line Length of longest adjacent line	Km	40.31
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0793
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.3975
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2702
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.2936
10	**Is there a transformer connected to the remote bus**	Yes/No	N/A
10.1	Number of Transformers		N/A
10.2	Voltage ratio of the Transformer	kV	N/A
10.3	MVA of the transformers 1	MVA	N/A
10.4	% Impedance of the transformers1	%	N/A

2.6.Input Data for Transmission Lines Substation – Khodri - Mazri 1

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD KHODRI POWER STATION UJVNL**	
1	**Line Reference**	**Khodri - Mazri 1**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		**Mazri 1**
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		GE Multilin & D60N03HKHF8LH6DM67P67U6UWXX
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		Alstom & P44231AB6M0550K
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	35.20
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0793
7.3	Positive seq. REACTANCE	Ohms/Km	0.3975
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2702
7.5	Zero seq. REACTANCE	Ohms/Km	1.2936
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Mazri II-Visco**
8.2	Line Length of shortest adjacent line	Km	2.65

8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0793
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.3975
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2702
8.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.2936
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Khodri-Mazri II**
9.2	Line Length of longest adjacent line	Km	35.20
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0793
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.3975
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2702
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.2936
10	**Is there a transformer connected to the remote bus**	Yes/No	N/A
10.1	Number of Transformers		N/A
10.2	Voltage ratio of the Transformer	kV	N/A
10.3	MVA of the transformers 1	MVA	N/A
10.4	% Impedance of the transformers1	%	N/A

2.7.Input Data for Transmission Lines Substation – Khodri - Mazri 2

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD KHODRI POWER STATION UJVNL**	
1	**Line Reference**	**Khodri - Mazri II**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		**Mazri II**
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		ABB & REL670
3	**Main 2 Protection**		
3.1	Protection Type		Numerical
3.2	Model & Make		ABB & REL670
4	**CT data for Main 1**		
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	35.20
7.2	Positive seq. RESISTANCE	Ohms/Km	0.0793
7.3	Positive seq. REACTANCE	Ohms/Km	0.3975
7.4	Zero seq. RESISTANCE	Ohms/Km	0.2702
7.5	Zero seq. REACTANCE	Ohms/Km	1.2936
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Mazri I-Visco**
8.2	Line Length of shortest adjacent line	Km	2.65
8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.0793
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.3975
8.5	Zero seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.2702
8.6	Zero seq. REACTANCE of	Ohms/Km	1.2936

	shortest adjacent line		
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Khodri-Mazri I**
9.2	Line Length of longest adjacent line	Km	35.20
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.0793
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.3975
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.2702
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.2936
10	**Is there a transformer connected to the remote bus**	Yes/No	YES
10.1	Number of Transformers		2
10.2	Voltage ratio of the Transformer	kV	-
10.3	MVA of the transformers 1	MVA	2*100
10.4	% Impedance of the transformers1	%	12.10

2.8.Input Data for Transmission Lines Substation – Khodri - Dhakrani

Sl. No.	Description	Units	Value
	Station Name	**220 kV SWITCHYARD KHODRI POWER STATION UJVNL**	
1	**Line Reference**	**Khodri - Dhakrani**	
1.1	Line voltage level	kV	220
1.2	Name of remote substation		**Dhakrani**
2	**Main 1 Protection**		
2.1	Protection Type		Numerical
2.2	Model & Make		English Electric & SSRR3V71FF19ED
3	**Main 2 Protection**		
3.1	Protection Type		N/A
3.2	Model & Make		N/A
4	**CT data for Main 1**		**N/A**
4.1	Ratio	A/A	800/1
4.2	Class		PS
4.3	Vk / VA burden	Vk/VA	800/30
4.4	Rct	Ohms	5
4.5	Imag @ Vk	mA	30
5	**CT data for Main 2**		
5.1	Ratio		800/1
5.2	Class		PS
5.3	Vk / VA burden		800/30
5.4	Rct		5
5.5	Imag @ Vk		30
6	**PT Ratio**	kV/V	220kV/110V
7	**PROTECTED LINE DATA**		
7.1	Line Length	Km	8.835
7.2	Positive seq. RESISTANCE	Ohms/Km	0.1603
7.3	Positive seq. REACTANCE	Ohms/Km	0.4080
7.4	Zero seq. RESISTANCE	Ohms/Km	0.4800
7.5	Zero seq. REACTANCE	Ohms/Km	1.2160
8	**ADJACENT SHORTEST LINE DATA (from remote bus)**		
8.1	Name of the substation to which the shortest adjacent line is connected		**Dhakrani-Dhalipur**
8.2	Line Length of shortest adjacent line	Km	5.6
8.3	Positive seq. RESISTANCE of shortest adjacent line	Ohms/Km	0.1603
8.4	Positive seq. REACTANCE of shortest adjacent line	Ohms/Km	0.4080
8.5	Zero seq. RESISTANCE of	Ohms/Km	0.4800

	shortest adjacent line		
8.6	Zero seq. REACTANCE of shortest adjacent line	Ohms/Km	1.2160
9	**ADJACENT LONGEST LINE DATA (from remote bus)**		
9.1	Name of the substation to which the longest adjacent line is connected		**Dhakrani-Dhalipur**
9.2	Line Length of longest adjacent line	Km	5.6
9.3	Positive seq. RESISTANCE of longest adjacent line	Ohms/Km	0.1603
9.4	Positive seq. REACTANCE of longest adjacent line	Ohms/Km	0.4080
9.5	Zero seq. RESISTANCE of longest adjacent line	Ohms/Km	0.4800
9.6	Zero seq. REACTANCE of longest adjacent line	Ohms/Km	1.2160
10	**Is there a transformer connected to the remote bus**	Yes/No	YES
10.1	Number of Transformers		2
10.2	Voltage ratio of the Transformer	kV	-
10.3	MVA of the transformers 1	MVA	2*100
10.4	% Impedance of the transformers1	%	12.10

3. Transmission line protective relay settings review

Description	Existing Setting	Reviewed Setting	Existing setting	Reviewed setting
Line Name	**Khodri-Chibro-1**			
Main I/II	**Main-I**		**Main-II**	
Relay	**ABB REL 511**		**ABB REL 521**	
ZONE 1	Forward	Forward	Forward	Forward
R(Z1), Resistance for Ph-Ph faults	0.15	0.15	0.15	0.15
X(Z1), Reactance	0.76	0.76	0.76	0.76
RE(Z1), Resistance for ph-gnd	0.44	0.52	0.44	0.52
T1-1phase, delay for single phase	0	0	0	0
T1multi-ph, delay for multi-phase faults	0	0	0	0
ZONE 2	Forward	Forward	Forward	Forward
R(Z2), Resistance for Ph-Ph faults	0.27	0.22	0.27	0.22
X(Z2), Reactance	1.4	1.14	1.4	1.14
RE(Z2), Resistance for ph-gnd	0.8	0.78	0.8	0.78
T2-1phase, delay for single phase	0.4	0.35	0.4	0.35
T2multi-ph, delay for multi-phase	0.4	0.35	0.4	0.35
ZONE 3	Forward	Forward	Forward	Forward
R(Z3), Resistance for Ph-Ph faults	0.54	0.55	0.54	0.55
X(Z3), Reactance	2.78	2.83	2.78	2.83
RE(Z3), Resistance for ph-gnd	1.63	1.94	1.63	1.94
T3 delay	0.8	0.8	0.8	0.8
T3 Multi Phase	0.8	0.8	0.8	0.8
ZONE 4	Reverse	Reverse	Reverse	Reverse
R(Z4), Resistance for Ph-Ph faults	0.1	0.04	0.1	0.04
X(Z4), Reactance	0.19	0.19	0.19	0.19
RE(Z4), Resistance for ph-gnd	0.11	0.13	0.11	0.13
T4 delay	1	0.16	1	0.16
T4 Multi Phase	1	0.16	1	0.16
Power Swing Settings				
Operation	ON	ON	ON	ON
X1In(FW & RV) = 1.1 * maximum of all zone's X1	30.00	7.77	30.00	7.77
R1Lln = maximum of all zone's R1	30.00	1.39	30.00	1.39
tp1(sec) (tp1>=0.03) The general tendency should be to set the tP1 time to at least 30 ms	0.045	0.03	0.045	0.03
tp2(sec) (tp1>=0.01)	0.015	0.01	0.015	0.01

Description	Existing Setting	Reviewed Setting	Existing setting	Reviewed setting
Line Name	**Khodri-Chibro-II**			
Main I/II	**Main-I**		**Main-II**	
Relay	**ABB REL 511**		**ABB REL 521**	
ZONE 1	Forward	Forward	Forward	Forward
R(Z1), Resistance for Ph-Ph faults	0.22	0.22	0.22	0.22
X(Z1), Reactance	1.12	1.13	1.12	1.13
RE(Z1), Resistance for ph-gnd	0.66	0.77	0.66	0.77
T1-1phase, delay for single phase	0	0	0	0
T1multi-ph, delay for multi-phase faults	0	0	0	0
ZONE 2	Forward	Forward	Forward	Forward
R(Z2), Resistance for Ph-Ph faults	0.33	0.33	0.33	0.33
X(Z2), Reactance	1.69	1.69	1.69	1.69
RE(Z2), Resistance for ph-gnd	0.99	1.16	0.99	1.16
T2-1phase, delay for single phase	0.6	0.5	0.6	0.5
T2multi-ph, delay for multi-phase	0.6	0.5	0.6	0.5
ZONE 3	Forward	Forward	Forward	Forward
R(Z3), Resistance for Ph-Ph faults	0.51	0.55	0.51	0.55
X(Z3), Reactance	2.63	2.83	2.63	2.83
RE(Z3), Resistance for ph-gnd	1.54	1.94	1.54	1.94
T3 delay	1.2	0.8	1.2	0.8
T3 Multi Phase	1.2	0.8	1.2	0.8
ZONE 4	Reverse	Reverse	Reverse	Reverse
R(Z4), Resistance for Ph-Ph faults	0.1	0.06	0.1	0.06
X(Z4), Reactance	0.28	0.28	0.28	0.28
RE(Z4), Resistance for ph-gnd	0.17	0.19	0.17	0.19
T4 delay	1	0.16	1	0.16
T4 Multi Phase	1	0.16	1	0.16

Description	Existing Setting	Reviewed Setting
Line Name	**Khodri-Sarsawa**	
Main I/II	**Main-I**	
Relay	**GE-D60**	
ZONE-1		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	Quad
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	11.14	**11.14**
RCA	79	78.91
Rev Reach	2.78	2.7853
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	6.29	6.29
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	3.14	3.14
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	0.000	0.000 s
Block	21 BLOCK On(VO10)	21 BLOCK On(VO10)
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-2		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	14.84	**14.84**
RCA	79	78.91

Rev Reach	2.78	2.7853
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	7.71	7.71
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	3.86	3.86
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	0.350	0.350 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-3		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	16.38	**16.35**
RCA	79	78.91
Rev Reach	2.78	2.7853
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	8.29	8.29
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	4.15	4.15
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	1.00	0.800 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled

ZONE-4		
Function	Enabled	Enabled
Direction	Reverse	Reverse
Shape	Quad	
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	2.79	**2.79**
RCA	79	78.91
Rev Reach	2.78	2.7853
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	3.07	3.07
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	1.54	1.54
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	1.00	1.000 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled

Description	Existing Setting	Reviewed Setting
Line Name	**Khodri-Saharanpur II**	
Main I/II	**Main-I**	
Relay	**GE-D60**	
ZONE-1		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	10.84	10.74
RCA	79	78.91
Rev Reach	2.71	2.6847
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	6.17	6.11
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	3.09	3.06
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	0.000	0.000 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-2		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	14.30	**14.18**
RCA	79	78.91
Rev Reach	2.71	2.6847

Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	7.51	7.44
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	3.75	3.72
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	0.350	0.350 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-3		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	Quad
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	19.40	**19.22**
RCA	79	78.91
Rev Reach	2.71	2.6847
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	9.47	9.38
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	4.73	4.69
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	1.000	0.800 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-4		

Function	Enabled	Enabled
Direction	Reverse	Reverse
Shape	Quad	Quad
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	2.71	**2.68**
RCA	79	78.91
Rev Reach	2.71	2.6847
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	3.04	3.02
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	1.52	1.51
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	1.000	1.000 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled

Description	Existing Setting	Reviewed Setting
Line Name	**Khodri-Jhajhra**	
Main I/II	**Main-I**	
Relay	**GE-D60**	
ZONE-1		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	Quad
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	3.68	3.65
RCA	79	78.91
Rev Reach	0.92	0.9119
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	3.42	3.39
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	1.71	1.69
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.00	0.000 pu
Delay	0.00	0.000 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-2		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	5.11	**5.07**
RCA	79	78.91
Rev Reach	0.92	0.9119

Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	3.97	3.93
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	1.98	1.97
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	0.350	0.350 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-3		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	11.34	**11.24**
RCA	79	78.91
Rev Reach	0.92	0.9119
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	6.36	6.31
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	3.18	3.15
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	1.00	0.800 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-4		

Function	Enabled	Enabled
Direction	Reverse	Reverse
Shape	Quad	
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	0.92	**0.91**
RCA	79	78.91
Rev Reach	0.92	0.9119
Rev Reach RCA	79	78.91
Comp Limit	90	90
DIR RCA	79	78.91
DIR Comp Limit	90	90
Quad Right Blinder	2.35	2.33
Quad Right Blinder RCA	79	78.91
Quad Left Blinder	1.18	1.17
Quad Left Blinder RCA	79	78.91
Supervision	0.200	0.200 pu
Volt Level	0.00	0.000 pu
Delay	1.000	1.000 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled

Description	Existing Setting	Reviewed Setting
Line Name	**Khodri-Mazri I**	
Main I/II	**Main-I**	
Relay	**GE-D60**	
ZONE-1		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	Quad
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	4.57	4.52
RCA	79	78.72
Rev Reach	1.14	1.1311
Rev Reach RCA	79	78.72
Comp Limit	90	90
DIR RCA	79	78.72
DIR Comp Limit	90	90
Quad Right Blinder	3.79	3.75
Quad Right Blinder RCA	79	78.72
Quad Left Blinder	1.89	1.88
Quad Left Blinder RCA	79	78.72
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	0.000	0.000 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-2		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	Quad
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	5.92	**5.87**
RCA	79	78.72
Rev Reach	1.14	1.1311

Rev Reach RCA	79	78.72
Comp Limit	90	90
DIR RCA	79	78.72
DIR Comp Limit	90	90
Quad Right Blinder	4.32	4.28
Quad Right Blinder RCA	79	78.72
Quad Left Blinder	2.16	2.14
Quad Left Blinder RCA	79	78.72
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	0.350	0.350 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-3		
Function	Enabled	Enabled
Direction	Forward	Forward
Shape	Quad	Quad
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	11.41	**11.31**
RCA	79	78.72
Rev Reach	1.14	1.1311
Rev Reach RCA	79	78.72
Comp Limit	90	90
DIR RCA	79	78.72
DIR Comp Limit	90	90
Quad Right Blinder	6.47	6.41
Quad Right Blinder RCA	79	78.72
Quad Left Blinder	3.23	3.2
Quad Left Blinder RCA	79	78.72
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	1.000	0.800 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled
ZONE-4		

Function	Enabled	Enabled
Direction	Reverse	Reverse
Shape	Quad	Quad
Xfmr Vol Connection	None	None
Xfmr Curr Connection	None	None
Reach	1.14	**1.13**
RCA	79	78.72
Rev Reach	1.14	1.1311
Rev Reach RCA	79	78.72
Comp Limit	90	90
DIR RCA	79	78.72
DIR Comp Limit	90	90
Quad Right Blinder	2.45	2.42
Quad Right Blinder RCA	79	78.72
Quad Left Blinder	1.22	1.21
Quad Left Blinder RCA	79	78.72
Supervision	0.200	0.200 pu
Volt Level	0.000	0.000 pu
Delay	1.000	1.000 s
Block		
Target	Latched	Latched
Events	Enabled	Enabled

Description	Existing Setting	Reviewed Setting
MICOM P442	**220KV Khodri-Sarsawa**	
Line Settings	**MAIN-2**	
Line Length	83.33	83.33
Line Impedance	13.92	13.92
Line Angle	79	79
Zone Status	110010	110010
kZ1 Res Compensation	0.834	0.833
k Z1 Angle	0	0
Z1	11.13	11.141
R1 G	**55.67**	**24.779**
R1 Ph	22.27	18.585
tZ1	0	0
kZ2 Res Compensation	0.834	0.8333
kZ2 Angle	0	0
Z2	**14.83**	**16.712**
R2 G	74.17	24.779
R2 Ph	29.67	18.585
tZ2	0.35	0.35
kZ3/4 Res Compensation	0.834	0.8333
kZ3/4 Angle	0	0
Z3	19.12	19.62
R3G - R4G	**95.61**	**24.78**
R3Ph - R4Ph	**38.24**	**18.58**
tZ3	-	1
Z4	2.78	2.79
tZ4	**1**	**0.5**
Status	Enabled	Enabled
Broken conductor	Enable	Enabled

Description	Existing Setting	Reviewed Setting
MICOM P442	**220KV Khodri-Saharanpur II**	
Line Settings	MAIN-2	
Line Length	81.05	81.05
Line Impedance	13.54	13.54
Line Angle	79	79
Zone Status	110010	110010
kZ1 Res Compensation	0.834	0.833
k Z1 Angle	0	0
Z1	10.83	10.836
R1 G	54.15	24.779
R1 Ph	21.66	18.585
tZ1	0	0
kZ2 Res Compensation	0.834	0.8333
kZ2 Angle	0	0
Z2	14.29	16.254
R2 G	71.47	24.779
R2 Ph	28.59	18.585
tZ2	0.35	0.35
kZ3/4 Res Compensation	0.834	0.8333
kZ3/4 Angle	0	0
Z3	19.39	23.05
R3G - R4G	96.94	24.78
R3Ph - R4Ph	38.77	18.58
tZ3	1	1
Z4	2.71	2.71
tZ4	1	0.5
Status	Enabled	Enabled
Broken conductor	Enable	Enabled

Description	Existing Setting	Reviewed Setting
MICOM P442	**220KV Khodri-Jhajhra**	
Line Settings	**MAIN-2**	
Line Length	27.53	81.05
Line Impedance	4.597	4.597
Line Angle	79	79
Zone Status	110010	110010
kZ1 Res Compensation	0.834	0.833
k Z1 Angle	0	0
Z1	3.68	3.681
R1 G	**18.4**	**24.779**
R1 Ph	**7.36**	**18.585**
tZ1	0	0
kZ2 Res Compensation	0.834	0.8333
kZ2 Angle	0	0
Z2	5.11	5.521
R2 G	25.55	24.779
R2 Ph	**10.22**	**18.585**
tZ2	0.35	0.35
kZ3/4 Res Compensation	0.833	0.8333
kZ3/4 Angle	0	0
Z3	**11.33**	**13.61**
R3G - R4G	**56.68**	**24.78**
R3Ph - R4Ph	**22.67**	**18.58**
tZ3	1	1
Z4	1.15	0.92
tZ4	**1**	**0.5**
Status	Enabled	Enabled
Broken conductor	Enable	Enabled

Description	Existing Setting	Reviewed Setting
MICOM P442	**220KV Khodri-Mazri I**	
Line Settings	**MAIN-2**	
Line Length	35.2	35.2
Line Impedance	5.71	5.71
Line Angle	79	79
Zone Status	110010	110010
kZ1 Res Compensation	0.753	0.753
k Z1 Angle	-0.7	-0.744
Z1	4.57	4.566
R1 G	**22.83**	**24.725**
R1 Ph	**9.13**	**18.543**
tZ1	0	0
kZ2 Res Compensation	0.753	0.7535
kZ2 Angle	-0.7	-0.7444
Z2	5.92	6.849
R2 G	**29.61**	**24.725**
R2 Ph	**11.84**	**18.543**
tZ2	0.35	0.35
kZ3/4 Res Compensation	0.753	0.7535
kZ3/4 Angle	-0.7	-0.7444
Z3	12.56	13.7
R3G - R4G	**62.78**	**24.72**
R3Ph - R4Ph	**25.11**	**18.54**
tZ3	1	1
Z4	1.14	1.14
tZ4	**1**	**0.5**
Status	Enabled	Enabled
Broken conductor	Enable	Enabled

Description	Existing Setting	Reviewed Setting
Line Name	**Khodri-Mazri-II**	
Main I/II	**Main-I & Main II**	
Relay	**ABB REL 670**	
ZONE 1	Forward	Forward
X(Z1), Reactance	-	11.19
R(Z1), Resistance for Ph-Ph faults	-	2.23
ZPP/ZPE	**10.924**	**11.41**
ZAngPE	78	78.72
TPP/TPE	0	0
ZONE 2	Forward	Forward
X(Z1), Reactance	-	20.99
R(Z1), Resistance for Ph-Ph faults	-	4.19
ZPP/ZPE	**14.168**	**21.40**
ZAngPE	78	78.72
TPP/TPE	0.4	0.5
ZONE 3	Forward	Forward
X(Z1), Reactance	-	33.58
R(Z1), Resistance for Ph-Ph faults	-	6.70
ZPP/ZPE	**27.309**	**34.24**
ZAngPE	78	78.72
TPP/TPE	0.8	0.8
ZONE 4	Reverse	Reverse
X(Z1), Reactance	-	2.80
R(Z1), Resistance for Ph-Ph faults	-	0.56
ZPP/ZPE	2.731	2.85
ZAngPE	78	78.72
TPP/TPE	1.5	0.16

Description	Existing Setting	Reviewed Setting
Line Name	**Khodri-Dhakrani**	
Main I/II	**Main-I & Main II**	
Relay	**RR3B English Electric**	
ZONE 1	Forward	Forward
X(Z1), Reactance	1.22	1.202
R(Z1), Resistance for Ph-Ph faults	-	3.910
ZONE 2	Forward	Forward
X(Z1), Reactance	1.83	1.802
R(Z1), Resistance for Ph-Ph faults	-	4.146
ZONE 3	Forward	Forward
X(Z1), Reactance	**4.92**	**2.945**
R(Z1), Resistance for Ph-Ph faults	-	4.594

4.0 Input Data for Transformer Protection

Sl. No.	Description	Units	Value
1	**Transformer Name**		ICT-Unit 1,2,3 & 4
1.1	**Ratings**		
1.2	MVA	MVA	200
2	Voltage Ratio	kV/kV	230/11
3	**Impedance**	%	13.7
4	**Vector Group**		YNd11
`5	**NGR Data (if Present)**	Ohms	-
5.1	**OLTC Present**	Yes/No	Yes
5.2	OLTC Data		
5.3	Min Tap (%)	% (-)	-15
5.4	Max Tap (%)	% (+)	15
6	No. of Steps		5
6.1	**Differential Protection provided**	Yes/No	Yes
6.2	Differential CT Ratio		
6.3	HV CT Ratio (Main & ICT)	A/A	800/1
7	LV CT Ratio (Main & ICT)	A/A	2000/1
7.1	**Differential Relay**		
7.2	Make		ABB
8	Model		REG 670
8.1	**Backup REF provided**	Yes/No	Yes

8.2	REF Protection CTs Ratio **(Main & ICT)**	A/A	HV: 800/1 LV: NIL
8.3	Acc Class		PS
8.4	RCT (Ω)	Ohms	5
8.5	Vk(V)	V	>2000
8.6	Im@Vk/2	mA	30
8.7	Longest sec. one way lead R Ω	Ohms	1.3065
8.8	REF Relay		
8.9	Make		ABB
8.10	Model		REG 670
9	Rstab Range (Ω)	Ohms	2848.40
9.1	**Over fluxing Protection provided**	Yes/No	Yes
9.2	Over fluxing Protection Relay		
9.3	Make		ABB
10	Model		REG 670
10.1	**Backup Over Current**	Yes/No	Yes
10.2	Backup Over Current Protection Relay		
10.3	Make		ABB
10.4	Model		REG 670
10.5	Back-Up Over Current Protection CTs Ratio	A/A	-
			-

4.1 Transformers Protection Relay Setting Review

Sl.No	Protection	Discription	Existing Settings	Reviewed Settings
		Name	**ICT-Unit 1,2,3 & 4**	
		Type of Relay Used	**ABB REG 670**	
		Line Voltage (kV)	220	
		Capacity In MVA	100	
1	**Transformer Differential**	Operation	On	On
		IDiffAlarm	0.1	0.1
		tAlarmDelay	10	10
		IdMin	0.2	0.2
		EndSection1	1.25	1.25
		EndSection2	3	3
		SlopeSection2	40	40
		SlopeSection3	80	80
		IdUnre	9.6	9.6
		I2/I1Ratio	15	15
		I5/I1Ratio	25	25
2	**REF Protection**	High/Low Impedance Settings:	High Impedence	
		Rated Current of the in Primary Amps	3000	
		Equivalent secondary current in amps	1	
		Maximum Bus fault current in Amps	50000	
		Equivalent sec. fault current in Amps	16.66666667	
		Differential Pickup Settings in Amps	300	
		Equivalent Secondary current in Amps	0.1	

3	**Phase Over Current (51/67)**	Operation	On	On
		IBase	289	289
		UBase	400	400
		AngleRCA	65	65
		AngleROA	80	80
		DirMode1	Forward	Forward
		Characterist1	IEC Norm. inv.	IEC Norm. inv.
		I1>	120	120
		t1	0	0
		DirMode2	Non-directional	Non-directional
		Characterist2	IEC Def. Time	IEC Def. Time
		I2>	900	900
		t2	0.05	0.05
4	**Residual Over Current (51N/67N)**	Operation	On	On
		Ibase	289	289
		Ubase	400	400
		AngleRCA	65	65
		DirMode1	Forward	Forward
		Characterist1	IEC Norm. inv.	IEC Norm. inv.
		IN1>	30	30
		t1	0	0
		DirMode2	Non-directional	Non-directional
		Characterist2	IEC Def. Time	IEC Def. Time
		IN2>	900	900
		t2	0.05	0.05
		k2	1	1

5	**Breaker Failure**	Operation	On	On
		Ibase	1125	1125
		FunctionMode	Current	Current
		BuTripMode	1 Out of 3	1 Out of 3
		RetripMode	No CBPos Check	No CBPos Check
		IP>	5	5
		IN>	5	5
		t1	0.05	0.05
		t2	0.2	0.2

5 DC Measurements

DC battery and chargers are very important units as they are required to operate the protection relays. In this section, the details of the batteries and chargers are provided.

Following is the measurement of DC source which was taken during the site visit:

A. DC Supply

		Positive to Negative	Positive to Earth	Negative To Earth
1	DC Bank 1	237.67	+152.40	-84.60

6. Protection Review and Recommendations:

In general, protection schemes and setting are in order. All the 400 kV lines, Transformers are protected through numerical based Protection schemes.

1. The distance protection Main-I & II of all Zone impedance reach setting for Khodri - Chibro-I lines are properly set.
2. The distance protection Main-I & II of all Zone impedance reach setting for Khodri - Chibro-II lines are properly set.
3. The distance protection Main-I of all Zone impedance reach setting for Khodri-Sarsawa , Khodri-Saharanpur II , Khodri-Jhajhra & Khodri-Mazri I lines are properly set.
4. The distance protection Main-II, Zone 1 & Zone 3 impedance reach setting for Khodri-Sarsawa are properly set and some minor revisions are required in Zone 2 impedance reach settings.
5. The distance protection Main-II, Zone 1 impedance reach setting for Khodri-Saharanpur II are properly set and some minor revisions are required in Zone 2 & Zone 3 impedance reach settings.
6. The distance protection Main-II, Zone 1 impedance reach setting for Khodri-Mazri I properly set and some minor revisions are required in Zone 2 & Zone 3 impedance reach settings.
7. Some revisions are required in Zone 1,Zone 2 & Zone 3 impedance reach settings for Khodri-Mazri II.
8. The distance protection Main-I Zone 1 & Zone 2 impedance reach setting for Khodri-Dhakrani are properly set and some minor revisions are required in Zone 3 impedance reach settings.the available protection is electromechanical type. This needs to be upgraded with the latest numerical IED.
9. The earth fault protection is also protected to all line protection. Power swing, CB fail, and broken conductor is also provided on all lines. Minor changes in Power swing.
10. Resistive reach for Ph-Ph & Ph-Gnd may be reviewed for all the Lines. Since, For the calculation of resistive reach (Ph-Ph & Ph-Gnd), CPRI considered the Arc Resistance and Tower footing resistance as 28.864 Ω & 10 Ω respectively. If the Arc Resistance and Tower footing resistance values are different at the substation based on local substation condition, then all resistive reach (Ph-Ph & Ph-Gnd) same setting may be retained.
11. Other Protection functionality for lines like broken conductor Voltage supervision and Carrier communication are working satisfactory.
12. The differential protection setting for transformers are properly set and stable.
13. The differential protection setting for busbar are properly set and stable.
14. Relay coordination has been reviewed and some minor variation is required for few settings. The same has been provided in relay coordination sheet.
15. It is suggested to perform the third-party protection audit of substation/generating station periodically.

Note: Difference observed between existing settings and reviewed settings are given in bold font in respective protection.

7. Review of reports

Review of test reports of CTs & CVTs:

Pre-commissioning test reports were provided for all relays and CTs & CVT and these were reviewed. It is recommended that pre-commissioning reports of all relays, CTs and CVTs should be kept properly and they should be mandatorily provided whenever they are required to be reviewed. It is also recommended that routine testing of all relays should be carried out regularly in future.

Review of test reports of Circuit Breaker:

Test reports of all Circuit Breakers were provided and reviewed. It is recommended that pre-commissioning reports of all circuit breakers should be kept properly and they should be mandatorily being provided whenever they are required to be reviewed. It is also recommended that routine testing of all circuit breakers should be carried out regularly in future.

CONSULTANCY REPORT

Protection audit of 220kV Substation at 120MW Khodri Power House

VOLUME-I

Clients Reference: PO NO: 5300000132
CPRI Reference: No. 2/9/PSD/UJVNL/2022-23
CPRI Report: No. 2/9/PSD/RT99/2023

CUSTOMER

M/s UJVNL, Dehradun

CONSULTANT

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November 2023

Current Transformer

Sl. no	Location	CT ratio	Make and Model	CT serial no	Date of commissioning	Date of last testing	Serviceable/ Non Serviceable in case of Breakdown	Remarks
1	Unit no 1	800/1	ABB	R-2109575	2009	2009	Serviceable	The life span of CT is 25 years. Test report shows that Tan delta and accuracy are well within limits. The performance of CT is satisfactory
				Y-2109575	2009	2009		
				B-2109575	2009	2009		
2	Unit no 2	100/1	ABB	R-2109570	2009	2009	Serviceable	
				Y-2109566	2009	2009		
				B-2109563	2009	2009		
3	Unit no 3	100/1	ABB	R-2109568	2009	2009	Serviceable	
				Y-2109571	2009	2009		
				B-2109569	2009	2009		
4	Unit no 4	100/1	ABB	R-2109574	2009	2009	Serviceable	
				Y-2109573	2009	2009		
				B-2109567	2009	2009		
5	220 kV Khodri - Chibro 1 (81)	800/1	BHEL	R-2051371	2021-22	2021-22	Serviceable	CTs commissioned in the year 2021-22 and all the tests were conducted during commissioning. Performance of the CTs is satisfactory.
				Y-2051372	2021-22	2021-22		
				B-2051373	2021-22	2021-22		
6	220 kV Khodri - Chibro 2 (82)	800/1	BHEL	R-2051383	2021-22	2021-22	Serviceable	
				Y-2051384	2021-22	2021-22		
				B-2051385	2021-22	2021-22		
7	220 kV Khodri - Jhajra (87)	800/1	BHEL	R-2051394	2021-22	2021-22	Serviceable	
				Y-2051392	2021-22	2021-22		
				B-2051393	2021-22	2021-22		

8	220 kV Khodri - Saharanpur 1 (83)	800/1	BHEL	R-2051378	2021-22	2021-22	Serviceable	CTs commissioned in the year 2021-22 and all the tests were conducted during commissioning. Performance of the CTs is satisfactory.
				Y-2051379	2021-22	2021-22		
				B-2051377	2021-22	2021-22		
9	220 kV Khodri - Saharanpur 2 (84)	800/1	BHEL	R-2051382	2021-22	2021-22	Serviceable	
				Y-2051380	2021-22	2021-22		
				B-2051381	2021-22	2021-22		
10	220/132 kV Khodri - Dhakrani (785)	500/1	BHEL	R-2051395	2021-22	2021-22	Serviceable	
				Y-2051396	2021-22	2021-22		
				B-2051397	2021-22	2021-22		
11	220 kV Khodri - Majri 1 (86)	800/1	BHEL	R-2051390	2021-22	2021-22	Serviceable	
				Y-2051389	2021-22	2021-22		
				B-2051391	2021-22	2021-22		
12	220 kV Khodri - Majri 2 (88)	800/1	SCT	R-2002/668	2021-22	2021-22	Serviceable	
				Y-2002/1667	2021-22	2021-22		
				B-2002/666	2021-22	2021-22		
13	220 kV 100 MVA Auto Transformer (885)	800/1	BHEL	R-2051387	2021-22	2021-22	Serviceable	
				Y-2051386	2021-22	2021-22		
				B-2051388	2021-22	2021-22		

Capacitive Voltage Transformer

Sl. no	Location	CVT ratio	Make and Model	CVT serial no	Date of commissioning	Date of last testing	Serviceable/ Non Serviceable	Remarks
1	DHAKRANI	132kV/110 V	SIEMENS	1CV 3653 / 3 CORE	9/5/2020	9/5/2020	Serviceable	CVTs commissioned in the year 2020 and all the tests were conducted during commissioning. Performance of the CVTs is satisfactory.
2	DHAKRANI	132kV/110 V	SIEMENS	1CV 3655 / 3 CORE	9/5/2020	9/5/2020	Serviceable	
3	DHAKRANI	132kV/110 V	SIEMENS	1CV 3654 / 3 CORE	9/5/2020	9/5/2020	Serviceable	
4	CHIBRO 1	220kV/110 V	SIEMENS	1CV 5915 / 3 CORE	15/5/2020	15/5/2020	Serviceable	
5	CHIBRO 1	220kV/110 V	SIEMENS	1CV 5916 / 3 CORE	15/5/2020	15/5/2020	Serviceable	
6	CHIBRO 1	220kV/110 V	SIEMENS	1CV 5917 / 3 CORE	15/5/2020	15/5/2020	Serviceable	
7	CHIBRO 2	220kV/110 V	SIEMENS	2CV 5918 / 2 CORE	9/5/2020	9/5/2020	Serviceable	
8	CHIBRO 2	220kV/110 V	SIEMENS	2CV 5919 / 2 CORE	9/5/2020	9/5/2020	Serviceable	
9	CHIBRO 2	220kV/110 V	SIEMENS	2CV 5920 / 2 CORE	15/05/2020	15/05/2020	Serviceable	
10	SAHARANPUR & SARSAWA	220kV/110 V	SIEMENS	2CV 5921 / 2 CORE	14/05/2020	14/05/2020	Serviceable	
11	SAHARANPUR & SARSAWA	220kV/110 V	SIEMENS	2CV 5922 / 2 CORE	14/05/2020	14/05/2020	Serviceable	
12	SAHARANPUR & SARSAWA	220kV/110 V	SIEMENS	2CV 5923 / 2 CORE	14/05/2020	14/05/2020	Serviceable	
13	JHAJRA	220kV/110 V	SIEMENS	2CV 5924 / 2 CORE	9/5/2020	9/5/2020	Serviceable	
14	JHAJRA	220kV/110 V	SIEMENS	2CV 5925 / 2 CORE	14/05/2020	14/05/2020	Serviceable	
15	JHAJRA	220kV/110 V	SIEMENS	2CV 5926 / 2 CORE	9/5/2020	9/5/2020	Serviceable	
16	MAZRI 1 & 2	220kV/110 V	SIEMENS	2CV 5927 / 2 CORE	14/05/2020	14/05/2020	Serviceable	
17	MAZRI 1 & 2	220kV/110 V	SIEMENS	2CV 5928 / 2 CORE	9/5/2020	9/5/2020	Serviceable	
18	MAZRI 1 & 2	220kV/110 V	SIEMENS	2CV 5929 / 2 CORE	14/05/2020	14/05/2020	Serviceable	

CIRCUIT BREAKER

Sl. no	Location	Make and Model	Serial Number	Status of Breaker available or not	Number of Trip/close coil and healthiness	Date of commissioning	Date of Last timing taken	Operating time (ms)	Serviceable/ Non serviceable	Remarks
A	**220 kV System**									
1	220 kV Bay 1 U# 01	CGL, 200-SFM-40A	16489C	YES	6/6 Healthy	2002	11/17/2022	21.1	Serviceable	The opening time is well within the limit and performance of CB is satisfactory.
2	220 kV Bay 2 U# 02		16470C	YES	6/6 Healthy	2002	11/17/2022	22.5	Serviceable	
3	220 kV Bay 3 U# 03		16468C	YES	6/6 Healthy	2002	11/17/2022	22.8	Serviceable	
4	220 kV Bay 4 U# 04		16467C	YES	6/6 Healthy	2002	11/17/2022	22.6	Serviceable	
5	220 kV Bay 5 B/C (85)	ABB, LTB245 E-1	30000162	YES	6/6 Healthy	2016	2016	-	Serviceable	CBs commissioned in the year 2016 and all the tests were conducted during commissioning. Performance of the CBs is satisfactory.
6	220 kV Bay 6 Fdr no. 82		30000157	YES	6/6 Healthy	2016	2016	-	Serviceable	
7	220 kV Bay 7 Fdr no. 87		30000161	YES	6/6 Healthy	2016	2016	-	Serviceable	
8	220 kV Bay 8 Fdr no. 84		30000159	YES	6/6 Healthy	2016	2016	-	Serviceable	
9	220 kV Bay 9 Fdr no. 83		30000158	YES	6/6 Healthy	2016	2016	-	Serviceable	
10	220 kV Bay 10 Fdr no. 885		300001	YES	6/6 Healthy	2016	2016	-	Serviceable	
11	220 kV Bay 11 Fdr no. 81		30000163	YES	6/6 Healthy	2016	2016	-	Serviceable	
12	220 kV Bay 13 Fdr no. 86	CGL, 200-SFM-40A	2250-C	YES	6/6 Healthy	2002	Managed by HPSEB	20.76	Serviceable	The opening time is well within the limit and performance of CB is satisfactory.
13	220 kV Bay 14 Fdr no. 88		13316-C	YES	6/6 Healthy	2002		22	Serviceable	

B	132 kV System									
1	132 kV Bay 12 Feeder no. 785	ABB, LTB145 D1/B	19002376	YES	6/6 Healthy	2016	2016	-	Serviceable	CB commissioned in the year 2016 and all the tests were conducted during commissioning. Performance of the CB is satisfactory.

DC Supply				
Sl. no	**Name**	**Date of Commission**	**Last testing**	**Remarks**
1	220/110 V DC-1	2007	13/12/2018	The Performance of battery is satisfactory. It is suggested to extend the both 220V DC source to the switchyard for breaker operation.
2	220/110 V DC-2	2007	14/12/2018	
3	48 V DC-1	2008	30/07/2021	
4	48 V DC-2	-	-	

Transmission Line Protection

<table>
<tr><th>Sl. no</th><th>Voltage</th><th>Name of Protection Line</th><th></th><th>Make & Model</th><th>Serial No</th><th>Functional</th><th>Date of last testing</th><th>Date of Commissioning</th><th>Remark</th></tr>
<tr><td>1</td><td rowspan="7">220 kV</td><td>Khodri - Chibro 1</td><td rowspan="8">MAIN 1</td><td>ABB & REL511</td><td>T0507007</td><td>YES</td><td>NOT TESTED</td><td>08.02.2006</td><td rowspan="2">Since the available protection relay has no provision for communication and time sync facility. It is suggested to replace with the latest numerical IEDs.</td></tr>
<tr><td>2</td><td>Khodri - Chibro 2</td><td>ABB & REL511</td><td>T0507008</td><td>YES</td><td>08.05.2010</td><td>03.03.2006</td></tr>
<tr><td>3</td><td>Khodri - Sarawa</td><td>GE Multilin & D60N03HKHF8LH6DM67P67U6UWXX</td><td>AABC11000997</td><td>YES</td><td>NOT TESTED</td><td>23.01.2012</td><td rowspan="5">The available protection is latest numerical IED. Performance is satisfactory.</td></tr>
<tr><td>4</td><td>Khodri - Saharanpur 2</td><td>GE Multilin & D60N03HKHF8LH6DM67P67U6UWXX</td><td>AABC11000995</td><td>YES</td><td>NOT TESTED</td><td>12.02.2012</td></tr>
<tr><td>5</td><td>Khodri - Jhajhra</td><td>GE Multilin & D60N03HKHF8LH6DM67P67U6UWXX</td><td>AABC11000996</td><td>YES</td><td>NOT TESTED</td><td>-</td></tr>
<tr><td>6</td><td>Khodri - Mazri 1</td><td>GE Multilin & D60N03HKHF8LH6DM67P67U6UWXX</td><td>AABC11000994</td><td>YES</td><td>NOT TESTED</td><td>31.08.2012</td></tr>
<tr><td>7</td><td>Khodri - Mazri 2</td><td>ABB & REL670</td><td>11725086</td><td>NO</td><td>NOT TESTED</td><td>-</td></tr>
<tr><td>8</td><td>132 kV</td><td>Khodri - Dhakrani</td><td>English Electric & SSRR3V71FF19ED</td><td>M220979</td><td>YES</td><td>NOT TESTED</td><td>-</td><td>The available protection is electromechanical type. This needs to be upgraded with the latest numerical IED.</td></tr>
</table>

Sl. no	Voltage	Name of Protection Line		Make & Model	Serial No	Functional	Date of last testing	Date of Commissioning	Remark
1	220 kV	Khodri - Chibro 1	MAIN 2	ABB & REL521	T0449074	YES	NOT TESTED	2005-2006	This needs to be replaced. Since relay has no provision for communication and time sync facility.
2		Khodri - Chibro 2		ABB & REL521	T0449075	YES	NOT TESTED	2005-2006	
3		Khodri - Sarawa		Alstom & P44231AB6M0550K	31914767/10/11	YES	NOT TESTED	23.01.2012	The available protection is latest numerical IED. Performance is satisfactory.
4		Khodri - Saharanpur 2		Alstom & P44231AB6M0550K	31914769/10/11	YES	NOT TESTED	12.02.2012	
5		Khodri - Jhajhra		Alstom & P44231AB6M0550K	31914766/10/11	YES	NOT TESTED	2012	
6		Khodri - Mazri 1		Alstom & P44231AB6M0550K	31914768/10/11	YES	NOT TESTED	31.08.2012	
7		Khodri - Mazri 2		ABB & REL670		YES	NOT TESTED	2019	

Transformer Protection

Sl. no	Transformer (ICT/GT/ST)	TYPE	Make and model	Serial No	Functional	Date of Testing	Date of Commissioning	Serviceable/ Non serviceable	OTI/WTI INDICATOR	Bucholtz/ PDR	Remarks
1	34 MVA GT 1	Differential	ABB & REG 670	1814015, 1814016	YES	28.11.22	20.07.18	Serviceable	Working	YES	Performance is satisfactory.
2	34 MVA GT 2			2231055, 2218001	YES	06.02.23	02.08.17	Serviceable	Working	YES	
3	35 MVA GT 3			2217002, 2217003	YES	18.03.23	05.01.23	Serviceable	Working	YES	
4	34 MVA GT 4			2001103, 2001104	YES	2023	22.01.21	Serviceable	Working	YES	

Sl. no	Transformer (ICT/GT/ST)	TYPE	Make and model	Serial No	Functional	Date of Testing	Date of Commissioning	Serviceable/ Non serviceable	Remarks
1	34 MVA GT 1	BACK UP REF	ABB & REG 670	1814015, 1814016	YES	28.11.22	20.07.18	Serviceable	Performance is satisfactory.
2	34 MVA GT 2			2231055, 2218001	YES	06.02.23	02.08.17	Serviceable	
3	35 MVA GT 3			2217002, 2217003	YES	18.03.23	05.01.23	Serviceable	
4	34 MVA GT 4			2001103, 2001104	YES	2023	22.01.21	Serviceable	

Sl. no	Transformer (ICT/GT/ST)	TYPE	Make and model	Serial No	Functional	Date of Testing	Date of Commissioning	Serviceable/ Non serviceable	Remarks
1	34 MVA GT 1	BACK UP OVER CURRENT	ABB & REG 670	1814015, 1814016	YES	28.11.22	20.07.18	Serviceable	Performance is satisfactory.
2	34 MVA GT 2			2231055, 2218001	YES	06.02.23	02.08.17	Serviceable	
3	35 MVA GT 3			2217002, 2217003	YES	18.03.23	05.01.23	Serviceable	
4	34 MVA GT 4			2001103, 2001104	YES	2023	22.01.21	Serviceable	
1	34 MVA GT 1	BACK UP OVER FLUX	ABB & REG 670	1814015, 1814016	YES	28.11.22	20.07.18	Serviceable	Performance is satisfactory.
2	34 MVA GT 2			2231055, 2218001	YES	06.02.23	02.08.17	Serviceable	
3	35 MVA GT 3			2217002, 2217003	YES	18.03.23	05.01.23	Serviceable	
4	34 MVA GT 4			2001103, 2001104	YES	2023	22.01.21	Serviceable	

Sl. no	Transformer	Vector Group	MVA capacity in MVA	Percentage Impedance	Rated kV in kV		CT ratio			Remarks
					HV	LV	HV	LV	NCT	
1	34 MVA GT 1	YNd11	34	13.7	230	11	800/1	2000/1	100/1	The data is used for the relay setting calculation and review.
2	34 MVA GT 2	YNd11	34	13.7	230	11	800/1	2000/1	100/1	
3	35 MVA GT 3	YNd11	34	13.7	230	11	800/1	2000/1	100/1	
4	34 MVA GT 4	YNd11	34	13.7	230	11	800/1	2000/1	100/1	

Bus bar Protection

Sl no	Bus bar	Make and model	Serial number	Serviceable/ Non Serviceable	Stability check	Remarks
1	220 kV	English Electrical	M220917, M220916, M220915	Non Serviceable	Not done after commissioning	The available protection is electro-mechanical type and very old & trouble prone. This needs to be upgraded with the latest numerical IED.

<table>
<tr><th colspan="12">Auxiliary Systems</th></tr>
<tr><th>Sl. no</th><th>Auxiliary supply</th><th>Sources of Supply</th><th>Reliability of Supply</th><th>Average of Tripping Month</th><th colspan="7">Remarks</th></tr>
<tr><td>1</td><td>Supply 1</td><td>Station Auxiliary Transformer</td><td>100%</td><td>9</td><td colspan="7" rowspan="2">Performance is satisfactory.</td></tr>
<tr><td>2</td><td>Supply 2</td><td>Unit Auxiliary Transformer</td><td>100%</td><td>-</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><th>Sl. no</th><th>Supply</th><th>Make and model</th><th>Serial Number</th><th>Rating</th><th>Auto/Manual</th><th>Fuel Level</th><th>Date of last testing</th><th>Date of Commissioning</th><th>Serviceable / Non Serviceable</th><th colspan="2">Remarks</th></tr>
<tr><td>1</td><td>DG set</td><td>Caterpillar</td><td>H5G00653, H5G00757</td><td>500kVA</td><td>Manual</td><td>Normal</td><td>21/07/2023</td><td>2016</td><td>Serviceable</td><td colspan="2">Performance is satisfactory.</td></tr>
</table>

SUMMARY & RECOMMENDATION Protection audit of 220kV Substation at 120MW Khodri Power House		
1	**DC Supply**	The Performance of battery is satisfactory. It is suggested to extend the both 220V DC source to the switchyard for breaker operation.
2	**220kV Khodri - Chibro 1 & Khodri - Chibro 2 (MAIN 1)**	Since the available distance protection relay has no provision for communication and time synchronization facility. It is recommended to replace with the latest numerical IEDs.
3	**132kV Khodri - Dhakrani (MAIN 1)**	The available distance protection is electromechanical type. It is recommended to replace with the latest numerical IEDs.
4	**220kV Khodri - Chibro 1 & Khodri - Chibro 2 (MAIN 2)**	Since the available distance protection relay has no provision for communication and time synchronization facility. It is recommended to replace with the latest numerical IEDs..
5	**220kV/132kV Busbar**	The available differential protection is electro-mechanical type and very old & trouble prone. For the fault on 11.09.2022, the unit 3, R-phase CB blasted. The bus bar protection not operated but the breaker at far end got tripped. So it was found that bus bar protection is not healthy and M/s UJVNL tried to rectify with OEM and found that spares are not available. It is found that, the 132kV line side, breaker is not available and hence for any fault at 132kV side, the network of 33kV is getting isolated and solar power integrated at 33kV is unable to evacuate power resulting in generation loss. Also, in case of fault, shutdown and maintenance, the breaker operation is being done from remote end, hence 132kV breaker is recommended.

<table>
<tr><td></td><td></td><td>The following relays needs to be upgraded with the latest numerical IEDs
❖ Bus bar protection
➢ Bus bar super vison relay type VTX 95A, 95B, 95CH;
➢ Differential Protection 87A, 87B, 87CH,
➢ Auxiliary relays 95AX, 95BX, 95CHX
➢ Trip circuit supervision relays 95AY, 95BY, 95CHY
➢ Interlock over current relay 51B1
➢ Tripping Relay: 13 No. (96A, 96B, 96C to 96H)
❖ Synchronizing relay need to be installed.
❖ Bay control unit is not available in the substation and need to be installed.</td></tr>
<tr><td>6</td><td>Khodri – Chibro line</td><td>It is observed that the PLCC on Khodri - Chibro lines for tandem operation of generators which was commissioned in 2005-06 is obsolete and spares are not available. It is very much important to have a healthy PLCC communication for tandem operation and needs to be replaced.</td></tr>
<tr><td>7</td><td>Transformer</td><td>It is observed that the oil leakage is present in the 100 MVA 220/132 kV transformer in switchyard and this needs to be attended at the earliest.</td></tr>
<tr><td>8</td><td>Testing</td><td>It is recommended that all the CT, CVT, PT,CB and Numerical Protection IEDs shall be tested once in 3/4/5 years.</td></tr>
<tr><td>9</td><td>Calibration</td><td>It is recommended that Relay Test System and other testing equipment must be calibrated from NABL Accredited Laboratory</td></tr>
<tr><td>10</td><td>Testing equipment</td><td>It is recommended that the testing equipment such as tan delta kit, secondary injection kit, leakage current tester, power analyzer, winding resistance, TTR meter, energy meter testing is required at Khodri power house site for periodic testing and fault analysis.</td></tr>
</table>

STATUS OF WORK/TASK IN COMPLIANCE OF CPRI AUDIT OF CHIBRO POWER HOUSE

S.N	ISSUES	ACTION TAKEN
1.	Electromechanical Relays to be replaced with Numerical Relays	Proposed to change
2.	Time synchronizing of all IEDs of Chibro & Khodri	Existing IEDs at Chibro haven't Time synchronizing feature
3.	Negative D.C at Switchyard found ground	Issue resolved
4.	Only one source of D.C available	Work is under execution
5.	Testing of CT,CVT and PT done at the commissioning time	Testing done in last year Nov-23
6.	Tan delta and Insulation Resistance test of CT, CVT and PT to be done periodically	Tan delta test kit is proposed to procured soon; IR test done periodically
7.	Testing of All numerical IEDs to be tested in 3/4/5 years	Case moved for testing

STATUS OF WORK/TASK IN COMPLIANCE OF CPRI AUDIT OF KHODRI POWER HOUSE

S.N	ISSUES	ACTION TAKEN
1.	Electromechanical Relays to be replaced with Numerical Relays	Proposed to change
2.	132 KV Breaker not available. To be recommended	Case is under process
3.	Time synchronizing of all IEDs of Chibro & Khodri	All Numerical IEDs of Khodri are Time synchronized except 220 KV Khori-Chibro-I & II, The case for replacing is in process.
3.	Positive D.C at Switchyard found ground	Issue resolved
4.	Oil leakage in 100 MVA 220KV/132 KV ICT	Issue resolved
5.	Only one source of D.C available	Tendering process is in progress
6.	Testing of All numerical IEDs to be tested in 3/4/5 years	Case moved for testing
7.	Tan delta, Power analyzer, Meter test etc. not done periodically	Tan delta, Power analyzer, Meter test kit are old and irreparable. Case Preparation is in progress
8.	Relay Test Kit and other measuring instruments not calibrated	Calibration of said Equipment has been done from NABL certified Lab

Annexure-A.X

New AC Lines Report from 01-11-2024 to 30-11-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Circuit No	Line Length	Conductor Type	Tower Configuration	State	Approved in SCM/Statury Body	Remark	Intimation request for charging of new element (FormatA)	Acknowledment sent by NRLDC (Format II)	Request for test charging and trial run (FormatB)	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
													Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119292	Nov - 2024	220kV AGE24L(Bhimsar)SL_Ftg2_PG-Fatehgarh_II(PG)-1	AGE24L	220kV	1	Total Line Length:12 kms. Overhead- 5.5 km & Underground-6.5 kms	AL59 Zebra	Double	RAJASTHAN to RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	27-Nov-2024	23:10			
2	1119292	Nov - 2024	220kV AGE24L(Bhimsar)SL_Ftg2_PG-Fatehgarh_II(PG)-2	AGE24L	220kV	2	Total Line Length:12 kms. Overhead- 5.5 km & Underground-6.5 kms	AL59 Zebra	Double	RAJASTHAN to RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	27-Nov-2024	23:30			

Bays Report from 01-11-2024 to 30-11-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Bay No	Bay Type	Substation	State	Approved in SCM/Statury Body	Remark	Intimation request for charging of new element (FormatA)	Acknowledment sent by NRLDC (Format II)	Request for test charging and trial run (FormatB)	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
												Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119242	Sep - 2024	400kV Main Bay 412 of 411- Tie Bay of Nakodar(PSTCL)- Makhu (PSTCL) Ckt 2 and Future ICT bay at Nakodar (PSTCL) and NA at Nakodar(PSG)	PSTCL	400kV	412	Main Bay	Nakodar(PSG)	PUNJAB	24-02-2023 - 10:00, It is already intimated to CTU and CMTES., NA, NA		18 Sep 2024 16:34	22 Sep 2024 08:16	25 Oct 2024 14:27, 18 Oct 2024 16:46	28 Oct 2024 12:29, 22 Oct 2024 10:44	07-Nov-2024	20:28			
2	1119271	Oct - 2024	400kV Main Bay 427 of 400/220 kV, 500 MVA ICT-5 at Bikaner_2 (PBTSL)	PBTSL	400kV	427	Main Bay	Bikaner_2 (PBTSL)	RAJASTHAN	28-09-2022 - 10:30, 9, 4.5.2 point no.9, 19		29 Oct 2024 13:31, 26 Oct 2024 12:44	29 Oct 2024 14:57, 29 Oct 2024 10:31	20 Nov 2024 16:44	22 Nov 2024 11:49	23-Nov-2024	00:44	02 Dec 2024 00:58	27-11-2024 - 01:00 to 28-11-2024 - 01:00	
3	1119271	Oct - 2024	400kV Tie Bay 426 of 400/220 kV, 500 MVA ICT-5 and Future Line at Bikaner_2 (PBTSL)	PBTSL	400kV	426	Tie Bay	Bikaner_2 (PBTSL)	RAJASTHAN	28-09-2022 - 10:30, 9, 4.5.2 point no.9, 19		29 Oct 2024 13:31, 26 Oct 2024 12:44	29 Oct 2024 14:57, 29 Oct 2024 10:31	20 Nov 2024 16:44	22 Nov 2024 11:49	23-Nov-2024	00:49	02 Dec 2024 00:58	27-11-2024 - 01:00 to 28-11-2024 - 01:00	
4	1119271	Oct - 2024	220kV Main Bay 210 of 400/220 kV, 500 MVA ICT-5 at Bikaner_2 (PBTSL)	PBTSL	220kV	210	Main Bay	Bikaner_2 (PBTSL)	RAJASTHAN	28-09-2022 - 10:30, 9, 4.5.2 point no.9, 19		29 Oct 2024 13:31, 26 Oct 2024 12:44	29 Oct 2024 14:57, 29 Oct 2024 10:31	20 Nov 2024 16:44	22 Nov 2024 11:49	23-Nov-2024	18:24	02 Dec 2024 00:58	27-11-2024 - 01:00 to 28-11-2024 - 01:00	
5	1119300	Nov - 2024	220kV Main Bay 240(A210) of 220 kV Adani Renewable Energy Holding Four Ltd ckt-I at Fatehgarh_II(PG)	POWERGRID	220kV	240(A210)	Main Bay	Fatehgarh_II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2(xix) , 5		20 Nov 2024 17:59	22 Nov 2024 11:35	26 Nov 2024 16:48, 23 Nov 2024 21:49	26 Nov 2024 20:16, 26 Nov 2024 12:10	27-Nov-2024	23:10			
6	1119292	Nov - 2024	220kV Main Bay 202 of 220 kV AGE24L(Bhimsar)SL_Ftg2_PG-Fatehgarh_II(PG)-1 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	220kV	202	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	27-Nov-2024	23:19			
7	1119300	Nov - 2024	220kV Main Bay 239(A209) of 220 kV Adani Renewable Energy Holding Four Ltd ckt-II at Fatehgarh_II(PG)	POWERGRID	220kV	239(A209)	Main Bay	Fatehgarh_II(PG)	RAJASTHAN	13-09-2019 - 10:30, 5, 2.2(xix) , 5		20 Nov 2024 17:59	22 Nov 2024 11:35	26 Nov 2024 16:48, 23 Nov 2024 21:49	26 Nov 2024 20:16, 26 Nov 2024 12:10	27-Nov-2024	23:30			
8	1119292	Nov - 2024	220kV Main Bay 203 of 220 kV AGE24L(Bhimsar)SL_Ftg2_PG-Fatehgarh_II(PG)-2 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	220kV	203	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	28-Nov-2024	00:10			
9	1119292	Nov - 2024	220kV Main Bay 201 of ICT-1 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	220kV	201	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	28-Nov-2024	00:42			
10	1119292	Nov - 2024	220kV Main Bay 204 of ICT-2 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	220kV	204	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	28-Nov-2024	01:55			
11	1119293	Nov - 2024	33kV Main Bay 0202 of ICT-1 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0202	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	03:50			
12	1119293	Nov - 2024	33kV Main Bay 0302 of ICT-2 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0302	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	04:18			
13	1119293	Nov - 2024	33kV Main Bay 0218 of ICT-2 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0218	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	04:19			
14	1119293	Nov - 2024	33kV Main Bay 0402 of ICT-2 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0402	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	04:20			
15	1119293	Nov - 2024	33kV Main Bay 0118 of ICT-2 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0118	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	04:21			
16	1119293	Nov - 2024	33kV Main Bay 0318 of ICT-1 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0318	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	04:21			
17	1119293	Nov - 2024	33kV Main Bay 0204 of Auxiliary Transformer no. 02 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0204	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	05:09			
18	1119293	Nov - 2024	33kV Main Bay 0102 of ICT -1 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0102	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	21:16			
19	1119293	Nov - 2024	33kV Main Bay 0418 of ICT-1 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	0418	Main Bay	AGE24L(Bhimsar)SL_Ftg2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	21:17			
20	1119213	Aug - 2024	400kV Main Bay 410 (C10) of Generator Step-Up Transformer Unit#6 at Tehri(THDC)	Tehri PSP	400kV	410 (C10)	Main Bay	Tehri(THDC)	UTTARAKHAND	30-05-2009 - 10:00, 27th , 9.0, 10 of 41		15 Nov 2024 18:17, 10 Nov 2024 17:22	25 Nov 2024 14:53, 13 Nov 2024 12:48	27 Nov 2024 17:18, 26 Nov 2024 10:09	28 Nov 2024 14:57, 27 Nov 2024 17:14	30-Nov-2024	13:53			

Bus Coupler Report from 01-11-2024 to 30-11-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Associated Transmission Element1	Associated Transmission Element2	Substation	State	Approved in SCM/Statury Body	Remark	Intimation request for charging of new element (FormatA)	Acknowledment sent by NRLDC (Format II)	Request for test charging and trial run (FormatB)	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
												Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119292	Nov - 2024	220kV Bus Coupler Bay 205 of Bus-1 and Bus-2 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	220kV	Bus-2	Bus-1	AGE24L(Bhimsar)SL_Ftg 2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	28-Nov-2024	00:20			
2	1119293	Nov - 2024	33kV Bus Coupler Bay 0210 of Bus-1 and Bus-2 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	33kV	Bus-2	Bus-1	AGE24L(Bhimsar)SL_Ftg 2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28	28-Nov-2024	17:42			

BUS Report from 01-11-2024 to 30-11-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Bus No	Bus Type	Bus Scheme	Fault Level	Normal Current Capacity	Substation	State	Approved in SCM/Statury Body	Remark	Intimation request for charging of new element (FormatA)	Acknowledment sent by NRLDC (Format II)	Request for test charging and trial run (FormatB)	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
															Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119292	Nov - 2024	220kV Main Bus 01 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	220kV	01	Main Bus	Double Bus	50KA for 3 Sec	2000A	AGE24L(Bhimsar)SL_Ftg 2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19. 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	27-Nov-2024	23:10			
2	1119292	Nov - 2024	220kV Main Bus 02 at AGE24L(Bhimsar)SL_Ftg2_PG	AGE24L	220kV	02	Main Bus	Double Bus	50KA for 3 Sec	2000A	AGE24L(Bhimsar)SL_Ftg 2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19. 56		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17	28-Nov-2024	00:20			

Capacitor Bank Report from 01-11-2024 to 30-11-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (in kV)	Type of Capacitor	Capacitor Bank No	Sub Capacitor Bank MVAR Rating	Capacitor MVAR Rating	State	Approved in SCM/Statury Body	Remark	Intimation request for charging of new element (FormatA)	Acknowledment sent by NRLDC (Format II)	Request for test charging and trial run (FormatB)	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charging		Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details	
													Date	Date	Date	Date	Date	Time	Date	Trial Run/Operation Period	Certificate No.
1	1119263	Oct - 2024	33kV, Harmonic Filter Capacitor Bank, 9 MVAR(9 MVAR Filter bank as per compliances related to Clause B.1 Power Quality Norms. 1x9 MVAr Hi-pass Filter (10th Harmonic) with quality factor of 2, cut off frequency 500 Hz.) Capacitor bank no-02 at bay no. 03-IC01 SWGR-03 at AGE25L SL BHD2 PG	AGE25L	33kV	Harmonic Filter Capacitor Bank	02 at bay no. 03-IC01 SWGR-03	9 MVAR Filter bank as per compliances related to Clause B.1 Power Quality Norms. 1x9 MVAr Hi-pass Filter (10th Harmonic) with quality factor of 2, cut off frequency 500 Hz.	9	to	01-09-2010 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/7 , 56		18 Oct 2024 10:36, 16 Oct 2024 16:10	22 Oct 2024 10:29, 17 Oct 2024 10:29	08 Nov 2024 18:18, 29 Oct 2024 12:02	12 Nov 2024 09:48, 05 Nov 2024 08:47	13-Nov-2024	20:03			
2	1119263	Oct - 2024	33kV, Harmonic Filter Capacitor Bank, 19 MVAR(10+9 MVAR Filter bank as per compliances related to Clause B.1 Power Quality Norms. 1x9 MVAr Hi-pass Filter (10th Harmonic) with quality factor of 2, cut off frequency 500 Hz. 1x10 MVAr Single tuned Filter (2nd Harmonic) with quality factor of 30, cut off frequency 100 Hz.) Capacitor bank no-03 at bay no. 04-IC11 SWGR-04 at AGE25L SL BHD2 PG	AGE25L	33kV	Harmonic Filter Capacitor Bank	03 at bay no. 04-IC11 SWGR-04	10+9 MVAR Filter bank as per compliances related to Clause B.1 Power Quality Norms. 1x9 MVAr Hi-pass Filter (10th Harmonic) with quality factor of 2, cut off frequency 500 Hz. 1x10 MVAr Single tuned Filter (2nd Harmonic) with quality factor of 30, cut off frequency 100 Hz.	19	to	01-09-2010 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/7 , 56		18 Oct 2024 10:36, 16 Oct 2024 16:10	22 Oct 2024 10:29, 17 Oct 2024 10:29	08 Nov 2024 18:18, 29 Oct 2024 12:02	12 Nov 2024 09:48, 05 Nov 2024 08:47	13-Nov-2024	20:03			
3	1119263	Oct - 2024	33kV, Harmonic Filter Capacitor Bank, 18 MVAR(9+9 MVAR Filter bank as per compliances related to Clause B.1 Power Quality Norms. 1x9 MVAR Hi-pass Filter (10th Harmonic) with quality factor of 2, cut off frequency 500 Hz. 1x9 MVAr Single tuned Filter (4th Harmonic) with quality factor of 30, cut off frequency 225 Hz.) Capacitor bank no-01 at bay no. 03-IC10 SWGR-3 at AGE25L SL BHD2 PG	AGE25L	33kV	Harmonic Filter Capacitor Bank	01 at bay no. 03-IC10 SWGR-3	9+9 MVAR Filter bank as per compliances related to Clause B.1 Power Quality Norms. 1x9 MVAR Hi-pass Filter (10th Harmonic) with quality factor of 2, cut off frequency 500 Hz. 1x9 MVAr Single tuned Filter (4th Harmonic) with quality factor of 30, cut off frequency 225 Hz.	18	to	01-09-2010 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/7 , 56		18 Oct 2024 10:36, 16 Oct 2024 16:10	22 Oct 2024 10:29, 17 Oct 2024 10:29	08 Nov 2024 18:18, 29 Oct 2024 12:02	12 Nov 2024 09:48, 05 Nov 2024 08:47	13-Nov-2024	20:03			
4	1119263	Oct - 2024	33kV, Harmonic Filter Capacitor Bank, 18 MVAR(9+9 MVAR Filter bank as per compliances related to Clause B.1 Power Quality Norms. 1x9 MVAr Hi-pass Filter (10th Harmonic) with quality factor of 2, cut off frequency 500 Hz. 1x9 MVAr Single tuned Filter (4th Harmonic) with quality factor of 30, cut off frequency 225 Hz.) Capacitor bank no-04 at Bay no. 04-IC02 SWGR-04 at AGE25L SL BHD2 PG	AGE25L	33kV	Harmonic Filter Capacitor Bank	04 at Bay no. 04-IC02 SWGR-04	9+9 MVAR Filter bank as per compliances related to Clause B.1 Power Quality Norms. 1x9 MVAr Hi-pass Filter (10th Harmonic) with quality factor of 2, cut off frequency 500 Hz. 1x9 MVAr Single tuned Filter (4th Harmonic) with quality factor of 30, cut off frequency 225 Hz.	18	to	01-09-2010 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/7 , 56		18 Oct 2024 10:36, 16 Oct 2024 16:10	22 Oct 2024 10:29, 17 Oct 2024 10:29	08 Nov 2024 18:18, 29 Oct 2024 12:02	12 Nov 2024 09:48, 05 Nov 2024 08:47	13-Nov-2024	20:03			

SOLAR ICR/BLOCK Report from 01-11-2024 to 30-11-2024

S.No	CASE ID	Application Month	Plant Name	Capacity to be charged	Voltage Level	Total Installed Capacity of Plant	Type of RE	Feeder No	Solar ICR/Block No	IDT No	IDT Make	IDT MVA Rating	IDT Votage Rating(HV/LV)	Inverter Type	Inverter Make	Total No of Inverters	Inverter AC Rating	Agency/ Owner	Evacuation Path	Remark	Intimation request for charging of new element Date	Acknowledgement sent by NRLDC Date	Request for test charging and trial run Date	Provisional Approval for Test Charging/Trial operation Date	Actual date & time of charging Date	Actual date & time of charging Time	Power Flow Started Date	Power Flow Started Time	COD Declared by Transmission Licensee	Other Works
1	1119264	Oct - 2024	ACME Raisar Solar Energy Private Limited	136MW	33kV	272MW	Solar	[illegible]	13	13	NUCON	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Raisar_SEPL			18 Oct 2024 12:19, 17 Oct 2024 17:15	18 Oct 2024 17:36, 18 Oct 2024 12:08	22 Oct 2024 17:14, 18 Oct 2024 20:25	23 Oct 2024 11:42, 22 Oct 2024 15:27	[illegible]	[illegible]				
2	1119264	Oct - 2024	ACME Raisar Solar Energy Private Limited	136MW	33kV	272MW	Solar	[illegible]	8	8	NUCON	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Raisar_SEPL			18 Oct 2024 12:19, 17 Oct 2024 17:15	18 Oct 2024 17:36, 18 Oct 2024 12:08	22 Oct 2024 17:14, 18 Oct 2024 20:25	23 Oct 2024 11:42, 22 Oct 2024 15:27	[illegible]	[illegible]				
3	1119259	Oct - 2024	ACME Dhaulpur Powertech Private Limited	226.67 MW	33kV	272MW	Solar	[illegible]	19	19	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Dhaulpur_PPL			16 Oct 2024 17:08, 14 Oct 2024 16:54, 14 Oct 2024 13:56, 11 Oct 2024 11:45	17 Oct 2024 10:46, 16 Oct 2024 16:28, 14 Oct 2024 16:36, 14 Oct 2024 11:48	23 Oct 2024 17:01, 17 Oct 2024 16:22	24 Oct 2024 15:23, 22 Oct 2024 15:30	[illegible]	[illegible]				
4	1119259	Oct - 2024	ACME Dhaulpur Powertech Private Limited	226.67 MW	33kV	272MW	SOLAR	[illegible]	7	7	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Dhaulpur_PPL			16 Oct 2024 17:08, 14 Oct 2024 16:54, 14 Oct 2024 13:56, 11 Oct 2024 11:45	17 Oct 2024 10:46, 16 Oct 2024 16:28, 14 Oct 2024 16:36, 14 Oct 2024 11:48	23 Oct 2024 17:01, 17 Oct 2024 16:22	24 Oct 2024 15:23, 22 Oct 2024 15:30	[illegible]	[illegible]				
5	1119265	Oct - 2024	ACME Dhaulpur Powertech Private Limited	45.33MW	33kV	272MW	Solar	[illegible]	21	21	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Dhaulpur_PPL			17 Oct 2024 17:45	18 Oct 2024 17:36	23 Oct 2024 16:59, 18 Oct 2024 19:52	24 Oct 2024 15:23, 22 Oct 2024 15:28	[illegible]	[illegible]				
6	1119259	Oct - 2024	ACME Dhaulpur Powertech Private Limited	226.67 MW	33kV	272MW	Solar	1-IC04-Panel-1	11	11	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Dhaulpur_PPL			16 Oct 2024 17:08, 14 Oct 2024 16:54, 14 Oct 2024 13:56, 11 Oct 2024 11:45	17 Oct 2024 10:46, 16 Oct 2024 16:28, 14 Oct 2024 16:36, 14 Oct 2024 11:48	23 Oct 2024 17:01, 17 Oct 2024 16:22	24 Oct 2024 15:23, 22 Oct 2024 15:30	19-Nov-2024	21:34				
7	1119264	Oct - 2024	ACME Raisar Solar Energy Private Limited	136MW	33kV	272MW	Solar	1-IC03-Panel-1	15	15	NUCON	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Raisar_SEPL			18 Oct 2024 12:19, 17 Oct 2024 17:15	18 Oct 2024 17:36, 18 Oct 2024 12:08	22 Oct 2024 17:14, 18 Oct 2024 20:25	23 Oct 2024 11:42, 22 Oct 2024 15:27	12-Nov-2024	19:25				
8	1119265	Oct - 2024	ACME Dhaulpur Powertech Private Limited	45.33MW	33kV	272MW	Solar	2-IC03-Panel-2	20	20	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Dhaulpur_PPL			17 Oct 2024 17:45	18 Oct 2024 17:36	23 Oct 2024 16:59, 18 Oct 2024 19:52	24 Oct 2024 15:23, 22 Oct 2024 15:28	14-Nov-2024	19:46				
9	1119264	Oct - 2024	ACME Raisar Solar Energy Private Limited	136MW	33kV	272MW	Solar	2-IC02-Panel-2	3	3	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Raisar_SEPL			18 Oct 2024 12:19, 17 Oct 2024 17:15	18 Oct 2024 17:36, 18 Oct 2024 12:08	22 Oct 2024 17:14, 18 Oct 2024 20:25	23 Oct 2024 11:42, 22 Oct 2024 15:27	14-Nov-2024	22:10				
10	1119264	Oct - 2024	ACME Raisar Solar Energy Private Limited	136MW	33kV	272MW	Solar	2-IC01-Panel-2	2	2	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Raisar_SEPL			18 Oct 2024 12:19, 17 Oct 2024 17:15	18 Oct 2024 17:36, 18 Oct 2024 12:08	22 Oct 2024 17:14, 18 Oct 2024 20:25	23 Oct 2024 11:42, 22 Oct 2024 15:27	14-Nov-2024	22:14				
11	1119264	Oct - 2024	ACME Raisar Solar Energy Private Limited	136MW	33kV	272MW	Solar	1-IC03-Panel-1	17	17	NUCON	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Raisar_SEPL			18 Oct 2024 12:19, 17 Oct 2024 17:15	18 Oct 2024 17:36, 18 Oct 2024 12:08	22 Oct 2024 17:14, 18 Oct 2024 20:25	23 Oct 2024 11:42, 22 Oct 2024 15:27	16-Nov-2024	19:10				
12	1119259	Oct - 2024	ACME Dhaulpur Powertech Private Limited	226.67 MW	33kV	272MW	SOLAR	1-IC03-Panel-1	8	8	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Dhaulpur_PPL			16 Oct 2024 17:08, 14 Oct 2024 16:54, 14 Oct 2024 13:56, 11 Oct 2024 11:45	17 Oct 2024 10:46, 16 Oct 2024 16:28, 14 Oct 2024 16:36, 14 Oct 2024 11:48	23 Oct 2024 17:01, 17 Oct 2024 16:22	24 Oct 2024 15:23, 22 Oct 2024 15:30	19-Nov-2024	20:33				
13	1119264	Oct - 2024	ACME Raisar Solar Energy Private Limited	136MW	33kV	272MW	Solar	1-IC02-Panel-1	18	18	NUCON	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Raisar_SEPL			18 Oct 2024 12:19, 17 Oct 2024 17:15	18 Oct 2024 17:36, 18 Oct 2024 12:08	22 Oct 2024 17:14, 18 Oct 2024 20:25	23 Oct 2024 11:42, 22 Oct 2024 15:27	19-Nov-2024	22:10				
14	1119259	Oct - 2024	ACME Dhaulpur Powertech Private Limited	226.67 MW	33kV	272MW	Solar	1-IC03-Panel-1	9	9	TESLA	12.5MVA	33kV/4x0.66 kV	Central Inveter	Sungrow	4	3.33MVA	ACME_Dhaulpur_PPL			16 Oct 2024 17:08, 14 Oct 2024 16:54, 14 Oct 2024 13:56, 11 Oct 2024 11:45	17 Oct 2024 10:46, 16 Oct 2024 16:28, 14 Oct 2024 16:36, 14 Oct 2024 11:48	23 Oct 2024 17:01, 17 Oct 2024 16:22	24 Oct 2024 15:23, 22 Oct 2024 15:30	24-Nov-2024	19:35				
15	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	406	18	18	Shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
16	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	408	3	3	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
17	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	214	13	13	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
18	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	206	01	01	shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
19	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	413	23	23	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
20	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	212	15	15	Shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
21	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	113	8	8	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
22	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	207	2	2	Ornet Transformers LLP	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
23	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	212	22	22	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
24	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	114	9	9	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
25	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	207	19	19	Shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
26	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	113	7	7	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
27	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	413	24	24	Shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
28	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	213	14	14	Shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
29	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	112	05	05	Shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
30	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	206	04	04	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
31	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	114	10	10	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
32	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	408	6	6	Ornet	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	28-Nov-2024	23:33				
33	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	407	16	16	Shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	30-Nov-2024	03:44				
34	1119294	Nov - 2024	Adani Green Energy Twenty Four Limited	238 MW	33kV	500 MW	Solar	407	17	17	Shilchar	12.5 MVA	33 kV/0.8 kV	String Inverter	TBEA	42	0.3 MVA	AGE24L			16 Nov 2024 13:09	20 Nov 2024 14:40	27 Nov 2024 12:01, 25 Nov 2024 19:16, 20 Nov 2024 20:03	27 Nov 2024 15:26, 27 Nov 2024 11:51, 22 Nov 2024 16:32	30-Nov-2024	03:44				

Transformer Report from 01-11-2024 to 30-11-2024

S.No	CASE ID	Application Month	Name of element	Owner	Voltage Level (HV/LV/Tertiary)	MVA Capacity	Type of Transformer	Make	Configuration	Total Tap	Nominal Tap	Present Tap	Vector Group	% Impedance	HV Stattion	State	Approved in SCM/Statury Body	Remark	Transformer Details	OLD MVA Capacity	Intimation request for charging of new element (FormatA)	Acknowledment sent by NRLDC (Format II)	Request for test charging and trial run (FormatB)	Provisional Approval for Test Charging/Trial operation(Format IV)	Actual date & time of charging (HV Side)		Actual date & time of charging (LV Side)		Power Flow Started	Request for Trial Operation Certificate(Format C)	Trial Run Operation Certificate Details		Actual date & time of charging	
																					Date	Date	Date	Date	Date	Time	Date	Time	Date	Date	Trial Run/Operation Period	Certificate No	Date	Time
1	1119242	Sep - 2024	400/220/33kV, 500 MVA, 3-Phase, KANOHAR, ICT - 3 at Nakodar(PSG)	PSTCL	400/220/33kV	500	ICT	KANOHAR	3-Phase	17	9B	9B	YNa0d11, YNa0d11	12.11%	Nakodar(PSG)	PUNJAB	24-02-2023 - 10:00, It is already intimated to CTU and CMTES., NA, NA		New		18 Sep 2024 16:34	22 Sep 2024 08:16	25 Oct 2024 14:27, 18 Oct 2024 16:46	28 Oct 2024 12:29, 22 Oct 2024 10:44									07-Nov-2024	20:28
2	1119271	Oct - 2024	400/220/33kV, 500 MVA MVA, 3-Phase, T & R, ICT - 5 at Bikaner_2 (PBTSL)	PBTSL	400/220/33kV	500 MVA	ICT	T & R	3-Phase	17	9B	9B	YNa0d11 , YNa0d11	11.70	Bikaner_2 (PBTSL)	RAJASTHAN	28-09-2022 - 10:30, 9, 4.5.2 point no 9, 19		New		29 Oct 2024 13:31, 26 Oct 2024 12:44	29 Oct 2024 14:57, 29 Oct 2024 10:31	20 Nov 2024 16:44	22 Nov 2024 11:49						02 Dec 2024 00:58	27-11-2024 - 01:00 to 28-11-2024 - 01:00		23-Nov-2024	18:24
3	1119292	Nov - 2024	220/33kV, 250 MVA, 3-Phase, TBEA, Power Transformer - 1 at AGE24L(Bhimsar)SL_Fte2_PG	AGE24L	220/33/na	250	Power Transformer	TBEA	3-Phase	17	9	9	NA, YN, yn0	17.32	AGE24L(Bhimsar)SL_Fte2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19		New		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17									28-Nov-2024	00:42
4	1119292	Nov - 2024	220/33kV, 250 MVA, 3-Phase, TBEA, Power Transformer - 2 at AGE24L(Bhimsar)SL_Fte2_PG	AGE24L	220/33/na	250	Power Transformer	TBEA	3-Phase	17	9	9	NA, YN, yn0	17.82	AGE24L(Bhimsar)SL_Fte2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19		New		14 Nov 2024 20:53	20 Nov 2024 14:40	20 Nov 2024 20:03	26 Nov 2024 20:17									28-Nov-2024	01:55
5	1119293	Nov - 2024	33/0.433kV, 0.630 MVA, 3-Phase, KALPA ELECTRICAL PVT LTD, Auxiliary Transformer - 2 at AGE24L(Bhimsar)SL_Fte2_PG	AGE24L	33/0.433/na	0.63	Auxiliary Transformer	KALPA ELECTRICAL PVT LTD	3-Phase	NA	NA	NA	NA, DELTA, yn11	4.5%	AGE24L(Bhimsar)SL_Fte2_PG	RAJASTHAN	01-09-2020 - 11:00, 2nd NRPCTP Meeting , Anne.V/Table 2/19, 56		New		16 Nov 2024 13:09	20 Nov 2024 14:40	20 Nov 2024 20:03	27 Nov 2024 15:28									28-Nov-2024	05:09
6	1119213	Aug - 2024	420/15.75kV, 306 MVA, 3-Phase, M/s GE, GT - 6 at Tehri(THDC)	Tehri PSP	420/15.75/na	306	GT	M/s GE	3-Phase	5	2	2	, YN, d11	14.5	Tehri(THDC)	UTTARAKHAND	30-05-2009 - 10:00, 27th , 9.0, 10 of 41		New		15 Nov 2024 18:17, 10 Nov 2024 17:22	25 Nov 2024 14:53, 13 Nov 2024 12:48	27 Nov 2024 17:18, 26 Nov 2024 10:09	28 Nov 2024 14:57, 27 Nov 2024 17:14									30-Nov-2024	13:53

Annexure-A.XI

Protection related compliance during First Time Charging and Modified Elements in the Grid

02-01-2025

FIRST TIME CHARGING ADVISORY REGARDING PROTECTION SYSTEM TRANSMISSION ELEMENTS AND GENERATING UNITS

Ensure:

1. Suitable RPC protection philosophy compliant relay settings have been loaded in all protection relays and are properly activated.

2. All protection relays installed for subject element are powered ON and healthy status LED is glowing.

3. All the relays have their time GPS synchronized and relay is receiving regular synchronization signal from GPS clock.

4. Analog and Digital channels are properly configured in Disturbance recorder of all relays and proper identifiable nomenclature has been provided for channels, Device ID and Station name in relay. The list of important DR channels which must be configured at least is annexed herewith.

5. Dedicated station Event logger/ SAS Event logger is functioning and recording at the instant of first time charging.

6. Circuit Breaker close transition status signal is mapped as Trigger signal for initiating recording of DR. If automatic trigger signal is not mapped ensure manual triggering of DR at the instant of first time charging at one end and Synchronizing at remote end.

7. If the element trips on first time charging the relay flags and indications are recorded promptly.

FIRST TIME CHARGING ADVISORY REGARDING PROTECTION SYSTEM TRANSMISSION ELEMENTS AND GENERATING UNITS

REQUIREMENTS FOR TRIAL RUN CERTIFICATE

After first time charging followings should be sent to RLDC for verification of Protection system and issue of Trial run certificate:

1. **For Transmission Elements:**

- In case of Transmission lines charging instant Disturbance recording of one end and synchronizing instant Disturbance recording of remote end of all the relays installed for subject element at both ends of Line in COMTRADE format.
- In case of Transformers and Reactors, charging instant Disturbance recording of all the relays installed for subject element in COMTRADE format.
- Charging/ synchronizing instant Station Event logger recording of both ends.
- Relay settings** of all the Protection relays installed for subject element in RIO/Pdf file format.

* In order to ascertain charging/ synchronizing time.

** NRPC is in the process of developing an online portal for maintaining a database of relay settings, until the portal is ready relay settings are being sought to maintain a offline database.

FIRST TIME CHARGING ADVISORY REGARDING PROTECTION SYSTEM TRANSMISSION ELEMENTS AND GENERATING UNITS

2. For Generating Units:

- ❑ PSS, AVR and Governor Test Reports.
- ❑ Dynamic data for short circuit studies in desired format. Format is available at NRPC website.
- ❑ Turbine type and ratings.
- ❑ List of Generator protections provided and their relay settings.
- ❑ Station SLD depicting Auxiliary supply.
- ❑ Capability curve of Generator.
- ❑ Station Event Log depicting charging instant.
- ❑ DR of protection relay at the instant of charging.

FIRST TIME CHARGING ADVISORY REGARDING PROTECTION SYSTEM TRANSMISSION ELEMENTS AND GENERATING UNITS

ANNEXURE LISTING MINIMUM REQUIRED DR CHANNELS TO BE CONFIGURED

- **The disturbance recorder function for Transformer and Reactors shall have the facility to record at least following digital channel signals:**

1. Differential protection operated

2. REF protection operated

2. HV Breaker status (Main & tie/transfer both separately)

3. IV Breaker status (Main & tie/transfer both separately)

4. Bucholz / OLTC/ WTI/ OTI alarm

5. Bucholz / PRD / SPR/ Trip

6. Group-A, Group-B lock-out relay trip

FIRST TIME CHARGING ADVISORY REGARDING PROTECTION SYSTEM TRANSMISSION ELEMENTS AND GENERATING UNITS

The disturbance recorder function for Transmission Lines shall have the facility to record the at least following digital channel signals:

1. Main CB R phase open
2. Main CB Y phase open
3. Main CB B phase open
4. Tie/TBC CB R phase open
5. Tie/TBC CB Y phase open
6. Tie/TBC CB B phase open
7. Main-1 carrier received
8. Main-1 protection operated
9. Main/Tie /TBC Auto reclose operated
10. Over Voltage -Stage-1 operated
11. Over Voltage -Stage-2 operated
12. Reactor / Stub/TEE-1/2/UF protection operated
13. Direct Trip received
14. Main-2 (other relay) carrier received
15. Main- 2 (other relay) Back Up protection operated
16. Bus bar protection operated
17. LBB operated of Main /Tie/TBC circuit breaker

FIRST TIME CHARGING ADVISORY REGARDING PROTECTION SYSTEM TRANSMISSION ELEMENTS AND GENERATING UNITS

- **DR Nomenclature:** Station Name/Element Name or bay name/protection relay name (M1/M2,21,87,64 etc.)
- **DR standard time window:** 3sec (0.5sec pre fault and 2.5sec post fault)
- Time sync of DR & Station Event logger

Requirements only for RE:

- ✓ Relay extracted setting and DR (disturbance recorder) of all the elements (220kV line (both end, RE station end and pooling station end), 220/33kV ICTs & 33kV feeders).
- ✓ Protection relay setting kept in 33kV feeders
- ✓ DR(.dat/.cfg) file, station event logger details
- ✓ Dummy DR trigger for overvoltage(1.1pu) & undervoltage(0.9pu) at 33kV level. (Note: no CB tripping should occur, only DR triggering would be implemented, DR triggering is to be kept for recording and analysis purpose only)
- ✓ Inverter(LVRT/HVRT) and PPC setting as per standard format.

FORMAT FOR PPC AND INVERTER

Important Parameter of PPC		
Description	**Value**	**Unit**
Active Power control mode		Enabled/Disabled
Maximum Active power command		MW
Active Power ramp rate		%/sec
Voltage control mode		Enabled/Disabled
PPC Reference voltage		kV (or PU)
Minimum Reactive Power command		MVAR
Maximum Reactive power command		MVAR
Voltage dead band		%
Voltage droop		%
Over Voltage limit		kV (or PU)
Under Voltage limit		kV (or PU)
Power Factor limit		
PPC Reference point		Point from which PPC is taking reference Voltage(kV), Active power(MW), Reactive Power(MVAR) and frequency(Hz) for controlling the plant. (Bus name)
PPC Communication time		ms
Sampling time of PQ meter		ms
PPC total execution time		(ms) PPC total execution time once it senses any required change with respect to reference set points and send commands to inverters.

Important Parameter of Inverters/WTG		
Description	**Value**	**Unit**
LVRT		
LVRT		Enable/Disable
LVRT Mode		Reactive power priority(Yes/No)
LVRT Triggering threshold		V
LVRT K-factor		
LVRT Response time		ms
Level-1 UV protection		V
Level-1 UV protection time		ms
Level-2 UV protection		V
Level-2 UV protection time		ms
Level-3 UV protection		V
Level-3 UV protection time		ms
Level-4 UV protection		V
Level-4 UV protection time		ms
Active power change gradient		%/sec
HVRT		
HVRT		Enable/Disable
HVRT Mode		Reactive power priority(Yes/No)
HVRT Triggering threshold		V
HVRT K-factor		
LVRT Response time		ms
Level-1 OV protection		V
Level-1 OV protection time		ms
Level-2 OV protection		V
Level-2 OV protection time		ms
Level-3 OV protection		V
Level-3 OV protection time		ms
Level-4 OV protection		V
Level-4 OV protection time		ms
VRT active power recovery gradient		%/sec
Frequency		
Level-1 Over frequency protection		Hz
Level-1 Over frequency protection time		sec
Level-1 Under frequency protection		Hz
Level-1 Under frequency protection time		sec
Other important setting		
Inverter recovery time		sec (Time required for revival of inverter after tripping)
Duration of momentary cessation of Inverter		ms

आज़ादी का अमृत महोत्सव

G20 भारत 2023 INDIA

ग्रिड-इंडिया GRID-INDIA

SAMPLE OF DISTURBANCE RECORDER AND EVENT LOGGER FILES

```
File: C:\Users\d.kumar\AppData\Local\Wavewin\WAVEDAUI.DTB
Channel Title Information for Device: 250

 Station: MiCOM

->Analog Titles                                   Scale Value
 001 VA                                             1038713.90000000
 002 VB                                             1038713.90000000
 003 VC                                             1038713.90000000
 004 VN                                             1038713.90000000
 005 IA                                             181037.67500000
 006 IB                                             181037.67500000
 007 IC                                             181037.67500000
 008 IN                                             181037.67500000
 009 {Software Channel}                             1.00000000
 010 {Software Channel}                             1.00000000
 011 {Software Channel}                             1.00000000
 012 {Software Channel}                             1.00000000
 013 {Software Channel}                             1.00000000
 014 {Software Channel}                             1.00000000
 015 {Software Channel}                             1.00000000
 016 {Software Channel}                             1.00000000
 017 {Software Channel}                             1.00000000
 018 {Software Channel}                             1.00000000
 019 {Software Radial Single Ended}                 1.00000000
 020 {Software Reactance Single Ended}              1.00000000
 021 {Software Double Ended}                        1.00000000
 022 {Software Vector Integrity}                    1.00000000

->Digital Titles                         Original State
 1 Any Trip                                   0
 2 DIST Trip A                                0
 3 DIST Trip B                                0
 4 DIST Trip C                                0
 5 Z1                                         0
 6 Z2                                         0
 7 Z3                                         0
 8 Z4                                         0
 9 DIST Fwd                                   0
 10 DIST Rev                                  0
 11 Power Swing                               0
 12 Unused                                    0
 13 Unused                                    0
 14 VT Fail Alarm                             0
*15 Brok.Cond. Alarm                          0
 16 87L1 OPTD                                 0
 17 AR BLOCK                                  0
 18 CB CLOSE CMD                              0
 19 Unused                                    0
 20 AR Lockout Shot>                          0
 21 Relay 11                                  0
 22 Relay 12                                  0
 23 Unused                                    0
 24 Relay 21                                  0
 25 AR BLOCK                                  0
*26 MCB BOPEN                                 0
*27 TIE ROPEN                                 0
*28 TIE YOPEN                                 0
 29 Unused                                    0
 30 Relay 19                                  0
 31 I>1 Trip                                  0
 32 IN>1 Trip                                 0
 33 A/R Close                                 0
```

Configuration o
standard chann

```
* File Information::
* --------------------
        Station: MiCOM
         Device: 1
          File Name: \\10.10.0.111\SO2\STUDYPC\FTC\2024\JAISALMI
          File Size: 806401 Bytes
      Prefault Time: 17/07/2024 19:47:52.992000
       Trigger Time: 17/07/2024 19:47:53.491000
          Save Time: 07-23-2024 18:02:40
       Process Time: 07-29-2024 10:17:30
 Start Date && Time: 17/07/2024 19:47:52.992000
   End Date && Time: 17/07/2024 19:47:54.993183
      File Duration: 2  Sec(s) - 1 Mils(s) - 183 Mics(s)
 Sampling Frequency: 2398.081535, 417.000  Microsecond Rate
     Line Frequency: 50.000000
```

Nomenclature not as per standard

```
* File Information::
* --------------------
        Station: RHUPL B401 21LM2
         Device: 1
          File Name: \\10.10.0.111\SO2\STUDYPC\FTC\2024\JAISAL
          File Size: 2423602 Bytes
      Prefault Time: 24/07/2024 19:13:45.379000
       Trigger Time: 24/07/2024 19:13:47.374000
          Save Time: 07-24-2024 19:15:00
       Process Time: 07-29-2024 10:22:19
 Start Date && Time: 24/07/2024 19:13:45.379000
   End Date && Time: 24/07/2024 19:13:51.383383
      File Duration: 6  Sec(s) - 4 Mils(s) - 383 Mics(s)
 Sampling Frequency: 2398.081535, 417.000  Microsecond Rate
     Line Frequency: 50.000000
```

Nomenclature as per standard

Time Synchronization of recording devices

SAS1 (NCC 1) Page 1 of 1 Printed on 2024-07-24 19:23:02

SYS 600 Monitor Pro **Events from 2024-07-24 07:22:28 to 2024-07-24 19:13:54** **JSM**

ReNew Power
600MW AC, RTC Rajasthan, Server

ABB

<No Preconfiguration>

#			Time (ET+EM)	Station	Bay	Device	Object Text	Event Text
2		T	2024-07-24 19:13:54.392	RHUPL	401_LINE1	P444	DC-1 MCB TRIP/FAIL	Off
4	*	T	2024-07-24 19:13:47.374	RHUPL	401_LINE1	P444	DC-1 MCB TRIP/FAIL	On
5		T	2024-07-24 19:09:39.869	RHUPL	401_LINE1	P444	DR TESTING	Off
6	*	T	2024-07-24 19:09:39.727	RHUPL	401_LINE1	P444	DR TESTING	On
7		T	2024-07-24 18:51:19.626	RHUPL	401_LINE1	P444	PERMIT 3-PH TRIP FROM MAIN BCU	Off
8		T	2024-07-24 18:51:19.626	RHUPL	401_LINE1	P444	CARRIER FAIL CHANNEL-2	Off
9	*	T	2024-07-24 18:51:19.585	RHUPL	401_LINE1	P444	MAIN CB CLOSE B-PH	On
10	*	T	2024-07-24 18:51:19.585	RHUPL	401_LINE1	P444	MAIN CB CLOSE Y-PH	On
11	*	T	2024-07-24 18:51:19.585	RHUPL	401_LINE1	P444	MAIN CB CLOSE R-PH	On

```
* File Information::
* --------------------
             Station: RHUPL B401 21LM2
              Device: 1
           File Name: \\10.10.0.111\SO2\STUDYPC\FTC\2024\JA
           File Size: 2423602 Bytes
       Prefault Time: 24/07/2024 19:13:45.379000
        Trigger Time: 24/07/2024 19:13:47.374000
           Save Time: 07-24-2024 19:15:00
        Process Time: 07-29-2024 10:28:36
 Start Date && Time: 24/07/2024 19:13:45.379000
   End Date && Time: 24/07/2024 19:13:51.383383
       File Duration: 6  Sec(s) - 4 Mils(s) - 383 Mics(s)
  Sampling Frequency: 2398.081535, 417.000  Microsecond Rat
      Line Frequency: 50.000000

* Maximum/Minimum Analog Summary:
* --------------------------------
>  Max-Inst      Min-Inst       Max-RMS      Min-RMS      One-B
 339950.800   -340141.000   317155.281   239652.188    31.70
 338143.900   -338460.900   318394.781   187189.672    31.70
 338651.100   -338873.000   251158.422    38207.664    31.70
   3328.500     -3328.500     1680.137      865.338    31.70
     16.575       -16.575        6.265        0.000     5.52
     16.575       -16.575        6.767        0.000     5.52
     11.050       -11.050        6.021        0.000     5.52
     27.625       -27.625       10.648        0.000     5.52

* Events/Sensors Activity Summary:
* ---------------------------------
>Fst  Lst  Fst-Change        Lst-Change        Changes    Des
  N    N    19:13:47.373928  xx:xx:xx.xxxxxx   001         2

* Events/Sensors Activity Log:
* ----------------------------
> State    Trigger-Time                  Description
    A      24/07/2024 19:13:47.373928    28-DC-1 MCB FAIL
```

GRID CODE, REGULATIONS

- As per IEGC clause 13.1, All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.
- Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.
- As per IEGC clause 17
  - ✓ All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.
  - ✓ The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals.
- As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event and as per IEGC clause 37.2 (e), the user shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to RLDC and RPC.

Thank You

Fwd: Re: Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously-reg.

Annexure-A.XII

DK D K Meena <seo-nrpc@nic.in>
Mon, 02 Dec 2024 5:16:17 PM +0530 •
To "LokeshAgrawal" <lokesh.cea@gov.in>

महोदय / महोदया,

fna

भवदीय,
डी.के. मीना
निदेशक (प्रचालन एवं संरक्षण),
उत्तर क्षेत्रीय विद्युत समिति
विद्युत् मंत्रालय
१८-शहीद जीत सिंह मार्ग, कटवरिया सराय
नई दिल्ली - १६

============ Forwarded message ============
From: SE T&C Meerut <setncmrt@upptcl.org>
To: "SE (R&A)"<sera@upsldc.org>
Cc: <seo-nrpc@nic.in>
Date: Mon, 02 Dec 2024 15:48:21 +0530
Subject: Re: Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously-reg.
============ Forwarded message ============

Dear Sir,
With reference to above subject, it is to mention that the matter of enabling tripping on broken conductor for substations having two lines only, was discussed during 54th PSC meeting,however the committee could not reach on a consensus during the meet.During the discussion the undersigned has suggested following scheme,
i. In case of S/S fed by only two lines, both lines' distance protection should be programmed for detection of loss of voltage(using undervoltage function 27) for detection of shutdown/breakdown
ii.This loss of voltage output should be crosswired to binary input of other line distance protection.
iii. Tripping on broken conductor on any line should take place only if the other line is showing loss of voltage.

Regards,
P.K Mishra

On Mon, 2 Dec 2024 at 13:57, SE (R&A) <sera@upsldc.org> wrote:

> ---------- Forwarded message ---------
> From: **Lokesh Agrawal** <lokesh.cea@gov.in>
> Date: Mon, Dec 2, 2024 at 1:53 PM
> Subject: Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously-reg.
> To: satyendra Kumar Dotan <skdotancea@nic.in>, Ishan Sharan <i.sharan@nic.in>, schakraborty <schakraborty@powergrid.in>, gunjanagrawal <gunjan.agrawal@powergrid.in>, scsaxena <scsaxena@grid-india.in>, somaralakra <somara.lakra@grid-india.in>, dmandal <dmandal@ntpc.co.in>, dirpc <dirpc@bbmb.nic.in>, rrsemwal <rrsemwal@thdc.co.in>, sjvncso <sjvn.cso@sjvn.nic.in>, hod-om-co <hod-om-co@nhpc.nic.in>, df <df@npcil.co.in>, rajeshsharma <rajeshsharma@npcil.co.in>, gmsldc

<gmsldc@delhisldc.org>, cesocomml <cesocomml@hvpn.org.in>, celd <ce.ld@rvpn.co.in>, sera <sera@upsldc.org>, anupam_singh <anupam_singh@ptcul.org>, ce-sldc <ce-sldc@punjabsldc.org>, cehpsldc <cehpsldc@gmail.com>, bharatgujardtl <bharatgujardtl@gmail.com>
Cc: Sh Singh <ms-nrpc@nic.in>, Santosh Kumar <seo-nrpc@nic.in>, Reeturaj Pandey <pandeyr.cea@gov.in>, Kaushik Panditrao <kaushik.panditrao@gov.in>

महोदय/महोदया,

Reference is invited to agenda item no. **10** (**Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously** (agenda by RVPN)) discussed in the 54th Protection Sub-Committee meeting held on 25.11.2024.

After deliberation, MS, NRPC stated to ask the comments of utilities on the proposal of RVPN and the same may be again discussed in the next PSC meeting based on received inputs.

In view of above, it is requested to kindly send the comments/inputs/observations/suggestions for the above to further deliberate in the next PSC meeting scheduled on 20.12.2024.

सादर,
लोकेश अग्रवाल,
सहायक कार्यपालक अभियंता (संरक्षण),
उत्तर क्षेत्रीय विद्युत् समिति सचिवालय,
नई दिल्ली - 110016

--
Superintending Engineer ,
Reliability & Ancillary, UPSLDC
Gomti Nagar , Lucknow.

RE: Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously-reg.

au aupadhyay.ltp@lpgcl.com
Tue, 03 Dec 2024 12:49:23 PM +0530

To "LokeshAgrawal" <lokesh.cea@gov.in>

Cc "ansar.ltp" <ansar.ltp@lpgcl.com>, "alokkumar.ltp" <alokkumar.ltp@lpgcl.com>, "sushantg.ltp" <sushantg.ltp@lpgcl.com>, "Sh V K Singh" <ms-nrpc@nic.in>, "Santosh Kumar" <seo-nrpc@nic.in>, "Reeturaj Pandey" <pandeyr.cea@gov.in>, "Kaushik Panditrao" <kaushik.panditrao@gov.in>

Tags Not in Contacts

Dear Sir,

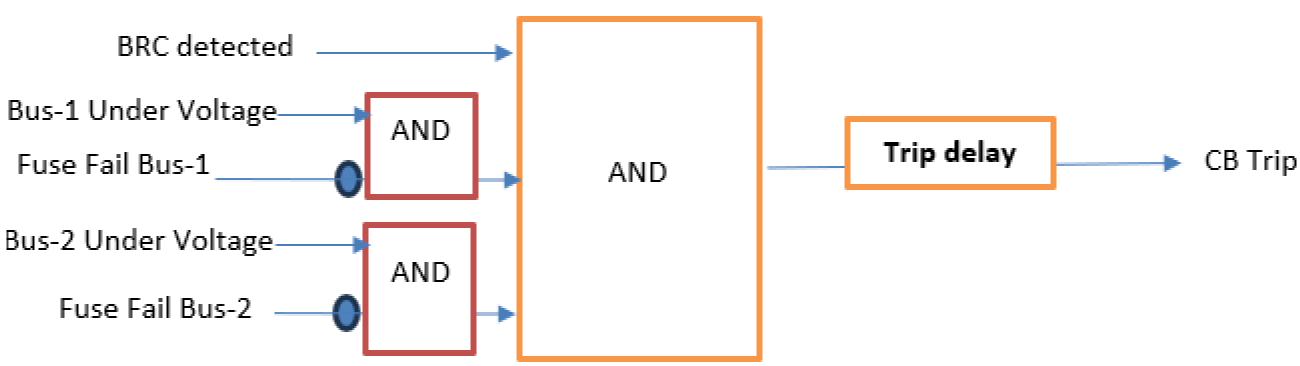
Please find below our observations :

LPGCL Reply on BRC Tripping as per Reference is invited to RVPN agenda item no. 10 discussed in the 54th Protection Sub-Committee meeting held on 25.11.2024 at Jodhpur.

-

1. Sending end (i.e. Generating End) substations where multiple lines and Generating end Transformer are already connected, will not be experienced undervoltage during broken conductor condition, however when receiving end substation having only one single line as incoming (radial substation) will detect undervoltage during broken conductor and tripping is required to avoid the single phasing of transformer. Hence Generating end substation lines tripping on Broken conductor are not required until further co-ordination with Grid authority.
2. BRC logic is available in distance protection relay and generally selected bus voltage (two phase) will come to distance relay for synch purpose. For detecting undervoltage of both buses, we need to create logic in bus coupler relays where both the bus voltages (3ph) will come together and its should be provided in AND logic with fuse fail condition.
3. BRC tripping to be co-ordinated with auto recloser time. In case of radial substation, bus voltage will be experienced undervoltage during auto-recloser. To avoid mal operation of BRC, its time should be co-ordinated with AR close timing.
4. LPGCL agreed with RVPN, however feasibility inside the existing relay to be explored with relay OEM.

LPGCL Suggested Tripping Logic



Thanks & Regards
Abhimanyu Upadhyay
General Manager-Electrical
aupadhyay.ltp@lpgcl.com

Lalitpur Power Generation Company Limited
Village Mirchwara Burogaon,
Tehsil Mehrauni, Lalitpur -284 123
Uttar Pradesh
P +917408418182/9151897271
www.lpgcl.com

From: Lokesh Agrawal <lokesh.cea@gov.in>
Sent: 02 December 2024 13:54
To: navinchaturvedi <navin.chaturvedi@apraava.com>; VibhavAgarwal <Vibhav.Agarwal@vedanta.co.in>; sknarang <sk.narang@larsentoubro.com>; anandkumarsingh <anandkumar.singh@meilanparapower.com>; aruntholia <arun.tholia@meilanparapower.com>; kesarinandanpandey <kesarinandan.pandey@relianceada.com>; Alok Kumar Srivastava <alokkumar.ltp@lpgcl.com>; Abhimanyu Upadhyay <aupadhyay.ltp@lpgcl.com>; SPSPUNDIR <SPSPUNDIR@NTPC.CO.IN>; jayadebnanda <jayadeb.nanda@adani.com>; jyotiprakashpanda <jyotiprakash.panda@jsw.in>; dhmahabale <dhmahabale@tatapower.com>; cejkpcl2 <cejkpcl2@gmail.com>; cepdladakh <cepdladakh@gmail.com>; elop2-chd <elop2-chd@nic.in>; ssrivastava <ssrivastava@noidapower.com>; SunilRaval <Sunil.Raval@adani.com>; ceonvvn <ceonvvn@ntpc.co.in>; sumant <sumant@renew.com>; rajivgupta <rajivgupta@ntpc.co.in>; sunilgupta <sunil.gupta@azurepower.com>; kishornair <kishor.nair@avaada.com>; chaitanyasahoo <chaitanya.sahoo@adani.com>
Cc: Sh Singh <ms-nrpc@nic.in>; Santosh Kumar <seo-nrpc@nic.in>; Reeturaj Pandey <pandeyr.cea@gov.in>; Kaushik Panditrao <kaushik.panditrao@gov.in>
Subject: Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously-reg.

महोदय/महोदया,

Reference is invited to agenda item no. **10** (**Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously** (agenda by RVPN)) discussed in the 54th Protection Sub-Committee meeting held on 25.11.2024.

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लोकेश अग्रवाल,
सहायक कार्यपालक अभियंता (संरक्षण),
उत्तर क्षेत्रीय विद्युत् समिति सचिवालय,
नई दिल्ली - 110016

============ Forwarded message ============
From: Lokesh Agrawal <lokesh.cea@gov.in>
To: "cetspkl"<cetspkl@hvpn.org.in>, "cemps"<ce.mps@rvpn.co.in>, "md"<md@upptcl.org>, "setandchld"

<setandchld@gmail.com>, "ce-pm"<ce-pm@pstcl.org>, "mdtcl"<md.tcl@hpmail.in>, "arifipgcl" <arif.ipgcl@gmail.com>, "semtrgtpp"<semt.rgtpp@hpgcl.org.in>, "cmd"<cmd@rrvun.com>, "ceppmm" <ce.ppmm@uprvunl.org>, "mdujvnl"<mdujvnl@ujvnl.com>, "md"<md@hppcl.in>, "ce-ghtp"<ce-ghtp@pspcl.in>, "md"<md@uhbvn.org.in>, "MDJDVVNL"<MD.JDVVNL@RAJASTHAN.GOV.IN>, "md" <md@pvvnl.org>, "md"<md@upcl.org>, "md"<md@hpseb.in>, "brahmajig"<brahmajig@ntpc.co.in>, "sanjay bhargava"<sanjay.bhargava@tatapower.com>, "dhananjay singh"<dhananjay.singh@ppgcl.co.in>
Cc: "Sh Singh"<ms-nrpc@nic.in>, "Santosh Kumar"<seo-nrpc@nic.in>, "Reeturaj Pandey" <pandeyr.cea@gov.in>, "Kaushik Panditrao"<kaushik.panditrao@gov.in>
Date: Mon, 02 Dec 2024 13:52:49 +0530
Subject: Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously-reg.
============ Forwarded message ============

महोदय/महोदया,

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उत्तर क्षेत्रीय विद्युत् समिति सचिवालय,
नई दिल्ली - 110016

============ Forwarded message ============
From: Lokesh Agrawal <lokesh.cea@gov.in>
To: "satyendra Kumar Dotan"<skdotancea@nic.in>, "Ishan Sharan"<i.sharan@nic.in>, "schakraborty"<schakraborty@powergrid.in>, "gunjanagrawal"<gunjan.agrawal@powergrid.in>, "scsaxena"<scsaxena@grid-india.in>, "somaralakra"<somara.lakra@grid-india.in>, "dmandal" <dmandal@ntpc.co.in>, "dirpc"<dirpc@bbmb.nic.in>, "rrsemwal"<rrsemwal@thdc.co.in>, "sjvncso"<sjvn.cso@sjvn.nic.in>, "hod-om-co"<hod-om-co@nhpc.nic.in>, "df"<df@npcil.co.in>, "rajeshsharma"<rajeshsharma@npcil.co.in>, "gmsldc"<gmsldc@delhisldc.org>, "cesocomml" <cesocomml@hvpn.org.in>, "celd"<ce.ld@rvpn.co.in>, "sera"<sera@upsldc.org>, "anupam_singh"<anupam_singh@ptcul.org>, "ce-sldc"<ce-sldc@punjabsldc.org>, "cehpsldc" <cehpsldc@gmail.com>, "bharatgujardtl"<bharatgujardtl@gmail.com>
Cc: "Sh Singh"<ms-nrpc@nic.in>, "Santosh Kumar"<seo-nrpc@nic.in>, "Reeturaj Pandey" <pandeyr.cea@gov.in>, "Kaushik Panditrao"<kaushik.panditrao@gov.in>
Date: Mon, 02 Dec 2024 13:51:43 +0530
Subject: Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder

and loss of VT (in any of phase) at 220kV bus is observed simultaneously-reg.
============ Forwarded message ============

महोदय/महोदया,

Reference is invited to agenda item no. **10** (**Tripping of every transmission line whenever Broken Conductor Alarm on 220kV feeder and loss of VT (in any of phase) at 220kV bus is observed simultaneously** (agenda by RVPN)) discussed in the 54th Protection Sub-Committee meeting held on 25.11.2024.

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उत्तर क्षेत्रीय विद्युत् समिति सचिवालय,
नई दिल्ली - 110016

Annexure-A.XIII

Outlook

Urgent Attention Required: Frequent Tripping of UPPTCL 220 kV Transmission Lines Connected to GIS Baghpat

From Pankaj Kumar Jha {पंकज कुमार झा} <pankaj.jha@powergrid.in>
Date Fri 2024-11-29 13:50
To cetw@upptcl.org <cetw@upptcl.org>
Cc eeetdmrt@gmail.com <eeetdmrt@gmail.com>; eeetdbaraut@upptcl.org <eeetdbaraut@upptcl.org>; eeetdshamli@upptcl.org <eeetdshamli@upptcl.org>; eeetd1gzb@upptcl.org <eeetd1gzb@upptcl.org>; setmrt@upptcl.org <setmrt@upptcl.org>; setgzb@upptcl.org <setgzb@upptcl.org>; rtamc.nr1 <rtamc.nr1@powergrid.in>; dharmendra.cea@gov.in <dharmendra.cea@gov.in>; Reeturaj Pandey <pandeyr.cea@gov.in>; Sh Singh <ms-nrpc@nic.in>; Santosh Kumar <seo-nrpc@nic.in>; LokeshAgrawal <lokesh.cea@gov.in>; Kuleshwar Sahu {कुलेश्वर साहू} <kuleshwar@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; M Thirumala Reddy {एम. तिरूमाला रेड्डी} <thirumalareddy@powergrid.in>; Tarun Bajaj {तरुण बजाज} <tarunbajaj@powergrid.in>; Ravi Wadyalkar {रवि अशोक वाड्यालकर} <wravi@powergrid.in>; Ankit Vaish {अंकित वैश्य} <ankit_vaish@powergrid.in>; ccprotection <ccprotection@powergrid.in>; deepak.kr@grid-india.in <deepak.kr@grid-india.in>

2 attachments (17 MB)

Email Communication with UPPTCL.pdf; Letter_Frequent Trippings of 220kV Lines at Baghpat.pdf;

Dear Sir,

This refers to our previous communications regarding the frequent tripping/auto-reclosures of UPPTCL's 220 kV transmission lines connected to POWERGRID's GIS Baghpat. These lines are experiencing severe transient and permanent faults, posing significant operational hazards, as detailed below:

S.N.	Name of the Element	No. of Faults			
		CY'22	CY'23	CY'24	Total
1	220kV Baghpat (PG)-Shamli (UP) Line	37	23	24	**84**
2	220kV Baghpat (PG)-Mandola Vihar (UP) Line	18	11	9	**38**
3	220kV Baghpat (PG)-Baghpat(UP) Ckt-I	4	1	3	**8**
4	220kV Baghpat (PG)-Baghpat(UP) Ckt-II	14	6	3	**23**
5	220kV Baghpat (PG)-Modipuram(UP) Ckt-I	4	20	7	**31**
6	220kV Baghpat (PG)-Modipuram(UP) Ckt-II	3	10	5	**18**

Frequent tripping of UPPTCL transmission lines is causing heavy fault currents through POWERGRID's 400/220 kV ICTs and bay equipment at GIS Baghpat, significantly impacting equipment lifespan. These recurring faults have already led to the failure of a circuit breaker on the 220 kV Baghpat (PG)-Shamli (UP) line in August 2023, resulting in substantial financial losses and a prolonged outage.

Given that Baghpat substation uses advanced GIS technology with expensive equipment, such faults are unsustainable.

We request urgent remedial action, including thorough patrolling of the affected lines, to rectify defects and maintain system reliability.
If this issue persists, POWERGRID will be forced to review its A/R settings to protect its equipment at Baghpat Substation. We urge your team to prioritize this matter and take immediate corrective measures.

Looking forward to your prompt action.

Warm Regards
Pankaj Kumar Jha
Chief Manager (Asset Management)
Power Grid Corporation of India Limited
Regional Headquarters, Northern Region-1
SCO Bay No.5 -10, Sector-16A, Faridabad, Haryana-121002
Mob: +919634440125

Ref: NR-1/AM/ Dt. 29.11.2024

To,

Chief Engineer (Transmission West, UPPTCL, Meerut)

Victoria Park, Ramgarhi, Meerut, Uttar Pradesh. Pin-250001

Subject: **Frequent tripping of 220 kV Transmission Lines of UPPTCL connected to POWERGRID, GIS Baghpat.**

Dear Sir,

It is to inform that in recent past the 220 kV Transmission Lines of UPPTCL connected to POWERGRID, GIS Baghpat are tripping/auto-reclosing very frequently due to severe transient and permanent faults. **The transmission lines are proving to be dangerously hazardous as is evident from the data tabulated below:**

S.N.	Name of the Element	No. of Faults			
		CY'22	CY'23	CY'24	Total
1	220kV Baghpat (PG)-Shamli (UP) Line	37	23	24	**84**
2	220kV Baghpat (PG)-Mandola Vihar (UP) Line	18	11	9	**38**
3	220kV Baghpat (PG)-Baghpat (UP) Ckt-I	4	1	3	**8**
4	220kV Baghpat (PG)-Baghpat (UP) Ckt-II	14	6	3	**23**
5	220kV Baghpat (PG)-Modipuram (UP) Ckt-I	4	20	7	**31**
6	220kV Baghpat (PG)-Modipuram (UP) Ckt-II	3	10	5	**18**

You will appreciate that such occurrences result in problems for not just UPPTCL but POWERGRID and Outage Management Units as well.

You are already aware that such frequent unwarranted tripping of transmission lines results in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life. **It is worth highlighting that these frequent faults causing tripping/auto-reclosure have already resulted in failure of circuit breaker of the bay connected to 220 kV Baghpat (PG)-Shamli (UP) transmission line in August 2023, thus resulting in heavy financial loss to**

POWERGRID and long system outage. POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and POWERGRID cannot afford such frequent feeding of severe fault current through its ICT & other equipment.

Considering the above-mentioned circumstances and already occurrence of a failure, **you are requested to kindly look into the matter on priority and arrange to take up necessary remedial action** including thorough patrolling of aforesaid lines **to ensure the rectification of defects and maintain healthiness of transmission system** elements installed at POWERGRID Baghpat GIS Station, so that uninterrupted power supply may be extended to UPPTCL substations.

In spite of our earlier requests to address this issue of frequent tripping/Autor reclosure, situation has not improved much in UPPTCL lines. It may please be noted that **POWERGRID shall be forced to review its A/R settings in case such frequent fault feeding is not arrested urgently from UPPTCL lines**. We trust that your team will prioritize this matter this time and take appropriate measures to address the ongoing challenges.

Looking forward for a prompt & positive action and continued support from your end.

Kuleshwar Sahu

CGM-AM, NR1 Gr-1

Encl: Line-wise tripping/AR list

Copy to:

1. Member Secretary, NRPC (E-mail: ms-nrpc@nic.in)
2. SEO, NRPC (E-mail: seo-nrpc@nic.in)
3. Executive Engineer, Electricity Transmission Circle – Meerut, UPPTCL (Email: eeetdmrt@gmail.com)
4. Executive Engineer, Power Transmission Division – Baraut, UPPTCL (Email: eeetdbaraut@upptcl.org)
5. Executive Engineer, 220 KV Sub-station, Shamli, UPPTCL (Email: eeetdshamli@upptcl.org)
6. Executive Engineer, Electricity Transmission Division-I, Ghaziabad, UPPTCL (Email: eeetd1gzb@upptcl.org)

Copy for kind information:

1. Executive Director (NR-1), POWERGRID
2. CGM-I/C CC-AM, POWERGRID

220 kV Baghpat-Shamli Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
1	14-Nov-24	Phase- B-G	Phase- L3-N	A/R
		Distance- 9.2Km	Distance- 9.2Km	
		Current- 9.4 KA	**Current- 9.402KA**	
		Zone-1	Zone-1	
2	14-Nov-24	Phase- B-G	Phase- L3-N	A/R
		Distance- 5.0Km	Distance- 5.0Km	
		Current- 12.76 KA	**Current- 12.856KA**	
		Zone-1	Zone-1	
3	17-Oct-24	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 12.7Km	Distance- 12.6Km	
		Current- 7.76 KA	**Current- 7.807KA**	
		Zone-1	Zone-1	
4	4-Oct-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 9.1Km	Distance- 9.0Km	
		Current- 9.47 KA	**Current- 09.455KA**	
		Zone-1	Zone-1	
5	29-Sep-24	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 3.2Km	Distance- 3.9Km	
		Current- 14.33 KA	**Current- 14.338KA**	
		Zone-1	Zone-1	
6	13-Sep-24	Phase- R-G	Phase- L1-N	TRIP
		Distance- 1.2Km	Distance- 1.2Km	
		Current- 19.14 KA	**Current- 19.31 KA**	
		Zone-1	Zone-1	
7	25-Aug-24	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 2.4Km	Distance- 2.4Km	
		Current- 17.29 KA	**Current- 17.25 KA**	
		Zone-1	Zone-1	
8	29-Jul-24	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 17.0 Km	Distance-17.0Km	
		Current- 6.25 KA	**Current- 6.25 KA**	
		Zone-1	Zone-1	
9	24-Jul-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 1.4 Km	Distance- 1.4 Km	
		Current- 19.10 KA	**Current- 19.016 KA**	
		Zone-1	Zone-1	
10	14-Jul-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 7.9 Km	Distance- 7.9 Km	
		Current- 9.97 KA	**Current- 10.014 KA**	
		Zone-1	Zone-1	
11	28-May-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 32.8 Km	Distance- 33.0 Km	
		Current- 4.22 KA	**Current- 4.21 KA**	
		Zone-1	Zone-1	
12	28-May-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 33.5 Km	Distance- 34.7 Km	
		Current- 4.13 KA	**Current- 4.091 KA**	
		Zone-1	Zone-1	

220 kV Baghpat-Shamli Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
13	27-May-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 33.3 Km	Distance- 33.3 Km	
		Current- 4.45 KA	**Current- 4.502 KA**	
		Zone-1	Zone-1	
14	17-May-24	Phase- Y-B	Phase- L2-L3	TRIP
		Distance- 38.06 Km	Distance- 38.8 Km	
		Current- 5.07KA, 5.06KA	**Current- 5.277KA, 4.649KA**	
		Zone-2	Zone-2	
15	12-May-24	Phase- R-G	Phase- L1-N	TRIP
		Distance- 4.00 Km	Distance- 3.9 Km	
		Current- 10.99 KA	**Current- 12.130 KA**	
		Zone-1	Zone-1	
16	12-May-24	Phase- R-G	Phase- L1-N	TRIP
		Distance- 4.1 Km	Distance- 4.00 Km	
		Current- 9.11 KA	**Current- 10.767 KA**	
		Zone-1	Zone-1	
17	6-May-24	Phase- R-G	Phase- L1-N	TRIP
		Distance- 3.6 Km	Distance-3.81 Km	
		Current- 12.50 KA	**Current- 12.563 KA**	
		Zone-1	Zone-1	
18	4-May-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 32.1 Km	Distance- 32.3 Km	
		Current- 4.09 KA	**Current- 4.12 KA**	
		Zone-1	Zone-1	
19	28-Apr-24	Phase- R-G	Phase- L1-N	TRIP
		Distance- 4.00 Km	Distance-3.9 Km	
		Current- 9.62 KA	**Current- 11.369 KA**	
		Zone-1	Zone-1	
20	26-Apr-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 31.9 Km	Distance-31.7Km	
		Current- 4.07 KA	**Current- 4.103 KA**	
		Zone-1	Zone-1	
21	18-Apr-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 9.2 Km	Distance-9.1 Km	
		Current- 8.35 KA	**Current- 8.894 KA**	
		Zone-1	Zone-1	
22	15-Apr-24	Phase- R-G	Phase- L1-N	TRIP
		Distance- 127.1 Km	Distance-6.1 Km	
		Current- 11.13 KA	**Current- 10.94 KA**	
		Zone-1	Zone-1	
23	12-Apr-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 11.2 Km	Distance-11.22 Km	
		Current- 7.99 KA	**Current- 7.83 KA**	
		Zone-1	Zone-1	
24	29-Mar-24	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 32.6.2 Km	Distance-32.7 Km	
		Current- 4.21 KA	**Current- 4.254 KA**	
		Zone-1	Zone-1	

220 kV Baghpat-Shamli Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
25	26-Dec-23	Phase- B-G	Phase- L2-N	TRIP
		Distance- 31.8 Km	Distance-30.6 Km	
		Current- 3.57 KA	**Current- 3.585 KA**	
		Zone-1	Zone-1	
26	8-Dec-23	Phase- R-G	Phase- L1-N	A/R
		Distance- 6.2 Km	Distance-6.1 Km	
		Current- 11.13 KA	**Current- 10.94 KA**	
		Zone-1	Zone-1	
27	24-Nov-23	Phase- R-G	Phase- L1-N	A/R
		Distance- 9.8 Km	Distance-9.6 Km	
		Current- 8.01 KA	**Current- 8.80 KA**	
		Zone-1	Zone-1	
28	15-Nov-23	Phase- R-G	Phase- L1-N	A/R
		Distance- 5.6 Km	Distance-5.56 Km	
		Current- 11.49 KA	**Current- 11.63 KA**	
		Zone-1	Zone-1	
29	4-Nov-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 5.2 Km	Distance-5.2 Km	
		Current- 11.39 KA	**Current- 12.050 KA**	
		Zone-1	Zone-1	
30	17-Oct-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 20.5 Km	Distance-20.52 Km	
		Current- 5.32 KA	**Current- 5.341 KA**	
		Zone-1	Zone-1	
31	17-Oct-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 20.5 Km	Distance-20.52 Km	
		Current- 5.32 KA	**Current- 5.341 KA**	
		Zone-1	Zone-1	
32	17-Oct-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 20.5 Km	Distance-20.52 Km	
		Current- 5.32 KA	**Current- 5.341 KA**	
		Zone-1	Zone-1	
33	7-Sep-23	Phase- R-G	Phase- L1-N	TRIP
		Distance- 3.8 Km	Distance-3.8 Km	
		Current- 9.45 KA	**Current- 10.731 KA**	
		Zone-1	Zone-1	
34	6-Sep-23	Phase- R-G	Phase- L1-N	TRIP
		Distance- 3.9 Km	Distance-3.9 Km	
		Current- 12.84 KA	**Current- 12.462 KA**	
		Zone-1	Zone-1	
35	5-Sep-23	Phase- B-G	Phase- L3-N	TRIP
		Distance- 32.2 Km	Distance-37.3 Km	
		Current- 4.01 KA	**Current- 4.017 KA**	
		Zone-1	Zone-1	
36	27-Aug-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 2.4 Km	Distance-2.4 Km	
		Current- 15.53 KA	**Current- 15.305 KA**	
		Zone-1	Zone-1	

220 kV Baghpat-Shamli Line
Tripping & A/R Details

S.No.	Date	Fault Details M1	Fault Details M2	Category
37	3-Aug-23	Phase- B-G	Phase- L3-N	TRIP
		Distance- 6.9 Km	Distance-7.0 Km	
		Current- 9.68 KA	**Current- 10.308 KA**	
		Zone-1	Zone-1	
38	17-Jul-23	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 37.3 Km	Distance-37.5 Km	
		Current- 4.06 KA	**Current- 4.331 KA**	
		Zone-2	Zone-2	
39	15-Jul-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 20.6 Km	Distance-20.7 Km	
		Current- 6.55 KA	**Current- 6.45 KA**	
		Zone-1	Zone-1	
40	9-Jul-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 21.1 Km	Distance-21.085 Km	
		Current- 6.13 KA	**Current- 6.36 KA**	
		Zone-1	Zone-1	
41	8-Jul-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 12.1 Km	Distance-12.08 Km	
		Current- 9.06 KA	**Current- 8.88 KA**	
		Zone-1	Zone-1	
42	8-Jul-23	Phase- R-G	Phase- L1-N	A/R
		Distance- 34.1 Km	Distance-33.9 Km	
		Current- 4.60 KA	**Current- 4.70 KA**	
		Zone-1	Zone-1	
43	8-Jul-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 19.3 Km	Distance-19.1 Km	
		Current- 6.56 KA	**Current- 6.87 KA**	
		Zone-1	Zone-1	
44	22-Jun-23	Phase- B-G	Phase- L3-N	A/R
		Distance- 14.5 Km	Distance-14.61 Km	
		Current- 7.93 KA	**Current- 7.907 KA**	
		Zone-1	Zone-1	
45	18-Jun-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 14.5 Km	Distance-14.5 Km	
		Current- 8.00 KA	**Current- 8.05 KA**	
		Zone-1	Zone-1	
46	21-May-23	Phase- NIL	Phase- L1-N	A/R
		Distance- NIL	Distance-34.48 Km	
		Current- NIL	**Current- 3.70 KA**	
		Zone- NIL	Zone-2	
47	20-May-23	Phase- R-G	Phase- L1-N	TRIP
		Distance- 40.9 Km	Distance-41.26Km	
		Current- 3.92 KA	**Current- 4.17 KA**	
		Zone-2	Zone-2	
48	13-Nov-22	Phase- B-G	Phase- L3-N	A/R
		Distance- 9.2 Km	Distance-9.2 Km	
		Current- 11.35 KA	**Current - 11.14 KA**	
		Zone-1	Zone-1	

220 kV Baghpat-Shamli Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
49	**8-Nov-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 1.2 Km	Distance-1.3 Km	
		Current- 19.94 KA	**Current- 21.2 KA**	
		Zone-1	Zone-1	
50	**3-Nov-22**	Phase- R-G	Phase- L1-N	**A/R**
		Distance- 12.4 Km	Distance-12.3 Km	
		Current- 9.02 KA	**Current- 9.42 KA**	
		Zone-1	Zone-1	
51	**31-Oct-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 5.6 Km	Distance-5.7 Km	
		Current- 13.77 KA	**Current- 13.98 KA**	
		Zone-1	Zone-1	
52	**19-Oct-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 14.2Km	Distance-13.9Km	
		Current- 8.08 KA	**Current- 8.855KA**	
		Zone-1	Zone-1	
53	**19-Oct-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 35.4Km	Distance-35.6Km	
		Current- 4.65 KA	Current- 4.685KA	
		Zone-1	Zone-1	
54	**19-Oct-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 23.8Km	Distance-23.5Km	
		Current- 5.76 KA	Current- 6.16 KA	
		Zone-1	Zone-1	
55	**18-Oct-22**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 4.5 Km	Distance-4.6 Km	
		Current- 13.74 KA	**Current- 14.75 KA**	
		Zone-1	Zone-1	
56	**16-Oct-22**	Phase- R-G	Phase- L1-N	**A/R**
		Distance- 34.8 Km	Distance-34.5Km	
		Current- 4.58 KA	Current- 4.64 KA	
		Zone-1	Zone-1	
57	**14-Oct-22**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 3.2 Km	Distance- 3.3Km	
		Current- 17.11 KA	**Current- 16.836 KA**	
		Zone-1	Zone-1	
58	**5-Oct-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 17.2 Km	Distance-17.00Km	
		Current- 7.71 KA	Current- 7.77 KA	
		Zone-1	Zone-1	
59	**24-Sep-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 30.00Km	Distance- 30Km	
		Current- 5.24 KA	Current- 5.283 KA	
		Zone-1	Zone-1	
60	**16-Sep-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 35.00 Km	Distance-35.00Km	
		Current- 4.74 KA	Current- 5.461KA	
		Zone-1	Zone-1	

220 kV Baghpat-Shamli Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
61	31-Aug-22	Phase- B-G	Phase- L3-N	A/R
		Distance- 10.5 Km	Distance-10.4Km	
		Current- 10.2 KA	**Current- 10.13 KA**	
		Zone-1	Zone-1	
62	30-Aug-22	Phase- B-G	Phase- L3-N	A/R
		Distance- 10.6 Km	Distance-10.5Km	
		Current- 10.14 KA	**Current- 10.13 KA**	
		Zone-1	Zone-1	
63	30-Aug-22	Phase- B-G	Phase- L3-N	A/R
		Distance- 10.5 Km	Distance-10.51Km	
		Current- 10.20KA	**Current- 10.23 KA**	
		Zone-1	Zone-1	
64	24-Aug-22	Phase- R-G	Phase- L1-N	A/R
		Distance- 10.4 Km	Distance-10.3Km	
		Current- 10.24 KA	**Current- 10.342 KA**	
		Zone-1	Zone-1	
65	11-Aug-22	Phase- R-G	Phase- L1-N	A/R
		Distance- 35.7 Km	Distance-35.9Km	
		Current- 4.67 KA	Current- 4.630 KA	
		Zone-1	Zone-1	
66	1-Aug-22	Phase- R-G	Phase- L1-N	TRIP
		Distance- 38.00 Km	Distance-38.1 Km	
		Current- 4.26 KA	Current- 4.51 KA	
		Zone-2	Zone-2	
67	30-Jul-22	Phase- R-G	Phase- L1-N	TRIP
		Distance- 36.2 Km	Distance-36.4 Km	
		Current- 4.41 KA	Current- 4.64 KA	
		Zone-2	Zone-2	
68	24-Jul-22	Phase- Y-G	Phase- L2-N	A/R
		Distance- 24.9 Km	Distance-24.9 Km	
		Current- 6.03KA	Current- 6.042 KA	
		Zone-1	Zone-1	
69	21-Jul-22	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 35.8 Km	Distance-36.1 Km	
		Current- 4.45 KA	Current- 4.74 KA	
		Zone-1	Zone-2	
70	21-Jul-22	Phase- B-G	Phase- L3-N	A/R
		Distance-23.2 Km	Distance-23.2 Km	
		Current- 6.22 KA	Current- 6.22 KA	
		Zone-1	Zone-1	
71	19-Jul-22	Phase- Y-G	Phase- L2-N	A/R
		Distance- 35.1Km	Distance-35.1Km	
		Current- 4.62 KA	Current- 4.69 KA	
		Zone-1	Zone-1	
72	18-Jul-22	Phase- Y-G	Phase- L2-N	A/R
		Distance- 1.5 Km	Distance-1.6 Km	
		Distance- 1.5 Km	Distance-1.6 Km	
		Zone-1	Zone-1	

220 kV Baghpat-Shamli Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
73	16-Jul-22	Phase- R-G	Phase- L1-N	TRIP
		Distance- 39.1 Km	Distance-39.1Km	
		Current- 4.20 KA	Current- 4.5 KA	
		Zone-2	Zone-2	
74	13-Jul-22	Phase- Y-G	Phase- L2-N	A/R
		Distance- 18.9 Km	Distance-18.7Km	
		Current- 6.58 KA	Current- 7.13 KA	
		Zone-1	Zone-1	
75	11-Jul-22	Phase- R-G	Phase- L1-N	A/R
		Distance- 17.3 Km	Distance-17.00 Km	
		Current- 6.89 KA	Current- 7.612 KA	
		Zone-1	Zone-1	
76	5-Jun-22	Phase- Y-B	Phase- L2-L3	Trip
		Distance- 37.8 Km	Distance-37.7 Km	
		Current Iy- 5.05 KA currrent Ib-5.05 KA	Current L2-5.36 KA Current L3-4.74 KA	
		Zone-2	Zone-2	
77	4-Jun-22	Phase- R-G	Phase- L1-N	Trip
		Distance- 7.1 Km	Distance-7.0 Km	
		Current- 11.15 KA	**Current- 11.662 KA**	
		Zone-1	Zone-1	
78	3-Jun-22	Phase- B-G	Phase- L3-N	Trip
		Distance- 41.1 Km	Distance-41.6 Km	
		Current- 3.78 KA	Current- 4.225 KA	
		Zone-2	Zone-2	
79	2-Jun-22	Phase- B-G	Phase- L3-N	Trip
		Distance- 41.1 Km	Distance-41.8 Km	
		Current- 3.75 KA	Current- 4.14 KA	
		Zone-2	Zone-2	
80	31-May-22	Phase- B-G	Phase- L3-N	A/R
		Distance- 14.3 Km	Distance-16.2 Km	
		Current- 5.54 KA	Current- 6.26 KA	
		Zone-1	Zone-1	
81	30-Apr-22	Phase- R-G	Phase- L1-N	Trip
		Distance- 37.5 Km	Distance-38.95Km	
		Current- 3.41KA	Current- 2.88 KA	
		Zone-2	Zone-2	
82	13-Apr-22	Phase- Y-G	Phase- L2-N	Trip
		Distance- 37 Km	Distance-37.1 Km	
		Current- 4.28 KA	Current- 4.572 KA	
		Zone-2	Zone-2	
83	8-Apr-22	Phase- B-G	Phase- L3-N	A/R
		Distance- 11.38 Km	Distance-11.30 Km	
		Current- 8.5 KA	Current- 8.9 KA	
		Zone-1	Zone-1	
84	21-Mar-22	Phase- B-G	Phase- L3-N	Trip
		Distance- 42.2 Km	Distance-45.1 Km	
		Current- 3.36 KA	Current- 3.51 KA	
		Zone-2	Zone-2	

220 kV Baghpat-Mandola Vihar Line Tripping & A/R Details				
S.No.	**Date**	**Fault Details**		**Category**
		M1	**M2**	
1	**13-Nov-24**	Phase- R-G	Phase- L1-N	**A/R**
		Distance- 19.1 Km	Distance- 18.9 Km	
		Current- 6.32 KA	**Current- 6.651KA**	
		Zone-1	Zone-1	
2	**19-Sep-24**	Phase- Y-G	Phase- L2-N	**TRIP**
		Distance- 9.5 Km	Distance- 9.4 Km	
		Current- 10.34 KA	**Current- 10.15 KA**	
		Zone-1	Zone-1	
3	**19-Sep-24**	Phase- Y-G	Phase- L2-N	**TRIP**
		Distance- 9.5 Km	Distance- 9.4 Km	
		Current- 10.34 KA	**Current- 10.15 KA**	
		Zone-1	Zone-1	
4	**15-Sep-24**	Phase- R-G	Phase- L1-N	**TRIP**
		Distance- 11.5 Km	Distance- 11.4 Km	
		Current- 8.55 KA	**Current- 8.791 KA**	
		Zone-1	Zone-1	
5	**6-Aug-24**	Phase- B-G	Phase- L3-N	**TRIP**
		Distance- 15.7 Km	Distance- 15.4 Km	
		Current- 7.06 KA	**Current- 7.08 KA**	
		Zone-1	Zone-1	
6	**6-Jun-24**	Phase- B-G	Phase- L3-N	**TRIP**
		Distance- 3.2 Km	Distance- 3.2 Km	
		Current- 15.67 KA	**Current- 15.186 KA**	
		Zone-1	Zone-1	
7	**24-Apr-24**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 8.0 Km	Distance- 7.9 Km	
		Current- 10.84 KA	**Current- 10.589 KA**	
		Zone-1	Zone-1	
8	**22-Apr-24**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 10.8 Km	Distance- 10.6 Km	
		Current- 9.00 KA	**Current- 9.094 KA**	
		Zone-1	Zone-1	
9	**13-Apr-24**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 10.8 Km	Distance- 10.6 Km	
		Current- 8.91 KA	**Current- 9.064 KA**	
		Zone-1	Zone-1	
10	**26-Dec-23**	Phase- R-G	Phase- L1-N	**A/R**
		Distance- 19.0 Km	Distance- 18.71 Km	
		Current- 6.09 KA	**Current- 6.159 KA**	
		Zone-1	Zone-1	
11	**3-Dec-23**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 9.6 Km	Distance-9.6 Km	
		Current- 9.66 KA	**Current- 9.64 KA**	
		Zone-1	Zone-1	
12	**21-Sep-23**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 7.8 Km	Distance-7.6 Km	
		Current- 10.23 KA	**Current- 10.859 KA**	
		Zone-1	Zone-1	

220 kV Baghpat-Mandola Vihar Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
13	30-Aug-23	Phase- B-G	Phase- L3-N	A/R
		Distance- 8.6 Km	Distance-8.4 Km	
		Current- 9.26 KA	**Current- 10.027 KA**	
		Zone-1	Zone-1	
14	5-Aug-23	Phase- B-G	Phase- L3-N	A/R
		Distance- 17.7 Km	Distance-17.2 Km	
		Current- 6.04 KA	**Current- 6.094 KA**	
		Zone-1	Zone-1	
15	27-Jul-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 3.2 Km	Distance-3.12 Km	
		Current- 15.61 KA	**Current- 15.41KA**	
		Zone-1	Zone-1	
16	24-Jul-23	Phase- Y-G	Phase- L2-N	A/R
		Distance- 17.5 Km	Distance-17.3 Km	
		Current- 6.33 KA	**Current- 6.22 KA**	
		Zone-1	Zone-1	
17	10-Jul-23	Phase- R-G	Phase- L1-N	A/R
		Distance- 10.5 Km	Distance-10.5 Km	
		Current- 16.46 KA	**Current- 10.53 KA**	
		Zone-1	Zone-1	
18	10-Jul-23	Phase- R-G	Phase- L1-N	A/R
		Distance- 10.5 Km	Distance-10.5 Km	
		Current- 16.46 KA	**Current- 10.53 KA**	
		Zone-1	Zone-1	
19	26-Jun-23	Phase- R-G	Phase- L1-N	A/R
		Distance- 23.1Km	Distance-22.9 Km	
		Current- 6.48 KA	**Current- 6.525 KA**	
		Zone-1	Zone-1	
20	9-Feb-23	Phase- R-G	Phase- L1-N	A/R
		Distance- 6.6 Km	Distance-6.6 Km	
		Current- 12.34 KA	**Current- 13.33 KA**	
		Zone-1	Zone-1	
21	19-Dec-22	Phase- R-G	Phase- L1-N	Trip
		Distance- 6.72 Km	Distance-22.6 Km	
		Current- 22.9 KA	**Current- 6.817 KA**	
		Zone-1	Zone-1	
22	19-Dec-22	Phase- R-G	Phase- L1-N	A/R
		Distance- 26.4 Km	Distance-26.1 Km	
		Current- 5.78 KA	**Current- 5.107 KA**	
		Zone-1	Zone-1	
23	19-Dec-22	Phase- R-G	Phase- L1-N	A/R
		Distance- 22.7 Km	Distance-22.9 Km	
		Current- 6.46 KA	**Current- 6.489 KA**	
		Zone-1	Zone-1	
24	8-Nov-22	Phase- R-G	Phase- L1-N	A/R
		Distance- 9.3 Km	Distance-9.3 Km	
		Current- 10.78 KA	**Current- 10.49 KA**	
		Zone-1	Zone-1	

220 kV Baghpat-Mandola Vihar Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
25	**8-Nov-22**	Phase- R-G	Phase- L1-N	**A/R**
		Distance- 9.3 Km	Distance-9.3 Km	
		Current- 10.78 KA	**Current- 10.49 KA**	
		Zone-1	Zone-1	
26	**30-Oct-22**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 6.6 Km	Distance-6.6 Km	
		Current- 12.91 KA	**Current- 12.91 KA**	
		Zone-1	Zone-1	
27	**30-Oct-22**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 10.3 Km	Distance-10.2 Km	
		Current- 10.57 KA	**Current- 10.45 KA**	
		Zone-1	Zone-1	
28	**29-Oct-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 11.5 Km	Distance-11.3 Km	
		Current- 9.04 KA	**Current- 9.916 KA**	
		Zone-1	Zone-1	
29	**10-Oct-22**	Phase- R-G	Phase- L1-N	**A/R**
		Distance- 4.3 Km	Distance-4.3 Km	
		Current- 14.08 KA	**Current- 15.05 KA**	
		Zone-1	Zone-1	
30	**5-Aug-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 5.2 Km	Distance-5.2 Km	
		Current- 13.13 KA	**Current- 14.12 KA**	
		Zone-1	Zone-1	
31	**31-Jul-22**	Phase- B-G	Phase- L3-N	**A/R**
		Distance-13.5 KM	Distance- 13.9KM	
		current-7.73KA	**current- 8.657KA**	
		zone-1	zone-1	
32	**21-Jul-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 22.1KM	Distance- 22.7KM	
		current- 6.20KA	**current- 6.288KA**	
		zone-1	zone-1	
33	**21-Jul-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 21.7KM	Distance- 21.6KM	
		current- 6.50KA	**current- 6.52KA**	
		zone-1	zone-1	
34	**10-Jul-22**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 11.7KM	Distance- 11.6KM	
		current- 9.64KA	**current- 9.501KA**	
		zone-1	zone-1	
35	**1-Jul-22**	Phase- Y-G	Phase- L2-N	**A/R**
		Distance- 14.9KM	Distance- 14.8KM	
		current- 8.13KA	**current- 8.083KA**	
		zone-1	zone-1	
36	**11-Jun-22**	Phase- B-G	Phase- L3-N	**A/R**
		Distance- 16.9KM	Distance- 16.7KM	
		current- 7.0KA	**current- 7.4KA**	
		zone-1	zone-1	

220 kV Baghpat-Mandola Vihar Line
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
37	29-May-22	Phase- R-G	Phase- L1-N	TRIP
		Distance- 23.0KM	Distance- 23.1KM	
		current- 6.18KA	**current- 6.15KA**	
		zone-1	zone-1	
38	30-Mar-22	Phase- Y-G	Phase- L2-N	A/R
		Distance- 12.4KM	Distance- 12.2KM	
		current- 8.65KA	**current- 9.53KA**	
		zone-1	zone-1	

220 kV Baghpat-Baghpat ckt-1
Tripping & A/R Details

S.No.	Date	Fault Details M1	Fault Details M2	Category
1	6-Sep-24	Phase- Y-G Distance- 14.2KM **Current-10.8KA** Zone-1	Phase- L2-N Distance-14.4KM **Current- 7.35KA** Zone-1	TRIP
2	1-Jul-24	Phase- B-G Distance- 11.5KM **Current-9.67KA** Zone-1	Phase- L3-N Distance-11.5KM **Current- 9.686KA** Zone-1	TRIP
3	21-Jan-24	Phase- Y-G Distance- 7.2KM **Current-10.85KA** Zone-1	Phase- L2-N Distance-7.3KM **Current- 10.678KA** Zone-1	TRIP
4	31-Dec-23	Phase- B-N Distance- 1.9 KM **Current-18.43 KA** Zone-1	Phase- L3-N Distance-1.9KM **Current- 17.905KA** Zone-1	TRIP
5	19-Dec-22	Phase- B-G Distance- 12.7KM **Current-9.89 KA** Zone-2	Phase- L3-N Distance-15.1KM **Current- 6.428 KA** Zone-2	TRIP
6	9-Nov-22	Phase- R-G Distance- 1.4KM **Current-20.36 KA** Zone-1	Phase- L1-N Distance-1.4KM **Current- 22.152 KA** Zone-1	A/R
7	8-Oct-22	Phase- Y-G Distance- 5.7KM **Current-12.53 KA** Zone-1	Phase- L2-N Distance-5.7KM **Current- 13.39 KA** Zone-1	A/R
8	22-May-22	Phase- Y-G Distance- 10.2KM **Current-7.28 KA** Zone-1	Phase- L2-N Distance-10.8KM **Current- 7.203 KA** Zone-1	A/R

220 kV Baghpat-Baghpat ckt-2
Tripping & A/R Details

S.No.	Date	Fault Details M1	Fault Details M2	Category
1	28-Aug-24	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 10.6KM	Distance- 11.7KM	
		Current- 8.58KA	**Current- 6.678KA**	
		Zone-1	Zone-1	
2	1-Jul-24	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 8.4KM	Distance- 8.6KM	
		Current- 8.97KA	**Current- 8.961KA**	
		Zone-1	Zone-1	
3	10-May-24	Phase- B-G	Phase- L3-N	TRIP
		Distance- 5.9 Km	Distance- 5.93 Km	
		Current- 10.96 KA	**Current- 11.313 KA**	
		Zone-1	Zone-1	
4	31-Dec-23	Phase- B-G	DATA NOT AVAILABLE	TRIP
		Distance- 15.10 Km		
		Current- 7.267 KA		
		Zone-1		
5	26-Dec-23	Phase- B-G	Phase- L3-N	TRIP
		Distance- 2.4 Km	Distance- 2.3 Km	
		Current- 15.38 KA	**Current- 15.21 KA**	
		Zone-1	Zone-1	
6	7-Dec-23	Phase- R-G	Phase- L1-N	TRIP
		Distance- 6.9 Km	Distance-6.9 Km	
		Current- 11.76 KA	**Current- 11.52 KA**	
		Zone-1	Zone-1	
7	23-Sep-23	Phase- R-G	Phase- L1-N	TRIP
		Distance- 2.3Km	Distance- 2.2Km	
		Current- 17.88 KA	**Current- 16.9 KA**	
		Zone-1	Zone-1	
8	14-May-23	Phase- R-G	Phase- L1-N	TRIP
		Distance- 97.8Km (137.7%)	Distance- **NA**	
		Current- 2.18KA	**Current- 2.228KA**	
		Zone-2	Zone-1	
9	13-Mar-23	Phase- R-G	Phase- L1-N	TRIP
		Distance- 8.1Km	Distance- 6.2Km	
		Current- 11.90KA	**Current- 11.662KA**	
		Zone-1	Zone-1	
10	20-Dec-22	Phase- B-G	Phase- L3-N	TRIP
		Distance- 20.9Km	Distance- 15.1Km	
		Current- 6.32KA	**Current- 6.346KA**	
		Zone-1	Zone-2	
11	20-Dec-22	Phase- B-G	Phase- L3-N	A/R
		Distance- 17.01Km	Distance- 12.9Km	
		Current- 7.19KA	**Current- 7.35KA**	
		Zone-1	Zone-1	
12	20-Dec-22	Phase- Y-G	Phase- L2-N	TRIP
		Distance- 12.6Km	Distance- 9.6Km	
		Current- 9.08KA	**Current- 9.29KA**	
		Zone-1	Zone-1	

220 kV Baghpat-Baghpat ckt-2
Tripping & A/R Details

S.No.	Date	Fault Details M1	Fault Details M2	Category
13	**19-Dec-22**	Phase- B-G Distance- 10.7Km **Current- 10.80KA** Zone-1	Phase- L3-N Distance- 8.1Km **Current- 11.13KA** Zone-1	**A/R**
14	**19-Dec-22**	Phase- B-G Distance- 2.2 Km **Current- 17.02 KA** Zone-1	Phase- L3-N Distance- 1.6Km **Current- 16.99 KA** Zone-1	**A/R**
15	**19-Dec-22**	Phase- B-G Distance- 12.4 Km **Current- 10.72 KA** Zone-1	Phase- L3-N Distance- **NA** **Current- NA** Zone-**NA**	**A/R**
16	**19-Dec-22**	Phase- Y-G Distance- 6.3 Km **Current- 14.59 KA** Zone-1	Phase- L2-N Distance- 4.9Km **Current- 14.65 KA** Zone-1	**A/R**
17	**19-Dec-22**	Phase- B-G Distance- 22.6 Km **Current- 5.83 KA** Zone-1	Phase- L3-N Distance- 15.1Km **Current- 5.91 KA** Zone-2	**A/R**
18	**19-Dec-22**	Phase- B-G Distance- 6.6 Km **Current- 14.14 KA** Zone-1	Phase- L3-N Distance- 5.0 Km **Current- 14.19 KA** Zone-1	**A/R**
19	**21-Nov-22**	Phase- Y-G Distance- 15.1 Km **Current- 8.81 KA** Zone-1	Phase- L2-N Distance- 11.7 Km **Current- 8.416 KA** Zone-1	**A/R**
20	**9-Nov-22**	Phase- R-G Distance- 75.7 Km **Current- 7.36 KA** Zone-1	Phase- L1-N Distance- 3.1 Km **Current- 17.475 KA** Zone-1	**A/R**
21	**17-Oct-22**	Phase- R-G Distance- 4.1 Km **Current- 17.47 KA** Zone-1	Phase- L1-N Distance- 3.1 Km **Current- 17.475 KA** Zone-1	**A/R**
22	**8-Oct-22**	Phase- Y-G Distance- 34.8 Km **Current- 3.28 KA** Zone-1	Phase- L2-N Distance-15.1 Km **Current- 3.32 KA** Zone-2	**A/R**
23	**30-May-22**	Phase- R-G Distance- 17.8 Km **Current- 6.84 KA** Zone-1	Phase- L1-N Distance-13.4 Km **Current- 7.08 KA** Zone-1	**TRIP**

220 kV Baghpat-Modipuram ckt-1 Tripping & A/R Details				
S.No.	**Date**	**Fault Details**		**Category**
		M1	**M2**	
1	**30-Oct-24**	Phase- B-G	Phase- L3-N	**TRIP**
		Current- 9.69 KA	**Current- 9.742 KA**	
		Distance- 10.9 Km	Distance- 11.7KM	
		Zone-1	Zone-1	
2	**29-Oct-24**	Phase- Y-G	Phase- L2-N	**TRIP**
		Current- 7.3 KA	**Current- 7.386 KA**	
		Distance- 16.2 Km	Distance- 17.9KM	
		Zone-1	Zone-1	
3	**19-Sep-24**	Phase- B-G	Phase- L3-N	**TRIP**
		Current- 6.86 KA	**Current- 6.462 KA**	
		Distance- 17.9 Km	Distance- 20.9KM	
		Zone-1	Zone-1	
4	**4-Aug-24**	Phase- B-G	Phase- L3-N	**TRIP**
		Current- 13.6 KA	**Current- 4.994 KA**	
		Distance- .2 Km	Distance- 38.3 KM	
		Zone-1	Zone-1	
5	**23-Jun-24**	Phase- B-G	Phase- L3-N	**TRIP**
		Current- 4.34 KA	**Current- 4.994 KA**	
		Distance- 29.2 Km	Distance- 38.3 KM	
		Zone-1	Zone-1	
6	**28-Apr-24**	Phase- Y-G	Phase- L2-N	**TRIP**
		Current- 6.33KA	**Current- 6.384KA**	
		Distance- 25.6 Km	Distance- 21.6 KM	
		Zone-1	Zone-1	
7	**23-Apr-24**	Phase- B-G	Phase- L3-N	**TRIP**
		Current- 6.05 KA	**Current- 6.063KA**	
		Distance- 25.8 Km	Distance- 25.4 KM	
		Zone-1	Zone-1	
8	**13-Dec-23**	Phase- B-G	Phase- L3-N	**A/R**
		Current- 8.78 KA	**Current- 8.911 KA**	
		Distance-11.9 Km	Distance- 14.9 KM	
		Zone-1	Zone-1	
9	**6-Dec-23**	Phase- B-G	Phase- L3-N	**A/R**
		Current- 5.52 KA	**Current- 5.57 KA**	
		Distance-20.8 KM	Distance- 38.3 KM	
		Zone-1	Zone-1	
10	**4-Dec-23**	Phase- B-G	Phase- L3-N	**A/R**
		Current- 9.22 KA	**Current- 9.558 KA**	
		Distance-10.8 KM	Distance- 13.1 KM	
		Zone-1	Zone-1	
11	**6-Nov-23**	Phase- R-G	Phase- L2-N	**A/R**
		Current- 12.42 KA	**Current- 12.175 KA**	
		Distance- 7.2 KM	Distance- 8.0 KM	
		Zone-1	Zone-1	
12	**9-Oct-23**	Phase- Y-G	Phase- L2-N	**A/R**
		Current- 2.685 KA	**Current- 2.759 KA**	
		Distance- 16.94 KM	Distance- 16.67 KM	
		Zone-1	Zone-1	

220 kV Baghpat-Modipuram ckt-1
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
13	8-Oct-23	Phase- Y-G	Phase- L2-N	A/R
		Current- 6.60 KA	**Current- 6.959 KA**	
		Distance- 16.8 KM	Distance- 24.2 KM	
		Zone-1	Zone-1	
14	8-Oct-23	Phase- Y-G	Phase- L2-N	A/R
		Current- 6.33 KA	**Current- 6.99KA**	
		Distance- 16.6 KM	Distance- 24.1 KM	
		Zone-1	Zone-1	
15	26-Sep-23	Phase- B-G	Phase- L3-N	A/R
		Current- 6.16 KA	**Current- 6.624 KA**	
		Distance- 17.7KM	Distance- 27.3KM	
		Zone-1	Zone-1	
16	25-Sep-23	Phase- B-G	Phase- L3-N	A/R
		Current- 5.96 KA	**Current- 6.564 KA**	
		Distance- 17.9KM	Distance- 27.3KM	
		Zone-1	Zone-1	
17	25-Sep-23	Phase- B-G	Phase- L3-N	A/R
		Current- 9.19 KA	**Current- 9.056 KA**	
		Distance- 10.9KM	Distance- 13.2KM	
		Zone-1	Zone-1	
18	23-Aug-23	Phase- B-G	Phase- L3-N	A/R
		Current- 6.48KA	**Current- 6.389KA**	
		Distance- 17.7KM	Distance- 28.7KM	
		Zone-1	Zone-1	
19	19-Aug-23	Phase- B-G	Phase- L3-N	A/R
		Current- 6.61KA	**Current- 6.656KA**	
		Distance- 18.1KM	Distance- 29.1KM	
		Zone-1	Zone-1	
20	3-Aug-23	Phase- B-G	Phase- L3-N	A/R
		Current- 8.00KA	**Current- 8.76KA**	
		Distance- 12.4KM	Distance- 15.4KM	
		Zone-1 (32.3%)	Zone-1 (40.2%)	
21	31-Jul-23	Phase- B-G	Phase- L3-N	A/R
		Current- 8.67KA	**Current- 8.516KA**	
		Distance- 11.7KM	Distance- 14.7KM	
		Zone-1	Zone-1	
22	11-Jul-23	Phase- B-G	Phase- L3-N	TRIP
		Current- 4.76KA	**Current- 3.576KA**	
		Distance-34.6KM	Distance- 38.3KM	
		Zone-2	Zone-2	
23	30-Jun-23	Phase- B-G	Phase- L3-N	A/R
		Current- 7.98KA	**Current- 8.479KA**	
		Distance-12.6KM	Distance- 16.0KM	
		Zone-1	Zone-1	
24	29-May-23	Phase- B-G	Phase- L3-N	TRIP
		Current- 6.20KA	**Current- 6.3KA**	
		Distance-17.8KM	Distance- 32.7KM	
		Zone-1	Zone-1	

220 kV Baghpat-Modipuram ckt-1
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	M2	
25	30-Mar-23	Phase- **NA**	Phase- L1-N & L2-N	TRIP
		Current-NA	**Current- 3.347KA**	
		Distance-**NA**	Distance- 38.3KM	
		Zone-**NA**	Zone-1	
26	29-Mar-23	Phase- R-Y	Phase- L1-L2	TRIP
		Current-7.27KA	**Current- 3.28KA**	
		Distance-149.9KM	Distance- 38.3KM	
		Zone-1	Zone-1	
27	10-Mar-23	Phase- R-G	Phase- L1-N	TRIP
		Current- 9.83KA	**Current- 9.791KA**	
		Distance-10.5KM	Distance- 13.50KM	
		Zone-1	Zone-1	
28	22-Oct-22	Phase- Y-G	Phase- L2-N	TRIP
		Current- 7.83KA	**Current- 8.31KA**	
		Distance-13.5KM	Distance- 20.5KM	
		Zone-1	Zone-1	
29	2-Oct-22	Phase- R-G	Phase- L1-N	TRIP/ SHUTDOWN
		Current- 6.89KA	**Current- 9.0KA**	
		Distance-8.7KM	Distance- 11.8KM	
		Zone-1	Zone-1	
30	1-Oct-22	Phase- R-G	Phase- L1-N	A/R+TRIP
		Current- 7.72KA+7.04KM	**Current- 2.5KA**	
		Distance-9.1KM+9.0KM	Distance-	
		Zone-1	Zone-1	
31	30-Sep-22	Phase- Y-G	Phase- L2-N	A/R
		Current- 5.36KA	**Current- 5.41KA**	
		Distance-20.5	Distance- 38.3KM	
		Zone-1	Zone-1	

220 kV Baghpat-Modipuram ckt-2
Tripping & A/R Details

S.No.	Date	Fault Details M1	Fault Details M2	Category
1	10-Oct-24	Phase- Y-G **Current- 4.45 KA** Distance- 27.4 KM Zone-1	Phase- L2-N **Current- 4.538KA** Distance- 38.3 KM Zone-1	TRIP
2	7-Sep-24	Phase- B-G **Current- 12.28 KA** Distance- 7 KM Zone-1	Phase- L3-N **Current- 12.556KA** Distance- 7 KM Zone-1	TRIP
3	5-May-24	Phase- R-G **Current- 9.18 KA** Distance- 11.2 KM Zone-1	Phase- L1-N **Current- 9.817 KA** Distance- 11.5 KM Zone-1	TRIP
4	21-Feb-24	Phase- R-G **Current- 9.53 KA** Distance- 11.1 KM Zone-1	Phase- L1-N **Current- 9.412KA** Distance- 13.5KM Zone-1	TRIP
5	8-Feb-24	Phase- B-G **Current- 15.34 KA** Distance- 4.1 KM Zone-1	Phase- L3-N **Current- 14.95 KA** Distance- 4.27 KM Zone-1	TRIP
6	1-Oct-23	Phase- Y-G **Current- 4.73 KA** Distance- 26.1 KM Zone-1	Phase- L2-N **Current- 4.7 KA** Distance-38.3 KM Zone-1	A/R
7	23-Sep-23	Phase- R-G **Current- 9.80 KA** Distance- 10.4 KM Zone-1	Phase- L1-N **Current- 9.88 KA** Distance- 5.1 KM Zone-1	A/R
8	7-Sep-23	Phase- R-G **Current- 8.06KA** Distance- 12.0KM Zone-1	Phase- L1-N **Current- 8.915KA** Distance- 14.5KM Zone-1	A/R
9	6-Sep-23	Phase- Y-G **Current- 4.45KA** Distance- 8.519KM Zone-1	Phase- L2-N **Current- 4.48KA** Distance- 8.397KM Zone-1	A/R
10	15-Aug-23	Phase- R-G **Current- 5.54KA** Distance- 21.2KM Zone-1 (55.4%)	Phase- L1-N **Current- 5.596KA** Distance- 37.0KM Zone-2 (96.7%)	A/R
11	12-Aug-23	Phase- R-G **Current- 6.12KA** Distance- 27.6KM Zone-1	Phase- L1-N **Current- 6.082KA** Distance- 21.6KM Zone-1	TRIP
12	29-Jul-23	Phase- B-G **Current- 6.08KA** Distance- 18.80KM Zone-1 (49.1%)	Phase- L3-N **Current- 6.358KA** Distance- 31.5KM Zone-2 (82.2%)	A/R

220 kV Baghpat-Modipuram ckt-2
Tripping & A/R Details

S.No.	Date	Fault Details		Category
		M1	**M2**	
13	10-Jul-23	Phase- R-G	Phase- L1-N	A/R
		Current- 3.78KA	**Current- 3.764KA**	
		Distance- 29.3KM	Distance- 38.3KM	
		Zone-1	Zone-	
14	19-Jun-23	Phase- B-G	Phase- L3-N	A/R
		Current- 7.29KA	**Current- 7.44KA**	
		Distance- 12.9KM	Distance- 16.4KM	
		Zone-1	Zone-1	
15	31-May-23	Phase- Y-G	Phase- L2-N	A/R
		Current- 6.36KA	**Current- 6.33KA**	
		Distance- 34.94KM	Distance- 17.9KM	
		Zone-1	Zone-1	
16	4-Dec-22	Phase- R-G	Phase- L1-N	TRIP
		Current- 4.62KA	**Current- 4.65KA**	
		Distance- 25.1KM	Distance- 38.3KM	
		Zone-1	Zone-2	
17	11-Oct-22	Phase- Y-G	Phase- L2-N	A/R
		Current- 8.05KA	**Current- 8.572KA**	
		Distance-13.7KM	Distance- 20.41KM	
		Zone-1	Zone-1	
18	20-Sep-22	Phase- B-G	Phase- L3-N	TRIP
		Current- 4.53KA	**Current- 4.57KA**	
		Distance-24.7KM	Distance- 38.3KM	
		Zone-1	Zone-2	

Outlook

Frequent tripping of 220 kV Transmission Lines of UPPTCL connected to POWERGRID, GIS Baghpat.

From Abhishek Shasta {अभिषेक शास्ता} <abhishek.shasta@powergrid.in>

Date Thu 11/21/2024 6:48 PM

To cetw@upptcl.org <cetw@upptcl.org>

Cc eeetdmrt@gmail.com <eeetdmrt@gmail.com>; EE ETD Baraut <eeetdbaraut@upptcl.org>; eeetdshamli@upptcl.org <eeetdshamli@upptcl.org>; eeetd1gzb@upptcl.org <eeetd1gzb@upptcl.org>; SE ETC Meerut <setmrt@upptcl.org>; seetcmzn@upptcl.org <seetcmzn@upptcl.org>; setgzb@upptcl.org <setgzb@upptcl.org>; rtamc.nr1 <rtamc.nr1@powergrid.in>; Vishal Roy {विशाल रॉय} <vishal.roy@powergrid.in>; Kuleshwar Sahu {कुलेश्वर साहू} <kuleshwar@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; Pankaj Kumar Jha {पंकज कुमार झा} <pankaj.jha@powergrid.in>; Aman Ankur {अमन अंकुर} <Aman.ankur@powergrid.in>; gisbaghpat <gisbaghpat@powergrid.in>

1 attachment (5 MB)

letter to UPPTCL dated 201124 alongwith Tripping Report.pdf;

Dear Sir,

This has reference to our earlier letters/emails written to UPPTCL on the subject matter. In this regard, it is to inform that in recent past the 220 kV Transmission Lines of UPPTCL connected to POWERGRID, GIS Baghpat are tripping/auto-reclosing very frequently due to severe transient and permanent faults. **The transmission lines are proving to be dangerously hazardous as is evident from the data tabulated below:**

S.N.	Name of the Element	No. of Faults			
		CY'22	CY'23	CY'24	Total
1	220kV Baghpat (PG)-Shamli (UP) Line	37	23	24	**84**
2	220kV Baghpat (PG)-Mandola Vihar (UP) Line	18	11	9	**38**
3	220kV Baghpat (PG)-Baghpat(UP) Ckt-I	4	1	3	**8**
4	220kV Baghpat (PG)-Baghpat(UP) Ckt-II	14	6	3	**23**
5	220kV Baghpat (PG)-Modipuram(UP) Ckt-I	4	20	7	**31**
6	220kV Baghpat (PG)-Modipuram(UP) Ckt-II	3	10	5	**18**

You will appreciate that such occurrences result in problems for not just UPPTCL but POWERGRID and Outage Management Units as well.

You are already aware that such frequent unwarranted trippings of transmission lines results in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life. **It is worth highlighting that these frequent faults causing tripping/auto-reclosure have already resulted in failure of circuit breaker of the bay connected**

to 220 kV Baghpat (PG)-Shamli (UP) transmission line in August 2023, thus resulting in heavy financial loss to POWERGRID and long system outage. POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and POWERGRID cannot afford such frequent feeding of severe fault current through its ICT & other equipment.

Considering the above-mentioned circumstances and already occurrence of a failure, **you are requested to kindly look into the matter on priority and arrange to take up necessary remedial action** including thorough patrolling of aforesaid lines **to ensure the rectification of defects and maintain healthiness of transmission system** elements installed at POWERGRID Baghpat GIS Station, so that uninterrupted power supply may be extended to UPPTCL substations.

Inspite of our earlier requests to address this issue of frequent tripping/autoreclosures, situation has not improved much in UPPTCL lines. It may please be noted that **POWERGRID shall be forced to review its A/R settings in case such frequent fault feeding is not arrested urgently from UPPTCL lines**. We trust that your team will prioritize this matter this time and take appropriate measures to address the ongoing challenges.

Looking forward for a prompt & positive action and continued support from your end.

Regards,
Abhishek Shasta
Sr.DGM (Baghpat GIS)
Power Grid Corporation of India Limited

Outlook

Re: Frequent tripping of 220 kV Transmission Lines of UPPTCL connected to POWERGRID GIS Baghpat

From gisbaghpat <gisbaghpat@powergrid.in>

Date Wed 6/26/2024 4:46 PM

To cetw@upptcl.org <cetw@upptcl.org>

Cc SE ETC Meerut <setmrt@upptcl.org>; eeetdmrt@gmail.com <eeetdmrt@gmail.com>; EE ETD Baraut <eeetdbaraut@upptcl.org>; eeetdshamli@upptcl.org <eeetdshamli@upptcl.org>; eeetd1gzb@upptcl.org <eeetd1gzb@upptcl.org>; Ravindra Nath Gupta {आर.एन. गुप्ता} <ravindrangupta@powergrid.in>; Ashok Kumar {ए. कुमार} <a.kumar@powergrid.in>; Rajeev Kumar {राजीव कुमार} <Rajivkumar@powergrid.in>; Abhishek Shasta {अभिषेक शास्ता} <abhishek.shasta@powergrid.in>; Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>

2 attachments (13 MB)

Letter to UPPTCL informing about multiple trippings in 220kV lines.PDF; Tripping Details.PDF;

Dear Sir,

This has reference to our earlier letters/Emails written to UPPTCL on the subject matter. In this regard, it is to inform that in these 220 kV Transmission Lines of UPPTCL connected to POWERGRID, GIS Baghpat are tripping/auto-reclosing very frequently again due to severe transient and permanent faults. **220 kV Baghpat(PG)-Shamli (UP) line tripped 08 times in the month of May'24.**

You are already aware that such frequent unwarranted trippings of transmission lines results in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life.

You are again requested to kindly look into the matter on priority and arrange to take up necessary action including thorough patrolling of aforesaid lines to ensure the rectification of defects and maintain healthiness of transmission system

The detail of trippings is attached herewith for your kind reference please.

Looking forward for a prompt & positive action and continued support from your end.

Regards,
Abhishek Shasta
Sr. DGM-Baghpat SS, POWERGRID

From: Abhishek Shasta {अभिषेक शास्ता} <abhishek.shasta@powergrid.in>
Sent: 06 February 2024 13:37
To: cetw@upptcl.org <cetw@upptcl.org>
Cc: SE ETC Meerut <setmrt@upptcl.org>; eeetdmrt@gmail.com <eeetdmrt@gmail.com>; EE ETD Baraut <eeetdbaraut@upptcl.org>; eeetdshamli@upptcl.org <eeetdshamli@upptcl.org>; eeetd1gzb@upptcl.org

<eeetd1gzb@upptcl.org>; Ravindra Nath Gupta {आर.एन. गुप्ता} <ravindrangupta@powergrid.in>; Ashok Kumar {ए. कुमार} <a.kumar@powergrid.in>; Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>; gisbaghpat <gisbaghpat@powergrid.in>
Subject: Fw: Frequent tripping of 220 kV Transmission Lines of UPPTCL connected to POWERGRID GIS Baghpat

Dear Sir,
As desired in yesterday's meeting, email dated 21.12.2023 containing attached letter of even date is being forwarded once again for your information & reference please, with a request for continued support from your end for improvement in transmission system.

Regards,
Abhishek Shasta
Sr.DGM (Baghpat GIS)
Power Grid Corporation of India Limited

From: Abhishek Shasta {अभिषेक शास्ता} <abhishek.shasta@powergrid.in>
Sent: Thursday, December 21, 2023 5:30 PM
To: cetw@upptcl.org <cetw@upptcl.org>
Cc: eeetdmrt@gmail.com <eeetdmrt@gmail.com>; eeetdbaraut@upptcl.org <eeetdbaraut@upptcl.org>; eeetdshamli@upptcl.org <eeetdshamli@upptcl.org>; eeetd1gzb@upptcl.org <eeetd1gzb@upptcl.org>; Ashok Kumar Behera {ए.के. बेहरा} <akbehera@powergrid.in>; Ravindra Nath Gupta {आर.एन. गुप्ता} <ravindrangupta@powergrid.in>; Surendra Kumar Jaiswal {एस.के. जयसवाल} <skjaiswal@powergrid.in>; Vishal Roy {विशाल रॉय} <vishal.roy@powergrid.in>; rtamc.nr1 <rtamc.nr1@powergrid.in>; Surya Chandra Rao Teki {टी.एस.सी.राव} <surya@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; Sandeep Yadav {संदीप यादव} <sandeepyadav@powergrid.in>; Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>; gisbaghpat <gisbaghpat@powergrid.in>
Subject: Frequent tripping of 220 kV Transmission Lines of UPPTCL connected to POWERGRID GIS Baghpat

Dear Sir,

This has reference to our earlier letters written to UPPTCL on the subject matter. In this regard, it is to inform that in recent past the 220 kV Transmission Lines of UPPTCL connected to POWERGRID, GIS Baghpat are tripping/auto-reclosing very frequently due to severe transient and permanent faults. **The transmission lines are proving to be dangerously hazardous as is evident from the data tabulated below:**

S.N.	Name of the Element	No. of Faults in CY'23 & CY'22
1	220 kV Baghpat (PG)-Shamli (UP) Line	59
2	220 kV Baghpat (PG)-Mandola Vihar (UP)	28
3	220 kV Baghpat (PG)-Baghpat(UP) Ckt-I	04
4	220 kV Baghpat (PG)-Baghpat(UP) Ckt-II	18
5	220 kV Baghpat (PG)-Modipuram(UP) Ckt-I	24
6	220 kV Baghpat (PG)-Modipuram(UP) Ckt-II	13

You will appreciate that such occurrences result in problems for not just UPPTCL but POWERGRID and Outage Management Units as well.

You are already aware that such frequent unwarranted trippings of transmission lines results in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life. **It is worth highlighting that these frequent faults causing tripping/auto-reclosure have already resulted in failure of circuit breaker of the bay connected to 220 kV Baghpat (PG)-Shamli (UP) transmission line recently in August 2023, thus resulting in heavy financial loss to POWERGRID and long system outage.** POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and POWERGRID cannot afford such frequent feeding of severe fault current through its ICT & other equipment.

Considering the above-mentioned circumstances and already occurrence of a failure, **you are requested to kindly look into the matter on priority and arrange to take up necessary action** including thorough patrolling of aforesaid lines **to ensure the rectification of defects and maintain healthiness of transmission system** elements installed at POWERGRID Baghpat GIS Station, so that uninterrupted power supply may be extended to UPPTCL substations.

Looking forward for a prompt & positive action and continued support from your end.

Regards,
Abhishek Shasta
DGM-Baghpat SS, POWERGRID

Outlook

Frequent tripping of 220 kV Baghpat- Shamli line of UPPTCL -reg.

From Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>

Date Thu 9/7/2023 12:11 PM

To eeetdshamli@upptcl.org <eeetdshamli@upptcl.org>

Cc cetw@upptcl.org <cetw@upptcl.org>; seetcmzn@upptcl.org <seetcmzn@upptcl.org>; rtamc.nr1 <rtamc.nr1@powergrid.in>; gisbaghpat <gisbaghpat@powergrid.in>; Rajeev Kumar {राजीव कुमार} <Rajivkumar@powergrid.in>; Ashok Kumar Behera {ए.के. बेहरा} <akbehera@powergrid.in>; Abhishek Shasta {अभिषेक शास्ता} <abhishek.shasta@powergrid.in>; Hemraj Lodha {एच.आर. लोढ़ा} <hrlodha@powergrid.in>; rtamc.nr1 <rtamc.nr1@powergrid.in>; Sandeep Yadav {संदीप यादव} <sandeepyadav@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>

Dear Sir,

In continuation to the earlier letters and trailing email, it is to once again inform you that the 220 kV Baghpat (POWERGRID)-Shamli (UPPTCL) Transmission line **owned by UPPTLC** is tripping/auto-reclosing very frequently due to transient and permanent faults.

In spite of giving regular reminders over email, letters and telephonically, the defects persisting in this transmission line is causing frequent tripping of line.

You are already aware that these unwarranted frequent trippings are causing **flow of heavy fault current through connected 400/220 kV ICTs and the respective bay also, which is adversely affecting equipment life.**

These frequent faults have **already caused failure of GIS circuit breaker of this line**, **which reduced the availability and moreover added financial burden on the owner**. POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and POWERGRID can not afford such frequent feeding of fault current through its ICT & other equipment.

The said transmission line tripped on persisting fault 06.09.2023 with FLR: 3.9 km/13kA and again tripped on persisting fault on 07.09.2023 with FLR: 3.8 km / 10 kA. **The FLR indicates defect at the same location** and that the **charging of the line was done without carrying out the patrolling** and resolving the persisting issue.

In view of the above frequent trippings, you are requested to kindly **carry out a thorough patrolling of the line before providing charging clearance** of the line in order to avoid frequent tripping and unnecessary stress of the GIS system at POWERGRID, Baghpat.

Thanks and Regards
Mayank Rana
Dy. Manager,
POWERGRID, Baghpat
8439885495

Outlook

Frequent tripping of 220 kV Baghpat-Modipuram line of UPPTCL -reg.

From Abhishek Shasta {अभिषेक शास्ता} </O=POWERGRID/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=ABHISHEK SHASTA3B5>

Date Fri 3/31/2023 6:27 PM

To eeetdmrt@upptcl.org <eeetdmrt@upptcl.org>; setmrt@upptcl.org <setmrt@upptcl.org>

Cc Hemraj Lodha {एच.आर. लोढ़ा} <hrlodha@powergrid.in>; A K Behera {ए.के. बेहरा} <akbehera@powergrid.in>; Rajeev Kumar {राजीव कुमार} <Rajivkumar@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; 'RTAMC NR I' <rtamc.nr1@powergrid.co.in>; Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>; gisbaghpat@powergrid.co.in <gisbaghpat@powergrid.co.in>

1 attachment (4 MB)
upptcl modipuram letter.pdf;

Dear Sir,

It is to bring to your kind notice that circuit-1 of Baghpat (POWERGRID) - Modipuram(UPPTCL) 220kV transmission line of UPPTCL had tripped yesterday and again today due to transient and permanent faults thus feeding cumulative fault current of around 10-12 kAmps on 220 kV side within 24 hours at Baghpat GIS. In addition to this, the aforesaid line has tripped 5 times earlier and auto-reclosed 3 times during last six months (event details attached). These are newly commissioned transmission assets and we don't expect to experience such issues in such new lines.

You are already aware that frequent unwarranted trippings/auto-reclosures of transmission lines result in flow of heavy fault current through connected ICTs and other bay equipment at 400/220 kV GIS Baghpat of POWERGRID, thus adversely affecting equipment life. These high value faults in this transmission line is proving to be dangerously hazardous and extremely detrimental to the health of the connected system, which may even lead to equipment failure resulting in additional financial burden on the owner. POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and the company can not afford such frequent feeding of fault current through its ICTs & other equipment.

Considering the above-mentioned circumstances, you are once again requested to kindly look into the matter on priority and arrange to take up necessary action including thorough patrolling of aforesaid line with a view to ensure the healthiness of transmission system.

In the unlikely event of such frequent trippings occurring repeatedly, POWERGRID shall be forced to set the auto-reclosure in this transmission line to 'OFF' condition as a temporary measure to prevent fault feeding in GIS system, till rectification of defects and confirmation of healthiness of line by UPPTCL.

Looking forward for a prompt & positive action and continued support from your end.

-
Regards,
Abhishek Shasta
DGM (Baghpat GIS), POWERGRID

Outlook

Frequent tripping/auto-reclosure of 220 kV Baghpat- Baghpat line of UPPTCL on 19.12.2022 -reg.

From Abhishek Shasta {अभिषेक शास्ता} </O=POWERGRID/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=ABHISHEK SHASTA3B5>

Date Mon 12/19/2022 6:37 PM

To eeetdbaraut@upptcl.org <eeetdbaraut@upptcl.org>

Cc A K Behera {ए.के. बेहरा} <akbehera@powergrid.in>; Rajeev Kumar {राजीव कुमार} <Rajivkumar@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; Sandeep Yadav {संदीप यादव} <sandeepyadav@powergrid.in>; 'RTAMC NR I' <rtamc.nr1@powergrid.co.in>; Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>; gisbaghpat@powergrid.co.in <gisbaghpat@powergrid.co.in>

1 attachment (121 KB)

Trip-AR details (19.12.2022) - baghpat.pdf;

Dear Sir,

You must be aware that circuit-1 of Baghpat(POWERGRID) – Baghpat(UPPTCL) 220kV transmission line of UPPTCL had tripped today morning while circuit-2 auto-reclosed six times due to transient and permanent faults thus feeding cumulative fault current of around 80 kAmps on 220 kV side within 3 hours at Bagpat GIS **(event details attached)**.

You are already aware that frequent unwarranted trippings/auto-reclosures of transmission line result in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life. These high value faults in this transmission line is proving to be dangerously hazardous and extremely detrimental to the health of the connected system, which may even lead to equipment failure resulting in additional financial burden on the owner. POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and the company can not afford such frequent feeding of fault current through its ICT & other equipment.

You are also aware that this line has been experiencing similar high value fault conditions for long time now and the issue has been taken up with UPPTCL as required. The issue of such frequent trippings of UPPTCL lines has further been deliberated in recently concluded 201st OCC Meeting of NRPC wherein UPPTCL has been directed to rectify the defects in its system in order to ensure stability and healthiness of both grid and Baghpat GIS.

In line with above, it may be informed that the auto-reclosure in this transmission line is being set to 'OFF' condition as a temporary measure to prevent fault feeding in GIS system, till rectification of defects and confirmation of healthiness of line by UPPTCL.

Considering the above-mentioned circumstances, you are once again requested to kindly look into the matter on priority and arrange to take up necessary action with a view to ensure the healthiness of transmission system.

Looking forward for a prompt & positive action and continued support from your end.

-
Regards,
Abhishek Shasta
DGM (Baghpat GIS), POWERGRID

Outlook

Frequent tripping/auto-reclosure of 220 kV Baghpat- Mandola Vihar line of UPPTCL on 19.12.2022 - reg.

From Abhishek Shasta {अभिषेक शास्ता} </O=POWERGRID/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=ABHISHEK SHASTA3B5>

Date Mon 12/19/2022 6:29 PM

To eeetd1gzb@upptcl.org <eeetd1gzb@upptcl.org>

Cc A K Behera {ए.के. बेहरा} <akbehera@powergrid.in>; Rajeev Kumar {राजीव कुमार} <Rajivkumar@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; Sandeep Yadav {संदीप यादव} <sandeepyadav@powergrid.in>; 'RTAMC NR I' <rtamc.nr1@powergrid.co.in>; Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>; gisbaghpat@powergrid.co.in <gisbaghpat@powergrid.co.in>

1 attachment (109 KB)

Trip-AR details (19.12.2022) - mandola vihar.pdf;

Dear Sir,

You must be aware that Baghpat(POWERGRID) - Mandola Vihar(UPPTCL) 220kV transmission line of UPPTCL had tripped today morning after auto-reclosing twice due to transient and permanent faults thus feeding cumulative fault current of around 20 kAmps on 220 kV side within 2 hours at Bagpat GIS **(event details attached)**.

You are already aware that frequent unwarranted trippings/auto-reclosures of transmission line result in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life. These high value faults in this transmission line is proving to be dangerously hazardous and extremely detrimental to the health of the connected system, which may even lead to equipment failure resulting in additional financial burden on the owner. POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and the company can not afford such frequent feeding of fault current through its ICT & other equipment.

You are also aware that this line has been experiencing similar high value fault conditions for long time now and the issue has been taken up with UPPTCL time & again. The issue of such frequent trippings of UPPTCL lines has further been deliberated in recently concluded 201st OCC Meeting of NRPC wherein UPPTCL has been directed to rectify the defects in its system in order to ensure stability and healthiness of both grid and Baghpat GIS.

In line with above, it may be informed that the auto-reclosure in this transmission line is being set to 'OFF' condition as a temporary measure to prevent fault feeding in GIS system, till rectification of defects and confirmation of healthiness of line by UPPTCL.

Considering the above-mentioned circumstances, you are once again requested to kindly look into the matter on priority and arrange to take up necessary action with a view to ensure the healthiness of transmission system.

Looking forward for a prompt & positive action and continued support from your end.

-
Regards,
Abhishek Shasta
DGM (Baghpat GIS), POWERGRID

From: Abhishek Shasta {अभिषेक शास्ता}
Sent: 31 October 2022 15:19
To: 'eeetd1gzb@upptcl.org' <eeetd1gzb@upptcl.org>
Cc: 'cetw@upptcl.org' <cetw@upptcl.org>; 'setgzb@upptcl.org' <setgzb@upptcl.org>; 'RTAMC NR I' <rtamc.nr1@powergrid.co.in>; 'gisbaghpat@powergrid.co.in' <gisbaghpat@powergrid.co.in>; Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>; Rajeev Kumar {राजीव कुमार} <Rajivkumar@powergrid.in>; A K Behera {ए.के. बेहरा} <akbehera@powergrid.in>; Sanjay Sharma {संजय शर्मा} <sanjay_sharma@powergrid.in>
Subject: Frequent auto-reclosure of 220 kV Baghpat- Mandola Vihar line of UPPTCL -reg.

Dear Sir,

In continuation to our earlier correspondence on the subject matter, it is once again informed that in recent past the Baghpat(POWERGRID) – Mandola Vihar(UPPTCL) 220kV transmission line of UPPTCL is tripping/auto-reclosing very frequently due to transient and permanent faults. The transmission line is proving to be dangerously hazardous as is evident from the fact that this line has actually auto reclosed 15 times and tripped once during last 1 year (list enclosed). You will appreciate that such occurrences result in problems for not just UPPTCL but POWERGRID and Outage Management Units as well.

You are already aware that such frequent unwarranted trippings/auto-reclosures of transmission line result in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life. This may even lead to equipment failure resulting in additional financial burden on the owner. POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and POWERGRID can not afford such frequent feeding of fault current through its ICT & other equipment.

Further, it has also been informed several times in the past that the PLCC panel of UPPTCL installed at Baghpat station is not in healthy condition thus resulting in more time of fault feeding in case the fault is in 80%-100% zone of the line, as in such scenario we do not receive any carrier due to non-healthiness of the PLCC panel of UPPTCL. This has been faulty for a long period now and requires immediate repair/replacement, or else POWERGRID will be forced to reduce its Zone-02 timing to zero(0) msec. in order to reduce the fault feeding time.

Considering the above-mentioned circumstances, you are once again requested to kindly look into the matter on priority and arrange to take up necessary action including thorough patrolling of aforesaid line and restoring the healthiness of your PLCC panel with a view to ensure the healthiness of transmission system elements installed at POWERGRID Baghpat GIS Station.

Looking forward for a prompt & positive action and continued support from your end.

P.S.: Scanned copy of letter attached herewith

Regards,
Abhishek Shasta
DGM (Baghpat GIS), POWERGRID

Mayank Rana {मयंक राणा}

From:	Mayank Rana {मयंक राणा}
Sent:	Sunday, October 30, 2022 11:23 AM
To:	eeetd1gzb@upptcl.org; eeetd2gzb@upptcl.org; eeetdmrd@upptcl.org
Cc:	cetw@upptcl.org; setgzb@upptcl.org; rtamc.nr1@powergrid.co.in; A K Behera {ए.के. बेहरा}; Abhishek Shasta {अभिषेक शास्ता}
Subject:	Regarding emergency patrolling of 220 kV Baghpat(PG)-Mandola Vihar(UP) line in view of recent trippings

Dear Sir,

It is to inform you that the 220kV Baghpat (POWERGRID) - Mandola Vihar (UPPTCL) transmission line of UPPTCL have auto-reclosed three (03) times already since last night as detailed below:-

S.No.	Date	Fault Details Parameter	M1	M2	Category
1	29-Oct-22	Phase	Y-G	L2-N	A/R
		Distance (km)	11.5	11.3	
		Current (kA)	9.04	9.916	
		Zone	1	1	
2	30-Oct-22	Phase	R-G	L1-N	A/R
		Distance (km)	10.3	10.2	
		Current (kA)	10.57	10.45	
		Zone	1	1	
3	30-Oct-22	Phase	B-G	L3-N	A/R
		Distance (km)	6.6	6.6	
		Current (kA)	12.91	12.91	
		Zone	1	1	

You will appreciate that such occurrences result in problems for not just UPPTCL, but RTAMC and POWERGRID alike.

You are already aware that such unwarranted tripping of transmission line result in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life. POWERGRID substation at Baghpat is based on advance GIS technology & loaded with expensive equipment; and **POWERGRID cannot afford such frequent feeding of fault current through its ICT & other equipment.**

Considering the above-mentioned circumstances, you are requested to kindly look into the matter on priority and *arrange emergency patrolling of the abovementioned transmission line* with a view to ensure the healthiness of transmission system elements installed at POWERGRID Baghpat GIS Station.

Looking forward for a prompt & positive action and continued support from your end.

Outlook

Frequent tripping of 220 kV Baghpat- Shamli line of UPPTCL -reg.

From Abhishek Shasta {अभिषेक शास्ता} </O=POWERGRID/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=ABHISHEK SHASTA3B5>

Date Thu 10/20/2022 12:47 PM

To eeetdshamli@upptcl.org <eeetdshamli@upptcl.org>

Cc cetw@upptcl.org <cetw@upptcl.org>; seetcmzn@upptcl.org <seetcmzn@upptcl.org>; 'RTAMC NR I' <rtamc.nr1@powergrid.co.in>; gisbaghpat@powergrid.co.in <gisbaghpat@powergrid.co.in>; Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>; Rajeev Kumar {राजीव कुमार} <Rajivkumar@powergrid.in>; A K Behera {ए.के. बेहरा} <akbehera@powergrid.in>; Sanjay Sharma {संजय शर्मा} <sanjay_sharma@powergrid.in>

1 attachment (4 MB)

Shamli Line Tripping Letter -201022.pdf;

Dear Sir,

In continuation to our earlier letters on the subject matter, it is once again informed that in recent past the Baghpat(POWERGRID) – Shamli(UPPTCL) 220kV transmission line of UPPTCL is tripping/auto-reclosing very frequently due to transient and permanent faults. **The transmission line is proving to be dangerously hazardous as is evident from the fact that this line has actually tripped 10 times since April 2022 and auto-reclosed 22 times (list enclosed).** You will appreciate that such occurrences result in problems for not just UPPTCL but POWERGRID and Outage Management Units as well.

You are already aware that such frequent unwarranted trippings of transmission line result in flow of heavy fault current through connected 400/220 kV ICTs and other bay equipment at GIS Baghpat of POWERGRID, thus adversely affecting equipment life. This may even result in equipment failure resulting in additional financial burden on the owner. POWERGRID substation at Baghpat is based on advance GIS technology loaded with expensive equipment and **POWERGRID can not afford such frequent feeding of fault current through its ICT & other equipment**.

Further, it has also been informed several times in the past that the **PLCC panel of UPPTCL installed at Baghpat station is not in healthy condition** thus resulting in more time of fault feeding in case the fault is in 80%-100% zone of the line, as in such scenario we do not receive any carrier due to non-healthiness of the PLCC panel of UPPTCL. This has been faulty for a long period now and requires immediate repair/replacement, or else **POWERGRID will be forced to reduce its Zone-02 timing to zero(0) msec. in order to reduce the fault feeding time**.

Considering the above-mentioned circumstances, **you are once again requested to kindly look into the matter on priority and arrange to take up necessary action** including thorough patrolling of aforesaid line and restoring the healthiness of your PLCC panel **with a view to ensure the healthiness of transmission system** elements installed at POWERGRID Baghpat GIS Station.

Looking forward for a prompt & positive action and continued support from your end.

P.S.: Scanned copy of letter attached herewith

Regards,
Abhishek Shasta
DGM (Baghpat GIS), POWERGRID

Outlook

Frequent tripping of 220 kV Baghpat- Shamli line of UPPTCL -reg.

From Abhishek Shasta {अभिषेक शास्ता} </O=POWERGRID/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=ABHISHEK SHASTA3B5>

Date Mon 8/1/2022 1:32 PM

To seetcmzn@upptcl.org <seetcmzn@upptcl.org>; eeetdshamli@upptcl.org <eeetdshamli@upptcl.org>

Cc Mayank Rana {मयंक राणा} <ranamayank11@powergrid.in>; Rajeev Kumar {राजीव कुमार} <Rajivkumar@powergrid.in>; A K Behera {ए.के. बेहरा} <akbehera@powergrid.in>; Sanjay Sharma {संजय शर्मा} <sanjay_sharma@powergrid.in>; gisbaghpat@powergrid.co.in <gisbaghpat@powergrid.co.in>; RTAMC NR I <rtamc.nr1@powergrid.co.in>

1 attachment (263 bytes)

Archived attachment list.txt;

Quick Look

Outlook

Regarding frequent tripping of 220 kV Baghpat (PG) - Shamli (UPPTCL) line

From gisbaghpatpowergrid <gisbaghpat@powergrid.co.in>
Date Mon 06-06-2022 17:02
To eeetdshamli <eeetdshamli@upptcl.org>
Cc director_sldc@upptcl.org <director_sldc@upptcl.org>; sanjay sharma <sanjay_sharma@powergrid.in>

1 attachment (566 KB)
Letter UPPTCL Shamli.pdf;

Dear Sir,

PFA the letter regarding subject cited above. The letter is self explanatory.

You are requested to kindly take necessary action please.

Thanks and Regards
Mayank Rana
Dy. Manager, Baghpat

Ref: NR-1/AM/UPPTCL/Tripping Dt. 03.12.2024

To,
Chief Engineer (Transmission West, UPPTCL, Meerut)
Victoria Park, Ramgarhi, Meerut, Uttar Pradesh. Pin-250001

Subject: **Request for Investigation into Frequent Faults in 220kV Lines Connected to Meerut (PG) Substation**

Dear Sir,

We would like to bring to your attention the frequent faults in the UPPTCL portion on the five 220kV lines connected to the Meerut Substation. The fault details over the last two years are summarized below:

Sr. No.	Name of the lines	No. of Faults in Last Two Years
1	220kV MEERUT-NARA	56
2	220kV MEERUT-SIMBHOLI	24
3	220kV MEERUT-MODIPURAM-1 & 2	20
4	220kV MEERUT-SHATABDINAGAR	14

These recurring faults have placed significant stress on the switchyard equipment, conductors/droppers, and ICTs connected to the Meerut Substation. Furthermore, the frequent faults on the 220kV Meerut-Nara line have led to the failure of CB earlier. The repeated fault clearance by the CB has caused decomposition of SF6 gas in the arc-interrupting chamber, ultimately rendering the CB unable to clear the faults effectively.

Given the critical importance of ensuring a reliable electricity supply, we kindly request your team to conduct a thorough investigation to identify and address the root causes of these frequent faults in the mentioned lines.

Please note that if the issue of frequent fault feeding is not urgently addressed on the UPPTCL side, POWERGRID may be compelled to review its auto-reclosing (AR) settings.

We trust that your team will prioritize this matter and take the necessary corrective measures to resolve the issue. We look forward to your prompt action and continued support in this regard.

Kuleshwar Sahu
CGM-AM, NR1 Gr-1

Encl: 1. Details of faults in last two years

DETAILS OF TRIPPING OF 220KV LINE CONNECTED TO MEERUT (PG) SUBSTATION

Sr. No.	Name of Lines	Tripping Date	Tripping Time	Fault Current	Faulty-Phase	Fault Location from Meerut end
1	220kV MEERUT-SIMBHOLI(UPPTCL)	09.01.2023	12:59:00	13.949 KA	Y-N	10.295 KM
2	220kV MEERUT-NARA(UPPTCL)	11-02-2023	16:10:00	16.16 KA	B-N	1.132 KM
3	220kV MEERUT-MODIPURAM(UPPTCL)-1	19-02-2023	05:29:00	12.18 KA	Y-N	10.18 KM
4	220kV MEERUT-MODIPURAM(UPPTCL)-2	19-02-2023	05:29:00	10.14 KA	Y-N	9.89 KM
5	220kV MEERUT-NARA(UPPTCL)	22-02-2023	11:32:00	5.7 KA	B-N	29.92 KM
6	220kV MEERUT-NARA(UPPTCL)	20-03-2023	15:46:00	11.80 KA	R-N	12.242KM
7	220kV MEERUT-NARA(UPPTCL)	28-03-2023	07:31:00	11.95 KA	B-N	13.31 KM
8	220kV MEERUT-NARA(UPPTCL)	08-04-2023	22:43:00	17.71 KA	Y-N	6.4 KM
9	220kV MEERUT-NARA(UPPTCL)	08-04-2023	21:41:00	17.97 KA	Y-N	6.49 KM
10	220kV MEERUT-SIMBHOLI(UPPTCL)	10-04-2023	20:52:00	13.5 KA	Y-N	10.27 KM
11	220kV MEERUT-NARA(UPPTCL)	11-04-2023	01:54:00	14.6 KA	B-N	8.62 KM
12	220kV MEERUT-SHATABDINAGAR(UPPTCL)	24-04-2023	11:23:00	7.818 KA	B-N	20.12 KM
13	220kV MEERUT-NARA(UPPTCL)	25-04-2023	05:48:00	10.09 KA	Y-N	16.17 KA
14	220kV MEERUT-NARA(UPPTCL)	05-05-2023	01:49:00	12.86 KA	Y-N	9.81 KM
15	220kV MEERUT-NARA(UPPTCL)	07-05-2023	22:41:00	17.2 KA	Y-N	6.56 KM
16	220kV MEERUT-NARA(UPPTCL)	08-05-2023	20:28:00	16.47 KA	Y-N	6.608KM
17	220kV MEERUT-NARA(UPPTCL)	24-05-2023	03:53:00	13.3 KA	B-N	10.83KM
18	220kV MEERUT-NARA(UPPTCL)	26-05-2023	18:36:00	9.637 KA	B-N	15.677KM
19	220kV MEERUT-NARA(UPPTCL)	31-05-2023	13:56:00	5.867 KA	B-N	30.111KM
20	220kV MEERUT-NARA(UPPTCL)	08-06-2023	08:55:00	15.9 KA	B-N	6.611KM
21	220kV MEERUT-NARA(UPPTCL)	10-06-2023	10:41:00	9.81 KA	R-N	27.545KM
22	220kV MEERUT-SIMBHOLI(UPPTCL)	22-06-2023	18:19:00	4.54 KA	R-N	42.776KM
23	220kV MEERUT-NARA(UPPTCL)	24-06-2023	19:46:00	41.12 KA	Y-N	0.025KM
24	220kV MEERUT-NARA(UPPTCL)	27-06-2023	13:39:00	6.87 KA	B-N	23.4KM
25	220kV MEERUT-NARA(UPPTCL)	01-07-2023	19:01:00	9.583 KA	R-N	15.707KM
26	220kV MEERUT-NARA(UPPTCL)	09-07-2023	18:35:00	7.875 KA	R-N	21.213KM
27	220kV MEERUT-NARA(UPPTCL)	14-07-2023	15:14:00	9.635 KA	R-N	14.618KM
28	220kV MEERUT-NARA(UPPTCL)	17-07-2023	05:53:00	9.907 KA	R-N	17.557KM
29	220kV MEERUT-SIMBHOLI(UPPTCL)	17-07-2023	17:42:00	4.739 KA	R-N	42.591KM
30	220kV MEERUT-NARA(UPPTCL)	26-07-2023	05:30:00	3.086 KA	R-N	32KM
31	220kV MEERUT-NARA(UPPTCL)	26-07-2023	09:47:00	12469 KA	R-N	12.16KM
32	220kV MEERUT-NARA(UPPTCL)	28-07-2023	07:12:00	2.817 KA	R-N	32KM
33	220kV MEERUT-SIMBHOLI(UPPTCL)	04-08-2023	11:36:00	4.7 KA	R-N	39.33KM
34	220kV MEERUT-NARA(UPPTCL)	04-08-2023	12:32:00	6.52 KA	R-N	29.6KM
35	220kV MEERUT-SHATABDINAGAR(UPPTCL)	07-08-2023	15:49:00	6.834 KA	R-N	29.676KM
36	220kV MEERUT-MODIPURAM(UPPTCL)-1	10-08-2023	13:04:00	6.076 KA	R-N	14.442KM
37	220kV MEERUT-NARA(UPPTCL)	15-08-2023	18:07:00	13.684 KA	R-N	10.012KM
38	220kV MEERUT-SHATABDINAGAR(UPPTCL)	17-08-2023	05:17:00	16.936 KA	B-N	6.416KM
39	220kV MEERUT-NARA(UPPTCL)	06-09-2023	09:56:00	11.546 KA	B-N	12.223KM
40	220kV MEERUT-NARA(UPPTCL)	24-09-2023	15:37:00	7.368 KA	R-N	21473KM
41	220kV MEERUT-SIMBHOLI(UPPTCL)	01-10-2023	10:21:00	6.578 KA	Y-N	23.841KM
42	220kV MEERUT-NARA(UPPTCL)	10-10-2023	12:44:00	15.698 KA	Y-N	3.628KM
43	220kV MEERUT-SIMBHOLI(UPPTCL)	10-10-2023	10:27:00	6.323 KA	Y-N	27.268KM
44	220kV MEERUT-NARA(UPPTCL)	14-10-2023	10:37:00	16.068 KA	Y-N	3.852KM
45	220kV MEERUT-SIMBHOLI(UPPTCL)	15-10-2023	16:02:00	7.763 KA	Y-N	22.193KM
46	220kV MEERUT-SIMBHOLI(UPPTCL)	17-10-2023	12:10:00	8.501 KA	Y-N	18.489KM
47	220kV MEERUT-SIMBHOLI(UPPTCL)	22-10-2023	09:43:00	4.332 KA	R-N	46.838KM
48	220kV MEERUT-NARA(UPPTCL)	26-12-2023	04:39:00	6.142 KA	R-N	27.642KM
49	220kV MEERUT-NARA(UPPTCL)	16-04-2024	02:27:00	7.272 KA	B-N	22.239KM
50	220kV MEERUT-NARA(UPPTCL)	16-04-2024	05:50:00	14.03 KA	Y-N	9.8KM
51	220kV MEERUT-NARA(UPPTCL)	26-04-2024	06:48:00	13.992 KA	Y-N	8.4KM
52	220kV MEERUT-NARA(UPPTCL)	26-04-2024	04:22:00	14.27 KA	Y-N	8.521KM
53	220kV MEERUT-SIMBHOLI(UPPTCL)	02-05-2024	23:48:00	6.841 KA	B-R	33.286KM
54	220kV MEERUT-SIMBHOLI(UPPTCL)	14-05-2024	18:39:00	10.89 KA	Y-N	15.187KM
55	220kV MEERUT-SHATABDINAGAR(UPPTCL)	31-05-2024	12:17:00	6.738 KA	Y-N	32.334KM

56	220kV MEERUT-SIMBHOLI(UPPTCL)	09-07-2024	09:14:00	5.687 KA	Y-B	43.713KM
57	220kV MEERUT-NARA(UPPTCL)	15-07-2024	03:40:00	9.16 KA	R-N	17.18 KM
58	220kV MEERUT-NARA(UPPTCL)	15-07-2024	05:18:00	11.87 KA	R-N	
59	220kV MEERUT-NARA(UPPTCL)	15-07-2024	05:18:00	13.18 KA	R-N	
60	220kV MEERUT-MODIPURAM(UPPTCL)-1	17-07-2024	12:40:00	6.52 KA	R-N	8.5KMKM
61	220kV MEERUT-SIMBHOLI(UPPTCL)	17-07-2024	23:11:00	6.643 KA	R-N	24.295KM
62	220kV MEERUT-NARA(UPPTCL)	18-07-2024	08:57:00	6.857 KA	Y-N	24.454KM
63	220kV MEERUT-MODIPURAM(UPPTCL)-2	24-07-2024	07:16:00	13.636 KA	R-N	10.21KM
64	220kV MEERUT-MODIPURAM(UPPTCL)-2	25-07-2024	13:30:00	16.18 KA	B-N	
65	220kV MEERUT-MODIPURAM(UPPTCL)-1	31-07-2024	20:18:00	26.341 KA	R-N	1.83KM
66	220kV MEERUT-NARA(UPPTCL)	11-08-2024	18:25:00	14.056 KA	B-N	10.565KM
67	220kV MEERUT-SIMBHOLI(UPPTCL)	12-08-2024	10:56:00	4.555 KA	R-N	38.156KM
68	220kV MEERUT-MODIPURAM(UPPTCL)-2	15-08-2024	17:35:00	13.76 KA	R-N	10.678KM
69	220kV MEERUT-SHATABDINAGAR(UPPTCL)	06-09-2024	21:05:00	13.157 KA	B-N	10.89KM
70	220kV MEERUT-NARA(UPPTCL)	11-09-2024	09:40:00	7.469 KA	R-N	24.567KM
71	220kV MEERUT-NARA(UPPTCL)	13-09-2024	00:01:00	7.32 KA	Y-N	22.68KM
72	220kV MEERUT-SIMBHOLI(UPPTCL)	29-09-2024	16:12:00	8.137 KA	R-N	19.841KM
73	220kV MEERUT-MODIPURAM(UPPTCL)-2	02-10-2024	23:27:00	29.75 KA	R-N	1.503KM
74	220kV MEERUT-MODIPURAM(UPPTCL)-1	08-10-2024	02:02:00	3.9 KA		67.33KM
75	220kV MEERUT-MODIPURAM(UPPTCL)-2	17-10-2024	10:03:00	5.765 KA	R-N	5.845KM
76	220kV MEERUT-NARA(UPPTCL)	20-10-2024	14:48:00	16.91 KA	Y-N	3.46KM
77	220kV MEERUT-NARA(UPPTCL)	21-10-2024	14:48:00	16.91 KA	Y-N	3.46KM
78	220kV MEERUT-SHATABDINAGAR(UPPTCL)	29-10-2024	00:12:00	16.46 KA	B-N	7.55KM
79	220kV MEERUT-SHATABDINAGAR(UPPTCL)	05-11-2024	03:37:00	12.766 KA	R-N	11.32 KM

Outlook

Frequent Faults on 220kV Lines at Meerut Substation

From Pankaj Kumar Jha {पंकज कुमार झा} <pankaj.jha@powergrid.in>
Date Wed 2024-12-04 15:25
To cetw@upptcl.org <cetw@upptcl.org>
Cc eeetdmrt@gmail.com <eeetdmrt@gmail.com>; setmrt@upptcl.org <setmrt@upptcl.org>; dharmendra.cea@gov.in <dharmendra.cea@gov.in>; Reeturaj Pandey <pandeyr.cea@gov.in>; Sh Singh <ms-nrpc@nic.in>; Santosh Kumar <seo-nrpc@nic.in>; LokeshAgrawal <lokesh.cea@gov.in>; Kuleshwar Sahu {कुलेश्वर साहू} <kuleshwar@powergrid.in>; M Thirumala Reddy {एम. तिरूमाला रेड्डी} <thirumalareddy@powergrid.in>; Ravi Wadyalkar {रवि अशोक वाड्यालकर} <wravi@powergrid.in>; Ankit Vaish {अंकित वैश्य} <ankit_vaish@powergrid.in>; ccprotection <ccprotection@powergrid.in>; deepak.kr@grid-india.in <deepak.kr@grid-india.in>; Kritika Chopra {कृतिका चोपड़ा} <kritika.chopra@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; Randhir Singh {रणधीर सिंह} <Randhir@powergrid.in>; Manpreet Singh {मनप्रीत सिंह} <manpreet@powergrid.in>; Rajib Lochan Jena {राजीव लोचन जेना} <lochan@powergrid.in>

2 attachments (3 MB)
Letter_UPPTCL_Meerut Tripping.pdf; Tripping of 220kV Lines Connected to Meerut Substation.pdf;

Dear Sir,

Please find attached the letter regarding frequent faults on the UPPTCL portion of the 220kV lines connected to the Meerut Substation, which are stressing the equipment and ICTs.

We request a prompt investigation to identify the root causes. **If unresolved, POWERGRID may review its AR settings.**

Warm Regards
Pankaj Kumar Jha
Chief Manager (Asset Management)
Power Grid Corporation of India Limited
Regional Headquarters, Northern Region-1
SCO Bay No.5 -10, Sector-16A, Faridabad, Haryana-121002
Mob: +919634440125

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

Ref: NR-1/AM/HVPNL/Tripping

Dt. 02.12.2024

To,

Chief Engineer

TS Circle, HVPNL

Vidyut Nagar, Hisar

Haryana-125044

Subject: **Urgent Attention Required Regarding Frequent Auto-Reclosing and Tripping on 220kV Hisar-Fatehabad Line**

Dear Sir,

With reference to our regular communication via phone and email with XENNAE-TL: Fatehabad from our Hisar Substation, as well as the letters dated 03.08.2023 addressed to XEN, HVPNL Fatehabad, letter dated 05.09.2023 & 12.08.2024 addressed to XEN, HVPNL Fatehabad, and letter dated 05.09.2024 addressed to SE, TS Circle, HVPNL, I am writing to express our ongoing concern regarding the frequent auto-reclosing (AR) and tripping incidents occurring on the 220kV Hisar-Fatehabad line, which is associated with the POWERGRID Hisar transmission substation.

In the last two years, more than 60 fault incidents have been recorded on the 220kV Hisar-Fatehabad line-1, and more than 45 fault incidents on 220kV Hisar-Fatehabad line-2. These disruptions have become increasingly frequent, resulting in significant hotspots and damage to conductors at our substations, particularly in the 220kV sections, in addition to stress and damage to other electrical equipment. Given the importance of maintaining a reliable electricity supply, we kindly request that your team conduct a thorough investigation to identify the root causes of the frequent tripping and AR events.

Despite our previous requests to address the issue of frequent tripping and auto-reclosure, the situation has not improved significantly in these two lines. Please note that if the issue of frequent fault feeding is not urgently addressed from the HVPNL side, **POWERGRID will be compelled to review its AR settings.** We trust that your team will prioritize this matter and take appropriate measures to resolve the ongoing issues.

We look forward to your prompt and positive action and continued support in this regard.

Kuleshwar Sahu
CGM-AM, NR1 Gr-1

Encl:
1. All communications from Hissar Substations
2. Copy of e-mail sent to Grid-India

Copy to:
1. Member Secretary, NRPC (E-mail: ms-nrpc@nic.in)
2. SEO, NRPC (E-mail: seo-nrpc@nic.in)
3. NRLDC SO2 (E-mail: nrldcso2@grid-india.in)

Copy for kind information:
1. Executive Director (NR-1), POWERGRID
2. CGM-I/C CC-AM, POWERGRID

पावरग्रिड POWERGRID
पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
400/220 KV Substation, V.P.O. Mayyar, NH-09, Distt. Hisar (HARYANA)-125044.
E-mail: hisarssnr1@powergrid.co.in, Mob. 8295903705.
CIN No. L40101DL1989GOI038121

Ref:NR1/HISAR/HVPNL-FBD/2024/03 **Date: 04.11.2024**

To,
Chief Engineer
TS Circle, HVPNL
Vidyut Nagar, Hisar
Haryana-125044

Sub: Frequent A/R of 220kV Hisar (PG)- Fatehabad line-1 & 2 -reg

Ref:
1. **Our regular intimation to XEN/AE-TL: Fatehabad over phone and e-mail**
2. **Our letter dated 03.08.2023 addressed to XEN, HVPNL Fatehabad**
3. **Our letter ref no. NR1/HISAR/HVPNL-FBD/ dtd. 05.09.2023 addressed to XEN, HVPNL Fatehabad.**
4. **Our letter ref no. NR1/HISAR/HVPNL-FBD/2024/01 Dtd. 12.08.2024 addressed to XEN, HVPNL Fatehabad**
5. **Our letter ref no. NR1/HISAR/HVPNL-FBD/2024/02 Dtd. 05.09.2024 addressed to SE,TS Circle,HVPNL**
6. **Email to Grid India on dtd. 05.09.2024 through RTAMC Manesar,POWERGRID**

Dear Sir,

I am writing to express our concern regarding the frequent auto-reclosing (AR) and tripping incidents occurring on the 220 kV Hisar-Fatehabad line, which is associated with the POWERGRID Hisar transmission substation. These disruptions have been increasingly frequent and are causing significant increase in number of hotspots and conductor damage at our sub-stations especially for 220kV parts besides stress/damage to our other electrical equipments.

The details of recent A/R and Tripping details (after our last letter) are listed below from which it is observed that A/R and Trippings are happening on weekly basis:

Sl. No	Name of line	Date of tripping	Date of tripping	Phase	Fault current (KA)	Fault location (KM)	Remarks
1	220KV Fatehabad line-1	06.09.2024	05:06:26	B Ph	5.672	23.052	AR Successful
2		14.09.2024	21:18:00	Y Ph	6.605	19.956	AR Successful
3		24.09.2024	02:40:12	B Ph	4.723	31.011	AR Successful
4		24.09.2024	04:03:34	B Ph	4.655	30.779	AR Successful
5		02.10.2024	17:29:42	B Ph	4.529	35.805	Trip
6		19.10.2024	18:28:58	R PH	4.538	31.163	Trip
7		21.10.2024	17:27:49	B Ph	7.567	15.614	Trip
1	220KV Fatehabad line-2	20.10.2024	22:55:37	B Ph	6.651	20.153	AR Sucessful
2		24.10.2024	09:20:27	R Ph	8.189	13.559	Trip
3		26.10.2024	02:20:15	B Ph	5.273	31.684	AR Sucessful
4		30.10.2024	19:34:04	Y Ph	8.629	14.414	Trip
5		02.11.2024	01:23:36	R Ph	8.254	14.553	Trip

Also, past AR & tripping details are attached herewith this letter.

Given the importance of reliable electricity supply, we kindly request that your team undertake a thorough investigation to identify the root causes of the frequent tripping and AR events.

दिनेश चन्द्रा नैनवाल/Dinesh Chandra Nainwal
वरिष्ठ उप महा प्रबन्धक/Sr. D.G.M.
Power Grid Corporation of India
400/220, KV Sub Station
Hisar-125044 (Haryana)

Specifically, we would appreciate:

1. A detailed analysis of the factors contributing to the recurrent tripping and AR incidents on the 220kV Hisar-Fatehabad line.
2. Recommendations and corrective actions to enhance the reliability of the power supply in this area.

Inspite of our earlier request to address this issue of Tripping/AR, same has not been resolved yet. You are once again requested to take remedial measures to avoid such Tripping abd A/Rs on regular basis and inform this office.

We trust that your team will prioritize this matter and take appropriate measures to address the on-going challenges.

Thank you for your attention to this issue. We look forward to your prompt response.

Sincerely,

Thanking you.

Yours faithfully,

Dinesh Chandra Nainwal 4/11/2024
Sr. DGM, POWERGRID

दिनेश चन्द्रा नैनवाल/Dinesh Chandra Nainwal
वरिष्ठ उप महा प्रबन्धक/Sr. D.G.M.
Power Grid Corporation of India
400/220. KV Sub Station
Mayyar, Hisar-125044 (Haryana)

Copy to 1. CGM (Cluster Head/ RHQ AM Faridabad)
2. Superintendent Engineer, TS, HVPNL, Hisar
3. Executive Engineer, HVPNL, 400kV Fatehabad

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD (HVPN) LINE-1

Sl No	Name of line	Time of tripping	Date of tripping	Phase	Fault current(KA)	Fault location(KM)	Remarks
1	220KV Fatehabad 1	05:23:00	02.08.2022	Rph	3.91	38.23	A/R sucessful
2	220KV Fatehabad 1	04:58	03.08.222	Yph	4.006	40.68	A/R sucessful
3	220KV Fatehabad 1	22:21	04.08.2022	Yph	4.05	34.96	A/R sucessful
4	220KV Fatehabad 1	12:17	08.08.2022	Yph	4.21	33.51	A/R sucessful
5	220KV Fatehabad 1	04:16	15.08.2022	Rph	8.9	15.37	A/R sucessful
6	220KV Fatehabad 1	05:45	15.08.2022	Rph	4.32	41.64	A/R sucessful
7	220KV Fatehabad 1	00:39	19.08.2022	Rph	5.65	23.3	A/R sucessful
8	220KV Fatehabad 1	00:39	19.08.2022	Rph	4.38	31.4	A/R sucessful
9	220KV Fatehabad 1	18:59	27.08.2022	Rph	6.83	18.7	A/R sucessful
10	220KV Fatehabad 1	14:41	05.09.2022	Rph	3.72	49.21	A/R sucessful
11	220KV Fatehabad 1	02:42	14.09.2022	Rph	4.05	36.96	A/R sucessful
12	220KV Fatehabad 1	06:01	19.09.2022	Rph	4.25	34.97	A/R sucessful
13	220KV Fatehabad 1	09:04	21.09.2022	Bph	4.39	35.26	Tripped
14	220KV Fatehabad 1	03:53	25.09.2022	Rph	4.86	31.76	A/R sucessful
15	220KV Fatehabad 1	05:34	27.09.2022	Rph	4.15	38.43	A/R sucessful
16	220KV Fatehabad 1	21:32	27.09.2022	Yph	4.59	32.55	A/R sucessful
17	220KV Fatehabad 1	21:31	27.09.2022	Rph	5.16	26.31	A/R sucessful
18	220KV Fatehabad 1	01:29	28.09.2022	Rph	5.35	32.81	A/R sucessful
19	220KV Fatehabad 1	19:31	29.09.2022	Rph	3.86	41.1	A/R sucessful
20	220KV Fatehabad 1	02:06	09.10.2022	Rph	4.65	32.61	A/R sucessful
21	220KV Fatehabad 1	20:25	09.10.2022	Rph	4.26	37.13	A/R sucessful
22	220KV Fatehabad 1	23:17	10.10.2022	Yph	3.97	47.77	A/R sucessful
23	220KV Fatehabad 1	00:36	11.10.2022	Rph	5.45	26.468	A/R sucessful
24	220KV Fatehabad 1	03:18	12.10.2022	Rph	4.318	37.69	A/R sucessful
25	220KV Fatehabad 1	16:07	13.10.2022	Rph	3.83	40.94	A/R sucessful
26	220KV Fatehabad line-1	05:41:50	12.09.2023	B-ph	10.026	10.688	A/R sucessful
27	220KV Fatehabad line-1	03:02:16	03.09.2023	B-ph	4.154	37.295	A/R sucessful
28	220KV Fatehabad line-1	13:39:13	09.08.2023	R-ph	5.086	29.214	A/R sucessful
29	220KV Fatehabad line-1	23:26:04	02.08.2023	B-ph	3.3	51.94	A/R sucessful
30	220KV Fatehabad line-1	20:36:57	30.07.2023	Y-ph	4.258	37.01	A/R sucessful
31	220KV Fatehabad line-1	04:36:09	30.07.2023	R-ph	4.405	34.864	A/R sucessful
32	220KV Fatehabad line-1	03:25:27	30.07.2023	R-ph	8.937	13.487	A/R sucessful
33	220KV Fatehabad line-1	01:24:13	26.07.2023	Y-ph	4.955	30.892	A/R sucessful
34	220KV Fatehabad line-1	00:01:28	26.07.2023	R-ph	4.766	32.682	A/R sucessful
35	220KV Fatehabad line-1	04:13:33	24.05.2023	B-ph	4.939	30.673	A/R sucessful
36	220KV Fatehabad line-1	12:34:45	07.12.2023	R-ph	3.38	50.973	AR Sucessful
37	220KV Fatehabad line-1	04:18:31	26.10.2023	B Ph	15.681	6.37	Trip
38	220KV Fatehabad line-1	05:54:23	20.10.2023	B-ph	3.884	46.48	AR Sucessful
39	220KV Fatehabad line-1	03:04:42	27.09.2023	R-Ph	9.922	12.724	Trip
40	220KV Fatehabad line-1	03:49:50	22.09.2023	R-Ph	7.264	19.219	AR Sucessful
41	220KV Fatehabad line-1	22:12:36	16.09.2023	Y ph	4.816	30.952	AR Sucessful
42	220KV Fatehabad line-1	21:06:06	19.02.2024	B-ph	4.749	32.711	Line tripped
43	220KV Fatehabad line-1	17:25:00	10.04.2024	Y ph	3.771	50.846	Re fault in re claim time and line got tripped.
44	220KV Fatehabad line-1	12:01	12.08.2024	Y Ph	7.518	15.458	Trip
45	220KV Fatehabad line-1	20:50	08.08.2024	R PH	5.822	22.026	AR Sucessful
46	220KV Fatehabad line-1	00:41	07.08.2024	Y Ph	5.586	23.223	AR Sucessful
47	220KV Fatehabad line-1	23:22:48	06.08.2024	B-ph	5.994	23.75	AR Sucessful
48	220KV Fatehabad line-1	05:12	27.07.2024	R PH	4.645	31.251	AR Sucessful
49	220KV Fatehabad line-1	20:52:00	18.08.2024	Y Ph	4.136	33.479	AR Sucessful
50	220KV Fatehabad line-1	01:53:00	04.09.2024	R PH	8.512	13.093	AR Sucessful
51	220KV Fatehabad line-1	04:53	04.09.2024	R PH	4.382	32.435	AR Sucessful
52	220KV Fatehabad line-1	18:17	04.09.2024	R PH	6.142	20.413	AR Sucessful
53	220KV Fatehabad line-1	19:25:00	04.09.2024	Y Ph	5.61	24.364	AR Sucessful
54	220KV Fatehabad line-1	10:52	05.09.2024	R PH	6.037	20.6	Trip
55	220KV Fatehabad line-1	05:06:26	06.09.2024	B Ph	5.672	23.052	AR Sucessful
56	220KV Fatehabad line-1	21:18	14.09.2024	Y Ph	6.605	19.956	AR Sucessful
57	220KV Fatehabad line-1	02:40:12	24.09.2024	B Ph	4.723	31.011	AR Sucessful
58	220KV Fatehabad line-1	04:03:34	24.09.2024	B Ph	4.655	30.779	AR Sucessful
59	220KV Fatehabad line-1	04:03:34	24.09.2024	B Ph	4.655	30.779	AR Sucessful
60	220KV Fatehabad line-1	17:29:42	02.10.2024	B Ph	4.529	35.805	Trip
61	220KV Fatehabad line-1	18:28:58	19.10.2024	R PH	4.538	31.163	Trip
62	220KV Fatehabad line-1	17:27:49	21.10.2024	B Ph	7.567	15.614	Trip

अर्पित कुमार जैन/Arpit Kumar Jain
प्रबंधक/Manager
पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लि., हिसार
Power Grid Corporation Of India Ltd., Hisar

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD (HVPN) LINE-2

Sl No	Name of line	Time of tripping	Date of tripping	Phase	Fault current(KA)	Fault location(KM)	Remarks
1	220 KV Fatehabad 2	03:08:02	01.08.2022	Rph	4.8	38.64	A/R sucesssful
2	220 KV Fatehabad 2	20:39	11.08.2022	Bph	5.36	32.31	A/R sucesssful
3	220 KV Fatehabad 2	18:40	22.08.2022	Rph	8.34	13.8	A/R sucesssful
4	220 KV Fatehabad 2	19:42	29.08.2022	Bph	8.96	15.08	A/R sucesssful
5	220 KV Fatehabad 2	19:25	03.09.2022	Y & Bph	2.9,2.7	63.93	Tripped
6	220 KV Fatehabad 2	21:57	04.09.2022	Rph	3.77	36.67	A/R sucesssful
7	220 KV Fatehabad 2	19:48	11.09.2022	Rph	8.41	13.14	A/R sucesssful
8	220 KV Fatehabad 2	21:45	18.09.2022	Yph	5	31.12	A/R sucesssful
9	220 KV Fatehabad 2	22:10	20.09.2022	Rph	4.8	35.92	A/R sucesssful
10	220 KV Fatehabad 2	21:52	22.09.2022	Yph	4.17	34.77	A/R sucesssful
11	220 KV Fatehabad 2	23:51	22.09.2022	Rph	4.6	35.68	A/R sucesssful
12	220 KV Fatehabad 2	01:53	23.09.2022	Rph	4.67	30.14	A/R sucesssful
13	220 KV Fatehabad 2	02:49	23.09.2022	Rph	4.77	30.04	A/R sucesssful
14	221 KV Fatehabad 2	18:59	25.09.2022	Rph	4.37	41.44	A/R sucessful
15	222 KV Fatehabad 2	21:22	26.09.2022	Rph	5.84	26.13	A/R sucessful
16	222 KV Fatehabad 2	05:26	30.09.2022	Yph	5.31	32.91	A/R sucessful
17	222 KV Fatehabad 2	19:31	09.10.2022	Yph	6.3	26.31	A/R sucessful
18	220KV Fatehabad line-2	05:52:47	07.09.2023	R-ph	9.456	13.49	A/R sucessful
19	220KV Fatehabad line-2	23:37:10	06.09.2023	B-ph	5.668	29.744	A/R sucessful
20	220KV Fatehabad line-2	05:32:32	04.09.2023	B-ph	4.647	38.676	A/R sucessful
21	220KV Fatehabad line-2	21:11:26	04.08.2023	R-ph	4.533	39.227	A/R sucessful
22	220KV Fatehabad line-2	01:30:53	03.08.2023	Y-ph	9.595	12.698	A/R sucessful
23	220KV Fatehabad line-2	05:30:10	24.07.2023	Y-ph	4.769	37.98	A/R sucessful
24	220KV Fatehabad line-2	16:22:57	19.07.2023	R-ph	4.183	43.177	A/R sucessful
25	220KV Fatehabad line-2	02:09:16	29.06.2023	R-ph	4.735	38.082	A/R sucessful
26	220KV Fatehabad line-2	23:55:42	28.06.2023	R-ph	4.683	36.589	A/R sucessful
27	220KV Fatehabad line-2	23:05:25	19.10.2023	B-ph	12.85	8.779	AR Sucessful
28	220KV Fatehabad line-2	02:55:37	05.10.2023	B-ph	5.568	31.759	AR Sucessful
29	220KV Fatehabad line-2	19:51:17	04.10.2023	Y-Ph	5.476	31.132	AR Sucessful
30	220KV Fatehabad line-2	19:14:22	04.10.2023	B-ph	5.4	31.537	AR Sucessful
31	220KV Fatehabad line-2	19:42:25	21.09.2023	B-ph	4.689	38.896	AR Sucessful
32	220KV Fatehabad line-2	01:26:23	19.09.2023	Y Ph	3.983	45.762	AR Sucessful
33	220KV Fatehabad line-2	23:20:35	16.09.2023	R Ph	5.129	33.541	AR Sucessful
34	220KV Fatehabad line-2	03:31:00	13.08.2024	R Ph	5.846	25.173	AR Sucessful
35	220KV Fatehabad line-2	20:13	21.08.2024	B-ph	5.42	28.271	AR Sucessful
36	220KV Fatehabad line-2	19:48	24.08.2024	R Ph	6.443	20.774	AR Sucessful
37	220KV Fatehabad line-2	22:55:37	20.10.2024	B Ph	6.651	20.153	AR Sucessful
38	220KV Fatehabad line-2	09:20:27	24.10.2024	R Ph	8.189	13.559	Trip
39	220KV Fatehabad line-2	02:20:15	26.10.2024	B Ph	5.273	31.684	AR Sucessful
40	220KV Fatehabad line-2	19:34:04	30.10.2024	Y Ph	8.629	14.414	Trip
41	220KV Fatehabad line-2	01:23:36	02.11.2024	R Ph	8.254	14.553	Trip

अर्पित कुमार जैन/Arpit Kumar Jain
प्रबंधक/Manager
पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लि., हिसार
Power Grid Corporation Of India Ltd., Hisar

पावरग्रिड
POWERGRID
पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
400/220 KV Substation, V.P.O- Mayyar, NH-09, Distt.-Hisar (HARYANA)-125044,
E-mail: hisarssnr1@powergrid.co.in, Mob. 8295903705.
CIN No. L40101DL1989GOI038121

Ref:NR1/HISAR/HVPNL-FBD/2024/02

Date: 05.09.2024

To,
Superintendent Engineer
TS Circle, HVPNL
Vidyut Nagar, Hisar
Haryana-125044

Sub: Frequent A/R of 220kV Hisar (PG)- Fatehabad line-1 & 2 -reg

Ref:

1. Our regular intimation to XEN/AE-TL: Fatehabad over phone and e-mail
2. Our letter dated 03.08.2023 addressed to XEN, HVPNL Fatehabad
3. Our letter ref no. NR1/HISAR/HVPNL-FBD/ dtd. 05.09.2023 addressed to XEN, HVPNL Fatehabad.
4. Our letter ref no. NR1/HISAR/HVPNL-FBD/2024/01 Dtd. 12.08.2024 addressed to XEN, HVPNL Fatehabad

Dear Sir,

This has reference to our above letters and various recent tele discussions regarding frequent Auto reclose on the above said lines, owned by HVPNL. The frequency of auto reclose has increased in last couple of days, a total of 4 numbers Auto-reclose has been recorded in a single day, raising serious concern about healthiness of both lines for taking into service. These AR's are creating stress on our equipment's as fault feeding through our ICTs. These are also creating hotspots at various points in our 220kV Switchyard. Recent A/R and Tripping details (After last letter) are as follows:

Sl. No	Name of line	Date of tripping	Time of tripping	Phase	Fault current (KA)	Fault location (KM)	Remarks
1	220KV Fatehabad line-1	18.08.2024	20:52:00	Y Ph	4.136	33.479	AR Successful
2		**04.09.2024**	01:53:00	R PH	8.512	13.093	AR Successful
3			04:53	R PH	4.382	32.435	AR Successful
4			18:17	R PH	6.142	20.413	AR Successful
5			19:25:00	Y Ph	5.61	24.364	AR Successful
6		05.09.2024	10:52	R PH	6.037	20.6	Trip
7	220KV Fatehabad line-2	13.08.2024	03:31:00	R Ph	5.846	25.173	AR Successful
8		21.08.2024	20:13	B-ph	5.42	28.271	AR Successful
9		24.08.2024	19:48	R Ph	6.443	20.774	AR Successful

Also, past AR & tripping details are attached herewith this letter.
You are requested to take remedial measures to avoid such A/Rs on regular basis and inform this office. We will be required to review our A/R settings in case the problem is not addressed immediately.

Thanking you.

Yours faithfully,
05/9/24
Dinesh Chandra Nainwal
Sr. DGM/Hisar
POWERGRID

दिनेश चन्द्रा नैनवाल/Dinesh Chandra Nainwal
वरिष्ठ उप महा प्रबन्धक/Sr. D.G.M.
Power Grid Corporation of India
400/220, KV Sub Station
Mayyar, Hisar-125044 (Haryana)

Copy to 1. CGM (Cluster Head/ RHQ AM Faridabad)

2. Chief Engineer, TS, HVPNL,Hisar

3. Executive Engineer, HVPNL, 400kV Fatehabad

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD (HVPN) LINE-1

Sl No	Name of line	Time of tripping	Date of tripping	Phase	Fault current(KA)	Fault location(KM)	Remarks
1	220KV Fatehabad 1	05:23:00	02.08.2022	Rph	3.91	38.23	A/R sucessful
2	220KV Fatehabad 1	04:58	03.08.222	Yph	4.006	40.68	A/R sucessful
3	220KV Fatehabad 1	22:21	04.08.2022	Yph	4.05	34.96	A/R sucessful
4	220KV Fatehabad 1	12:17	08.08.2022	Yph	4.21	33.51	A/R sucessful
5	220KV Fatehabad 1	04:16	15.08.2022	Rph	8.9	15.37	A/R sucessful
6	220KV Fatehabad 1	05:45	15.08.2022	Rph	4.32	41.64	A/R sucessful
7	220KV Fatehabad 1	00:39	19.08.2022	Rph	5.65	23.3	A/R sucessful
8	220KV Fatehabad 1	00:39	19.08.2022	Rph	4.38	31.4	A/R sucessful
9	220KV Fatehabad 1	18:59	27.08.2022	Rph	6.83	18.7	A/R sucessful
10	220KV Fatehabad 1	14:41	05.09.2022	Rph	3.72	49.21	A/R sucessful
11	220KV Fatehabad 1	02:42	14.09.2022	Rph	4.05	36.96	A/R sucessful
12	220KV Fatehabad 1	06:01	19.09.2022	Rph	4.25	34.97	A/R sucessful
13	220KV Fatehabad 1	09:04	21.09.2022	Bph	4.39	35.26	Tripped
14	220KV Fatehabad 1	03:53	25.09.2022	Rph	4.86	31.76	A/R sucessful
15	220KV Fatehabad 1	05:34	27.09.2022	Rph	4.15	38.43	A/R sucessful
16	220KV Fatehabad 1	21:32	27.09.2022	Yph	4.59	32.55	A/R sucessful
17	220KV Fatehabad 1	21:31	27.09.2022	Rph	5.16	26.31	A/R sucessful
18	220KV Fatehabad 1	01:29	28.09.2022	Rph	5.35	32.81	A/R sucessful
19	220KV Fatehabad 1	19:31	29.09.2022	Rph	3.86	41.1	A/R sucessful
20	220KV Fatehabad 1	02:06	09.10.2022	Rph	4.65	32.61	A/R sucessful
21	220KV Fatehabad 1	20:25	09.10.2022	Rph	4.26	37.13	A/R sucessful
22	220KV Fatehabad 1	23:17	10.10.2022	Yph	3.97	47.77	A/R sucessful
23	220KV Fatehabad 1	00:36	11.10.2022	Rph	5.45	26.468	A/R sucessful
24	220KV Fatehabad 1	03:18	12.10.2022	Rph	4.318	37.69	A/R sucessful
25	220KV Fatehabad 1	16:07	13.10.2022	Rph	3.83	40.94	A/R sucessful
26	220KV Fatehabad line-1	05:41:50	12.09.2023	B-ph	10.026	10.688	A/R sucessful
27	220KV Fatehabad line-1	03:02:16	03.09.2023	B-ph	4.154	37.295	A/R sucessful
28	220KV Fatehabad line-1	13:39:13	09.08.2023	R-ph	5.086	29.214	A/R sucessful
29	220KV Fatehabad line-1	23:26:04	02.08.2023	B-ph	3.3	51.94	A/R sucessful
30	220KV Fatehabad line-1	20:36:57	30.07.2023	Y-ph	4.258	37.01	A/R sucessful
31	220KV Fatehabad line-1	04:36:09	30.07.2023	R-ph	4.405	34.864	A/R sucessful
32	220KV Fatehabad line-1	03:25:27	30.07.2023	R-ph	8.937	13.487	A/R sucessful
33	220KV Fatehabad line-1	01:24:13	26.07.2023	Y-ph	4.955	30.892	A/R sucessful
34	220KV Fatehabad line-1	00:01:28	26.07.2023	R-ph	4.766	32.682	A/R sucessful
35	220KV Fatehabad line-1	04:13:33	24.05.2023	B-ph	4.939	30.673	A/R sucessful
36	220KV Fatehabad line-1	12:34:45	07.12.2023	R-ph	3.38	50.973	AR Sucessful
37	220KV Fatehabad line-1	04:18:31	26.10.2023	B Ph	15.681	6.37	Trip
38	220KV Fatehabad line-1	05:54:23	20.10.2023	B-ph	3.884	46.48	AR Sucessful
39	220KV Fatehabad line-1	03:04:42	27.09.2023	R-Ph	9.922	12.724	Trip
40	220KV Fatehabad line-1	03:49:50	22.09.2023	R-Ph	7.264	19.219	AR Sucessful
41	220KV Fatehabad line-1	22:12:36	16.09.2023	Y ph	4.816	30.952	AR Sucessful
42	220KV Fatehabad line-1	21:06:06	19.02.2024	B-ph	4.749	32.711	Line tripped
43	220KV Fatehabad line-1	17:25:00	10.04.2024	Y ph	3.771	50.846	Re fault in re claim time and line got tripped.
44	220KV Fatehabad line-1	12:01	12.08.2024	Y Ph	7.518	15.458	Trip
45	220KV Fatehabad line-1	20:50	08.08.2024	R PH	5.822	22.026	AR Sucessful
46	220KV Fatehabad line-1	00:41	07.08.2024	Y Ph	5.586	23.223	AR Sucessful
47	220KV Fatehabad line-1	23:22:48	06.08.2024	B-ph	5.994	23.75	AR Sucessful
48	220KV Fatehabad line-1	05:12	27.07.2024	R PH	4.645	31.251	AR Sucessful
49	220KV Fatehabad line-1	20:52:00	18.08.2024	Y Ph	4.136	33.479	AR Sucessful
50	220KV Fatehabad line-1	01:53:00	04.09.2024	R PH	8.512	13.093	AR Sucessful
51	220KV Fatehabad line-1	04:53	04.09.2024	R PH	4.382	32.435	AR Sucessful
52	220KV Fatehabad line-1	18:17	04.09.2024	R PH	6.142	20.413	AR Sucessful
53	220KV Fatehabad line-1	19:25:00	04.09.2024	Y Ph	5.61	24.364	AR Sucessful
54	220KV Fatehabad line-1	10:52	05.09.2024	R PH	6.037	20.6	Trip

Dinesh C Naimal
Sr DGM

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD (HVPN) LINE-2

Sl No	Name of line	Time of tripping	Date of tripping	Phase	Fault current(KA)	Fault location(KM)	Remarks
1	220 KV Fatehabad 2	03:08:02	01.08.2022	Rph	4.8	38.64	A/R sucesssful
2	220 KV Fatehabad 2	20:39	11.08.2022	Bph	5.36	32.31	A/R sucesssful
3	220 KV Fatehabad 2	18:40	22.08.2022	Rph	8.34	13.8	A/R sucesssful
4	220 KV Fatehabad 2	19:42	29.08.2022	Bph	8.96	15.08	A/R sucesssful
5	220 KV Fatehabad 2	19:25	03.09.2022	Y & Bph	2.9,2.7	63.93	Tripped
6	220 KV Fatehabad 2	21:57	04.09.2022	Rph	3.77	36.67	A/R sucesssful
7	220 KV Fatehabad 2	19:48	11.09.2022	Rph	8.41	13.14	A/R sucesssful
8	220 KV Fatehabad 2	21:45	18.09.2022	Yph	5	31.12	A/R sucesssful
9	220 KV Fatehabad 2	22:10	20.09.2022	Rph	4.8	35.92	A/R sucesssful
10	220 KV Fatehabad 2	21:52	22.09.2022	Yph	4.17	34.77	A/R sucesssful
11	220 KV Fatehabad 2	23:51	22.09.2022	Rph	4.6	35.68	A/R sucesssful
12	220 KV Fatehabad 2	01:53	23.09.2022	Rph	4.67	30.14	A/R sucesssful
13	220 KV Fatehabad 2	02:49	23.09.2022	Rph	4.77	30.04	A/R sucesssful
14	221 KV Fatehabad 2	18:59	25.09.2022	Rph	4.37	41.44	A/R sucessful
15	222 KV Fatehabad 2	21:22	26.09.2022	Rph	5.84	26.13	A/R sucessful
16	222 KV Fatehabad 2	05:26	30.09.2022	Yph	5.31	32.91	A/R sucessful
17	222 KV Fatehabad 2	19:31	09.10.2022	Yph	6.3	26.31	A/R sucessful
18	220KV Fatehabad line-2	05:52:47	07.09.2023	R-ph	9.456	13.49	A/R sucessful
19	220KV Fatehabad line-2	23:37:10	06.09.2023	B-ph	5.668	29.744	A/R sucessful
20	220KV Fatehabad line-2	05:32:32	04.09.2023	B-ph	4.647	38.676	A/R sucessful
21	220KV Fatehabad line-2	21:11:26	04.08.2023	R-ph	4.533	39.227	A/R sucessful
22	220KV Fatehabad line-2	01:30:53	03.08.2023	Y-ph	9.595	12.698	A/R sucessful
23	220KV Fatehabad line-2	05:30:10	24.07.2023	Y-ph	4.769	37.98	A/R sucessful
24	220KV Fatehabad line-2	16:22:57	19.07.2023	R-ph	4.183	43.177	A/R sucessful
25	220KV Fatehabad line-2	02:09:16	29.06.2023	R-ph	4.735	38.082	A/R sucessful
26	220KV Fatehabad line-2	23:55:42	28.06.2023	R-ph	4.683	36.589	A/R sucessful
27	220KV Fatehabad line-2	23:05:25	19.10.2023	B-ph	12.85	8.779	AR Sucessful
28	220KV Fatehabad line-2	02:55:37	05.10.2023	B-ph	5.568	31.759	AR Sucessful
29	220KV Fatehabad line-2	19:51:17	04.10.2023	Y-Ph	5.476	31.132	AR Sucessful
30	220KV Fatehabad line-2	19:14:22	04.10.2023	B-ph	5.4	31.537	AR Sucessful
31	220KV Fatehabad line-2	19:42:25	21.09.2023	B-ph	4.689	38.896	AR Sucessful
32	220KV Fatehabad line-2	01:26:23	19.09.2023	Y Ph	3.983	45.762	AR Sucessful
33	220KV Fatehabad line-2	23:20:35	16.09.2023	R Ph	5.129	33.541	AR Sucessful
34	220KV Fatehabad line-2	03:31:00	13.08.2024	R Ph	5.846	25.173	AR Sucessful
35	220KV Fatehabad line-2	20:13	21.08.2024	B-ph	5.42	28.271	AR Sucessful
36	220KV Fatehabad line-2	19:48	24.08.2024	R Ph	6.443	20.774	AR Sucessful

Dinesh Chairman

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

400/220 KV Substation, V.P.O- Mayyar, NH-09, Distt.-Hisar (HARYANA)-125044,
E-mail: hisarssnr1@powergrid.co.in, Mob. 8295903705.
CIN No. L40101DL1989GOI038121

Ref:NR1/HISAR/HVPNL-FBD/2024/01 Date: 12.08.2024

To,
XEN, HVPNL
Vidyut Nagar
HVPNL, Hiar.

Sub: Frequent A/R of 220kV Hisar (PG)- Fatehabad line-1 & 2 -reg

Ref: 1.our regular intimation to AE/TL/Fatehabad over phone and e-mail
2. Our letter dated 03.08.2023 addressed to you(Copy attached)
3.Our letter ref no. NR1/HISAR/HVPNL-FBD/ dtd. 05.09.2023 addressed to you (Copy attached).

Dear Sir,

This has reference to our letter dated 23.10.2023 and various recent tele discussions regarding frequent Auto reclose on the above said lines, owned by HVPNL. The frequency of auto reclose has increased in last days, a total of 4-5 numbers Auto-reclose & Tripping has been recorded in last one month. These AR & Tripping's are creating stress on our equipment's as fault feeding through our ICTs. These are also creating hotspots at various points in our 220kV Switchyard. Recent A/R and Tripping details are as follows:

Sl. No	Name of line	Time of tripping	Date of tripping	Phase	Fault current (KA)	Fault location (KM)	Remarks
1	220KV Fatehabad line-1	12:01	12.08.2024	Y Ph	7.518	15.458	Trip
2		20:50	08.08.2024	R PH	5.822	22.026	AR Successful
3		00:41	07.08.2024	Y Ph	5.586	23.223	AR Successful
4		23:22:48	06.08.2024	B-ph	5.994	23.75	AR Successful
5		05:12	27.07.2024	R PH	4.645	31.251	AR Successful

Also, Last 02-years AR & tripping details are attached herewith this letter.
You are requested to take remedial measures to avoid such A/Rs on regular basis and inform this office. We will be required to review our A/R settings in case the problem is not addressed immediately.

Thanking you.

Yours faithfully,

12/8/2024
Dinesh Chandra Nainwal
Sr. DGM/Hisar
POWERGRID

दिनेश चन्द्रा नैनवाल/Dinesh Chandra Nainwal
वरिष्ठ उप महा प्रबन्धक/Sr. D.G.M.
Power Grid Corporation of India
400/220. KV Sub Station
Mayyar, Hisar-125044 (Haryana)

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD (HVPN) LINE-1

Sl No	Name of line	Time of tripping	Date of tripping	Phase	Fault current(KA)	Fault location(KM)	Remarks
1	220KV Fatehabad 1	05:23:00	02.08.2022	Rph	3.91	38.23	A/R sucessful
2	220KV Fatehabad 1	04:58	03.08.222	Yph	4.006	40.68	A/R sucessful
3	220KV Fatehabad 1	22:21	04.08.2022	Yph	4.05	34.96	A/R sucessful
4	220KV Fatehabad 1	12:17	08.08.2022	Yph	4.21	33.51	A/R sucessful
5	220KV Fatehabad 1	04:16	15.08.2022	Rph	8.9	15.37	A/R sucessful
6	220KV Fatehabad 1	05:45	15.08.2022	Rph	4.32	41.64	A/R sucessful
7	220KV Fatehabad 1	00:39	19.08.2022	Rph	5.65	23.3	A/R sucessful
8	220KV Fatehabad 1	00:39	19.08.2022	Rph	4.38	31.4	A/R sucessful
9	220KV Fatehabad 1	18:59	27.08.2022	Rph	6.83	18.7	A/R sucessful
10	220KV Fatehabad 1	14:41	05.09.2022	Rph	3.72	49.21	A/R sucessful
11	220KV Fatehabad 1	02:42	14.09.2022	Rph	4.05	36.96	A/R sucessful
12	220KV Fatehabad 1	06:01	19.09.2022	Rph	4.25	34.97	A/R sucessful
13	220KV Fatehabad 1	09:04	21.09.2022	Bph	4.39	35.26	Tripped
14	220KV Fatehabad 1	03:53	25.09.2022	Rph	4.86	31.76	A/R sucessful
15	220KV Fatehabad 1	05:34	27.09.2022	Rph	4.15	38.43	A/R sucessful
16	220KV Fatehabad 1	21:32	27.09.2022	Yph	4.59	32.55	A/R sucessful
17	220KV Fatehabad 1	21:31	27.09.2022	Rph	5.16	26.31	A/R sucessful
18	220KV Fatehabad 1	01:29	28.09.2022	Rph	5.35	32.81	A/R sucessful
19	220KV Fatehabad 1	19:31	29.09.2022	Rph	3.86	41.1	A/R sucessful
20	220KV Fatehabad 1	02:06	09.10.2022	Rph	4.65	32.61	A/R sucessful
21	220KV Fatehabad 1	20:25	09.10.2022	Rph	4.26	37.13	A/R sucessful
22	220KV Fatehabad 1	23:17	10.10.2022	Yph	3.97	47.77	A/R sucessful
23	220KV Fatehabad 1	00:36	11.10.2022	Rph	5.45	26.468	A/R sucessful
24	220KV Fatehabad 1	03:18	12.10.2022	Rph	4.318	37.69	A/R sucessful
25	220KV Fatehabad 1	16:07	13.10.2022	Rph	3.83	40.94	A/R sucessful
26	220KV Fatehabad line-1	05:41:50	12.09.2023	B-ph	10.026	10.688	A/R sucessful
27	220KV Fatehabad line-1	03:02:16	03.09.2023	B-ph	4.154	37.295	A/R sucessful
28	220KV Fatehabad line-1	13:39:13	09.08.2023	R-ph	5.086	29.214	A/R sucessful
29	220KV Fatehabad line-1	23:26:04	02.08.2023	B-ph	3.3	51.94	A/R sucessful
30	220KV Fatehabad line-1	20:36:57	30.07.2023	Y-ph	4.258	37.01	A/R sucessful
31	220KV Fatehabad line-1	04:36:09	30.07.2023	R-ph	4.405	34.864	A/R sucessful
32	220KV Fatehabad line-1	03:25:27	30.07.2023	R-ph	8.937	13.487	A/R sucessful
33	220KV Fatehabad line-1	01:24:13	26.07.2023	Y-ph	4.955	30.892	A/R sucessful
34	220KV Fatehabad line-1	00:01:28	26.07.2023	R-ph	4.766	32.682	A/R sucessful
35	220KV Fatehabad line-1	04:13:33	24.05.2023	B-ph	4.939	30.673	A/R sucessful
36	220KV Fatehabad line-1	12:34:45	07.12.2023	R-ph	3.38	50.973	AR Sucessful
37	220KV Fatehabad line-1	04:18:31	26.10.2023	B Ph	15.681	6.37	Trip
38	220KV Fatehabad line-1	05:54:23	20.10.2023	B-ph	3.884	46.48	AR Sucessful
39	220KV Fatehabad line-1	03:04:42	27.09.2023	R-Ph	9.922	12.724	Trip
40	220KV Fatehabad line-1	03:49:50	22.09.2023	R-Ph	7.264	19.219	AR Sucessful
41	220KV Fatehabad line-1	22:12:36	16.09.2023	Y ph	4.816	30.952	AR Sucessful
42	220KV Fatehabad line-1	21:06:06	19.02.2024	B-ph	4.749	32.711	Line tripped
43	220KV Fatehabad line-1	17:25:00	10.04.2024	Y ph	3.771	50.846	Re fault in re claim time and line got tripped.
44	220KV Fatehabad line-1	12:01	12.08.2024	Y Ph	7.518	15.458	Trip
45	220KV Fatehabad line-1	20:50	08.08.2024	R PH	5.822	22.026	AR Sucessful
46	220KV Fatehabad line-1	00:41	07.08.2024	Y Ph	5.586	23.223	AR Sucessful
47	220KV Fatehabad line-1	23:22:48	06.08.2024	B-ph	5.994	23.75	AR Sucessful
48	220KV Fatehabad line-1	05:12	27.07.2024	R PH	4.645	31.251	AR Sucessful

Verified

अर्पित कुमार जैन/Arpit Kumar Jain
प्रबंधक/Manager
पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लि., हिसार
Power Grid Corporation Of India Ltd., Hisar

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD (HVPN) LINE-2

Sl No	Name of line	Time of tripping	Date of tripping	Phase	Fault current(KA)	Fault location(KM)	Remarks
1	220 KV Fatehabad 2	03:08:02	01.08.2022	Rph	4.8	38.64	A/R sucessful
2	220 KV Fatehabad 2	20:39	11.08.2022	Bph	5.36	32.31	A/R sucessful
3	220 KV Fatehabad 2	18:40	22.08.2022	Rph	8.34	13.8	A/R sucessful
4	220 KV Fatehabad 2	19:42	29.08.2022	Bph	8.96	15.08	A/R sucessful
5	220 KV Fatehabad 2	19:25	03.09.2022	Y & Bph	2.9,2.7	63.93	Tripped
6	220 KV Fatehabad 2	21:57	04.09.2022	Rph	3.77	36.67	A/R sucessful
7	220 KV Fatehabad 2	19:48	11.09.2022	Rph	8.41	13.14	A/R sucessful
8	220 KV Fatehabad 2	21:45	18.09.2022	Yph	5	31.12	A/R sucessful
9	220 KV Fatehabad 2	22:10	20.09.2022	Rph	4.8	35.92	A/R sucessful
10	220 KV Fatehabad 2	21:52	22.09.2022	Yph	4.17	34.77	A/R sucessful
11	220 KV Fatehabad 2	23:51	22.09.2022	Rph	4.6	35.68	A/R sucessful
12	220 KV Fatehabad 2	01:53	23.09.2022	Rph	4.67	30.14	A/R sucessful
13	220 KV Fatehabad 2	02:49	23.09.2022	Rph	4.77	30.04	A/R sucessful
14	221 KV Fatehabad 2	18:59	25.09.2022	Rph	4.37	41.44	A/R sucessful
15	222 KV Fatehabad 2	21:22	26.09.2022	Rph	5.84	26.13	A/R sucessful
16	222 KV Fatehabad 2	05:26	30.09.2022	Yph	5.31	32.91	A/R sucessful
17	222 KV Fatehabad 2	19:31	09.10.2022	Yph	6.3	26.31	A/R sucessful
18	220KV Fatehabad line-2	05:52:47	07.09.2023	R-ph	9.456	13.49	A/R sucessful
19	220KV Fatehabad line-2	23:37:10	06.09.2023	B-ph	5.668	29.744	A/R sucessful
20	220KV Fatehabad line-2	05:32:32	04.09.2023	B-ph	4.647	38.676	A/R sucessful
21	220KV Fatehabad line-2	21:11:26	04.08.2023	R-ph	4.533	39.227	A/R sucessful
22	220KV Fatehabad line-2	01:30:53	03.08.2023	Y-ph	9.595	12.698	A/R sucessful
23	220KV Fatehabad line-2	05:30:10	24.07.2023	Y-ph	4.769	37.98	A/R sucessful
24	220KV Fatehabad line-2	16:22:57	19.07.2023	R-ph	4.183	43.177	A/R sucessful
25	220KV Fatehabad line-2	02:09:16	29.06.2023	R-ph	4.735	38.082	A/R sucessful
26	220KV Fatehabad line-2	23:55:42	28.06.2023	R-ph	4.683	36.589	A/R sucessful
27	220KV Fatehabad line-2	23:05:25	19.10.2023	B-ph	12.85	8.779	AR Sucessful
28	220KV Fatehabad line-2	02:55:37	05.10.2023	B-ph	5.568	31.759	AR Sucessful
29	220KV Fatehabad line-2	19:51:17	04.10.2023	Y-Ph	5.476	31.132	AR Sucessful
30	220KV Fatehabad line-2	19:14:22	04.10.2023	B-ph	5.4	31.537	AR Sucessful
31	220KV Fatehabad line-2	19:42:25	21.09.2023	B-ph	4.689	38.896	AR Sucessful
32	220KV Fatehabad line-2	01:26:23	19.09.2023	Y Ph	3.983	45.762	AR Sucessful
33	220KV Fatehabad line-2	23:20:35	16.09.2023	R Ph	5.129	33.541	AR Sucessful

Verified

अर्पित कुमार जैन/Arpit Kumar Jain
प्रबंधक/Manager
पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लि., हिसार
Power Grid Corporation Of India Ltd., Hisar

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

400/220 KV Substation, V.P.O- Mayyar, NH-09, Distt.-Hisar (HARYANA)-125044.
E-mail: hisarssnr1@powergrid.co.in, Mob. 8295903705.
CIN No. L40101DL1989GOI038121

Ref:NR1/HISAR/HVPNL-FBD/ **Date: 05.09.2023.**

To:
XEN, HVPNL
Vidyut Nagar
HVPNL, Hiar.

Sub: Frequent A/R of 220kV Hisar(PG)- Fatehabad line-1 & 2 -reg

Ref: 1.our regular intimation to AE/TL/Fatehabad over phone and e-mail
2. Our letter dated 14.10.2022 & 03.08.2023 addressed to you.

Dear Sir,

In continuation of our earlier communication, it is once again requested to find out the root cause of frequent auto-reclosures in the 200kV Fatheabad-1 and 2. In the stating week of September 23, two numbers auto reclosure has occurred.

From the beginning of this Financial year total 16(Sixteen) numbers of auto-reclosed has been noticed. Frequent Auto reclosure causing hot-spot in our 220kV Yard and we are continuously changing terminal connectors on account of this. Besides un-necessary stress on transformer, Circuit Breakers and other equipments

You are once again requested to take necessary measure to control the auto-reclosure.

Thanking you,

Yours faithfully,

Dinesh Chandra Nainwal
Sr.DGM/Hisar

दिनेश चंद्र नैनवाल
Dinesh Chandra Nainwal
Sr. Dy. General Manager
Powergrid Corporation of India Ltd.
400/220 KV S/S
Delhi-Hisar NH-9, V.P.O. Mayar
Hisar (HR) - 125044

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

400/220 KV Substation, V.P.O- Mayyar, NH-09, Distt.-Hisar (HARYANA)-125044.
E-mail: hisarssnr1@powergrid.co.in, Mob. 8295903705.
CIN No. L40101DL1989GOI038121

Ref:NR1/HISAR/HVPNL-FBD/ Date: 03.08.2023.

To,
XEN, HVPNL
Vidyut Nagar
HVPNL, Hiar.

Sub: Frequent A/R of 220kV Hisar (PG)- Fatehabad line-1 & 2 -reg

Ref: 1.our regular intimation to AE/TL/Fatehabad over phone and e-mail
2. Our letter dated 14.10.2022 addressed to you.

Dear Sir,

This has reference to our letter dated 14.10.2022 and meeting held in your office in regard to frequent Auto reclose on the above said lines, owned by HVPNL. The frequency of auto reclose has increased in last 2 months, a total of 11 numbers Auto-reclose has been recorded. The above Auto-reclose are creating stress on our equipments as fault feeding through our ICTs. This is also creating hotspots at various points in our 220kV Switchyard.

You are requested to take remedial measures to avoid such A/Rs on regular basis and inform this office. We will required to review our A/R settings in case the problem is not attended.

Thanking you,

Yours faithfully,

Encl:- List of A/R

Dinesh Chandra Nainwal
Sr. DGM/Hisar

दिनेश चंद्र नैनवाल
Dinesh Chandra Nainwal
Sr. Dy. General Manager
Powergrid Corporation of India Ltd.
400/220 KV S/S
Delhi-Hisar NH-9, V.P.O. Mayar
Hisar (HR) - 125044

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD (HVPN) LINE-1 WEF 01.04.2023

Sl No	Name of line	Time of tripping	Date of tripping	Phase	Fault current(K	Fault location(KM)	Remarks
1	220KV Fatehabad line-1	23:26:04	02.08.2023	B-ph	3.3	51.94	
2	220KV Fatehabad line-1	20:36:57	30.07.2023	Y-ph	4.258	37.01	
3	220KV Fatehabad line-1	4:36:09	30.07.2023	R-ph	4.405	34.864	
4	220KV Fatehabad line-1	3:25:27	30.07.2023	R-ph	8.937	13.487	
5	220KV Fatehabad line-1	1:24:13	26.07.2023	Y-ph	4.955	30.892	
6	220KV Fatehabad line-1	0:01:28	26.07.2023	R-ph	4.766	32.682	
7	220KV Fatehabad line-1	4:13:33	24.05.2023	B-ph	4.939	30.673	

शिवप्रसाद G
03/08/2023

जी शिव प्रसाद/G Siva Parsad
उप प्रबंधक/Deputy Manager
Power Grid Corporation of India Ltd.
400/220 KV Sub Station
Mayyar Hisar Haryana-125044

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD (HVPN) LINE-2 W.E.F 01.04.2023

Sl No	Name of line	Time of tripping	Date of tripping	Phase	Fault current(KA)	Fault location(KM)	Remarks
1	220KV Fatehabad line-2	1:30:53	03.08.2023	Y-ph	9.595	12.698	
2	220KV Fatehabad line-2	5:30:10	24.07.2023	Y-ph	4.769	37.98	
3	220KV Fatehabad line-2	16:22:57	19.07.2023	R-ph	4.183	43.177	
4	220KV Fatehabad line-2	2:09:16	29.06.2023	R-ph	4.735	38.082	
5	220KV Fatehabad line-2	23:55:42	28.06.2023	R-ph	4.683	36.589	

शिवप्रसाद 03/08/23

जी शिव प्रसाद/G Siva Parsad
उप प्रबंधक/Deputy Manager
Power Grid Corporation of India Ltd.
400/220 KV Sub Station
Mayyar Hisar Haryana-125044

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
400/220 KV Substation, V.P.O- Mayyar, NH-09, Distt.-Hisar (HARYANA)-125044,
E-mail: hisarssnr1@powergrid.co.in, Mob. 8295903705,
CIN No. L40101DL1989GOI038121

Ref:NR1/HISAR/HVPNL-FBD/

Date: 14.10.2022.

To:
XEN, HVPNL
Vidyut Nagar
HVPNL, Hiar.

Sub: Frequent A/R of 220kV Hisar(PG)- Fatehabad line-1 & 2 -reg

Ref: our regular intimation to AE/TL/Fatehabad over phone and e-mail- reg

Dear Sir,

220kV Hisar(PG)-Fathehabad ckt-1 and ckt-2 lines are getting A/R on regular basis. In the last two months, there are 42 A/R operations on the both the lines, which is creating stress on the equipment and fault feeding through our ICTs.
You are requested to take remedial measures to avoid such A/Rs on regular basis.

Thanking you,

Yours faithfully,

Dinesh Chandra Nainwal
DGM/Hisar

Received
Sd/
14/10/22
H - Sunil Kumar

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD LINE-1

Sr no.	Name of line	Time of Triping	Date of triping	Phase	Fault current(KA)	Fault location(KM	Remarks
1	220KV Fatehabad 1	5:23:00	02.08.2022	Rph	3.91	38.23	A/R sucessful
2	220KV Fatehabad 1	4:58	03.08.222	Yph	4.006	40.68	A/R sucessful
3	220KV Fatehabad 1	22:21	04.08.2022	Yph	4.05	34.96	A/R sucessful
4	220KV Fatehabad 1	12:17	08.08.2022	Yph	4.21	33.51	A/R sucessful
5	220KV Fatehabad 1	4:16	15.08.2022	Rph	8.9	15.37	A/R sucessful
6	220KV Fatehabad 1	5:45	15.08.2022	Rph	4.32	41.64	A/R sucessful
7	220KV Fatehabad 1	0:39	19.08.2022	Rph	5.65	23.3	A/R sucessful
8	220KV Fatehabad 1	0:39	19.08.2022	Rph	4.38	31.4	A/R sucessful
9	220KV Fatehabad 1	18:59	27.08.2022	Rph	6.83	18.7	A/R sucessful
10	220KV Fatehabad 1	14:41	05.09.2022	Rph	3.72	49.21	A/R sucessful
11	220KV Fatehabad 1	2:42	14.09.2022	Rph	4.05	36.96	A/R sucessful
12	220KV Fatehabad 1	6:01	19.09.2022	Rph	4.25	34.97	A/R sucessful
13	220KV Fatehabad 1	9:04	21.09.2022	Bph	4.39	35.26	Tripped
14	220KV Fatehabad 1	3:53	25.09.2022	Rph	4.86	31.76	A/R sucessful
15	220KV Fatehabad 1	5:34	27.09.2022	Rph	4.15	38.43	A/R sucessful
16	220KV Fatehabad 1	21:32	27.09.2022	Yph	4.59	32.55	A/R sucessful
17	220KV Fatehabad 1	21:31	27.09.2022	Rph	5.16	26.31	A/R sucessful
18	220KV Fatehabad 1	1:29	28.09.2022	Rph	5.35	32.81	A/R sucessful
19	220KV Fatehabad 1	19:31	29.09.2022	Rph	3.86	41.1	A/R sucessful
20	220KV Fatehabad 1	2:06	09.10.2022	Rph	4.65	32.61	A/R sucessful
21	220KV Fatehabad 1	20:25	09.10.2022	Rph	4.26	37.13	A/R sucessful
22	220KV Fatehabad 1	23:17	10.10.2022	Yph	3.97	47.77	A/R sucessful
23	220KV Fatehabad 1	0:36	11.10.2022	Rph	5.45	26.468	A/R sucessful
24	220KV Fatehabad 1	3:18	12.10.2022	Rph	4.318	37.69	A/R sucessful
25	220KV Fatehabad 1	16:07	13.10.2022	Rph	3.83	40.94	A/R sucessful

शिवप्रसाद G

G. SIVA PRASAD

Dy Manager

जी शिव प्रसाद/G Siva Parsad
उप प्रबंधक/Deputy Manager
Power Grid Corporation of India Ltd.
400/220 KV Sub Station
Mayyar Hisar Haryana-125044

TRIPPING DETAILS OF 220KV HISAR(PG)-FATEHABAD LINE-2

Sr no.	Name of Line	Time of Triping	Date of triping	Phase	Fault current(KA)	Fault location(KM)	Remarks
1	220 KV Fatehabad 2	3:08:02	01.08.2022	Rph	4.8	38.64	A/R sucesssful
2	220 KV Fatehabad 2	20:39	11.08.2022	Bph	5.36	32.31	A/R sucesssful
3	220 KV Fatehabad 2	18:40	22.08.2022	Rph	8.34	13.8	A/R sucesssful
4	220 KV Fatehabad 2	19:42	29.08.2022	Bph	8.96	15.08	A/R sucesssful
5	220 KV Fatehabad 2	19:25	03.09.2022	Y & Bph	2.9,2.7	63.93	Tripped
6	220 KV Fatehabad 2	21:57	04.09.2022	Rph	3.77	36.67	A/R sucesssful
7	220 KV Fatehabad 2	19:48	11.09.2022	Rph	8.41	13.14	A/R sucesssful
8	220 KV Fatehabad 2	21:45	18.09.2022	Yph	5	31.12	A/R sucesssful
9	220 KV Fatehabad 2	22:10	20.09.2022	Rph	4.8	35.92	A/R sucesssful
10	220 KV Fatehabad 2	21:52	22.09.2022	Yph	4.17	34.77	A/R sucesssful
11	220 KV Fatehabad 2	23:51	22.09.2022	Rph	4.6	35.68	A/R sucesssful
12	220 KV Fatehabad 2	1:53	23.09.2022	Rph	4.67	30.14	A/R sucesssful
13	220 KV Fatehabad 2	2:49	23.09.2022	Rph	4.77	30.04	A/R sucesssful
14	221 KV Fatehabad 2	18:59	25.09.2022	Rph	4.37	41.44	A/R sucessful
15	222 KV Fatehabad 2	21:22	26.09.2022	Rph	5.84	26.13	A/R sucessful
16	222 KV Fatehabad 2	5:26	30.09.2022	Yph	5.31	32.91	A/R sucessful
17	222 KV Fatehabad 2	19:31	09.10.2022	Yph	6.3	26.31	A/R sucessful

शिवप्रसाद
G. SIVA PRASAD
Dy Manager
जी शिव प्रसाद/G Siva Parsad
उप प्रबंधक/Deputy Manager
Power Grid Corporation of India Ltd.
400/220 KV Sub Station
Mayyar Hisar Haryana-125044

Outlook

Frequent Faults on the 220kV Hisar-Fatehabad Lines

From Pankaj Kumar Jha {पंकज कुमार झा} <pankaj.jha@powergrid.in>

Date Mon 2024-12-02 16:53

To setshsr@hvpn.org.in <setshsr@hvpn.org.in>; cetshsr@hvpn.org.in <cetshsr@hvpn.org.in>; xentshsr@hvpn.org.in <xentshsr@hvpn.org.in>; xenomhsr@bbmb.nic.in <xenomhsr@bbmb.nic.in>; ddpntbwn1@gmail.com <ddpntbwn1@gmail.com>; xenomhsr@bbmb.nic.in <xenomhsr@bbmb.nic.in>; seombwn@bbmb.nic.in <seombwn@bbmb.nic.in>

Cc dharmendra.cea@gov.in <dharmendra.cea@gov.in>; pandeyr.cea@gov.in <pandeyr.cea@gov.in>; ms-nrpc@nic.in <ms-nrpc@nic.in>; seo-nrpc@nic.in <seo-nrpc@nic.in>; lokesh.cea@gov.in <lokesh.cea@gov.in>; deepak.kr@grid-india.in <deepak.kr@grid-india.in>; nrldcso2@grid-india.in <nrldcso2@grid-india.in>; somara.lakra@grid-india.in <somara.lakra@grid-india.in>; rtamc.nr1 <rtamc.nr1@powergrid.in>; Vishal Roy {विशाल रॉय} <vishal.roy@powergrid.in>; Kuleshwar Sahu {कुलेश्वर साहू} <kuleshwar@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; Ankit Bhargava {अंकित भार्गव} <ram.ankit05@powergrid.in>; Kritika Chopra {कृतिका चोपड़ा} <kritika.chopra@powergrid.in>; M Thirumala Reddy {एम. तिरूमाला रेड्डी} <thirumalareddy@powergrid.in>; Ravindra Nath Gupta {आर.एन. गुप्ता} <ravindrangupta@powergrid.in>; ccprotection <ccprotection@powergrid.in>; Ravi Wadyalkar {रवि अशोक वाड्यालकर} <wravi@powergrid.in>; Ankit Vaish {अंकित वैश्य} <ankit_vaish@powergrid.in>; Dinesh Chandra Nainwal {दिनेश चन्द्र नैनवाल} <nainwal@powergrid.in>

3 attachments (12 MB)

Letter_HVPNL_02.12.2024_Frequent Tripping.pdf; E-mail_Grid India_05.09.2024.pdf; Copy of letters to HVPLN from Hissar Substation.pdf;

Dear Sir,

Please find attached a letter regarding the frequent faults on the 220kV Hisar-Fatehabad lines. This refers to multiple communications concerning the recurring auto-reclosing and tripping incidents on the 220kV Hisar-Fatehabad lines, with over 60 faults on Line-1 and 45 on Line-2 in the past two years.

These frequent faults have caused significant damage to conductors and switching equipment in the 220kV switchyard at the Hisar Substation. Despite our previous requests, the issue remains unresolved. We kindly request that a thorough investigation be conducted and immediate corrective action be taken.

If this issue is not addressed soon, POWERGRID may need to review its AR settings.

We look forward to your prompt response.

Warm Regards

Pankaj Kumar Jha
Chief Manager (Asset Management)
Power Grid Corporation of India Limited
Regional Headquarters, Northern Region-1
SCO Bay No.5 -10, Sector-16A, Faridabad, Haryana-121002
Mob: +919634440125

S.No.	Element Name	Months							Total (Since June 2024 to till now, 6.5 months)
		Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	
1	220kV Shamli - Baghpat(PG) line	0	3 (3 out of 3 AR at UP end)	1 (1 out of 1 AR at UP end)	2 (2 out of 2 AR at UP end)	2 (2 out of 2 AR at UP end)	0	0	8 (8 out of 8 AR at UP end)
2	220kV Shamli - Saharanpur (PG) line	2 (2 out of 2 AR at UP end)	2 (2 out of 2 AR at UP end)	4 (4 out of 4 AR at UP end)	7 (7 out of 7 AR at UP end)	6 (5 out of 6 AR at UP end)	1 (1 out of 1 AR at UP end)	0	22 (21 out of 22 AR at UP end)
3	220kV Nara - Meerut (PG) line	0	0	1 (Bus bar protection at Nara)	2 (1 Bus bar protection at Nara and 1 line fault)	1	0	1	5 (2 bus faults at Nara 3 line faults)
4	220kV Khara - Saharanpur (PG) line	5	5	3	6	1	0	0	20 trippings
5	220kV Mandolavihar - Baghpat (PG) line	As per PG data approx 3 trippings in 2 months (since last two years)							
6	220kV Modipuram - Baghpat (PG) ckt - I	As per PG data approx 5 trippings in 4 months (since last two years)							

Sl. No.	Name of Line/Trans. Equip.	Trippings	Restoration	UPPTCL End	
		Date & Time	Date & Time	Flags	AR Status
Jun-24					
	220 kV Shamli - Saharanpur (PG) line	6/10/2024 20:23	6/10/2024 22:34	B Phase to Ground Fault, 56.683 km (88.901 %), 3.03 kA	
	220 kV Shamli - Saharanpur (PG) line	6/30/2024 20:56	6/30/2024 22:17	Line tripped on L-G fault in B-ph. Distance protection operated, M1- Operated M2- Operated M1 Details: IB = 3.990 kA, IN = 3.86 kA Location – 33.8 KM M2 Details: IB = 4.115 kA, Location – 33.85 KM	
2	220kV Shamli - Muzaffarnagar line	6/17/2024 9:50	6/17/2024 10:24	Bus Bar Protection Operated	
Jul-24					
1	220kV Shamli - Muzaffarnagar line	7/4/2024 5:14	7/4/2024 6:16	B-Phase, Zone-2, Dis 4.857KM, FC 3.673 KA	
6	220kV Shamli - Muzaffarnagar line	7/26/2024 5:20	7/26/2024 13:02	Insulator broken of Y-Phase at Tower No 141	
2	220 kV Shamli - Saharanpur (PG) line	7/12/2024 22:55	7/12/2024 23:08	R.Phase Z-1 Dis-3.13 IB 11.3 KA	
7	220 kV Shamli - Saharanpur (PG) line	7/26/2024 21:34	7/26/2024 23:15	R-Phase, Zone-1, Dist-3km	
3	220 kV Shamli - Baghpat (PG) line	7/14/2024 3:37	7/14/2024 5:05	B-Phase, Z-1, Dis-22KM, F/C 3KA	
5	220 kV Shamli - Baghpat (PG) line	7/24/2024 6:38	7/24/2024 7:58	Transient fault	
8	220 kV Shamli - Baghpat (PG) line	7/29/2024 7:54	7/29/2024 9:22	Transient Fault	
Aug-24					
1	220 kV Shamli - Saharanpur (PG) line	8/1/2024 3:37	8/1/2024 7:07	1optd, A/R optd, carrier /DT send ,R phase,F/D=78.29ms, RTT=79.95ms, F/L=20.97 Km iA = 4.707 ka	AR operated sucessfully
2		8/11/2024 22:09	8/11/2024 23:58	z-1optd, A/R optd, carrier /DT send ,R phase,F/D= 83.40ms, RTT=80.06ms, F/L=2.799 Km iA = 11.32 ka	AR operated sucessfully
3		8/13/2024 5:13	8/13/2024 7:52	M-1= z-1optd, A/R optd, carrier /DT send ,Y phase,F/D=73.38 ms, RTT=80.05ms, F/L=43.44 Km iB = 2.677 ka	AR operated sucessfully
4		8/17/2024 23:58	8/18/2024 2:06	M-1= z-1optd, A/R optd, carrier /DT send ,B phase,F/D=71.57 ms, RTT=79.89ms, F/L=21.14 Km iC = 4.461 ka	AR operated sucessfully
5	220 kV Modipuram (II) - Baghpat PG ckt-I	8/4/2024 1:29	8/4/2024 2:32	CN Tripped phase, Z-1 , Fault Location = 21.04 km	AR operated sucessfully
6	220 kV Mandola Vihar - Baghpat (PG) line	8/6/2024 19:08	8/6/2024 20:53	ZONE-1,TRIP PHASE-C, Ia- 392.6A, Ib- 392.6A, Ic- 392.6A	Final trip both end
7	220 kV Shamli - Baghpat (PG) line	8/25/2024 3:20	8/25/2024 6:16	main 1=z-1, A/R close, y phase, N, put-76 ms,trip time-0 ms, Dist-28.9km, il2= 3.62 ka	AR operated sucessfully

8	220 kV Baghpat-Baghpat PG ckt-II line	8/28/2024 5:20	8/28/2024 7:00	Z1, Y-ph, Distance-2.8Km, IY - 6331.35A	Final trip both end Y-phase disk flash found at tower no.9
Sep-24					
1		9/8/2024 20:54	9/8/2024 22:22	Main-1 A/R optd,z-1,Trip,B phase,carrier/DT send,fault duration-81.64 ms,Relay trip time 79.98 ms, Distance 9.280 km,fault current ic= 7.920 ka	AR operated sucessfully
2		9/11/2024 4:55	9/11/2024 7:15	Main-1 A/R optd,z-1,Trip,B phase,carrier/DT send,fault duration-83.32 ms,Relay trip time 79.99 ms, Distance 7.588 km,fault current ic= 8.673 ka	AR operated sucessfully
3		9/12/2024 23:29	8/13/2024 0:49	B phase , Zone 1 Dist : 7.597 km	AR operated sucessfully
4	220 kV Shamli - Saharanpur (PG) line	9/26/2024 19:45	9/26/2024 21:54	A/R optd,z-1,Trip,Y phase,carrier/DT send,fault duration-68.25 ms,Relay trip time 79.90 ms, Distance - 16.11 km,fault current ib= 5.530 ka.	AR operated sucessfully
5		9/28/2024 8:05	9/28/2024 9:32	ain-1 A/R optd,z-1,Trip,Y phase,carrier/DT send,fault duration=70.25 ms,Relay trip time 80.29 ms, fault Location=8.975 km,fault current ib= 8.081 ka Other end trip DISC FLASH OF Y PHASE AT TOWER NO 153	AR operated sucessfully
6		9/29/2024 2:24	9/29/2024 5:47	Main-1 A/R optd,z-1,Trip,Y phase,carrier/DT send,fault duration=78.41 ms,Relay trip time 80.08 ms, fault Location=9.631 km,fault current ib= 8.054 ka DISC FLASH OF Y PHASE AT TOWER NO 52	AR operated sucessfully
7		9/30/2024 1:04	9/30/2024 1:52	Main-1 A/R optd,z-1,Trip,B phase,carrier/DT send,fault duration=81.64 ms,Relay trip time 79.97 ms, fault Location=9.487 km,fault current IC= 7.853ka DISC FLASH OF B PHASE AT TOWER NO 153	AR operated sucessfully
8		9/13/2024 18:56	9/13/2024 19:53	M1 Distance 1.2km, Phase R-G, Fault current 19.14kA, Z-1 M2 Distance 1.2km, Phase L1-N, Fault current 19.31kA, Z-1	AR operated sucessfully
	220 kV Shamli - Baghpat (PG) line	9/29/2024 9:23	9/29/2024 11:44	main 1=z-1, A/R close, Y phase, N, pu time=80 ms,trip time- 1 ms, Distance 27.4km, fault current il2= 3.66ka	AR operated sucessfully
9	220 kV Baghpat-Baghpat PG ckt - I	9/6/2024 22:52	9/6/2024 23:00	Trip Z1, YG trip, type 1, pole Y, Distance - 10.73Km, IY - 6800A	AR operated sucessfully
10	220 kV Modipuram(II) -	9/7/2024 23:21	9/8/2024 0:27	CN Tripped phase, Z-1 , Fault Location = 24.38km	AR operated sucessfully

Annexure-A.XV

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

Ref: NR-1/AM/DTL/Tripping

Dt. 04.12.2024

To,
DGM (O&M)
Delhi Transco Limited (DTL)
220 kV Substation,
Park Street Delhi

Subject: Protection System Failure at Gopalpur (DTL) Substation Impacting Mandola (PG) Substation

Dear Sir,

As per the MoU between POWERGRID and DTL, POWERGRID Mandola is maintaining 4 nos. 400 kV bays and 18 nos. 220 kV bays, including 8 nos. 220 kV lines pertaining to DTL, on mutually agreed terms.

We wish to bring to your kind attention that, Mandola-Gopalpur lines are experiencing faults that are often cleared in Zone 2/Zone 3 from the Mandola end due to the failure of the protection system at the Gopalpur Substation. These delayed fault clearances are causing stress on the ICTs at Mandola Substation, as these faults are being fed by the ICTs installed at Mandola. As you are aware, most of the switchgear in the 220 kV bays has aged, and such frequent and prolonged fault feeding increases the risk of switchgear failure.

It is also noted that, as a stop-gap arrangement, DTL has implemented IDMT O/C & E/F protection for the Mandola-Gopalpur Line-1 and Line-2. However, this protection will only trip after a time delay in cases where faults are not cleared from the Gopalpur end. In light of the above, we request you to urgently address the issue and ensure that the protection system at Gopalpur Substation is made fully operational. Otherwise, **POWERGRID will be compelled to revise its Zone-2 and Zone-3 settings to operate instantaneously, instead of with a time delay, to prevent further stress on the system.**

Your immediate action in this matter will be greatly appreciated.

Thanking you.

Kuleshwar Sahu
CGM-AM, NR1 Gr-1

<u>Encl:</u> 1. Analysis of delayed fault clearance.

Copy to:
1. Member Secretary, NRPC (E-mail: ms-nrpc@nic.in)
2. SEO, NRPC (E-mail: seo-nrpc@nic.in)
3. NRLDC SO2 (E-mail: nrldcso2@grid-india.in)

Outlook

Urgent: Protection System Issue at Gopalpur Substation

From Pankaj Kumar Jha {पंकज कुमार झा} <pankaj.jha@powergrid.in>
Date Wed 2024-12-04 14:03
To dgm.north.dtl@gmail.com <dgm.north.dtl@gmail.com>
Cc dharmendra.cea@gov.in <dharmendra.cea@gov.in>; pandeyr.cea@gov.in <pandeyr.cea@gov.in>; ms-nrpc@nic.in <ms-nrpc@nic.in>; seo-nrpc@nic.in <seo-nrpc@nic.in>; lokesh.cea@gov.in <lokesh.cea@gov.in>; deepak.kr@grid-india.in <deepak.kr@grid-india.in>; nrldcso2@grid-india.in <nrldcso2@grid-india.in>; somara.lakra@grid-india.in <somara.lakra@grid-india.in>; rtamc.nr1 <rtamc.nr1@powergrid.in>; Vishal Roy {विशाल रॉय} <vishal.roy@powergrid.in>; Kuleshwar Sahu {कुलेश्वर साहू} <kuleshwar@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>; Ankit Bhargava {अंकित भार्गव} <ram.ankit05@powergrid.in>; Kritika Chopra {कृतिका चोपड़ा} <kritika.chopra@powergrid.in>; M Thirumala Reddy {एम. तिरूमाला रेड्डी} <thirumalareddy@powergrid.in>; Ravindra Nath Gupta {आर.एन. गुप्ता} <ravindrangupta@powergrid.in>; ccprotection <ccprotection@powergrid.in>; Ravi Wadyalkar {रवि अशोक वाड्यालकर} <wravi@powergrid.in>; Ankit Vaish {अंकित वैश्य} <ankit_vaish@powergrid.in>; Dr. Vinit Kr Singh {विनीत कुमार सिंह} <vineet@powergrid.in>

4 attachments (6 MB)

Re: Enabling Overcurrent & Earth Fault settings in 220 kV Mandola-Gopalpur Ckt.-1 & 2 at Mandola end; Gopalpur Line Tripping Incident-2.pdf; Gopalpur Line Tripping Incident-1.pdf; Letter_DTL_Gopalpur Lines.pdf;

Dear Sir,

Please find attached the letter regarding the frequent faults on the Mandola-Gopalpur lines, which are not being cleared promptly due to issues with the protection system at Gopalpur Substation. This delay is causing stress on the ICTs at Mandola and increasing the risk of switchgear failure.

We kindly request urgent action to make the protection system at Gopalpur fully operational. If this issue is not addressed, we may need to revise the Zone-2 and Zone-3 settings to prevent further stress on the system.

Your immediate attention to this matter is greatly appreciated.

Warm Regards
Pankaj Kumar Jha
Chief Manager (Asset Management)
Power Grid Corporation of India Limited
Regional Headquarters, Northern Region-1
SCO Bay No.5 -10, Sector-16A, Faridabad, Haryana-121002
Mob: +919634440125

Outlook

Re: Enabling Overcurrent & Earth Fault settings in 220 kV Mandola-Gopalpur Ckt.-1 & 2 at Mandola end

From Ramjash Bhakal {रामजस भाकल} <bhakalramjash@powergrid.in>
Date Wed 2024-11-06 18:47
To Shankar Kumar Jha <jhashankarjha@gmail.com>
Cc vinod35292 <vinod35292@gmail.com>; Pankaj Kumar Jha {पंकज कुमार झा} <pankaj.jha@powergrid.in>; Neeraj Kumar {नीरज कुमार} <Neerajk@powergrid.in>

1 attachment (279 KB)
GOPALPUR SETTINGS.rar;

Dear sir,
Please find attached revised settings in Gopalpur ckt 1& 2 as per trailing mail.

Ramjash Bhakal
Deputy Manager
Powergrid Corporation of India Ltd .
400/220 KV Mandola Sub-Station NR-1
Contact No-8769191986

From: Shankar Kumar Jha <jhashankarjha@gmail.com>
Sent: 02 July 2024 17:22
To: Ramjash Bhakal {रामजस भाकल} <bhakalramjash@powergrid.in>
Cc: vinod35292 <vinod35292@gmail.com>
Subject: Enabling Overcurrent & Earth Fault settings in 220 kV Mandola-Gopalpur Ckt.-1 & 2 at Mandola end

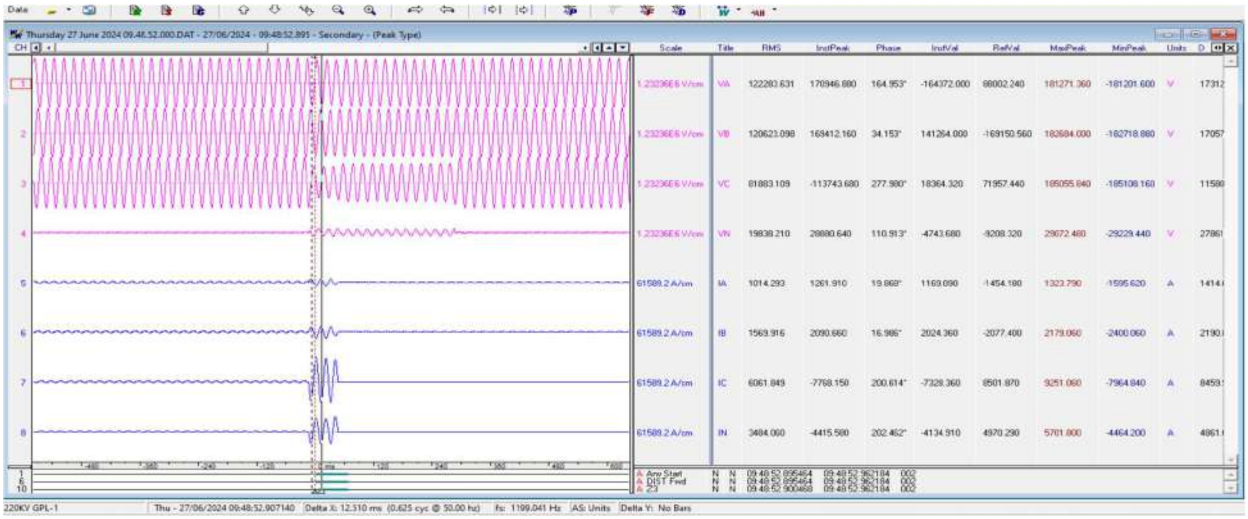
Dear sir,
Please enable Overcurrent & Earth Fault settings in 220 kV Mandola-Gopalpur Ckt.-1 & 2 at Mandola end as under :-
CT ratio at Mandola end - 800/1
Curve - IDMT Standard Inverse
Overcurrent PSM - 1200 Amp (150%)
Overcurrent TMS - 0.18
Earthfault PSM - 320 Amp (40%)
Earthfault TMS - 0.35

After enabling the above settings, please send the Distance and Line Differential relay settings of 220 kV Mandola-Gopalpur Ckt.-1 & 2 at Mandola end.

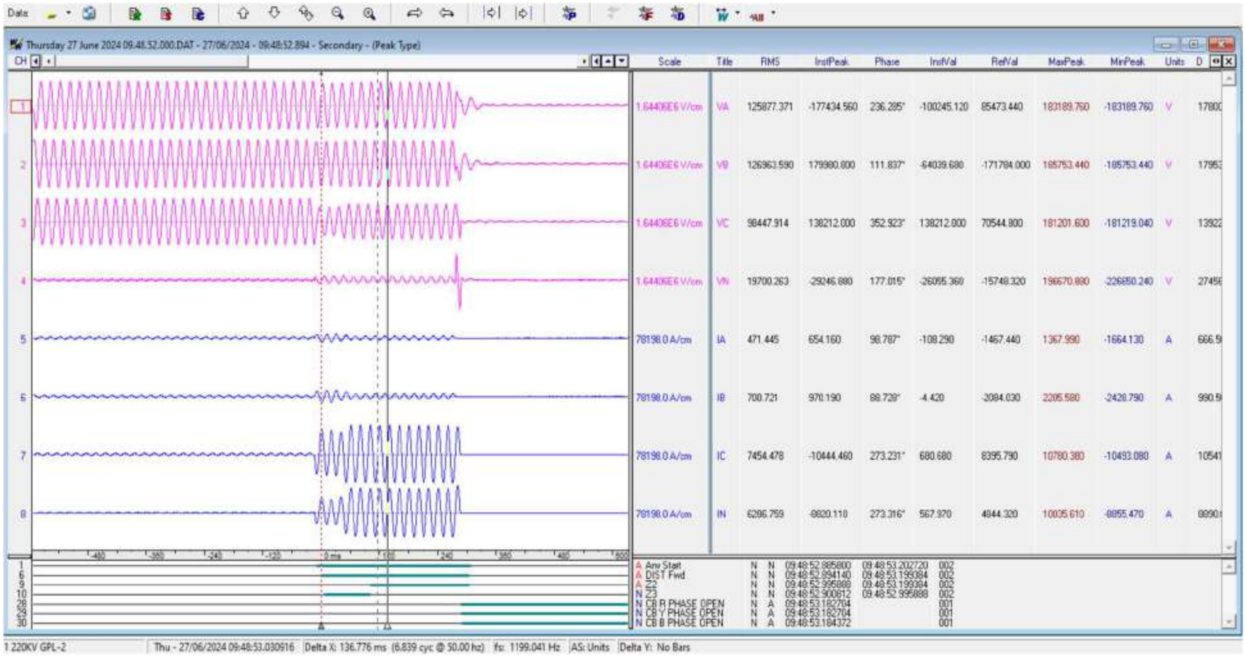
Thanks & Regards
Er. Shankar Kumar Jha
Sr. Manager (Protection)-III
Delhi Transco Limited
(A Govt. of NCT of Delhi Undertaking)
Mobile No.-8700829197

Incident 1: At 09:48:52 Hrs on 27/06/2024, Mandola-Gopalpur Circuit 2 tripped on Zone 2 protection, and both Zone 2 and Zone 3 protection were activated on Mandola-Gopalpur Circuit 1. It is important to note that the fault distance from the Mandola end was 27-28 km (line distance 22.48 km), and there was a fault current of 7.5 kA in both circuits at the time of the fault. Due to the non-clearance of the fault at the Gopalpur end, the fault was fed by all four ICTs at Mandola. During the fault, the current in the B-phase of all four ICTs at Mandola rose to six times the normal load current, causing significant stress on the ICTs and the switchgear in the associated bays of the ICTs and the affected lines for an extended period.

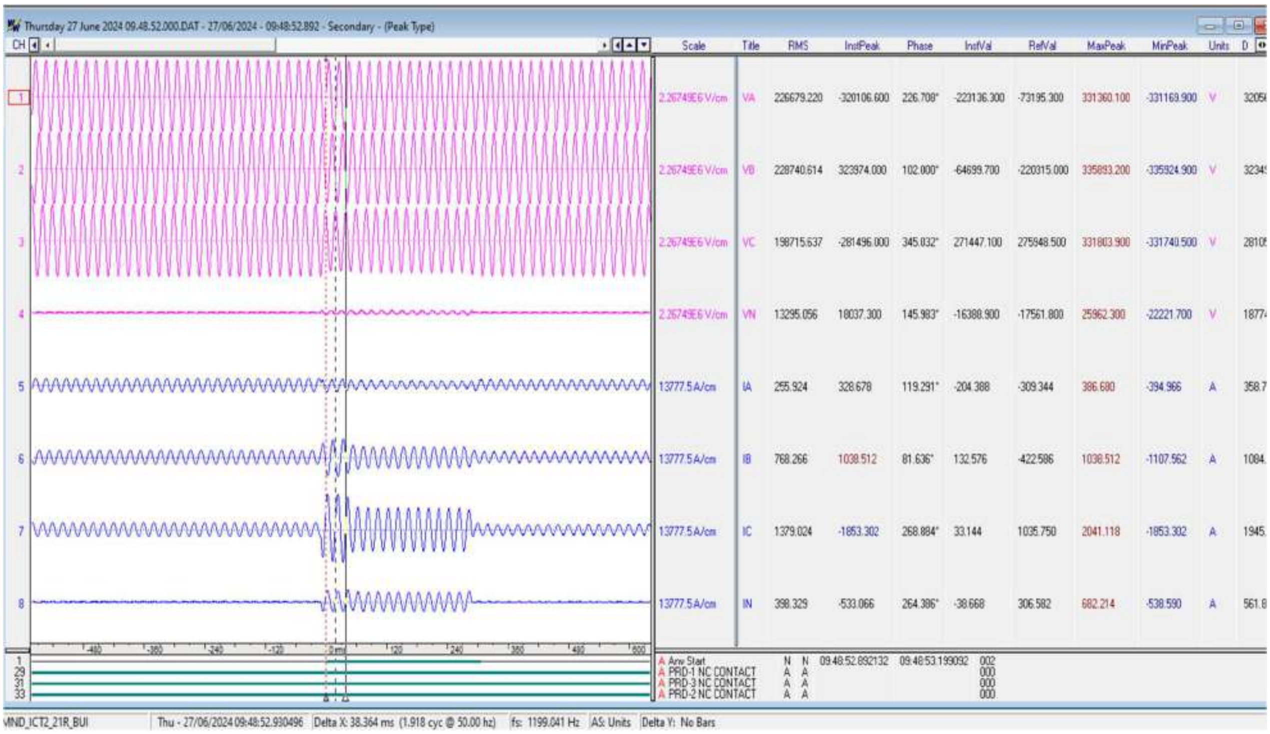
Gopalpur 1 line Fault current-



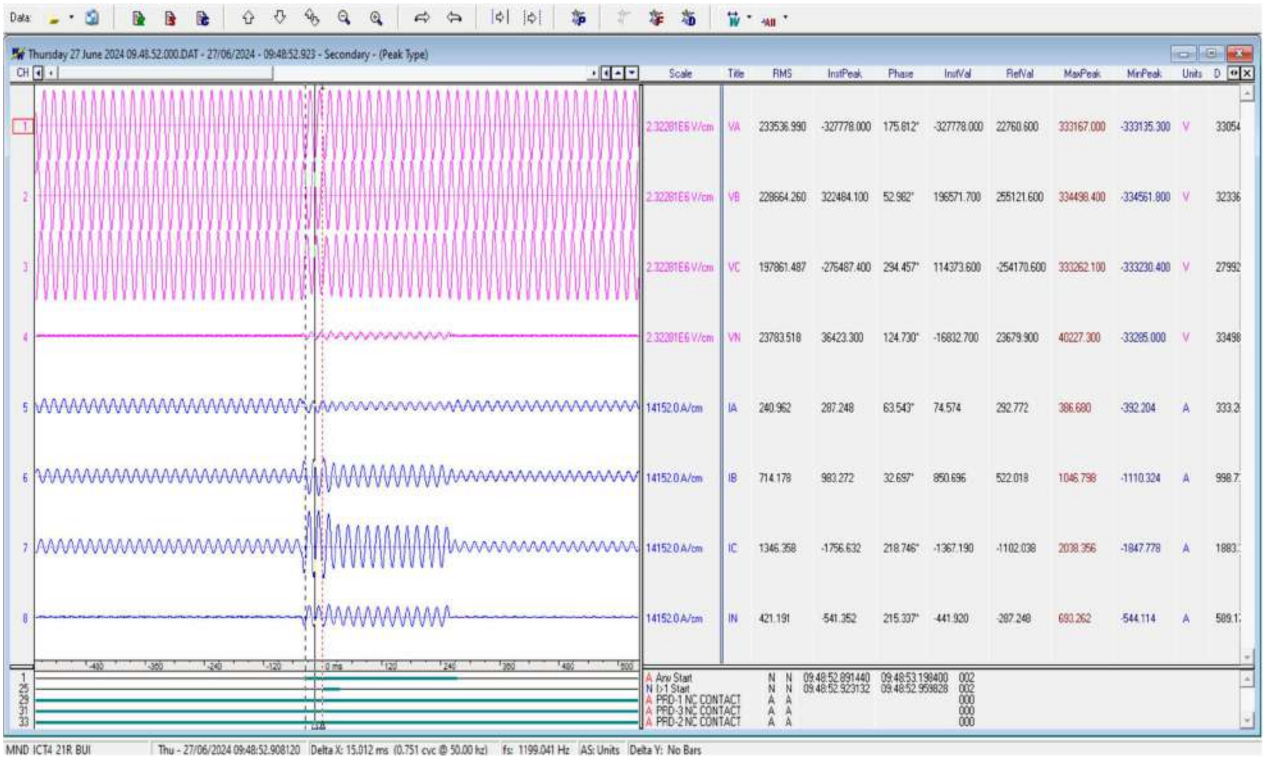
Gopalpur 2 line fault current-



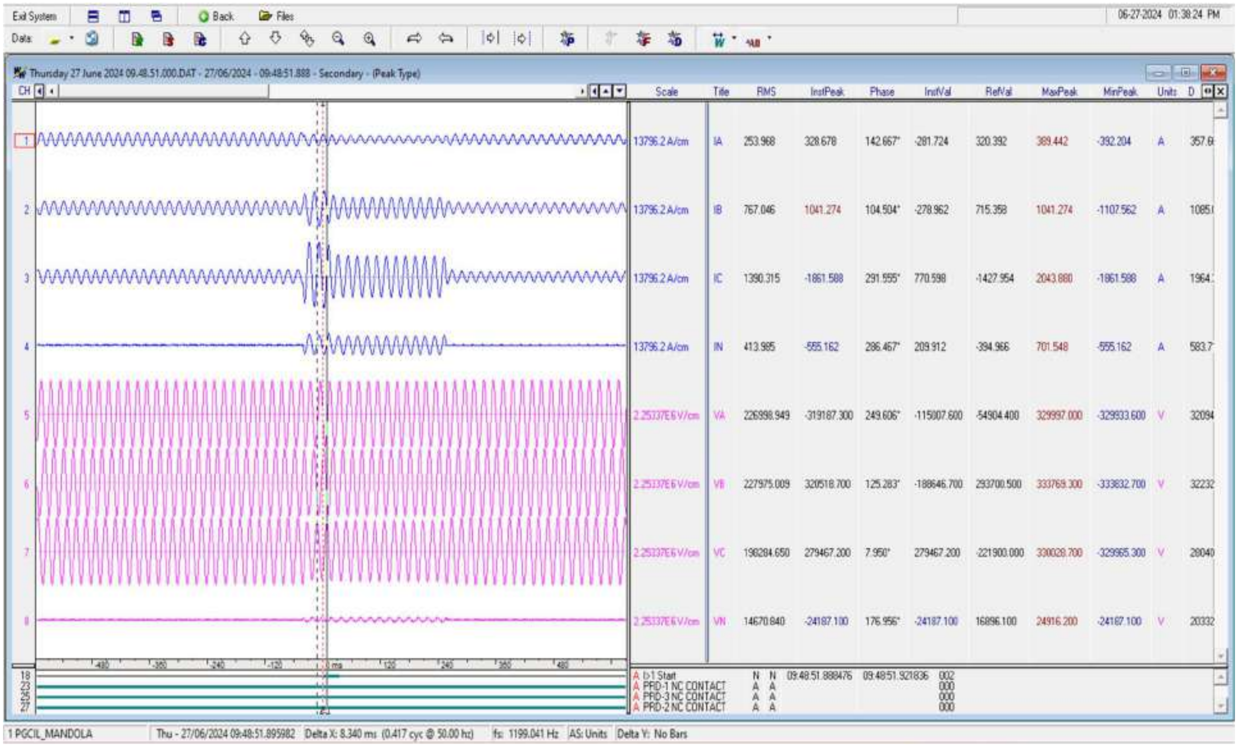
500 MVA ICT 2 Through fault current-



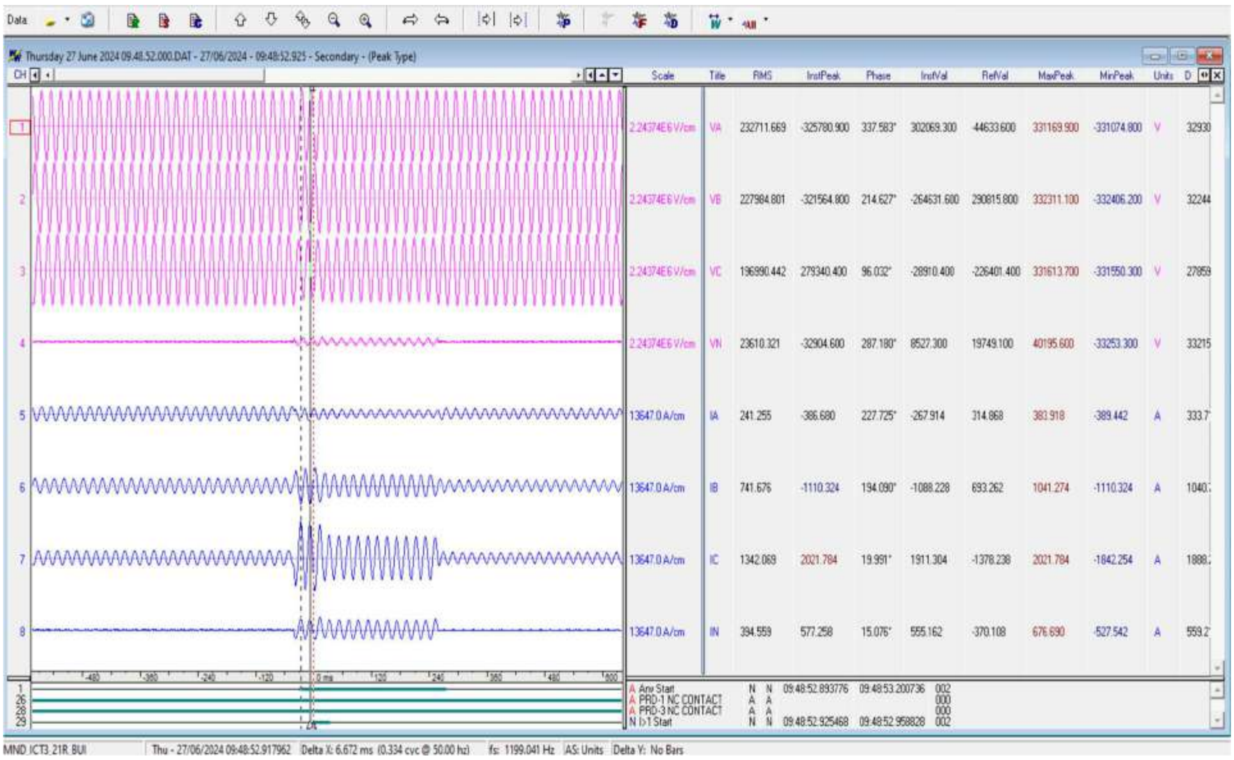
500 MVA ICT 4 Through fault current-



500 MVA ICT 1 Through fault current-

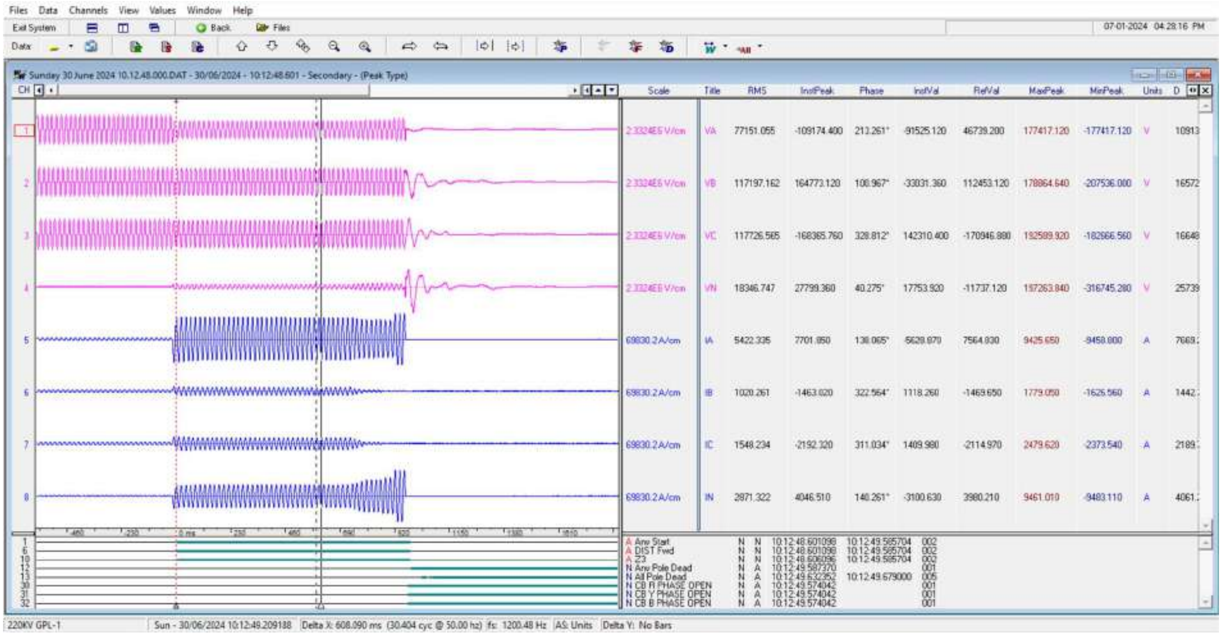


500 MVA ICT 3 Through fault current-

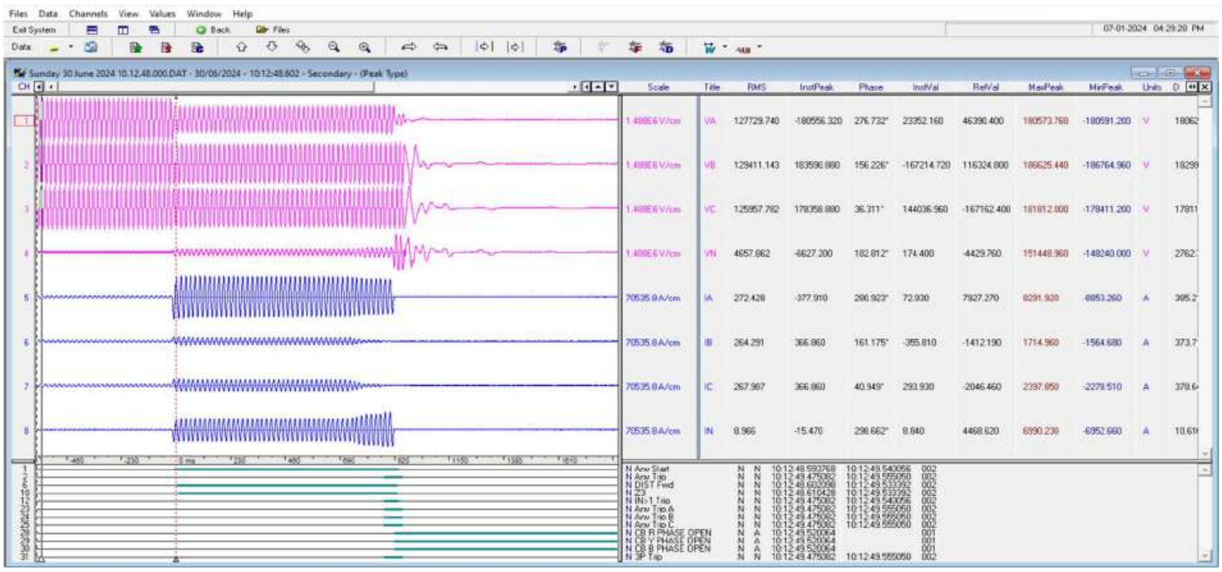


Incident 2: At 10:12:49 Hrs on 30/06/2024, the distance relays of Mandola-Gopalpur Circuits 1 and 2 picked up in Zone 3 protection and tripped due to a directional earth fault. It is important to note that the fault distance from the Mandola end was 27-28 km (line distance 22.48 km), and there was a fault current of 6.5 kA in both circuits at the time of the fault. Due to the non-clearance of the fault at the Gopalpur end, the fault was fed by all four ICTs at Mandola. During the fault, the current in the B-phase of all four ICTs at Mandola rose to six times the normal load current, causing significant stress on the ICTs and switchgear in the associated bays of the ICTs and the affected lines for an extended period.

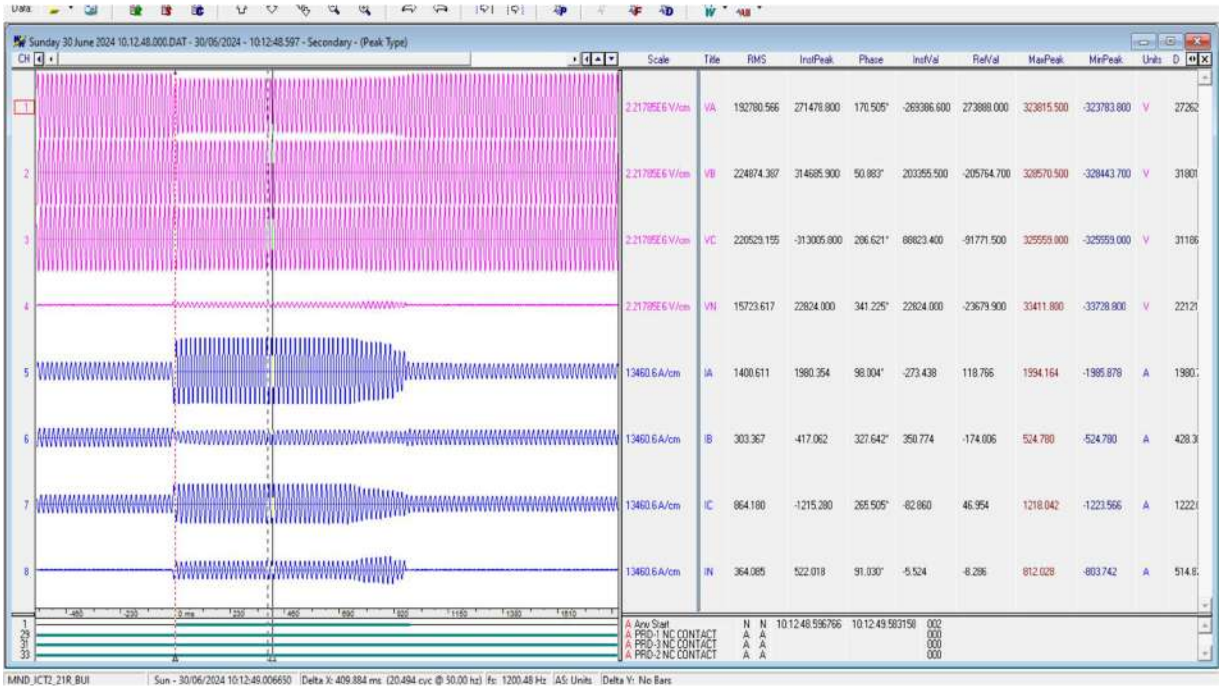
Gopalpur 1 line Fault current-



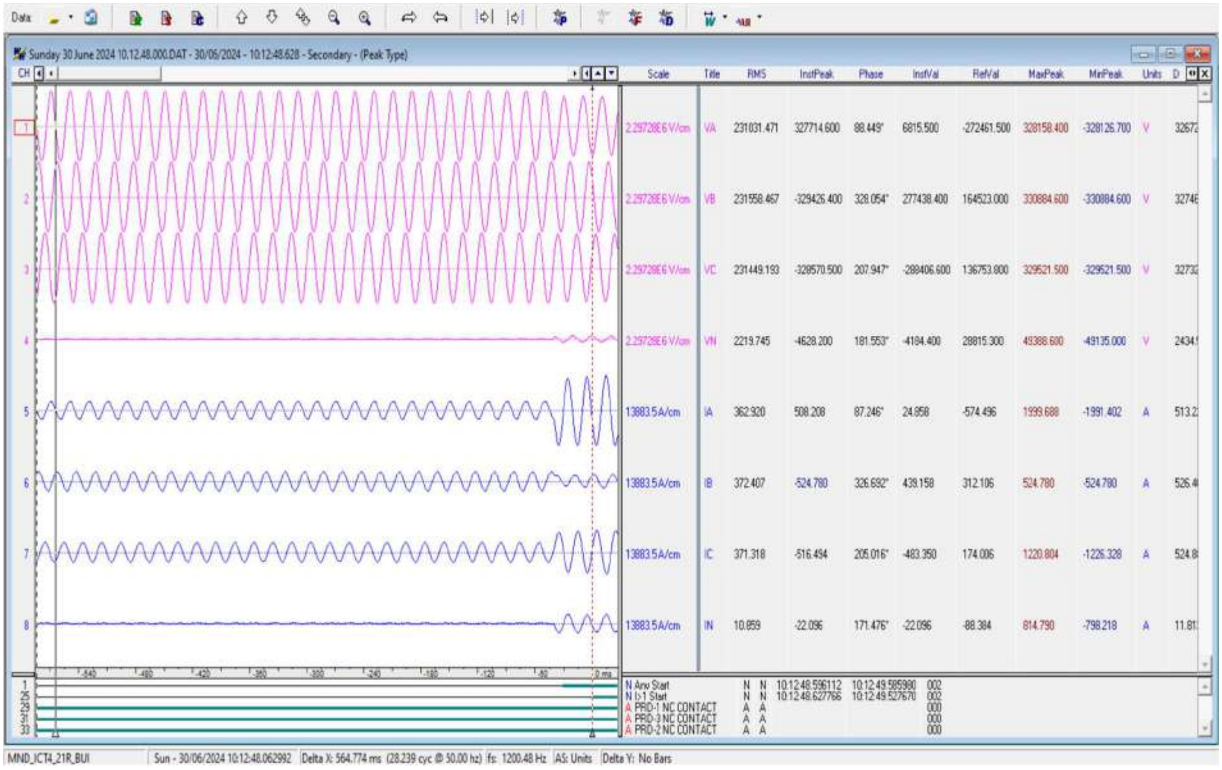
Gopalpur 2 line fault current-



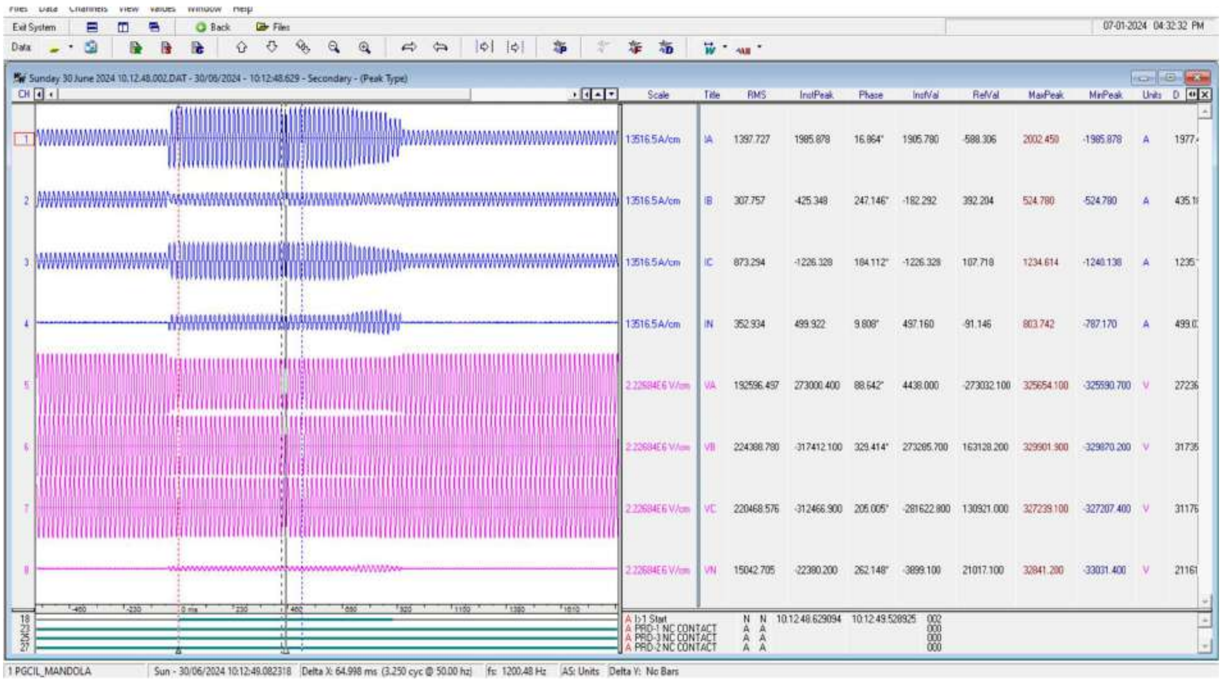
500 MVA ICT 2 Through fault current-



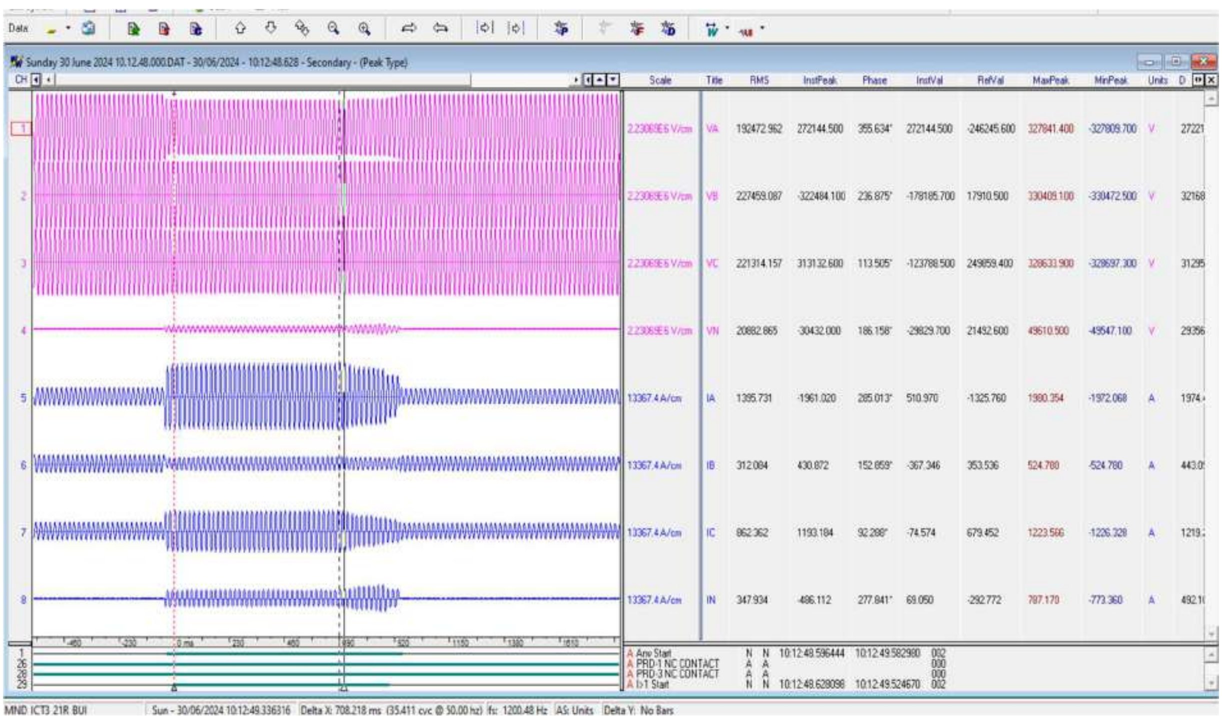
500 MVA ICT 4 Through fault current-



500 MVA ICT 1 Through fault current-



500 MVA ICT 3 Through fault current-



Annexure-A.XVI

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

Ref. No. N1SNP/SS/2024/ Date: 27.06.2024

To
SDO/Substation In-charge
220KV Substation HVPNL, Mohana , Sonipat

Subject: - Discrepancy in protection system of 220KV Jaji(PGCIL) – Mohana(HVPNL) ckt 1 & 2

Reference: - Letter no. N1SNP/SS/5125 dated 10.06.2023 **(Enclosed)**

Dear Sir,

This has reference to our office letter no. N1SNP/SS/5125 dated 10.06.2023 regarding discrepancy in protection at 220 KV Mohana Substation (HVPNL) end. It is once again observed that 220 KV Mohana Substation side faults are feeded from our 400/200 KV Substation(PG) through 220 KV Jaji (PGCIL) – Mohana (HVPNL) ckt 1 & 2. The protection system installed at Mohana (HVPNL) end were unable to clear the downstream fault/220kv Substation fault/Line fault within stipulated time. These faults being cleared by 220KV Jaji (PGCIL) end protection system every time in extended timings of Z2/Z3.

Details of recent faults which were cleared in Zone – 2/Zone – 3 timings at our end are as follows

Case – 1
220 KV Jaji (PGCIL) – Mohana (HVPNL) ckt 1
Date: - 15/05/2024, Time: - 23:12:12, Phase: - R-B ph.
Current - R ph. - 1.44 KA, B ph. – 1.46 KA, **Fault cleared by Jaji (PGCIL) in Zone – 3**

Case – 2
220 KV Jaji (PGCIL) – Mohana (HVPNL) ckt 2
Date: - 15/05/2024, Time: - 23:12:11, Phase: - Y ph.
Current – 1.359 kA, **Fault cleared by Jaji (PGCIL) in Zone – 3**

Case – 3
220 KV Jaji (PGCIL) – Mohana (HVPNL) ckt 2
Date: - 28/05/2024, Time: - 18:27:35, Phase: - R ph.
Current – 13.537 kA, **Fault cleared by Jaji (PGCIL) in Zone – 3**

From the above, it is clearly evident that the downstream fault of 220 KV Mohana Substation (HVPNL) were not clear by protection installed at 220 KV Mohana Substation (HVPNL). It is reiterated that failure of protection system of any element connected to National Grid may cause serious consequences to National Grid. Moreover, PLCC installed in 220KV Jaji (PGCIL) – Mohana (HVPNL) ckt 1 & 2 are not working due to which protection system is affected at our end.

In view of the above, it is requested to review the healthiness of the protection system installed at 220KV Substation, Mohana.

Thanking You

Your Faithfully

Devendra Kumar, DGM, Sonipat SS

Attachments
1) DR files of above incidents

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

Reference No.: N1SNP/SS/ 5125 **Date: 10.06.2023**

To

SDO/Substation In-charge

220 KV Substation HVPNL, Mohana , Sonipat

Subject: - Discrepancy in protection system of 220 kV Jaji(PGCIL)-Mohana(HVPNL) Ckt-1&2

Dear Sir

It has been observed multiple times that 220 kV Mohana Substation sides faults are feeded to our 400/220 kV Substation through 220 kV Jaji(PGCIL)-Mohana(HVPNL) Ckt-1&2. Protection system installed at Mohana(HVPNL) end is not able to clearing the downstream fault/220 kV Substation fault/Lines fault within stipulated time. These faults being cleared by **220 kV Jaji(PGCIL)** end protection system every time in extended timings of Z2/Z3/ZR.

Details of recent faults which were clear in Zone-2/Zone3 timings at our end are as hereunder.

Case-1

220 kV Jaji(PGCIL)-Mohana(HVPNL) Ckt-2
Date 10/05/2023 time 16.22:04, Phase- B
Current-5.61 kA, **fault clear in by Jaji(PGCIL) in Zone-2**

Case-2

220 kV Jaji(PGCIL)-Mohana(HVPNL) Ckt-2
Date 09/06/2023 time 21:09:43, Phase- R
Current-8.33 kA, **fault clear in by Jaji(PGCIL) in Zone-2**

Case-3

220 kV Jaji(PGCIL)-Mohana(HVPNL) Ckt-1
Date 10/06/2023 time 17:05:47, Phase- B
Current-3.187 kA, **fault clear in by Jaji(PGCIL) in Zone-3**

As per protection philosophy fault near to 220 kV HVPNL Substation shall be clear by protection system of 220 kV HVPNL Substation first then nearby substation's protection shall operate if first one fails to do so. It is here to reiterate that failure of protection system of any elements connected to National Grid may cause serious consequence to National Grid.

Moreover PLCC installed in 220 kV Jaji(PGCIL)-Mohana(HVPNL) Ckt-1&2 are not working due to which carrier Aided Function of our distance protection is not working for these feeder.

In view of above it is requested to please review the healthiness of protection system installed at 220 kV Substation Mohana.

Thanking You

Reciving
14/6/23

Yours faithfully

Devendra Kumar
10/06/23
Dy. General Manager, Sonipat SS

उप केन्द्र: 400/220 के वी. उप-केन्द्र, गाँव जाजी, सोनीपत-गोहाना रोड, सोनीपत 131024(हरियाणा) दूरभाष: 0130-2970027,
Sub-station: 400/220 KV Sub Station, Vill. Jaji, Sonepat-Gohana Road, Sonepat-131024, (Haryana) Tel: 0130- 2970027,
E-Mail: pgsonipat@powergrid.co.in GISTN.No.-06AAACP0252G1ZX
केन्द्रीय कार्यालय: "सौदामिनी", प्लॉट नंबर 2, सेक्टर -29, गुरुग्राम -122001, (हरियाणा) दूरभाष: 0124-2571700-719
Corporate Office: "Saudamini", Plot No. 2, Sector-29, Gurugram-122001, (Haryana) Tel.: 0124-2571700-719
पंजीकृत कार्यालय: बी -9, कुतुब इंस्टीट्यूशनल एरिया, कटवारिया सराय, नई दिल्ली -110 016. दूरभाष: 011-26560112, 26560121, 26564812, 26564892, CIN: L40101DL1989GOI038121
Registered Office: B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi-110 016. Tel: 011-26560112, 26560121, 26564812, 26564892, CIN : L40101DL1989GOI038121
Website: www.powergridindia.com

Annexure-A.XVII

Northern Regional Power Committee			
Centralized database of protection settings at RPCs for compliance of IEGC 2023			
Details of Substation & Relays for elements of 220 kV and above in Northern Region (finalzied in the 55th PSC meeting)			
Sr. No.	**Utility**	**Details**	
		No. of Substation/Generating Station	**No. of Relays**
	Transmission		
1	UPPTCL	194	4198
2	DTL	46	1387
3	HPPTCL	12	255
4	RVPN	143	7226
5	HVPN	90	2340
6	PTCUL	14	261
7	PSTCL	111	4523
8	JKPTCL	3	61
9	PGCIL	96	9172
10	Ghatampur Transmission Limited	0	29
11	Obra-C Badaun Transmission Ltd. (OBTL)	2	66
12	Western U.P. Power Transmission Co. Ltd	15	356
13	Adani Transmission (ATL, BKTL, FBTL)	7	205
14	INDIGRID	5	246
	Generation		
15	UPRVUNL (Obra, Anpara-C, Anpara-D)	4	209
16	UJVNL	2	44
17	RVUNL	11	566
18	HPSEB (Generation & Transmission)	10	400
19	IPGCL	1	42
20	HPPCL	1	25
21	HPGCL	3	135
22	PSPCL	3	115
23	SJVN	2	64
24	NPL	1	46
25	NPCIL	5	122
26	NTPC (Rihand, Unchahar, Dadri)	7	437
27	BBMB (Generation & Transmission)	24	1078
28	NHPC	13	298
29	THDC	5	405
30	NUPPL Ghatampur	2	113
31	Prayagraj Power Generation Co. Ltd.	2	97
32	Meja Urja Nigam Private Limited (400KV, 2x660MW)	1	88
33	Rosa Power Supply Company Ltd	2	77
34	JAYPEE VISHNUPRAYAG HYDRO - ELECTRIC PLANT (4X100 MW)	1	14
35	ALAKNANDA HYDRO POWER COMPANY LIMITED	1	50
36	Adani Power Ltd. Kawai (2X660 MW)	1	57
37	Lalitpur Power Generation Company Limited	2	114
38	AD Hydro Substation	1	24
39	GREENKO	1	25
40	Aravali Power Company Pvt. Ltd	1	66
41	Apraava Energy Private Limited	1	12
42	Talwandi Sabo Power Ltd.	1	45
43	Lanco Anpara Power Ltd (Anpara-C)	1	118
44	JSW Energy Ltd. (KWHEP)	1	44
	Renewable Energy		
45	ABC RENEWABLE ENERGY	1	15
46	ACME	2	32
47	Adani	16	251
48	CLEAN SOLAR POWER	2	28
49	EDEN RENEWABLE	1	9
50	TATA POWER RENEWABLE	1	32
51	THAR SURYA 1	1	8
52	TATA POWER Green Energy Ltd.	1	32
53	AMPlus Solar GRIAN Energy Pvt Ltd	1	20
A	**Total**	**875**	**35682**
B	**Assumption for addition as data is not received from few utilities (20%) (rounding off to nearest integer)**	175	7136
C	**Grand Total**	**1050**	**42818**

Scope of work for Centralized Database containing details of relay settings for grid elements connected to 220 kV and above

Scope of software shall be broadly as below for all elements in Northern Region connected to 220 kV and above voltage level:

A. **Protection Settings Database Management System.**
B. **Protection Setting Calculation and Study Tool.**
C. **Repository of DR/EL and analysis.**
D. **Application of protection settings by utilities and its approval by NRPC.**
E. **Reporting of performance indices by utilities.**
F. **Repository of protection audit reports.**

A. Protection Settings Database Management System

1. To create facility to store all types of relay settings of all power system elements (connected to 220 kV and above in Northern Region such as lines, cable, ICT, Reactor/Capacitor, generator, GT, STATCOM/SVC, FSC/TCSC, HVDC) in one system irrespective of the manufacturer and relay type and controlled access to users.
2. Complete modeling of elements with relevant system parameters **based on data received from utilities** for transmission lines, generators, transformers, reactors, substation layouts, and associated protective relays in the substations. The model should include CT, PT, Isolator, Breaker and other bay equipment's ratings along with rating of the BUS and the type of conductor used for the BUS. The modeling should be done as per bus-breaker philosophy instead of node-oriented model.
3. Creation of necessary relay templates of all make and model existing in grid. **Template for electro-mechanical relay shall also be required to be created. Users shall have option to provide settings of electro-mechanical relay.**
4. Option to users to upload relay setting files (downloaded from relay) directly.
5. To capture the life cycle of protection settings and template.
6. To create an interface with Protection Setting Calculation and Study Tool.

7. To provide Role based access control.
8. Building the entire Northern region network data for load flow and fault calculation, Protection database and substation SLD preparation.
9. Hardware setup and software package capable of meeting the above objectives. Associated servers for installation and Deployment of application and database software along with standard Operating System –With Main and Back up.
10. Work flow Management.
11. Availability of historical fault data for predicting nature of fault.
12. The tool should be capable of analyzing, storing, and handling all fault records (Disturbance record, Event Logger, COMTRADE files, etc.) for a minimum period of prescribed years; and the updated database to be used for fault analysis should be permanently available.
13. Reports:
    a. Feature to generate reports as per user requirement.
    b. User can generate report in standard format like .xls, .pdf.
14. History log: All user activities such as user operations, data management, template management, configuration management and workflow shall be logged to track the user activities.
15. Import and Export: There shall be an option to import template and data from any third party application in standard formats like .xml and .xls
16. Relay characteristics curve can be drawn from the setting data.
17. Provision to attach documents to relay template and relay data can be made available. Option to accept setting data as per the audit and verify/compare the field setting with protection database setting and generate error report.
18. Provision to store and retrieve audit reports.
    c. Provision to store and retrieve relay tripping incidence report.
    d. Facility to store and retrieve setting guidelines as per various committees.
    e. Automatic Reconciliation Tool should be available which will generate automatic reconciliation requests for relay settings in the database.
    f. Up-to-date application guides and user manuals of all relays is a part of the relay library.
19. A user-friendly interface with features such as
    a) Web based System.

b) Role based access control
c) Flexible customization of user roles, grants, actions from Master control panel
d) User Access Monitor
e) Relay Template Management
f) Create\Edit\Delete relay templates
g) Viewing relay template
h) Locking and Unlocking templates
i) Copy & Edit templates from the existing template
j) Import and Export templates
k) Relay Data management
l) Create\Edit\Delete relay data
m) Viewing relay data
n) Locking and Unlocking relay data
o) Copy & Edit relay data from the existing data
p) Import and Export relay data

20. Built with standard relays library data for different manufacturers, including but not restricted to the following protection features:

i. **Transmission Line & cable (including compensated):**

Distance, over current, earth fault, over voltage, Line Differential protection.

ii. **Power Transformer:**

Differential Protection, Under Impedance protection, Over fluxing Protection, Thermal Overload Protection, Low Impedance Restricted Earth Fault Protection, High Impedance Restricted Earth Fault Protection, back-up over current (Directional/ Non-Directional) and earth fault protection (Directional/ Non-Directional).

iii. **Shunt Reactors:**

Differential protection, Restricted Earth Fault, Back Up Protection (Impedance / overcurrent)

iv. **Generator:**

Differential Protection, Stator Earth Fault Protection (Both 95% and 100% protection), Inter – Turn Differential Protection, Backup impedance, Voltage Controlled O/C, Negative Sequence, Field Failure, Reverse Power/Low forward Power, Pole Slipping, Overload, Over voltage, Under Frequency, Dead Machine, Rotor Earth Fault, Over Fluxing.

v. **Generator Transformer/ Unit Auxiliary Transformer:**

Differential Protection, Back up Earth Fault Protection, Back up over current, Restricted Earth Fault.

vi. **HVDC:**

- Converter Protection: Valve Short Circuit Protection, DC Differential Protection, DC Harmonic Protection, DC Under voltage Protection, DC Overvoltage Protection, AC Over voltage Protection, AC Under voltage Protection, AC Voltage Stress Protection of Converter, Group Differential Protection, Bridge Differential Protection, Overcurrent Protection, Sub-Synchronous Resonance Protection, AC Valve Winding Ground Fault Supervision,
- DC Filter Protection: Capacitor Differential Over current Protection, Capacitor Unbalance Supervision, Inverse Overcurrent Time Protection, DC Filter Differential Protection,
- DC Line Protection: Travelling Wave Front Protection, Under voltage Sensing Protection, Under voltage Operation Protection, DC Line Differential Protection, AC-DC Conductor Contact Protection.
- Electrode Line Protection: Electrode Bus Differential Protection, Electrode Current Balance Protection, Electrode Over Current Protection, Electrode line open circuit Over voltage Protection, Station Ground Overcurrent Protection, Open Conductor Electrode Line Protection
- DC Busbar Protection: HV Side DC Bus bar Differential Protection, Neutral Side DC Busbar Differential Protection, DC Differential Backup Protection, Valve Protection
- Converter Transformer Protection: differential protection, high impedance, restricted earth fault protection, ground earth fault overcurrent protection, thermal overload protection, over-fluxing protection, directional definite time / inverse-time overcurrent protection and directional earth fault overcurrent protection.

- AC Filter Sub-bank Protection (Shunt/Capacitor/Resistor): Differential, overcurrent, overload, unbalance supervision, Zero Sequence Overcurrent.

vii. **STATCOM:**

- Transformer Protection: Differential protection, REF protection, Directional Overcurrent protection, Ground Overcurrent, over flux protection, Transformer mechanical trips.
- STATCOM (MV) Bus protection: Bus Differential protection, Ground over current protection, used with neutral Grounding Transformer, Under/ Over Voltage protection, Over voltage (Open Delta) protection.
- STATCOM Branch Protection: Differential protection and/or O/C protection, Ground over current protection , Valve Overcurrent protection (in Controls), DC overvoltage protection (in Controls)
- MSR/TCR Branch Protection: Differential protection, Ground over current protection, Reactor branch unbalance protection, Thermal Overload protection.
- MSC/TSC Branch Protection: Differential protection, Ground over current protection, Capacitor Overvoltage (Using current signal) protection, Capacitor unbalance protection, over current protection.
- Harmonic Filter Protection: Ground over current protection, Capacitor Overload (Using current signal) protection, over current protection, Neutral Voltage shift.
- Auxiliary Transformer Protection: Over current, open delta voltage protection.

viii. **SVC:**

- Coupling Transformer (HV & MV) Protection: Differential protection, REF protection, Directional Overcurrent protection, Ground Overcurrent, over flux protection, Transformer mechanical trips.
- SVC Bus Bar protection: Bus Differential protection, Ground over current protection, used with neutral Grounding Transformer, Under/ Over Voltage protection, Over voltage (Open Delta) protection.

- TCR Protection: Differential protection, Ground over current protection, Reactor branch unbalance protection, Thermal Overload protection.
- TSC Protection: Differential protection, Ground over current protection, Capacitor Overvoltage (Using current signal) protection, Capacitor unbalance protection, over current protection.
- Harmonic Filter Protection: Differential protection, Ground over current protection, Capacitor Overvoltage (Using current signal) protection, Capacitor unbalance protection, over current protection, Neutral Voltage shift.
- Auxiliary Transformer Protection: Over current, open delta voltage protection.

ix. **FSC & TCSC:** Capacitor unbalance, Capacitor overload, Line current supervision, MOV overload, MOV short term energy protection, MOV high current protection, MOV high temperature protection, MOV failure protection, Flashover to platform protection, Spark Gap protection, Trigger circuit supervision, Sub-harmonic protection, Pole disagreement protection, Bypass switch failure protection,

x. **BUSBAR & LBB**: Differential protection, Beaker Failure Protection

21. Protection Settings Database Management System shall be suitable for integration with other portals, software of protection. It shall be able to integrate any third party application to share data between protection database management software and calculation engine/tool and vice versa.
22. Training of utilities.
23. AMC.

B. Protection Setting Calculation and Study Tool.

This module shall be capable of giving recommendation of Protection Setting for protections of elements as mentioned under point no. 20 of para A. Calculation Tool should be capable of performing the following:

1. Relay co-ordination for power system elements. Co-ordination check shall be conducted for relays of all make.
2. Primary/back-up relay pairs generation.
3. Fault calculation will be a part of relay co-ordination program.

4. Transparent Fault calculation results.
5. Simulation engines for protection co-ordination, power flow analysis, fault calculation, transient stability studies, electromagnetic transient analysis, and protection relay operation post-mortem analysis. There should be features to study low frequency oscillations, 3rd zone tripping, PSS tuning support and Voltage collapse prediction feature.
6. The protection calculation tool should be capable of interacting with the relay data in the database.
7. Tool for simulating the performance/ behavior of the protection system under all possible normal and abnormal operating conditions of the power system, including effect of changing one or more parameter setting of the relays.
8. Diagnostics Tool for verifying proper coordination among various protective relays.
9. Computation of critical clearing time.
10. Plotting Log-Log grid and graphs.
11. Option to check existing relay settings with respect to field or vice versa.
12. Computation of Out of Step Tripping Protection Settings.
13. Display of sequence operation of relays with respect to tripping time.
14. Switching status for all relays elements from the screen.
15. Association of relays to power system elements.
16. Disturbance analysis can be done on mapping of disturbances files with corresponding relay.
17. It shall have standard power system components and relay symbols.
18. Automatic computation of zone setting for distance protection.
19. Feature for viewing existing and newly computed relay settings.
20. Pre-loaded standard relay curves.
21. Directional and non-directional feature for relays.
22. Overload factor, unbalance factor and discrimination time (user defined/selectable) for each relay.
23. Inbuilt discrimination time calculator for grading of relays.
24. Facility to model the back-up protection settings of generating units / GTs.

C. Repository of DR/EL and analysis.

a) Platform for upload of DR/EL by utilities and access to all.

b) Tracking of non-compliance in uploading.

c) Tool for analysis of DR/EL.

d) Tool shall be integrated with outage portal of NRLDC so that it can capture details of outages of elements automatically from NRLDC portal so that users can upload DR, EL, FIR, tripping report, analysis report.

D. Application of protection settings by utilities and its approval by NRPC.

a) Platform for application of protection setting by utilities.

b) Hierarchical role for scrutiny and approval of setting by NRPC.

c) Intimation of approval of settings by NRPC.

d) Intimation of implementation of settings by utilities.

E. Reporting of performance indices by utilities.

a) Platform for reporting of performance indices by utilities.

b) Feature for scrutiny and intimation of errors to utilities by NRPC.

c) Recording of justification note for non-compliance.

F. Repository of protection audit reports.

a) Platform for reporting of internal and external audit report of all utilities.

b) Tracking non-compliance and next due date.

c) Web-based Checklist for protection audit should be made available for Constituents to self-auditing.

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Annexure-A.XIX

सत्यमेव जयते

उत्तर क्षेत्रीय विद्युत समिति

NORTHERN REGIONAL POWER COMMITTEE

Procedure for Approval of Protection Settings in Northern Region

(In reference to regulation 14 of IEGC 2023)

Version: 1.0

(Approved in 75^{th} NRPC meeting held on 28.08.2024)

August, 2024

A. Procedure in case of new element charging

1. ISTS users shall submit the protection settings to NRPC and NRLDC for every new element to be commissioned one month in advance through mail.
   In case of intrastate elements, users shall submit the protection settings to NRPC and concerned SLDC for every new element to be commissioned one month in advance through mail.
2. NRLDC based on the above information and the First Time Charging (FTC) request by user through Outage Management System (OMS) portal of NRLDC, shall allow integration of new element in the system as per NRLDC FTC procedure with the prevailing practice to avoid any delay in charging of the new element. The settings shall be treated as provisional arrangement till approval in PSC (Protection Sub-Committee).
   In case of intrastate elements, SLDC shall allow integration of new element in the system. This shall be treated as provisional arrangement till approval in PSC.
3. NRLDC/SLDCs may ask any other relevant data/information from concerned utilities during scrutiny of settings.
4. Users will be responsible for any revision in settings of the existing element required due to charging of new element. The settings shall be treated as provisional arrangement.
5. The concerned utility shall put up the agenda for getting final approval in next PSC.
6. NR PSC will review and approve the final settings based on the inputs submitted by the utility. In case of any change required in final protection settings of the new element than the provisional one, as decided by the committee, the same shall be implemented within 7 days by the concerned utility.
7. Utility shall intimate to NRPC Secretariat and NRLDC/SLDC (as applicable) within fortnight after implementation of settings for record in regional protection settings database.

B. Procedure in case of revision of settings of any existing element (without any changes in network configuration):

1. Any change in the existing protection settings shall be carried out only after prior approval from PSC Forum of NRPC.
2. The concerned utility (both ISTS and intrastate) shall put up an agenda regarding any changes required in existing protection settings due to integration of new element in the existing system or otherwise, in PSC.
3. Utility shall intimate to NRLDC/SLDC (as applicable) and NRPC about the changes implemented in protection system or protection settings within 15 days of such changes.

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Scope of work for

Centralized Database containing details of relay settings for grid elements connected to 220 kV and above in Northern Region

Scope of software shall be broadly as below for all elements in Northern Region connected to 220 kV and above voltage level:

A. **Protection Settings Database Management System.**
B. **Protection Setting Calculation and Study Tool.**
C. **Repository of DR/EL and analysis.**
D. **Application of protection settings by utilities and its approval by NRPC.**
E. **Reporting of performance indices by utilities.**
F. **Repository of protection audit reports.**
G. **Warranty Period, AMC and support**
H. **Technical Specifications of Hardware/ Software**

A. Protection Settings Database Management System

1. To create facility to store all types of relay settings of all power system elements (connected to 220 kV and above in Northern Region such as lines, cable, ICT, Reactor/Capacitor, generator, GT, STATCOM/SVC, FSC/TCSC, HVDC) in one system irrespective of the manufacturer and relay type and controlled access to users.
2. Complete modeling of elements with relevant system parameters **based on data received from utilities** for transmission lines, generators, transformers, reactors, substation layouts, and associated protective relays in the substations. The model should include CT, PT, Isolator, Breaker and other bay equipment's ratings along with rating of the BUS and the type of conductor used for the BUS. The modeling should be done as per bus-breaker philosophy instead of node-oriented model.
3. Creation of necessary relay templates of all make and model existing in grid. **Template for electro-mechanical relay shall also be required to be created. Users shall have option to provide settings of electro-mechanical relay.**
4. Option to users to upload relay setting files (downloaded from relay) directly.

5. To capture the life cycle of protection settings and template.
6. To create an interface with Protection Setting Calculation and Study Tool.
7. To provide Role based access control.
8. Building the entire Northern region network data for load flow and fault calculation, Protection database and substation SLD preparation.
9. Hardware setup and software package capable of meeting the above objectives. Associated servers for installation and Deployment of application and database software along with standard Operating System –With Main and Back up.
10. Workflow Management.
11. Availability of historical fault data for predicting nature of fault.
12. The tool should be capable of analyzing, storing, and handling all fault records (Disturbance record, Event Logger, COMTRADE files, etc.) for a minimum period of prescribed years; and the updated database to be used for fault analysis should be permanently available.
13. Reports:
    a. Feature to generate reports as per user requirement.
    b. User can generate report in standard format like .xls, .pdf.
14. History log: All user activities such as user operations, data management, template management, configuration management and workflow shall be logged to track the user activities.
15. Import and Export: There shall be an option to import template and data from any third party application in standard formats like .xml and .xls
16. Relay characteristics curve can be drawn from the setting data.
17. Provision to attach documents to relay template and relay data can be made available. Option to accept setting data as per the audit and verify/compare the field setting with protection database setting and generate error report.
18. Provision to store and retrieve audit reports.
    c. Provision to store and retrieve relay tripping incidence report.
    d. Facility to store and retrieve setting guidelines as per various committees.
    e. Automatic Reconciliation Tool should be available which will generate automatic reconciliation requests for relay settings in the database.
    f. Up-to-date application guides and user manuals of all relays is a part of the relay library.

19. A user-friendly interface with features such as
    a) Web based System.
    b) Role based access control
    c) Flexible customization of user roles, grants, actions from Master control panel
    d) User Access Monitor
    e) Relay Template Management
    f) Create\Edit\Delete relay templates
    g) Viewing relay template
    h) Locking and Unlocking templates
    i) Copy & Edit templates from the existing template
    j) Import and Export templates
    k) Relay Data management
    l) Create\Edit\Delete relay data
    m) Viewing relay data
    n) Locking and Unlocking relay data
    o) Copy & Edit relay data from the existing data
    p) Import and Export relay data
20. Built with standard relays library data for different manufacturers, including but not restricted to the following protection features:
    i. **Transmission Line & cable (including compensated):**
    Distance, over current, earth fault, over voltage, Line Differential protection.
    ii. **Power Transformer:**
    Differential Protection, Under Impedance protection, Over fluxing Protection, Thermal Overload Protection, Low Impedance Restricted Earth Fault Protection, High Impedance Restricted Earth Fault Protection, back-up over current (Directional/ Non-Directional) and earth fault protection (Directional/ Non-Directional).
    iii. **Shunt Reactors:**
    Differential protection, Restricted Earth Fault, Back Up Protection (Impedance / overcurrent)
    iv. **Generator:**

Differential Protection, Stator Earth Fault Protection (Both 95% and 100% protection), Inter – Turn Differential Protection, Backup impedance, Voltage Controlled O/C, Negative Sequence, Field Failure, Reverse Power/Low forward Power, Pole Slipping, Overload, Over voltage, Under Frequency, Dead Machine, Rotor Earth Fault, Over Fluxing.

v. **Generator Transformer/ Unit Auxiliary Transformer:**

Differential Protection, Back up Earth Fault Protection, Back up over current, Restricted Earth Fault.

vi. **HVDC:**

- Converter Protection: Valve Short Circuit Protection, DC Differential Protection, DC Harmonic Protection, DC Under voltage Protection, DC Overvoltage Protection, AC Over voltage Protection, AC Under voltage Protection, AC Voltage Stress Protection of Converter, Group Differential Protection, Bridge Differential Protection, Overcurrent Protection, Sub-Synchronous Resonance Protection, AC Valve Winding Ground Fault Supervision,
- DC Filter Protection: Capacitor Differential Over current Protection, Capacitor Unbalance Supervision, Inverse Overcurrent Time Protection, DC Filter Differential Protection,
- DC Line Protection: Travelling Wave Front Protection, Under voltage Sensing Protection, Under voltage Operation Protection, DC Line Differential Protection, AC-DC Conductor Contact Protection.
- Electrode Line Protection: Electrode Bus Differential Protection, Electrode Current Balance Protection, Electrode Over Current Protection, Electrode line open circuit Over voltage Protection, Station Ground Overcurrent Protection, Open Conductor Electrode Line Protection
- DC Busbar Protection: HV Side DC Bus bar Differential Protection, Neutral Side DC Busbar Differential Protection, DC Differential Backup Protection, Valve Protection
- Converter Transformer Protection: differential protection, high impedance, restricted earth fault protection, ground earth fault overcurrent protection, thermal overload protection, over-fluxing

protection, directional definite time / inverse-time overcurrent protection and directional earth fault overcurrent protection.

- AC Filter Sub-bank Protection (Shunt/Capacitor/Resistor): Differential, overcurrent, overload, unbalance supervision, Zero Sequence Overcurrent.

vii. STATCOM:

- Transformer Protection: Differential protection, REF protection, Directional Overcurrent protection, Ground Overcurrent, over flux protection, Transformer mechanical trips.
- STATCOM (MV) Bus protection: Bus Differential protection, Ground over current protection, used with neutral Grounding Transformer, Under/ Over Voltage protection, Over voltage (Open Delta) protection.
- STATCOM Branch Protection: Differential protection and/or O/C protection, Ground over current protection , Valve Overcurrent protection (in Controls), DC overvoltage protection (in Controls)
- MSR/TCR Branch Protection: Differential protection, Ground over current protection, Reactor branch unbalance protection, Thermal Overload protection.
- MSC/TSC Branch Protection: Differential protection, Ground over current protection, Capacitor Overvoltage (Using current signal) protection, Capacitor unbalance protection, over current protection.
- Harmonic Filter Protection: Ground over current protection, Capacitor Overload (Using current signal) protection, over current protection, Neutral Voltage shift.
- Auxiliary Transformer Protection: Over current, open delta voltage protection.

viii. SVC:

- Coupling Transformer (HV & MV) Protection: Differential protection, REF protection, Directional Overcurrent protection, Ground Overcurrent, over flux protection, Transformer mechanical trips.

- SVC Bus Bar protection: Bus Differential protection, Ground over current protection, used with neutral Grounding Transformer, Under/ Over Voltage protection, Over voltage (Open Delta) protection.
- TCR Protection: Differential protection, Ground over current protection, Reactor branch unbalance protection, Thermal Overload protection.
- TSC Protection: Differential protection, Ground over current protection, Capacitor Overvoltage (Using current signal) protection, Capacitor unbalance protection, over current protection.
- Harmonic Filter Protection: Differential protection, Ground over current protection, Capacitor Overvoltage (Using current signal) protection, Capacitor unbalance protection, over current protection, Neutral Voltage shift.
- Auxiliary Transformer Protection: Over current, open delta voltage protection.

ix. **FSC & TCSC:** Capacitor unbalance, Capacitor overload, Line current supervision, MOV overload, MOV short term energy protection, MOV high current protection, MOV high temperature protection, MOV failure protection, Flashover to platform protection, Spark Gap protection, Trigger circuit supervision, Sub-harmonic protection, Pole disagreement protection, Bypass switch failure protection,

x. **BUSBAR & LBB**: Differential protection, Beaker Failure Protection

21. Protection Settings Database Management System shall be suitable for integration with other portals, software of protection. It shall be able to integrate any third party application to share data between protection database management software and calculation engine/tool and vice versa.
22. Training of utilities.
23. AMC.

B. Protection Setting Calculation and Study Tool.

This module shall be capable of giving recommendation of Protection Setting for protections of elements as mentioned under point no. 20 of para A. Calculation Tool should be capable of performing the following:

1. Relay co-ordination for power system elements. Co-ordination check shall be conducted for relays of all make.
2. Primary/back-up relay pairs generation.
3. Fault calculation will be a part of relay co-ordination program.
4. Transparent Fault calculation results.
5. Simulation engines for protection co-ordination, power flow analysis, fault calculation, transient stability studies, electromagnetic transient analysis, and protection relay operation post-mortem analysis. There should be features to study low frequency oscillations, 3rd zone tripping, PSS tuning support and Voltage collapse prediction feature.
6. The protection calculation tool should be capable of interacting with the relay data in the database.
7. Tool for simulating the performance/ behavior of the protection system under all possible normal and abnormal operating conditions of the power system, including effect of changing one or more parameter setting of the relays.
8. Diagnostics Tool for verifying proper coordination among various protective relays.
9. Computation of critical clearing time.
10. Plotting Log-Log grid and graphs.
11. Option to check existing relay settings with respect to field or vice versa.
12. Computation of Out of Step Tripping Protection Settings.
13. Display of sequence operation of relays with respect to tripping time.
14. Switching status for all relays elements from the screen.
15. Association of relays to power system elements.
16. Disturbance analysis can be done on mapping of disturbances files with corresponding relay.
17. It shall have standard power system components and relay symbols.
18. Automatic computation of zone setting for distance protection.
19. Feature for viewing existing and newly computed relay settings.
20. Pre-loaded standard relay curves.
21. Directional and non-directional feature for relays.
22. Overload factor, unbalance factor and discrimination time (user defined/selectable) for each relay.
23. Inbuilt discrimination time calculator for grading of relays.

24. Facility to model the back-up protection settings of generating units / GTs.

C. Repository of DR/EL and analysis.

a) Platform for upload of DR/EL by utilities and access to all.
b) Tracking of non-compliance in uploading.
c) Tool for analysis of DR/EL.
d) **Tool shall be integrated with outage portal of NRLDC so that it can capture details of outages of elements automatically from NRLDC portal so that users can upload DR, EL, FIR, tripping report, analysis report.**

D. Application of protection settings by utilities and its approval

a) Facility to utilities for providing details of new sub-station/ relays to be commissioned in near future.
b) Facility for application of protection setting by utilities before FTC as per approved procedure of NRPC for protection settings approval.
c) Facility for application of protection setting by utilities for revision in settings.
d) Hierarchical role for scrutiny and acceptance of settings by RLDCs/SLDCs.
e) Intimation of implementation of settings by utilities.
f) Facility for NRPC Secretariat to update status of approval of settings by PSC forum. Thereafter, approved settings shall go in database automatically.
g) Log sheet, date and time tracking for each step of above.
h) Generation of various reports for analysis such as settings pending for approval or settings at various stages.

E. Reporting of performance indices by utilities.

a) Platform for reporting of performance indices by utilities.
b) Feature for scrutiny and intimation of errors to utilities by NRPC Secretariat.
c) Recording of justification note for non-compliance.
d) Generation of various reports for analysis.

F. Repository of protection audit reports.

a) Platform for uploading of internal and external audit report by utilities for sub-station wise.
b) Tracking non-compliance and next due date.
c) Facility for uploading action plan within timeline and tracking of timeline.
d) Facility for uploading compliance report.
e) Web-based format for protection audit should be made available.
f) Generation of various reports for compliance tracking.

G. Warranty Period, AMC and support

a) Deploy adequate resident engineers at NRPC Secretariat for project.
b) Modelling of existing network and upcoming sub-stations/ relays shall be done parallelly to avoid piling of data of new sub-stations.
c) Provide support during office hours.
d) On-site warranty support for 1 year from Go-Live.
e) Provide administrator and operator level training.
f) 4 years of Comprehensive Annual Maintenance Contract (C-AMC).
g) Optional 2+3 years of Annual Maintenance Contract (C-AMC) extension.
h) Develop APIs for seamless integration with external systems.
i) Vendor shall demonstrate that database shall be able to integrate with any Protection Setting Calculation Tool available in market.
j) Vendor shall finalize format for collecting data of sub-station/ relay from utilities through online mode (mail/ portal). Collection of data physical is not required to avoid delay in modelling. Modelling is to be done in timebound manner after receiving data from utilities.
k) There should be no licensee requirement for portal and it shall be a perpetual software

H. Technical Specification of Hardware/ Software

a) Technical Specifications of hardware/ software shall be finalized by NRPC Secretariat in consultation with POWERGRID.
b) Tendering, and award of contract shall be done by POWERGRID via Quality-cum-Cost Based Selection (QCBS) Method preferably.

Compliance of contract shall be ensured by monitoring committee constituted by NRPC.

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Multiple element tripping event at 400kV Aligarh(UP)

At 01:51 hrs on 02nd November, 2024

Tripped Elements

S. No	Name of Elements	Outage Time	Revival Time	Reason of tripping
1.	400 KV Aligarh-Muradnagar_1 (UP) Ckt	01:51 hrs	03:42 hrs	B-N phase to earth fault
2.	400 KV Aligarh-Shamli (UP) Ckt-1		03:23 hrs	
3.	400 KV Aligarh-Shamli (UP) Ckt-2		03:29 hrs	

Brief details of the event

i) 400/220kV Aligarh(UP) has one and half breaker scheme at 400kV level and double main and transfer bus scheme at 220kV level.

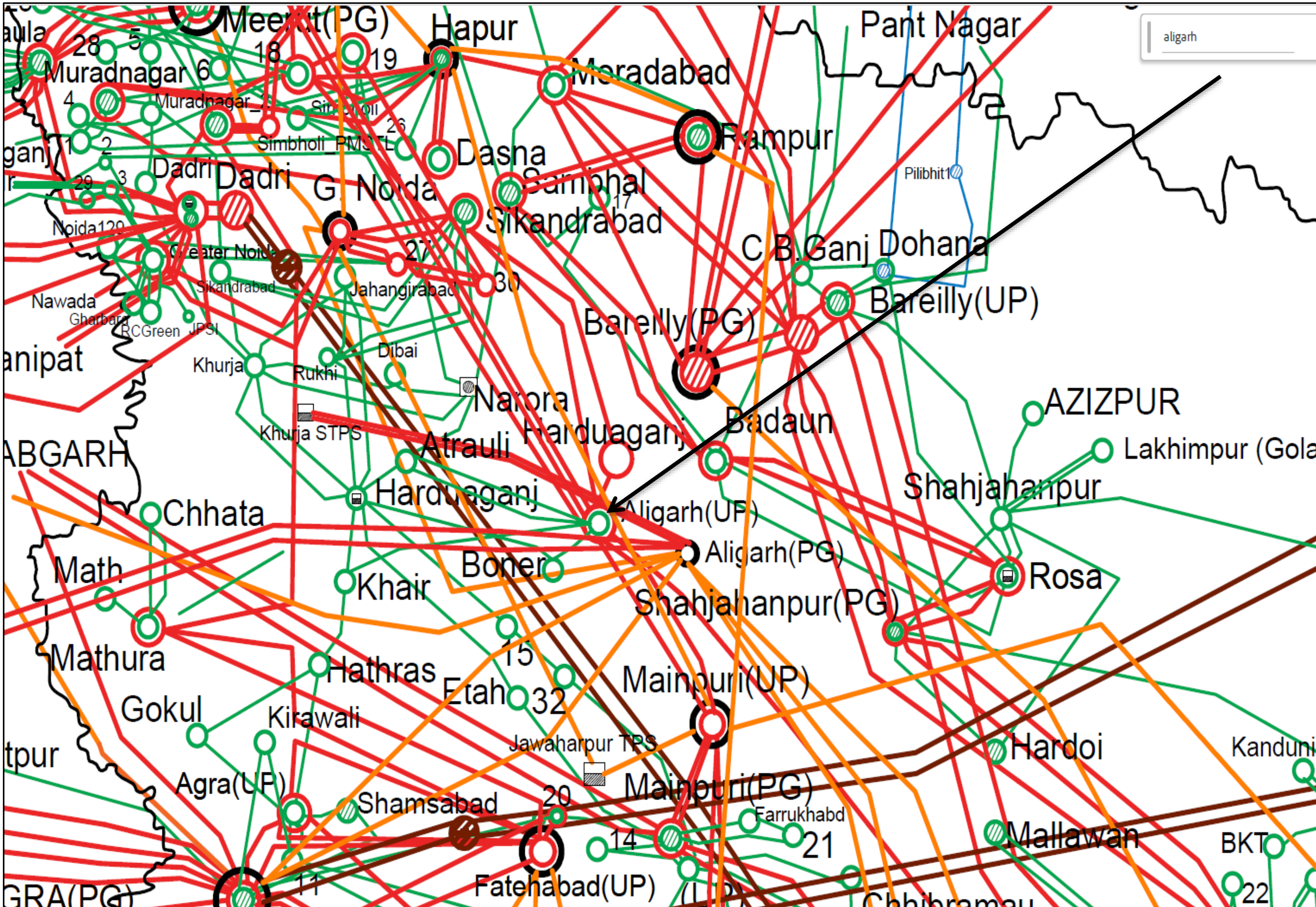
ii) As reported, at 01:51 hrs, 400 KV Aligarh-Muradnagar_1 (UP) Ckt tripped on B-N phase to earth fault with fault current of 2.912kA from Muradnagar_1 end and 18.916kA from Aligarh end; fault sensed in zone-1 at Aligarh end and zone-2 at Muradnagar_1 end. As per DR at Muradnagar_1 end, fault clearing time was ~377ms (delay in fault clearing at Muradnagar_1, carrier not received). As per DR at Aligarh end, unsuccessful A/R was observed with A/R dead time of 840 ms (less A/R dead time observed).

iii) During the same time, 400 KV Aligarh-Shamli (UP) Ckt-1 & 2 also tripped on over-voltage at Aligarh end (as per EL of Main-1 at Aligarh). As per DR, R-ph voltage reached upto ~1.35 p.u. at Aligarh end of 400 KV Aligarh-Shamli (UP) Ckt-1 and B-N phase to earth fault with fault current of 642 A from Aligarh end is observed in 400 KV Aligarh-Shamli (UP) Ckt-2. Time sync issue is observed in Main-2 relay at Aligarh end of both 400 KV Aligarh-Shamli (UP) Ckt-1 & 2. As reported, DT received at Shamli end for both the lines.

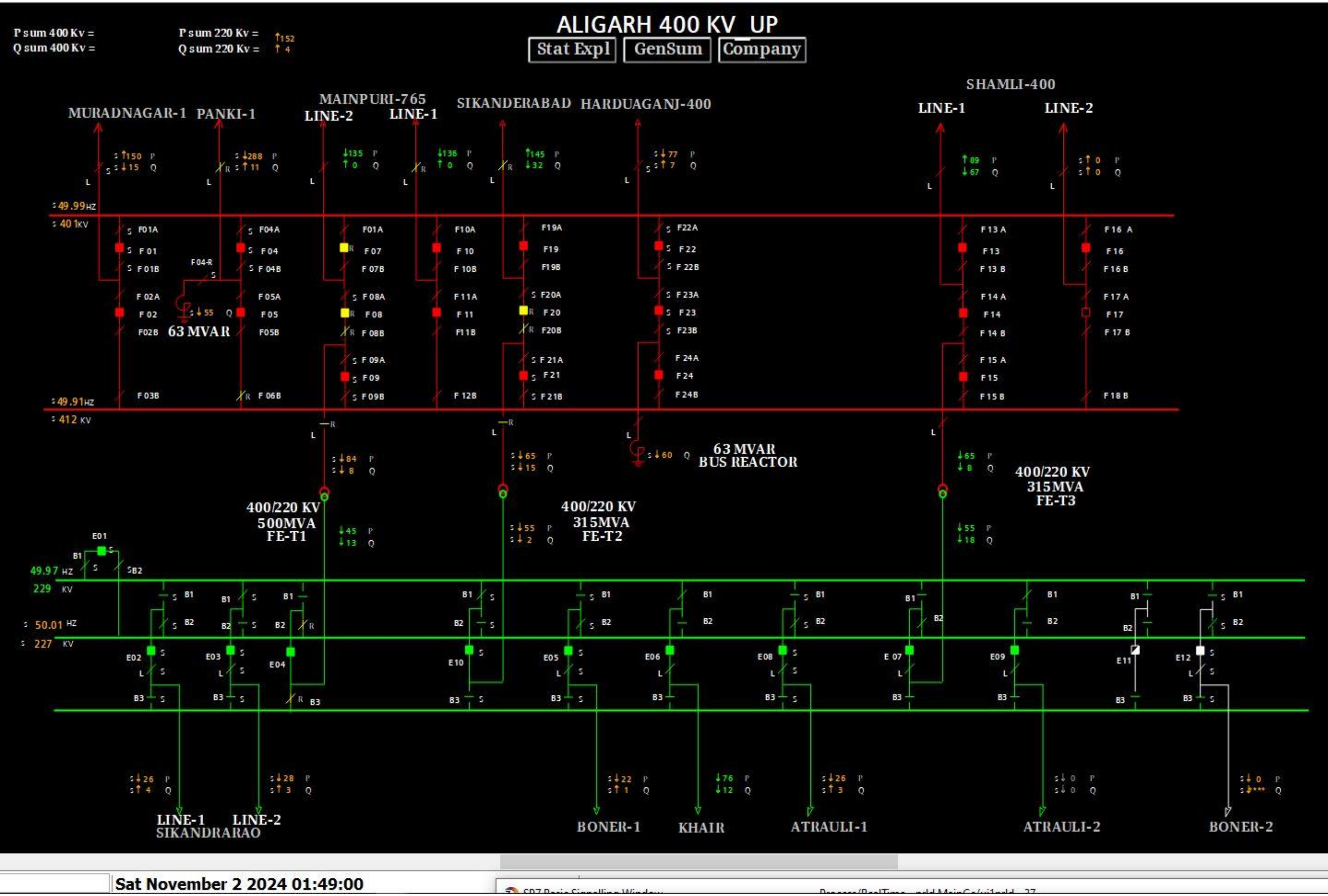
iv) As per PMU at Mainpuri(PG), B-N phase to earth fault with unsuccessful A/R is observed with fault clearing time of 80ms.

v) As per SCADA, change in demand of approx. 130 MW is observed in UP control area.

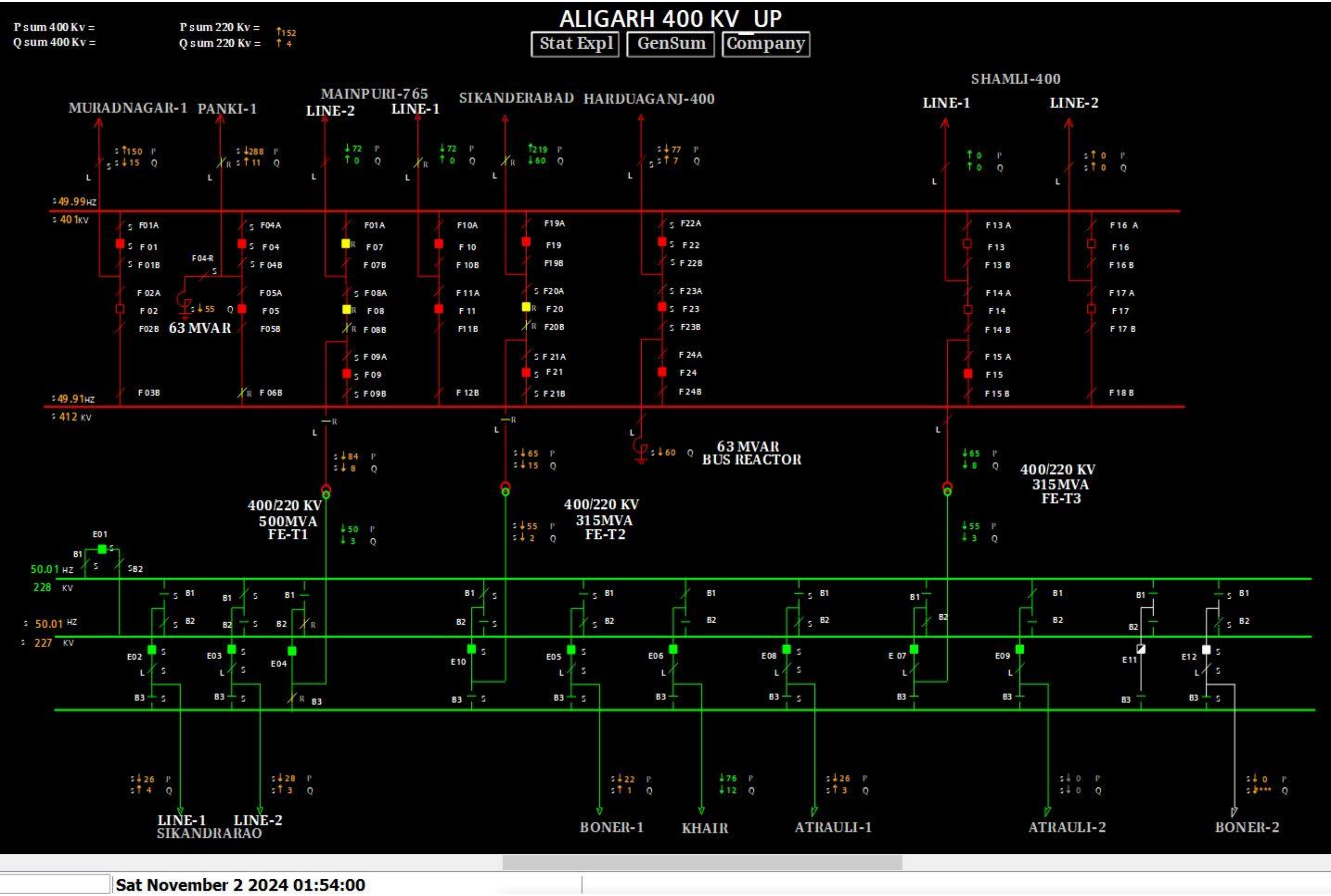
Network Diagram



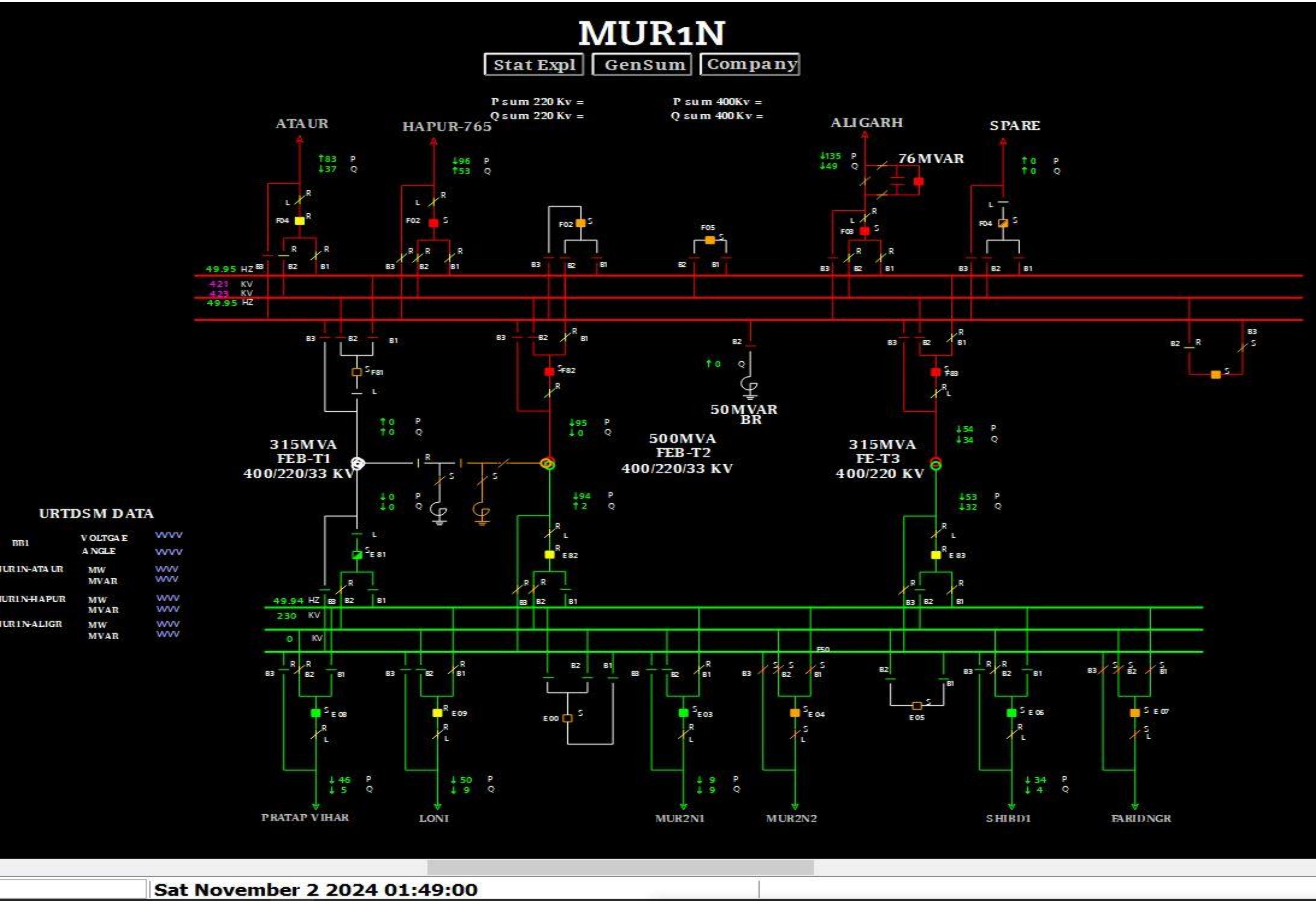
SLD of 400/220kV Aligarh(UP) before the event



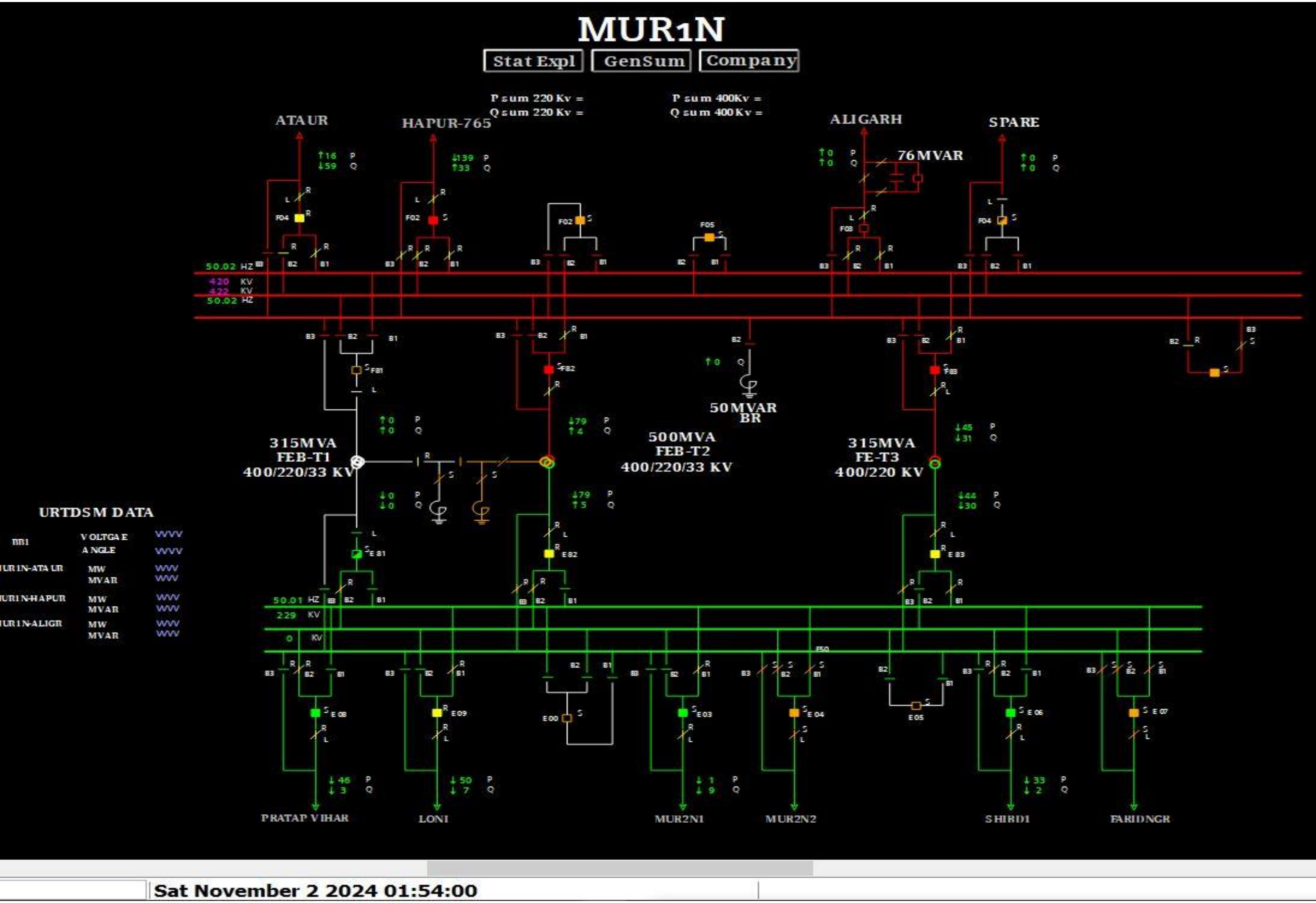
SLD of 400/220kV Aligarh(UP) after the event



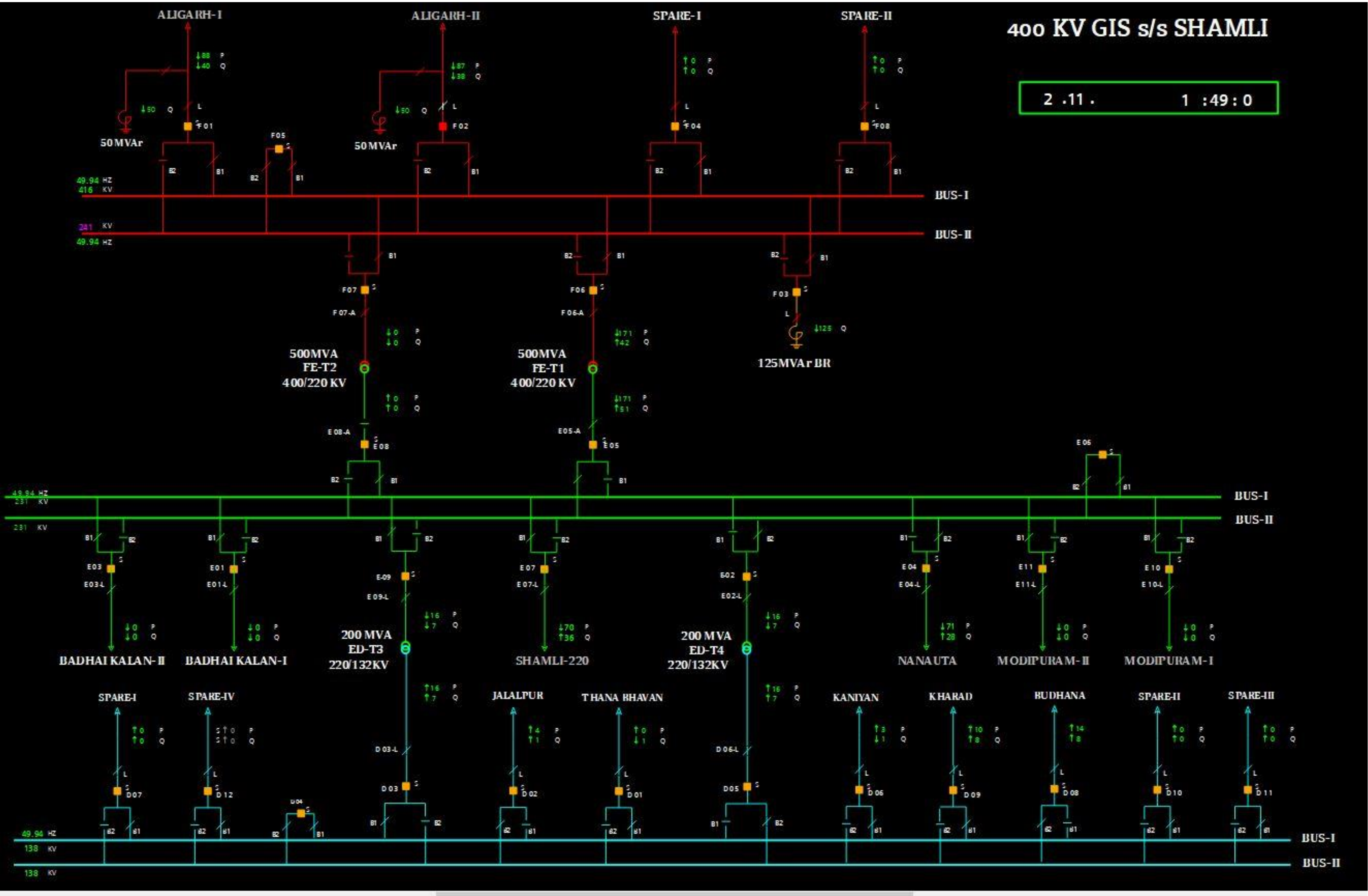
SLD of 400/220kV Muradnagar1(UP) before the event



SLD of 400/220kV Muradnagar1(UP) after the event

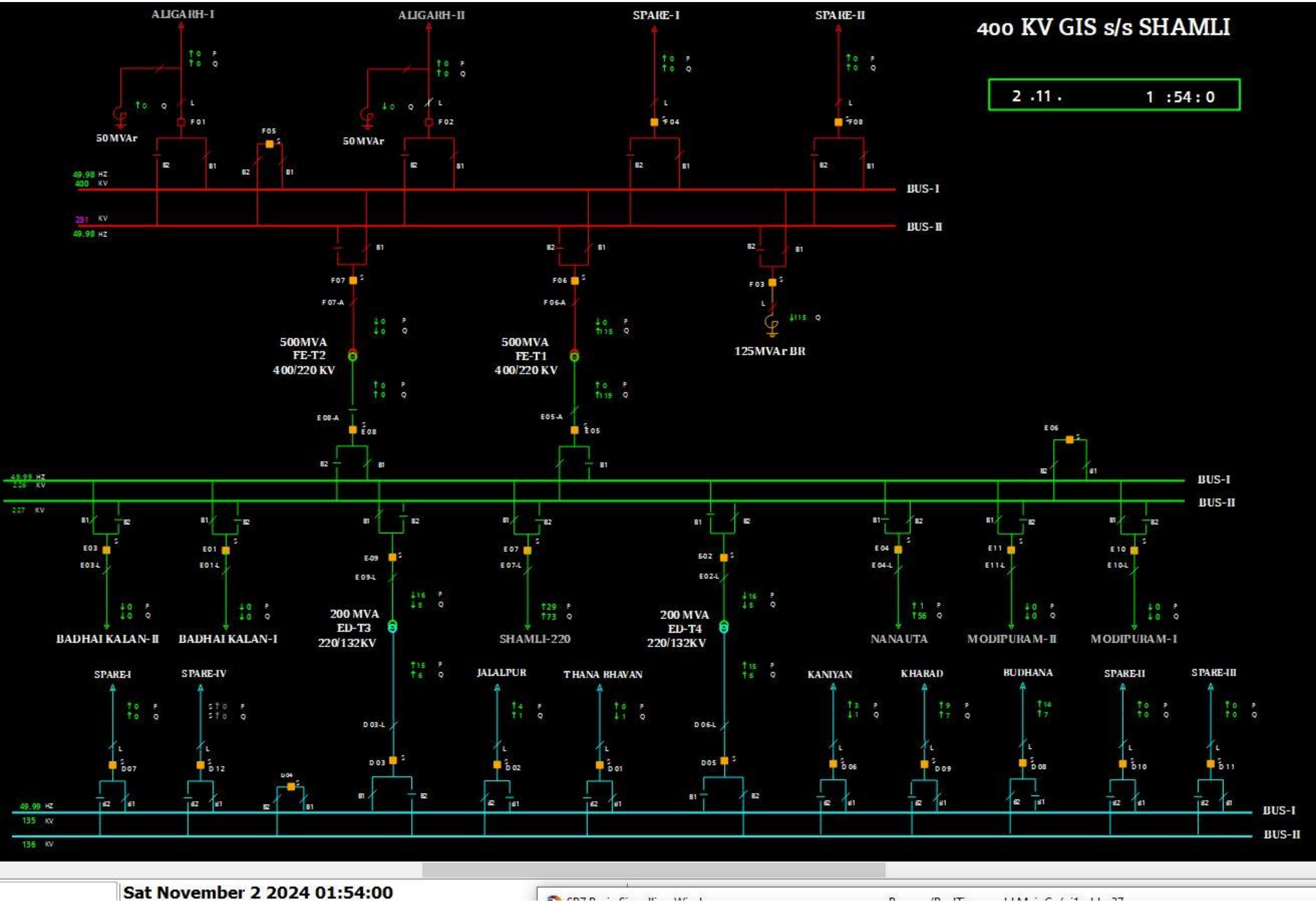


SLD of 400/220/132kV Shamli(UP) before the event

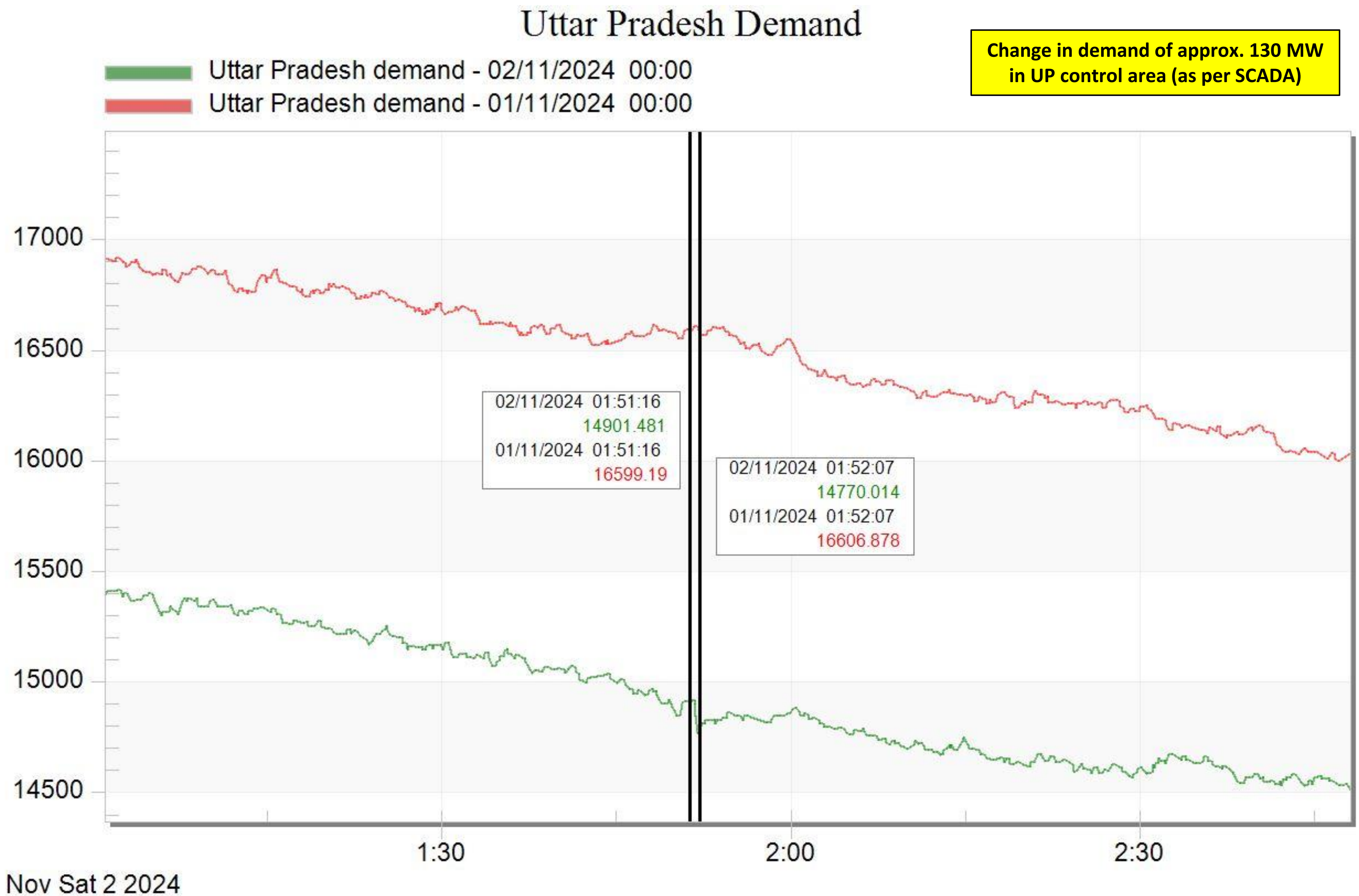


Sat November 2 2024 01:49:00

SLD of 400/220/132kV Shamli(UP) after the event

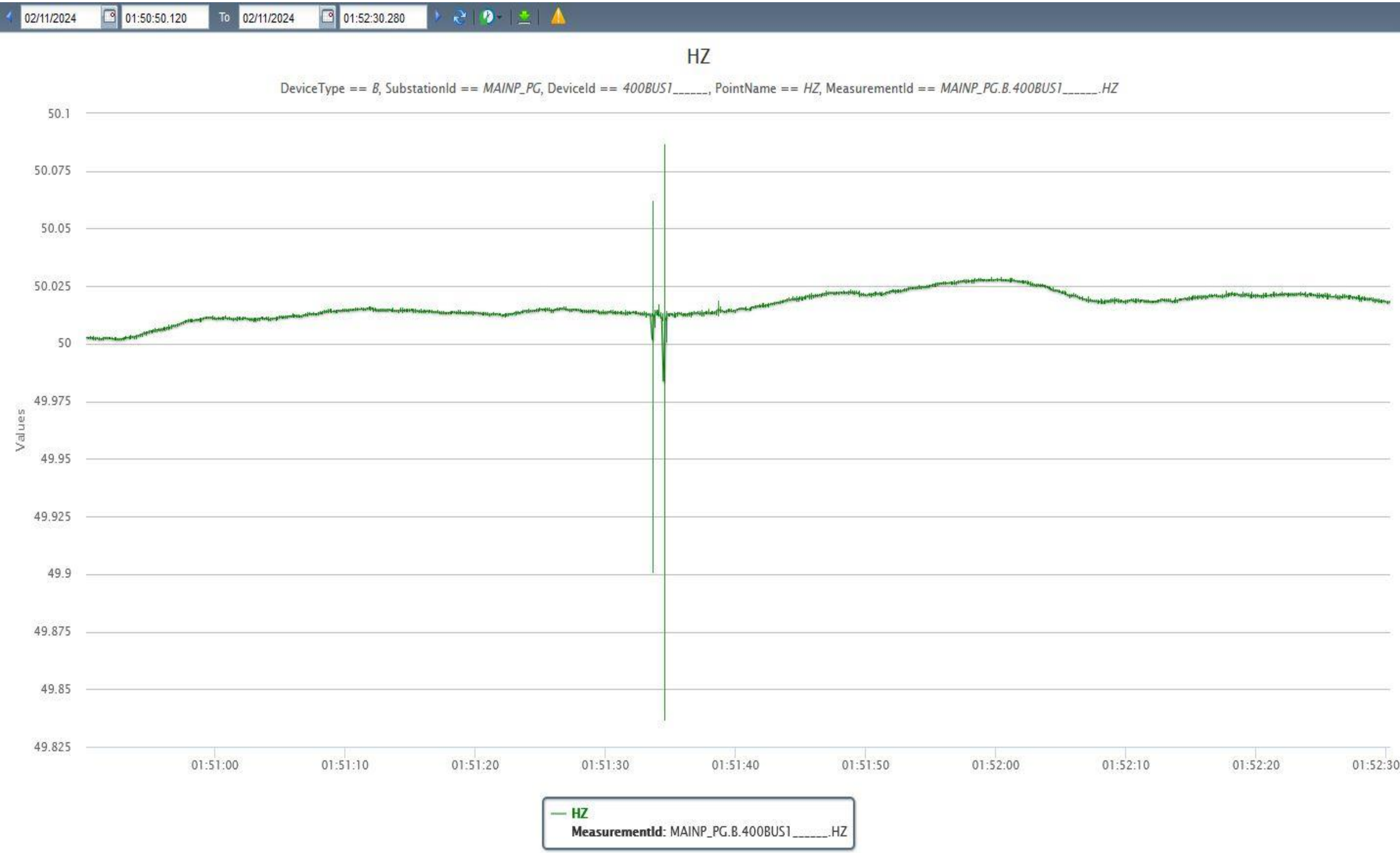


Uttar Pradesh Demand during the event



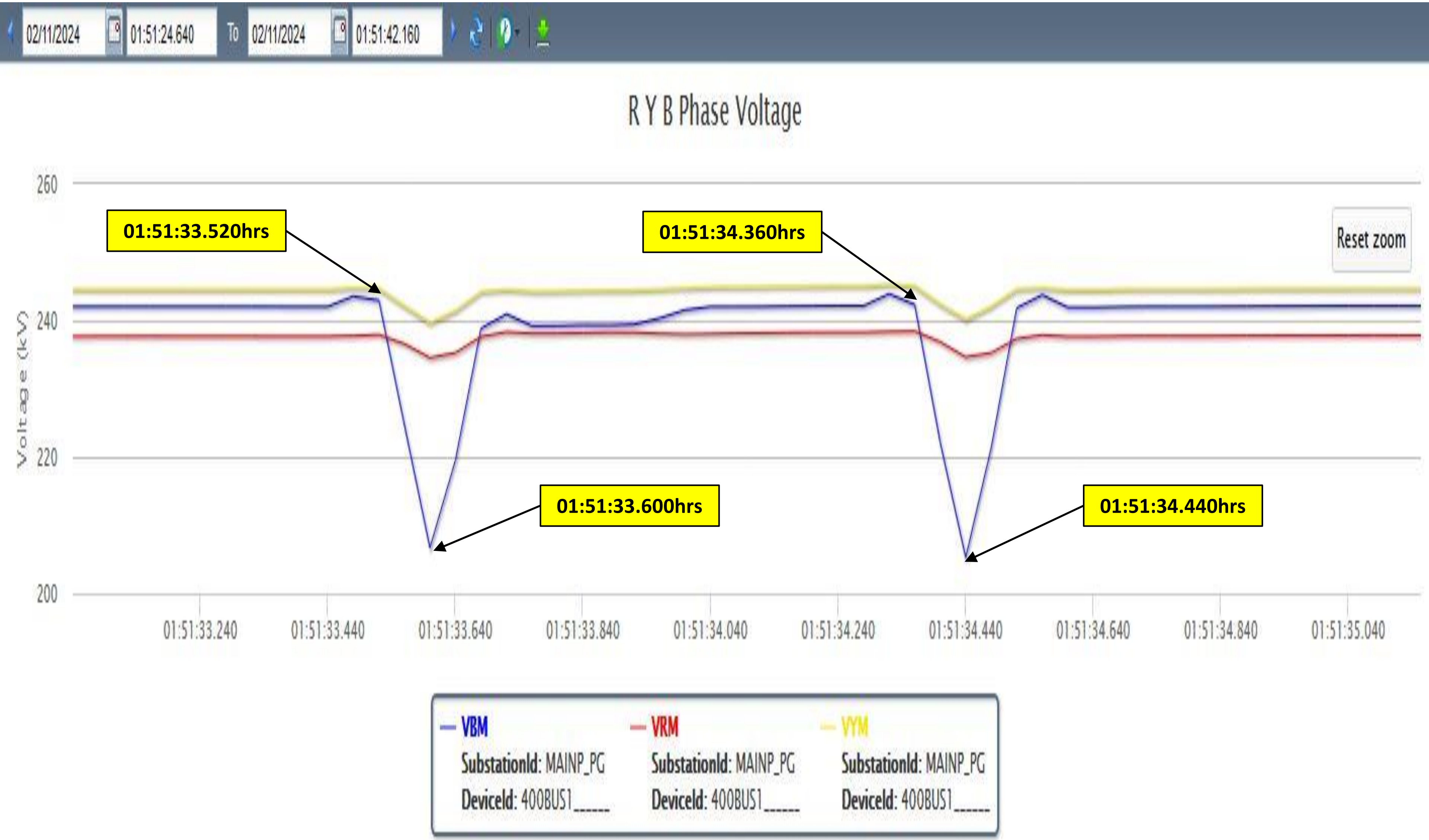
PMU Plot of frequency at Mainpuri(PG)

01:51 hrs/02-Nov-24

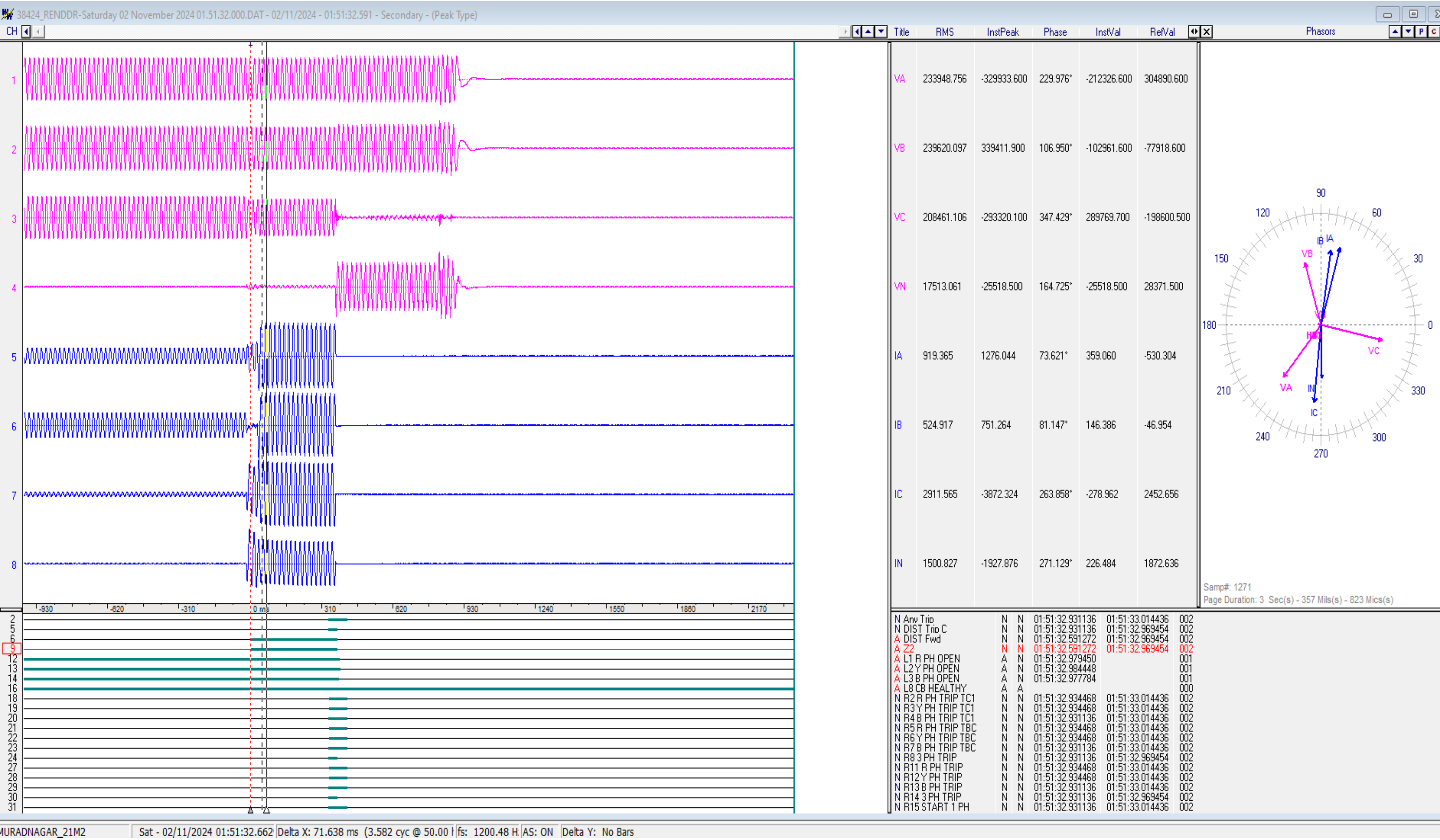


PMU Plot of phase voltage magnitude at Mainpuri(PG)

01:51 hrs/02-Nov-24

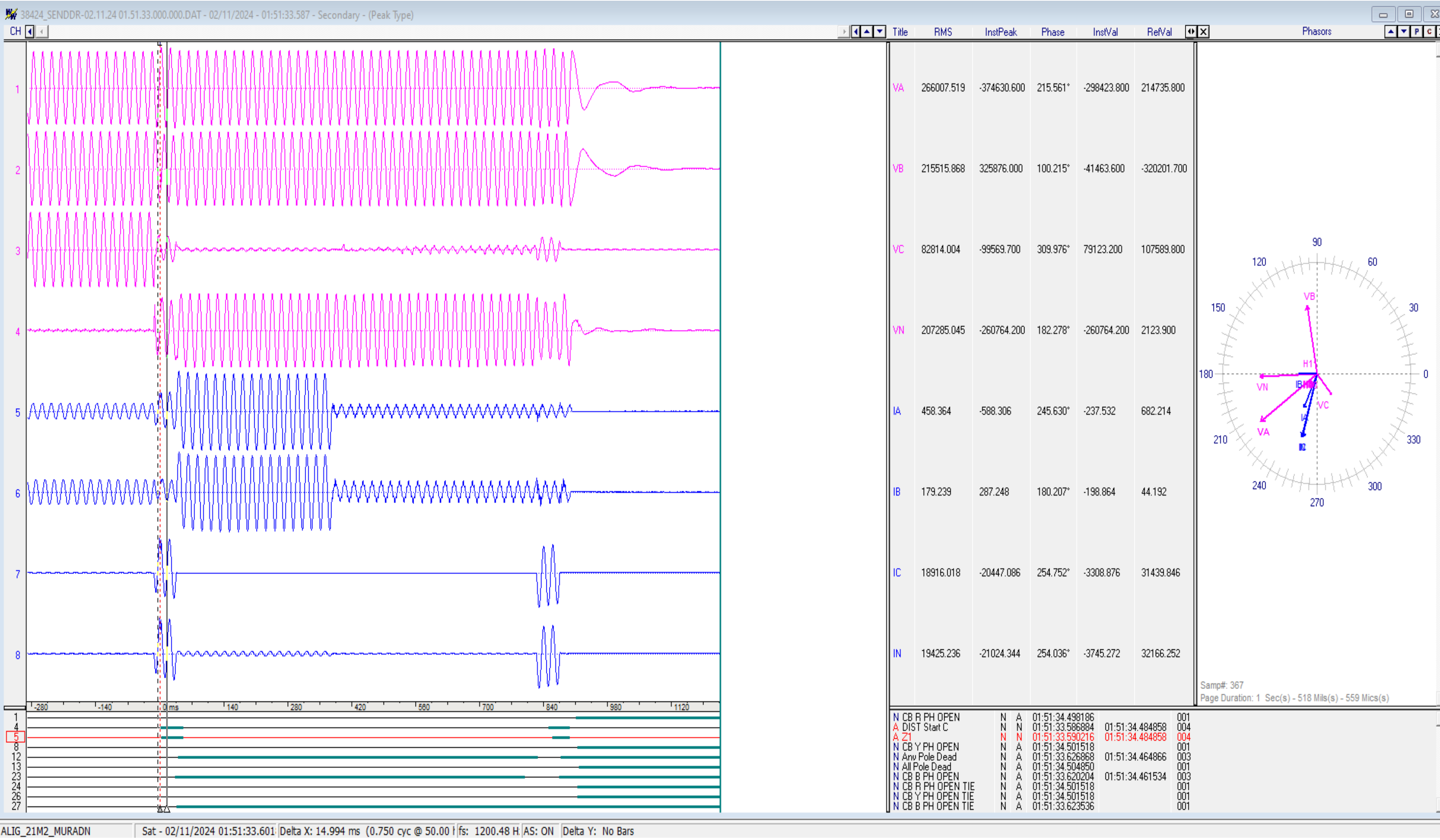


DR of 400 KV Aligarh-Muradnagar_1 (end) (UP) Ckt



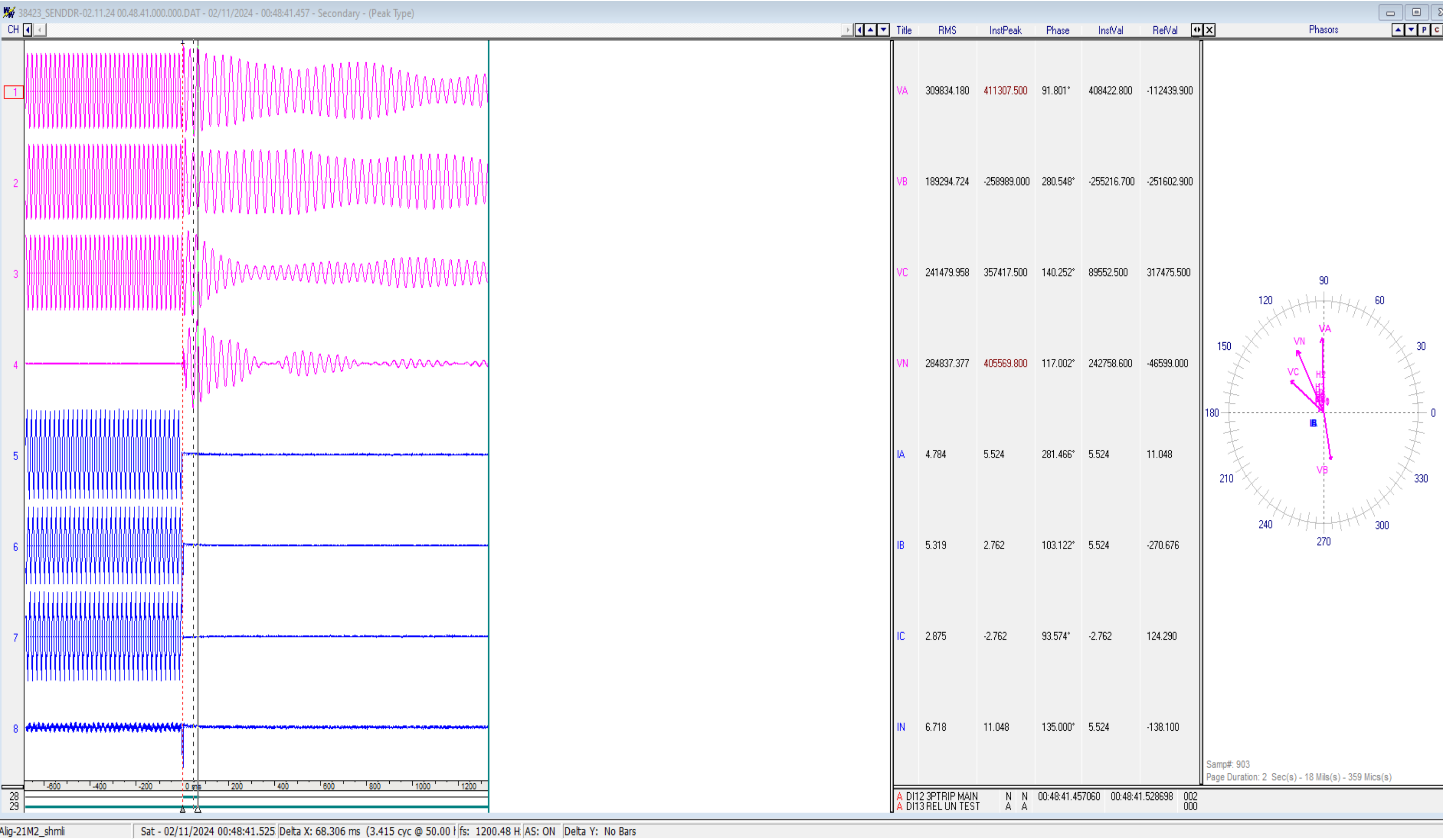
- ✓ B-N phase to earth fault; Ib=~2.912kA
- ✓ Fault sensed in zone-2 at Muradnagar_1 end
- ✓ Fault clearing time= ~377ms

DR of 400 KV Aligarh (end)-Muradnagar_1 (UP) Ckt



- ✓ B-N phase to earth fault; Ib=~18.916kA
- ✓ Fault sensed in zone-1 at Aligarh end
- ✓ Unsuccessful A/R observed; A/R dead time= ~840ms

DR of 400 KV Aligarh (end) -Shamli (UP) Ckt-1 (Main 2)



- ✓ R-ph voltage reached upto ~1.35 p.u.
- ✓ No flag in Main-2 relay at Aligarh
- ✓ Time sync issue observed

EL of 400 KV Aligarh (end) -Shamli (UP) Ckt-1 (Main 1)

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Digital Output 9
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Phase A Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Phase B Overvoltage Unit 1 Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

Tripped on over-voltage

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Phase B Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Phase C Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Pole A Open Command
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Pole B Open Command
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Pole C Open Command
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Three Phase Open Command
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Three Phase Overvoltage Unit 1 Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

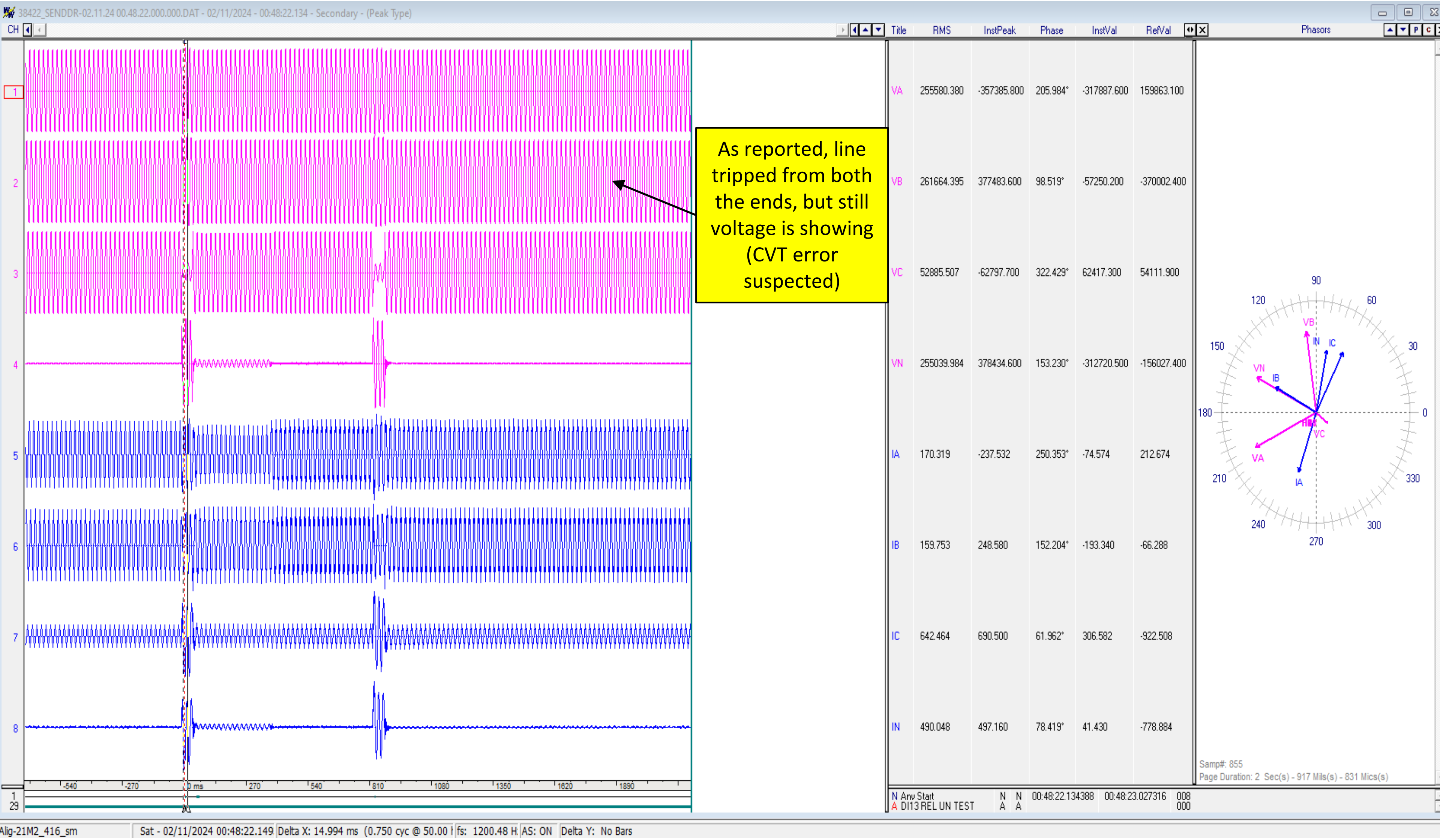
IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Three Phase Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Three Phase Trip Preparation
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

DR of 400 KV Aligarh (end) -Shamli (UP) Ckt-2 (Main 2)



- ✓ B-N phase to earth fault; Ib=~642A
- ✓ No flag in Main-2 relay at Aligarh end
- ✓ Time sync issue observed

EL of 400 KV Aligarh (end) -Shamli (UP) Ckt-2 (Main 1)

0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Pole C Open Command

0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Three Phase Open Command

0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Three Phase Overvoltage Unit 1 Trip

Tripped on over-voltage

0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Three Phase Trip

0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Three Phase Trip Preparation

0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Trip

0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.592**Event:** ON Digital Output 13

0.152A 0.165A 0.164A 0.007A 65.896V 66.473V 65.660V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.592**Event:** ON Digital Output 14

0.152A 0.165A 0.164A 0.007A 65.896V 66.473V 65.660V

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
01:51:33,726	MUR1N_UP	400kV	03ALIGR	Circuit Breaker	Open	Line CB at Muradnagar_1(UP) end of 400 KV Aligarh-Muradnagar_1 (UP) Ckt-1 opened
01:51:34,524	ALIGR_UP	400kV	02TIE	Circuit Breaker	Open	Tie CB at Aligarh(UP) end of 400 KV Aligarh-Muradnagar_1 (UP) Ckt-1 opened
01:51:38,640	SHML4_UP	400kV	02ALIGR2	Circuit Breaker	Open	Line CB at Shamli(UP) end of 400 KV Aligarh-Shamli (UP) Ckt-2 opened
01:51:38,642	ALIGR_UP	400kV	13SHMLI1	Circuit Breaker	disturbe	
01:51:38,643	SHML4_UP	400kV	01ALIGR1	Circuit Breaker	Open	Line CB at Shamli(UP) end of 400 KV Aligarh-Shamli (UP) Ckt-1 opened
01:51:38,643	ALIGR_UP	400kV	16SHMLI2	Circuit Breaker	disturbe	
01:51:38,658	ALIGR_UP	400kV	14TIE	Circuit Breaker	Open	Tie CB at Aligarh(UP) end of 400 KV Aligarh-Shamli (UP) Ckt-1 opened
01:51:38,682	ALIGR_UP	400kV	13SHMLI1	Circuit Breaker	Open	Main CB at Aligarh(UP) end of 400 KV Aligarh-Shamli (UP) Ckt-1 opened
01:51:38,683	ALIGR_UP	400kV	16SHMLI2	Circuit Breaker	Open	Main CB at Aligarh(UP) end of 400 KV Aligarh-Shamli (UP) Ckt-2 opened

Points for Discussion

i) Exact reason, nature and location of fault need to be shared.

ii) Reason of delay in fault clearance at Muradnagar_1 end need to be analysed. It is suspected that carrier is not received at Muradnagar_1 end. Healthiness of PLCC communication need to be ensured.

iii) Time sync issue in DR of Main-2 relay at Aligarh end of 400 KV Aligarh-Shamli (UP) Ckt-1 & 2 need to be resolved.

iv) As reported, 400 KV Aligarh-Shamli (UP) Ckt-2 tripped from both the ends, but still voltage is showing in DR, hence CVT error is suspected. The same need to be analysed and shared.

v) DR of Shamli end and Main-1 relay at Aligarh end of 400 KV Aligarh-Shamli (UP) Ckt-1 & 2 need to be shared.

vi) Remedial action taken report to be shared.

400KV Sub-Station Aligarh, UPPTCL

Date: 02.11.2024

Time- 01:51 hrs

400kV Shamli-1,Shamli-2 lines tripped at over voltage, and Muradnagar tripped at distance protection zone -1

400 KV S/S Aligarh : 400KV shamli-I,shamli-II lines tripped at over voltage and Muradnagar at distance protection zone -1

- **Date & Time of event**: 02.11.2024 at 01:51 hrs
- **Sub-Station affected**: 400KV S/S Aligarh
- **Date & Time of restoration**:

400KV Shamli -I	03:23hrs, 02.11.2024
400KV Shamli-II	03:29hrs, 02.11.2024
400KV Muradnagar	03:42hrs, 02.11.2024

Antecedents condition

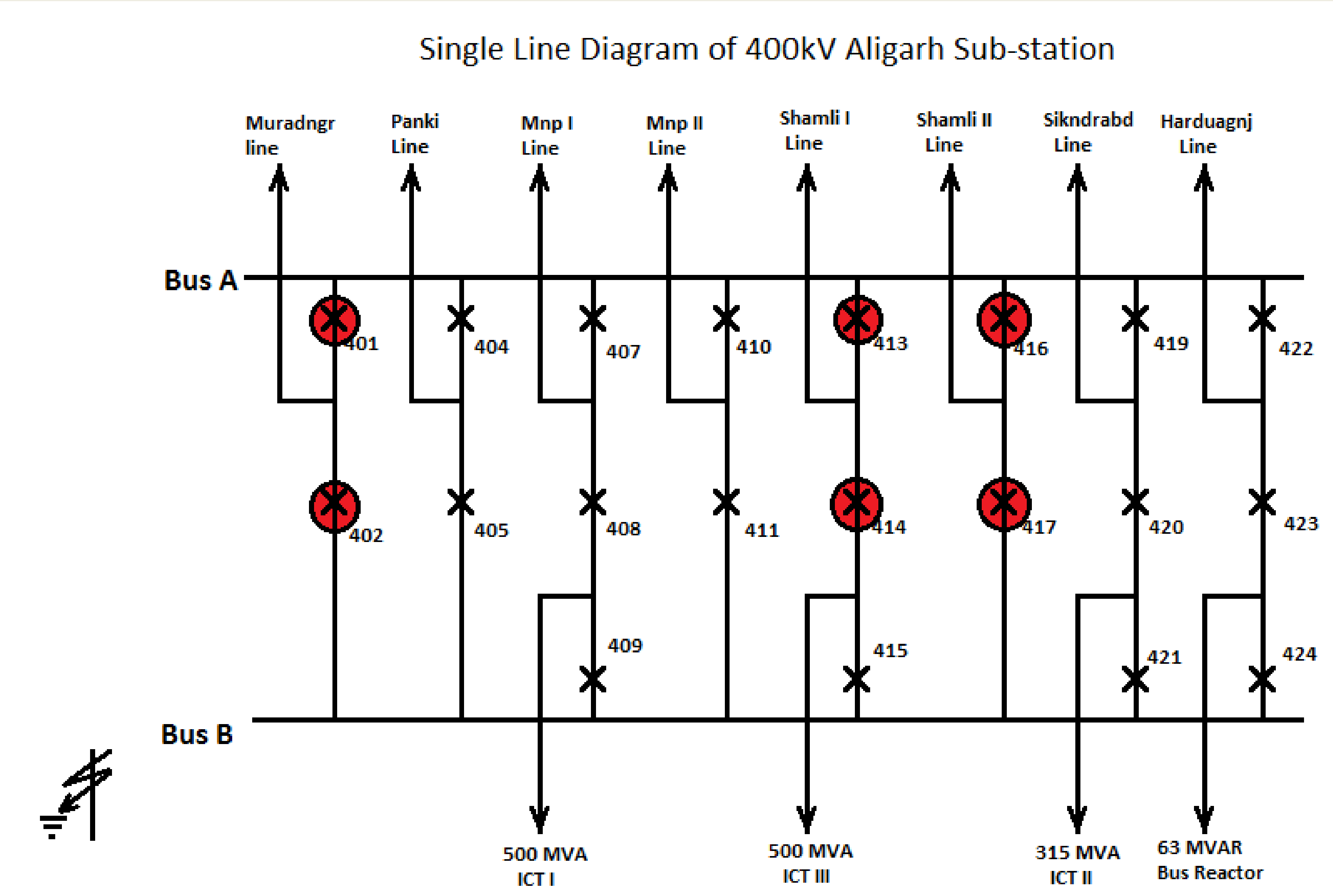
- In antecedents condition loading as follows:

400KV SHAMLI-I	Exp. 89 MW
400KV SHAMLI-II	Exp. 87 MW
400KV MURADNAGAR	Exp. 137 MW
400kV PANKI	Imp.151MW
400KV MAINPURI-1	Imp.72MW
400KV MAIPURI-2	Imp72MW
400KV HARDUAGANJ	Imp72MW
BUS -1 VOLTAGE	416KV
BUS-2 VOLTAGE	416KV

REPORT

ELECTRICITY TEST & COMMISSIONING CIRCLE, AGRA (DIV-T&C)							
FAULT ANALYSIS STATEMENT OF PROTECTIVE GEARS 400 KV FOR THE M/O-NOVEMBER 2024 (DIV Aligarh T&C)							
S. No.	**NAME OF SUBSTATION**	**TRIPPING DT/TIME**	**CLOSING DT/TIME**	**FEEDER NAME**	**TYPE OF Relay Aligarh End**	**Aligarh End flags**	**ANALYSIS**
1	400 kv SubStation Aligarh	02.11.2024 1:51Hrs.	02.11.2024 03:23Hrs.	400kv Shamli-1 Line	ZIV/micom	Main-1 Phase-B(ABC),Distance-(-2616.063Km) , Fault Duration-58.000mS,Over voltage B-Phase tripped,IA-0.159A ,IB-0.175A , IC-0.152A ,VA 168.143V,VB-70.77V ,VC-34.7V	As Per Analysis Of DR & Event Distance Protection Main1 & Main2 Over Voltage Unit-1 Tripped
2	400 kv SubStation Aligarh	02.11.2024 1:51Hrs.	02.11.2024 03:29Hrs.	400kv Shamli-2 Line	ZIV/micom	Main-1 Phase-B(ABC),Distance-(-22749.375Km) , Fault Duration-58.000mS,Over voltage B-Phase tripped,IA-0.152A ,IB-0.165A,IC-0.164A ,VA 68.340V ,VB-70.043V,VC-35.786V	As Per Analysis Of DR & Event Distance Protection Main1 & Main2 Over Voltage Unit-1 Tripped
3	400 kv SubStation Aligarh	02.11.2024 1:51Hrs.	02.11.2024 03:42Hrs.	400kv MURADNGARLine	ZIV/micom	Main-1 ,Phase-C(ABC),Zone-1,Distance-(-877.063Km) ,Over Volt Alarm , Fault Current - IA-0.245A ,IB-0.242A IC-0.250A ,VA -65.887V ,VB-68.484V ,VC-65.701V,Main-2 Phase -C(ABC), Fault Duration-69.99mS,Fault Current IA-147.0mA, IB- 151.2mA, IC- 18.08A,VAN-71.50V VBN-63.48V VCN-21.83V	As Per Analysis Of DR & Event Distance Protection Main1 & Main2 Zone-1 Tripped With Over Voltage

SINGLE LINE DIAGRAM OF 400 KV S/S ALIGARH



Events Description

- On 02/11/2024 at 01:51 hrs, following elements were tripped:
- (1) 400kV Shamli-I line, (2) 400kV Shamli-II line, (3) 400kV Muradnagar
- **(1) 400KV SHAMLI -I LINE:** AS PER ANALYSIS OF DR AND EVENT OF DISTANCE PROTECTION MAIN 1 ,MAIN 2,IT IS FOUND THAT THE LINE TRIPPED AT OVER VOLTAGE STAGE- I. OVER VOLTAGE STAGE- I AT 01:51 38:596HRS SETTINGS WAS 107% AS PER SOP WITH DELAY TIME 05 SEC.
- **(2) 400KV SHAMLI -II LINE:** AS PER ANALYSIS OF DR AND EVENT OF DISTANCE PROTECTION MAIN 1 ,MAIN 2,IT IS FOUND THAT THE LINE TRIPPED AT OVER VOLTAGE STAGE- I. OVER VOLTAGE STAGE- I AT 01:51:38:592HRS, SETTINGS WAS 109% AS PER SOP WITH DELAY TIME OF 05 SEC.
- **(3) MURADNAGAR :** AS PER ANALYSIS OF DR AND EVENT OF MI & M2 DIST PROT RELAY , IT FOUND THAT OVER VOLTAGE PICKUP AT TIME 01:51:33:583HRS WITH DISTANCE PROTECTION B PHASE ZONE- 1 ,TRIPPING.AT 01:51:34HRS

Reason of Over voltage operated:

Shamli-1 and shamli -2

- Due to the long transmission line(243km) and absence of line reactor, there is insufficient reactive power compensation at Aligarh end.
  This causes the voltage at Aligarh end Increase above the normal operating value.
- Other end reactor rating 50MVAR
- As per SOP Operation director letter No 6346 dated by 31/12/22 over voltage setting of double circuit feeder were set as 107% to 110 % and time Delay of 05 sec for both circuits. Time grading is not taken for double circuit, but at the time of tripping voltage recorded more than 110% at the time of tripping. Therefore both circuits tripped instantaneously.

400KV Muradnagar feeder :

- Line tripped at distance protection zone -1,But at the time of distance tripping, line over voltage already picked up ,this resulted final tripping of line.

EVENTS OF 400 KV SHAMLI-I LINE

Events

11/02/2024-01:51:33.588**Event:** OFF Power Swing Detector Enabled
0.166A 0.165A 0.296A 0.215A 68.439V 69.420V 39.551V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.592**Event:** ON Phase B Overvoltage Unit 1 Pick Up
0.172A 0.163A 0.404A 0.296A 68.143V 70.777V 34.791V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.597**Event:** ON Open Phase Detector Pick Up
0.175A 0.164A 0.449A 0.359A 70.324V 70.645V 22.918V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.597**Event:** ON Phase A Overvoltage Unit 1 Pick Up
0.175A 0.164A 0.449A 0.359A 70.324V 70.645V 22.918V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.637**Event:** OFF Open Phase Detector Pick Up
0.166A 0.172A 0.384A 0.285A 67.213V 69.744V 36.434V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.641**Event:** ON Power Swing Detector Enabled
0.149A 0.180A 0.229A 0.150A 67.006V 67.764V 50.247V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF Power Swing Detector Enabled
0.140A 0.184A 0.189A 0.087A 65.770V 67.896V 61.061V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.649**Event:** OFF Phase A Overvoltage Unit 1 Pick Up
0.143A 0.179A 0.186A 0.072A 65.967V 68.078V 63.412V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.711**Event:** ON Power Swing Detector Enabled
0.133A 0.179A 0.151A 0.048A 66.750V 67.957V 63.688V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.423**Event:** OFF Power Swing Detector Enabled
0.171A 0.165A 0.280A 0.152A 66.908V 69.129V 50.505V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.429**Event:** ON Open Phase Detector Pick Up
0.185A 0.162A 0.395A 0.296A 69.504V 70.557V 29.075V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.437**Event:** ON Phase A Overvoltage Unit 1 Pick Up
0.194A 0.159A 0.542A 0.425A 70.680V 71.816V 14.392V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.481**Event:** OFF Open Phase Detector Pick Up
0.171A 0.177A 0.221A 0.144A 67.336V 67.025V 51.273V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.481**Event:** ON Power Swing Detector Enabled
0.171A 0.177A 0.221A 0.144A 67.336V 67.025V 51.273V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.487**Event:** OFF Power Swing Detector Enabled
0.165A 0.179A 0.198A 0.060A 65.313V 67.143V 63.170V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.489**Event:** OFF Phase A Overvoltage Unit 1 Pick Up
0.167A 0.175A 0.194A 0.041A 65.307V 67.238V 65.582V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.551**Event:** ON Power Swing Detector Enabled
0.161A 0.175A 0.154A 0.006A 65.934V 66.676V 65.793V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Any Unit Picked Up
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Digital Output 11
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Digital Output 12
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Digital Output 23
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Digital Output 25
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Digital Output 36
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Digital Output 6
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Digital Output 9
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Phase A Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Phase B Overvoltage Unit 1 Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Phase B Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Phase C Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Pole A Open Command
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Pole B Open Command
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Pole C Open Command
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Three Phase Open Command
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Three Phase Overvoltage Unit 1 Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Three Phase Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Three Phase Trip Preparation
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.594**Event:** ON Trip
0.160A 0.174A 0.152A 0.007A 65.863V 66.533V 65.611V

IA	IB	IC	IN	VA	VB	VC

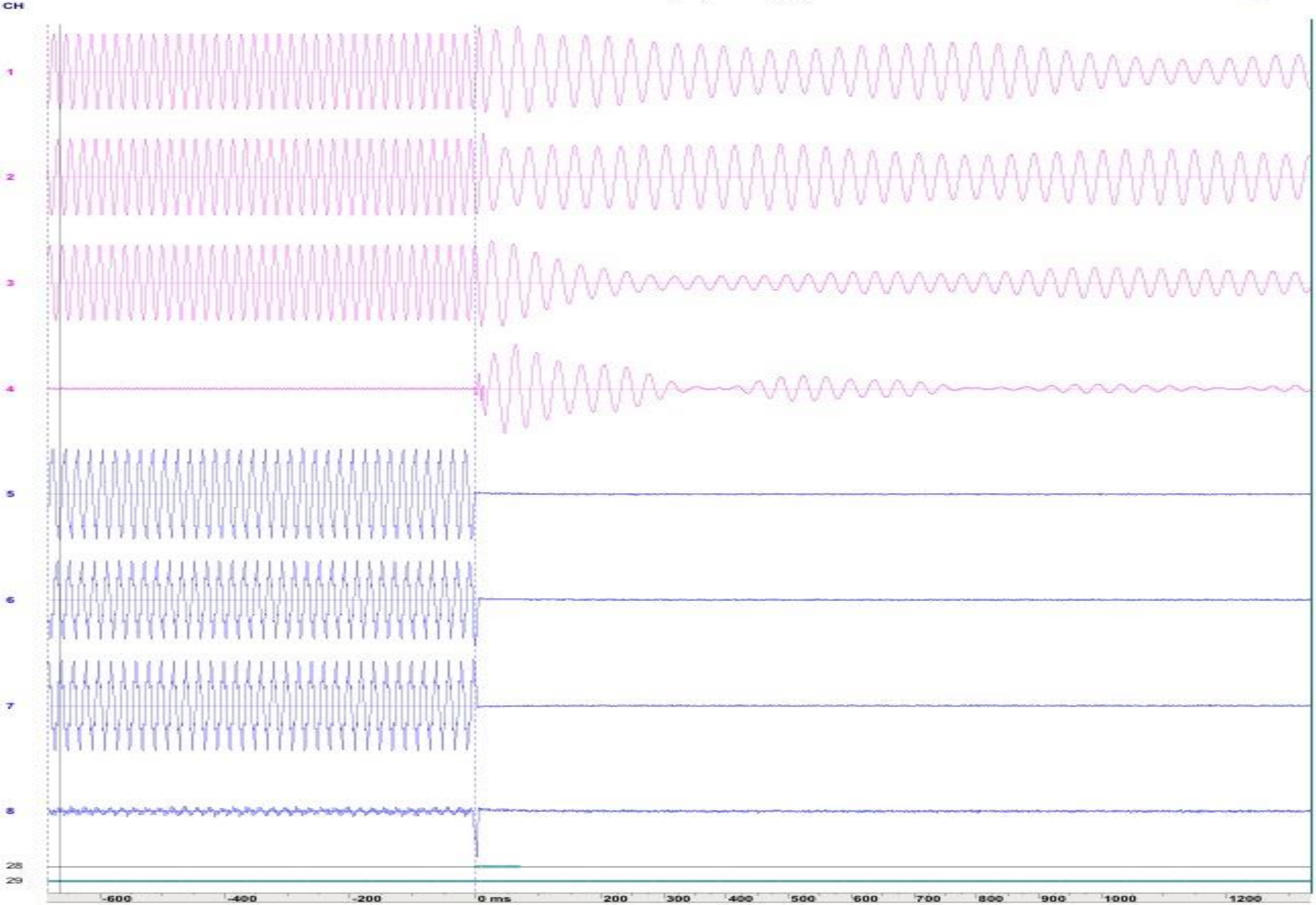
11/02/2024-01:51:38.596**Event:** ON Digital Output 10

```
* File Information::
* -------------------
           Station: Alig-21M2_shmli
            Device: 1
         File Name: C:\USERS\DELL\DESKTOP\XYZ\02112024SHAML-1\MAIN 2 DR\02.11.24 00.48
         File Size: 484801 Bytes
     Prefault Time: 02/11/2024 00:48:40.774000
        Fault Time: 02/11/2024 00:48:41.457000
         Save Time: 11/02/2024 11:24:16
      Process Time: 12/12/2024 17:09:02
 Start Date && Time: 02/11/2024 00:48:40.774000
   End Date && Time: 02/11/2024 00:48:42.792359
     File Duration: 2  Sec(s) - 18 Mils(s) - 359 Mics(s)
 Sampling Frequency: 1200.480192, 833.000  Microsecond Rate
    Line Frequency: 50.000000

* Maximum/Minimum Analog Summary:
* --------------------------------
>  Max-Inst      Min-Inst        Max-RMS       Min-RMS      One-Bit    Inst-Diff     RMS-Diff   p
 411307.500  -421229.600   318204.594    75135.563     31.7000     9922.100   243069.031
 401987.700  -349048.700   264932.656    56076.652     31.7000    52939.000   208856.004
 384996.500  -398849.400   310542.563    41458.824     31.7000    13852.900   269083.738
 405569.800  -409500.600   302066.781     1702.295     31.7000     3930.800   300364.486
    262.390     -259.628      164.811        1.127      2.7620        2.762      163.685
    303.820     -353.536      213.916        1.264      2.7620       49.716      212.652
    270.676     -265.152      248.963        1.126      2.7620        5.524      247.837
     27.620     -237.532       94.317        2.325      2.7620      209.912       91.992

* Events/Sensors Activity Summary:
* ----------------------------------
>Fst  Lst  Fst-Change       Lst-Change       Changes    Description
  N    N    00:48:41.457060  00:48:41.528698  002          28-DI12 3PTRIP MAIN
  A    A    xx:xx:xx.xxxxxx  xx:xx:xx.xxxxxx  000          29-DI13 REL UN TEST
```

02.11.24 00.48.41.000.000.DAT - 02/11/2024 - 00:48:41.457 - Secondary - (Peak Type) Page: 1



Alig-21M2 shmli DT: 02/11/2024 00:48:40.793992 Dt: 663068 microsec - 33.15 Cyc 1200.4802 AS: ON

EVENTS OF 400 KV SHAMLI-II LINE

Events

11/02/2024-01:51:33.587**Event:** OFF Multi Phase Fault
0.159A 0.146A 0.295A 0.176A 68.361V 69.010V 41.466V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.587**Event:** OFF Power Swing Detector Enabled
0.159A 0.146A 0.295A 0.176A 68.361V 69.010V 41.466V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.587**Event:** OFF Three Phase Fault
0.159A 0.146A 0.295A 0.176A 68.361V 69.010V 41.466V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.587**Event:** ON CG Fault
0.159A 0.146A 0.295A 0.176A 68.361V 69.010V 41.466V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.587**Event:** ON Fault Detector Activation
0.159A 0.146A 0.295A 0.176A 68.361V 69.010V 41.466V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.587**Event:** ON Ground Fault
0.159A 0.146A 0.295A 0.176A 68.361V 69.010V 41.466V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.589**Event:** ON Phase B Overvoltage Unit 1 Pick Up
0.162A 0.146A 0.377A 0.239A 68.346V 70.043V 35.786V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.597**Event:** ON Phase A Overvoltage Unit 1 Pick Up
0.171A 0.145A 0.533A 0.398A 70.848V 71.516V 15.519V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.641**Event:** OFF CG Fault
0.131A 0.173A 0.196A 0.133A 67.035V 67.635V 52.979V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.641**Event:** OFF Ground Fault
0.131A 0.173A 0.196A 0.133A 67.035V 67.635V 52.979V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.641**Event:** ON Multi Phase Fault
0.131A 0.173A 0.196A 0.133A 67.035V 67.635V 52.979V

IA	IB	IC	IN	VA	VB	VC

CONTINUE…

11/02/2024-01:51:33.641**Event:** ON Power Swing Detector Enabled
0.131A 0.173A 0.196A 0.133A 67.035V 67.635V 52.979V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.641**Event:** ON Three Phase Fault
0.131A 0.173A 0.196A 0.133A 67.035V 67.635V 52.979V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.645**Event:** OFF Multi Phase Fault
0.130A 0.176A 0.203A 0.081A 65.943V 67.879V 60.928V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.645**Event:** OFF Power Swing Detector Enabled
0.130A 0.176A 0.203A 0.081A 65.943V 67.879V 60.928V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.645**Event:** OFF Three Phase Fault
0.130A 0.176A 0.203A 0.081A 65.943V 67.879V 60.928V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.707**Event:** OFF Fault Detector Activation
0.124A 0.170A 0.162A 0.036A 66.736V 67.896V 63.656V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.709**Event:** ON Multi Phase Fault
0.124A 0.170A 0.162A 0.036A 66.744V 67.898V 63.725V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.709**Event:** ON Power Swing Detector Enabled
0.124A 0.170A 0.162A 0.036A 66.744V 67.898V 63.725V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.709**Event:** ON Three Phase Fault
0.124A 0.170A 0.162A 0.036A 66.744V 67.898V 63.725V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** OFF Multi Phase Fault
0.156A 0.158A 0.297A 0.141A 66.803V 69.154V 50.958V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** OFF Power Swing Detector Enabled
0.156A 0.158A 0.297A 0.141A 66.803V 69.154V 50.958V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** OFF Three Phase Fault
0.156A 0.158A 0.297A 0.141A 66.803V 69.154V 50.958V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON CG Fault
0.156A 0.158A 0.297A 0.141A 66.803V 69.154V 50.958V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON Fault Detector Activation
0.156A 0.158A 0.297A 0.141A 66.803V 69.154V 50.958V

CONTINUE….

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON Ground Fault
0.156A 0.158A 0.297A 0.141A 66.803V 69.154V 50.958V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.479**Event:** OFF CG Fault
0.159A 0.172A 0.248A 0.138A 67.268V 67.148V 50.205V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.479**Event:** OFF Ground Fault
0.159A 0.172A 0.248A 0.138A 67.268V 67.148V 50.205V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.479**Event:** ON Multi Phase Fault
0.159A 0.172A 0.248A 0.138A 67.268V 67.148V 50.205V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.479**Event:** ON Power Swing Detector Enabled
0.159A 0.172A 0.248A 0.138A 67.268V 67.148V 50.205V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.479**Event:** ON Three Phase Fault
0.159A 0.172A 0.248A 0.138A 67.268V 67.148V 50.205V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.487**Event:** OFF Multi Phase Fault
0.159A 0.169A 0.213A 0.030A 65.346V 67.174V 65.490V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.487**Event:** OFF Power Swing Detector Enabled
0.159A 0.169A 0.213A 0.030A 65.346V 67.174V 65.490V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.487**Event:** OFF Three Phase Fault
0.159A 0.169A 0.213A 0.030A 65.346V 67.174V 65.490V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.547**Event:** OFF Fault Detector Activation
0.152A 0.166A 0.165A 0.007A 65.928V 66.617V 65.779V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.549**Event:** ON Multi Phase Fault
0.152A 0.166A 0.165A 0.007A 65.941V 66.617V 65.830V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.549**Event:** ON Power Swing Detector Enabled
0.152A 0.166A 0.165A 0.007A 65.941V 66.617V 65.830V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.549**Event:** ON Three Phase Fault
0.152A 0.166A 0.165A 0.007A 65.941V 66.617V 65.830V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Any Unit Picked Up

CONTINUE…

11/02/2024-01:51:38.590**Event:** ON Digital Output 11
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Digital Output 12
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Digital Output 23
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Digital Output 25
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Digital Output 36
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Digital Output 6
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Digital Output 8
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Digital Output 9
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Phase A Trip
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Phase B Overvoltage Unit 1 Trip
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

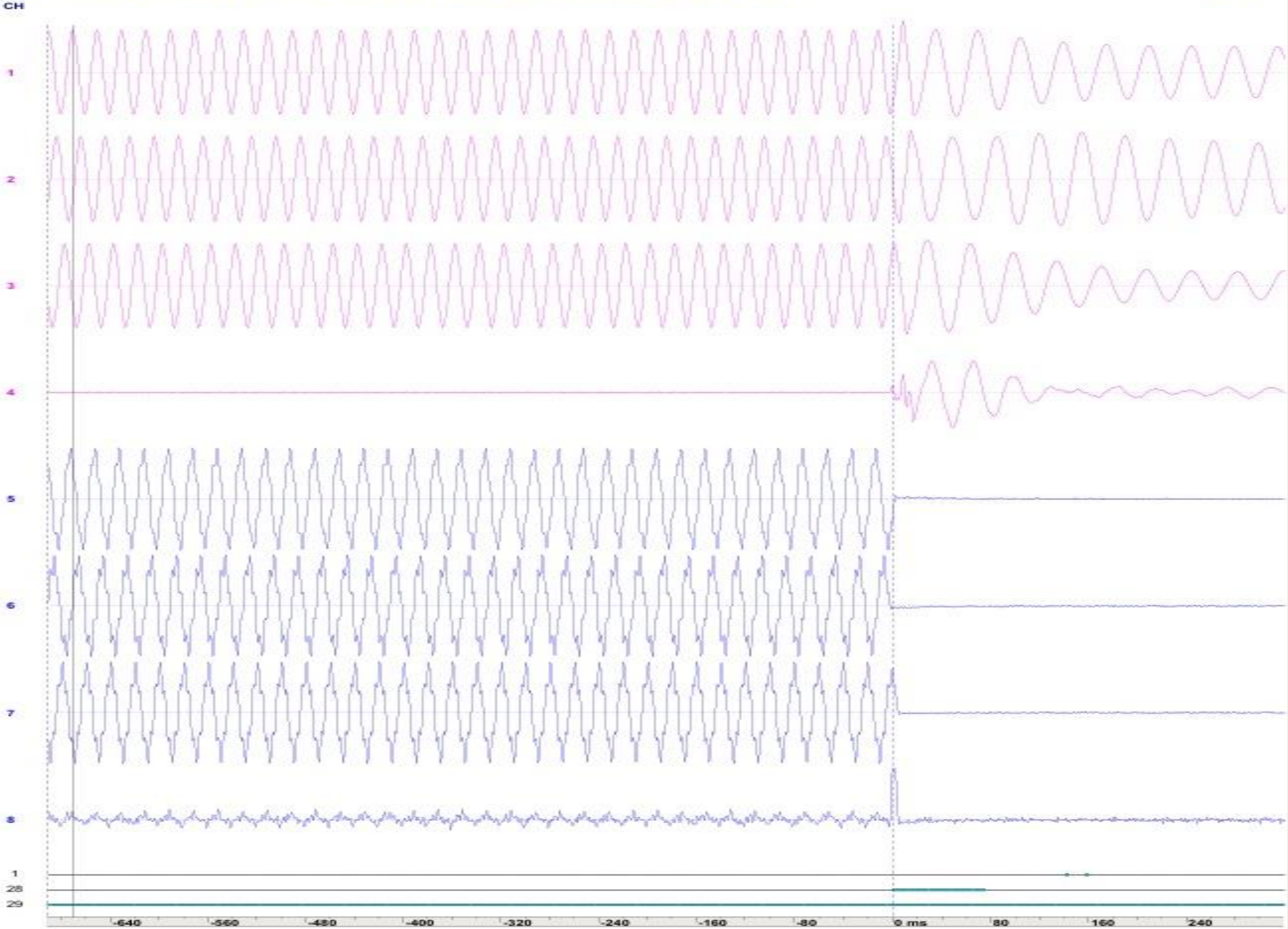
IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Phase B Trip
0.152A 0.165A 0.164A 0.007A 65.902V 66.482V 65.652V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:38.590**Event:** ON Phase C Trip

02.11.24 00.48.27.000.000.DAT - 02/11/2024 - 00:48:27.168 - Secondary - (Peak Type) Page: 1



Alig-21M2_416_sm DT: 02/11/2024 00:48:26.496992 Dt: 671398 microsec - 33.57 Cyc 1200.4802 AS: ON

```
* File Information::
* ------------------
           Station: Alig-21M2_416_sm
            Device: 1
         File Name: C:\USERS\DELL\DESKTOP\XYZ\02 11 2024SHAMLI-2\MAIN 2 DR\02.11.24 00.48.22.000.000.DAT
         File Size: 700801 Bytes
     Prefault Time: 02/11/2024 00:48:21.438000
        Fault Time: 02/11/2024 00:48:22.134000
         Save Time: 11/02/2024 11:43:52
      Process Time: 12/12/2024 17:13:07
 Start Date && Time: 02/11/2024 00:48:21.438000
   End Date && Time: 02/11/2024 00:48:24.355831
     File Duration: 2  Sec(s) - 917 Mils(s) - 831 Mics(s)
 Sampling Frequency: 1200.480192, 833.000  Microsecond Rate
     Line Frequency: 50.000000

* Maximum/Minimum Analog Summary:
* -------------------------------
```

> Max-Inst	Min-Inst	Max-RMS	Min-RMS	One-Bit	Inst-Diff	RMS-Diff	pUnits	Description
363916.000	-379132.000	344927.688	219092.906	31.7000	15216.000	125834.781	V	1-VA
381985.000	-377103.200	263051.031	108251.336	31.7000	4881.800	154799.695	V	2-VB
351489.600	-352155.300	291542.125	50387.336	31.7000	665.700	241154.789	V	3-VC
385503.700	-380114.700	257572.125	1492.569	31.7000	5389.000	256079.556	V	4-VN
278.962	-317.630	182.410	81.392	2.7620	38.668	101.017	A	5-IA
309.344	-339.726	191.260	63.526	2.7620	30.382	127.734	A	6-IB
1038.512	-1060.608	642.464	158.859	2.7620	22.096	483.605	A	7-IC
864.506	-814.790	490.048	6.765	2.7620	49.716	483.282	A	8-IN

```
* Events/Sensors Activity Summary:
* ---------------------------------
```

>Fst	Lst	Fst-Change	Lst-Change	Changes	Description
N	N	00:48:22.134388	00:48:23.027316	008	1-Any Start
A	A	xx:xx:xx.xxxxxx	xx:xx:xx.xxxxxx	000	29-DI13 REL UN TEST

EVENTS OF 400 KV MURADNAGAR LINE

0.214A 0.197A 1.222A 1.353A 66.809V 67.857V 61.293V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** OFF Phase B Overvoltage Unit 1 Pick Up
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** OFF Phase B Overvoltage Unit 1 Trip
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** OFF Three Phase Overvoltage Unit 1 Trip
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON CG Zone 1 Unit Pick Up
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON CG Zone 2 Unit Pick Up
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON CG Zone 3 Unit Pick Up
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Digital Output 28
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Overreaching Zone Pick Up
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Phase C Trip
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Pole C Open Command
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Stepped Distance Trip
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Trip
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Zone 1 Ground Unit Pick Up
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

CONTINUE...

0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Zone 2 Ground Unit Pick Up
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.583**Event:** ON Zone 3 Ground Unit Pick Up
0.253A 0.206A 3.016A 3.283A 68.848V 65.912V 58.586V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.585**Event:** ON Digital Output 13
0.260A 0.189A 3.389A 3.570A 67.766V 65.680V 53.561V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.585**Event:** ON Digital Output 16
0.260A 0.189A 3.389A 3.570A 67.766V 65.680V 53.561V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.585**Event:** ON Digital Output 19
0.260A 0.189A 3.389A 3.570A 67.766V 65.680V 53.561V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.585**Event:** ON Digital Output 22
0.260A 0.189A 3.389A 3.570A 67.766V 65.680V 53.561V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.585**Event:** ON Digital Output 6
0.260A 0.189A 3.389A 3.570A 67.766V 65.680V 53.561V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.585**Event:** ON Digital Output 9
0.260A 0.189A 3.389A 3.570A 67.766V 65.680V 53.561V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.587**Event:** OFF Open Phase Detector Pick Up
0.295A 0.168A 6.107A 6.296A 66.656V 63.865V 48.760V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.587**Event:** ON Oscillography External Trigger
0.295A 0.168A 6.107A 6.296A 66.656V 63.865V 48.760V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.591**Event:** ON Phase A Overvoltage Unit 1 Pick Up
0.373A 0.179A 11.057A 11.433A 70.975V 56.732V 47.491V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.621**Event:** ON Digital Input 3
0.479A 0.169A 16.936A 17.468A 75.559V 42.311V 43.547V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.621**Event:** ON Digital Input 7
0.479A 0.169A 16.936A 17.468A 75.559V 42.311V 43.547V

IA	IB	IC	IN	VA	VB	VC

CONTINUE….

11/02/2024-01:51:33.647**Event:** OFF Any Unit Picked Up
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF CG Zone 1 Unit Pick Up
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF CG Zone 2 Unit Pick Up
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF CG Zone 3 Unit Pick Up
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF Overreaching Zone Pick Up
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF Stepped Distance Trip
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF Zone 1 Ground Unit Pick Up
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF Zone 1 Trip
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF Zone 2 Ground Unit Pick Up
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.647**Event:** OFF Zone 3 Ground Unit Pick Up
0.937A 0.565A 0.689A 2.175A 80.461V 40.064V 30.570V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.651**Event:** ON Open Phase Detector Pick Up
0.976A 0.600A 0.002A 1.569A 82.396V 38.019V 31.753V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.657**Event:** OFF Oscillography External Trigger
0.977A 0.600A 0.001A 1.568A 84.143V 37.512V 31.964V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.675**Event:** OFF Digital Output 28
0.975A 0.598A 0.000A 1.565A 85.123V 37.222V 32.522V

CONTINUE….

11/02/2024-01:51:33.675**Event:** OFF Phase C Trip
0.975A 0.598A 0.000A 1.565A 85.123V 37.222V 32.522V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.675**Event:** OFF Trip
0.975A 0.598A 0.000A 1.565A 85.123V 37.222V 32.522V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.677**Event:** OFF Digital Output 13
0.975A 0.598A 0.000A 1.564A 85.129V 37.260V 32.519V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.677**Event:** OFF Digital Output 16
0.975A 0.598A 0.000A 1.564A 85.129V 37.260V 32.519V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.677**Event:** OFF Digital Output 19
0.975A 0.598A 0.000A 1.564A 85.129V 37.260V 32.519V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.677**Event:** OFF Digital Output 22
0.975A 0.598A 0.000A 1.564A 85.129V 37.260V 32.519V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.677**Event:** OFF Digital Output 6
0.975A 0.598A 0.000A 1.564A 85.129V 37.260V 32.519V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.677**Event:** OFF Digital Output 9
0.975A 0.598A 0.000A 1.564A 85.129V 37.260V 32.519V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.783**Event:** OFF Pole C Open Command
0.968A 0.597A 0.001A 1.556A 84.986V 37.570V 32.681V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:33.979**Event:** OFF Open Phase Detector Pick Up
0.406A 0.266A 0.000A 0.638A 85.223V 37.643V 30.349V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.015**Event:** ON Open Phase Detector Pick Up
0.143A 0.144A 0.000A 0.130A 84.971V 37.661V 30.986V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.023**Event:** OFF Open Phase Detector Pick Up
0.143A 0.143A 0.000A 0.129A 84.867V 38.091V 30.962V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.371**Event:** ON Open Phase Detector Pick Up

11/02/2024-01:51:34.383**Event:** OFF Digital Input 3
0.141A 0.144A 0.000A 0.129A 83.199V 38.486V 35.145V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.389**Event:** ON Digital Output 26
0.141A 0.144A 0.000A 0.129A 83.199V 38.486V 35.145V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.419**Event:** ON Open Phase Detector Pick Up
0.135A 0.153A 4.586A 4.725A 83.395V 39.488V 39.135V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON Any Unit Picked Up
0.135A 0.153A 5.916A 6.055A 83.115V 39.661V 38.127V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON CG Zone 2 Unit Pick Up
0.135A 0.153A 5.916A 6.055A 83.115V 39.661V 38.127V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON CG Zone 3 Unit Pick Up
0.135A 0.153A 5.916A 6.055A 83.115V 39.661V 38.127V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON Overreaching Zone Pick Up
0.135A 0.153A 5.916A 6.055A 83.115V 39.661V 38.127V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON Zone 2 Ground Unit Pick Up
0.135A 0.153A 5.916A 6.055A 83.115V 39.661V 38.127V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.421**Event:** ON Zone 3 Ground Unit Pick Up
0.135A 0.153A 5.916A 6.055A 83.115V 39.661V 38.127V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.423**Event:** ON CG Zone 1 Unit Pick Up
0.136A 0.158A 5.902A 6.044A 82.973V 39.684V 37.263V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.423**Event:** ON Digital Output 28
0.136A 0.158A 5.902A 6.044A 82.973V 39.684V 37.263V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.423**Event:** ON Phase C Trip
0.136A 0.158A 5.902A 6.044A 82.973V 39.684V 37.263V

IA	IB	IC	IN	VA	VB	VC

0.136A 0.158A 5.902A 6.044A 82.973V 39.684V 37.263V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.423**Event:** ON Trip
0.136A 0.158A 5.902A 6.044A 82.973V 39.684V 37.263V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.423**Event:** ON Zone 1 Ground Unit Pick Up
0.136A 0.158A 5.902A 6.044A 82.973V 39.684V 37.263V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.423**Event:** ON Zone 1 Trip
0.136A 0.158A 5.902A 6.044A 82.973V 39.684V 37.263V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.425**Event:** ON Digital Output 13
0.136A 0.155A 6.918A 7.057A 82.887V 39.748V 39.390V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.425**Event:** ON Digital Output 16
0.136A 0.155A 6.918A 7.057A 82.887V 39.748V 39.390V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.425**Event:** ON Digital Output 19
0.136A 0.155A 6.918A 7.057A 82.887V 39.748V 39.390V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.425**Event:** ON Digital Output 22
0.136A 0.155A 6.918A 7.057A 82.887V 39.748V 39.390V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.425**Event:** ON Digital Output 6
0.136A 0.155A 6.918A 7.057A 82.887V 39.748V 39.390V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.425**Event:** ON Digital Output 9
0.136A 0.155A 6.918A 7.057A 82.887V 39.748V 39.390V

IA	IB	IC	IN	VA	VB	VC

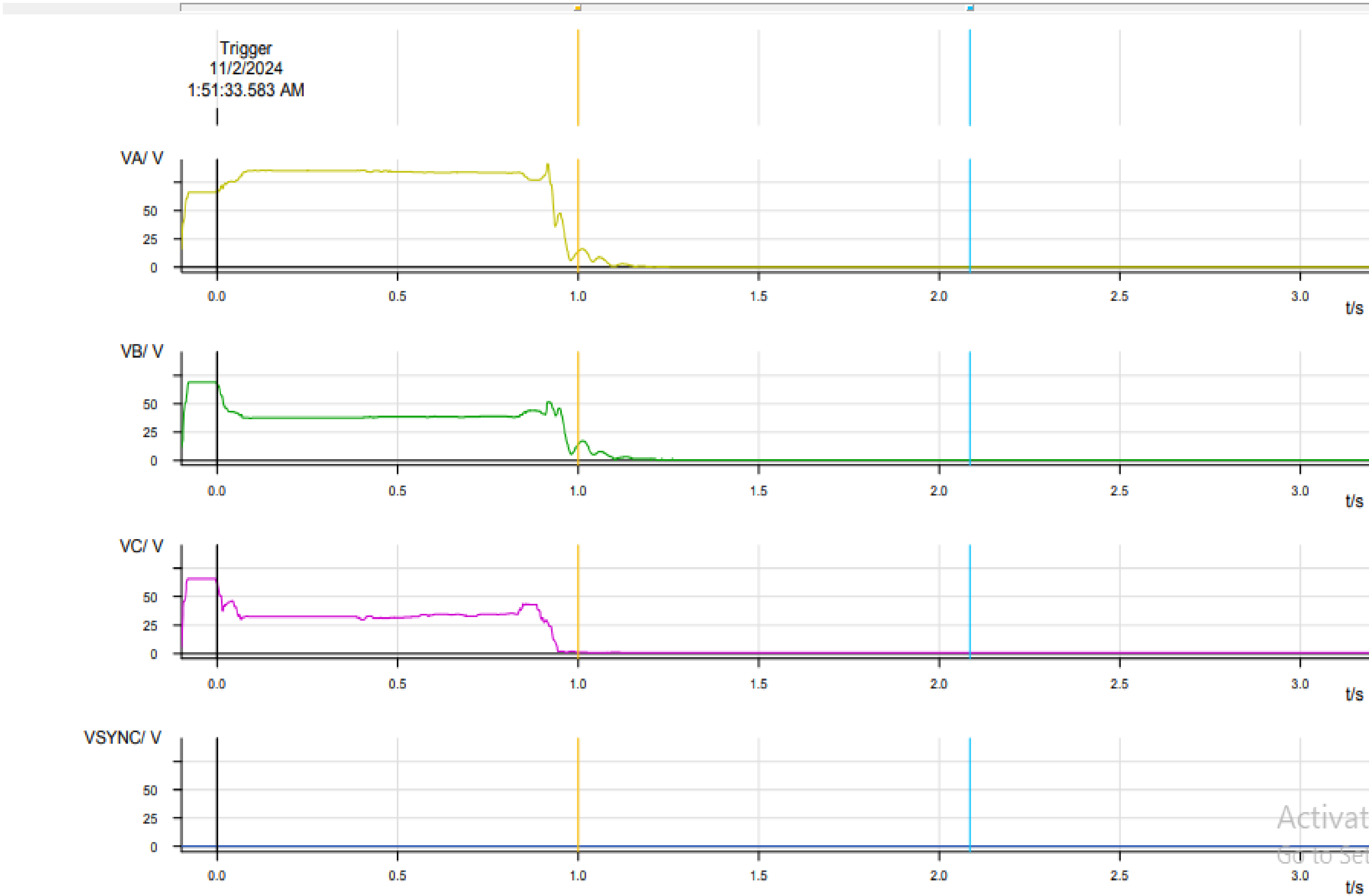
11/02/2024-01:51:34.427**Event:** OFF Open Phase Detector Pick Up
0.139A 0.157A 11.143A 11.284A 82.789V 40.461V 42.126V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.427**Event:** ON Oscillography External Trigger
0.139A 0.157A 11.143A 11.284A 82.789V 40.461V 42.126V

IA	IB	IC	IN	VA	VB	VC

11/02/2024-01:51:34.455**Event:** ON Digital Input 19
0.153A 0.155A 18.141A 18.306A 76.713V 44.246V 43.182V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11/2/2024
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VB/ V
VC/ V
VSYNC/ V
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1.5
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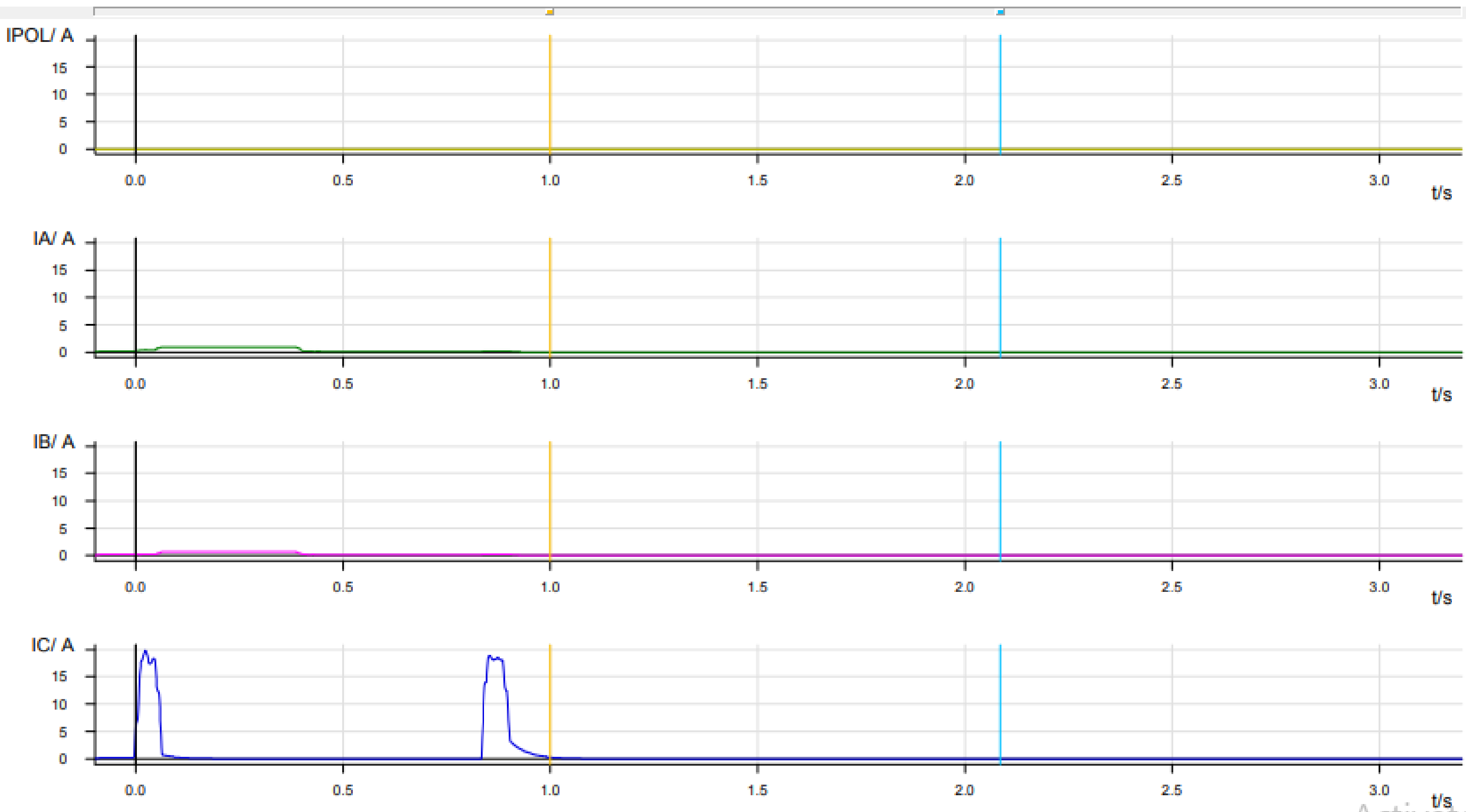
2.5
3.0
t/s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t/s
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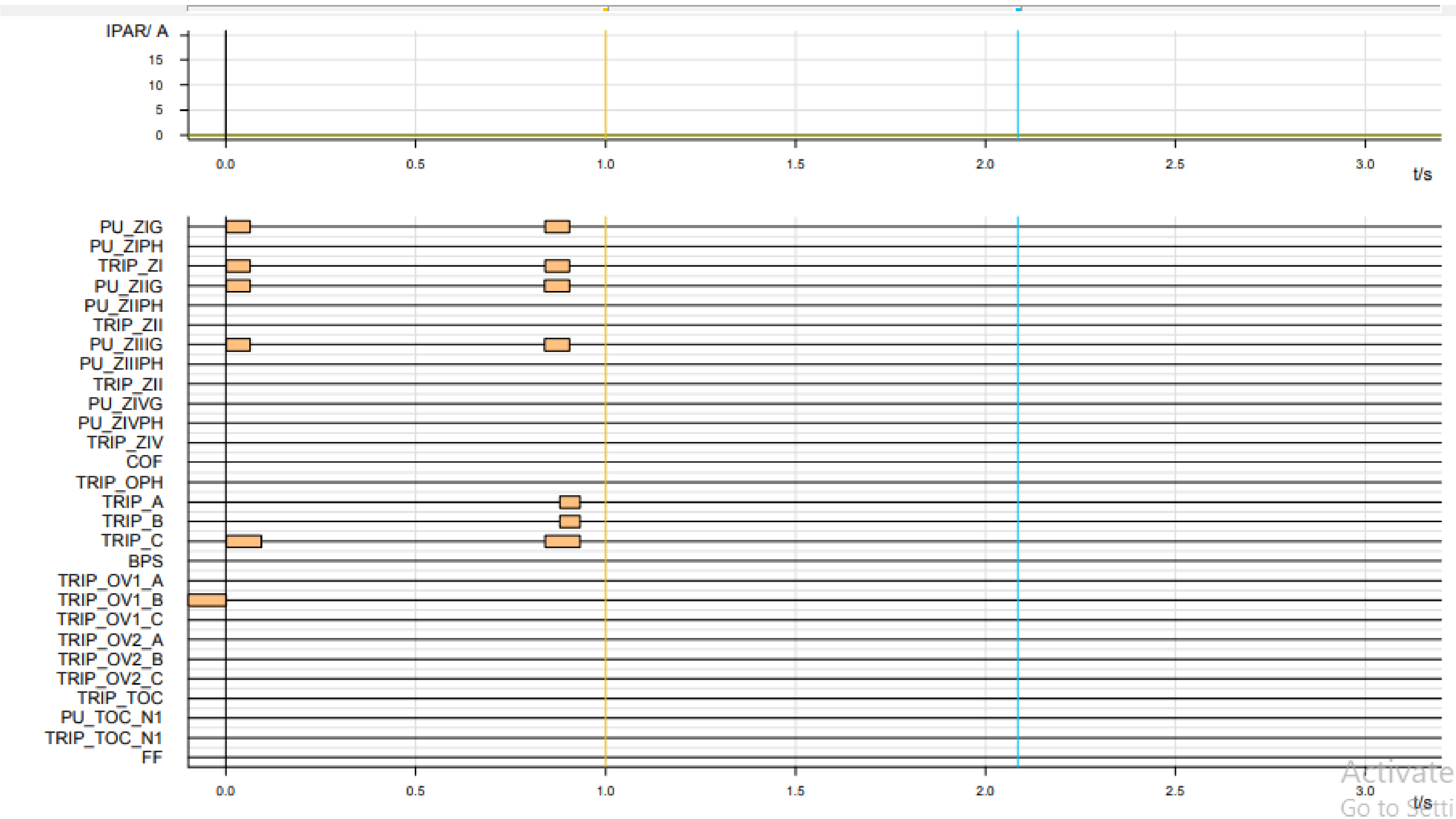
IB/ A
IC/ A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TRIP_ZI
PU_ZIIG
PU_ZIIPH
TRIP_ZII
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TRIP_ZII
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COF
TRIP_OPH
TRIP_A
TRIP_B
TRIP_C
BPS
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TRIP_OV1_B
TRIP_OV1_C
TRIP_OV2_A
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TRIP_OV2_C
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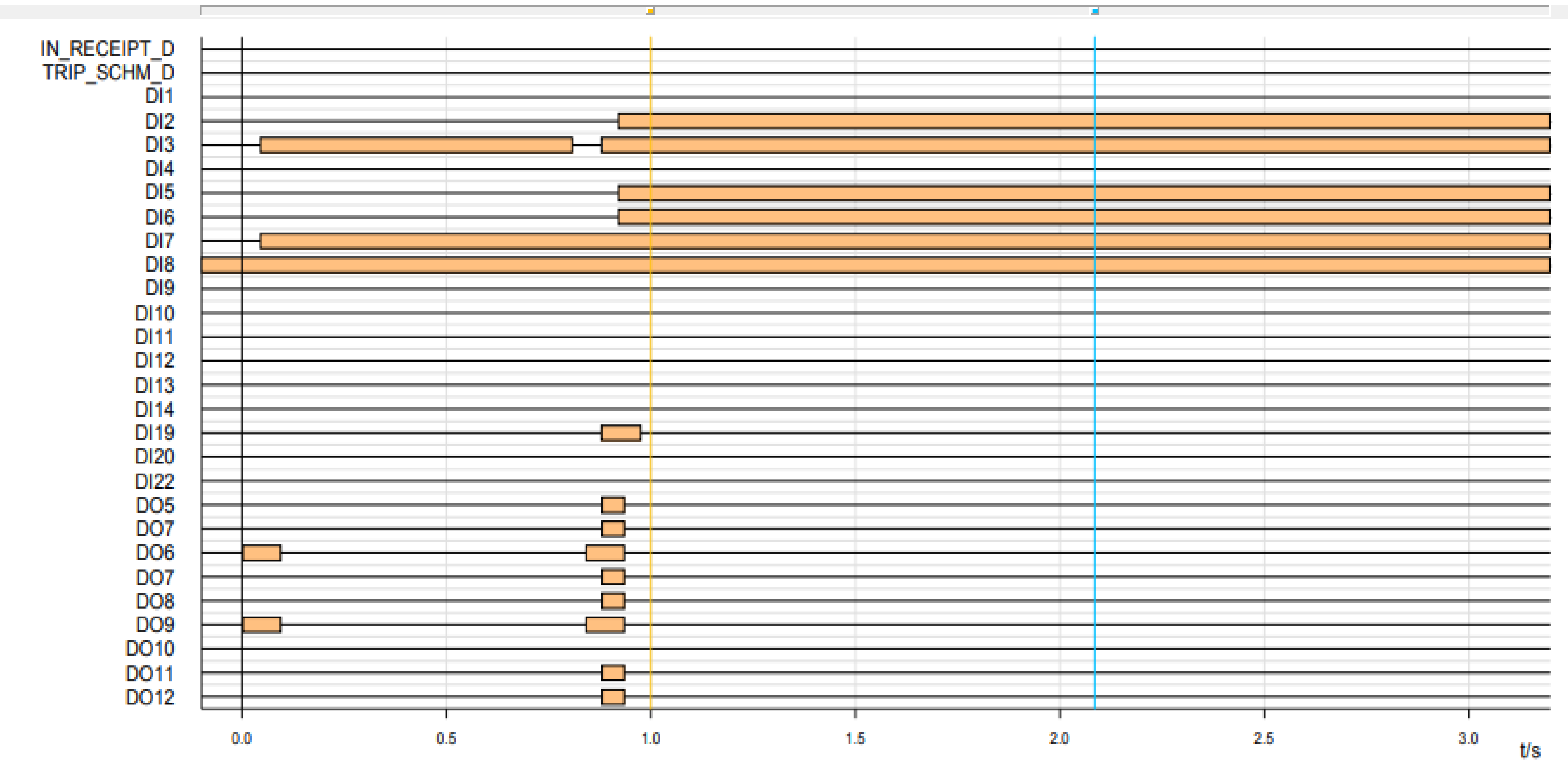
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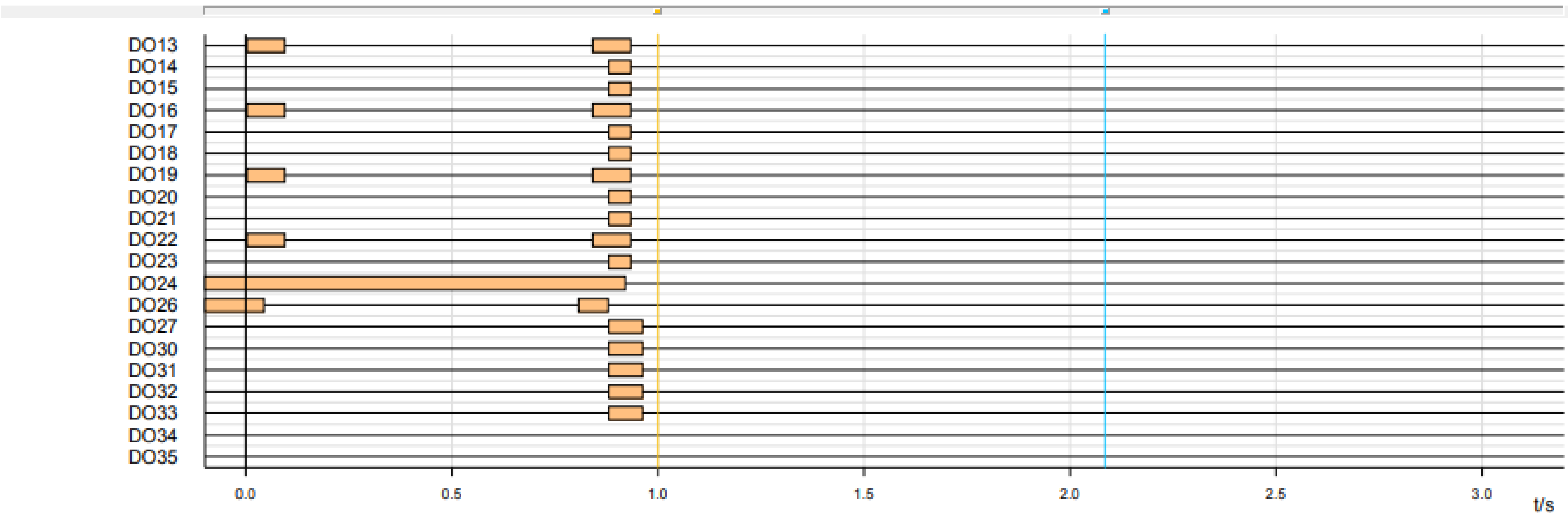
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DO35
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0.5
1.0
1.5
2.0
2.5
3.0
t/s

Remedial Measures Taken

- 400kV Substation Aligarh,(bays no 413) Shamli-I, (bay no416) Shamli- II over voltage setting changed as per NRPC guide lines.
- For Shamli-I over voltage setting stage -1 is 110 % and time delay 5sec, stage -2, 150 % time delay 100ms.
- For Shamli -II over voltage stage -1 is 112% and time delay 6sec , stage -2 150% time delay 100ms.
- Muradnagar line over voltage and AR settings checked and found ok.

THANK YOU

Multiple element tripping event at 765/400kV Jawaharpur(UP)

At 15:56 hrs on 11th November, 2024

Tripped Elements

S. No	Name of Elements	Outage Time	Revival Time	Reason of tripping
1.	400 KV Jawaharpur_TPS(UP) - Bus 2	15:56 hrs	21:44 hrs	Bus Bar protection Operated
2.	400/220 kV 500 MVA ICT 3 at Jawaharpur_TPS(UP)		22:03 hrs	TEED protection
3.	400/220 kV 500 MVA ICT 4 at Jawaharpur_TPS(UP)		--	TEED protection
4.	125 MVAR Bus Reactor No 1 at 400 KV Jawaharpur_TPS(UP)		21:46 hrs	Back up impedance protection

Brief details of the event

i) During antecedent condition, 400 kV Firozabad–Jawaharpur Ckt 2 (28 MW) and 400/220 kV 500 MVA ICT 4 (27 MW) were connected to 400 kV Bus 2. 400 kV Firozabad–Jawaharpur Ckt 1 (26 MW), 125 MVAR bus reactor, and 400/220 kV 500 MVA ICT 3 (27 MW) were connected to 400 kV Bus 1. The 765/400 KV ICT 1 and 2 were not in service at that point of time.

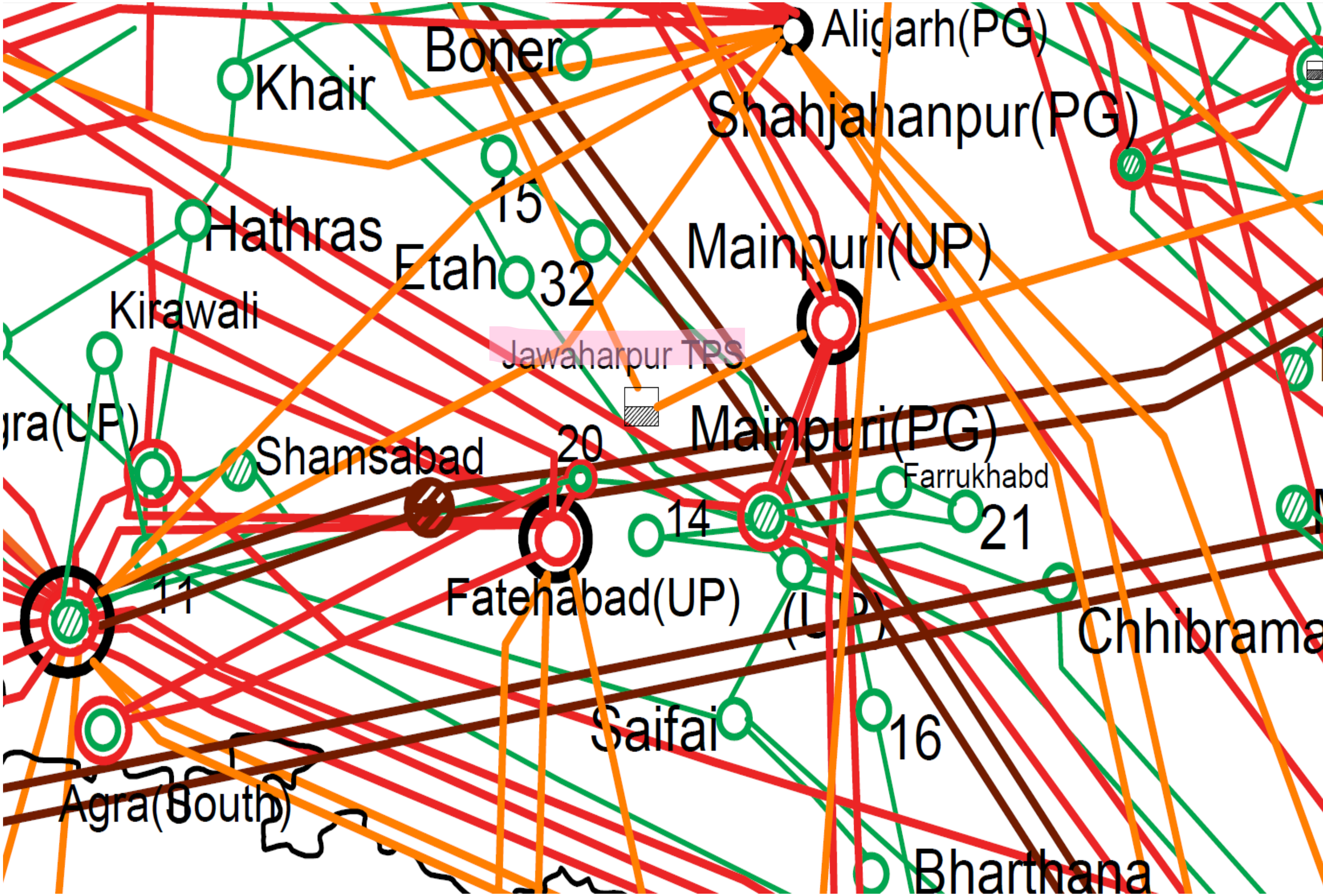
ii) As reported at 15:56:14:463 hrs, R-N fault occurred at TEED portion of bay 401 & 402. On this fault, bus bar protection of 400KV Bus-2 at 400 KV JAWAHARPUR_TPS(UP) operated. This led to tripping of breakers 410, 407 & 401 bay connected to 400KV Bus 2. At the same time (with the gap of 20msec), TEED protection operated which tripped Bay 402 (Tie Bay of 400/220KV ICT 3 & 4). This led to tripping of 400/220KV ICT 4. Further after ~30msec, 400KV Bay No 403 breaker opened led to the tripping 400/220 KV ICT 3 at Jawaharpur(UP). Exact reason of operation of bus bar protection along with TEED protection is yet to be received from UP. DR/EL of the tripping events also yet to be received.

iii) After further 60msec, 125 MVAR Bus Reactor No 1 at 400 KV Jawaharpur_TPS(UP) also tripped on back up impedance protection operation. DR of the tripping is yet to be received.

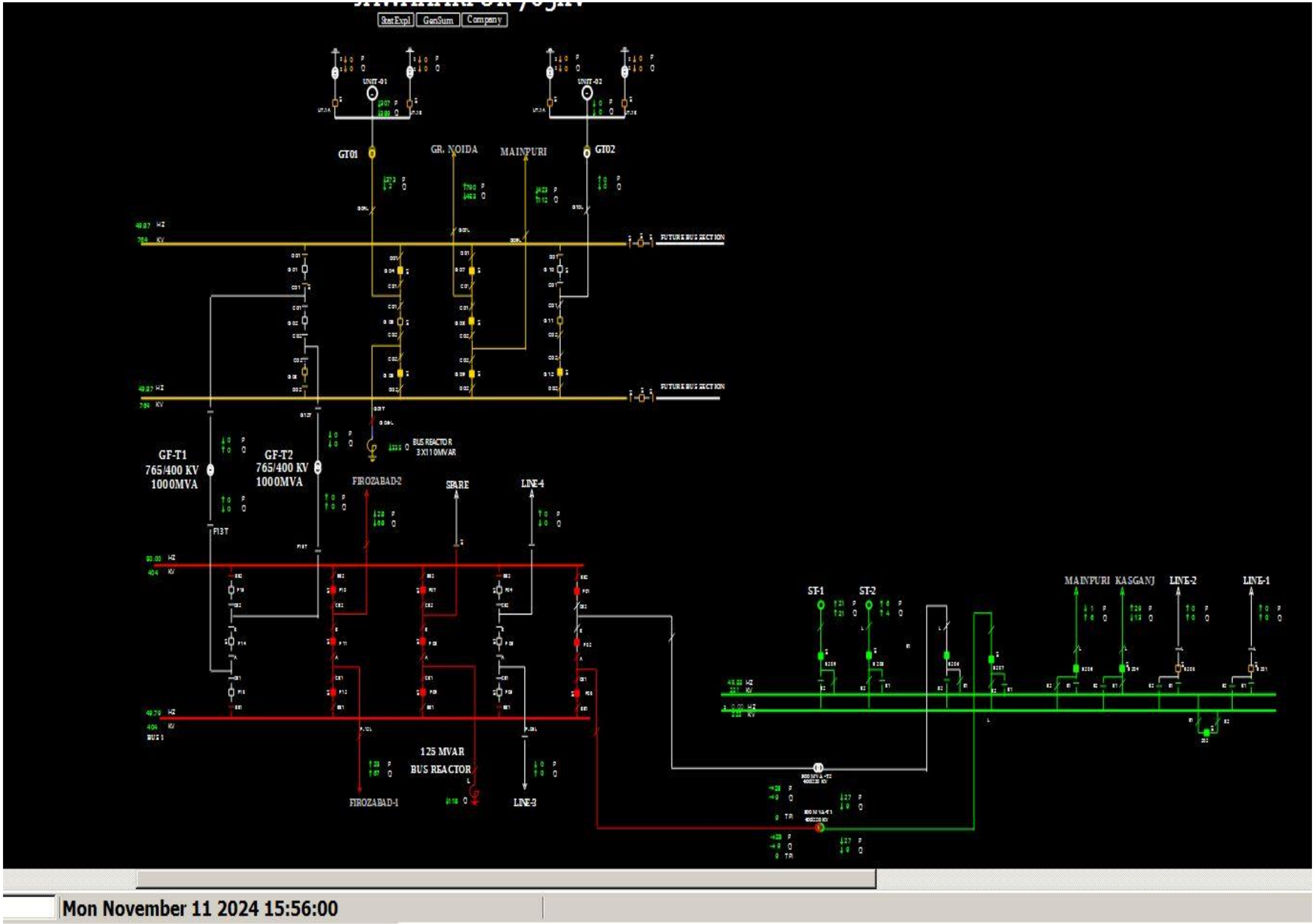
iv) As per PMU at Mainpuri (PG), R-N fault which cleared within 100msec is observed.

v) As per SCADA, no load loss is observed in UP control area.

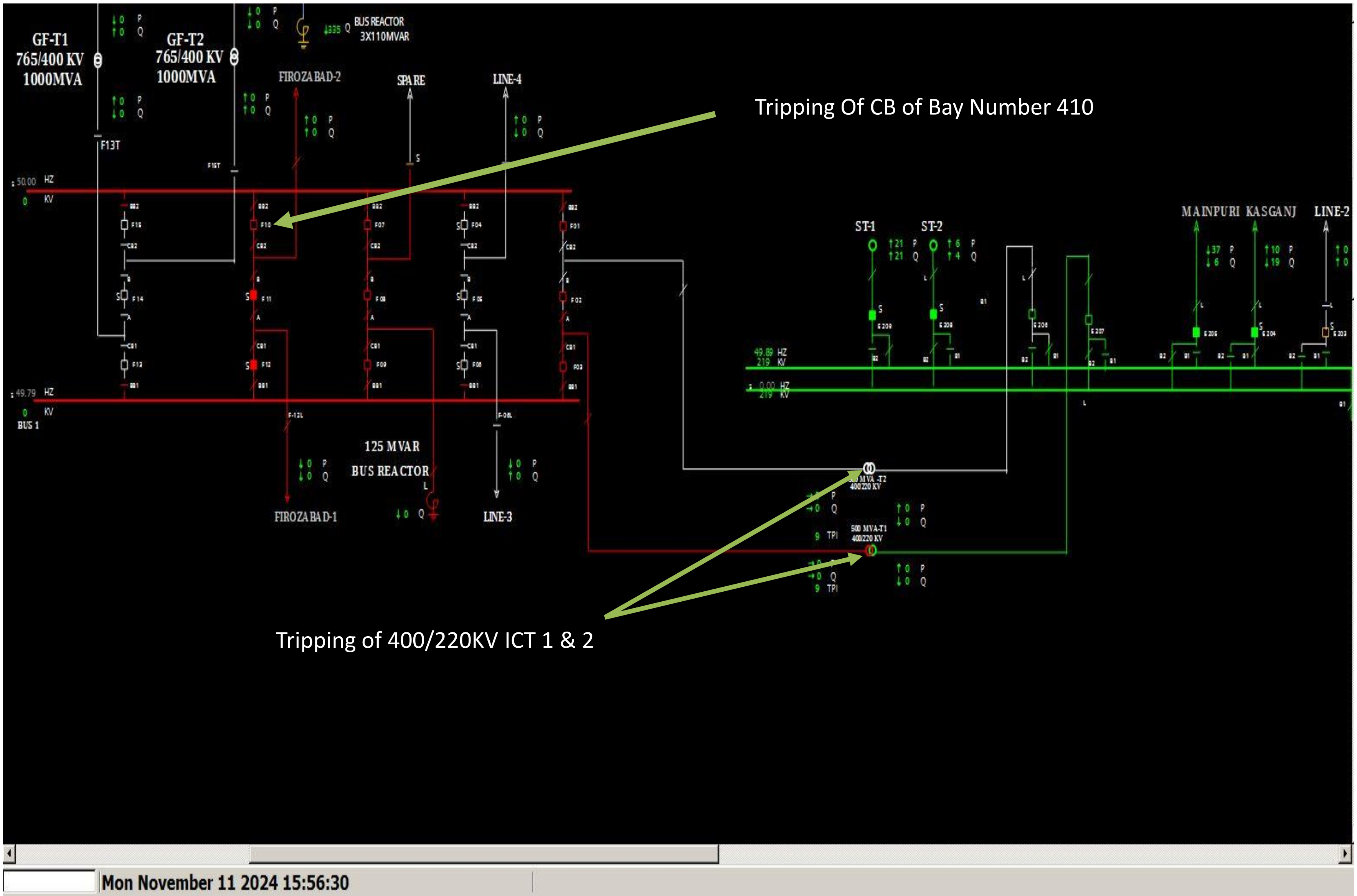
Network Diagram



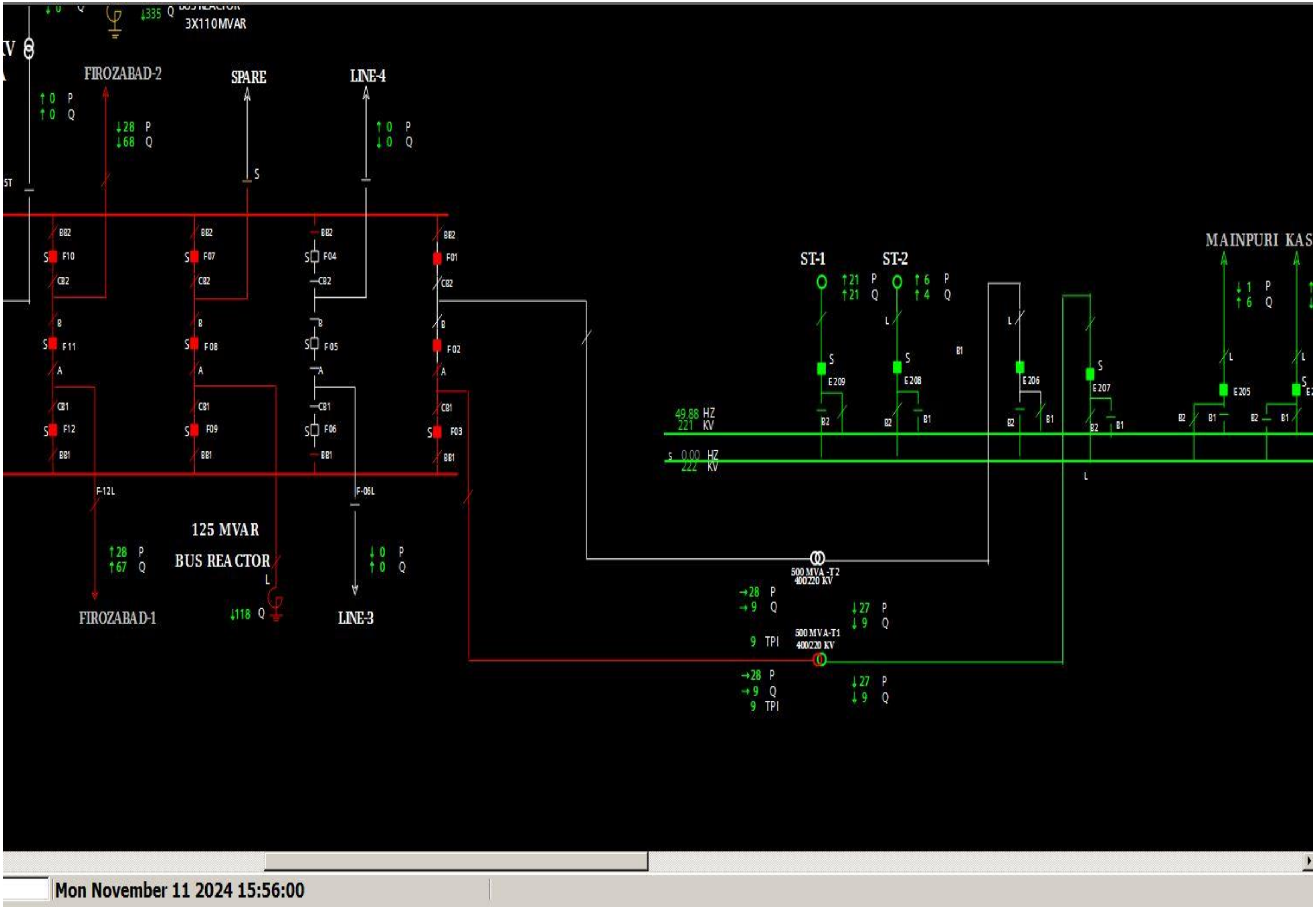
SLD of 765/400/220KV Jawaharpur S/s before the event



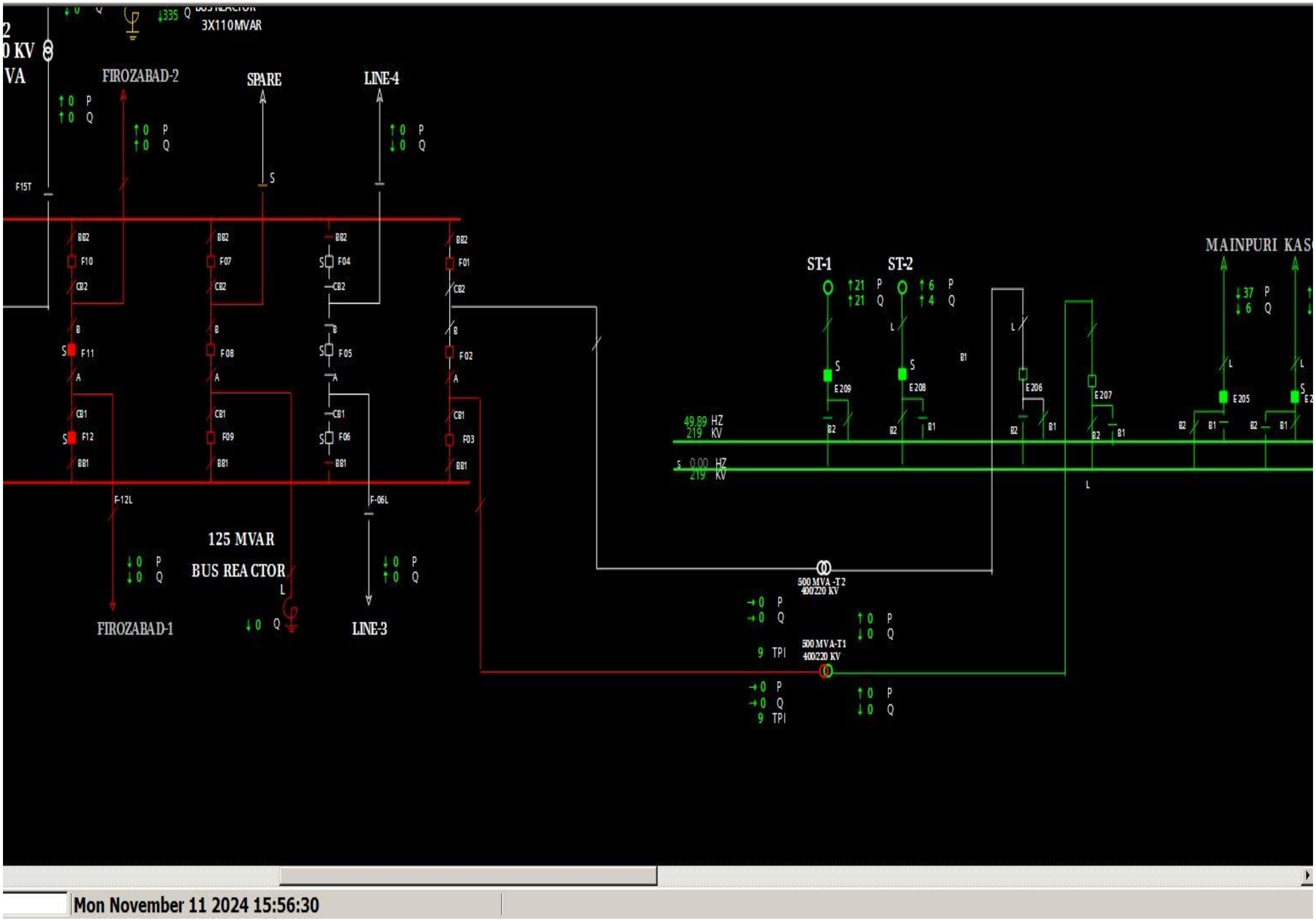
SLD of 765/400/220KV Jawaharpur S/s after the event



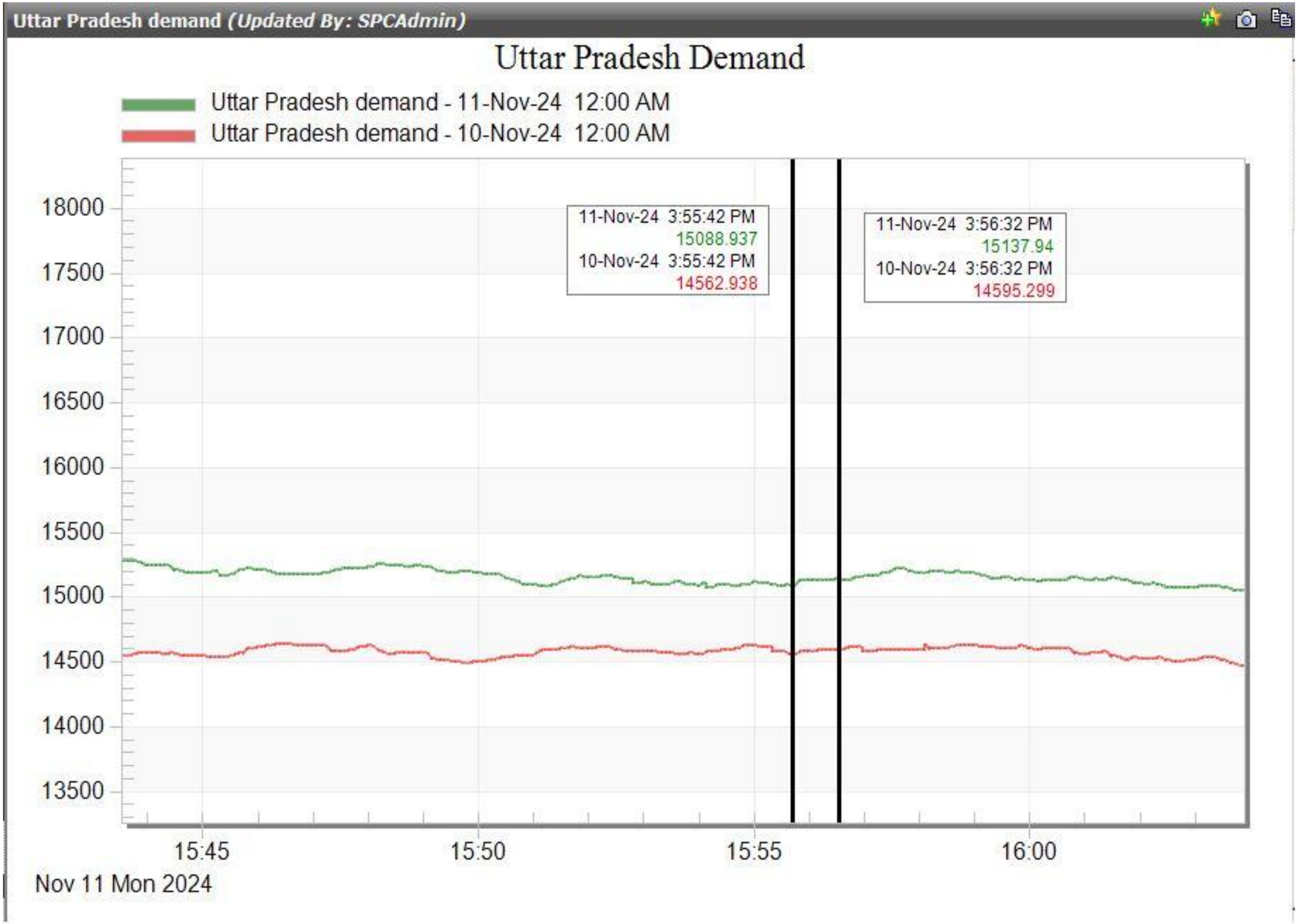
SLD of 765/400/220KV Jawaharpur S/s before the event(Zoomed)



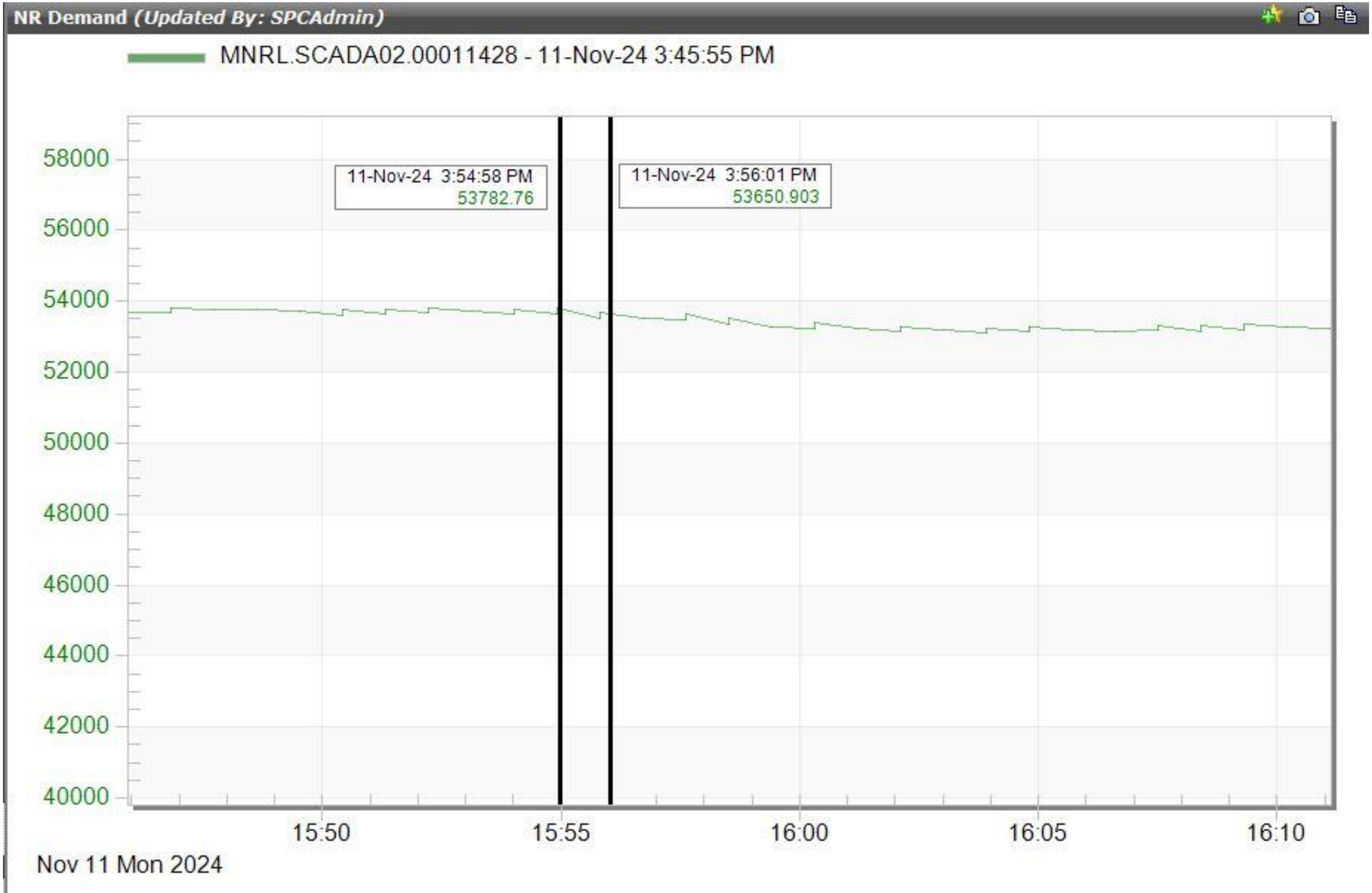
SLD of 765/400/220KV Jawaharpur S/s after the event(Zoomed)



Uttar Pradesh demand during the event

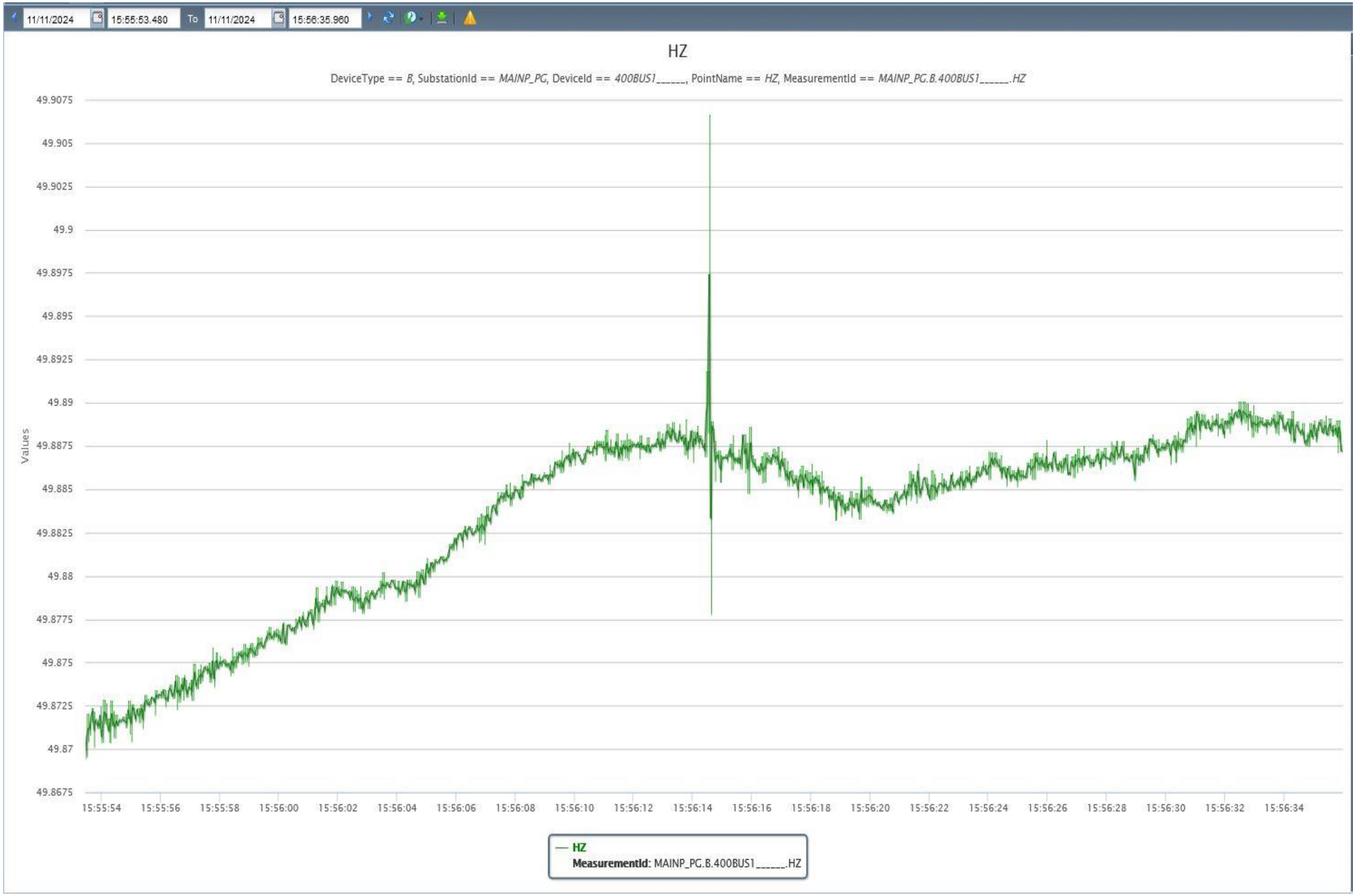


NR Demand during the event



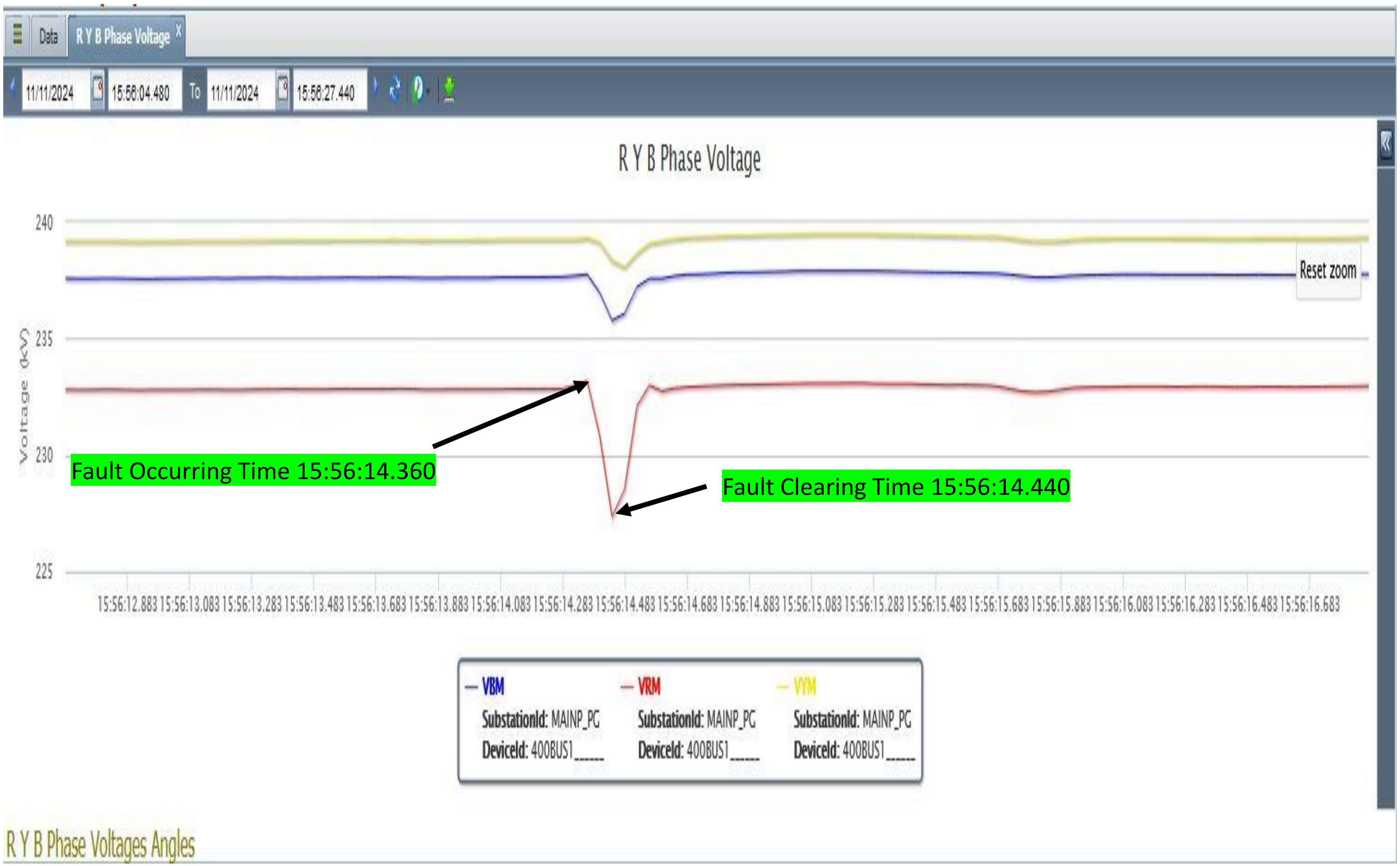
PMU Plot of frequency at Mainpuri(PG)

15:56hrs/11-Nov-24



PMU Plot of phase voltage magnitude at Mainpuri(PG)

15:56hrs/11-Nov-24



SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
15:56:14,463	JAWAH_UP	400	10FIROZ2	Circuit Breaker	Open	Main CB of 400KV Jawaharpur - Firozabad 2 opened at Jawaharpur
15:56:14,463	JAWAH_UP	400	01T4	Circuit Breaker	Open	Main CB of 400/220 KV 500 MVA ICT 4 AT JAWAHARPUR_TPS(UP) opened at 400KV Side
15:56:14,482	JAWAH_UP	400	02T3T4	Circuit Breaker	Open	Tie CB between 400/220 KV 500 MVA ICT 4 & ICT 3 opened at 400KV Side
15:56:14,483	JAWAH_UP	220	06T4	Circuit Breaker	Open	CB of 400/220 KV 500 MVA ICT 4 AT JAWAHARPUR_TPS(UP) opened at 220KV Side
15:56:14,515	JAWAH_UP	400	03T3	Circuit Breaker	Open	Main CB of 400/220 KV 500 MVA ICT 3 AT JAWAHARPUR_TPS(UP) opened at 400KV Side
15:56:14,517	JAWAH_UP	220	07T3	Circuit Breaker	Open	CB of 400/220 KV 500 MVA ICT 3 AT JAWAHARPUR_TPS(UP) opened at 220KV Side
15:56:14,579	JAWAH_UP	400	09BR	Circuit Breaker	Open	Main CB of 125 MVAR BUS REACTOR NO 1 opened 400 KV JAWAHARPUR_TPS(UP)

DR of ICT-4 at Jawaharpur(UP)

File: Monday 11 November 2024 15.56.14.000.dat - 11/11/2024 - 15:56:14.459 - Secondary - (Peak Type) Page: 1

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             Device: 1
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      Prefault Time: 11/11/2024 15:56:13.464000
         Fault Time: 11/11/2024 15:56:14.459000
          Save Time: 11-11-2024 16:05:42
       Process Time: 11-13-2024 15:18:41
 Start Date && Time: 11/11/2024 15:56:13.464000
   End Date && Time: 11/11/2024 15:56:16.464449
      File Duration: 3  Sec(s) - 449 Mics(s)
 Sampling Frequency: 1197.604790, 835.000  Microsecond Rate
     Line Frequency: 50.000000

* Maximum/Minimum Analog Summary:
* -------------------------------
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2049.404	-2154.360	1479.971	3.572	5.5240	104.956	1476.398	A	1-IA-1
629.736	-690.500	466.249	3.743	5.5240	60.764	462.506	A	2-IB-1
662.880	-734.692	492.765	3.744	5.5240	71.812	489.021	A	3-IC-1
35.360	-30.940	16.612	3.494	4.4200	4.420	13.117	A	4-IN-1
22.096	-22.096	12.352	2.088	5.5240	0.000	10.264	A	5-IA-2
22.096	-22.096	9.568	3.189	5.5240	0.000	6.379	A	6-IB-2
27.620	-22.096	13.437	0.000	5.5240	5.524	13.437	A	7-IC-2
861.900	-543.660	524.356	2.709	4.4200	318.240	521.647	A	8-IN-2
2734.380	-2728.856	1918.687	3.793	5.5240	5.524	1914.893	A	9-IA-3
154.672	-143.624	110.480	4.510	5.5240	11.048	105.970	A	10-IB-3
171.244	-176.768	119.385	3.740	5.5240	5.524	115.645	A	11-IC-3
17.680	-17.680	9.157	0.000	4.4200	0.000	9.157	A	12-IN-3
0.017	0.000	0.016	0.000	0.0028	0.017	0.016	PU	13-IA-DIFF
0.011	0.000	0.010	0.000	0.0028	0.011	0.010	PU	14-IB-DIFF
0.008	0.000	0.007	0.000	0.0028	0.008	0.007	PU	15-IC-DIFF
0.931	0.000	0.924	0.000	0.0028	0.931	0.924	PU	16-IA-BIAS
0.483	0.000	0.483	0.000	0.0028	0.483	0.483	PU	17-IB-BIAS
0.447	0.000	0.443	0.000	0.0028	0.447	0.442	PU	18-IC-BIAS
2415.392	0.000	2377.301	1.156	1.8410	2415.392	2376.145	A	19-LoZREF-DIFF-HV
743.966	0.000	737.534	0.293	3.6830	743.966	737.241	A	20-LoZREF-BIAS-HV
2509.283	0.000	2463.163	0.255	1.8410	2509.283	2462.908	A	21-LoZREF-DIFF-LV
1200.658	0.000	1184.119	0.712	3.6830	1200.658	1183.407	A	22-LoZREF-BIAS-LV
7.364	0.000	6.950	0.000	1.8410	7.364	6.949	A	23-LoZREF-DIFF-TV
3.683	0.000	3.683	0.000	3.6830	3.683	3.683	A	24-LoZREF-BIAS-TV
158.550	-158.550	101.108	0.000	31.7100	0.000	101.108	V	25-Vx
50.000	0.000	50.000	0.047	0.0025	50.000	49.953	Hz	26-Frequency

```
* Events/Sensors Activity Summary:
* ---------------------------------
```

Fst	Lst	Fst-Change	Lst-Change	Changes	Description
N	N	15:56:14.459320	15:56:14.489380	002	2-Any Start
A	A	xx:xx:xx.xxxxxx	xx:xx:xx.xxxxxx	000	31-L23 86A1 SUPVN
A	A	xx:xx:xx.xxxxxx	xx:xx:xx.xxxxxx	000	32-L24 86A2 SUPVN

```
* Events/Sensors Activity Log:
* ----------------------------
```

State	Trigger-Time	Description
A	11/11/2024 15:56:14.459320	2-Any Start
N	11/11/2024 15:56:14.489380	2-Any Start

Details received from UP

Acording to SLD ,report analysis fault occur in tie breaker 402 .and tripped after other CB 401,402,407,408,409 ,410 tripped,

401-ICT 4

402-TIE

403-ICT3

Points for Discussion

i) Exact reason of the fault needs to be shared.
ii) Exact reason for tripping of 400/220 KV ICT-3 needs to be shared.
iii) Exact reason of operation of bus bar protection along with TEED protection is yet to be received from UP
iv) DR/EL (.dat/.cfg) file along with detailed tripping report need to be shared from both the ends.
v) Remedial action taken report to be shared.

Multiple element tripping event at 400/220kV Merta(RS)

At 12:22 hrs on 11th November, 2024

Tripped Elements

S. No	Name of Elements	Outage Time	Revival Time	Reason of tripping
1.	220KV BUS1&2 AT MERTA(RS)	12:22 hrs	23:55 hrs	The 220 kV bus bar protection was triggered due to the snapping of the R-phase jumper of the 220 kV Merta-Jethana line, which fell onto both 220 kV Bus A and Bus B.
2.	400/220 KV 315 MVA ICT 1 AT MERTA(RS)		23:55 hrs	
3.	400/220 KV 315 MVA ICT 2 AT MERTA(RS)		01:05 hrs (12.11.2024)	
4.	220KV MERTA-BHOPALGARH (RS) CKT		00:31 hrs (12.11.2024)	
5.	220KV MERTA-KUCHERA (RS) CKT		00:29 hrs (12.11.2024)	
6.	220/132 KV 100 MVA ICT 1 AT MERTA(RS)		01:10 hrs (12.11.2024)	
7.	220/132 KV 100 MVA ICT 2 AT MERTA(RS)			
8.	220/132 KV 100 MVA ICT 3 AT MERTA(RS)			
9.	220KV MERTA-JETHANA(RS) CKT			

Brief details of the event

i) During antecedent condition, loading of 400/220 kV 315 MVA ICT 1 & 2 and 220/132kV 100MVA ICT-1, 2 & 3 at Merta(RS) were 171 MW, 177 MW, 62 MW, 62 MW and 56 MW respectively as per SCADA. 220kV Merta(RS)-Makrana(RS) Ckt was not in service.

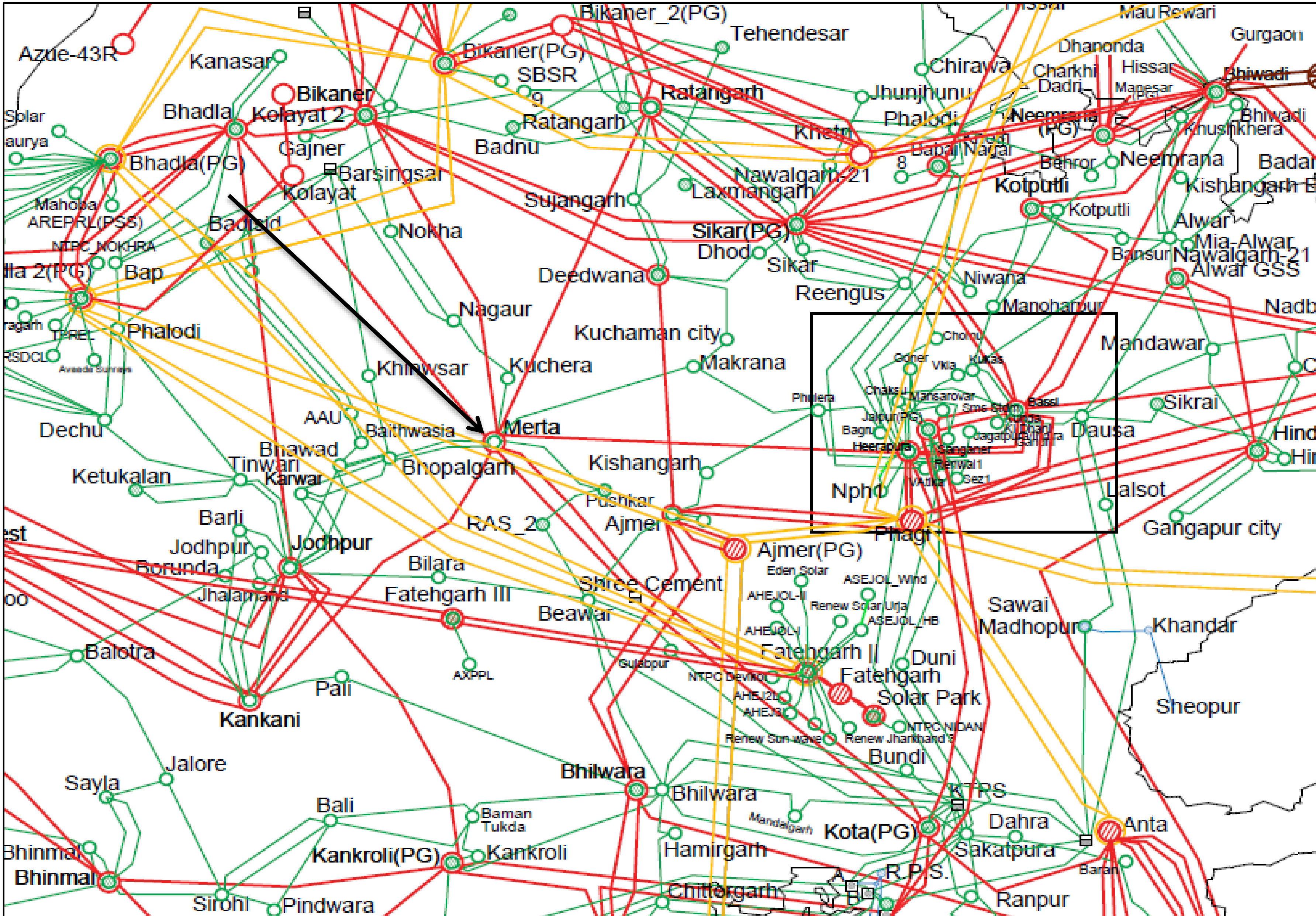
ii) As reported, at 12:22hrs, R-phase jumper of 220 kV Merta-Jethana snapped, and this broken jumper conductor fell on both 220 kV Bus-A and Bus-B at Merta. Because of this, Bus Bar protection operated at 400/220/132kV Merta S/s.

iii) As a result, both 220KV Bus 1 & 2, along with all the elements connected to them i.e., 400/220 ICT-1 & 2, 220KV MERTA-JETHANA(RS), 220KV MERTA-BHOPALGARH (RS), 220KV MERTA-KUCHERA (RS), 220/132 KV 100 MVA ICT 1, ICT 2 & ICT 3 AT MERTA(RS) tripped.

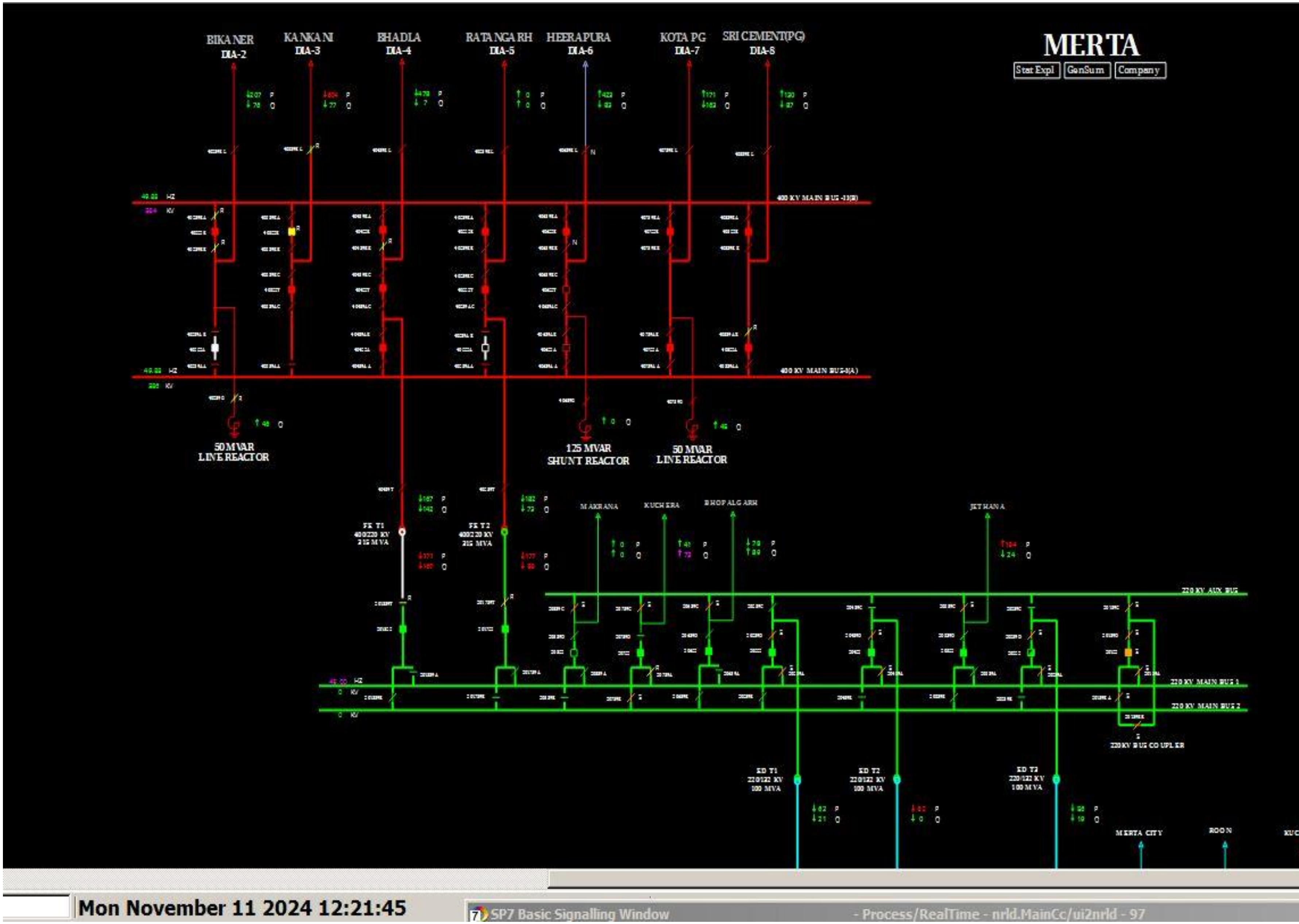
iv) As per PMU at Merta(RS), R-Y-B fault is observed with delayed fault clearance time of 720 msec.

v) As per SCADA, change in demand of approx. 635 MW is observed in Rajasthan control area.

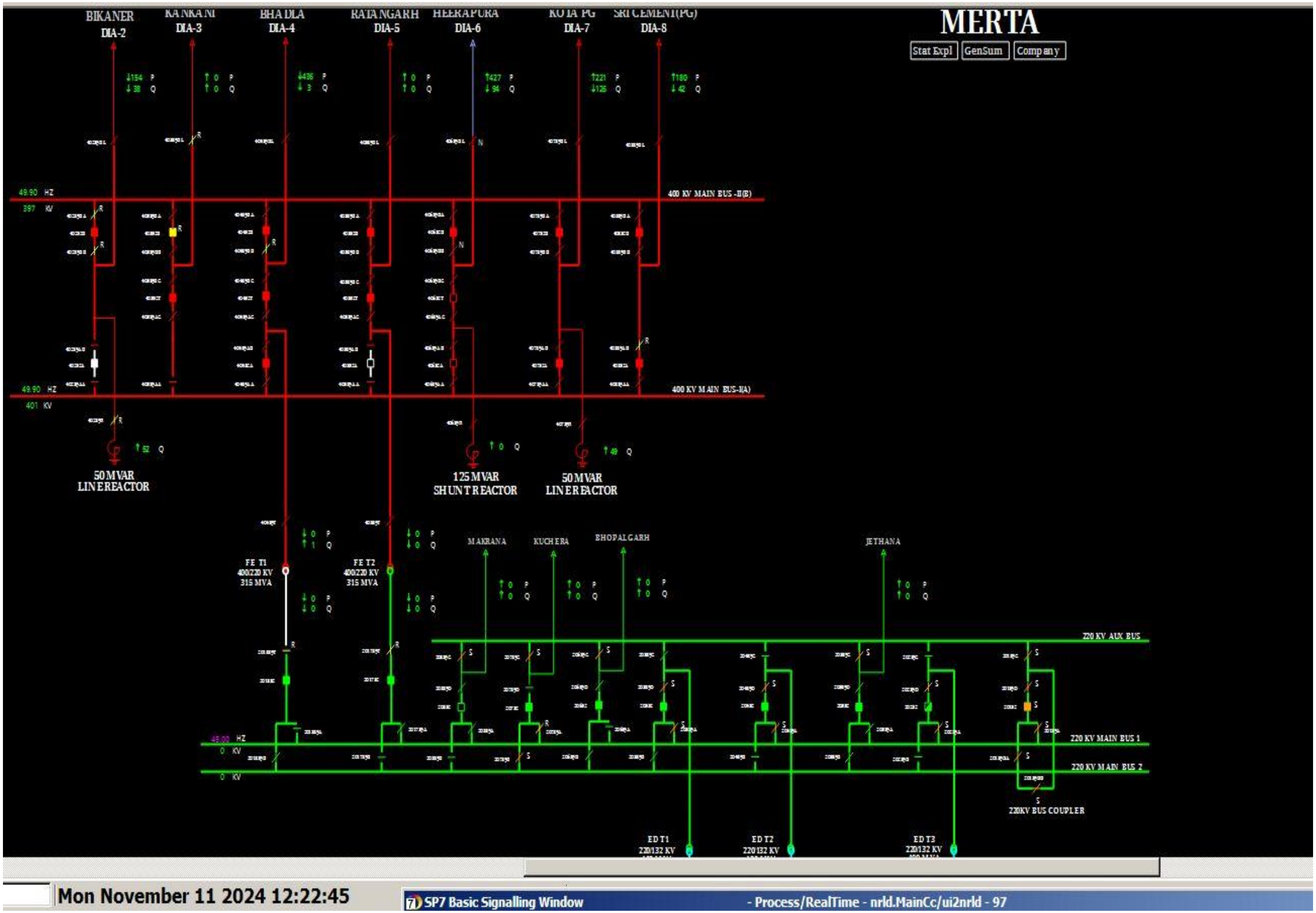
Network Diagram



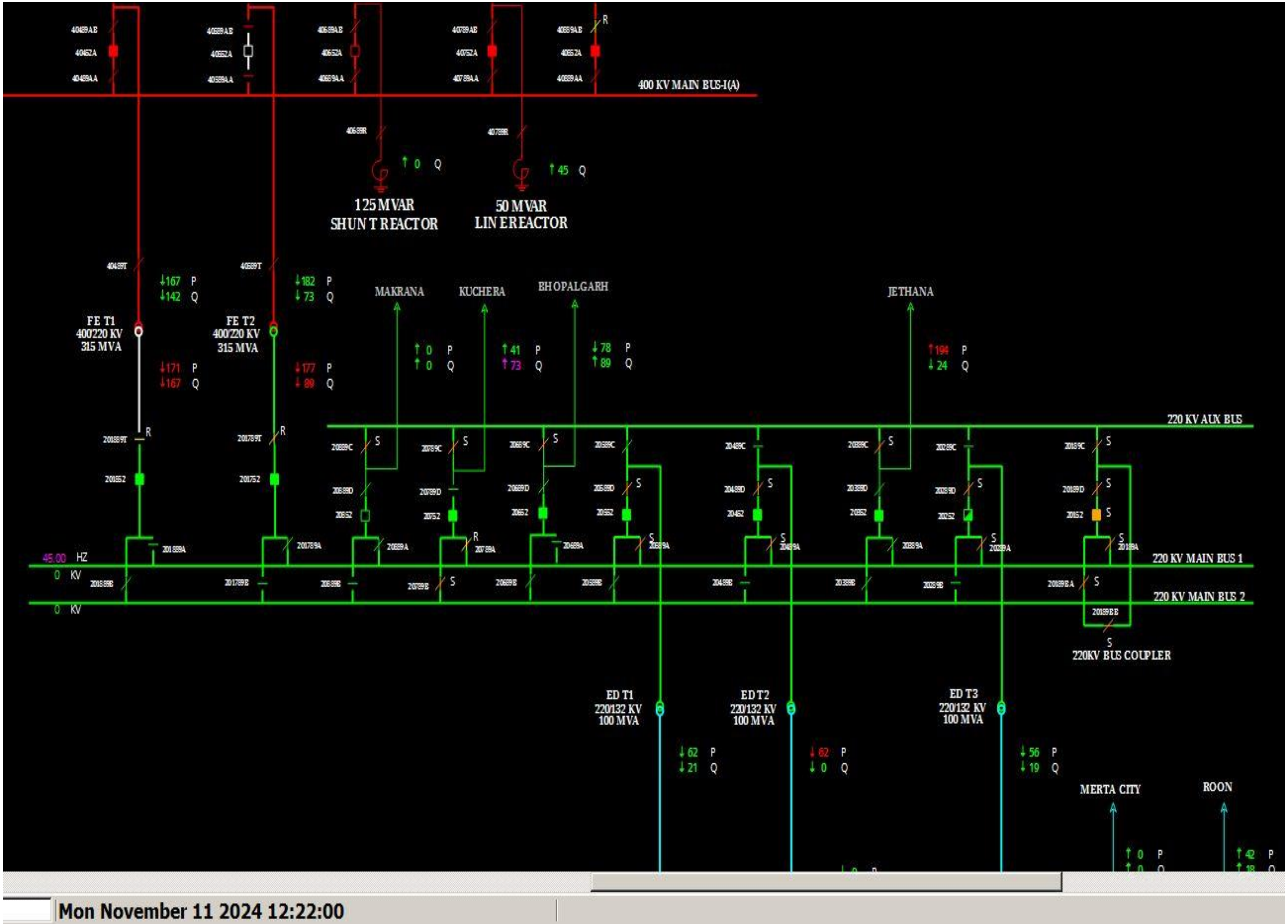
SLD of 400/220/132kV Merta(RS) before the event



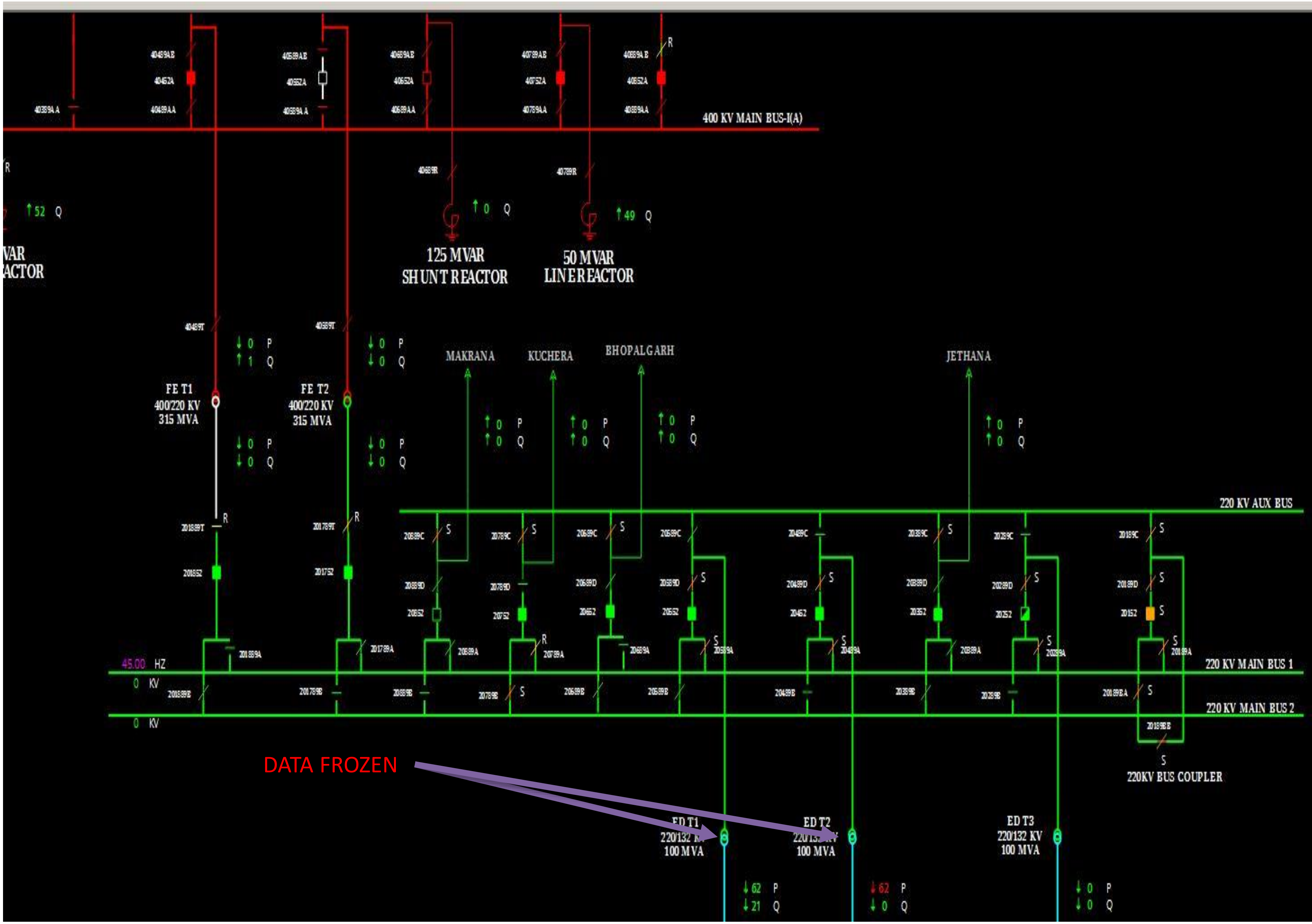
SLD of 400/220/132kV Merta(RS) after the event



SLD of 400/220/132kV Merta(RS) (zoomed) before the event

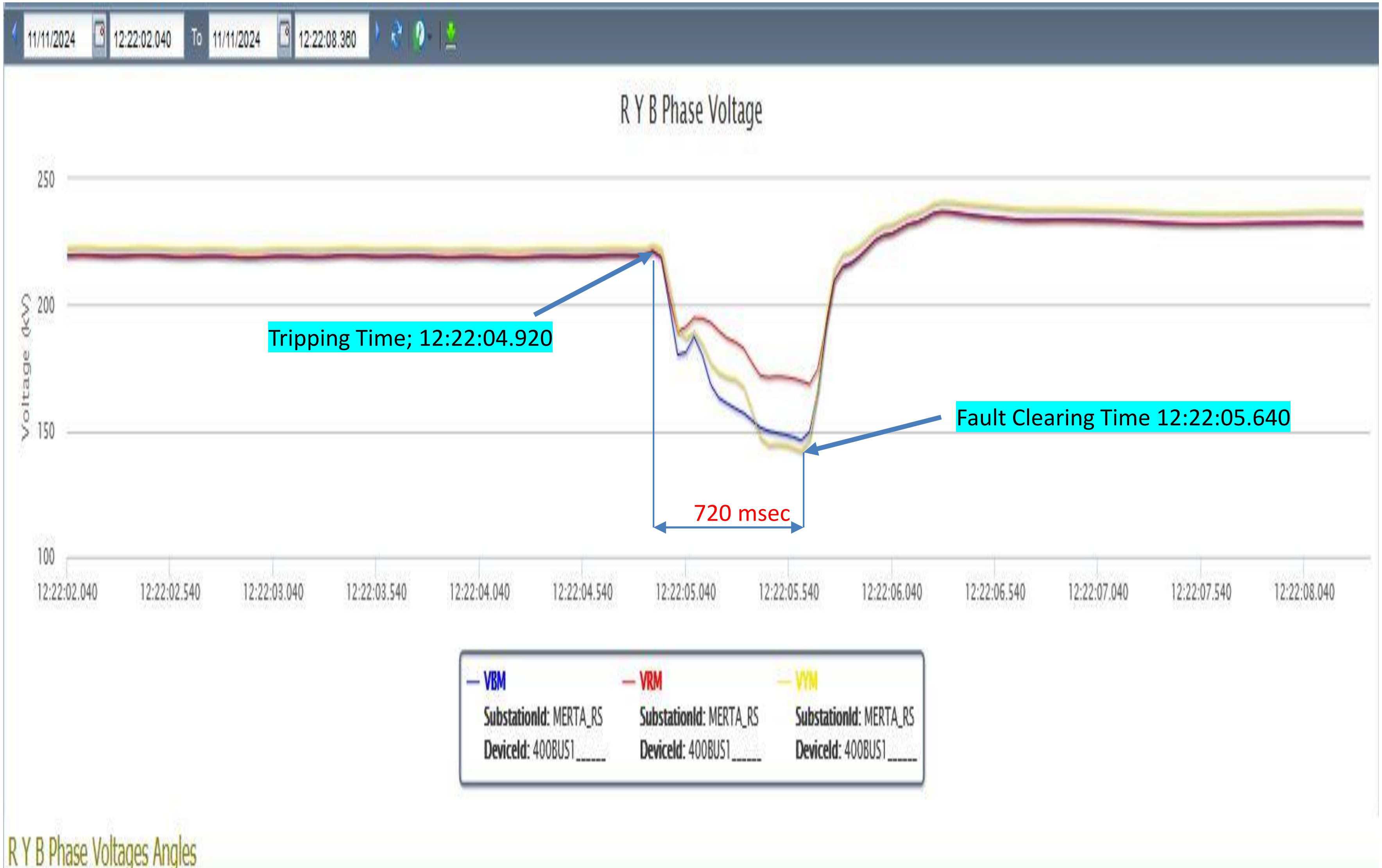


SLD of 400/220/132kV Merta(RS) (zoomed) after the event



PMU Plot of phase voltage magnitude at Merta(RS)

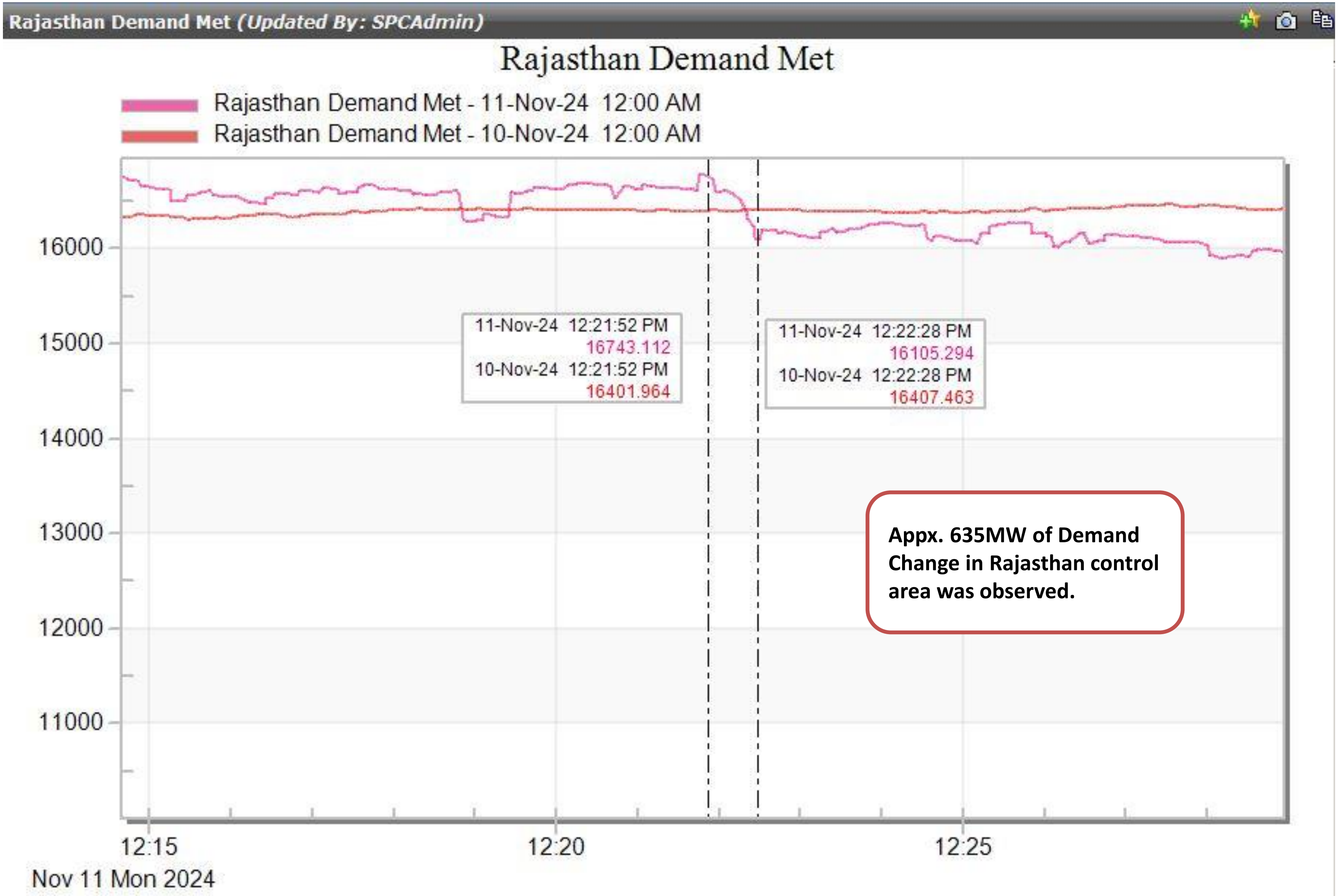
12:22 hrs/11-Nov-24



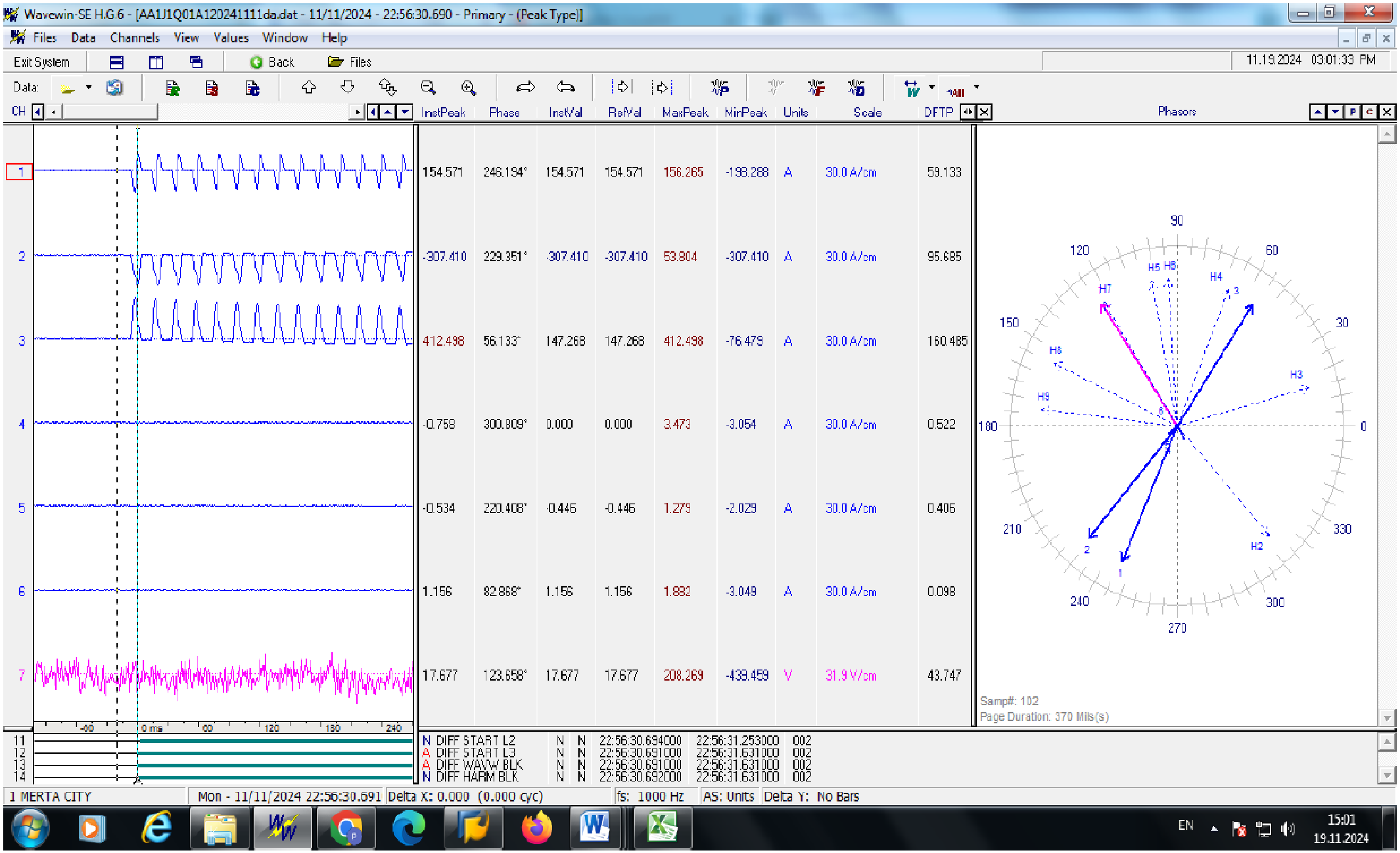
PMU Plot of Frequency at Merta(RS)

12:22 hrs/11-Nov-24

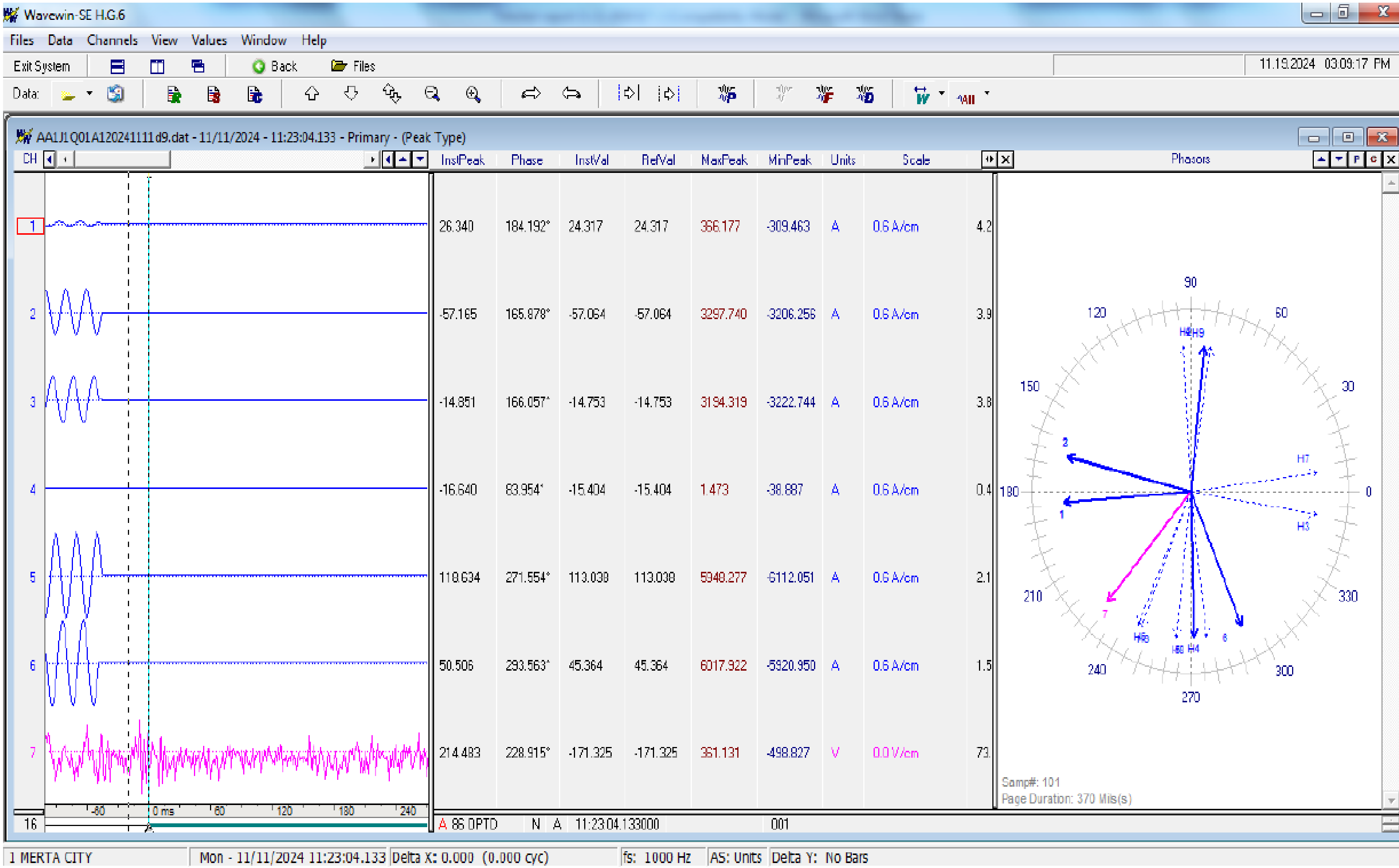
Rajasthan Demand during the event



DR of ICT-1 at Merta(RS)



DR of ICT-2 at Merta(RS)



Points for Discussion

i) The healthiness of the protection system and equipment need to be ensured.
ii) DR/EL along with tripping report need to be submitted from both the ends.
iii) SCADA data of 220/132KV ICT 1 and 2 freezes at Merta substation after the tripping. Availability of SCADA data needs to be ensured.
iv) Tripping of elements not recorded in SCADA SOE. Availability of all the breaker status in SCADA SOE need to be ensured.

Multiple element tripping event at 400/220kV Hinduan(RS)

At 12:22 hrs on 11th November, 2024

Tripped Elements

S. No	Name of Elements	Outage Time	Revival Time	Reason of tripping
1.	125 MVAR BUS REACTOR NO 1 AT 400KV HINDAUN(RS)	05:21Hrs	19:22 hrs (19.11.2024)	Due to Explosion of R-Phase of 125 MVAR BUS REACTOR NO 1 AT 400KV HINDAUN Sub-station
2.	400 KV Heerapura-Hindaun (RS) CKT-1		07:23 hrs	
3.	400 KV Hindaun(RS)-Chhabra(RVUN) (RS) Ckt		07:30 hrs	
4.	400 KV Alwar(ATIL)-Hindaun(RS) (ATIL) Ckt		08:23 hrs	

Brief details of the event

i) As reported, at 05:21 hrs, interrupter of CB Pole (R-Ph.) blasted at the time of opening of CB of 125MVAR Bus Reactor at Hindaun (RS) on voltage regulation.

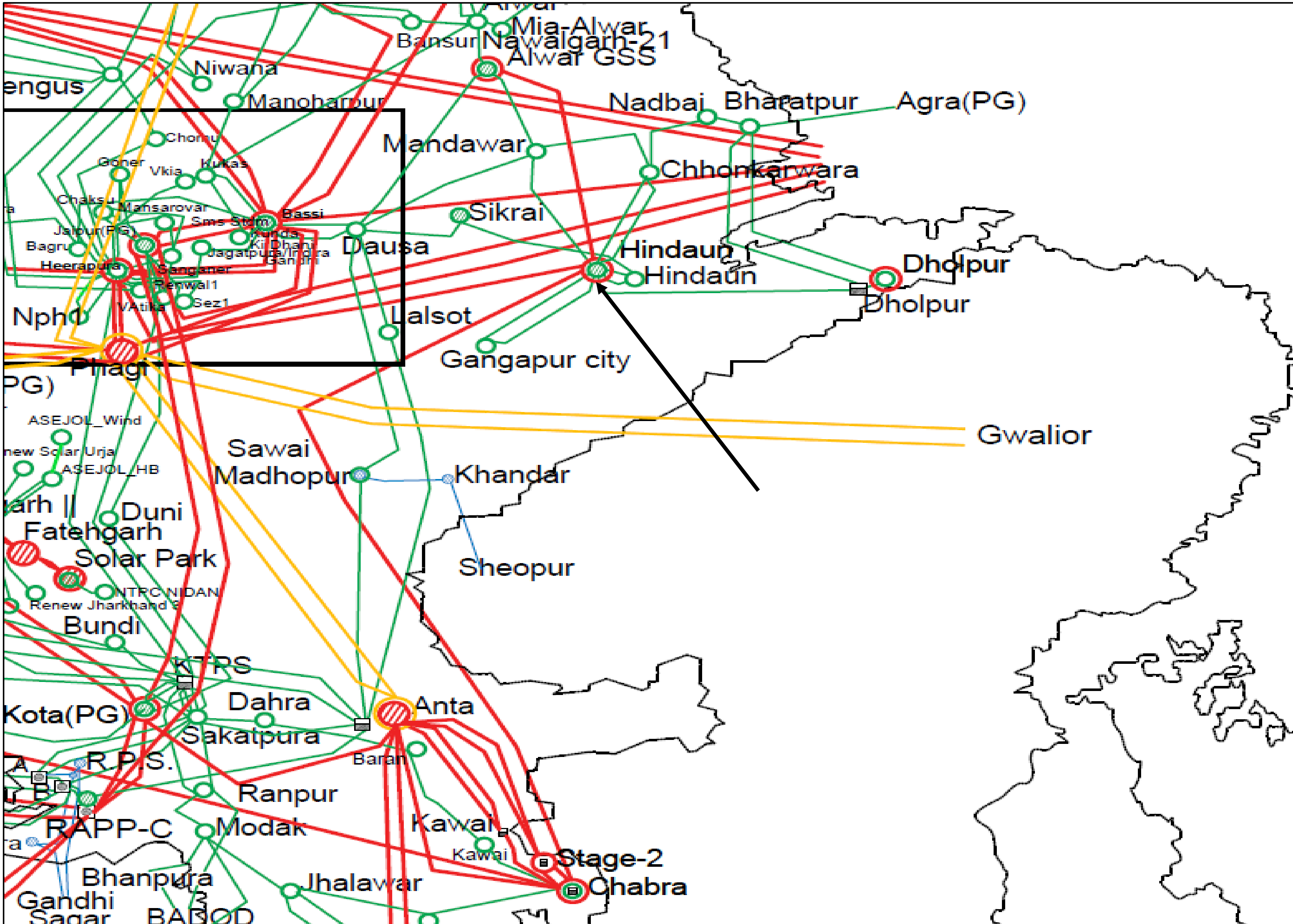
ii) During the same time, 400 KV Hindaun(RS)-Chhabra(RVUN) (RS) Ckt, 400 KV Heerapura-Hindaun (RS) Ckt, and 400 KV Alwar(ATIL)-Hindaun(RS) (ATIL) Ckt at Hindaun(Raj) also tripped (exact reason of tripping yet to be shared).

iii) As per DR of 400 KV Hindaun(RS)-Chhabra(RVUN) (end) (RS) Ckt, zone-2 distance protection operated at Chhabra end. R-N phase to earth fault was observed with fault current of 1.676kA and delayed fault clearance time of ~350ms. (DR nomenclature & time sync issue in DR need to be corrected.)

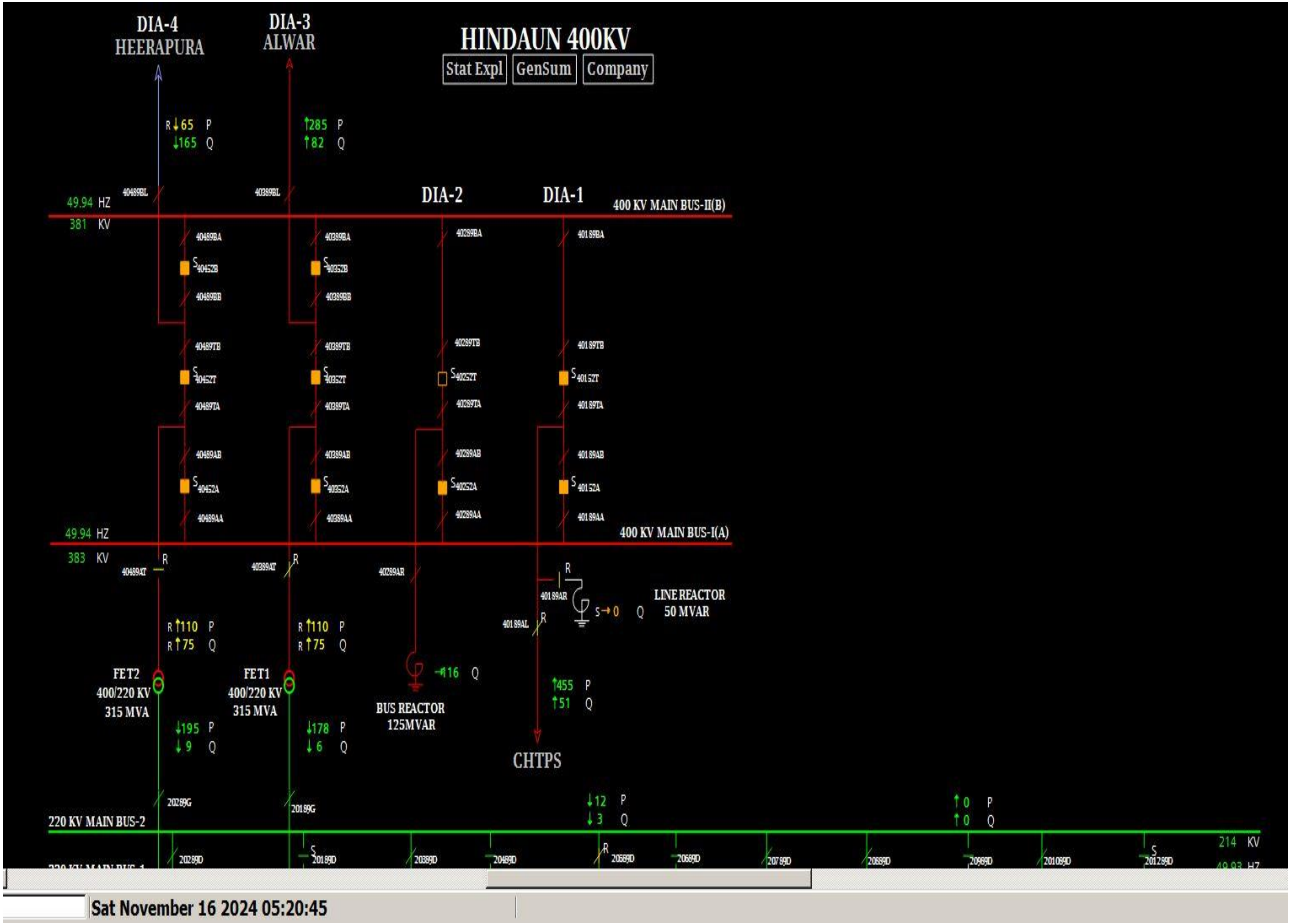
iv) As per PMU at Heerapura (RS) and DR of Chhabra end, R-N fault is observed with delayed fault clearance time of 360 ms.

v) As per SCADA, load loss of approx. 325 MW in Rajasthan control area was observed.

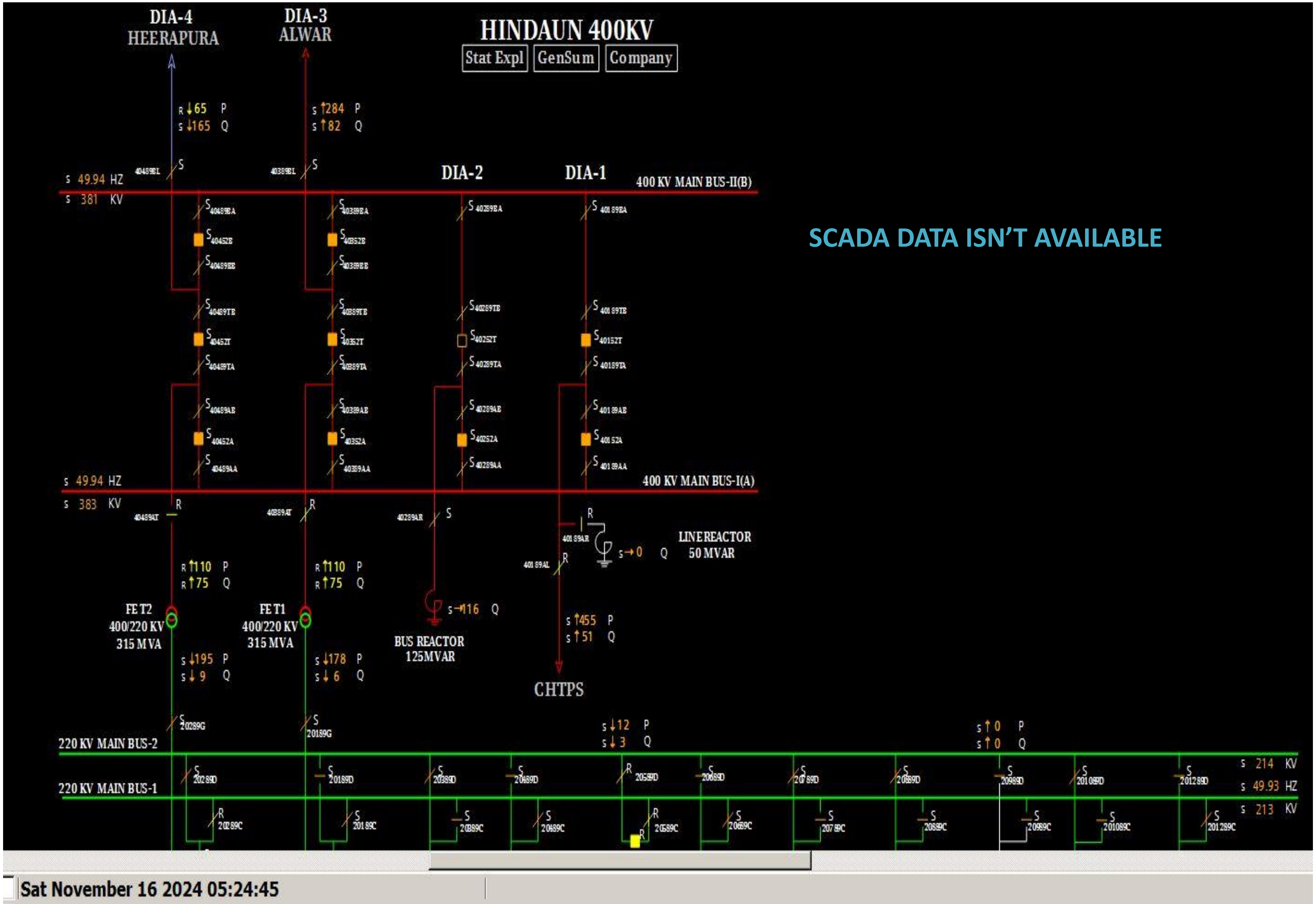
Network Diagram



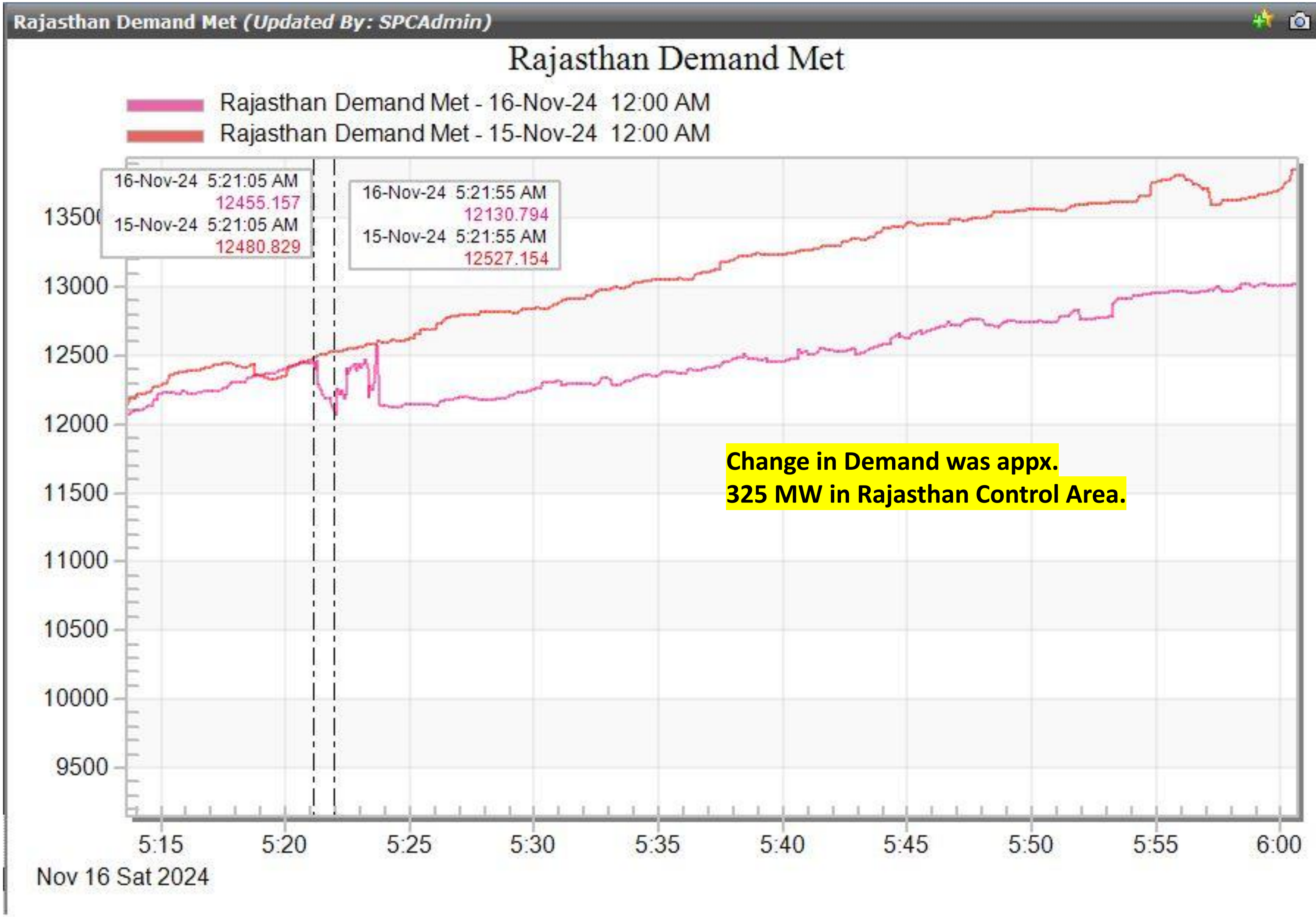
SLD of 400/220kV Hindaun(Raj) before the event



SLD of 400/220kV Hindaun(Raj) after the event



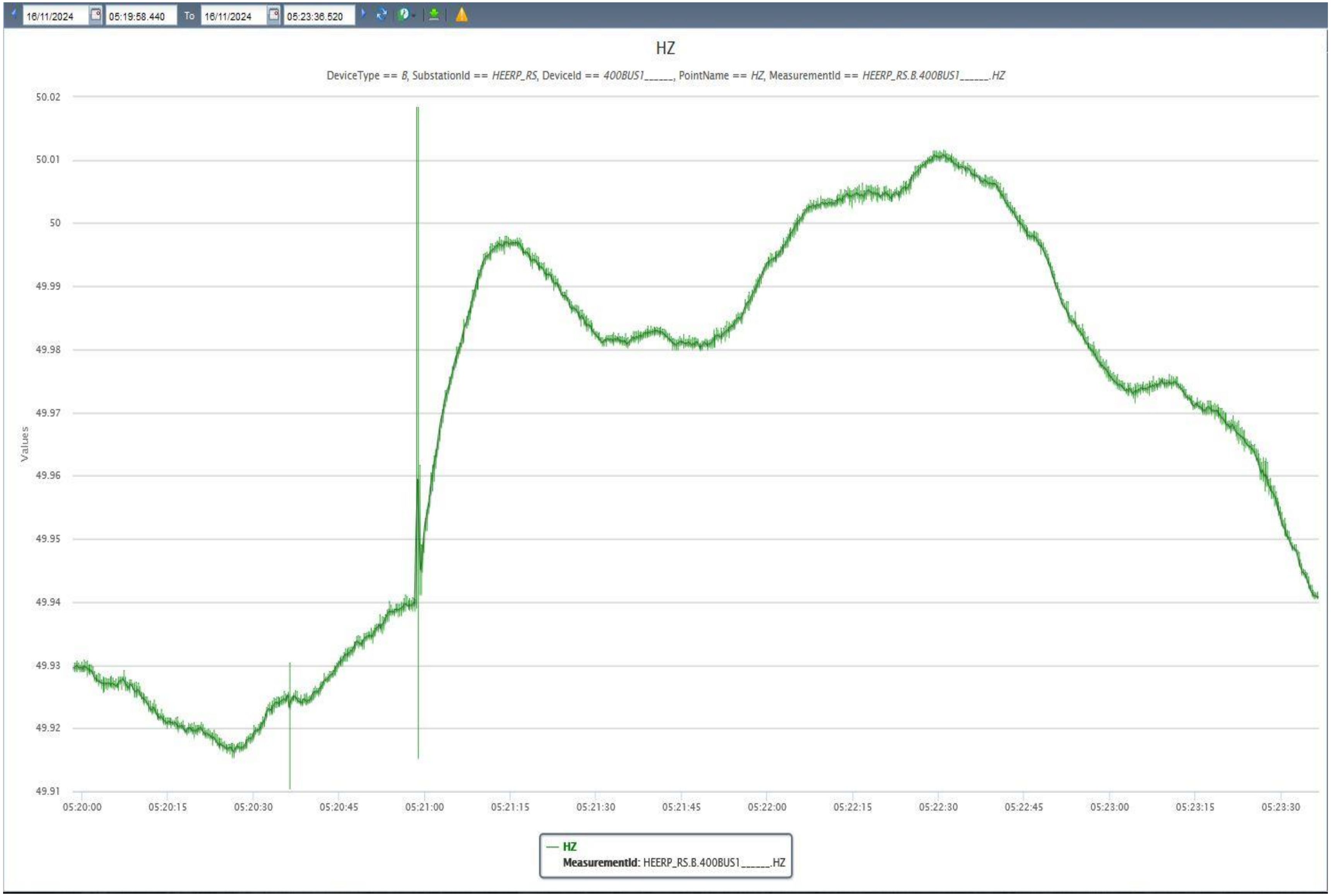
Rajasthan demand during the event



Change in Demand was appx.
325 MW in Rajasthan Control Area.

PMU Plot of frequency at Heerapura(RS)

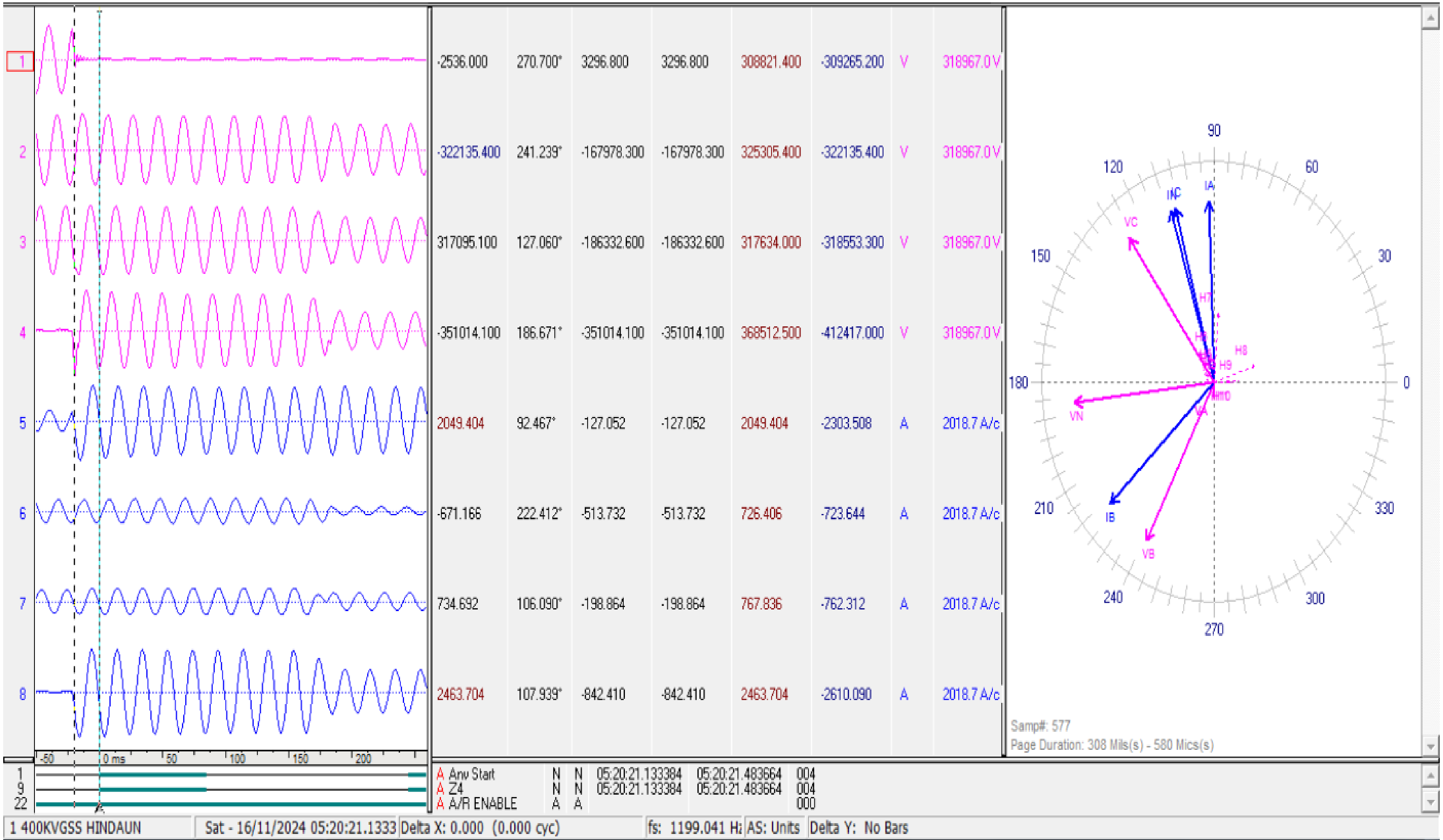
05:21 hrs/16-Nov-24



PMU Plot of Voltage at Heerapura(RJS)

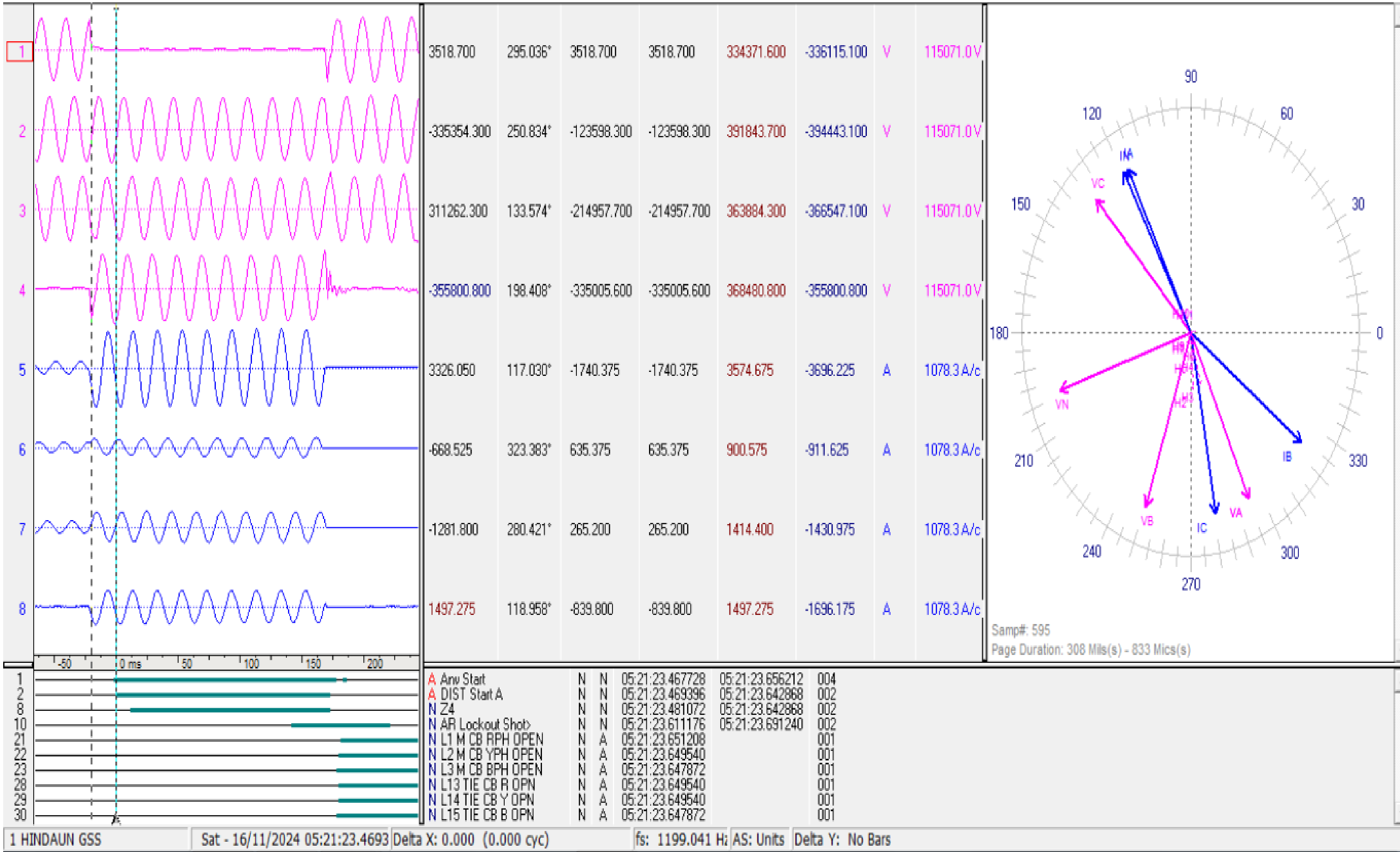
05:21 hrs/16-Nov-24

DR of 400 KV Hindaun(RS)-Alwar(RVUN) (end) (RS) Ckt



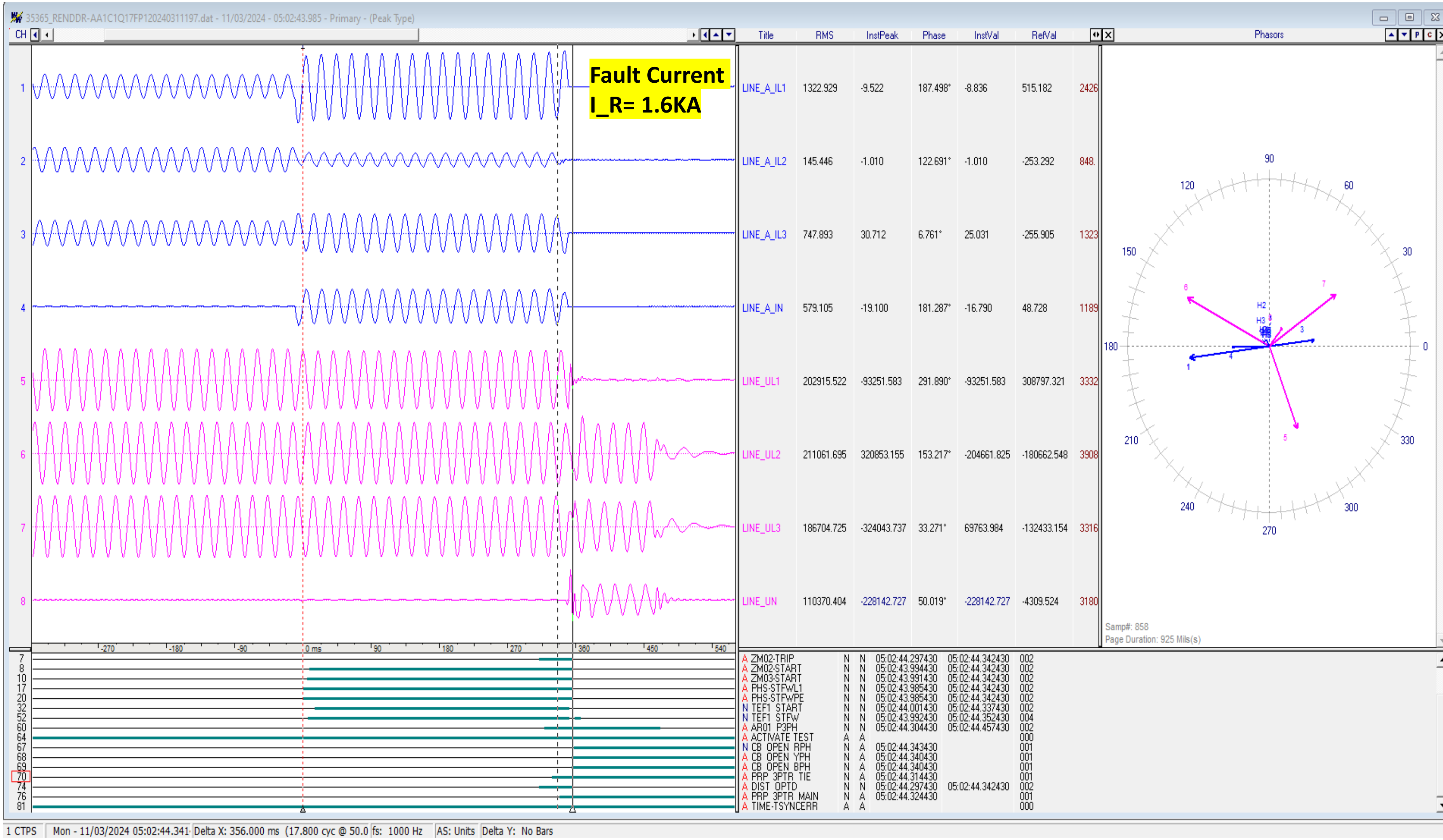
- ✓ Zone-4 distance protection operated at Hindaun end;
- ✓ Complete DR file need to be sent to NRLDC of both Hindaun and Alwar end;

DR of 400 KV Hindaun(RS)-Heerapura(RVUN) (end) (RS) Ckt



- ✓ Zone-4 distance protection operated at Hindaun end;
- ✓ Complete DR file need to be sent to NRLDC for both Hindaun and Alwar end;

DR of 400 KV Hindaun(RS)-Chhabra(RVUN) (end) (RS) Ckt



- ✓ Zone-2 distance protection operated at Chhabra end; fault clearing time=~355ms
- ✓ DR nomenclature need to be corrected
- ✓ Time sync issue is observed

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
05:20:59,136	HINDAUN	220kV	E_07(HIND4-1)	Circuit	Breaker	AbNoSta
05:20:59,136	HINDAUN	220kV	E_07(HIND4-1)	Circuit	Breaker	

Points for Discussion

i) Exact location and nature of fault?
ii) Reason of delayed clearance of fault need to be shared.
iii) Details of all the protection operation need to be shared.
iv) DR/EL along with tripping report of all the elements need to be shared from both the ends.
v) DR uploaded on tripping portal are not time synced. Time syncing of DR & EL needs to be ensured and DR nomenclature of the elements needs to be corrected.
vi) Remedial action taken report to be shared.

Multiple element tripping event at 400/220kV Bhadla(RS)

At 22:11 hrs on 23rd November, 2024

Tripped Elements

S. No	Name of Elements	Outage Time	Revival Time	Reason of tripping (as reported)
1.	400 KV Bhadla-Merta (RS) Ckt-1	22:11 hrs	10:50 (24.11.2024)	R-N fault
2.	400 KV Bikaner-Bhadla (RS) Ckt-1	22:11 hrs	00:02 hrs (24.11.2024)	Details awaited
3.	400 KV Bikaner-Bhadla (RS) Ckt-2	22:11 hrs	00:02 hrs (24.11.2024)	Tripped due to DT received from Bhadla

Brief details of the event

i) During antecedent condition, 400 KV Bhadla-Merta (RS) Ckt-1, 400 KV Bikaner-Bhadla (RS) Ckt-1 and 400 KV Bikaner-Bhadla (RS) Ckt-2 were connected to 400KV Bus-I and were carrying 13MW, 86MW and 87MW of load respectively.

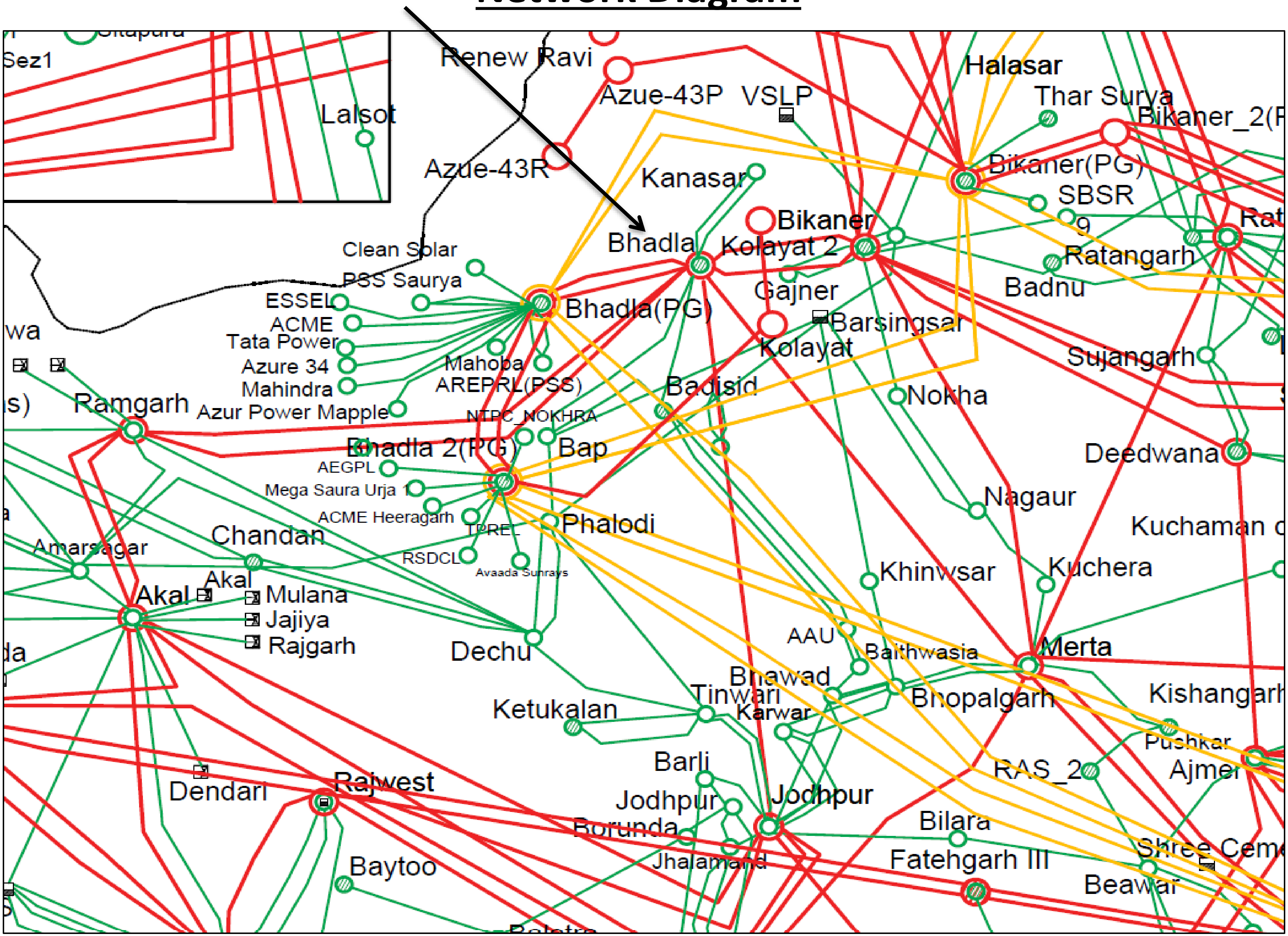
ii) As reported at 22:11hrs, 400 KV Bhadla-Merta (RS) Ckt-1 tripped on R-N fault. At the same time, 400 KV Bikaner-Bhadla (RS) Ckt-1 and 400 KV Bikaner-Bhadla (RS) Ckt-2 also tripped. 400 KV Bikaner-Bhadla (RS) Ckt-2 tripped due to DT received from Bhadla end. (Exact reason of fault, DT received from Bhadla end and tripping of 400 KV Bikaner-Bhadla (RS) Ckt-2 yet to be shared).

iii) As per DR of 400 KV Bikaner-Bhadla (RS) Ckt-2, Bikaner (end), the circuit tripped at due to DT received at Bikaner end from Bhadla. (DR nomenclature & time sync issue in DR need to be corrected.)

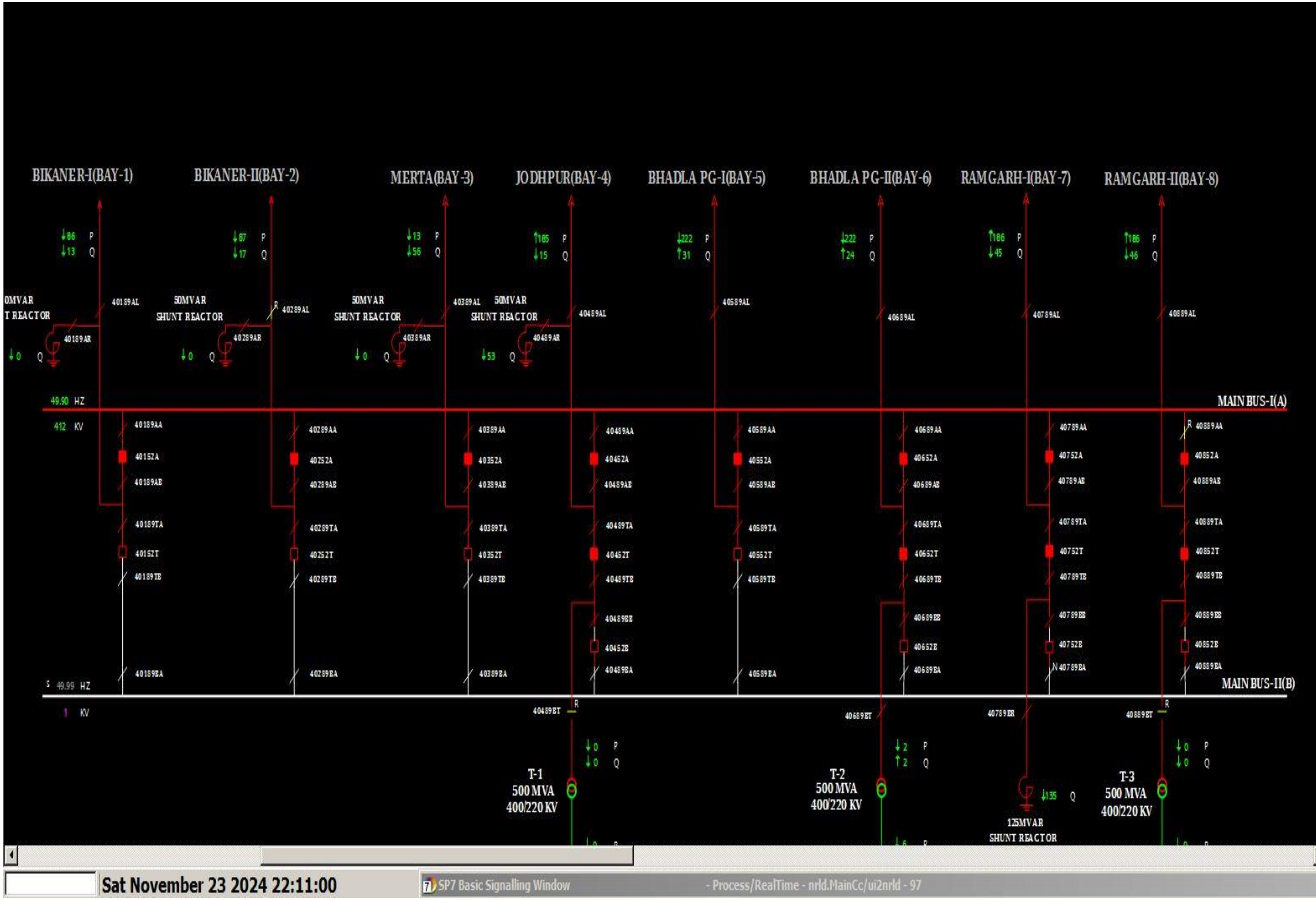
iv) As per PMU at Bikaner (PG) and DR of Bikaner (RS) end, R-N fault is observed which cleared within 100 ms.

v) As per SCADA, no change in demand is observed in Rajasthan control area

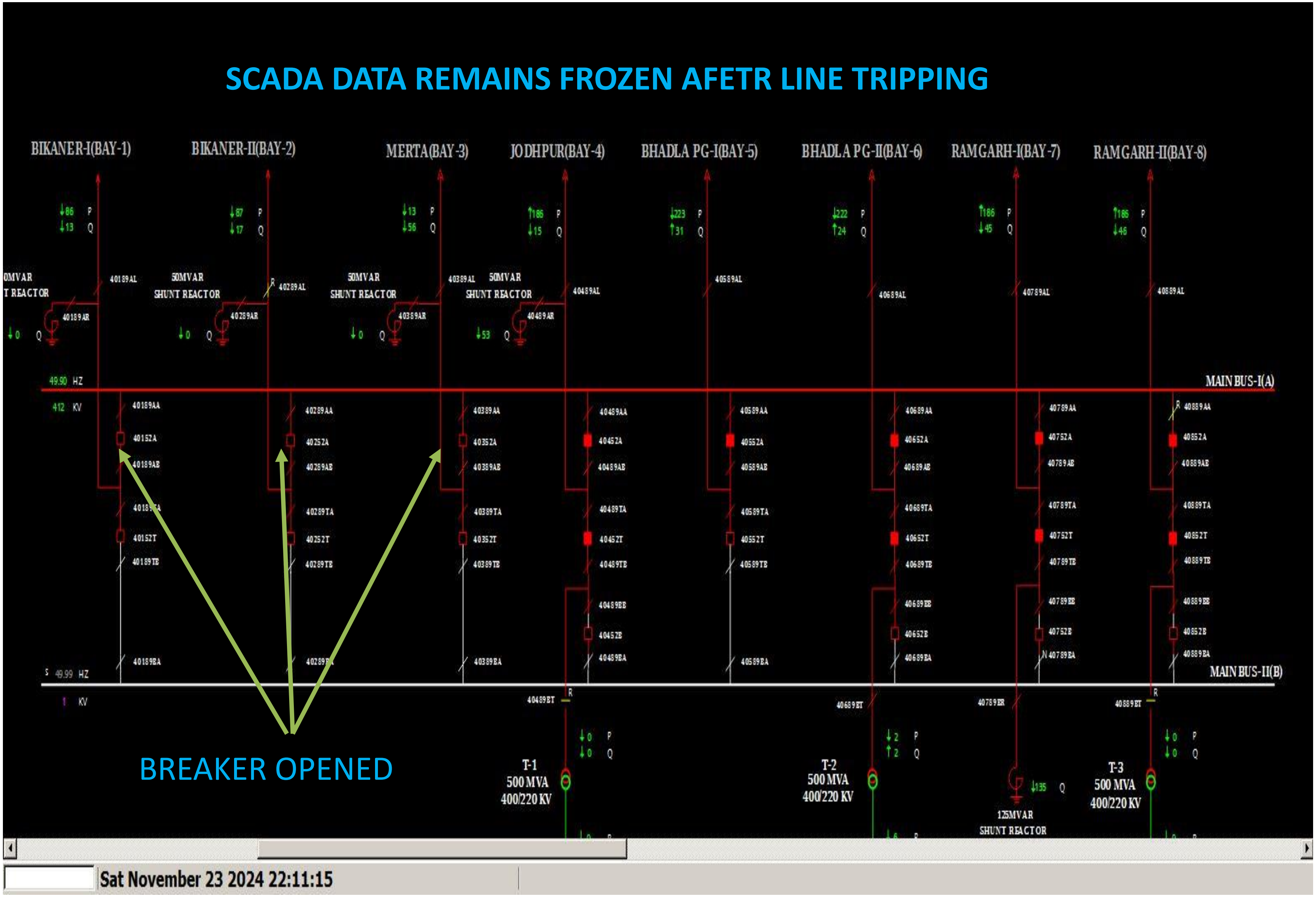
Network Diagram



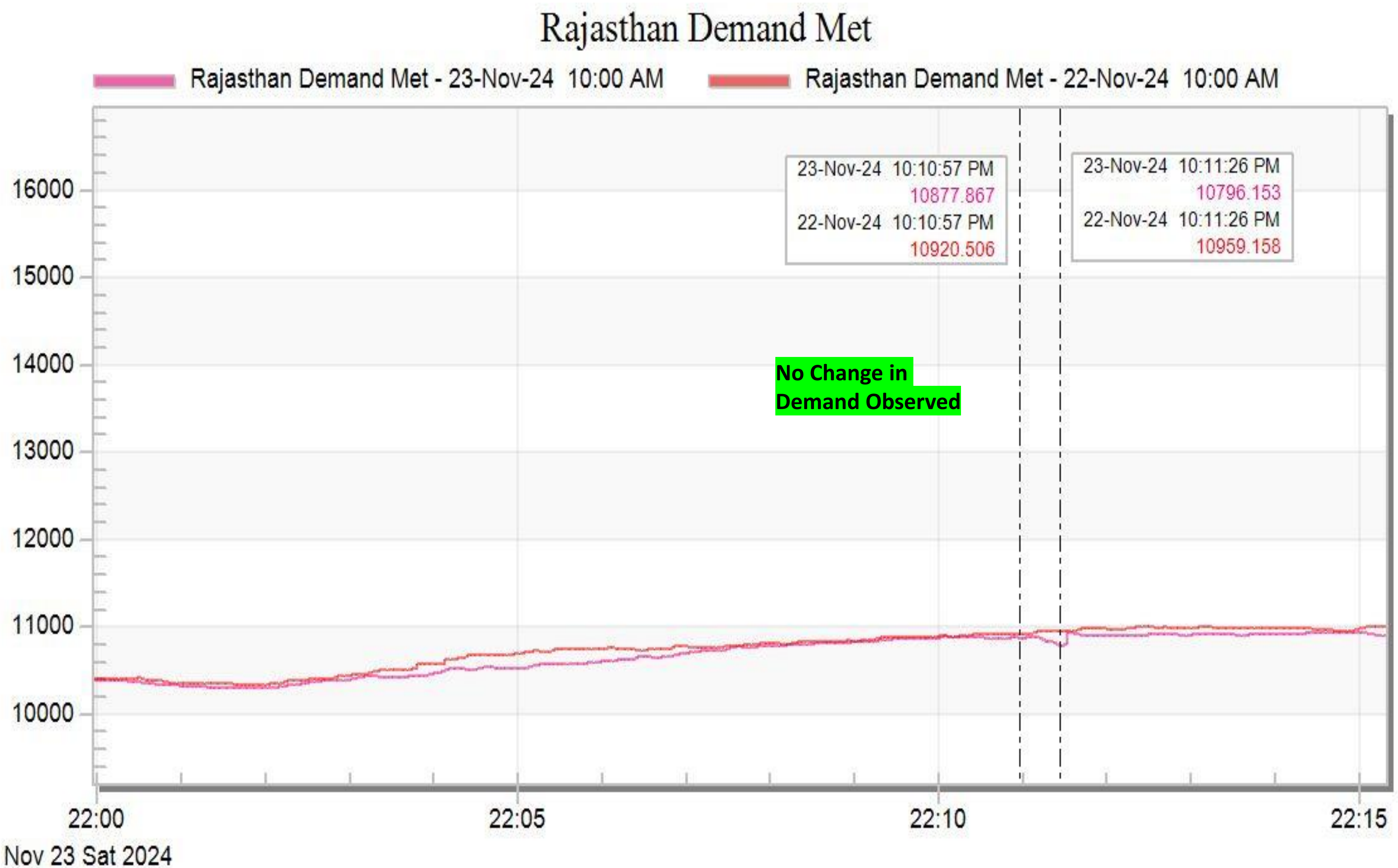
SLD of 400 KV Bhadla(RS) before the event



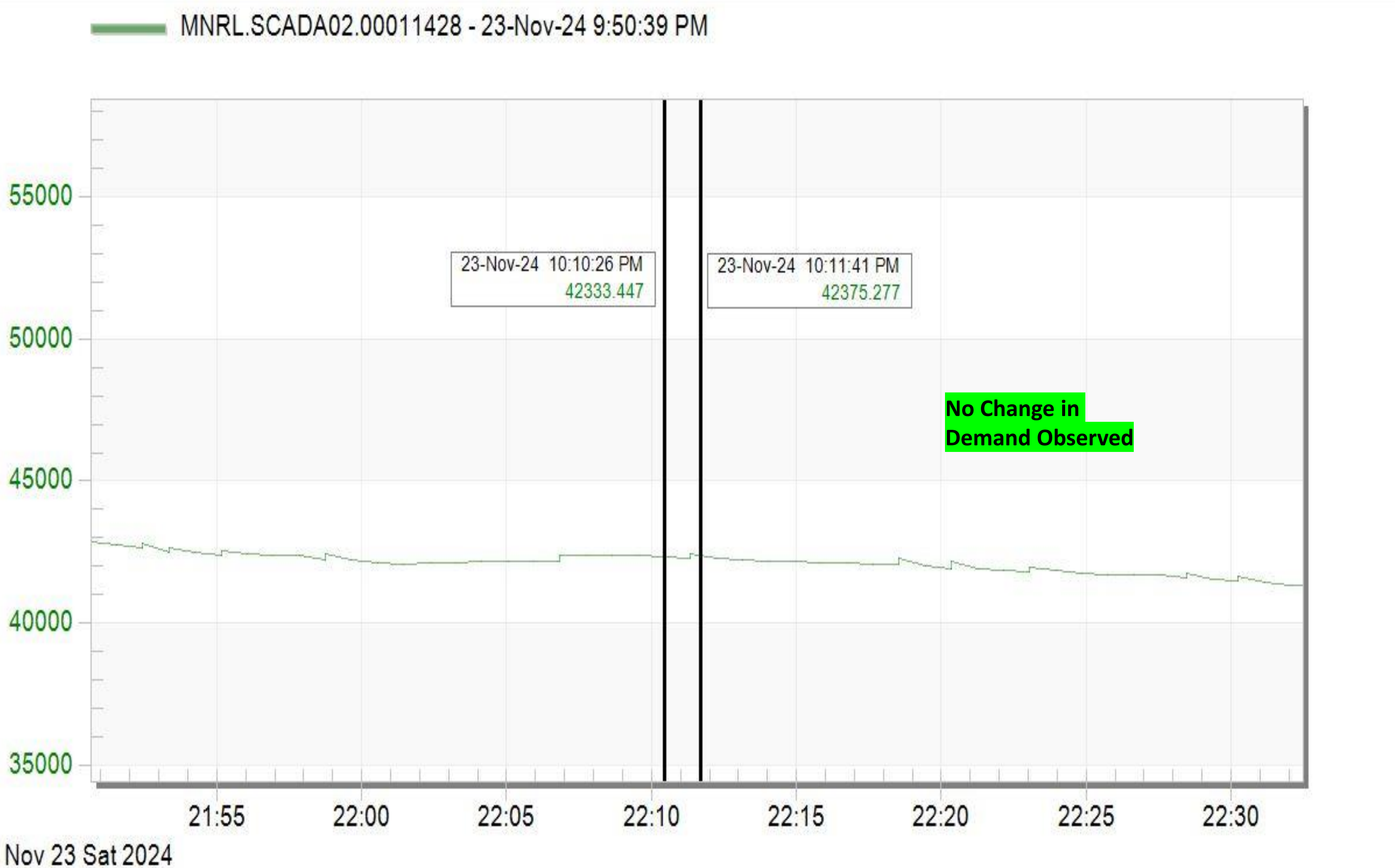
SLD of 400 KV Bhadla(RS) After the event



Rajasthan Demand during the event



Northern Region Demand during the event



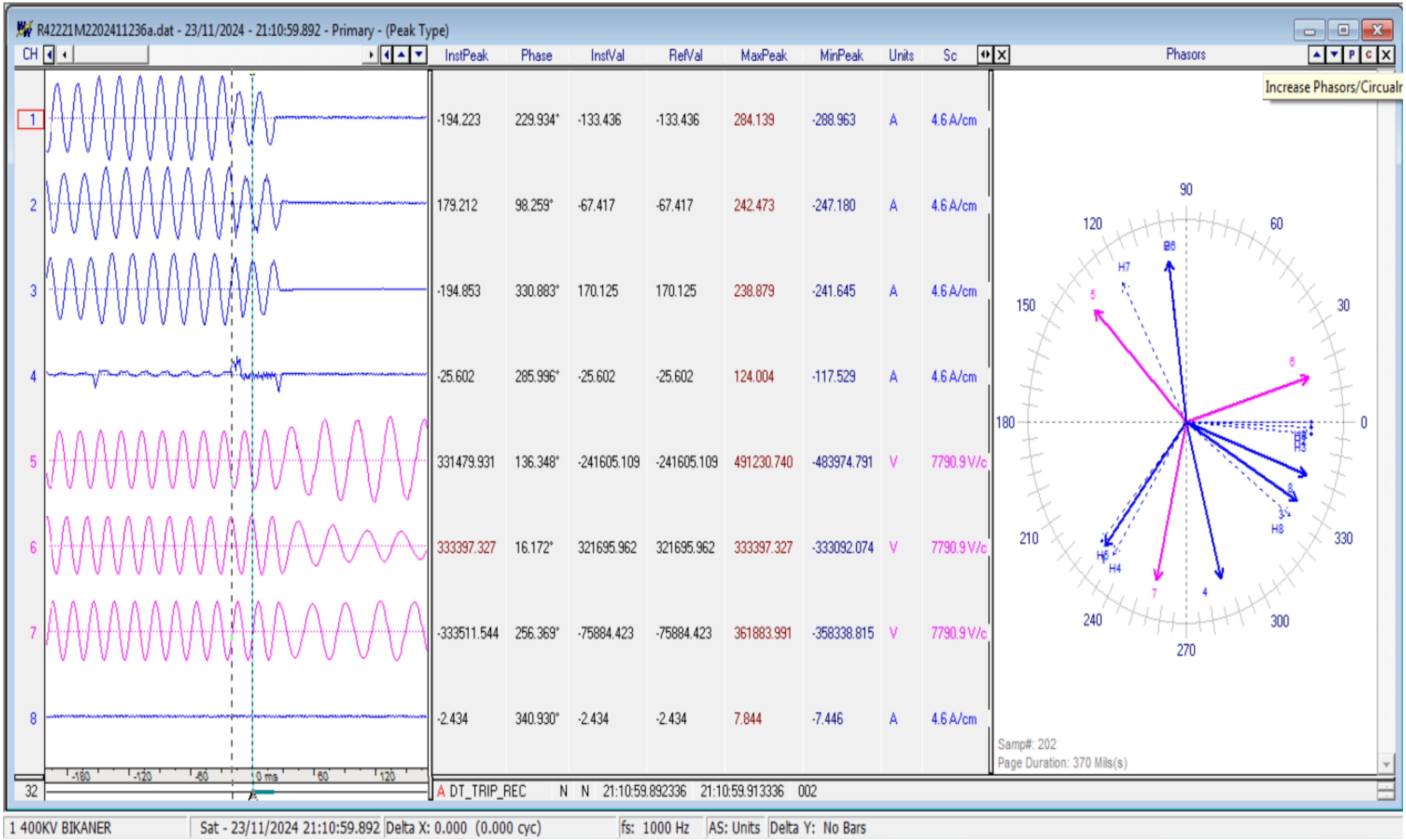
PMU Plot of frequency at Bikaner(PG)

22:11 hrs/23-Nov-24

PMU Plot of phase voltage magnitude at Bikaner(PG)

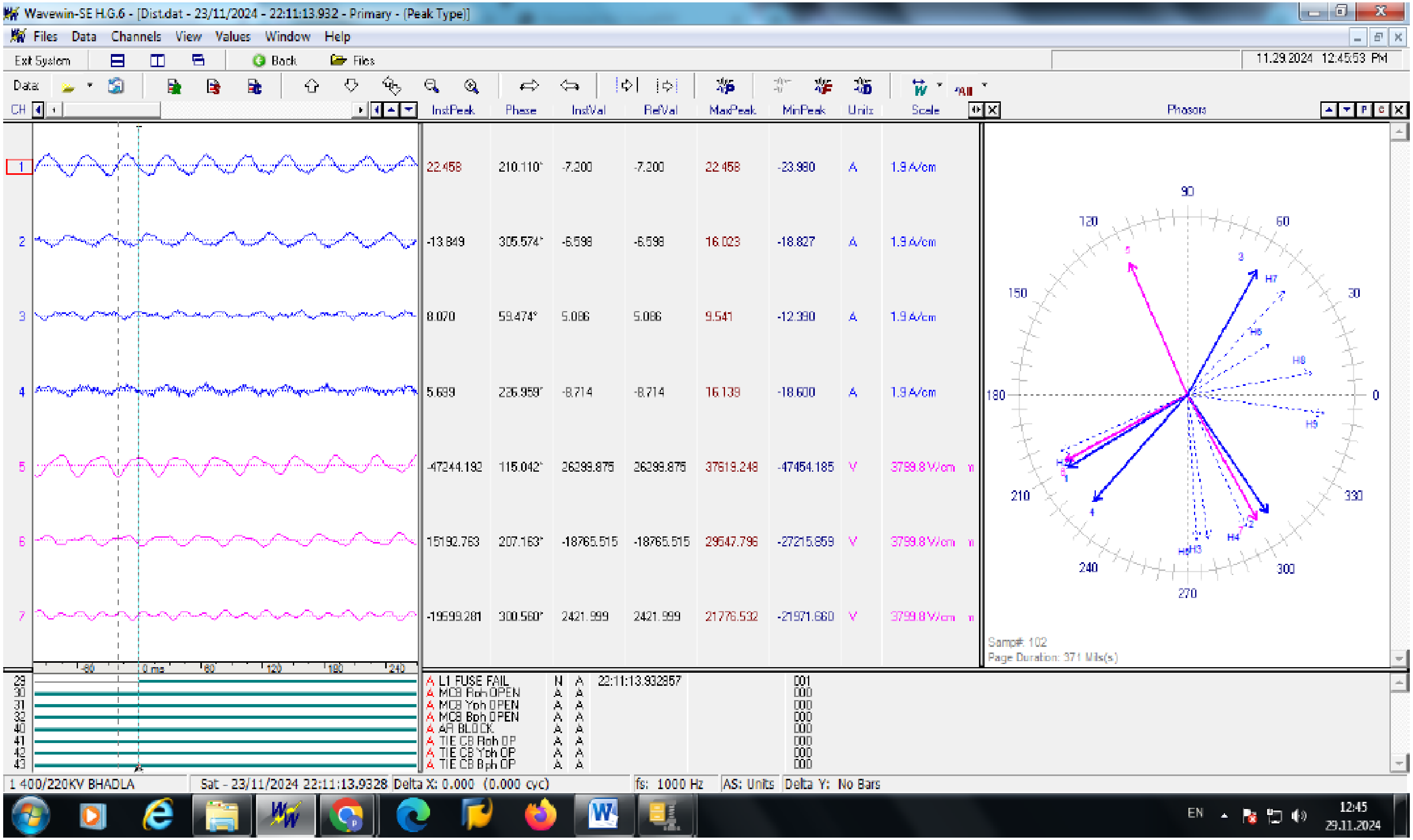
22:11 hrs/23-Nov-24

DR of 400 KV Bikaner-Bhadla (RS) Ckt-2 at Bikaner End



DT received at Bikaner(RS) end

DR of 400 KV Bhadla-Merta (RS) Ckt-1 at Bhadla End



DT received at Bikaner(RS) end

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
22:11:08,100	BHDLA_R	400	01BKNR1	Circuit Breaker	Open	Main CB of 400 KV BIKANER-BHADLA (RS) CKT-1 opened at Bhadla S/s
22:11:08,237	BHDLA_R	400	04BKNR2	Circuit Breaker	Open	Main CB of 400 KV BIKANER-BHADLA (RS) CKT-1 opened at Bhadla S/s

Points for Discussion

i) Exact location and nature of fault needs to be shared
ii) Reason of DT sent from Bhadla end need to be shared.
iii) Details of all the protection operation need to be shared.
iv) DR/EL along with tripping report of all the elements need to be shared from both the ends.
v) DR uploaded on tripping portal are not time synced. Time syncing of DR & EL needs to be ensured and DR nomenclature of the elements needs to be corrected.
vi) Remedial action taken report to be shared.

Multiple element tripping event at 220kV Pong(BB)

At 20:45 hrs on 06th November, 2024

Tripped Elements

S. No	Name of Elements	Outage Time	Revival Time	Reason of tripping
1.	66 MW Pong HPS - UNIT 6	20:45 hrs	00:00 hrs	MICOM P643 relay of Unit-6- CB Head Flashover Operated and tripped along with Bus 2 due to LBB Operation
2.	66 MW Pong HPS - UNIT 2		00:00 hrs	
3.	220KV Bus 2 at Pong(BB)		22:54 hrs	
4.	220 KV Jalandhar-Pong (BB) Ckt-2		22:59 hrs	
5.	220 KV Jessore(HP)-Pong(BB) (PG) Ckt-1		23:15 hrs	
6.	220 KV Pong(BB)-Dasuya(PS) (BBMB) Ckt-2		23:04 hrs	

Brief details of the event

i) During antecedent condition, 66MW Unit-2, 3, 5 & 6 at Pong HEP were running and generating approx. 66MW, 66MW, 64MW and 56MW respectively (as per SCADA). 66MW Unit-1 & 4 at Pong HEP were not in service.

ii) As reported, at 20:45 hrs, while stopping 66 MW Unit-6 at Pong (BB), the Relay MICOM P643- CB Head Flashover operated. As informed by the site, the Earth Fault relay connected to Unit-06 GT neutral operated, and the CB of Unit-6 opened. However, the Earth Fault current did not reduce to 0 A immediately. As a result, due to the AND operation logic (where the CB is open and the Earth Fault remains active), the CB Head Flashover was initiated, causing simultaneous tripping of 220 kV Bus-2 at Pong(BB).

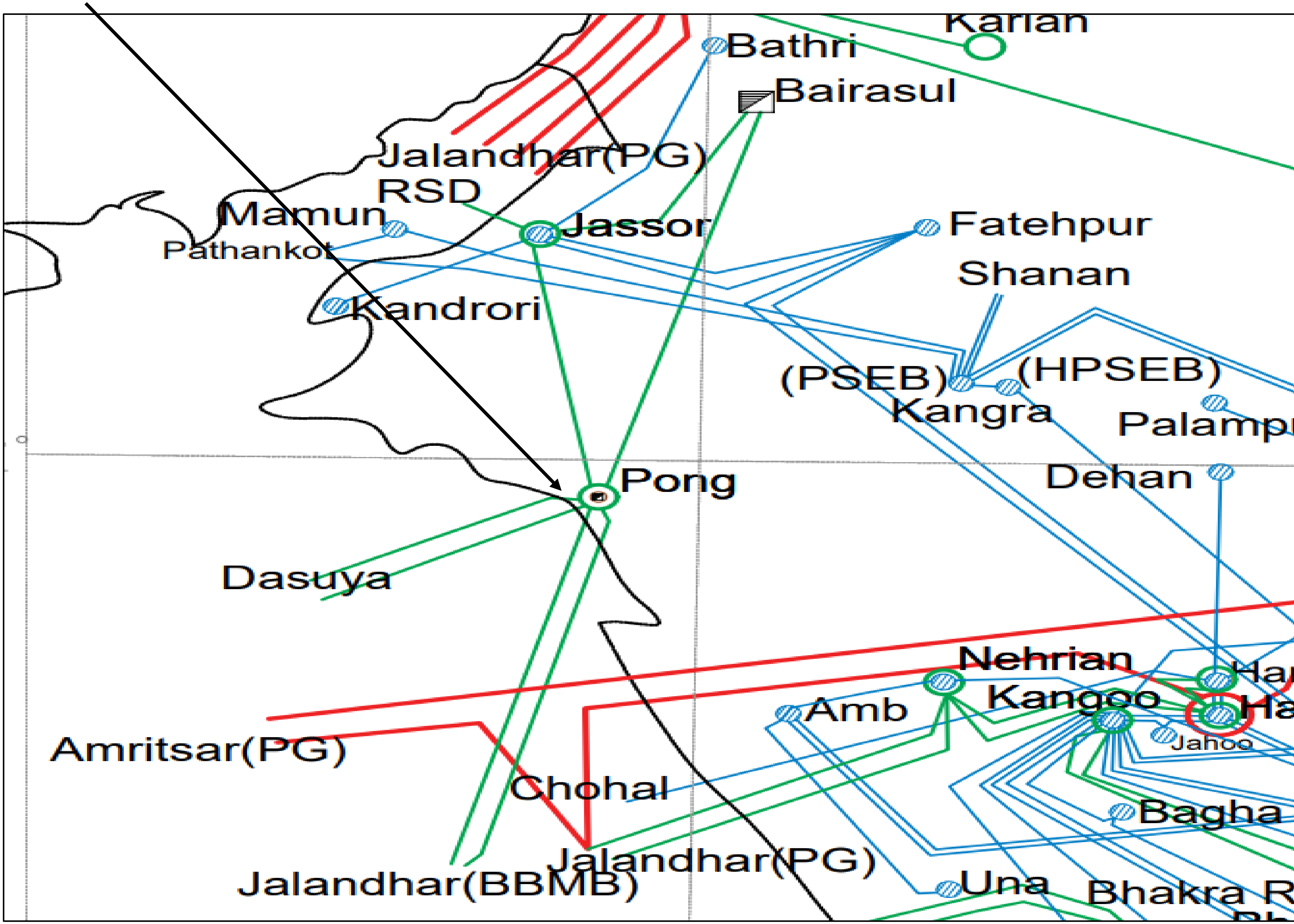
iii) As 220 KV Jalandhar-Pong (BB) Ckt-2, 220 KV Jessore(HP)-Pong(BB) (PG) Ckt-1, 220 KV Pong(BB)-Dasuya(PS) (BBMB) Ckt-2 and 66 MW Pong HPS - UNIT 2 were connected to 220 kV Bus-2 at Pong(BB), all these elements tripped from Pong end along with Bus-2.

iv) As discussed with BBMB personnel, a delay of 15 ms is kept for reduction of earth fault current to 0 A (in case of CB open condition) in CB Head Flashover protection logic to avoid overlapping conditions.

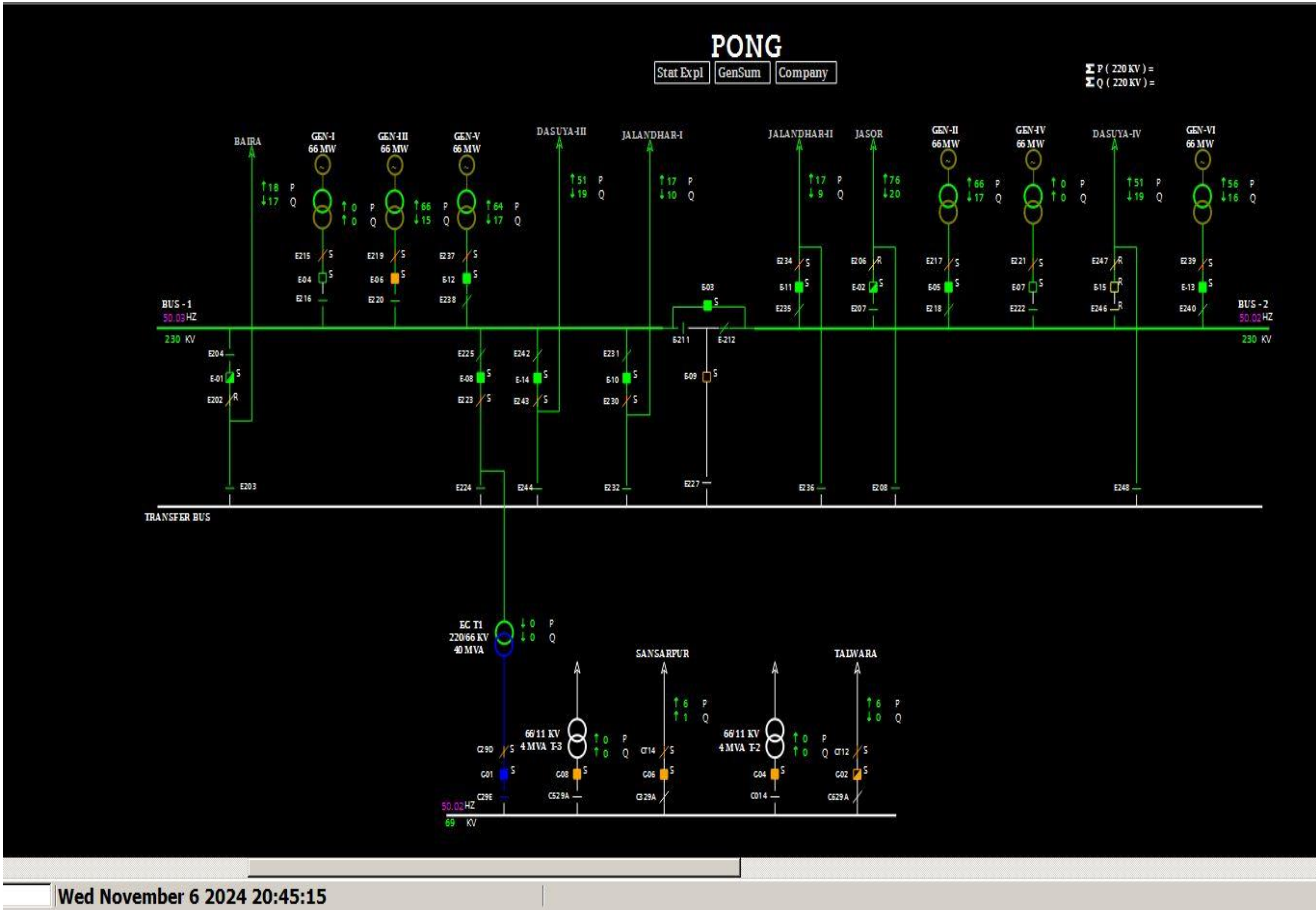
v) As per PMU at Jalandhar(PG), no fault is observed in the system. However, fluctuation in voltage is observed.

vi) As per SCADA, generation loss of approx. 125 MW at Pong HEP (BB) and no load loss is observed in HP control area

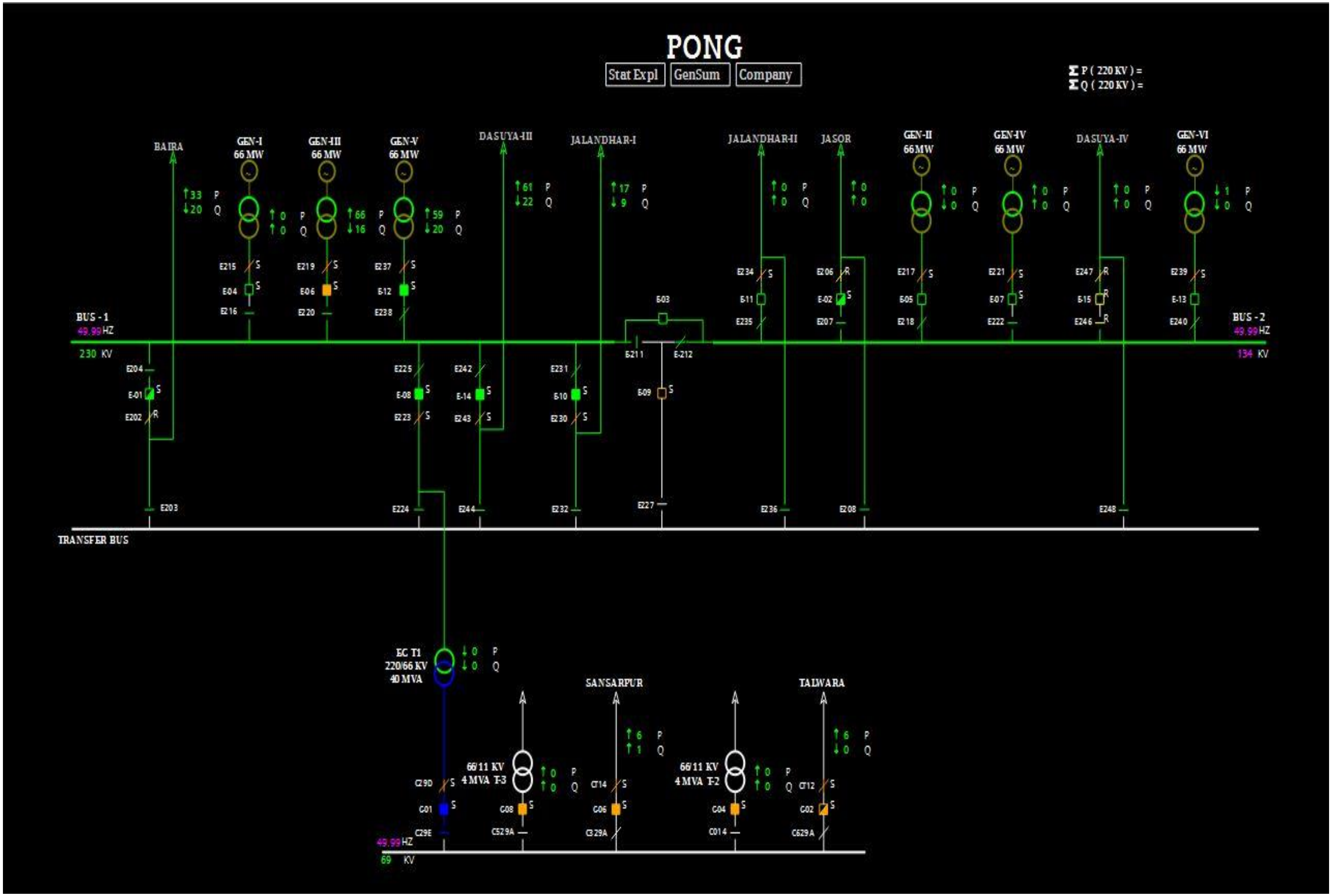
Network Diagram



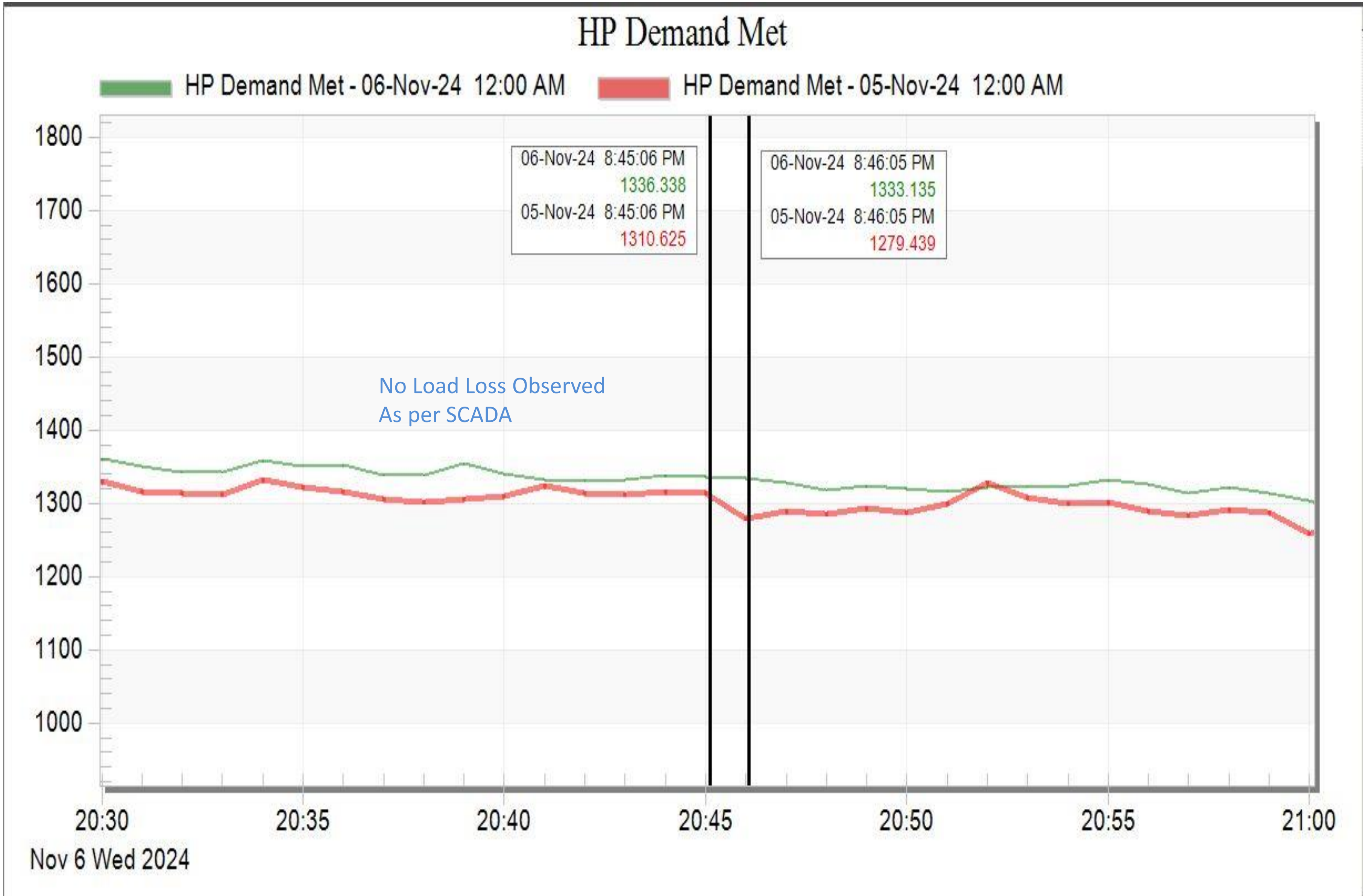
SLD of 220kV Pong(BB) before the event



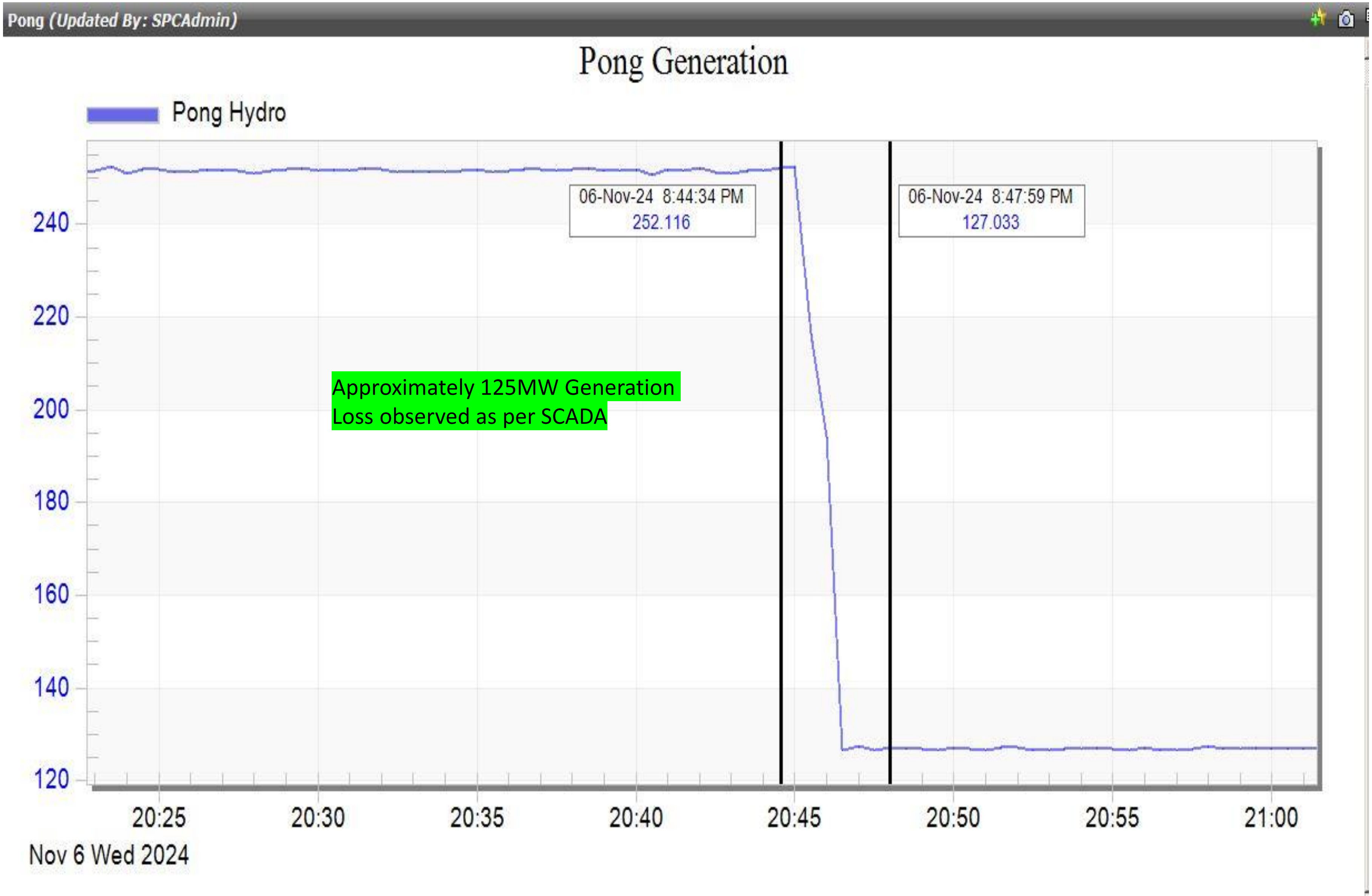
SLD of 220kV Pong(BB) after the event



Himachal Pradesh demand during the event



Pong HEP generation during the event

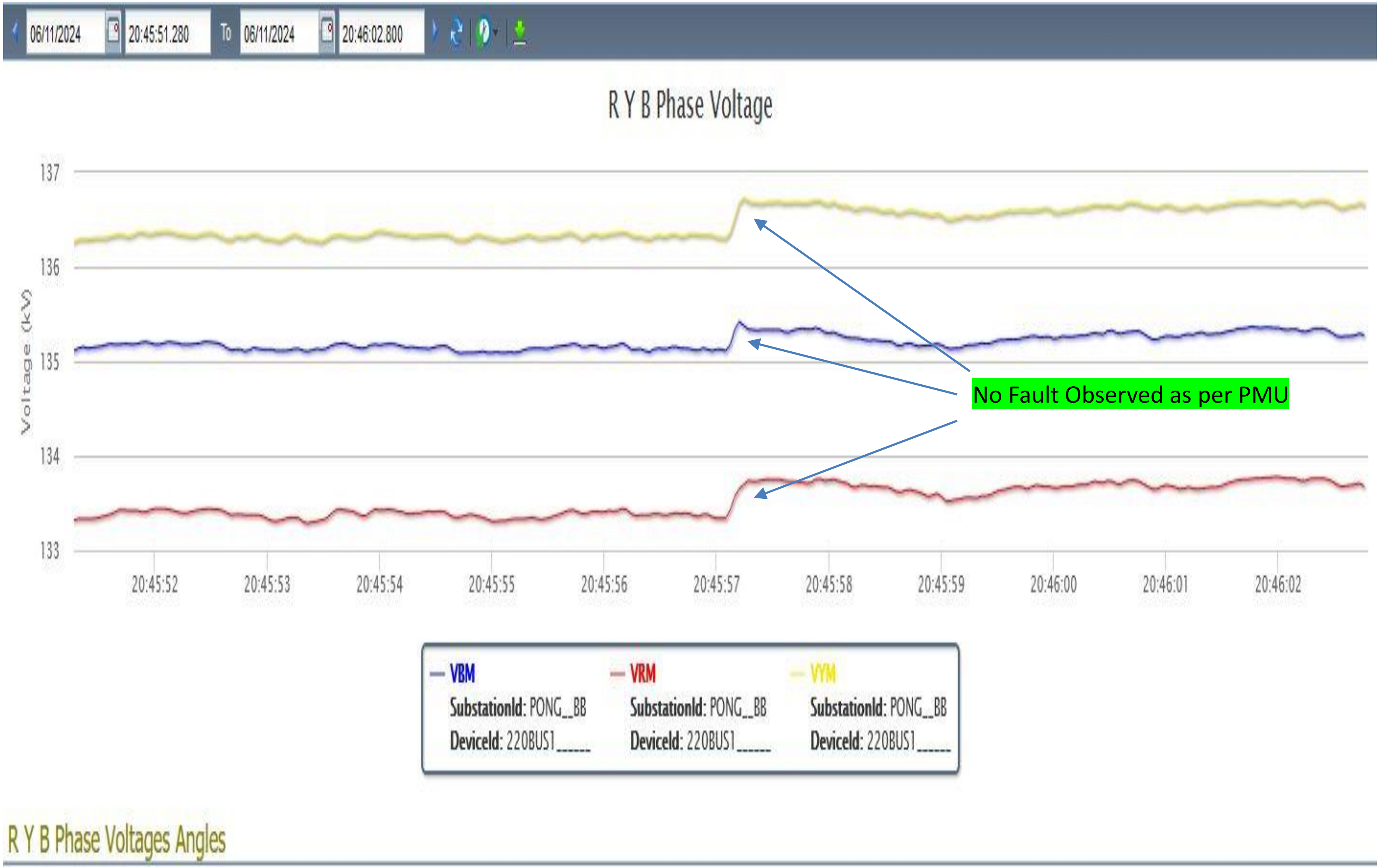


PMU Plot of frequency at Pong(BB)

20:45hrs/06-Nov-24

PMU Plot of phase voltage magnitude at Pong(BB)

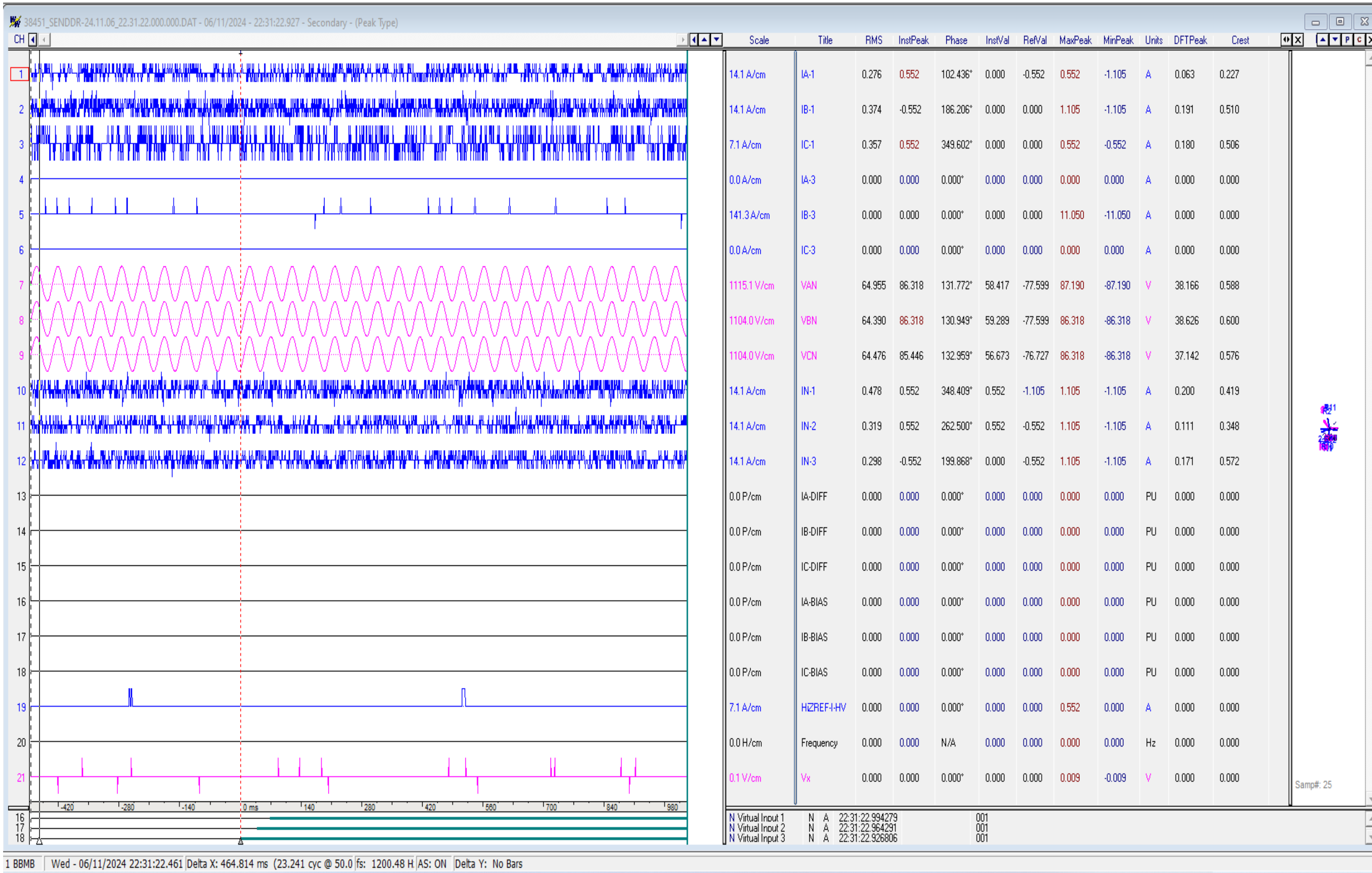
20:45hrs/06-Nov-24



SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
20:45:57,211	PONG__BB	220kV	13H06	Circuit Breaker	Open	CB at 220kV side of 66 MW Pong HPS - UNIT 6 opened
20:45:57,281	PONG__BB	220kV	05H02	Circuit Breaker	Open	CB at 220kV side of 66 MW Pong HPS - UNIT 2 opened
20:45:57,341	PONG__BB	220kV	03MBC	Circuit Breaker	Open	Main Bus Coupler CB at 220kV Pong(BB) opened
20:45:57,371	PONG__BB	220kV	11JLNDR2	Circuit Breaker	Open	Line CB at Pong(BB) end of 220 KV Jalandhar-Pong (BB) Ckt-2 opened

DR of Pong HPS Unit-2

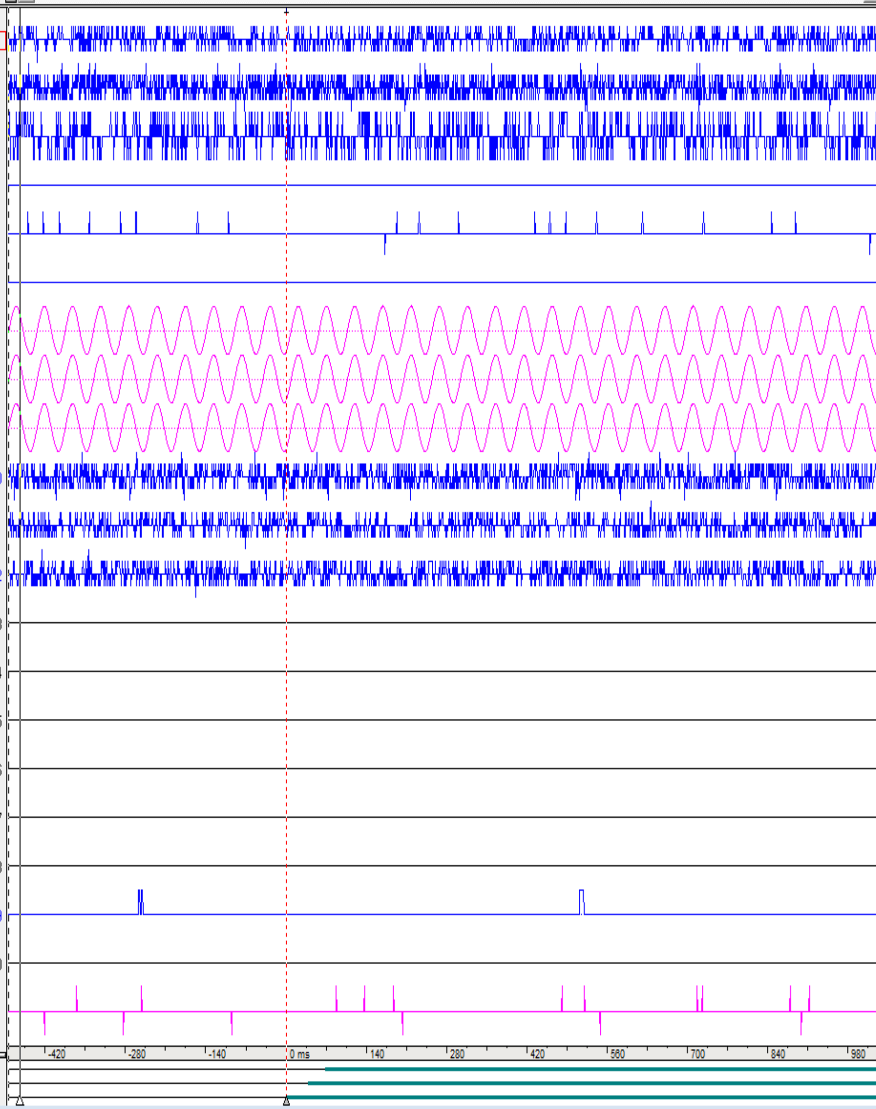


CH	Scale	Title	RMS	InstPeak	Phase	InstVal	RefVal	MaxPeak	MinPeak	Units	DFTPeak	Crest
1	14.1 A/cm	IA-1	0.276	0.552	102.436°	0.000	-0.552	0.552	-1.105	A	0.063	0.227
2	14.1 A/cm	IB-1	0.374	-0.552	186.206°	0.000	0.000	1.105	-1.105	A	0.191	0.510
3	7.1 A/cm	IC-1	0.357	0.552	349.602°	0.000	0.000	0.552	-0.552	A	0.180	0.506
4	0.0 A/cm	IA-3	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	A	0.000	0.000
5	141.3 A/cm	IB-3	0.000	0.000	0.000°	0.000	0.000	11.050	-11.050	A	0.000	0.000
6	0.0 A/cm	IC-3	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	A	0.000	0.000
7	1115.1 V/cm	VAN	64.955	86.318	131.772°	58.417	-77.599	87.190	-87.190	V	38.166	0.588
8	1104.0 V/cm	VBN	64.390	86.318	130.949°	59.289	-77.599	86.318	-86.318	V	38.626	0.600
9	1104.0 V/cm	VCN	64.476	85.446	132.959°	56.673	-76.727	86.318	-86.318	V	37.142	0.576
10	14.1 A/cm	IN-1	0.478	0.552	348.409°	0.552	-1.105	1.105	-1.105	A	0.200	0.419
11	14.1 A/cm	IN-2	0.319	0.552	262.500°	0.552	-0.552	1.105	-1.105	A	0.111	0.348
12	14.1 A/cm	IN-3	0.298	-0.552	199.868°	0.000	-0.552	1.105	-1.105	A	0.171	0.572
13	0.0 P/cm	IA-DIFF	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
14	0.0 P/cm	IB-DIFF	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
15	0.0 P/cm	IC-DIFF	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
16	0.0 P/cm	IA-BIAS	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
17	0.0 P/cm	IB-BIAS	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
18	0.0 P/cm	IC-BIAS	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
19	7.1 A/cm	HZREF-I-HV	0.000	0.000	0.000°	0.000	0.000	0.552	0.000	A	0.000	0.000
20	0.0 H/cm	Frequency	0.000	0.000	N/A	0.000	0.000	0.000	0.000	Hz	0.000	0.000
21	0.1 V/cm	Vx	0.000	0.000	0.000°	0.000	0.000	0.009	-0.009	V	0.000	0.000

CH						
16	N	Virtual Input 1	N	A	22:31:22.994279	001
17	N	Virtual Input 2	N	A	22:31:22.964291	001
18	N	Virtual Input 3	N	A	22:31:22.926806	001

DR of Pong HPS Unit-6

38449_SENDDR-24.11.06_22.31.22.000.000.DAT - 06/11/2024 - 22:31:22.927 - Secondary - (Peak Type)



CH	Scale	Title	RMS	InstPeak	Phase	InstVal	RefVal	MaxPeak	MinPeak	Units	DFTPeak	Crest
1	14.1 A/cm	IA-1	0.276	0.552	102.436°	0.000	-0.552	0.552	-1.105	A	0.063	0.227
2	14.1 A/cm	IB-1	0.374	-0.552	186.206°	0.000	0.000	1.105	-1.105	A	0.191	0.510
3	7.1 A/cm	IC-1	0.357	0.552	349.602°	0.000	0.000	0.552	-0.552	A	0.180	0.506
4	0.0 A/cm	IA-3	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	A	0.000	0.000
5	141.3 A/cm	IB-3	0.000	0.000	0.000°	0.000	0.000	11.050	-11.050	A	0.000	0.000
6	0.0 A/cm	IC-3	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	A	0.000	0.000
7	1115.1 V/cm	VAN	64.955	86.318	131.772°	58.417	-77.599	87.190	-87.190	V	38.166	0.588
8	1104.0 V/cm	VBN	64.390	86.318	130.949°	59.289	-77.599	86.318	-86.318	V	38.626	0.600
9	1104.0 V/cm	VCN	64.476	85.446	132.959°	56.673	-76.727	86.318	-86.318	V	37.142	0.576
10	14.1 A/cm	IN-1	0.478	0.552	348.409°	0.552	-1.105	1.105	-1.105	A	0.200	0.419
11	14.1 A/cm	IN-2	0.319	0.552	262.500°	0.552	-0.552	1.105	-1.105	A	0.111	0.348
12	14.1 A/cm	IN-3	0.298	-0.552	199.868°	0.000	-0.552	1.105	-1.105	A	0.171	0.572
13	0.0 P/cm	IA-DIFF	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
14	0.0 P/cm	IB-DIFF	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
15	0.0 P/cm	IC-DIFF	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
16	0.0 P/cm	IA-BIAS	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
17	0.0 P/cm	IB-BIAS	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
18	0.0 P/cm	IC-BIAS	0.000	0.000	0.000°	0.000	0.000	0.000	0.000	PU	0.000	0.000
19	7.1 A/cm	HZREF-I-HV	0.000	0.000	0.000°	0.000	0.000	0.552	0.000	A	0.000	0.000
20	0.0 H/cm	Frequency	0.000	0.000	N/A	0.000	0.000	0.000	0.000	Hz	0.000	0.000
21	0.1 V/cm	Vx	0.000	0.000	0.000°	0.000	0.000	0.009	-0.009	V	0.000	0.000

Samp#: 25

16	N Virtual Input 1	N	A	22:31:22.994279	001
17	N Virtual Input 2	N	A	22:31:22.964291	001
18	N Virtual Input 3	N	A	22:31:22.926806	001

1 BBMB | Wed - 06/11/2024 22:31:22.461 | Delta X: 464.814 ms (23.241 cyc @ 50.0 | fs: 1200.48 H | AS: ON | Delta Y: No Bars

Details received from Pong(BBMB)

3. Brief event summary:
A.

(I) At 20:45 Hrs / dated 06.11.2024, 220 KV Bus-Bar protection .operated
(II) Units No – 02 and 06, Bus-II and all 03 nos. Outgoing 220 KV feeders connected to Bus-II tripped.
(III) 220 KV Pong –Jassure Circuit –II, 220 KV Pong- Jalandhar Circuit-II and 220 KV Pong-Dasuya Circuit-IV Tripped from Pong end only due to Bus-Bar protection operated.

5. Relay Indications :

Sr. no.	Name of the element	Relay - Details
1.	Unit no. 02	Tripped along with Bus-II due to LBB Operation and 86A1, 86B, 86C- At C&R Pannel
2.	Unit no. 06	Relay MICOM P643- CB Head Flashover Optd. And Tripped along with Bus-II due to LBB Operation
3.	220 KV Pong –Jassure Circuit -II	Tripped along with Bus-II due to LBB Operation
4.	220 KV Pong- Jalandhar Circuit-II	Tripped along with Bus-II due to LBB Operation
5.	220 KV Pong- Dasuya Circuit-IV	Tripped along with Bus-II due to LBB Operation
6.	220 KV Bus- Bar II (A-3)	LBB Optd. due to tripping of Unit No.-06

6. Description / Analysis of tripping:-

(A) Sequence of event : -

(I) At 20:45 Hrs / dated 06.11.2024, during stopping of **Unit No.-06** LBB Optd. with Head Flash Over Optd.
(II) At 20:45 Hrs / dated 06.11.2024, 220 KV Bus-Bar protection .operated on Main Bus-II.
(III) At 20:45 Hrs / dated 06.11.2024, Units No – 02,, Bus-II and all 03 nos. Outgoing 220 KV feeders connected to Bus-II tripped.
(IV) 220 KV Pong –Jassure Circuit –II, 220 KV Pong- Jalandhar Circuit-II and 220 KV Pong-Dasuya Circuit-IV Tripped from Pong end only due to Bus-Bar protection operated.

Points for Discussion

i) The healthiness of protection system and equipment's need to be ensured.

Annexure-B.VIII

Status of Bus bar protection				
Constituent Name	Name of Station	Status of Bus bar protection(as reported)	Expected date of implementation (as reported in 51st PSC meeting)	Remarks
Uttarakhand	220 KV Substation, Ramnagar, Roorkee	Blocked due to more elements added at 220 KV Voltage level.		
	220 KV Sub Station, SIDCUL, Haridwar			
	220kV Jhajhra, Dehradun	Not commissioned yet		
	400KV Kashipur (220kV side)	Available but Non operational	Revised date not received	Work is under process.
	220kv Haldwani	Not Available	31 December 2024	Budget for FY 2023-24.
	220kv Pantnagar	Available but Non operational	Revised date not received	Work is under process.
	220kV Rishikesh	Available but Non operational	31 December 2024	It has been Taken in Budget for FY 2023-24.
	220kV Chamba	Not commissioned yet	31 December 2024	It has been Taken in Budget for FY 2023-24.
Haryana	220kV S/Stn Badshahpur	Installed and Operational		Commissioned on 20.02.2023
	220kV S/Stn Sec-52A, Gurgaon	Not Installed	31.12.2024	Panel has been installed. Commissioning pending due to non- availability of shutdown.
	220kV S/Stn Sec-1 Manesar	Installed and Operational		Commissioned on 26.02.2023
	220kV S/Stn Panchgaon	Installed and Operational		Commissioned on 05.01.2024
	220kV S/Stn Rewari	Not Installed	31.03.2025	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV S/Stn Narnaul	Not Installed	31.12.2024	Panel has been installed. Work in progress on turnkey basis. Isolators of 220 kV TFs have to be replaced thereafter the work shall be completed.
	220kV S/Stn Mohinder Garh	Installed and Operational		Commissioned on 28.10.2023
	220 KV S/Stn Palwal	Not Installed	31.01.2025	Panel has been installed. Commissioning is pending.
	220 KV S/Stn Rangala Rajpur	Installed and Operational		Commissioned on 22.06.2023
	220 kV Unispur	Installed but Non-Operational	31.03.2025	5 Nos. Peripheral relay of bus bar protection are defective. The same shall be made operational by 31.03.2024.
	220 kV Nissing	Installed but Non-Operational	31.03.2025	Existing Bus bar panel is of old and obsolete design. New Bus Bar protection scheme panel has been drawn from the store & Commissioning& installation are pending.
	220KV Pehowa	Installed but Non-Operational	31.03.2025	Old & Obsolete, Allocation of New BBP and allied material awaited.
	220kV Kaithal	Not Installed	31.12.2024	Control Cable for Bus-Bar Protection Scheme has been drawn from DD Stores, 220kV Bus-Bar Protection panel is awaited.
	220 KV Sonepat	Not Installed	31.03.2025	220 KV Bus Bar Protection Scheme will be installed / commissioned within 45 days after the availability of the necessary material i.e 220kV Duplex, Directional, Bus Bar Cum Bus Coupler C and R Panel, Auxiliary Voltage 220V DC (without SAS) required for commissioning. It has been gathered from the P&M wing that the material is likely to be available in DD stores by April 2024.
	220 KV REGC, Sonepat	Not Installed	28.02.2025	The 220KV C&R Panel for Bus Bar Protection has been drawn from DD Store on dated 20.04.2023 and the work for installation of Bus Bar protection scheme is under progress. Erection work & wiring work completed with all respect. Testing of relays is pending at the end of Firm M/s Shifang and Bus Bar protection scheme will be commissioned dt 15.03.2024.
	220KV Jind	Installed and Operational		Commissioned on dated 27.06.23.
	220 KV Fatehabad	Installed and Operational		Commissioned on dated 22.07.23
	220 KV Hukmawali	Installed and Operational		Commissioned on dated 25.07.2024
	220 KV Bhuna	Installed but Non-Operational	31.03.2026	The Siemens make Bus Bar protection Scheme installed at the time of commissioning of the substation went out of order. The higher authority decided to replace with new one. M/s Schneider make new Scheme was then allocated and drawn from DDS Ballabgarh and installed at site, but while testing of same, three out of four relays of the Bus Bar Panel found faulty for which matter is under pursuance with firm.
	220 KV Sirsa	Not Installed		Not required being single source of supply
	220 KV Rania	Not Installed	30.09.2025	Estimate for Bus Bar Protection is sanctioned but C&R panel is not available in store.
	220 KV Bhiwani	Not Installed	30.09.2025	Bus Bar Protection scheme has been proposed in integrated planning meeting and requirement of material have been generated in PR.
	220kV Madanpur	Not Installed	30.06.2025	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV Tepla	Installed but Non-Operational	30.06.2025	material allocation is awaited.
	220kV Rajokheri	Installed and Operational		Made operational on dated 30.05.2024.
BBMB	220kV Charkhi Dadri	Installed and Operational		commissioned on 31.01.2023
	220kV Samaypur	Installed and Operational		made operational on 23.12.2023
	220kV Dhulkote	Not Installed		Not feasible
	220kV Jagadhari	Not Installed		
	220kV Barnala	Not Installed		
	220kV Partapur	Installed and Operational		made operational on 06.01.2023
	220kV Pilibhit	Installed and Operational		commissioned on 28.10.2023
	220kV Amariya	Installed and Operational		commissioned on 15th July 2023
	220kV Sultanpur	Installed and Operational		commissioned on 02.03.2024
	220kV New Tanda	Installed and Operational		commissioned on 20.04.2024
	220kV IITGNL	Installed and Operational		made operational on 19.02.2023
	220kV Barahua	Installed and Operational		made operational on 28.01.2024

UP	220kV Bansi	Installed and Operational		commissioned on 10th August 2023
	220 KV S/S Azamgarh-2(Bargahan)	Installed and Operational		made operational on 28.01.2024
	220kV Chandausi	Installed and Operational		made operational on 13.10.2023
	220kV Sec. - 148, Noida	Installed and Operational		made operational on 27.01.2024
	220kV sec.-62, Noida	Installed and Operational		made operational on 12.10.2023
	220kV Dadri	Installed and Operational		made operational on 23.04.2024
	400kV S/S Agra	Installed and Operational		commissioned on 13th September 2023
	220kV S/S Farrukhabad (New)	Installed and Operational		commissioned on 25th August 2023
	220kV Boner	Installed and Operational		commissioned on 19.03.2024
	220kV Kasganj (Soron)	Installed and Operational		
	220kV Lalitpur	Installed and Operational		commissioned on 09.02.2024
	220kV substation Fatehpur	Installed and Operational		Operational
	220kV Hardoi Road, Lucknow	Installed and Operational		commissioned on 08th October 2023
	400 KV Substation Sarnath	Installed and Operational		Now operational
	220kV S/S Raja Talab	Installed and Operational		Commissioned on 30.04.2024
	220kV S/S Mirzapur	Installed and Operational		Commissioned on 17.07.2024
	220kV Parichha	Installed but Non-Operational	Revised date not received	
	220kV Bareilly (400/220kV Bareilly)	Installed but Non-Operational	Revised date not received	Arrange of control cable is being done
	220kV Shahjhanpur	Installed but Non-Operational	Revised date not received	Cable partially received, work will start soon
	220kV Ajijpur	Installed but Non-Operational		1. HV side 220kV CT of 160MVA T/F-I & II has bot proper ratio for bus bar
	220kV Nirpura	Installed but Non-Operational	Revised date not received	
	220kV Rampur	Installed but Non-Operational	Revised date not received	
	220kV Rasara	Not Installed		
	220kV Rampur	Installed but Non-Operational	Revised date not received	Central unit of bus bar protection faulty. Expected to revive by November-24.
	220kV sec. 38A, Botanicla Garden	Not Installed	Revised date not received	Bus Bar protection panel awaited
	220kV S/S Bah	Not Installed		Pannel not alloted
	220kV Sirsaganj	Not Installed		Pannel not alloted
	220kV Khair	Installed but Non-Operational	31.01.2025	Tender in process
	220kV Kidwainagar	Installed but Non-Operational		
	220kV Chhata	Installed but Non-Operational	Revised date not received	New 160MVA transformer-3 is not configured with bus bar
	220kV Harduaganj	Installed but Non-Operational	Revised date not received	
	220kV Khorabar	Installed but Non-Operational	31.01.2025	
	220kV Phoolbagh	Not Installed		Availability to be checked from designe circle
	220kV Mahoba	Installed but Non-Operational		Relay error has been resolved,will be tested as soon as shut down will be
	220kV Sarnath	Installed but Non-Operational	Revised date not received	
	220kV Sirathu, Kaushambi	Not Installed	31.01.2025	Service Engineer awaited for commissining
	220kV S/S Bhelupur	Not Installed		Radial feeder
	220kV CG City, Lucknow	Installed but Non-Operational	Revised date not received	alloted agency confirmed that bus bar protection will healthy soon
	220kV Barabanki	Installed but Non-Operational	31.01.2025	2no peripheral Relay OEM repairing under progress
	220kV Kursi Road, Lucknow	Installed but Non-Operational	Revised date not received	Retrofitting work of auxilliary relay completed. Dut to non-functioning of new
	220kV BKT, Lucknow	Installed but Non-Operational	Revised date not received	Main bus bar relay power card is damaged.which would be rectified at M/s
	220kV Gomti Nagar, Lucknow	Installed and Operational		Now bus bar protection is in opration dated on 11/11/2024
	20kV S/S Harahua	Installed but Non-Operational	28-Feb-25	Service Engineer awaited for commissining
	220kv Rewa Road	Installed but Non-Operational	31-Mar-25	Informed to Transmission wing but they have not any action till date
	220kV S/S Sahupuri	Installed but Non-Operational	28-Feb-25	Requirement for New panel has been raised, not received from headquaters.
	220kv Robertganj	partillay operational	31.01.2025	New Panel have been Alloted but not recived
HP	220kV Chamba	Installed and Operational		commissioned in Jan-2024
	220kV MattaSidh	Installed but Non-Operational	31.12.2024	Work in under progress, issues are being taken up with ABB
	220kV kangoo	Installed but Non-Operational		
	220kV Nangal	Installed but Non-Operational		
	220kV Katha Baddi	Installed but Non-Operational		
Punjab	220 KV S/S Kotlisurat Malhi	Not Installed	Dec-24	Commissioning is in process. Material has arrived, commissioning shall be done as per shutdown availability.
	220 KV S/S Maur	Not Installed		
	220 KV S/S Science city	Not Installed		
	220 KV S/S Banga	Not Installed		
	220 KV S/S Hoshiarpur	Not Installed		
	220 KV S/S Goraya	Not Installed		
	220 KV S/S Bhawanigarh	Installed and Operational		Commissioned
	220 KV S/S Badhni kalan	Installed and Operational		Commissioned
	220 KV S/S Bhari	Installed and Operational		Commissioned
Rajasthan	220KV GSS Dooni	Installed and Operational		commissioned
	220KV GSS Bhawanimandi	Installed and Operational		commissioned
	220 KV GSS Sakatpura, Kota	Installed and Operational		commissioned on 09.07.2024
	220 kV GSS, Beawar	Installed and Operational		commissioned
	220 KV GSS Jethana	Installed and Operational		commissioned
	220 KV GSS Bherunda	Installed and Operational		commissioned
	220 KV GSS Kuchera	Installed and Operational		commissioned
	220 KV GSS Reengus	Installed and Operational		commissioned
	220 KV GSS Laxmangarh	Installed and Operational		Commissioned
	220KV GSS Khetri Nagar	Installed and Operational		commissioned
	400 KV GSS, Babai	Installed and Operational		commissioned
	220 KV GSS Chittorgarh	Installed and Operational		commissioned
	400 KV GSS BHILWARA(220 KV BUS)	Installed and Operational		commissioned
	220 KV GSS MANDALGARH	Installed and Operational		commissioned
	220KV GSS Debari	Installed and Operational		commissioned
	220KV GSS Amberi	Installed and Operational		commissioned
	220KV GSS Madri	Installed and Operational		commissioned
	220 KV GSS Badisid	Installed and Operational		commissioned
	220 KV GSS Pali	Installed and Operational		commissioned
	220 KV GSS Balotra	Installed and Operational		commissioned
	220 KV GSS Sayla	Installed and Operational		commissioned
	220 KV GSS Ratangarh	Installed and Operational		commissioned
	220 KV GSS Sujangarh	Installed and Operational		commissioned
	220 KV GSS Halasar	Installed and Operational		commissioned
	220 KV GSS Rawatsar	Installed and Operational		commissioned
	220 KV GSS Tehandesar	Installed and Operational		commissioned
	220 KV GSS Bhadla	Installed and Operational		commissioned
	400 KV GSS Bikaner 400 KV BUS	Installed but non operational	Revised date not received	to be done with transformer work
	220 KV GSS Ramgarh	Not installed	Revised date not received	Commissioning work started, to be commissioned shortly

400 KV GSS Surpura (Jodhpur) 220 KV	Installed but non operational	Revised date not received	Commissioning work started, to be commissioned shortly
400 KV GSS Akal (Jaisalmer) 220 KV	Installed but non operational	Revised date not received	One PU defective. Case has been taken up with firm
220 KV GSS Jodhpur	Installed but non operational	Revised date not received	A&FS and TS issued. Case has been send for approval
220 KV GSS NPH Jodhpur	Not installed	Revised date not received	Case file moved
220 KV GSS Kuchaman City	Installed but non operational	Revised date not received	CU is defective. Purchase has been taken up with the firm
400 KV GSS Ajmer (220 KV BUS)	Installed but non operational	Revised date not received	One number of PU is defective. Isolator status is OK.
765 KV GSS Phagi	Installed but non operational	Revised date not received	CU of Alstom make Bus-Bar is defective. Purchas case will be taken up
220 kV GSS Vatika	Not installed		As M/s ER did not finished the project, so it was awarded to M/s Kaycee infra on risk-cost basis , however the bus bar scheme has not been commissioned yet. Matter has been taken up with firm
220 kV GSS Niwana	Not installed		Commissioning work started, to be commissioned shortly
220 kV GSS Alwar	Not installed		Commissioning work started, to be commissioned shortly
220 kV GSS Bansur	Not installed		Commissioning work started, to be commissioned shortly
220 kV GSS Behror	Not installed		Commissioning work started, to be commissioned shortly
220KV GSS Hindaun	Not installed		Commissioning work started, to be commissioned shortly

Status of protection relay type				
Constituent Name	**Name of Station**	**Element Name**	**Present Status**	**Remark**
Uttarakhand	220kV Rishikesh	SIDCUL line	Main-II is not installed	
		Chamba line		
		Dharasu line-2		
	220kV Chamba	Rishikesh line		
HP	220kV MattaSidh	220kV transformer bank-1 & 2	Static relay	
Rajasthan	220 kV GSS Sanganer	220 kV HEERAPURA	Static	
	220 kV GSS Phulera	220 KV HEERAPURA	Static	Replaced by numerical relay
		220 kV Makrana	Static	
	220 KV GSS CHOMU	220 kV Heerapura	Static	
		220 kV Reengus Line	Static	
	220 kV GSS Kukas	**220 kV Manoharpur Line**	**Static**	**Replaced by numerical relay**
		220 kV Alwar Line	Static	
	220kV GSS Dausa	220 kV SawaiMadhopur Line	Static	
		220 kV Bassi-I Line	Static	
		220 kV Bassi-II Line	Static	
		220 kV Alwar Line	Static	
		220 kV Mandawar Line	Static	
	220KV BHARATPUR GSS	**220 KV DHOLPUR**	**Static**	**Replaced by numerical relay**
	220 KV GSS SAKATPURA	220 kV ANTA(NTPC)	Static	
	220 KV DAHRA	220 kV BARAN	Static	
		220 kV SAKATPURA	Static	
	220KV GSS MODAK	220 kV RANPUR	Static	
		220 kV Jhalawar	Static	
	220 KV GSS JHALAWAR	220 kV Modak	Static	
	220KV GSS HINDAUN	220KV Sikrai Line	Static	relay defective
	220KV GSS DHOLPUR	**220 kV DCPP**	**Static**	**Replaced by numerical relay**
	220 KV GSS Reengus	220 KV Laxmangarh	Static	
	220 KV GSS Nagour	220KV NOKHA	Static	
		220KV KUCHERA	Static	
	220KV GSS Kankroli	220 KV PGCIL-I	Static	
	220 KV GSS SIROHI	220 KV (400) KV PGCIL Bhinmal	Static	
	220 KV GSS SIROHI	220 KV Jalore	Static	
	220 KV GSS BHINMAL	220 KV (400) KV PGCIL Bhinmal-I	Static	
	220 KV GSS BALI	**220kV Sirohi**	**Static**	**Replaced by numerical relay**
	220 KV GSS Suratgarh	220 KV STPS-I	Static	
		220 KV STPS-II	Static	
		220 KV Hanumangarh Line	Static	
	220 KV GSS Sri Ganganagar	**220 KV Hanumangarh Line**	**Static**	**Replaced by numerical relay**
	220 KV GSS Hanumangarh	220 KV Suratgarh	Static	
	220KV GSS Ratangarh	220KV Rawatsar	Static	
	220KV GSS Ratangarh	220KV Halasar	Static	
	220KV GSS Ratangarh	220KV InterConnector-I	Static	
	220KV GSS Ratangarh	220KV InterConnector-II	Static	
	220KV GSS Sujangarh	220KV Ratangarh	Static	
	220 KV GSS Bikaner	220 KV Badnu Line	Static	
	220 KV GSS Bikaner	220 KV Interconnector-I Line	Static	
	220 KV GSS Bikaner	220 KV Spare Line	Static	
	220kV Madanpur	220/66kV 100 MVA PTF T-1	Electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical Except Differential relay (Numerical)	Working properly, need to be replace with numerical relay
		220kV Bus-Coupler	All relays are Numerical	New 220 KV C&R panel replaced on dated 26.05.2022
		220/66kV 100 MVA PTF T-1 A	Electromechanical Except Differential relay (Numerical)	Working properly, need to be replace with numerical relay
	220 KV S/Stn Shahbad	100 MVA 220/66 KV T/F T-1	All relays are electromechical and static	New C&R panel laying at S/Stn.for commissioning
		220 KV Bus Coupler	Electromechanical	Working properly, need to be replace with numerical relay
	220 KV S/STnTepla	220KV Bus Coupler	Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Shahbad Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay

Haryana	220KV S/Stn Jorian	220KV Jorian -Shahbad Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 160MVA T/F T-1	Defferntial Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-2	All Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-3	Defferntial & REF Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
	220 kv Salempur	220 KV BAKANA–SALEMPUR CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BAKANA–SALEMPUR CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BUS-COUPLER	All electromechanical type	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-I	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-2	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
	TS Division Karnal	220kV Nissing-PTPS Ckt-I	Main-1 & Main-2 = Numerical, other (O/C+E/F) Electromechanical	Only Backup relays are electromechenical
		100 MVA 220/132kV T-8	R.E.F & Differential relays are Numerical, other (O/C+E/F) Electromechanical	Working properly, need to be replace with numerical relay
		220 kV Bus-coupler	Bus bar protection and panel relay are Numerical	all relay are Numerical type
		220 KV DCRTPP–UNISPUR CKT-I	Main-1 & Main-2 = Numerical, other (O/C+E/F) Electromechanical	Only Backup relays are electromechenical relays need to be replaced with numerical
		220 KV DCRTPP–UNISPUR CKT-II	Main-1 & Main-2 = Numerical, other (O/C+E/F) Electromechanical	Only Backup relays are electromechenical
		220 KV KARNAL–UNISPUR LINE	Main-1 & Main-2 = Numerical, other (O/C+E/F) Electromechanical	Only Backup relays are electromechenical
		220/132 KV 100 MVA T/F T-1	R.E.F & Differential relays are Numerical, other (O/C) Electromechanical	Working properly, need to be replace with numerical relay
		220/132 KV 100 MVA T/F T-2	R.E.F & Differential relays are Numerical, other (O/C) Electromechanical	Working properly, need to be replace with numerical relay
		220/132 KV 160 MVA T/F T-4	R.E.F & Differential relays are Numerical, other (O/C) Electromechanical	Working properly, need to be replace with numerical relay
	220kV S/Stn Palla	100MVA 220/66kV T-1	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		100MVA 220/66kV T-2	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		100MVA 220/66kV T-7	differencial & Backup electromechanical, REF static	Working properly, need to be replace with numerical relay
		220kV Palla - Sector 78	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220kV Palla - FGPP ckt-II	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
	220 kV S/Stn. Pali	100 MVA 220/66 kV T-1	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		100 MVA 220/66 kV T-3	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		220 kV Pali-BBMB Samaypur Ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-BBMB Samaypur Ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 46 Ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 46 Ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 65 Ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Badshahpur Ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 56 Ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220 kV Pali-Sector 56 Ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
	220kV S/Stn Palwal	220/66kV 160MVA T-1 T/F	differencial numerical, REF & Backup electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100MVA T-2 T/F	all electromechanical	Working properly, need to be replace with numerical relay
		220kV Prithala Palwal Ckt I	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		220kV Prithala Palwal Ckt II	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
	220kv S/Stn. Sector 52A GGM	Sec 56-Sec 52A ckt 1	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		Sec 56-Sec 52A ckt 2	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		Sec 72-Sec 52A	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
		Sec 57-Sec 52A	DPR numerical, Backup electromechanical	Only Backup relays are electromechenical
	220kV Sonipat	220KV Barhi-Sonepat Line	DPR numerical, Backup electromechanical	Working properly and the respective C&R panels are to be changed with new C&R panels having all numerical /digital relays. The estimate 220/132KV 100MVA T-4 T/F is sanctioned and others is under preparation to replace the same.
		220/132KV 100MVA T-3 T/F	Differencial,REF and O/C ,E/F relays are Electromechanical	
		220/132KV 100MVA T-4 T/F	Differencial,REF and O/C ,E/F relays are Electromechanical	
		220/132KV 100MVA T-5 T/F	Differencial,REF and O/C ,E/F relays are Electromechanical	

	220kV Rohtak	220 KV Rohtak - Kabulpur line	DPR numerical but E/F are conventional	The Numerical O/c has been replaced.
		220 KV Rohtak - Sampla line	DPR numerical but E/F are conventional	
		220 KV Rohtak - PTPS Ckt-1	DPR numerical but E/F are conventional	
		220 KV Rohtak - PTPS Ckt-2	DPR numerical but E/F are conventional	
		100 MVA, 220/132 KV T-3 T/F,	Differential relay numerical but O/C conventional.	The relay has been replaced with the numerical relay.
		100 MVA, 220/132 KV T-4 T/F,	Differential relay numerical but O/C and REF conventional.	
		100 MVA, 220/132 KV T-6 T/F,	Differential relay numerical but O/C and REF conventional.	
		220kV Bus-Coupler	all relays are conventional	The Numerical O/c has been replaced.
	220kV Nuna Majra	220 Kv Nuna Majra-Sampla Ckt-1	DPR Numerical, Earth fault electromechanical	Working properly, need to be replace with numerical relay in Phased manner. The estimates is under sanction to replace the same.
		220 Kv Nuna Majra-Sampla Ckt-2	DPR Numerical, Earth fault electromechanical	
		220 Kv Nuna Majra-PGCIL Ckt-1	DPR Numerical, Earth fault electromechanical	
		220 Kv Nuna Majra-PGCIL Ckt-2	DPR Numerical, Earth fault electromechanical	
		220 Kv Nuna Majra-Sector-107	DPR Numerical, Earth fault electromechanical	
		220 Kv Nuna Majra-Daultabad	DPR Numerical, Earth fault electromechanical	
		100 MVA,220/132 KV T/F T-1	Differential and REF Numerical,Non directional Over Current Electromechanical	
		100 MVA,220/132 KV T/F T-2	Differential and REF Numerical,Non directional Over Current Electromechanical	
		100 MVA,220/132 KV T/F T-4	Differential and REF Numerical,Non directional Over Current Electromechanical	

UP	400 KV S/S Moradabad	400 KV MORADABAD - RAMPUR LINE	LBB- ABB(RAICA) / STATIC	UNDER PGCIL
		400 KV MORADABAD - KASHIPUR LINE	LBB- English Electric(CTIG) / Electromechnical	Will be replaced by July24
		400 KV, TRANSFER BUS	LBB- English Electric(CTIG) / Electromechnical	
		400 KV, BUS COUPLER	LBB- English Electric(CTIG) / Electromechnical	
	220kV S/S BARAUT	220/132kV 200MVA TRANSFORMER-1	REF Protection - Electromechanical	
	220kV S/S BAGHPAT	220/132kV 160MVA TRANSORMER-1	Backup (L.V. Side) - Electromechanical	
	220 kV KHURJA	220/132Kv 200MVA Transformer-I	REF-Static	
	220 kV DEBAI	220/132Kv 100MVA Transformer-I	Numerical	
	220 kV Jahangirabad	220/132Kv 160MVA Transformer-I	REF-Static	
	400KV S/S MURAD NAGAR	220KV LONI LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV FARID NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-I MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-II MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV SAHIBABAD LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV PRATAP VIHAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV ALIGARH LINE	LBB RELAY IS ELECTROMECHANICAL.	
		400KV ATOUR LINE	LBB RELAY IS ELECTROMECHANICAL.	
	220KV S/S MURAD NAGAR	220KV BUS COUPLER	O/C RELAY IS ELECTROMECHANICAL	
	400KV S/S Gorakhpur	400KV TBC	Electromechanical	
		220KV TBC	Electromechanical	
	220KV S/S Barahua	220KV PGCIL	Back up relay electromechenical	
	220KV S/S Basti	220 KV Basti Tanda line	67N(2TJM12)(Electromechanical)	
		63MVA Transformer-II	HV Side directional o/c&e/f(Electromechanical)	
	400 KV SS Kasara,Mau	200MVA, 400/132KV ICT-1st	REF & Over flux relay Electromechanical	
		200MVA, 400/132KV ICT-2nd	REF & Over flux relay Electromechanical	
	220 KV SS Substation Hafizpur Azamgarh	160 MVA ICT -1	Electromechanical(EE Make)	Replaced with Siemens make numerical relay on 16.10.2023
	220kV Khara		Electromechanical	process of replacing electrochemical relay with numerical relay has been started, it will be completed within 2-3 months.
	220kV Gokul	160MVA ICT-1	Electromechanical (Diff and O/C)	New panels are available at S/s and replacement work is under process
	220kV Meetai	200MVA ICT-1	Electromechanical (E/F and O/C), Diff:Static	
		200MVA ICT-2	Electromechanical (E/F and O/C), Diff:Static	
	220kV Atrauli	160MVA ICT-1	Electromechanical + Numerical	Tender process is complete.
		160MVA ICT-2	Electromechanical + Numerical	
	220kV Mainpuri	160MVA ICT-1	Electromechanical(REF) + Numerical	New panels are available at S/s and replacement work is under process
		160MVA ICT-2	Electromechanical(REF) + Numerical	
	220kV Panki	220kV Bus coupler	Electromechanical	Under process
	400kV S/S Sultanpur	240 MVA ICT-II	Non Numerical	
		50 MVAR Obra Line Reactor	Non Numerical	
	220kV S/S Sultanpur	220kV B/C	Non Numerical	
		160 MVA T/F-I	Non Numerical	
NPCIL	220kV RAPPC	220KV Anta line	Backup relay: Static relay(RAPDK3)	Completed
	220kV NAPP	NAPP-SAMBHAL		Completed
		NAPP-SIBHOLI		Completed
		NAPP-DIBAI		Completed
		NAPP-KHURJA		Completed
		NAPP-ATRAULI		Completed

Details Of Protection Relay

S. No.	Name of Division	Name of Substation	Element Name	Voltage Level	Protection Relays type Static/Electromechnical	Status of Action being taken: Tenetative date for replacement of relay	Status of Action being taken: Any other remarks
1	T&CD, Shahjahanpur	220KV S/S Shahjahanpur	220KV Gola line	220KV	Backup Relay Electromechanical	30.06.2024	
		220KV S/S Hardoi	220KV Shahjahanpur line	220KV	Backup Relay Electromechanical	31.07.2024	
2	T&CD, Gonda	132 KV Sub Station Balrampur	132 KV Balrampur-Utraula line	132 kV	Electromechnical	30.05.2024	
			132 KV Balrampur- Chini Mill line	132 kV	Electromechnical	30.05.2024	
		132 KV Sub Station Mankapur	132 kv MCM line	132 kV	Electromechnical	30.05.2024	Main Distance Protection is Numerical but Back Up relay is Electromechanical
		132 KV Sub Station Mankapur	5 MVA Ist(33 KV)	33 kV	Electromechnical	30.05.2024	
			5 MVA Iind(33 KV)	33 kV	Electromechnical	30.05.2024	
		132 KV Sub Station Utraula	132 KV Sub Station Utraula	132 kV	Electromechnical	30.05.2024	Main Distance Protection is Numerical but Back Up relay is Electromechanical
3	T&CD, Sarojini Nagar	400/220kV UNNAO	400 KV UNNAO MOHANLALGANJ LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400 KV UNNAO BAREILLY 1 LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400 KV UNNAO BAREILLY 2 LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400kV UNNAO- PANKI LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400 KV UNNAO AGRA LINE	400 KV	STATIC(ABB RXEG21)	31.09.2024	
			400/220 KV 315 MVA ICT -1	400/220kV	STATIC(ABB RADSB,RATUB,RADHD), Electromechnical(TJM12)	31.09.2024	
			50MVAR LINE REACTOR ON 400KV AGRA, BAREILLY-I,	400 KV	STATIC(ABB RADHA,RAKZB,RADHD)	31.09.2024	
			63MVAR BUS REACTOR	400 KV	STATIC(ABB RADHA,RAKZB,RADHD)	31.09.2024	
		220/132kV UNNAO	220 KV UNNAO-BITHOOR LINE	220KV	STATIC(ABB RXPE+RXIG)	31.09.2024	
			220 KV UNNAO-RPH LINE	220KV	STATIC(ABB RXPE+RXIG)	31.09.2024	
			220 KV UNNAO-GIS KANPUR ROAD LINE	220KV	STATIC(ABB RXPE+RXIG)	31.09.2024	
			220/132 KV 160 MVA ICT -1	220/132kV	STATIC(ABB RADSB,RATUB,RADHD), Electromechnical(TJM12)	31.09.2024	
			220/132 KV 160 MVA ICT -2	220/132kV	STATIC(ABB RADSB,RATUB,RADHD), Electromechnical(TJM12)	31.09.2024	
		220kV Sarojini Nagar	132kV TRT-1	132kV	Electro-Mechanical (EASUN REYROLLE (TJM12))	31.09.2024	
			132kV TRT-2	132kV	Electro-Mechanical (EASUN REYROLLE (TJM12))	31.09.2024	
			132kV RAHIMABAD	132kV	Electro-Mechanical (EASUN REYROLLE (2TJM12))	31.09.2024	
			132kV SGPGI-1	132kV	Electro-Mechanical (EASUN REYROLLE (2TJM12))	31.09.2024	
			132kV BIJNOUR	132kV	Electro-Mechanical (EASUN REYROLLE (2TJM12))	31.09.2024	
			200MVA T/F-2	132kV	Electro-Mechanical (AREVA (CAG14AF12A))	31.09.2024	
4	T&CD, Sultanpur	400kV S/S Sultanpur	400/220kV, 240MVA ICT-II	400/220kV	Diff.:- (English Electric- DTH32), O/C&E/F:- (English Electric type-CDD)	31.08.2024	
			50MVAR Obra line Reactor	400kV	Diff.:- (English Electric type-CAG), Backup:- (English Electric type-YTG33)	30.09.2024	
		220kV S/S Sultanpur	220kV Bus Coupler	220kV	English Electric type-CDG	31.07.2024	
			220/132kV, 160MVA T/F-I	220/132kV	Diff.:- (English Electric DMH3232DF1A5), O/C&E/F (HV):- (English Electric CDG 61EG8081BX), O/C&E/F (LV):- (English Electric CDG 31EG164A5), REF:- (English Electric CAG 14AF12A)	30.06.2024	
5	T&CD, Bareilly	400KV S/S Bareilly	315 MVA ICT-1	400/220KV	Diff/ REF/ Over flux,/ LBB/ HV & LV Backup Relay Electromechanical	Requisition of relay sent	
			80 MVAR Bus Reactor	400 KV	Diff/ REF/ Backup Impedance Relay Electromechanical	Requisition of relay sent	
			220 KV CB GANJ Ckt-1	220 KV	DIR E/F & LBB RELAY STATIC	Requisition of relay sent	
			220 KV PANTNAGAR	220 KV	DIR E/F & LBB RELAY STATIC	Requisition of relay sent	
			220 KV PILIBHIT CKT-2	220 KV	DIR E/F & LBB RELAY STATIC	Requisition of relay sent	
		220 KV S/S CB Ganj	200/132 KV 200 MVA T/F-II	220KV	Main Reyrolle Duo Bias M / Backup(ERL-Electro Mechanical)	Requisition of relay sent	
6	T&CD, Lucknow	220 KV CHINHAT	220/132 KV 200 MVA T/F-II ADITYA	220KV	ELECTROMECHENICAL (ESUN REYROLL, 2TJM12,2TJM12)REF,HV &LV BU		
		220 KV GOMTINAGAR	220/33 KV 60 MVA T/F -I	220KV	ELECROMECHENICAL AREVA MAKE HV & LV REF		
			220/33 KV 60 MVA T/F -II	220KV	ELECROMECHENICAL AREVA MAKE HV & LV REF		
			220/33 KV 60 MVA T/F -III	220KV	ELECROMECHENICAL AREVA MAKE HV & LV REF		

~~Annex V~~

Annexure-B.X

Status of Recording Instruments (220kV & above stations)						
Sr. No	**Station Name**	**Voltage Level**	**Disturbance Recorder/Station Event logger healthy (Yes or No)**	**Standardisation (Yes or No)**	**Time Sync (Yes or No)**	**Remarks**

Format for Station Event logger/SAS status										
								Status of Action being taken		
S. No.	**Name of Division**	**Name of the station**	**Voltage Level (in kV)**	**Availability of station event logger**	**Healthiness of Event Logger**	**Is event logger time synchronised with GPS (Yes/No)**	**Date of commissioining / rectification of station event logger (in case of non-existence or unhelathy EL)**	**Tenetative date for commissioning/healthiness**	**Any other remarks**
1	T&CD, Shahjahanpur	220KV S/S Shahjahanpur	220KV	No	No	No	No	No	No
		220KV S/S Azizpur	220KV	YES	YES	YES			
		220KV S/S Hardoi	220KV	No	No	No	No	No	No
		220KV S/S Mallawa	220KV	YES	YES	YES			
		220 KV SITAPUR	220KV	No	No	No	No	No	No
		220 KV KANDUNI	220 KV	YES	YES	NO			
		220 KV NIGHASAN	220KV	YES	YES	NO			
		220 KV GOLA	220KV	YES	YES	YES			
2	T&CD, Gonda	220 KV GONDA	220/132/33 KV	NOT AVAILABLE					
		220 KV BALRAMPUR	220/132/33 KV	NOT AVAILABLE					
		220KV BAHRAICH	220/132/33 KV	NOT AVAILABLE					
3	T&CD, Sarojini Nagar	765kV Unnao	765kV	No	-	-	-	31.08.2024	-
		400kV Unnao	400kV	Yes	Healthy	No	31.05.2024	-	-
		400kV Sarojini Nagar	400kV	Yes	Unhealthy	-	31.05.2024	-	-
		220kV Sarojini Nagar	220kV	No	-	-	-	31.08.2024	-
		220kV/33kV Dan Chowki Unnao	220kV	Yes	Healthy	Yes	-	-	-
4	T&CD, Sultanpur	400kV S/S Sultanpur	400/220kV	Yes	Unhealthy	No	May-15	31.07.2024	Hard Disc of Event Logger Industrial PC (Advantech make) crashed and ELB relay defective in Event Logger Panel. It is requested to Executive Engineer, Electy 400kV S/S Division, Sultanpur for an early repair/replacement of defective elements of Event Logger.
		220kV S/S Sultanpur	220kV	NO	Not Available	Not Available	Not Available	–	–
		220kV S/S Amethi	220kV	YES	Healthy	yes	04.04.2018	–	SAS Based Event Logger
		220kV S/S Bachhrawan	220kV	YES	Healthy	yes	26.05.2018	–	SAS Based Event Logger
		220kV S/S New Tanda	220kV	NO	Not Available	Not Available	Not Available	–	–
		220kV S/S Sohawal	220kV	NO	Not Available	Not Available	Not Available	–	–
		220kV S/S GIS Ayodhya	220kV	NO	Not Available	Not Available	Not Available	–	–
5	T&CD, Bareilly	400KV S/S BAREILLY	400KV	YES	YES	YES	-	-	All elements not connected due to exhausted capacity
			220KV	YES	YES	YES	-	-	
		220KV S/S DOHNA	220KV	No	N/A	N/A	-	-	-
		220 KV PILIBHIT	220KV	SAS	YES	NO	-	-	-
		220 KV AMARIYA	220 KV	SAS	YES	YES			
		220 KV Badaun	220 KV	Not Installed					
		220 KV Dataganj	220 KV	SAS	Yes	Yes			
		220 KV C B ganj	220 KV	Not Installed					
		220 KV Faridpur	220 KV	SAS	No				
6	T&CD, Lucknow	220KV Hardoi Rd	220KV	NO	-	-	-	-	
		220KV GIS Kanpur Rd	220KV	Yes	Yes	Yes	-	-	
		220KV Bijnor Rd.	220KV	Yes	Yes	Yes	-	-	
		220 KV SS CHINHAT	220 KV	NO	NA	NA			
		220 KV SS C G CITY	220 KV	NOT WORKING	Unhealthy	NA			
		220 KV SS K ROAD	220 KV	YES	Healthy	SYNC			
		220 KV SS BKT	220 KV	YES	Healthy	SYNC			
		220 KV SS GOMTI NAGAR	220 KV	NO	NA	NA			
		220 KV SS SATRIKH ROAD	220 KV	YES	Healthy	SYNC			
		220 KV SS BARABANKI	220 KV	YES	Healthy	SYNC			

DETAILS OF TIME SYNCHRONISATION OF RELAY WITH GPS CLOCK AT 765/400/220 KV SUBSTATION

SNO.	Name of Division	NAME OF S/S	DETAILS OF GPS CLOCK: AVAILABLE	WHETHER WORKING IF AVAILABLE	WHETHER GPS CLOCK HAS SUFFICIENT NO OF PORTS SNTP, RS 85 ETC	DETAILS OF TRANSMISSION LINE: SNO.	NAME OF TRANSMISSION LINE	MAIN 1	MAIN 2	LBB	DETAILS OF ICTS: SNO.	NAME OF ICT	DIFFERENTIAL PROTECTION	HV SIDE BACK UP PROTECTION	LV SIDE BACK UP PROTECTION	REF PROTECTION	OVERFLUX RELAY	WHETHER BUS BAR PLROTECTION IS TIME SYNCHRONISED: HV SIDE	LV SIDE	WHETHER EVENT LOGGER IS TIME SYNCHRONISED	WHETHER DR IS TIME SYNCHRONISED	WHETHER SPS SCHEME IS GPS SYNCHRONISED	Action being taken and tentative date of synchronization
1	T&CD, Shahjahanpur	220KV S/S Shahjahanpur	GPS CLOCK IS AVAILABLE	GPS CLOCK IS NOT WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220 KV RPSCL ROSA -I	NOT SYNC	NOT SYNC	NOT SYNC	1	160 MVA ICT -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	NOT SYNC	NOT APPLICABLE	
						2	220 KV RPSCL ROSA -II	NOT SYNC	NOT SYNC	NOT SYNC	2	160 MVA ICT -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV Faridpur	NOT SYNC	NOT SYNC	NOT SYNC	3	200 MVA ICT	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						4	220 KV Hardoi line	NOT SYNC	NOT SYNC	NOT SYNC													
						5	220 KV Gola line	NOT SYNC	NOT SYNC	NOT SYNC													
						6	220 KV Azizpur line	NOT SYNC	NOT SYNC	NOT SYNC													
		220KV S/S Hardoi	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220 KV Shahjahanpur line	NOT SYNC	NOT SYNC	NOT SYNC	1	160 MVA ICT -I	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	NOT APPLICABLE	NOT SYNC	NOT APPLICABLE	
						2	220KV Mallawan line	SYNC	NOT SYNC	NOT SYNC	2	160 MVA ICT -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
		220 KV S/S SITAPUR	GPS CLOCK IS NOT AVAILABLE	------------------------	-------------	1	220 KV BKT LINE	NOT SYNC	NOT SYNC	NOT SYNC		200 MVA TXR	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	
						2	220 KV SPN PGCIL LINE	NOT SYNC	NOT SYNC	NOT SYNC		160 MVA TXR	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV KANDUNI LINE	NOT SYNC	NOT SYNC	NOT SYNC		100 MVA TXR	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
		220 KV S/S KANDUNI	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220 KV SITAPUR LINE	NOT SYNC	NOT SYNC	NOT SYNC		200 MVA TXR	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						2	220 KV NIGHASHAN LINE	NOT SYNC	NOT SYNC	NOT SYNC													
						3	220 KV PGCIL LKO 1 LINE	NOT SYNC	NOT SYNC	NOT SYNC													
						4	220 KV PGCIL LKO 2 LINE	NOT SYNC	NOT SYNC	NOT SYNC													
		220 KV SS NIGHASAN	GPS CLOCK IS NOT AVILABLE	------------------------	-------------	1	220 KV GOLA LINE	NOT SYNC	NOT SYNC	NOT SYNC	1	160 MVA TXR	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	
						2	220 KV KANDUNI LINE	NOT SYNC	NOT SYNC	NOT SYNC	2	100 MVA TXR 1	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC		
											3	100 MVA TXR 2	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC		
2	T&CD, Gonda	220/132 KV Gonda	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220 KV PGCIL LINE	NOT SYNC	NOT SYNC	NOT SYNC	1	220/132 KV 200 MVA ICT -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	NOT SYNC	NOT APPLICABLE	
						2	220 KV INTERCONNECTOR	NOT SYNC	NOT SYNC	NOT SYNC	2	220/132 KV 200 MVA ICT -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 kv BASTI(400)-I	NOT SYNC	NOT SYNC	NOT SYNC													
						4	220 kv BASTI(400)-II	NOT SYNC	NOT SYNC	NOT SYNC													
		220/132 KV Bahraich	GPS CLOCK IS AVAILABLE	GPS CLOCK IS Not WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220 KV PGCIL LINE	NOT SYNC	NOT SYNC	NOT SYNC	1	220/132 KV 160 MVA ICT -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	NOT SYNC	NOT APPLICABLE	
						2	220 kv Balrampur Line	NOT SYNC	NOT SYNC	NOT SYNC	2	220/132 KV 160 MVA ICT -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
											3	220/132 KV 100 MVA ICT	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
3	T&CD, Sarojini Nagar	765 KV UNNAO	GPS CLOCK IS NOT AVAILABLE	NOT APPLICABLE	NOT APPLICABLE	1	765 KV UNNAO-ANPARA C LINE	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	1	765/400 KV 1000 MVA ICT -I	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	NOT APPLICABLE	SYNC BY SNTP	NOT APPLICABLE	
						2	765 KV UNNAO-OBRA C LINE	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	2	765/400 KV 1000 MVA ICT -II	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP				
											3	765/400 KV 1000 MVA ICT -III	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP				
											4	3X63 MVAR BUS REACTOR	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP	SYNC BY SNTP				
		400/220 KV UNNAO	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK DOES NOT HAVE SUFFICIENT NO OF PORTS	1	400 KV UNNAO JEHTA 1 LINE	SYNC	SYNC	NOT SYNC	1	400/220 KV 500 MVA ICT -2	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	EVENT LOGGER HAS TIME SYNCHRONISATION CONNECTION DONE, BUT IS NOT SHOWING CORRECT TIME(APPROXIMATELY THREE MINUTE ADVANCE)
						2	400 KV UNNAO JEHTA 2 LINE	SYNC	NOT SYNC	NOT SYNC	2	400/220 KV 315 MVA ICT -2	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	400 KV UNNAO MOHANLALGANJ LINE	SYNC	NOT SYNC	NOT SYNC	3	400/220 KV 315 MVA ICT -3	SYNC	SYNC	SYNC	SYNC	SYNC	NOT SYNC	NOT SYNC				
						4	400 KV UNNAO BAREILLY 1 LINE	SYNC	NOT SYNC	NOT SYNC													
						5	400 KV UNNAO BAREILLY 2 LINE	SYNC	NOT SYNC	NOT SYNC													
						6	400kV UNNAO- PANKI LINE	SYNC	NOT SYNC	NOT SYNC													
						7	400 KV UNNAO AGRA LINE	SYNC	NOT SYNC	NOT SYNC													
		220/132 KV UNNAO	GPS CLOCK IS NOT AVAILABLE	NOT APPLICABLE	NOT APPLICABLE	1	220 KV UNNAO-PHOOL BAGH-1 LINE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	1	220/132 KV 160 MVA ICT -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	GPS CLOCK IS NOT AVAILABLE	GPS CLOCK IS NOT AVAILABLE	GPS CLOCK IS NOT AVAILABLE	NO EVENT LOGGER IS INSTALLED
						2	220 KV UNNAO-PHOOL BAGH-2 LINE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	2	220/132 KV 160 MVA ICT -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE				
						3	220 KV UNNAO- BITHOOR LINE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	3	220/132 KV 160 MVA ICT -III	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE				
						4	220 KV UNNAO- RPH LINE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE													
						5	220 KV UNNAO- GIS KANPUR ROAD LINE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE													
						6	220 KV UNNAO- AJGAIN TSS LINE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE													
						7	220 KV UNNAO- DAHI CHOWKI LINE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE													
		400KV Sarojini Nagar Lucknow	GPS Clock is Available	Working	GPS Clock has not Sufficient No. of Ports	1	400 KV Singrauli Line	-	-	Non Numerical Relay	Reactor Back Up Impedance Not Sync	1	400/220 KV 500 MVA ICT -I	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	-	Non Numerical Relay	-	Unhealthy	-
						2	400 KV Bareilly Line	-	-	Non Numerical Relay	-	2	220/132 KV 200 MVA ICT -I	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	-				
						-	-	-	-	-	-	3	80MVAr Bus Reactor	Not Sync	-	-	Not Sync	-	Back Up Impedance				
		220/132/33 KV SAROJINI NAGAR	GPS CLOCK IS AVAILABLE	GPS Clock is Working DATE : Wrong Time : Ok	GPS CLOCK HAS NOT SUFFICIENT NO OF PORTS	1	220KV Gomati Nagar	Not Sync	Not Sync (Bakup Relay)	-		1	220/132 KV 200 MVA ICT-I	-	Not Sync	Not Sync	Not Sync		Not Sync	Not Sync	-	Not Available	-
						2	220KV Hardoi Road	Not Sync	Not Sync (Bakup Relay)	-		2	220/132 KV 200 MVA ICT-2	-	Not Sync	Not Sync	Electro Mechanical Relay		Not Sync				
						3	220KV Dahi Chauki	Not Sync	Not Sync (Bakup Relay)	-		3	220/132 KV 200 MVA ICT-3	-	Not Sync	Not Sync	Not Sync		Not Sync				
						4	220KV Kanpur Road	Not Sync	Not Sync (Bakup Relay)														
						5	220KV Bijnaur	-	Not Sync														
4	T&CD, Sultanpur	400kV S/S Sultanpur	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	400kV NTPC Tanda line	SYNC	SYNC	SYNC	1	400/220kV, 315MVA ICT-I	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	NOT SYNCHRONISED (DEFECTIVE)	SYNC	NOT SYNCHRONISED (DEFECTIVE)	
						2	400kV Obra line	SYNC	SYNC	SYNC	2	400/220kV, 240MVA ICT-II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	
						3	400kV PGCIL Mohanlalganj line	SYNC	SYNC	SYNC	3	400/220kV, 315MVA ICT-III	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	NOT SYNCHRONISED (DEFECTIVE)	SYNC	NOT SYNCHRONISED (DEFECTIVE)	
						4	220kV Amethi line	SYNC	SYNC	SYNC	4	400/220kV, 315MVA ICT-IV	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	NOT SYNCHRONISED (DEFECTIVE)	SYNC	NOT SYNCHRONISED (DEFECTIVE)	
						5	220kV Sangipur line	SYNC	SYNC	SYNC													
		220KV S/S Sultanpur	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK HAS NOT SUFFICIENT NO. OF PORTS	1	220 KV PRATAPGARH LINE	SYNC	SYNC	NA	1	220/132kV, 160 MVA ICT -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	PARTIAL SYNC	SPS SYSTEM DEFECTIVE	
						2	220 KV SOHAWAL LINE	SYNC	SYNC	NA	2	220/132kV, 160 MVA ICT -III	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV NEW TANDA LINE	SYNC	NOT SYNC	NA	3	220/132kV, 200 MVA ICT -II	SYNC	NOT SYNC	NOT SYNC	SYNC	SYNC	NOT SYNC	NOT SYNC				
						4	220 KV NTPC TANDA LINE	SYNC	NOT SYNC	NA													
		220KV S/S BACHRAWAN	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	YES	1	220 KV BIJNAUR ROAD	SYNC	SYNC	SYNC	1	220/132kV, 160 MVA ICT -I	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	YES	YES	SPS SYSTEM NA	
						2	220KV PGCIL RAIBARELI	SYNC	SYNC	SYNC	2	220/132kV, 160 MVA ICT -II	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
		220 KV S/S AMETHI	GPS SYSTEM IS AVAILABLE	GPS SYSTEM IS AVAILABLE	YES	1	220 KV SANGIPUR	SYNC	SYNC	SYNC	1	220/132kV, 160 MVA ICT -I	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	YES	YES	SPS SYSTEM NA	
						2	220 KV SULTANPUR	SYNC	SYNC	SYNC	2	220/132kV, 160 MVA ICT -II	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
						3	220 KV RAIBARELI (SIRSIRA) CKT1	SYNC	SYNC	SYNC													
							220 KV RAIBARELI (SIRSIRA) CKT2	SYNC	SYNC	SYNC													
		220 KV S/S GIS AYODHYA	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220 KV NEW TANDA LINE	SYNC	SYNC	SYNC	1	220/132kV, 160 MVA ICT -I	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	Inbuilt in relay SYNC	SYNC	
						2	220 KV PGCIL LINE	SYNC	SYNC	SYNC	2	220/132kV, 160 MVA ICT -II	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
		220 KV S/S SOHAWAL	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220 KV SULTANPUR LINE	NOT SYNC	NOT SYNC	NOT SYNC	1	220/132kV, 160 MVA ICT -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	Inbuilt in relay SYNC	NOT SYNC	
						2	220 KV GONDA LINE	NOT SYNC	NOT SYNC	NOT SYNC	2	220/132kV, 160 MVA ICT -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV PGCIL LINE-1	NOT SYNC	NOT SYNC	NOT SYNC													
						4	220 KV PGCIL LINE-2	NOT SYNC	NOT SYNC	NOT SYNC													
		220 KV S/S NEW TANDA	GPS CLOCK IS AVAILABLE	GPS CLOCK IS NOT WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220 KV SULTANPUR LINE	NOT SYNC	NA	NA	1	220/132kV, 160 MVA ICT -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	
						2	220 KV GIS AYODHYA LINE	NOT SYNC	NA	NA	2	220/132kV, 160 MVA ICT -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV PGCIL LINE	NOT SYNC	NA	NA	3	220/132kV, 160 MVA ICT -III	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						4	220 KV NTPC LINE-1	NOT SYNC	NA	NA													
						5	220 KV NTPC LINE-2	NOT SYNC	NOT SYNC	NA													
						6	220 KV NTPC LINE-3	NOT SYNC	NOT SYNC	NA													
5	T&CD, Bareilly	400/220 KV Bareilly	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK DOES NOT HAVE SUFFICIENT NO OF PORTS	1	400 KV UNNAO-1 LINE	SYNC	SYNC	Non Numerical Relay	1	400/220 KV 315 MVA ICT -1	Non Numerical Relay	Non Numerical Relay	Non Numerical Relay	Non Numerical Relay	Non Numerical Relay	Non Numerical Relay	Non Numerical Relay	SYNC	-	Not available	EVENT LOGGER HAS TIME SYNCHRONISATION CONNECTION DONE BUT CAPACITY IS EXHAUSTED(ALL BAYS ARE NOT CONNECTED IN EL)
						2	400 KV UNNAO-2 LINE	SYNC	SYNC	Non Numerical Relay	2	400/220 KV 315 MVA ICT -2	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	400 KV PGCIL BAREILLY 1 LINE	SYNC	SYNC	Non Numerical Relay	3	400/220 KV 315 MVA ICT -3	SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						4	400 KV PGCIL BAREILLY 2 LINE	SYNC	SYNC	Non Numerical Relay	4	80 MVAr Bus Reactor	Non Numerical Relay	Non Numerical Relay	-	Non Numerical Relay	-	-	-				
						5	220 KV DOHNA-1	SYNC	SYNC	SYNC													
						6	220 KV DOHNA-2	SYNC	SYNC	SYNC													
						7	220 KV CB GANJ-1	SYNC	Non Numerical Relay	Non Numerical Relay													
						8	220 KV CB GANJ-2	SYNC	SYNC	SYNC													
						9	220 KV PILIBHIT-1	NOT SYNC	NOT SYNC	NOT SYNC													
						10	220 KV PILIBHIT-2	SYNC	Non Numerical Relay	Non Numerical Relay													
						11	220 KV AMARIYA-1	SYNC	SYNC	SYNC													
						12	220 KV AMARIYA-2	SYNC	SYNC	SYNC													
						13	220 KV PANTNAGAR	SYNC	Non Numerical Relay	Non Numerical Relay													
						14	220 KV FARIDPUR	SYNC	SYNC	SYNC													
		220/132 KV PILIBHIT	GPS CLOCK IS DEFECTIVE	NOT APPLICABLE	NOT APPLICABLE	1	220 KV BAREILLY-1	NOT SYNC	NOT SYNC	NOT SYNC	1	220/132 KV 160 MVA ICT -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	N/A	-	Not available	SAS S/S
						2	220 KV BAREILLY-2	NOT SYNC	NOT SYNC	NOT SYNC	2	220/132 KV 160 MVA ICT -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
		220/132 KV AMARIYA	GPS Clock is Available	Working	YES	1	220 KV BAREILLY-1	SYNC	SYNC	SYNC	1	220/132 100 MVA T/F-1	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	N/A	-	Not Available	SAS S/S
						2	220 KV BAREILLY-2	SYNC	SYNC	SYNC	2	220/132 100 MVA T/F-2	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
		220/132/33 KV DOHNA	GPS CLOCK IS AVAILABLE	Working	GPS CLOCK HAS NOT SUFFICIENT NO OF PORTS	1	220 KV BAREILLY-1	Not Sync	Not Sync	Not Sync	1	220/132 160 MVA T/F-1	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	N/A	-	Not Available	EVENT LOGGER NOT INSTALLED
						2	220 KV BAREILLY-2	Not Sync	Not Sync	Not Sync	2	220/132 160 MVA T/F-2	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync				
						3	220KV CB GANJ	Not Sync	Not Sync	Not Sync													
						4	220KV ROZA	Not Sync	Not Sync	Not Sync													
		220KV S/S Badaun	GPS CLOCK IS NOT AVAILABLE	---------------------	-----------	1	220 KV C.B.Ganj(OCBTL-1)	NOT SYNC	NOT SYNC	NOT SYNC	1	200MVA T/F I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	NOT SYNC	NOT APPLICABLE	
						2	220 KV Roza PH-I	NOT SYNC	NOT SYNC	NOT SYNC	2	200MVA T/F II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV Roza PH-II	NOT SYNC	NOT SYNC	NOT SYNC													
						4	220 KV Sambhal/ chandosi (OCBTL-2)	NOT SYNC	NOT SYNC	NOT SYNC													
		220KV S/S CBGanj	GPS CLOCK IS AVAILABLE	GPS CLOCK IS NOT WORKING	GPS CLOCK HAS NOT SUFFICIENT NO OF PORTS	1	220 Kv 400 Kv BLY	NOT SYNC	NOT SYNC	NOT SYNC	1	200 MVAT/FI	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	NOT SYNC	NOT APPLICABLE	
						2	220 Kv 400 Kv BLY (New)	NOT SYNC	NOT SYNC	NOT SYNC	2	200 MVAT/FII	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 Kv Dohna	NOT SYNC	NOT SYNC	NOT SYNC													
						4	220 Kv Tanakpur	SYNC	SYNC	SYNC													
						5	220 Kv Sitarganj	SYNC	SYNC	SYNC													
						6	220 Kv Rampur	NOT SYNC	NOT SYNC	NOT SYNC													
						7	220 KV OCBTL	NOT SYNC	NOT SYNC	NOT SYNC													
						8	220 Kv Roza (New)	NOT SYNC	NOT SYNC	NOT SYNC													
		220 KV S/S Faridpur	GPS CLOCK IS AVAILABLE	GPS CLOCK IS NOT WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220KV Bareilly (400)	NOT SYNC	NOT SYNC	NOT SYNC		100MVA T/F -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	
						2	220KV Shahjahanpur	NOT SYNC	NOT SYNC	NOT SYNC													
		220 KV S/S Dataganj	GPS CLOCK IS AVAILABLE	GPS CLOCK IS WORKING	GPS CLOCK HAS SUFFICIENT NO OF PORTS	1	220KV Badaun	SYNC	SYNC	SYNC		160 MVA T/F-I	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	NOT APPLICABLE	
						2	220KV Roza	SYNC	SYNC	SYNC		160 MVA T/F-II	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
						3	220KV OCBTL-I	SYNC	SYNC	SYNC													
						4	220KV OCBTL-II	SYNC	SYNC	SYNC													
6	T&CD, Lucknow	400kV GIS JEHTA	AVAILABLE	WORKING	YES	1	400KV JEHTA(400) - UNNAO CKT-1	SYNC	SYNC	SYNC	SYNC	400/220KV 500 MVA ICT-1	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	YES	YES	NA	
							400KV JEHTA(400) - UNNAO CKT-2	SYNC	SYNC	SYNC	SYNC	400/220KV 500 MVA ICT-2	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
							400KV JEHTA(400) - KURSI ROAD CKT-1	SYNC	SYNC	SYNC	SYNC	220/132KV 200 MVA ICT-1	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
							400KV JEHTA(400) - KURSI ROAD CKT-2	SYNC	SYNC	SYNC	SYNC	220/132KV 200 MVA ICT-2	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
							220KV JEHTA(400) - HARDOI ROAD CKT-1	SYNC	SYNC	SYNC	SYNC												
							220KV JEHTA(400) - HARDOI ROAD CKT-2	SYNC	SYNC	SYNC	SYNC												
							220KV JEHTA(400) - MALLAWAN CKT-1	SYNC	SYNC	SYNC	SYNC												
							220KV JEHTA(400) - MALLAWAN CKT-2	SYNC	SYNC	SYNC	SYNC												
		220KV Hardoi Rd	Yes	No	No	1	220KV Jehta I	Not Sync	Not Sync	Not Sync	1	200MVA TF I	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	HV Side		NA	NA	NA	Has been informed to SDO regarding this, Process is going on as informed.
						2	220KV Jehta II	Not Sync	Not Sync	Not Sync	2	200MVA TF II	Not Sync	Not Sync	Not Sync	Not Sync	Not Sync	HV Side					
						3	220KV Sarojininagar	Not Sync	Not Sync	Not Sync								HV Side					
						4	220KV Kursi Rd.	Not Sync.	Not Sync.	Not Sync.								HV Side					
		220KV Kanpur Rd	Yes	Yes	Yes	1	220KV Sarojininagar	Sync	Sync	Sync	1	60 MVA TF I	Sync	Sync	Sync	Sync	Sync	HV Side		YES	YES	YES	
						2	220KV Unnao	Sync	Sync	Sync	2	60 MVA TF II	Sync	Sync	Sync	Sync	Sync	HV Side					
											3	60 MVA TF III	Sync.	Sync.	Sync.	Sync.	Sync.	HV Side					
		220KV Bijnor Rd.	Yes	Yes	Yes	1	220KV Sarojininagar	Sync	Sync	Sync	1	160MVA TF I	Sync	Sync	Sync	Sync	Sync	HV Side		YES	YES	YES	
						2	220KV Baccharawan	Sync.	Sync.	Sync.	2	160MVA TF II	Sync.	Sync.	Sync.	Sync.	Sync.	HV Side					
		220 KV CHINHAT	AVAILABLE	NOT WORKING	yes	1	220 KV SATRIKH LINE	NOT SYNC	NOT SYNC		1	220/132 KV 200 MVA T/F-I(BHEL)	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NO	NO	NO	
						2	220 KV GOMTINAGAR	NOT SYNC	NOT SYNC		2	220/132 KV 200 MVA T/F-II(ADITYA)	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV PGCIL LKO	NOT SYNC	NOT SYNC														
						4	220 KV KURSI ROAD	NOT SYNC	NOT SYNC														
						5	220 KV LMRC-I	NOT SYNC	NOT SYNC														
						6	220 KV LMRC-II	NOT SYNC	NOT SYNC														
		220 KV GOMTI NAGAR	AVAILABLE	NOT WORKING	YES	1	220 KV CHINHAT	NOT SYNC	NOT SYNC		1	220/33 KV 60 MVA T/F -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NO	NO	NO	
											2	220/33 KV 60 MVA T/F -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
											3	220/33 KV 60 MVA T/F -III	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						2	220 KV SAROJINI NAGAR	NOT SYNC	NOT SYNC		4	220/33 KV 60 MVA T/F -IV	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
		220 KV SATRIKH	AVAILABLE	WORKING	YES	1	220 KV CG CITY LINE	SYNC	SYNC		1	220/33 KV 60 MVA T/F -I (TA)	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	YES	YES	YES	
						2	220 KV CHINHAT LINE	SYNC	SYNC		2	220/33 KV 60 MVA T/F -II (BBL)	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC				
						3	220 KV Barabanki CKT-I	SYNC	SYNC														
						4	220 KV Barabanki CKT-II	SYNC	SYNC														
		220 KV C.G.CITY	AVAILABLE	NOT WORKING	YES	1	220 KV PGCIL -Raibareilly LINE	NOT SYNC	NOT SYNC		1	220/33 KV 60 MVA T/F -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NO	NO	NO	
						2	220 KV SATRIKH ROAD LINE	NOT SYNC	NOT SYNC		2	220/33 KV 60 MVA T/F -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
		220 KV BKT	AVAILABLE	NOT WORKING	YES	1	220 KV PGCIL LINE	NOT SYNC	NOT SYNC		1	220/33 KV 60 MVA T/F -I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NO	NO	NO	
						2	220 KV SITAPUR LINE	NOT SYNC	NOT SYNC		2	220/33 KV 60 MVA T/F -II	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
		220 KV KURSI ROAD	AVAILABLE	NOT WORKING	YES	1	220 KV CHINHAT	NOT SYNC	NOT SYNC		1	200 MVA T/F-I	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NO	NO	NO	
						2	220 KV HARDOI ROAD	NOT SYNC	NOT SYNC		2	100MVA T/F	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV PGCIL CKT-I	NOT SYNC	NOT SYNC		3	160 MVA T/F	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
											4												
						4	220 KV PGCIL CKT-II	NOT SYNC	NOT SYNC		5												
		220 KV BARABANKI	AVAILABLE	NOT WORKING	YES	1	220 KV PGCIL CKT-I	NOT SYNC	NOT SYNC		1	220/132 KV 160 MVA T/F -I(BBL)	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NO	NO	NO	
						2	220 KV PGCIL CKT-II	NOT SYNC	NOT SYNC		2	220/132 KV 160 MVA T/F -II(BBL)	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC	NOT SYNC				
						3	220 KV SATRIKH ROAD LINE -I	NOT SYNC	NOT SYNC		3												
						4	221 KV SATRIKH ROAD LINE -II	NOT SYNC	NOT SYNC		4												

ELECTRICITY TEST & COMMISSIONING CIRCLE, MEERUT						
TRANSMISSION WEST ZONE UPPTCL,MEERUT						
Status of recording instruments(220kV and above stations) Annexure-XVII Date: 18.9.24						
Sr.No	**Station Name**	**Voltage Level**	**Disturbance recorder/station event logger healthy (Yes or No)**	**Standardisation (Yes or No)**	**Time synch (Yes or No)**	**Remarks**
1	220 kV SS CHANDPUR	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Yes	
2	220 kV SS NEHTAUR	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Yes	
3	220 kV Amroha	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Yes	
4	220 kV Gajraula	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock is not working.
5	400kV S/S Moradabad	400kV	DR Inbuilt in Relay/Centralised Event Logger Available (Yes)	Yes	Yes	Relays are partially time Synchronized.
6	220kV S/S Sambhal	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock is not working.
7	220kV S/S Chandausi	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Yes	
8	220kV S/S Moradabad	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Yes	Partially Relays are time Synchronized
9	220 kV SS Rampur	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Yes	

10	220kV Nara S/S MZN	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock unhealthy.
11	220kV BadhaiKalan S/S MZN	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Yes	
12	220kV Khatauli S/S MZN	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	
13	220kV Jansath S/S MZN	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	Communication cable laying pending.
14	400 kV S/S GIS Shamli	400 kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
15	220 kV S/S Shamli	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS Clock not available
16	400 kV S/S MUZAFFARNAGAR	400 kV	DR is inbuilt in relays.(Yes) Centralised event logger is available.	Yes	Yes	
17	220 kV Saharanpur	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	
18	220 kV Behat	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	No	No	
19	220kV Sarsawa	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	No	
20	220 kV Nanauta	220 kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS Clock not available
21	220 kV Deoband	220 kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
22	220kV S/S SEC 62	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock is defective
23	220kV S/S DADRI	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock to relay wiring pending
24	220kV S/S RC GREEN	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	No	SAS unhealthy

25	220kV S/S JALPURA	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
26	220kV S/S KP5	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
27	220kV S/S JEWAR	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
28	220kV S/S METRO DEPOT	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
29	220kV S/S SEC 20	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock to relay wiring pending
30	220kV S/S SEC 129	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock is defective
31	220kV S/S BOTANICAL GARDEN	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
32	400kV SEC 123	400kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
33	400kV SEC 148	400kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
34	220kV S/S SIKANDRABAD	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock is defective
35	220kV S/S RUKHI	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
36	400kV S/S GR NOIDA	400kV	DR inbuilt in relay.(Yes)/ Station Event Logger available	Yes	Yes	Few numerical relays (CSC211) do Not have the inbuilt time sync provision
37	220kV GIS S/S IITGNL	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	SAS Healthy
38	220kV S/S YEIDA SEC-18	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	No	GPS clock not available
39	220kV S/S YEIDA SEC-24	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	No	GPS clock not available

40	220 kV HYBRID S/S HAPUR	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
41	220 kV S/S SIMBHAOLI	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock is defective
42	220kV S/S KHURJA	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock not available
43	220kV S/S JAHANGIRABAD	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS clock is defective
44	220kV S/S DEBAI	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	Yes	
45	Shatabdinagar	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes (Partial)	Yes	--------
46	Partapur (Jagriti Vihar)	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes (Partial)	Yes	--------
47	Modipuram	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS Clock is not Healthy
48	Modipuram-2	220kV	DR is inbuilt in relays.(Yes). Centralised event logger is part of SAS.	Yes	No	GPS Clock is not Healthy
49	Charla	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS Clock is not Healthy
50	Baraut	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Partially Synchronised	--------
51	Baghpat	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	Partially Synchronised	--------
52	Nirpura	220kV	DR and event logger are inbuilt in relays.(Yes) No centralised event logger is available.	Yes	No	GPS Clock is not Healthy

Note:- No station event logger is available in any of the conventional 220kV Sub-stations under Transmission west zone Meerut UPPTCL.

Status of recording instruments (220 kV & above station of PTCUL)

SR NO	Station name	Voltage level	Disturbance recorder /Station event logger healthy (Yes or No)	Standardisation (Yes or No)	Time sync (Yes or No)	Remarks
1	400KV S/s Kashipur	400 kV	Inbuilt in Numerical Relays	YES	YES	
2	400KV RISHIKESH	400 kV	Inbuilt in Numerical Relays	YES	YES	
3	400KV SRINAGAR	400 kV	Inbuilt in Numerical Relays	YES	YES	
4	220KV S/s Mahuakheraganj	220 kV	Inbuilt in Numerical Relays	YES	YES	
5	220KV S/s Pantnagar	220 kV	Inbuilt in Numerical Relays	YES	NO	
6	220KV S/s Jafarpur	220 kV	Inbuilt in Numerical Relays	YES	NO	
7	220KV S/s Kamaluaganja	220 kV	Inbuilt in Numerical Relays	YES	NO	
8	220KV Jhajra	220 kV	Inbuilt in Numerical Relays	YES	YES	
9	220KV Rishikesh	220 kV	Inbuilt in Numerical Relays	YES	YES	
10	220KV IIP Harrawala	220 kV	Inbuilt in Numerical Relays	YES	YES	
11	220KV Chamba	220 kV	Inbuilt in Numerical Relays	YES	YES	
12	220KV SIDCUL, Haridwar	220 kV	Inbuilt in Numerical Relays	YES	NO	
13	220KV Pirankaliyar	220 kV	Inbuilt in Numerical Relays	YES	YES	
14	220KV Roorkee	220 kV	Inbuilt in Numerical Relays	YES	NO	

SPS of 500kV HVDC Mundra-Mahindergarh

SPS cases:

Case-1: Blocking of (one pole or Bipole) AND Reduction in power injection at Mahindergarh by more than 600 MW and up to 900 MW

Action: *Shed 300 MW (Haryana: 150 MW, Punjab: 50 MW, Rajasthan: 50 MW, UP: 50 MW) identified load in Northern Region within 500 ms (including all signal propagation / breaker opening time delay).*

Case-2: Blocking of (one pole or Bipole) AND Reduction in power injection at Mahindergarh by more than 900 MW and up to 1250 MW.

Action: *Shed 600 MW (Haryana: 300 MW, Punjab: 100 MW, Rajasthan: 100 MW, UP: 100 MW) identified load in Northern Region within 500 ms (including all signal propagation / breaker opening time delay).*

Case-3: Blocking of (one pole or Bipole) AND Reduction in power injection at Mahindergarh by more than 1250 MW and up to 2000 MW

Action: *Shed 1400 MW (Haryana: 600 MW, Punjab: 200MW, Rajasthan: 200 MW, UP: 200 MW, Delhi: 200 MW) identified load in Northern Region within 500 ms (including all signal propagation / breaker opening time delay).*

Case-4: Blocking of (one pole or Bipole) AND Reduction in power injection at Mahindergarh by more than 2000 MW

Action: *Shed 1900 MW (Haryana: 700 MW, Punjab:300MW, Rajasthan: 300 MW, UP: 300 MW, Delhi: 300 MW) identified load in Northern Region within 500 ms (including all signal propagation / breaker opening time delay).*

Load Groups: In approved SPS

S. No.	State/ L.S. quantum	Name of feeding substation	Feeder/ line/ equipment	MW	Case-1 300MW	Case-2 600MW	Case-3 1400MW	Case-4 2000MW
1	Rajasthan Case-1: 50MW Case-2: 100MW Case-3: 200MW Case-4: 300MW	220/132kV Alwar	132kV Mandawar	25	1	1	1	1
2			132kV Bansoor	45		1	1	1
3			132kV Ramgarh	14		1	1	1
4			132kV Malakheda	10			1	1
5			132kV Alwar(local load)	50				1
6		220/132kV Ratangarh	132kV Sardar Shahar	26	1	1	1	1
7		220/132kV Bhilwara	132kV Gangapur	20			1	1
8			132kV Danta	15			1	1
9			132kV Devgarh	10			1	1
10			132kV Kareda	10			1	1
11		220/132kV Merta	132kV Kuchera	35			1	1
12			132kV Lamaba	25				1
13			132kV Gotan	25				1
14	Haryana Case-1: 150MW Case-2: 300MW Case-3: 600MW Case-4: 700MW	400/220kV Bhiwani_BBMB	220kV Bapora D/C	65+65			1	1
15		400/220kV Hissar_PG	220kV Isharwal D/C	40+35			1	1
16		400/220kV Dhanonda through 220kV Lula Ahir	220kV Rewari D/C (3x100MVA)	95+90	1	1	1	1
17		400/220kV Bahadurgarh	220kV Nuna Majra D/C (3x100MVA)	80+80		1	1	1
18		132kV Charkhi Dadri	132kV Kalanaur	50			1	1

Existing feeders at 220/132kV Alwar (as per SCADA)
132kV Telco circle
132kV KG Bas
132kV Local MACL
132kV Ramgarh
132kV ALMIA
132kV Pinan
132kV Malakhera

Load Groups: In approved SPS

19	Punjab Case-1: 50MW Case-2: 100MW Case-3: 200MW Case-4: 300MW	220/66kV Gobindgarh	66kV Talwara-1	35			1	1
20			66kV Talwara-2	35				1
21		220/66kV Laltokalan	66kV Gill Road-1	50		1	1	1
22			66kV Gill Road-2	50	1	1	1	1
23			66kV Dugri	65			1	1
24		220/66kV Malerkotla	66kV Malerkotla	35				1
25			66kV Lasoi Amargarh	45				1
26			66kV Malaud$	20				
27			66kV Siarh$	20				
28	Uttar Pradesh Case-1: 50MW Case-2: 100MW Case-3: 200MW Case-4: 300MW	Shamli	Thana Bhagwan-1	25	1	1	1	
29			Thana Bhagwan-2	25	1	1	1	
30			Jasala-1	25		1	1	
31			Jasala-2	25		1	1	
32			Kharad-1	50			1	
33			Kharad-2	50			1	
34			Baraut-1	150				1
35			Baraut-2	150				1
36	Delhi Case-1: 50MW Case-2: 100MW Case-3: 200MW Case-4: 300MW	400/220kV Bamnauli	Papankalan1 ckt-1	100			1	1
37			Papankalan1 ckt-2	100			1	1
38		400/220kV Mandola	Gopalpur-1	150			1	1
39			Gopalpur-2	150			1	1

$: New feeder added in Punjab for peak demand period

132kV Feeders at 220kV Shamli	132kV Feeders at 400kV Shamli (alternate option)
132kV Lalukheri 132kV Jhinjhana 132kV Kairana-1 & II 132kV Jasala	132kV Budhana 132kV Kharad 132kV Jalalpur 132kV Thanabhawan 132kV Kaniyan
Max. load: 251MW & Avg. Load: 164MW	Max. load: 310MW & Avg. Load: 202MW

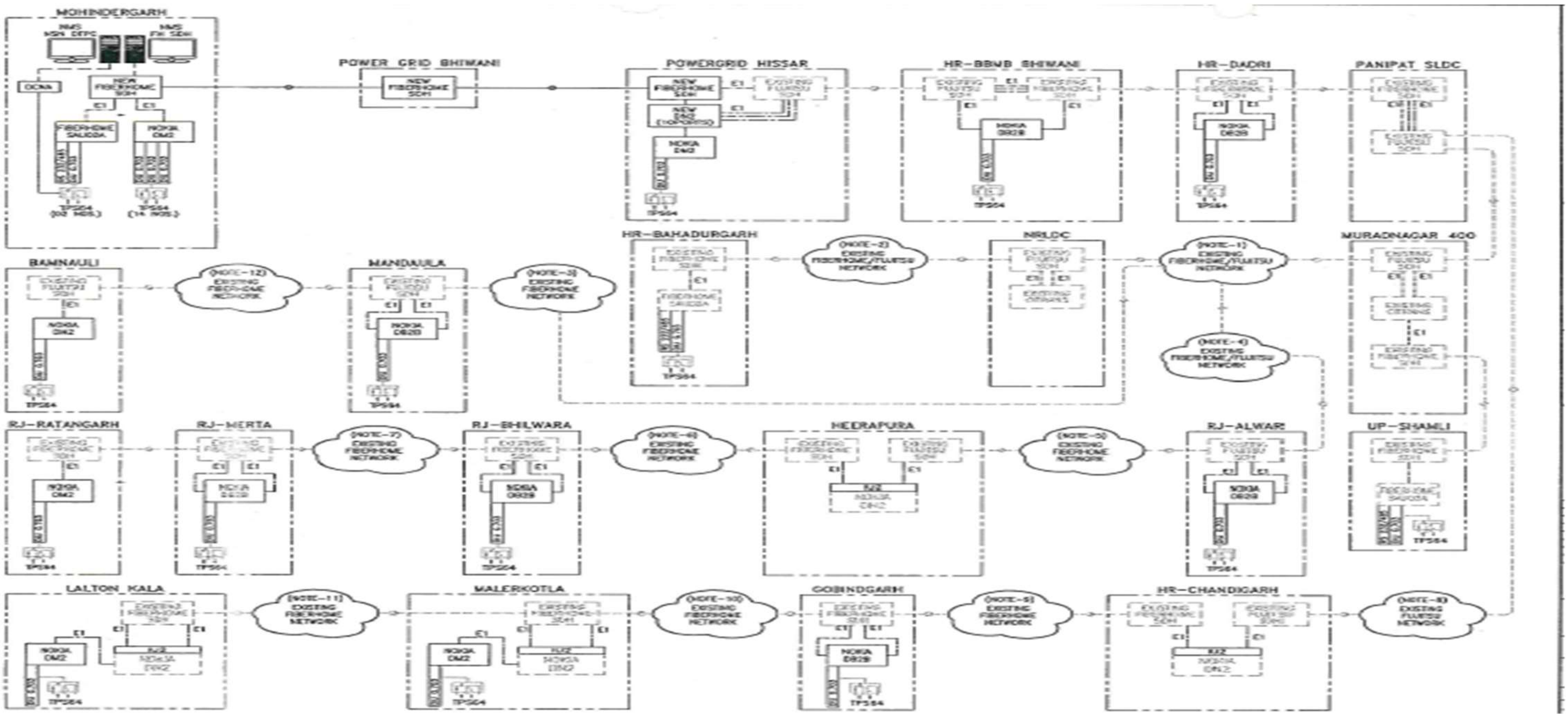
220kV Papankalan has tow (02) source:

1. 220kV Bamnauli-Papankalan D/C
2. 220kV Dwarka-Papankalan D/C

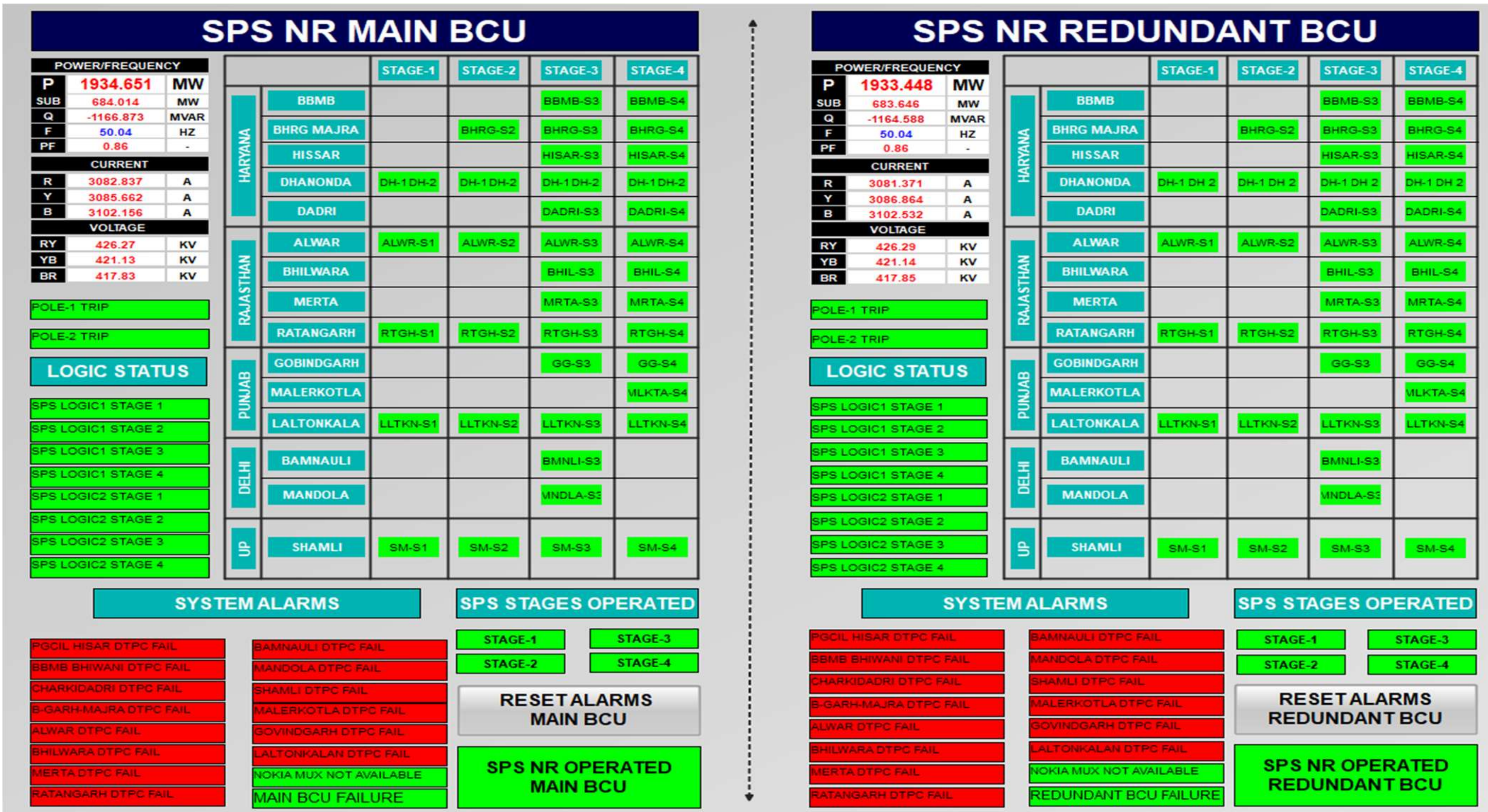
❖ All four feeders may be incorporated in SPS to ensure load relief in any scenario.

Communication path:

There are two links for SPS signal communication to load centers. One is **directly to 220kV Dhanonda(HR)** and communication to rest of load centers is through Bhiwani & Hissar S/s of POWERGRID.

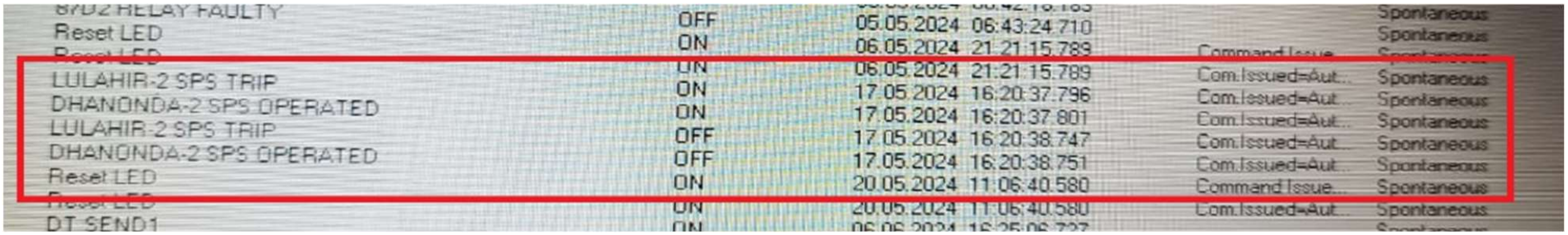


SPS SCADA display at Mahindergarh (5-08-2024)



Bipole tripping on 17th May 2024 (power order:1500MW)

SPS link to Dhanonda operated. SPS operation at other stations was not occurred.



87D2 RELAY FAULTY	OFF	05.05.2024 06:43:24.710		Spontaneous
Reset LED	ON	06.05.2024 21:21:15.789	Command Issue...	Spontaneous
Reset LED	ON	06.05.2024 21:21:15.789	Com.Issued=Aut...	Spontaneous
LULAHIR-2 SPS TRIP	ON	17.05.2024 16:20:37.796	Com.Issued=Aut...	Spontaneous
DHANONDA-2 SPS OPERATED	ON	17.05.2024 16:20:37.801	Com.Issued=Aut...	Spontaneous
LULAHIR-2 SPS TRIP	OFF	17.05.2024 16:20:38.747	Com.Issued=Aut...	Spontaneous
DHANONDA-2 SPS OPERATED	OFF	17.05.2024 16:20:38.751	Com.Issued=Aut...	Spontaneous
Reset LED	ON	20.05.2024 11:06:40.580	Command Issue...	Spontaneous
Reset LED	ON	20.05.2024 11:06:40.580	Com.Issued=Aut...	Spontaneous
DT SEND1	ON	06.06.2024 16:25:06.727		Spontaneous

Annexure-C.I

Format No.-PSA-01

Application of protection settings for approval of NRPC

(for elements connected at 220 kV and above)

1. **Name of Utility:** HVPNL (Haryana Vidyut Prasaran Nigam Ltd)
2. **Sub-station:** 220 kV S/Stn. Masudpur (Distt. Hisar)
3. **Unit (Generator/ICT/GT/Reactor etc.)** 220/132 kV 100 MVA TF T-4
4. **Purpose of approval: New/Revision** New
5. **Tentative date for implementation:** 28.11.2024
6. **Settings proposed:**

S.N.	Protection	Setting	Time	Whether as per protection philosophy of NRPC
1.	Differential	Attached	--	As per CBIP manual, NRPC guidelines/HVPN practice/OEM recommendation
2.	REF	Attached	--	As per CBIP manual, NRPC guidelines/HVPN practice/OEM recommendation
3.	OC HV	Attached	--	As per CBIP manual, NRPC guidelines/HVPN practice/OEM recommendation
4.	LV OC - E/F	Attached	--	As per CBIP manual, NRPC guidelines/HVPN practice/OEM recommendation

7. **Supporting Calculation for submission:**

Attached.

Signature with date and seal

Executive Engineer
M&P cum CC Division
HVPNL, HISAR

Protection setting (220 kV S/Stn. Masudpur)
Utility : HVPNL

	220/132 kV 100 MVA TF Protection			
1	**Differential Protection for 100 MVA Transformer :**			**UNIT**
	Relay Used	=	**ZIV 8IDV-A4F-230GB6**	
	TF Capacity in MVA	=	100	MVA
	TF Total Capacity in MVA	=	100	MVA
	HV Voltage rating in kV	=	220	KV
	LV Voltage rating in kV	=	132	KV
	HV Side CT – Pri.	=	300	A
	HV Side CT - Sec.	=	0.577	A
	LV Side CT – Pri.	=	500	A
	IV Side CT - Sec	=	0.577	A
	Rated Voltage in kV	=	220	KV
	OLTC Range (Tap change on 132 kV side)	=	(+15% to -5%)	
	Voltage at Maximum tap (@+15%) in kV at Tap 1	=	151.8	KV
	Voltage at Minimum tap (@-5%) in kV at Tap 17	=	125.4	KV
1.1	**Backup Calculations :**			
	Capacity of the Transformer, Sref in MVA	=	100	MVA
	System voltage in KV	=	220	KV
	Transformer % Impedance (at max tap)	=	8.65	
	Transformer % Impedance (at normal. tap)	=	12.08	
	Transformer % Impedance (at min tap)	=	13.87	
	Vector Group	=	Yna0	
	Rated current of the Transformer HV side (in Primary)	=	Sref / (√3 * HV voltage)	
			100 MVA/ (√3 * 220 kV)	
			262.43	A
	Rated current of the Transformer HV side (in Secondary)	=	262.4/(300/0.577)	
			0.504	A
	HV Side CTR in relay	=	300/0.577	
		=	520	
	Rated current of the Transformer LV side	=	Sref / (√3 * LV voltage)	
		=	100 MVA/ (√3 * 132 kV)	
		=	437.37	A
	Rated current of the Transformer LV side (in Secondary)	=	437.37 / (500/0.577)	
		=	0.504	A
	LV Side CTR in relay	=	500/0.577	
		=	866.5	
1.2	The following setting in the ZIV TF Differential protection as per technical manual & recommendation of ZIV.			
	| General			
	Unit In Service		Yes	
	Winding 1 ratio		520	
	Winding 2 ratio		866	
	Phase VT Ratio		2000	
	Neutral VT Ratio		2000	
	Gnd 1 CT Ratio		1	
	Gnd 2 CT Ratio		1	
	Phase Sequence		ABC	
	Voltage Type		Vab	
	Diff current measure		Times Tap	
	Reference Angle		IA Wndg 1	
	Connection Groups			
	Wndg 1 connection		WYE	
	ZS Filter wndg 1		Yes	
	Wndg 2 connection		WYE	
	Wndg 2 phase ang		0	
	ZS Filter wndg 2		Yes	
	Zero Seq Filter Type		Phase Channels	
	Gnd C1 Winding		1	
	Gnd C2 Winding		2	
	Autotransformer		Yes	
	Protection			
	Differential Units			
	Restraint Type (As per OEM recommendation)		(I1+I2-Id)/2	
	Reference Wndg		1	
	Tap winding 1		0.5	A
	Tap winding 2		0.5	A
	Fault Detector Supervision		Yes	

Protection setting (220 kV S/Stn. Masudpur)
Utility : HVPNL

	Differential			
	Diff Enable		Yes	
	Sensitivity		0.2	pu
	Restraint slope 1		20	%
	R Slope 1 Start		0	pu
	Restraint slope 2		70	%
	R Slope 2 Start		2.5	pu
	Ext Fault Block Enable		Yes	
	Harmonic Restraint Mode		Continuous	
	Diff Time Delay		0	sec
	H Blocking Logic		OR	
	Cross Blocking Time		0.1	sec
	2nd Block. Enab.		Yes	
	2nd Blocking PU		15	%
	5th Block. Enab.		Yes	
	5th Blocking PU		25	%
	Harmonic Blocking Mode		Continuous	
	Inhibition Time for Harmonics		5	Sec
	Parallel Transformer		No	
	Instantaneous Differential			
	Inst Diff Enable		Yes	
	Inst Diff Pickup		8	pu
	Inst Diff Delay		0	Sec
	Ext Fault Block Enable		Yes	
1.3	**HV Overfluxing Protection**			
	Relay used (in built in differential)	=	**ZIV 8IDV-A4F-230GB6**	
	HV PT Rating-Primary kV	=	220 /√3	
	HV PT Rating-Secondary V	=	110 /√3	
	Continuous withstand capacity	=	110 %	
	Characteristics (as per model setting calculation by NRPC)			
	Overexcitation			
	Unit 1			
	Overex. Enable		Yes	
	Overex. Pickup		1.2	V/F
	Overex. Curve		Definite Time	
	Overex. Dial		1	
	Overex. Delay		90 S	sec
	Unit 2			
	Overex. Enable		Yes	
	Overex. Pickup		1.3	V/F
	Overex. Curve		Definite Time	
	Overex. Dial		1	
	Overex. Delay		50 S	sec
	Unit 3			
	Overex. Enable		Yes	
	Overex. Pickup		1.4	V/F
	Overex. Curve		Definite Time	
	Overex. Dial		1	
	Overex. Delay		4 S	sec
	Unit 4			
	Overex. Enable		Yes	
	Overex. Pickup		1.5	V/F
	Overex. Curve		Definite Time	
	Overex. Dial		1	
	Overex. Delay		1 S	sec

Protection setting (220 kV S/Stn. Masudpur)
Utility : HVPNL

	220/132 kV 100 MVA TF Protection			
2	**HV REF Protection for 100 MVA Transformer:**			**UNIT**
	Relay Used	=	**ZIV IRLF1BDAA0BBB1B**	
	Relay Nominal Value	=	1	**A**
	TF Capacity in MVA	=	100	MVA
	HV Voltage rating in kV	=	220	KV
	HV Side CT - Pri.	=	300	A
	HV Side CT - Sec.	=	1	A
	Transformer % Impedance (at normal. tap)		12.08	
2.1	**HV side Calculation for REF**			
	Type of Impedance	=	High Impedance	
	Rated current of the Transformer HV side (in Primary)	=	Sref / (√3 * HV voltage)	
			100 MVA/ (√3 * 220 kV	
			262.4	A
	Rated current of the Transformer HV side (in Secondary)	=	262.4/300	
			0.874	A
	Fault MVA	=	100/0.1208	
		=	827.81	MVA
	T/F HV side Current in Amp	=	827.81 MVA/(√3 * 220 kV	
		=	2172.43	A
	Equivalent Secondary current HV side in Amp	=	2172.43/300	
		=	**7.24**	A
	REF Pickup Current in Amp	=	10 % of full load current	
		=	0.10 x 262.4	
		=	26.2	A
	Equivalent Secondary current HV side in Amp	=	26.2/300	
		=	0.08	A
	REF pick up (To be set in relay)	=	0.10 x In	A
	Note: This is actual current, which is required for the relay to operate, hence we consider this value for calculating the Rstab value.			
2.2	**Rstab Calculations for HV SIDE**			
	RCT in Ohms	=	3.8	Ohm
	Lead Length in Mtrs (assumed)	=	70	Mtr
	Resistance in ohm/ KM of the cable	=	4.5	Ohm
	Lead resistance (RL) in Ohms	=	4.5 x 70/1000	
		=	0.315	Ohm
	Voltage developed across the relay (Vs) in Volt	=	IFL x (RCT + 2RL)	
		=	7.24 X (3.8 + 0.63)	
		=	32.07	V
	Stabilizing Resistor value R stab in Ohms considering 150 % margin	=	Vs/Is	
		=	32.07/0.1	
		=	320.7	Ohm
		=	**481.05** ohms (to be set)	Ohm

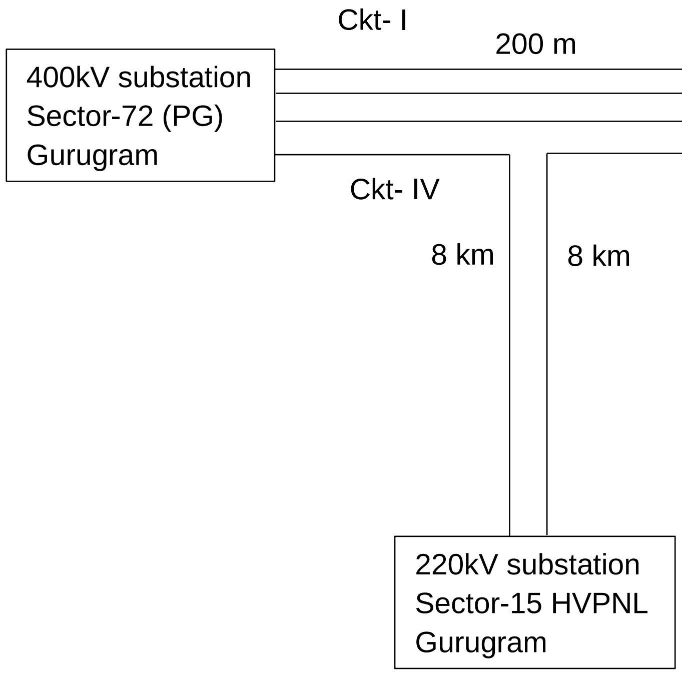
Protection setting (220 kV S/Stn. Masudpur)
Utility : HVPNL

220/132 kV 100 MVA TF Protection				
3	**Non-Directional Over Current Protection for 100 MVA Transformer:**			**UNIT**
	Relay Used	=	**ZIV IRLF1BDAA0BBB1B**	
	TF Capacity in MVA	=	100	MVA
	HV Voltage rating in kV	=	220	KV
	HV Side CT - Pri.	=	300	A
	HV Side CT - Sec.	=	1	A
	Transformer % Impedance (at normal. tap)		12.08	
	Rated current of the Transformer HV side (in Primary)	=	262.4	A
	Rated current of the Transformer HV side (in Secondary)	=	262.4/300	
			0.874	A
	Fault MVA	=	100/0.1208	
		=	827.81	MVA
	Maximum through fault current in amp	=	827.81 MVA/(√3 * 220 kV	
		=	2172.43	A
	Equivalent through fault current secondary in amp	=	2172.43/300	
		=	7.24	A
	Time Over Current setting 51		110 % of full load Current	
			262.4x 1.10	
			288	A
	Equivalent Current in secondary in Amp		288/300	
		Is	0.96	A
	Delay Type/IEC Curve		IEC- Normal Inverse	
	Required operating time in sec t	t	0.730 s	sec
	TMS setting adopted in relay(calculated from IDMT trip curve equation) curve Standard inverse= k= 0.140, α=0.020		$t(I) = TMS\left(\frac{k}{\left(\frac{I}{Is}\right)^{\alpha} - 1}\right)$ IEC 60255 Trip Curve Equation	
	TMS setting adopted in relay(calculated from IDMT trip curve equation) curve		0.22	
	Direction		Non-Directional	
	High set Current setting		120 % of maximum thru fault current	
			1.2 x 7.4	
			8.93 So done 9 A	A
	Time delay		0 sec	sec
	Direction		Non-Directional	
	Note: No Earth fault time current protection of HV side			

Protection setting (220 kV S/Stn. Masudpur)
Utility : HVPNL

	220/132 kV 100 MVA TF Protection			
4	**Non-Directional Overcurrent Protection (LV side) for 100 MVA Transformer:**			**UNIT**
	Relay Used	=	Alstom P14NB	
	TF Capacity in MVA	=	100	MVA
	LV Voltage rating in kV	=	132	KV
	LV Side CT - Pri.	=	500	A
	LV Side CT - Sec.	=	1	A
	Transformer % Impedance (at normal. tap)		12.08	
	Rated current of the Transformer LV side (in Primary)	=	437	
	Rated current of the Transformer LV side (in Secondary)	=	437/(500/1)	
		=	0.870	A
	Fault MVA	=	100/0.1208	
		=	827.81	MVA
	Maximum through fault current in amp	=	827.81 MVA/(√3 * 132 kV	
		=	3620.83	A
	Equivalent through fault current secondary in amp		3620.83/(500/1)	
		I	7.24	A
	Time Over Current setting 51	=	110 % of full load Current	
		=	437 x 1.10	
			480	A
	Equivalent Current in secondary in Amp (Relay In=5 A)	=	480 /(500/1)	
			0.960	A
		Is	0.96 x In	
	Delay Type/IEC Curve	=	IEC- Normal Inverse	
	Required operating time in sec t	t	0.600 s	sec
	TMS setting adopted in relay (calculated from IDMT trip curve equation) curve Standard inverse= k= 0.140, α=0.020		$t(I) = TMS\left(\frac{k}{\left(\frac{I}{Is}\right)^{\alpha} - 1}\right)$ IEC 60255 Trip Curve Equation	
	TMS setting adopted in relay	=	0.18	
	Direction	=	Non-Directional	
	Earth Fault protection (LV side)	=	20 % of full load Current	
		=	0.20 x In	A
	TMS setting in relay	=	0.18	

Note: No high set protection on LV side


Ckt- I
200 m
400kV substation
Sector-72 (PG)
Gurugram
220kV substation
Sector- 72 HVPNL
Gurugram
Ckt- IV
8 km
8 km
220kV substation
Sector-15 HVPNL
Gurugram